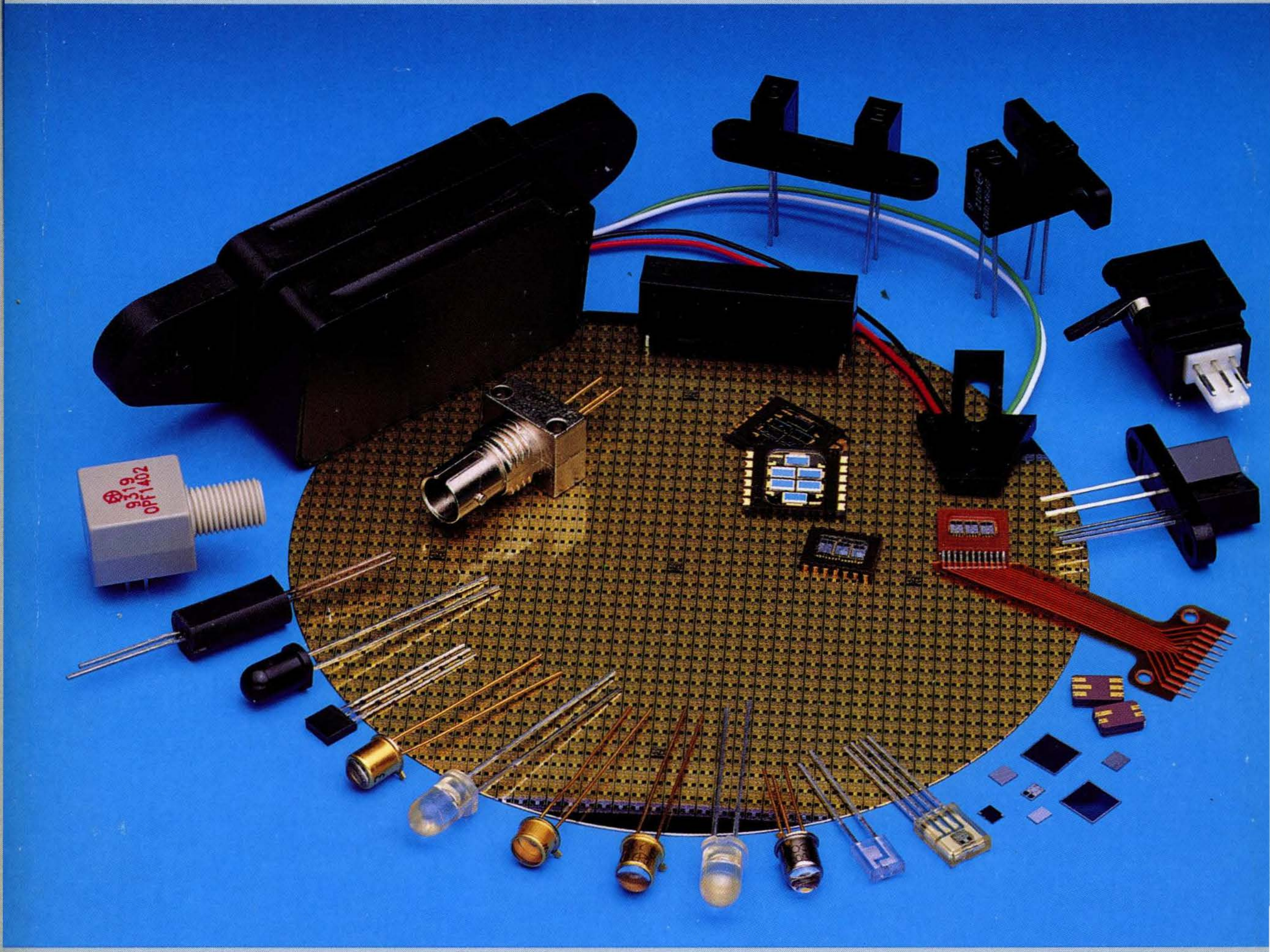
OPTEK TECHNOLOGY, INC.

PRODUCT CATALOG



Engineered Solutions...

INFRARED OPTOELECTRONICS
MAGNETIC SENSORS
FIBER OPTICS
HI-REL SERIES

OPTEK TECHNOLOGY, INC. PRODUCT CATALOG

OPTEK TECHNOLOGY, INC.

PRODUCT CATALOG

500-0090-088

OPTEK

OPTEK TECHNOLOGY, INC.

1993 Product Catalog

Optek Technology, Inc. is the world's leading manufacturer of standard and custom sensing solutions using infrared and magnetic sensors.

Engineering

For over 25 years, we have built our success upon a customer oriented team committed to technical leadership. Our engineers are the industry's most experienced and innovative. We manufacture three styles of product:

- Standard Components
  - As described in this catalog.
- Special Components
  - Electrical or mechanical variations of our standard components.
- Custom Sensor Systems
  - We are the industry experts, from concept and design to final assembly of fully custom sensors, using infrared or hall effect technologies.

Quality/Reliability

Quality and reliability are designed-in at Optek from the initial product concept. At Optek we are committed and dedicated to being the Quality Leader in the markets we serve. Our internal program is known as **Excellence Through Quality**.

This program includes not only manufacturing but all facets of the Optek organization.

In short, Excellence Through Quality requires the participation of the total company doing its very best to recognize and achieve customer requirements.

Optek is dedicated to delivering defect free, competitive products and services, on-time, to meet the requirements of our customers.

Total Vertical Integration

Optek is a highly vertically integrated sensor and component manufacturer. Vertical integration assures complete control of the total manufacturing cycle. Furthermore, vertical integration allows customization for application specific sensors from concept and design to final assembly and test.

- Concept and Design
- Wafer Fabrication
- Discrete Component Manufacturing
- Tooling and Plastic Manufacturing
- Printed Circuit Board Fabrication
- Wire and Cable Manufacturing
- Final Assembly and Test

The entire product line is designed to provide the product you need to satisfy your most demanding requirements. Optek has the industries' broadest line of standard components plus the capability to customize the components to individual needs.

We invite you to join the growing number of satisfied customers using Optek sensors, Fiber Optic components and Military Processed components.

To find out more about Optek products and solutions, or for technical assistance, call our technical sales department at:

214-323-2200

214-323-2396 (FAX)

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OPTEK TECHNOLOGY, INC.

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PRODUCT SELECTION GUIDE

OPTEK

DISCRETE COMPONENTS

PART NUMBER	DESCRIPTION	
OP1XX	GaAs INFRARED LIGHT EMITTING DIODE	
OP2XX	GaAlAs INFRARED LIGHT EMITTING DIODE	
OP3XX	PHOTODARLINGTON	
OP5XX	PHOTOSENSOR	
OPL5XX	PHOTOLOGIC™ SENSOR	
OP6XX	PHOTOTRANSISTOR	
OP8XX	PHOTOSENSOR	
OPL8XX	PHOTOLOGIC™ SENSOR	
OP9XX	PHOTODIODE	
OPSXXX	EMITTER AND SENSOR MATCHED PAIR	
OPXXXX	SPECIAL OR CUSTOM DISCRETE OPTOELECTRONIC COMPONENT	
OHNXXXX	HALL EFFECT SENSOR	
OHSXXXX	HALL EFFECT SENSOR (HIGH TEMPERATURE)	
OHDXXXX	SPECIAL OR CUSTOM HALL EFFECT DISCRETE	
OPCXXXX	CHIPS	SUFFIX TP (SAWN ON TAPE)
		SUFFIX WP (WAFFLE PACK)
		SUFFIX VP (VIALS)
OMH	MILITARY HALL EFFECT	

ASSEMBLIES

OHBXXXX	HALL EFFECT ASSEMBLY
OPB6XX	LOW-COST REFLECTIVE, TRANSMISSIVE, AND FLAG SWITCHES
OPB7XX	REFLECTIVE OBJECT SENSOR
OPB8XX	SLOTTED OPTICAL SWITCHES, PHOTOTRANSISTOR OUTPUT
OPB9XX	SLOTTED OPTICAL SWITCHES, PHOTOLOGIC™ OUTPUT
OPBXXXX	OPTICAL SWITCH, SPECIAL OR CUSTOM PACKAGE
OPF1XXX	FIBER OPTIC TRANSMITTER
OPF2XXX	FIBER OPTIC RECEIVER
OPF3XX	FIBER OPTIC LED
OPF4XX	FIBER OPTIC SENSOR
OMFXXX	MILITARY FIBER OPTIC LED OR SENSOR
OPIXXX	OPTICALLY COUPLED ISOLATOR

SURFACE MOUNT

HCCXXX	SURFACE MOUNT OPTOCOUPLER
HCTXXX	SURFACE MOUNT TRANSISTOR
HDCXXX	SURFACE MOUNT LOGIC OPTOCOUPLER
OPRXXXX	HYBRID OPTICAL ASSEMBLY

OPTEK

Infrared-Light Emitting Diodes (IRED's)

PRODUCT SELECTION GUIDE

Part No.	Case Style	Type	Output Power $E_{e(APT)}$ (mW/cm^2) Min	Max	Test Conditions I_F(mA)	Beam Angle (Deg.)	Page No.
OP123	Pill, lensed	GaAs	0.4	—	50	24	2-4
OP124	Pill, lensed	GaAs	1.0	—	50	24	2-4
OP130	TO-46, lensed	GaAs	1.0*	—	100	18	2-6
OP130W	TO-46	GaAs	1.0*	—	100	50	2-8
OP131	TO-46, lensed	GaAs	3.0*	—	100	18	2-6
OP131W	TO-46	GaAs	3.0*	—	100	50	2-8
OP132	TO-46, lensed	GaAs	4.0*	—	100	18	2-6
OP132W	TO-46	GaAs	4.0*	—	100	50	2-8
OP133	TO-46, lensed	GaAs	5.0*	—	100	18	2-6
OP133W	TO-46	GaAs	5.0*	—	100	50	2-8
OP140A	Plastic lateral	GaAs	0.4	—	20	40	2-10
OP140B	Plastic lateral	GaAs	0.3	0.55	20	40	2-10
OP140C	Plastic lateral	GaAs	0.2	0.4	20	40	2-10
OP140D	Plastic lateral	GaAs	0.1	—	20	40	2-10
OP145A	Plastic lateral	GaAs	0.4	—	20	40	2-12
OP145B	Plastic lateral	GaAs	0.3	0.55	20	40	2-12
OP145C	Plastic lateral	GaAs	0.2	0.4	20	40	2-12
OP145D	Plastic lateral	GaAs	0.1	—	20	40	2-12
OP163A	Plastic T-1	GaAs	1.4	—	20	18	2-14
OP163B	Plastic T-1	GaAs	1.4	2.20	20	18	2-14
OP163C	Plastic T-1	GaAs	0.85	1.60	20	18	2-14
OP163D	Plastic T-1	GaAs	0.28	—	20	18	2-14
OP164A	Plastic T-1	GaAs	1.4	—	20	18	2-16
OP164B	Plastic T-1	GaAs	1.4	2.20	20	18	2-16
OP164C	Plastic T-1	GaAs	0.85	1.60	20	18	2-16
OP164D	Plastic T-1	GaAs	0.28	—	20	18	2-16
OP165A	Plastic T-1	GaAs	1.95	3.70	20	18	2-18
OP165D	Plastic T-1	GaAs	1.40	—	20	18	2-18
OP165W	Plastic T-1	GaAs	0.5*	—	20	90	2-20
OP166A	Plastic T-1	GaAs	1.95	3.70	20	18	2-22
OP166D	Plastic T-1	GaAs	1.40	—	20	18	2-22
OP166W	Plastic T-1	GaAs	0.5*	—	20	90	2-24
OP168FA	Plastic end-looker	GaAs	0.48	—	20	104	2-26
OP168FB	Plastic end-looker	GaAs	0.43	0.73	20	104	2-26
OP168FC	Plastic end-looker	GaAs	0.27	—	20	104	2-26
OP169A	Plastic end-looker	GaAs	0.180	—	20	46	2-28
OP169B	Plastic end-looker	GaAs	0.108	0.220	20	46	2-28
OP169C	Plastic end-looker	GaAs	0.027	—	20	46	2-28
OP223	Pill, lensed	GaAlAs	1.0	—	50	24	2-30
OP224	Pill, lensed	GaAlAs	3.5	—	50	24	2-30
OP231	TO-46, lensed	GaAlAs	1.5	—	100	18	2-32
OP231W	TO-46	GaAlAs	1.5	—	100	50	2-34
OP232	TO-46, lensed	GaAlAs	2.0	6.0	100	18	2-32
OP232W	TO-46	GaAlAs	3.5	7.0	100	50	2-34
OP233	TO-46, lensed	GaAlAs	3.0	—	100	18	2-32

*mW

Wavelength at peak emission is GaAs = 935nm, GaAlAs = 890nm

Infrared-Light Emitting Diodes (IRED's)(cont)

OPTEK

Part No.	Case Style	Type	Output Power $E_{e(APT)}$ (mW/cm^2) Min	Max	Test Conditions I_F(mA)	Beam Angle (Deg.)	Page No.
OP240A	Plastic lateral	GaAlAs	0.60	—	20	40	2-36
OP240B	Plastic lateral	GaAlAs	0.40	1.20	20	40	2-36
OP240C	Plastic lateral	GaAlAs	0.20	0.86	20	40	2-36
OP240D	Plastic lateral	GaAlAs	0.05	—	20	40	2-36
OP245A	Plastic lateral	GaAlAs	0.60	—	20	40	2-38
OP245B	Plastic lateral	GaAlAs	0.40	1.20	20	40	2-38
OP245C	Plastic lateral	GaAlAs	0.20	0.86	20	40	2-38
OP245D	Plastic lateral	GaAlAs	0.05	—	20	40	2-38
OP265A	Plastic T-1	GaAlAs	2.70	—	20	18	2-40
OP265B	Plastic T-1	GaAlAs	1.65	4.70	20	18	2-40
OP265C	Plastic T-1	GaAlAs	0.54	3.30	20	18	2-40
OP265D	Plastic T-1	GaAlAs	0.54	—	20	18	2-40
OP265W	Plastic T-1	GaAlAs	1.0*	—	20	90	2-42
OP266A	Plastic T-1	GaAlAs	2.70	—	20	18	2-44
OP266B	Plastic T-1	GaAlAs	1.65	4.70	20	18	2-44
OP266C	Plastic T-1	GaAlAs	0.54	3.30	20	18	2-44
OP266D	Plastic T-1	GaAlAs	0.54	—	20	18	2-44
OP266W	Plastic T-1	GaAlAs	1.0*	—	20	90	2-46
OP268FA	Plastic end-looker	GaAlAs	0.64	—	20	104	2-48
OP268FB	Plastic end-looker	GaAlAs	0.45	0.99	20	104	2-48
OP268FC	Plastic end-looker	GaAlAs	0.36	—	20	104	2-48
OP269A	Plastic end-looker	GaAlAs	0.58	—	20	46	2-50
OP269B	Plastic end-looker	GaAlAs	0.42	0.82	20	46	2-50
OP269C	Plastic end-looker	GaAlAs	0.34	—	20	46	2-50
OP290A	Plastic T- 1 3/4	GaAlAs	210	—	1500	50	2-52
OP290B	Plastic T- 1 3/4	GaAlAs	180	300	1500	50	2-52
OP290C	Plastic T- 1 3/4	GaAlAs	150	—	1500	50	2-52
OP291A	Plastic T- 1 3/4	GaAlAs	16.0	—	100	50	2-52
OP291B	Plastic T- 1 3/4	GaAlAs	13.0	26.0	100	50	2-52
OP291C	Plastic T- 1 3/4	GaAlAs	10.0	—	100	50	2-52
OP292A	Plastic T- 1 3/4	GaAlAs	2.7	—	20	50	2-52
OP292B	Plastic T- 1 3/4	GaAlAs	2.2	4.4	20	50	2-52
OP292C	Plastic T- 1 3/4	GaAlAs	1.7	—	20	50	2-52
OP293A	Plastic TO-18	GaAlAs	16.0	—	100	60	2-56
OP293B	Plastic TO-18	GaAlAs	13.0	26.0	100	60	2-56
OP293C	Plastic TO-18	GaAlAs	10.0	—	100	60	2-56
OP294	Plastic T-1 3/4	GaAlAs	0.5	1.5	5	50	2-60
OP295A	Plastic T-1 3/4	GaAlAs	44.0	—	1500	20	2-62
OP295B	Plastic T-1 3/4	GaAlAs	33.0	77.0	1500	20	2-62
OP295C	Plastic T-1 3/4	GaAlAs	22.0	—	1500	20	2-62
OP296A	Plastic T-1 3/4	GaAlAs	3.6	—	100	20	2-62
OP296B	Plastic T-1 3/4	GaAlAs	2.6	6.6	100	20	2-62
OP296C	Plastic T-1 3/4	GaAlAs	1.6	—	100	20	2-62

*mW
Wavelength at peak emission is GaAs = 935nm, GaAlAs = 890nm

Infrared-Light Emitting Diodes (IRED's)(cont)

Part No.	Case Style	Type	Output Power $E_{e(APT)}$ (mW/cm²) Min	Max	Test Conditions I_F(mA)	Beam Angle (Deg.)	Page No.
OP297A	Plastic T-1 3/4	GaAlAs	0.7	—	20	20	2-62
OP297B	Plastic T-1 3/4	GaAlAs	0.5	1.3	20	20	2-62
OP297C	Plastic T-1 3/4	GaAlAs	0.3	—	20	20	2-62
OP298A	Plastic TO-18	GaAlAs	3.0	—	100	25	2-56
OP298B	Plastic TO-18	GaAlAs	2.4	4.8	100	25	2-56
OP298C	Plastic TO-18	GaAlAs	1.8	—	100	25	2-56
OP299	Plastic T-1 3/4	GaAlAs	0.15	0.45	5	20	2-60

*mW
Wavelength at peak emission is GaAs = 935nm, GaAlAs = 890nm
Consult product catalog for full test and electrical specifications

Photosensors

Part No.	Case Style	Light Current $I_{C(ON)}$ (mA) Min	Max	Test Conditions V_{CE}	E_e(mW/cm²)	Beam Angle (Deg.)	Page No.
OP300SL(1)	Pill, lensed	0.8	—	5.0	1.0	35	3-4
OP301SL(1)	Pill, lensed	0.8	2.4	5.0	1.0	35	3-4
OP302SL(1)	Pill, lensed	1.8	5.4	5.0	1.0	35	3-4
OP303SL(1)	Pill, lensed	3.6	12.0	5.0	1.0	35	3-4
OP304SL(1)	Pill, lensed	7.0	21.0	5.0	1.0	35	3-4
OP305SL(1)	Pill, lensed	14.0	—	5.0	1.0	35	3-4
OP505A	Plastic T-1	4.30	—	5.0	0.50	18	3-6
OP505B	Plastic T-1	2.15	5.95	5.0	0.50	18	3-6
OP505C	Plastic T-1	1.10	3.00	5.0	0.50	18	3-6
OP505D	Plastic T-1	0.55	—	5.0	0.50	18	3-6
OP505W	Plastic T-1	0.10	—	5.0	0.75	90	3-8
OP506A	Plastic T-1	4.30	—	5.0	0.50	18	3-10
OP506B	Plastic T-1	2.15	5.95	5.0	0.50	18	3-10
OP506C	Plastic T-1	1.10	3.00	5.0	0.50	18	3-10
OP506D	Plastic T-1	0.55	—	5.0	0.50	18	3-10
OP506W	Plastic T-1	0.10	—	5.0	0.75	90	3-12
OP508FA	Plastic end-looker	2.70	—	5.0	5.0	120	3-14
OP508FB	Plastic end-looker	0.65	5.10	5.0	5.0	120	3-14
OP508FC	Plastic end-looker	0.34	—	5.0	5.0	120	3-14
OP509A	Plastic end-looker	5.7	—	5.0	5.0	50	3-16
OP509B	Plastic end-looker	1.4	10.6	5.0	5.0	50	3-16
OP509C	Plastic end-looker	0.7	—	5.0	5.0	50	3-16
OP535A(1)	Plastic T-1	10.5	—	5.0	0.13	18	3-18
OP535B	Plastic T-1	3.5	32.0	5.0	0.13	18	3-18
OP535C	Plastic T-1	1.5	—	5.0	0.13	18	3-18

(1) Photodarlington
(2) Photodiode
All others are phototransistors
Part numbers with "SL" suffix are tested using Tungsten light source @ 2870K
All others are tested with an infrared LED light source

Photosensors (cont)

OPTEK

Part No.	Case Style	Light Current $I_{C(ON)}$ (mA) Min	Max	Test Conditions V_{CE}	E_e(mW/cm^2)	Beam Angle (Deg.)	Page No.
OP538FA(1)	Plastic end-looker	6.8	—	5.0	0.50	120	3-20
OP538FB(1)	Plastic end-looker	2.3	20.5	5.0	0.50	120	3-20
OP538FC(1)	Plastic end-looker	1.1	—	5.0	0.50	120	3-20
OP550A	Plastic lateral	2.55	—	5.0	1.0	60	3-22
OP550B	Plastic lateral	1.30	4.70	5.0	1.0	60	3-22
OP550C	Plastic lateral	0.25	2.40	5.0	1.0	60	3-22
OP550D	Plastic lateral	0.25	—	5.0	1.0	60	3-22
OP555A	Plastic lateral	2.55	—	5.0	1.0	60	3-24
OP555B	Plastic lateral	1.30	4.70	5.0	1.0	60	3-24
OP555C	Plastic lateral	0.25	2.40	5.0	1.0	60	3-24
OP555D	Plastic lateral	0.25	—	5.0	1.0	60	3-24
OP560A(1)	Plastic lateral	6.6	—	2.0	0.1	60	3-26
OP560B(1)	Plastic lateral	3.3	9.8	2.0	0.1	60	3-26
OP560C(1)	Plastic lateral	1.1	—	2.0	0.1	60	3-26
OP565A(1)	Plastic lateral	6.6	—	2.0	0.1	60	3-28
OP565B(1)	Plastic lateral	3.3	9.8	2.0	0.1	60	3-28
OP565C(1)	Plastic lateral	1.1	—	2.0	0.1	60	3-28
OP593A	Plastic TO-18	3.0	—	5.0	1.7	130	3-30
OP593B	Plastic TO-18	2.0	4.0	5.0	1.7	130	3-30
OP593C	Plastic TO-18	1.0	—	5.0	1.7	130	3-30
OP598A	Plastic TO-18	7.5	—	5.0	1.7	25	3-30
OP598B	Plastic TO-18	5.0	10.0	5.0	1.7	25	3-30
OP598C	Plastic TO-18	2.5	—	5.0	1.7	25	3-30
OP599A	Plastic T 1 3/4	2.35	—	5.0	0.25	20	3-34
OP599B	Plastic T 1 3/4	1.20	3.85	5.0	0.25	20	3-34
OP599C	Plastic T 1 3/4	0.40	1.95	5.0	0.25	20	3-34
OP599D	Plastic T 1 3/4	0.20	—	5.0	0.25	20	3-34
OP600A	Pill, lensed	1.2	—	5.0	2.5	35	3-36
OP600B	Pill, lensed	0.6	1.8	5.0	2.5	35	3-36
OP600C	Pill, lensed	0.3	—	5.0	2.5	35	3-36
OP641SL	Pill, lensed	0.5	3.0	5.0	20.0	35	3-38
OP642SL	Pill, lensed	2.0	5.0	5.0	20.0	35	3-38
OP643SL	Pill, lensed	4.0	8.0	5.0	20.0	35	3-38
OP644SL	Pill, lensed	7.0	22.0	5.0	20.0	35	3-38
OP800A	TO-18, lensed	3.60	—	5.0	0.5	25	3-40
OP800B	TO-18, lensed	1.80	5.40	5.0	0.5	25	3-40
OP800C	TO-18, lensed	0.90	3.60	5.0	0.5	25	3-40
OP800D	TO-18, lensed	0.45	—	5.0	0.5	25	3-40
OP800SL	TO-18, lensed	0.5	—	5.0	5.0	25	3-42
OP800WSL	TO-18	0.3	—	5.0	5.0	75	3-44
OP801SL	TO-18, lensed	0.5	3.0	5.0	5.0	25	3-42
OP801WSL	TO-18	0.5	3.0	5.0	5.0	75	3-44
OP802SL	TO-18, lensed	2.0	5.0	5.0	5.0	25	3-42
OP802WSL	TO-18	2.5	—	5.0	5.0	75	3-44

(1) Photodarlington
(2) Photodiode
All others are phototransistors
Part numbers with "SL" suffix are tested using Tungsten light source @ 2870K
All others are tested with an infrared LED light source

Photosensors (cont)

Part No.	Case Style	Light Current $I_{C(ON)}$ (mA) Min	Max	Test Conditions V_{CE}	E_e(mW/cm^2)	Beam Angle (Deg.)	Page No.
OP803SL	TO-18, lensed	4.0	8.0	5.0	5.0	25	3-42
OP804SL	TO-18, lensed	7.0	22.0	5.0	5.0	25	3-42
OP805SL	TO-18, lensed	15.0	—	5.0	5.0	25	3-42
OP830SL(1)	TO-18, lensed	15.0	—	5.0	0.5	25	3-46
OP830WSL(1)	TO-18	4.0	—	5.0	0.5	75	3-48
OP900SL(2)	Pill, lensed	8.0	—	10.0	20.0	35	3-50
OP913SL(2)	TO-5, lensed	0.12	—	5.0	5.0	20	3-52
OP913WSL(2)	TO-5	0.04	—	5.0	5.0	60	3-52

(1) Photodarlington
(2) Photodiode
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Photologic™ Sensors

Part No.	Case Style	Positive Threshold Irradiance* $E_eT(+)$ (mW/cm^2) Min	Max	Output Circuit	Page No.
OPL550	Plastic lateral	0.25	2.4	Totem-Pole Buffer	4-4
OPL550A	Plastic lateral	0.25	1.4	Totem-Pole Buffer	4-4
OPL550B	Plastic lateral	0.65	1.9	Totem-Pole Buffer	4-4
OPL550-OC	Plastic lateral	0.25	2.4	Open-Collector Buffer	4-4
OPL550-OCA	Plastic lateral	0.25	1.4	Open-Collector Buffer	4-4
OPL550-OCB	Plastic lateral	0.65	1.9	Open-Collector Buffer	4-4
OPL551	Plastic lateral	0.25	2.4	Totem-Pole Inverter	4-4
OPL551A	Plastic lateral	0.25	1.4	Totem-Pole Inverter	4-4
OPL551B	Plastic lateral	0.65	1.9	Totem-Pole Inverter	4-4
OPL551-OC	Plastic lateral	0.25	2.4	Open-Collector Inverter	4-4
OPL551-OCA	Plastic lateral	0.25	1.4	Open-Collector Inverter	4-4
OPL551-OCB	Plastic lateral	0.65	1.9	Open-Collector Inverter	4-4
OPL560	Plastic lateral	0.09	0.55	Totem-Pole Buffer	4-8
OPL560A	Plastic lateral	0.09	0.36	Totem-Pole Buffer	4-8
OPL560B	Plastic lateral	0.18	0.55	Totem-Pole Buffer	4-8
OPL560-OC	Plastic lateral	0.09	0.55	Open-Collector Buffer	4-8
OPL560-OCA	Plastic lateral	0.09	0.36	Open-Collector Buffer	4-8
OPL560-OCB	Plastic lateral	0.18	0.55	Open-Collector Buffer	4-8
OPL561	Plastic lateral	0.09	0.55	Totem-Pole Inverter	4-8
OPL561A	Plastic lateral	0.09	0.36	Totem-Pole Inverter	4-8
OPL561B	Plastic lateral	0.18	0.55	Totem-Pole Inverter	4-8
OPL561-OC	Plastic lateral	0.09	0.55	Open-Collector Inverter	4-8
OPL561-OCA	Plastic lateral	0.09	0.36	Open-Collector Inverter	4-8
OPL561-OCB	Plastic lateral	0.18	0.55	Open-Collector Inverter	4-8
OPL562	Plastic lateral	0.025	0.23	Totem-Pole Buffer	4-8
OPL562A	Plastic lateral	0.025	0.14	Totem-Pole Buffer	4-8
OPL562B	Plastic lateral	0.070	0.23	Totem-Pole Buffer	4-8

* λ_i = 935nm Note: The OPL560 & OPL810 series include a voltage regulator allowing operating voltages from 4.5 to 16.0 volts.

Photologic™ Sensors (cont)

Part No.	Case Style	Positive Threshold Irradiance* $E_eT(+)$ (mW/cm^2) Min	Max	Output Circuit	Page No.
OPL562-OC	Plastic lateral	0.025	0.23	Open-Collector Buffer	4-8
OPL562-OCA	Plastic lateral	0.025	0.14	Open-Collector Buffer	4-8
OPL562-OCB	Plastic lateral	0.070	0.23	Open-Collector Buffer	4-8
OPL563	Plastic lateral	0.025	0.23	Totem-Pole Inverter	4-8
OPL563A	Plastic lateral	0.025	0.14	Totem-Pole Inverter	4-8
OPL563B	Plastic lateral	0.070	0.23	Totem-Pole Inverter	4-8
OPL563-OC	Plastic lateral	0.025	0.23	Open-Collector Inverter	4-8
OPL563-OCA	Plastic lateral	0.025	0.14	Open-Collector Inverter	4-8
OPL563-OCB	Plastic lateral	0.070	0.23	Open-Collector Inverter	4-8
OPL583	Plastic lateral	0.050	0.25	Dual Channel	4-12
OPL800	TO-18, lensed	0.05	0.60	Totem-Pole Buffer	4-16
OPL800-OC	TO-18, lensed	0.05	0.60	Open-Collector Buffer	4-16
OPL801	TO-18, lensed	0.05	0.60	Totem-Pole Inverter	4-16
OPL801-OC	TO-18, lensed	0.05	0.60	Open-Collector Inverter	4-16
OPL810	TO-18, lensed	0.015	0.20	Totem-Pole Buffer	4-20
OPL810-OC	TO-18, lensed	0.015	0.20	Open-Collector Buffer	4-20
OPL811	TO-18, lensed	0.015	0.20	Totem-Pole Inverter	4-20
OPL811-OC	TO-18, lensed	0.015	0.20	Open-Collector Inverter	4-20
OPL812	TO-18, lensed	0.005	0.10	Totem-Pole Buffer	4-20
OPL812-OC	TO-18, lensed	0.005	0.10	Open-Collector Buffer	4-20
OPL813	TO-18, lensed	0.005	0.10	Totem-Pole Inverter	4-20
OPL813-OC	TO-18, lensed	0.005	0.10	Open-Collector Inverter	4-20

* λ_i = 935nm Note: The OPL560 & OPL810 series include a voltage regulator allowing operating voltages from 4.5 to 16.0 volts.

Emitter and Photosensor Matched Pairs

Part No.	Case Style	Light Current $I_{C(ON)}$ mA Min	Max	Test Conditions V_{CE}	I_F (mA)	Page No.
OPS665	Plastic T-1	0.5	—	5.0	20	5-2
OPS666	Plastic T-1	1.0	10.0	5.0	20	5-2
OPS667	Plastic T-1	5.0	—	5.0	20	5-2
OPS690	Plastic lateral	100*	—	10.0	20	5-4
OPS691	Plastic lateral	500*	—	10.0	20	5-4
OPS692	Plastic lateral	1.0	—	10.0	20	5-4
OPS693	Plastic lateral	2.0	—	10.0	20	5-4
OPS695	Plastic lateral	100*	—	10.0	20	5-6
OPS696	Plastic lateral	500*	—	10.0	20	5-6
OPS697	Plastic lateral	1.0	—	10.0	20	5-6
OPS698	Plastic lateral	2.0	—	10.0	20	5-6

* µA

Optically Coupled Isolators

Part No.	Case Style	CTR % Min	CTR % Max	VCE	IF mA	Isolation kVDC	Page No.
OPI110	Plastic Axial	12.5	—	5.0	10.0	10.0	6-4
OPI110A	Plastic Axial	25.0	—	5.0	10.0	10.0	6-4
OPI110B	Plastic Axial	50.0	125	5.0	10.0	10.0	6-4
OPI110C	Plastic Axial	100.0	—	5.0	10.0	10.0	6-4
OPI113	Plastic Axial	50.0	—	2.0	5.0	10.0	6-4
OPI120	Hermetic Axial	20.0	—	5.0	10.0	15.0	6-6
OPI123	Hermetic Axial	50.0	—	2.0	10.0	15.0	6-6
OPI125	Hermetic Axial	Buffer, Totem Pole				15.0	6-8
OPI126	Hermetic Axial	Buffer, Open-Collector				15.0	6-8
OPI127	Hermetic Axial	Inverter, Totem-Pole				15.0	6-8
OPI128	Hermetic Axial	Inverter, Open-Collector				15.0	6-8
OPI1264	Plastic Axial	12.5	—	5.0	10.0	10.0	6-12
OPI1264A	Plastic Axial	25.0	—	5.0	10.0	10.0	6-12
OPI1264B	Plastic Axial	50.0	125	5.0	10.0	10.0	6-12
OPI1264C	Plastic Axial	100.0	—	5.0	10.0	10.0	6-12
OPI1266	Custom Dip	High Speed Photologic				16.0	6-14
OPI150	Hermetic Axial	10.0	—	5.0	10.0	50.0	6-16
OPI153	Hermetic Axial	25.0	—	5.0	20.0	50.0	6-16
OPI7002	Custom Dip	20.0	—	5.0	10.0	6.0	6-18
OPI7010	Custom Dip	100.0	—	5.0	10.0	6.0	6-18
OPI7320	Custom Dip	200.0	—	5.0	5.0	6.0	6-20
OPI7340	Custom Dip	400.0	—	5.0	5.0	6.0	6-20

Fiber Optics PIN Photodiodes & Receivers

Part No.	Case Style	Flux Responsivity (A/W) Min	Flux Responsivity (A/W) Typ	Output Rise Time (ns) Typ	Page No.
OPF2404	Plastic Dip	5.1(1)	7.0	14.0	8-6
OPF2406	Plastic Dip	5.0(1)	7.0	3.3	8-8
OPF2414	Plastic Dip	5.1(1)	7.0	14.0	8-6
OPF2416	Plastic Dip	5.0(1)	7.0	3.3	8-8
OPF420	Hermetic TO-46	0.45	0.55	6.0	8-46
OPF421	SMA	0.45	0.55	6.0	8-48
OPF422	ST(2)	0.45	0.55	6.0	8-50
OPF430	Hermetic TO-46	0.45	0.55	1.0	8-52
OPF431	SMA	0.45	0.55	1.0	8-54
OPF432	ST(2)	0.45	0.55	1.0	8-56
OPF470	Plastic TO-46	0.45	0.55	6.0	8-58
OPF471	SMA	0.45	0.55	6.0	8-60
OPF472	ST(2)	0.45	0.55	6.0	8-62
OPF480	Plastic TO-46	0.45	0.55	1.0	8-64
OPF481	SMA	0.45	0.55	1.0	8-66
OPF482	ST(2)	0.45	0.55	1.0	8-68
OPF540	Plastic TO-46	5.1(1)	7.0	14.0	8-70
OPF541	SMA	5.1(1)	7.0	14.0	8-72
OPF542	ST(2)	5.1(1)	7.0	14.0	8-74

(1) mV/μW

Fiber Optics (850nm) Light Emitting Diodes

Part No.	Case Style	Radiant Output[3] Power (µW) Min	Typ	Test Conditions I_F (mA)		Output Rise Time (ns) Typ	Page No.
OPF1402	Plastic Dip	-19.0 dBm	-16.0 dBm	60	(62.5µm core)	4.0	8-4
OPF1404	Plastic Dip	-15.0 dBm	-12.0 dBm	60	(62.5µm core)	4.0	8-4
OPF1412	Plastic Dip	-19.0 dBm	-16.0 dBm	60	(62.5µm core)	4.0	8-4
OPF1414	Plastic Dip	-15.0 dBm	-12.0 dBm	60	(62.5µm core)	4.0	8-4
OPF320A	Hermetic TO-46	15.0	19.0	100	(50 µm core)	6.0	8-10
OPF320B	Hermetic TO-46	10.0	12.5	100	(50 µm core)	6.0	8-10
OPF320C	Hermetic TO-46	5.0	7.5	100	(50 µm core)	6.0	8-10
OPF321A	SMA	15.0	19.0	100	(50 µm core)	6.0	8-12
OPF321B	SMA	10.0	12.5	100	(50 µm core)	6.0	8-12
OPF321C	SMA	5.0	7.5	100	(50 µm core)	6.0	8-12
OPF322A	ST(2)	15.0	19.0	100	(50 µm core)	6.0	8-14
OPF322B	ST(2)	10.0	12.5	100	(50 µm core)	6.0	8-14
OPF322C	ST(2)	5.0	7.5	100	(50 µm core)	6.0	8-14
OPF340A	Hermetic TO-46	20.0	25.0	100	(50 µm core)	4.5	8-16
OPF340B	Hermetic TO-46	15.0	18.0	100	(50 µm core)	4.5	8-16
OPF340C	Hermetic TO-46	10.0	12.5	100	(50 µm core)	4.5	8-16
OPF340D	Hermetic TO-46	5.0	7.5	100	(50 µm core)	4.5	8-16
OPF341A	SMA	20.0	25.0	100	(50 µm core)	4.5	8-18
OPF341B	SMA	15.0	18.0	100	(50 µm core)	4.5	8-18
OPF341C	SMA	10.0	12.5	100	(50 µm core)	4.5	8-18
OPF341D	SMA	5.0	7.5	100	(50 µm core)	4.5	8-18
OPF342A	ST(2)	20.0	25.0	100	(50 µm core)	4.5	8-20
OPF342B	ST(2)	15.0	18.0	100	(50 µm core)	4.5	8-20
OPF342C	ST(2)	10.0	12.5	100	(50 µm core)	4.5	8-20
OPF342D	ST(2)	5.0	7.5	100	(50 µm core)	4.5	8-20
OPF345A	Hermetic TO-46	20.0	25.0	100	(50 µm core)	3.5	8-22
OPF345B	Hermetic TO-46	15.0	18.0	100	(50 µm core)	3.5	8-22
OPF345C	Hermetic TO-46	10.0	12.5	100	(50 µm core)	3.5	8-22
OPF345D	Hermetic TO-46	5.0	7.5	100	(50 µm core)	3.5	8-22
OPF346A	SMA	20.0	25.0	100	(50 µm core)	3.5	8-24
OPF346B	SMA	15.0	18.0	100	(50 µm core)	3.5	8-24
OPF346C	SMA	10.0	12.5	100	(50 µm core)	3.5	8-24
OPF346D	SMA	5.0	7.5	100	(50 µm core)	3.5	8-24
OPF347A	ST(2)	20.0	25.0	100	(50 µm core)	3.5	8-26
OPF347B	ST(2)	15.0	18.0	100	(50 µm core)	3.5	8-26
OPF347C	ST(2)	10.0	12.5	100	(50 µm core)	3.5	8-26
OPF347D	ST(2)	5.0	7.5	100	(50 µm core)	3.5	8-26
OPF370A	Plastic TO-46	25.0	29.0	100	(50 µm core)	6.0	8-28
OPF370B	Plastic TO-46	15.0	19.0	100	(50 µm core)	6.0	8-28
OPF370C	Plastic TO-46	10.0	12.5	100	(50 µm core)	6.0	8-28
OPF370D	Plastic TO-46	5.0	7.5	100	(50 µm core)	6.0	8-28

(2) ST is a registered trademark of AT&T
(3) Fiber Optic components tested with graded index fiber 50µM core: NA = 0.20

Fiber Optics (850nm) Light Emitting Diodes (cont)

Part No.	Case Style	Radiant Output[3] Power (μW) Min	Typ	Test Conditions I_F (mA)	Output Rise Time (ns) Typ	Page No.
OPF371A	SMA	25.0	29.0	100 (50 μm core)	6.0	8-30
OPF371B	SMA	15.0	19.0	100 (50 μm core)	6.0	8-30
OPF371C	SMA	10.0	12.5	100 (50 μm core)	6.0	8-30
OPF371D	SMA	5.0	7.5	100 (50 μm core)	6.0	8-30
OPF372A	ST[2]	25.0	29.0	100 (50 μm core)	6.0	8-32
OPF372B	ST[2]	15.0	19.0	100 (50 μm core)	6.0	8-32
OPF372C	ST[2]	10.0	12.5	100 (50 μm core)	6.0	8-32
OPF372D	ST[2]	5.0	7.5	100 (50 μm core)	6.0	8-32
OPF390A	Plastic TO-46	20.0	25.0	100 (50 μm core)	4.5	8-34
OPF390B	Plastic TO-46	15.0	18.0	100 (50 μm core)	4.5	8-34
OPF390C	Plastic TO-46	10.0	12.5	100 (50 μm core)	4.5	8-34
OPF390D	Plastic TO-46	5.0	7.5	100 (50 μm core)	4.5	8-34
OPF391A	SMA	20.0	25.0	100 (50 μm core)	4.5	8-36
OPF391B	SMA	15.0	18.0	100 (50 μm core)	4.5	8-36
OPF391C	SMA	10.0	12.5	100 (50 μm core)	4.5	8-36
OPF391D	SMA	5.0	7.5	100 (50 μm core)	4.5	8-36
OPF392A	ST[2]	20.0	25.0	100 (50 μm core)	4.5	8-38
OPF392B	ST[2]	15.0	18.0	100 (50 μm core)	4.5	8-38
OPF392C	ST[2]	10.0	12.5	100 (50 μm core)	4.5	8-38
OPF392D	ST[2]	5.0	7.5	100 (50 μm core)	4.5	8-38
OPF395A	Plastic TO-46	20.0	25.0	100 (50 μm core)	3.5	8-40
OPF395B	Plastic TO-46	15.0	18.0	100 (50 μm core)	3.5	8-40
OPF395C	Plastic TO-46	10.0	12.5	100 (50 μm core)	3.5	8-40
OPF395D	Plastic TO-46	5.0	7.5	100 (50 μm core)	3.5	8-40
OPF396A	SMA	20.0	25.0	100 (50 μm core)	3.5	8-42
OPF396B	SMA	15.0	18.0	100 (50 μm core)	3.5	8-42
OPF396C	SMA	10.0	12.5	100 (50 μm core)	3.5	8-42
OPF396D	SMA	5.0	7.5	100 (50 μm core)	3.5	8-42
OPF397A	ST[2]	20.0	25.0	100 (50 μm core)	3.5	8-44
OPF397B	ST[2]	15.0	18.0	100 (50 μm core)	3.5	8-44
OPF397C	ST[2]	10.0	12.5	100 (50 μm core)	3.5	8-44
OPF397D	ST[2]	5.0	7.5	100 (50 μm core)	3.5	8-44

(2) ST is a registered trademark of AT&T
(3) Fiber Optic components tested with graded index fiber 50μM core: NA = 0.20

OPTEK

Hybrid Assemblies
Infrared Emitting Diodes

Part No.	Type	Output Power	Test Conditions I_F (mA)	Case Style	Page No.
OPR5200	GaAlAs	350 µW (min)	20	Surface Mount	9-22

Phototransistor

Part No.	Light Current	Test Conditions V_{CE} (V)	E_e (mW/cm²)	Case Style	Page No.
OPR5500	36 µA (min)	5	.15	Surface Mount	9-23

Photodiodes

Part No.	Responsivity (A/W)	Test Conditions ϕ_e (µW)	Size (mm²)	Case Style	Page No.
OPR2100	0.45	10	6 × 2.9	Surface Mount	9-16
OPR5910	0.45	10	0.73	Surface Mount	9-24
OPR5911	0.45	10	1.0	Surface Mount	9-25
OPR5913	0.40	10	25	Surface Mount	9-26
OPR5915	0.45	10	7.3	Surface Mount	9-27
OPR5925	0.45	10	4 × 0.64	Surface Mount	9-28
OPR5929	0.45	10	6 × 2.9	Surface Mount	9-29

Optical Comparator Arrays

Part No.	I_{CC} (max) (mA)	Channels	Case Style	Page No.
OPR5001B	7	1	Surface Mount	9-17
OPR5002B	14	2	Surface Mount	9-17
OPR5003B	20	3	Surface Mount	9-17

Reflective Object Sensor

Part No.	$I_{C(ON)}$	Test Conditions I_F (mA)	V_{CE} (V)	Case Style	Page No.
OPR5005	100 µA (min)	20	5	Surface Mount	9-20

Hallogic™ Hall Effect Sensors

Part No.	Operate Point Gauss			Release Point Gauss			Hysteresis Gauss			Case Style	Page No.
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
OH090U(1)	0	90	180	-100	65	100	10	25	100	Plastic Lateral	10-4
OH180U(1)	70	180	290	0	140	230	20	40	120	Plastic Lateral	10-6
OH360U(1)	235	300	465	120	235	325	30	65	200	Plastic Lateral	10-8
OHN3013U(1)		300	450	25	235		30	65		Plastic Lateral	10-10
OHN3019U(1)		300	500	125	235		50	65		Plastic Lateral	10-12
OHS3019U(1)		300	500	125	235		50	65		Plastic Lateral	10-12
OHN3020U(1)		230	350	50	180		20	50		Plastic Lateral	10-14
OHS3020U(1)		230	350	50	180		20	50		Plastic Lateral	10-14

(1) $T_A = 25° C$

Hallogic™ Hall Effect Sensors (cont)

Part No.	Operate Point Gauss			Release Point Gauss			Hysteresis Gauss			Case Style	Page No.
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
OHN3030U(1)		205	250	0	160		20	45		Plastic Lateral	10-16
OHS3030U(1)		205	250	0	160		20	45		Plastic Lateral	10-16
OHN3040U(1)		150	200	50	115		20	35		Plastic Lateral	10-18
OHS3040U(1)		150	200	50	115		20	35		Plastic Lateral	10-18
OHN3075U(1)	50	100	250	-250	-100	-50	100	200	500	Plastic Lateral	10-20
OHS3075U(1)	50	100	250	-250	-100	-50	100	200	500	Plastic Lateral	10-20
OHN3113U(2)			510	20			10			Plastic Lateral	10-22
OHN3119U(2)	100		545	50		495	50			Plastic Lateral	10-24
OHS3119U(3)	45		575	25		555	20			Plastic Lateral	10-24
OHN3120U(2)	70		425	50		405	20			Plastic Lateral	10-26
OHS3120U(3)	35		450	25		430	20			Plastic Lateral	10-26
OHN3130U(2)			175	-175			20			Plastic Lateral	10-28
OHS3130U(3)			200	-200			20			Plastic Lateral	10-28
OHN3131U(2)	-75		95	-95		85	10			Plastic Lateral	10-30
OHS3131U(3)	-115		135	-135		125	10			Plastic Lateral	10-30
OHN3140U(2)	45		260	25		240	20			Plastic Lateral	10-32
OHS3140U(3)	45		270	25		250	20			Plastic Lateral	10-32
OHN3175U(2)	15		180	-180		-15	80			Plastic Lateral	10-34
OHS3175U(3)	10		260	-10		-260	60			Plastic Lateral	10-34
OHN3177U(2)	25		150	-150		-25	50			Plastic Lateral	10-36
OHS3177U(3)	25		200	-200		-25	50			Plastic Lateral	10-36

Operate Point at Temperature, T_A

Note:
(1) $T_A = 25^oC$
(2) $T_A = -20^oC$ to 85^oC
(3) $T_A = -40^oC$ to 125^oC

Reflective Object Sensors

Part No.	Output Type	Coupled Light Current $I_{C(ON)}$ Min*	Test Conditions I_F (mA)	V_{CE} (V)	d (inch)	Page No.
OPB606A	PT	500 µA	20	5.0	0.110	11-4
OPB606B	PT	350 µA	20	5.0	0.110	11-4
OPB606C	PT	200 µA	20	5.0	0.110	11-4
OPB607A	PD	25 mA	20	5.0	0.110	11-6
OPB607B	PD	17 mA	20	5.0	0.110	11-6
OPB607C	PD	10 mA	20	5.0	0.110	11-6
OPB700(AL)	PT	25 µA	40	5.0	0.200	11-8
OPB701(AL)	PD	2.0 mA	40	5.0	0.200	11-10
OPB703(W)	PT	200 µA	40	5.0	0.150	11-12
OPB704(W)	PT	200 µA	40	5.0	0.150	11-12
OPB705(W)	PT	100 µA	40	5.0	0.150	11-12
OPB706A	PT	500 µA	20	5.0	0.050	11-16
OPB706B	PT	350 µA	20	5.0	0.050	11-16
OPB706C	PT	200 µA	20	5.0	0.050	11-16

d = distance from the assembly face to the reflective surface
* Test surface is an Eastman Kodak neutral white test card

Reflective Object Sensors (cont)

Part No.	Output Type	Coupled Light Current $I_{C(ON)}$ Min*	Test Conditions I_F (mA)	V_{CE} (V)	d (inch)	Page No.
OPB707A	PD	25 mA	20	5.0	0.050	11-18
OPB707B	PD	17 mA	20	5.0	0.050	11-18
OPB707C	PD	10 mA	20	5.0	0.050	11-18
OPB708	PT	10 µA	40	5.0	0.150	11-20
OPB709	PD	1.0 mA	40	5.0	0.150	11-20
OPB710(F)	PT	150 µA	50	5.0	0.250	11-24
OPB711	PT	350 µA	20	5.0	0.080	11-26
OPB712	PD	20 mA	20	5.0	0.080	11-28
OPB730(F)	PD	1.0 mA	50	5.0	0.250	11-30
OPB740(W)	PT	50 µA	40	5.0	0.150	11-32
OPB741(W)	PT	50 µA	40	5.0	0.150	11-32
OPB742(W)	PT	10 µA	40	5.0	0.150	11-32
OPB743(W)	PT	200 µA	40	5.0	0.150	11-32
OPB744(W)	PT	200 µA	40	5.0	0.150	11-32
OPB745(W)	PD	1.0 mA	40	5.0	0.150	11-36
OPB750N	PT	500 µA	30	5.0	0.080	11-40
OPB750T	PT	500 µA	30	5.0	0.080	11-42
OPB755N	PT	500 µA	30	5.0	0.080	11-44
OPB755T	PT	500 µA	30	5.0	0.080	11-46

d = distance from the assembly face to the reflective surface
* Test surface is an Eastman Kodak neutral white test card

Reflective Object Sensors - Photologic™

Part No.	Output Type	Electrical Output	Page No.
OPB760N Series	logic	See Below	11-48
OPB760T Series	logic	See Below	11-51
OPB770N Series	logic	See Below	11-54
OPB770T Series	logic	See Below	11-57

Part Number Guide

OPB 7 X X X

- OPB — Optek Assembly
- 7 — Reflective Sensor Family Photologic™ Photo Integrated Circuit
- X — 6 - PC Board Mounting; 7 - Wire Leads with Connector
- X — Electrical Specification Options
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- X — Mounting Configurations
  - T - Two Mounting Tabs
  - N - No Mounting Tabs

Slotted Optical Switches - Phototransistor

Part No.	Coupled Light Current $I_{C(ON)}$ Min	Test Conditions I_F (mA)	V_{CE} (V)	Slot Width/ Lead Spacing (Inches)	Page No.
CNY36	200 µA	20	10.0	0.120/0.220	12-4
OPB610	1 mA	5	5.0	0.15/0.275	12-10
OPB620	1 mA	5	5.0	0.19/0.320	12-16
OPB660N	600 µA	10	5.0	0.125/0.320	12-22
OPB660T	600 µA	10	5.0	0.125/0.320	12-22
OPB804	500 µA	20	10.0	0.155/0.300	12-54
OPB806	0.40 mA	20	0.5	0.125/NA	12-56
OPB818	100 µA	20	10.0	0.200/0.400	12-58
OPB820	500 µA	20	5.0	0.080/0.275	12-60
OPB820S3	60 µA	20	5.0	0.080/0.275	12-60
OPB820S5	300 µA	20	5.0	0.080/0.275	12-60
OPB820S10	400 µA	20	5.0	0.080/0.275	12-60
OPB821	500 µA	20	5.0	0.080/Wire	12-62
OPB821S3	60 µA	20	5.0	0.080/Wire	12-62
OPB821S5	300 µA	20	5.0	0.080/Wire	12-62
OPB821S10	400 µA	20	5.0	0.080/Wire	12-62
OPB822S(2)	250 µA	20	10.0	0.090/0.300	12-64
OPB822SD(2)	100 µA	20	10.0	0.090/0.300	12-64
OPB825(A)(B)	500 µA	20	10.0	0.160/0.300	12-66
OPB826S(3)	250 µA	20	10.0	0.100/0.740	12-68
OPB826SD(3)	100 µA	20	10.0	0.100/0.740	12-68
OPB827A(B)(C)(D)	1.8 mA	20	0.6	0.125/0.300	12-70
OPB828A(B)(C)(D)	1.8 mA	20	0.6	0.125/0.220	12-72
OPB829A(B)(C)(D)	1.8 mA	20	0.6	0.125/Wire	12-74
OPB844A(B)	1.8 mA	20	0.6	0.125/0.300	12-84
OPB845A(B)	1.8 mA	20	0.6	0.125/0.300	12-86
OPB847	4.0 mA	20	10.0	0.100/0.300	12-88
OPB848	1.0 mA	20	10.0	0.100/0.300	12-88
OPB852A1	1.0 mA	20	5.0	0.125/0.290	12-92
OPB852A2	2.0 mA	20	5.0	0.125/0.290	12-92
OPB852A3	4.0 mA	20	5.0	0.125/0.290	12-92
OPB853A1(1)	2.5 mA	5	1.5	0.125/0.290	12-94
OPB853A2(1)	5.0 mA	5	1.5	0.125/0.290	12-94
OPB853A3(1)	10.0 mA	5	1.5	0.125/0.290	12-94
OPB854A1	3.0 mA	16	1.0	0.100/0.300	12-96
OPB854A2	3.0 mA	16	1.0	0.100/0.300	12-98
OPB854A3	3.0 mA	16	1.0	0.100/0.300	12-100
OPB854B1	1.0 mA	20	10.0	0.100/0.300	12-96
OPB854B2	1.0 mA	20	10.0	0.100/0.300	12-98
OPB854B3	1.0 mA	20	10.0	0.100/0.300	12-100
OPB855	500 µA	20	5.0	0.205/0.380	12-102
OPB856	1.8 mA	20	5.0	Variable	12-104
OPB857	1.5 mA	20	10.0	0.15/Wire	12-106
OPB859	250 µA	20	10.0	0.125/0.220	12-108

(1) Photodarlington Output all others Phototransistor
(2) Dual channel horizontal
(3) Dual channel vertical

Slotted Optical Switches - Phototransistor

OPTEK

Part No.	Electrical Characteristics	Slot Width/ Lead Spacing	Page No.
OPB800L/OPB810L Series	See Below	0.375/0.570	12-46
OPB800W/OPB810W Series	See Below	0.375/ NA	12-50
OPB830L/OPB840L Series	See Below	0.125/ *	12-76
OPB830W/OPB840W Series	See Below	0.125/ NA	12-80
OPB860/OPB870 Series	See Below	0.125/ *	12-110
OPB880/OPB890 Series	See Below	0.125/ NA	12-114

Electrical characteristics

	Collector-Emitter Saturation Voltage	**Max.**	**Test Conditions**
$V_{CE(SAT)}$	Parameter A	0.4V	$I_C = 400\ \mu A$, $I_F = 20mA$
	Parameter B	0.4V	$I_C = 800\ \mu A$, $I_F = 10mA$
	Parameter C	0.6V	$I_C = 1800\ \mu A$, $I_F = 20mA$
	On-State Collector Current	**Min.**	**Test Conditions**
$I_{C(ON)}$	Parameter A	500μA	$V_{CE} = 10V$, $I_F = 20mA$
	Parameter B	1000μA	$V_{CE} = 5V$, $I_F = 10mA$
	Parameter C	1800μA	$V_{CE} = 0.6V$, $I_F = 20mA$

Part Number Guide

OPB 8 X X X X X

Optek Assembly Prefix

Slotted Optical Switch
8 = Phototransistor Output

Housing
0 = Wide Gap Transmissive
1 = Wide Gap Opaque
3 = Side Mount Transmissive
4 = Side Mount Opaque
6 = PC Termination Transmissive
7 = PC Termination Opaque
8 = Wire Termination Transmissive
9 = Wire Termination Opaque

Mechanical and Electrical Specification Variations
0 = Electrical parameter A lead spacing 0.320" (8.13mm)
1 = Electrical parameter B lead spacing 0.320" (8.13mm)
2 = Electrical parameter C lead spacing 0.320" (8.13mm)
5 = Electrical parameter A lead spacing 0.220" (5.59mm)
6 = Electrical parameter B lead spacing 0.220" (5.59mm)
7 = Electrical parameter C lead spacing 0.220" (5.59mm)

Mounting Configurations
T = Both mounting tabs
N = No tabs
L = Single mounting tab,Emitter side
P = Single mounting tab, Sensor side
Wide Gap and Side Mount
W = Wire Termination
L = PC Lead Termination

Aperture width in front of LED
5 = 0.050" (1.27mm) *1 = 0.010"(0.25mm)
*Available only with electrical parameter A

Aperture Width in front of sensor
5 = 0.050" (1.27mm)
1 = 0.010" (0.25mm)

Wide gap switch: lead spacing is 0.570" (14.48mm) Electrical specifications 0,1& 2

Slotted Optical Switches - Photologic™

Part No.	Electrical Characteristics	Slot Width/ Lead Spacing (Inches)	Page No.
OPB120A	Buffer Totem-Pole	0.080/0.275	12-6
OPB120B	Buffer Totem-Pole	0.080/0.275	12-6
OPB121A	Buffer Open-Collector	0.080/0.275	12-6
OPB121B	Buffer Open-Collector	0.080/0.275	12-6
OPB122A	Inverter Totem-Pole	0.080/0.275	12-6
OPB122B	Inverter Totem-Pole	0.080/0.275	12-6
OPB123A	Inverter Open-Collector	0.080/0.275	12-6
OPB123B	Inverter Open-Collector	0.080/0.275	12-6
OPB615	Buffer, 10K Ω	0.150/0.275	12-12
OPB616	Buffer, Open-Collector	0.150/0.275	12-12
OPB617	Inverter, 10K Ω	0.150/0.275	12-12
OPB618	Inverter, Open-Collector	0.150/0.275	12-12
OPB625	Buffer, 10K Ω	0.190/0.320	12-18
OPB626	Buffer, Open-Collector	0.190/0.320	12-18
OPB627	Inverter, 10K Ω	0.190/0.320	12-18
OPB628	Inverter, Open-Collector	0.190/0.320	12-18
OPB665N	Buffer, 10K Ω	0.125/0.320	12-26
OPB665T	Buffer, 10K Ω	0.125/0.320	12-26
OPB666N	Buffer, Open-Collector	0.125/0.320	12-26
OPB666T	Buffer, Open-Collector	0.125/0.320	12-26
OPB667N	Inverter, 10K Ω	0.125/0.320	12-26
OPB667T	Inverter, 10K Ω	0.125/0.320	12-26
OPB668N	Inverter, Open-Collector	0.125/0.320	12-26
OPB668T	Inverter, Open-Collector	0.125/0.320	12-26
OPB900L/OPB910L Series	See Next Page	0.375/0.570	12-118
OPB900W/OPB910W Series	See Next Page	0.375/NA	12-122
OPB930/OPB940L Series	See Next Page	0.125/0.320	12-126
OPB930W/OPB940W	See Next Page	0.125/NA	12-130
OPB960/OPB970	See Next Page	0.125/0.320	12-134
OPB980/OPB990	See Next Page	0.125/NA	12-140

Part Number Guide

OPB 9 X X X X X

Optek Assembly Prefix — OPB

Slotted Optical Switch — 9
9 = Photologic™ Output

Housing Material — first X
0 = Wide Gap Transmissive
1 = Wide Gap Opaque
3 = Side Mount Transmissive
4 = Side Mount Opaque
6 = PC Termination Transmissive
7 = PC Termination Opaque
8 = Wire Termination Transmissive
9 = Wire Termination Opaque

Mechanical and Electrical Specification Variations — second X
0 = Buffer Totem-Pole
1 = Buffer Open-Collector
2 = Inverter Totem-Pole
3 = Inverter Open-Collector

Mounting Configurations — third X
T = Both mounting tabs
N = No tabs
L = Single mounting tab, emitter side
P = Single mounting tab, sensor side
Wide Gap and Side Mount
W = Wire Termination
L = PC lead Termination

Aperture width in front of LED — fourth X
5 = 0.050" (1.27mm)
1 = 0.010" (0.25mm)

Aperture Width in front of sensor — fifth X
5 = 0.050" (1.27mm)
1 = 0.010" (0.25mm)

Optical Flag Switches

Part No.	Coupled Light Current $I_{C(ON)}$ Min	Test Conditions I_F (mA)	Test Conditions V_{CE} (V)	Lead Spacing (Inches)	Page No.
OPB680	600 µA	10	5.0	0.275	12-32
OPB685	logic	10	4.5-16.0	0.275	12-34
OPB686	logic	10	4.5-16.0	0.275	12-34
OPB687	logic	10	4.5-16.0	0.275	12-34
OPB688	logic	10	4.5-16.0	0.275	12-34
OPB690	600 µA	10	5.0	Connector	12-38
OPB695A(B)(C)	logic	10	4.5-16.0	Connector	12-40
OPB696A(B)(C)	logic	10	4.5-16.0	Connector	12-40
OPB697A(B)(C)	logic	10	4.5-16.0	Connector	12-40
OPB698A(B)(C)	logic	10	4.5-16.0	Connector	12-40
OPB850	500 µA	20	10.0	Wire	12-90

Hi-Rel Infrared Emitting Diodes

Part No.	Type	Output Power	Test Conditions I_F (mA)	Case Style	Page No.
OP223TX(TXV)	GaAlAs	1.00mW	50	Pill	13-44
OP224TX(TXV)	GaAlAs	1.50mW	50	Pill	13-44
OP235TX(TXV)	GaAlAs	$1.5mW/cm^2$	100	TO-46	13-48
OP236TX(TXV)	GaAlAs	$3.5mW/cm^2$	100	TO-46	13-48

Hi-Rel Photosensors

Part No.	Light Current	Test Conditions	Case Style	Page No.
OP602TX(TXV)	2.0-5.0mA	$E_e = 20mW/cm^2$, $V_{CE} = 5V$	Pill	13-52
OP603TX(TXV)	4.0-8.0mA	$E_e = 20mW/cm^2$, $V_{CE} = 5V$	Pill	13-52
OP604TX(TXV)	7.0mA	$E_e = 20mW/cm^2$, $V_{CE} = 5V$	Pill	13-52
OP803TX(TXV)	4.0-8.0mA	$E_e = 5mW/cm^2$, $V_{CE} = 5V$	TO-18	13-56
OP804TX(TXV)	7.0-22.0mA	$E_e = 5mW/cm^2$, $V_{CE} = 5V$	TO-18	13-56
OP805TX(TXV)	15.0mA	$E_e = 5mW/cm^2$, $V_{CE} = 5V$	TO-18	13-56
OPL800TXV	Logic	Totem-pole	TO-18	13-80

Hi-Rel Optical Isolators

Part No.	Isolation	$I_{C(ON)}$	Test Conditions	Case Style	Page No.
3N243(TX)	1kV	1.5mA min	$I_F = 10mA$, $V_{CE} = 10V$	TO-72	13-4
3N244(TX)	1kV	3.0mA min	$I_F = 10mA$, $V_{CE} = 10V$	TO-72	13-4
3N245(TX)	1kV	6.0mA min	$I_F = 10mA$, $V_{CE} = 10V$	TO-72	13-4
3N261(TX)	1kV	0.5mA min	$I_F = 1mA$, $V_{CE} = 5V$	TO-72	13-10
3N262(TX)	1kV	1.0-5.0mA	$I_F = 1mA$, $V_{CE} = 5V$	TO-72	13-10
3N263(TX)	1kV	2.0-10.0mA	$I_F = 1mA$, $V_{CE} = 5V$	TO-72	13-10
4N22A(JANTX) (JANTXV)	1kV	2.5mA min	$I_F = 10mA$, $V_{CE} = 5V$	TO-78	13-16
4N22AU(JANTX) (JANTXV)	1kV	2.5mA min	$I_F = 10mA$, $V_{CE} = 5V$	SMD	13-22
4N23A(JANTX) (JANTXV)	1kV	6.0mA min	$I_F = 10mA$, $V_{CE} = 5V$	TO-78	13-16
4N23AU(JANTX) (JANTXV)	1kV	6.0mA min	$I_F = 10mA$, $V_{CE} = 5V$	SMD	13-22
4N24A(JANTX) (JANTXV)	1kV	10.0mA min	$I_F = 10mA$, $V_{CE} = 5V$	TO-78	13-16
4N24AU(JANTX) (JANTXV)	1kV	10.0mA min	$I_F = 10mA$, $V_{CE} = 5V$	SMD	13-22
4N47(JANTX)(JANTXV)	1kV	0.5mA min	$I_F = 1.0mA$, $V_{CE} = 5V$	TO-78	13-26
4N48(JANTX)(JANTXV)	1kV	1.0-5.0mA	$I_F = 1.0mA$, $V_{CE} = 5V$	TO-78	13-26
4N49(JANTX)(JANTXV)	1kV	2.0-10.0mA	$I_F = 1.0mA$, $V_{CE} = 5V$	TO-78	13-26
HCC135(TXV)	1kV	logic		SMD	13-30
HCC136(TXV)	1kV	logic		SMD	13-30
HCC240	1kV	2.5mA min	$I_F = 10mA$, $V_{CE} = 5V$	SMD	13-32
HCC242	1kV	10.0mA min	$I_F = 10mA$, $V_{CE} = 5V$	SMD	13-32
HCC247	1kV	0.5mA min	$I_F = 1.0mA$, $V_{CE} = 5V$	SMD	13-34
HCC248	1kV	1.0-5.0mA	$I_F = 1.0mA$, $V_{CE} = 5V$	SMD	13-34
HCC249	1kV	2.0-10.0mA	$I_F = 1.0mA$, $V_{CE} = 5V$	SMD	13-34
HCC340	1.5kV	zero crossing triac		SMD	13-36
HCC640(TXV)	1.5kV	4.8mA min	$I_F = 1.6mA$, $V_O = 0.4V$, $V_{CC} = 4.5V$	SMD	13-38
HDA140A	1.5kV	4.8mA min	$I_F = 1.6mA$, $V_O = 0.4V$, $V_{CC} = 4.5V$	4 ch. Dip	13-40
HDC135	1kV	logic		Dip	13-42
HDC136	1kV	logic		Dip	13-42

Hi-Rel Optical Isolators (cont)

Part No.	Isolation	$I_{C(ON)}$	Test Conditions	Case Style	Page No.
OPI120TX(TXV)	15kV	2.0mA	I_F = 10mA, V_{CE} = 5V	Axial	13-70
OPI125TXV	15kV	logic	V_{CC} = 5V	Axial	13-72
OPI150TX(TXV)	50kV	1.0mA	I_F = 10mA, V_{CE} = 5V	Axial	13-74
OPI210	1.0kV	5mA min	I_F = 10mA, V_{CE} = 5V	SMD	13-76
OPI211	1.0kV	20mA min	I_F = 10mA, V_{CE} = 5V	SMD	13-76
OPI340	1.0kV	zero crossing triac		TO-78	13-78

Hi-Rel Optical Assemblies

Part No.	Type	$I_{C(ON)}$	Test Conditions	Page No.
OPB700TX(TXV)	reflective	50µA min	V_{CE} = 5V, I_F = 40mA	13-60
OPB821TX(TXV)	slotted	800µA min	V_{CE} = 10V, I_F = 20mA	13-62
OPB847TX(TXV)	slotted	4.0mA min	V_{CE} = 10V, I_F = 20mA	13-64
OPB848TX(TXV)	slotted	1.0mA min	V_{CE} = 10V, I_F = 20mA	13-64
OPB870X5XTX(TV)	slotted	500µA min	V_{CE} = 10V, I_F = 20mA	13-66
OPB871X5XTX(TV)	slotted	1.0mA min	V_{CE} = 5V, I_F = 10mA	13-66
OPB872X5XTX(TV)	slotted	1.8mA min	V_{CE} = 0.4V, I_F = 20mA	13-66

Hi-Rel Fiber Optics

LEDs

Part No.	Output Power (µW)		Test Conditions I_F (mA)	Rise Time Typ (ns)	Case Style	Page No.
	Min	Typ				
OMF320TX(TXV)	15.0	19.0	100	6.0	TO-46	14-2
OMF321TX(TXV)	15.0	19.0	100	6.0	SMA	14-4
OMF322TX(TXV)	15.0	19.0	100	6.0	ST*	14-6
OMF340TX(TXV)	20.0	25.0	100	4.5	TO-46	14-8
OMF341TX(TXV)	20.0	25.0	100	4.5	SMA	14-10
OMF342TX(TXV)	20.0	25.0	100	4.5	ST*	14-12
OMF345TX(TXV)	20.0	25.0	100	3.5	TO-46	14-14
OMF346TX(TXV)	20.0	25.0	100	3.5	SMA	14-16
OMF347TX(TXV)	20.0	25.0	100	3.5	ST*	14-18

Photodiodes

Part No.	Responsivity (A/W)		Test Conditions	Rise Time Typ (ns)	Case Style	Page No.
	Min	Typ				
OMF420TX/(TXV)	0.45	0.55	V_R = 5V, P_O = 10µW	6.0	TO-46	14-20
OMF421TX/(TXV)	0.45	0.55	V_R = 5V, P_O = 10µW	6.0	SMA	14-22
OMF422TX/(TXV)	0.45	0.55	V_R = 5V, P_O = 10µW	6.0	ST*	14-24
OMF430TX/(TXV)	0.45	0.55	V_R = 5V, P_O = 10µW	2.0	TO-46	14-26
OMF431TX/(TXV)	0.45	0.55	V_R = 5V, P_O = 10µW	2.0	SMA	14-28
OMF432TX/(TXV)	0.45	0.55	V_R = 5V, P_O = 10µW	2.0	ST*	14-30

*ST is a registered trademark of AT&T

Hi-Rel Hall Effect

Part No.	Operate Point			Release Point			Hysteresis			Case Style	Page No.
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
OMH090B(S)	50	90	180	30	60	160	5	30	70	Ceramic	15-2
OMH360B(S)	235	360	465	170	280	360	30	80	150	Ceramic	15-14
OMH3019B(S)	175	420	500	125	220	420	30	100	155	Ceramic	15-4
OMH3020B(S)	70	220	350	50	165	330	20	55	200	Ceramic	15-6
OMH3040B(S)	70	150	200	50	115	180	10	35	60	Ceramic	15-8
OMH3075B(S)	50	150	250	-250	-150	-50	100	300	500	Ceramic	15-10
OMH3131B(S)	20	60	95	10	45	85	5	15	40	Ceramic	15-12

Hi-Rel Surface Mount Semiconductors

Transistors

Part No.	Type	H_{FE}	Test Conditions	Page No.
2N2907AUA(JANTX) (JANTXV)	PNP	100-300	V_{CE} = 10V, I_C = 150mA	16-2
2N2907AUB(JANTX) (JANTXV)	PNP	100-300	V_{CE} = 10V, I_C = 150mA	16-4
2N4854U(JANTX) (JANTXV)	NPN/PNP pair	100-300	V_{CE} = 10V, I_C = 150mA	16-6
HCT2222A(TX)	NPN	100-300	V_{CE} = 10V, I_C = 150mA	16-8
HCT2222M(TX)	NPN	100-300	V_{CE} = 10V, I_C = 150mA	16-10
HCT700(TX)(TXV)	NPN/PNP pair	100-300	V_{CE} = 10V, I_C = 150mA	16-12
HCT720(TX)(TXV)	dual NPN	100-300	V_{CE} = 10V, I_C = 150mA	16-14
HCT740(TX)(TXV)	dual PNP	100-300	V_{CE} = 10V, I_C = 150mA	16-16
HCT780(TX)(TXV)	quad NPN	100-300	V_{CE} = 10V, I_C = 150mA	16-18
HCT790(TX)(TXV)	quad PNP	100-300	V_{CE} = 10V, I_C = 150mA	16-20

Enhancement MOSFETs

Part No.	Type	$r_{ds(on)}$	Test Conditions	Page No.
HCT801(TX)	dual	3.2/8 Ω (max)	V_{GS} = ±10V, I_D = ±1A	16-22
HCT802(TX)	dual	5/5 Ω (max)	V_{GS} = ±10V, I_D = ±1A	16-24
HCT7000M(TX)(TXV)	n-channel	5 Ω (max)	V_{GS} = 10V, I_D = 0.5A	16-26

Optical Isolators

Listed under Hi-Rel Optical Isolators (See SMD case style).

INFRARED
EMITTING
DIODES

OPTEK TECHNOLOGY, INC.

INFRARED EMITTING DIODES

Infrared Emitting Diodes

Optek remains unchallenged as the industry's most complete high quality source for infrared emitters. The latest state-of-the-art solution grown epitaxial techniques are used to produce the high quality GaAs and GaAlAs diode material required to make Optek infrared emitting diodes. This precision processing ensures high junction emission efficiency and long operating life with minimal degradation. The added benefit of over 16 years of mounting, bonding, and packaging experience makes Optek the undisputed technological leader in the design and production of infrared emitting diodes.

Leadership in Manufacturing

When engineers are asked which product features they value most in Optek's electronic components, the answers most often given are quality and reliability. Assuring high quality is a philosophy that begins at product conception and is carried through the design phase and heavily emphasized during every step in the manufacture of Optek infrared emitting diodes.

Production begins in Optek's own wafer processing area located in Carrollton, Texas. A GaAlAs or GaAs melt is added to high purity GaAs wafers at precisely controlled temper atures. As cooling takes place, the crystalline structure begins to grow. Partially into the growth, at exactly the right temperature, the material changes from "N"-type to "P"-type and the diode junction is formed. To complete the process, excess starting material is removed and metallization layers are added for electrical contacts. The individual diode chips are then sliced from the wafer. Application Bulletin 205, printed in this data book, discusses these materials in additional detail.

The infrared emitting diode is then carefully mounted in a specially designed reflective "well" as shown in Figure 1. Depending upon the device type, conductive epoxy or soldering is used to attach the chip to the lead frame or header. Gold wire is bonded to the top contact pad ("N" - type material) using Optek's specially developed techniques designed to minimize stress or possible damage to the delicate chip material. A refractive index matching silicone overcoat is added to "ruggedize" the entire assembly and improve optical efficiency. Hermetic parts are then weld-sealed. After assembly, 100 percent of the devices are electrically tested and sorted in order to guarantee compliance with the electrical limits specified in Optek data sheets. Prior to final release for shipment, Optek's outgoing quality control department independently retests samples from each lot.

Output Specifications Designed for Engineering Convenience

The outputs of the vast majority of Optek emitters are specified using apertured radiant incidence, $E_{e(APT)}$, expressed in milliwatts per square centimeter. This method, also known as on-axis intensity measurement, provides the best accuracy and convenience for the design engineer. Production testing consists of measuring 100 percent of the energy passing through a specified diameter aperture orthogonal to the optical axis, and a specified distance from the device. For Optek devices, the distance chosen for this measurement is equivalent to the typical operating distance from emitter to sensor. Most specifications for compatible photosensors describe output current at a specified radiant intensity, also expressed in milliwatts per square centimeter. Therefore, the design of close proximity transmissive emitter/sensor assemblies can be done more accurately, and with a minimum of optical calculations and specification conversions.

Infrared emitter manufacturers use three methods of specifying output limits on infrared emitters. These are Radiant Power Output (P_O), Radiant Intensity (I_e) and Apertured Radiant Incidence [$E_{e(APT)}$]. Radiant Power Output (P_O) sometimes called Total Power, is strictly interpreted as a measure of the total energy emitted from the device. Optek has interpreted this to include only the energy useful to most customers. Therefore, side and backward emissions are not measured. As a benchmark for comparison among devices, Optek devices are conservatively rated. For example, the P_O reading for the useful portion of the OP295A radiation pattern is 60 percent higher when a parabolic reflector is used to capture normally unused side emissions as opposed to Optek's more conservative rating method. When making P_O comparisons among manufacturers, the design engineer should always investigate the methods of measurement.

Radiant Intensity (I_e) is usually expressed in milliwatts per steradian. This method attempts to account for useable energy, where the peak intensity falls within an included angle centered around the optical axis. Through some moderately complex geometrical calculations, the energy falling on the sensor can be roughly estimated if the sensor is on or close to the optical axis and if the distance from emitter to sensor is known. However, most infrared emitters can not accurately be modeled as a point source at the close proximity used in many applications (less than four inches); therefore, this method has the potential to result in serious design errors. Additionally, it is more cumbersome than Optek's direct approach of characterizing emitters in terms of apertured radiant incidence.

Diode Material Selection

Gallium arsenide (GaAs) and gallium aluminum arsenide (GaAlAs) each have specific advantages when used in the manufacture of Optek infrared emitters. GaAs emits energy at 935 ±15 nanometers while GaAlAs emits at 890 ±20 nanometers. As temperature increases, these peaks shift upward by 0.26 and 0.20 nanometers per degree centigrade, respectively. Due to the spectral matching with photosensitive silicon, which exhibits a sensitivity maximum of 850 nanometers, as shown in Figure 2, (the second peak is caused by a fractional wave sensor overcoat), GaAlAs has the advantage of more efficient coupling. The sensor is better able to "see" the energy emitted by GaAlAs. In addition, at equivalent forward currents, GaAlAs is typically a more efficient emitter of infrared energy.

GaAs is considered to be less susceptible to output degradation than GaAlAs. Figure 3 shows typical percentage changes in output versus time for GaAs and GaAlAs operating at the absolute maximum forward current rating of I_F = 100 mA, on a TO-46 header. While the effects of degradation on both materials are insignificant at normal operating currents (10-20 mA), GaAs is, nevertheless, the preferable choice of material in applications where high operating currents or temperatures are expected and long-term reliability is critical.

GaAs offers the second advantage of having lower forward voltage characteristics than GaAlAs. If large numbers of devices are to be placed in series or if power supply voltage is limited, the selection of GaAs over GaAlAs devices may be the best design choice.

Package Selection

The two broad classifications of package types are hermetic and plastic . Each offers its own distinct advantages. In many demanding environments, hermetic packaging may be mandatory. It has excellent resistance to water and other solvents, while offering the broadest operating temperature range and resistance to thermal shocks. Plastic packaging, in addition to a cost advantage over hermetic packaging, exhibits excellent optical properties. Overall emission efficiency is also superior because optical interfaces are minimized. Finally, resistance to mechanical shock and vibration is excellent because both chip and bond wire are fully encased in supportive material. Application Bulletin 208 compares these package types.

Special Product Capability

In addition to the standard products shown, Optek leads the industry in custom product capability. Special selections or custom package designs may be the solution to your unique application problem. Call your local Optek office for more information.

Figure 1.
Infrared Emitting Diode Radiation

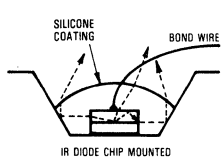
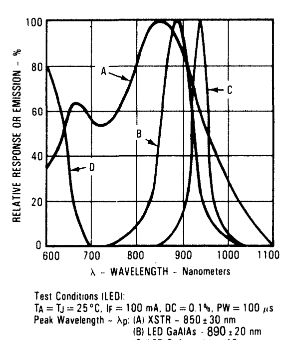
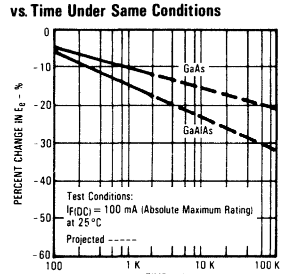


Figure 2.
Photosensor Spectral Response vs. GaAlAs and GaAs



Test Conditions (LED):
$T_A = T_J = 25°C$, $I_F = 100$ mA, DC = 0.1%, PW = 100 μs
Peak Wavelength - λ_p: (A) XSTR - 850±30 nm
(B) LED GaAlAs - 890±20 nm
(C) LED GaAs - 935±15 nm
(D) Human Eye Response

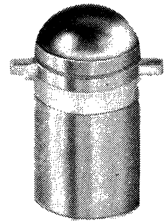
Figure 3.
Percent Change in GaAs and GaAlAs IR Emitters Mounted in Metal TO-46 Package vs. Time Under Same Conditions

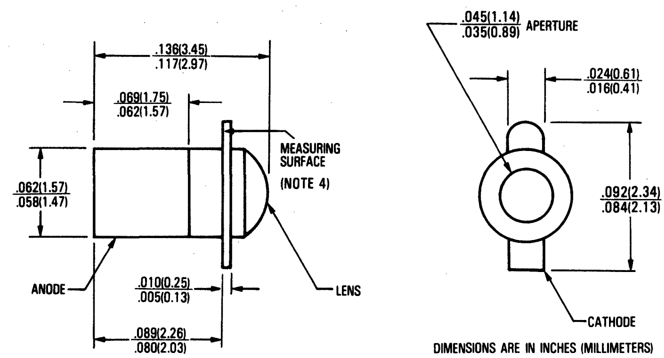


Product Bulletin OP123
April 1993

OPTEK

GaAs Hermetic Infrared Emitting Diodes
Types OP123, OP124





Features

- Miniature hermetically sealed "Pill" package
- Enhanced temperature range
- Ideal for direct mounting to PC boards[1]
- High power output
- Mechanically and spectrally matched to the OP600 phototransistor and the OP300 photodarlington

Description

The OP123 and OP124 series are high intensity gallium arsenide infrared emitting diodes mounted in miniature "Pill" type hermetically sealed packages. This package style is intended for direct mounting into PC boards.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

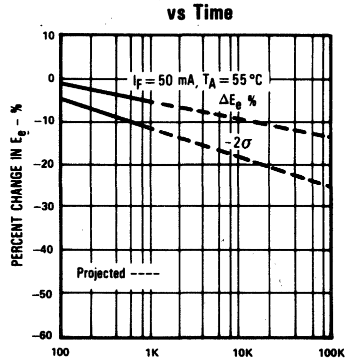
Reverse Voltage	2.0V
Continuous Forward Current	100mA
Peak Forward Current (2μs pulse width, 0.1% duty cycle)	1.0A
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Soldering Temperature (5 sec. with soldering iron)	260°C[1][2]
Power Dissipation	150mW[3]

Notes:

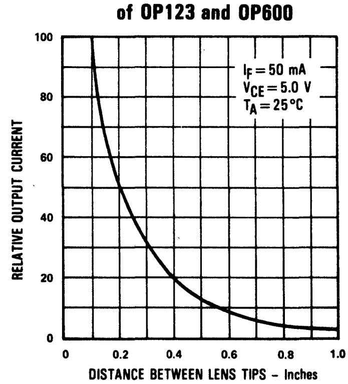
(1) Refer to Application Bulletin 202 which reviews proper soldering techniques for pill-type devices.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.50mW/°C above 25°C.
(4) $E_{e(APT)}$ is measured using a 0.031" (0.787mm) diameter apertured sensor placed 0.50" (12.7mm) from the measuring surface.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP123 and OP600



Types OP123, OP124

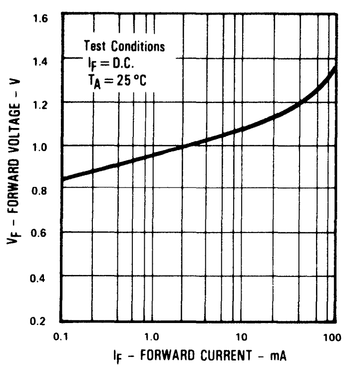
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence OP123 OP124	0.40 1.00			mW/cm^2	I_F = 50 mA(4)
V_F	Forward Voltage			1.50	V	I_F = 50 mA
I_R	Reverse Current			100	μA	V_R = 2.0 V
λp	Wavelength at Peak Emission		935		nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		50		nm	I_F = 50 mA
$\Delta\lambda p/\Delta T$	Spectral shift with Temperature		+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		24		Deg.	I_F = 50 mA
t_r	Output Rise Time		1000		ns	$I_{F(PK)}$ = 100 mA, PW = 10.0 μs, D.C. = 10.0%
t_f	Output Fall Time		500		ns	

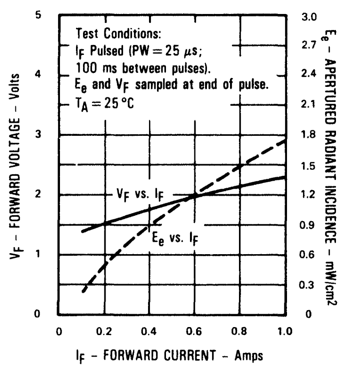
INFRARED EMITTING DIODES

Typical Performance Curves

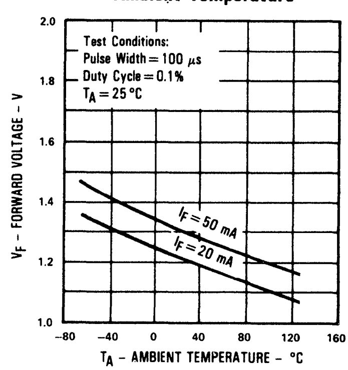
Forward Voltage vs Forward Current



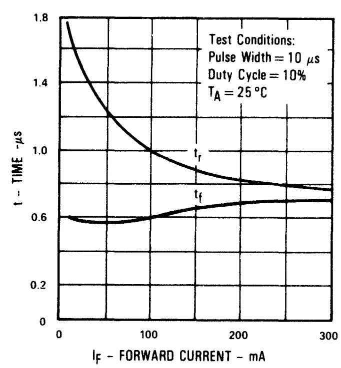
Forward Voltage and Radiant Incidence vs Forward Current



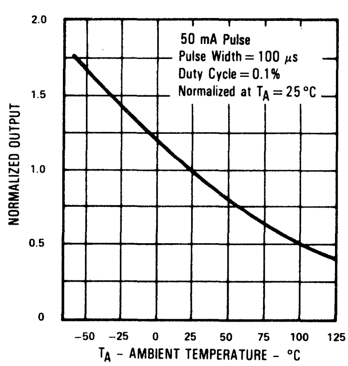
Forward Voltage vs Ambient Temperature



Rise Time and Fall Time vs Forward Current



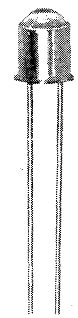
Normalized Power Output vs Ambient Temperature

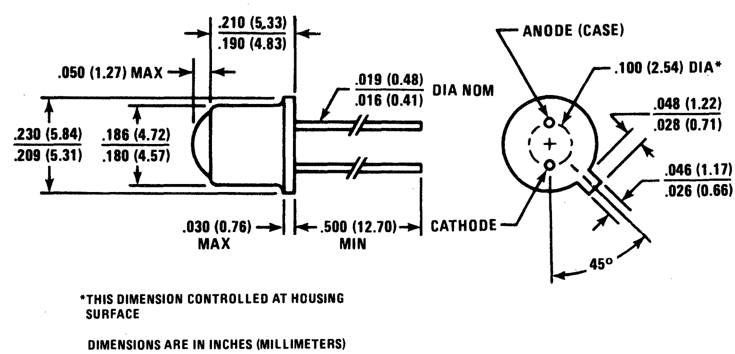


Product Bulletin OP130
April 1993

OPTEK

GaAs Hermetic Infrared Emitting Diodes
Types OP130, OP131, OP132, OP133





Features

- TO-46 hermetically sealed package
- Mechanically and spectrally matched to the OP800 and OP593 phototransistors or OP830 photodarlingtons
- Variety of power ranges
- Enhanced temperature range

Description

The OP130 series are high intensity gallium arsenide infrared emitting diodes mounted in hermetic TO-46 housings. The narrow beam allows ease of design in beam interrupt applications in conjunction with the OP800 or OP598 series phototransistors. TO-46 housings offer high power dissipation and superior hostile environment operation.

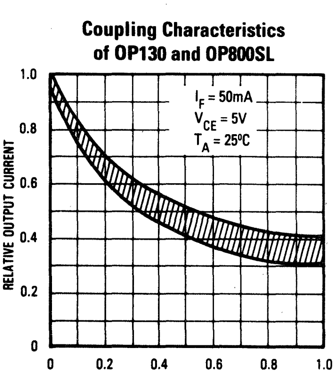
Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 100mA
Peak Forward Current (2 µs pulse width, 0.1% duty cycle) 10.0A
Storage Temperature Range . . . . . -65°C to +150°C
Operating Temperature Range . . . . . -65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . . 260°C(1)
Power Dissipation . . . . . 200mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.1% and an I_F = 100mA.

Typical Performance Curves

Coupling Characteristics of OP130 and OP800SL



Types OP130, OP131, OP132, OP133

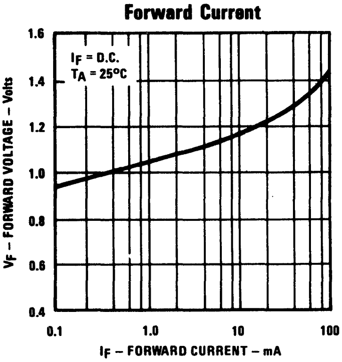
INFRARED EMITTING DIODES

Electrical Characteristics (T_A = 25°C unless otherwise noted)

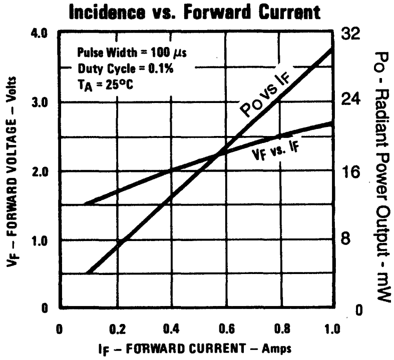
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	OP130	1.0			mW	I_F = 100 mA(3)
		OP131	3.0			mW	I_F = 100 mA(3)
		OP132	4.0			mW	I_F = 100 mA(3)
		OP133	5.0			mW	I_F = 100 mA(3)
V_F	Forward Voltage				1.75	V	I_F = 100 mA(3)
I_R	Reverse Current				100	µA	V_R = 2.0 V
λ_P	Wavelength at Peak Emission			935		nm	I_F = 10 mA(3)
B	Spectral Bandwidth Between Half Power Points			50		nm	I_F = 10 mA(3)
$\Delta\lambda_P/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 100 mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)}$ = 100 mA, PW = 10 µs, D.C. = 10%
t_f	Output Fall Time			500		ns	

Typical Performance Curves

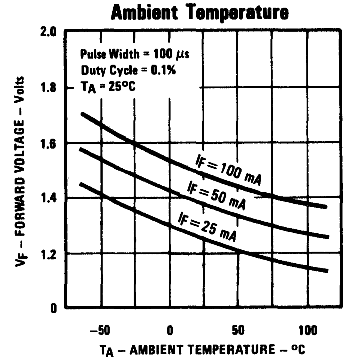
Forward Voltage vs. Forward Current



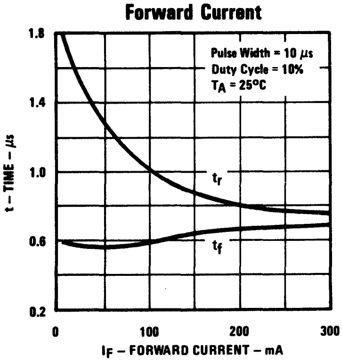
Forward Voltage and Radiant Incidence vs. Forward Current



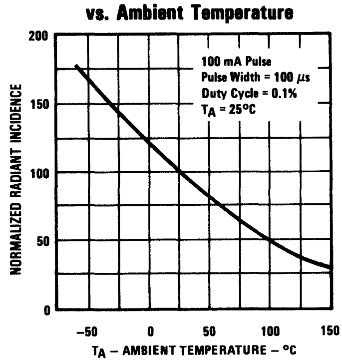
Forward Voltage vs. Ambient Temperature



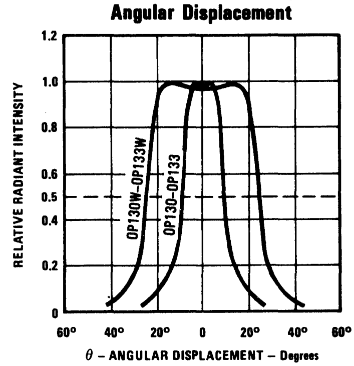
Rise and Fall Time vs. Forward Current



Normalized Radiant Incidence vs. Ambient Temperature

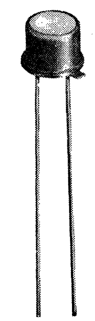


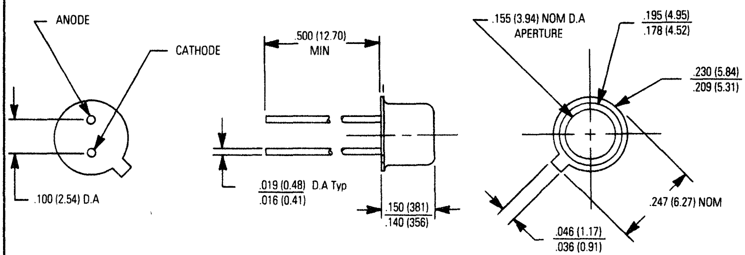
Relative Radiant Intensity vs. Angular Displacement



OPTEK

GaAs Hermetic Infrared Emitting Diodes
Types OP130W, OP131W, OP132W, OP133W





Features

- Wide irradiance pattern
- Enhanced temperature range
- Mechanically and spectrally matched to the OP800WSL and OP830WSL series devices
- Variety of power ranges
- TO-46 hermetically sealed package

Description

The OP130W series devices are 935nm gallium arsenide infrared emitting diodes mounted in hermetically sealed packages. The broad irradiance pattern provides relatively even illumination over a large area.

Replaces

K6200 series

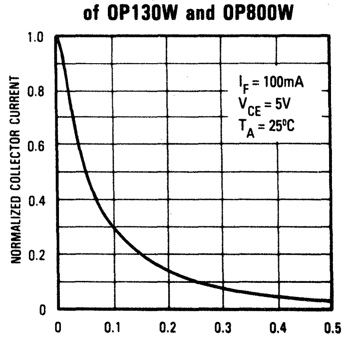
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage.......... 2.0V
Continuous Forward Current 100mA
Peak Forward Current (2 µs pulse width, 0.1% duty cycle).......... 10.0A
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron].......... 260°C(1)
Power Dissipation.......... 200mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0mW/°C above 25°C.
(3) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.1% and an I_F = 100mA.

Typical Performance Curves

Coupling Characteristics of OP130W and OP800W



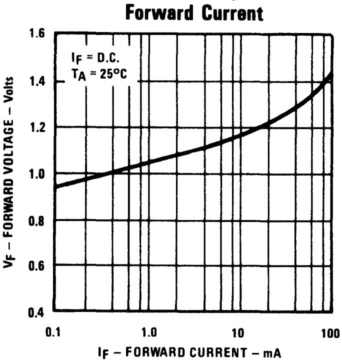
Types OP130W, OP131W, OP132W, OP133W

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

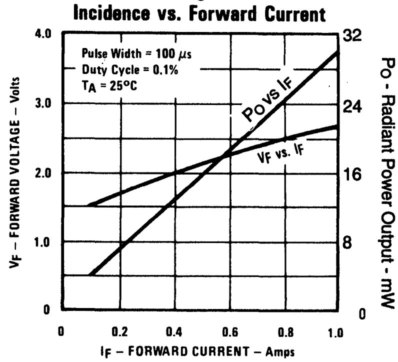
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	OP130W	1.0			mW	$I_F = 100$ mA(3)
		OP131W	3.0			mW	$I_F = 100$ mA(3)
		OP132W	4.0			mW	$I_F = 100$ mA(3)
		OP133W	5.0			mW	$I_F = 100$ mA(3)
V_F	Forward Voltage				1.75	V	$I_F = 100$ mA(3)
I_R	Reverse Current				100	μA	$V_R = 2.0$ V
λp	Wavelength at Peak Emission			935		nm	$I_F = 10$ mA
B	Spectral Bandwidth Half Power Points			50		nm	$I_F = 10$ mA
$\Delta\lambda_P/\Delta_T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			50		Deg.	$I_F = 100$ mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)} = 100$ mA, PW = 10 μs, D.C. = 10%
t_f	Output Fall Time			500		ns	

Typical Performance Curves

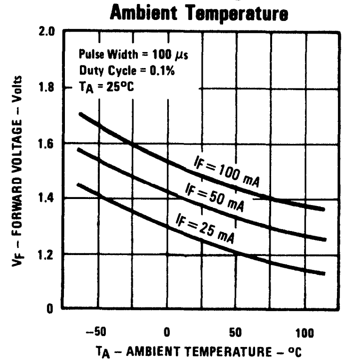
Forward Voltage vs. Forward Current



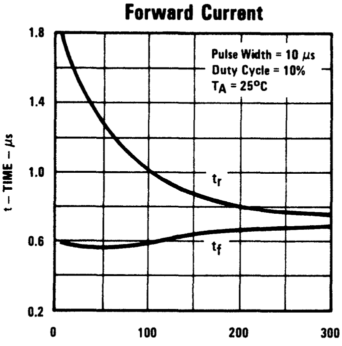
Forward Voltage and Radiant Incidence vs. Forward Current



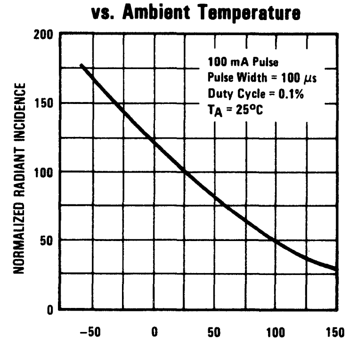
Forward Voltage vs. Ambient Temperature



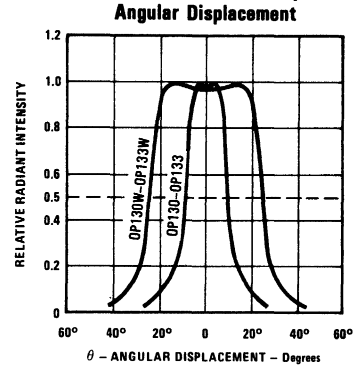
Rise and Fall Time vs. Forward Current



Normalized Radiant Incidence vs. Ambient Temperature



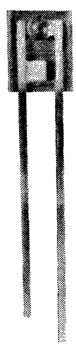
Relative Radiant Intensity vs. Angular Displacement

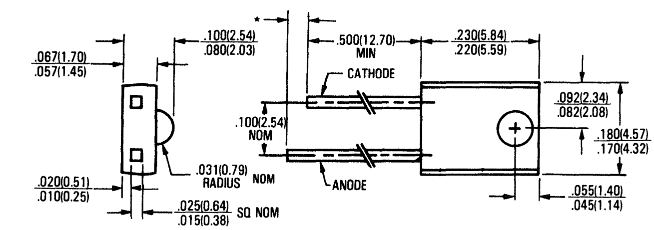


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP140A, OP140B, OP140C, OP140D





DIMENSIONS ARE IN INCHES (MILLIMETERS).

* FOR IDENTIFICATION PURPOSES, ANODE IS .060(1.52) NOM. LONGER THAN CATHODE LEAD..

Features

- Wide irradiance pattern
- Selected to specific on-line intensity ranges
- Low cost, miniature plastic side-looking package
- Mechanically and spectrally matched to the OP550 series of phototransistors and the OP560 series of photodarlingtons

Description

The OP140 series devices are 935nm high intensity gallium arsenide infrared emitting diodes molded in IR transmissive plastic side-looking packages. The side looking packages are for use in PC board mounted slotted switches or as an easy mount PC board interrupter.

Replaces

OP140SL series

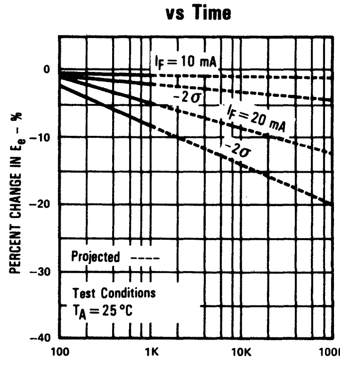
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

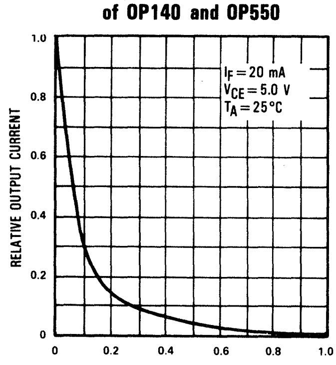
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP140 and OP550



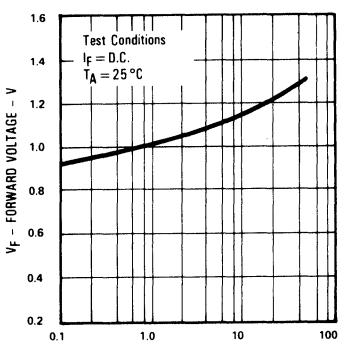
Types OP140A, OP140B, OP140C, OP140D

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

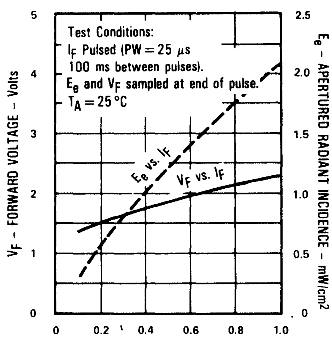
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP140D	0.10			mW/cm^2	$I_F = 20$ mA(3)
		OP140C	0.20		0.40	mW/cm^2	$I_F = 20$ mA(3)
		OP140B	0.30		0.55	mW/cm^2	$I_F = 20$ mA(3)
		OP140A	0.40			mW/cm^2	$I_F = 20$ mA(3)
V_F	Forward Voltage				1.60	V	$I_F = 20$ mA
I_R	Reverse Current				100	µA	$V_R = 2.0$ V
λp	Wavelength at Peak Emission			935		nm	$I_F = 10$ mA
B	Spectral Bandwidth Between Half Power Points			50		nm	$I_F = 10$ mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			40		Deg.	$I_F = 20$ mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)}$ =100 mA,
t_f	Output Fall Time			500		ns	PW = 10.0µs, D.C.=10.0%

Typical Performance Curves

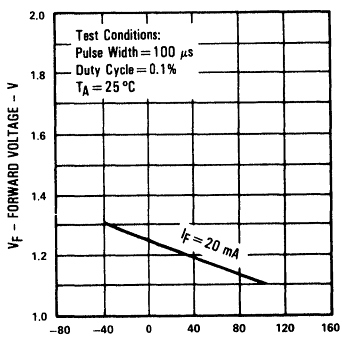
Forward Voltage vs Forward Current



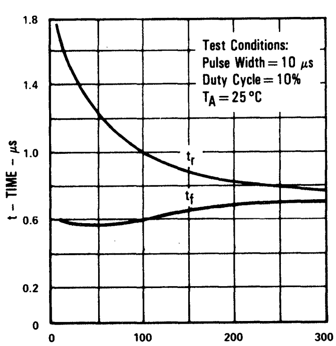
Forward Voltage and Radiant Incidence vs Forward Current



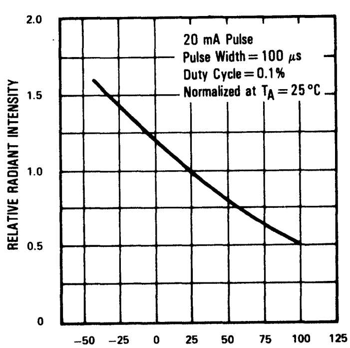
Forward Voltage vs Ambient Temperature



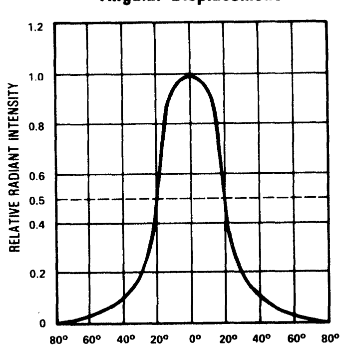
Rise Time and Fall Time vs Forward Current



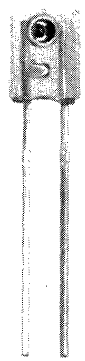
Relative Radiant Intensity vs Ambient Temperature



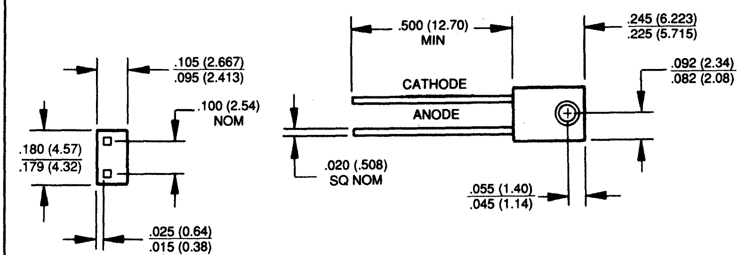
Relative Radiant Intensity vs Angular Displacement



GaAs Plastic Infrared Emitting Diodes
Types OP145A, OP145B, OP145C, OP145D



Dimensions are in inches (millimeters)



Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP555 and OP565 series devices
- Variety of power ranges

Description

The OP145 series devices are 935nm high intensity gallium arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The side-looking packages are for use in PC board slotted switches or as an easy mounted PC board interrupter.

Replaces

K6550 series

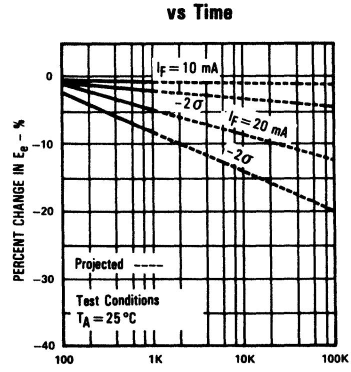
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 μs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

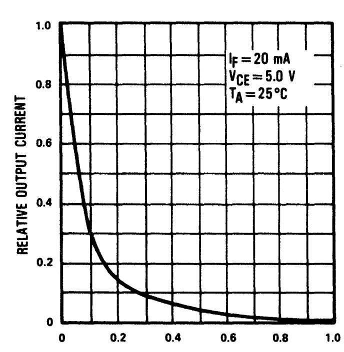
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP145 and OP555



Types OP145A, OP145B, OP145C, OP145D

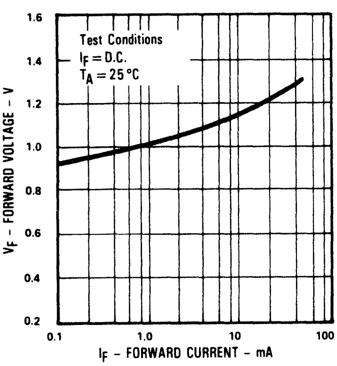
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP145D	0.10			mW/cm^2	I_F = 20 mA(3)
		OP145C	0.20		0.40	mW/cm^2	I_F = 20 mA(3)
		OP145B	0.30		0.55	mW/cm^2	I_F = 20 mA(3)
		OP145A	0.40			mW/cm^2	I_F = 20 mA(3)
V_F	Forward Voltage				1.60	V	I_F = 20 mA
I_R	Reverse Current				100	μA	V_R = 2.0 V
λp	Wavelength at Peak Emission			935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			50		nm	I_F = 10mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			40		Deg.	I_F = 20mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			500		ns	PW = 10 μs, D.C. = 10.0%

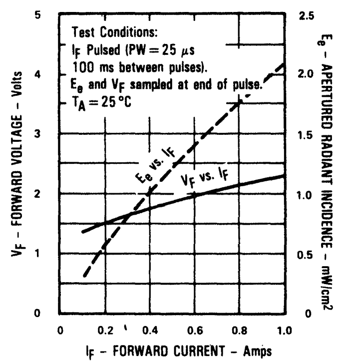
INFRARED EMITTING DIODES

Typical Performance Curves

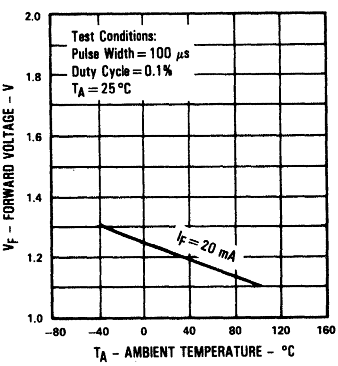
Forward Voltage vs Forward Current



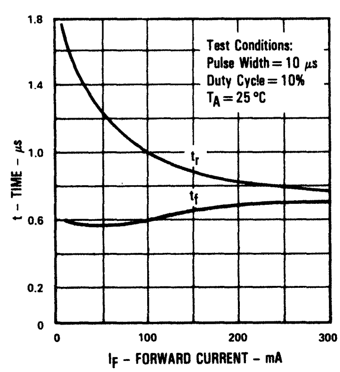
Forward Voltage and Radiant Incidence vs Forward Current



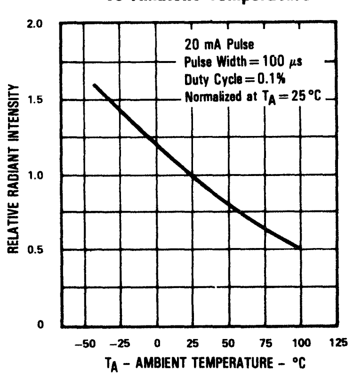
Forward Voltage vs Ambient Temperature



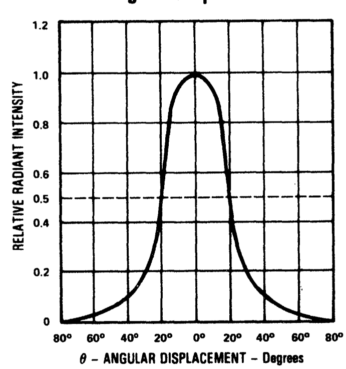
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity vs Ambient Temperature



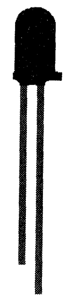
Relative Radiant Intensity vs Angular Displacement

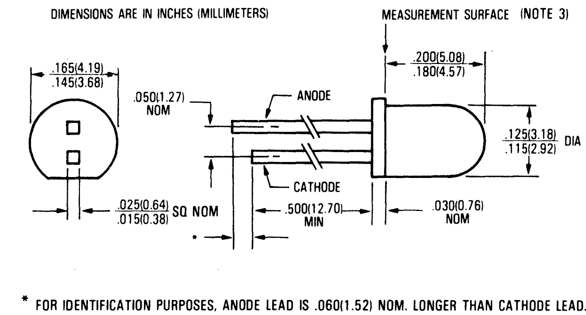


Product Bulletin OP163A
April 1993

OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP163A, OP163B, OP163C, OP163D





Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP505 and OP535 series devices
- Variety of power ranges
- Small package size for limited space applications
- T-1 package style

Description

The OP163 series devices are 935nm gallium arsenide infrared emitting diodes molded in IR transmissive black tinted plastic packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

Replaces

K6500 series
OP165 Series lower ranges.

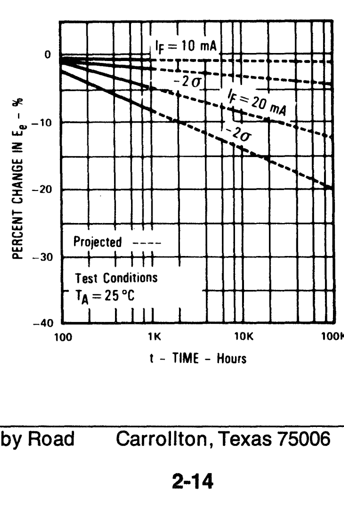
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

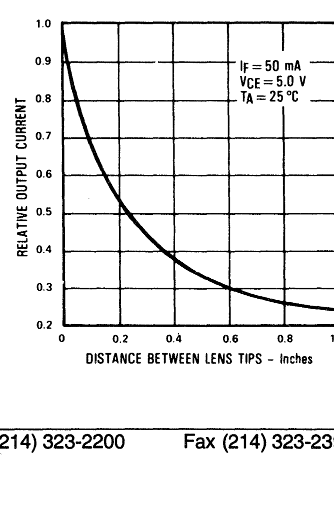
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to, and centered on, the mechanical axis of the lens and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics OP163 and OP505



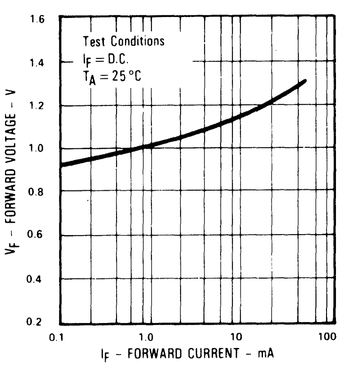
Types OP163A, OP163B, OP163C, OP163D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

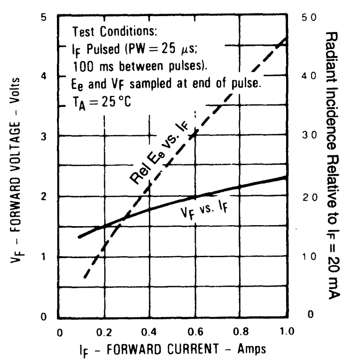
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP163D OP163C OP163B OP163A	0.28 0.85 1.40 1.40		1.60 2.20	mW/cm²	I_F = 20 mA(3)
V_F	Forward Voltage				1.60	V	I_F = 20 mA
I_R	Reverse Current				100	μA	V_R = 2.0 V
λp	Wavelength at Peak Emission			935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			50		nm	I_F = 10 mA
Δλp/ΔT	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 20 mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)}$ = 100 mA, PW = 10.0 μs, D.C. = 10.0%
t_f	Output Fall Time			500		ns	

Typical Performance Curves

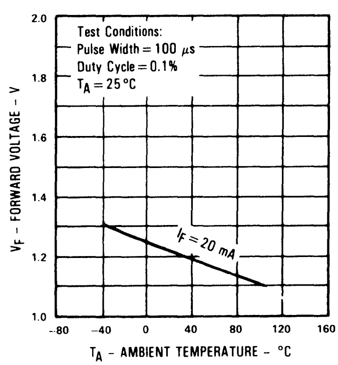
Forward Voltage vs Forward Current



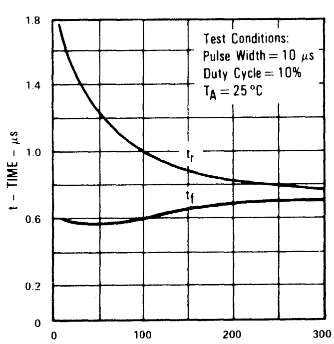
Forward Voltage and Relative Radiant Incidence vs. Forward Current



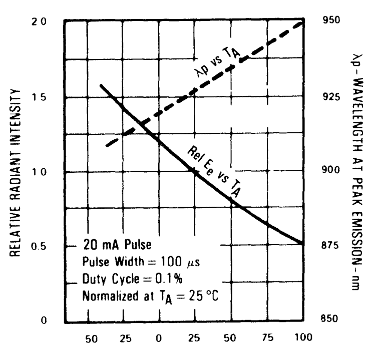
Forward Voltage vs Ambient Temperature



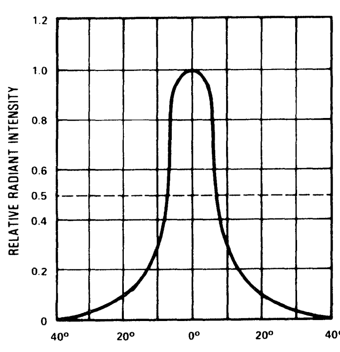
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



Relative Radiant Intensity vs Angular Displacement

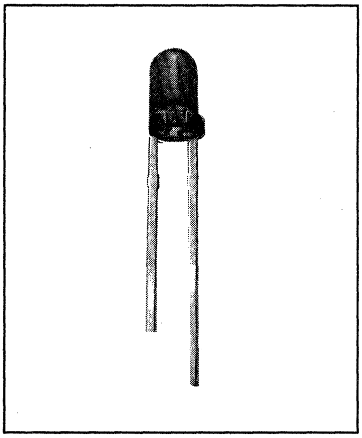


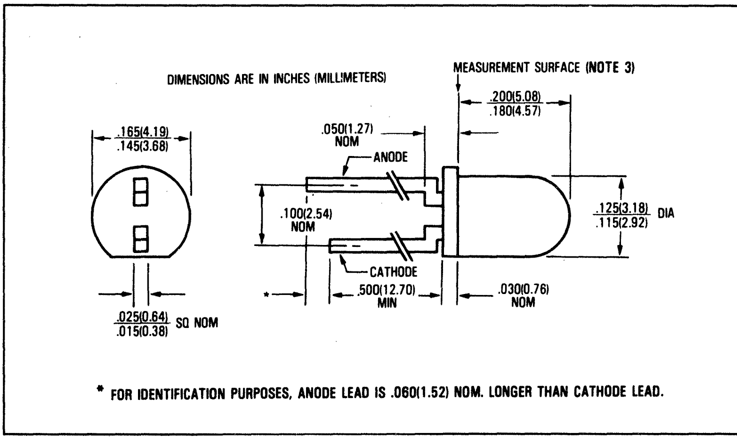
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP164A
April 1993

OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP164A, OP164B, OP164C, OP164D





Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP506 series devices
- Four power ranges
- Small package size for limited space applications
- T-1 package style

Description

The OP164 series devices are 935nm gallium arsenide infrared emitting diodes molded in IR transmissive black tinted plastic packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency. Lead spacing is 0.100" (2.54mm) to facilitate soldering processes.

Replaces

OP166 Series lower ranges.

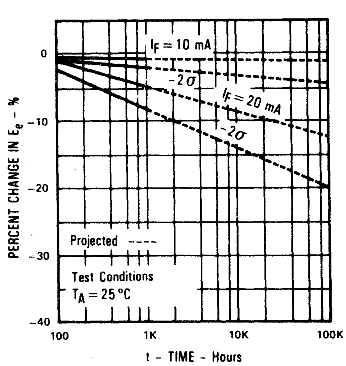
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage	2.0V
Continuous Forward Current	50mA
Peak Forward Current (1 µs pulse width, 300 pps)	3.0A
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	100mW(2)

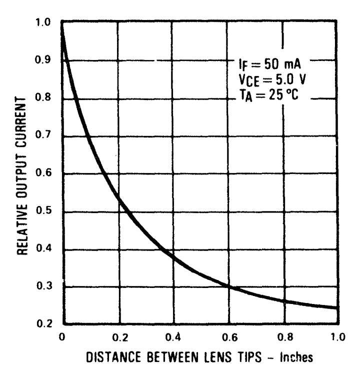
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to, and centered on, the mechanical axis of the lens and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics OP164 and OP506



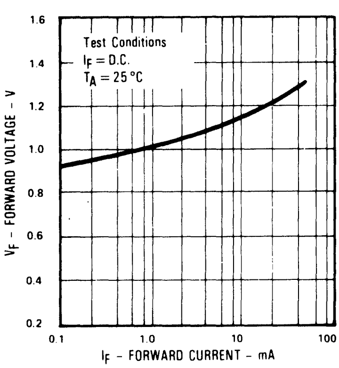
Types OP164A, OP164B, OP164C, OP164D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

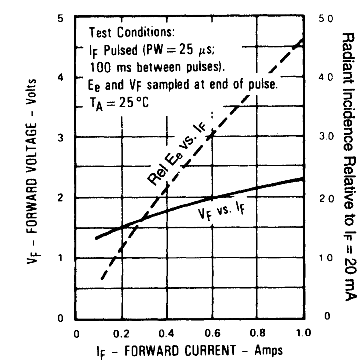
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP164D	0.28			mW/cm²	I_F = 20 mA(3)
		OP164C	0.85		1.60		
		OP164B	1.40		2.20		
		OP164A	1.40				
V_F	Forward Voltage				1.60	V	I_F = 20 mA
I_R	Reverse Current				100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission			935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			50		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 20 mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)}$ = 100 mA, PW = 10.0 µs, D.C. = 10.0%
t_f	Output Fall Time			500		ns	

Typical Performance Curves

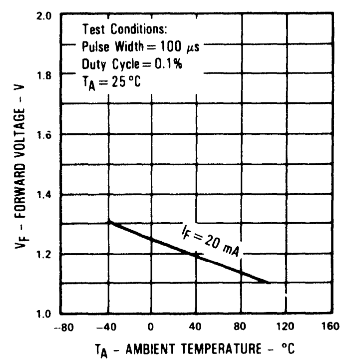
Forward Voltage vs Forward Current



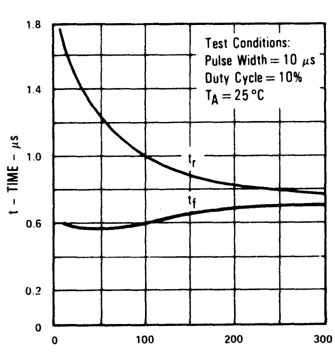
Forward Voltage and Relative Radiant Incidence vs. Forward Current



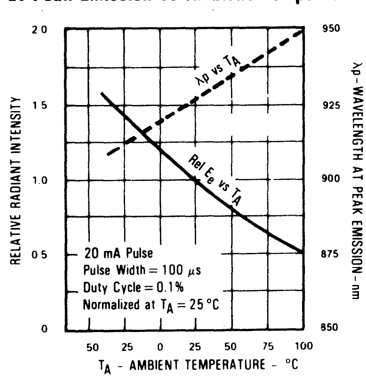
Forward Voltage vs Ambient Temperature



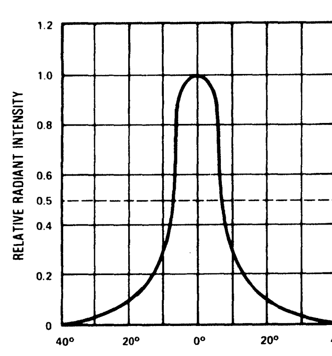
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



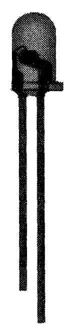
Relative Radiant Intensity vs Angular Displacement

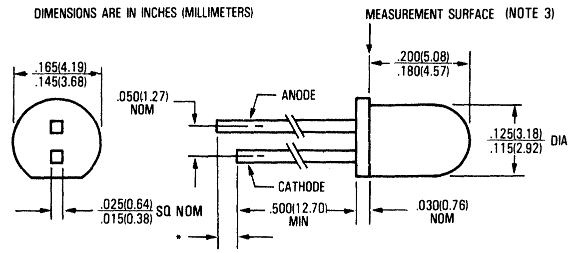


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP165A, OP165D





* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP505 and OP535 series devices
- Two power ranges
- Small package size for space limited applications
- T-1 package style

Description

The OP165 series devices are 935nm gallium arsenide infrared emitting diodes molded in IR transmissive amber tinted plastic packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

Replaces

K6500 series

Note

OP165B, C are replaced by OP163B, C which are equivalent except for the color of the package.

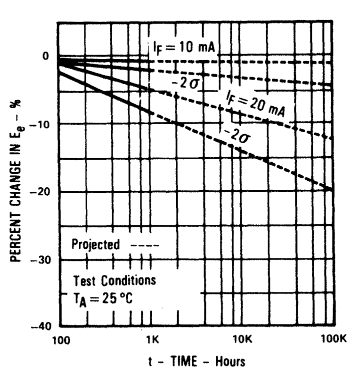
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage	2.0V
Continuous Forward Current	50mA
Peak Forward Current (1 µs pulse width, 300 pps)	3.0A
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	100mW(2)

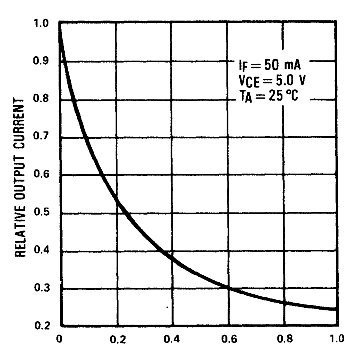
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics OP165 and OP505



Types OP165A, OP165D

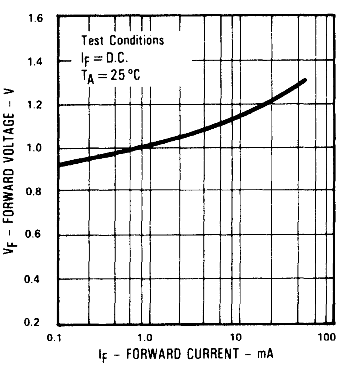
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence OP165D OP165A	1.40 1.95		 3.70	mW/cm^2 mW/cm^2	I_F = 20 mA(3) I_F = 20 mA(3)
V_F	Forward Voltage			1.60	V	I_F = 20 mA
I_R	Reverse Current			100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission		935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points		50		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		18		Deg.	I_F = 20 mA
t_r	Output Rise Time		1000		ns	$I_{F(PK)}$ = 100 mA, PW = 10 µs, D.C. = 10%
t_f	Output Fall Time		500		ns	

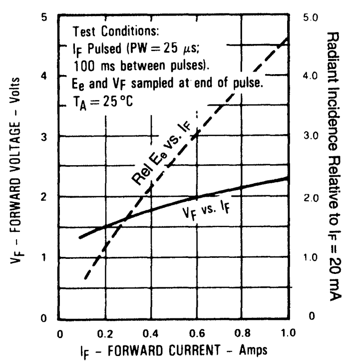
INFRARED EMITTING DIODES

Typical Performance Curves

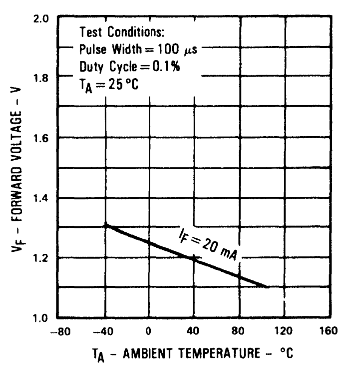
Forward Voltage vs Forward Current



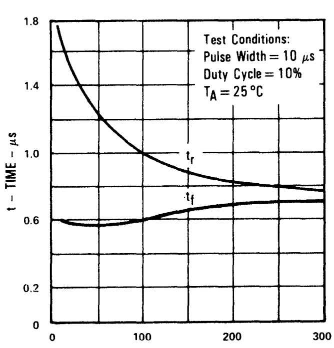
Forward Voltage and Relative Radiant Incidence vs. Forward Current



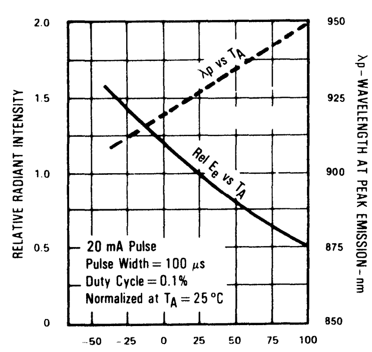
Forward Voltage vs Ambient Temperature



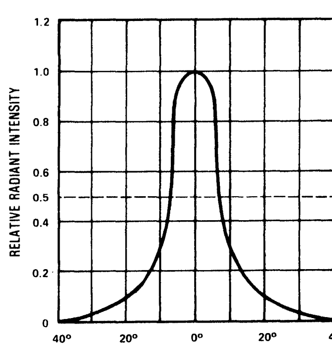
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature

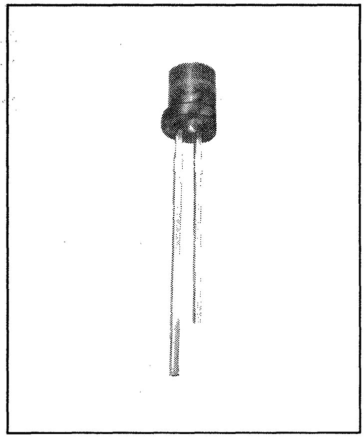


Relative Radiant Intensity vs Angular Displacement

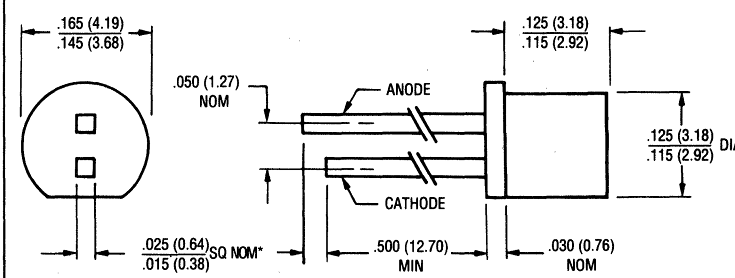


OPTEK

GaAs Plastic Infrared Emitting Diode
Type OP165W



DIMENSIONS ARE IN INCHES (MILLIMETERS)



* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060 (1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP505W
- Small package size for space limited applications
- T-1 package style

Description

The OP165W is a 935nm high intensity gallium arsenide infrared emitting diode molded in an IR transmissive amber tinted epoxy package. The broad irradiance pattern provides relatively even illumination over a large area. This package is a T-1 style in all respects except for the length of the plastic package.

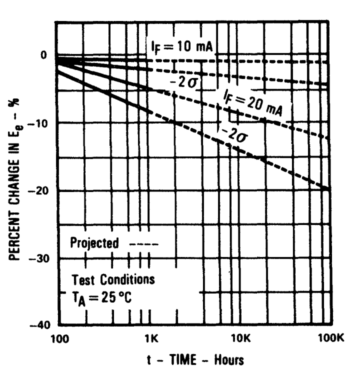
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

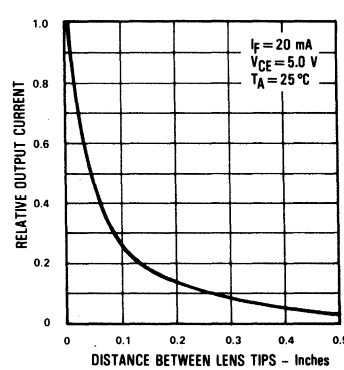
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.

Typical Performance Curves

Percent Changes in Power Output vs Time



Coupling Characteristics of OP165W and OP505W



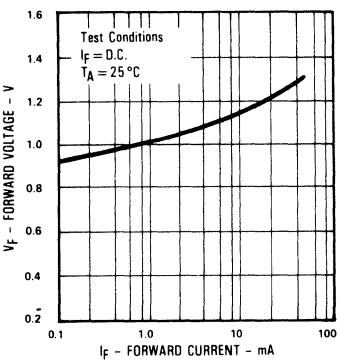
Type OP165W

Electrical Characteristics (T_A = 25°C unless otherwise noted)

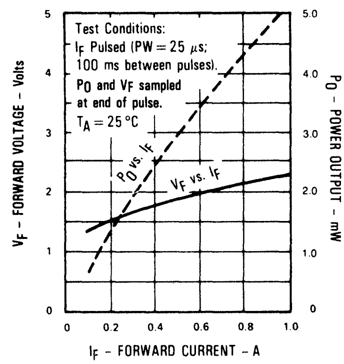
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	0.50			mW	I_F = 20 mA
V_F	Forward Voltage			1.60	V	I_F = 20 mA
I_R	Reverse Current			100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission		935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points		50		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		90		Deg.	I_F = 20 mA
t_r	Output Rise Time		1000		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time		500		ns	PW = 10 µs, D.C. = 10.0%

Typical Performance Curves

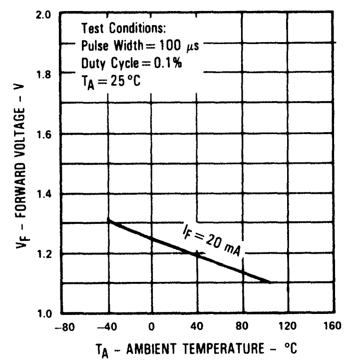
Forward Voltage vs Forward Current



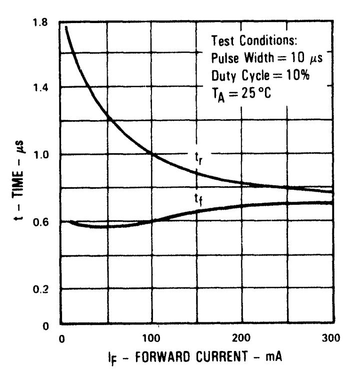
Forward Voltage and Power Output vs Forward Current



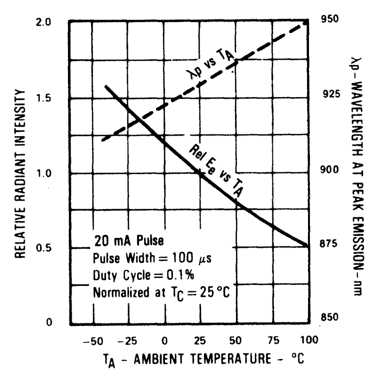
Forward Voltage vs Ambient Temperature



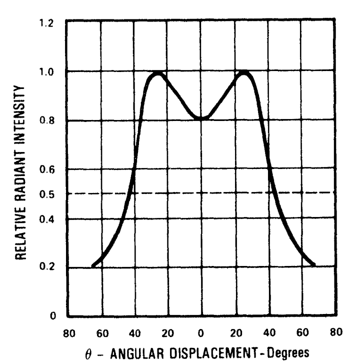
Rise Time and Fall Time vs Forward Current



Normalized Power Output and Wavelength at Peak Emission vs Ambient Temperature



Relative Radiant Intensity vs Angular Displacement

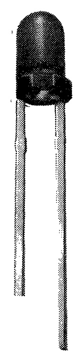


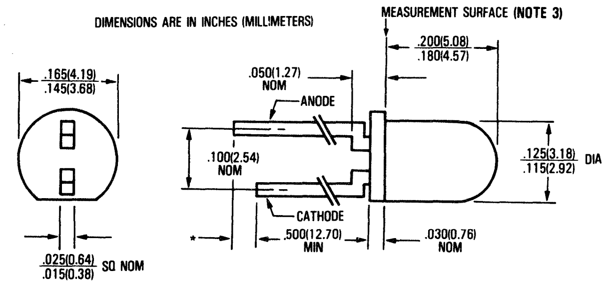
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP166A
April 1993

OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP166A, OP166D





* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP506 series phototransistors
- T-1 package style
- Two power ranges

Description

The OP166 series devices are 935nm high intensity gallium arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency. Lead spacing on this series is .100 inch (2.54mm).

Replaces

OP161SL series.

Note

The OP166B, C have been replaced by OP164B, C which are equivalent except for the color of the package.

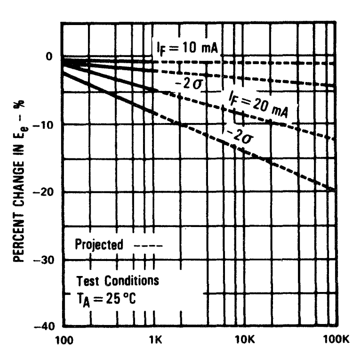
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

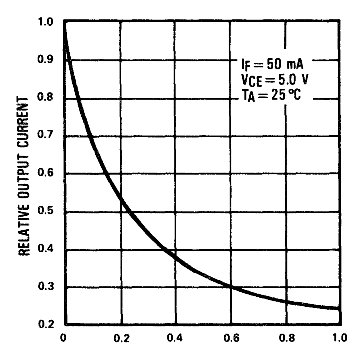
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics OP166 and OP506



Types OP166A, OP166D

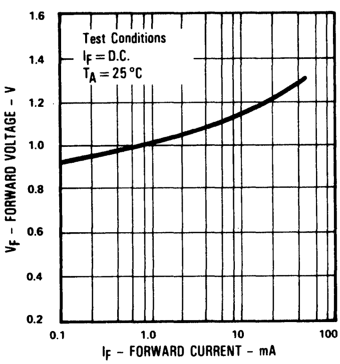
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP166D OP166A	1.40 1.95		 3.70	mW/cm^2 mW/cm^2	I_F = 20 mA(3) I_F = 20 mA(3)
V_F	Forward Voltage				1.60	V	I_F = 20 mA
I_R	Reverse Current				100	μA	V_R = 2.0 V
λp	Wavelength at Peak Emission			935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			50		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 20 mA
t_r	Output Rise Time			1000		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			500		ns	PW = 10μs, D.C. = 10.0%

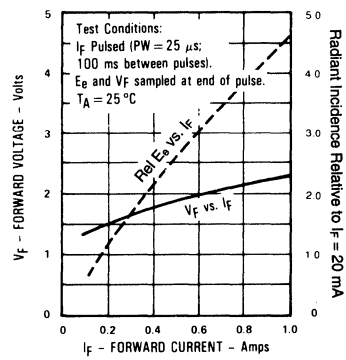
INFRARED EMITTING DIODES

Typical Performance Curves

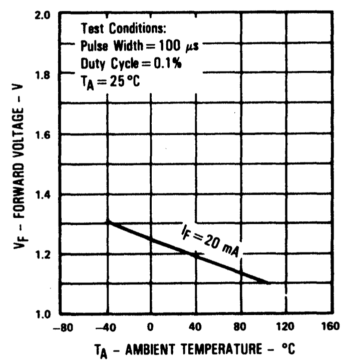
Forward Voltage vs Forward Current



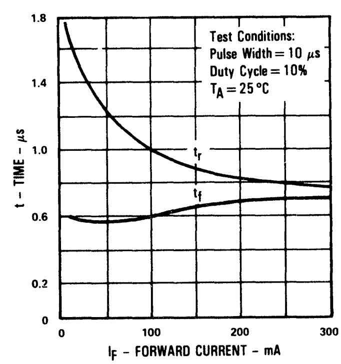
Forward Voltage and Relative Radiant Incidence vs. Forward Current



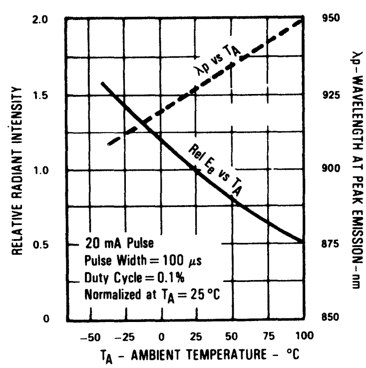
Forward Voltage vs Ambient Temperature



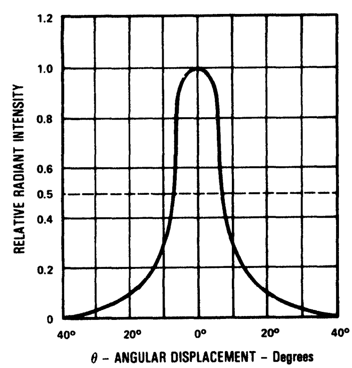
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



Relative Radiant Intensity vs Angular Displacement

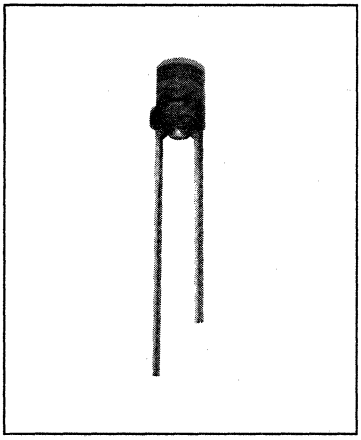


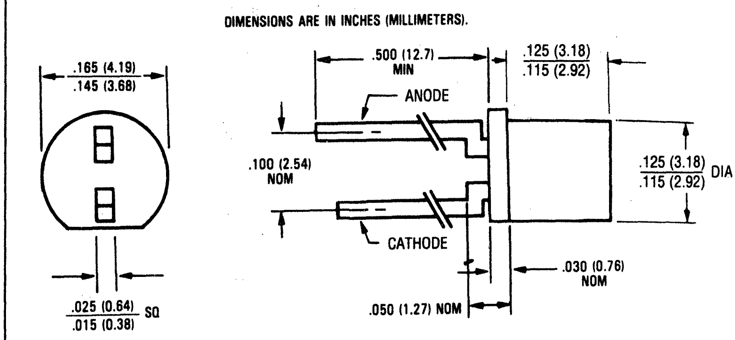
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP166W
April 1993

OPTEK

GaAs Plastic Infrared Emitting Diode
Type OP166W





Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP506W
- Small package size for space limited applications
- T-1 package style

Description

The OP166W is a 935nm high intensity gallium arsenide infrared emitting diode molded in an IR transmissive amber tinted epoxy package. This package is a T-1 style in all respects except for the length of the plastic package. Lead spacing on this part is .100 inch (2.54mm).

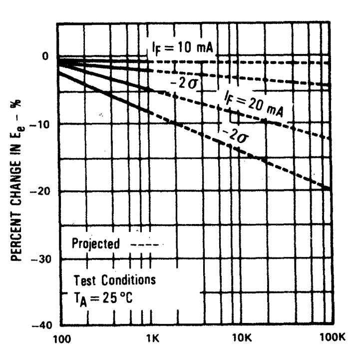
Absolute Maximum Ratings (T_A 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µsec pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 Sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

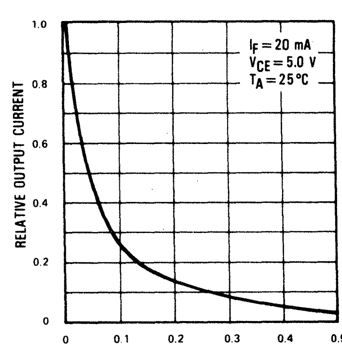
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C.
(3) For identification purposes, cathode lead is 0.060(1.52) nom shorter than anode lead.

Typical Performance Curves

Percent Changes in Power Output vs Time



Coupling Characteristics of OP166W and OP506W



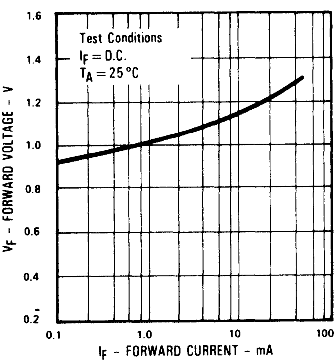
Type OP166W

Electrical Characteristics (T_A = 25°C unless otherwise noted)

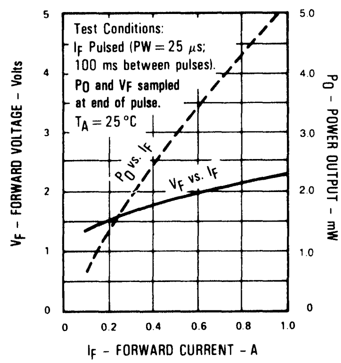
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	0.50			mW	I_F = 20 mA
V_F	Forward Voltage			1.60	V	I_F = 20 mA
I_R	Reverse Current			100	μA	V_R = 2.0 V
λp	Wavelength at Peak Emission		935		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points		50		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		90		Deg.	I_F = 20 mA
t_r	Output Rise Time		1000		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fa:l Time		500		ns	PW = 10 μs, D.C. = 10.0%

Typical Performance Curves

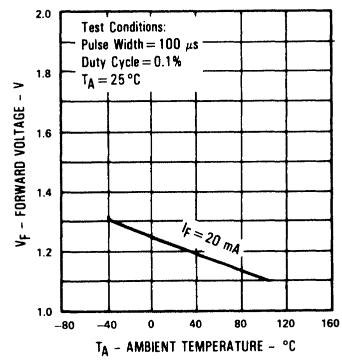
Forward Voltage vs Forward Current



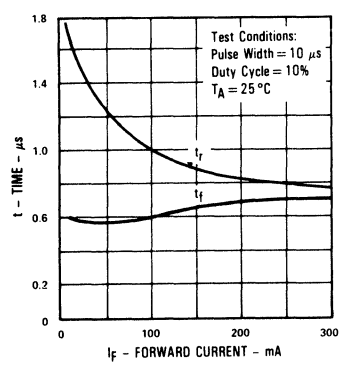
Forward Voltage and Power Output vs Forward Current



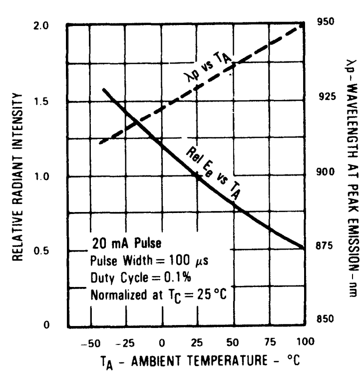
Forward Voltage vs Ambient Temperature



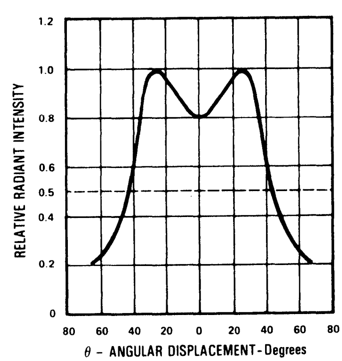
Rise Time and Fall Time vs Forward Current



Normalized Power Output and Wavelength at Peak Emission vs Ambient Temperature

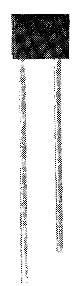


Relative Radiant Intensity vs Angular Displacement

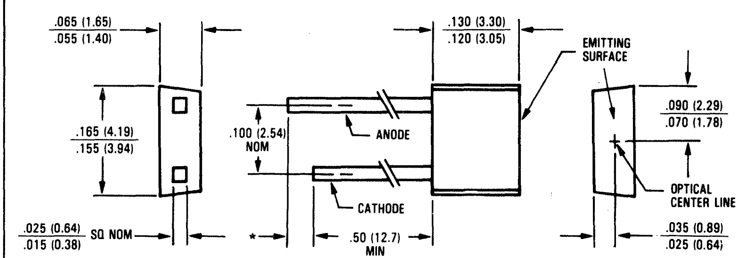


OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP168FA, OP168FB, OP168FC



DIMENSIONS ARE IN INCHES (MILLIMETERS).



*FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .06 (1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Flat lensed for wide radiation angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP508F series phototransistor and the OP538F series photodarlingtons

Description

The OP168F series are gallium arsenide infrared emitting diodes molded in "end looking" miniature black plastic packages. This device has a wide radiation angle due to its flat emitting surface. Small size and 0.100 (2.54mm) lead spacing allow considerable design flexibility.

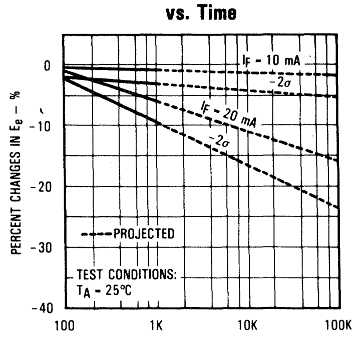
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Continuous Forward Current 50mA
Peak Forward Current (Pulse Width = 1 µsec, 300pps) 3.0A
Reverse Voltage 2.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron) .... 260°C(1)
Power Dissipation .... 100mW(2)

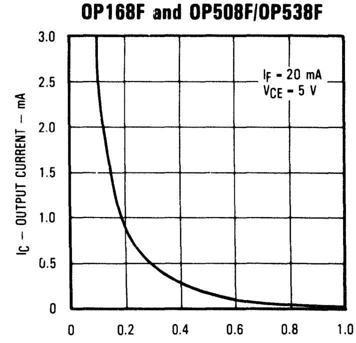
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.081" (2.06mm) in diameter perpendicular to and centered on the mechanical axis of the "emitting surface" and 0.400" (10.16mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs. Time



Coupling Characteristics of OP168F and OP508F/OP538F



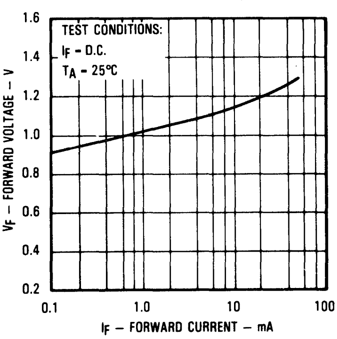
Types OP168FA, OP168FB, OP168FC

Electrical Characteristics (T_A = 25°C unless otherwise noted)

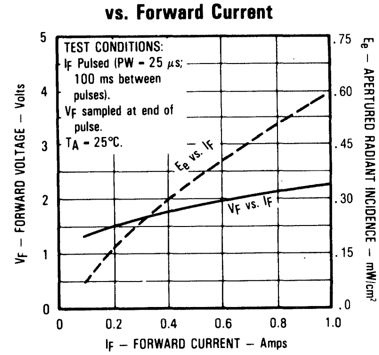
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence OP168FC OP168FB OP168FA	0.27 0.43 0.48		0.73	mW/cm^2	I_F = 20 mA(3)
V_F	Forward Voltage			1.60	V	I_F = 20 mA
I_R	Reverse Current			100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission		935		nm	I_F = 20 mA
B	Bandwidth Between Half Power Points		50		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		104		Deg.	I_F = 20 mA
t_r	Output Rise Time		1000		ns	$I_{F(PK)}$ = 100 mA, PW = 10 µs, D.C. = 10.0%
t_f	Output Fall Time		500		ns	

Typical Performance Curves

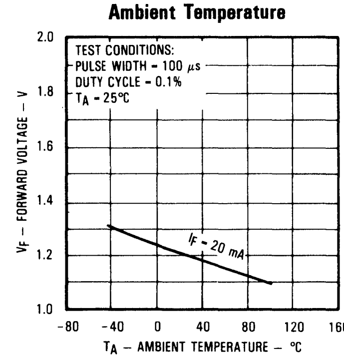
Forward Voltage vs. Forward Current



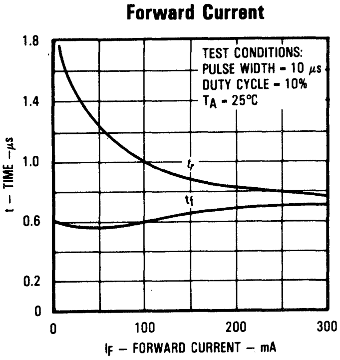
Forward Voltage and Radiant Incidence vs. Forward Current



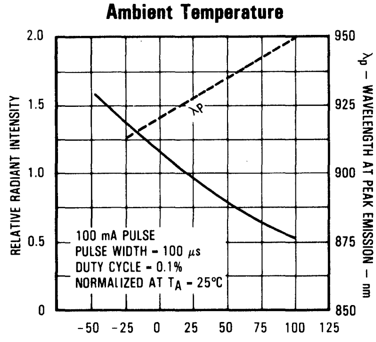
Forward Voltage vs. Ambient Temperature



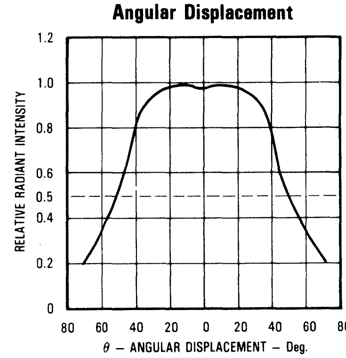
Rise Time and Fall Time vs. Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs. Ambient Temperature



Relative Radiant Intensity vs. Angular Displacement

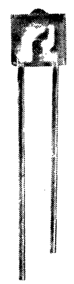


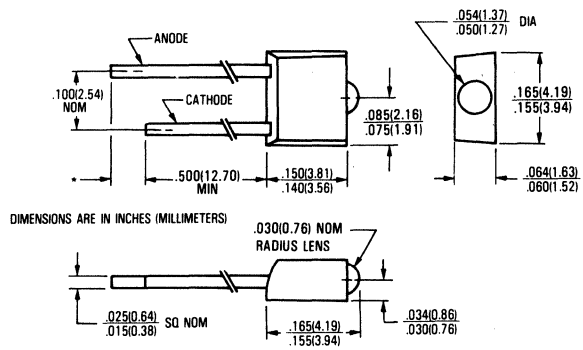
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP169
April 1993

OPTEK

GaAs Plastic Infrared Emitting Diodes
Types OP169A, OP169B, OP169C





* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Integral lens for narrow beam angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP509 phototransistor series

Description

The OP169 series are gallium arsenide infrared emitting diodes molded in "end looking" miniature clear packages. The molded lens insures improved uniformity of lens magnification from unit to unit. The OP169 series provides a broad range of on-line and radiant intensities and has considerable design flexibility due to its small size. These devices are mechanically and spectrally matched to the OP509 series phototransistors.

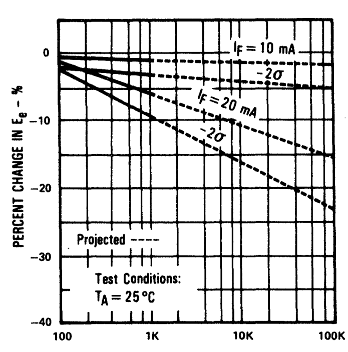
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Continuous Forward Current 50mA
Peak Forward Current (Pulse Width = 1 μsec, 300pps) 3.0A
Reverse Voltage 2.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron) .... 260°C(1)
Power Dissipation .... 100mW(2)

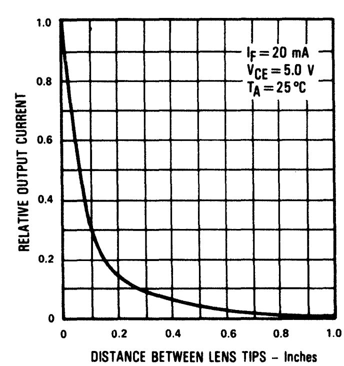
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the above conditions. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP169 and OP509



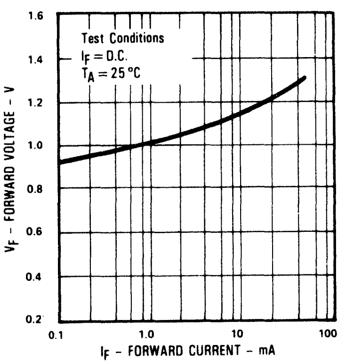
Types OP169A, OP169B, OP169C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

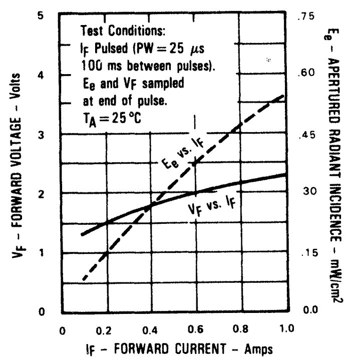
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence OP169C OP169B OP169A	0.027 0.108 0.180		0.220	mW/cm^2	I_F = 20mA(3)
V_F	Forward Voltage			1.60	V	I_F = 20mA
I_R	Reverse Current			100	µA	V_R = 2.0V
λp	Wavelength at Peak Emission		935		nm	I_F = 20mA
B	Bandwidth Between Half Power Points		50		nm	I_F = 10mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		46		Deg.	I_F = 20mA
t_r	Output Rise Time		1000		ns	$I_{F(PK)}$ = 100mA, PW = 10 µs, D.C. = 10.0%
t_f	Output Fall Time		500		ns	

Typical Performance Curves

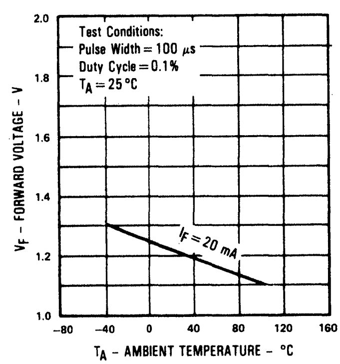
Forward Voltage vs Forward Current



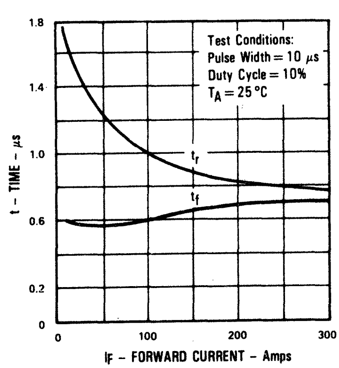
Forward Voltage and Radiant Incidence vs Forward Current



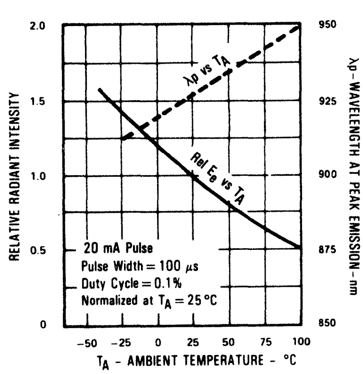
Forward Voltage vs Ambient Temperature



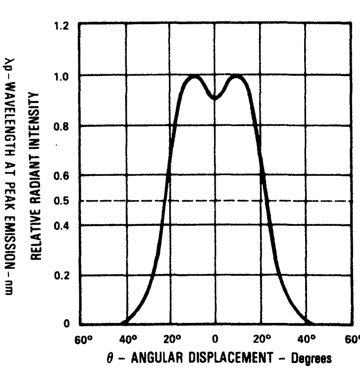
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



Relative Radiant Intensity vs Angular Displacement



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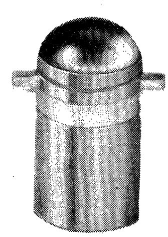
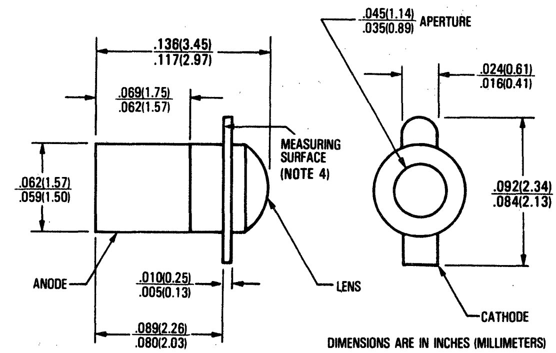
Product Bulletin OP223
April 1993

OPTEK

GaAlAs Hermetic Infrared Emitting Diodes
Types OP223, OP224





Features

- Narrow irradiance pattern
- Enhanced temperature range
- Small package size permits high device density mounting
- Mechanically and spectrally matched to the OP640SL and OP300SL series devices
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response

Description

The OP223 and OP224 devices are 890nm gallium aluminum arsenide infrared emitting diodes mounted in hermetically sealed "Pill" type packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

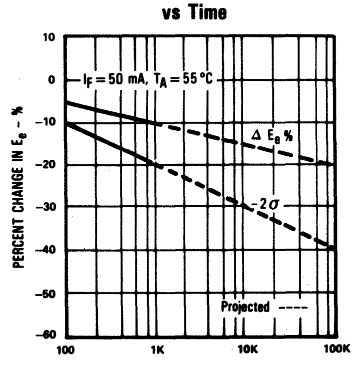
Reverse Voltage	2.0V
Continuous Forward Current	100mA
Peak Forward Current (2 µs pulse width, 0.1% duty cycle)	1.0A
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Soldering Temperature (5 sec. with soldering iron)	260°C(1)(2)
Power Dissipation	150mW(3)

Notes:

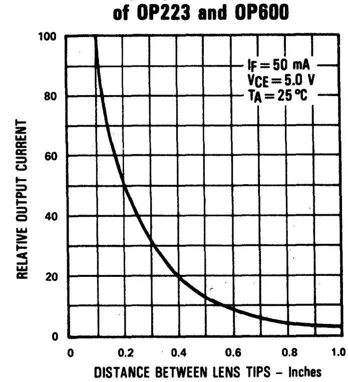
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices into PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.50mW/°C above 25°C.
(4) $E_{e(APT)}$ is measured using a 0.031" (0.787mm) diameter apertured sensor placed 0.50" (12.7mm) from the mounting plane. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP223 and OP600



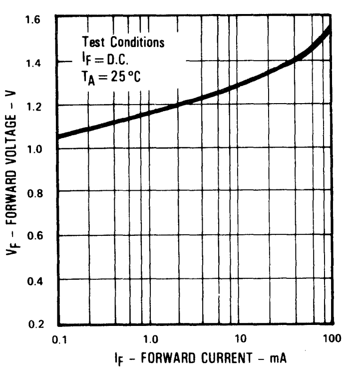
Types OP223, OP224

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

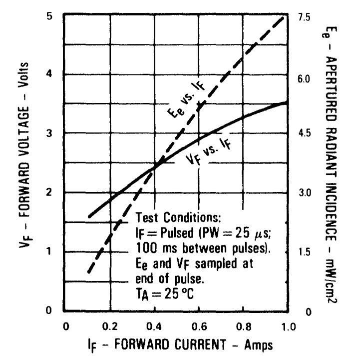
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP223 OP224	1.00 3.50			mW/cm^2 mW/cm^2	$I_F = 50mA^{(4)}$ $I_F = 50mA^{(4)}$
V_F	Forward Voltage				1.80	V	$I_F = 50mA$
I_R	Reverse Current				100	µA	$V_R = 2.0V$
λp	Wavelength at Peak Emission			890		nm	$I_F = 10mA$
B	Spectral Bandwidth Between Half Power Points			80		nm	$I_F = 10mA$
$\Delta \lambda p / \Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			24		Deg.	$I_F = 50mA$
t_r	Output Rise Time			500		ns	$I_{F(PK)} = 100mA$, PW = 10µs
t_f	Output Fall Time			250		ns	D.C. = 10.0%

Typical Performance Curves

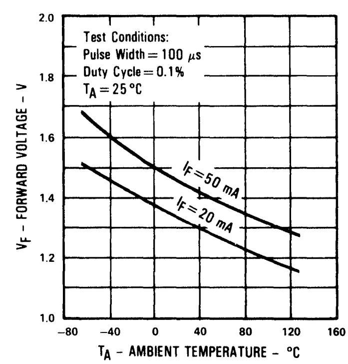
Forward Voltage vs Forward Current



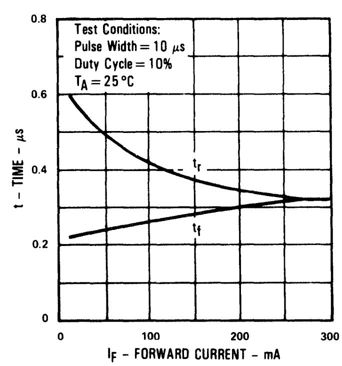
Forward Voltage and Radiant Incidence vs Forward Current



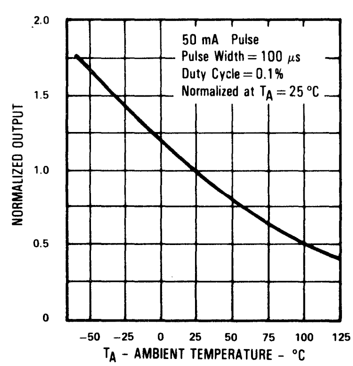
Forward Voltage vs Ambient Temperature



Rise Time and Fall Time vs Forward Current



Normalized Power Output vs Ambient Temperature



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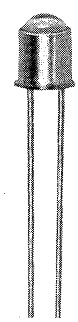
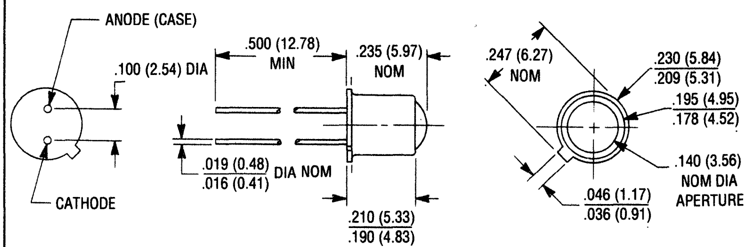
Product Bulletin OP231
April 1993

OPTEK

GaAlAs Hermetic Infrared Emitting Diodes
Types OP231, OP232, OP233





Features

- Enhanced temperature range
- TO-46 hermetically sealed package
- Mechanically and spectrally matched to OP800, OP593, and OP598 phototransistors
- Specified apertured power in ranges to satisfy most applications
- Variety of power ranges

Description

The OP231 series devices are gallium aluminum arsenide infrared emitting diodes mounted in hermetic TO-46 housings. Gallium aluminum arsenide features higher radiated output than gallium arsenide at the same forward current. The wavelength is centered at 890 nm which closely matches the spectral response of silicon phototransistors. The OP231 series is lensed to provide a narrow beam angle (18° between half power points). The narrow beam angle and the specified radiant intensity of the OP231 series allow ease of design in beam interrupt applications in conjunction with the OP800 or OP598 series photosensor.

Please refer to application bulletins 208 and 210 for additional design information and reliability (degradation) data.

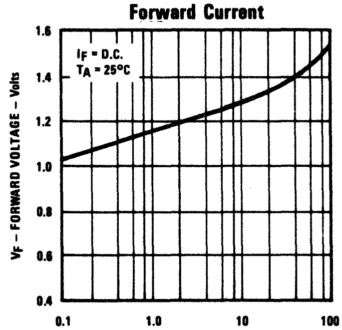
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 100mA
Peak Forward Current (2 µs pulse width, 0.1% duty cycle) 10.0A
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 200mW(2)

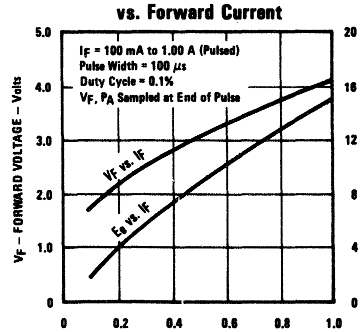
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface, a radius of 1.429" (36.30mm) measured from the lens side of the tab to the sensing surface and a sensing surface of 0.250" (6.35mm) in diameter forming a 10° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.10% and an I_F = 100mA.

Typical Performance Curves

Forward Voltage vs. Forward Current



Forward Voltage and Radiant Incidence vs. Forward Current



Types OP231, OP232, OP233

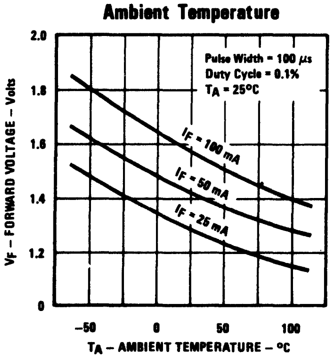
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP231 OP232 OP233	1.5 2.0 3.0		6.0	mW/cm^2 mW/cm^2 mW/cm^2	I_F = 100 mA(3)(4) I_F = 100 mA(3)(4) I_F = 100 mA(3)(4)
P_O	Radiant Power Output	OP231 OP232 OP233		6.0 8.0 10.0		mW mW mW	I_F = 100 mA(3)(4) I_F = 100 mA(3)(4) I_F = 100 mA(3)(4)
V_F	Forward Voltage				2.0	V	I_F = 100 mA(4)
I_R	Reverse Current				100	µA	V_R = 2.0 V
λ_P	Wavelength at Peak Emission			890		nm	I_F = 10 mA
B	Spectral Bandwidth Half Power Points			80		nm	I_F = 10 mA
$\Delta\lambda_P/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 100 mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			250		ns	PW = 10µs, D.C. = 10%

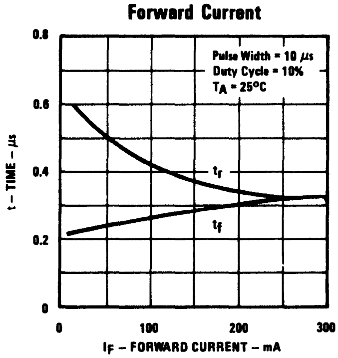
INFRARED EMITTING DIODES

Typical Performance Curves

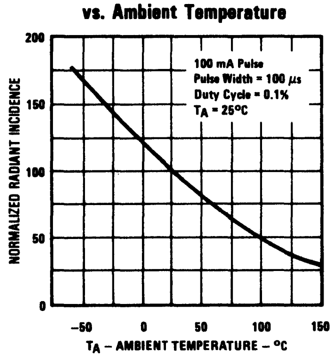
Forward Voltage vs. Ambient Temperature



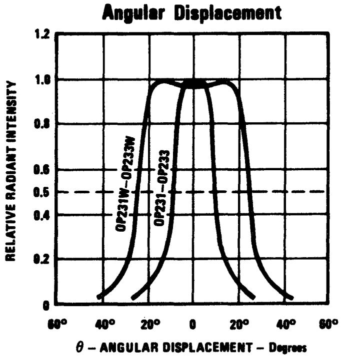
Rise Time and Fall Time vs. Forward Current



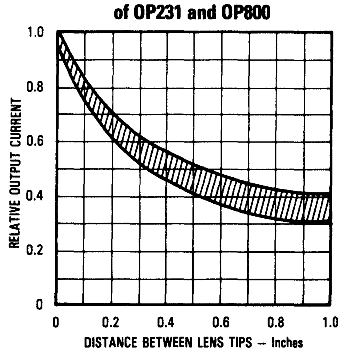
Normalized Radiant Incidence vs. Ambient Temperature



Relative Radiant Intensity vs. Angular Displacement

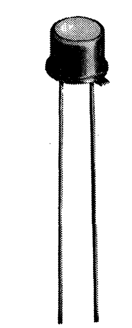


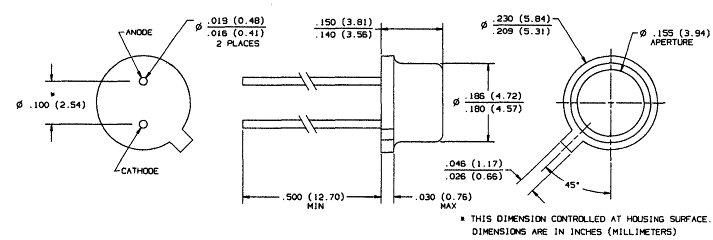
Coupling Characteristics of OP231 and OP800



OPTEK

GaAlAs Hermetic Infrared Emitting Diodes
Types OP231W, OP232W, OP233W





Features

- Wide irradiance pattern
- Enhanced temperature range
- Mechanically and spectrally matched to the OP800WSL and OP830SL series devices
- Significantly higher power output than GaAs at equivalent drive currents
- TO-46 hermetically sealed package

Description

The OP231W series devices are 890nm gallium aluminum arsenide infrared emitting diodes mounted in hermetically sealed packages. The broad irradiance pattern provides relatively even illumination over a large area.

Replaces

K6300 series

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Reverse Voltage	2.0V
Continuous Forward Current	100mA
Peak Forward Current (2 µs pulse width, 0.1% duty cycle)	10.0A
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	200mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface, a radius of 0.466" (11.84mm) measured from the lens side of the tab to the sensing surface, and a sensing surface of 0.250" (6.35mm) in diameter forming a 30° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) Measurement made with 100µs pulse measured at the trailing edge of the pulse with a duty cycle of 0.1% and an I_F = 100mA.

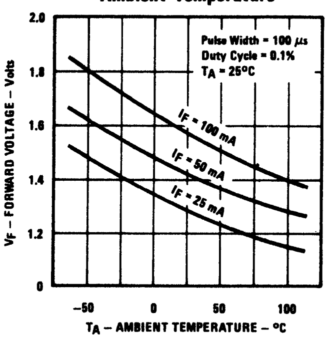
Types OP231W, OP232W, OP233W

Electrical Characteristics (T_A = 25°C unless otherwise noted)

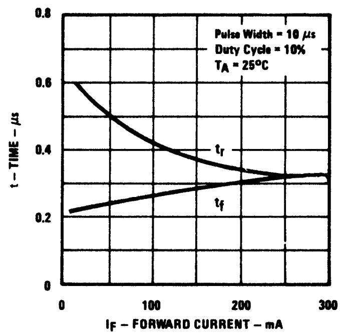
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP231W OP232W OP233W	1.5 3.5 5.0		 7.0 	mW/cm² mW/cm² mW/cm²	I_F = 100 mA(3)(4) I_F = 100 mA(3)(4) I_F = 100 mA(3)(4)
V_F	Forward Voltage				2.0	V	I_F = 100 mA(4)
I_R	Reverse Current				100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission			890		nm	I_F = 10 mA
B	Spectral Bandwidth Half Power Points			80		nm	I_F = 10 mA
$\Delta\lambda_P/\Delta T$	Spectral Shift with Temperature			+0.30		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			50		Deg.	I_F = 100 mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100 mA, PW = 10 µs, D.C. = 10%
t_f	Output Fall Time			250		ns	

Typical Performance Curves

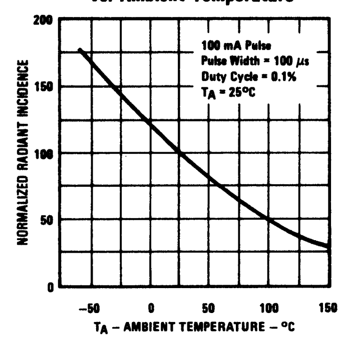
Forward Voltage vs. Ambient Temperature



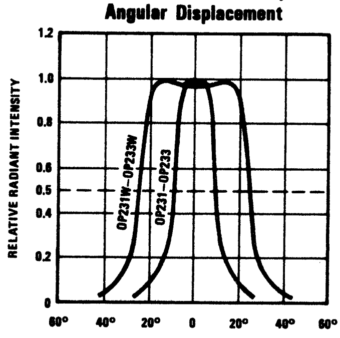
Rise Time and Fall Time vs. Forward Current



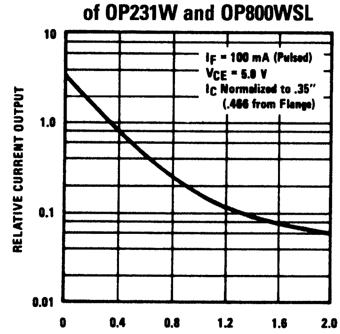
Normalized Radiant Incidence vs. Ambient Temperature



Relative Radiant Intensity vs. Angular Displacement



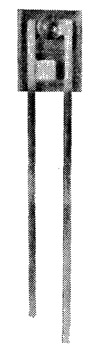
Coupling Characteristics of OP231W and OP800WSL

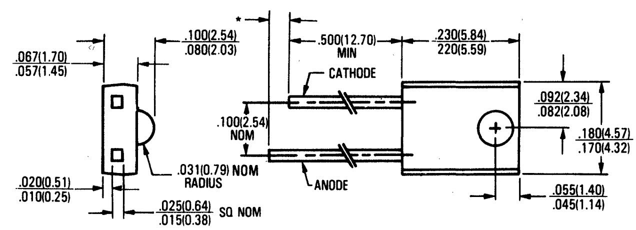


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP240A, OP240B, OP240C, OP240D





DIMENSIONS ARE IN INCHES (MILLIMETERS).

* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP550 and OP560 series phototransistors
- Wavelength matched to silicon's peak response
- Significantly higher power output than GaAs at equivalent drive currents
- Side-looking package for space limited applications

Description

The OP240 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive clear epoxy packages. The side-looking packages are for use in PC board mounted slotted switches or as easily mounted interrupt detectors.

Replaces

OP240SL series

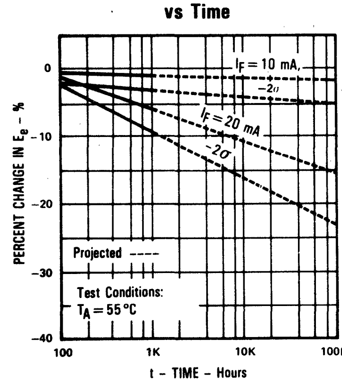
Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

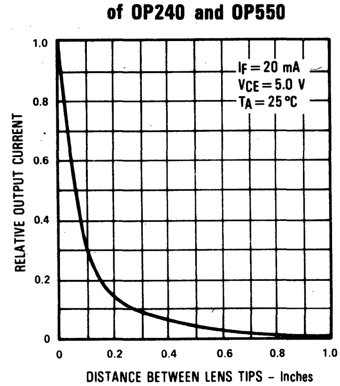
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP240 and OP550



Types OP240A, OP240B, OP240C, OP240D

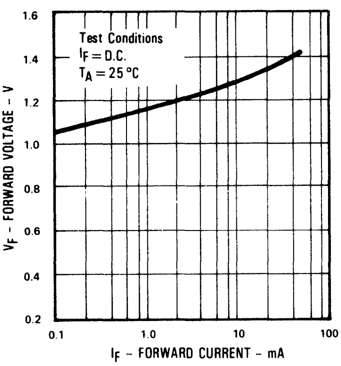
INFRARED EMITTING DIODES

Electrical Characteristics (T_A = 25°C unless otherwise noted)

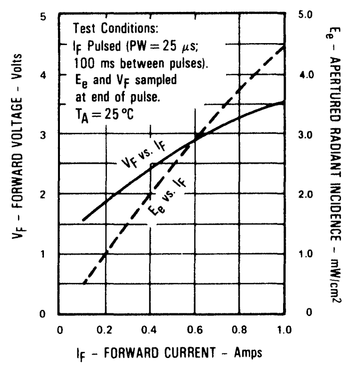
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP240D	0.05			mW/cm^2	I_F = 20 mA[(3)]
		OP240C	0.20		0.86	mW/cm^2	I_F = 20 mA[(3)]
		OP240B	0.40		1.20	mW/cm^2	I_F = 20 mA[(3)]
		OP240A	0.60			mW/cm^2	I_F = 20 mA[(3)]
V_F	Forward Voltage				1.80	V	I_F = 20 mA
I_R	Reverse Current				100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission			890		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			40		Deg.	I_F = 20 mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			250		ns	PW = 10 µs, D.C. = 10%

Typical Performance Curves

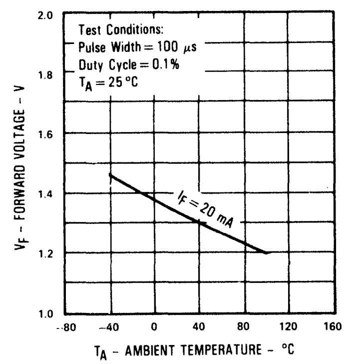
Forward Voltage vs Forward Current



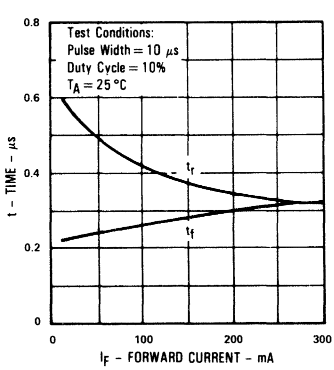
Forward Voltage and Radiant Incidence vs Forward Current



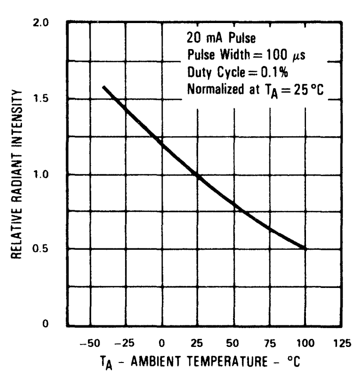
Forward Voltage vs Ambient Temperature



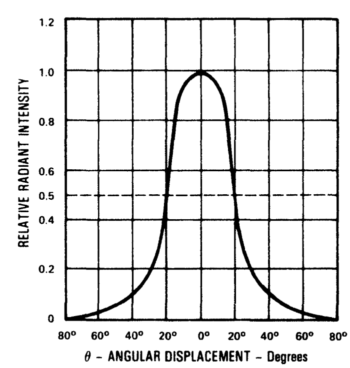
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity vs Ambient Temperature



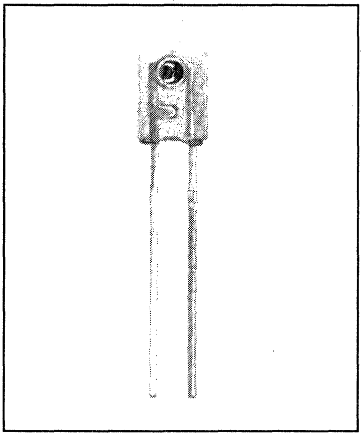
Relative Radiant Intensity vs Angular Displacement

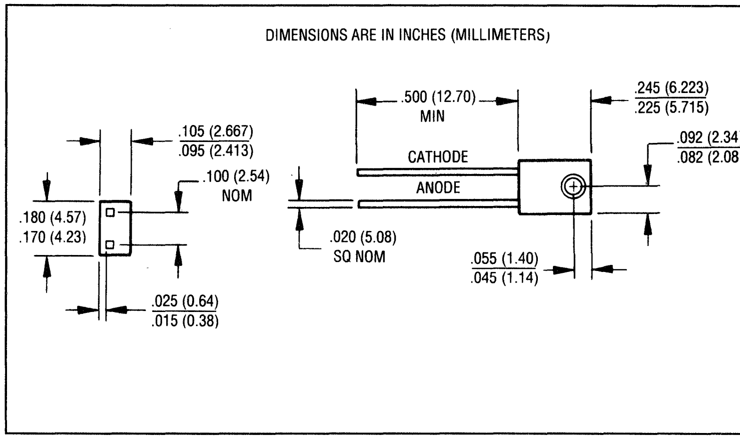


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP245A, OP245B, OP245C, OP245D





Features

- Mechanically and spectrally matched to the OP555 and OP565 series devices
- Wavelength matched to silicon's peak response
- Significantly higher power output than GaAs at equivalent drive currents
- Side-looking package for space limited applications

Description

The OP245 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The side-looking packages are for use in PC board mounted slotted switches or as easily mounted interrupt detectors.

Replaces

K6650

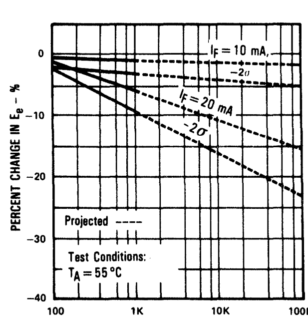
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range . . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . . 260°C[(1)]
Power Dissipation . . . . . 100mW[(2)]

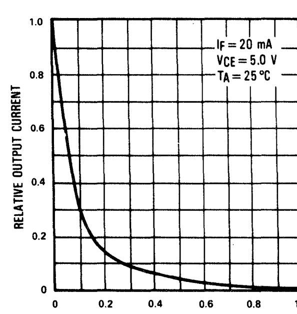
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP245 and OP555



Types OP245A, OP245B, OP245C, OP245D

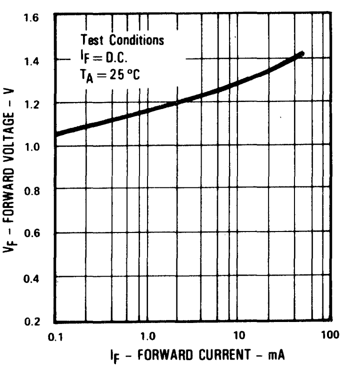
INFRARED EMITTING DIODES

Electrical Characteristics (T_A = 25°C unless otherwise noted)

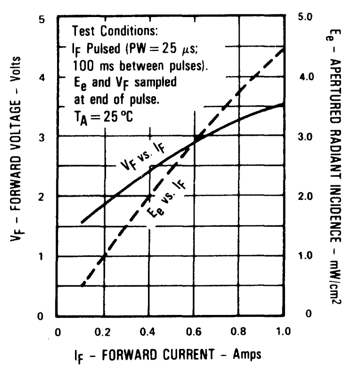
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP245D	0.05			mW/cm^2	I_F = 20 mA(3)
		OP245C	0.20		0.86	mW/cm^2	I_F = 20 mA(3)
		OP245B	0.40		1.20	mW/cm^2	I_F = 20 mA(3)
		OP245A	0.60			mW/cm^2	I_F = 20 mA(3)
V_F	Forward Voltage				1.80	V	I_F = 20 mA
I_R	Reverse Current				100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission			890		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			40		Deg.	I_F = 20 mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			250		ns	PW = 10 µs, D.C. = 10.0%

Typical Performance Curves

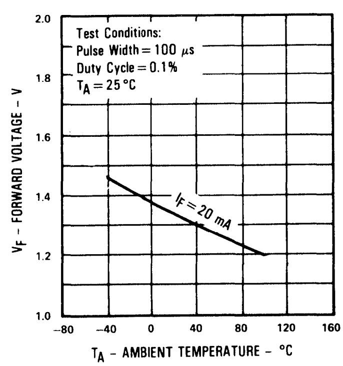
Forward Voltage vs Forward Current



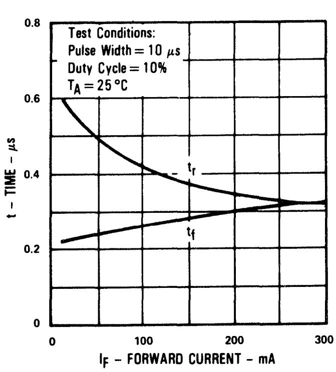
Forward Voltage and Radiant Incidence vs Forward Current



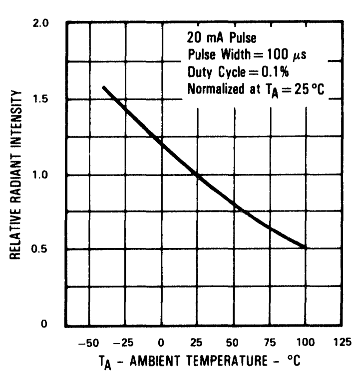
Forward Voltage vs Ambient Temperature



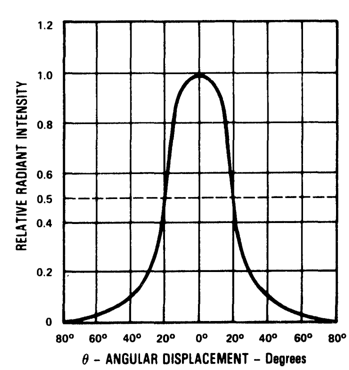
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity vs Ambient Temperature



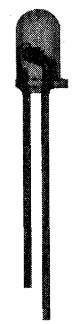
Relative Radiant Intensity vs Angular Displacement

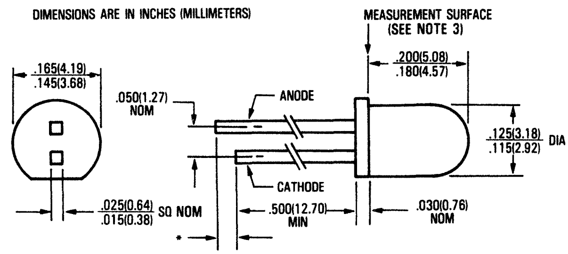


Product Bulletin OP265A
April 1993

OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP265A, OP265B, OP265C, OP265D





* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP505, OP535 series devices
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- T-1 package style

Description

The OP265 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive amber tinted epoxy packages. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency.

Replaces

K6600

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

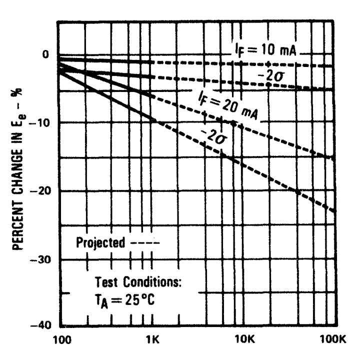
Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

Notes:

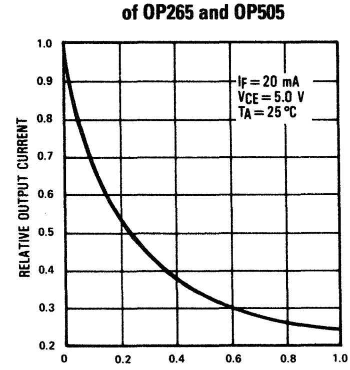
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP265 and OP505



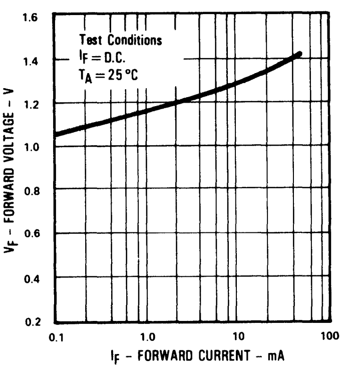
Types OP265A, OP265B, OP265C, OP265D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

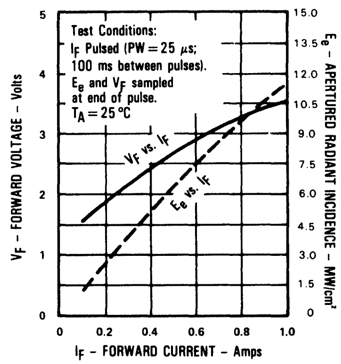
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP265D	0.54			mW/cm^2	I_F = 20 mA(3)
		OP265C	0.54		3.30	mW/cm^2	I_F = 20 mA(3)
		OP265B	1.65		4.70	mW/cm^2	I_F = 20 mA(3)
		OP265A	2.70			mW/cm^2	I_F = 20 mA(3)
V_F	Forward Voltage				1.80	V	I_F = 20 mA
I_R	Reverse Current				100	µA	V_R = 2.0 V
λp	Wavelength at Peak Emission			890		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 20mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			250		ns	PW = 10µs, D.C. = 10.0%

Typical Performance Curves

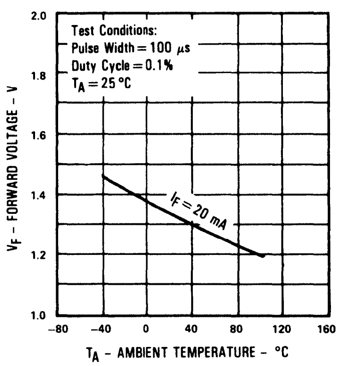
Forward Voltage vs Forward Current



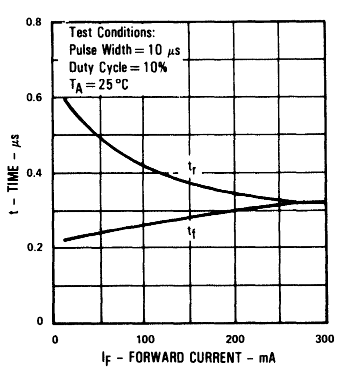
Forward Voltage and Radiant Incidence vs Forward Current



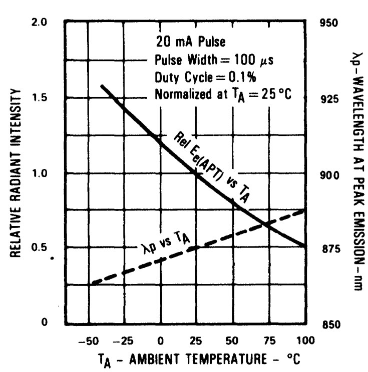
Forward Voltage vs Ambient Temperature



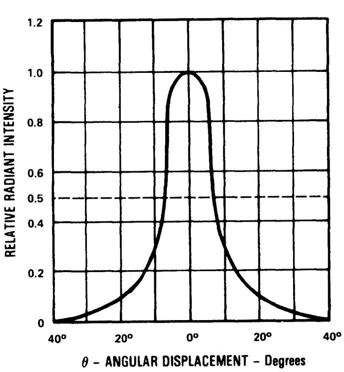
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



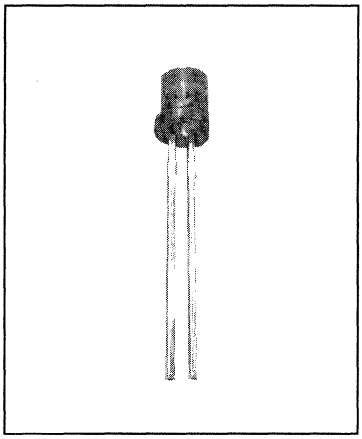
Relative Radiant Intensity vs Angular Displacement

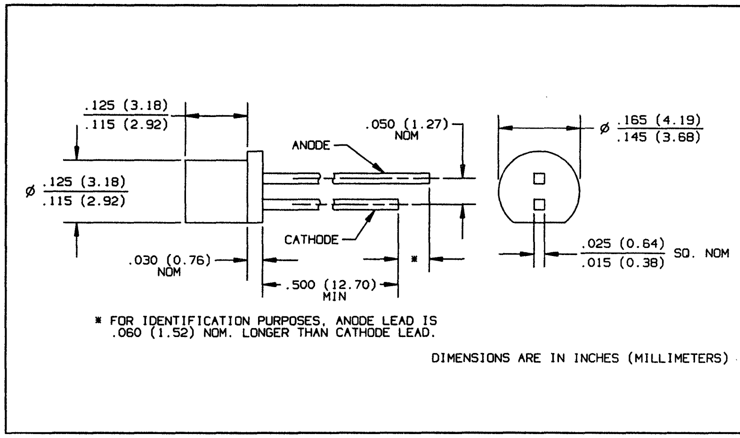


Product Bulletin OP265W
December 1994

OPTEK

GaAlAs Plastic Infrared Emitting Diode
Type OP265W





Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP505W
- Small package size for space limited applications
- T-1 package style
- Significantly higher power output than GaAs at equivalent drive currents

Description

The OP265W is an 890nm high intensity gallium aluminum arsenide infrared emitting diode molded in an IR transmissive amber-tinted epoxy package. The broad irradiance pattern provides relatively even illumination over a large area. This package is a T-1 style in all respects except for the length of the plastic package.

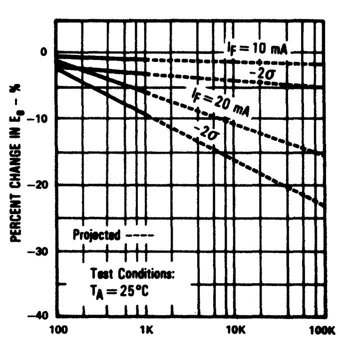
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

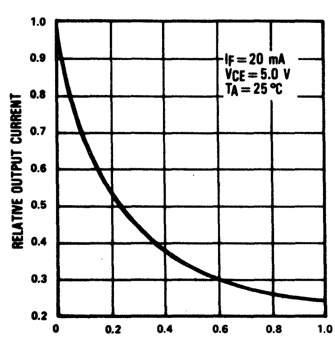
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP265W and OP505W



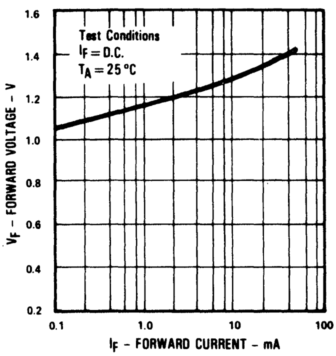
Type OP265W

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

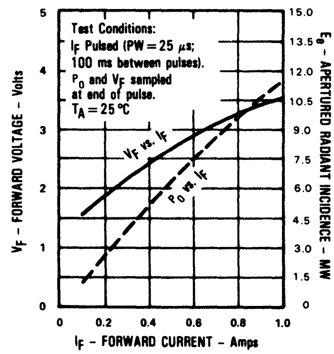
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	1.00			mW	$I_F = 20$ mA
V_F	Forward Voltage			1.80	V	$I_F = 20$ mA
I_R	Reverse Current			100	μA	$V_R = 2.0$ V
λp	Wavelength at Peak Emission		890		nm	$I_F = 10$ mA
B	Spectral Bandwidth Between Half Power Points		80		nm	$I_F = 10$ mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		90		Deg.	$I_F = 20$ mA
t_r	Output Rise Time		500		ns	$I_{F(PK)} = 100$ mA,
t_f	Output Fall Time		250		ns	PW = 10μs, D.C. = 10.0%

Typical Performance Curves

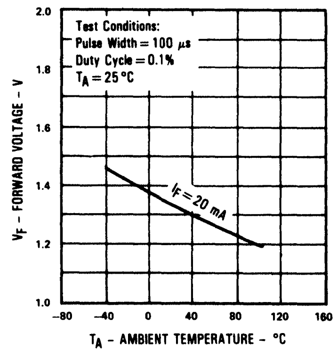
Forward Voltage vs Forward Current



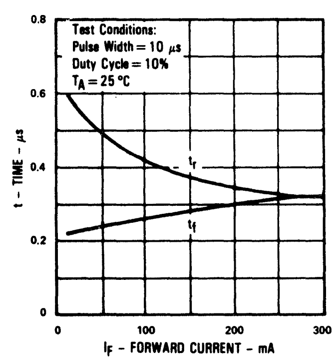
Forward Voltage and Radiant Incidence vs Forward Current



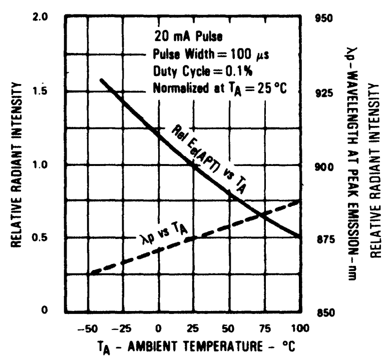
Forward Voltage vs Ambient Temperature



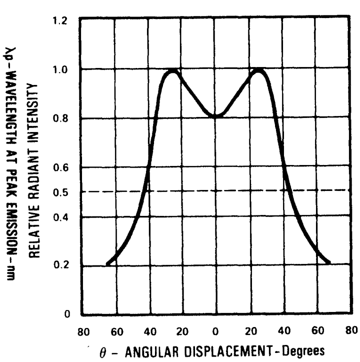
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



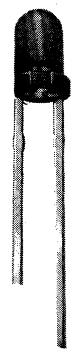
Relative Radiant Intensity vs Angular Displacement

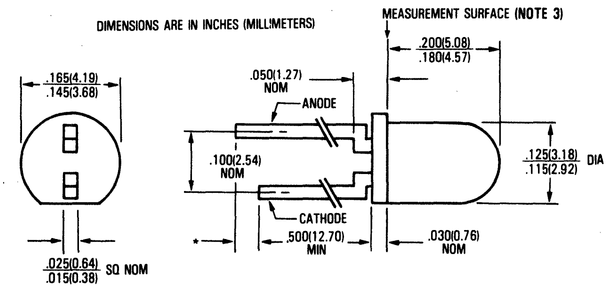


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP266A
May 1993

GaAlAs Plastic Infrared Emitting Diodes
Types OP266A, OP266B, OP266C, OP266D





* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Narrow irradiance pattern
- Mechanically and spectrally matched to the OP506 series devices
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- T-1 package style

Description

The OP266 device is an 890nm high intensity gallium aluminum arsenide infrared emitting diode molded in an IR transmissive amber tinted epoxy package. The narrow irradiance pattern provides high on-axis intensity for excellent coupling efficiency. Lead spacing on this device is .100 inch (2.54mm).

Replaces

OP261

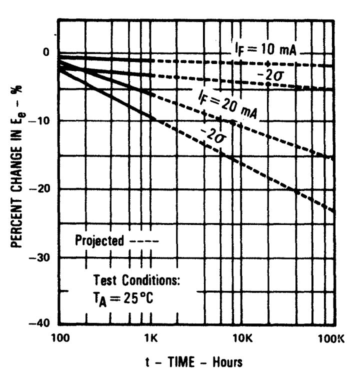
Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Reverse Voltage	2.0V
Continuous Forward Current	50mA
Peak Forward Current (1 µs pulse width, 300 pps)	3.0A
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	100mW(2)

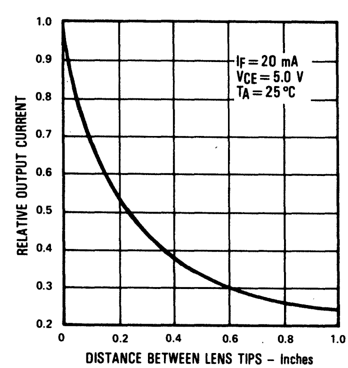
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.081" (2.06mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.590" (14.99mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP266 and OP506



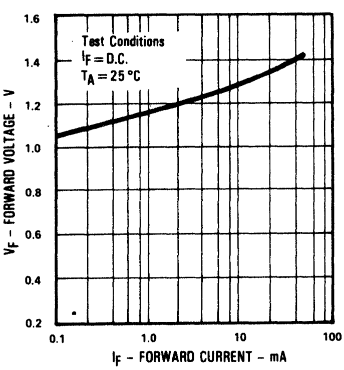
Types OP266A, OP266B, OP266C, OP266D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

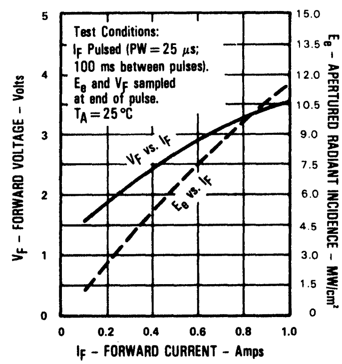
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP266D	0.54			mW/cm^2	I_F = 20 mA(3)
		OP266C	0.54		3.30	mW/cm^2	I_F = 20 mA(3)
		OP266B	1.65		4.70	mW/cm^2	I_F = 20 mA(3)
		OP266A	2.70			mW/cm^2	I_F = 20 mA(3)
V_F	Forward Voltage				1.80	V	I_F = 20 mA
I_R	Reverse Current				100	μA	V_R = 2.0 V
λp	Wavelength at Peak Emission			890		nm	I_F = 10 mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10 mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			18		Deg.	I_F = 20 mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100 mA,
t_f	Output Fall Time			250		ns	PW = 10 μs, D.C. = 10.0%

Typical Performance Curves

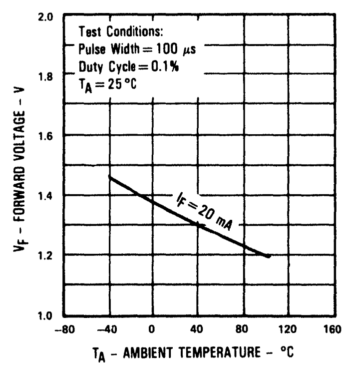
Forward Voltage vs Forward Current



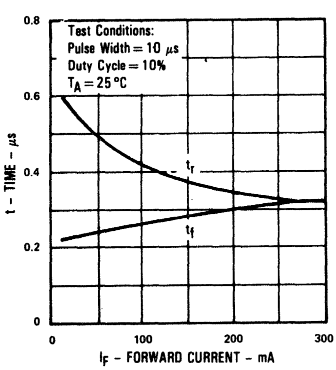
Forward Voltage and Radiant Incidence vs Forward Current



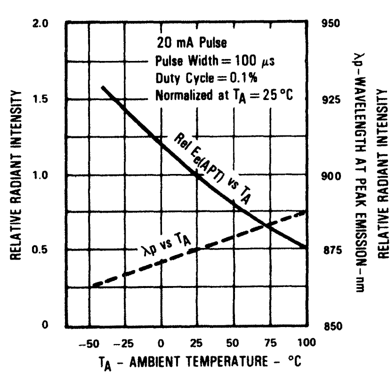
Forward Voltage vs Ambient Temperature



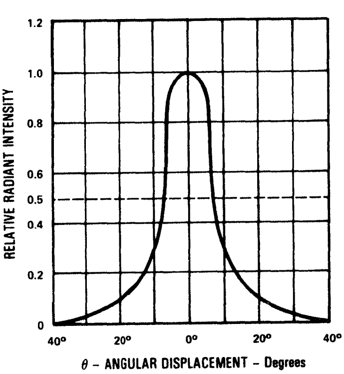
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



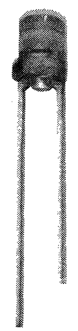
Relative Radiant Intensity vs Angular Displacement

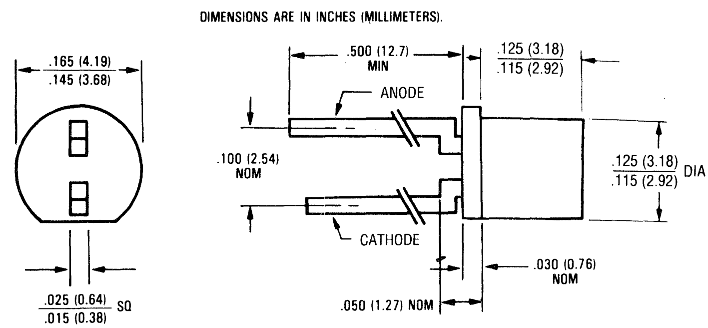


Product Bulletin OP266W
July 1989

OPTEK

GaAlAs Plastic Infrared Emitting Diode
Type OP266W





Features

- Wide irradiance pattern
- Mechanically and spectrally matched to the OP506W
- Small package size for space limited applications
- T-1 package style
- Significantly higher power output than GaAs at equivalent drive currents

Description

The OP266W is an 890nm high intensity gallium aluminum arsenide infrared emitting diode molded in an IR transmissive amber-tinted epoxy package. This package is a T-1 style in all respects except for the length of the plastic package. Lead spacing on this part is .100 inch (2.54mm).

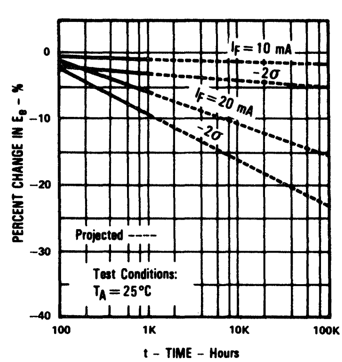
Absolute Maximum Ratings (T_A 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 μsec pulse width, 300 pps) 3.0A
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 Sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

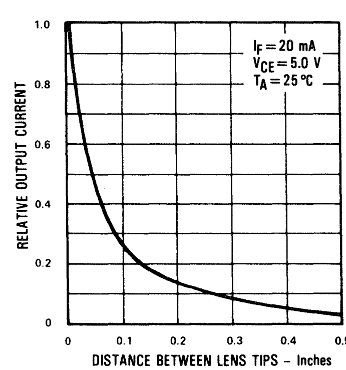
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33mW/°C.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP266W and OP506W



Type OP266W

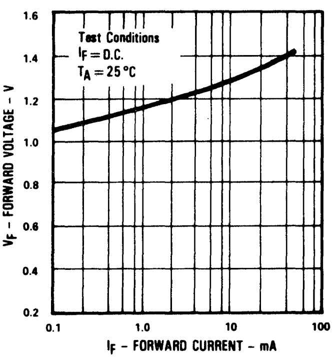
INFRARED EMITTING DIODES

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

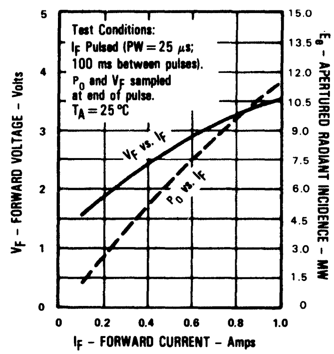
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	1.00			mW	$I_F = 20$ mA
V_F	Forward Voltage			1.80	V	$I_F = 20$ mA
I_R	Reverse Current			100	µA	$V_R = 2.0$ V
λp	Wavelength at Peak Emission		890		nm	$I_F = 10$ mA
B	Spectral Bandwidth Between Half Power Points		80		nm	$I_F = 10$ mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.18		nm/°C	$I_F =$ Constant
θ_{HP}	Emission Angle at Half Power Points		90		Deg.	$I_F = 20$ mA
t_r	Output Rise Time		500		ns	$I_{F(PK)} = 100$ mA, PW = 10 µs, D.C. = 10.0%
t_f	Output Fall Time		250		ns	

Typical Performance Curves

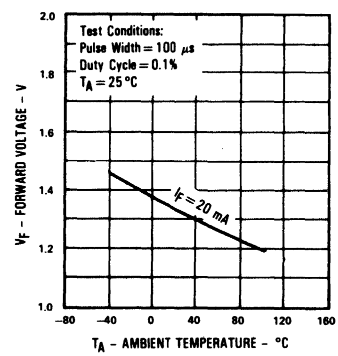
Forward Voltage vs Forward Current



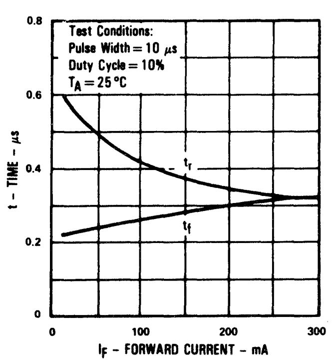
Forward Voltage and Radiant Incidence vs Forward Current



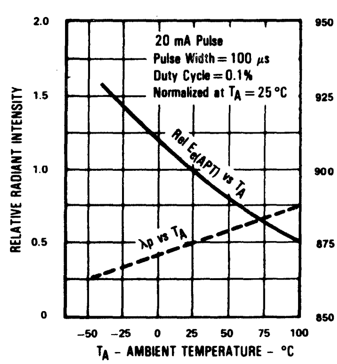
Forward Voltage vs Ambient Temperature



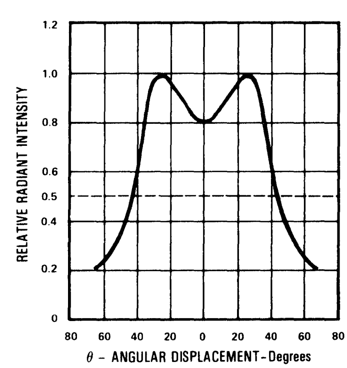
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



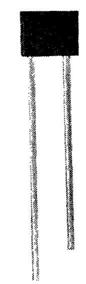
Relative Radiant Intensity vs Angular Displacement

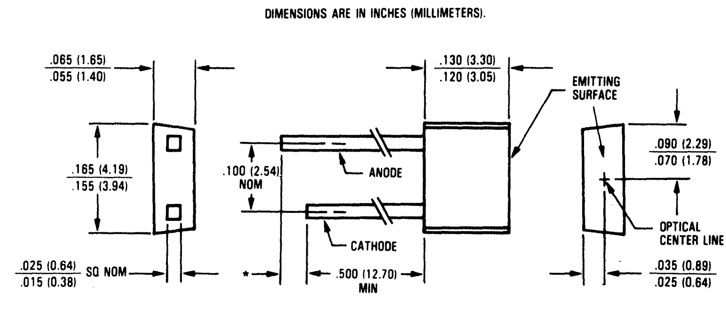


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP268FA, OP268FB, OP268FC





*FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .06 (1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Flat lensed for wide radiation angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP508F series phototransistor and the OP538F series photodarlingtons

Description

The OP268F series contains a gallium aluminum arsenide infrared emitting diode mounted in an "end-looking" miniature black package. This device has a wide radiation angle due to its flat emitting surface. Small size and 0.100" (2.54) lead spacing allow considerable design flexibility.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

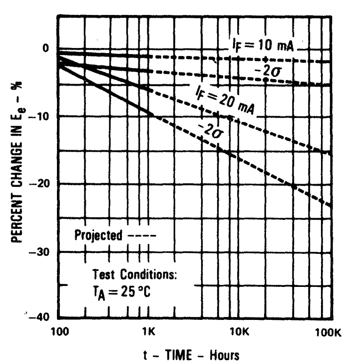
Continuous Forward Current 50mA
Peak Forward Current (Pulse Width = 1 µsec, 300pps) 3.0A
Reverse Voltage 2.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron) . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

Notes:

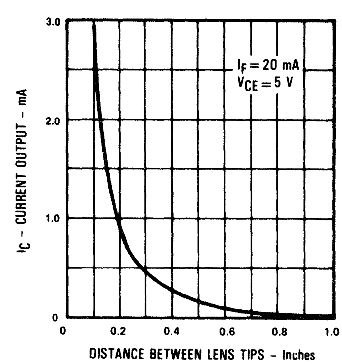
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.081" (2.06mm) in diameter perpendicular to and centered on the mechanical axis of the "emitting surface" and 0.400" (10.16mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs Time



Coupling Characteristics of OP268F and OP508F/OP538F



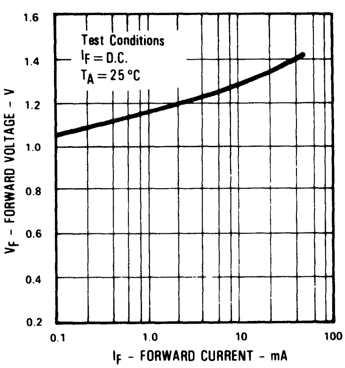
Types OP268FA, OP268FB, OP268FC

Electrical Characteristics (T_A = 25°C unless otherwise noted)

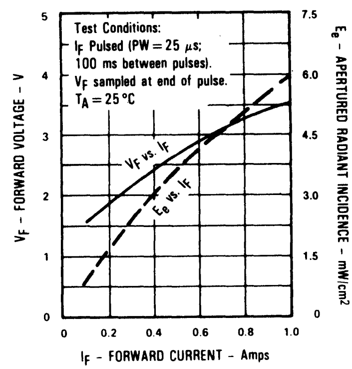
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence OP268FC OP268FB OP268FA	0.36 0.45 0.64		0.99	mW/cm^2	I_F = 20mA(3)
V_F	Forward Voltage			1.80	V	I_F = 20mA
I_R	Reverse Current			100	μA	V_R = 2.0V
λp	Wavelength at Peak Emission		890		nm	I_F = 20mA
B	Bandwidth Between Half Power Points		80		nm	I_F = 10mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		104		Deg.	I_F = 20mA
t_r	Output Rise Time		500		ns	$I_{F(PK)}$ = 100mA, PW = 10.0μs,
t_f	Output Fall Time		250		ns	D.C. = 10.0%

Typical Performance Curves

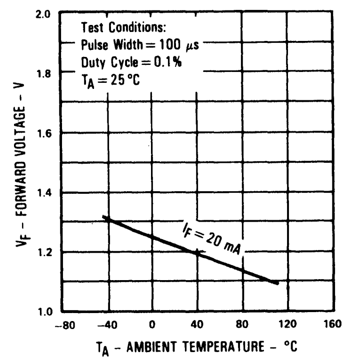
Forward Voltage vs Forward Current



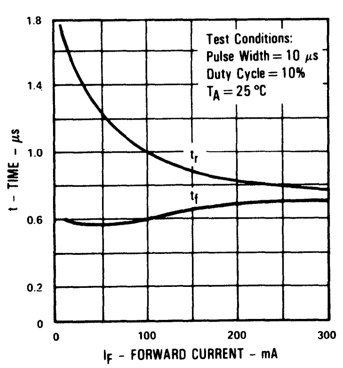
Forward Voltage and Radiant Incidence vs Forward Current



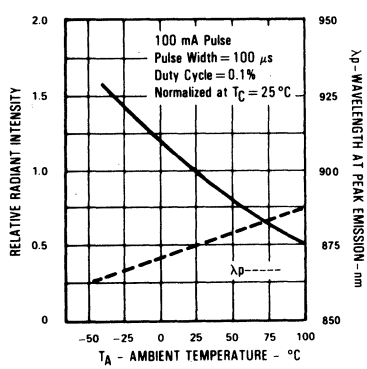
Forward Voltage vs Ambient Temperature



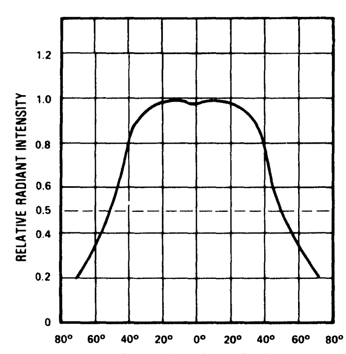
Rise Time and Fall Time vs Forward Current



Relative Radiant Intensity and Wavelength at Peak Emission vs Ambient Temperature



Relative Radiant Intensity vs Angular Displacement



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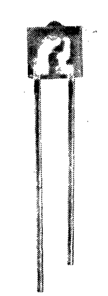
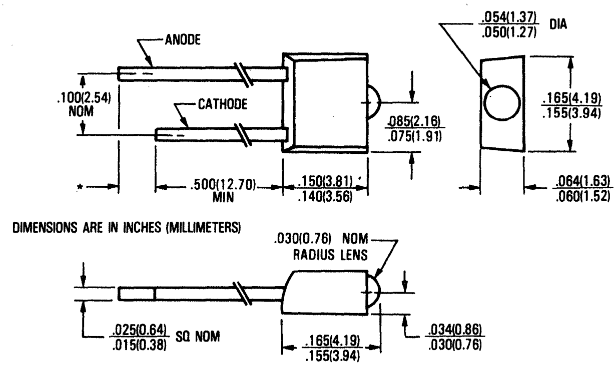
Product Bulletin OP269
April 1993

OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP269A, OP269B, OP269C





* FOR IDENTIFICATION PURPOSES, ANODE LEAD IS .060(1.52) NOM. LONGER THAN CATHODE LEAD.

Features

- Integral lens for narrow beam angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Mechanically and spectrally matched to the OP509 phototransistor series

Description

The OP269 series are gallium aluminum arsenide infrared emitting diodes molded in "end looking" miniature clear packages. The molded lens insures improved uniformity of lens magnification from unit to unit. The OP269 series provides a broad range of on-line and radiant intensities and has considerable design flexibility due to its small size. These devices are mechanically and spectrally matched to the OP509 series of phototransistors. The wavelength at peak emission for this series is 890 nm.

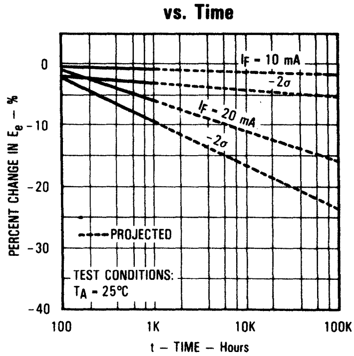
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Continuous Forward Current 50mA
Peak Forward Current (Pulse Width = 1 µsec, 300pps) 3.0A
Reverse Voltage 2.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron) . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

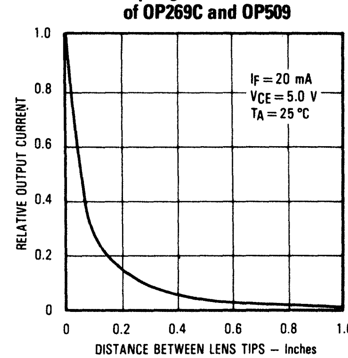
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant incidence upon a sensing area 0.180" (4.57mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 0.653" (16.6mm) from the lens tip. $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the above conditions. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Typical Performance Curves

Percent Changes in Radiant Intensity vs. Time



Coupling Characteristics of OP269C and OP509



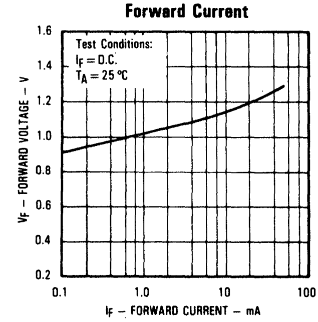
Types OP269A, OP269B, OP269C

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

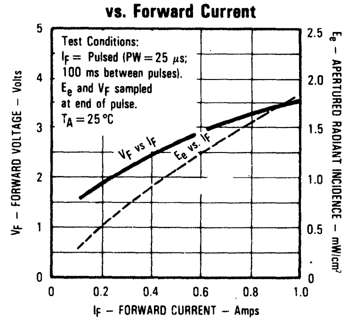
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence	OP269C OP269B OP269A	0.34 0.42 0.58		0.82	mW/cm^2	$I_F = 20$ mA(3)
V_F	Forward Voltage				1.80	V	$I_F = 20$ mA
I_R	Reverse Current				100	μA	$V_R = 2.0$ V
λp	Wavelength at Peak Emission			890		nm	$I_F = 20$ mA
B	Bandwidth Between Half Power Points			80		nm	$I_F = 10$ mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			46		Deg.	$I_F = 20$ mA
t_r	Output Rise Time			500		ns	$I_{F(PK)} = 100$ mA, PW = 10 μs,
t_f	Output Fall Time			250		ns	D.C. = 10.0%

Typical Performance Curves

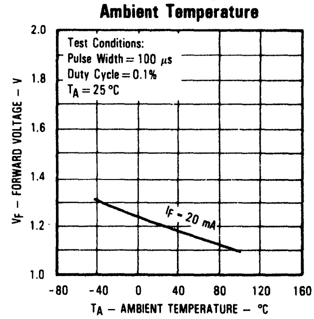
Forward Voltage vs. Forward Current



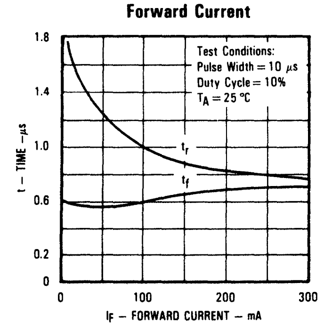
Forward Voltage and Radiant Incidence vs. Forward Current



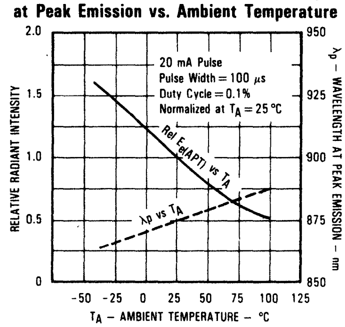
Forward Voltage vs. Ambient Temperature



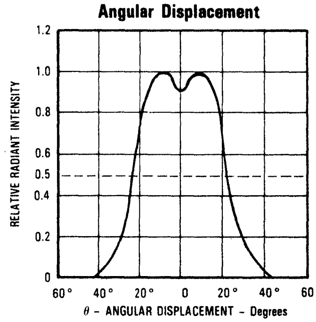
Rise Time and Fall Time vs. Forward Current



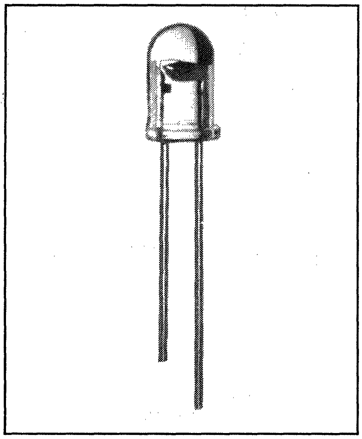
Relative Radiant Intensity and Wavelength at Peak Emission vs. Ambient Temperature

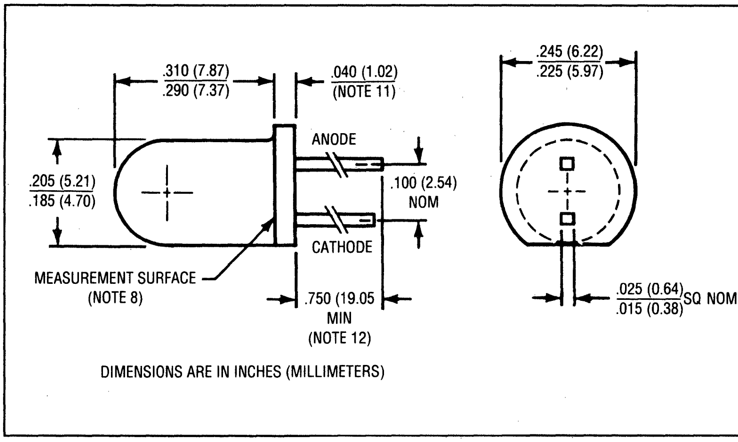


Relative Radiant Intensity vs. Angular Displacement



GaAlAs Plastic Infrared Emitting Diodes
Types OP290, OP291, OP292 Series





Features

- Wide irradiance pattern
- Significantly higher power output than GaAs at equivalent drive currents
- T-1 3/4 package style
- UL recognized, File No. S2047

Description

The OP290, OP291, and OP292 are gallium aluminum arsenide infrared emitting diodes molded in IR transmissive plastic packages. The OP290 is specified under pulse conditions to 1.5 amps and can be used up to 5 amps. The OP291 is specified under pulse conditions to 100mA and is intended for use as low cost plastic replacements for TO-46 hermetic units. The OP292 is specified under pulse conditions to 20mA and is intended for use in low current applications. The wavelength is centered at 890 nm and closely matches the spectral response of silicon phototransistors. Each of the these unit types is categorized into three ranges of apertured power output. They are also completely characterized for ease of system design. Silver-copper lead frames offer excellent thermal characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage OP290	5.0V
OP291	2.0V
OP292	5.0V
Continuous Forward Current	150mA(1)
Peak Forward Current OP290 (25 µs pulse width)	5.0A
OP291 (100 µs pulse width)	2.0A
OP292 (100 µs pulse width)	1.00A
Maximum Duty Cycle OP290 (25 µs pulse width, @ 5 A)	1.25%(2)
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec with soldering iron]	260°C(3)
Power Dissipation, Free Air	333mW(4)
Power Dissipation, Board Mounted	533mW(5)
Power Dissipation, Full Heat Sink	1.11W(6)

Notes:

(1) Derate linearly 1.67 mA/°C above 25°C (Free-Air). When used with heat sink (See Note 5) derate linearly 2.07 mA/°C above 65°C (Normal use).
(2) Refer to graph of Maximum Peak Pulse Current vs. Pulse Width.
(3) RMA flux is recommended. Duration can be extended to 10 sec max. when soldering. Max. 20 grams force may be applied to the leads when flow soldering.
(4) Measured in Free-Air. Derate linearly 3.33 mW/°C above 25°C.
(5) Mounted on 1/16" (1.6mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35mm) below flange of device. Derate linearly 5.33 mW/°C above 62.5°C.
(6) Immersed in silicone fluid to simulate infinite heat sink. Derate linearly 11.1 mW/°C above 95°C.
(7) Measurement is taken at the end of a single 100 µs pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
(8) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.500" (12.7mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(9) Typical total Power Out (P_O) @ I_F = 20mA pulsed all units is 3.6mW, @ I_F = 100mA is 19mW, and @ I_F = 1.5 A is 240mW.
(10) Measured at the end of a 10 msec. voltage soak.
(11) This dimension is held to within ± 0.005" on the flange edge and may vary ± 0.020" in the area of the leads.
(12) Cathode lead is 0.070" nom shorter than anode lead.

Types OP290, OP291, OP292 Series

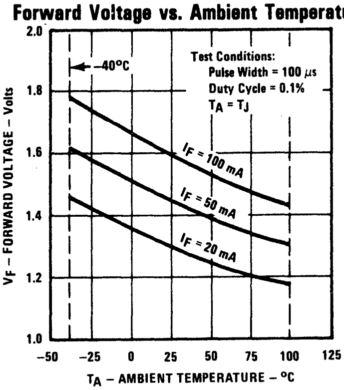
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence*	OP290C	150			mW/cm²	I_F = 1.50A(7)(8)(9)
		OP290B	180		300	mW/cm²	I_F = 1.50A(7)(8)(9)
		OP290A	210			mW/cm²	I_F = 1.50A(7)(8)(9)
	* OP290 series is measured into	OP291C	10.0			mW/cm²	I_F = 100mA(7)(8)(9)
	a 30° cone with the aperture 0.5"	OP291B	13.0		26.0	mW/cm²	I_F = 100mA(7)(8)(9)
	from the device measurement	OP291A	16.0			mW/cm²	I_F = 100mA(7)(8)(9)
	surface.	OP292C	1.7			mW/cm²	I_F = 20mA(7)(8)(9)
		OP292B	2.2		4.4	mW/cm²	I_F = 20mA(7)(8)(9)
		OP292A	2.7			mW/cm²	I_F = 20mA(7)(8)(9)
V_F	Forward Voltage	OP290			4.00	V	I_F = 1.50A(7)
		OP291			2.00	V	I_F = 100mA(7)
		OP292			1.75	V	I_F = 20mA(7)
I_R	Reverse Current	OP290/OP292			10	µA	V_R = 5.0V(10)
		OP291			100	µA	V_R = 2.0V(10)
λp	Wavelength at Peak Emission			890		nm	I_F = 10mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10mA
Δλp/ΔT	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			50		Deg.	I_F = 20mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100mA,
t_f	Output Fall Time			250		ns	PW = 10µs, D.C. = 10.0%

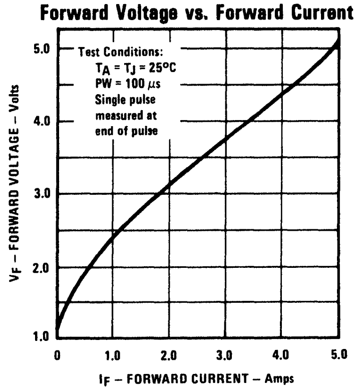
INFRARED EMITTING DIODES

Typical Performance Curves

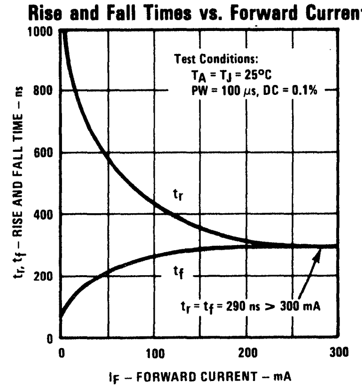
Forward Voltage vs. Ambient Temperature



Forward Voltage vs. Forward Current



Rise and Fall Times vs. Forward Current



Thermal Parameters

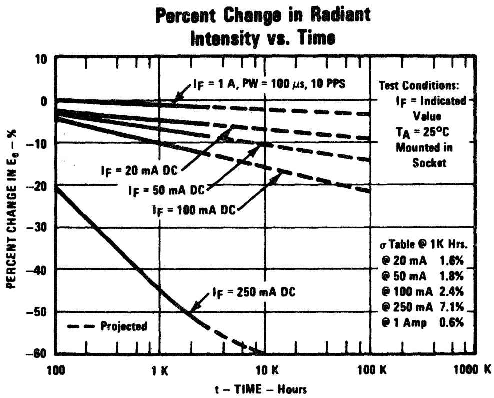
Type Units	R_{THJA} (°C/W)			C_{TH} (10^{-5} Ws/°C)	τ_{TH} (10^{-2} s)	K
	Free Air(1)	Normal(2)	Infinite Heat Sink(3)			
All	300	188	90	1.42	0.263	0.008

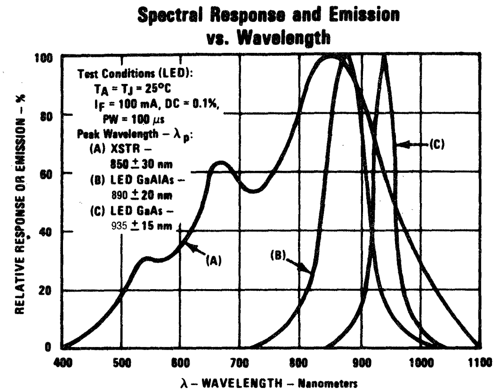
Refer to Application Bulletin 105 for use of these constants.

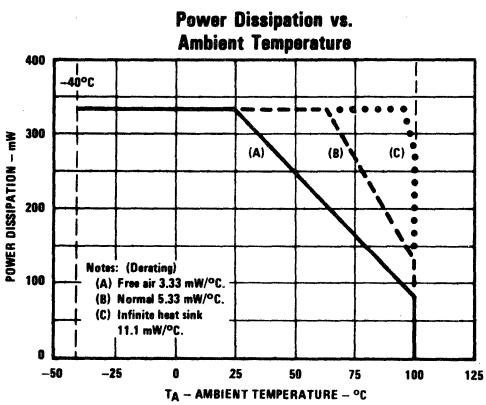
Notes to Thermal Parameters

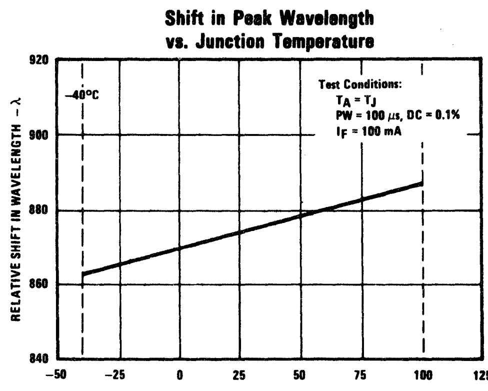
(1) Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.
(2) Unit mounted in double sided printed circuit board ≈ 0.250 inches (6.35 mm) below plastic. The land areas are 0.080 inches square. This simulates normal use.
(3) Unit immersed in circulating silicone fluid holding T_{CASE} = 25°C. This simulates an infinite heat sink.

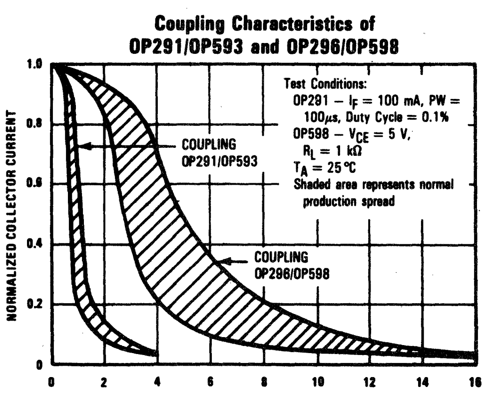
Typical Performance Curves

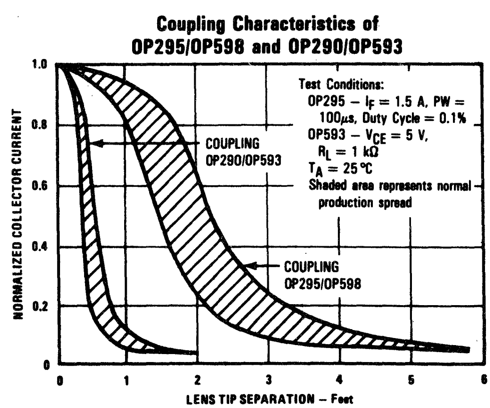






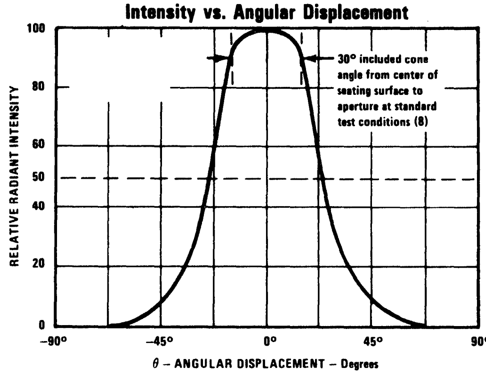




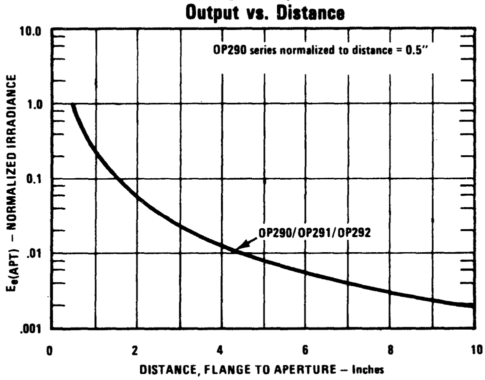


Typical Performance Curves

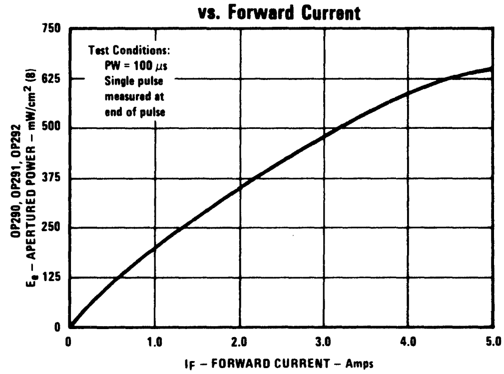
OP290/OP291/OP292 Relative Radiant Intensity vs. Angular Displacement



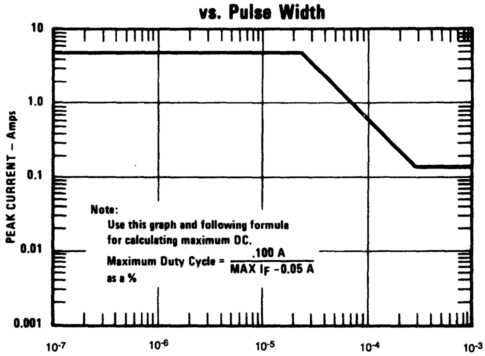
Percent Change in Apertured Power Output vs. Distance



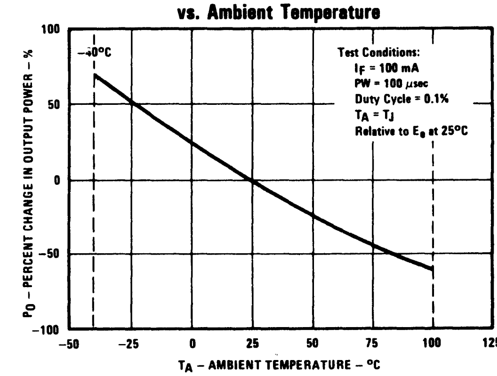
Power Output or Radiant Incidence vs. Forward Current



Maximum Peak Pulse Current vs. Pulse Width



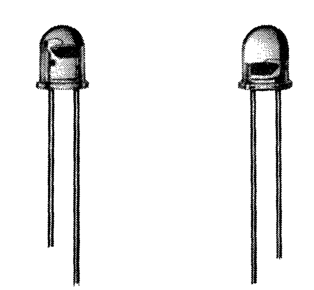
Percent Change in Power Output vs. Ambient Temperature



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

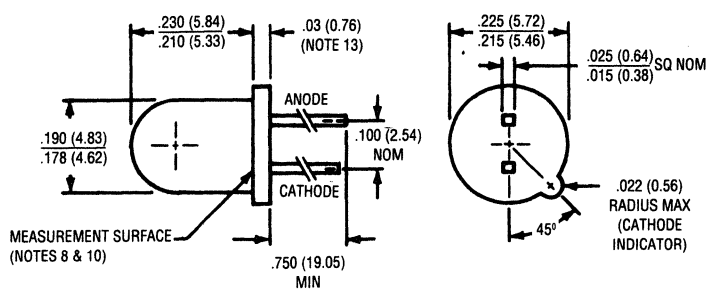
OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP293 and OP298 Series



OP293 SERIES

OP298 SERIES



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Wide irradiance pattern (OP293 series)
- Narrow irradiance pattern (OP298 series)
- Mechanically and spectrally matched to the OP593 and OP598 series phototransistors
- Variety of power ranges
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- Low cost replacement for TO-46 hermetic package

Description

The OP293 and OP298 series devices are 890nm high intensity gallium aluminum arsenide infrared emitting diodes molded in IR transmissive packages. The broad irradiance pattern of the OP293 series provides relatively even illumination over a large area. The OP298 series is focused with an emission angle of 25°.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current, Free Air . . . . 100mA[2]
Continuous Forward Current, Board Mounted . . . . 133mA[3]
Continuous Forward Current, Full Heat Sink . . . . 200mA[4]
Peak Forward Current (25 µs pulse width) 2.0A
Maximum Duty Cycle (250 µs pulse width, @ 2 A) 5.0%
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec with soldering iron] . . . . 260°C[1]
Power Dissipation, Free Air . . . . 142mW[2]
Power Dissipation, Board Mounted . . . . 200mW[3]
Power Dissipation, Full Heat Sink . . . . 400mW[4]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec max. when flow soldering. Max. 20 grams force may be applied to the leads when soldering.
(2) Measured in Free-Air. Derate power dissipation linearly 1.43 mW/°C above 25°C.
(3) Mounted on 1/16" (1.6mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35mm) below flange of device. Derate power dissipation linearly 2.00 mW/°C above 25°C. (Normal Use)
(4) Immersed in silicone fluid to simulate infinite heat sink. Derate power dissipation linearly 2.50 mW/°C above 25°C.
(5) Measurement is taken at the end of a single 100 µs pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
(6) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.420" (10.7mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(7) Typical Total Power Out (P_O) @ I_F = 100mA pulsed on OP293C = 13 mW; OP293B = 18 mW; OP293A = 22 mW.
(8) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.5mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 1.429" (36.30mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(9) For press fit, drill 0.184 ± 0.001" diameter hole.
(10) This dimension is held to within ± 0.005" on the flange edge and may vary ± 0.020" in the area of the leads.
(11) Cathode lead is 0.070" nom shorter than anode lead.

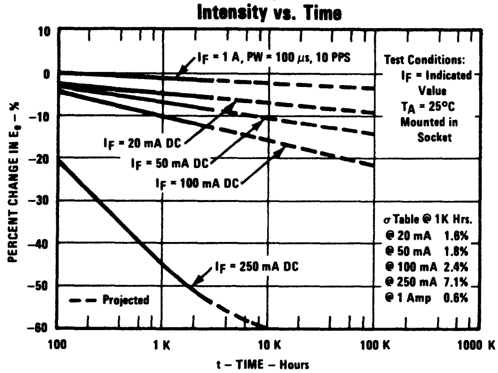
Types OP293 and OP298 Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

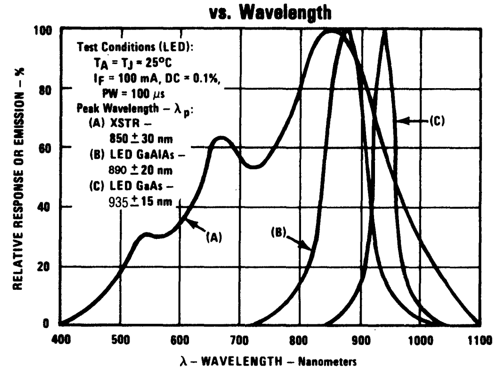
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence*	OP293C	10.0			mW/cm²	I_F = 100mA(5)(6)(7)
	*OP293 is measured with a 30° cone angle at 0.420"	OP293B	13.0		26.0	mW/cm²	I_F = 100mA(5)(6)(7)
		OP293A	16.0			mW/cm²	I_F = 100mA(5)(6)(7)
	*OP298 is measured with a 10° cone angle at 1.429"	OP298C	1.8			mW/cm²	I_F = 100mA(5)(7)(8)
		OP298B	2.4		4.8	mW/cm²	I_F = 100mA(5)(7)(8)
		OP298A	3.0			mW/cm²	I_F = 100mA(5)(7)(8)
V_F	Forward Voltage				2.0	V	I_F = 100mA(5)
I_R	Reverse Current				100	μA	V_R = 2.0V
λp	Wavelength at Peak Emission			890		nm	I_F = 10mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points	OP293		60		Deg.	I_F = 20mA
		OP298		25		Deg.	I_F = 20mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100mA,
t_f	Output Fall Time			250		ns	PW = 10μs, D.C. = 10.0%

Typical Performance Curves

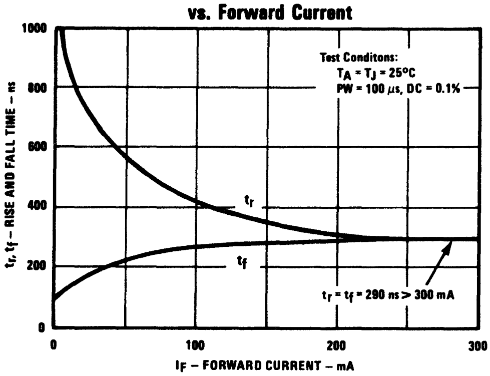
Percent Change in Radiant Intensity vs. Time



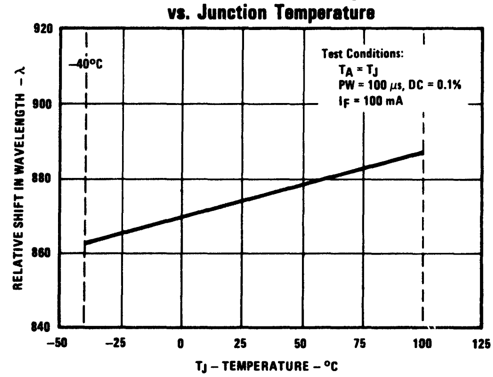
Spectral Response and Emission vs. Wavelength



Rise and Fall Time vs. Forward Current



Shift in Peak Wavelength vs. Junction Temperature



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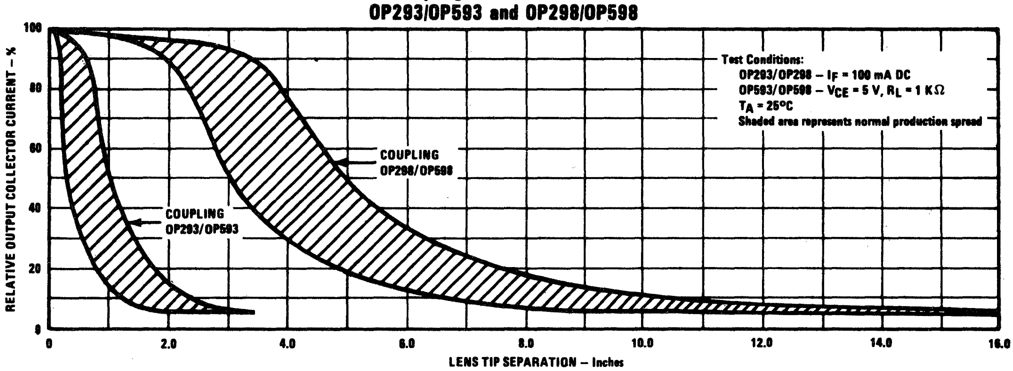
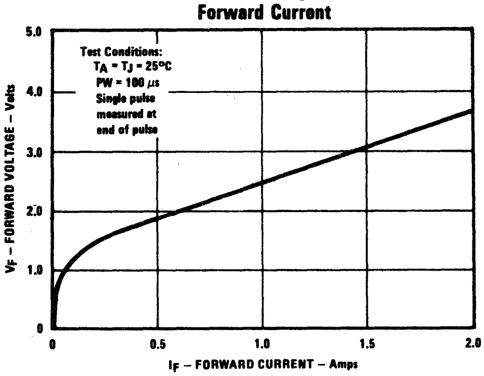
Typical Performance Curves

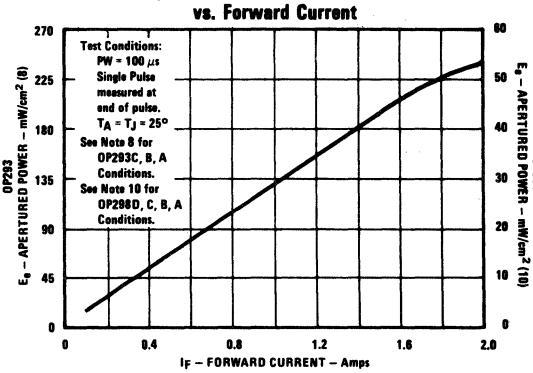
Coupling Characteristics of OP293/OP593 and OP298/OP598



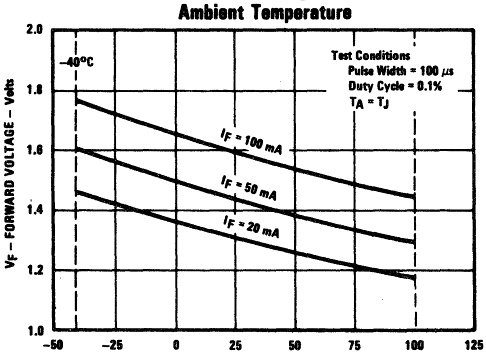
Forward Voltage vs. Forward Current



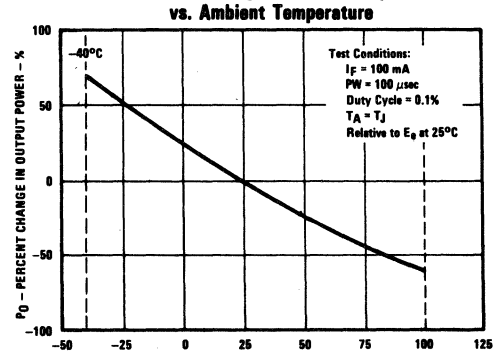
Apertured Power OP293/OP298 vs. Forward Current



Forward Voltage vs. Ambient Temperature

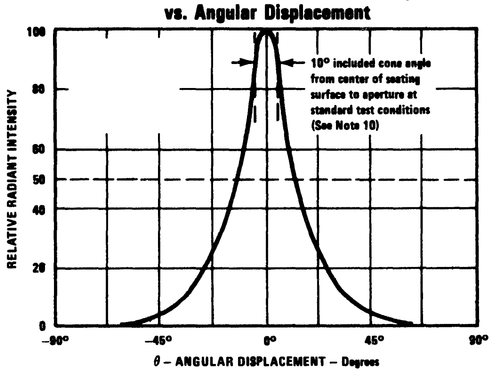


Percent Change in Power Output vs. Ambient Temperature

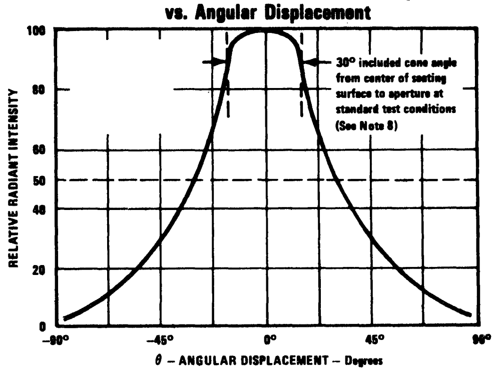


Typical Performance Curves

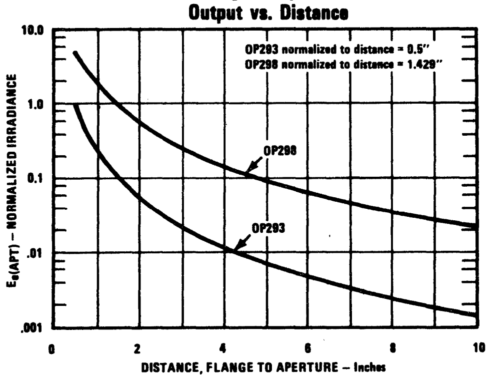
OP298 – Relative Radiant Intensity vs. Angular Displacement



OP293 – Relative Radiant Intensity vs. Angular Displacement



Percent Change in Apertured Power Output vs. Distance



Thermal Parameters

Type Units	R_{THJA} (°C/W) Free Air(1)	Normal(2)	Infinite Heat Sink(3)	C_{TH} (10^{-5} Ws/°C)	τ_{TH} (10^{-2} s)	K
AH	700	500	250	4.0	1.5	0.008

Notes:

(1) Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.

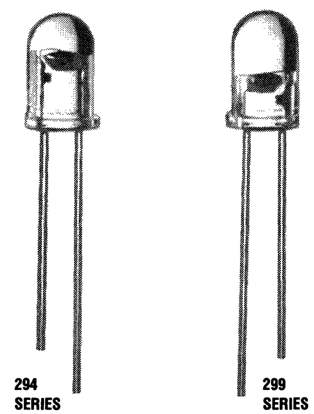
(2) Unit mounted in double sided printed circuit board 0.250 inches (6.35 mm) below plastic. The land areas are 0.080 inches square. This simulates normal use.

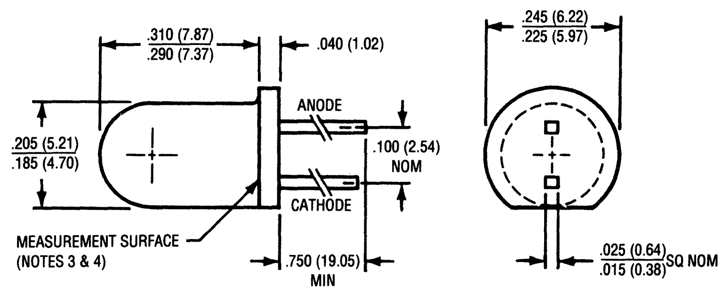
(3) Unit immersed in circulating silicone fluid holding T_{CASE} @ 25°C. This simulates an infinite heat sink.

Refer to Application Bulletin 200 for use of these constants.

OPTEK

GaAlAs Plastic Infrared Emitting Diode
Types OP294, OP299





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Characterized at 5mA for battery operated systems or other low drive current systems
- Wide irradiance pattern (OP294) or narrow irradiance pattern (OP299)
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- T-1 3/4 package

Description

The OP294 and OP299 are gallium arsenide infrared emitting diodes designed for low current or power limited applications (such as battery supplies). These LEDs are similar in design to the OP290 and OP295 but use a smaller chip which increases output efficiency at low current levels by increasing current density. Light output can be maximized with continuous (d.c.) forward current up to 100mA or with pulsed forward current operation up to 750mA. The chip is mounted in an IR transmissive plastic package and has been designed and tested for use with OP593/598 phototransistors or similar photodetector.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage	5.0V
Continuous Forward Current	100mA
Peak Forward Current	750mA
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	180mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. A max. of 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.80mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 1.429" (36.3 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(4) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35 mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and .500" (12.7 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(5) Cathode lead is 0.070" nom shorter than anode lead.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

Types OP294, OP299

Electrical Characteristics (T_A = 25°C unless otherwise noted)

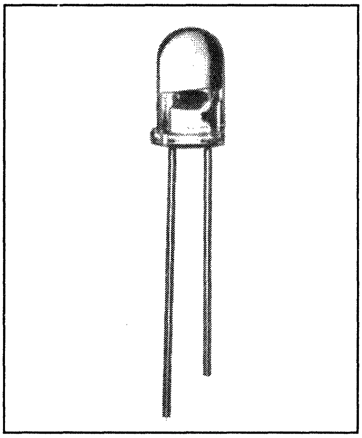
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence OP294 OP299	0.50 0.15		1.50 0.45	mW/cm^2 mW/cm^2	I_F = 5mA(4) I_F = 5mA(3)
V_F	Forward Voltage			1.50	V	I_F = 5mA
I_R	Reverse Current			10	µA	V_R = 2V
λp	Wavelength at Peak Emission		890		nm	I_F = 10mA
B	Spectral Bandwidth Between Half Power Points		80		nm	I_F = 10mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points OP294 OP299		50 20		Deg. Deg.	I_F = 10mA I_F = 10mA
t_r	Output Rise Time		500		ns	$I_{F(PK)}$ = 100mA
t_f	Output Fall Time		250		ns	PW = 10µs, D.C. = 10.0%

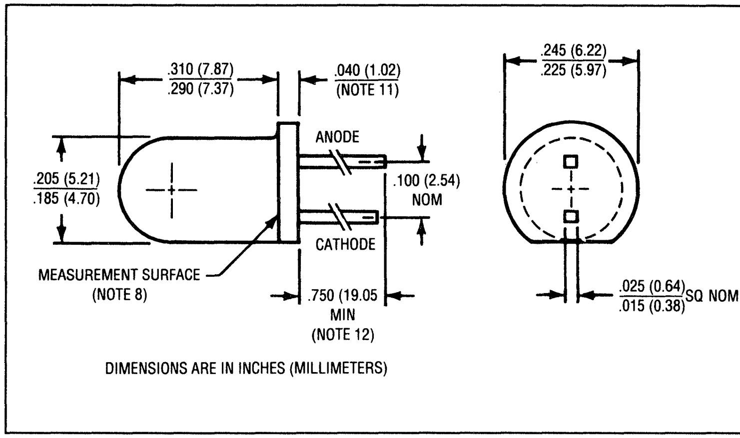
INFRARED EMITTING DIODES

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

GaAlAs Plastic Infrared Emitting Diodes
Types OP295, OP296, OP297 Series





Features

- Narrow irradiance pattern
- Significantly higher power output than GaAs at equivalent drive currents
- Wavelength matched to silicon's peak response
- Excellent heat dissipation
- UL recognized, File No. S2047
- T-1 3/4 package style

Description

The OP295, OP296, and OP297 are gallium aluminum arsenide infrared emitting diodes mounted in IR transmissive plastic packages. The OP295 is specified under pulse conditions to 1.5 amps and can be used up to 5 amps. The OP296 is specified under pulse conditions to 100mA and is intended for use as a low cost plastic replacement for TO-46 hermetic units. The OP297 is specified under pulse conditions to 20mA and is intended for use in low current applications. The wavelength is centered at 890 nm and closely matches the spectral response of silicon phototransistors. Each of these unit types are categorized into three ranges of apertured power output. They are also completely characterized for ease of system design. Silver-copper lead frames offer excellent thermal characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage OP295 . . . . 5.0V
OP296 . . . . 2.0V
OP297 . . . . 5.0V
Continuous Forward Current . . . . 150mA(1)
Peak Forward Current OP295 (25 µs pulse width) 5.0A
OP296 (100 µs pulse width) 2.0A
OP297 (100 µs pulse width) 1.0A
Maximum Duty Cycle OP295 (25 µs pulse width, @ 5 A) . . . . 1.25%(2)
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec with soldering iron] . . . . 260°C(3)
Power Dissipation, Free Air . . . . 333mW(4)
Power Dissipation, Board Mounted . . . . 533mW(5)
Power Dissipation, Full Heat Sink . . . . 1.11W(6)

Notes:
(1) Derate linearly 1.67 mA/°C above 25°C (Free-Air). When used with heat sink (See Note 5) derate linearly 2.07 mA/°C above 65°C (Normal use).
(2) Refer to graph of Maximum Peak Pulse Current vs. Pulse Width.
(3) RMA flux is recommended. Duration can be extended to 10 sec max. when flow soldering. Max. 20 grams force may be applied to the leads when soldering.
(4) Measured in Free-Air. Derate linearly 3.33 mW/°C above 25°C.
(5) Mounted on 1/16" (1.6mm) thick PC board with each lead soldered through 80 mil square lands 0.250" (6.35mm) below flange of device. Derate linearly 5.33 mW/°C above 25°C.
(6) Immersed in silicone fluid to simulate infinite heat sink. Derate linearly 11.1 mW/°C above 25°C.
(7) Measurement is taken at the end of a single 100 µs pulse. Heating due to increased pulse rate or pulse width will cause a decrease in reading.
(8) Typical total Power Out (P_O) @ I_F = 20mA pulsed all units is 3.6mW, @ I_F = 100mA is 19mW, and @ I_F = 1.5 A is 240mW.
(9) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250" (6.35mm) in diameter, perpendicular to and centered on the mechanical axis of the lens, and 1.429" (36.30mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.
(10) Measured at the end of a 10 msec. voltage soak.
(11) This dimension is held to within ± 0.005" on the flange edge and may vary ± 0.020" in the area of the leads.
(12) Cathode lead is 0.070" nom shorter than anode lead.

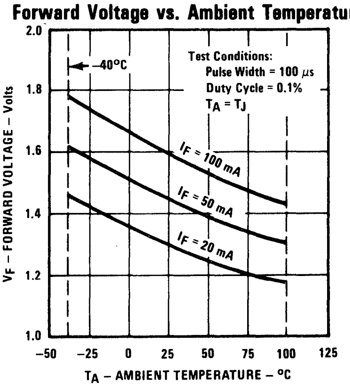
Types OP295, OP296, OP297 Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

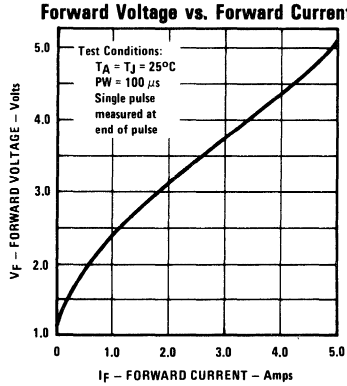
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$E_{e(APT)}$	Apertured Radiant Incidence*	OP295C	22			mW/cm^2	I_F = 1.5A(7)(8)(9)
		OP295B	33		77	mW/cm^2	I_F = 1.5A(7)(8)(9)
		OP295A	44			mW/cm^2	I_F = 1.5A(7)(8)(9)
	*OP295 series is measured into	OP296C	1.6			mW/cm^2	I_F = 100mA(7)(8)(9)
	a 10° cone with the aperture	OP296B	2.6		6.6	mW/cm^2	I_F = 100mA(7)(8)(9)
	1.429" from the device	OP296A	3.6			mW/cm^2	I_F = 100mA(7)(8)(9)
	measurement surface	OP297C	0.30			mW/cm^2	I_F = 20mA(7)(8)(9)
		OP297B	0.50		1.30	mW/cm^2	I_F = 20mA(7)(8)(9)
		OP297A	0.70			mW/cm^2	I_F = 20mA(7)(8)(9)
V_F	Forward Voltage	OP295			4.00	V	I_F = 1.50A(7)
		OP296			2.00	V	I_F = 100mA(7)
		OP297			1.75	V	I_F = 20mA(7)
I_R	Reverse Current	OP295/297			10	µA	V_R = 5.0V(10)
		OP296			100	µA	V_R = 2.0V(10)
λp	Wavelength at Peak Emission			890		nm	I_F = 10mA
B	Spectral Bandwidth Between Half Power Points			80		nm	I_F = 10mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature			+0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points			20		Deg.	I_F = 20mA
t_r	Output Rise Time			500		ns	$I_{F(PK)}$ = 100mA,
t_f	Output Fall Time			250		ns	PW = 10µs, D.C. = 10.0%

Typical Performance Curves

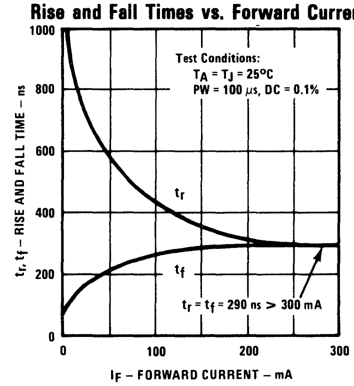
Forward Voltage vs. Ambient Temperature



Forward Voltage vs. Forward Current



Rise and Fall Times vs. Forward Current



Thermal Parameters

Type Units	R_{THJA} (°C/W)			C_{TH} (10^{-5} Ws/°C)	τ_{TH} (10^{-2} s)	K
	Free Air(1)	Normal(2)	Infinite Heat Sink(3)			
All	300	188	90	1.42	0.263	0.008

Refer to Application Bulletin 105 for use of these constants.

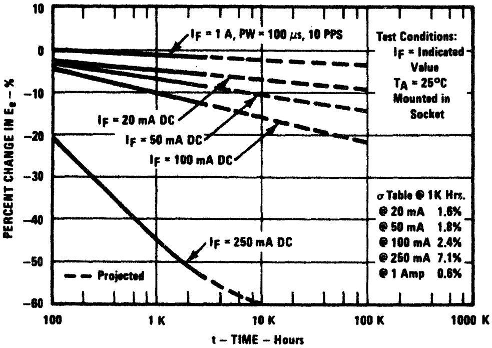
Notes to Thermal Parameters

(1) Heat transfer minimized by holding unit in still air with minimum heat transferred through leads by conduction.
(2) Unit mounted in double sided printed circuit board ≈ 0.250 inches (6.35 mm) below plastic. The land areas are 0.080 inches square. This simulates normal use.
(3) Unit immersed in circulating silicone fluid holding T_{CASE} = 25°C. This simulates an infinite heat sink.

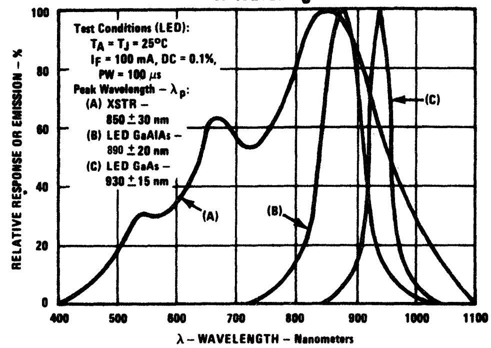
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Typical Performance Curves

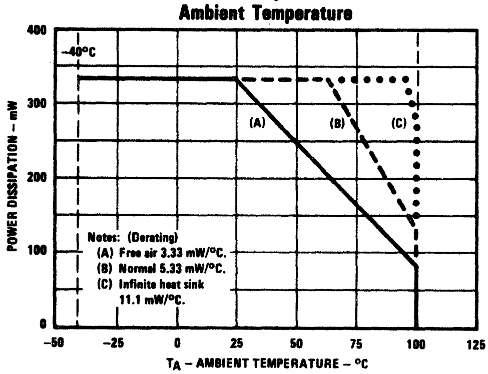
Percent Change in Radiant Intensity vs. Time



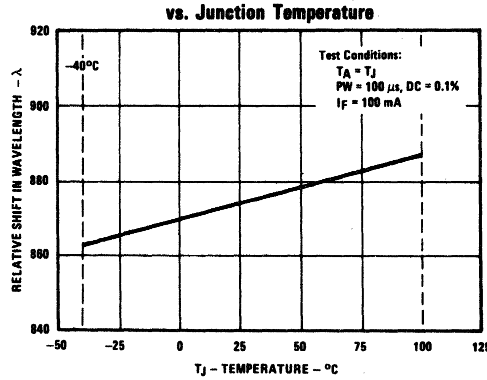
Spectral Response and Emission vs. Wavelength



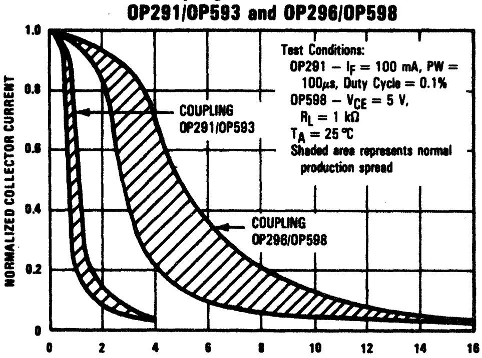
Power Dissipation vs. Ambient Temperature



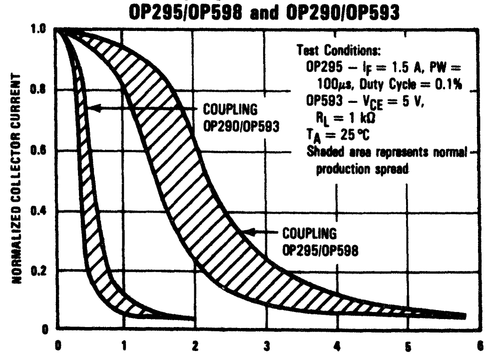
Shift in Peak Wavelength vs. Junction Temperature



Coupling Characteristics of OP291/OP593 and OP296/OP598

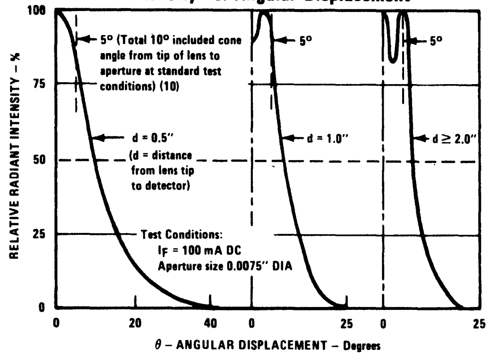


Coupling Characteristics of OP295/OP598 and OP290/OP593

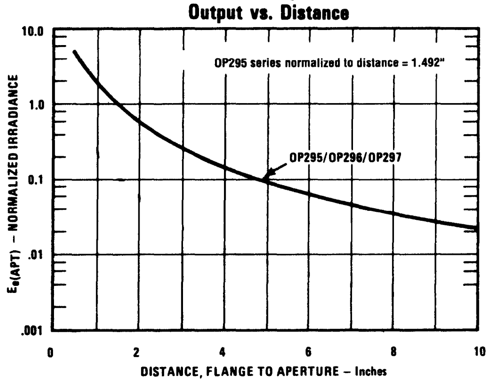


Typical Performance Curves

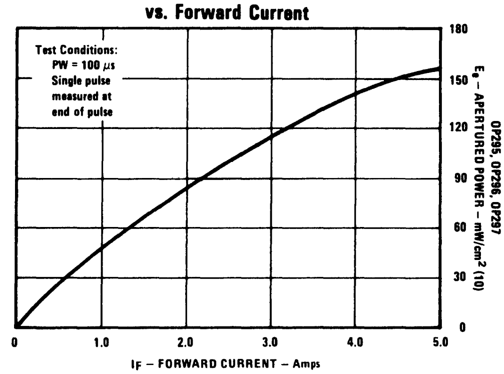
OP295/OP296/OP297 Relative Radiant Intensity vs. Angular Displacement



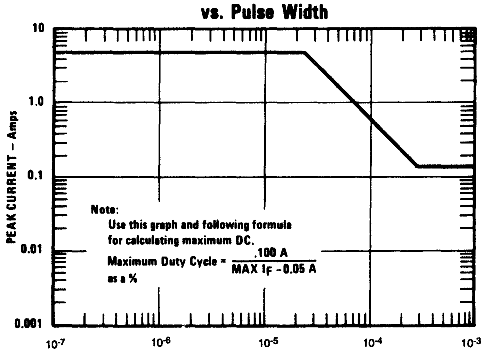
Percent Change in Apertured Power Output vs. Distance



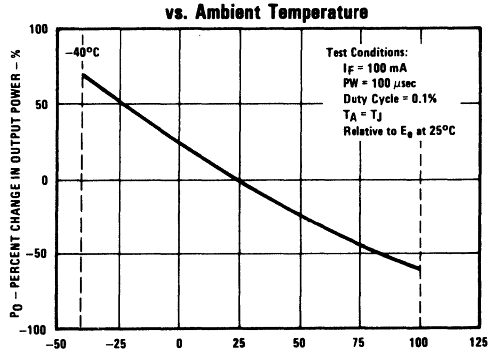
Power Output or Radiant Incidence vs. Forward Current



Maximum Peak Pulse Current vs. Pulse Width



Percent Change in Power Output vs. Ambient Temperature



OPTEK TECHNOLOGY, INC.

PHOTOSENSORS

PHOTOSENSORS

PHOTODIODES

PHOTOTRANSISTORS

PHOTODARLINGTONS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Photosensors

Selecting the Right Optek Sensor

The Optek line of photosensors includes four basic infrared-sensitive device types: photodiodes, phototransistors, photodarlingtons and Photologic™ sensors. Each basic type is available in a variety of case styles. For every infrared emitter made by Optek, there is a mechanically and spectrally matched sensor. Case styles include several sizes of hermetic devices, and an even wider variety of plastic encapsulated types. Plastic versions of the popular hermetic T0-18 part are also available, offering improved optical design and drop-in replacement at substantial cost savings.

Important factors to consider when selecting the right device for an application are: operating speed required, available infrared energy, and the desired output current. Depending on the required balance of these design factors, Optek offers a choice of several appropriate types of photosensors.

Photodiodes

PN junction silicon photodiodes have the fastest operating speed of all the photosensors in the Optek product family. Rise and fall times of 100 nanoseconds are typical for these devices. However, light current (I_C) for these devices tends to be low; therefore, additional amplification is almost always required. Nevertheless, where speed considerations predominate, photodiodes are the best option. Figure 3 illustrates typical circuit requirements for the photoconductive and photovoltaic modes of operation.

Photologic™ Devices

Photologic™ is a term Optek uses to refer to complex integrated circuitry combined with a high speed, high sensitivity photodiode on a single silicon chip. Photologic™ devices offer the speed advantage of photodiodes along with a Schmitt trigger and amplifier to directly drive up to eight TTL loads. Medium speed data rates to 250 kbaud are possible with typical output rise and fall times of 25 nanoseconds. These devices are excellent choices where speed, accuracy and logic interface are required. Typical examples include high speed motion encoding, modulated (pulsed) long distance beam interrupt applications, such as touch screens, and track ball type devices for video games or "mouse" applications for computer accessories.

Phototransistors and Photodarlingtons

Phototransistors and photodarlingtons are Optek's most widely used photosensor types. For most traditional applications, NPN silicon phototransistors offer the best value in terms of output current, sensitivity, speed, reliability and quality. Devices with minimum on-state collector currents ranging up to 40 mA are available, while output rise and fall times of 60-100 microseconds (R_L=5 KΩ) are typical. Optek phototransistors are 100 percent tested and specified at light levels which range upwards from 1.00mW/cm^2 with collector-to-emitter voltage (V_{CE}) set at 5.0 volts.

Photodarlingtons provide the higher sensitivity and gain needed for many applications; however, rise and fall times are slower. When switching time is not critical, the choice of a photodarlington can offer improved sensing reliability and reduce the need for additional signal amplification.

Optek Leadership in Advanced Photosensor

Optek scientists and engineers continue to advance the state of the art in Photologic™ monolithic optoelectronic IC's, a product originally conceived and developed by Optek. The next generation of Photologic™ devices will include substantially increased sensitivity, making longer beam distances possible and offering even higher reliability at lower irradiance levels. Direct TTL and CMOS compatibility is also featured with increased sink/source capability. Supply voltage requirements are more flexible than before due to an on-chip voltage regulator designed by Optek. And finally, the new Photologic™ devices will offer a choice of two hysteresis ratios [$E_{eT}(+)/E_{eT}(-)$] of 2 and 1.4. With these new advancements, Optek continues its leadership role in advanced photosensor design.

Spectral Matching for Improved Coupling Efficency

Optek photosensors are spectrally matched to the Optek line of infrared emitting diodes. Figure 1 shows the spectral response curve for Optek phototransistors, photodarlingtons, and junction photodiodes. The output peak wavelengths for both GaAs and GaAlAs lie very close to the silicon sensitivity peak of about 850 nanometers.

Controlling Ambient Light

The spectral response of silicon extends into the visible light range. This makes the sensors vulnerable to ambient light; particularly from tungsten sources (or the sun) where red light is present. In addition, many of Optek's slotted optical switches shield the sensor in an opaque housing designed to control ambient light. External light filters or controlled modulation of the LED and/or sensor may also be used to reduce the noise from ambient light. As another alternative, most photographic shops can supply infrared passing gelatin filters for laboratory experimentation. For production use, several types of plastic are commercially available with varying degrees of infrared and visible transmissivity (e.g., polysulfone and polycarbonate).

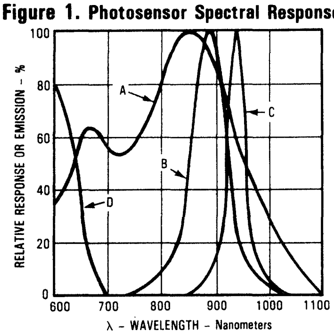
Production Specifications Written for Easy Design

The product specifications in this book were written with ease of design in mind. Emitter output and sensor response levels are specified in terms of milliwatts per square centimeter at separation distances typical for most applications. In addition, as shown in Figure 2, phototransistor collector current versus collector-to-emitter voltage curves are provided for stepped levels of photocurrent (measured in mW/cm^2). These curves allow the design-in process to be analogous to the design of a simple transistor amplifier or switching circuit. The application notes appearing in the back of this data book also provide additional information.

Custom Design and Selection for Unique Applications

While the Optek line is the industry's broadest, a unique application requirement may result in the need for custom selection or package design. Call your local Optek sales office for more information.

Figure 1. Photosensor Spectral Response



Test Conditions (LED):
$T_A = T_J = 25°C$, $I_F = 100$ mA, DC = 0.1%, PW = 100 μs
Peak Wavelength - $λ_p$: (A) XSTR - 850 ± 30 nm
(B) LED GaAlAs - 890 ± 20 nm
(C) LED GaAs - 935 ± 15 nm
(D) Human Eye Response

Figure 2. Collector Current vs Collector to Emitter Voltage

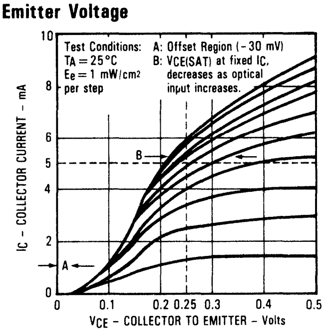
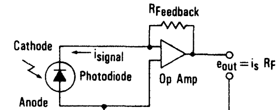
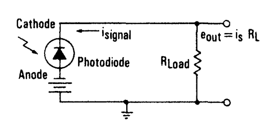


Figure 3. Photodiode in Photovoltaic Mode

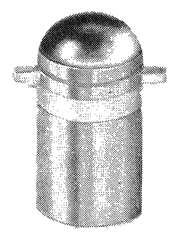


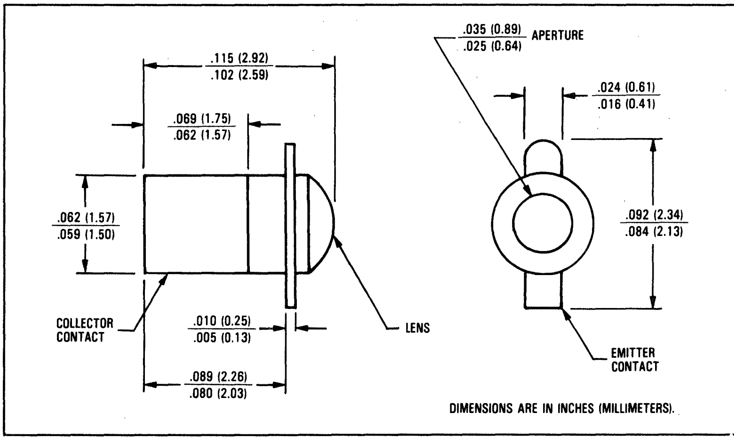
Photodiode in Photoconductive Mode



OPTEK

NPN Silicon Photodarlingtons
Types OP300SL, OP301SL, OP302SL, OP303SL, OP304SL, OP305SL





Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- High current gain
- Ideal for direct mounting in PC boards
- Mechanically and spectrally matched to the OP123 and OP223 series emitters

Description

The OP300SL through OP305SL series devices consist of NPN silicon photodarlingtons mounted in hermetically sealed "Pill" type packages. The narrow receiving angle provides excellent on-axis coupling. Photodarlingtons are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors.

Replaces

OP300 series

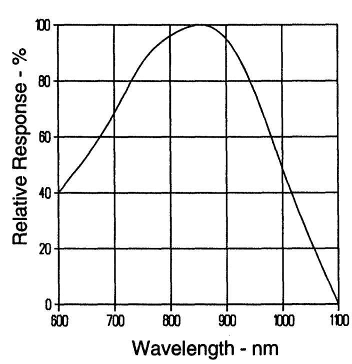
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage	15.0V
Emitter-Collector Voltage	5.0V
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Soldering Temperature (5 sec. with soldering iron)	260°C(1)(2)
Power Dissipation	50mW(3)
Continuous Collector Current	50mA

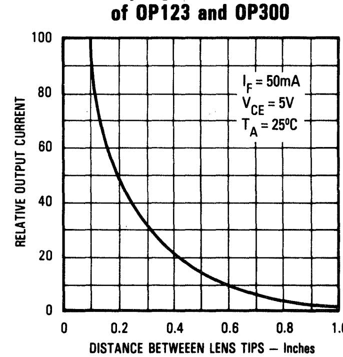
Notes:
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices to PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.5mW/°C above 25°C.
(4) Junction temperature maintained at 25°C.
(5) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP123 and OP300



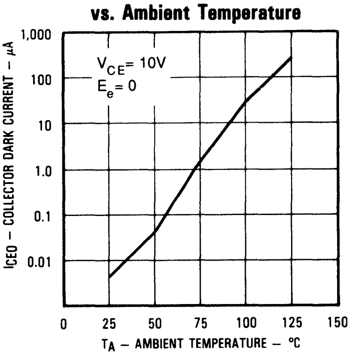
Types OP300SL Thru OP305SL

Electrical Characteristics (T_A = 25°C unless otherwise noted)

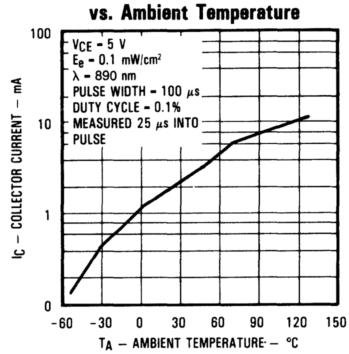
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$ (4)	On-State Collector Current OP300SL	0.8			mA	
	OP301SL	0.8		2.4	mA	
	OP302SL	1.8		5.4	mA	V_{CE} = 5.0 V,
	OP303SL	3.6		12.0	mA	E_e = 1.00 mW/cm² (5)
	OP304SL	7.0		21.0	mA	
	OP305SL	14.0			mA	
I_{CEO}	Collector Dark Current			1.00	µA	V_{CE} = 10.0 V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0			V	I_C = 100 µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100 µA
$V_{CE(SAT)}$ (4)	Collector-Emitter Saturation Voltage OP300SL, OP301SL			1.10	V	I_C = 0.4mA, E_e = 1.0mW/cm² (5)
	OP302SL thru OP305SL			1.10	V	I_C = 1.0mA, E_e = 1.0mW/cm² (5)

Typical Performance Curves

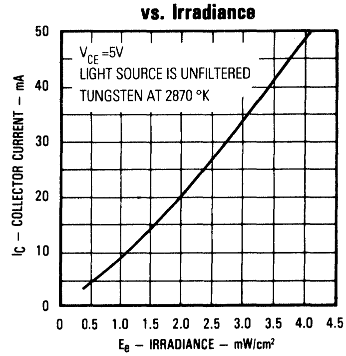
Collector Dark Current vs. Ambient Temperature



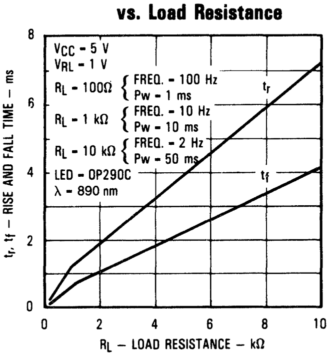
Collector Current vs. Ambient Temperature



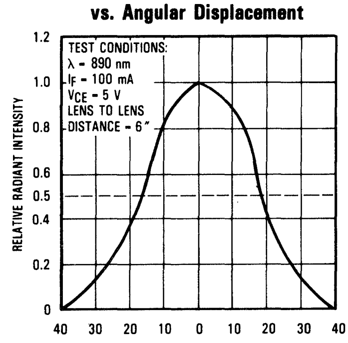
Collector Current vs. Irradiance



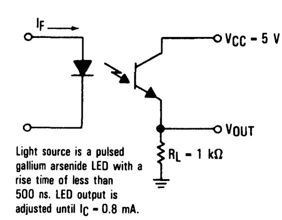
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



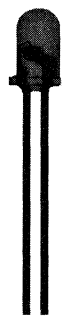
Switching Time Test Circuit

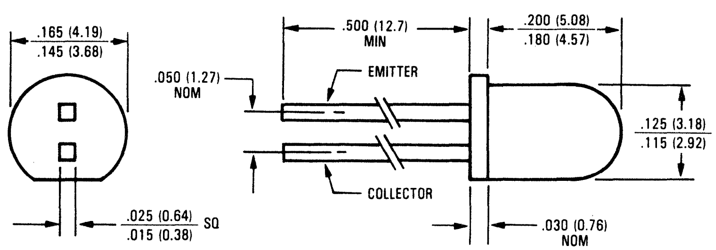


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Infrared Selected NPN Silicon Phototransistors
Types OP505A, OP505B, OP505C, OP505D





Features

- Narrow receiving angle
- Variety of sensitivity ranges
- T-1 package style
- Small package size for space limited applications

Description

The OP505 series devices consist of NPN silicon phototransistors molded in blue tinted epoxy packages. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

Replaces

K5500 Series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

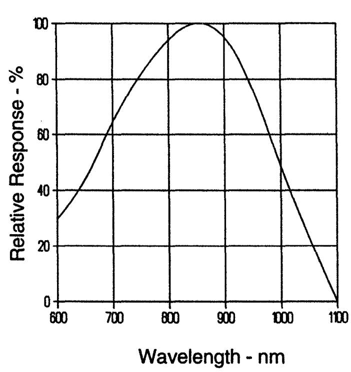
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

Notes:

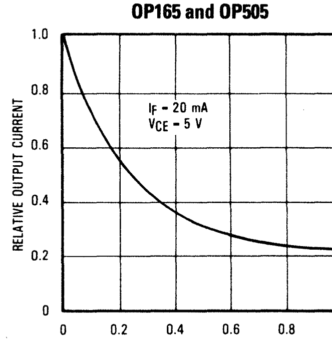
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in µA, use the formula $I_{CED} = 10^{(0.040\,T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics OP165 and OP505



Types OP505A, OP505B, OP505C, OP505D

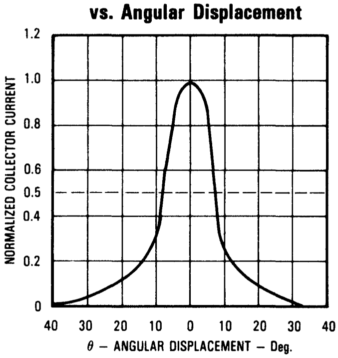
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP505D	0.55			mA	V_{CE} = 5V, E_e = 0.50mW/cm^{2}(3)
		OP505C	1.10		3.00	mA	V_{CE} = 5V, E_e = 0.50mW/cm^{2}(3)
		OP505B	2.15		5.95	mA	V_{CE} = 5V, E_e = 0.50mW/cm^{2}(3)
		OP505A	4.30			mA	V_{CE} = 5V, E_e = 0.50mW/cm^{2}(3)
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature			1.00		%/°C	V_{CE} = 5V, E_e = 1.00mW/cm^2 λ = 935nm
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0(4)
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	I_C = 250μA, E_e = 0.50mW/cm^2 λ = 935nm(3)

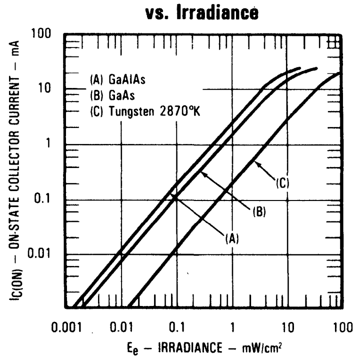
PHOTOSENSORS

Typical Performance Curves

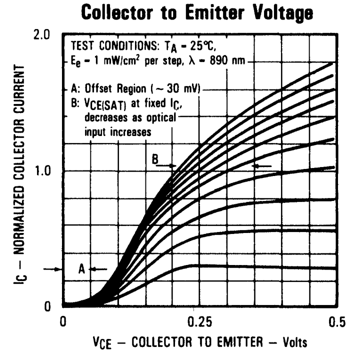
Normalized Collector Current vs. Angular Displacement



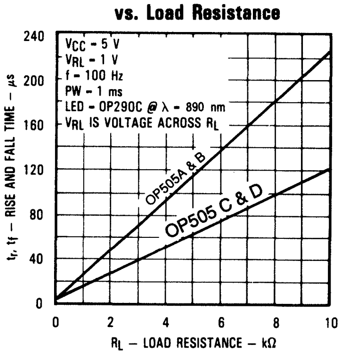
On-State Collector Current vs. Irradiance



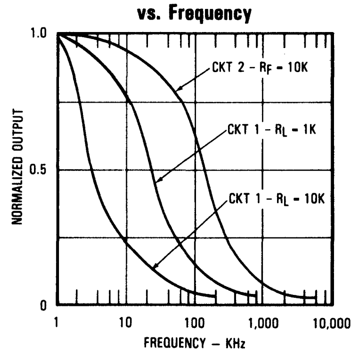
Normalized Collector Current vs. Collector to Emitter Voltage



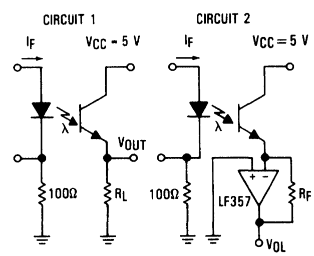
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



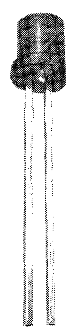
Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq$ 500 ns.
I_F is adjusted for V_{OUT} = 1 Volt.

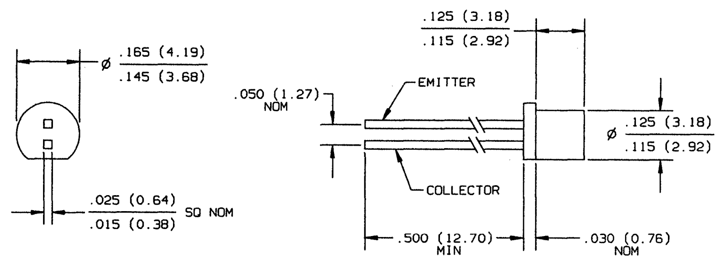
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP505W
April 1993

OPTEK

NPN Silicon Phototransistor
Type OP505W





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Wide receiving angle
- T-1 package style
- Small package size for space limited applications

Description

The OP505W consists of an NPN silicon phototransistor molded in a blue tinted plastic package. The wide receiving angle provides relatively even reception over a large area. This device is 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

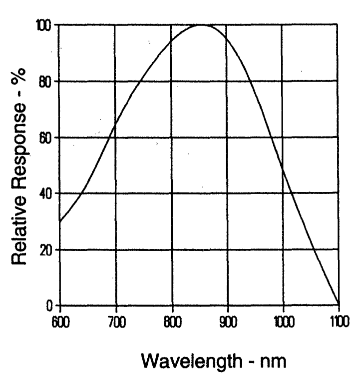
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

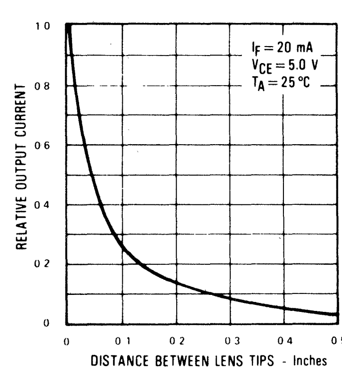
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire surface of the phototransistor being tested.
(4) To calculate typical collector dark current in µA, use the formula $I_{CED} = 10^{(0.04\,T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP165W and OP505W



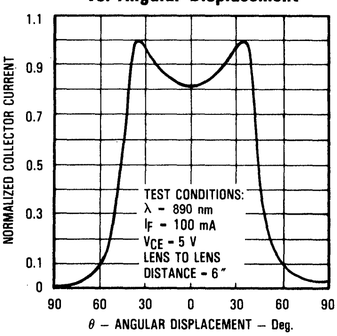
Types OP505W

Electrical Characteristics (T_A = 25°C unless otherwise noted)

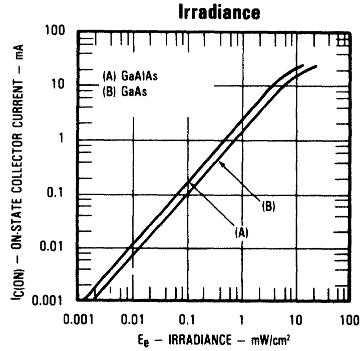
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	100.0			μA	V_{CE} = 5V, E_e = 0.75mW/cm²[2(3)]
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 10.0V E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40	V	I_C = 50μA, E_e = .75mW/cm²[2(3)]

Typical Performance Curves

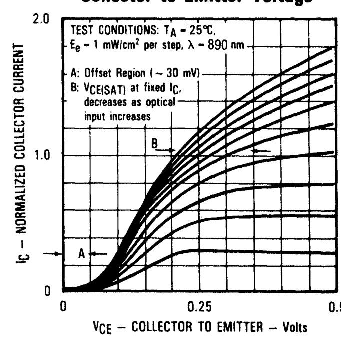
Normalized Collector Current vs. Angular Displacement



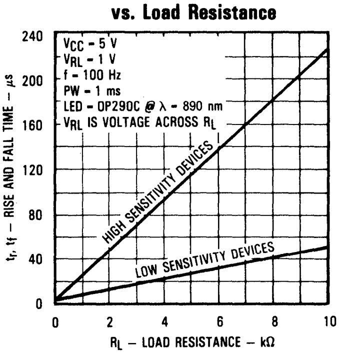
On-State Collector Current vs Irradiance



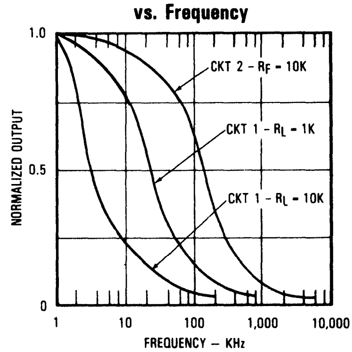
Normalized Collector Current vs. Collector to Emitter Voltage



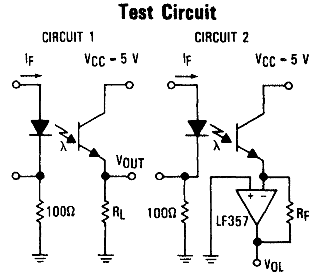
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



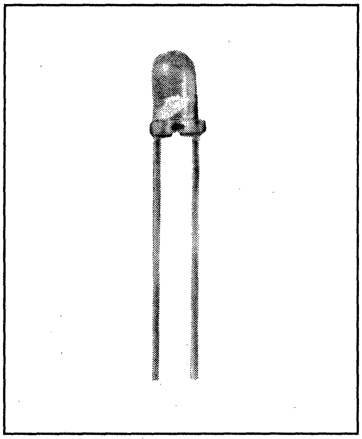
Switching Time Test Circuit

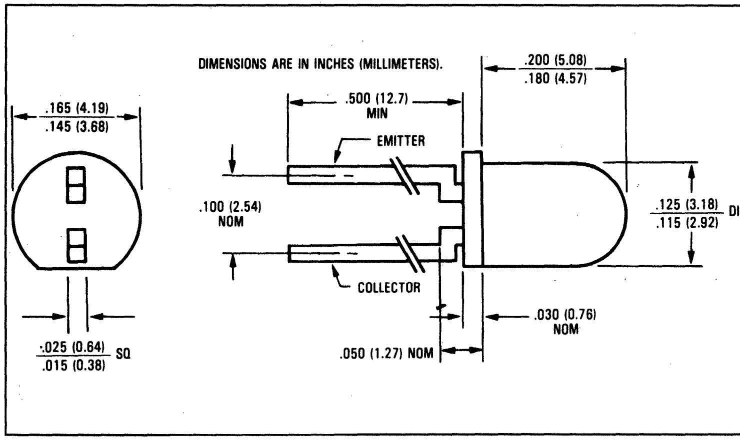


Test Conditions:
Light source is pulsed LED with t_r and t_f ≤ 500 ns.
I_F is adjusted for V_{OUT} = 1 Volt.

OPTEK

NPN Silicon Phototransistors
Types OP506A, OP506B, OP506C, OP506D





Features

- Narrow receiving angle
- Variety of sensitivity ranges
- T-1 package style
- Small package size for space limited applications

Description

The OP506 series devices consist of NPN silicon phototransistors molded in blue tinted epoxy packages. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters. Lead spacing is .100 inch (2.54mm).

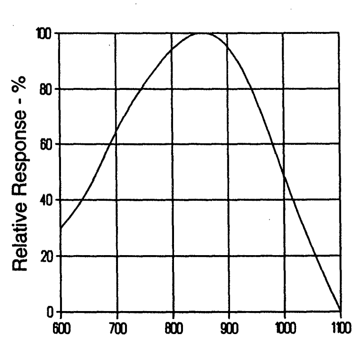
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

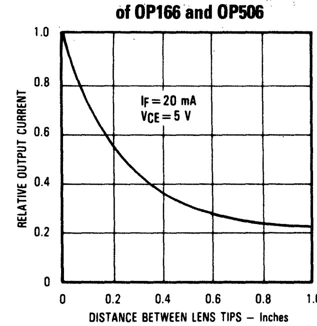
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in µA, use the formula $I_{CED} = 10^{(0.040\,T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP166 and OP506



Types OP506A, OP506B, OP506C, OP506D

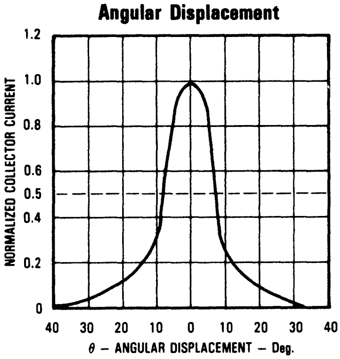
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP506D	0.55			mA	$V_{CE} = 5V, E_e = 0.50mW/cm^2$ (4)
		OP506C	1.10		3.00	mA	$V_{CE} = 5V, E_e = 0.50mW/cm^2$ (4)
		OP506B	2.15		5.95	mA	$V_{CE} = 5V, E_e = 0.50mW/cm^2$ (4)
		OP506A	4.30			mA	$V_{CE} = 5V, E_e = 0.50mW/cm^2$ (4)
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature			1.00		%/°C	$V_{CE} = 5V, E_e = 1.00mW/cm^2$ $\lambda = 935nm$
I_{CEO}	Collector Dark Current				100	nA	$V_{CE} = 10.0V, E_e = 0$ (4)
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100\mu A$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	$I_C = 250\mu A, E_e = 0.50mW/cm^2$ $\lambda = 935nm$ (3)

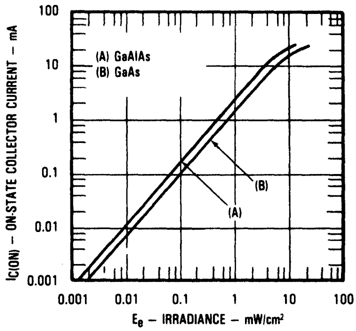
PHOTOSENSORS

Typical Performance Curves

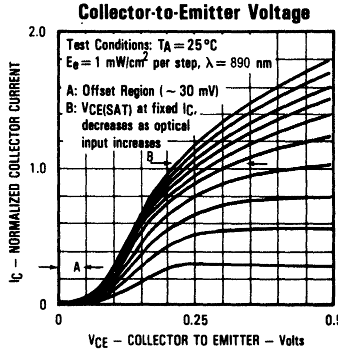
Normalized Collector Current vs Angular Displacement



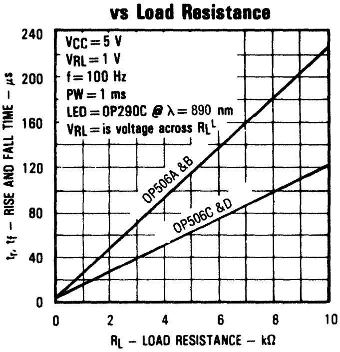
On-State Collector Current vs Irradiance



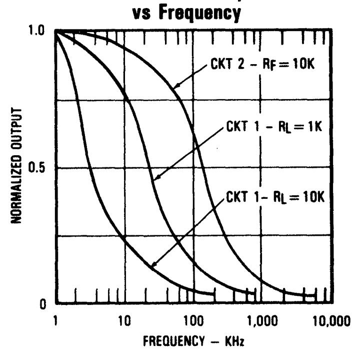
Normalized Collector Current vs Collector-to-Emitter Voltage



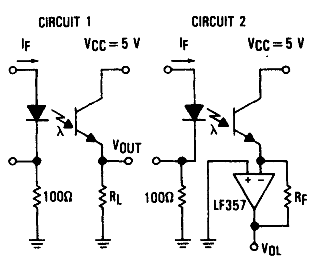
Rise and Fall Time vs Load Resistance



Normalized Output vs Frequency



Switching Time Test Circuit

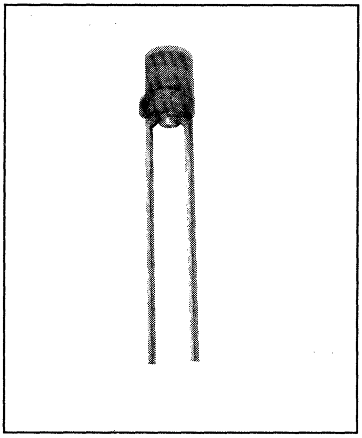


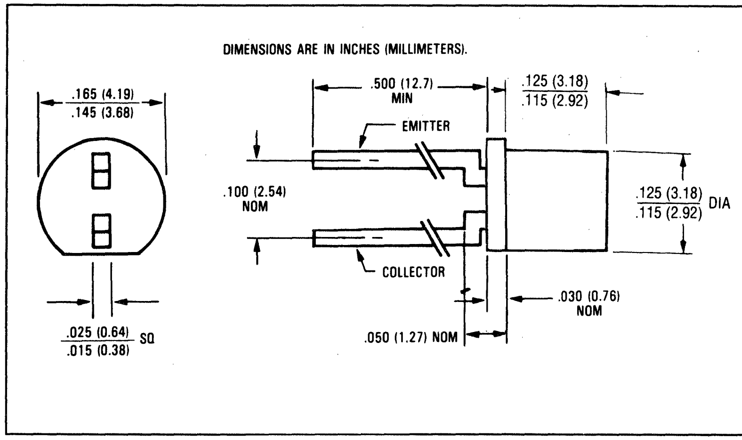
Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq$ 500 ns.
I_F is adjusted for V_{OUT} = 1 Volt.

Product Bulletin OP506W
April 1993

OPTEK

NPN Silicon Phototransistor
Type OP506W





Features

- Wide receiving angle
- T-1 package style
- Small package size for space limited applications

Description

The OP506W consists of an NPN silicon phototransistor molded in a blue tinted plastic package. The wide receiving angle provides relatively even reception over a large area. This device is 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters. Lead spacing is .100 inch (2.54mm).

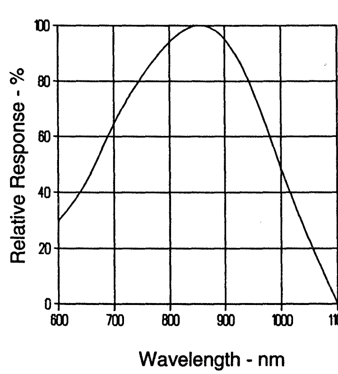
Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Collector-Emitter Voltage	30V
Emitter-Collector Voltage	5.0V
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	100mW(2)

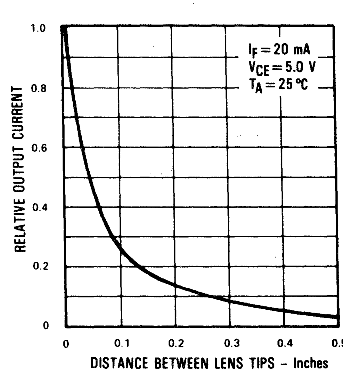
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.04 T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics



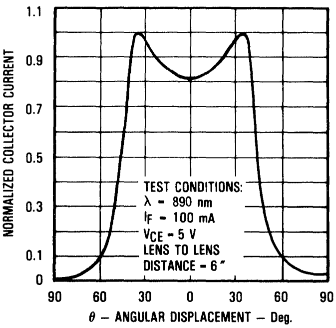
Type OP506W

Electrical Characteristics ($T_A = 25°C$ unless otherwise noted)

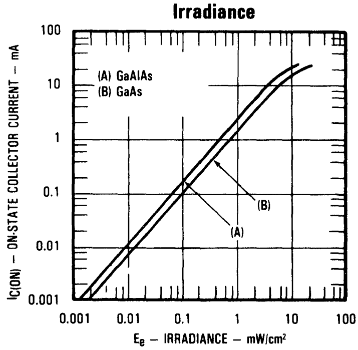
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	100			μA	$V_{CE} = 5V$, $E_e = 0.75mW/cm^2$ (2)(3)
I_{CEO}	Collector Dark Current			100	nA	$V_{CE} = 10.0V$, $E_e = 0$
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	$I_C = 100μA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	$I_E = 100μA$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40	V	$I_C = 50μA$, $E_e = .75mW/cm^2$ (2)(3)

Typical Performance Curves

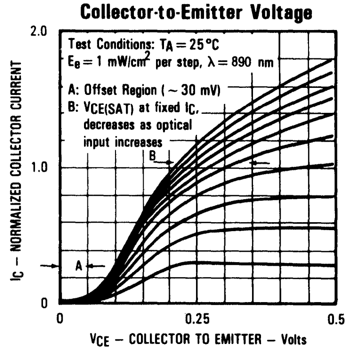
Normalized Collector Current vs. Angular Displacement



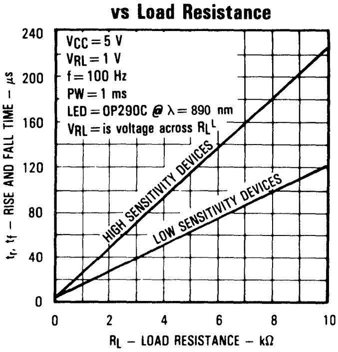
On-State Collector Current vs Irradiance



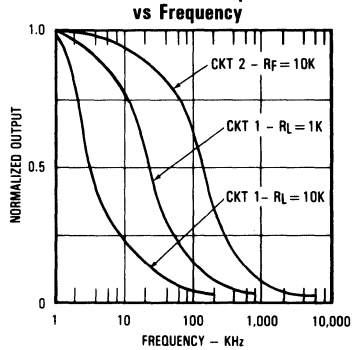
Normalized Collector Current vs Collector-to-Emitter Voltage



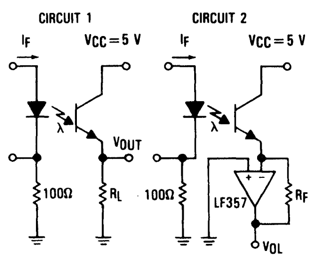
Rise and Fall Time vs Load Resistance



Normalized Output vs Frequency



Switching Time Test Circuit

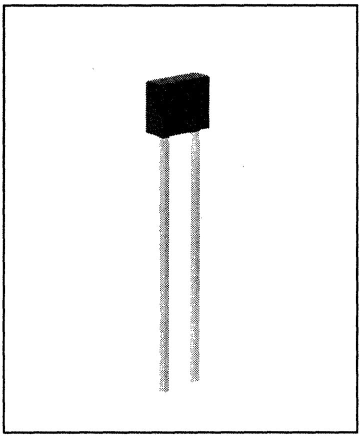


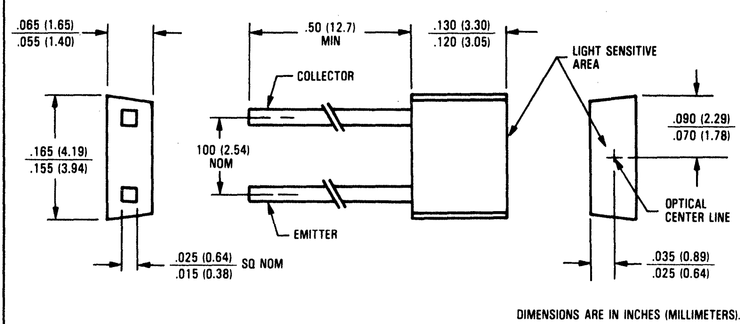
Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq$ 500 ns.
I_F is adjusted for V_{OUT} = 1 Volt.

Product Bulletin OP508F
April 1993

OPTEK

NPN Silicon Phototransistors
Types OP508FA, OP508FB, OP508FC





Features

- Flat lensed for wide acceptance angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP168F and OP268F series of infrared emitting diodes

Description

The OP508F series consist of NPN silicon phototransistors mounted in flat, black plastic, "end looking" packages. The flat sensing surface allows an acceptance half angle of 60° measured from the optical axis to the half power point. The black plastic package significantly reduces ambient light noise. These devices can be mounted on 0.100" (2.54mm) hole centers, making them an ideal low cost alternate to hermetic pill discretes.

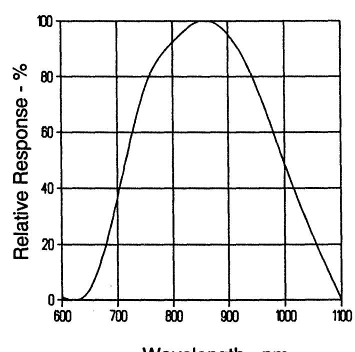
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

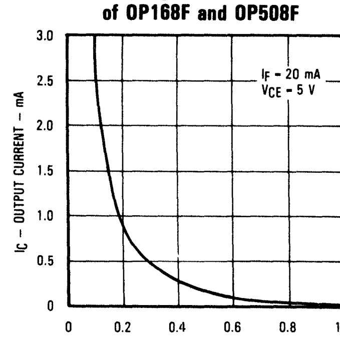
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in µA, use the formula $I_{CEO} = 10^{(0.040T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP168F and OP508F



Types OP508FA, OP508FB, OP508FC

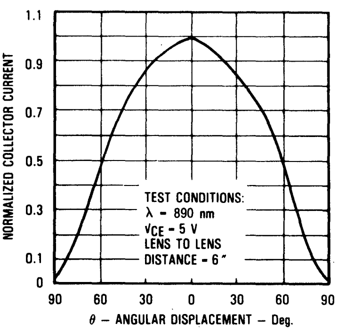
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP508FC OP508FB OP508FA	0.34 0.65 2.70		5.10	mA	V_{CE} = 5.0V, E_e = 5mW/cm^{2}(3)
$I_C/\Delta T$	Relative I_C Change with Temperature			1.00		%/°C	V_{CE} = 5.0V, E_e = 1.0mW/cm^{2}(3) λ = 890nm
I_{CEO}	Collector-Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0(4)
$V_{(BR)CEO}$	Collector-Emittor Breakdown Voltage		30			V	I_C = 100µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100µA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	I_C = 100µA, E_e = 5mW/cm^{2}(3)

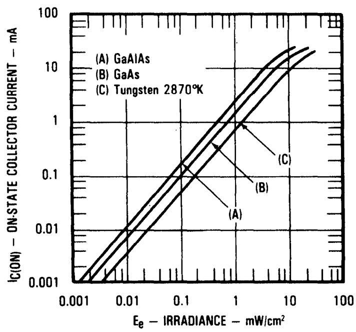
PHOTOSENSORS

Typical Performance Curves

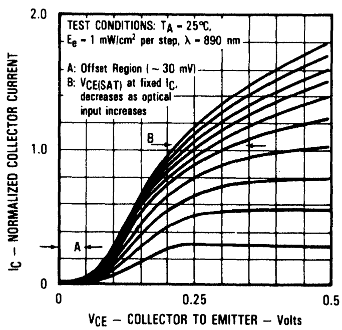
Normalized Collector Current vs. Angular Displacement



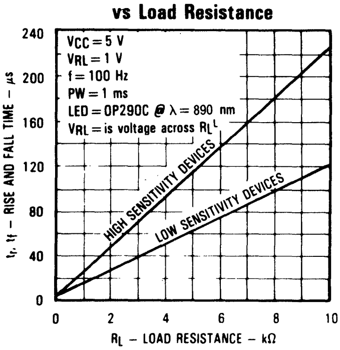
On-State Collector Current vs. Irradiance



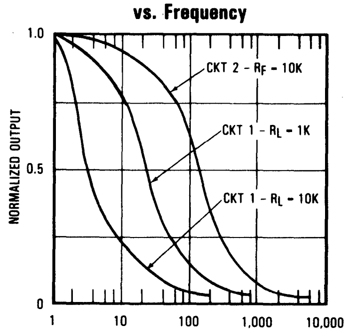
Normalized Collector Current vs. Collector to Emitter Voltage



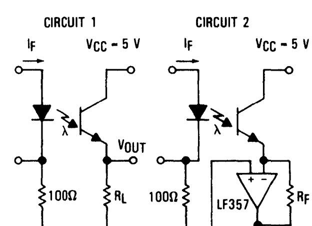
Rise and Fall Time vs Load Resistance



Normalized Output vs. Frequency



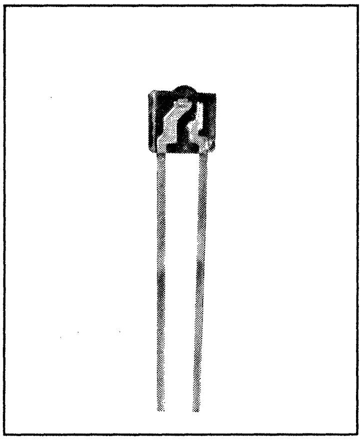
Switching Time Test Circuit

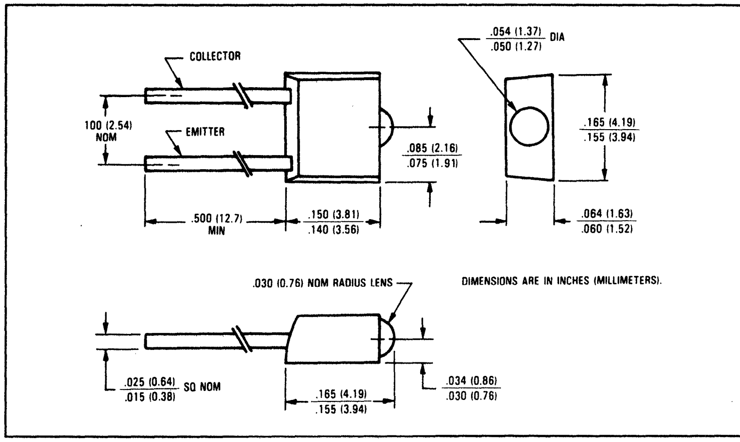


Test Conditions:
Light source is pulsed LED with t_r and t_f ≤ 500 ns.
I_F is adjusted for V_{OUT} = 1 Volt.

OPTEK

NPN Silicon Phototransistors
Types OP509A, OP509B, OP509C





Features

- Lensed for high sensitivity
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP169 and OP269 series of infrared emitting diodes

Description

The OP509 series consist of NPN silicon phototransistors mounted in lensed, clear plastic, "end looking" packages. The lensing effect of the package allows an acceptance half angle of 25° measured from the optical axis to the half power point.

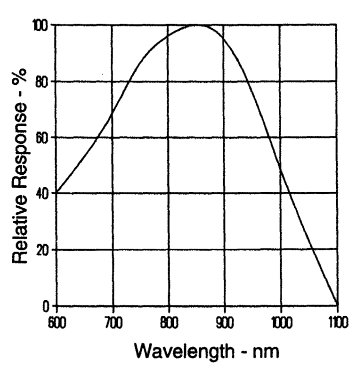
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

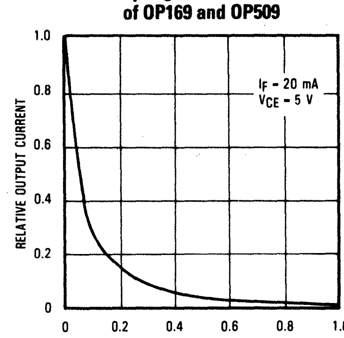
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in µA, use the formula $I_{CEO} = 10^{(0.040T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP169 and OP509



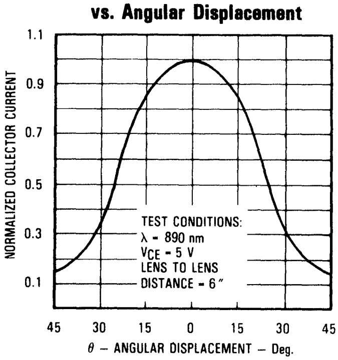
Types OP509A, OP509B, OP509C

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

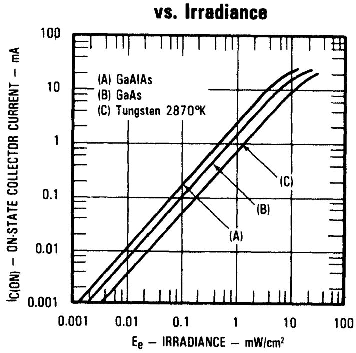
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP509C OP509B OP509A	0.7 1.4 5.7		10.6	mA	$V_{CE} = 5.0V$, $E_e = 5mW/cm^{2(3)}$
$I_C/\Delta T$	Relative I_C Change with Temperature			1.00		%/°C	$V_{CE} = 5.0V$, $E_e = 1.0mW/cm^{2(3)}$ $\lambda = 890nm$
I_{CEO}	Collector-Dark Current				100	nA	$V_{CE} = 10.0V$, $E_e = 0^{(4)}$
$V_{(BR)CEO}$	Collector-Emittor Breakdown Voltage		30			V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100\mu A$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	$I_C = 250\mu A$, $E_e = 5mW/cm^{2(3)}$

Typical Performance Curves

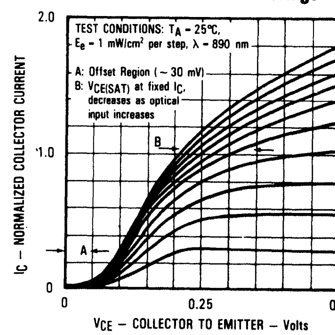
Normalized Collector Current vs. Angular Displacement



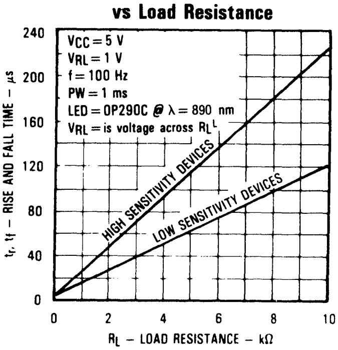
On-State Collector Current vs. Irradiance



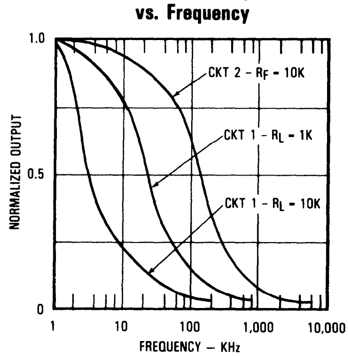
Normalized Collector Current vs. Collector to Emitter Voltage



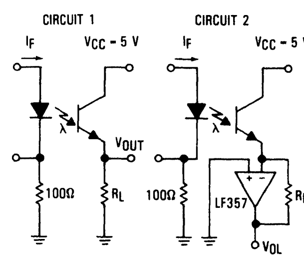
Rise and Fall Time vs Load Resistance



Normalized Output vs. Frequency



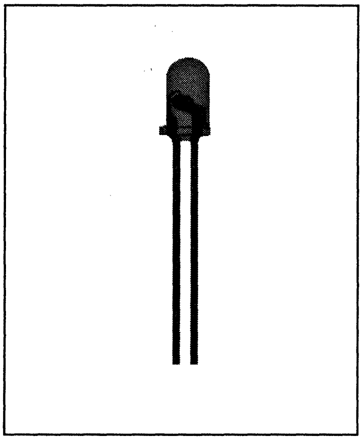
Switching Time Test Circuit

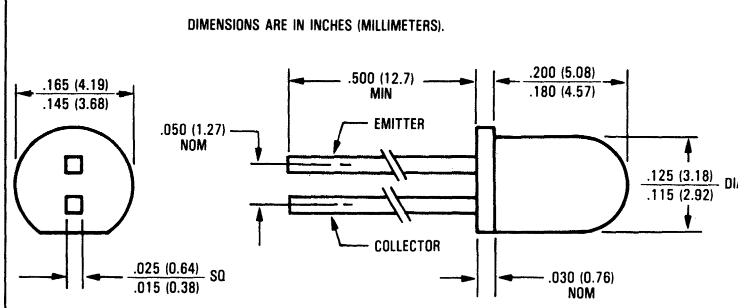


Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq 500$ ns.
I_F is adjusted for $V_{OUT} = 1$ Volt.

OPTEK

NPN Silicon Photodarlington
Type OP535A, OP535B, OP535C





Features

- Narrow receiving angle
- T-1 package style
- High current gain
- Small package size for space limited applications

Description

The OP535 consists of an NPN silicon photodarlington molded in a green plastic package. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors.

Replaces

OP530 and K9000

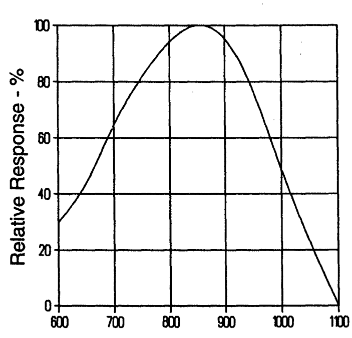
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 15.0V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 100mW(2)

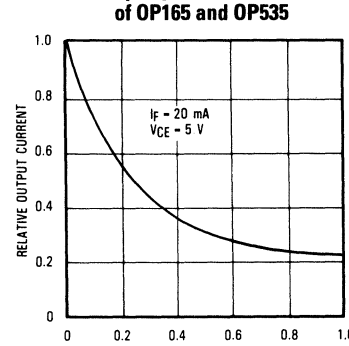
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP165 and OP535



Types OP535A, OP535B, OP535C

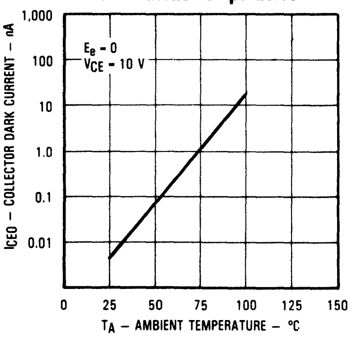
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$(3)	On-State Collector Current	OP535C OP535B OP535A	1.5 3.5 10.5		32.0	mA	$V_{CE} = 5.0$ V, $E_e = 0.13$ mW/cm^2
I_{CEO}	Collector Dark Current				100	nA	$V_{CE} = 10.0$ V, $E_e = 0$
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		15.0			V	$I_C = 1.0$ mA, $E_e = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100\ \mu$A, $E_e = 0$
$V_{CE(SAT)}$(3)	Collector-Emitter Saturation Voltage				1.10	V	$I_C = 0.4$ mA, $E_e = 0.13$ mW/cm^2

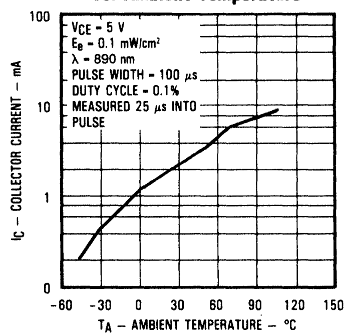
PHOTOSENSORS

Typical Performance Curves

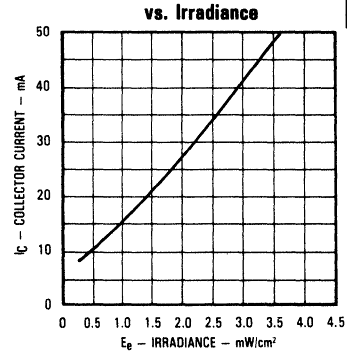
Collector Dark Current vs. Ambient Temperature



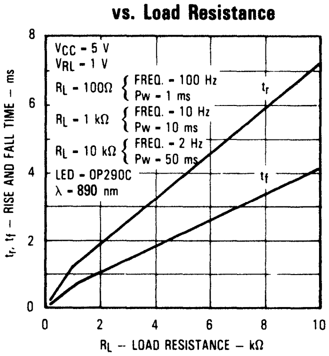
Collector Current vs. Ambient Temperature



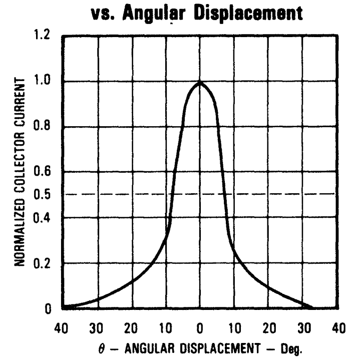
Collector Current vs. Irradiance



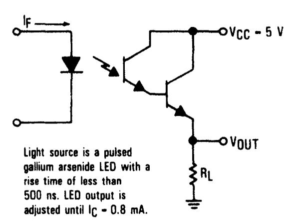
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



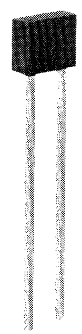
Switching Time Test Circuit

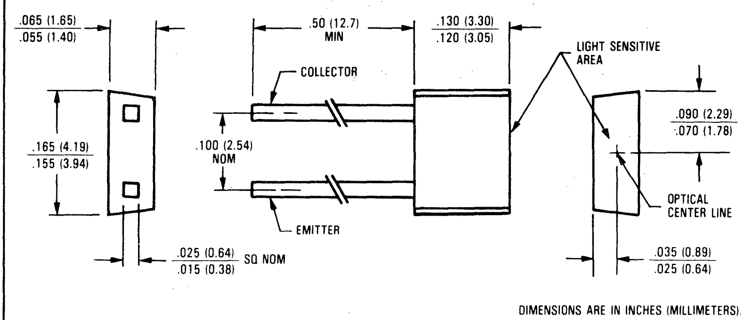


Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until $I_C = 0.8$ mA.

OPTEK

NPN Silicon Photodarlingtons
Types OP538FA, OP538FB, OP538FC





Features

- Flat lensed for wide acceptance angle
- Easily stackable on 0.100 inch (2.54mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP168F and OP268F series of infrared emitting diodes

Description

The OP538F series consists of NPN silicon photodarlingtons mounted in flat lensed, black plastic, "end looking" packages. The flat sensing surface allows an acceptance half angle of 65° measured from the optical axis to the half power point. The black plastic package significantly reduces ambient light noise. These devices can be mounted on 0.100" (2.54mm) hole centers making them an ideal low cost alternative to hermetic pill discretes.

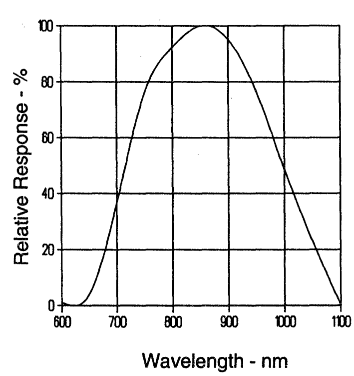
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage	30V
Emitter-Collector Voltage	5.0V
Storage and Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	100mW(2)

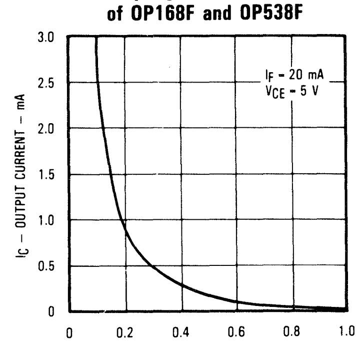
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering. Maximum 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) Due to high gain of photodarlington, a load resistor should be used to avoid thermal runaways.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP168F and OP538F



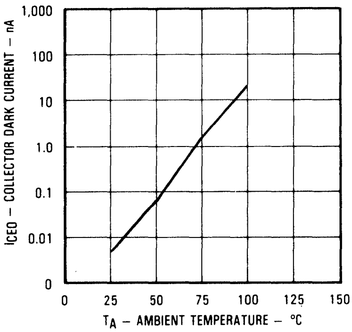
Types OP538FA, OP538FB, OP538FC

Electrical Characteristics (T_A = 25°C unless otherwise noted)

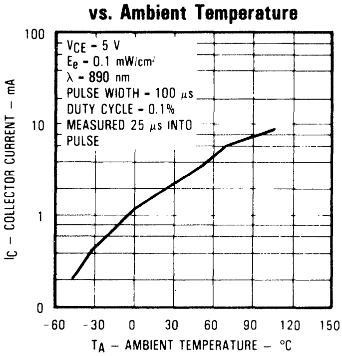
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$(4)	On-State Collector Current OP538FC OP538FB OP538FA	1.1 2.3 6.8		20.5	mA	V_{CE} = 5.0V, E_e = 0.5mW/cm²(2)(3)
I_{CEO}	Collector-Dark Current			225	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emittor Breakdown Voltage	15.0			V	I_C = 1.00mA, E_e = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA, E_e = 0
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			1.00	V	I_C = 0.5mA, E_e = 0.5mW/cm²(2)(3)

Typical Performance Curves

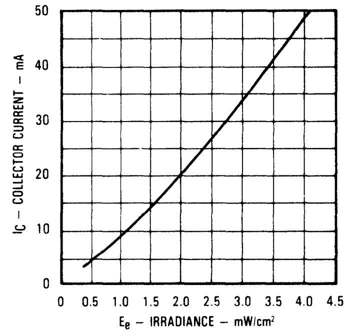
Collector Dark Current vs. Ambient Temperature



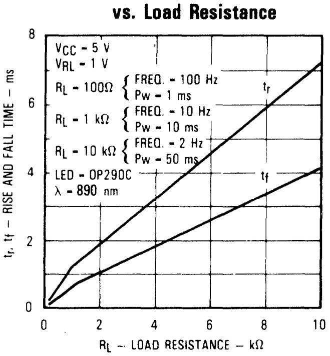
Collector Current vs. Ambient Temperature



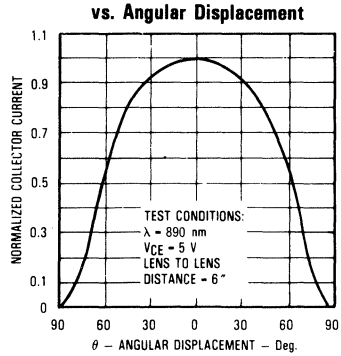
Collector Current vs. Irradiance



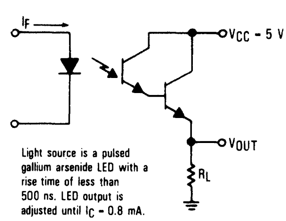
Rise and Fall Time vs. Load Resistance



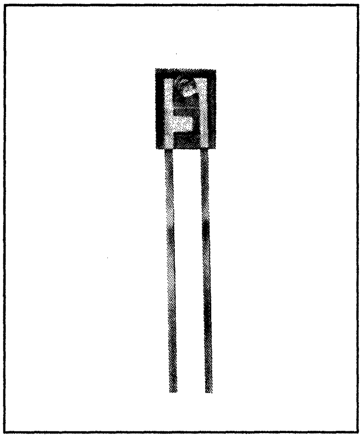
Normalized Collector Current vs. Angular Displacement

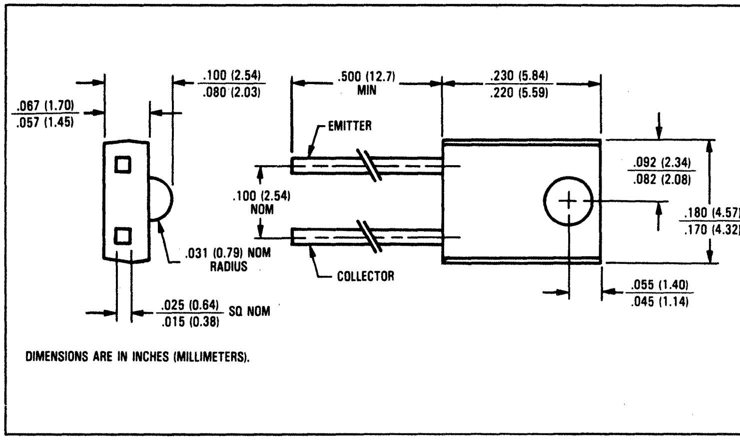


Switching Time Test Circuit



NPN Silicon Phototransistors
Types OP550A, OP550B, OP550C, OP550D





Features

- Wide receiving angle
- Variety of sensitivity ranges
- Side-looking package for space limited applications

Description

The OP550 series devices consist of NPN silicon phototransistors molded in clear epoxy packages. The wide receiving angle provides relatively even reception over a large area. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. This series is mechanically and spectrally matched to the OP140 and OP240 series of infrared emitting diodes.

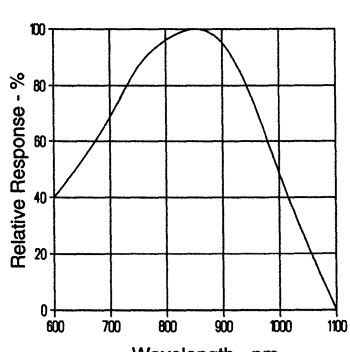
Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

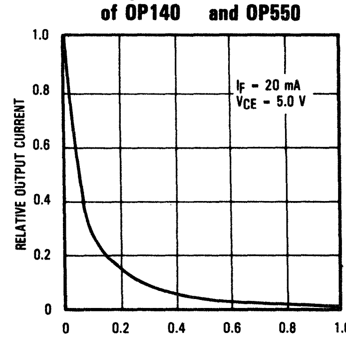
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.040\,T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP140 and OP550



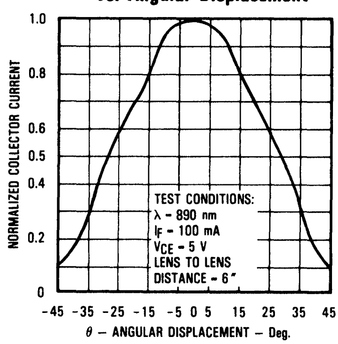
Types OP550A, OP550B, OP550C, OP550D

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

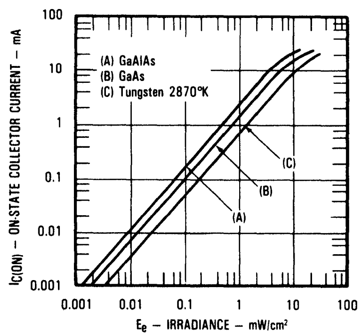
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP550D OP550C OP550B OP550A	0.25 0.25 1.30 2.55		 2.40 4.70 	mA mA mA mA	$V_{CE} = 5.0V$, $E_e = 1.0mW/cm^2$ (3)
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature			1.00		%/°C	$V_{CE} = 5.0V$, $E_e = 1.00mW/cm^2$ $\lambda = 935nm$
I_{CEO}	Collector Dark Current			100		nA	$V_{CE} = 10.0V$, $E_e = 0$ (4)
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100\mu A$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40		V	$I_C = 100\mu A$, $E_e = 1.0mW/cm^2$ (3)

Typical Performance Curves

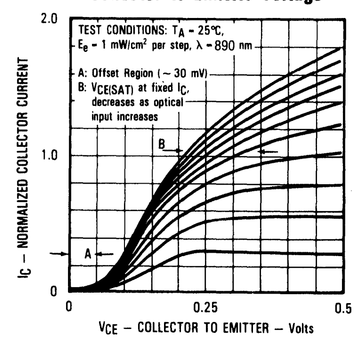
Normalized Collector Current vs. Angular Displacement



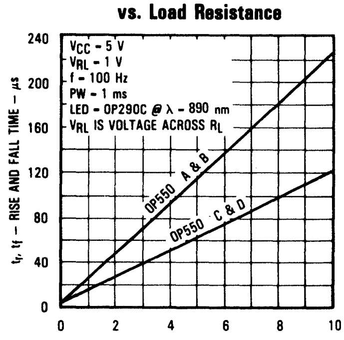
On-State Collector Current vs. Irradiance



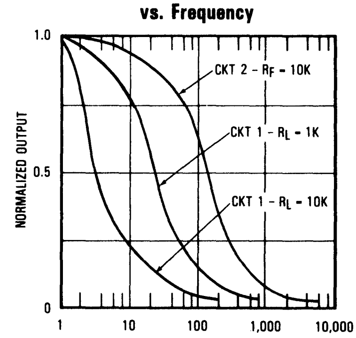
Normalized Collector Current vs. Collector to Emitter Voltage



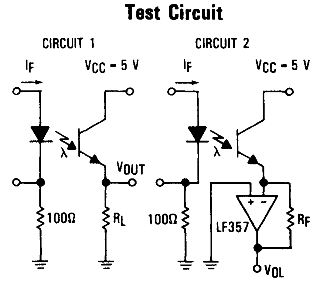
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



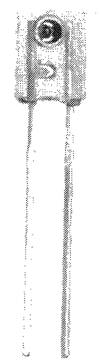
Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq 500$ ns.
I_F is adjusted for V_{OUT} - 1 Volt.

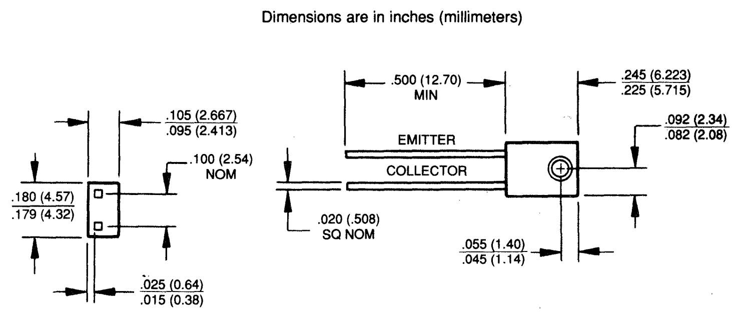
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP555A
April 1993

OPTEK

NPN Silicon Phototransistors
Types OP555A, OP555B, OP555C, OP555D





Features

- Wide receiving angle
- Variety of sensitivity ranges
- Side-looking package for space limited applications

Description

The OP555 series devices consist of NPN silicon phototransistors molded in blue tinted epoxy packages. The wide receiving angle provides relatively even reception over a large area. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. The lensing effect of the package allows an acceptance half angle of 28°C measured from the optical axis to the half power point. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

Replaces

K5550

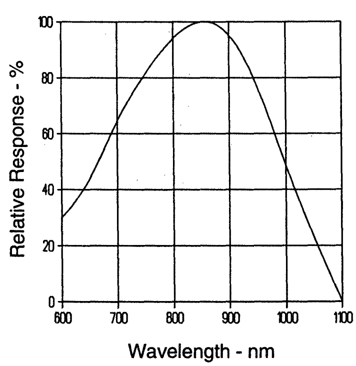
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

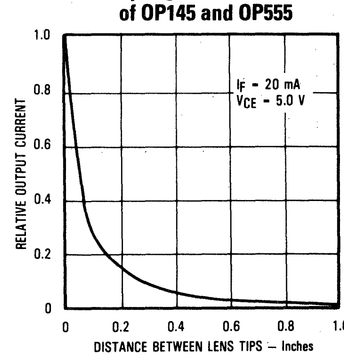
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) To calculate typical collector dark current in μA, use the formula $I_{CED} = 10^{(0.040\ T_A - 3.4)}$ where T_A is ambient temperature in °C.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP145 and OP555



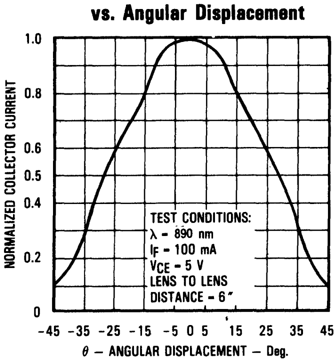
Types OP555A, OP555B, OP555C, OP555D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

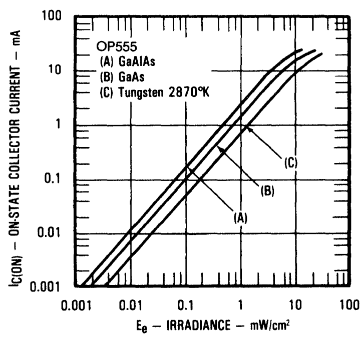
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP555D	0.25			mA	V_{CE} = 5.0V, E_e = 1.0mW/cm^2(3)
		OP555C	0.25		2.40	mA	
		OP555B	1.30		4.70	mA	
		OP555A	2.55			mA	
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature			1.00		%/°C	V_{CE} = 5.0V, E_e = 1.0mW/cm^2 λ = 935nm
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0(4)
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	I_C = 100μA, E_e = 1.0mW/cm^2(3)

Typical Performance Curves

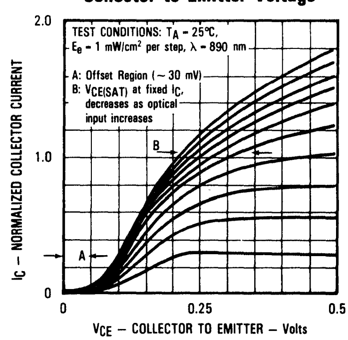
Normalized Collector Current vs. Angular Displacement



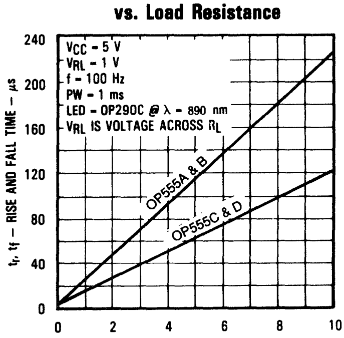
On-State Collector Current vs. Irradiance



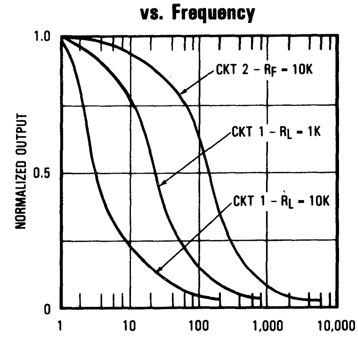
Normalized Collector Current vs. Collector to Emitter Voltage



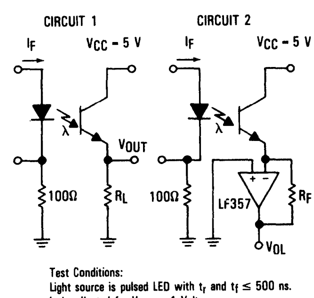
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



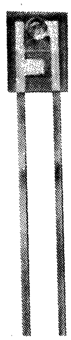
Switching Time Test Circuit

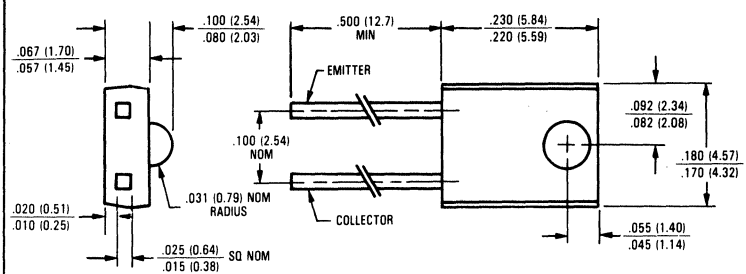


Test Conditions:
Light source is pulsed LED with t_r and t_f ≤ 500 ns.
I_F is adjusted for V_{OUT} = 1 Volt.

OPTEK

NPN Silicon Photodarlington
Types OP560A, OP560B, OP560C





DIMENSIONS ARE IN INCHES (MILLIMETERS).

Features

- Variety of sensitivity ranges
- High current gain
- Side-looking package for space limited applications

Description

The OP560 series consists of NPN silicon photodarlingtons molded in clear epoxy packages. The lensing effect allows an acceptance half angle of 28° measured from the optical axis to the half power point. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters.

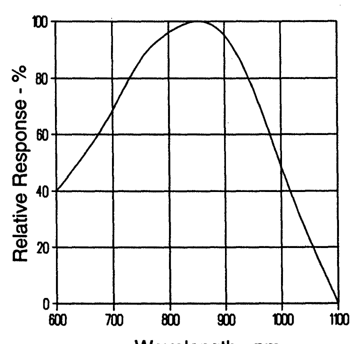
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 15.0V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

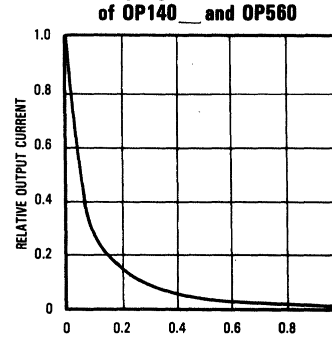
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 935nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP140__ and OP560



Types OP560A, OP560B, OP560C

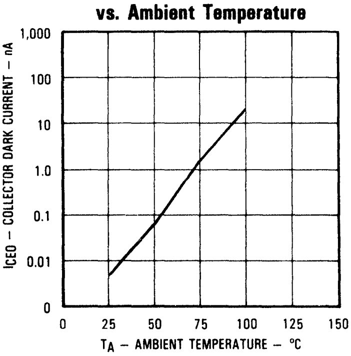
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP560C	1.1			mA	V_{CE} = 2V, E_e = .1mW/cm^2 (3)
		OP560B	3.3		9.8	mA	V_{CE} = 2V, E_e = .1mW/cm^2 (3)
		OP560A	6.6			mA	V_{CE} = 2V, E_e = .1mW/cm^2 (3)
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		15.0			V	I_C = 1.00mA, E_e = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA, E_e = 0
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				1.10	V	I_C = .4mA, E_e = .10mW/cm^2 (3)

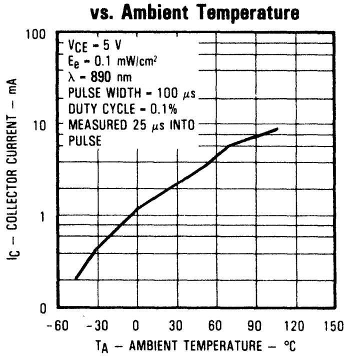
PHOTOSENSORS

Typical Performance Curves

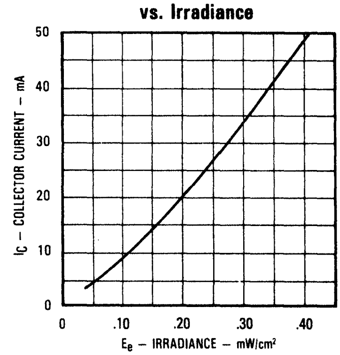
Collector Dark Current vs. Ambient Temperature



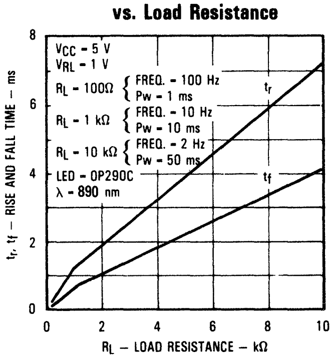
Collector Current vs. Ambient Temperature



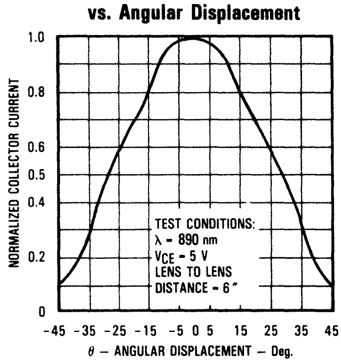
Collector Current vs. Irradiance



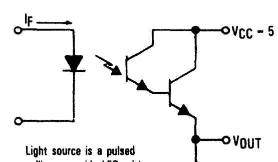
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



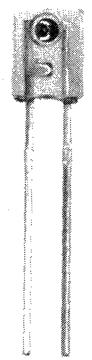
Switching Time Test Circuit



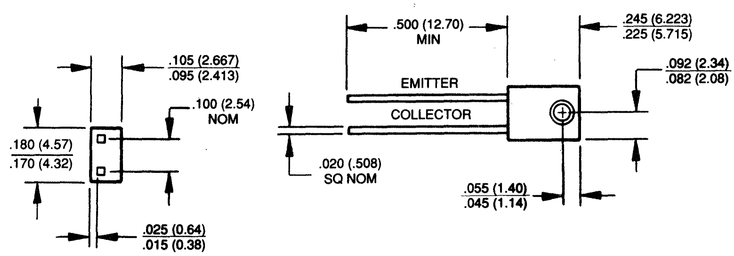
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until I_C = 0.8 mA.

OPTEK

NPN Silicon Photodarlington
Types OP565A, OP565B, OP565C



Dimensions are in inches (millimeters)



Features

- Variety of sensitivity ranges
- High current gain
- Side-looking package for space limited applications

Description

The OP565 series consist of NPN silicon photodarlingtons molded in green-tinted epoxy packages. The lensing effect allows an acceptance half angle of 28° measured from the optical axis to the half power point. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. The side-looking package is designed for easy PC board mounting of slotted optical switches or optical interrupt detectors. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters.

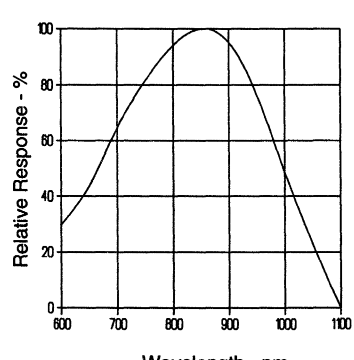
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 15.0V
Emitter-Collector Voltage 5.0V
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 100mW(2)

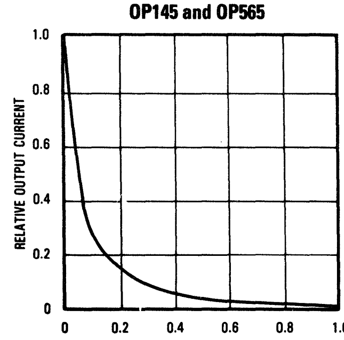
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Light source is an unfiltered GaAs LED with a peak emission wavelength of 930nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics OP145 and OP565



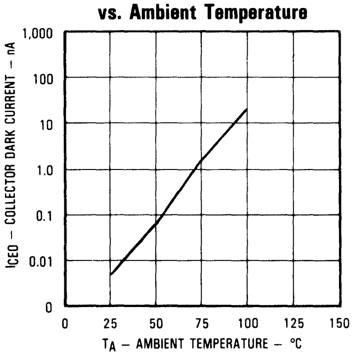
Types OP565A, OP565B, OP565C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

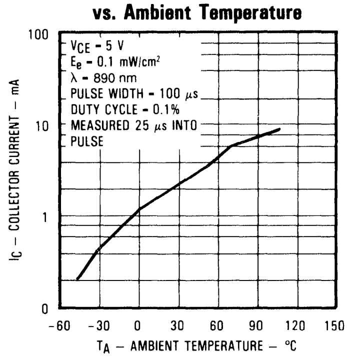
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP565C OP565B OP565A	1.1 3.3 6.6		 9.8 	mA mA mA	V_{CE} = 2V, E_e = .10mW/cm^2(3) V_{CE} = 2V, E_e = .10mW/cm^2(3) V_{CE} = 2V, E_e = .10mW/cm^2(3)
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		15.0			V	I_C = 1.00mA, E_e = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA, E_e = 0
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				1.1	V	I_C = .40mA, E_e = .10mW/cm^2(3)

Typical Performance Curves

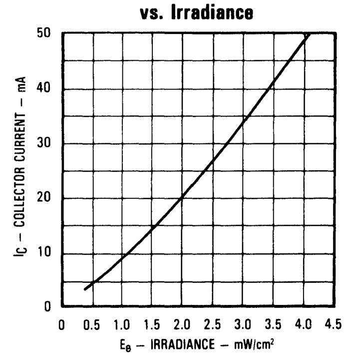
Collector Dark Current vs. Ambient Temperature



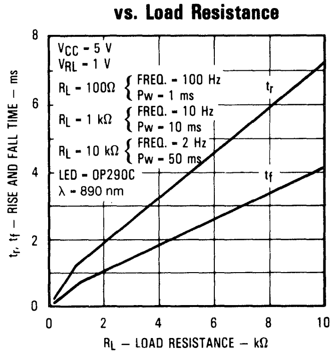
Collector Current vs. Ambient Temperature



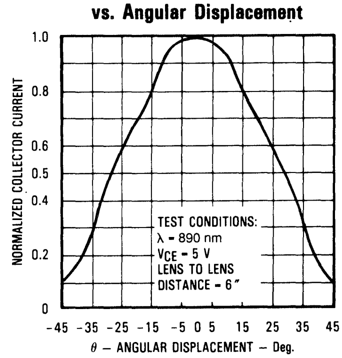
Collector Current vs. Irradiance



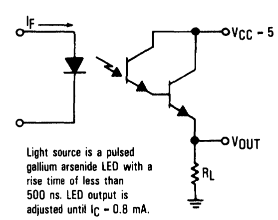
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit

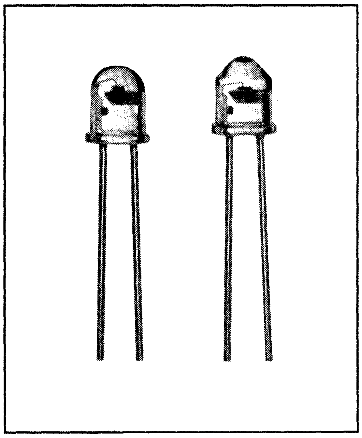


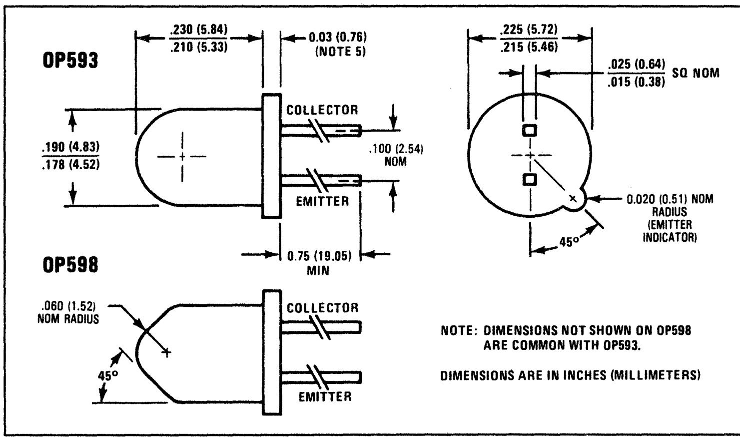
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP593A
April 1993

OPTEK

NPN Plastic Silicon Phototransistors
Types OP593, OP598 Series





Features

- Wide receiving angle
- Variety of sensitivity ranges
- TO-18 equivalent package style

Description

The OP593/598 series consist of NPN silicon phototransistors molded in dark blue epoxy packages. The wide receiving angle provides relatively even reception over a large area. These devices are 100% production tested using infrared light for close correlation with Optek's GaAs and GaAlAs emitters.

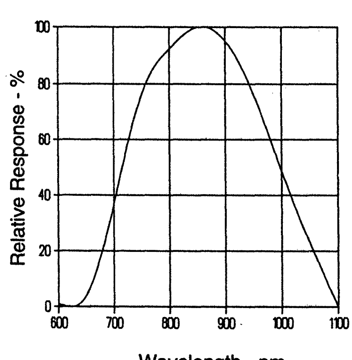
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Continuous Collector Current 50mA
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 250mW(2)

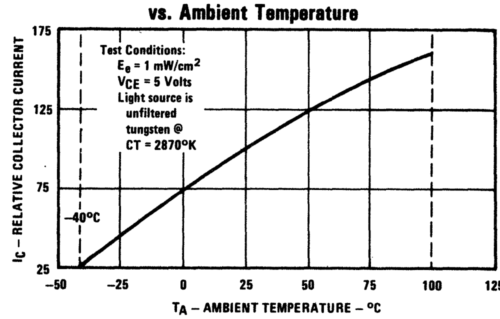
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 3.33 mW/°C above 25°C.
(3) V_{CE} = 5V. Light source is an unfiltered GaAlAs emitting diode operating at peak emission wavelength of 890nm and $E_{e(APT)}$ of 1.7mW/cm^2 average within a .250" dia. aperture.
(4) This dimension is held to within ± 0.005" on the flange edge and may vary up to ± 0.020" in the area of the leads.

Typical Performance Curves

Typical Spectral Response



Normalized Collector Current vs. Ambient Temperature



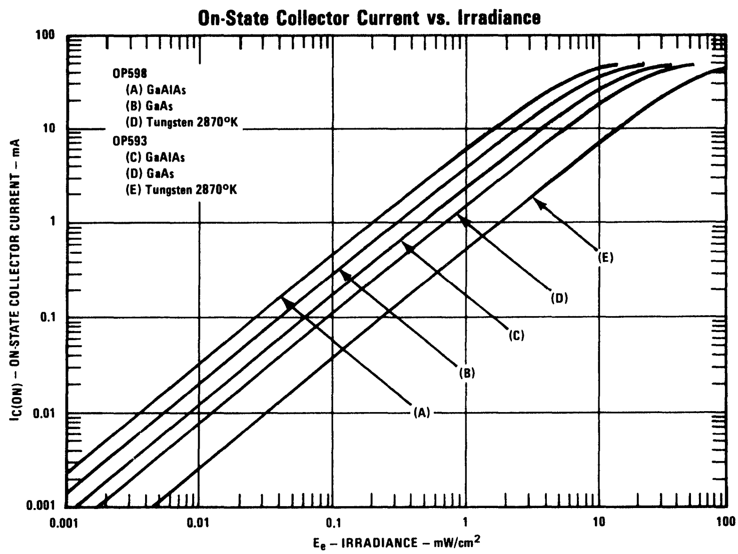
Types OP593, OP598 Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP593C	1.0			mA	See Note (3)
		OP593B	2.0		4.0	mA	See Note (3)
		OP593A	3.0			mA	See Note (3)
		OP598C	2.5			mA	See Note (3)
		OP598B	5.0		10.0	mA	See Note (3)
		OP598A	7.5			mA	See Note (3)
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	I_C = 0.40mA, E_e = 1.7mW/cm^2(3)

PHOTOSENSORS

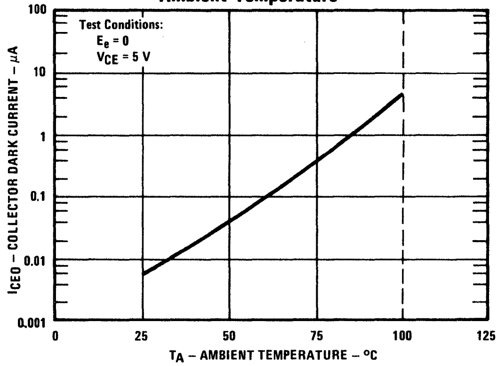
Typical Performance Curves



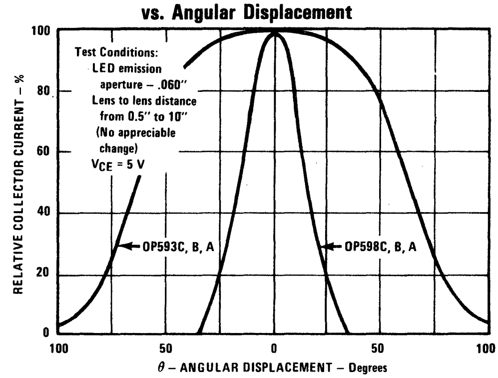
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Typical Performance Curves

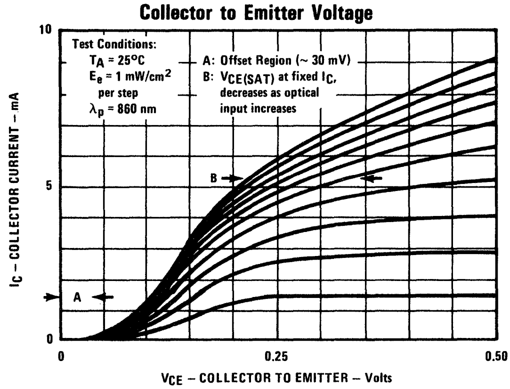
Collector Dark Current vs. Ambient Temperature



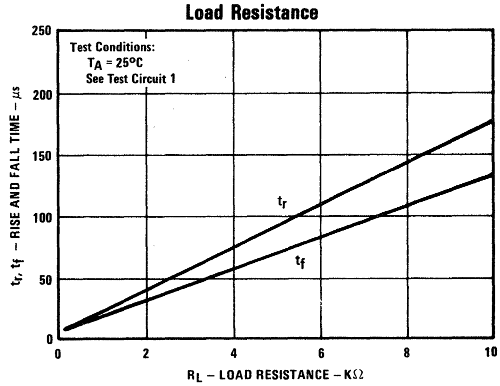
Relative Collector Current vs. Angular Displacement



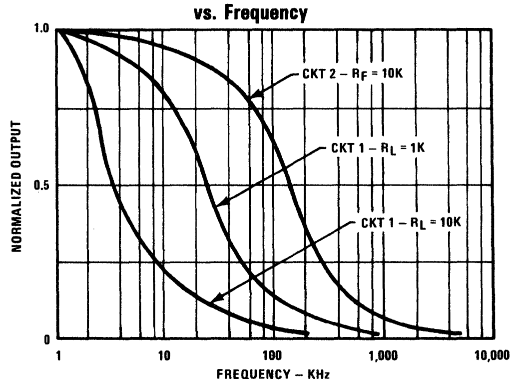
Collector Current vs. Collector to Emitter Voltage



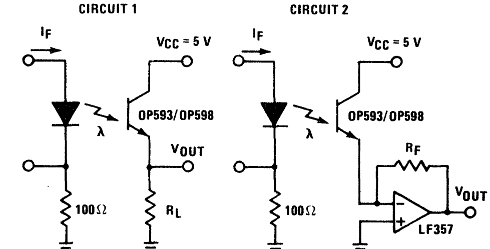
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



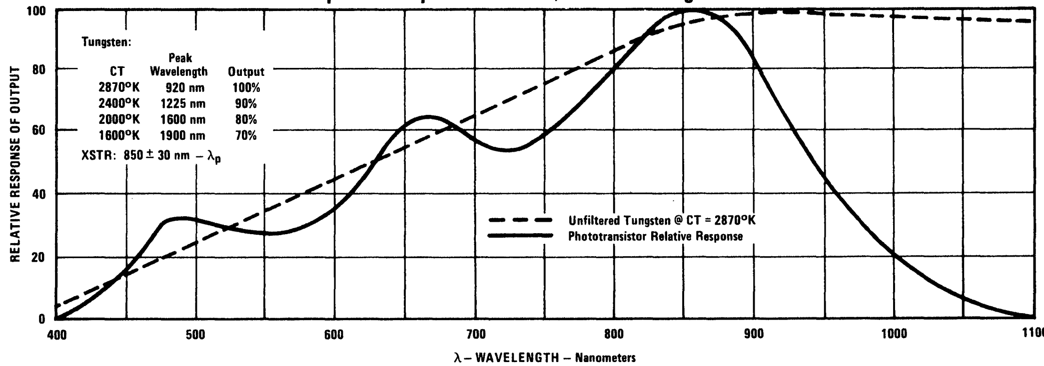
Switching Time Test Circuit



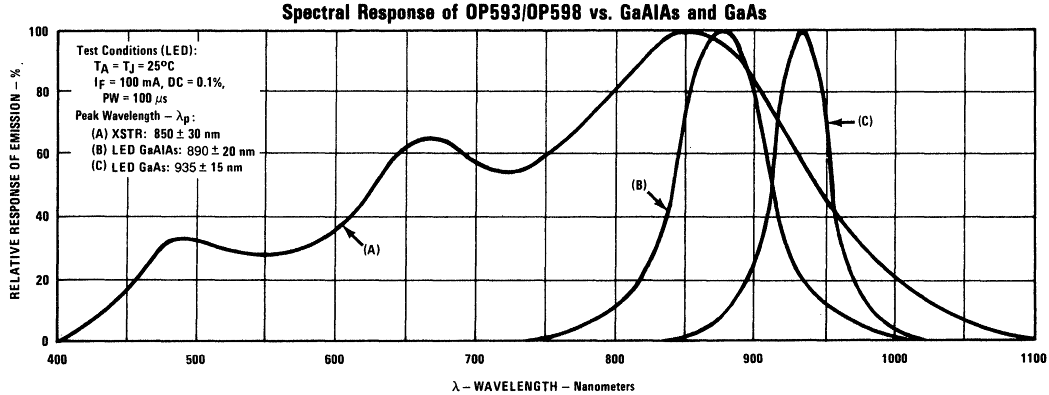
Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq 500$ ns.
I_F is adjusted for $V_{OUT} = 1$ Volt.

Typical Performance Curves

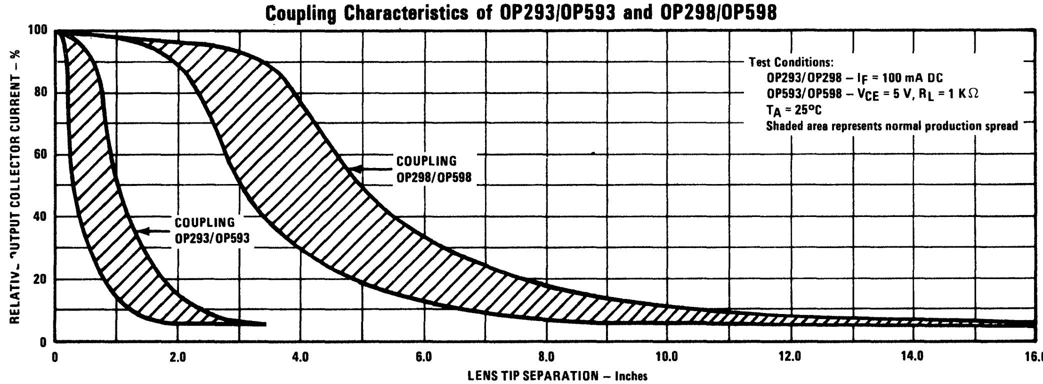
Spectral Response of OP593/OP598 vs. Tungsten



Spectral Response of OP593/OP598 vs. GaAlAs and GaAs

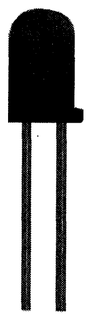


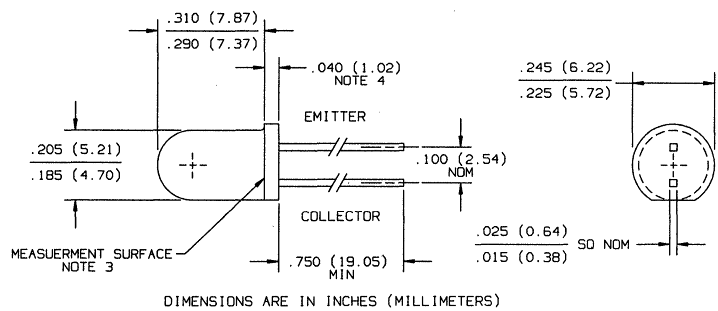
Coupling Characteristics of OP293/OP593 and OP298/OP598



OPTEK

NPN Plastic Silicon Phototransistors
Type OP599 Series





Features

- Variety of sensitivity ranges
- T-1 3/4 package style

Description

The OP599 series phototransistor consists of an NPN silicon phototransistor mounted in a dark blue plastic injection molded shell package. The narrow receiving angle provides excellent on-axis coupling. The sensors are 100% production tested for close correlation with Optek GaAlAs emitters.

Optek's packaging process provides excellent optical and mechanical axis alignment. The shell also provides excellent optical lens surface, control of chip placement, and consistency of the outside package dimensions.

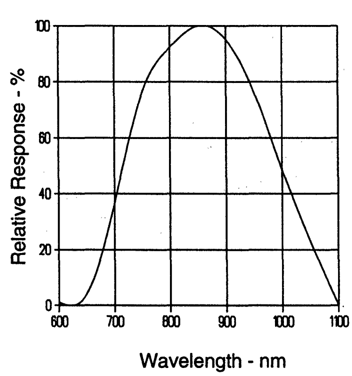
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage . . . . 30 V
Emitter-Collector Voltage . . . . 5.0 V
Continuous Collector Current . . . . 50 mA
Storage and Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature (1/16 inch [1.6 mm] from case for 5 sec. with soldering iron) . . . . 260°C(1)
Power Dissipation . . . . 100 mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) V_{CE} = 5 V. Light source is an unfiltered GaAlAs emitting diode operating at peak emission wavelength of 890 nm and $E_{e(APT)}$ of .25 mW/cm^2.
(4) This dimension is held to within ± 0.005" on the flange edge and may vary up to ± 0.020" in the area of the leads.

Typical Performance Curves

Typical Spectral Response

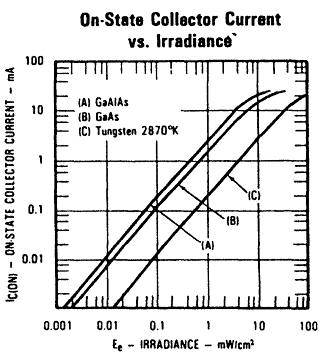


Electrical Characteristics (T_A = 25°C unless otherwise noted)

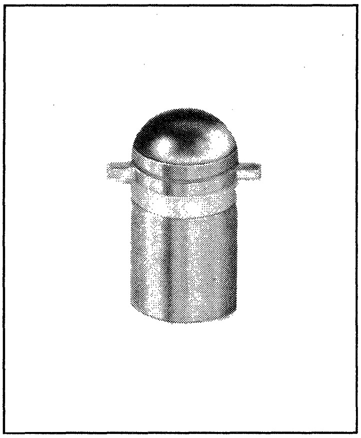
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP599D	0.20			mA	See Note (3)
		OP599C	0.40		1.95	mA	See Note (3)
		OP599B	1.20		3.85	mA	See Note (3)
		OP599A	2.35			mA	See Note (3)
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0 V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100 μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100 μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.40	V	I_C = 100 μA E_e = 0.25 mW/cm²(3)

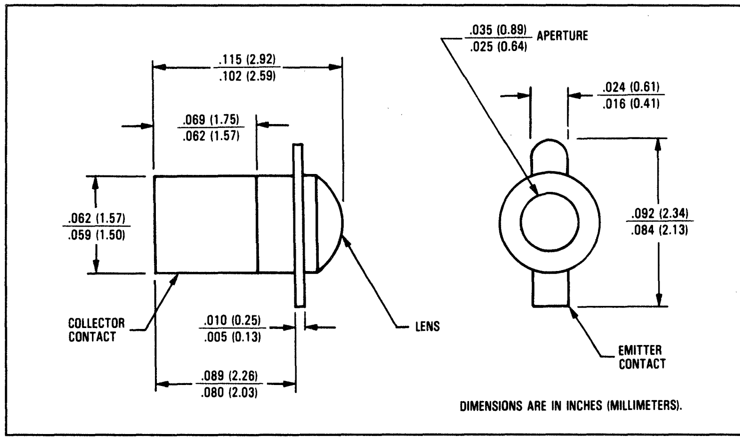
PHOTOSENSORS

Typical Performance Curves



NPN Silicon Phototransistors
Types OP600A, OP600B, OP600C





Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- Ideal for direct mounting in PC boards
- Mechanically and spectrally matched to the OP123 and OP223 series devices
- TX/TXV processing available (see Hi-Rel section)

Description

The OP600 series device consists of an NPN silicon phototransistor mounted in a hermetically sealed "Pill" type package. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% production tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

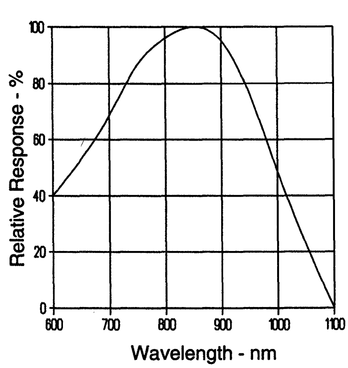
Collector-Emitter Voltage	25V
Emitter-Collector Voltage	5.0V
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Soldering Temperature (5 sec. with soldering iron)	260°C(1)(2)
Power Dissipation	50mW(3)
Continuous Collector Current	50mA

Notes:

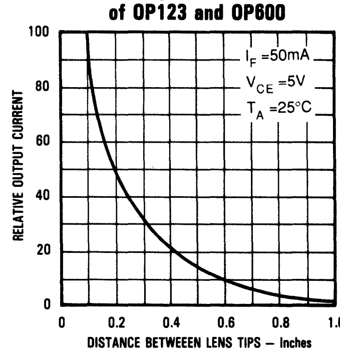
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices to PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.5mW/°C above 25°C.
(4) Junction temperature maintained at 25°C.
(5) Light source is a GaAlAs LED, peak Wavelength = 890nm, providing an irradiance of $2.5mW/cm^2$. The source irradiance is not necessarily uniform over the entire lens area of the unit under test.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP123 and OP600



Types OP600A, OP600B, OP600C

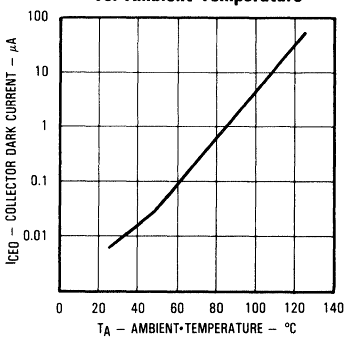
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$(4)	On-State Collector Current OP600C OP600B OP600A	0.30 0.60 1.20		 1.8	mA mA mA	V_{CE} = 5V, E_e = 2.5mW/cm^2(5) V_{CE} = 5V, E_e = 2.5mW/cm^2(5) V_{CE} = 5V, E_e = 2.5mW/cm^2(5)
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	25			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA
$V_{CE(SAT)}$(4)	Collector-Emitter Saturation Voltage			0.40	V	I_C =0.15mA, E_e=2.5mW/cm^2(5)
t_r t_f	Rise Time Fall Time		15.0 15.0		μs μs	V_{CC} = 5.0V, I_C = 0.80mA, R_L = 1.0kΩ, See Test Circuit

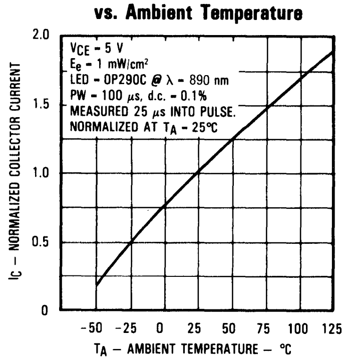
PHOTOSENSORS

Typical Performance Curves

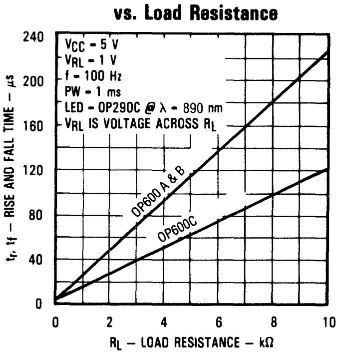
Collector Dark Current vs. Ambient Temperature



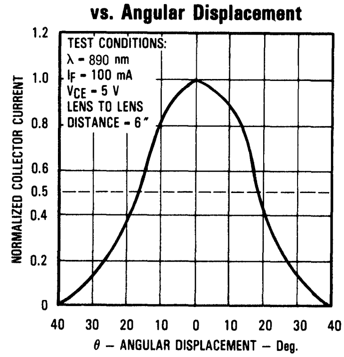
Normalized Collector Current vs. Ambient Temperature



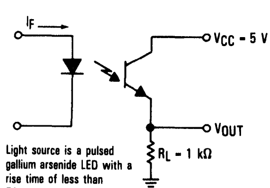
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit

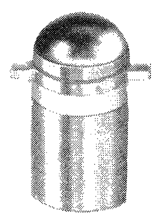


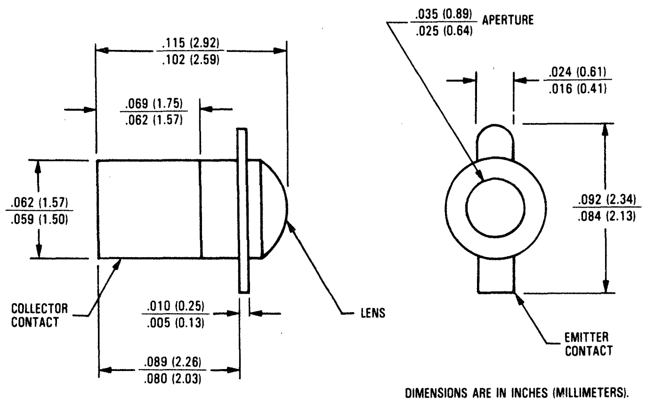
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until I_C = 0.8 mA.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

NPN Silicon Phototransistors
Types OP641SL, OP642SL, OP643SL, OP644SL





Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- Ideal for direct mounting in PC boards
- Mechanically and spectrally matched to the OP123 and OP223 series LED's

Description

The OP641SL series devices consist of NPN silicon phototransistors mounted in hermetically sealed packages. The narrow receiving angle provides excellent on-axis coupling.

Replaces

OP600, OP640 series

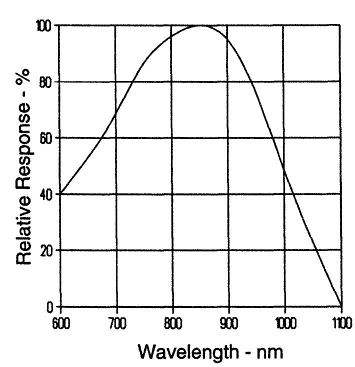
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage	25V
Emitter-Collector Voltage	5.0V
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Soldering Temperature (5 sec. with soldering iron)	260°C(1)(2)
Power Dissipation	50mW(3)
Continuous Collector Current	50mA

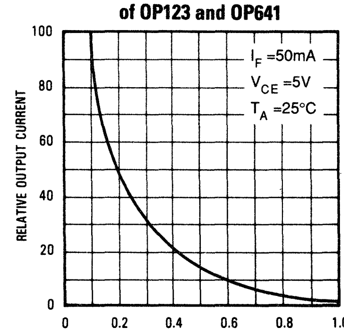
Notes:
(1) Refer to Application Bulletin 202 which discusses proper techniques for soldering Pill type devices to PC boards.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.5mW/°C above 25°C.
(4) Junction temperature maintained at 25°C.
(5) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP123 and OP641



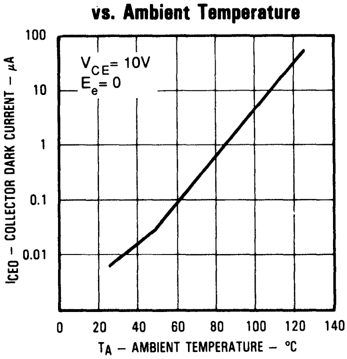
Types OP641SL, OP642SL, OP643SL, OP644SL

Electrical Characteristics ($T_A = 25^\circ C$ unless otherwise noted)

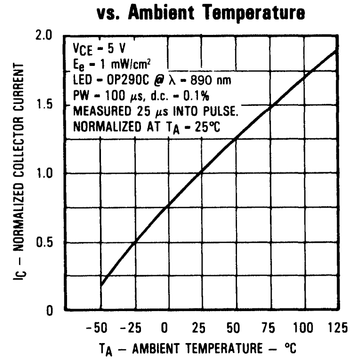
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$[4]	On-State Collector Current	OP641SL OP642SL OP643SL OP644SL	0.5 2.0 4.0 7.0		3.0 5.0 8.0 22.0	mA mA mA mA	$V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5] $V_{CE} = 5V$, $E_e = 20mW/cm^2$[5]
I_{CEO}	Collector Dark Current				100	nA	$V_{CE} = 10.0V$, $E_e = 0$
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		25			V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100\mu A$
$V_{CE(SAT)}$[4]	Collector-Emitter Saturation Voltage				0.40	V	$I_C = 0.4mA$, $E_e = 20mW/cm^2$[5]
t_r t_f	Rise Time Fall Time			15.0 15.0		µs µs	$V_{CC} = 5.0V$, $I_C = 0.80mA$, $R_L = 1.0k\Omega$, (See Test Circuit)

Typical Performance Curves

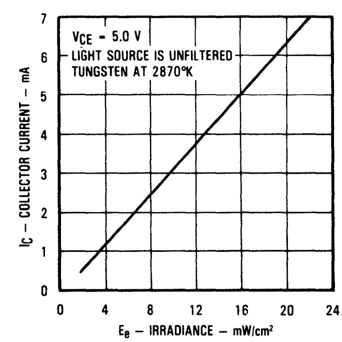
Collector Dark Current vs. Ambient Temperature



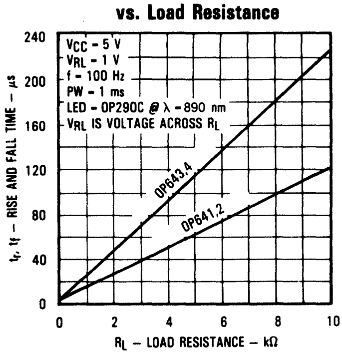
Normalized Collector Current vs. Ambient Temperature



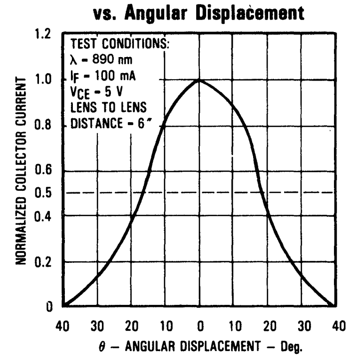
Collector Current vs. Irradiance



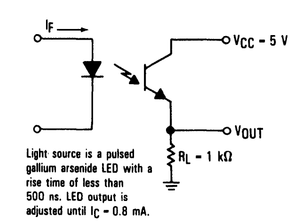
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



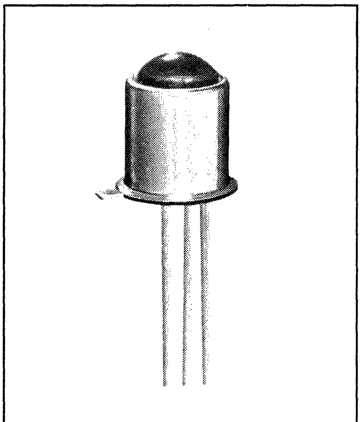
Switching Time Test Circuit

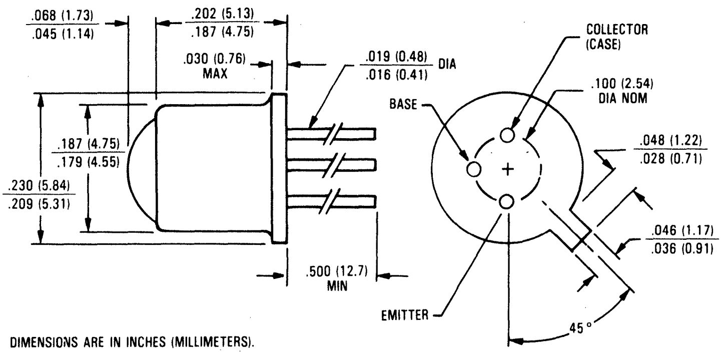


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

NPN Silicon Phototransistors
Types OP800A, OP800B, OP800C, OP800D





DIMENSIONS ARE IN INCHES (MILLIMETERS).

Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130 and OP230 series LED's
- TX-TXV process available (see Hi-Rel section)

Description

The OP800 series devices consist of NPN silicon phototransistors mounted in hermetically sealed packages. The narrow receiving angle provides excellent on-axis coupling. These devices are 100% tested using infrared light for close correlation with Optek GaAs and GaAlAs emitters. TO-18 packages offer high power dissipation and superior hostile environment operation. The base lead is bonded to enable conventional transistor biasing.

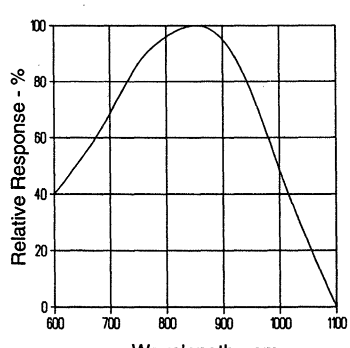
Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Collector-Base Voltage	30.0V
Collector-Emitter Voltage	30.0V
Emitter-Base Voltage	5.0V
Emitter-Collector Voltage	5.0V
Continuous Collector Current	50mA
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Lead Soldering Temperature Range [1/16 inch (1.6mm) 5 sec. with soldering iron]	260°C(2)
Power Dissipation	250mW(3)

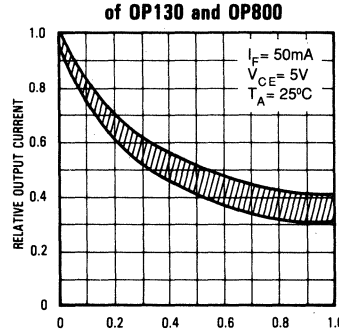
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is a GaAlAs LED, 890nm peak emission wavelength, providing a $0.5 mW/cm^2$ radiant intensity on the unit under test. The intensity level is not necessarily uniform over the lens area of the unit under test.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP130 and OP800



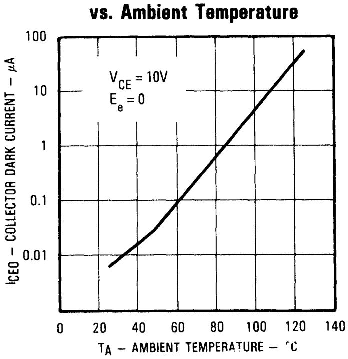
Types OP800A, OP800B, OP800C, OP800D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

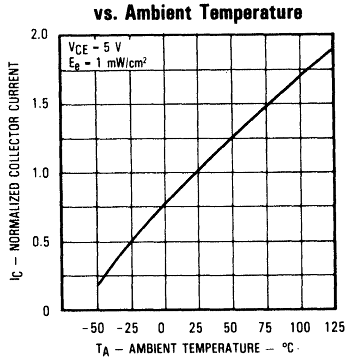
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$[3]	On-State Collector Current	OP800D	0.45			mA	V_{CE} = 5V, E_e = 0.5mW/cm^2[4]
		OP800C	0.90		3.60	mA	V_{CE} = 5V, E_e = 0.5mW/cm^2[4]
		OP800B	1.80		5.40	mA	V_{CE} = 5V, E_e = 0.5mW/cm^2[4]
		OP800A	3.60			mA	V_{CE} = 5V, E_e = 0.5mW/cm^2[4]
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		5.0			V	I_E = 100μA
$V_{CE(SAT)}$[3]	Collector-Emitter Saturation Voltage				0.40	V	I_C = 0.15mA, E_e= 0.5mW/cm^2[4]
t_r	Rise Time			7.0		μs	V_{CC} = 5V, I_C = 0.80mA,
t_f	Fall Time			7.0		μs	R_L = 100Ω, (See Test Circuit)

Typical Performance Curves

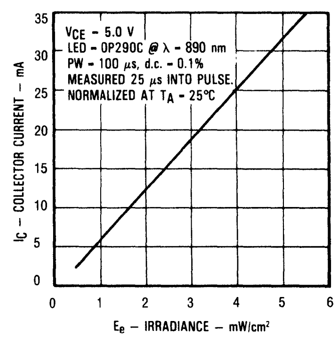
Collector Dark Current vs. Ambient Temperature



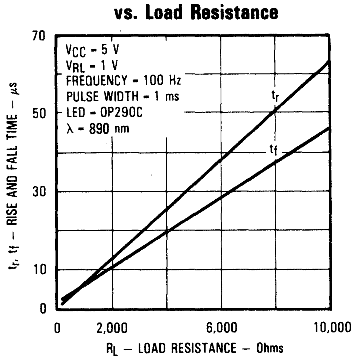
Normalized Collector Current vs. Ambient Temperature



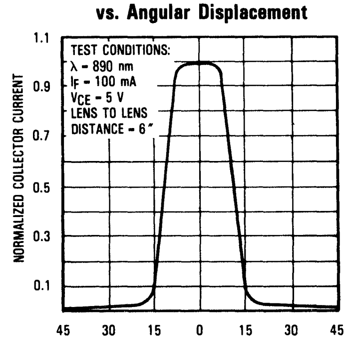
Collector Current vs. Irradiance



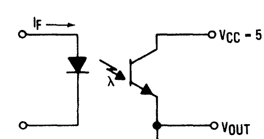
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit



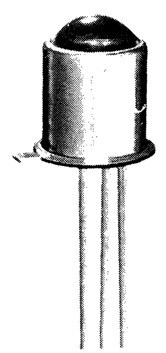
Light source is a pulsed gallium arsenide LED with a rise time of less than 500 ns. LED output is adjusted until I_C - 0.8 mA.

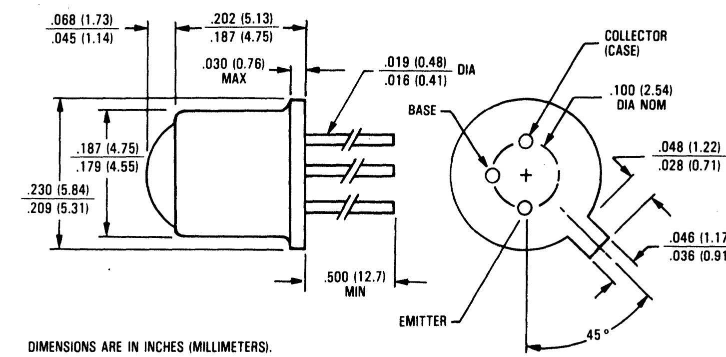
Product Bulletin OP800SL
April 1993

OPTEK

NPN Silicon Phototransistors

Types OP800SL, OP801SL, OP802SL, OP803SL, OP804SL, OP805SL





DIMENSIONS ARE IN INCHES (MILLIMETERS).

Features

- Narrow receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130 and OP231 series of infrared emitting diodes
- TX/TXV processing available

Description

The OP800SL series device consists of an NPN silicon phototransistor mounted in a hermetically sealed package. The narrow receiving angle provides excellent on-axis coupling. TO-18 packages offer high power dissipation and superior hostile environment operation. The base lead is bonded to enable conventional transistor biasing.

Replaces

OP800 and K5251 series

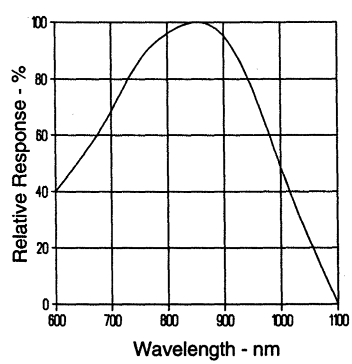
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Base Voltage	30V
Collector-Emitter Voltage	30V
Emitter-Base Voltage	5.0V
Emitter-Collector Voltage	5.0V
Continuous Collector Current	50mA
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C[(1)]
Power Dissipation	250mW[(2)]

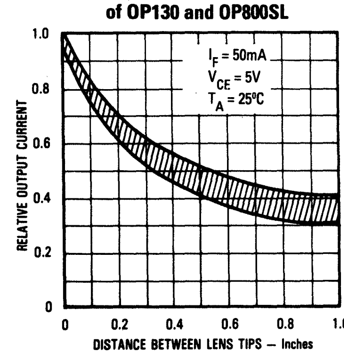
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP130 and OP800SL



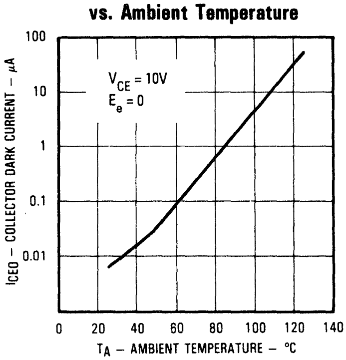
Types OP800SL thru OP805SL

Electrical Characteristics (T_A = 25°C unless otherwise noted)

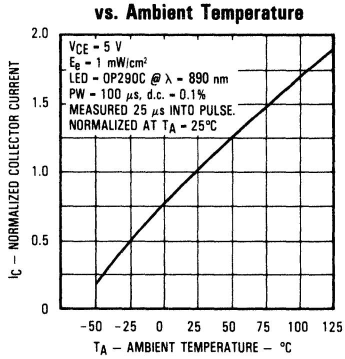
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current	OP800SL	0.5			mA	V_{CE} = 5V, E_e = 5mW/cm^2 (3)(4)
		OP801SL	0.5		3.0	mA	V_{CE} = 5V, E_e = 5mW/cm^2 (3)(4)
		OP802SL	2.0		5.0	mA	V_{CE} = 5V, E_e = 5mW/cm^2 (3)(4)
		OP803SL	4.0		8.0	mA	V_{CE} = 5V, E_e = 5mW/cm^2 ((3)4)
		OP804SL	7.0		22.0	mA	V_{CE} = 5V, E_e = 5mW/cm^2 ((3)4)
		OP805SL	15.0			mA	V_{CE} = 5V, E_e = 5mW/cm^2 ((3)4)
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		5.0			V	I_E = 100μA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				0.4	V	I_C = 0.40mA, E_e = 5.0mW/cm^2 (4)
t_r	Rise Time			7.0		μs	V_{CC} = 5.0V, I_C = 0.80mA
t_f	Fall Time			7.0		μs	R_L = 100Ω, See Test Circuit

Typical Performance Curves

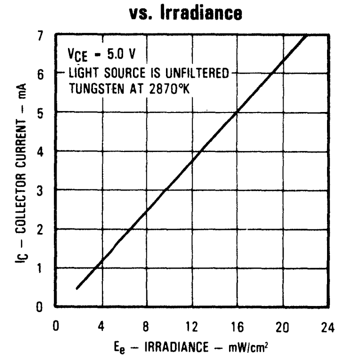
Collector Dark Current vs. Ambient Temperature



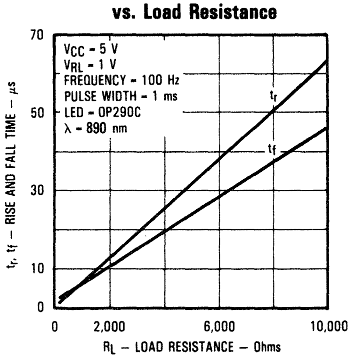
Normalized Collector Current vs. Ambient Temperature



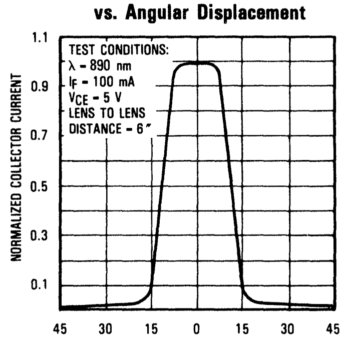
Collector Current vs. Irradiance



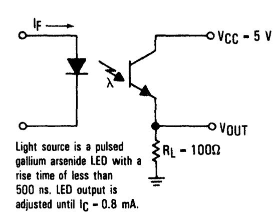
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



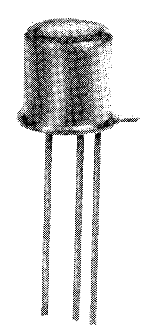
Switching Time Test Circuit

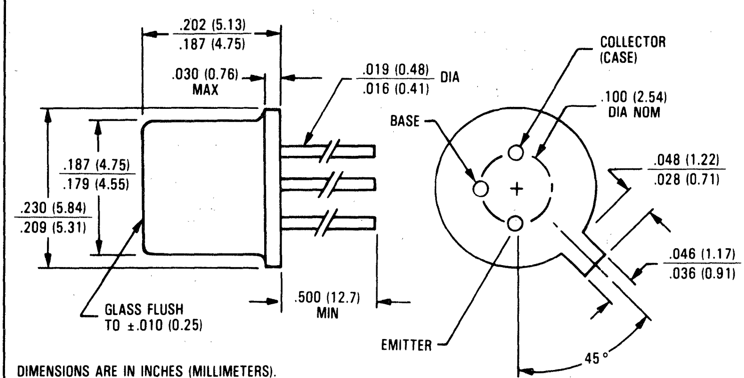


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

NPN Silicon Phototransistors
Types OP800WSL, OP801WSL, OP802WSL





Features

- Wide receiving angle
- Variety of sensitivity ranges
- Enhanced temperature range
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130W and OP231W series emitters

Description

The OP800WSL series device consists of an NPN silicon phototransistor mounted in a hermetically sealed package. The wide receiving angle provides relatively even reception over a large area. TO-18 packages offer high power dissipation and superior hostile environment operation.

Replaces

OP800W and K5201 series

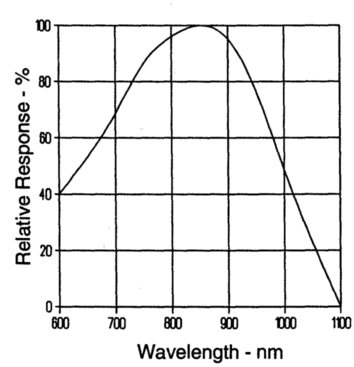
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Continuous Collector Current 50mA
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 250mW(2)

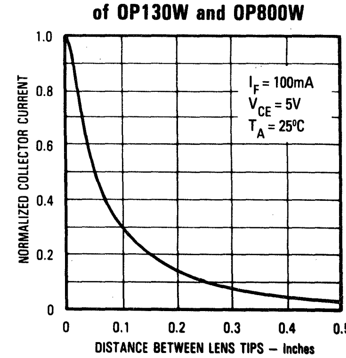
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP130W and OP800W



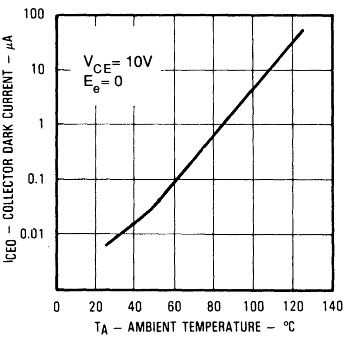
Types OP800WSL, OP801WSL, OP802WSL

Electrical Characteristics (T_A = 25°C unless otherwise noted)

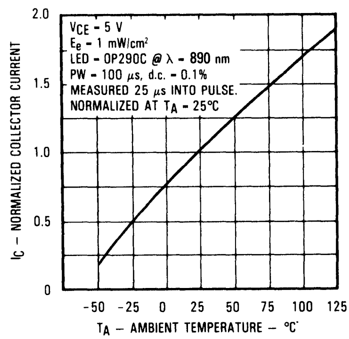
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$ (3)	On-State Collector Current	OP800WSL	0.3			mA	V_{CE} = 5V, E_e = 5mW/cm² (4)
		OP801WSL	0.5		3.0	mA	V_{CE} = 5V, E_e = 5mW/cm² (4)
		OP802WSL	2.5			mA	V_{CE} = 5V, E_e = 5mW/cm² (4)
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA
$V_{CE(SAT)}$ (3)	Collector-Emitter Saturation Voltage				0.4	V	I_C = 0.40mA, E_e = 5.0mW/cm² (4)
t_r	Rise Time			7.0		μs	V_{CC} = 5.0V, I_C = 0.80mA
t_f	Fall Time			7.0		μs	R_L = 100Ω, See Test Circuit

Typical Performance Curves

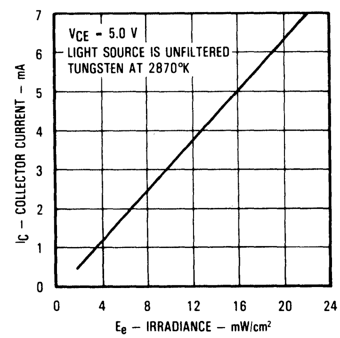
Collector Dark Current vs. Ambient Temperature



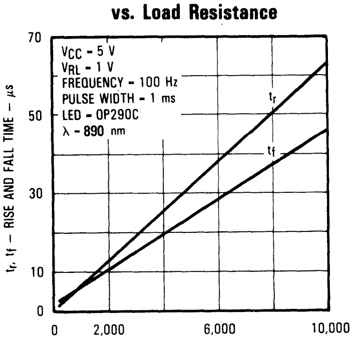
Normalized Collector Current vs. Ambient Temperature



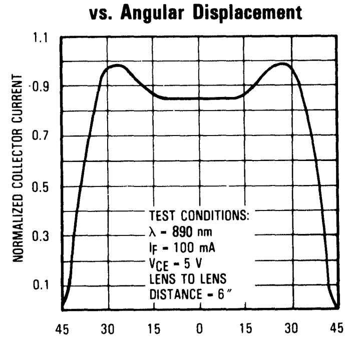
Collector Current vs. Irradiance



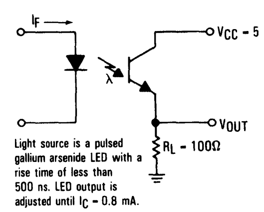
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement

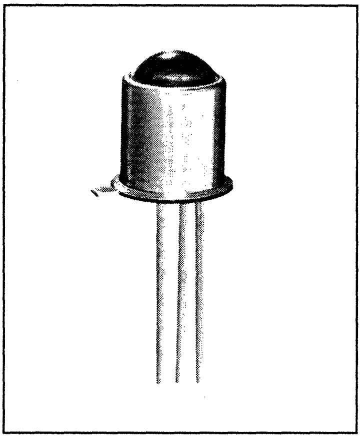


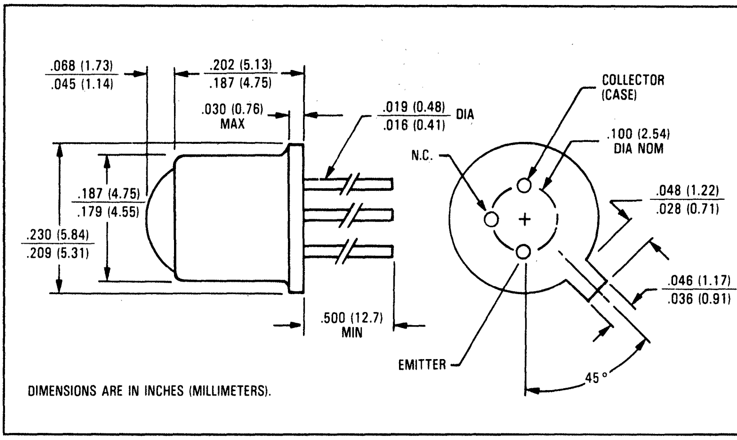
Switching Time Test Circuit



OPTEK

NPN Silicon Photodarlington
Type OP830SL





Features

- Narrow receiving angle
- Enhanced temperature range
- Excellent thermal characteristics
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130 and OP231 series of infrared emitting diodes

Description

The OP830SL consists of an NPN silicon photodarlington mounted in a hermetically sealed package. The narrow receiving angle provides excellent on-axis coupling. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. TO-18 packages offer high power dissipation and superior hostile environment operation.

Replaces

OP830 and K9020 series

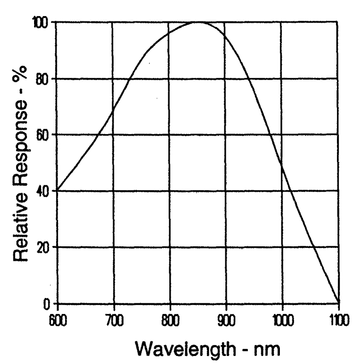
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage	15.0V
Emitter-Collector Voltage	5.0V
Continous Collector Current	50mA
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	250mW(2)

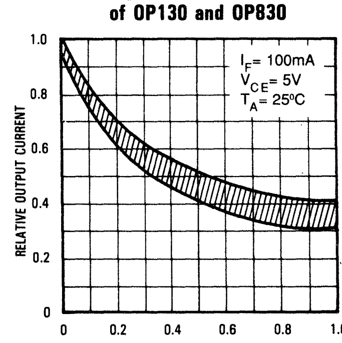
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5 mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP130 and OP830



Type OP830SL

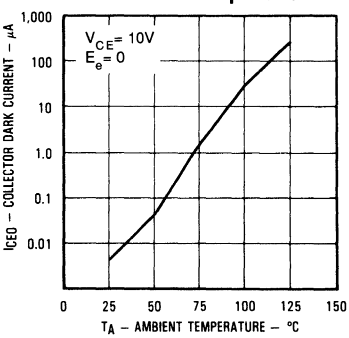
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$(3)	On-State Collector Current	15.0			mA	V_{CE} = 5V, E_e = 0.50mW/cm^2(4)
I_{CEO}	Collector Dark Current			1.0	μA	V_{CE} = 10.0V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA
$V_{CE(SAT)}$(3)	Collector-Emitter Saturation Voltage			1.20	V	I_C = 1.00mA, E_e = 0.50mW/cm^2(4)

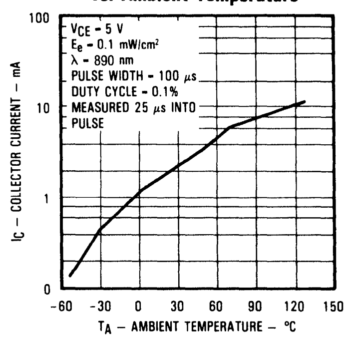
PHOTOSENSORS

Typical Performance Curves

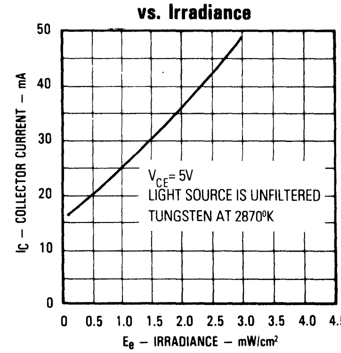
Collector Dark Current vs. Ambient Temperature



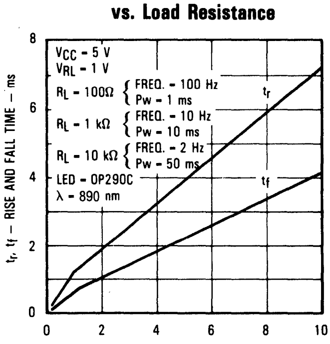
Collector Current vs. Ambient Temperature



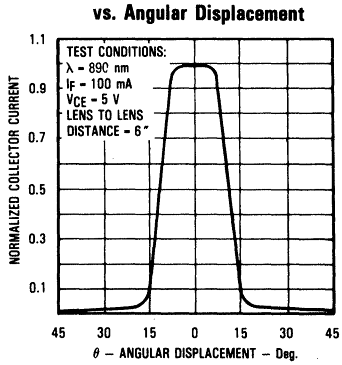
Collector Current vs. Irradiance



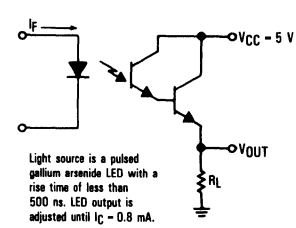
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit



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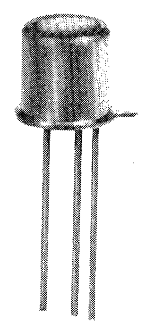
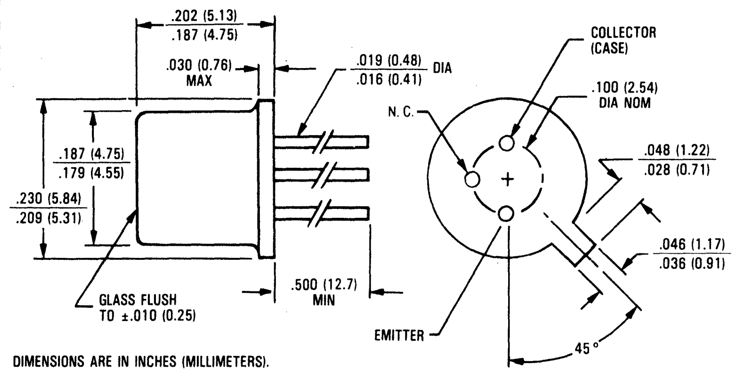
OPTEK

NPN Silicon Photodarlington
Type OP830WSL





Features

- Wide receiving angle
- Enhanced temperature range
- Excellent thermal characteristics
- TO-18 hermetically sealed package
- Mechanically and spectrally matched to the OP130W and OP231W series of infrared emitting diodes

Description

The OP830WSL consists of an NPN silicon photodarlington mounted in a hermetically sealed package. The wide receiving angle provides relatively even reception over a large area. Photodarlington devices are normally used in applications where light signal levels are low and more current gain is needed than is possible with phototransistors. TO-18 packages offer high power dissipation and superior hostile environment operation.

Replaces

OP830W and K9030 series

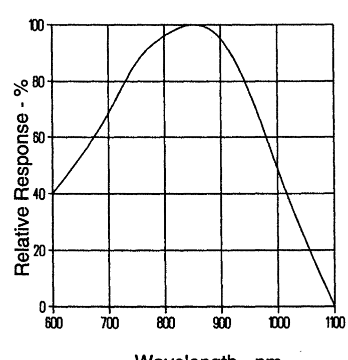
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Emitter Voltage	15.0V
Emitter-Collector Voltage	5.0V
Continous Collector Current	50mA
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	250mW(2)

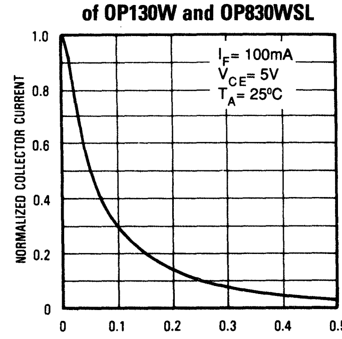
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5 mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP130W and OP830WSL



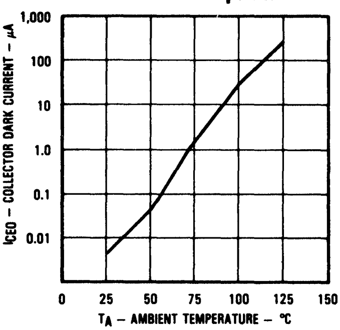
OP830WSL

Electrical Characteristics (T_A = 25°C unless otherwise noted)

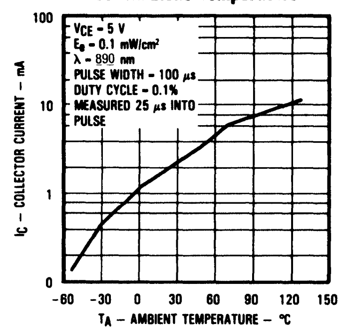
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$ (3)	On-State Collector Current	4.0			mA	V_{CE} = 5V, E_e = 0.50mW/cm^2 (4)
I_{CEO}	Collector Dark Current			1.0	μA	V_{CE} = 10.0V
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0			V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA
$V_{CE(SAT)}$ (3)	Collector-Emitter Saturation Voltage			1.20	V	I_C = 1.00mA, E_e = 0.50mW/cm^2 (4)

Typical Performance Curves

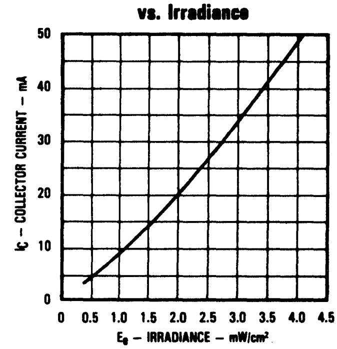
Collector Dark Current vs. Ambient Temperature



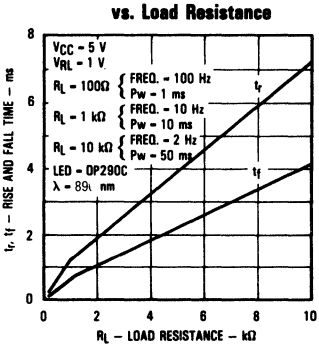
Collector Current vs. Ambient Temperature



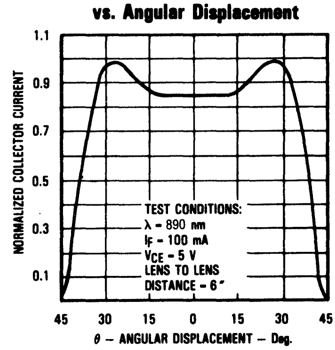
Collector Current vs. Irradiance



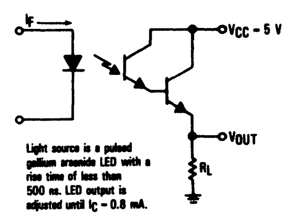
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



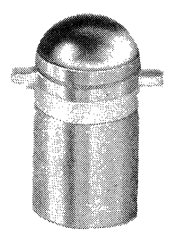
Switching Time Test Circuit

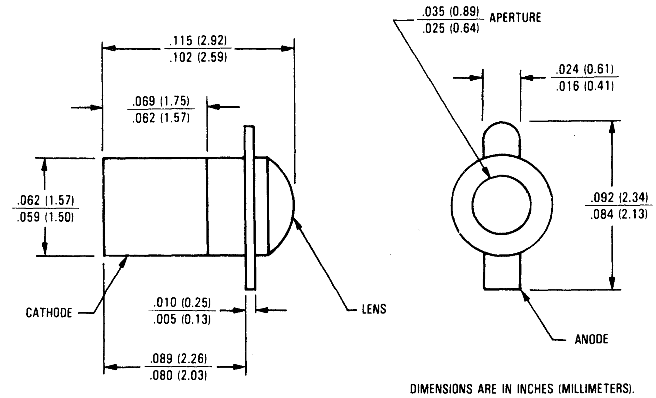


Product Bulletin OP900SL
April 1993

OPTEK

PN Junction Silicon Photodiode
Type OP900SL





Features

- Narrow receiving angle
- Enhanced temperature range
- Ideal for direct mounting in PC boards
- Fast switching speed
- Mechanically and spectrally matched to the OP123 series emitters
- Linear response vs. irradiance

Description

The OP900SL consists of a PN junction silicon photodiode mounted in a miniature, glass lensed, hermetically sealed "Pill" package. The lensing effect allows an acceptance half angle of 18° measured from the optical axis to the half power point.

Replaces

OP900 series

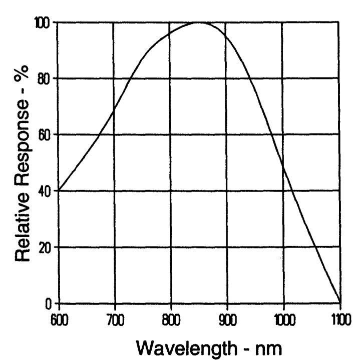
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100V
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -65°C to +125°C
Soldering Temperature (5 sec. with soldering iron) .... 260°C(1)
Power Dissipation .... 50mW(2)

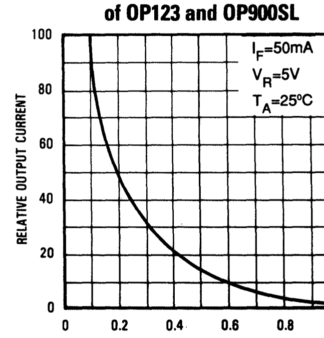
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 0.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.

Typical Performance Curves

Typical Spectral Response



Coupling Characteristics of OP123 and OP900SL



Type OP900SL

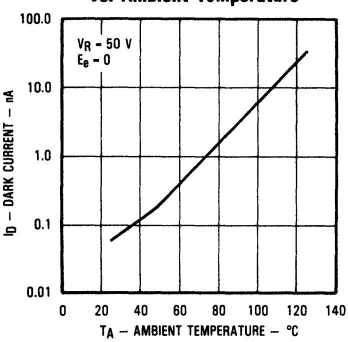
Electrical Characteristics ($T_A = 25^{\circ}C$ unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_L	Light Current	8.0	14.0		µA	$V_R = 10V$, $E_e = 20mW/cm^2$ (3)(4)
I_D	Dark Current			10.0	nA	$V_R = 10.0V$, $E_e = 0$ (3)
$V_{(BR)R}$	Reverse Voltage Breakdown	100	150		V	$I_R = 100µA$
t_r t_f	Rise Time Fall Time		100 100		ns ns	$V_R = 50V$, $I_L = 8.0µA$ $R_L = 1.00k\Omega$, (See Test Circuit)

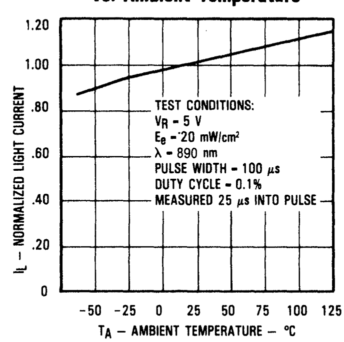
PHOTOSENSORS

Typical Performance Curves

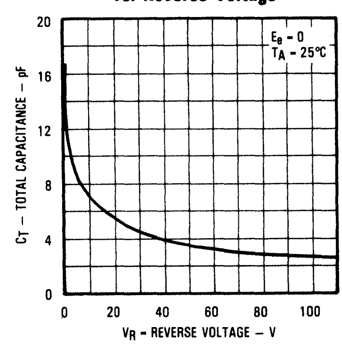
Dark Current vs. Ambient Temperature



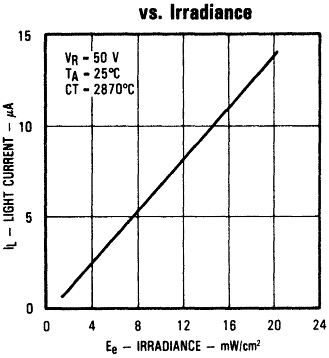
Normalized Light Current vs. Ambient Temperature



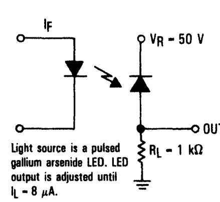
Total Capacitance vs. Reverse Voltage



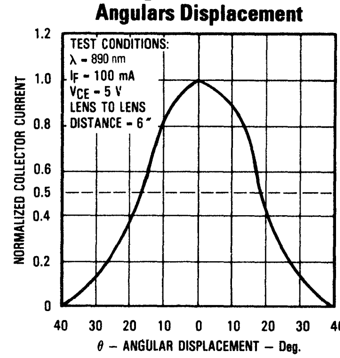
Light Current vs. Irradiance



Switching Time Test Circuit



Light Current vs. Angulars Displacement

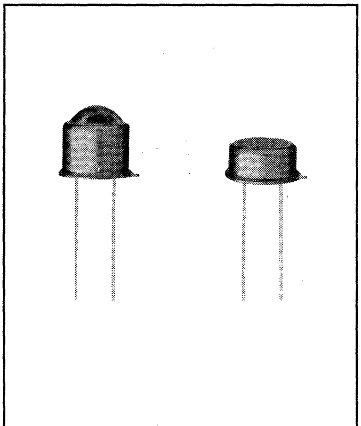


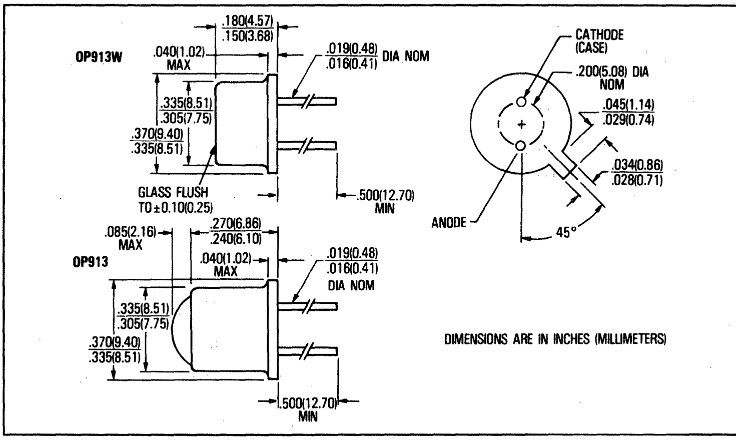
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OP913SL
April 1993

OPTEK

PIN Silicon Photodiodes
Types OP913SL, OP913WSL





Features

- Wide or Narrow receiving angle available
- Large active area (.115" x .115")
- Fast switching time
- Linear response vs irradiance
- Enhanced temperature range

Description

The OP913SL and OP913WSL each consist of a PIN silicon photodiode mounted in a two-leaded, TO-5 hermetically sealed package. The lensing effect of the OP913SL allows an acceptance angle of 10° measured from the optical axis to the half power point. The flat lens of the OP913WSL has an acceptance half angle of 30°. The large active area allows very low light level detection.

Replaces

OP913 and OP913W

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Reverse Voltage 32V
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -65°C to +125°C
Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)
Power Dissipation . . . . 150mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870 K or equivalent infrared source.
(5) At any particular wavelength the flux responsivity, Rθ, is the ratio of the diode photocurrent to the radiant flux producing it. Rθ is related to quantum efficiency by:

$$R_\theta = \eta q \left(\frac{\lambda}{1240} \right)$$

Where ηq is the quantum efficiency in electrons per photon and λ is the wavelength in nanometers. Thus at 900 nm, 0.60 A/W corresponds to a quantum efficiency of 83%.
(6) NEP is the radiant flux at a specified wavelength, required for unity signal-to-noise ratio normalized for bandwidth.

$$NEP = \frac{I_N/\sqrt{\Delta f}}{R_\theta}$$ where $I_N/\sqrt{\Delta f}$ is the bandwidth normalized shot noise.

NEP calculation is made using responsivity at peak sensitivity wavelength, with spot noise measurement at 1000 Hz in a noise bandwidth of 6Hz. $(\lambda, f, \Delta f) = (\lambda p, 1000\ Hz, 6\ Hz)$.

Types OP913SL, OP913WSL

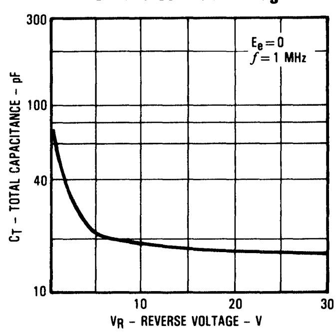
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_L	Reverse Light Current	OP913SL OP913WSL	120 40			µA µA	$V_R = 5V$, $E_e = 5mW/cm^2$(3)(4) $V_R = 5V$, $E_e = 5mW/cm^2$(3)(4)
I_D	Reverse Dark Current				25	nA	$V_R = 10.0V$, $E_e = 0$(3)
V_{OC}	Open Circuit Voltage	OP913SL OP913WSL		400 300		mV mV	$E_e = 5.0mW/cm^2$(4) $E_e = 5.0mW/cm^2$(4)
I_{SC}	Short Circuit Current	OP913SL OP913WSL	120 40			µA µA	$E_e = 5.0mW/cm^2$(4) $E_e = 5.0mW/cm^2$(4)
$V_{(BR)R}$	Reverse Breakdown Voltage		32			V	$I_R = 100\mu A$
C_T	Total Capacitance	OP913SL OP913WSL			150 150	pF pF	$V_R = 0$, $E_e = 0$, $f = 1.00MHz$ $V_R = 0$, $E_e = 0$, $f = 1.00MHz$
t_{on}, t_{off}	Turn-On Time, Turn-Off Time	OP913SL OP913WSL		50 50		ns ns	$V_R = 10.0V$, $R_L = 1k\Omega$ $V_R = 10.0V$, $R_L = 1k\Omega$

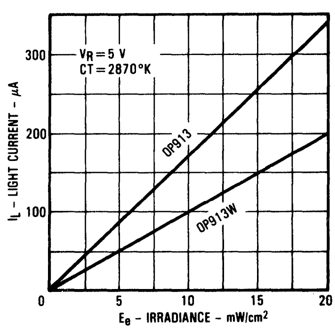
PHOTOSENSORS

Typical Performance Curves

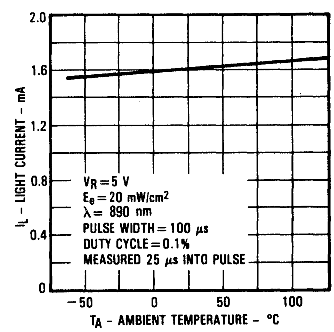
Total Capacitance vs Reverse Bias Voltage



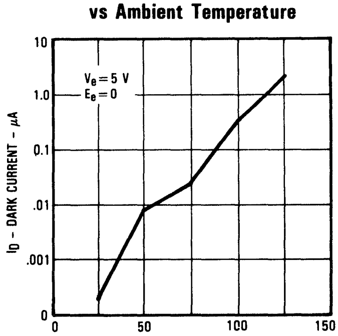
Light Current vs Irradiance



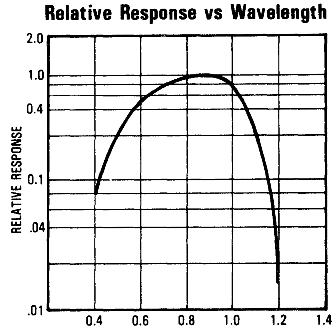
Light Current vs Ambient Temperature



Dark Current vs Ambient Temperature



Relative Response vs Wavelength



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OPTEK TECHNOLOGY, INC.

PHOTOLOGIC™ SENSORS

Historically optoelectronic components such as phototransistors have been analog output devices. The designer had to design with an output current from the phototransistor generated by a given input bias circuit. The advent of integrated circuits and microprocessors has required the electronics world to turn digital. The sophisticated electronics today communicate by logic levels of 1's or O's. This means that the design engineer must now convert the analog light current of a phototransistor to a voltage level in order to communicate the sensing function to downstream processing electronics. This signal processing represents additional system cost in components and performance specification guardbanding which can be reflected in the unit pricing of the optoelectronic component or assembly.

Photologic™ discrete components utilize the best of the analog characteristics of optoelectronic components and the signal processing capabilities of linear integrated circuits and combines the two on one chip. The stable response and speed of a photodiode is used as an input to trigger the onboard integrated circuitry. The output of the optoelectronic component provides the designer a logic level output, instead of an analog current. This saves the end user processing circuitry system cost and affords performance specifications which are more easily designed and integrated into their application. In other words single switching to an on/off state, or dynamically switched signals, as in encoders, to multiple on/off states. The resulting output will be a high logic level (1), low logic level (0) or corresponding pulse train corresponding to the synamic triggering.

Output Options

The Photologic™ family of photointegrated circuits is available with various output options. The output options for the buffer types (high logic level with light sensed) and inverter types (low logic level with light sensed) are a totem-pole output or open-collector output. These optional output configurations are offered to afford the design engineer the most versatility in addressing their system applications.

Totem-Pole

A totem-pole configuration is very popular because of its inherent low output resistance for both a high and low output level. The low level output resistance will be the resistance at the collector of a saturated output transistor, typically in the order of 10 ohms. The high level output resistance in a totem-pole output is that of an emitter follower configuration. This is typically less than 100 ohms as compared to most collector load resistance values in the 1 kilo ohms range. The low output resistance of the totem pole configuration in both a high and low output level allows a more rapid charge and discharge of any load capacitance at the output. This results in comparable high to low and low to high transition times.

Open-Collector

Even with the numerous advantages of the totem-pole configuration the open-collector output configuration has its place in the design world. With an open-collector output configuration the designer can configure one or more collector outputs into what is referred to as collector logic or wired logic. This is simply the ability to form a logic function using the available collector outputs. In this case the low output resistance for both the high and low output level of a totem-pole configuration is not desirable. The ability to design with wired logic can save on the number of logic gates required in a system design resulting in a cost savings.

HYSTERESIS

The Photologic family incorporates a Schmitt trigger as part of the integrated circuit. The Schmitt trigger is a very useful circuit in steering the leading and trailing edges of a slowly rising or falling pulse. An inherent characteristic of a Schmitt trigger circuit is that a different input threshold level exists for a positive and negative signal. Hysteresis is the difference between the input thresholds of the Schmitt trigger.

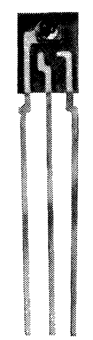
The hysteresis, or threshold window, of the Schmitt trigger provides immunity to small input signal variations that are not desired on the output of the Photologic circuit. The larger the difference between the input thresholds the greater the immunity to noise or signal variations. The trade off is unfortunately speed or output response time.

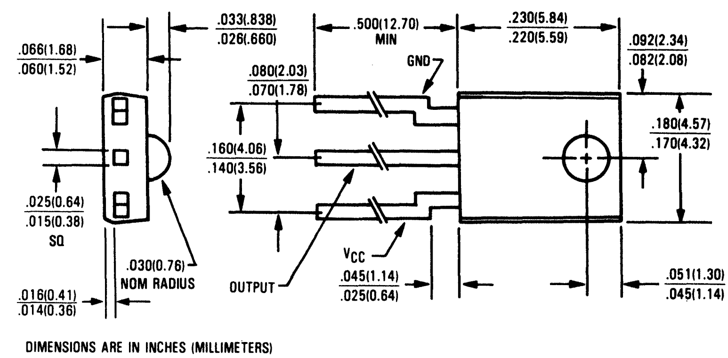
ASSEMBLIES

The combination of Photologic discrete components and the large selection of standard housings, mechanical configurations and apertures provides the designer with literally hundreds of options available to address their application utilizing standard products. Optek offers the designer a value added assembly by adding a wide variety of connectors to the standard assemblies.* Contact an Optek sales office for price and delivery of value added assemblies.

OPTEK

Photologic™ Plastic Sensors
Types OPL550, OPL551 Series





Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- Low cost plastic side-looking package
- Mechanically and spectrally matched to OP140 and OP240 series LEDs
- Data rates to 250 kBaud

Description

The OPL550, OPL550-OC, OPL551, and OPL551-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads without additional circuitry. Also featured are medium speed data rates to 250 kBaud with typical rise and fall times of 25 nsec. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and V_{CC}. The Photologic™ chip is encapsulated in a molded plastic package which has an integral lens for enhanced optical coupling. These devices are mechanically and spectrally matched to OP140 and OP240 infrared emitting diodes.

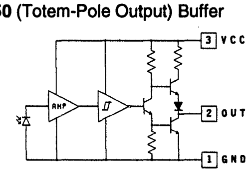
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (not to exceed 3 seconds)	+10.0V
Storage Temperature Range	-40°C to +100°C
Operating Temperature Range	-40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Power Dissipation	200mW(2)
Duration of Output Short to V_{CC} or Ground (OPL550, OPL551)	1.00 sec.
Duration of Output Short to V_{CC} (OPL550-OC, OPL551-OC)	1.00 sec.
Voltage at Output Lead (OPL550-OC, OPL551-OC)	35V
Low Level Output Current	16.0mA
High Level Output Current (OPL550, OPL551)	1.00mA
Irradiance	10mW/cm^2

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 2.5 mW/°C above 25°C.
(3) Irradiance measurements are made with λ_i = 935nm.

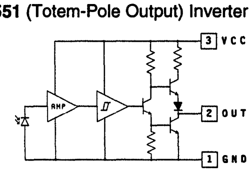
Schematics

OPL550 (Totem-Pole Output) Buffer



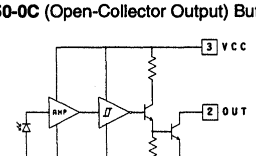
Light On - Output High

OPL551 (Totem-Pole Output) Inverter



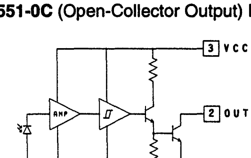
Light On - Output Low

OPL550-OC (Open-Collector Output) Buffer



Light On - Output High

OPL551-OC (Open-Collector Output) Inverter



Light On - Output Low

Types OPL550, OPL551 Series

Electrical Characteristics (-40°C to +85°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage	4.5		5.5	V	
	Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output		2.0		V	V_{CC} = 5.0VDC f = DC to 50 MHz
$E_eT(+)$	Positive-Going Threshold Irradiance					
	OPL550, OPL550-OC, OPL551, OPL551-OC	.25		2.40	mW/cm²	V_{CC} = 5.0V, T_A = 25°C[3]
	OPL550A, OPL550-OCA, OPL551A, OPL551-OCA	.25		1.40	mW/cm²	V_{CC} = 5.0V, T_A = 25°C
	OPL550B, OPL550-OCB, OPL551B, OPL551-OCB	.65		1.90	mW/cm²	V_{CC} = 5.0V, T_A = 25°C
$E_eT(+)/E_eT(-)$	Hysteresis Ratio	1.50	2.0	2.5		
I_{CC}	Supply Current		8.0	15.0	mA	V_{CC} = 5.5V, E_e = 0 or 3mW/cm²

OPL550 (Buffer, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	2.4	3.3		V	V_{CC} = 4.5V, I_{OH} = -800µA, E_e = 3.0 mW/cm²
V_{OL}	Low Level Output Voltage		0.25	0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 0
I_{OS}	Short Circuit Output Current	-20	-55	-100	mA	V_{CC} = 5.5V, E_e = 3.0mW/cm², Output = GND

OPL550-OC (Buffer, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current		1.00	100	µA	V_{CC} = 4.5V, V_{OH} = 30V, E_e = 3.0mW/cm²
V_{OL}	Low Level Output Voltage		0.25	0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 0

OPL551 (Inverter, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	2.4	3.3		V	V_{CC} = 4.5V, I_{OH} = -800µA, E_e = 0
V_{OL}	Low Level Output Voltage		0.25	0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 3.0mW/cm²
I_{OS}	Short Circuit Output Current	-20	-55	-100	mA	V_{CC} = 5.5V, E_e = 0, Output = GND

OPL551-OC (Inverter, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current		1.00	100	µA	V_{CC} = 4.5V, V_{OH} = 30V, E_e = 0
V_{OL}	Low Level Output Voltage		0.25	0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 3.0mW/cm²

OPL550,OPL551

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise, Time Output Fall Time		25	70	ns	V_{CC} = 5.0V, T_A = 25°C, Ee = 0 or 3.0mW/cm²
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		2.5	5.0	µs	f = 10.0kHz, D.C. = 50%, R_L = 8TTL Loads

OPL550-OC, OPL551-OC

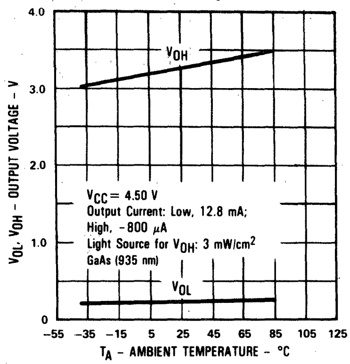
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise, Time Output Fall Time		25	70	ns	V_{CC} = 5.0V, T_A = 25°C, Ee = 0 or 3.0mW/cm²
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		2.5	5.0	µs	f = 10.0kHz, D.C. = 50%, R_L = 360Ω

PHOTOLOGIC SENSORS

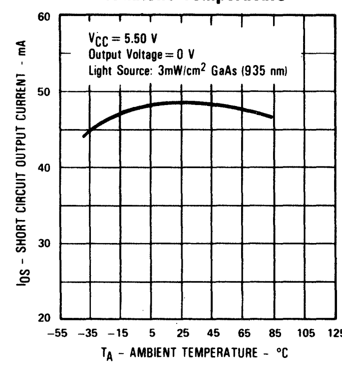
Typical Performance Curves

OPL550, OPL551

Output Voltage vs. Ambient Temperature

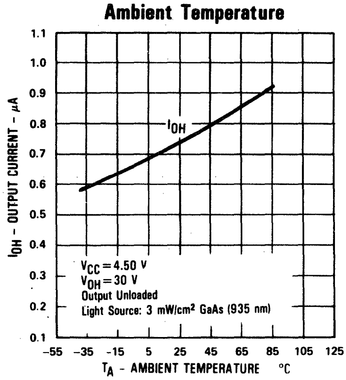


Short Circuit Output Current vs. Ambient Temperature

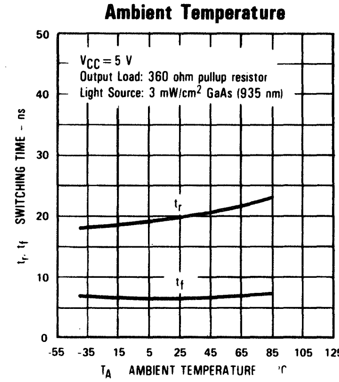


OPL550-OC, OPL551-OC

Output Current (High) vs Ambient Temperature

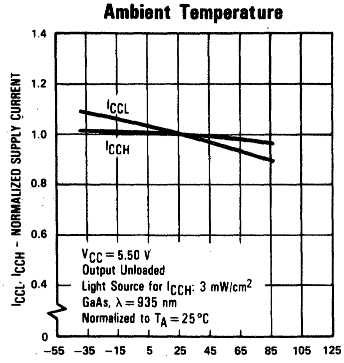


Rise Time and Fall time vs Ambient Temperature



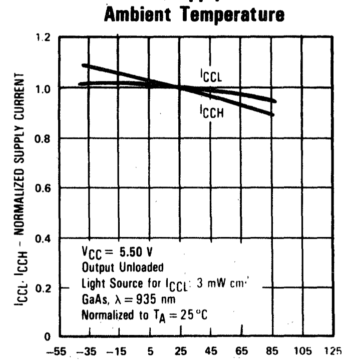
OPL550, OPL550-OC

Normalized Supply Current vs Ambient Temperature

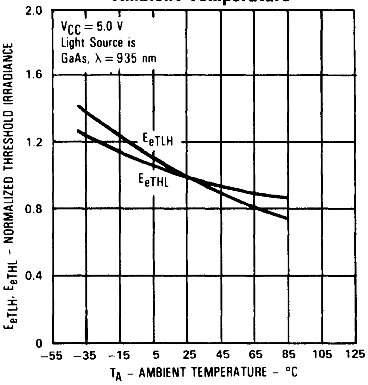


OPL551, OPL551-OC

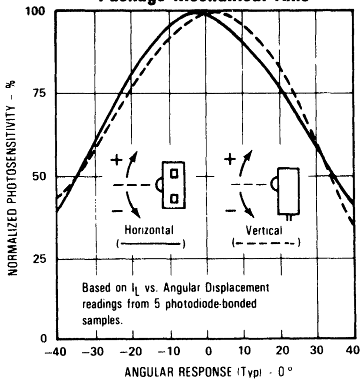
Normalized Supply Current vs Ambient Temperature



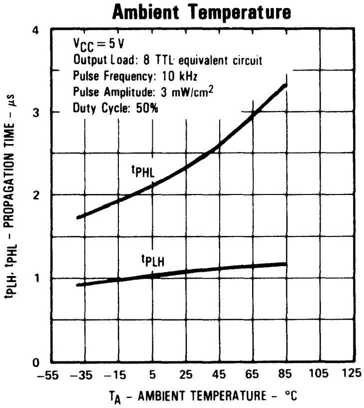
Normalized Threshold Irradiance vs Ambient Temperature



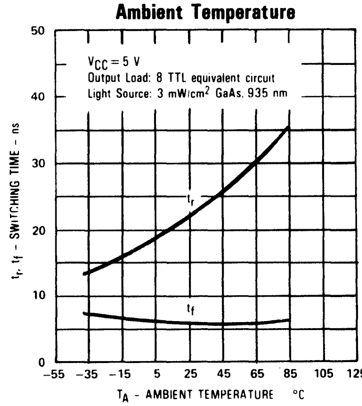
Angular Displacement from Package Mechanical Axis



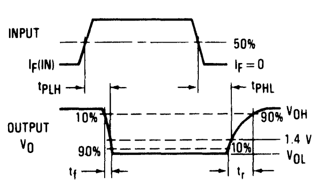
Propagation Time vs Ambient Temperature



Rise Time and Fall time vs Ambient Temperature

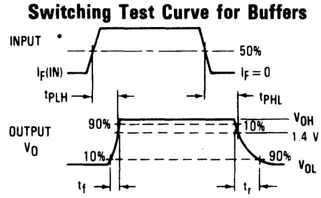


Switching Test Curve for Inverters



LED: f = 10 kHz, D.C. = 50%

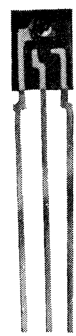
Switching Test Curve for Buffers

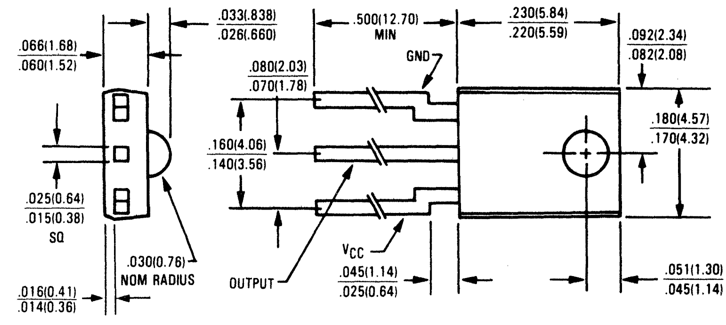


LED: f = 10 kHz, D.C. = 50%

OPTEK

Photologic™ Sensors
Types OPL560, OPL561, OPL562, OPL563 Series





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- Low cost plastic side-looking package
- Mechanically and spectrally matched to the OP140 and OP240 series LED's
- Data rates to 200 kBaud
- Two sensitivity options

Description

The OPL560, OPL560-OC, OPL561, OPL561-OC, OPL562, OPL562-OC, OPL563, and OPL563-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier, voltage regulator, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over supply voltages ranging from 4.5 V to 16 V. The Photologic™ chip is encapsulated in a molded plastic package which has an integral lens for enhanced optical coupling.

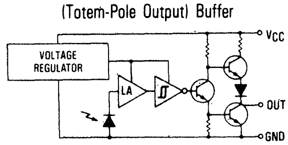
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 18V
Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature Range [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C
Power Dissipation . . . . 200mW(1)
Duration of Output Short to V_{CC} (OPL560, OPL561, OPL562, OPL563) . . . . 1.00sec.
Duration of Output Short to V_{CC} (OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC) . 1.00sec.
Voltage at Output Lead (OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC) 35V
Sinking Current 50.0mA
Sourcing Current (OPL560, OPL561, OPL562, OPL563) 10.0mA
Irradiance (OPL560, OPL560-OC, OPL561, OPL561-OC) . . . . $9mW/cm^2$
Irradiance (OPL562, OPL562-OC, OPL563, OPL563-OC) . . . . $3mW/cm^2$

Notes:
(1) Derate linearly 2.50mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. maximum when flow soldering. Max 20 grams force may be applied to the leads when soldering.
(3) Irradiance measurements are made with λi = 935nm.

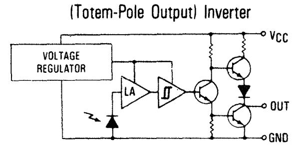
Schematics

OPL560/OPL562
(Totem-Pole Output) Buffer



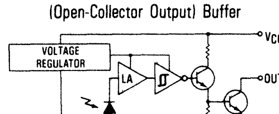
Light On - Output High

OPL561/OPL563
(Totem-Pole Output) Inverter



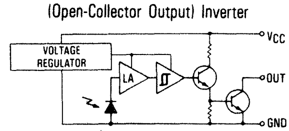
Light On - Output Low

OPL560-OC, OPL562-OC
(Open-Collector Output) Buffer



Light On - Output High

OPL561-OC, OPL563-OC
(Open-Collector Output) Inverter



Light On - Output Low

Types OPL560, OPL561 Series

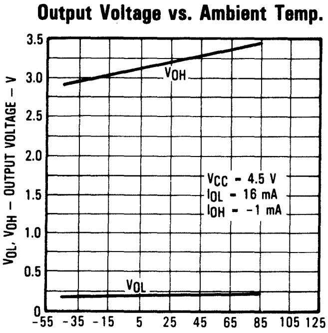
Electrical Characteristics (-40°C to +85°C unless otherwise noted) V_{CC} = 4.5 to 16.0 V

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage	4.5		16.0	V	
	Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output			2	V	f = DC to 50 MHz
$E_{eT}(+)$	Positive-Going Threshold Irradiance(3)					
	OPL560, OPL560-OC, OPL561, OPL561-OC	.09		.55	mW/cm²	T_A = 25°C
	OPL560A, OPL560-OCA, OPL561A, OPL561-OCA	.09		.36	mW/cm²	T_A = 25°C
	OPL560B, OPL560-OCB, OPL561B, OPL561-OCB	.18		.55	mW/cm²	T_A = 25°C
$E_{eT}(+)/E_{eT}(-)$	Hysteresis Ratio	1.20	1.55	2.00		
I_{CC}	Supply Current		8.0	12.0	mA	E_e = 0 or 1 mW/cm²
OPL560 (Buffer, Totem-Pole)						
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1.0µA, E_e = 1 mW/cm²
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0
OPL560-OC (Buffer, Open-Collector)						
I_{OH}	High Level Output Current			100	µA	V_{OH} = 30V, E_e = 1.0mW/cm²
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0
OPL561 (Inverter, Totem-Pole)						
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1mA, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 1.0mW/cm²
OPL561-OC (Inverter, Open-Collector)						
I_{OH}	High Level Output Current			100	µA	V_{OH} = 30V, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 1.0mW/cm²
OPL560, OPL561						
t_r, t_f	Output Rise Time, Output Fall Time			70	ns	T_A = 25°C, E_e = 0 or 1.0mW/cm², f = 10.0kHz DC = 50%, R_L = 10TTL Loads
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	
OPL560-OC, OPL561-OC						
t_r, t_f	Output Rise Time, Output Fall Time			100	ns	T_A = 25°C, E_e = 0 or 1.0mW/cm², f = 10.0kHz, DC = 50%, R_L = 300Ω
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	

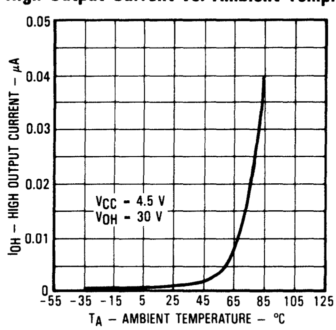
PHOTOLOGIC SENSORS

Typical Performance Curves

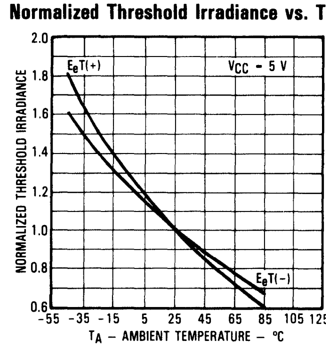
OPL560, OPL561, OPL562, OPL563
Output Voltage vs. Ambient Temp.



OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC
High Output Current vs. Ambient Temp.



OPL560, OPL560-OC, OPL561, OPL561-OC
Normalized Threshold Irradiance vs. T_A



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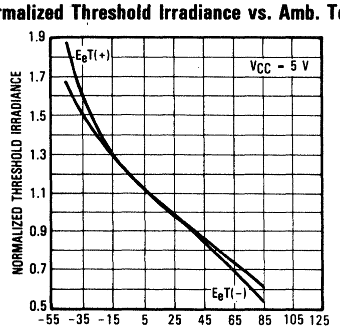
Types OPL562, OPL563 Series

Electrical Characteristics (-40°C to +85°C unless otherwise noted) V_{CC} = 4.5 to 16.0 V

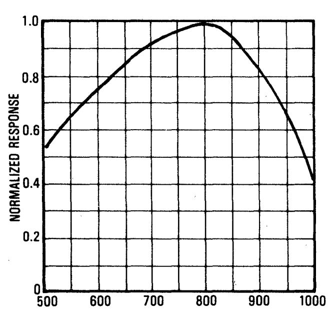
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage	4.5		16.0	V	
	Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output			2	V	f = DC to 50 MHz
$E_{eT}(+)$	Positive-Going Threshold Irradiance(3)					
	OPL562, OPL562-OC, OPL563, OPL563-OC	.025		.230	mW/cm^2	T_A = 25°C
	OPL562A, OPL562-OCA, OPL563A, OPL563-OCA	.025		.140	mW/cm^2	T_A = 25°C
	OPL562B, OPL562-OCB, OPL563B, OPL563-OCB	.070		.230	mW/cm^2	T_A = 25°C
$E_{eT}(+)/E_{eT}(-)$	Hysteresis Ratio	1.20	1.55	2.00		
I_{CC}	Supply Current		8.0	12.0	mA	E_e = 0 or .3mW/cm^2
OPL562 (Buffer, Totem-Pole)						
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1.0μA, E_e = .3mW/cm^2
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0
OPL562-OC (Buffer, Open-Collector)						
I_{OH}	High Level Output Current			100	μA	V_{OH} = 30V, E_e = .3mW/cm^2
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0
OPL563 (Inverter, Totem-Pole)						
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1mA, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = .3mW/cm^2
OPL563-OC (Inverter, Open-Collector)						
I_{OH}	High Level Output Current			100	μA	V_{OH} = 30V, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = .3mW/cm^2
OPL562, OPL563						
t_r, t_f	Output Rise Time, Output Fall Time			70	ns	T_A = 25°C, E_e = 0 or .3mW/cm^2, f = 10.0kHz DC = 50%, R_L = 10TTL Loads
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		6.0		μs	
OPL562-OC, OPL563-OC						
t_r, t_f	Output Rise Time, Output Fall Time			100	ns	T_A = 25°C, E_e = 0 or .3mW/cm^2, f = 10.0kHz, DC = 50%, R_L = 300Ω
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		6.0		μs	

Typical Performance Curves

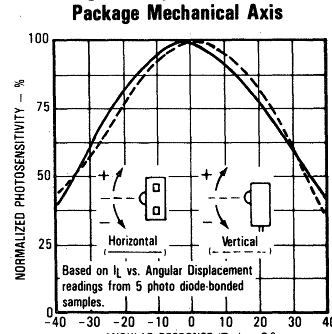
OPL562, OPL562-OC, OPL563, OPL563-OC
Normalized Threshold Irradiance vs. Amb. Temp.



Normalized Spectral Response

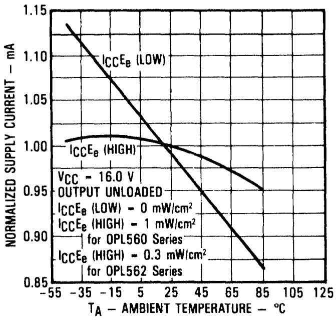


Angular Displacement from Package Mechanical Axis

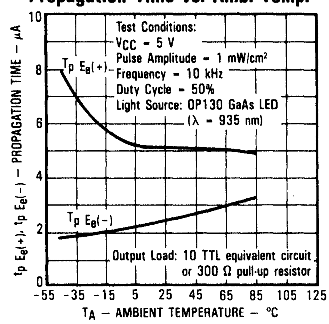


Typical Performance Curves

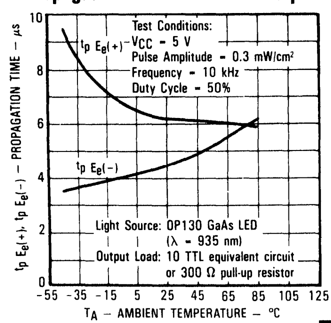
Normalized Supply Current vs. Ambient Temperature



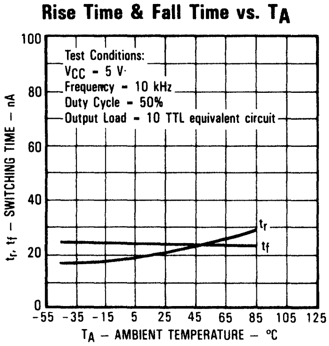
OPL560, OPL560-OC, OPL561, OPL561-OC Propagation Time vs. Amb. Temp.



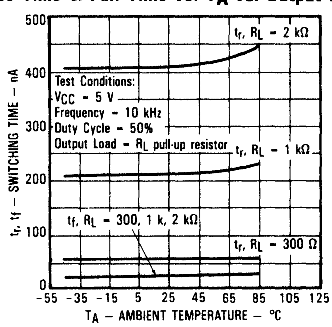
OPL562, OPL562-OC, OPL563, OPL563-OC Propagation Time vs. Amb. Temp.



OPL560, OPL561, OPL562, OPL563 Rise Time & Fall Time vs. T_A

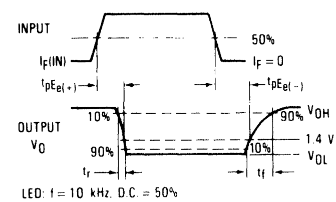


OPL560-OC, OPL561-OC, OPL562-OC, OPL563-OC Rise Time & Fall Time vs. T_A vs. Output Load

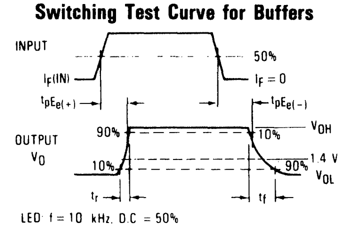


Switching Test Curves

Switching Test Curve for Inverters



Switching Test Curve for Buffers



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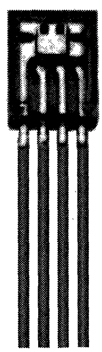
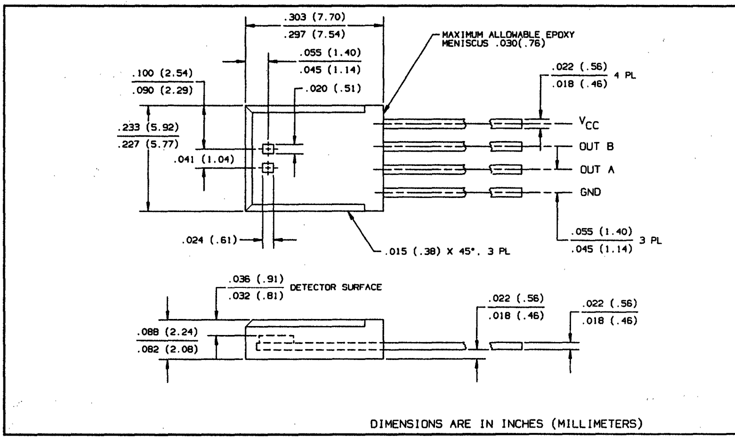
OPTEK

Dual Channel Photologic™ Encoder Detector Type OPL583





Features

- Two matched detectors with photolithographic control of relative position
- Dual Photologic™ circuitry in single package provides reduced component count
- Open collector inverter output for flexibility of circuit interface
- Low cost plastic housing

Description

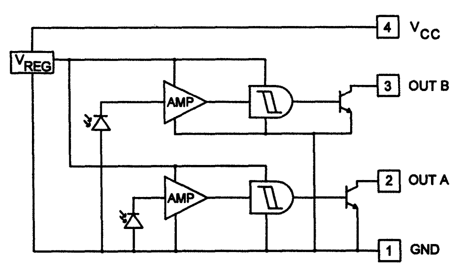
The OPL583 contains a monolithic integrated circuit which incorporates two independent photodiodes, linear amplifiers, Schmitt trigger circuits, and output transistors served by a common voltage regulator. The outputs are TTL/LSTTL compatible and can drive 8 TTL loads over a voltage range from 4.5 to 16 V. Applications include linear and rotary encoders with resolutions determined by external apertures. The fixed relative position of the two photodiodes and the matched characteristics of the two channels allow considerable design flexibility.

Absolute Maximum Ratings (T_A = 25° C unless otherwise noted)

Supply Voltage	18 V[5]
Storage Temperature	-40° C to +100° C
Operate Temperature	-40° C to +85° C
Lead Solder Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron]	260° C[2]
Power Dissipation	200 mW[1]
Duration of Output Short to V_{CC}	1.00 sec.
Voltage At Output	18 V
Low Level Output Current (sinking)	40 mA

Notes:
(1) Derate linearly 2.67 mW/° C above 25° C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max 20 grams force may be applied to leads when flow soldering.
(3) A 0.01 µF capacitor should be used across the V_{CC} and GND leads to stabilize the power supply line.
(4) Irradiance measurements are made with λ = 940 nm.
(5) Derate linearly 0.37 V/° C above 58° C.

Schematic



Type OPL583

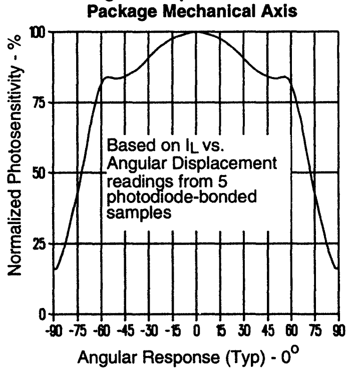
Electrical Characteristics (T_A = 25°C, V_{CC} = 4.5 V - 16.0 V unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage[3]	4.5		16	V	
$E_{eT(+)}$	Positive Going Threshold Irradiance[4]	.05	.10	.25	mW/cm²	
$E_{eT}(+)/E_{eT}(-)$	Hysteresis Ratio	1.1	1.5	2.0		
MATCH	Channel Match $E_{eT}(+,A)/E_{eT}(+,B)$	0.67	1.00	1.50		
I_{CCL}	Supply Current Both Outputs Low (Both Photodiodes Irradiated)		8.5	12.0	mA	E_e = 0.5 mW/cm², No Load on Output
I_{CCH}	Supply Current Both Outputs High (Both Photodiodes Shaded)		3.5	6.0	mA	E_e = 0 mW/cm², No Load on Output
I_{CCM}	Supply Current Mixed Output States (One High, One Low)		6		mA	E_e = 0 mW/cm² and 0.5 mW/cm²
I_{OH}	High Level Output Current		1.0	30.0	µA	E_e = 0 mW/cm², V_{OH} = 16 V
V_{OL}	Low Level Output Voltage		0.21	0.40	V	E_e = 0.5 mW/cm², I_{OL} = 12.8 mA
 T_{PHL} T_{PLH}	Propagation Delay Output High to Low Output Low to High		 2 10		 µs µs	Vcc = 5 V, R_L = 360 Ω E_e = 0 or 0.5 mW/cm², f = 10 kHz, D.C. = 50%
t_r t_f	Output Rise Time Output Fall Time		20 15		ns ns	

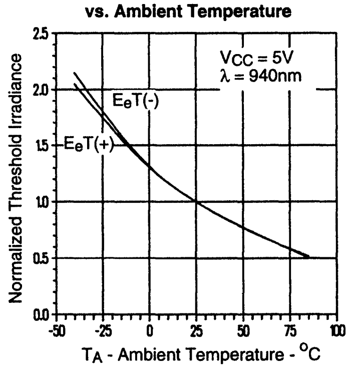
PHOTOLOGIC SENSORS

Typical Performance Curves

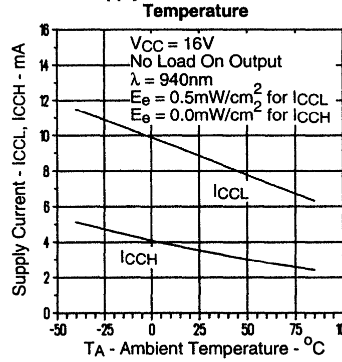
Angular Displacement from Package Mechanical Axis



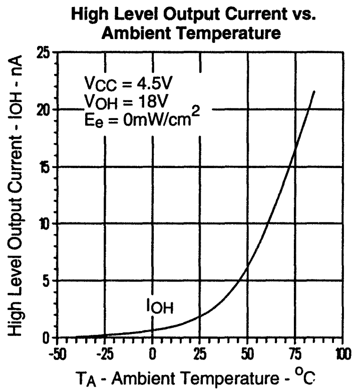
Normalized Threshold Irradiance vs. Ambient Temperature

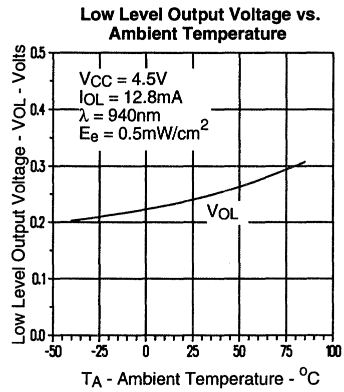


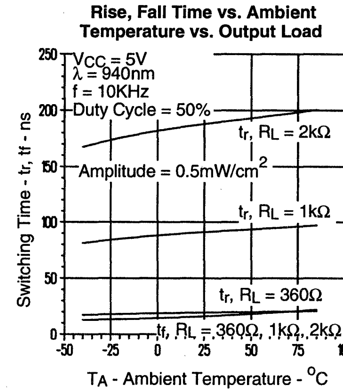
Supply Current vs. Ambient Temperature

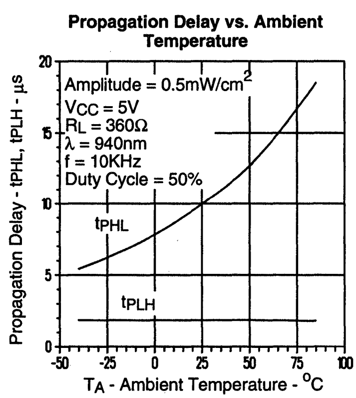


Typical Performance Curves

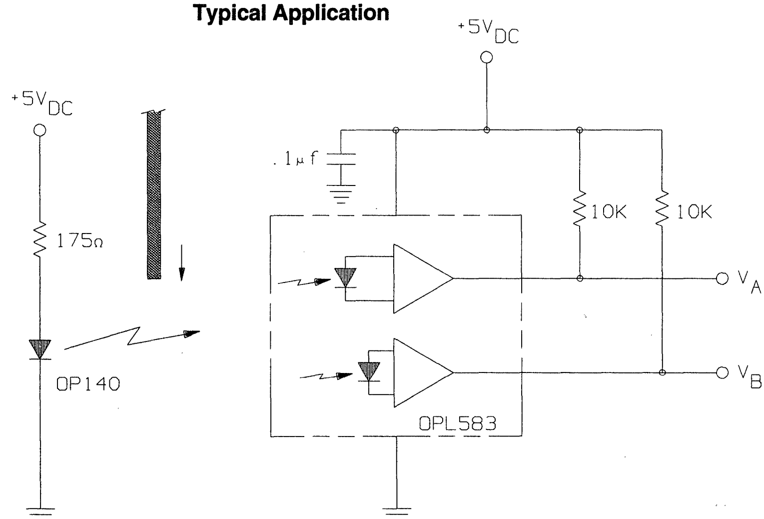








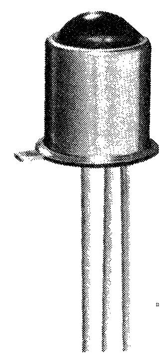
Typical Application

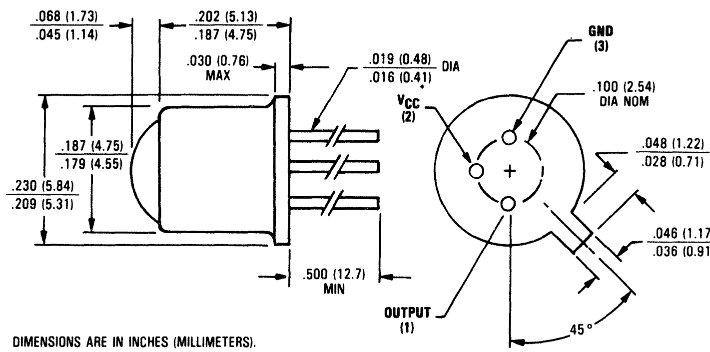


PHOTOLOGIC SENSORS

OPTEK

Photologic™ Hermetic Sensors
Types OPL800, OPL801 Series





DIMENSIONS ARE IN INCHES (MILLIMETERS).

Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- TO-18 hermetic package
- Mechanically and spectrally matched to OP130 and OP231 series LEDs
- Data rates to 250 kBaud
- TX-TXV process available (see Hi-Rel section)

Description

The OPL800, OPL800-OC, OPL801, and OPL801-OC each incorporate a photodiode, a linear amplifier, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads without additional circuitry. Also featured are medium speed data rates to 250 kBaud with typical rise and fall times of 25 nsec. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and V_{CC}. The Photologic™ chip is mounted on a standard TO-18 header which is hermetically sealed in a lensed metal can. These devices are mechanically and spectrally matched to OP130 and OP230 infrared emitting diodes.

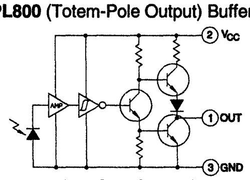
Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Supply Voltage, V_{CC} (not to exceed 3 seconds) .... +10.0V
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -55°C to +110°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C[(1)]
Power Dissipation .... 120mW[(2)]
Duration of Output Short to V_{CC} or Ground (OPL800, OPL801) .... 1.00 sec.
Duration of Output Short to V_{CC} (OPL800-OC, OPL801-OC) .... 1.00 sec.
Voltage at Output Lead (OPL800-OC, OPL801-OC) 35V
Irradiance .... $3mW/cm^2$

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 3.4 mW/°C above 90°C.
(3) Light measurements are made with λ = 935nm.

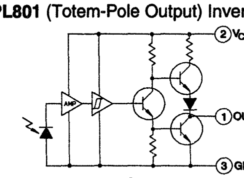
Schematic

OPL800 (Totem-Pole Output) Buffer



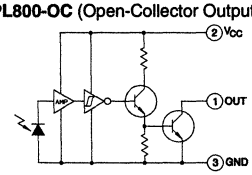
Light On - Output High

OPL801 (Totem-Pole Output) Inverter



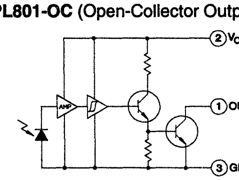
Light On - Output Low

OPL800-OC (Open-Collector Output) Buffer



Light On - Output High

OPL801-OC (Open-Collector Output) Inverter



Light On - Output Low

Types OPL800, OPL801 Series

Electrical Characteristics (-40°C to +100°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage	4.5		5.5	V	
	Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output		2.0		V	V_{CC} = 5.0VDC f = DC to 50 MHz
$E_eT(+)$	Positive-Going Threshold Irradiance	0.05	0.18	0.60	mW/cm^2	V_{CC} = 5.0V, T_A = 25°C(3)
$E_eT(+)/E_eT(-)$	Hysteresis Ratio	1.5	2.0	2.5		
I_{CC}	Supply Current			15	mA	V_{CC} = 5.5V, E_e = 0 or 1mW/cm^2

OPL800 (Buffer, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	2.4			V	V_{CC} = 4.5V, I_{OH} = -800µA, E_e = 1.0 mW/cm^2
V_{OL}	Low Level Output Voltage			0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 0
I_{OS}	Short Circuit Output Current	-20		-100	mA	V_{CC} = 5.5V, E_e = 1mW/cm^2, Output = GND

OPL800-OC (Buffer, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current			100	µA	V_{CC} = 4.5V, V_{OH} = 30V, E_e = 2.0mW/cm^2
V_{OL}	Low Level Output Voltage			0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 0

OPL801 (Inverter, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	2.4			V	V_{CC} = 4.5V, I_{OH} = -800µA, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 1.0mW/cm^2
I_{OS}	Short Circuit Output Current	-20		-100	mA	V_{CC} = 5.5V, E_e = 0, Output = GND

OPL801-OC (Inverter, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current			100	µA	V_{CC} = 4.5V, V_{OH} = 30V, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	V_{CC} = 4.5V, I_{OL} = 12.8mA, E_e = 1.0mW/cm^2

OPL800, OPL801

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5.0V, T_A = 25°C, E_e = 0 or 1.00mW/cm^2
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	f = 10.0kHz, D.C. = 50%, R_L = 8TTL Loads

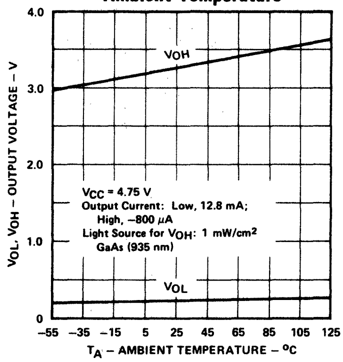
OPL800-OC, OPL801-OC

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5.0V, T_A = 25°C, E_e = 0 or 1.00mW/cm^2
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	f = 10.0kHz, D.C. = 50%, R_L = 360Ω

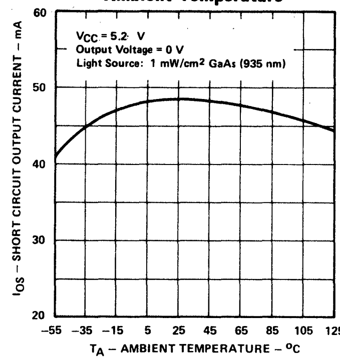
Typical Performance Curves

OPL800, OPL801

Output Voltage vs. Ambient Temperature

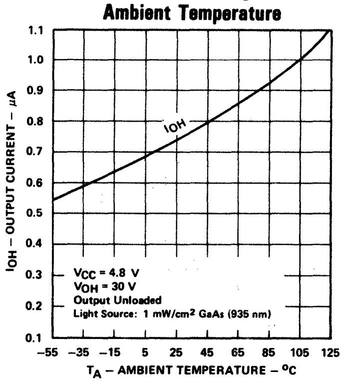


Short Circuit Output Current vs. Ambient Temperature

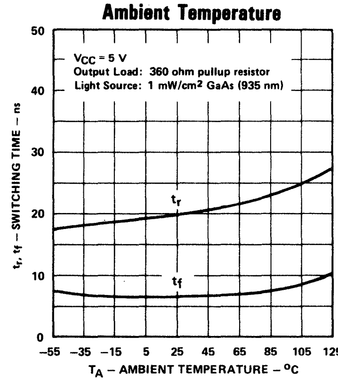


OPL800-OC, OPL801-OC

Output Current (High) vs. Ambient Temperature

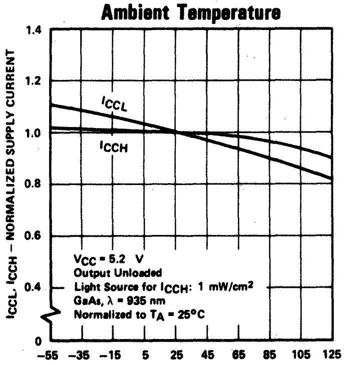


Rise Time and Fall Time vs. Ambient Temperature



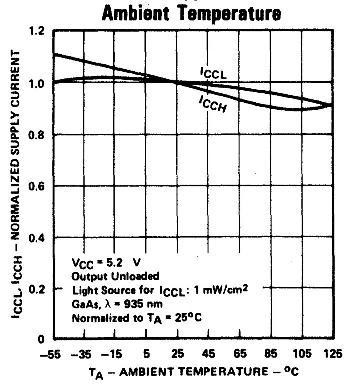
OPL800, OPL800-OC

Normalized Supply Current vs. Ambient Temperature



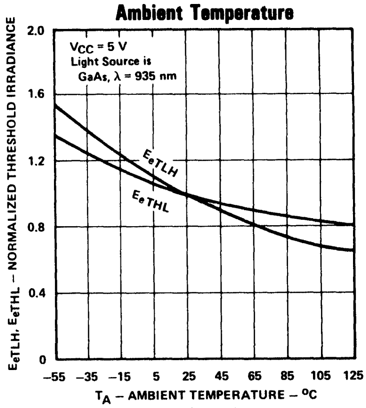
OPL801, OPL801-OC

Normalized Supply Current vs. Ambient Temperature

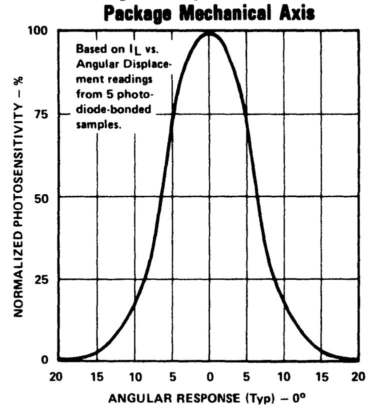


Typical Performance Curves

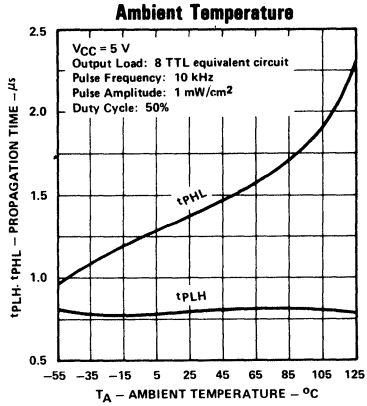
Normalized Threshold Irradiance vs. Ambient Temperature



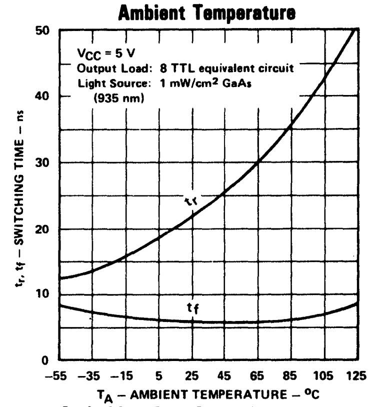
Angular Displacement from Package Mechanical Axis



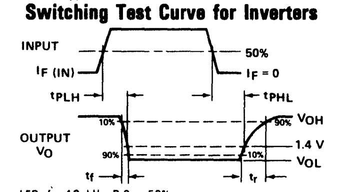
Propagation Time vs. Ambient Temperature



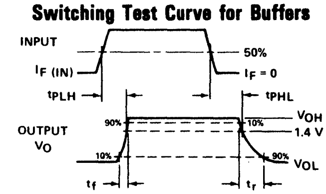
Rise Time and Fall Time vs. Ambient Temperature



Switching Test Curve for Inverters



Switching Test Curve for Buffers

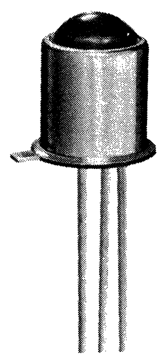


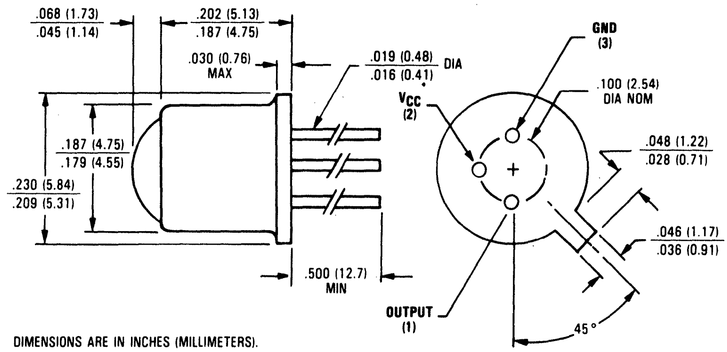
LED: f = 10 kHz, D.C. = 50%

PHOTOLOGIC SENSORS

OPTEK

Photologic™ Hermetic Sensors
Types OPL810, OPL811, OPL812, OPL813 Series





Features

- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- TO-18 hermetic package
- Mechanically and spectrally matched to the OP130 and OP230 series devices
- Two sensitivity options
- Data rate to 200 kBaud

Description

The OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812, OPL812-OC, OPL813, and OPL8130-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier, a voltage regulator, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over supply voltages ranging from 4.5V to 16V. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and V_{CC}. The Photologic™ chip is mounted on a standard TO-18 header which is hermetically sealed in a lensed metal can.

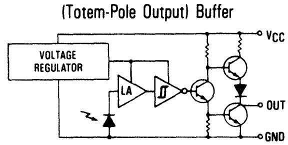
Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Supply Voltage, V_{CC} 18V
Storage Temperature Range .... -65°C to +125°C
Operating Temperature Range .... -55°C to +105°C
Lead Soldering Temperature Range [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Power Dissipation .... 250mW(2)
Duration of Output Short to V_{CC} (OPL810, OPL811, OPL812, OPL813) .... 1sec.
Duration of Output Short to V_{CC} (OPL810-OC, OPL811-OC, OPL812-OC, OPL813-OC) .... 1sec.
Voltage at Output Lead (OPL810-OC, OPL811-OC, OPL812-OC, OPL813-OC) 35V
Sinking Current 50mA
Sourcing Current (OPL810, OPL811, OPL812, OPL813) 10mA
Irradiance (OPL810, OPL810-OC, OPL811, OPL811-OC) .... $2mW/cm^2$
Irradiance (OPL812, OPL812-OC, OPL813, OPL813-OC) .... $1mW/cm^2$

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max 20 grams force may be applied to the leads when soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Light measurements are made with λi = 935nm.

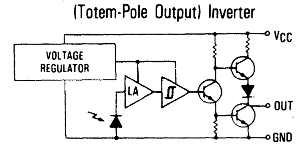
Schematics

OPL810, OPL812
(Totem-Pole Output) Buffer



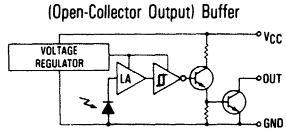
Light On - Output High

OPL811, OPL813
(Totem-Pole Output) Inverter



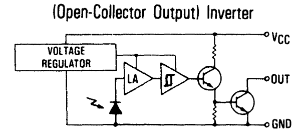
Light On - Output Low

OPL810-OC, OPL812-OC
(Open-Collector Output) Buffer



Light On - Output High

OPL811-OC, OPL813-OC
(Open-Collector Output) Inverter



Light On - Output Low

Types OPL810, OPL811 Series

Electrical Characteristics (-40°C to +100°C unless otherwise noted) V_{CC} = 4.5 to 16.0 V

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage	4.5		16.0	V	
	Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output			1.0	V	f = DC to 50 MHz
$E_{eT}(+)$	Positive-Going Threshold Irradiance(3)	.015	.06	.20	mW/cm²	T_A = 25°C
$E_{eT}(+)/E_{eT}(-)$	Hysteresis Ratio	1.20	1.55	2.00		
I_{CC}	Supply Current			15.0	mA	E_e = 0 or 0.4 mW/cm²

OPL810 (Buffer, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1.0mA, E_e = 0.4 mW/cm²
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0

OPL810-OC (Buffer, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current			100	µA	V_{OH} = 30V, E_e = 0.4mW/cm²
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0

OPL811 (Inverter, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1mA, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0.4mW/cm²

OPL811-OC (Inverter, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current			100	µA	V_{OH} = 30V, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0.4mW/cm²

OPL810, OPL811

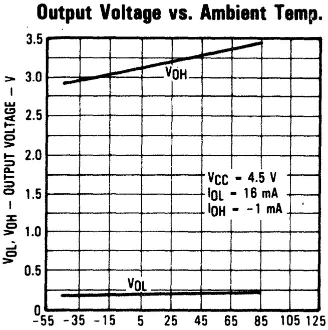
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise Time, Output Fall Time			70	ns	V_{CC}=5V, T_A= 25°C, E_e= 0 or 0.4mW/cm², f = 10.0kHz DC = 50%, R_L = 10TTL Loads
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	

OPL810-OC, OPL811-OC

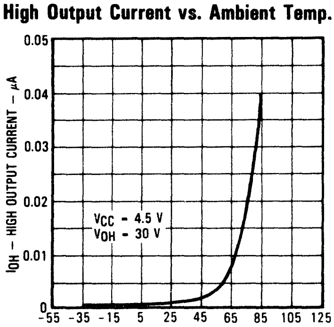
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise Time, Output Fall Time			100	ns	V_{CC}=5V, T_A = 25°C, E_e= 0 or 0.4mW/cm², f = 10.0kHz, DC = 50%, R_L = 300Ω
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	

Typical Performance Curves

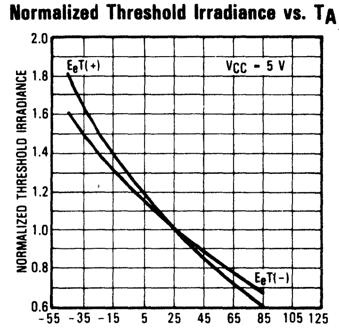
Output Voltage vs. Ambient Temp.



High Output Current vs. Ambient Temp.



Normalized Threshold Irradiance vs. T_A



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Electrical Characteristics (-40°C to +100°C unless otherwise noted) V_{CC} = 4.5 to 16.0 V

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{CC}	Operating Supply Voltage	4.5		16.0	V	
	Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output			1.0	V	f = DC to 50 MHz
$E_{eT}(+)$	Positive-Going Threshold Irradiance[3]	.005	.025	.10	mW/cm^2	T_A = 25°C
$E_{eT}(+)/E_{eT}(-)$	Hysteresis Ratio	1.20	1.55	2.00		
I_{CC}	Supply Current			15.0	mA	E_e = 0 or 0.2 mW/cm^2

OPL812 (Buffer, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1.0mA, E_e = 0.2 mW/cm^2
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0

OPL812-OC (Buffer, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current			100	µA	V_{OH} = 30V, E_e = 0.2mW/cm^2
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0

OPL813 (Inverter, Totem-Pole)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{OH}	High Level Output Voltage	V_{CC}-2.1			V	I_{OH} = -1mA, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0.2mW/cm^2

OPL813-OC (Inverter, Open-Collector)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{OH}	High Level Output Current			100	µA	V_{OH} = 30V, E_e = 0
V_{OL}	Low Level Output Voltage			0.40	V	I_{OL} = 16mA, E_e = 0.2mW/cm^2

OPL812, OPL813

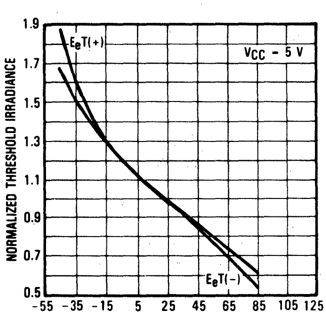
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise Time, Output Fall Time			70	ns	V_{CC}=5V, T_A= 25°C, E_e= 0 or
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	0.2mW/cm^2, f = 10.0kHz DC = 50%, R_L = 10TTL Loads

OPL812-OC, OPL813-OC

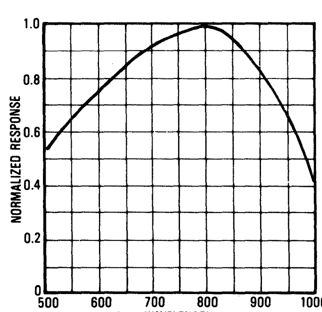
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
t_r, t_f	Output Rise Time, Output Fall Time			100	ns	V_{CC}=5V, T_A = 25°C, E_e= 0 or
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5.0		µs	0.2mW/cm^2, f = 10.0kHz, DC = 50%, R_L = 300Ω

Typical Performance Curves

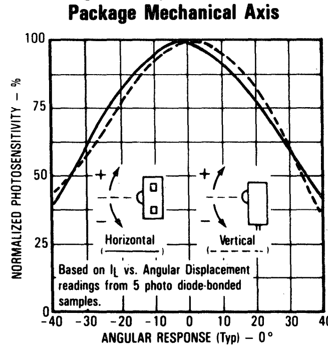
Normalized Threshold Irradiance vs. Amb. Temp.



Normalized Spectral Response

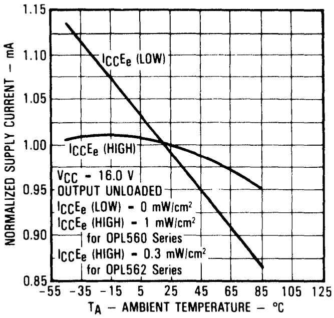


Angular Displacement from Package Mechanical Axis

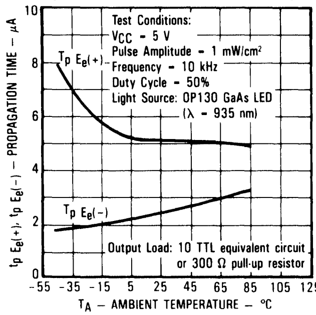


Typical Performance Curves

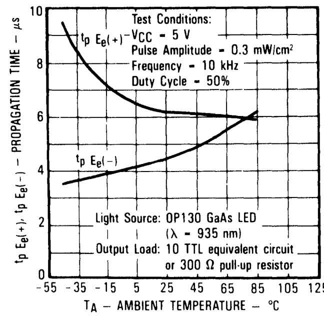
Normalized Supply Current vs. Ambient Temperature



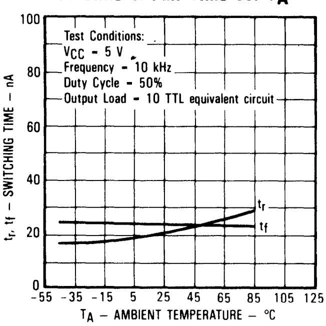
Propagation Time vs. Amb. Temp.



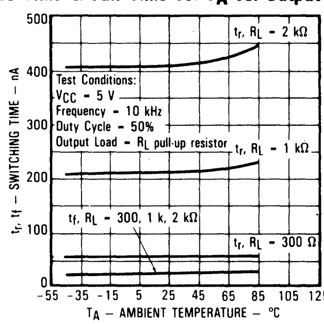
Propagation Time vs. Amb. Temp.



Rise Time & Fall Time vs. T_A

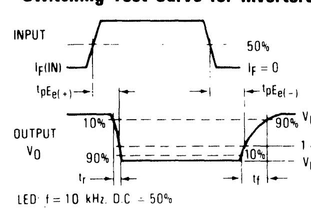


Rise Time & Fall Time vs. T_A vs. Output Load

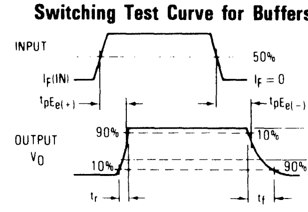


Switching Test Curves

Switching Test Curve for Inverters



Switching Test Curve for Buffers



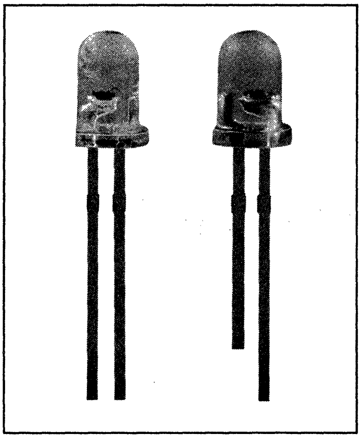
OPTEK TECHNOLOGY, INC.

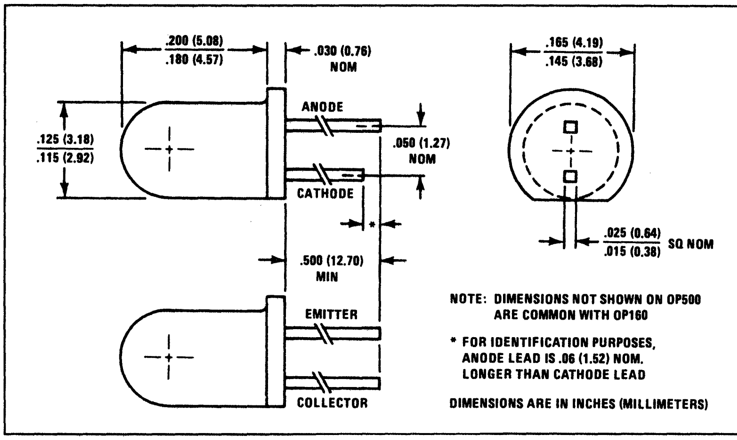
EMITTER AND PHOTOSENSOR MATCHED PAIRS

MATCHED PAIRS

OPTEK

Matched LED and Photosensor Pair
Types OPS665, OPS666, OPS667





Features

- T-1 package style
- High current transfer ratio
- Low cost plastic package
- Three current range selections

Description

The OPS665 through OPS667 each consist of a gallium arsenide infrared emitting diode (OP165) and an NPN silicon phototransistor (OP505) mounted in matched plastic T-1 packages. Matched pairs are desirable where the application is unique and the quantity required does not justify assembly tooling costs. The units are offered in three different sensitivity ranges to give the designer more flexibility. If separation between the LED and sensor is greater than two times the specified $I_{C(ON)}$ distance, proper alignment becomes critical. It should be remembered that the sensor is sensitive to ambient light. Although sold as pairs, emitters are packaged separately from sensors for ease of handling.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Photosensor

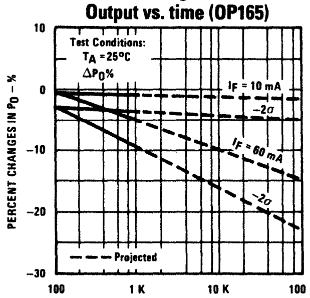
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(2)

Notes:

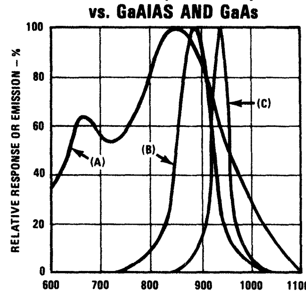
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.

Typical Performance Curves

Percent Changes in Power Output vs. time (OP165)



Photosensor Spectral Response vs. GaAIAS AND GaAs



Test Conditions (LED):
$T_A = T_J$ = 25°C; I_F = 100 mA, DC = 0.1%, PW = 100 µs
Peak Wavelength - λp: (A) XSTR – 850 ± 30 nm
(B) LED GaAlAs – 890 ± 20 nm
(C) LED GaAs – 930 ± 15 nm

Types OPS665, OPS666, OPS667

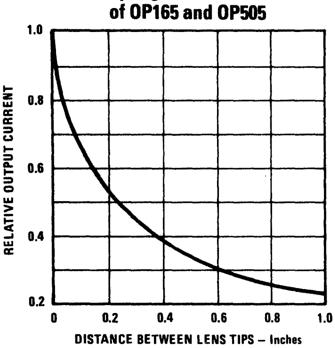
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.60	V	I_F = 20mA
I_R	Reverse Current				100	µA	V_R = 2.0V
Output Photosensor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100µA
I_{CEO}	Collector Dark Current				100	nA	V_{CE} = 15.0V, E_e = 0
$I_{C(ON)}$	On-State Collector Current	OPS665	0.5			mA	V_{CE} = 5.0V, I_F = 20mA
		OPS666	1.0		10.0	mA	d = 0.25" lens tip to lens tip
		OPS667	5.0			mA	

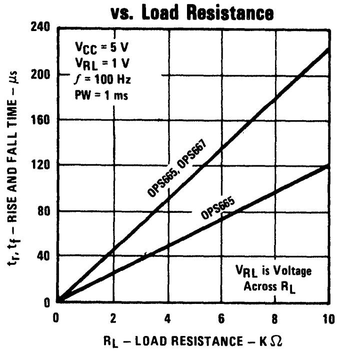
MATCHED PAIRS

Typical Performance Curves

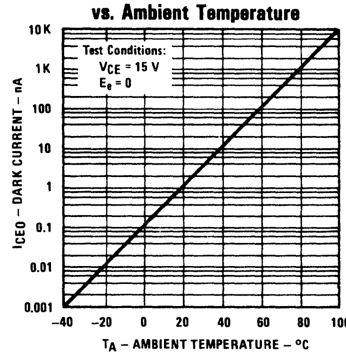
Coupling Characteristics of OP165 and OP505



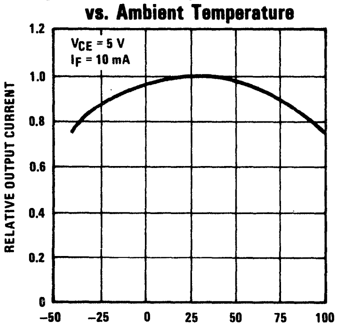
Rise and Fall Time vs. Load Resistance



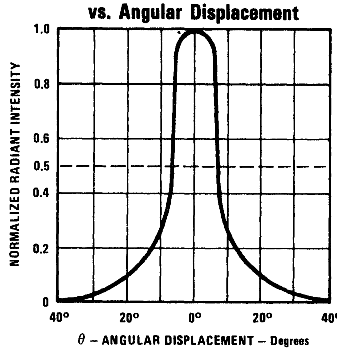
Collector Dark Current vs. Ambient Temperature



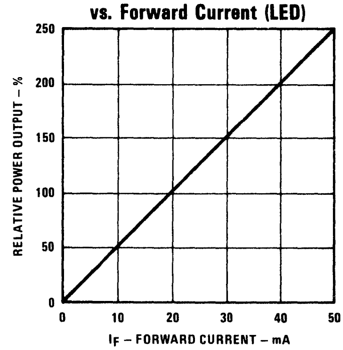
Coupled-Relative Output Collector Current vs. Ambient Temperature



Emission (LED) and Response (Sensor) Normalized Radiant Intensity vs. Angular Displacement



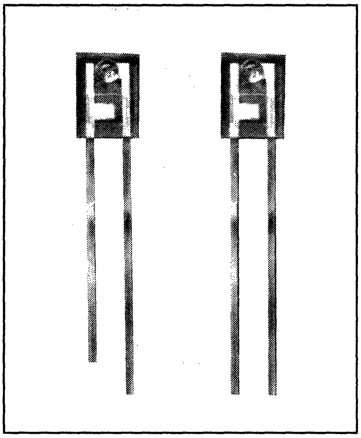
Relative Power Output vs. Forward Current (LED)

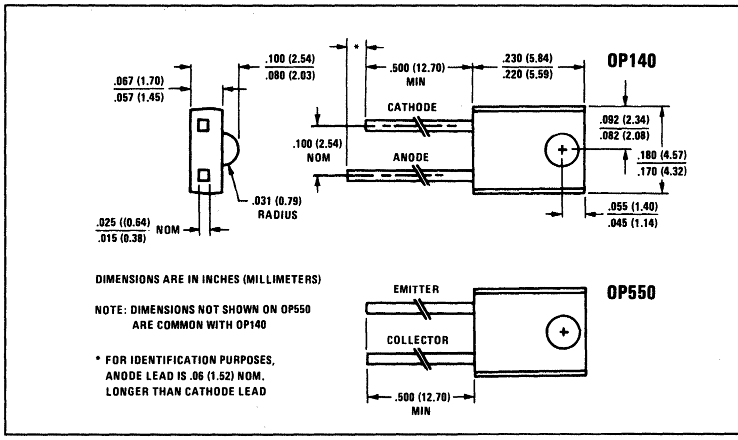


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Matched LED and Photosensor Pair
Types OPS690, OPS691, OPS692, OPS693





Features

- Lateral side-looking clear plastic package
- High current transfer ratio
- Low cost plastic package

Description

The OPS690 through OPS693 each consist of a gallium arsenide infrared emitting diode (OP140) and an NPN silicon phototransistor (OP550) mounted in matched lateral side-looking plastic packages. Matched pairs are desirable where the application is unique and the quantity required does not justify assembly tooling costs. If separation between the LED and the sensor is greater than two times the specified $I_{C(ON)}$ distance, proper alignment becomes critical. It should be remembered that the sensor is sensitive to ambient light. Although sold as pairs, emitters are packaged separately from sensors for ease of handling.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Distance from lens tip to lens tip is 0.125 inches (3.18mm).

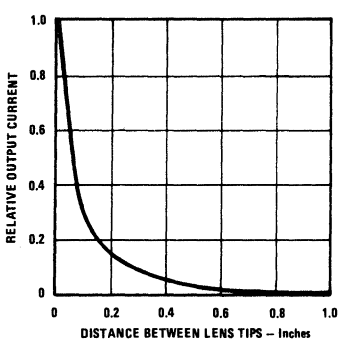
Types OPS690, OPS691, OPS692, OPS693

Electrical Characteristics (T_A = 25°C unless otherwise noted)

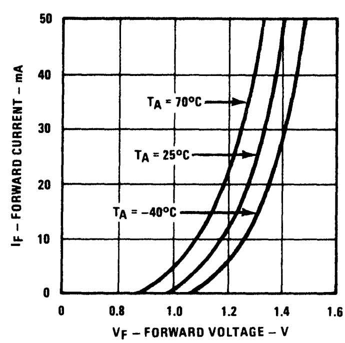
SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.60	V	I_F = 20mA
I_R	Reverse Current				100	μA	V_R = 2.0V
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA, E_e = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA, E_e = 0
I_{CEO}	Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
Coupled							
$V_{CE(SAT)}$	Saturation Voltage				0.40	V	I_F = 20mA, I_C = 50μA(3)
$I_{C(ON)}$	On-State Collector Current	OPS690	100			μA	V_{CE} = 10.0V, I_F = 20mA(3)
		OPS691	500			μA	
		OPS692	1.0			mA	
		OPS693	2.0			mA	

Typical Performance Curves

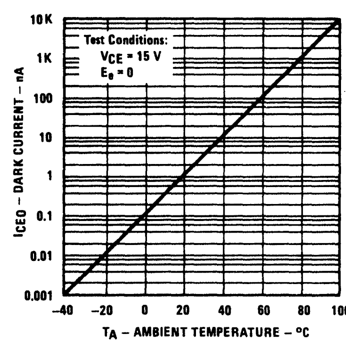
Coupling Characteristics of OP140 and OP550



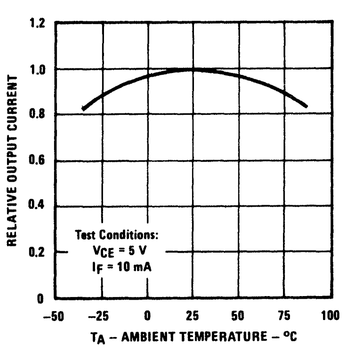
Forward Current vs Forward Voltage



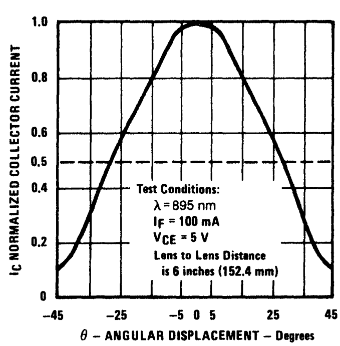
Dark Current vs Free Air Temperature



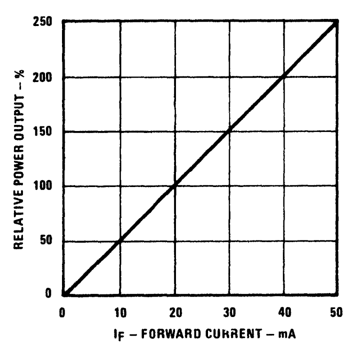
Relative Output Current vs Free Air Temperature



Normalized Collector Current vs Angular Displacement



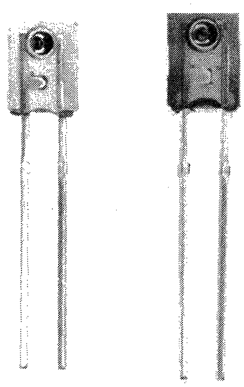
Relative Power Output vs Forward Current (LED)



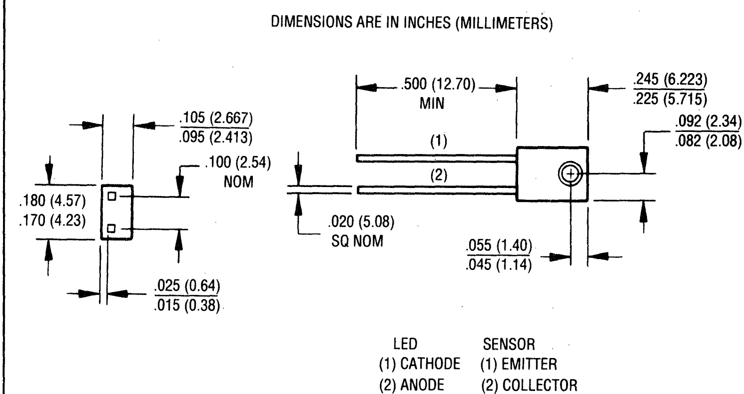
MATCHED PAIRS

OPTEK

Matched LED and Photosensor Pair
Types OPS695, OPS696, OPS697, OPS698



LED SENSOR



Features

- Lateral side-looking plastic package
- High current transfer ratio
- Low cost plastic package

Description

The OPS695 through OPS698 each consist of a gallium arsenide infrared emitting diode (OP145) and an NPN silicon phototransistor (OP555) mounted in matched lateral side-looking plastic packages. Matched pairs are desirable where the application is unique and the quantity required does not justify assembly tooling costs. If separation between the LED and the sensor is greater than two times the specified $I_{C(ON)}$ distance, proper alignment becomes critical. It should be remembered that the sensor is sensitive to ambient light. Although sold as pairs, emitters are packaged separately from sensors for ease of handling.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(1)
Input Diode	
Continuous Forward Current	50mA
Peak Forward Current (1 µs pulse width, 300 pps)	3.0A
Reverse Voltage	2.0V
Power Dissipation	100mW(2)
Output Phototransistor	
Collector-Emitter Voltage	30V
Emitter-Collector Voltage	5.0V
Power Dissipation	100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) Distance from lens tip to lens tip is 0.125 inches (3.18mm).

Types OPS695, OPS696, OPS697, OPS698

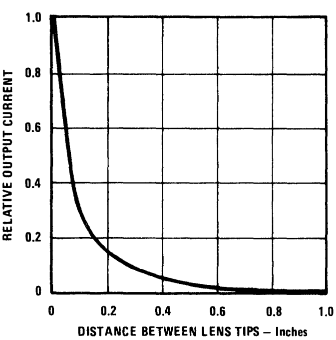
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.60	V	I_F = 20mA
I_R	Reverse Current				100	μA	V_R = 2.0V
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100μA, E_e = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100μA, E_e = 0
I_{CEO}	Dark Current				100	nA	V_{CE} = 10.0V, E_e = 0
Coupled							
$V_{CE(SAT)}$	Saturation Voltage				0.40	V	I_F = 20mA, I_C = 50μA(3)
$I_{C(ON)}$	On-State Collector Current	OPS695	100			μA	V_{CE} = 10.0V, I_F = 20mA(3)
		OPS696	500			μA	
		OPS697	1.0			mA	
		OPS698	2.0			mA	

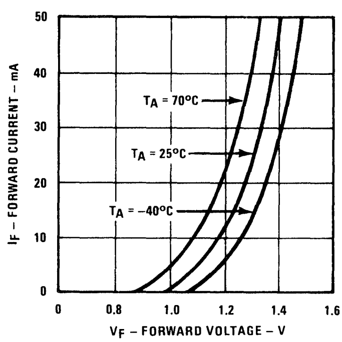
MATCHED PAIRS

Typical Performance Curves

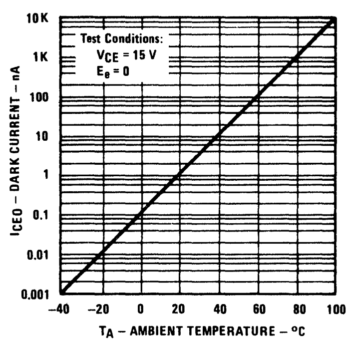
Coupling Characteristics of OP145 and OP555



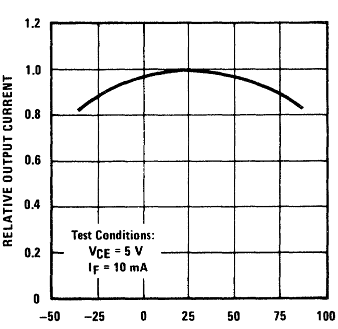
Forward Current vs Forward Voltage



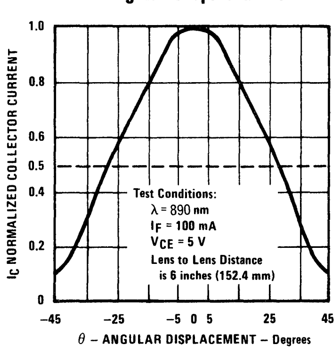
Dark Current vs Free Air Temperature



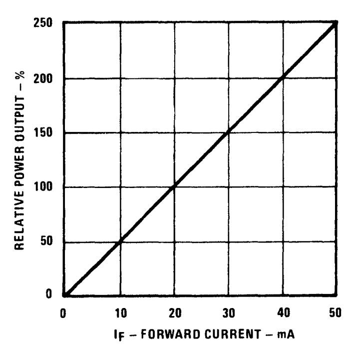
Relative Output Current vs Free Air Temperature



Normalized Collector Current vs Angular Displacement



Relative Power Output vs Forward Current (LED)



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK TECHNOLOGY, INC.

OPTICALLY COUPLED ISOLATORS

OPTICALLY COUPLED ISOLATORS

Optically Coupled Isolators

Optically coupled isolators, also called optocouplers, are used to isolate one electrical system from another in an electronic circuit. They allow direct circuit control with complete electrical isolation of input from output. These isolators are considered the best, most cost effective devices to eliminate associated differential ground, ground loop and EMI/RFI problems.

An optically coupled isolator consists of an IRED (infrared emitting diode) connected to the input circuit, optically coupled to a silicon photosensor at the output circuit. Both IRED and photosensor are housed in a single package with a light-conducting medium between them.

Optically coupled isolators are used in control and computer networks to isolate electrical "spikes" in one part of the circuit from transmission to another part. These isolators are especially useful in appliances and manually controlled electronic equipment to guard the operator against direct electrical contact with the line voltage. They can also serve as replacements for DC transformers or mechanical relays. With twenty years of experience in the design and manufacture of optically coupled isolators, Optek is a market leader in high technology and specialty couplers. Optek led the industry by obtaining the first VDE approved IR optoisolator.

The Optek product line is broad and can meet a wide variety of unique applications. The line consists of:

- **Standard couplers** are available with (1) either phototransistor or photodarlington output, (2) current transfer ratios (CTR) as high as 400 percent, and (3) input current as low as 0.5 mA.
- **Specialty couplers** available in several styles of hermetic packages, with isolation voltages up to 50,000 VDC, with guaranteed CTRs up to 700 percent, and with input currents as low as 5 mA.
- **High technology couplers** with TTL-compatible Photologic™ output, with isolation voltages up to 15,000 VDC, and with the ultimate in speed - up to 5 MHz - available.

Standard Optically Coupled Isolators

Optek's standard optocoupler line features optocouplers especially useful in applications requiring high voltage and noise isolation. Among such applications are computer and telephone interconnections, and level shifting and interfacing between logic families and low input current line receivers. When the application is networking among multiple hardware units, optically coupled isolators should be designed in for ground loop elimination and electrical protection.

Optek standard optocouplers contain either a gallium arsenide (GaAs) or gallium aluminum arsenide (GaAlAs) IRED as input, and a silicon (Si) phototransistor sensor (NPN type) as output. The coupling medium between the IRED and sensor is a high dielectric silicone gel. The infrared light emitted from the IRED has a wavelength of 930 nm for the GaAs IRED and 890 for the GaAlAs IRED. Both are spectrally matched with the photosensor peak spectral response, centered at 850 nm, in order to assure optimum DC transfer characteristics.

The key design parameters of an optically coupled isolator are the current transfer ratio (CTR), which is a measure of the output current for a given input current, and the isolation voltage, which is the amount of voltage that can be applied between input and output without causing arcing or breakdown. The CTR for Optek's standard optocouplers range from 2 to 400 percent. The isolation voltages range as high as 15000 VDC. Specialty couplers and custom products have CTRs and isolation voltages that often exceed these ranges.

Optek's leadership in optoisolator technology and manufacture began 20 years ago when engineers developed the company's first infrared optoisolator using hermetic devices. Today, this product, the OPI120, remains one of the more popular of Otpek's line of specialty couplers.

The line also offers a wide selection of case types and electrical variations. Isolation voltages range from 1000 VDC in hermetic TO-5 and TO-72 packages, to 50 KV DC, made possible by Optek's development of an optical waveguide and custom package using hermetic discretes. Some of the line's most cost effective parts are the OPI1264A, B, and C types, which offer 10 KV electrical isolation in a popular axial package design. Choices of CTRs of 25, 50 or 100 percent are available with phototransistor output.

The OPI102, and OPI103 and JEDEC registered 3N and 4N types are hermetically packaged in TO-5 and TO-72 metal cans. CTRs range from 15 to 100 percent, and the parts feature phototransistor output for easy design-in to most circuits. The Hi-Rel and Military parts section of this data book contain descriptions of JAN and JANTX versions of many of these specialty coupler products.

High Technology or Photologic™ Couplers

Optek's development of Photologic™ advanced IC photosensors has also led to the design of high technology couplers with 250 K-Baud TTL capability. They represent four types of output: buffer totem-pole, buffer open-collector, inverter totem-pole, and inverter open-collector. If high voltage electrical isolation is required, the OPI125 through OPI128 are photodarlington optocouplers with 15,000 VDC isolation in a hermetic axial-leaded package.

SURFACE MOUNT

The OPI210, OPI211 optoisolators consist of an LED and a silicon phototransistor mounted and coupled on a thick film ceramic substrate. These solid-state optocouplers are ideal for hybrid applications. Optoisolation is rated at 1000 VDC. Four thick film bonding pads make the electrical connections easy. Device mounting may be achieved using silver or gold filled epoxies.

A full line of hermetic chip carriers is also offered which are surface mountable on ceramic or printed circuit boards. The miniature package saves circuit board area. Many of the popular 4N series optoisolators are available in this HCC series of optocouplers shown in the surface mount area of this data book. High speed (1megabit/second) TTL versions are also available.

High Speed Very High Voltage Isolator

The OPI1266 features isolation to 16KV DC with a transfer rate to 500 kbits as standard. The OPI1266 optoisolator consists of a GaAlAs LED coupled with a unique integrated circuit detector. Photons are collected in the detector by a photodiode and amplified by a high gain linear amplifier that drives a Schottky clamped open collector output transistor. The circuit is temperature, current, and voltage compensated. This design produces maximum DC and AC current isolation between input and output while providing TTL/LSTTL circuit compatibility. Propagation delay times are matched within 500ns over the entire temperature range for timing purposes.

Custom Optoisolator Capability

In some critical applications, standard electrical characteristics or package types simply will not work. Optek has extensive experience in designing and manufacturing custom optoisolators to meet the most demanding application requirements.

Leadership in Advanced Coupler Research

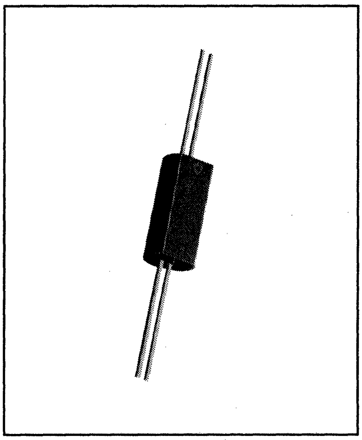
Optek has recently patented surface mount optoisolators, OPI210 and OPI211, symbols of Optek's leadership through optoisolator technology.

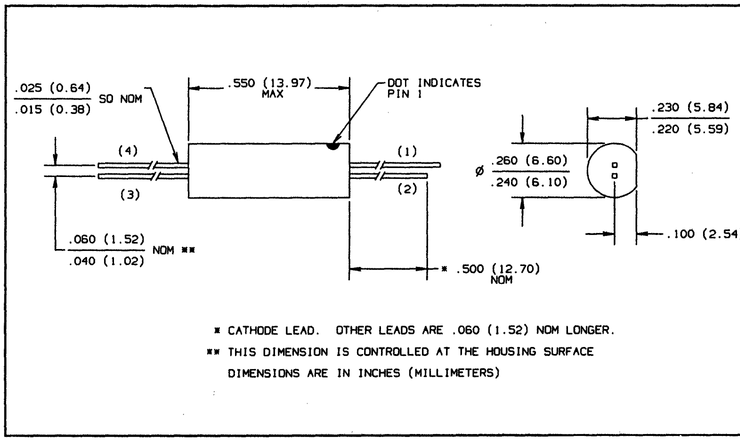
Projects currently in progress at Optek include operating speed improvements, increased photosensor functionality, input sensitivity enhancements, and innovations in package designs. Optek continues to lead the industry in state-of-the-art optically coupled isolators.

Applications

AC Voltage Sensing
Computer Peripherals
Current Sensing
Data Transmission
Ground Loop Elimination
Home Appliances
Industrial Controls
Instrument I/O Isolation
Level Shifting
Line Receivers
Line Voltage Status Indicators
Logic Interface
Microprocessor Interface
Motor or Light Controls
Network Isolation
Polarity Sensing
Solid State Relays
Switching Power Supply
Telephone Ring Detection
Telephone Switching

Optically Coupled Isolators
Types OPI110, OPI110A, OPI110B, OPI110C, OPI113





Features

- 10kV electrical isolation
- Phototransistor output
- Low cost plastic housing
- UL Recognized File Number E58730(6)

Description

The OPI110 and OPI113 series devices are optically coupled isolators, each containing an infrared emitting diode and an NPN silicon photosensor. The OPI110 uses a phototransistor and the OPI113 uses either a photodarlington or phototransistor sensor. The devices are sealed in a precast opaque housing. This series is designed for applications requiring high voltage isolation between input and output.

Replaces

K8900 series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ± 10kVDC(1)(6)
Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]. . . . . 260°C(2)

Input Diode

Forward DC Current. . . . . 40mA(3)
Reverse DC Voltage 2.0V
Power Dissipation . . . . 50mW(4)

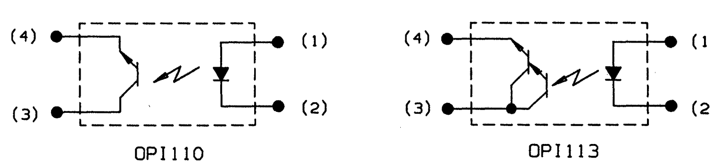
Output Photosensor

Collector-Emitter Voltage OPI110 . . . . 30V
OPI113 . . . . 15V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(5)

Notes:

(1) Measured with input and output leads shorted. Typical input/output capacitance is 0.06pF.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.67mA/°C above 25°C.
(4) Derate linearly 0.83mW/°C above 25°C.
(5) Derate linearly 1.67mW/°C above 25°C.
(6) UL recognition is for 3500 VAC, 1 minute only.

Schematics



Types OPI110, OPI110A, OPI110B, OPI110C, OPI113

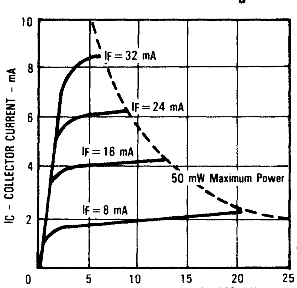
Electrical Characteristics ($T_A = 25°C$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.60	V	$I_F = 20$ mA
I_R	Reverse Current				100	µA	$V_R = 2.0$ V
Output Photosensor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	OPI110 OPI113	30 15			V V	$I_C = 100$ µA $I_C = 100$ µA, $I_F = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100$ µA, $I_F = 0$
I_{CEO}	Collector-Emitter Dark Current	OPI110 OPI113			100 100	nA nA	$V_{CE} = 15$ V, $E_e = 0$ $V_{CE} = 10$ V, $E_e = 0$
Coupled							
I_C/I_F	DC Current Transfer Ratio	OPI110 OPI110A OPI110B OPI110C OPI113	12.5 25 50 100 50	 400	 125 	% % % % %	$I_F = 10.0$ mA, $V_{CE} = 5.0$ V $I_F = 10.0$ mA, $V_{CE} = 5.0$ V $I_F = 10.0$ mA, $V_{CE} = 5.0$ V $I_F = 10.0$ mA, $V_{CE} = 5.0$ V $I_F = 5.0$ mA, $V_{CE} = 2.0$ V
$V_{CE(SAT)}$	Collector Saturation Voltage	OPI110 OPI113			0.40 1.20	V V	$I_F = 10.0$ mA, $I_C = 1.6$ mA $I_F = 10.0$ mA, $I_C = 5.0$ mA
I_{CEO}	Collector-Emitter Dark Current	OPI110 OPI113			200 100	nA nA	$V_{CE} = 20.0$ V, $I_F = 0$ $V_{CE} = 10.0$ V, $I_F = 0$
V_{ISO}	Isolation Voltage		10.0			kVDC	(See Note 1)

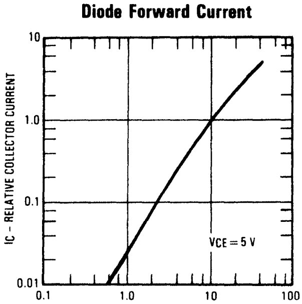
OPTICALLY COUPLED ISOLATORS

Typical Performance Curves (OPI110 Only)

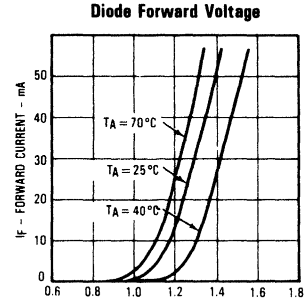
Collector Current vs Collector-Emitter Voltage



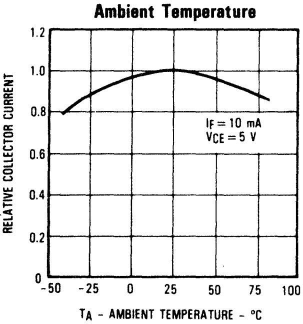
Relative Collector Current vs Diode Forward Current



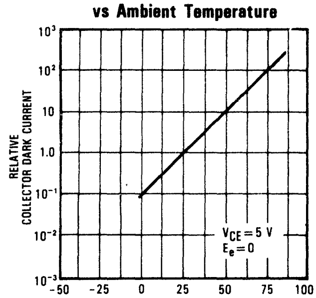
Diode Forward Current vs Diode Forward Voltage



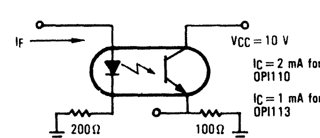
Relative Collector Current vs Ambient Temperature



Relative Collector Dark Current vs Ambient Temperature



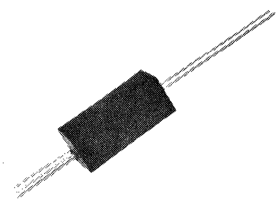
Switching Time Test Circuit

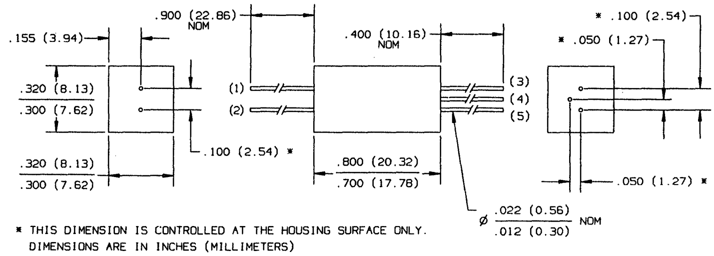


t_r and t_f for OPI110 are typically 4 µs.
t_r and t_f for OPI113 are typically 40 µs.
The input waveform is supplied by a generator with the following characteristics: $Z_{OUT} = 50\Omega$, $t_r \leq 15$ ns, duty cycle ≅ 1%, pulse width = 100 µs.

OPTEK

Optically Coupled Isolators
Types OPI120, OPI123





Features

- 15kV electrical isolation
- Phototransistor output (OPI120) or photodarlington output (OPI123)
- Hermetically sealed LED and photosensor
- Base contact lead for conventional transistor biasing
- TX-TXV process available (see Hi-Rel section)

Description

The OPI120 and OPI123 are optically coupled isolators, each containing an infrared emitting diode and an NPN silicon phototransistor (OPI120) or photodarlington (OPI123) sealed in a high dielectric plastic housing. The LED and sensor are in hermetically sealed packages. These series are designed for applications requiring high voltage isolation between input and output over a wide range of temperatures.

Replaces

K8920 series

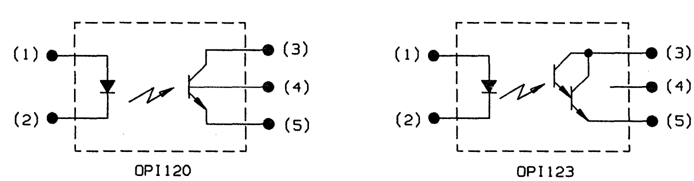
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage	± 15kVDC(1)
Storage Temperature Range	-55°C to +125°C
Operating Temperature Range	-55°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(2)
Input Diode	
Forward DC Current	150mA(3)
Reverse DC Current	3.0V
Power Dissipation	200mW(4)
Output Photosensor	
Collector-Emitter Voltage (OPI120)	25V
(OPI123)	20V
Emitter-Collector Voltage	5.0V
Collector-Base Voltage (OPI120)	25V
Power Dissipation	250mW(5)

Notes:

(1) Measured with input and output leads shorted in air with a max. relative humidity of 50%. If suitably encapsulated or oil immersed, the isolation voltage is increased to 25kV minimum.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 2.0mA/°C above 25°C.
(4) Derate linearly 2.67mW/°C above 25°C.
(5) Derate linearly 3.33mW/°C above 25°C.

Schematics



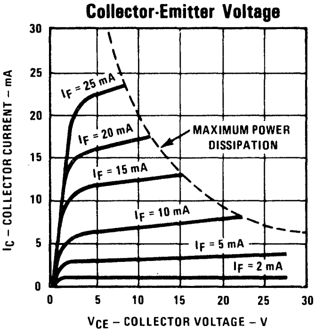
Types OPI120, OPI123

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

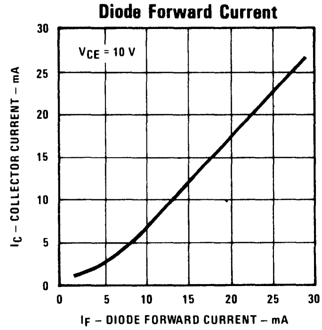
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage	OPI120			1.50	V	$I_F = 30.0mA$
		OPI123			1.50	V	$I_F = 10.0mA$
I_R	Reverse Current	OPI120			100	µA	$V_R = 3.0V$
		OPI123			100	µA	$V_R = 3.0V$
Output Photosensor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	OPI120	25			V	$I_C = 1.00mA$
		OPI123	20			V	$I_C = 1.00mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	$I_E = 100\mu A$
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	OPI120	25			V	$I_C = 1.00\mu A$
I_{CEO}	Collector-Emitter Dark Current				100	nA	$V_{CE} = 10.0V$
Coupled							
I_C/I_F	DC Current Transfer Ratio	OPI120	20	70		%	$I_F = 10.0mA$, $V_{CE} = 5.0V$
		OPI123	50			%	$I_F = 10.0mA$, $V_{CE} = 2.0V$
$V_{CE(SAT)}$	Saturation Voltage	OPI120			0.50	V	$I_F = 30mA$, $I_C = 1.00mA$
		OPI123			1.20	V	$I_F = 5.0mA$, $I_C = 1.00mA$
V_{ISO}	Isolation Voltage		15.0			kV	(See Note 1)
t_r	Output Rise Time	OPI120		2.0		µs	See Test Circuit
		OPI123		40		µs	See Test Circuit
t_f	Output Fall Time	OPI120		2.0		µs	See Test Circuit
		OPI123		40		µs	See Test Circuit

Typical Performance Curves (OPI120 Only)

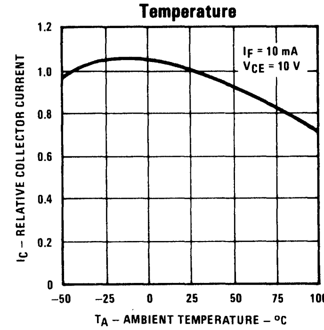
Collector Current vs. Collector-Emitter Voltage



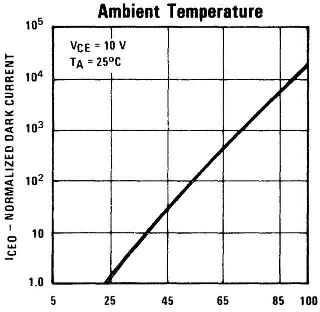
Collector Current vs. Diode Forward Current



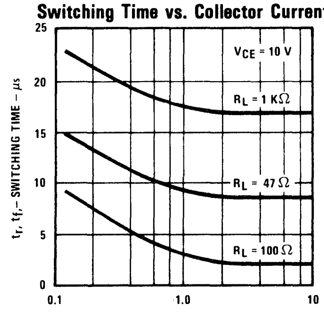
Relative Collector Current vs. Temperature



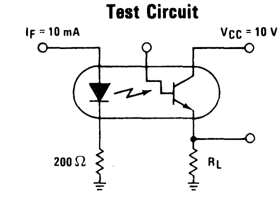
Normalized Dark Current vs. Ambient Temperature



Switching Time vs. Collector Current



Test Circuit

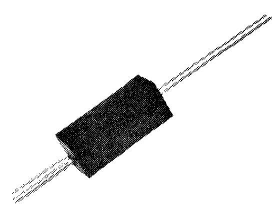


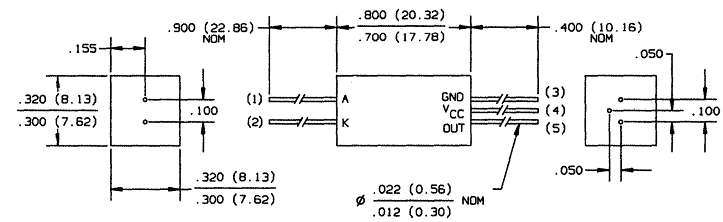
The input waveform is supplied by a generator with the following characteristics: $Z_{OUT} = 50\Omega$, $t_r \leq 15$ ns. Duty cycle ≈ 1%, pulse width ≈ 100 µs.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Photologic™ Optically Coupled Isolators
Types OPI125, OPI126, OPI127, OPI128





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Four output options
- 15kV input-to-output isolation voltage
- Direct TTL/STTL interface
- High noise immunity
- Data rates to 250 kBaud
- Hermetically sealed
- TX-TXV process available (see Hi-Rel section)

Description

The OPI125, OPI126, OPI127, and OPI128 each contain a gallium arsenide infrared emitting diode coupled to a monolithic integrated circuit which incorporates a photodiode, a linear amplifier, and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads directly without additional circuitry. Also featured are medium speed data rates to 250 kBaud with typical rise and fall times of 25 nsec. Both the infrared emitting diode and the Photologic™ sensor are in hermetically sealed packages for maximum long term stability and are mounted in a high dielectric plastic housing.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage .... ±15kVDC(1)
Supply Voltage, V_{CC} (not to exceed 3 sec.) .... +10.0V
Storage Temperature Range .... -55°C to +100°C
Operating Temperature Range .... -55°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)
Input Diode Power Dissipation .... 200mW(3)
Output Photologic Power Dissipation .... 120mW(4)
Duration of Output Short to V_{CC} or Ground (OPI125, OPI127) .... 1.00 sec.
Duration of Output Short to V_{CC} (OPI126, OPI128) .... 1.00 sec.
Voltage at Output Lead (OPI126, OPI128) 35V

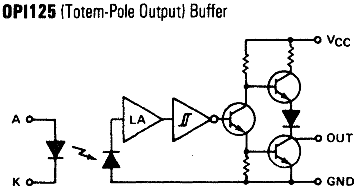
Input Diode

Forward D.C. Current 25mA
Reverse D.C. Voltage 2.0V

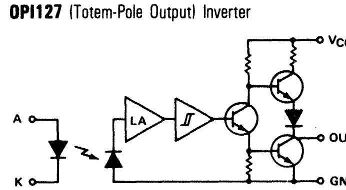
Notes:
(1) Measured with input and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.33mW/°C above 25°C.
(4) Derate linearly 3.40mW/°C above 90°C.

Schematics

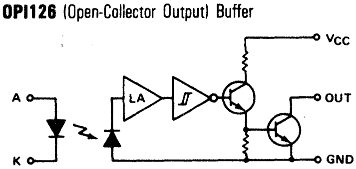
OPI125 (Totem-Pole Output) Buffer



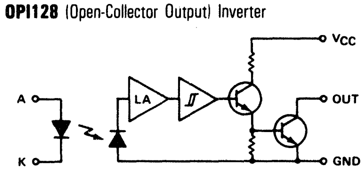
OPI127 (Totem-Pole Output) Inverter



OPI126 (Open-Collector Output) Buffer



OPI128 (Open-Collector Output) Inverter



Types OPI125, OPI126, OPI127, OPI128

Electrical Characteristics (-40°C to +85°C unless otherwise noted)

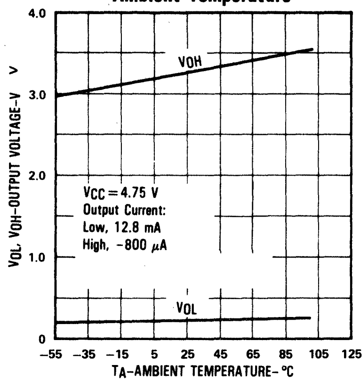
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Diode Input						
V_F	Forward Voltage			1.50	V	$I_F = 10.0mA$, $T_A = 25°C$
I_R	Reverse Current			100	µA	$V_R = 2.0V$, $T_A = 25°C$
$I_F(+)$	LED Positive-Going Threshold Current			7.5	mA	$V_{CC} = 5.0V$, $T_A = 25°C$
$I_F(+)/I_F(-)$	Hysteresis Ratio		2.0			
Photologic™Output						
V_{CC}	Operating Supply Voltage	4.5		5.5	V	
I_{CC}	Supply Current			20	mA	$V_{CC} = 5.5V$, $I_F = 0$ or 7.5mA
OPI125 (Buffer, Totem-Pole)						
V_{OL}	Low Level Output Voltage			0.40	V	$V_{CC} = 4.5V$, $I_{OL} = 13.0mA$, $I_F = 0mA$
V_{OH}	High Level Output Voltage	2.4			V	$V_{CC} = 4.5V$, $I_{OH} = -800µA$, $I_F = 7.5mA$
I_{OS}	Short Circuit Output Current	-20		-120	mA	$V_{CC} = 5.5V$, $I_F = 7.5mA$, Output = GND
OPI126 (Buffer, Open-Collector)						
V_{OL}	Low Level Output Voltage			0.40	V	$V_{CC} = 4.5V$, $I_{OL} = 13.0mA$, $I_F = 0mA$
I_{OH}	High Level Output Current			100	µA	$V_{CC} = 4.5V$, $V_{OH} = 30V$, $I_F = 7.5mA$
OPI127 (Inverter, Totem-Pole)						
V_{OL}	Low Level Output Voltage			0.40	V	$V_{CC} = 4.5V$, $I_{OL} = 13.0mA$, $I_F = 7.5mA$
V_{OH}	High Level Output Voltage	2.4			V	$V_{CC} = 4.5V$, $I_{OH} = -800µA$, $I_F = 0mA$
I_{OS}	Short Current Output Current	-20		-120	mA	$V_{CC} = 5.5V$, $I_F = 0mA$, Output = GND
OPI128 (Inverter, Open-Collector)						
V_{OL}	Low Level Output Voltage			0.40	V	$V_{CC} = 4.5V$ $I_{OL} = 13.0mA$, $I_F = 7.5mA$
I_{OH}	High Level Output Current			100	µA	$V_{CC} = 4.5V$, $V_{OH} = 30V$, $I_F = 0mA$
OPI125, OPI127						
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	$V_{CC} = 5V$, $T_A = 25°C$, $I_F = 0$ or 10mA, f = 10kHz,
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5		µs	D.C. = 50%, R_L = 8TTL Loads
OPI126, OPI128						
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	$V_{CC} = 5V$, $T_A = 25°C$, $I_F = 0$ or 10mA, f = 10kHz,
t_{PLH}, t_{PHL}	Propagation Delay, Low-High, High-Low		5		µs	D.C. = 50%, $R_L = 360\ \Omega$

OPTICALLY COUPLED ISOLATORS

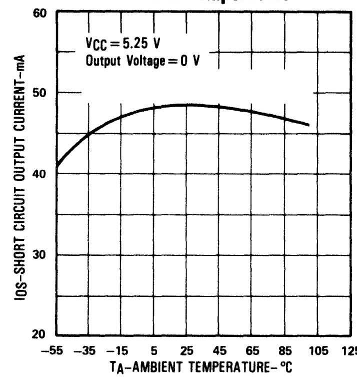
Typical Performance Curves

OPI125, OPI127

Output Voltage vs. Ambient Temperature

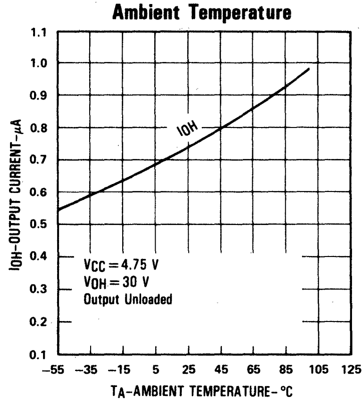


Short Circuit Output Current vs. Ambient Temperature

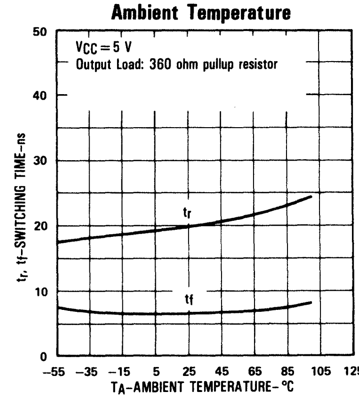


OPI126, OPI128

Output Current (High) vs Ambient Temperature

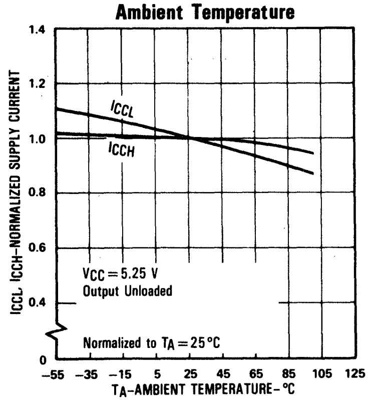


Rise Time and Fall time vs Ambient Temperature



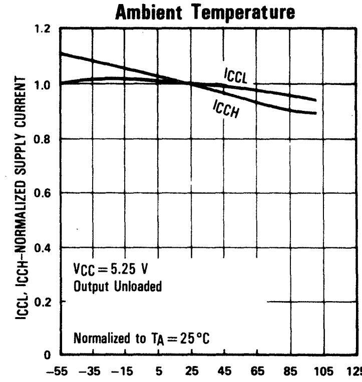
OPI125, OPI126

Normalized Supply Current vs Ambient Temperature



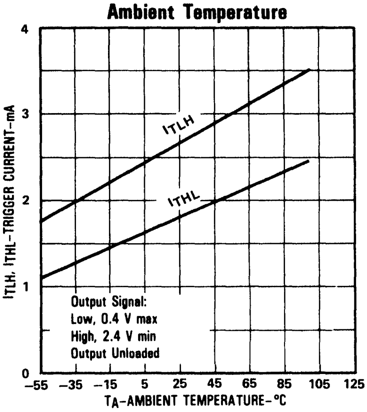
OPI127, OPI128

Normalized Supply Current vs Ambient Temperature

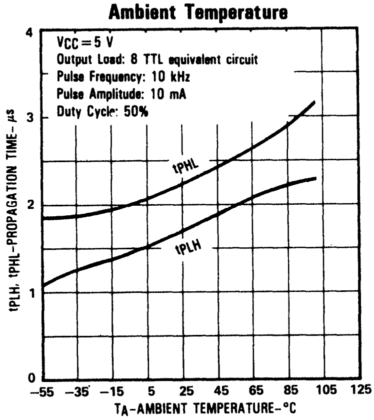


Typical Performance Curves

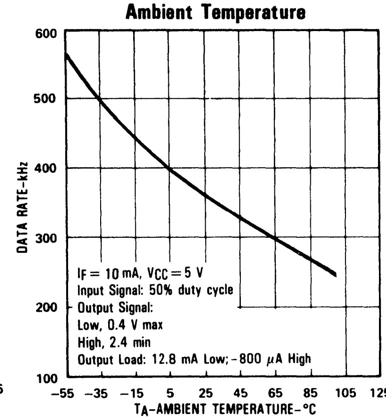
Trigger Current vs Ambient Temperature



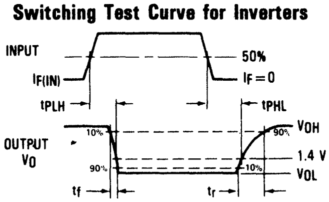
Propagation Time vs Ambient Temperature



Data Rate vs Ambient Temperature

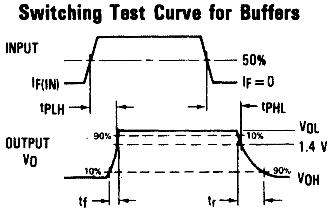


Switching Test Curve for Inverters



LED: f = 1kHz, D.C. = 50%

Switching Test Curve for Buffers



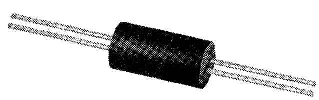
LED: f = kHz, D.C. = 50%

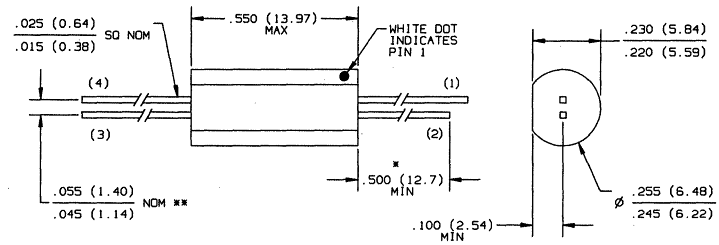
OPTICALLY COUPLED ISOLATORS

Product Bulletin OPI1264
May 1993

OPTEK

Optically Coupled Isolators
Types OPI1264, OPI1264A, OPI1264B, OPI1264C





** THIS DIMENSION IS CONTROLLED AT THE HOUSING SURFACE
* CATHODE LEAD. OTHER LEADS ARE .060 (1.52) NOM LONGER.
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- 10kV electrical rating
- High current transfer ratio
- Low cost plastic module
- UL recognized File NO. E58730(6)

Description

The OPI1264 series are optically coupled isolators, each consisting of an infrared emitting diode coupled to an NPN silicon phototransistor and sealed in a precast opaque housing. The isolators are designed for applications requiring high voltage isolation between input and output.

Replaces

K8900 series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

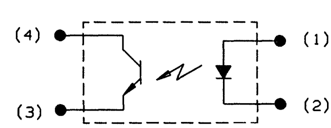
Input-to-Output Isolation Voltage . . . . ± 10.0kVDC(1)(6)
Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(2)

Input Diode
Forward DC Current . . . . 40mA(3)
Reverse DC Voltage 2.0V
Power Dissipation . . . . 50mW(4)

Output Photosensor
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(5)

Notes:
(1) Measured with input and output leads shorted. Typical input/output capacitance is 0.06pf.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.67mA/°C above 25°C.
(4) Derate linearly 0.83mW/°C above 25°C.
(5) Derate linearly 1.66mW/°C above 25°C.
(6) UL recognition is for 3500 VAC, 1 minute only.

Schematic



OPI1264

Types OPI1264, OPI1264A, OPI1264B, OPI1264C

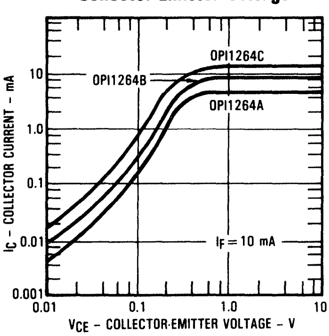
Electrical Characteristics ($T_A = 25°C$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.60	V	$I_F = 20$ mA
I_R	Reverse Current				100	µA	$V_R = 2.0$ V
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	$I_C = 100$ µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5			V	$I_E = 100$ µA
I_{CEO}	Collector-Emitter Dark Current				100	nA	$V_{CE} = 15$ V, Ee = 0
Coupled							
I_C/I_F	DC Current Transfer Ratio	OPI1264 OPI1264A OPI1264B OPI1264C	12.5 25 50 100		 125 	%	$I_F = 10.0$ mA, $V_{CE} = 5.0$ V
V_{ISO}	Isolation Voltage		10			kVDC	(See Note 1)
$V_{CE(SAT)}$	Collector-Saturation Voltage				0.40	V	$I_F = 10.0$ mA, $I_C = 1.6$ mA
I_{CEO}	Collector-Emitter Dark Current				200	nA	$I_F = 0$, $V_{CE} = 20$ V

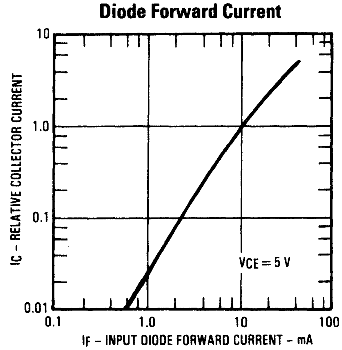
OPTICALLY COUPLED ISOLATORS

Typical Performance Curves

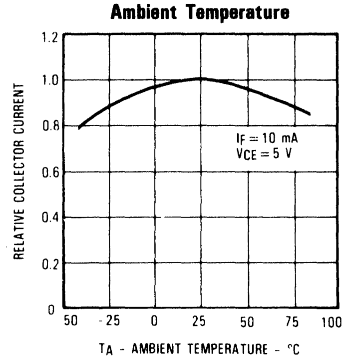
Collector Current vs Collector-Emitter Voltage



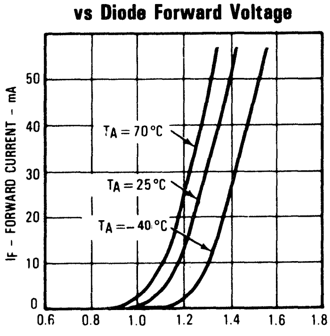
Relative Collector Current vs Diode Forward Current



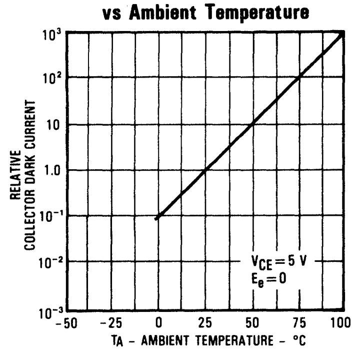
Relative Collector Current vs Ambient Temperature



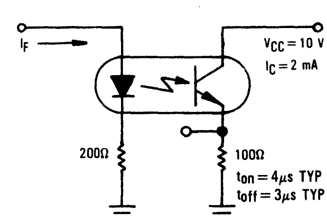
Diode Forward Current vs Diode Forward Voltage



Collector Dark Current vs Ambient Temperature



Switching Time Test Circuit



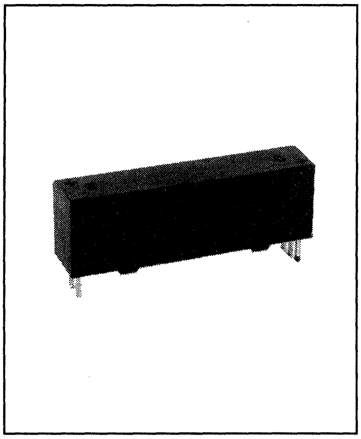
The input waveform is supplied by a generator with the following characteristics: $Z_{OUT} = 50\Omega$, $t_r \leq 15$ ns, duty cycle ≈ 1%, pulse width ≈ 100 µs.

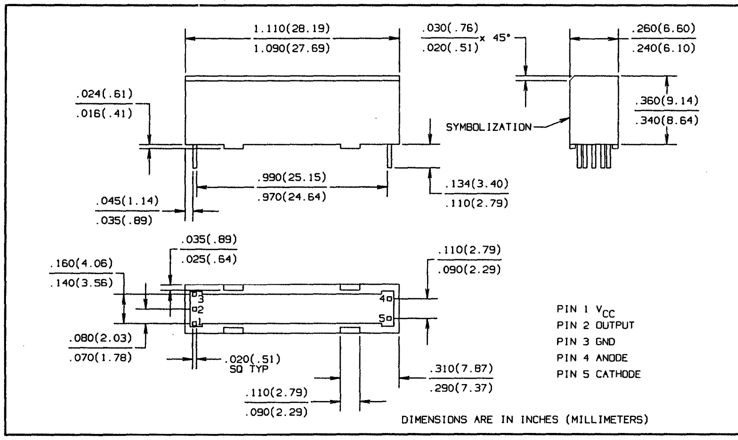
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPI1266
May 1993

OPTEK

High Speed, Very High Voltage Isolator
Type OPI1266





Features:

- TTL compatible output
- 16kV Isolation
- 500 kbits/s transfer rate
- Creepage path: 0.970"
- Air path: 0.970"
- t_{PHL}-$t_{PLH} \le$ 500ns
- UL recognized File No. E58730[4]

Description

The OPI1266 consists of a GaAlAs LED coupled with a unique integrated circuit detector. Photons are collected in the detector by a photodiode and amplified by a high gain linear amplifier that drives a Schottky clamped open collector output transistor. The circuit is temperature, current, and voltage compensated. This design produces maximum DC and AC current isolation between input and output while providing TTL/LSTTL circuit compatibility. Propagation delay times are matched within 500ns over the entire temperature range for timing purposes[2].

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage .... 16kVDC[3][4]
Operating Temperature Range.................................. 0 to + 70°C
Storage Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron].. 260°C[1]

Input Diode

Forward DC Current .... 50 mA
Reverse Voltage 2.0V
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Power Dissipation 100mW

Output IC

Maximum Supply Voltage 7.0V
Power Dissipation 100mW

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec max. when flow soldering.
(2) $\Delta T_P = t_{PHL}$-t_{PLH}.
(3) Measured with input and output leads shorted. Typical input/output capacitance is 0.05pF.
(4) UL recognition is for 5833 VAC, for 1 minute.

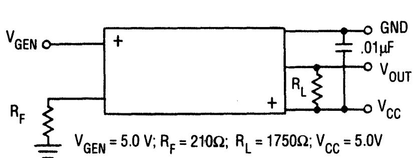


FIG. 1

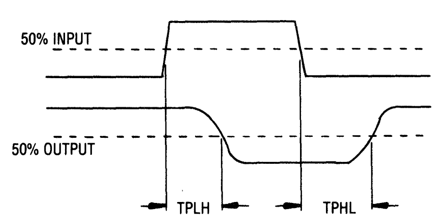


FIG. 2

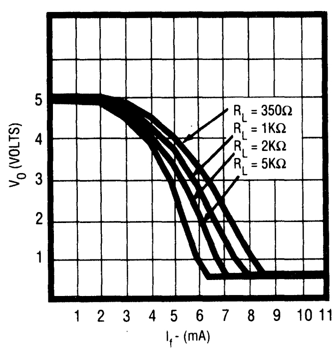
Type OPI1266

Electrical Characteristics (T_A = 0°C to +70°C unless otherwise noted)

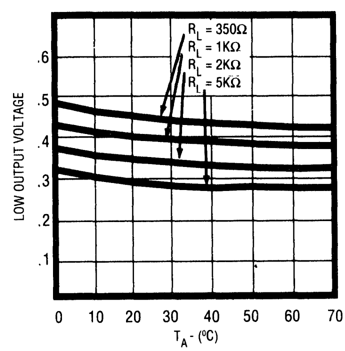
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.8	V	I_F = 20mA
I_R	Reverse Current			100	µA	V_R = 2.0V
Output Ic (V_{CC} = 4.75V to 5.25V)						
I_{OH}	High Level Output Current			100	µA	I_F = 0, V_{OUT} = 5.5V
V_{OL}	Low Level Output Voltage			0.6	V	I_F = 13.5mA, I_{OL} = 2.6mA
I_{CCH}	High Level Supply Current			15	mA	I_F = 0
I_{CCL}	Low Level Supply Current			18	mA	I_F = 13.5mA
Coupled (V_{CC} = 5.0V)						
C_{IO}	Coupling Capacitance			2.0	pF	Input & Output Leads Shorted
t_{PLH}	Propagation Delay to Low Output Level			800	ns	See Fig. 1&2
t_{PHL}	Propagation Delay to High Output Level			800	ns	See Fig. 1&2
$\Delta TP^{(2)}$	Difference in Propagation Delays	-500		500	ns	
I_{ISO}	Isolation Leakage			1.0	µA	@ 7kV RMS Input & Output Leads Shorted

TYPICAL PERFORMANCE CURVES

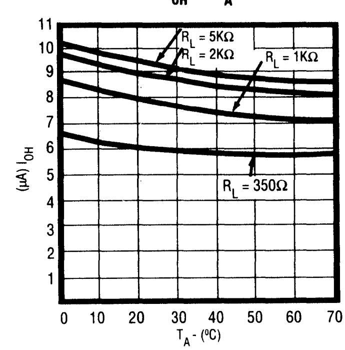
V_{OUT} vs. I_f



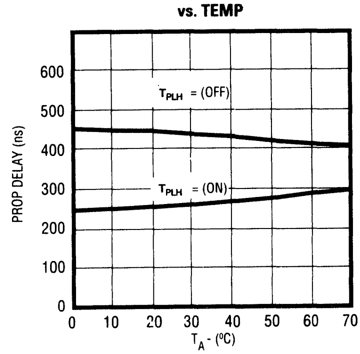
V_{OL} vs. T_A



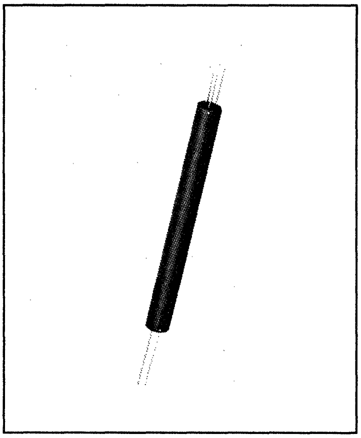
I_{OH} vs. T_A

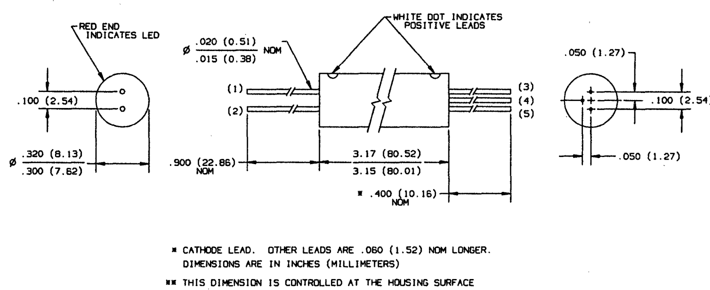


PROPAGATION DELAY vs. TEMP



Optically Coupled Isolators
Types OPI150, OPI153





Features

- 50kV electrical isolation
- Phototransistor output (OPI150) or photodarlington output (OPI153)
- Hermetically sealed LED and photosensor
- Base contact lead for conventional transistor biasing
- TX-TXV process available (see Hi-Rel section)

Description

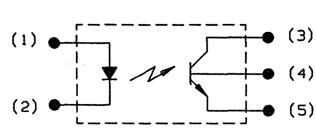
The OPI150 and OPI153 each contain an infrared emitting diode and an NPN silicon phototransistor (OPI150) or photodarlington (OPI153) optically coupled by means of a light pipe and mounted in a high dielectric plastic housing. The LED and sensor are in hermetically sealed packages. These series are designed for applications requiring very high isolation between input and output.

Absolute Maximum Ratings ($T_A = 25^\circ C$ unless otherwise noted)

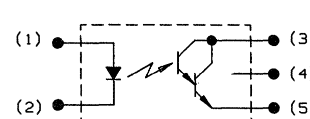
Input-to-Output Isolation Voltage	± 50kVDC(1)
Storage Temperature Range	-40°C to +85°C
Operating Temperature Range	-40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	260°C(2)
Input Diode	
Continuous Forward Current	50mA
Reverse Voltage	3.0V
Power Dissipation	200mW(3)
Output Photosensor	
Collector-Emitter Voltage OPI150	30V
OPI153	15.0V
Emitter-Collector Voltage OPI150	5.0V
OPI153	5.0V
Collector-Base Voltage OPI150	30V
OPI153	20V
Power Dissipation OPI150	250mW(4)
OPI153	250mW(4)

Notes:
(1) Measured with input and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 3.33mW/°C above 25°C.
(4) Derate linearly 4.17mW/°C above 25°C.

Schematics



OPI150



OPI153

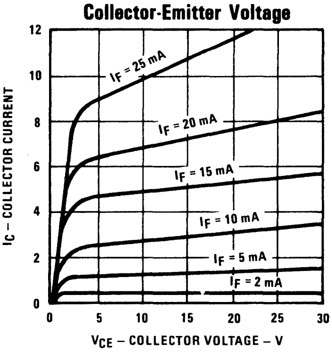
Types OPI150, OPI153

Electrical Characteristics (T_A = 25°C unless otherwise noted)

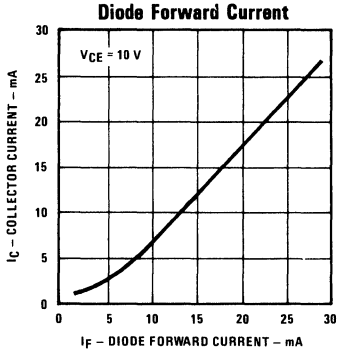
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage	OPI150 OPI153			1.60 1.60	V V	I_F = 50mA I_F = 50mA
I_R	Reverse Current				100	μA	V_R = 3.0V
Output Photosensor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	OPI150 OPI153	30 15			V V	I_C = 1.00mA I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	OPI150	5			V	I_F = 100μA
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	OPI150 OPI153	30 20			V V	I_C = 100μA I_C = 100μA
I_{CEO}	Collector-Emitter Dark Current	OPI150 OPI153			100 500	nA nA	V_{CE} = 10.0V V_{CE} = 10.0V
I_{CBO}	Collector-Base Dark Current	OPI150			50	nA	V_{CB} = 10.0V
Coupled							
I_C/I_F	DC Current Transfer Ratio	OPI150 OPI153	10 25			% %	I_F = 10mA, V_{CE} = 5.0V I_F = 20mA, V_{CE} = 5.0V
$I_{CB(ON)}$	On-State Photodiode Current	OPI150	10			μA	I_F = 20mA, V_{CB} = 5.0V
$V_{CE(SAT)}$	Saturation Voltage	OPI150 OPI153			0.50 1.20	V V	I_F = 16.0mA, I_C = 1.0mA I_F = 30.0mA, I_C = 2.0mA

Typical Performance Curves (OPI150 Only)

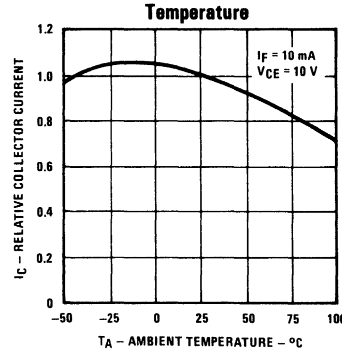
Collector Current vs. Collector-Emitter Voltage



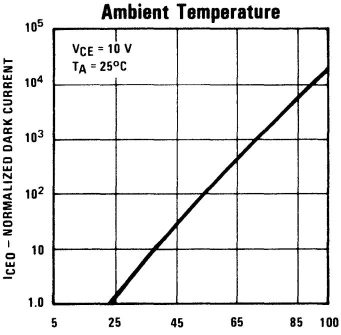
Collector Current vs. Diode Forward Current



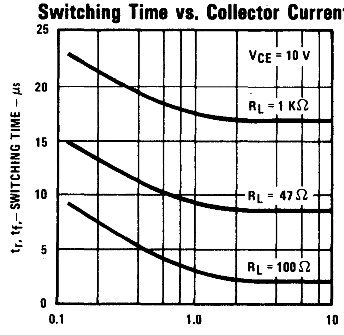
Relative Collector Current vs. Temperature



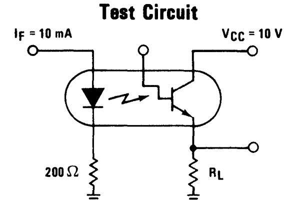
Normalized Dark Current vs. Ambient Temperature



Switching Time vs. Collector Current



Test Circuit

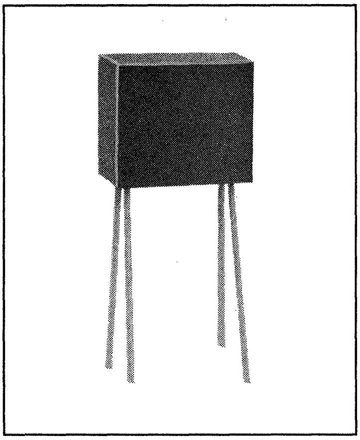


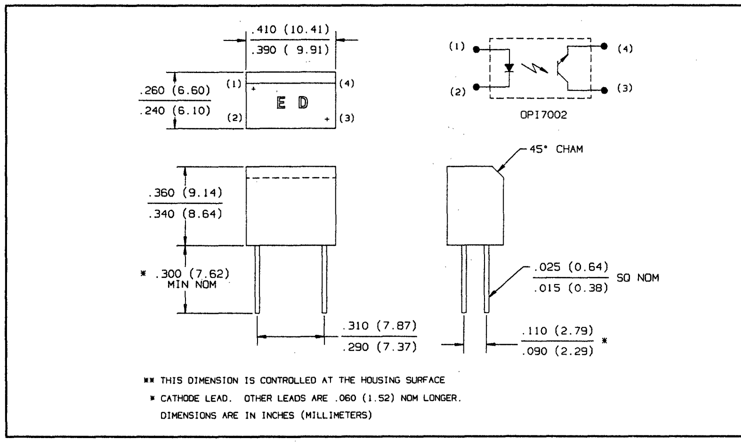
The input waveform is supplied by a generator with the following characteristics: Z_{OUT} = 50Ω, t_r ≤ 15 ns. Duty cycle ≈ 1%, pulse width ≈ 100 μ .

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Optically Coupled Isolators
Types OPI7002, OPI7010





Features

- 6kV electrical isolation
- Low cost plastic housing
- UL recognized File No. E58730(4)
- Phototransistor output

Description

The OPI7002 and OPI7010 each consist of an infrared emitting diode coupled to an NPN silicon phototransistor. The LED and sensor are encased in a black, low-cost plastic housing. Pin spacing is compatible with standard dual-in-line packages.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ± 6kVDC(1)(4)
Operating and Storage Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(3)

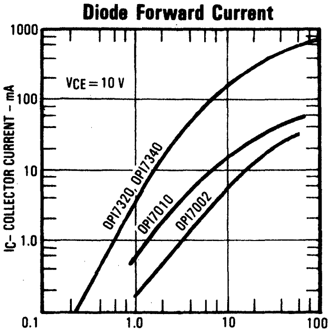
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(3)

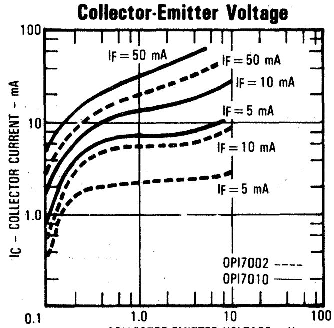
Notes:
(1) Measured with input leads and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.66mW/°C above 25°C.
(4) UL recognition is for 3500 VAC, 1 minute only.

Typical Performance Curves

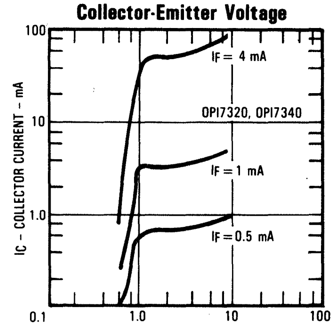
Collector Current vs Diode Forward Current



Collector Current vs Collector-Emitter Voltage



Collector Current vs Collector-Emitter Voltage



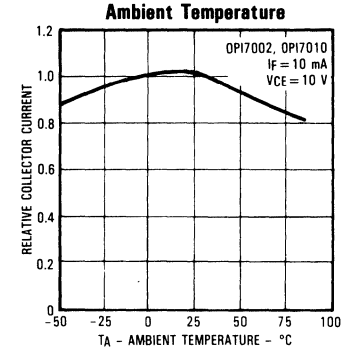
Types OPI7002, OPI7010

Electrical Characteristics (T_A = 25°C unless otherwise noted)

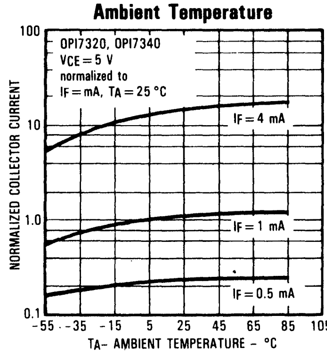
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 10.0mA
I_R	Reverse Current			100	μA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30.0			V	I_C = 100μA, I_F = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA, I_F = 0
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 10.0V, I_F = 0
Coupled						
I_C/I_F	DC Current Transfer Ratio OPI7002 OPI7010	20 100			% %	I_F = 10.0mA, V_{CE} = 5.0V I_F = 10.0mA, V_{CE} = 5.0V
V_{CE}	Collector-Emitter Saturation Voltage			0.40	V	I_F = 10.0mA, I_C = 0.50mA
V_{ISO}	Isolation Voltage	6			kVDC	(See Note 1)
t_{on}	Turn-On Time		4.0		μs	V_{CE} = 10.0V, I_C = 10.0mA, R_L = 100Ω
t_{off}	Turn-Off Time		3.0		μs	V_{CE} = 10.0V, I_C = 10.0mA, R_L = 100Ω
C_{IO}	Capacitance Input-to-Output		0.20		pF	V_{IO} = 0, f = 1MHz[1]

Typical Performance Curves

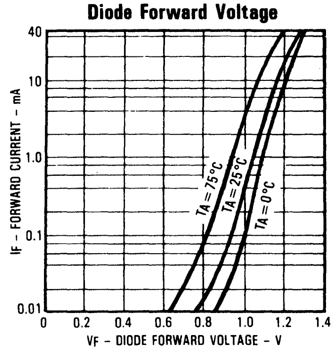
Relative Collector Current vs Ambient Temperature



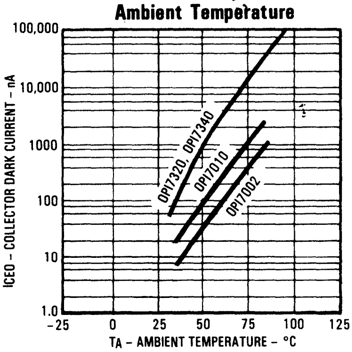
Normalized Collector Current vs Ambient Temperature



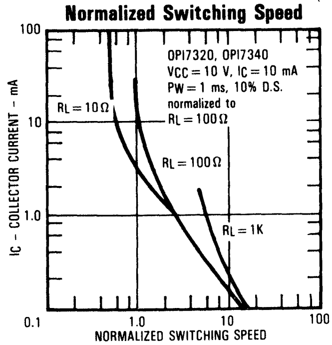
Diode Forward Current vs Diode Forward Voltage



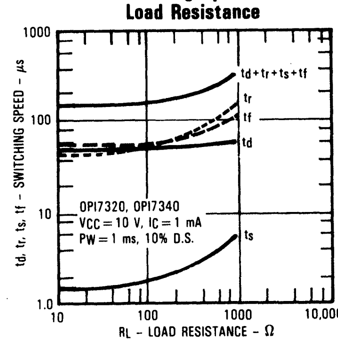
Collector Dark Current vs Ambient Temperature



Collector Current vs Normalized Switching Speed

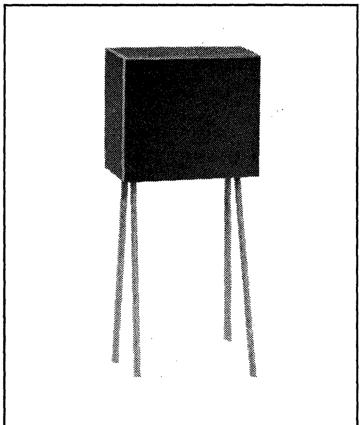


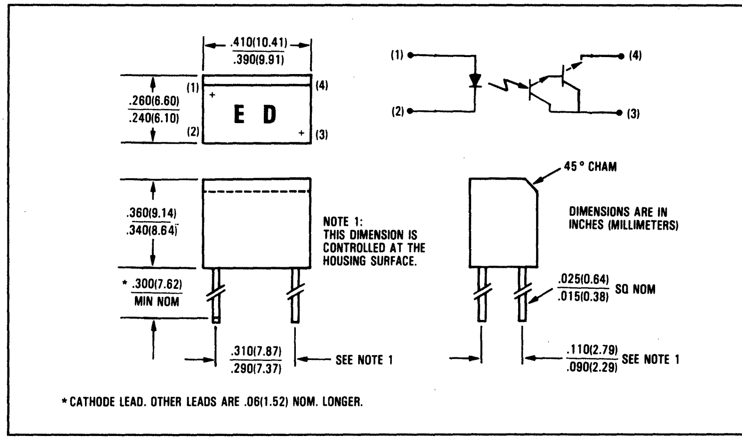
Switching Speed vs Load Resistance



OPTEK

Optically Coupled Isolators
Types OPI7320, OPI7340





Features

- 6kV electrical isolation
- Low cost plastic housing
- UL recognized File No. E58730(4)
- Photodarlington output

Description

The OPI7320 and OPI7340 each consist of an infrared emitting diode coupled to an NPN silicon photodarlington in a high dielectric plastic housing. This device is designed for applications requiring a high current transfer ratio. Pin spacing is compatible with standard dual-in-line packages.

Absolute Maximum Ratings ($T_A = 25^\circ C$ unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ±6kVDC(1)(4)
Operating and Storage Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 260°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 μs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(3)

Output Photodarlington

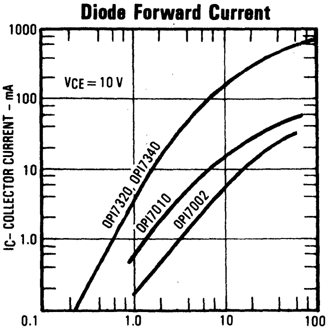
Collector-Emitter Voltage 15.0V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(3)

Notes:

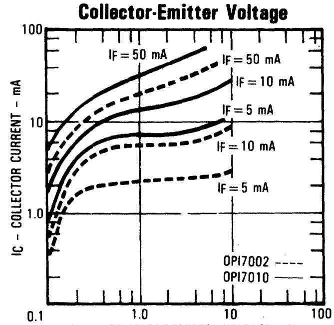
(1) Measured with input and output leads shorted.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(3) Derate linearly 1.66mW/°C above 25°C.
(4) UL recognition is for 3500 VAC, 1 minute only.

Typical Performance Curves

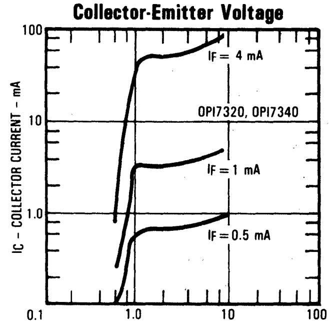
Collector Current vs Diode Forward Current



Collector Current vs Collector-Emitter Voltage



Collector Current vs Collector-Emitter Voltage



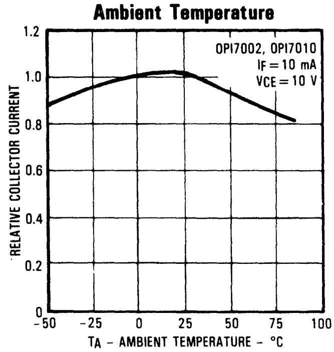
Types OPI7320, OPI7340

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

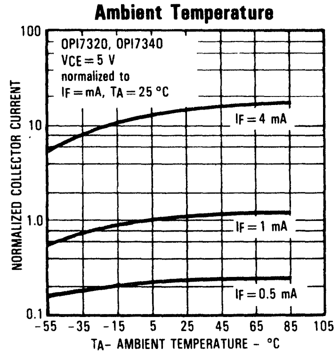
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	$I_F = 10.0mA$
I_R	Reverse Current			100	μA	$V_R = 2.0V$
Output Photodarlington						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0			V	$I_C = 1.00mA, I_F = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	$I_E = 100\mu A, I_F = 0$
I_{CEO}	Collector Dark Current			100	nA	$V_{CE} = 10.0V, I_F = 0$
Coupled						
I_C/I_F	DC Current Transfer Ratio OPI7320 OPI7340	200 400			% %	$I_F = 5.0mA, V_{CE} = 5.0V$ $I_F = 5.0mA, V_{CE} = 5.0V$
$V_{(SAT)}$	Collector-Emitter Saturation Voltage			1.00	V	$I_F = 5.0mA, I_C = 2.0mA$
V_{ISO}	Isolation Voltage	6			kVDC	(See Note 1)
t_{on}	Turn-On Time		150		μs	$V_{CE} = 10.0V, I_C = 10.0mA, R_L = 100\Omega$
t_{off}	Turn-Off Time		125		μs	$V_{CE} = 10.0V, I_C = 10.0mA, R_L = 100\Omega$
C_{IO}	Capacitance Input-to-Output		0.20		pF	$V_{IO} = 0, f = 1MHz^{(1)}$

Typical Performance Curves

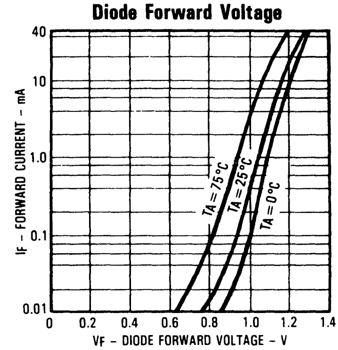
Relative Collector Current vs Ambient Temperature



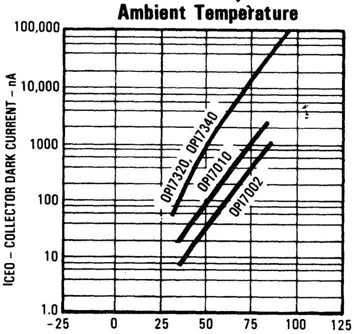
Normalized Collector Current vs Ambient Temperature



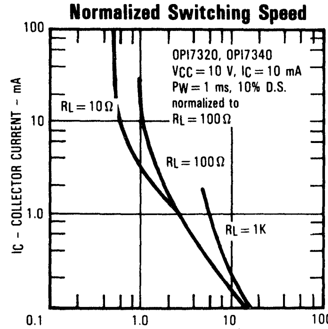
Diode Forward Current vs Diode Forward Voltage



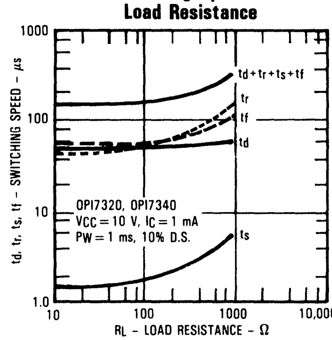
Collector Dark Current vs Ambient Temperature



Collector Current vs Normalized Switching Speed



Switching Speed vs Load Resistance



OPTICALLY COUPLED ISOLATORS

OPTEK TECHNOLOGY, INC.

EMITTER AND PHOTOSENSOR CHIPS

Emitter and Photosensor Chips

OPTEK

Optek Technology, Inc. is widely recognized as one of the industry's leading suppliers of high quality gallium arsenide (GaAs) and gallium aluminum arsenide (GaAlAs) infrared emitter chips and silicon photosensor chips. In hybrid or other applications, where space forbids use of a discrete optoelectronics component, direct placement of emitter and/or sensor chips may be the best alternative. With over twenty years experience, Optek is the technological leader in the design and fabrication of optoelectronic semiconductor chips.

Emitter and sensor chips are manufactured in the closely controlled clean rooms of our headquarters located in Carrollton, Texas. The building was designed and built specifically for the purpose of being used as a semiconductor fabrication facility.

Emitter Chips Material Fabrication

Two basic types of infrared emitting diode chips are offered by Optek: GaAs or GaAlAs. In the early 1970's, Optron (today known as Optek) pioneered in the development of solution grown epitaxial GaAs IRED's.

Emitter Chip Selection

GaAs is often chosen for its lower rate of output degradation over time. Throughout their operating lives, crystalline degradation occurs in all III-IV compounds (e.g., GaAs) as micro-flaws propagate due to the combined effects of current and temperature change. Optical efficiency is lowered; hence overall infrared power output drops with time. Heat sinking and careful limiting of operating currents, of course, can have a dramatic effect on the life of the chip. GaAlAs is usually the material of choice when the decision centers upon device efficiency and spectral matching.

The metallization area and chip size are important factors in the IRED output capability. Optek offers smaller chips with smaller metallization areas for low current applications. Typically operated in the range of 10-20 mA, many of these devices may be designed with applications demanding up to 100 mA of forward current. The larger chips with bonding areas designed for high current may be operated at up to five amperes in the pulse mode.

Photosensor Chip Selection

The basic phototransistor consists of three regions (NPN) with the base (P-type material) acting as receiver of the infrared energy (Figure 2). As such, the bulk of the surface area consists of the base diffusion region to optimize optical collection efficiency. In some chips, the base may also be bonded and electrically biased in order to improve device speed and/or sensitivity. In addition, these products may also be used as PN photodiodes by connecting only the base and collector.

Photodarlington chips are, as expected, more complex than the basic phototransistor. Again, the base region for the photosensitive transistor is designed to be as large as possible to maximize the photosensitive area.

A variety of factors must be considered when choosing the correct chip.

1) **Responsivity:** Photodiodes, particularly PIN structures, offer the highest levels of responsivity in the near infrared wavelengths due to their thicker depletion regions.

2) **Sensitivity:** The current gain available in photodarlingtons and phototransistors produce a sensitivity advantage over photodiodes. Photologic™ chips are available in two levels of radiant power threshold.

3) **Speed:** Due to a lower capacitance and the ability to eliminate the Miller effect associated with the transistor current gain, photodiodes offer superior frequency response. Photologic™ chips perform to 250 kbps.

4) **Package Integration/Volume:** Photologic™ is the choice where package volume is the key factor, combining the functions of several chips into one.

5) **Ease of Logic Interfacing:** With four options on output logic and levels, a Photologic™ chip is the choice.

Chip Mounting and Bonding Recommendations

Two basic mounting (alloy) methods are recommended for the chip products described herein: eutectic and epoxy. Eutectic scrub mounting is most often used with a metal header type of packaging. Solder preforms are required and are commonly available for this type of work. Conductive epoxy (silver based) is generally used when mounting the chip in a silver plated lead frame. Again, these epoxies are commonly available from a variety of suppliers. Mounting to a hybrid ceramic substrate may be accomplished by either of the above methods.

Thermo-compression bonding (ball bonding) is the recommended method of IRED wire bonding. Caution is urged to avoid damage to the delicate chip structure (particularly with GaAs and GaAlAs). The possibility of chip damage should be carefully considered before using ultrasonic, thermo-sonic or other methods. Optek only recommends the use of carefully monitored thermo-compression bonding for gold wire attachment to the metallization area of its IRED chips.

With standard aluminum metallization or all sensor chips, a variety of bonding techniques may be successfully utilized on sensors.

Chip Packaging

Optek offers three standard methods of packaging chips, in Vials, Tape Pack and Waffle Pack.

Vial - This type of packaging is offered for most chips, (very large chips and Photologic-chips are not available in vial packs due to potential damage in shipping). The slice is tested, sawed, sorted, and weigh counted into vials.

Tape Pack - A tested slice is mounted on Nitto tape and sawed. This is the least expensive of the three methods

Waffle Pack - A slice is tested, sawed on tape and loaded into waffle trays. This is the most expensive of the three methods.

Optek Hybrid Capability

In many cases, an application demands the use of a hybrid circuit, yet in-house engineering resources and equipment may not be available. Having the chips is only a part of the solution. The investment required to develop the complete hybrid in-house may be unrealistic for many customers.

Optek has a state-of-the-art hybrid facility that may be able to meet your specific needs. Specializing in the automated design and fabrication of complex opto custom hybrid circuits, Optek engineers can solve your most demanding application problems. Many satisfied customers have found that the cost of letting Optek do the entire circuit is often less than the "in-house" approach.

Optek, long known as the leader in custom opto assemblies, is now a leader in opto hybrid design and production. For more information, contact your local Optek sales office.

Figure 1. IRED Chip Fabrication

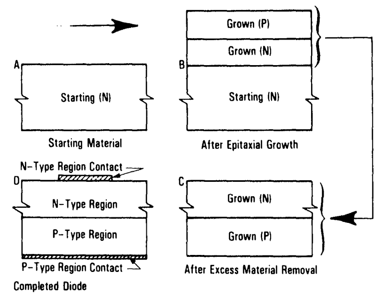
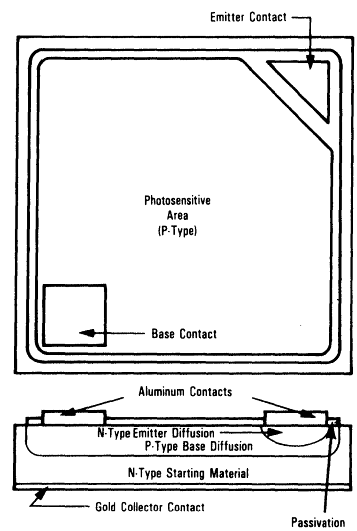


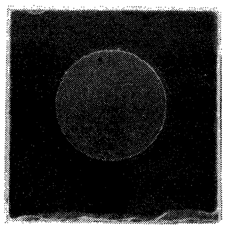
Figure 2. Typical Phototransistor Layout

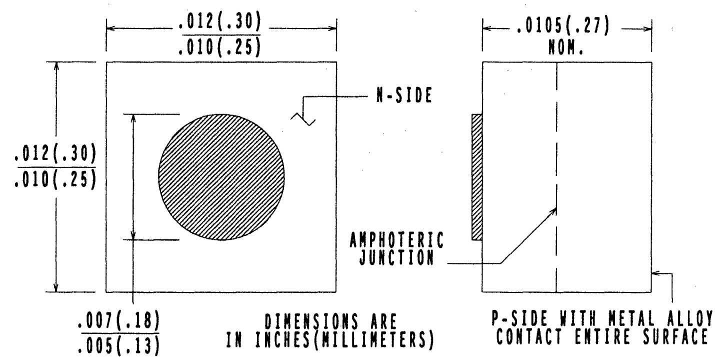


EMITTER & PHOTOSENSOR CHIPS

OPTEK

GaAs Infrared Emitter Chip
Type OPC126





Features

- High infrared radiation output
- Low degradation
- Microalloyed gold contacts

Description

Infrared emitting diode chips are fabricated by solution epitaxial techniques which provide high efficiency, long operating life, and minimum degradation. Spectral emission is centered at 935 nanometers.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC126	Vials
OPC126TP	Sawn on Tape
OPC126WP	Waffle Pack

Replaces

OPC125

Absolute Maximum Ratings (1)(T_A = 25°C unless otherwise noted)

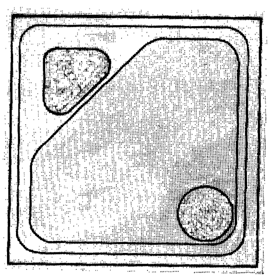
Storage and Operating Temperature . . . . -55°C to +150°C
Forward DC Current . . . . 150mA(2)
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Power Dissipation 200mW

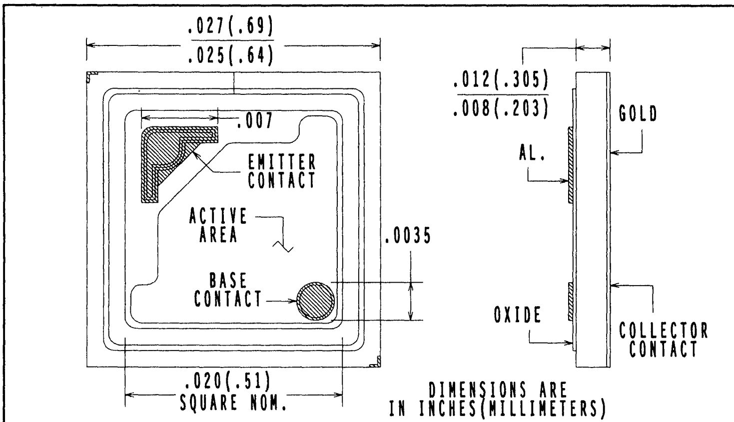
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_R	Reverse Voltage	2.0			V	I_R = 10µA
V_F	Forward Voltage			1.75	V	I_F = 100mA
P_O	Radiant Power Output	2.0	4.5		mW	I_F = 100mA

Notes: (1) All maximum ratings are determined with the chip mounted on a dimple TO-46 header using Optek techniques. (2) Maximum operating current is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Typical wavelength at peak emission is 935 nm.

NPN Silicon Phototransistor Chip
Type OPC200





Features

- Active area centered on chip
- Low Cost
- Silicon nitride passivation

Description

Optek Technology photosensor chips are fabricated using the latest silicon planar diffused technology and are silicon nitride passivated for long term stability. All photosensors have an anti-reflective coating over the active area to ensure maximum absorption of irradiated light. Chips can be specially probed for custom requirements.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Package Options

OPC200VP Vials
OPC200TP Sawn on Tape
OPC200WP Waffle Pack
OPC200SP Unsawn Slice
Special packaging and testing available upon request. Special transistor arrays available upon request.

Replaces

OPC600L

Absolute Maximum Ratings (1)(T_A = 25°C unless otherwise noted)

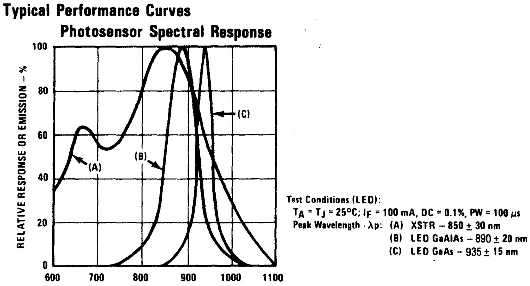
Operating Temperature .... -40°C to +85°C
Storage Temperature .... -65°C to +150°C
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 50mW(2)

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30	60		V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0	7.5		V	I_E = 100μA
I_{CEO}	Collector Dark Current		<1	100	nA	V_{CE} = 10.0V, Φ = 0
R_λ	Responsivity		0.25		A/W	V_{CE}=5.0V,Φ=10μW(3)
h_{FE}	Current Gain	100				V_{CE} = 5.0V,I_C =1.0mA

Notes: (1) All maximum ratings are determined with the chip mounted on a dimpled TO-18 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, λ_P = 935nm, typical.

Typical Performance Curves

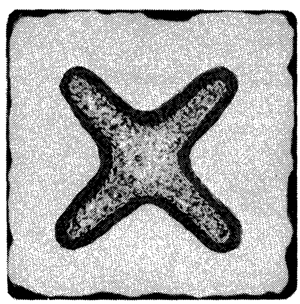


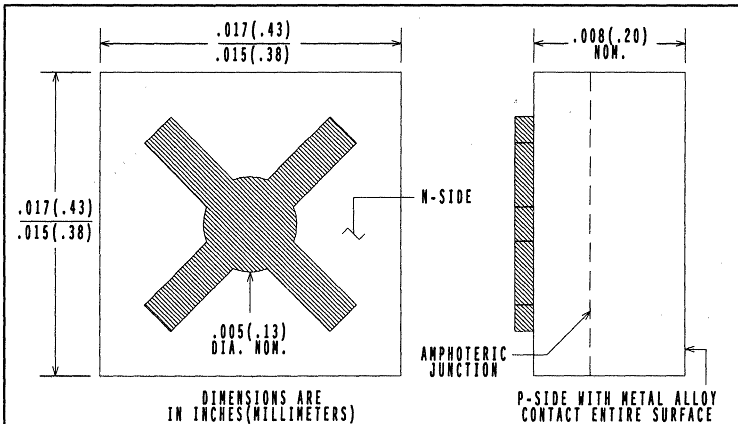
EMITTER & PHOTOSENSOR CHIPS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

GaAlAs Infrared Emitter Chip
Type OPC216





Features

- High infrared radiation output
- Low degradation
- Microalloyed gold contacts

Description

Infrared emitting diode chips are fabricated by solution epitaxial techniques which provide high efficiency, long operating life, and minimum degradation. Spectral emission is centered at 890 nanometers.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC216	Vials
OPC216TP	Sawn on Tape
OPC216WP	Waffle Pack

Absolute Maximum Ratings (1)(T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -55°C to +150°C
Forward DC Current .... 150mA(2)
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Power Dissipation 200mW

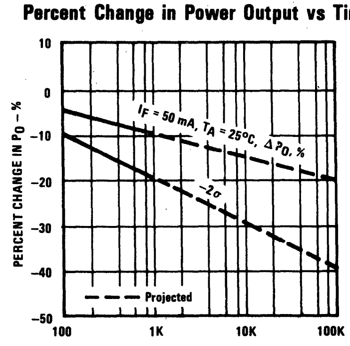
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_R	Reverse Voltage	2.0			V	I_R = 10µA
V_F	Forward Voltage			1.95	V	I_F = 100mA
P_O	Radiant Power Output	4.0	7.5		mW	I_F = 100mA(3)

Notes: (1) All maximum ratings are determined with the chip mounted on a dimpled TO-46 header using Optek techniques. (2) Maximum operating current is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Typical wavelength at peak emission is 890 nm.

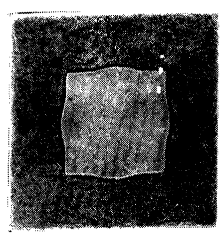
Typical Performance Curves

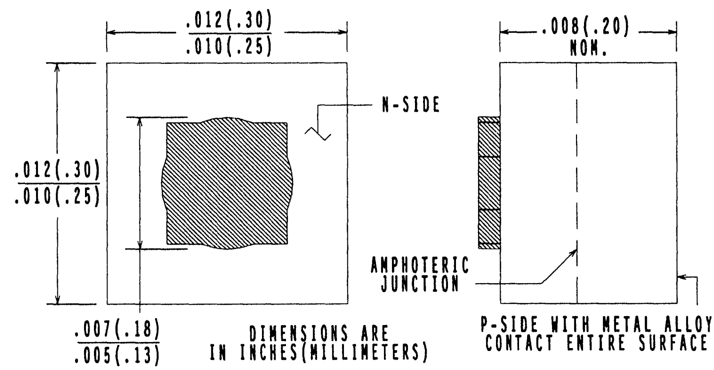
Percent Change in Power Output vs Time



OPTEK

GaAlAs Infrared Emitter Chip
Type OPC226





Features

- High infrared radiation output
- Low degradation
- Microalloyed gold contacts

Description

Infrared emitting diode chips are fabricated by solution epitaxial techniques which provide high efficiency, long operating life, and minimum degradation. Spectral emission is centered at 890 nanometers.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC226	Vials
OPC226TP	Sawn on Tape
OPC226WP	Waffle Pack

Replaces

OPC225

Absolute Maximum Ratings (1)(T_A = 25°C unless otherwise noted)

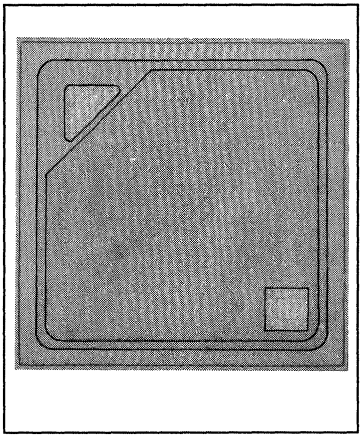
Storage and Operating Temperature .... -55°C to +150°C
Forward DC Current .... 150mA(2)
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Power Dissipation 200mW

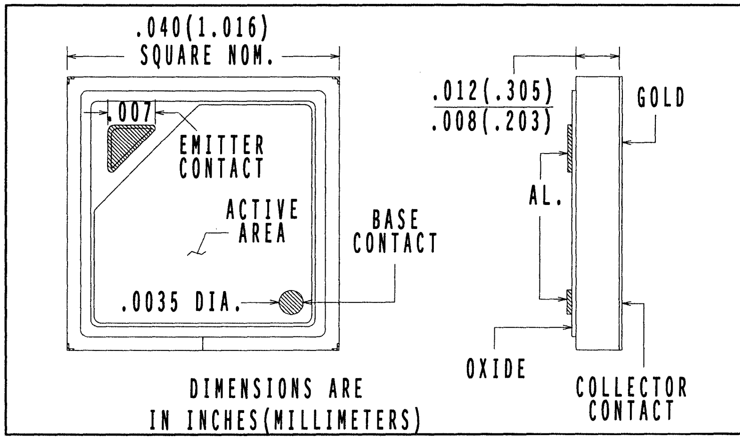
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_R	Reverse Voltage	2.0			V	I_R = 10µA
V_F	Forward Voltage			1.95	V	I_F = 100mA
P_O	Radiant Power Output	4.0	7.5		mW	I_F = 100mA(3)

Notes: (1) All maximum ratings are determined with the chip mounted on a dimpled TO-46 header using Optek techniques. (2) Maximum operating current is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Typical wavelength at peak emission is 890 nm.

NPN Silicon Phototransistor Chip
Type OPC260





Features

- 2.7 times the active area of OPC200
- More sensitive at low light levels
- Active area centered on chip

Description

Optek Technology photosensor chips are fabricated using the latest silicon planar diffused technology and are silicon nitride passivated for long term stability. All photosensors have an anti-reflective coating over the active area to ensure maximum absorption of irradiated light. Chips can be specially probed for custom requirements.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC260VP	Vials
OPC260TP	Sawn on Tape
OPC260WP	Waffle Pack
OPC260SP	Unsawn Slice

Special packaging and testing available upon request. Special transistor arrays available upon request

Replaces

OPC60X

Absolute Maximum Ratings [1](T_A = 25°C unless otherwise noted)

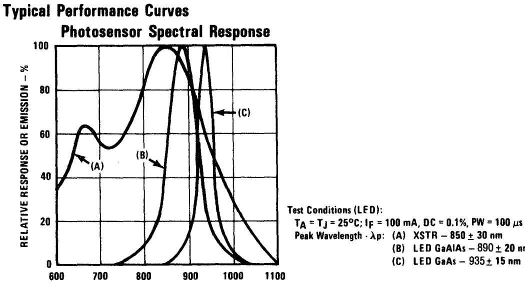
Operating Temperature .... -40°C to +85°C
Storage Temperature .... -65°C to +150°C
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 50mW[2]

Electrical Characteristics (T_A = 25°C unless otherwise noted)

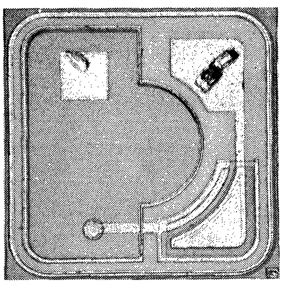
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30	60		V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0	7.5		V	$I_E = 100\mu A$
I_{CEO}	Collector Dark Current		<1	100	nA	$V_{CE} = 10.0V$, $\Phi=0\mu W$
R_λ	Responsivity		0.25		A/W	$V_{CE}=5.0V$, $\Phi=10\mu W$[3]
h_{FE}	Current Gain	50				$V_{CE} = 5.0V$, $I_C = 1mA$

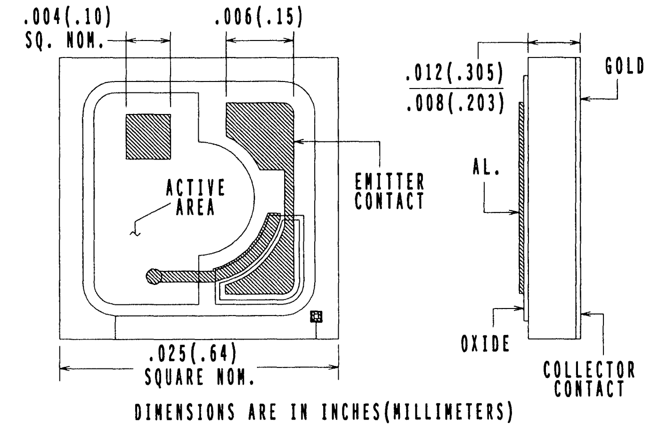
Notes: (1) All maximum ratings are determined with the chip mounted on a dimpled TO-18 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, λ_P = 935nm, typical.

Typical Performance Curves



NPN Silicon Photodarlington Chip
Type OPC300R





Features

- High Collector Current
- Improved current sinking characteristics
- Silicon nitride passivation
- Enhanced low current gain

Description

Optek Technology photosensor chips are fabricated using the latest silicon planar diffused technology and are silicon nitride passivated for long term stability. All photosensors have an anti-reflective coating over the active area to ensure maximum absorption of irradiated light. Bond pads are oxide passivated to protect against mechanical damage.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC300RVP Vials
OPC300RTP Sawn on Tape
OPC300RWP Waffle Pack
OPC300RSP Unsawn Slice
Special packaging and testing available upon request.

Absolute Maximum Ratings (1) (T_A = 25°C unless otherwise noted)

Operating Temperature .... -40°C to +85°C
Storage Temperature .... -65°C to +150°C
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 50mW(2)

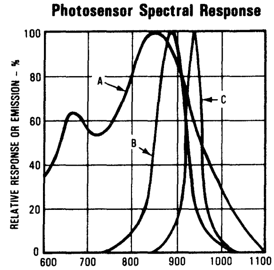
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30	60		V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0	12.5		V	I_E = 100μA
I_{CEO}	Collector Dark Current		<10	100	nA	V_{CE}=10.0V, Φ=0μW
R_λ	Responsivity		0.2		A/W	Φ=10μW(3)
h_{FE}	Current Gain	3K				V_{CE}=5.0V, Ib =1.0μA

Notes: (1) All maximum ratings are determined with the chip mounted on a dimpled TO-18 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, λ_P = 935nm, typical.

Typical Performance Curves

Photosensor Spectral Response



Test Conditions (LED):
$T_A = T_J$ = 25°C, I_F = 100 mA, DC = 0.1%, PW = 100 μs
Peak Wavelength – λ_p: (A) XSTR – 850±30 nm
(B) LED GaAlAs – 890 ±20 nm
(C) LED GaAs – 935±15 nm

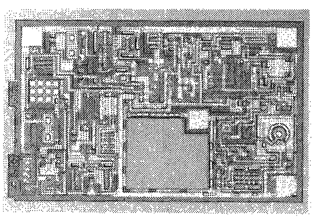
EMITTER & PHOTOSENSOR CHIPS

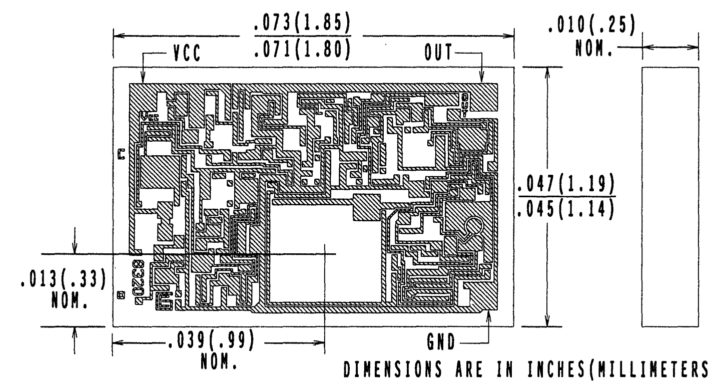
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPC8320
June 1993

OPTEK

Photologic™ Chips
Types OPC8320, OPC8321, OPC8322, OPC8323





Features

- Internal voltage regulator for 4.5V to 18V operation
- Open collector or totem-pole output
- Drive up to 10 TTL loads
- Data rates to 250 kBaud

Description

The OPC8320 family of photologic chips are bipolar monolithic integrated circuits consisting of a photodiode, a voltage regulator, a linear amplifier, and a Schmitt trigger on a single silicon chip. Four output options are available, buffer-totem pole (OPC8320), buffer-open collector (OPC8321), inverter-open collector (OPC8322), and inverter- totem pole (OPC8323). Featured is logic level output and up to 16mA of sink current for direct driving up to 10 TTL loads. The Schmitt trigger provides hysteresis for high noise immunity.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options for 8320 Series

OPCXXXXTP Sawn on Tape
OPCXXXXWP Waffle Pack
OPCXXXXSP Unsawn Slice
Special packaging and testing available upon request. Call Optek for availability of other logic chips.

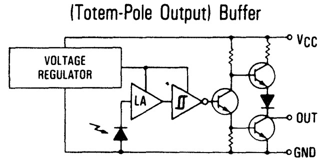
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Operating Temperature .... -40°C to +85°C
Storage Temperature .... -55°C to +125°C
Supply Voltage, V_{CC} 18V
Junction Temperature .... 125°C

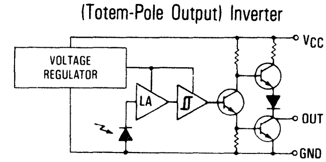
Notes: (1) Light level sufficient to cause high level output (see Φ_{T+}). Light source is a GaAs LED, λ_P = 935nm. (2) Light level sufficient to cause low level output (see Φ_{T-}). Light source is a GaAs LED, λ_P = 935nm, typical.

Schematics

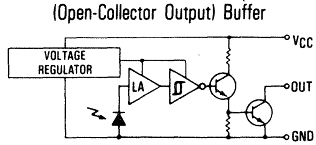
OPC8320
(Totem-Pole Output) Buffer



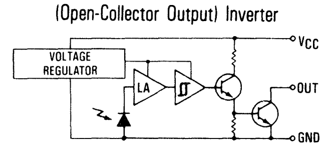
OPC8323
(Totem-Pole Output) Inverter



OPC8321
(Open-Collector Output) Buffer



OPC8322
(Open-Collector Output) Inverter



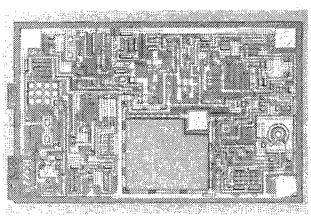
Types OPC8320, OPC8321, OPC8322, OPC8323

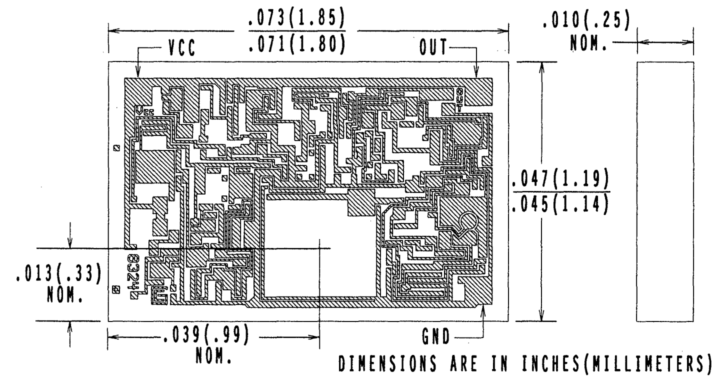
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITIONS
OPC8320 (Buffer-Totem Pole)						
I_{CCH}	High Level Supply Current		8.0	10	mA	V_{CC} = 18V, Φ = 8µW
V_{OH}	High Level Output Voltage	15.5	16.5		V	V_{CC} = 18V, I_{OH} = -1.0mA, Φ = 8µW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5V, I_{OL} = 16mA, Φ = 0µW
Φ_{T+}	Incident Radiant Power Threshold(1)	0.5	1.5	3	µW	V_{CC} = 5.0V
Φ_{T+}/Φ_{T-}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V
OPC8321 (Buffer-Open Collector)						
I_{CCH}	High Level Supply Current		8.0	10	mA	V_{CC} = 18V, Φ = 8µW
I_{OH}	High Level Output Current		<1	100	µA	V_{CC} = 18V, V_{OH} = 32V, Φ = 8µW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5, I_{OL} = 16mA, Φ = 0µW
Φ_{T+}	Incident Radiant Power Threshold(1)	0.5	1.5	3	µW	V_{CC} = 5.0V
Φ_{T+}/Φ_{T-}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V
OPC8322 (Inverter-Open Collector)						
I_{CCL}	Low Level Supply Current		8	10	mA	V_{CC} = 18V, Φ = 0µW
I_{OH}	High Level Output Current		<1	15	µA	V_{CC} = 18V, V_{OH} = 32V, Φ = 0µW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5, I_{OL} = 16mA, Φ = 8µW
Φ_{T-}	Incident Radiant Power Threshold(2)	0.5	1.5	3	µW	V_{CC} = 5.0V
Φ_{T-}/Φ_{T+}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V
OPC8323 (Inverter-Totem Pole)						
I_{CCH}	High Level Supply Current		8.0	10	mA	V_{CC} = 18V, Φ = 0µW
V_{OH}	High Level Output Voltage	15.5	16.5		V	V_{CC} = 18, I_{OH} = -1.0mA, Φ = 0µW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5, I_{OH} = 16mA, Φ = 8µW
Φ_{T-}	Incident Radiant Power Threshold(2)	0.5	1.5	3	µW	V_{CC} = 5.0V
Φ_{T-}/Φ_{T+}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V

OPTEK

Photologic™ Chips
Types OPC8324, OPC8325, OPC8326, OPC8327





Features

- Internal voltage regulator for 4.5V to 18V operation
- Open collector or totem-pole output
- Drive up to 10 TTL loads
- Data rates to 250 kBaud
- High sensitivity

Description

The OPC8324 family of photologic chips are bipolar monolithic integrated circuits consisting of a photodiode, a voltage regulator, a linear amplifier, and a Schmitt trigger on a single silicon chip. Four output options are available, buffer-totem pole (OPC8324), buffer-open collector (OPC8325), inverter-open collector (OPC8326), and inverter- totem pole (OPC8327). The OPC8324 family features significantly lower thresholds than the companion OPC8320 family.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options for 8324 Series

OPC8XXXTP Sawn on Tape
OPC8XXXWP Waffle Pack
OPC8XXXSP Unsawn Slice
Special packaging and testing available upon request. Call Optek for availability of other logic chips.

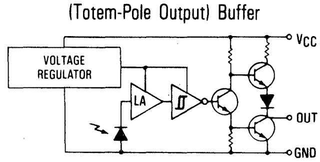
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +125°C
Supply Voltage, V_{CC}	18V
Junction Temperature	125°C

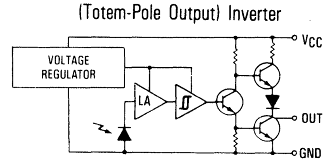
Notes: (1) Light level sufficient to cause high level output (see Φ_{T+}). Light source is a GaAs LED, λ_P = 935nm. (2) Light level sufficient to cause low level output (see Φ_{T-}). Light source is a GaAs LED, λ_P = 935nm, typical.

Schematics

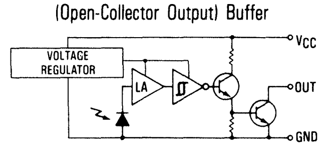
OPC8324
(Totem-Pole Output) Buffer



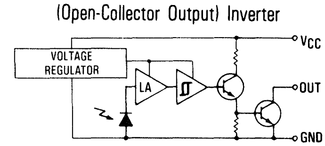
OPC8327
(Totem-Pole Output) Inverter



OPC8325
(Open-Collector Output) Buffer



OPC8326
(Open-Collector Output) Inverter



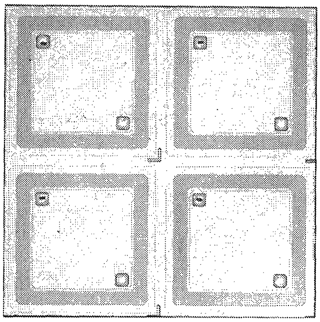
Types OPC8324, OPC8325, OPC8326, OPC8327

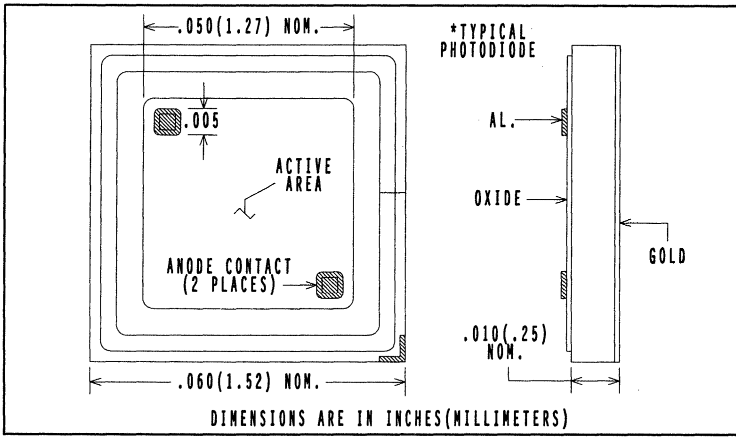
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITIONS
OPC8324 (Buffer-Totem Pole)						
I_{CCH}	High Level Supply Current		8.0	10	mA	V_{CC} = 18V, Φ = 8μW
V_{OH}	High Level Output Voltage	15.5	16.5		V	V_{CC} = 18V, I_{OH} = -1.0mA, Φ = 8μW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5V, I_{OL} = 16mA, Φ = 0μW
Φ_{T+}	Incident Radiant Power Threshold(1)	0.1	0.7	1.5	μW	V_{CC} = 5.0V
Φ_{T+}/Φ_{T-}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V
OPC8325 (Buffer-Open Collector)						
I_{CCH}	High Level Supply Current		8.0	10	mA	V_{CC} = 18V, Φ = 8μW
I_{OH}	High Level Output Current		<1	100	μA	V_{CC} = 18V, V_{OH} = 32V, Φ = 8μW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5, I_{OL} = 16mA, Φ = 0μW
Φ_{T+}	Incident Radiant Power Threshold(1)	0.1	0.7	1.5	μW	V_{CC} = 5.0V
Φ_{T+}/Φ_{T-}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V
OPC8326 (Inverter-Open Collector)						
I_{CCL}	Low Level Supply Current		8	10	mA	V_{CC} = 18V, Φ = 0μW
I_{OH}	High Level Output Current		<1	15	μA	V_{CC} = 18V, V_{OH} = 32V, Φ = 0μW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5, I_{OL} = 16mA, Φ = 8μW
Φ_{T-}	Incident Radiant Power Threshold(2)	0.1	0.7	1.5	μW	V_{CC} = 5.0V
Φ_{T-}/Φ_{T+}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V
OPC8327 (Inverter-Totem Pole)						
I_{CCH}	High Level Supply Current		8.0	10	mA	V_{CC} = 18V, Φ = 0μW
V_{OH}	High Level Output Voltage	15.5	16.5		V	V_{CC} = 18, I_{OH} = -1.0mA, Φ = 0μW
V_{OL}	Low Level Output Voltage		280	400	mV	V_{CC} = 4.5, I_{OH} = 16mA, Φ = 8μW
Φ_{T-}	Incident Radiant Power Threshold(2)	0.1	0.7	1.5	μW	V_{CC} = 5.0V
Φ_{T-}/Φ_{T+}	Hysteresis	1.1	1.5	2		V_{CC} = 5.0V

Product Bulletin OPC911
June 1993

PN Photodiodes
Type OPC9XXX





Features

- PN photodiode elements
- Silicon nitride passivation anti-reflective coating

Description

Multi-element arrays are recommended for a variety of motion sensing and control applications ranging from encoding to quadrant sensing. Optek's photodiodes may be operated from zero bias (photovoltaic) up to the diode's reverse breakdown voltage.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC9XXXTP Sawn on Tape
OPC9XXXWP Waffle Pack
OPC9XXXSP Unsawn Slice
Special packaging and testing available upon request.

Absolute Maximum Ratings(1) (T_A = 25°C unless otherwise noted)

Operating Temperature .... -40°C to +85°C
Storage Temperature .... -65°C to +150°C
Reverse Breakdown Voltage 30V
Power Dissipation .... 150mW(2)

Electrical Characteristics Per Element (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{(BR)R}$	Reverse Breakdown Voltage	30	80		V	I_R = 100μA
I_D	Reverse Dark Current		<1	15	nA	V_R = 10V
R_λ	Responsivity	0.45	0.50		A/W	Φ = 10μW(3)
C_T	Capacitance per sq. mil		0.03		pF	V_R =1V, Φ = 0μW

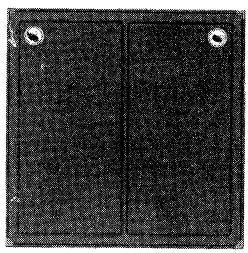
Notes: (1) All maximum ratings are determined with the chip mounted on a TO-15 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, λ_P = 935nm, typical.

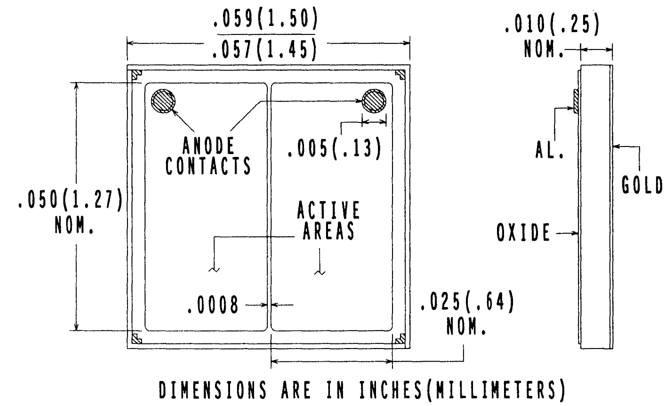
Photodiodes Available	
Part Number	**Sizes**
OPC910	0.050 X 0.050 inches
OPC911	0.060 X 0.060 inches (2 X 2 Array)
OPC915	0.120 X 0.120 inches
OPC925	0.040 X 0.040 inches
OPC9013	0.210 X 0.210 inches
Other sizes available	

Product Bulletin OPC922
June 1993

OPTEK

Dual Element Silicon PN Photodiode
Type OPC922





Features

- 25 mil x 50 mil PN photodiode elements
- Silicon nitride passivation
- Anti-reflective coating

Description

Dual photodiodes are useful in a variety of motion sensing and control applications ranging from encoding to position sensing. Optek's photodiodes may be operated from zero bias (photovoltaic) up to the diode's reverse breakdown voltage.

Optek chip warranty excludes any damage resulting from improper bonding or alloying techniques.

Packaging Options

OPC922TP Sawn on Tape
OPC922WP Waffle Pack
OPC922SP Unsawn Slice
Special packaging and testing available upon request.

Absolute Maximum Ratings(1) (T_A = 25°C unless otherwise noted)

Operating Temperature .... -40°C to +85°C
Storage Temperature .... -65°C to +120°C
Reverse Breakdown Voltage 40V
Power Dissipation .... 150mW(2)

Electrical Characteristics Per Element (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{(BR)R}$	Reverse Breakdown Voltage	40	70		V	I_R = 100μA
I_D	Reverse Dark Current		<1	10	nA	V_R = 15V
R_λ	Responsivity	0.35	0.5		A/W	Φ = 10μW, V_R=0V(3)
C_T	Capacitance		50		pF	V_R =01V, Φ = 0

Notes: (1) All maximum ratings are determined with the chip mounted on a TO-15 header using Optek techniques. (2) Maximum power dissipation is a function of the package in which the chip is housed and the environment in which the assembled package will be used. (3) Light source is a GaAs LED, λ_P = 935nm, typical.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK TECHNOLOGY, INC.

FIBER OPTIC COMPONENTS

FIBER OPTIC COMPONENTS

OPTEK

Features

LED coupled power 89 μW into 62.5 micron fiber.

Low capacitance, low leakage PIN photodiodes.

Components available pre-mounted and tested in receptacles.

Packages compatible with standard receptacles, SMA, ST*, and others.

Description

The Optek fiber optic components are optomized for use with multimode fiber optic cable at 850nm. The optical design provides good coupling with 50/125, 62.5/125, 100/140 and larger optical fibers. The mechanical design offers the user a choice between a hermetically sealed device, and a less expensive plastic cap component. LED's and PIN diodes are subjected to testing to eliminate infant mortality failures, and thus improve field reliability. Performances tests are accomplished with as near to actual use conditions as possible. Devices which are mounted in SMA or ST* style receptacles are easily mounted to printed circuit boards or panels.

LED Burn-in

All LED's are subjected to 100% burn-in testing. Test conditions are: 96 hours at 100mA, continuous current in 25° C ambient.

Why Use Fiber Optics

Electrical Isolation

EMI Immunity

Increased Bandwidth

Low Loss

Reduced Size, Weight

Secure Transmission

Lower Material Cost

Applications

System operating in high EMI or RFI ambients.

Explosive environments such as found in the petroleum/chemical processing or mining industries.

Optical coupling where high isolation voltage is required.

Secure communications.

Local area networks.

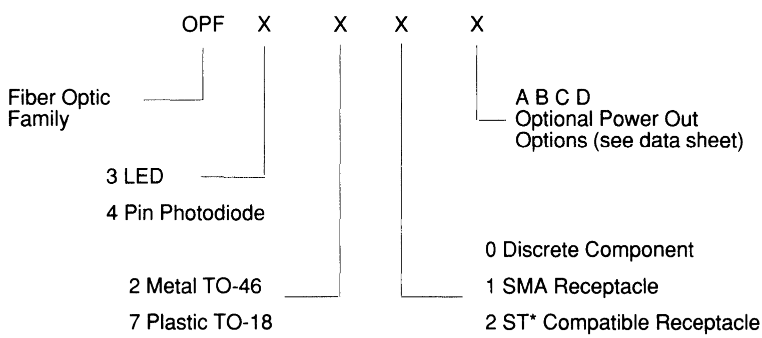
*ST is a registered trademark of AT&T

Part Number System

	Discrete Component	Mounted in SMA Receptacle	Mounted in ST* Compatible Receptacle
LED			
Metal Package	OPF320X	OPF321X	OPF322X
Plastic Package	OPF370X	OPF371X	OPF372X
PIN PHOTODIODE			
Metal Package	OPF420	OPF421	OPF422
Plastic Package	OPF470	OPF471	OPF472

Metal Package, TO-46 Hermetic Sealed

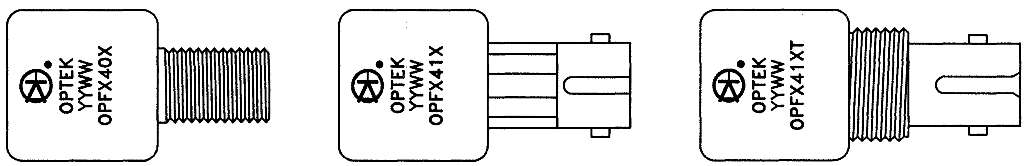
Plastic Package, TO-18



*ST is a registered trademark of AT&T

OPTEK

High Speed Fiber Optic Transmitter
Types OPF1402/1404 Series



Features
- Low Cost
- High Speed
- No Mounting Hardware Required
- Wide Temperature Range
- 100% LED Burn-In (96 hours)
- SMA or ST* Style Ports
- Wave Solderable

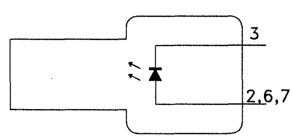
Description
The OPF14XX series fiber optic transmitters contain a high speed 840 nm GaAlAs LED. This LED in conjunction with the package lensing is designed to efficiently couple light into optical fibers ranging in size from 50/125 µm up to 200 µm PCS. These devices were designed to work together with the Optek OPF24XX series receivers to make-up a complete high speed fiber optic link.

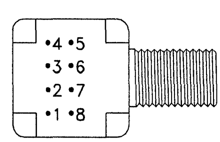
The high coupling efficiency of the LED and lensing allows the devices to be used at low current drive levels thus decreasing the power consumption and increasing system reliability. The consistency of coupling varies by less than 5 dB from part to part which reduces the dynamic range requirements of the receiver.

The high power (-16.5 dBm into 50/125 µm) OPF14X4 was designed for small fiber applications or where there are large fixed losses such as in systems that contain star couplers or in line connectors. The OPF14X2 (-11.5 dBm optical power) is ideal for 100/140 µm fiber applications.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)
Storage Temperature .... -55°C to +85°C
Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature .... 260°C(10 sec)
Forward Input Current .... Peak 200mA
.... DC 100mA
Reverse Input Voltage 1.8V





Bottom View

PIN	FUNCTION
1	N.C.
2	Anode
3	Cathode
4	N.C.
5	N.C.
6	Anode
7	Anode
8	N.C.

Available in Panel Mount ST package; add "T" suffix to part number.

This component is susceptible to damage from electrostatic discharge (ESD). Normal static precautions should be taken in handling and assembly of this component to prevent ESD damage or degradation.

Types OPF1402/1404 Series

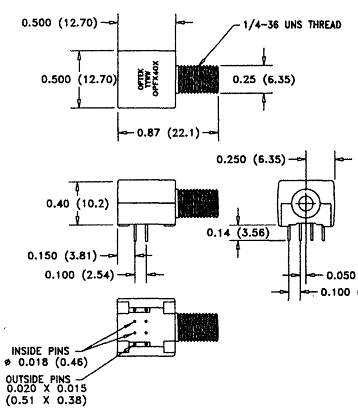
Electrical Characteristics (T_A = 25°C unless otherwise noted)

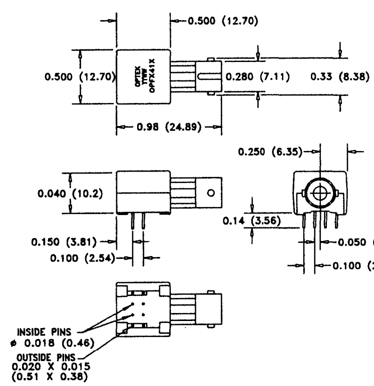
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITION
V_F	Forward Voltage	1.48	1.70	2.09	V	I_F = 60 mA, T_A = -40°C to +85°C
V_{BR}	Reverse Input Voltage	1.8	3.8		V	I_R = 100 µA, T_A = -40°C to +85°C
λ_P	Peak Emission Wavelength		840		nm	I_F = 60 mA

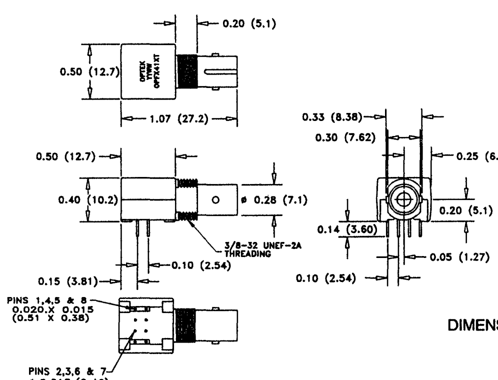
Peak Output Optical Power Measured Through 1 m of Cable

SYMBOL	PARAMETER	1412/1402			1414/1404			UNIT	TEST CONDITION
		MIN	TYP	MAX	MIN	TYP	MAX		
P_{T100}	100/140 µm Fiber Cable N.A. = 0.30	-15.0	-12.0	-9.5	-10.0	-6.5	-4.5	dBm	I_F = 60 mA
P_{T62}	62.5/125 µm Fiber Cable N.A. = 0.27	-19.0	-16.0	-14.0	-15.0	-12.0	-10.0	dBm	I_F = 60 mA
P_{T50}	50/125 µm Fiber Cable N.A. = 0.18	-21.8	-19.5	-16.8	-18.8	-16.5	-13.8	dBm	I_F = 60 mA
t_r, t_f	Rise Time, Fall Time (10% to 90%)		4.0	6.5		4.0	6.5	ns	I_F = 60 mA, No pre-bias

Mechanical Dimensions



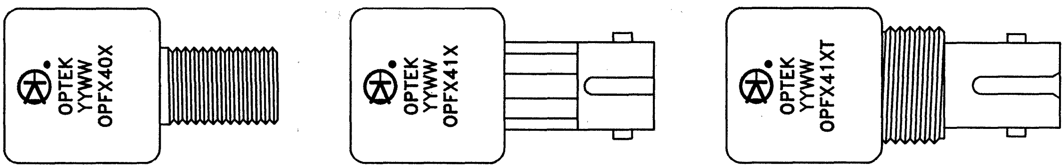




DIMENSIONS ARE IN INCHES (MILLIMETERS)

OPTEK

25 MHz Fiber Optic Receiver
Types OPF2404(SMA), OPF2414(ST*), OPF2414T



Features
- Low Cost
- No Mounting Hardware Required
- Wide Temperature Range
- Link Distances up to 4 KM
- SMA or ST* Style Ports
- Wave Solderable

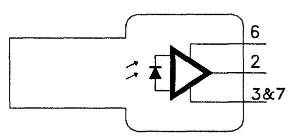
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)
Storage Temperature . . . . -55°C to +85°C
Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature (for 10 sec.) . . . . 260°C
Supply Voltage . . . . -0.5 to 7.0V

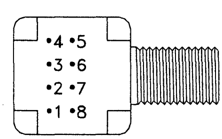
Description
The OPF2404/2414 is a low cost high speed fiber optic receiver. The OPF2404/2414 is ideal for fibers as small as 50/125 µm. The lensed optical system keeps the receiver's response consistent for all fiber sizes.

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

*ST is a registered trademark of AT&T.





Bottom View

PIN	FUNCTION
1	N.C.
2	Signal
3	Common
4	N.C.
5	N.C.
6	Vcc
7	Common
8	N.C.

Available in Panel Mount ST package; add "T" suffix to part number.

This component is susceptible to damage from electrostatic discharge (ESD). Normal static precautions should be taken in handling and assembly of this component to prevent ESD damage or degradation.

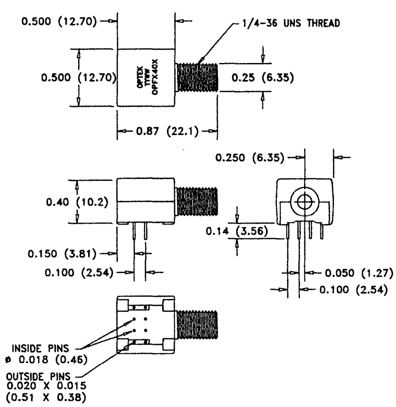
Types OPF2404(SMA), OPF2414(ST*), OPF2414T

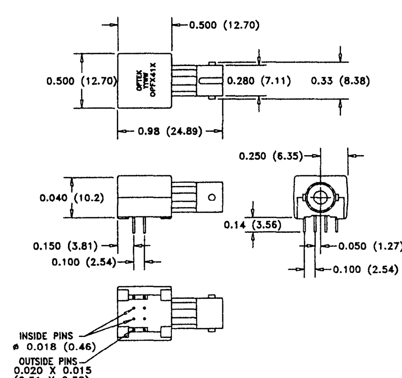
Electrical Characteristics (T_A = 25°C unless otherwise noted)

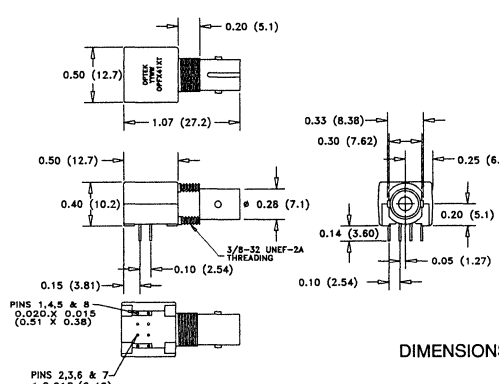
4.75 ≤ V_{CC} ≤ 5.25, R_{LOAD} = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITION
R_P	Responsivity	5.1	7	10.9	mV/µW	at 840 nm
		4.6		12.3	mV/µW	at 840 nm, -40°C ≤ T_A ≤ +85°C
V_{NO}	RMS Output Noise Voltage		.30	.36	mV	P_R = 0 µW
				.43	mV	P_R = 0 µW, -40°C ≤ T_A ≤ +85°C
P_N	Equivalent Optical Noise Input Power		-43.7	-40.3	dBm	
			.042	.094	µW	
P_R	Peak Input Power			-12.6	dBm	T_A = 25°C
				55	µW	T_A = 25°C
				-14	dBm	-40°C ≤ T_A ≤ +85°C
				40	µW	-40°C ≤ T_A ≤ +85°C
I_{CC}	Power Supply Current		3.4	6.0	mA	R_{LOAD} = ∞
t_r, t_f	Rise Time, Fall Time (10% to 90%)		14	19.5	ns	P_R = 10 µW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF
PWD	Pulse Width Distortion			2	ns	P_R = 40 µW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF

Mechanical Dimensions





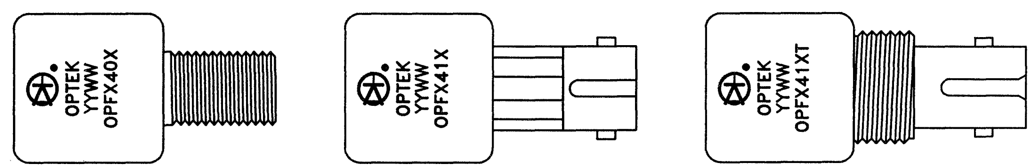


DIMENSIONS ARE IN INCHES (MILLIMETERS)

Product Bulletin OPF2406/2416
August 1994

OPTEK

125 MHz Fiber Optic Receiver
Types OPF2406(SMA), OPF2416(ST*), OPF2416T



Features
- Low Cost
- Data Rates up to 155 MBd
- Wide Temperature Range
- Link Distances up to 4 km
- SMA, ST, or Panel Mount ST Style Ports
- Wave Solderable

Description
The OPF2406/2416 is a low cost solution for high speed fiber optic communication designs. The lensing of the OPF24X6 optimizes response for fiber sizes of 100 µm and smaller.

The output of the receiver is an analog, low impedance, emitter follower voltage source capable of driving an amplifier or level translating circuitry. This allows the subsequent circuitry to use the device in either the analog mode or translated to ECL/TTL levels for use in a digital mode at data rates up to 155MBaud.

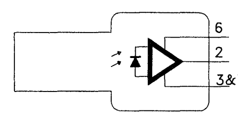
The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The amplification of the transimpedance amplifier makes the output signal much less susceptible to EMI.

An AC coupled receiver application circuit is shown. Both the 10 ohm resistor and by-pass capacitor are critical.

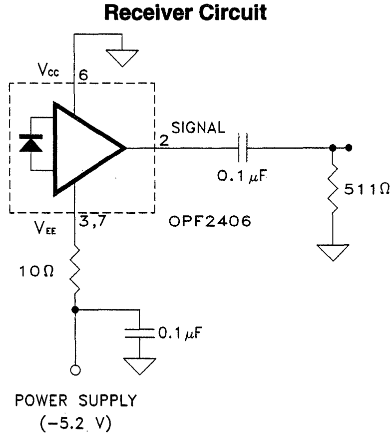
*ST is a registered trademark of AT&T.

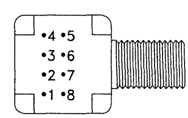
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature	-55°C to +85°C
Operating Temperature	-40°C to +85°C
Lead Soldering Temperature (for 10 sec.)	260°C
Signal Pin Voltage	-0.5V_{CC}
Supply Voltage	-0.5 to 6.0V
Output Current	25mA



Recommended AC Coupled Receiver Circuit





Bottom View

PIN	FUNCTION
1	N.C.
2	Signal
3	V_{EE}
4	N.C.
5	N.C.
6	V_{CC}
7	V_{EE}
8	N.C.

Available in Panel Mount ST package; add "T" suffix to part number.

This component is susceptible to damage from electrostatic discharge (ESD). Normal static precautions should be taken in handling and assembly of this component to prevent ESD damage or degradation.

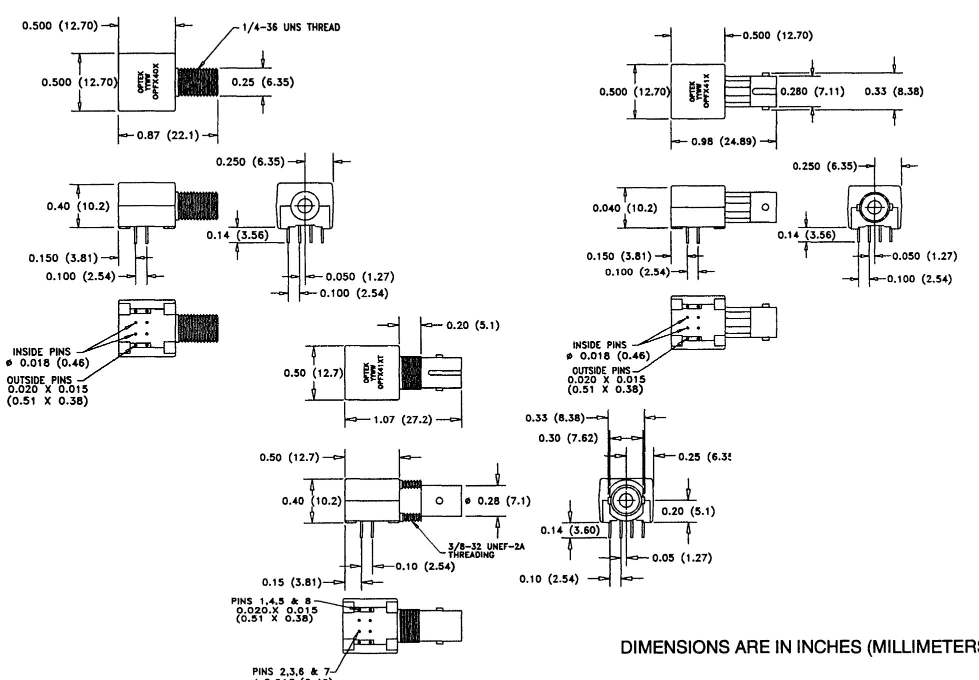
Types OPF2406(SMA), OPF2416(ST), OPF2416T

Electrical Characteristics ($T_A = 25^o$ C unless otherwise noted)

-5.45 ≤ Supply Voltage ≤ -4.75, R_{LOAD} = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITION
R_P	Responsivity	5.3	7	9.6	mV/µW	at 840 nm, 50 MHz
		4.5		11.5	mV/µW	at 840 nm, 50 MHz $-40^o C \le T_A \le +85^o$ C
V_{NO}	RMS Output Noise Voltage		0.40	0.59	mV	Bandwidth Filtered @ 75 MHz, P_R = 0 µW
				0.7	mV	Unfiltered Bandwidth P_R = 0 µW
P_N	Equivalent Optical Noise Input Power (RMS)		-43.0	-41.4	dBm	Bandwidth Filtered @ 75 MHz
			0.050	0.065	µW	
P_R	Peak Input Power			-7.6	dBm	$T_A = 25^o$ C
				175	µW	$T_A = 25^o$ C
				-8.2	dBm	$-40^o C \le T_A \le +85^o$ C
				150	µW	$-40^o C \le T_A \le +85^o$ C
V_{odc}	DC Output Voltage	-4.2	-3.1	-2.4	V	P_R = 0 µW
I_{EE}	Power Supply Current		9	15	mA	$R_{LOAD} = \infty$
t_r, t_f	Rise Time, Fall Time (10% to 90%)		3.3	6.3	ns	P_R = 100 µW, R_{LOAD} = 511 Ω, C_{LOAD} = 5 pF
PWD	Pulse Width Distortion		0.4	2.5	ns	P_R = 150 µW Peak, Pwidth = 10 ns, 50% Duty Cycle
BW	Bandwidth		125		MHz	-3 dB Electrical
PSRR	Power Supply Rejection Ratio		20		dB	@ 10 MHz

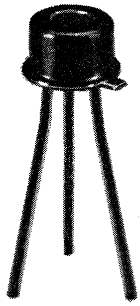
Mechanical Dimensions

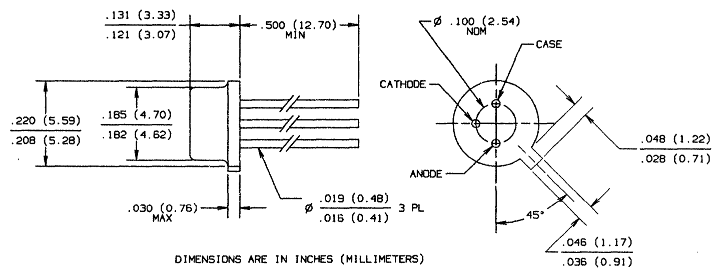


DIMENSIONS ARE IN INCHES (MILLIMETERS)

OPTEK

Fiber Optic GaAlAs LED
Types OPF320A, OPF320B, OPF320C





Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case

Description

The OPF320 series LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted hermetic package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . . 100mA(4)
Storage Temperature Range . . . . . -55°C to +150°C
Operating Temperature Range . . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C					
Fiber	**Refractive Index**	**N.A.**	**OPF320C**	**OPF320B**	**OPF320A**
50/125μm	Graded	0.20	7.5μW	12.5μW	19μW
62.5/125μm	Graded	0.28	16μW	22μW	34μW
100/140μm	Graded	0.29	38μW	62μW	95μW
200/300μm*	Step	0.41	140μW	235μW	360μW

*PCS - Plastic Clad Silica

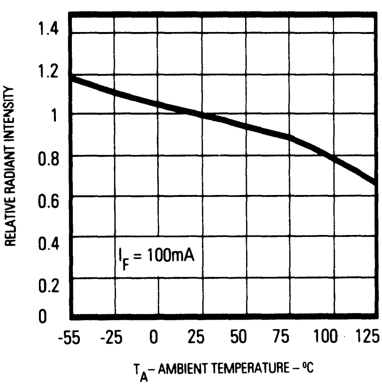
Types OPF320A, OPF320B, OPF320C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

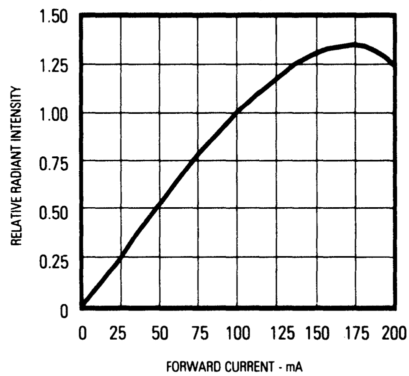
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF320C	5.0	7.5			
		OPF320B	10.0	12.5		µW	I_F = 100 mA(2)
		OPF320A	15.0	19.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50 mA
t_r	Output Rise Time			6.0	8.0	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time			6.0	10.0	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

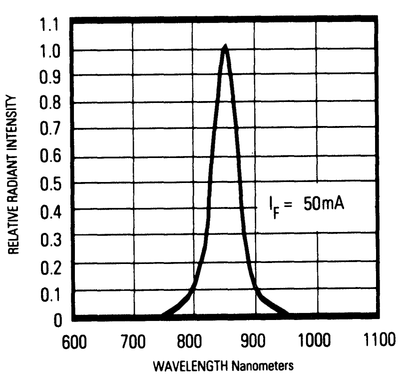
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



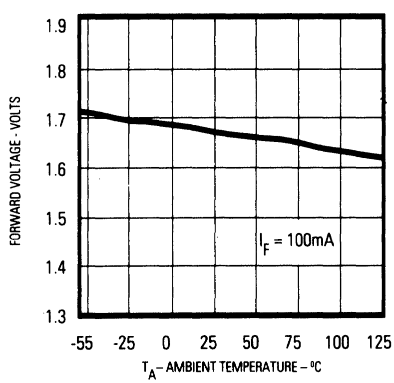
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

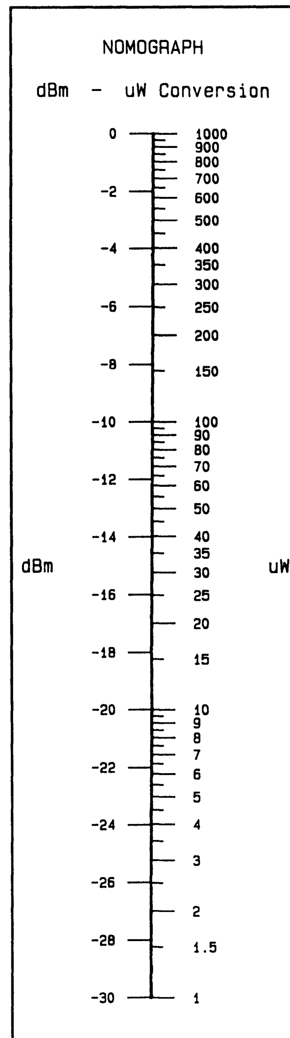


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

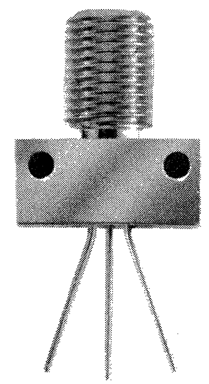


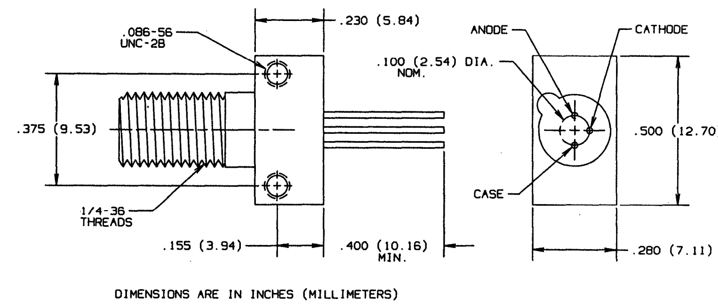


FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Fiber Optic GaAlAs LED in SMA Receptacle
Types OPF321A, OPF321B, OPF321C





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

Description

The OPF321 series LED consists of a hermetic LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +125°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Pre Bias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100 mA continuous current in 25° C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C					
Fiber	**Refractive Index**	**N.A.**	**OPF321C**	**OPF321B**	**OPF321A**
50/125µm	Graded	0.20	7.5µW	12.5µW	19µW
62.5/125µm	Graded	0.28	16µW	22µW	34µW
100/140µm	Graded	0.29	38µW	62µW	95µW
200/300µm*	Step	0.41	140µW	235µW	360µW

*PCS - Plastic Clad Silica

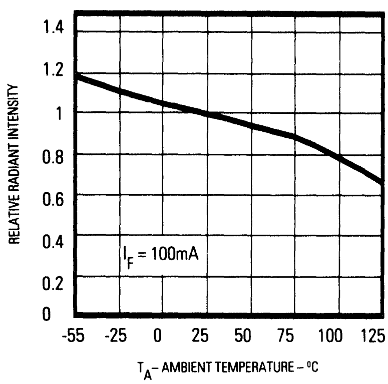
Types OPF321A, OPF321B, OPF321C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

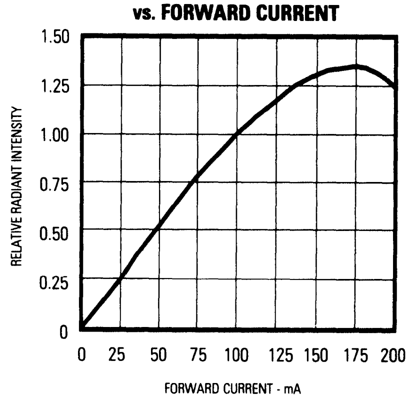
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF321C	5.0	7.5			
		OPF321B	10.0	12.5		µW	I_F = 100 mA[(2)]
		OPF321A	15.0	19.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50 mA
t_r	Output Rise Time			6.0	8.0	ns	I_F = 100 mA, 10%-90%[(5)]
t_f	Output Fall Time			6.0	10.0	ns	I_F = 100 mA, 90%-10%[(5)]

TYPICAL PERFORMANCE CURVES

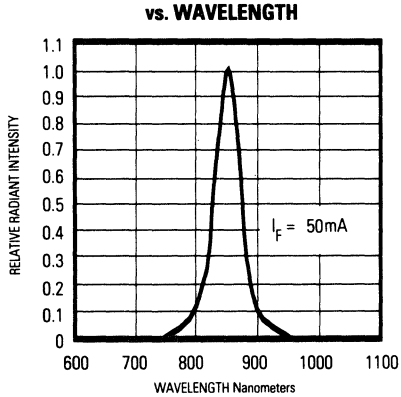
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



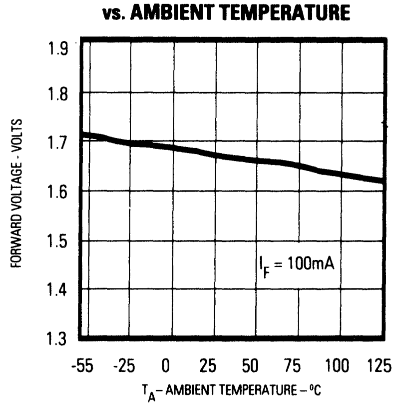
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

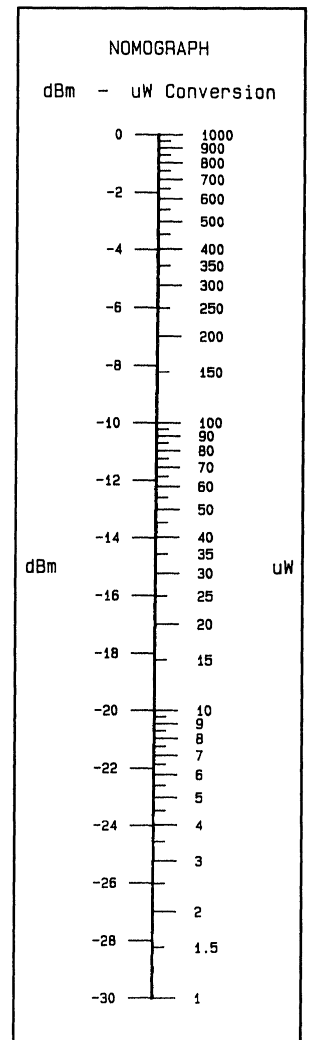


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

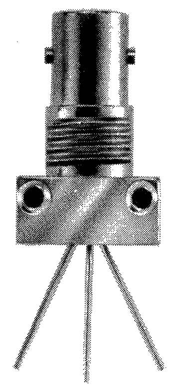


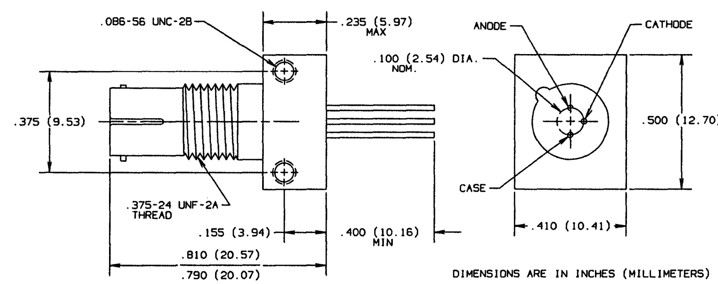


Product Bulletin OPF322
May 1993

OPTEK

Fiber Optic GaAlAs LED in ST* Receptacle
Types OPF322A, OPF322B, OPF322C





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

Description

The OPF322 series LED consists of a hermetic LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +125°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C					
Fiber	**Refractive Index**	**N.A.**	**OPF322C**	**OPF322B**	**OPF322A**
50/125µm	Graded	0.20	7.5µW	12.5µW	19µW
62.5/125µm	Graded	0.28	16µW	22µW	34µW
100/140µm	Graded	0.29	38µW	62µW	95µW
200/300µm*	Step	0.41	140µW	235µW	360µW

*PCS - Plastic Clad Silica

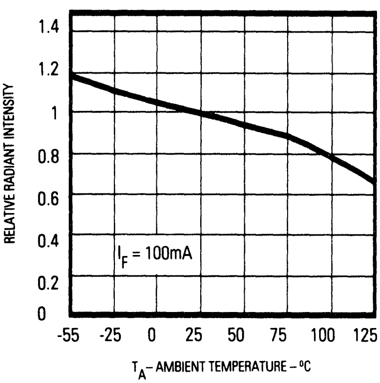
Types OPF322A, OPF322B, OPF322C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

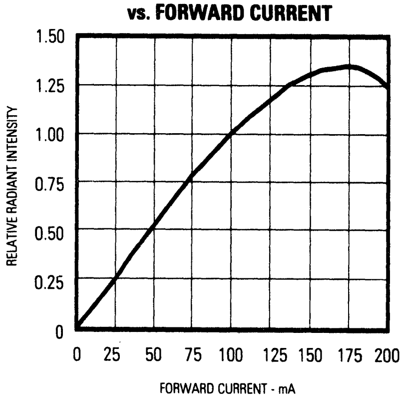
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF322C OPF322B OPF322A	5.0 10.0 15.0	7.5 12.5 19.0		μW	I_F = 100 mA[(2)]
V_F	Forward Voltage			1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50 mA
t_r	Output Rise Time			6.0	8.0	ns	I_F = 100 mA, 10%-90%[(5)]
t_f	Output Fall Time			6.0	10.0	ns	I_F = 100 mA, 90%-10%[(5)]

TYPICAL PERFORMANCE CURVES

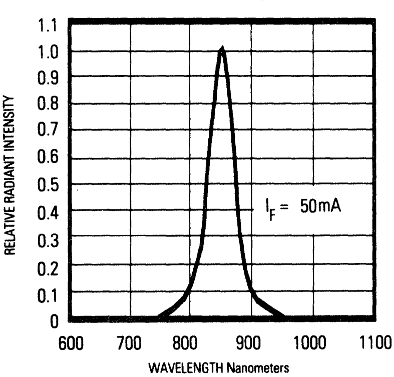
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



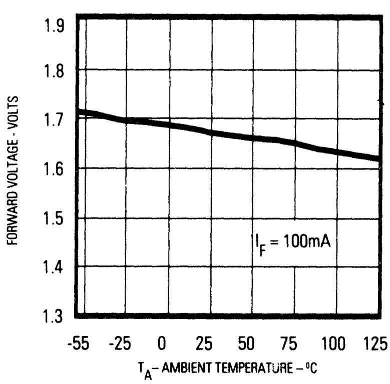
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

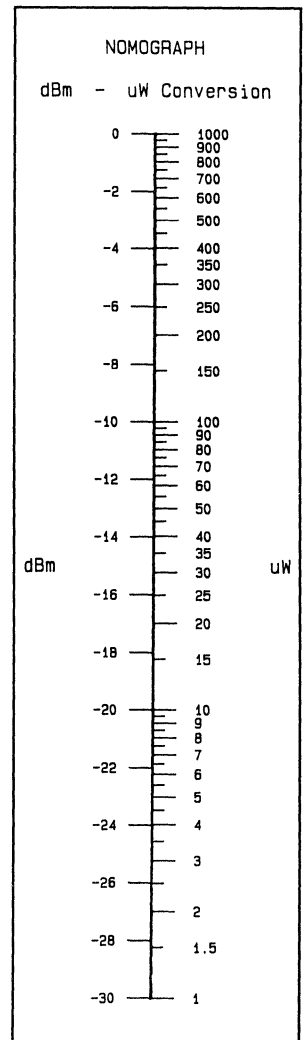


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

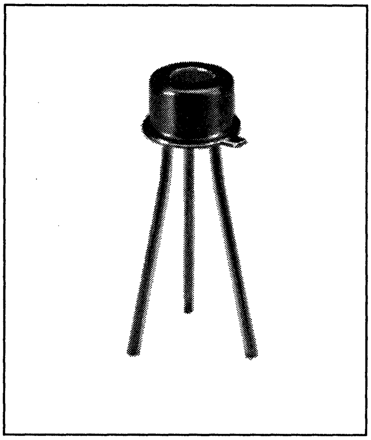


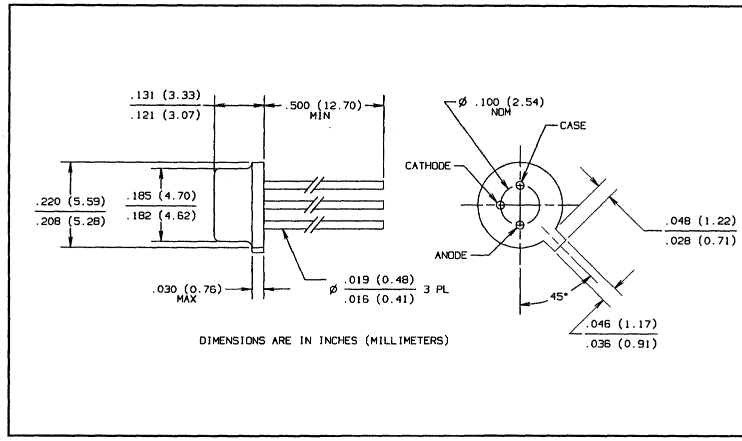


FIBER OPTIC COMPONENTS

Product Bulletin OPF340
May 1993

Fiber Optic GaAlAs High Speed LED
Types OPF340A, OPF340B, OPF340C, OPF340D





Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case

Description

The OPF340 series LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Fiber	Refractive Index	N.A.	Typical Coupled Power I_F = 100mA @ 25°C OPF340D	OPF340C	OPF340B	OPF340A
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	14μW	22μW	34μW	45μW
100/140μm	Graded	0.29	38μW	62μW	95μW	125μW
200/300μm*	Step	0.41	140μW	235μW	340μW	475μW

*PCS - Plastic Clad Silica

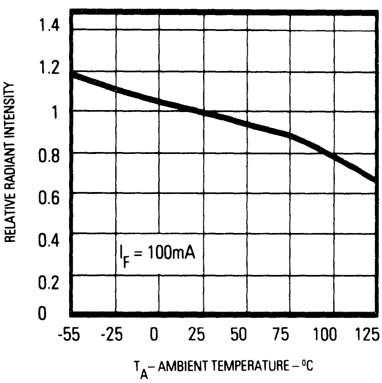
Types OPF340A, OPF340B, OPF340C, OPF340D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

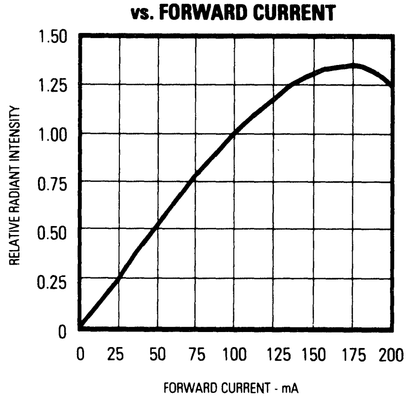
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF340D OPF340C OPF340B OPF340A	5.0 10.0 15.0 20.0	7.5 12.5 18.0 25.0		µW	I_F = 100mA(2)
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			4.5	6.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			4.5	6.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

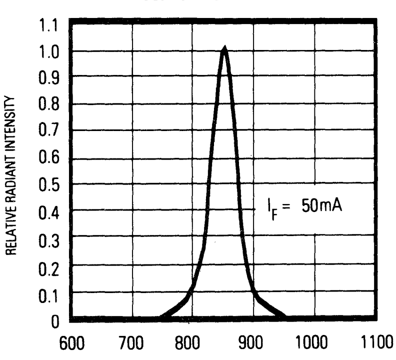
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



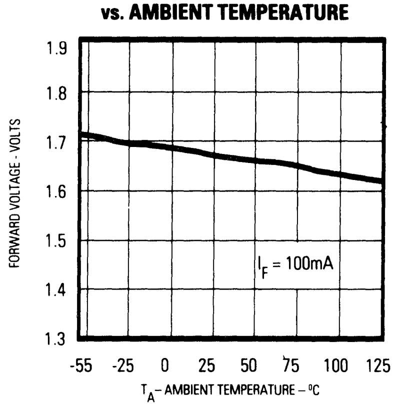
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

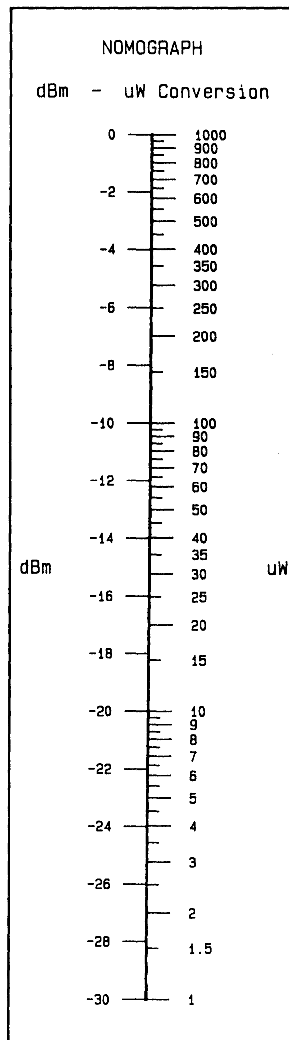


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE



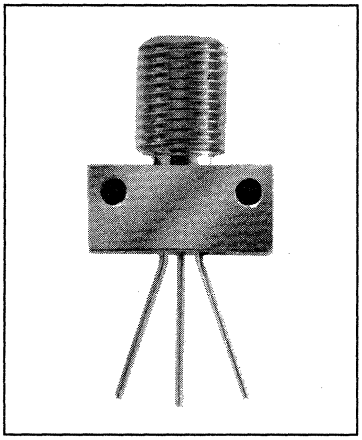


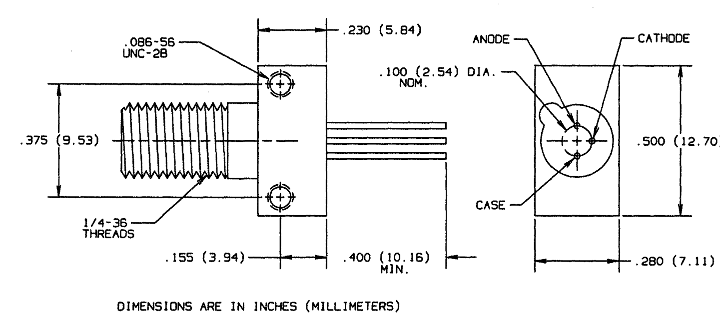
FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Fiber Optic GaAlAs High Speed LED in SMA Receptacle
Types OPF341A, OPF341B, OPF341C, OPF341D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF341 series LED consists of a hermetic LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Fiber	Refractive Index	N.A.	Typical Coupled Power I_F = 100mA @ 25°C OPF341D	OPF341C	OPF341B	OPF341A
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	14μW	22μW	34μW	45μW
100/140μm	Graded	0.29	38μW	62μW	95μW	125μW
200/300μm*	Step	0.41	140μW	235μW	340μW	475μW

*PCS - Plastic Clad Silica

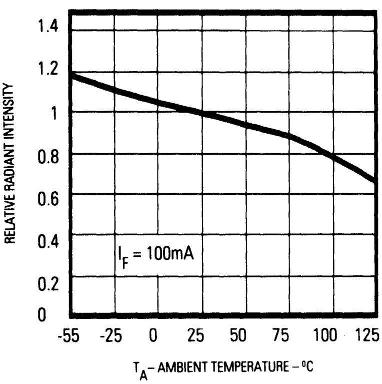
Types OPF341A, OPF341B, OPF341C, OPF341D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

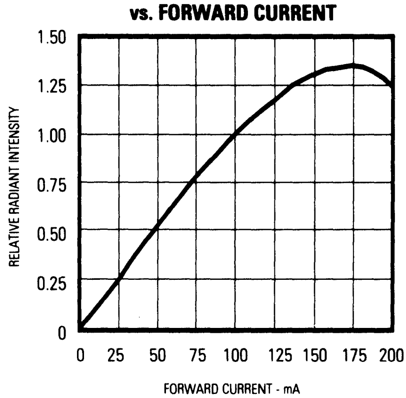
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF341D OPF341C OPF341B OPF341A	5.0 10.0 15.0 20.0	7.5 12.5 18.0 25.0		µW	I_F = 100mA(2)
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			4.5	6.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			4.5	6.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

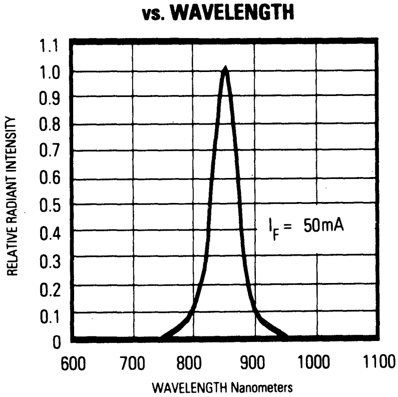
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



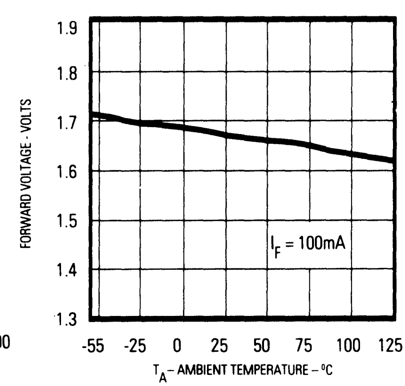
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

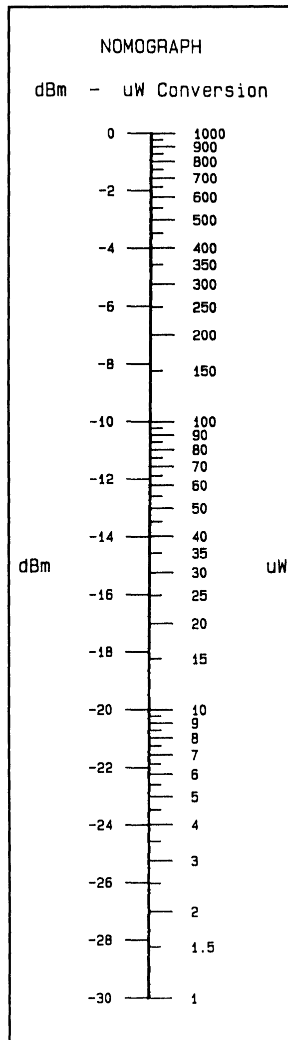


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE





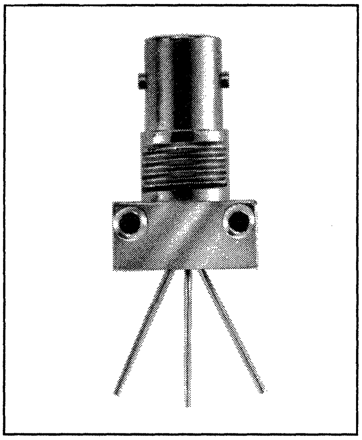
FIBER OPTIC COMPONENTS

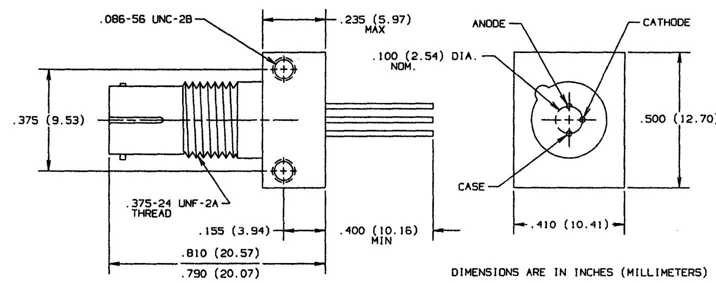
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPF342
May 1993

OPTEK

Fiber Optic GaAlAs High Speed LED in ST* Receptacle
Types OPF342A, OPF342B, OPF342C, OPF342D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF342 series LED consists of a hermetic LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF342D**	**OPF342C**	**OPF342B**	**OPF342A**
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	14μW	22μW	34μW	45μW
100/140μm	Graded	0.29	38μW	62μW	95μW	125μW
200/300μm*	Step	0.41	140μW	235μW	340μW	475μW

*PCS - Plastic Clad Silica

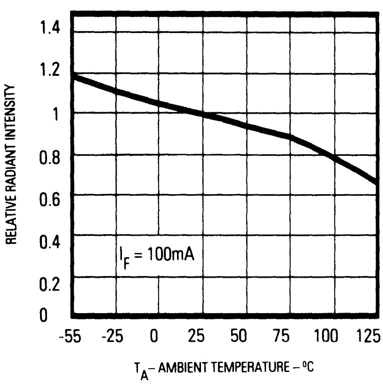
Types OPF342A, OPF342B, OPF342C, OPF342D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

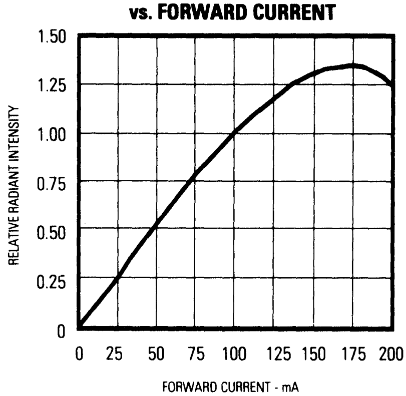
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF342D	5.0	7.5		μW	I_F = 100mA(2)
		OPF342C	10.0	12.5			
		OPF342B	15.0	18.0			
		OPF342A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

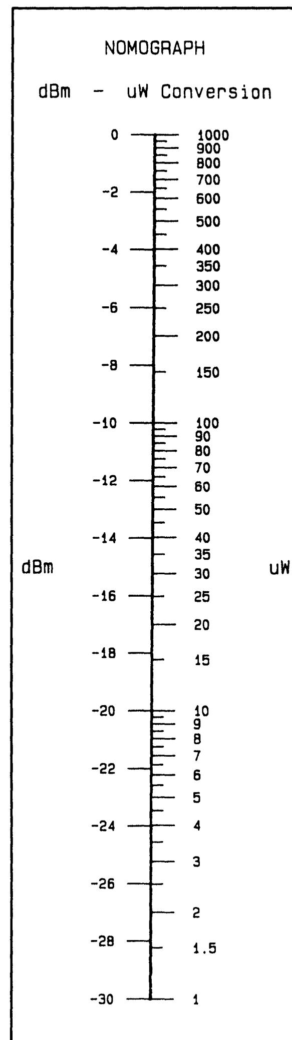
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



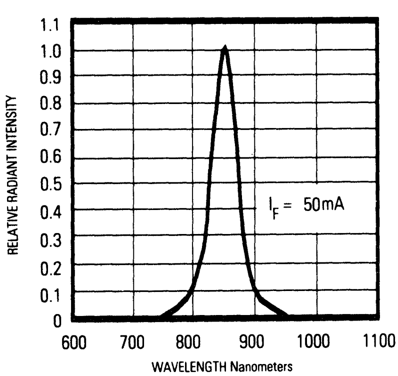
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT



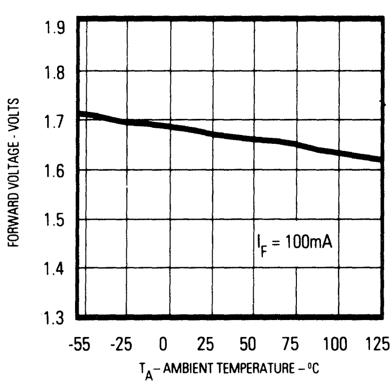
NOMOGRAPH



RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

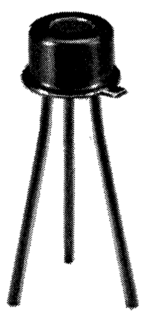


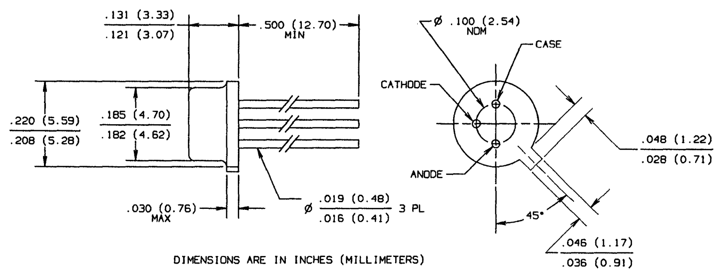
FIBER OPTIC COMPONENTS

Product Bulletin OPF345
May 1993

OPTEK

Fiber Optic GaAlAs High Speed LED
Types OPF345A, OPF345B, OPF345C, OPF345D





Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case

Description

The OPF345 series LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA[4]
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C[1]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF345D**	**OPF345C**	**OPF345B**	**OPF345A**
50/125µm	Graded	0.20	7.5µW	12.5µW	18µW	25µW
62.5/125µm	Graded	0.28	14µW	22µW	34µW	45µW
100/140µm	Graded	0.29	38µW	62µW	95µW	125µW
200/300µm*	Step	0.41	140µW	235µW	340µW	475µW

*PCS - Plastic Clad Silica

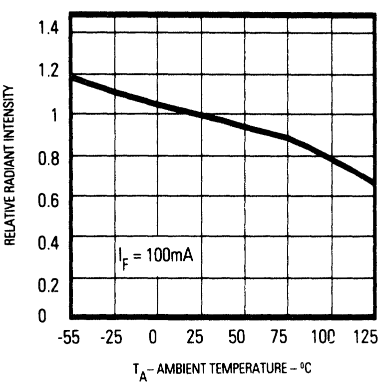
Types OPF345A, OPF345B, OPF345C, OPF345D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

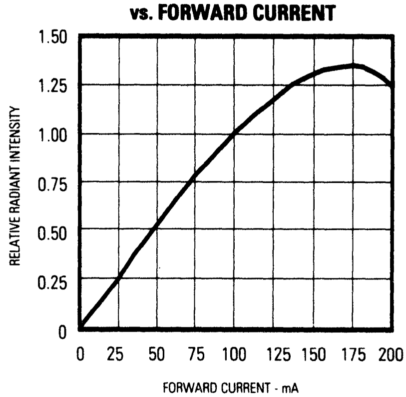
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF345D	5.0	7.5		µW	I_F = 100mA(2)
		OPF345C	10.0	12.5			
		OPF345B	15.0	18.0			
		OPF345A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

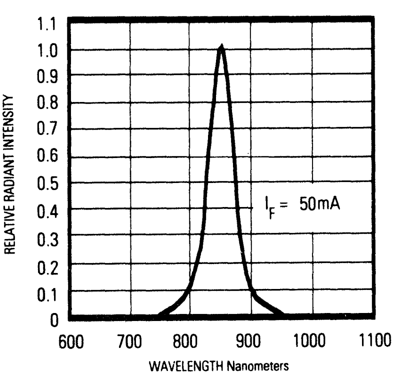
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



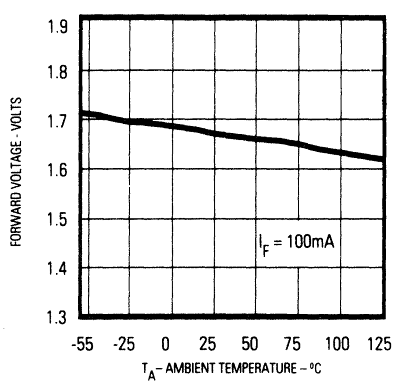
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

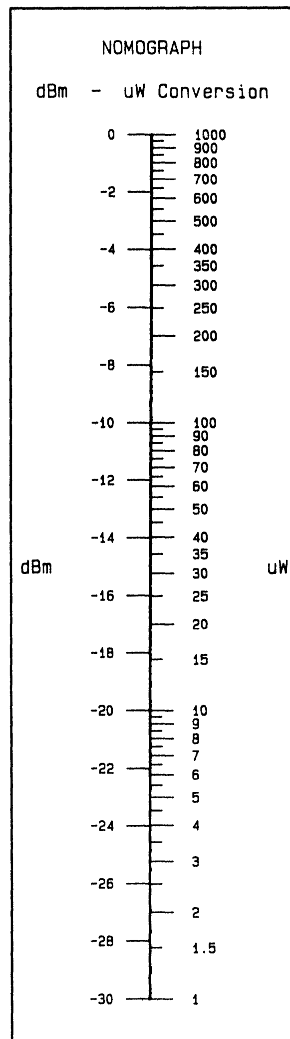


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



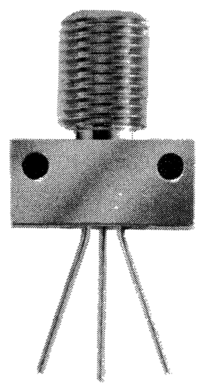
FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

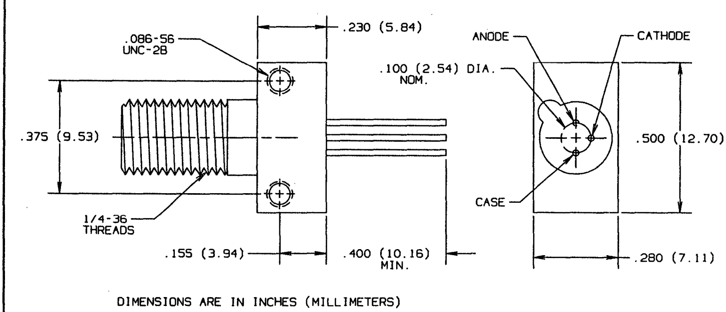




OPTEK

Fiber Optic GaAlAs High Speed LED in SMA Receptacle Types OPF346A, OPF346B, OPF346C, OPF346D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF346 series LED consists of a hermetic LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF346D**	**OPF346C**	**OPF346B**	**OPF346A**
50/125µm	Graded	0.20	7.5µW	12.5µW	18µW	25µW
62.5/125µm	Graded	0.28	14µW	22µW	34µW	45µW
100/140µm	Graded	0.29	38µW	62µW	95µW	125µW
200/300µm*	Step	0.41	140µW	235µW	340µW	475µW

*PCS - Plastic Clad Silica

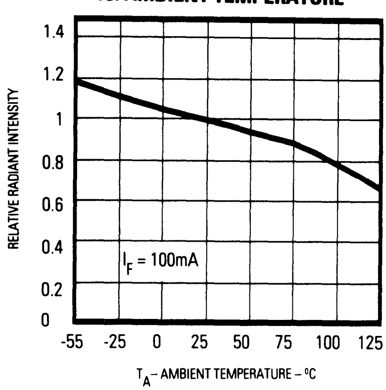
Types OPF346A, OPF346B, OPF346C, OPF346D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

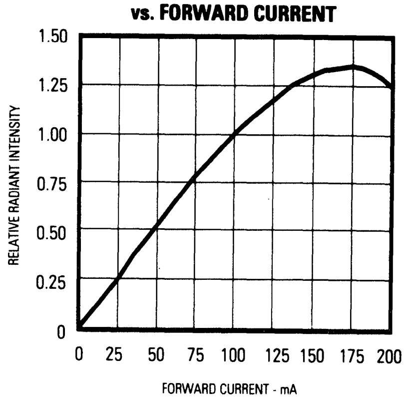
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF346D	5.0	7.5		μW	I_F = 100mA(2)
		OPF346C	10.0	12.5			
		OPF346B	15.0	18.0			
		OPF346A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

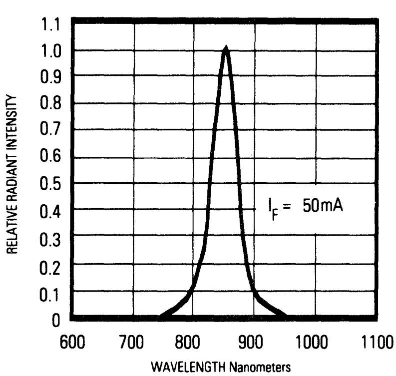
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



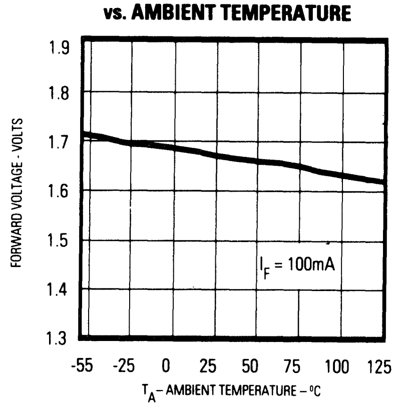
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

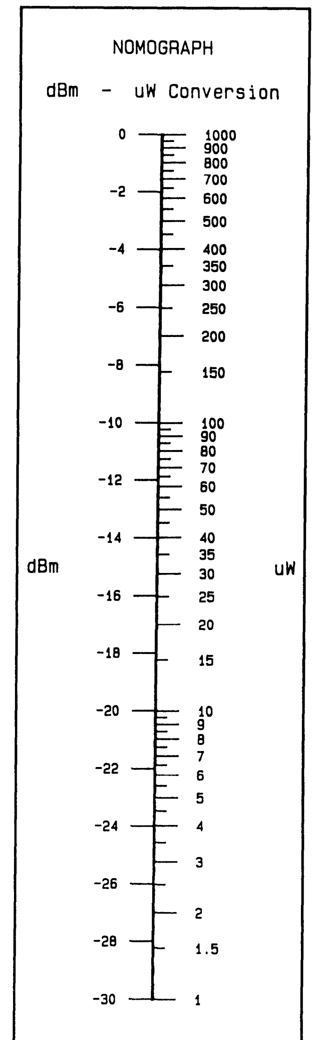


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

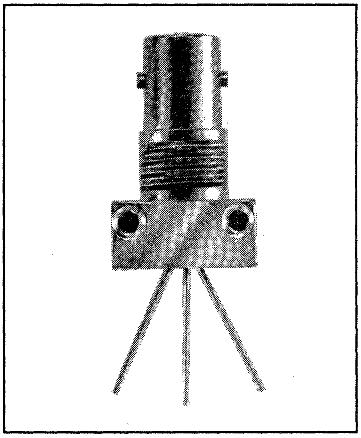


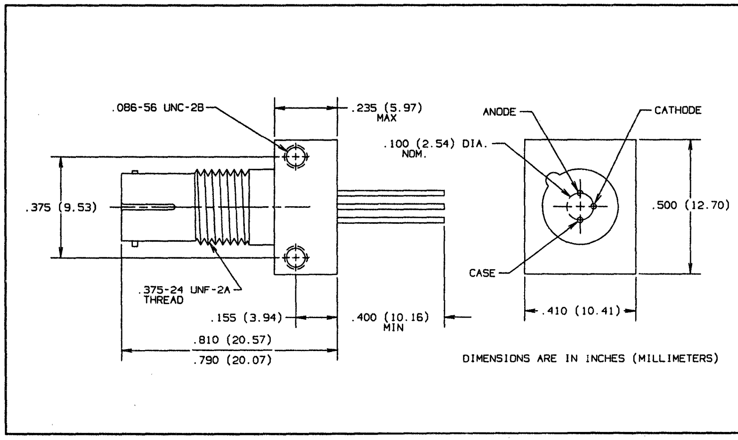


FIBER OPTIC COMPONENTS

OPTEK

Fiber Optic GaAlAs High Speed LED in ST* Receptacle
Types OPF347A, OPF347B, OPF347C, OPF347D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF347 series LED consists of a hermetic LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF347D**	**OPF347C**	**OPF347B**	**OPF347A**
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	14μW	22μW	34μW	45μW
100/140μm	Graded	0.29	38μW	62μW	95μW	125μW
200/300μm*	Step	0.41	140μW	235μW	340μW	475μW

*PCS - Plastic Clad Silica

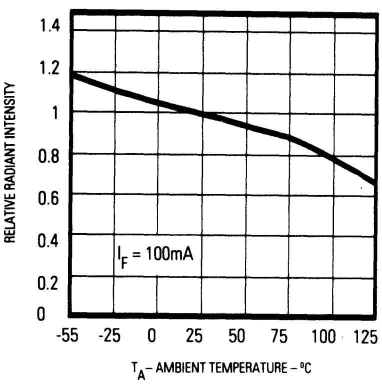
Types OPF347A, OPF347B, OPF347C, OPF347D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

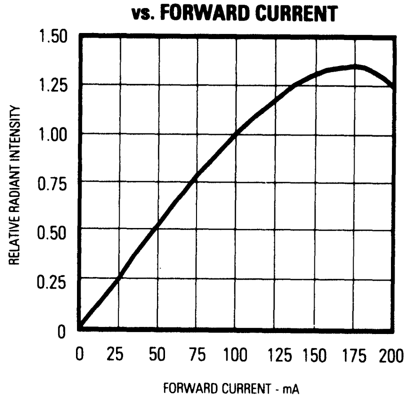
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF347D	5.0	7.5		µW	I_F = 100mA(2)
		OPF347C	10.0	12.5			
		OPF347B	15.0	18.0			
		OPF347A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

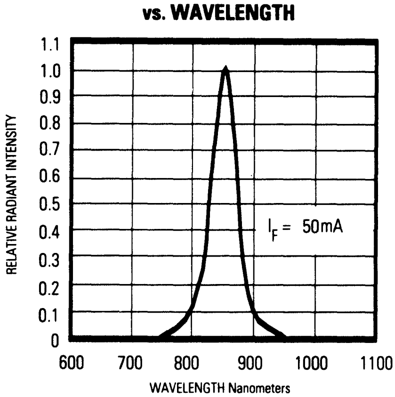
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



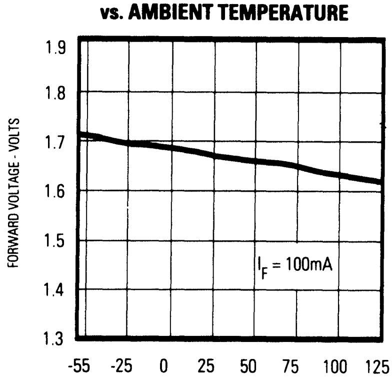
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

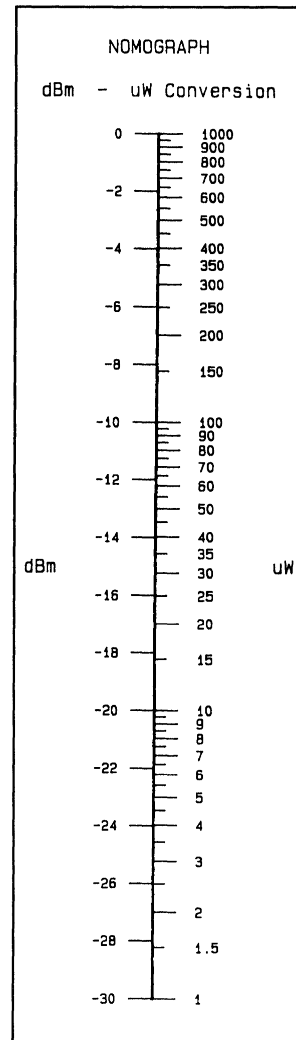


RELATIVE RADIANT INTENSITY vs. WAVELENGTH

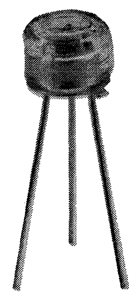


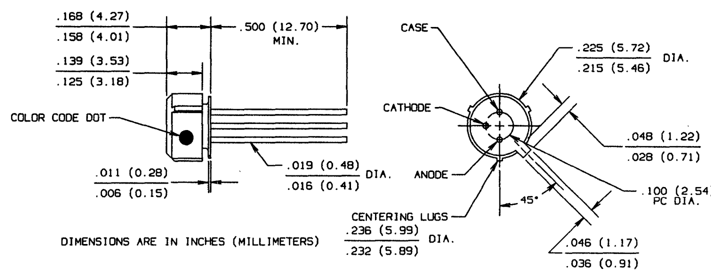
FORWARD VOLTAGE vs. AMBIENT TEMPERATURE





Fiber Optic GaAlAs LED
Types OPF370A, OPF370B, OPF370C, OPF370D





Features

- Electrically isolated plastic cap package
- High radiant output for fiber optic applications
- High speed
- Designed to self align in the 0.228 inch diameter bore of standard fiber optic receptacles. Press fit simplifies component installation.

Description

The OPF370 series LED provides fiber optic users with high coupled power and wide bandwidth in a low cost package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +115°C
Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25 °C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	Refractive Index	N.A.	OPF370D	OPF370C	OPF370B	OPF370A
50/125µm	Graded	0.20	7.5µW	12.5µW	19µW	29µW
62.5/125µm	Graded	0.28	27µW	35µW	51µW	89µW
100/140µm	Graded	0.29	60µW	87µW	129µW	200µW
200/300µm*	Step	0.41	320µW	463µW	606µW	750µW

*PCS - Plastic Clad Silica

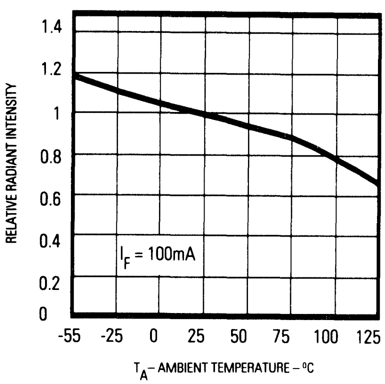
Types OPF370A, OPF370B, OPF370C, OPF370D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

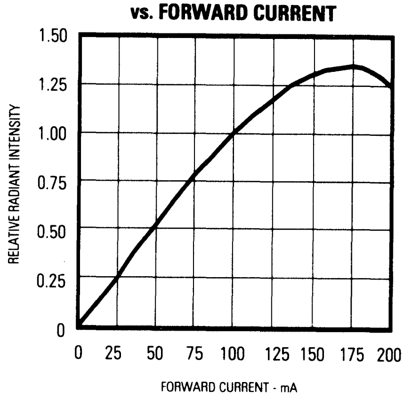
Symbol	Parameter	Dot	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF370D (No Dot)	5.0	7.5		μW	I_F = 100mA(2)
		OPF370C (Blue)	10.0	12.5			
		OPF370B (Yellow)	15.0	19.0			
		OPF370A (Red)	25.0	29.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λ_p	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Band Width Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			6.0	8.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			6.0	10.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

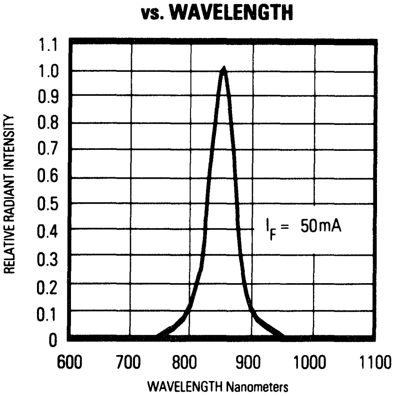
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



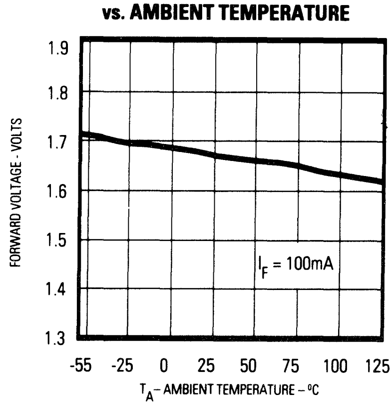
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

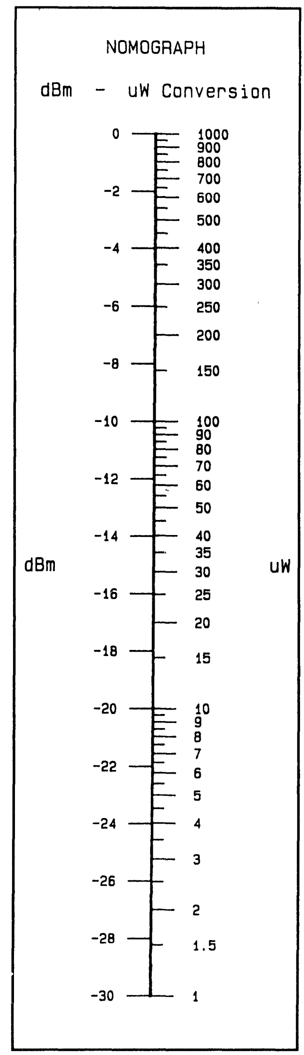


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



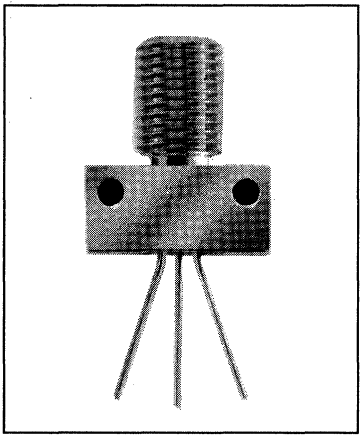
FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

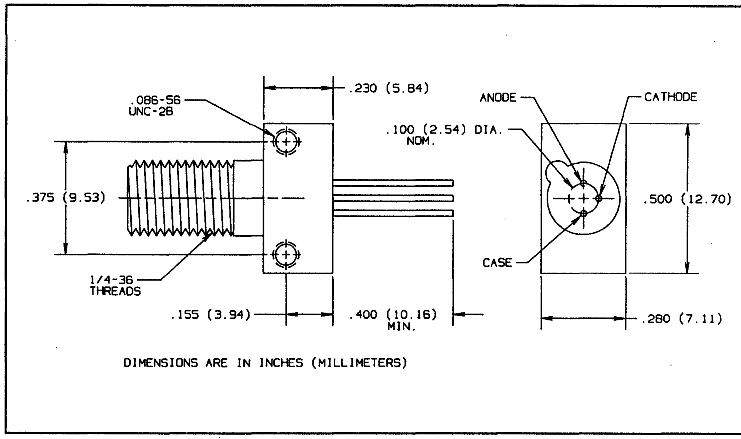




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Fiber Optic GaAlAs LED in SMA Receptacle Types OPF371A, OPF371B, OPF371C, OPF371D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

Description

The OPF371 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with mulitmode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage.. 1.0V
Continuous Forward Current .... 100mA[(4)]
Storage Temperature Range .... -55°C to +100°C
Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]... 240°C[(1)]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Pre Bias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25° C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF371D**	**OPF371C**	**OPF371B**	**OPF371A**
50/125µm	Graded	0.20	7.5µW	12.5µW	19µW	29µW
62.5/125µm	Graded	0.28	27µW	35µW	51µW	89µW
100/140µm	Graded	0.29	60µW	87µW	129µW	200µW
200/300µm*	Step	0.41	320µW	463µW	606µW	750µW

*PCS - Plastic Clad Silica

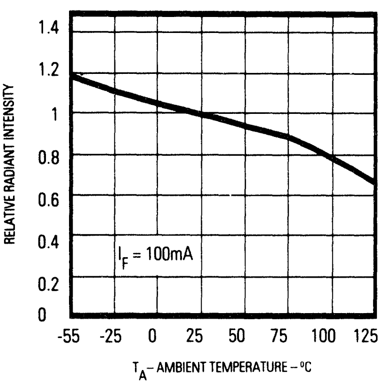
Types OPF371A, OPF371B, OPF371C, OPF371D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

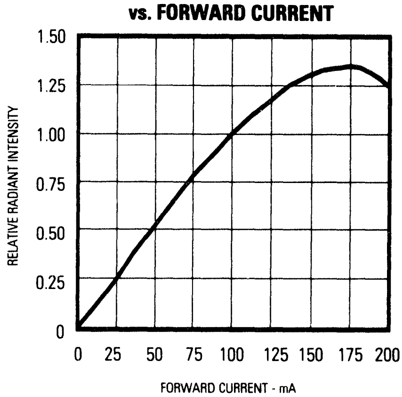
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF371D	5.0	7.5		µW	I_F = 100mA(2)
		OPF371C	10.0	12.5			
		OPF371B	15.0	19.0			
		OPF371A	25.0	29.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Band Width Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			6.0	8.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			6.0	10.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

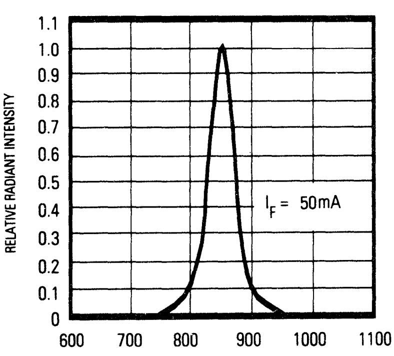
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



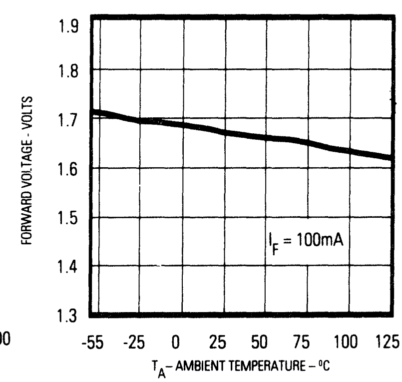
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

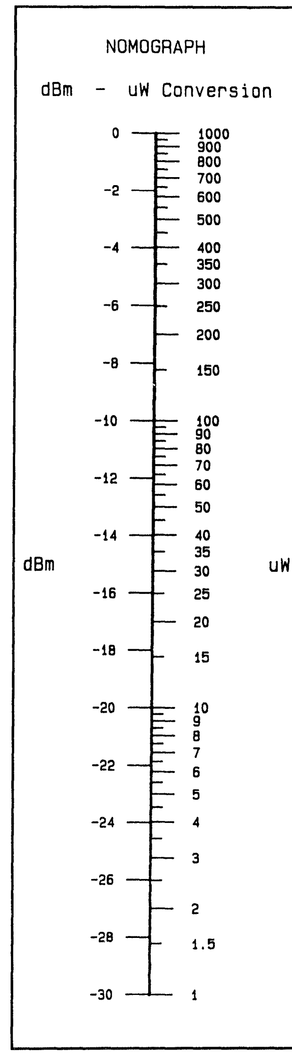


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE



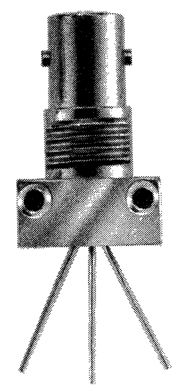


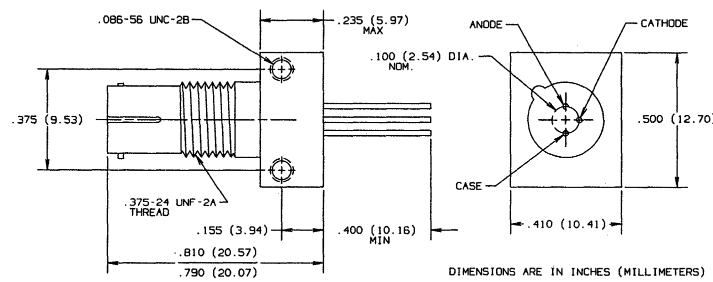
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPF372
May 1993

OPTEK

Fiber Optic GaAlAs LED in ST* Receptacle
Types OPF372A, OPF372B, OPF372C, OPF372D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

Description

The OPF372 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power IF = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF372D**	**OPF372C**	**OPF372B**	**OPF372A**
50/125μm	Graded	0.20	7.5μW	12.5μW	19μW	29μW
62.5/125μm	Graded	0.28	27μW	35μW	51μW	89μW
100/140μm	Graded	0.29	60μW	87μW	129μW	200μW
200/300μm*	Step	0.41	320μW	463μW	606μW	750μW

*PCS - Plastic Clad Silica

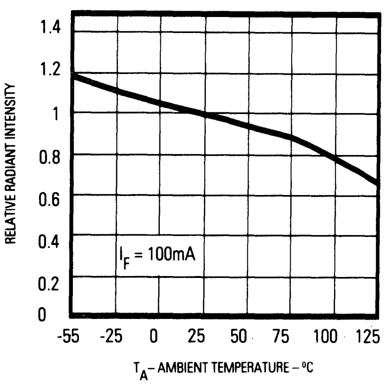
Types OPF372A, OPF372B, OPF372C, OPF372D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

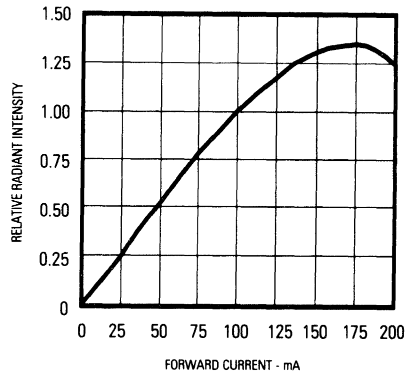
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF372D OPF372C OPF372B OPF372A	5.0 10.0 15.0 25.0	7.5 12.5 19.0 29.0		µW	I_F = 100mA(2)
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Band Width Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			6.0	8.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			6.0	10.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

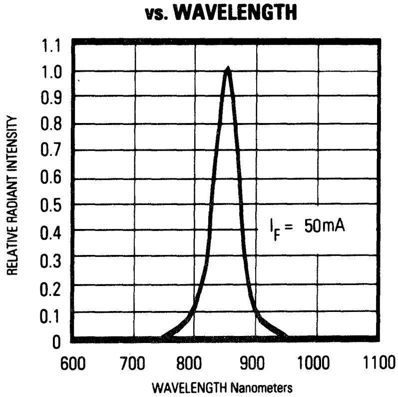
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



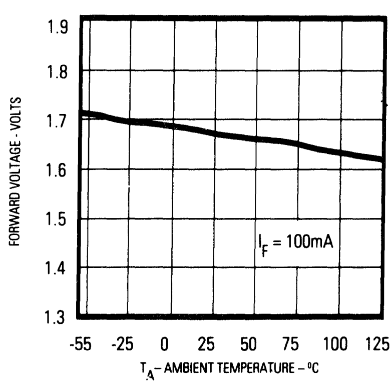
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

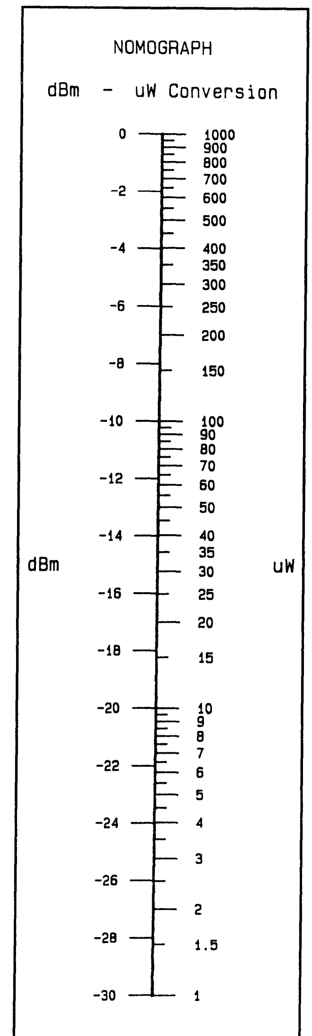


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



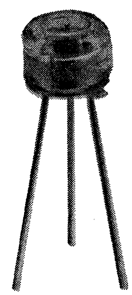
FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

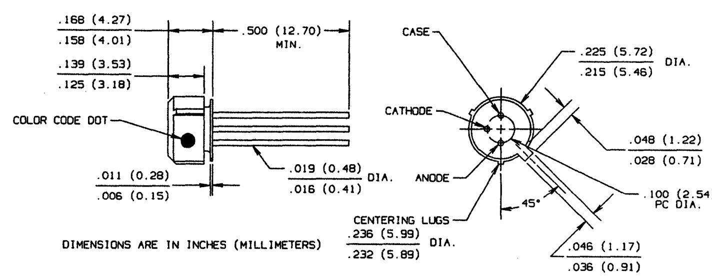




FIBER OPTIC COMPONENTS

Fiber Optic GaAlAs High Speed LED
Types OPF390A, OPF390B, OPF390C, OPF390D





Features

- Electrically isolated plastic cap package
- High radiant output for fiber optic applications
- High speed
- Designed to self align in the 0.228 inch diameter bore of standard fiber optic receptacles. Press fit simplifies component installation.

Description

The OPF390 series LED provides fiber optic users with high coupled power and wide bandwidth in a low cost package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +115°C
Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF390D**	**OPF390C**	**OPF390B**	**OPF390A**
50/125µm	Graded	0.20	7.5µW	12.5µW	18µW	25µW
62.5/125µm	Graded	0.28	27µW	35µW	45µW	75µW
100/140µm	Graded	0.29	58µW	85µW	115µW	170µW
200/300µm*	Step	0.41	290µW	450µW	545µW	650µW

*PCS - Plastic Clad Silica

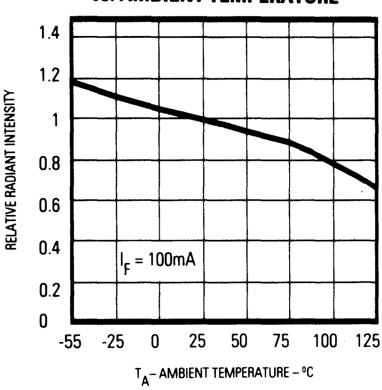
Types OPF390A, OPF390B, OPF390C, OPF390D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

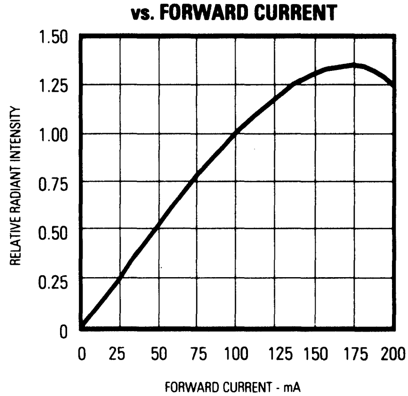
Symbol	Parameter	Dot	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF390D (Silver) OPF390C (Black) OPF390B (Green) OPF390A (Orange)	5.0 10.0 15.0 20.0	7.5 12.5 18.0 25.0		µW	I_F = 100mA(2)
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			4.5	6.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			4.5	6.0	ns	I_F = 100mA, 90%-10%(5)

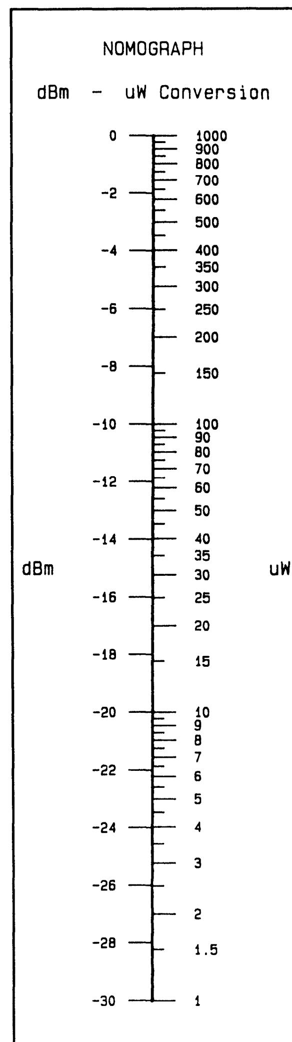
TYPICAL PERFORMANCE CURVES

RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE

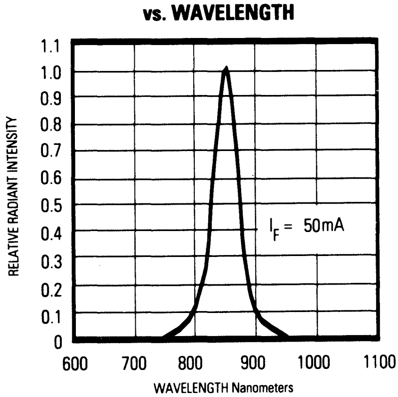


RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

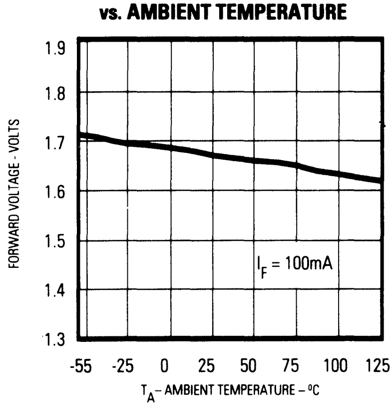




RELATIVE RADIANT INTENSITY vs. WAVELENGTH



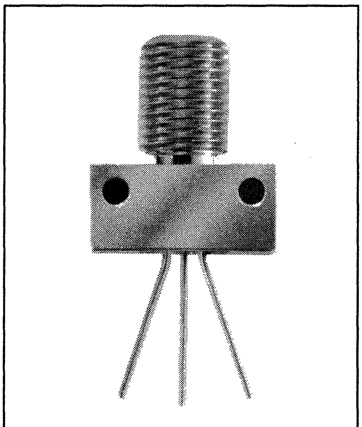
FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

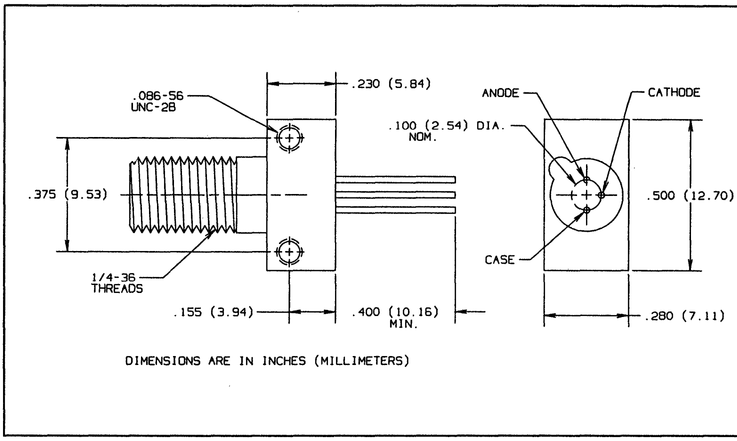


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Fiber Optic GaAlAs High Speed LED in SMA Receptacle
Types OPF391A, OPF391B, OPF391C, OPF391D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF391 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with mulitmode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF391D**	**OPF391C**	**OPF391B**	**OPF391A**
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	27μW	35μW	45μW	75μW
100/140μm	Graded	0.29	58μW	85μW	115μW	170μW
200/300μm*	Step	0.41	290μW	450μW	545μW	650μW

*PCS - Plastic Clad Silica

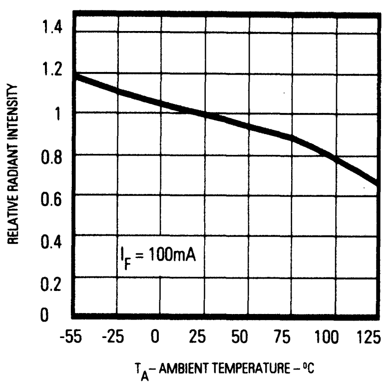
Types OPF391A, OPF391B, OPF391C, OPF391D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

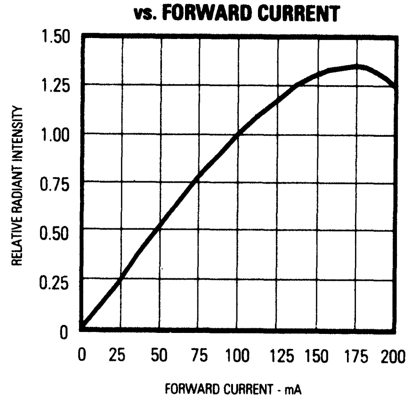
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF391D	5.0	7.5		µW	I_F = 100mA(2)
		OPF391C	10.0	12.5			
		OPF391B	15.0	18.0			
		OPF391A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			4.5	6.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			4.5	6.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

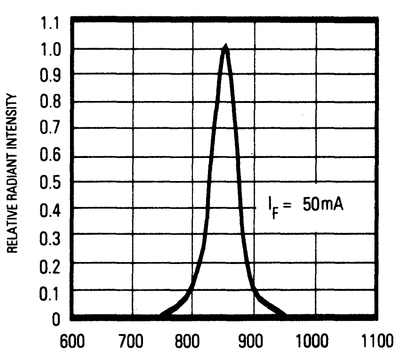
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



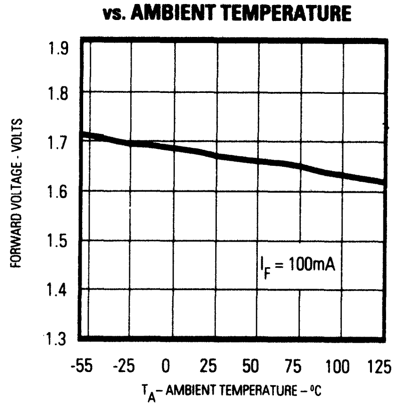
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

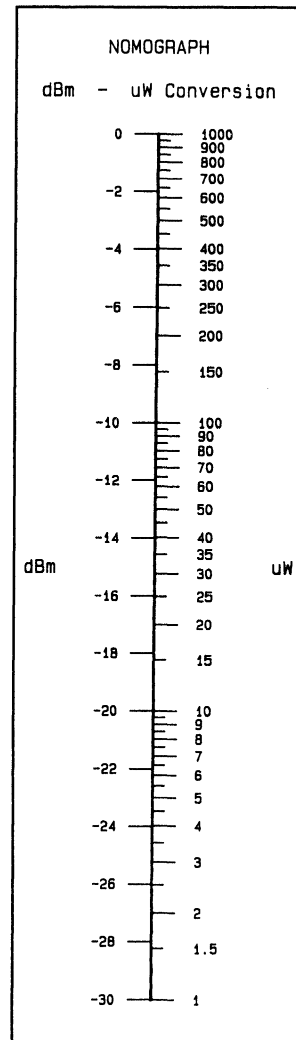


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

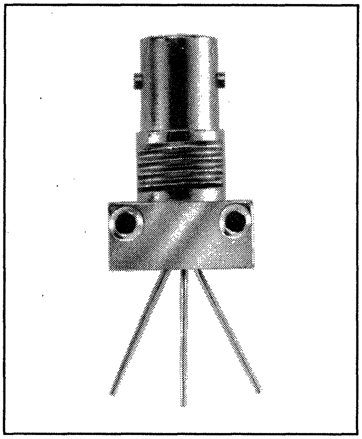


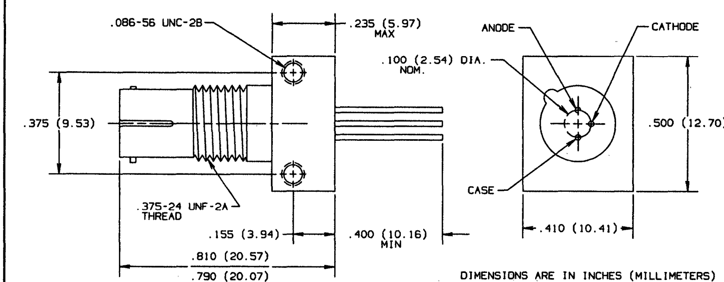


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Fiber Optic GaAlAs High Speed LED in ST* Receptacle
Types OPF392A, OPF392B, OPF392C, OPF392D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF392 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +100°C
Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	Refractive Index	N.A.	OPF392D	OPF392C	OPF392B	OPF392A
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	27μW	35μW	45μW	75μW
100/140μm	Graded	0.29	58μW	85μW	115μW	170μW
200/300μm*	Step	0.41	290μW	450μW	545μW	650μW

*PCS - Plastic Clad Silica

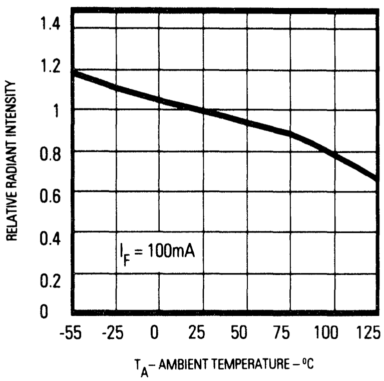
Types OPF392A, OPF392B, OPF392C, OPF392D

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

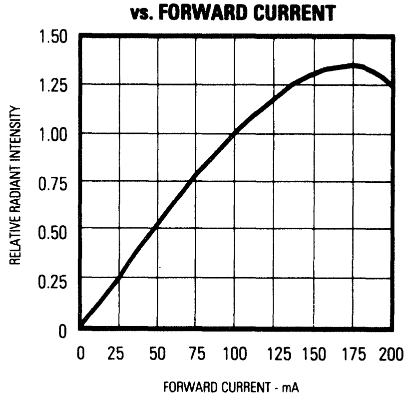
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF392D	5.0	7.5		µW	$I_F = 100mA$ (2)
		OPF392C	10.0	12.5			
		OPF392B	15.0	18.0			
		OPF392A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	$I_F = 100mA$
λp	Peak Output Wavelength			850	870	nm	$I_F = 50mA$
B	Spectral Bandwidth Between Half Power Points			35		nm	$I_F = 50mA$
t_r	Output Rise Time			4.5	6.0	ns	$I_F = 100mA$, 10%-90% (5)
t_f	Output Fall Time			4.5	6.0	ns	$I_F = 100mA$, 90%-10% (5)

TYPICAL PERFORMANCE CURVES

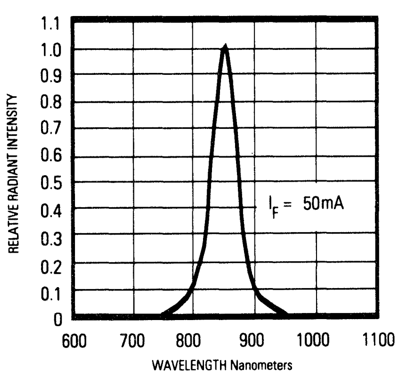
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



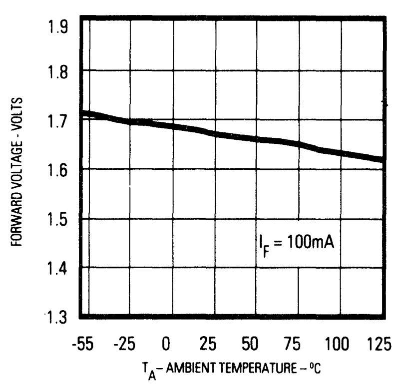
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

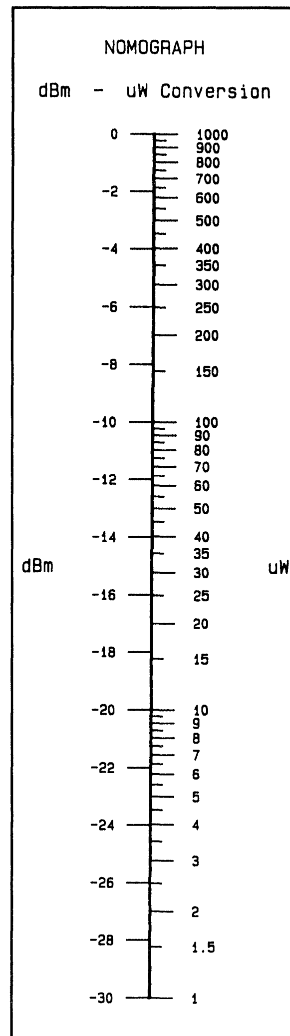


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

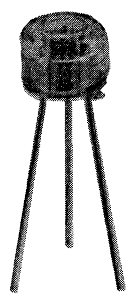


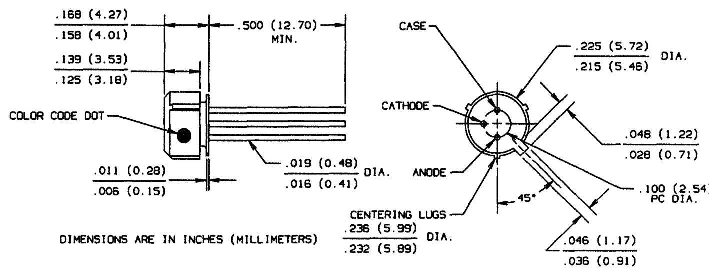


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPF395A
January 1994

Fiber Optic GaAlAs High Speed LED
Types OPF395A, OPF395B, OPF395C, OPF395D





Features

- Electrically isolated plastic cap package
- High radiant output for fiber optic applications
- High speed
- Designed to self align in the 0.228 inch diameter bore of standard fiber optic receptacles. Press fit simplifies component installation.

Description

The OPF395 series LED provides fiber optic users with high coupled power and wide bandwidth in a low cost package.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . . 100mA(4)
Storage Temperature Range . . . . . -55°C to +115°C
Operating Temperature Range . . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF395D**	**OPF395C**	**OPF395B**	**OPF395A**
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	27μW	35μW	45μW	75μW
100/140μm	Graded	0.29	58μW	85μW	115μW	170μW
200/300μm*	Step	0.41	290μW	450μW	545μW	650μW

*PCS - Plastic Clad Silica

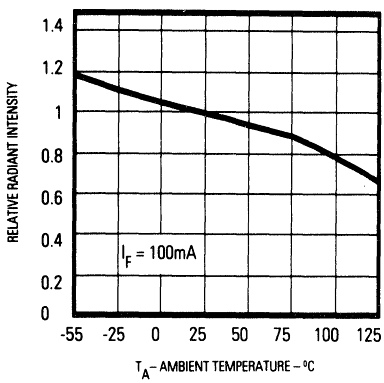
Types OPF395A, OPF395B, OPF395C, OPF395D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

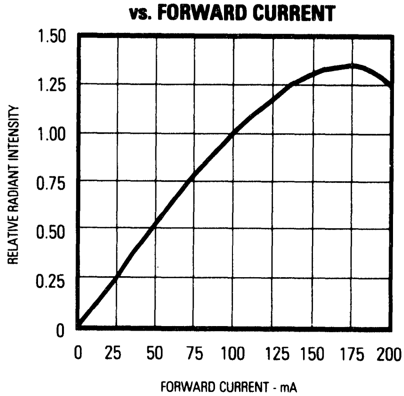
Symbol	Parameter	Dot	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF395D (Silver)	5.0	7.5		μW	I_F = 100mA(2)
		OPF395C (Black)	10.0	12.5			
		OPF395B (Green)	15.0	18.0			
		OPF395A (Orange)	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

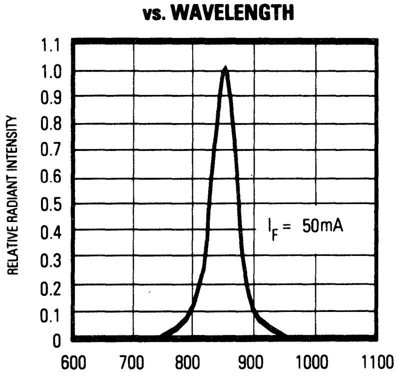
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



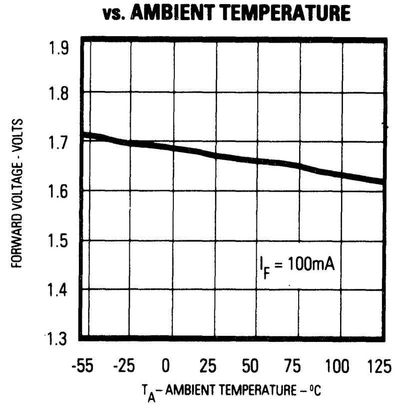
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

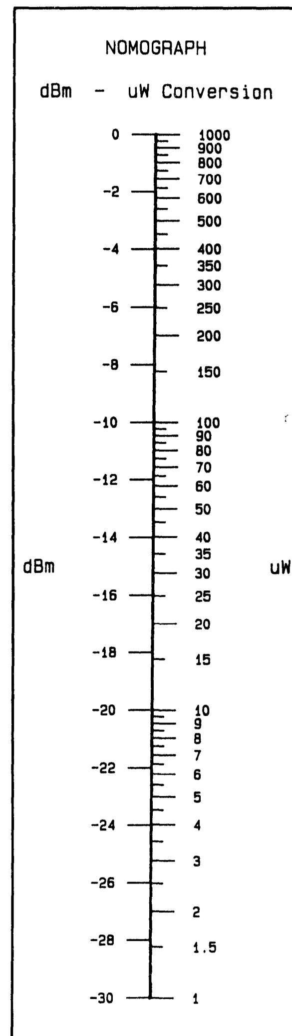


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE



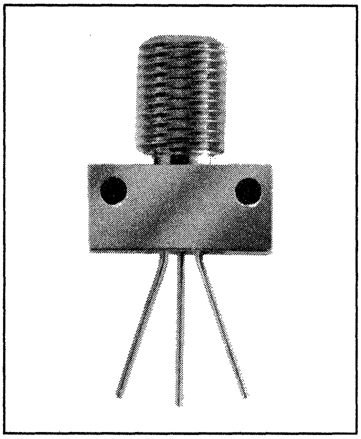


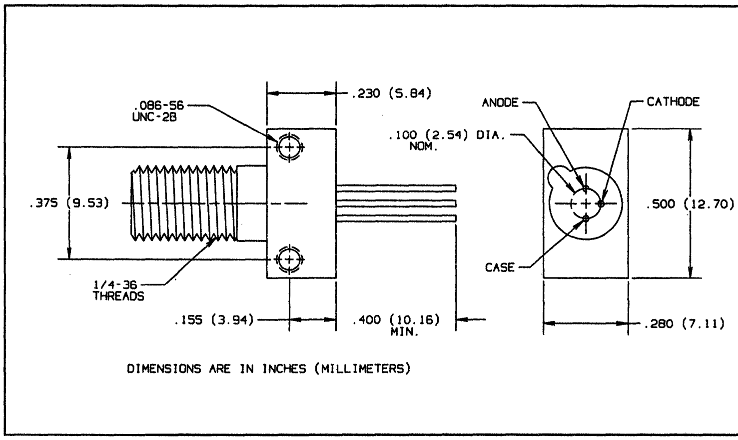
FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Fiber Optic GaAlAs High Speed LED in SMA Receptacle
Types OPF396A, OPF396B, OPF396C, OPF396D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF396 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with mulitmode optical fibers from 50/125 to 200/300 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA[(4)]
Storage Temperature Range . . . . -55°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C[(1)]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50µm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-In

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF396D**	**OPF396C**	**OPF396B**	**OPF396A**
50/125µm	Graded	0.20	7.5µW	12.5µW	18µW	25µW
62.5/125µm	Graded	0.28	27µW	35µW	45µW	75µW
100/140µm	Graded	0.29	58µW	85µW	115µW	170µW
200/300µm*	Step	0.41	290µW	450µW	545µW	650µW

*PCS - Plastic Clad Silica

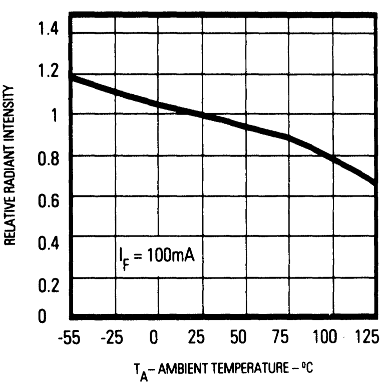
Types OPF396A, OPF396B, OPF396C, OPF396D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

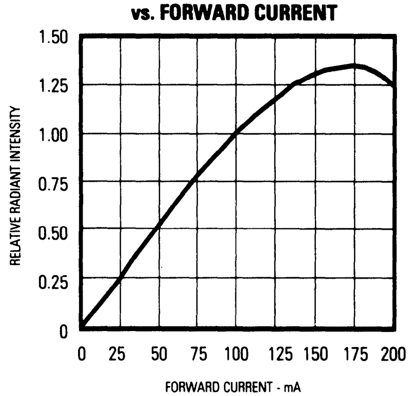
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF396D	5.0	7.5		µW	I_F = 100mA(2)
		OPF396C	10.0	12.5			
		OPF396B	15.0	18.0			
		OPF396A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

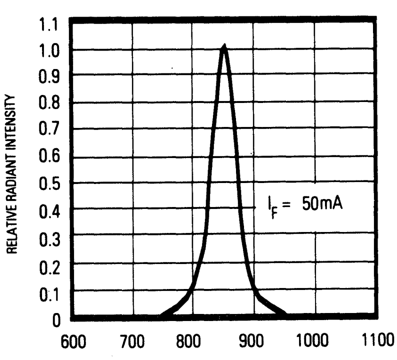
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



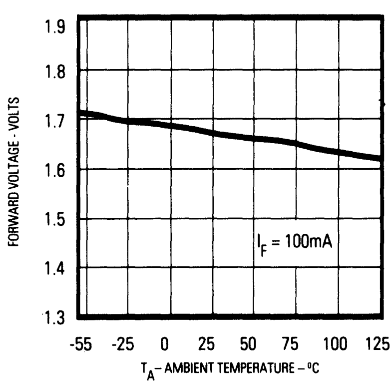
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT



RELATIVE RADIANT INTENSITY vs. WAVELENGTH

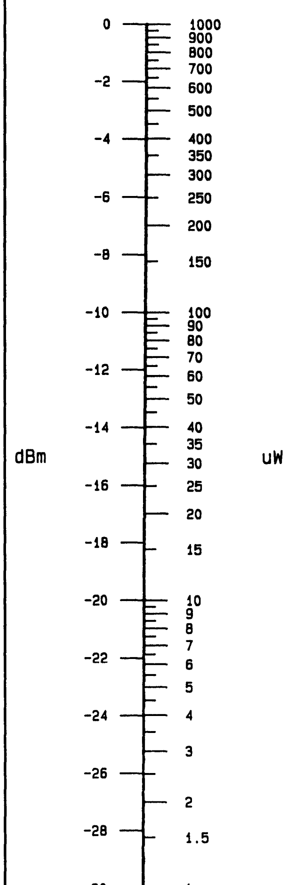


FORWARD VOLTAGE vs. AMBIENT TEMPERATURE



NOMOGRAPH

dBm - uW Conversion

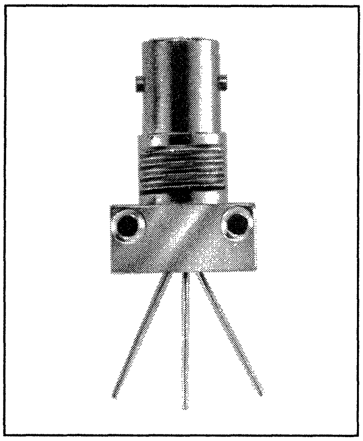


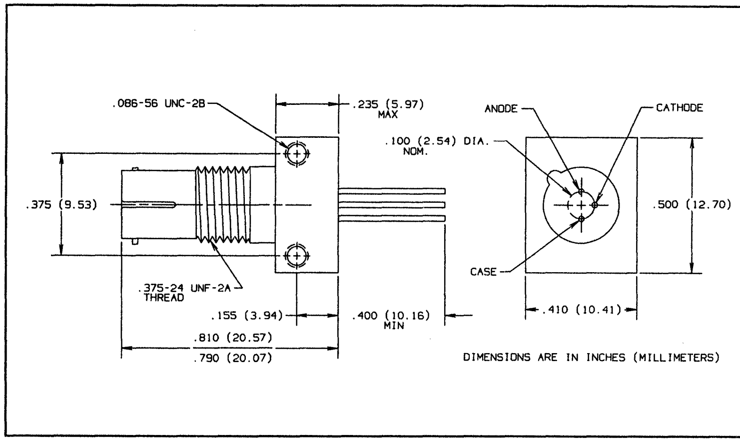
FIBER OPTIC COMPONENTS

Product Bulletin OPF397
May 1993

OPTEK

Fiber Optic GaAlAs High Speed LED in ST* Receptacle
Types OPF397A, OPF397B, OPF397C, OPF397D





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- High Speed
- Electrically isolated from case

Description

The OPF397 series LED consists of a low cost plastic cap LED, pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LED's are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +100°C
Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber, 50μm core, N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

LED Burn-in

All LED's are subject to 100% burn-in testing. Test conditions are 96 hours at 100mA continuous current in 25°C ambient.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100mA @ 25°C						
Fiber	**Refractive Index**	**N.A.**	**OPF397D**	**OPF397C**	**OPF397B**	**OPF397A**
50/125μm	Graded	0.20	7.5μW	12.5μW	18μW	25μW
62.5/125μm	Graded	0.28	27μW	35μW	45μW	75μW
100/140μm	Graded	0.29	58μW	85μW	115μW	170μW
200/300μm*	Step	0.41	290μW	450μW	545μW	650μW

*PCS - Plastic Clad Silica

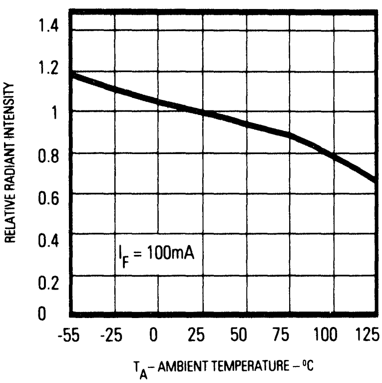
Types OPF397A, OPF397B, OPF397C, OPF397D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

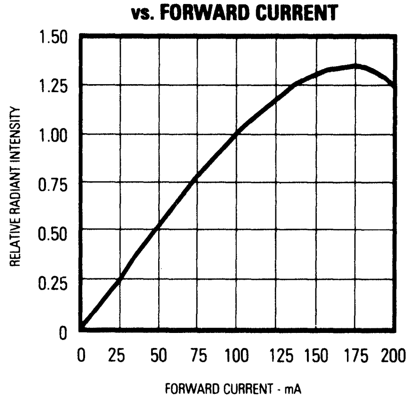
Symbol	Parameter		Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	OPF397D	5.0	7.5		μW	I_F = 100mA(2)
		OPF397C	10.0	12.5			
		OPF397B	15.0	18.0			
		OPF397A	20.0	25.0			
V_F	Forward Voltage			1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength		830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points			35		nm	I_F = 50mA
t_r	Output Rise Time			3.5	4.5	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time			3.5	4.5	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

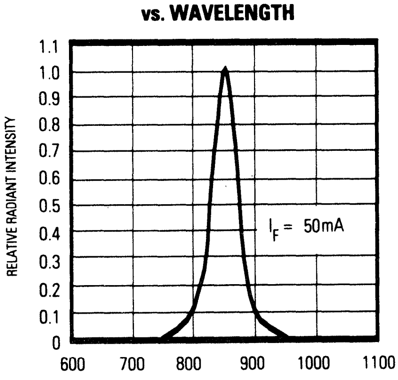
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



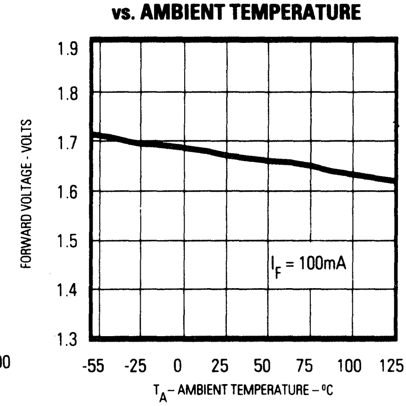
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

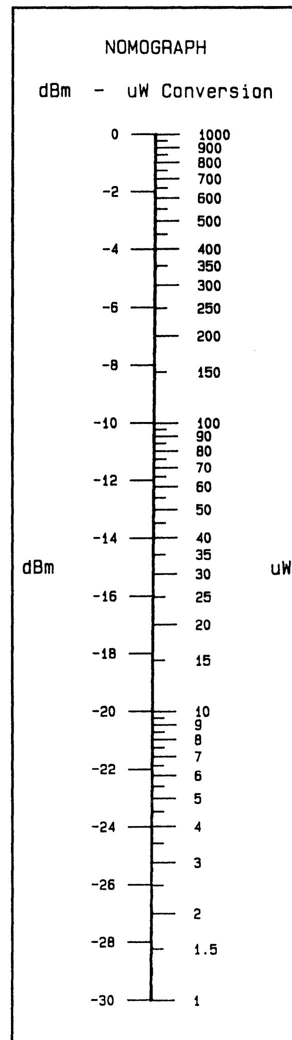


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE



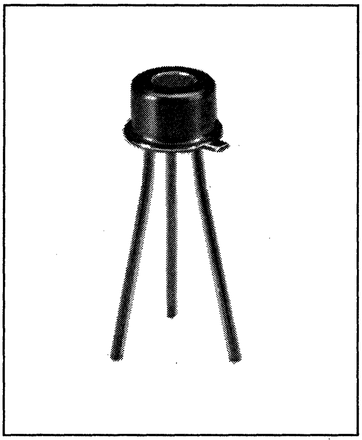


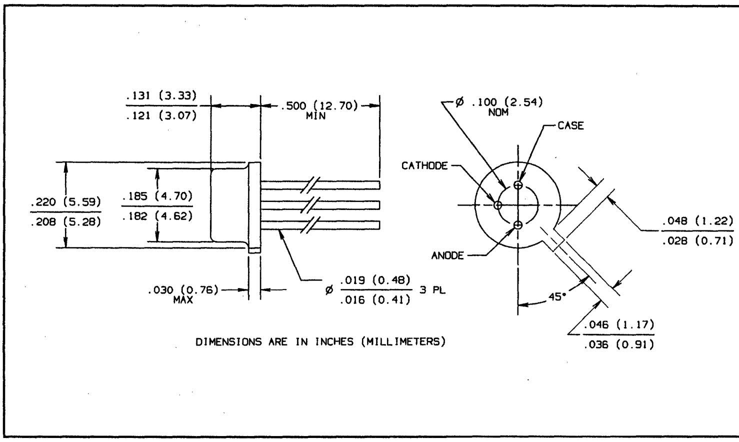
FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Fiber Optic PIN Photodiode
Type OPF420





Features

- Electrically isolated TO-46 package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 200 micron fiber

Description

The OPF420 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optic applications. It offers fast response at moderate bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

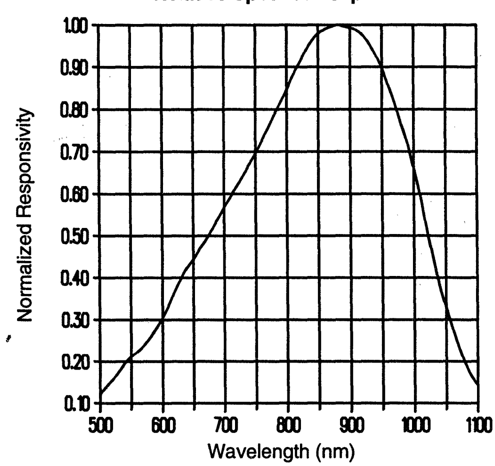
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) R_L = 50 Ω, 10%-90%

Typical Performance Curves

Relative Spectral Response



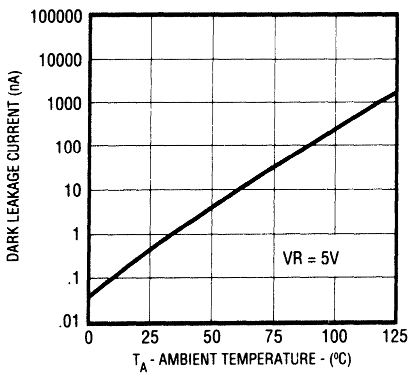
Type OPF420

Electrical Characteristics (T_A = 25°C unless outherwise noted)

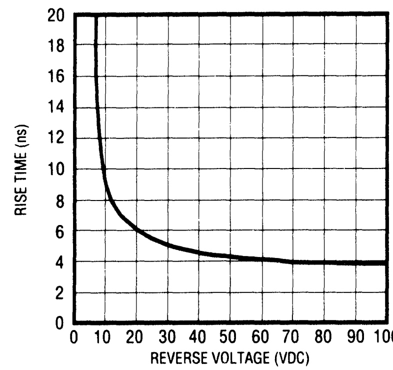
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0V (4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0V
FoV	Field of View		80		Deg.	

TYPICAL PERFORMANCE CURVES

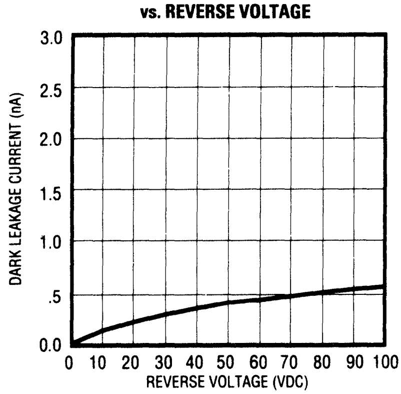
DARK CURRENT vs. AMBIENT TEMPERATURE



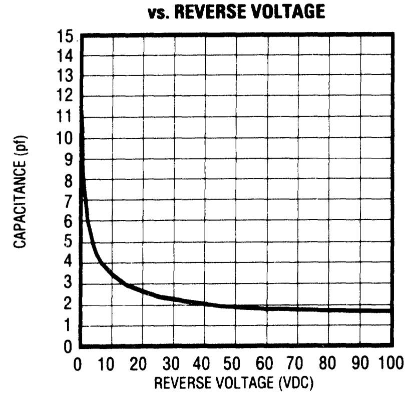
RISE TIME vs. REVERSE VOLTAGE



DARK CURRENT vs. REVERSE VOLTAGE

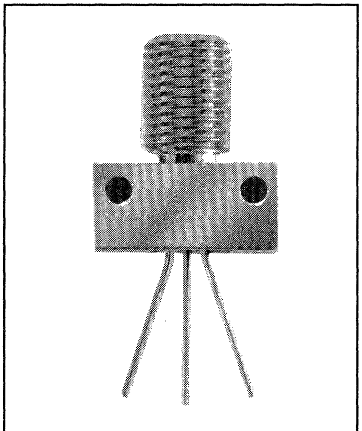


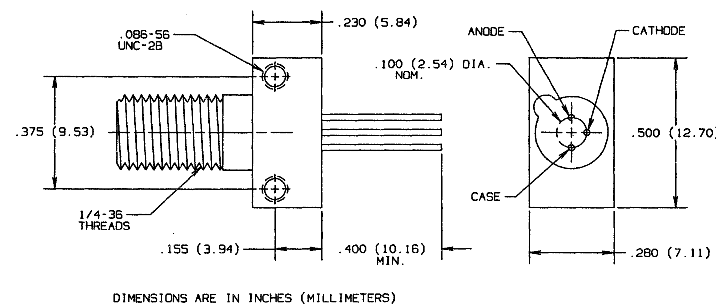
TYPICAL CAPACITANCE vs. REVERSE VOLTAGE



OPTEK

Fiber Optic PIN Photodiode in SMA Receptacle Type OPF421





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

Description

The OPF421 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

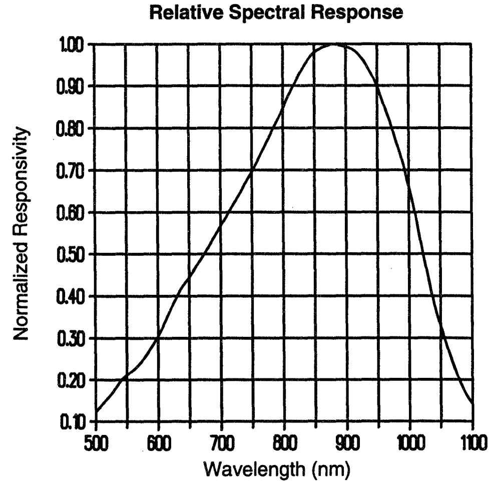
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100V
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +125°C
Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μW optical power @ 850nm. Responsivity levels apply to 50 μm, 62.5 μm, and 100 μm core optical fibers.
(4) R_L = 50 Ω, 10%-90%.

Typical Performance Curves

Relative Spectral Response



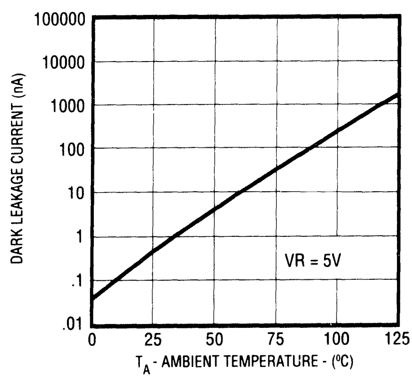
Type OPF421

Electrical Characteristics (T_A = 25°C unless outherwise noted)

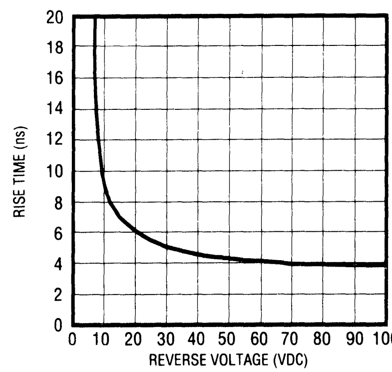
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V[(3)]
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0V [(4)]
C_T	Total Capacitance		3.0		pF	V_R = 20.0V

TYPICAL PERFORMANCE CURVES

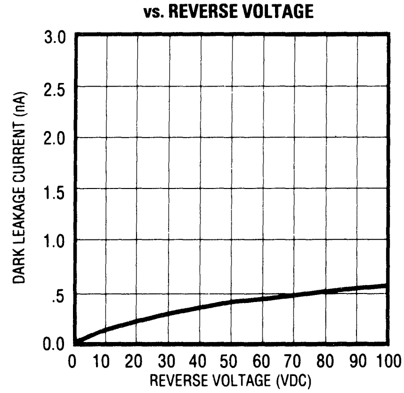
DARK CURRENT vs. AMBIENT TEMPERATURE



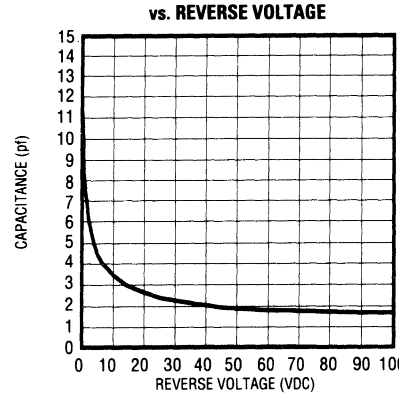
RISE TIME vs. REVERSE VOLTAGE



DARK CURRENT vs. REVERSE VOLTAGE

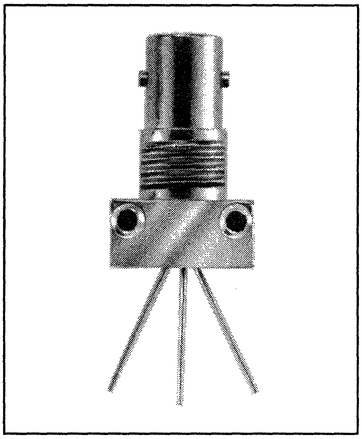


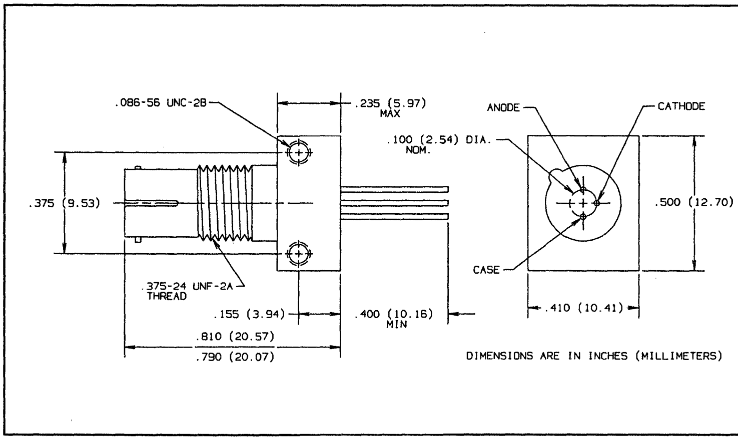
TYPICAL CAPACITANCE vs. REVERSE VOLTAGE



FIBER OPTIC COMPONENTS

Fiber Optic PIN Photodiode in ST* Receptacle
Type OPF422





Features

- Component pre-mounted and ready for use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

Description

The OPF422 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

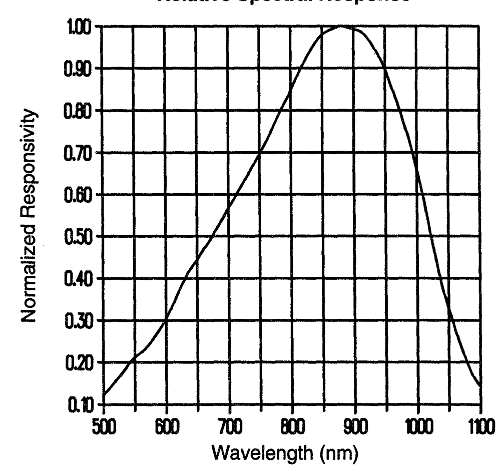
*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +125°C
Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μW optical power @ 850nm. Responsivity levels apply to 50 μm, 62.5 μm, and 100 μm core optical fibers.
(4) R_L = 50 Ω, 10%-90%.

Relative Spectral Response



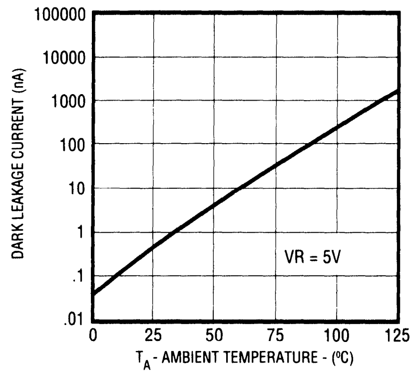
Type OPF422

Electrical Characteristics (T_A = 25°C unless outherwise noted)

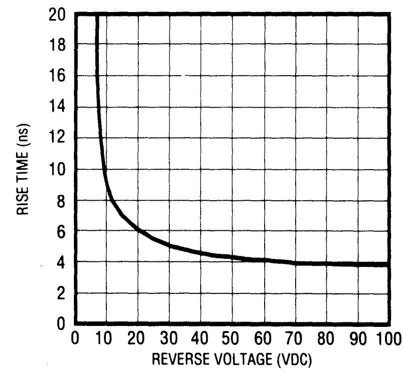
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0V(4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0V

TYPICAL PERFORMANCE CURVES

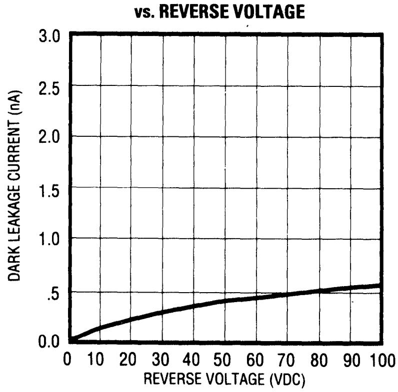
DARK CURRENT vs. AMBIENT TEMPERATURE



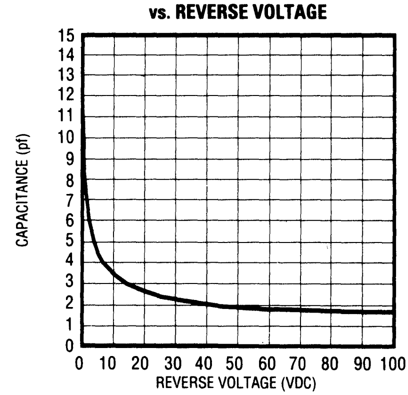
RISE TIME vs. REVERSE VOLTAGE



DARK CURRENT vs. REVERSE VOLTAGE

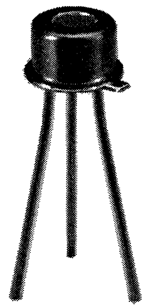


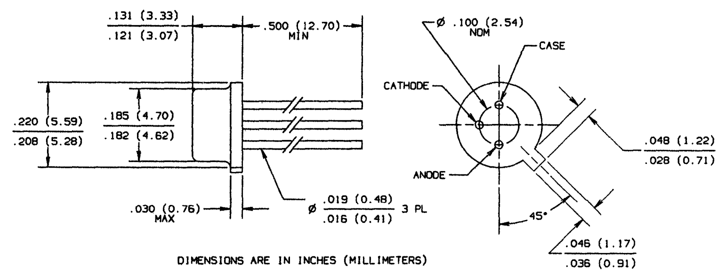
TYPICAL CAPACITANCE vs. REVERSE VOLTAGE



OPTEK

Fiber Optic High Speed PIN Photodiode
Type OPF430





Features

- Electrically isolated TO-46 package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 100 micron fiber

Description

The OPF430 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optics applications. It offers fast response at low bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

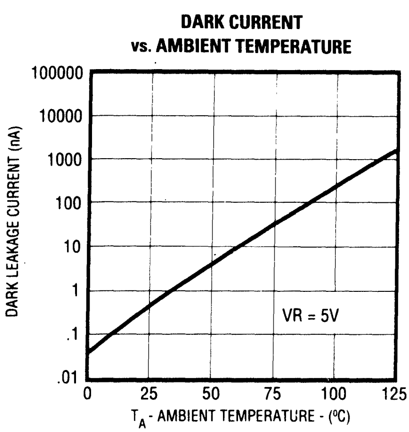
Notes:
(1) Derate linearly @ 2.0 mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

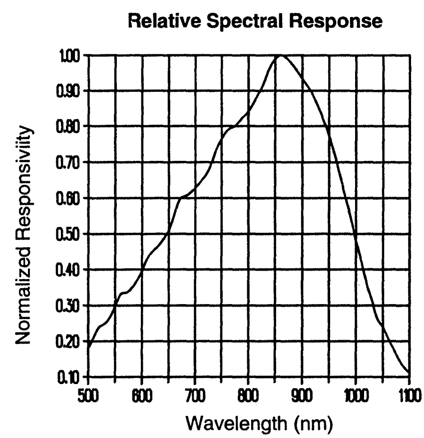
Type OPF430

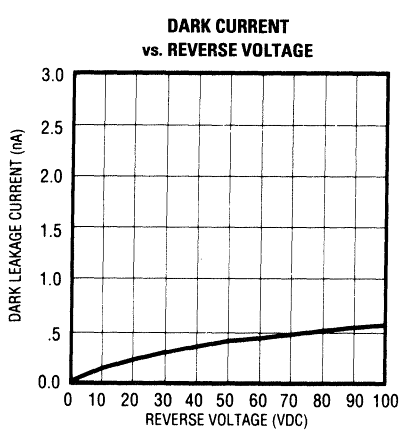
Electrical Characteristics (T_A = 25°C unless otherwise noted)

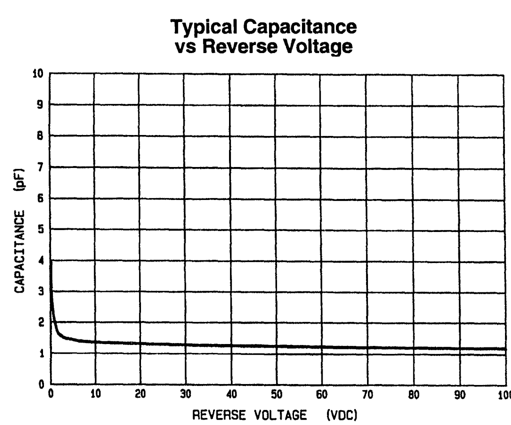
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V
FoV	Field of View		80		Deg.	

Typical Performance Curves





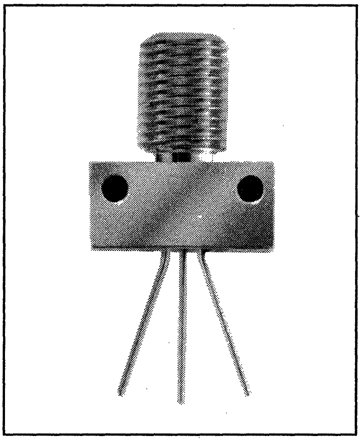


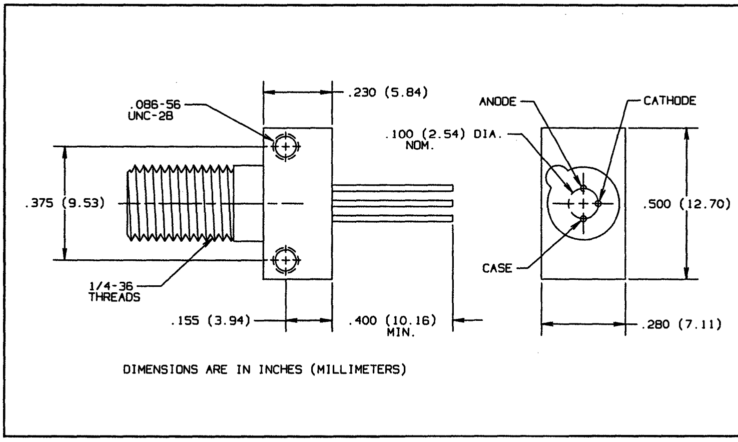


FIBER OPTIC COMPONENTS

OPTEK

Fiber Optic High Speed PIN Photodiode in SMA Receptacle Type OPF431





Features

- Component pre-mounted and ready to use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- Electrically isolated from case

Description

The OPF431 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100V
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +125°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μW optical power @ 850 nm. Responsivity levels apply to 50 μm, 62.5 μm and 100 μm core optical fibers.

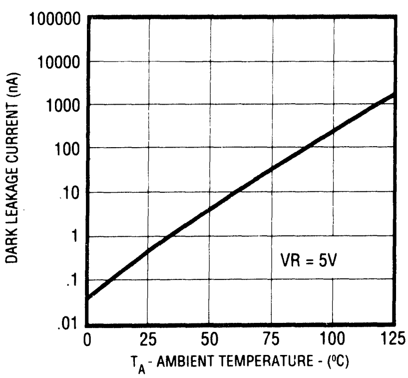
Type OPF431

Electrical Characteristics (T_A = 25°C unless otherwise noted)

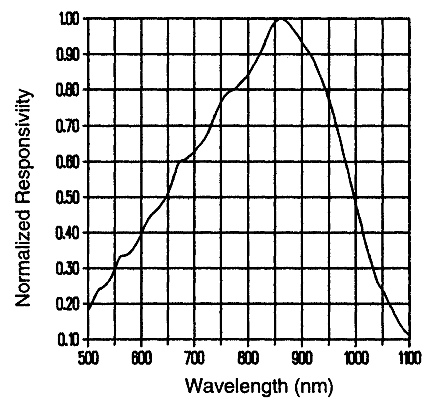
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V

Typical Performance Curves

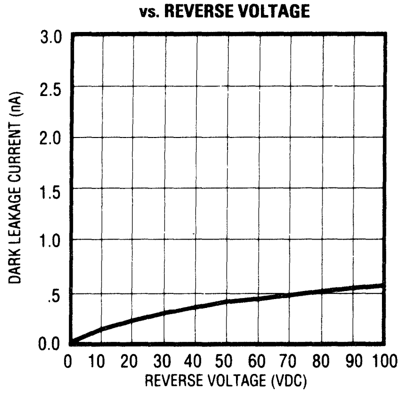
DARK CURRENT vs. AMBIENT TEMPERATURE



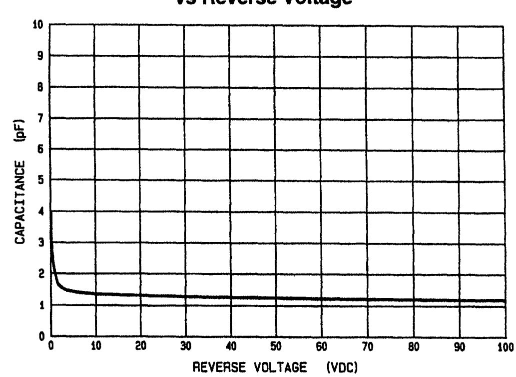
Relative Spectral Response



DARK CURRENT vs. REVERSE VOLTAGE



Typical Capacitance vs Reverse Voltage



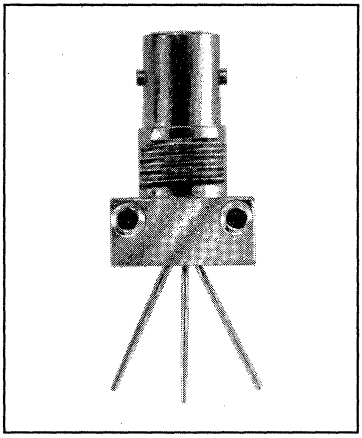
FIBER OPTIC COMPONENTS

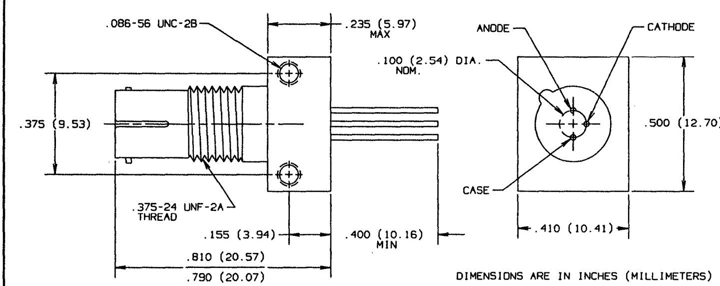
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPF432
May 1993

OPTEK

Fiber Optic High Speed PIN Photodiode in ST* Receptacle
Type OPF432





Features

- Component pre-mounted and ready for use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- Electrically isolated from case

Description

The OPF432 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

*ST is a registered trademark of AT&T

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +125°C
Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μW optical power @ 850 nm. Responsivity levels apply to 50 μm, 62.5 μm and 100 μm core optical fibers.

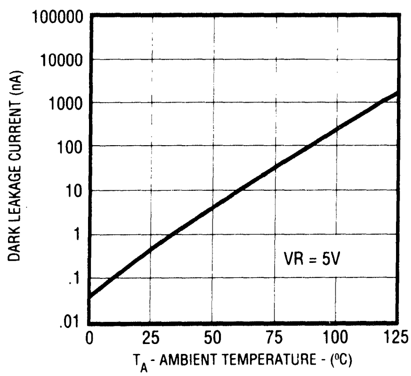
Type OPF432

Electrical Characteristics (T_A = 25°C unless otherwise noted)

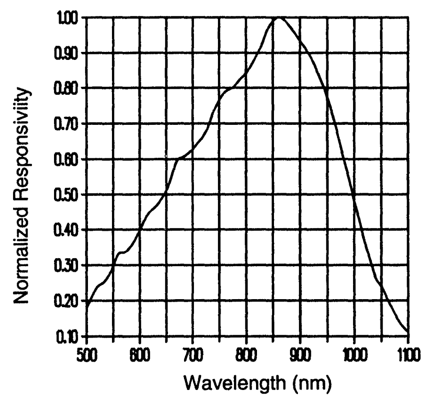
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V[(3)]
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V

Typical Performance Curves

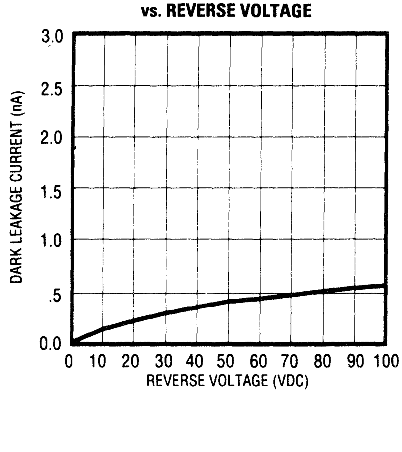
DARK CURRENT vs. AMBIENT TEMPERATURE



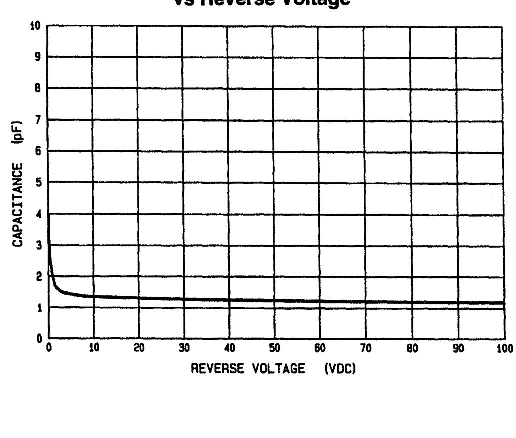
Relative Spectral Response



DARK CURRENT vs. REVERSE VOLTAGE



Typical Capacitance vs Reverse Voltage

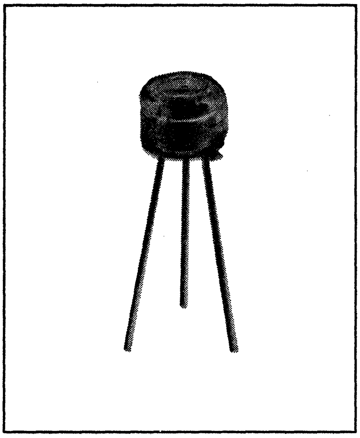


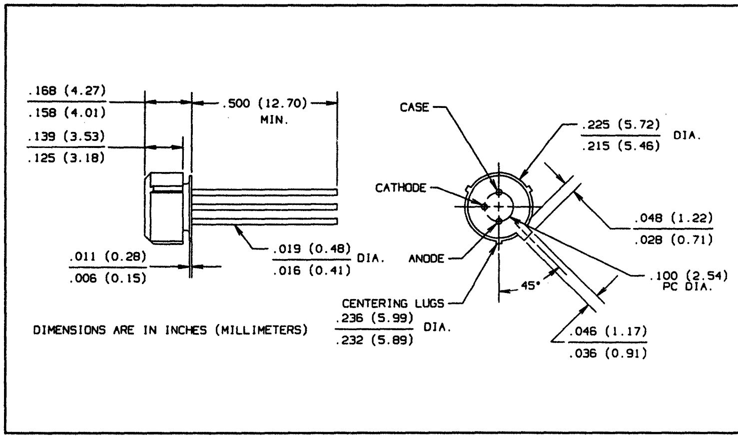
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPF470
January 1994

OPTEK

Fiber Optic PIN Photodiode
Type OPF470





Features

- Electrically isolated plastic cap package
- High speed, low capacitance
- Designed to self align in the 0.228 diameter bore of standard fiber optic receptacles
- Press fit simplifies component installation
- Optimized for fiber optic applications using 50 to 200 micron fiber

Description

The OPF470 is a low noise silicon PIN photodiode mounted in a low cost package for fiber optic applications. It offers fast response at moderate bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

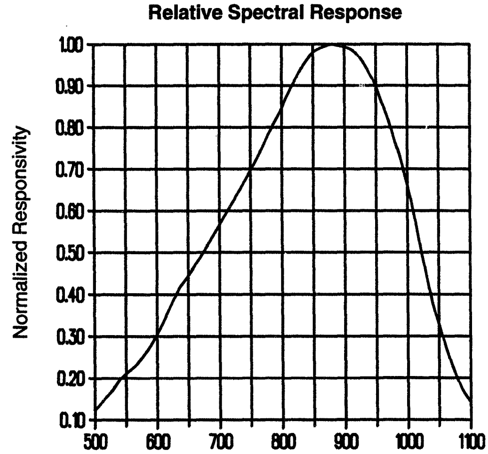
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +115°C
Operating Temperature Range .... -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μW optical power @ 850nm. Responsivity levels apply to 50 μm, 62.5 μm and 100μm core optical fibers.
(4) R_L = 50 Ω, 10%-90%

Typical Performance Curves

Relative Spectral Response

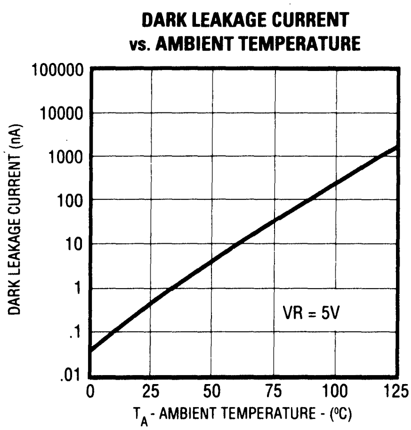


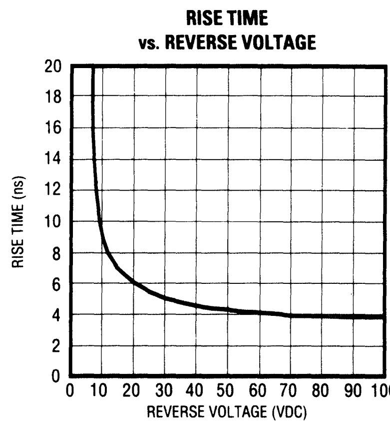
Type OPF470

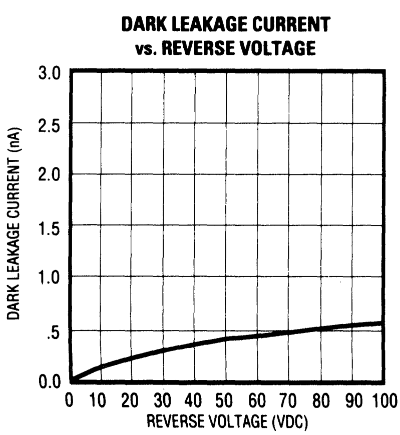
Electrical Characteristics (T_A = 25°C unless outherwise noted)

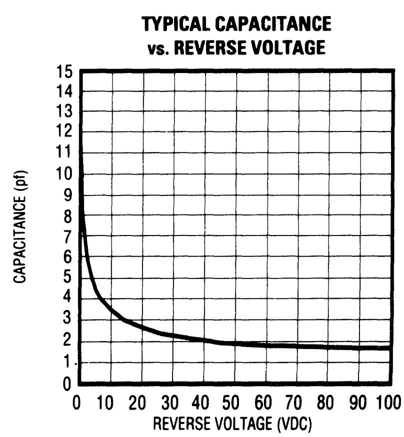
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0V(4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0V
FoV	Field of View		80		Deg.	

TYPICAL PERFORMANCE CURVES







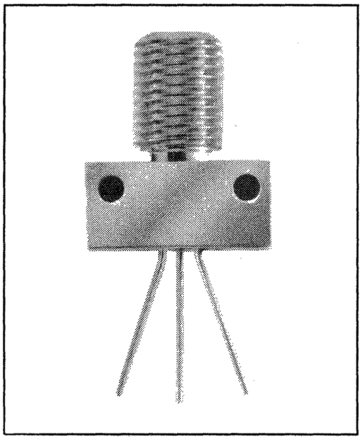


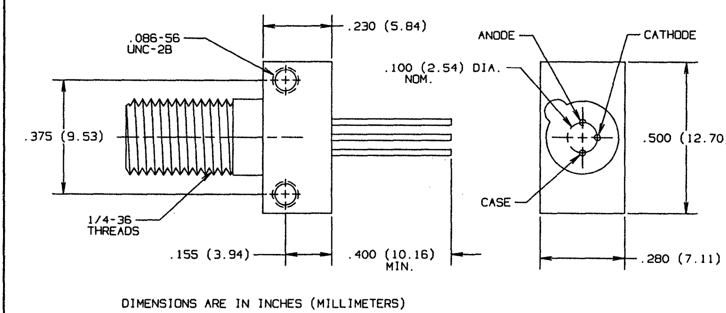
FIBER OPTIC COMPONENTS

Product Bulletin OPF471
May 1993

OPTEK

Fiber Optic PIN Photodiode in SMA Receptacle Type OPF471





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

Description

The OPF471 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

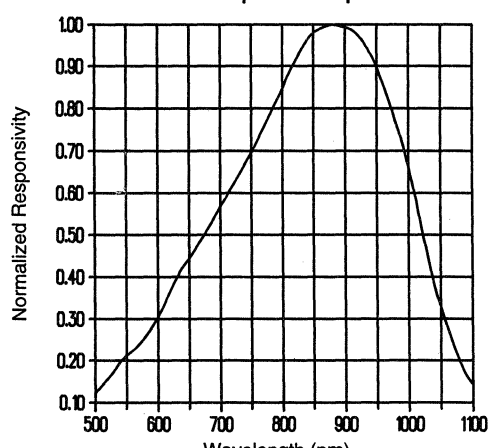
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) R_L = 50 Ω, 10% - 90%.

Typical Performance Curves

Relative Spectral Response

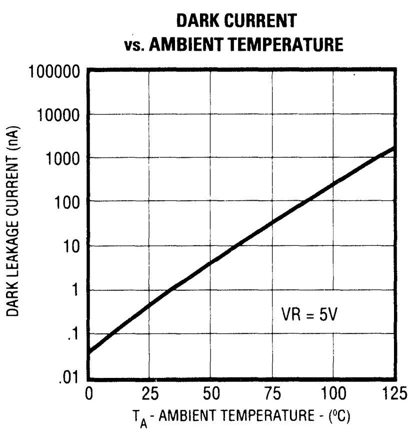


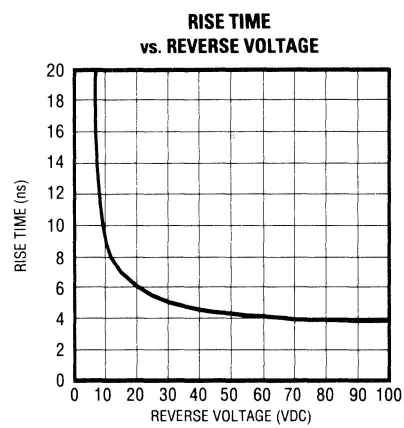
Type OPF471

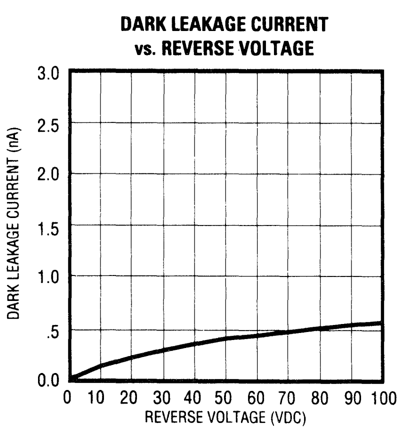
Electrical Characteristics (T_A = 25°C unless outherwise noted)

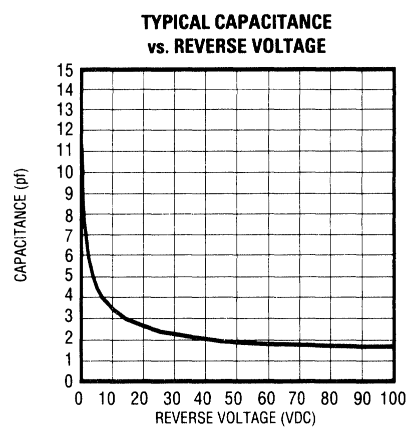
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0V(4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0V

TYPICAL PERFORMANCE CURVES







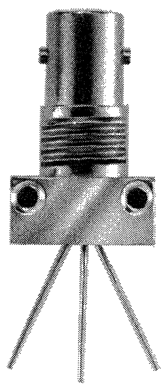


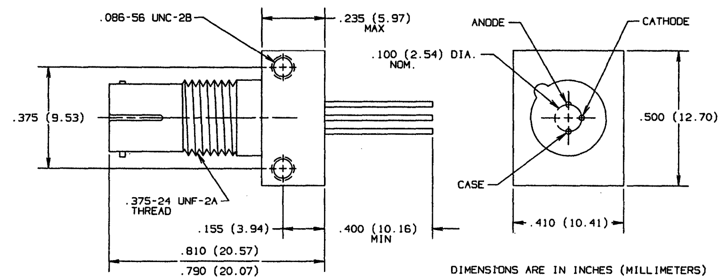
FIBER OPTIC COMPONENTS

Product Bulletin OPF472
May 1993

OPTEK

Fiber Optic PIN Photodiode in ST* Receptacle
Type OPF472





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle

Description

The OPF472 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/300 microns.

*ST is a registered tardemark of AT&T.

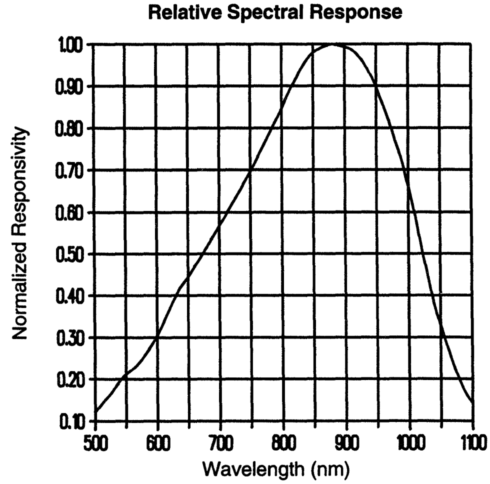
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +100°C
Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μm optical power @ 850nm. Responsivity levels apply to 50 μm, 62.5 μm and 100 μm core optical fibers.
(4) R_L = 50 Ω, 10% - 90%.

Typical Performance Curves

Relative Spectral Response



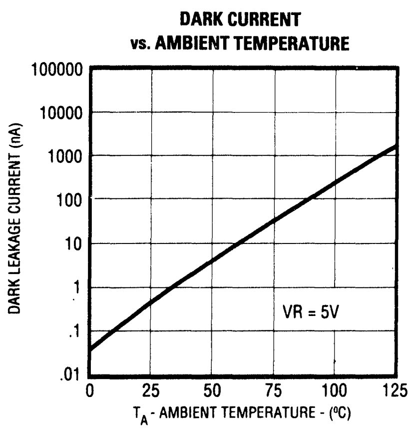
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

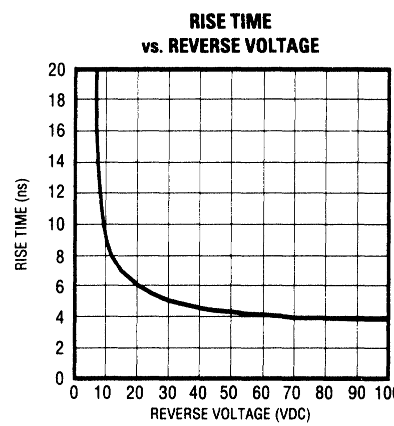
Type OPF472

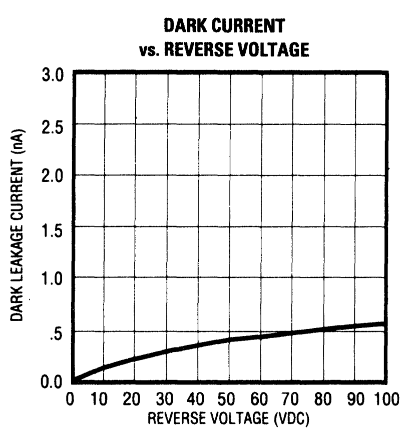
Electrical Characteristics (T_A = 25°C unless outherwise noted)

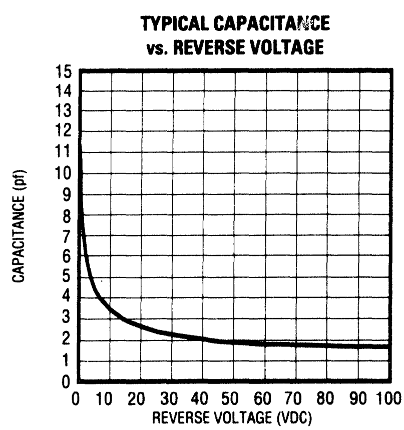
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0V(4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0V

TYPICAL PERFORMANCE CURVES





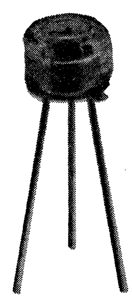


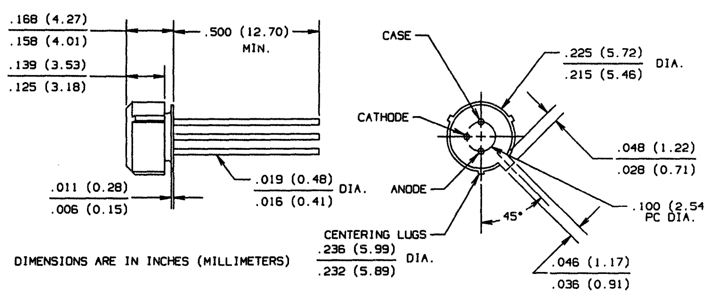


FIBER OPTIC COMPONENTS

Product Bulletin OPF480
January 1994

Fiber Optic High Speed PIN Photodiode
Type OPF480





Features

- Electrically isolated plastic cap package
- High speed, low capacitance
- Designed to self align in the 0.228 diameter bore of standard fiber optic receptacles
- Press fit simplifies component installation
- Optimized for fiber optic applications using 50 to 100 micron fiber

Description

The OPF480 is a low noise silicon PIN photodiode mounted in a low cost package for fiber optic applications. It offers fast response at low bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +115°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

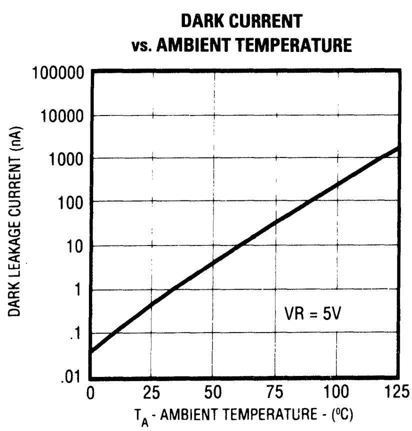
Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

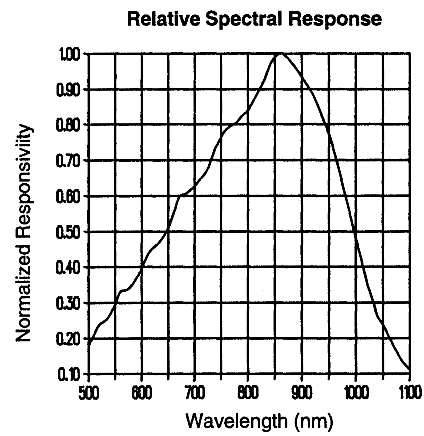
Type OPF480

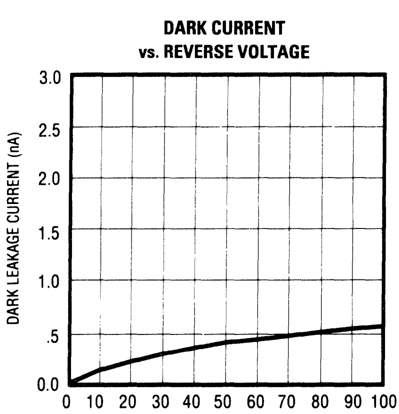
Electrical Characteristics (T_A = 25°C unless otherwise noted)

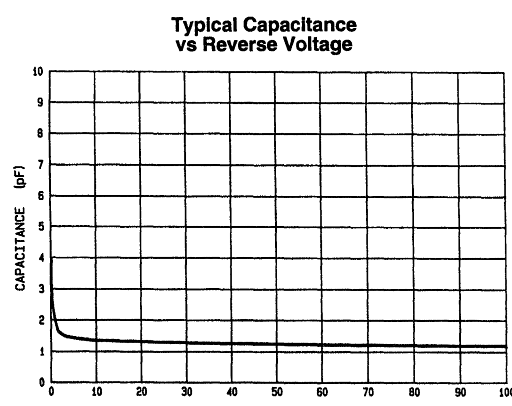
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V
FoV	Field of View		80		Deg.	

Typical Performance Curves







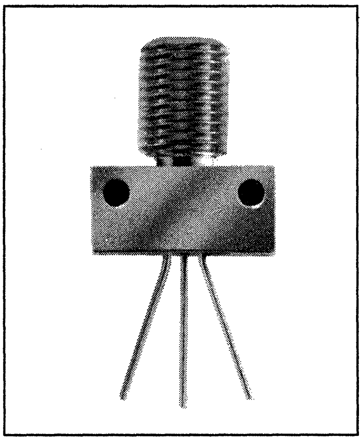


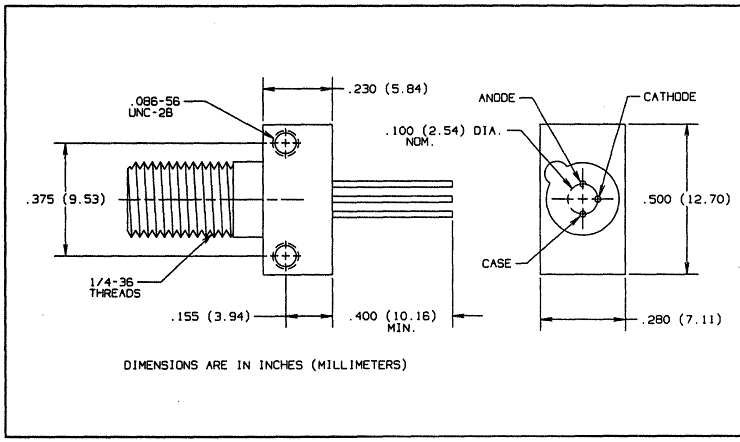
FIBER OPTIC COMPONENTS

Product Bulletin OPF481
May 1993

OPTEK

Fiber Optic High Speed PIN Photodiode in SMA Receptacle Type OPF481





Features

- Component pre-mounted and ready to use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- Electrically isolated from case

Description

The OPF481 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

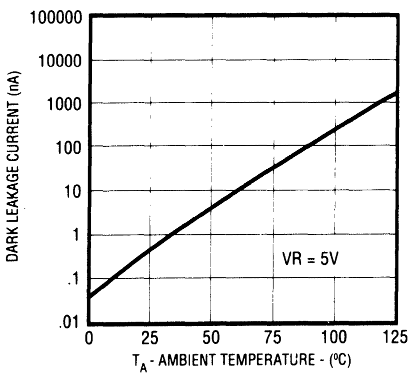
Type OPF481

Electrical Characteristics (T_A = 25°C unless otherwise noted)

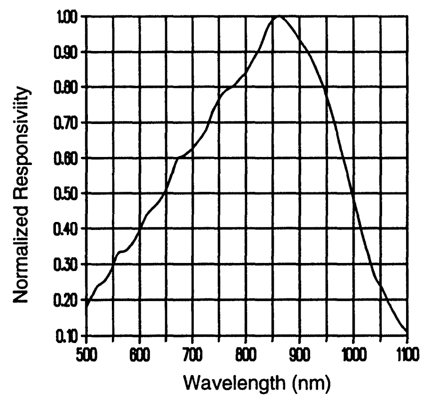
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V

Typical Performance Curves

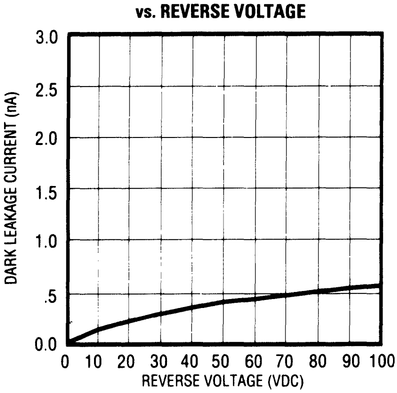
DARK CURRENT vs. AMBIENT TEMPERATURE



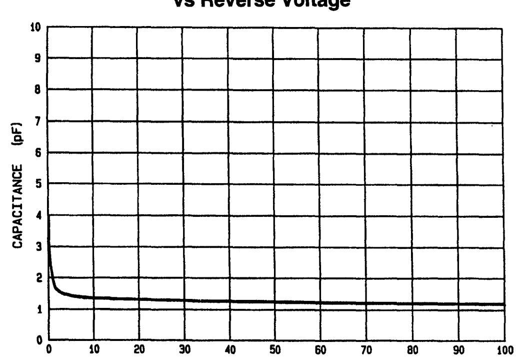
Relative Spectral Response



DARK CURRENT vs. REVERSE VOLTAGE

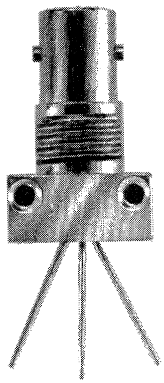


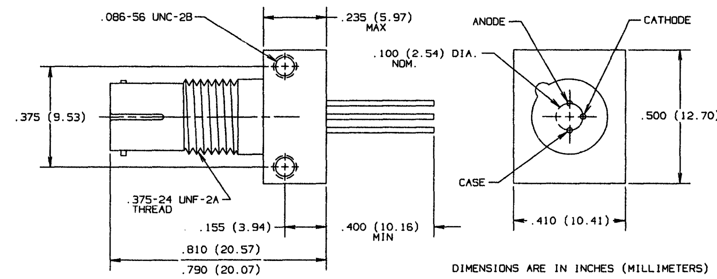
Typical Capacitance vs Reverse Voltage



OPTEK

Fiber Optic High Speed PIN Photodiode in ST* Receptacle
Type OPF482





Features

- Component pre-mounted and ready to use
- High speed, low capacitance
- Pre-tested with fiber to assure performance
- Popular ST* style receptacle
- Electronically isolated from case

Description

The OPF482 consists of a low cost plastic cap PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

*ST is a registered trademark of AT&T.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +100°C
Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

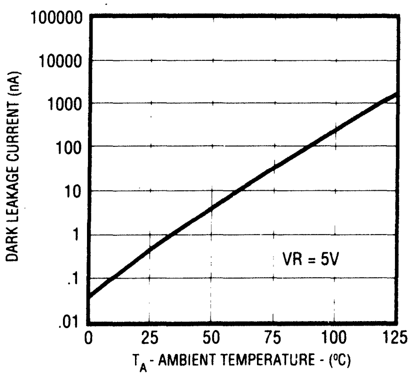
Type OPF482

Electrical Characteristics (T_A = 25°C unless otherwise noted)

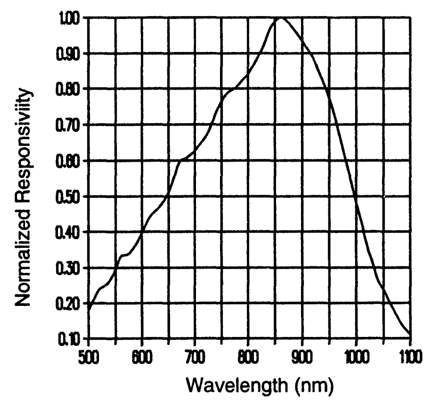
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V

Typical Performance Curves

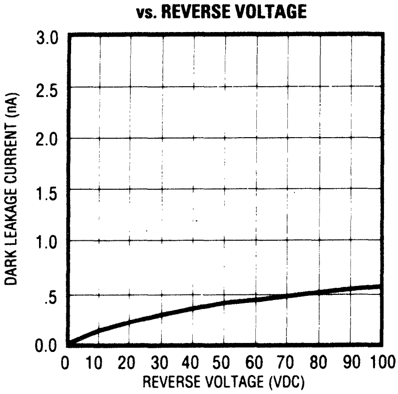
DARK CURRENT vs. AMBIENT TEMPERATURE



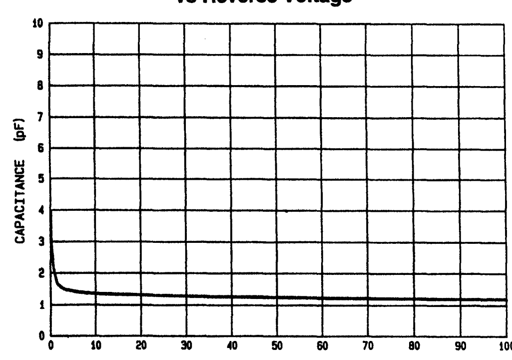
Relative Spectral Response



DARK CURRENT vs. REVERSE VOLTAGE



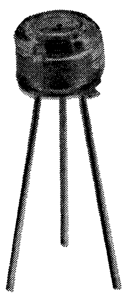
Typical Capacitance vs Reverse Voltage

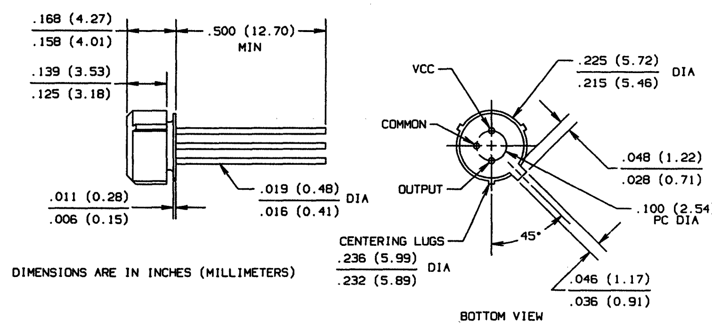


FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

25 MHz Fiber Optic Receiver
Type OPF540





Features

- Electrically isolated plastic cap package
- Designed to self align in the 0.228 diameter bore of standard fiber optic receptacles
- Press fit simplifies component installation
- Optimized for fiber optic applications using 50 to 200 micron fiber

Description

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35 MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature	-55°C to +115°C
Operating Temperature	-40°C to +85°C
Lead Soldering Temperature (for 10 sec.)	260°C
Supply Voltage	-0.5 to 7.0V

Type OPF540

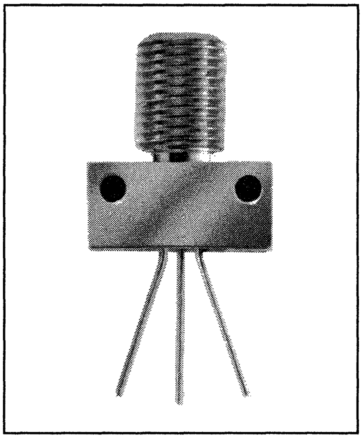
Electrical Characteristics (T_A = 25°C unless otherwise noted)

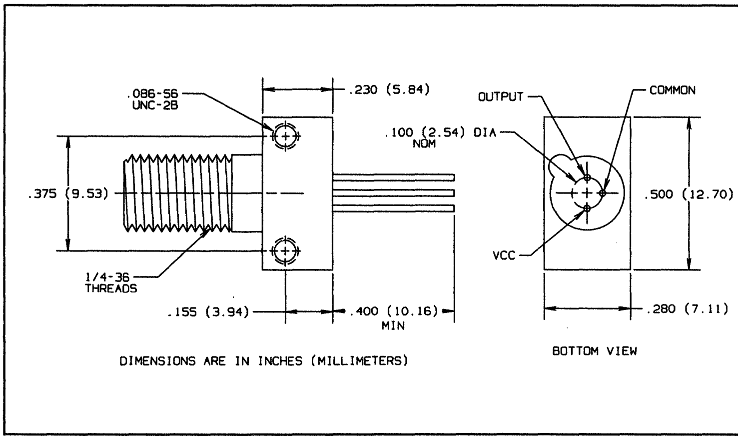
4.75 ≤ V_{CC} ≤ 5.25, R_{LOAD} = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35

SYMBOL	PARAMETERS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R_P	Responsivity	6.5 5.8	9.3	12.5 14.1	mV/µW mV/µW	at 840 nm at 840 nm, -40°C ≤ T_A ≤ +85°C
V_{NO}	RMS Output Noise Voltage		0.30	0.36 0.43	mV mV	P_R = 0 µW P_R = 0 µW, -40°C ≤ T_A ≤ +85°C
P_N	Equivalent Optical Noise Input Power		-44.9 0.032	-40.9 0.082	dBm µW	
P_R	Peak Input Power			-13.2 48 -14.7 34	dBm µW dBm µW	T_A = 25°C T_A = 25°C -40°C ≤ T_A ≤ +85°C -40°C ≤ T_A ≤ +85°C
I_{CC}	Power Supply Current		3.4	6.0	mA	R_{LOAD} = ∞
t_r, t_f	Rise Time, Fall Time (10% to 90%)		14	19.5	ns	P_R = 10 µW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF
PWD	Pulse Width Distortion			2	ns	P_R = 40 µW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF

Product Bulletin OPF541
May 1993

25 MHz Fiber Optic Receiver
Type OPF541





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle

Description

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35 MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature . . . . -55°C to +115°C
Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature (for 10 sec.) . . . . 260°C
Supply Voltage . . . . -0.5 to 7.0V

Type OPF541

Electrical Characteristics (T_A = 25°C unless otherwise noted)

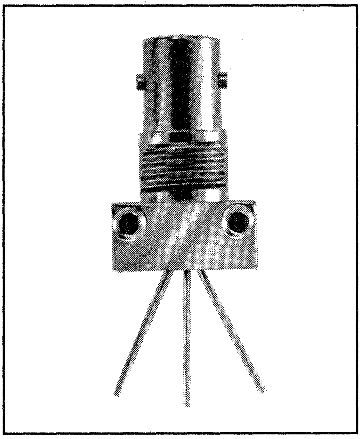
4.75 ≤ V_{CC} ≤ 5.25, R_{LOAD} = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35

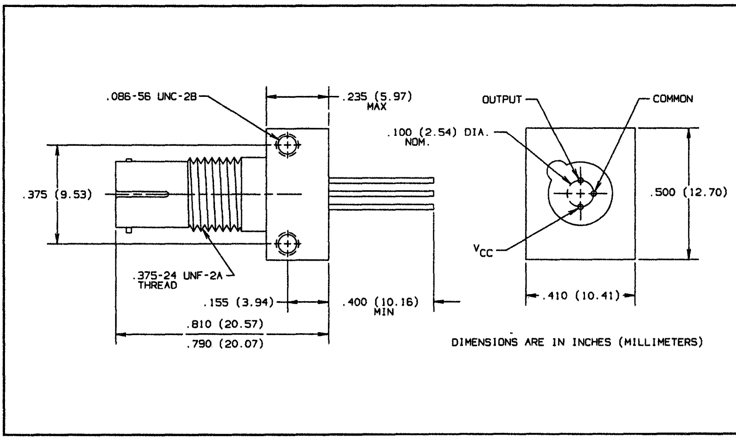
SYMBOL	PARAMETERS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R_P	Responsivity	6.5 5.8	9.3	12.5 14.1	mV/μW mV/μW	at 840 nm at 840 nm, -40°C ≤ T_A ≤ +85°C
V_{NO}	RMS Output Noise Voltage		0.30	0.36 0.43	mV mV	P_R = 0 μW P_R = 0 μW, -40°C ≤ T_A ≤ +85°C
P_N	Equivalent Optical Noise Input Power		-44.9 0.032	-40.9 0.082	dBm μW	
P_R	Peak Input Power			-13.2 48 -14.7 34	dBm μW dBm μW	T_A = 25°C T_A = 25°C -40°C ≤ T_A ≤ +85°C -40°C ≤ T_A ≤ +85°C
I_{CC}	Power Supply Current		3.4	6.0	mA	R_{LOAD} = ∞
t_r, t_f	Rise Time, Fall Time (10% to 90%)		14	19.5	ns	P_R = 10 μW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF
PWD	Pulse Width Distortion			2	ns	P_R = 40 μW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF

FIBER OPTIC COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

25 MHz Fiber Optic Receiver
Type OPF542





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle

Description

The output of the receiver is an analog, low impedance, voltage source capable of driving an amplifier or level translating circuitry for use on various data formats and data rates up to 35 MBaud.

The receiver is comprised of a high speed, low noise, photodiode coupled to a transimpedance amplifier which produces an output voltage proportional to the input light amplitude. This hybrid approach solves many of the problems of high speed data link designs by placing a pre-amplifier close to the photodiode. The level amplification produced by the transimpedance amplifier makes the output signal much less susceptible to interference which is a problem often found at high data rates and in high EMI environments.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature . . . . -55°C to +115°C
Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature (for 10 sec.) . . . . 260°C
Supply Voltage . . . . -0.5 to 7.0V

Type OPF542

Electrical Characteristics (T_A = 25°C unless otherwise noted)

4.75 ≤ V_{CC} ≤ 5.25, R_{LOAD} = 511 Ω, Fiber Sizes ≤ 100 Microns, N.A. ≤ 0.35

SYMBOL	PARAMETERS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R_P	Responsivity	6.5 5.8	9.3	12.5 14.1	mV/µW mV/µW	at 840 nm at 840 nm, -40°C ≤ T_A ≤ +85°C
V_{NO}	RMS Output Noise Voltage		0.30	0.36 0.43	mV mV	P_R = 0 µW P_R = 0 µW, -40°C ≤ T_A ≤ +85°C
P_N	Equivalent Optical Noise Input Power		-44.9 0.032	-40.9 0.082	dBm µW	
P_R	Peak Input Power			-13.2 48 -14.7 34	dBm µW dBm µW	T_A = 25°C T_A = 25°C -40°C ≤ T_A ≤ +85°C -40°C ≤ T_A ≤ +85°C
I_{CC}	Power Supply Current		3.4	6.0	mA	R_{LOAD} = ∞
t_r, t_f	Rise Time, Fall Time (10% to 90%)		14	19.5	ns	P_R = 10 µW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF
PWD	Pulse Width Distortion			2	ns	P_R = 40 µW Peak, R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF

OPTEK TECHNOLOGY, INC.

HYBRID ASSEMBLIES

The Opto Hybrid

Hybrid Assemblies are a strategic product area for Optek Technology. This means Optek is dedicated to be the best at what we do and to service the needs of our customers.

Opto hybrids offer solutions to many applications that cannot be satisfied with standard or conventional components.

Hybrid technology offers significant advantages for many electronic applications. Size constraints and performance targets typically determine the choice of hybrid construction.

Optek's broad capabilities make it possible to address a diverse range of applications. Furthermore, our customers can specify and procure a total functional system package from a single, experienced source.

Our expertise includes:

APPLICATION ENGINEERING
COMPUTER AIDED DESIGN
CUSTOM TEST SYSTEM DESIGN
CUSTOM SENSOR AND IC DEVELOPMENT
ENGINEERED PLASTICS AND INJECTION MOLDS
CHARACTERIZATION OF OPTOELECTRONIC PARTS
VERTICALLY INTEGRATED MANUFACTURING

OPTO HYBRID FEATURES

Chip-on-board design provides several advantages:

SIZE: Used where the function cannot be accomplished with conventional through hole, leaded components. Space savings can be as much as 80% as compared with discrete packaged parts.

PERFORMANCE: Allows the designer to create functions that cannot be fabricated with separately made components. The vast majority of components are available in chip, SMD or thick film form. Laser trimming allows designs that require uniform characteristics over time and temperature and the entire population of assemblies.

PACKAGING: The opto hybrid offers unique shape and mounting configurations and material combinations to suit a special set of environmental conditions. The standard materials and processes result in packages that accommodate extended temperatures beyond the range of many commercial components.

RELIABILITY: Reduced part count, automated processes, and Optek's commitment to quality result in robust, defect free parts.

COST: Chip carriers withstand the challenges of low cost automated handling, placement, and reflow soldering. In comparison to a custom IC solution, the development cost of a typical hybrid circuit is far less and modifications are quicker and easier. Array processing in hybrid fabrication minimizes cost and optimizes quality.

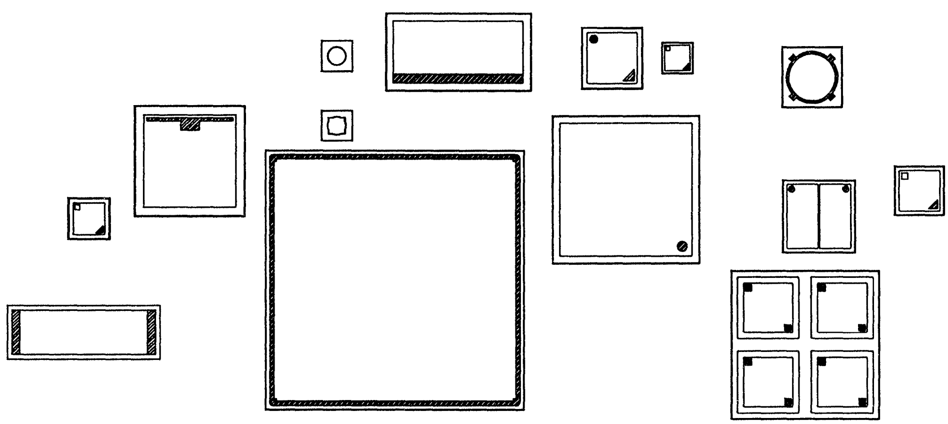
The flexibility to choose and combine the best technologies for your application is the feature that makes hybrid technology so valuable.

CUSTOM CAPABILITIES

Standard PC board fabrication flexibility allows for various component orientations, mounting features, and interconnect schemes.

The starting substrates can be Epoxy-glass, Polyimide, Flex Circuits, or Ceramic. Production tooling is in place for a standard array format of 4" X 4", but custom tooling can be designed to meet the needs of other materials, sizes, and shapes.

Substrates, encapsulants, and plating can be tailored to meet the circuit requirements.



Even with the standard chip carrier materials and processes, imagination is the only limit to the possible configurations.

Design variables include:

- MATERIALS
- OPTICAL PROPERTIES
- LEADS, PINS, OR CABLES
- SPECIAL TESTS AND PROCESSING

CUSTOM CAPABILITIES

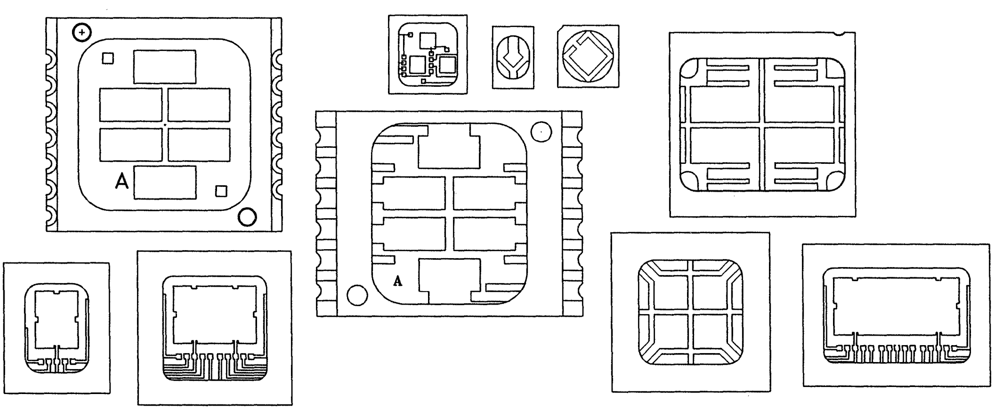
Optek produces a variety of IC's, Photosensors, and Light Emitting Diodes that can be incorporated in custom designs. Optek is not limited to the sensor applications which use optoelectronics. Starting at the chip level, we design, develop, and manufacture state-of-the-art Hall Effect and Power devices.

When standard devices are not a match, our internal design capability will satisfy the application circuit requirement.

Manufacturing flexibility makes the Hybrid facility effective for serving both the high complexity and high volume assembly needs.

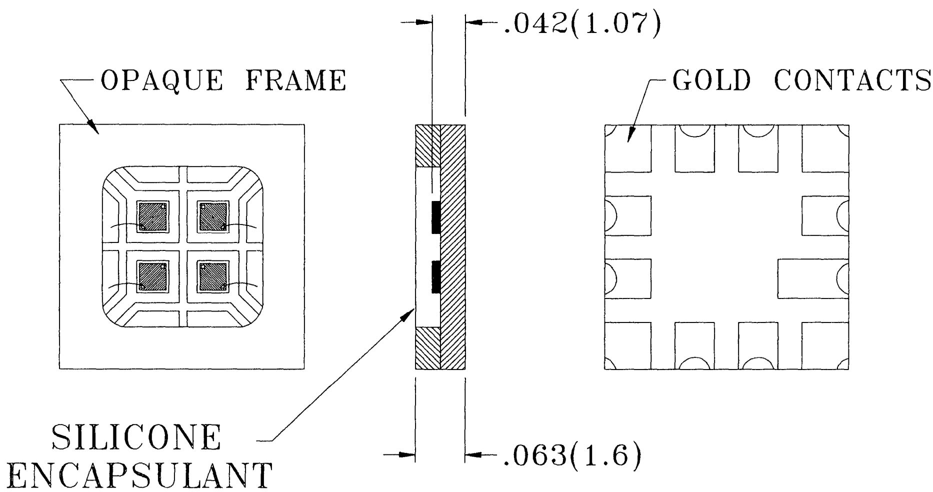
Computer controlled manufacturing operations include:

- CHIP AND SMD PICK AND PLACE
- WIRE BONDING
- ENCAPSULANT DISPENSING
- SINGULATING
- CURE AND REFLOW OVEN CYCLES
- FINAL ELECTRICAL TEST



OPTEK TECHNOLOGY
HYBRID CHIP CARRIER DESIGN RULES

The most cost effective chip-on-board products take advantage of standards in design and processing. The following guidelines for substrate layout are intended TO ASSIST the designer in the first stage of product development .



The Chip Carrier

The polyimide chip carrier, an Optek Standard packaging method, has four main parts: substrate, frame, components, and encapsulation. The substrate is fabricated from high temperature copper-clad laminate. Standard pc board processing provides the plated and non-plated holes, circuit patterns, and chip mounting features. The frame layer is made from the same polyimide laminates.

To make the substrate compatible with die attach and wire bonding techniques, the copper surface is plated with a nickel barrier and gold. After the chip components are mounted and bonded, the frame is screen printed with a pattern of non-conductive epoxy, aligned with the matching substrate cells and laminated under elevated temperature and pressure.

A conformal coating is applied to fill the component cavities. After curing, the array is sawed into individual product elements and ready for test.

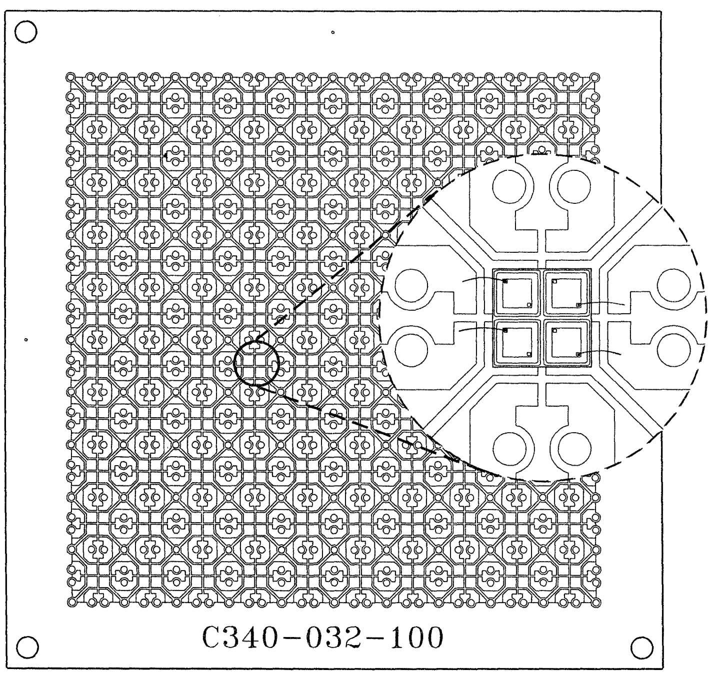
HYBRID CHIP CARRIER DESIGN RULES

The Substrate Material

The Optek standard chip carrier substrate and frame material thickness is .030"(0.76 mm). Including the adhesive and metal layers, this two layer, laminated package has a nominal thickness of .063"(1.6 mm).

While thinner substrates can be specified (commercially available materials as thin as .005"), the standard thickness frame layer is ideal for encapsulant containment and insuring complete protection of the chips and bond wires.

Polyimide is an excellent substrate because of its strength, high processing temperature, and close match with the expansion coefficient of silicon devices. Optek uses a special opaque grade of .030" polyimide which can effectively shield sensors from stray light. The specifications and curves shown on the following page illustrate these characteristics.

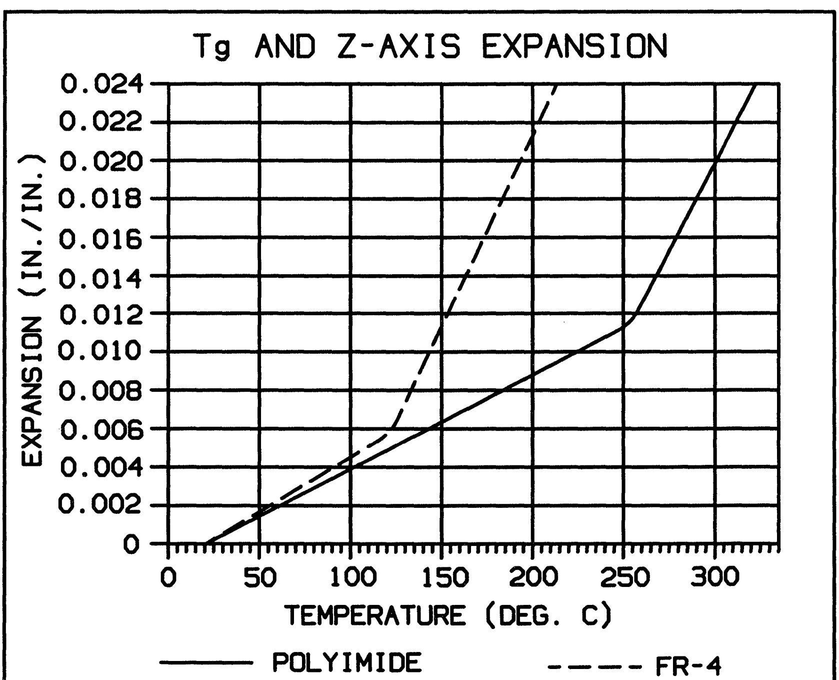


FR-4 and other high temperature epoxy-glass laminates are also suitable for the chip-on-board processing and may be recommended for certain applications.

HYBRID CHIP CARRIER DESIGN RULES

Polyimide Substrate Characteristics

Operating Temperature (10K Hours)	250°C
Glass Transition Temperature (Tg)	260°C
Flammability (UL94)	V1
Coefficient of Thermal Expansion(µin./in./°C)	Z AXIS=55
(µin./in./°C)	X,Y AXIS=15
Peel Strength (Pounds/Inch)	8
Flexural Strength (psi @ 200°C)	52,000
Water Absorption (%)	0.32
Dielectric Constant (@ 1MHz)	4.3
Dissipation Factor (@ 1MHz)	0.015
Volume Resistivity (OHM-CM @ 25°C)	5 E15
Surface Resistivity (OHM-CM @ 25°C)	7.6 E13

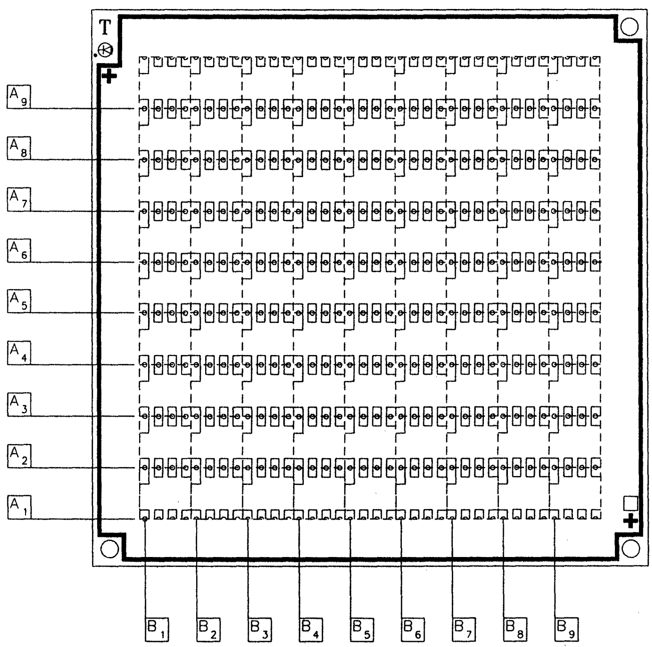


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

HYBRID CHIP CARRIER DESIGN RULES

The Substrate Layout

Minimizing the size of the final package maximizes the cost effectiveness of the array process. As shown in the figure below, improved packing density is possible on the 4" X 4" substrate when cells are arranged to share through hole connections. A "half hole" contact remains with each cell when the elements are cut into the individual parts. Individual cells are arranged with separations or borders of .015"(0.38 mm). This is the thickness of the standard saw blade used for separation. Wider blades are available to accommodate special perimeter features.



The Metal Pattern Features

Conductor widths and spaces of .010"(2.5 mm) are preferred where the design allows. Lines and spaces of less than .005"(0.13 mm) should be avoided for optimum pattern uniformity.

Conductor thickness is determined by the specified starting material and secondary plating process. Standard double sided substrates have a minimum of 25 μin. of gold over 200 μin. of nickel over copper plating that is .002" to .003" thick.

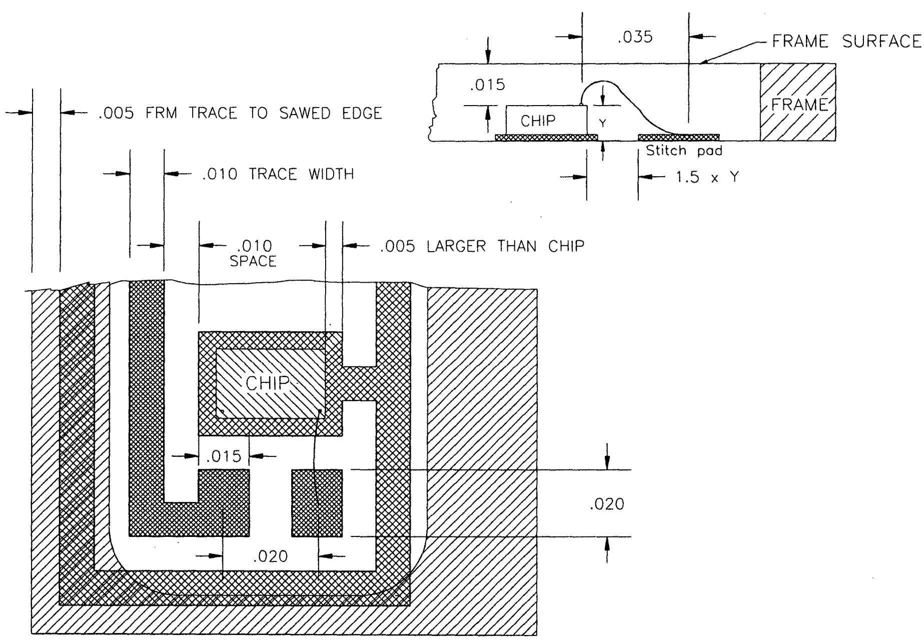
HYBRID CHIP CARRIER DESIGN RULES

Metal Pattern Features (Continued)

Alignment between the metal pattern and drilled or routed features is held to ±.002"(0.05 mm). Chip registration may be specified in relation to substrate holes or the sawed perimeter to eliminate the metal to hole pattern tolerance as a consideration.

The wire bonding stitch pads on the metal pattern are nominally .015" x .020"(0.38 mm x 0.5 mm) with the longer dimension aligned with the bond wire. Stitch pads of .007" x .015"(0.18 mm x 0.38 mm) are considered the minimum size.

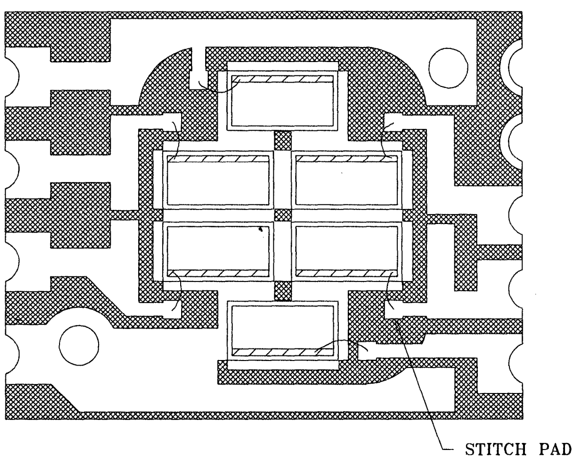
Stitch pad spacing (pad to pad) can be as close as .012"(0.38 mm). Larger spacing (.020" is ideal) is always preferable for optimizing processing speed and inspection.

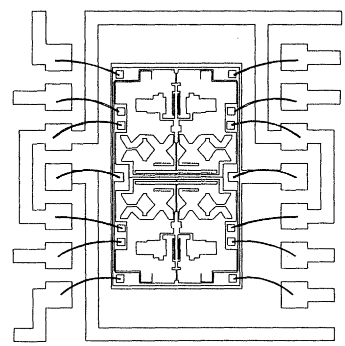


HYBRID CHIP CARRIER DESIGN RULES

Metal Pattern Features (Continued)

Chip mounting pads are often sized to be at least .005" larger than small chips such as LEDs. Even larger pads may be desirable for increased power dissipation or to provide a greater light reflecting surface. The mounting pad can be as small as the die itself for larger components. The pad edges can then be used as chip alignment features. This is particularly useful for designs where the metal pattern establishes a datum.





Drill, Rout, and Saw Features

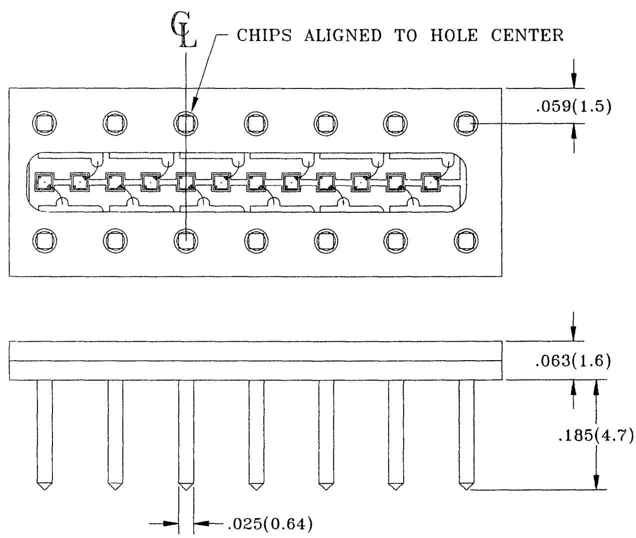
For standard thickness substrates (.030"), hole diameters should be no smaller than .015"(0.38 mm). Drilled holes of .020" or larger are used for most applications. Holes are guaranteed to be within ± .002"(0.05 mm) of absolute position.

When specifying .062"(1.57 mm) thickness for the substrate layer, the minimum recommended hole diameter is .030" to minimize cost.

HYBRID CHIP CARRIER DESIGN RULES

Drill, Rout, and Saw Features (Continued)

To make leaded parts, square pins can be pressed into substrate holes. Standard press fit terminals (.025" square) require enough substrate area for a .031"(0.8 mm) diameter plated through hole with a pad diameter of .062"(1.57 mm). Pin centers should be no closer than .050"(1.27 mm) to the perimeter of the part to avoid fracturing the laminate.



Wrap around edge contacts, formed by saw separation of plated through holes at cell boundaries, must be designed to accommodate the width of the blade. To insure a reliable contact remains after saw, the boundary holes should be no smaller than .025"(0.64 mm). The half hole contacts can be made smaller only if they are offset from the boundary centers so that .005"(0.13 mm) minimum of the hole remains after saw.

The tolerance between drilled features and any of the sawed edges is held to within ± .0025"(0.06 mm). Standard edge to edge tolerance is ± .005"(0.13 mm).

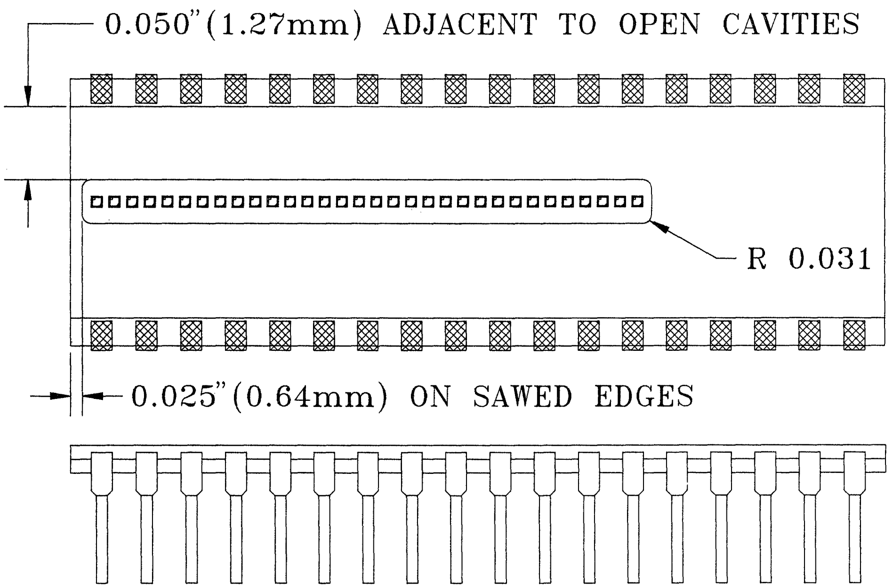
When sawed edges are specified in relationship to chip position, a total tolerance of ± .005"(0.13 mm) is used.

Wherever the design permits, metal patterns are typically recessed a minimum of .005"(0.13 mm) from these sawed edges to minimize metal flash or burrs between conductors.

HYBRID CHIP CARRIER DESIGN RULES

Frame Size and Shape

The size of the routed frame is often based on the need for including features for mounting or alignment with other components. Minimizing the size of a framed carrier depends on chip placement, the arrangement of wire bond patterns, and strength considerations.



The frame width (distance from the chip cavity to an outside edge) is recommended to be .050"(1.27 mm) when space allows. A wide frame insures maximum adhesion to the substrate and prevents low viscosity encapsulant from escaping the cavity. This is especially important for wall sections adjacent to unfilled cavities where a width of .040"(1.0 mm) should be considered the absolute minimum. Thinner walls are effective encapsulant barriers when adjacent cavities are also filled. Minimum wall width is also affected by the cavity size. Longer sections require wider walls for strength. Frame walls of .025"(0.64 mm) or wider are recommended.

The frame cavities can be a variety of shapes and sizes, but because they are formed by a routing operation, inside features are rounded. Chip placement must accommodate these radii which are nominally .031"(0.8 mm). The smallest radius which can be specified for standard processing is .020"(0.5 mm). Sharp inside corners can be fabricated with laser machining but at a significantly higher processing cost.

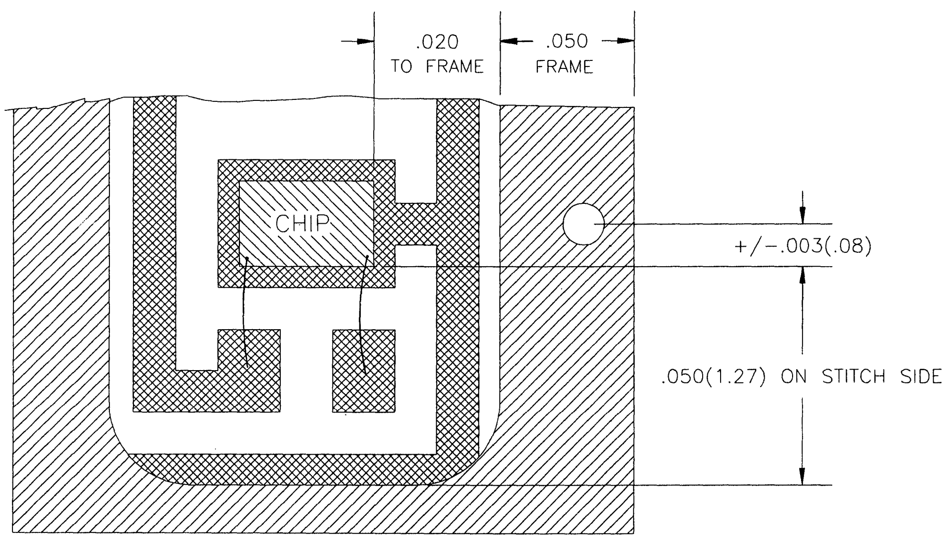
HYBRID CHIP CARRIER DESIGN RULES

Chip Placement and Wire Bonds

Chip position may be specified with relation to drilled holes, routed or sawed edges, or the circuit's metal pattern. Registering the chips (especially sensors and LEDs) to holes is typically done when these holes will be used for aligning the carrier to features of the next level assembly or other optical components such as aperture masks.

Precise alignment marks can also be added to the metal patterns to produce a common datum for the die and carrier placement.

The relationship of the chip to the inside edge of the frame can vary greatly by the components selected (chip size and bond pad arrangement). In general, a chip edge can be as close as .015"(0.38 mm) to the frame where room is not required for bond wires. Spacing of .020"(0.5 mm) is preferred.



To allow room on a wire bonded side, the design rules call for .050" (1.27 mm) between the frame and the chip if possible and .035"(0.9 mm) as an absolute minimum.

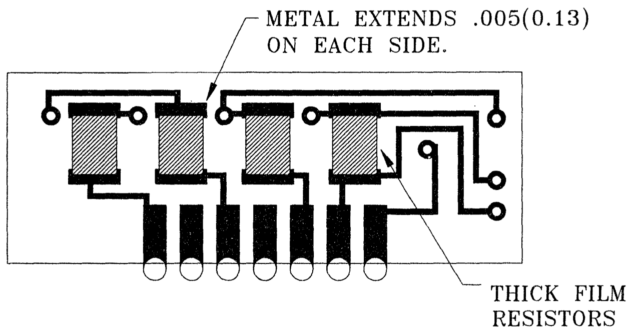
The position of the bond pads on the chip is an important factor. A distance of .035"(0.9 mm) from the ball bond to the stitch bond is recommended when calculating the stitch pad position and the spacing to the edge of the frame. This allows for .015"(0.38 mm) nominal distance between the frame and stitch.

HYBRID CHIP CARRIER DESIGN RULES

Screen Printed Materials

The alignment tolerance between the substrate and a screened image, such as solder mask, thick film resistors, or solder paste, is ± .005"(0.13 mm). Metal pattern features are made slightly larger than the screened image to include this tolerance.

Special processes can improve this tolerance to ± .003"(0.08 mm) for some materials and geometries.

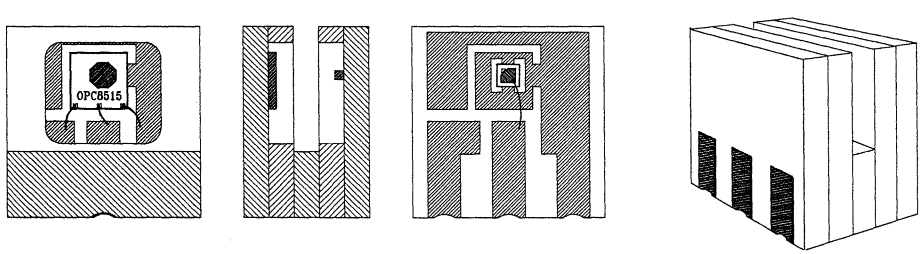


Polymer thick film resistor pastes range from 3 ohms per square to one Meg ohm per square with a temperature coefficient of less than 100ppm (parts per million per degree C).

Without laser trimming, the screened resistor typically has a value tolerance of 20%.

The resistor tolerance after trimming varies by the type and rate of the trimming performed and can be limited by the image size. Standard processing produces a trim tolerance of 1%, but wider tolerances enable faster trims and lower processing costs.

Design rules allow for trimmable resistors as small as .040"(1 mm) and untrimmed resistors as small as .020"(0.5 mm).



Discrete components may be placed on the back side of the substrate along with screened materials. Most surface mount parts can be placed automatically. Pad size and spacing for such components should follow manufacturer recommendations.

HYBRID CHIP CARRIER DESIGN RULES

Encapsulation

The standard chip carrier construction is compatible with a wide variety of encapsulation materials, viscosities, and cure cycles because the framed cavities are completely enclosed and deep enough for any chip and bond wire profile.

Silicone is used as the standard encapsulant because of its wide operating temperature range, excellent adhesion, and ease of processing. It is ideal for optoelectronic applications because of its clarity and resistance to abrasion in subsequent cleaning operations.

Other encapsulants may be indicated where specific mechanical or chemical environments are not compatible with silicone. The material or its characteristics may be specified for new products.

The specifications for Optek's standard silicone are shown below.

Silicone Characteristics

Tensile Strength	500 PSI
Elongation	200%
Durometer, Shore A	30
Operating Temperature Range	-55°C TO +200°C
Refractive Index @ 25°C	1.43
Linear Coefficient of Expansion (in/in/°C)	0.00021
Dielectric Constant, @1KHz	3.0
Dielectric Strength, @1KHz	500 V/mil
Sodium ION Content, ppm	2
Potassium ION Content, ppm	4

Temperature Limits of The Package

The operating temperature range of any particular design will typically be limited by the performance of the circuit components.

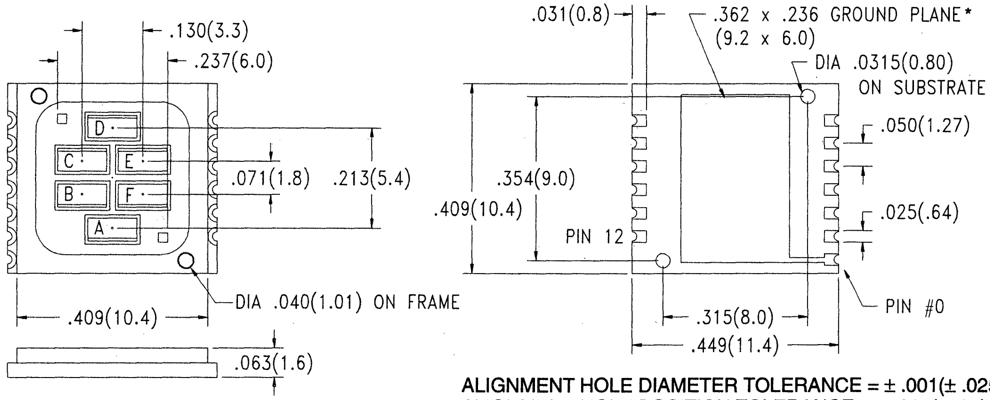
Special encapsulants and other attached components such as molded plastic lenses or housings must also be considered in both the operating and processing temperature of the chip carrier.

The standard silicone encapsulated polyimide package can withstand an environment of -55°C to +150°C indefinitely.

Reflow soldering of the surface mount packages can be performed with infrared, vapor phase, convection, or wave solder methods. The recommended limit for vapor phase reflow (up to 235°C) is 30 seconds.

OPTEK

Six Element SMD Photodiode Array
Type OPR2100



*SOLDER MASK COVERS GROUND PLANE

ALIGNMENT HOLE DIAMETER TOLERANCE = ± .001(± .025)
ALIGNMENT HOLE POSITION TOLERANCE = ± .002(± .05)
OTHER TOLERANCES = ± .005(± .13)

Features

- Surface Mountable
- Closely Matched Responsivity
- High Temperature Operation

Description

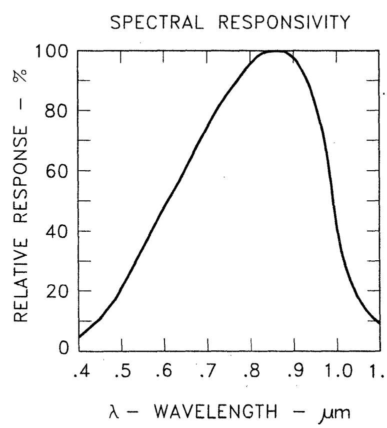
Enclosed in a compact polyimide chip carrier, this six element photodiode has been specifically designed to meet the needs of motor encoder applications. Six individual chips are mounted on isolated cathode contacts to allow external connection in any desired configuration. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -55°C to +125°C
Reverse Breakdown Voltage . . . . 50V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) . . . . 235°C

PIN OUT:

PIN #0. GROUND PLANE
1. CATHODE A
2. CATHODE B
3. ANODE B
4. ANODE C
5. CATHODE C
6. CATHODE D
7. ANODE D
8. CATHODE E
9. ANODE E
10. ANODE F
11. CATHODE F
12. ANODE A



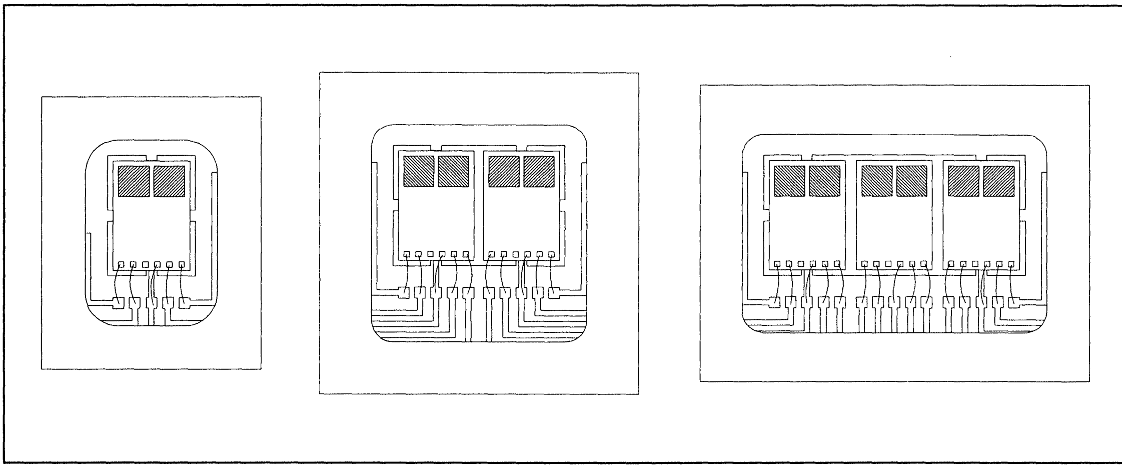
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETERS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R_λ	Responsivity	.45			A/W	Φ_e= 10 μW, λ = 890 nm, V = 0
$V_{(BR)R}$	Reverse Breakdown Voltage	50			V	I_R = 100 μA
I_D	Reverse Dark Current			10	nA	V_R = 10 V
C_T	Capacitance		10		pf	V_R = 10 V
L x W	Active Area (per diode)		2.9		mm^2	(1.1 mm x 2.6 mm)

Product Bulletin OPR5001B
May 1993

OPTEK

Optical Comparator Arrays
Type OPR5001B, OPR5002B, OPR5003B



Features

- Surface mountable
- Multiple channels available
- TTL compatible output
- Wide supply voltage range

Description

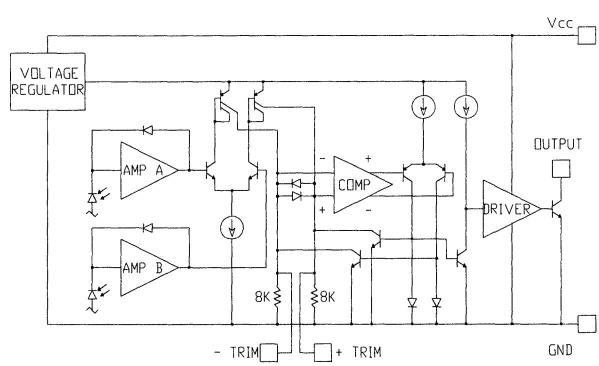
The OPR5001B, OPR5002B and OPR5003B are hybrid sensor arrays consisting of one, two or three channels of the Optek OPC8032 Differential Optical Comparator, ("DOC") IC. Specifically designed for encoder applications, the open collector output switches based on the comparison of input photodiode's light current levels. Logarithmic amplification of the input signals makes possible operation over a wide range of light levels.

The packages are surface mountable and made from a custom opaque polyimide which shields the active devices from stray light. The high temperature laminate can withstand multiple exposures to the most demanding soldering conditions. Wrap around contacts are gold plated for exceptional storage and wetting characteristics.

Replaces OPR5001A Series.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature	-55°C to +125°C
Operating temperature	-20°C to +80°C
Supply Voltage	24V
Output Voltage	24V
Output Current	14mA
Power Dissipation	500mW
Soldering Temperature (Vapor Phase Reflow for 30 sec.)	235°C



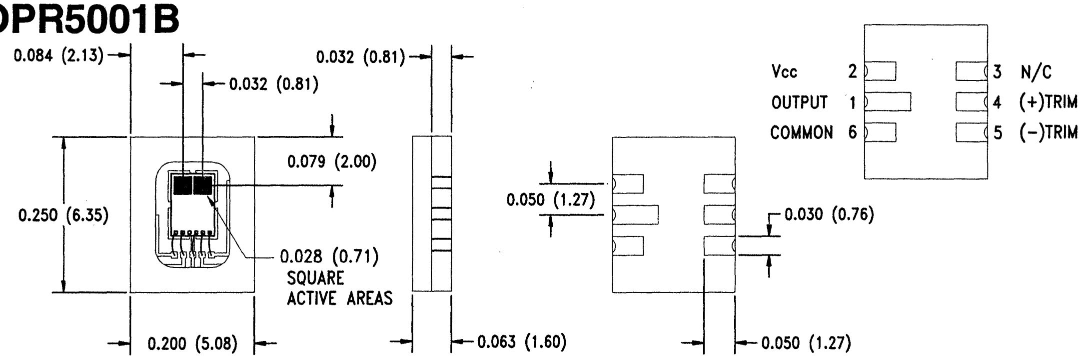
OPC8032 Block Diagram

HYBRID ASSEMBLIES

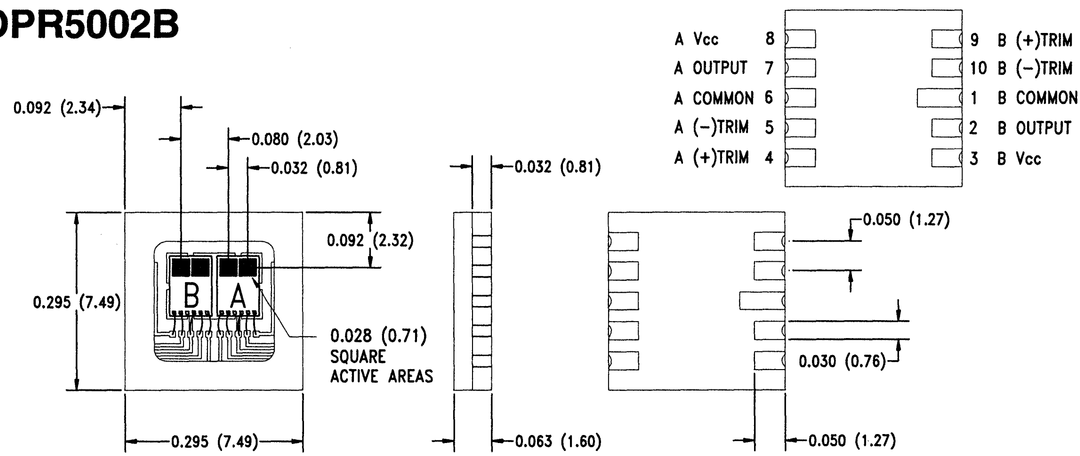
Type OPR5001B, OPR5002B, OPR5003B

Tolerance = ± .005(± .13) unless otherwise noted.

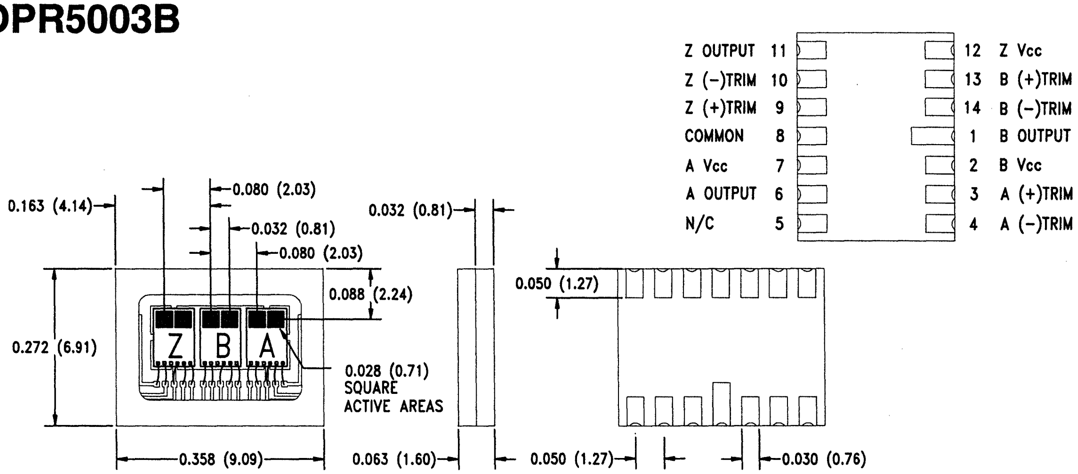
OPR5001B



OPR5002B



OPR5003B



Type OPR5001B, OPR5002B, OPR5003B

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS	NOTES
I_{CC}	Supply Current	5001		3	7	mA	V_{CC} = 24 V	1
		5002		6	14	mA		
		5003		9	20	mA		
V_{OL}	Low Level Output Voltage			0.3	0.4	V	I_{OL} = 14 mA, V_{CC} = 4.5 V	2
I_{OH}	High Level Output Current			0.1	1.0	µA	V_{CC} = V_O = 20.0 V	3
OPT-HYS	Optical Hysteresis		2.0	15.0	40	%	V_{CC} = 5.0 V, I_{OL} = 1.0 mA	4, 7
OPT-OFF	Optical Offset		-40	10	+40	%	V_{CC} = 5.0 V, I_{OL} = 1.0 mA	4, 7
fmax	Frequency Response			100		kHz	V_{CC} = 5.0 V,	5
tlh	Output Rise Time			2.0		µs	R1 = 100 Ω,	6
thl	Output Fall Time			500		ns	C1 = 50 pf	

Notes:

1. Pin (+) = 1.2 µW and Pin (-) = 0.8 µW.
2. Pin (+) = 100.0 nW and Pin (-) = 1.0 µW.
3. Pin (+) = 1.0 µW and Pin (-) 100.0 nW.
4. Pin (-) held at 1.0 µW while Pin (+) is ramped from 0.5 µW to 1.5 µW and back to 0.5 µW.
5. Pin (+) modulated from 1.0 µW to 2.0 µW. Pin (-) modulated from 1.0 µW to 2.0 µW with phase shifted 180° with respect to Pin (+).
6. Measured between 10% and 90% points.
7. Optical Hysteresis and Optical Offset are found by placing 1.0 µW of light on the inverting photodiode and ramping the light intensity of the noninverting input from .5 µW up to 1.5 µW and back down. This will produce two trigger points, an upper trigger point and lower trigger point. These points are used to calculate the optical hysteresis and offset.

These are defined as:

$$\text{\% Optical Hysteresis} = 100 \times \frac{(\text{P rise} - \text{P fall})}{\text{P in (-)}}$$

$$\text{\% Optical Offset} = 100 \times \frac{(\text{P average} - \text{P (-)})}{\text{P in (-)}}$$

Where:

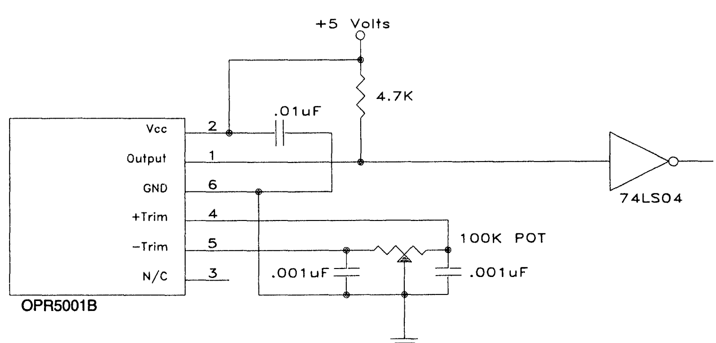
P in (-) = Light level incident upon the "-" photodiode on the I.C. chip (Pin (-) = 1.0 µW).

P rise = Value of light power level incident upon the "+" photodiode that is required to switch the digital output when the light level is an increasing level (rising edge).

P fall = Value of light power level incident upon the "+" photodiode that is required to switch the digital output when the light level is a decreasing level (falling edge).

$$\text{P average} = \frac{(\text{P rise} + \text{P fall})}{2}$$

Application Circuit



Notes:

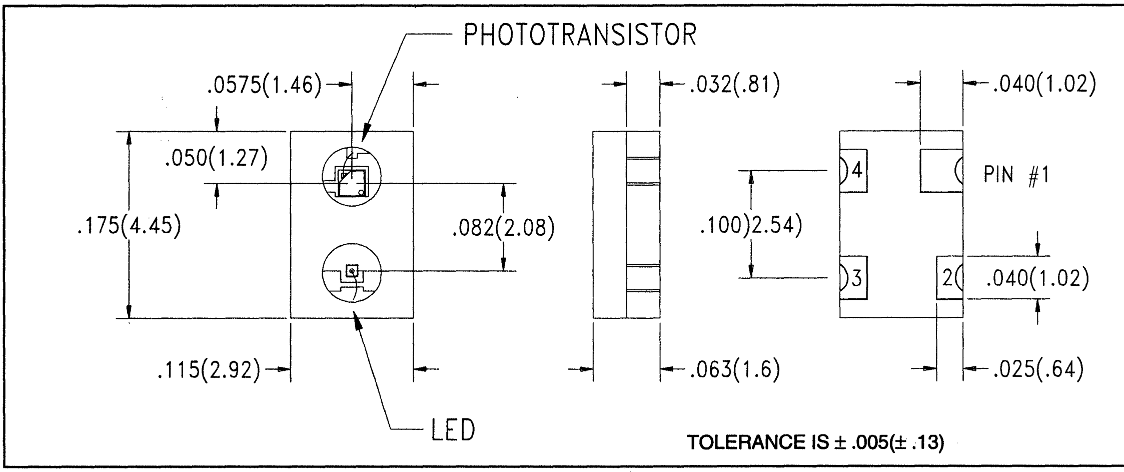
1. A capacitance of a value between .001 to .01 µF connected as close as possible to the trim terminals is recommended if the device appears to be susceptable to noise transients. It is left to the user to determine the best value for the application.
2. The 74LS04 is recommended as a means of isolating the "DOC" comparator circuitry from transients induced by inductive and capacitive loads.
3. It is recommeded that a decoupling capacitor be placed as close as possible to the device.

HYBRID ASSEMBLIES

Product Bulletin OPR5005
May 1993

OPTEK

SMD Reflective Sensor
Type OPR5005



Features

- Surface mountable
- High temperature operation
- Compact size

Description

This miniature sensor combines a silicon phototransistor with a GaAlAs LED in a high temperature opaque polyimide chip carrier. It is designed to sense the motion or proximity of diffuse reflective surfaces in applications where space constraints preclude the use of larger leaded components. The opaque package insures very low cross talk and shields the phototransistor from ambient light sources. Silicone encapsulation allows operation over a wide temperature range, and the wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -55°C to +125°C
Soldering Temperature (Vapor Phase Reflow for 10 sec.) .... 235°C

Input Diode

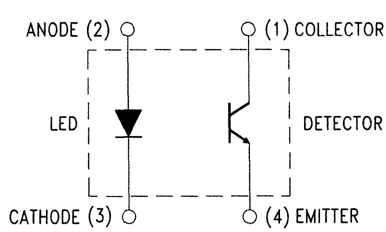
Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 1.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 75mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation .... 75mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 30 sec. max when flow soldering.
(2) Derate linearly 0.75mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.



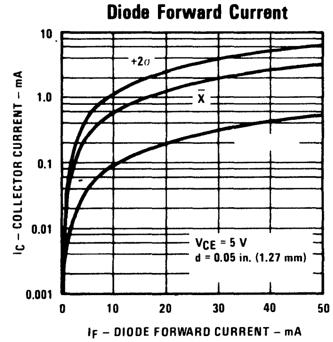
Type OPR5005

Electrical Characteristics (T_A = 25°C unless otherwise noted)

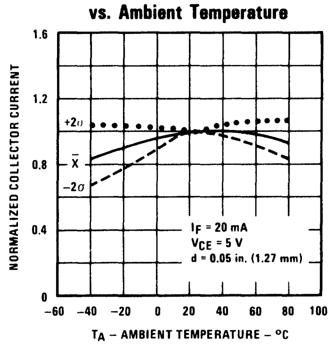
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20 mA
I_R	Reverse Current			100	µA	V_R = 2.0 V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	I_C = 100 µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100 µA
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 5.0 V, I_F = 0, E_e = ≤ 0.10 µW/cm²
Combined						
$I_{C(ON)}$	On-State Collector Current	100			µA	V_{CE} = 5.0 V, I_F = 20 mA, d = 0.050 in. (1.27 mm)(3)(4)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40	V	I_F = 20 mA, I_C = 100 µA, d = 0.050 in. (1.27 mm)(3)(4)

Typical Performance Curves

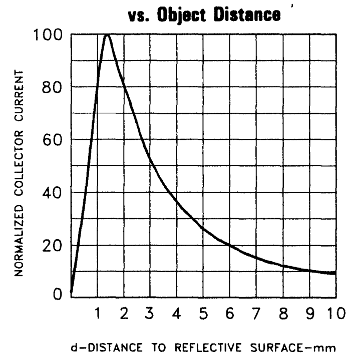
Collector Current vs. Diode Forward Current



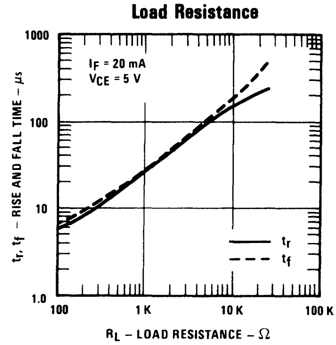
Normalized Collector Current vs. Ambient Temperature

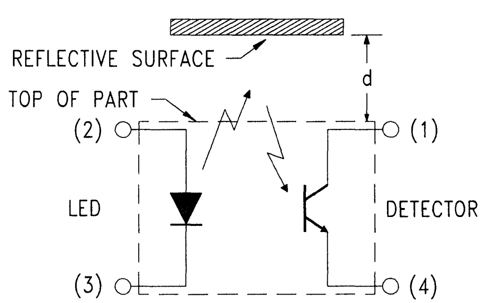


Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

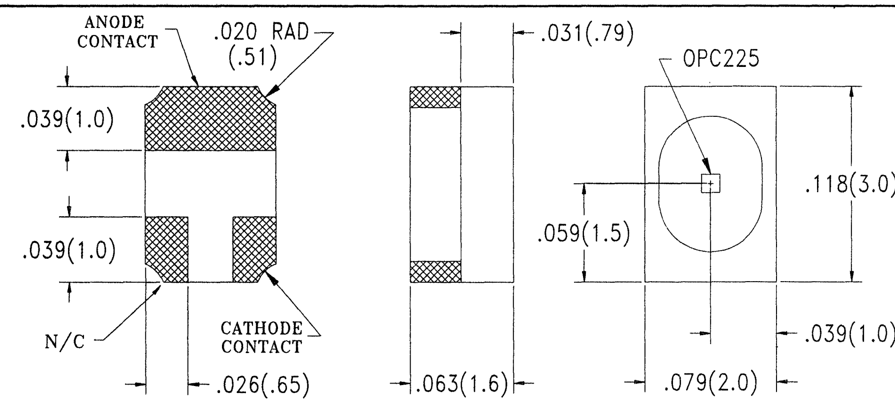




Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPR5200
May 1993

Miniature Surface Mount LED
OPR5200



TOLERANCE IS ± .005(± .13)

Features

- Stackable on 2 mm centers
- Vertical or horizontal mounting
- Automatic pick and place compatible

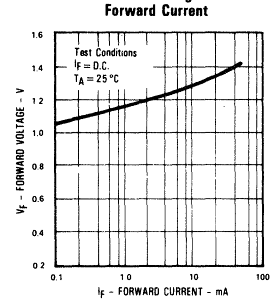
Description

The OPR5200 is a high efficiency GaAlAs light emitting diode in a high temperature polyimide chip carrier. Its small size is well suited to applications requiring close channel spacing. It can be placed automatically with standard SMD equipment and can be reflow soldered by virtually any conventional means. Wrap around contacts enable the part to be mounted face up or on edge for a beam direction parallel to the seating plane. In combination with the OPR5500, the miniature phototransistor, this lateral mounting option can be used to create a slotted switch configuration.

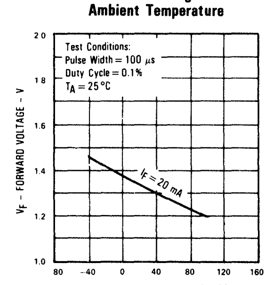
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 1.0A
Storage and Operating Temperature .... -55°C to +125°C
Soldering Temperature (Vapor Phase Reflow for 30 sec.) .... 235°C
Power Dissipation (derate @ 1.00mW/°C above 25°C) 100mW

Forward Voltage vs Forward Current



Forward Voltage vs Ambient Temperature

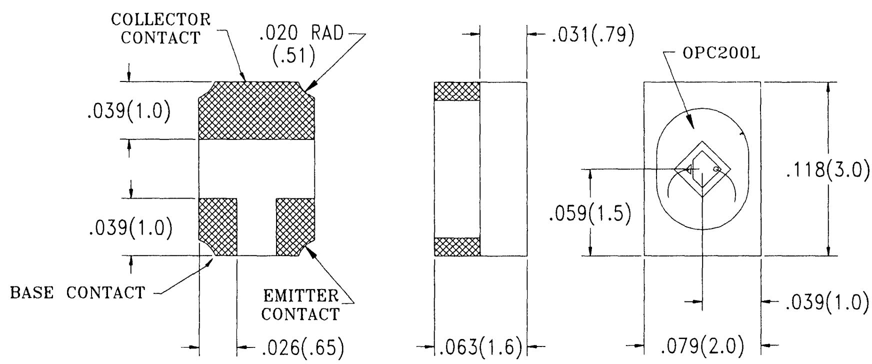


Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Output Power	350			µW	I_F = 20 mA
V_F	Forward Voltage			1.8	V	I_F = 20 mA
I_R	Reverse Current			100	µA	V_R = 2 V
λ_p	Peak Wavelength		890		nm	I_F = 20 mA
λ_{BW}	Spectral Bandwidth		80		nm	I_F = 20 mA
θ_{HP}	Emission Angle		± 45°			at half power points
t_r	Output Rise Time		500		ns	I_p = 100 mA, P_W = 10.0 µs, D.C. = 10%
t_f	Output Fall Time		250		ns	

Product Bulletin OPR5500
May 1993

Surface Mount Phototransistor
OPR5500



TOLERANCE IS ± .005(± .13)

Features

- Stackable on 2 mm centers
- Vertical or horizontal mounting
- Automatic pick and place compatible

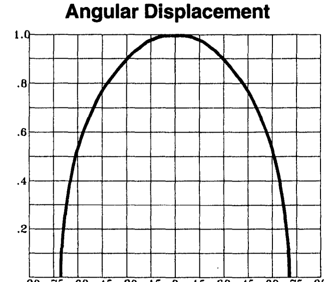
Description

The OPR5500 is an NPN silicon phototransistor in a high temperature polyimide chip carrier. It's small size is well suited to applications requiring close channel spacing. It can be placed with any standard SMD equipment and can be reflow soldered by virtually any conventional means. Wrap around contacts enable the part to be mounted face up or on edge for beam detection parallel to the seating plane. In combination with the OPR5200, the miniature SMD LED, this lateral mounting option can be used to create a slotted switch configuration.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

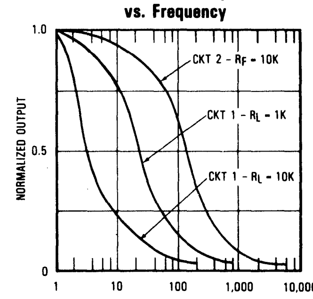
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5V
Storage and Operating Temperature .... -55°C to +125°C
Soldering Temperature (Vapor Phase Reflow for 30 sec.) .... 235°C
Power Dissipation (derate @ 1.00mW/°C above 25°C) 100mW

Normalized Collector Current vs. Angular Displacement



θ Angular Displacement

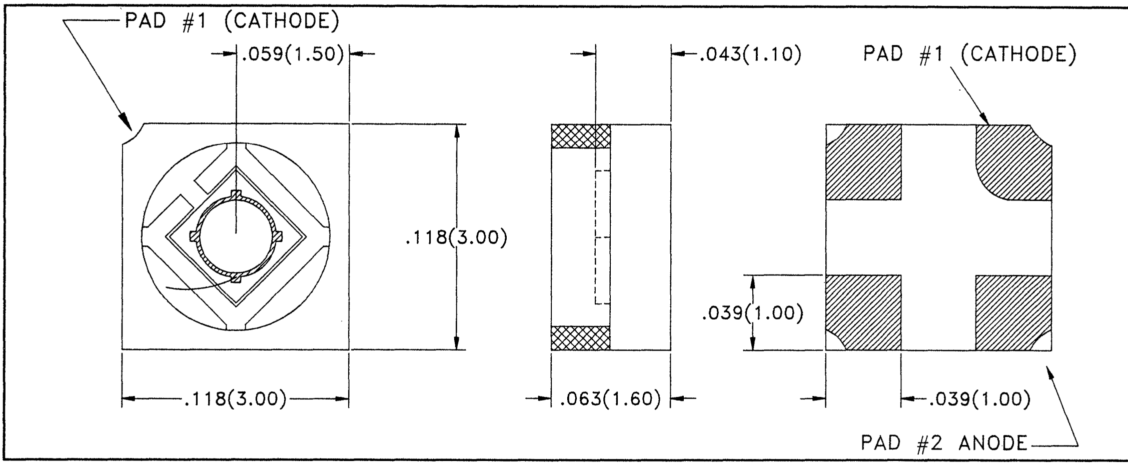
Normalized Output vs. Frequency



Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On State Collector Current	36			µA	V_{CE} = 5 V, E_e = 150 µW/cm^2 (890 nm light source)
I_{CEO}	Dark Current			100	nA	V_{CE} = 5 V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	I_C = 100 µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5			V	I_e = 100 µA
$V_{CE(SAT)}$	Saturation Voltage			0.4	V	I_C = 100 µA, E_e = 5 mW/cm^2
t_r, t_f	Rise Time, Fall Time		2.5		µs	V_{CC} = 5 V, I_C = 800 µA, R = 100 Ω

Surface Mount Silicon PIN Photodiode
Type OPR5910



Features

- Surface Mountable
- Circular Active Area
- High Temperature Operation

Description

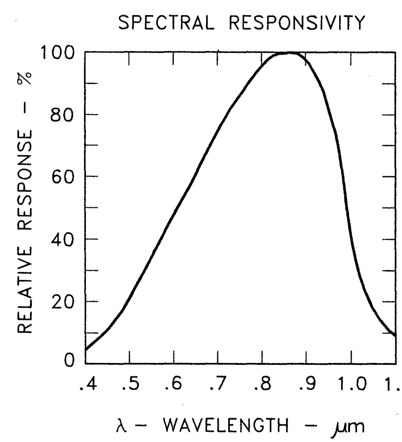
Enclosed in a compact polyimide chip carrier, this circular PIN photodiode is well suited for open air communications and ambient light detection circuits. Peak responsivity at the wavelength of 880 nm results in maximum coupling efficiency with Optek GaAlAs LEDs. The custom opaque package material shields the photodiode from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -55°C to +125°C
Reverse Breakdown Voltage .... 35V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) .... 235°C

PIN OUT:

PIN #1. CATHODE
2. ANODE
3. N/C
4. N/C



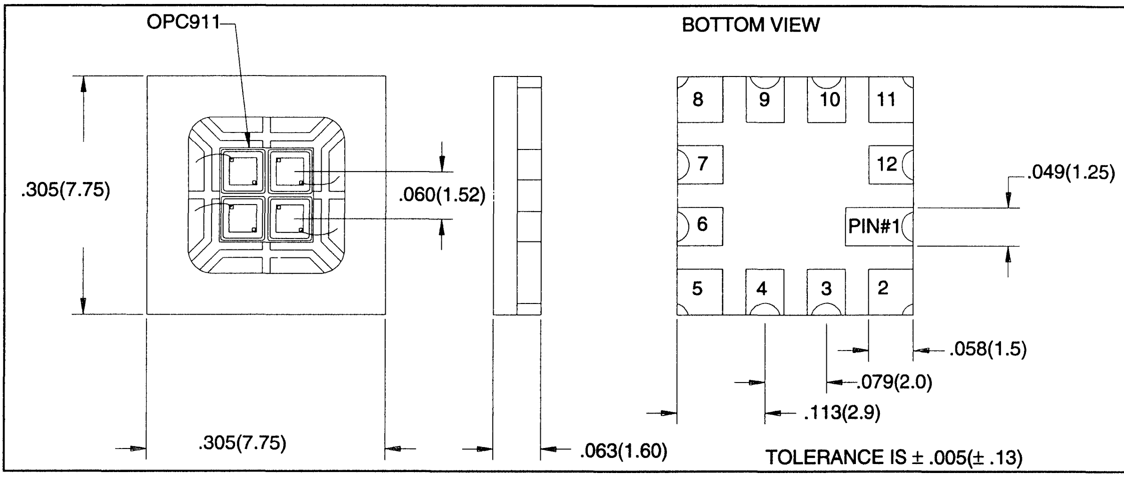
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITION
R_λ	Responsivity	.45			A/W	Φ_e = 10 μW, λ = 890 nm, V = 0
$V_{(BR)R}$	Reverse Breakdown Voltage	35			V	I_R = 100 μA
I_D	Reverse Dark Current			30	nA	V_R = 10 V
C_T	Capacitance		25		pf	V_R = 0
L x W	Active Area		.73		mm^2	

Product Bulletin OPR5911
December 1994

OPTEK

Surface Mount Quad Photodiode
Type OPR5911



Features

- Surface Mountable
- Closely Matched Responsivity
- High Temperature Operation

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

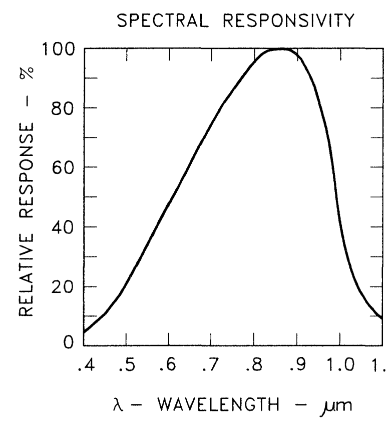
Storage and Operating Temperature . . . . -55°C to +125°C
Reverse Breakdown Voltage . . . . 14V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) . . . . 235°C

Description

Enclosed in a compact polyimide chip carrier, this four element photodiode is ideal for a variety of encoder and controls applications. The single chip construction insures excellent matching and very tight dimensional tolerances between the active areas. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

PIN OUT:

PIN # 1. ANODE #1
2. COMMON CATHODE
3. N/C
4. N/C
5. COMMON CATHODE
6. ANODE #4
7. ANODE #3
8. COMMON CATHODE
9. N/C
10. N/C
11. COMMON CATHODE
12. ANODE #2



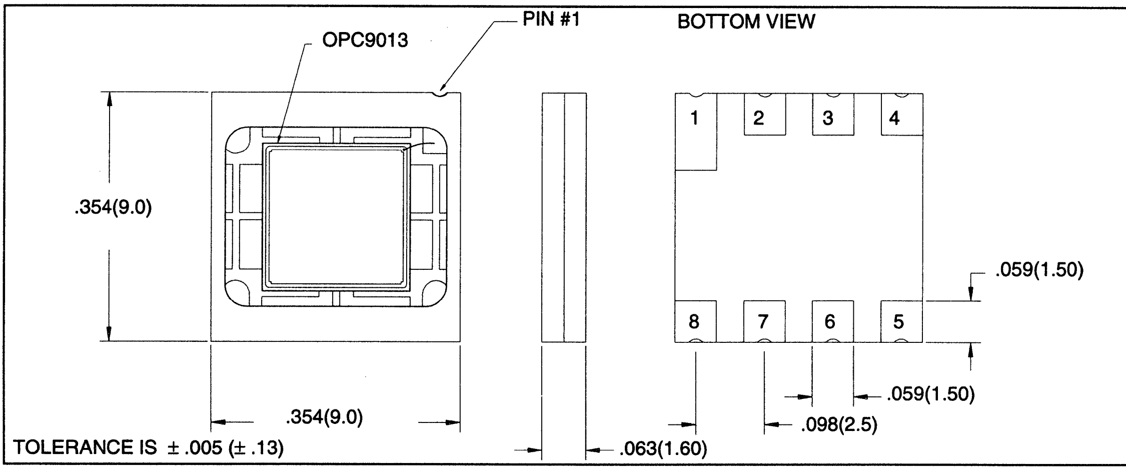
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITION
R_λ	Responsivity	.45			A/W	Φ_e = 10 μW, λ = 890 nm, V = 0
$V_{(BR)R}$	Reverse Breakdown Voltage	14			V	I_R = 100 μA
I_D	Reverse Dark Current			15	nA	V_R = 10 V
C_T	Capacitance		10		pf	V_R = 0
L x W	Active Area (per diode)		1.0		mm^2	(1.0 mm x 1.0 mm)

HYBRID ASSEMBLIES

OPTEK

Large Area SMD Silicon Photodiode
Type OPR5913



Features

- Surface Mountable
- Large Active Area
- High Temperature Operation

Description

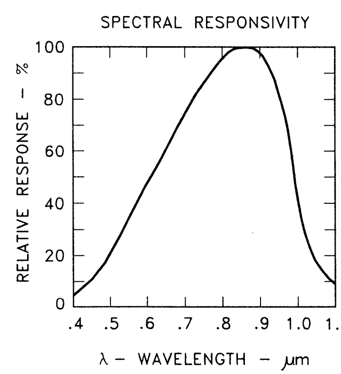
Enclosed in a compact polyimide chip carrier, this large area photodiode is well suited for open air communication applications and ambient light detection. The custom opaque package material shields the photodiode from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -55°C to +125°C.
Reverse Breakdown Voltage . . . . 10V MIN.
Soldering Temperature (Vapor Phase Reflow for 30 sec.) . . . . 235°C

PIN OUT:

PIN #1. ANODE
2. COMMON CATHODE
3. COMMON CATHODE
4. N/C
5. N/C
6. COMMON CATHODE
7. COMMON CATHODE
8. N/C

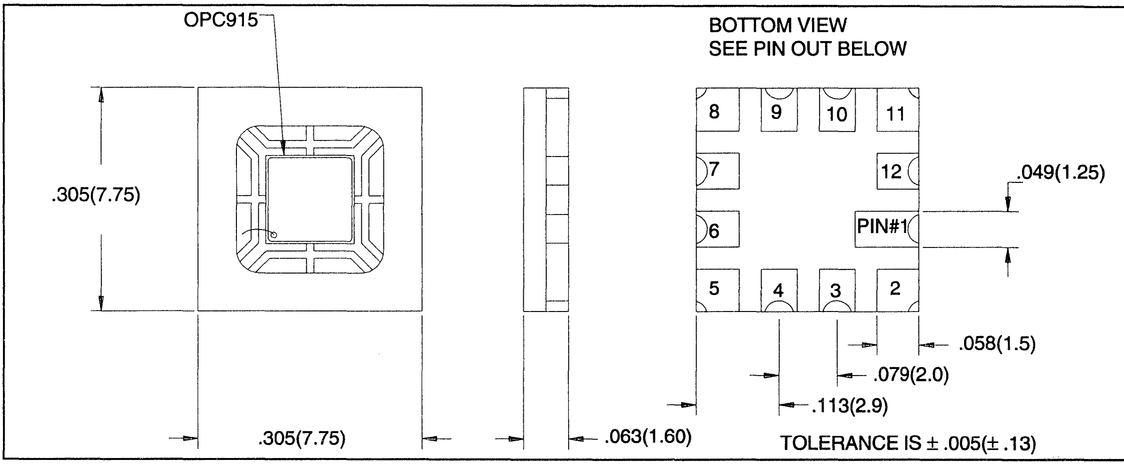


Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITION
R_λ	Responsivity	.40			A/W	Φ_e = 10 μW, λ = 890 nm, V = 0
$V_{(BR)R}$	Reverse Breakdown Voltage	10			V	I_R = 100 μA
I_D	Reverse Dark Current			100	nA	V_R = 0.5 V
C_T	Capacitance		1000		pf	V_R = 0 V
			250		pf	V_R = 10 V
L x W	Active Area		25		mm^2	(5.0 mm x 5.0 mm)

OPTEK

Surface Mount Silicon PIN Photodiode
Type OPR5915



Features

- Surface Mountable
- Large Active Area
- High Temperature Operation

Description

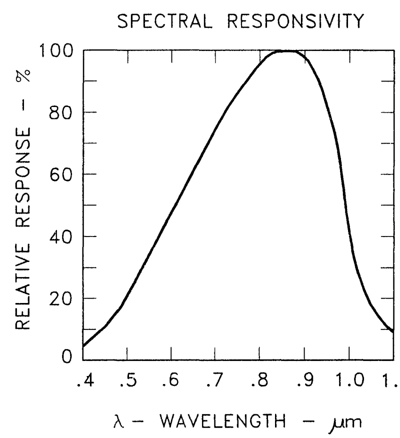
Enclosed in a compact polyimide chip carrier, this large area photodiode is well suited for open air communication applications and ambient light detection. Peak responsivity at the wavelength of 880 nm results in maximum coupling efficiency with Optek GaAlAs LEDs. The custom opaque package material shields the photodiode from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -55°C to +125°C
Reverse Breakdown Voltage .... 35V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) .... 235°C

PIN OUT:

PIN #1. ANODE
2. COMMON CATHODE
3. N/C
4. N/C
5. COMMON CATHODE
6. N/C
7. N/C
8. COMMON CATHODE
9. N/C
10. N/C
11. COMMON CATHODE
12. N/C



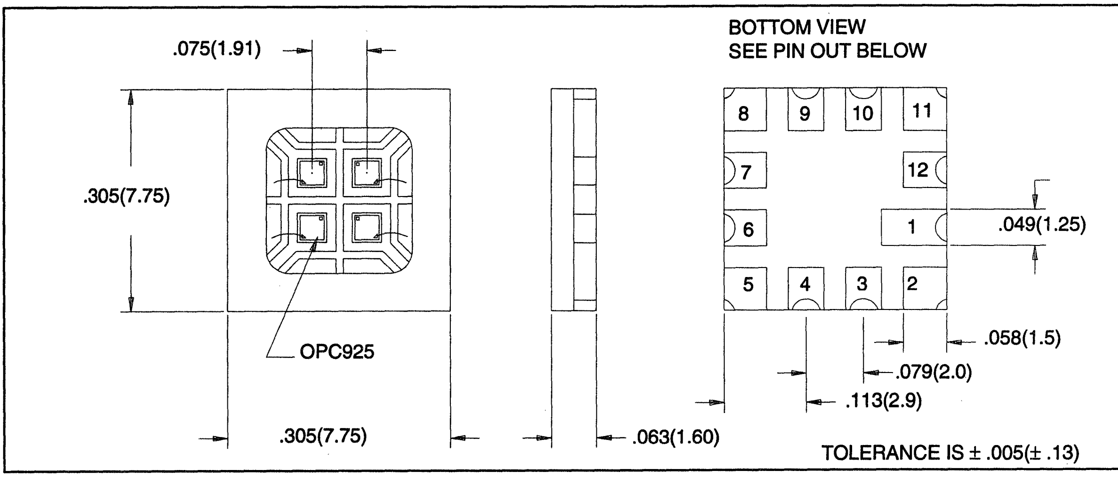
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITION
R_λ	Responsivity	.45			A/W	Φ_e = 10 μW, λ = 890 nm, V = 0
$V_{(BR)R}$	Reverse Breakdown Voltage	35			V	I_R = 100 μA
I_D	Reverse Dark Current			30	nA	V_R = 10 V
C_T	Capacitance		125		pf	V_R = 0
L x W	Active Area		7.3		mm^2	(2.7 mm x 2.7 mm)

HYBRID ASSEMBLIES

Product Bulletin OPR5925
January 1995

Surface Mount Quad Photodiode
Type OPR5925



Features

- Surface Mountable
- Separate Cathode Connections
- High Temperature Operation

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

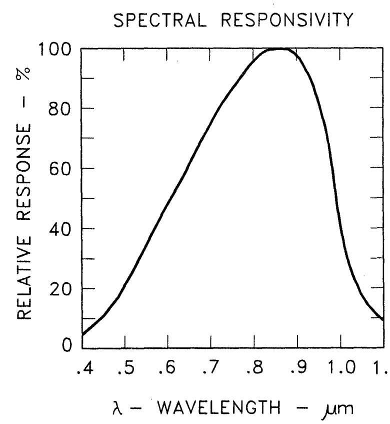
Storage and Operating Temperature .... -55°C to +125°C
Reverse Breakdown Voltage .... 35V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) .... 235°C

Description

This compact polyimide chip carrier contains four silicon photodiodes in a quad arrangement with each anode and cathode bonded out separately. The internal isolation enables external connection in any desired configuration to match the sensing circuit requirements. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

PIN OUT:

PIN #1. ANODE #1
2. CATHODE #1
3. N/C
4. N/C
5. CATHODE #2
6. ANODE #2
7. ANODE #3
8. CATHODE #3
9. N/C
10. N/C
11. CATHODE #4
12. ANODE #4

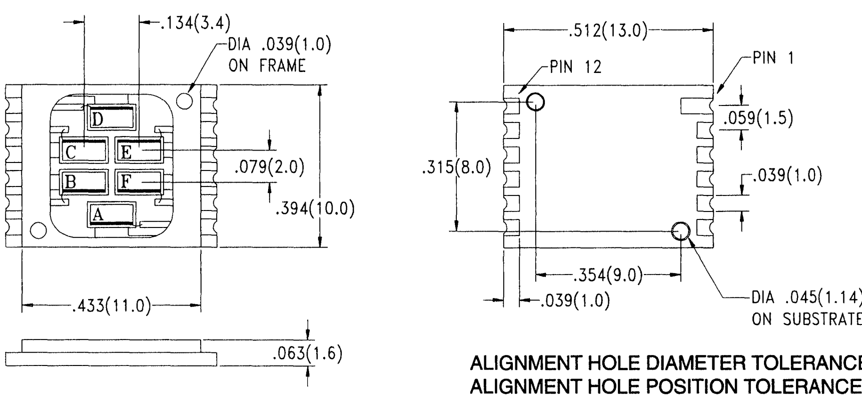


Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITION
R_λ	Responsivity	.45			A/W	$\Phi_e = 10\ \mu W, \lambda = 890\ nm, V_R = 0\ V$
$V_{(BR)R}$	Reverse Breakdown Voltage	35			V	$I_R = 100\ \mu A$
I_D	Reverse Dark Current			30	nA	$V_R = 10\ V$
C_T	Capacitance		10		pf	$V_R = 10\ V$
L x W	Active Area (per diode)		0.64		mm^2	(0.8 mm x 0.8 mm)

Product Bulletin OPR5929
January 1995

Six Element SMD Photodiode Array
Type OPR5929



ALIGNMENT HOLE DIAMETER TOLERANCE = ± .001(± .025)
ALIGNMENT HOLE POSITION TOLERANCE = ± .002(± .05)
OTHER TOLERANCES = ± .005(± .13)

Features

- Surface Mountable
- Closely Matched Responsivity
- High Temperature Operation

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

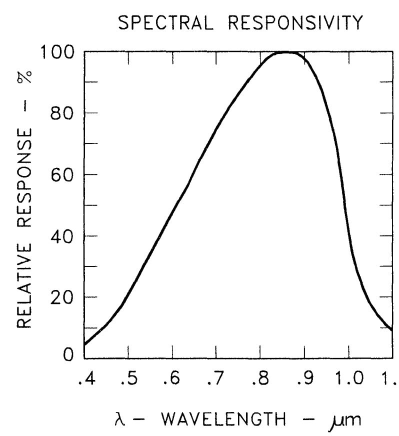
Storage and Operating Temperature .... -55°C to +125°C
Reverse Breakdown Voltage .... 50V MIN.
Solder Temperature (Vapor Phase Reflow for 30 sec.) .... 235°C

Description

Enclosed in a compact polyimide chip carrier, this six element photodiode has been specifically designed to meet the needs of motor encoder applications. Six individual chips are mounted on isolated cathode contacts to allow external connection in any desired configuration. The custom opaque package material shields the photodiodes from stray light and can withstand multiple exposures to the most demanding soldering conditions. The wrap around solder pads are gold plated for exceptional storage and wetting characteristics.

PIN OUT:

PIN #1. CATHODE D
2. ANODE D
3. ANODE C
4. CATHODE C
5. CATHODE B
6. ANODE B
7. CATHODE A
8. ANODE A
9. ANODE F
10. CATHODE F
11. CATHODE E
12. ANODE E



HYBRID ASSEMBLIES

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETERS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
R_λ	Responsivity	.45			A/W	Φ_e = 10 μW, λ = 890 nm, V = 0
$V_{(BR)R}$	Reverse Breakdown Voltage	50			V	I_R = 100 μA
I_D	Reverse Dark Current			10	nA	V_R = 10 V
C_T	Capacitance		10		pf	V_R = 10 V
L x W	Active Area (per diode)		2.9		mm^2	(1.1 mm x 2.6 mm)

OPTEK TECHNOLOGY, INC.

HALL EFFECT SENSORS

HALL EFFECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Hallogic™ Hall Effect Sensors

Optek Technology, Inc. produces temperature-compensated Hall effect magnetic sensing devices. The Hallogic™ Hall Effect Sensors are superior products that meet the demands of motion sensing in extremely harsh environments such as under-the-hood automotive and heavy industrial machinery applications, including robotics.

Hallogic™ refers to the combination of a Hall element magnetic field sensor with highly refined integrated circuitry on a single, monolithic bipolar silicon chip. Incorporated on the Hallogic™ sensor chip are:

- a Hall element
- a bandgap voltage regulator
- a threshold amplifier including a linear amplifier and a Schmitt trigger
- an open-collector output transistor that can drive ten TTL loads

The Hall Element

The basic Hall element relies on a magnetic field in order to sense motion. The principle is based on the Hall effect, discovered more than 100 years ago by the American physicist, Edwin Herbert Hall. The Hall effect is the small electrical potential created when a stationary magnetic field is placed perpendicular to a current-carrying conductor (see Figure 1).

Most available Hall elements hold current constant and measure voltage, which is then correlated with magnetic field strength. The superior performance of the Optek device is due in part to a fundamental design change which instead provides a constant bias *voltage* and measures the Hall *current.* This method proves more accurate for sensing magnetic field strength when temperature varies. It also provides a better way to interface the Hall element with the complex integrated circuitry of the Hallogic™ sensor.

The Optek Hall element then is basically a block of semiconductor material with four contact points. Two contacts (or electrodes) are used to supply a constant bias voltage to the element; the other two are used for the varying current output. If voltage is held constant across the device while a perpendicular magnetic field is applied, the Hall current can be sensed across the output connections. The Hall current is proportional to the strength of the applied magnetic field.

Unprecedented Temperature Stability

Temperature coefficients have been optimized to insure stable electrical characteristics over the temperature range of -55°C to +150°C. Other design aspects of the Hallogic™ sensor that enable it to meet Optek's demanding temperature stability objectives are two important circuit areas on the chip, the bandgap regulator and the threshold amplifier:

1. Bandgap Voltage Regulator:

In addition to maintaining a constant output voltage level (no matter what changes occur in input voltage or output current), the Optek Hallogic™ bandgap voltage regulator also serves as an extremely good temperature compensated voltage source to bias the Hall element. This bandgap voltage regulator enables Hallogic™ devices to operate with a supply voltage ranging from 4.5 to 24 volts DC, with virtually no drift in magnetic sensitivity (i.e., in the magnetic trigger point).

2. Threshold Amplifier:

The amplifier/detector circuit is a constant-gain type, designed with temperature-compensated trip points at the input to the voltage comparator. The Schmitt trigger output then drives an open-collector transistor with a 50 mA current sinking capability. This open-collector transistor enables the device output to drive up to ten TTL loads directly.

Low Power Consumption

Yet another advantage is the low power consumption, which results from no bias current being required by the permanent magnet. The sensor itself draws only 5 mA (typical) of supply current (I_{CC}).

Package Design

Optek uses a very high density transfer molded plastic to encapsulate the Hallogic™ lead frame and chip. Both the density and the transfer molding process result in a dirt and moisture barrier effective enough to pass Military Standard 883. The sensor passes "pressure cooker" and similar moisture and temperature testing procedures to insure a reliable product.

In addition, the lead frame is designed with superior thermal characteristics for maximum reliability at the ten TTL load capability of the device.

The dimensional outline of the package and the precise placement of the Hall element are standard. This design allows for the superior, temperature compensated Optek device to be specified for instant replacement. A significant upgrade in performance can be achieved without costly redesign and retooling.

Because the Hallogic™ Hall Effect Sensor is smaller than conventional emitter-detector pairs, it will more easily fit into areas with small size constraints.

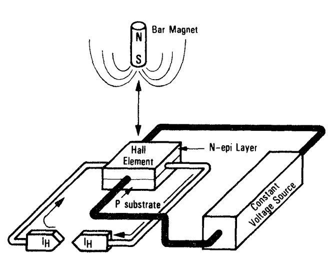
Designed for the Toughest Environments

The result is that the Hallogic™ Hall Effect Sensor is virtually immune to environmental contaminants. It is rugged and suitable for use under severe service conditions. Even in the toughest environment, the Hallogic™ sensor will exhibit excellent magnetic sensitivity to provide reliable, repetitive operations in close tolerance applications. These devices are excellent choices for DC motors, automotive applications, robotic and heavy machinery sensing applications, or for any application in a harsh environment where optoelectronic devices are unsuitable.

Custom Sensor Assemblies

Optek offers the customer the same custom assembly capability they have come to expect from the Optoelectronic division. Custom designed sensors with Hall effect devices and magnets, long lead wires, special connectors etc., are available. With Optek's complete plastic tooling and molding operations, Hall Effect sensors are available in a wide variety of hybrid packages.

Figure 1. Basic Hall Element



Typical Applications

Appliances

Automotive OEM & Aftermarket

Business machines

Communications

Computers/peripherals

Controls

DC motors & electrical motor controls

Entertainment products

Industrial and commercial switches

Instrumentation

Machinery

Machine tools

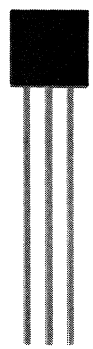
Military systems and equipment

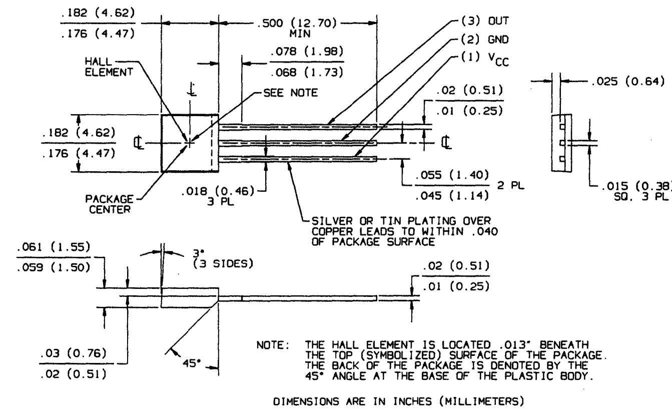
Power supplies

Test equipment

OPTEK

Hallogic™ Hall Effect Sensors
Type OH090U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 10 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OH090U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 30 mA of sink current. This allows direct driving of more than 10 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OH090U is a high performance device capable of operation from -40°C to +150°C. Stability of the magnetic operate and release points is excellent over this entire temperature range.

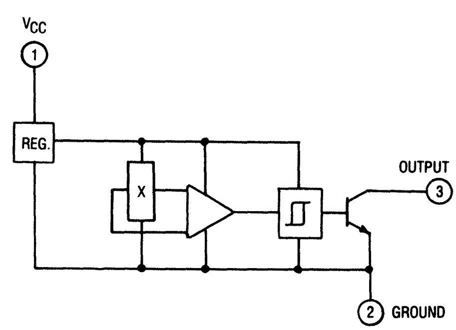
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +160°C
Operating Temperature Range, T_A .... -40°C to +150°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Output ON Current, I_{SINK} 50mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



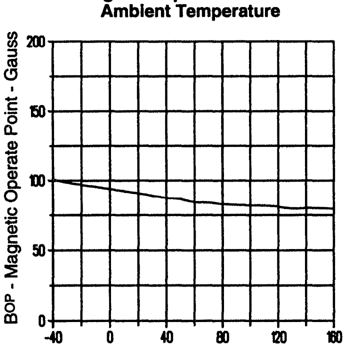
Type OH090U

Electrical Characteristics (V_{CC} = 4.5 V to 24 VDC, T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	0	90	180	Gauss	
B_{RP}	Magnetic Release Point	-100	65	100	Gauss	
B_H	Magnetic Hysteresis	10	25	100	Gauss	
I_{CC}	Supply Current		6	9	mA	V_{CC} = 24 V, Output On
V_{OL}	Output Saturation Voltage		100	300	mV	V_{CC} = 4.5 V, I_{OL} = 30 mA
I_{OH}	Output Leakage Current		0.50	10.0	μA	V_{CC} = 24 V, V_{OUT} = 24 V
t_r	Output Rise Time		0.30	1.00	μs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.30	1.00	μs	

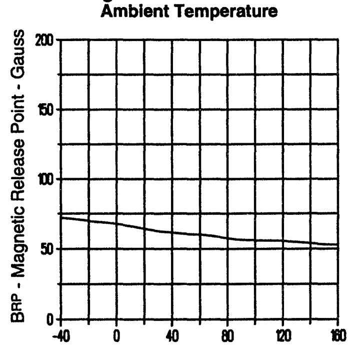
Typical Performance Curves

Magnetic Operate Point vs Ambient Temperature



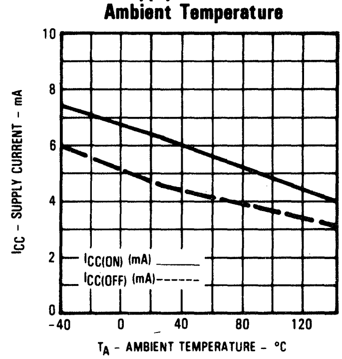
TA - Ambient Temperature - °C

Magnetic Release Point vs Ambient Temperature

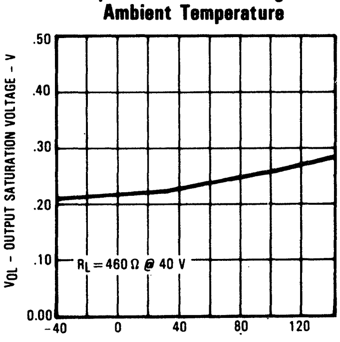


TA - Ambient Temperature - °C

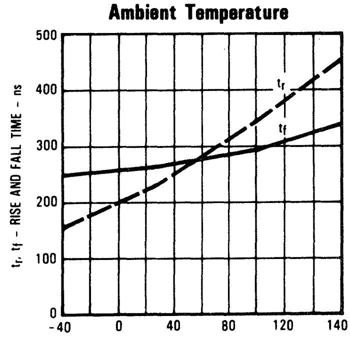
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

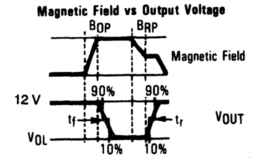


Rise and Fall Time vs Ambient Temperature

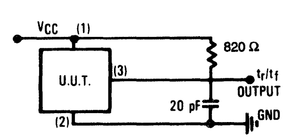


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit



HALL EFFECT SENSORS

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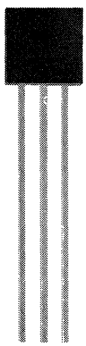
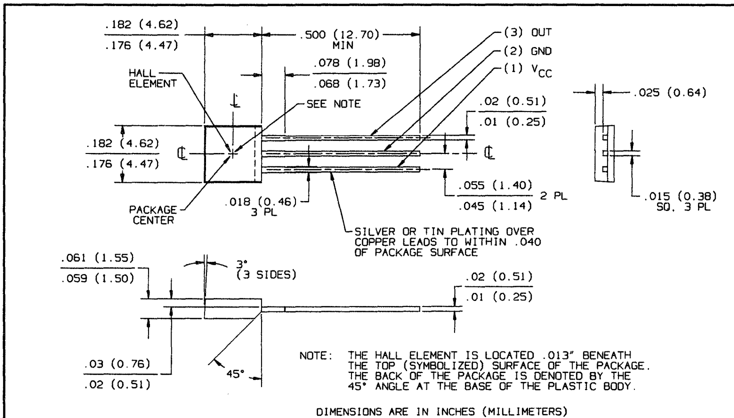
Product Bulletin OH180U
May 1993

Hallogic™ Hall Effect Sensors
Type OH180U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 10 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OH180U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 30 mA of sink current. This allows direct driving of more than 10 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OH180U is a high performance device capable of operation from -40°C to +150°C. Stability of the magnetic operate and release points is excellent over this entire temperature range.

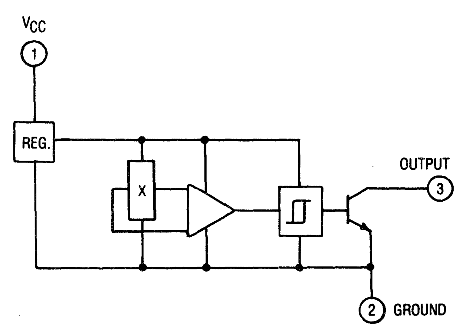
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +160°C
Operating Temperature Range, T_A .... -40°C to +150°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 50mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



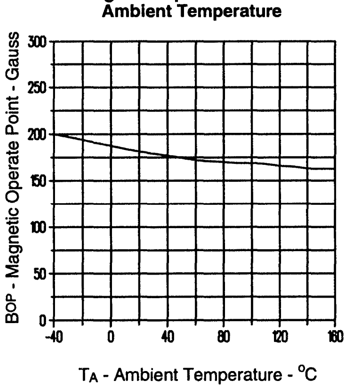
Type OH180U

Electrical Characteristics (V_{CC} = 4.5 V to 24 VDC, T_A = 25°C unless otherwise noted)

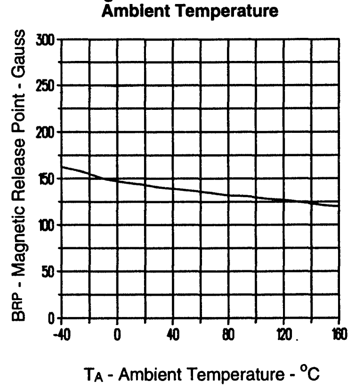
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	70	180	290	Gauss	
B_{RP}	Magnetic Release Point	0	140	230	Gauss	
B_H	Magnetic Hysteresis	20	40	120	Gauss	
I_{CC}	Supply Current		6	9	mA	V_{CC} = 24 V, Output On
V_{OL}	Output Saturation Voltage		100	300	mV	V_{CC} = 4.5 V, I_{OL} = 30 mA
I_{OH}	Output Leakage Current		0.50	10.0	μA	V_{CC} = 24 V, V_{OUT} = 24 V
t_r	Output Rise Time		0.30	1.00	μs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.30	1.00	μs	

Typical Performance Curves

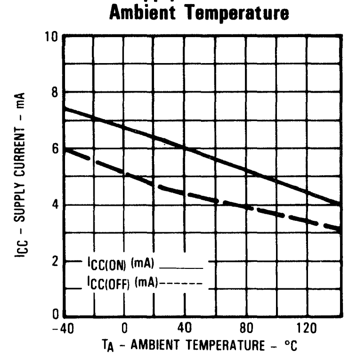
Magnetic Operate Point vs Ambient Temperature



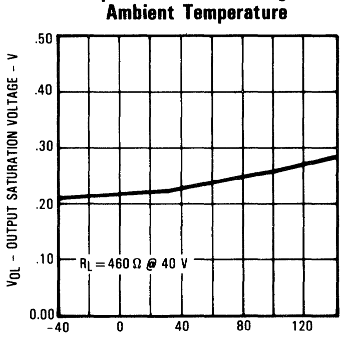
Magnetic Release Point vs Ambient Temperature



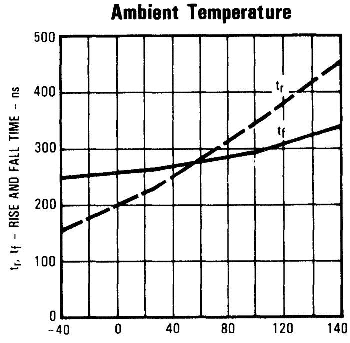
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

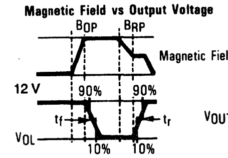


Rise and Fall Time vs Ambient Temperature

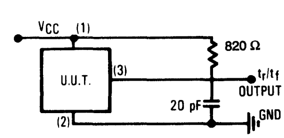


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



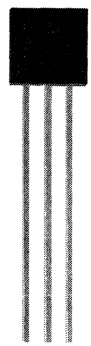
Rise and Fall Time Test Circuit

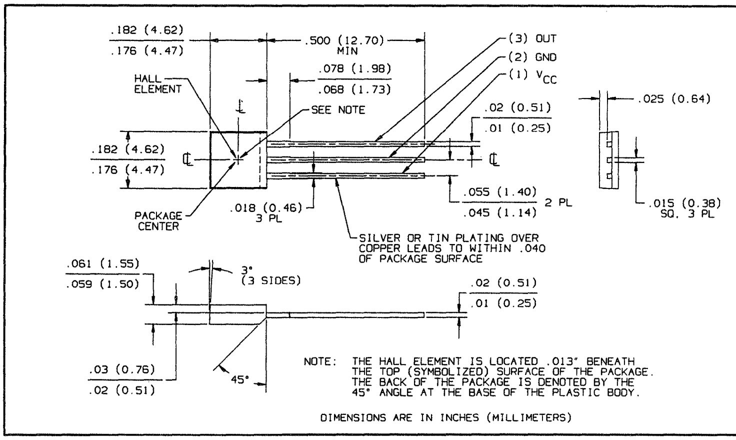


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Hallogic™ Hall Effect Sensors
Type OH360U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 10 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OH360U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 30 mA of sink current. This allows direct driving of more than 10 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OH360U is a high performance device capable of operation from -40°C to +150°C. Stability of the magnetic operate and release points is excellent over this entire temperature range.

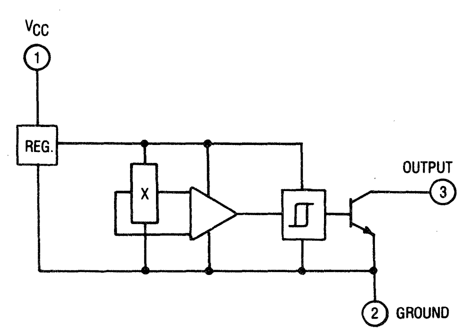
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +160°C
Operating Temperature Range, T_A .... -40°C to +150°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Output ON Current, I_{SINK} 50mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



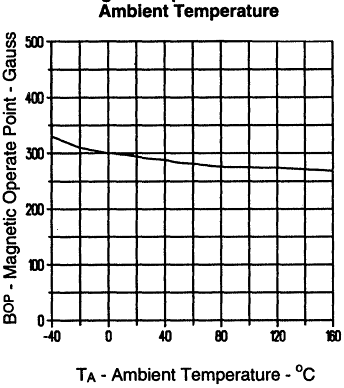
Type OH360U

Electrical Characteristics (V_{CC} = 4.5 V to 24 VDC, T_A = 25°C unless otherwise noted)

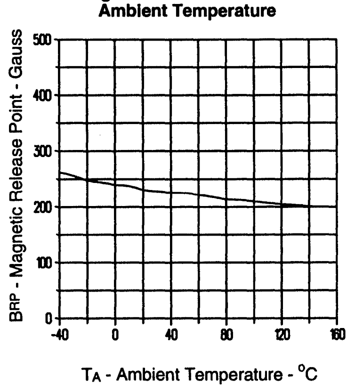
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	235	300	465	Gauss	
B_{RP}	Magnetic Release Point	120	235	325	Gauss	
B_H	Magnetic Hysteresis	30	65	200	Gauss	
I_{CC}	Supply Current		6	9	mA	V_{CC} = 24 V, Output On
V_{OL}	Output Saturation Voltage		100	300	mV	V_{CC} = 4.5 V, I_{OL} = 30 mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT} = 24 V
t_r	Output Rise Time		0.3	1.00	µs	R_L = 820 Ω, C_L = 20 pF,
t_f	Output Fall Time		0.3	1.00	µs	V_{CC} = 14.0 V

Typical Performance Curves

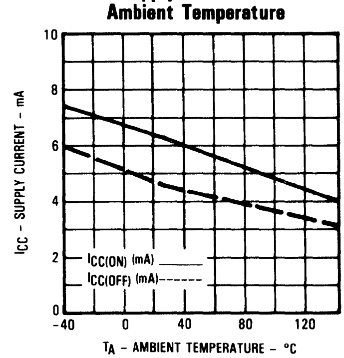
Magnetic Operate Point vs Ambient Temperature



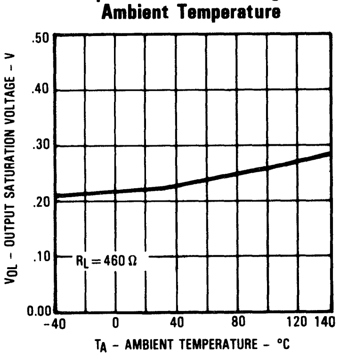
Magnetic Release Point vs Ambient Temperature



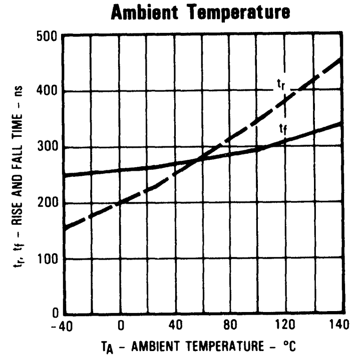
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

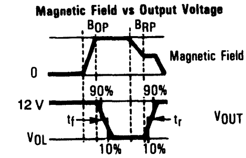


Rise and Fall Time vs Ambient Temperature

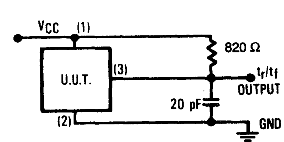


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



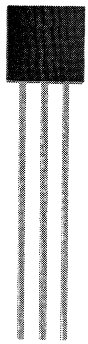
Rise and Fall Time Test Circuit

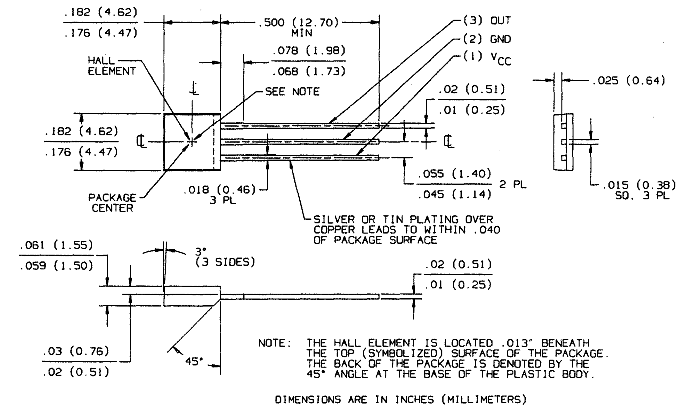


Product Bulletin OHN3013U
May 1993

OPTEK

Hallogic™ Hall Effect Sensors
Type OHN3013U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3013U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range. The release point over the temperature range will always be greater than zero gauss.

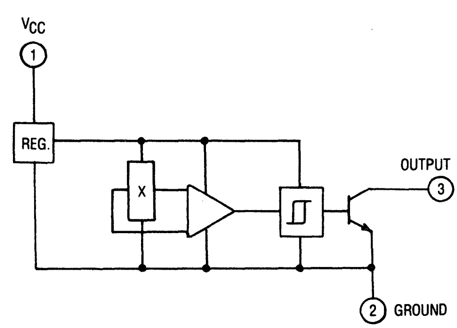
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -20°C to +85°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

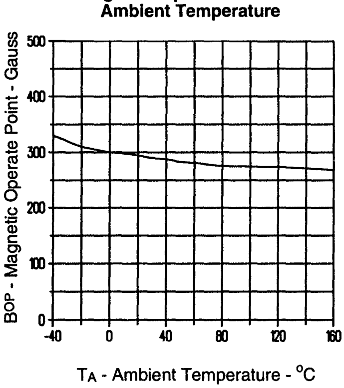
Type OHN3013U

Electrical Characteristics (V_{CC} = 4.5 V to 24 VDC, T_A = 25°C unless otherwise noted)

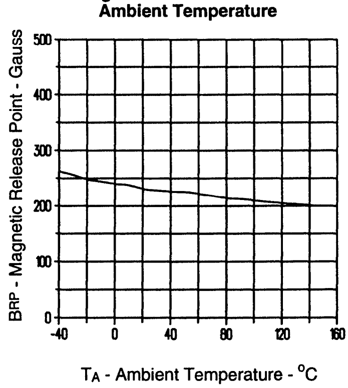
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point		300	450	Gauss	
B_{RP}	Magnetic Release Point	25	235		Gauss	
B_H	Magnetic Hysteresis	30	65		Gauss	
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 450 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT} = 24 V, B ≤ 25 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Typical Performance Curves

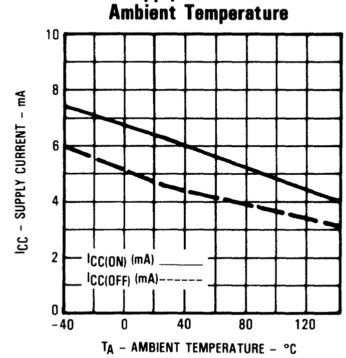
Magnetic Operate Point vs Ambient Temperature



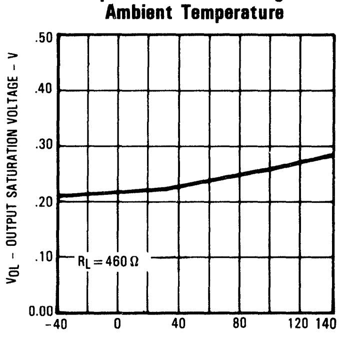
Magnetic Release Point vs Ambient Temperature



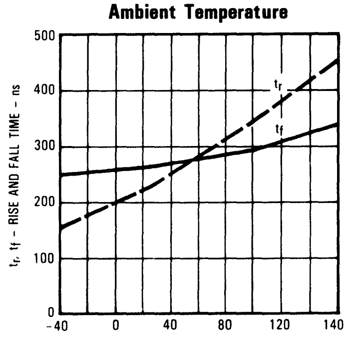
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

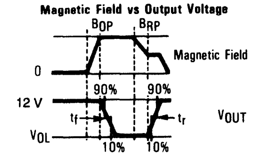


Rise and Fall Time vs Ambient Temperature

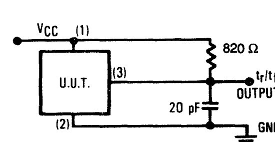


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit

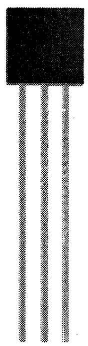


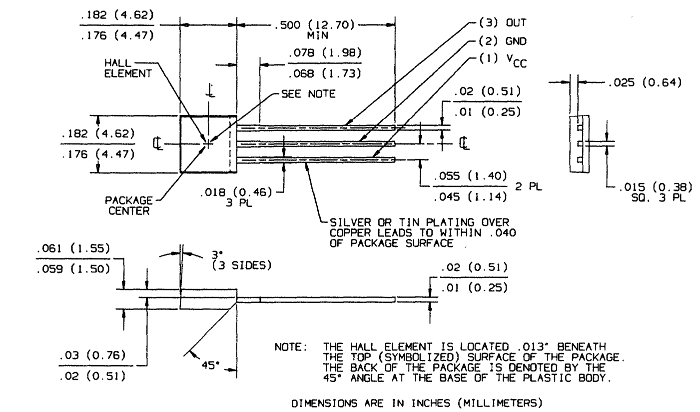
HALL EFFECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Hallogic™ Hall Effect Sensors
Types OHN3019U, OHS3019U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3019U and OHS3019U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range.

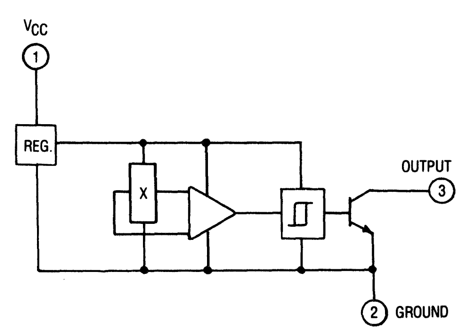
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S . . . . -65°C to +150°C
Operating Temperature Range, T_A OHN3019U. . . . . -20°C to +85°C
OHS3019U . . . . -40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron]. . . . . 260°C [(1)]
Output ON Current, I_{SINK}. 25mA
Output OFF Voltage, V_{OUT}. 25V
Magnetic Flux Density, B . . . . Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



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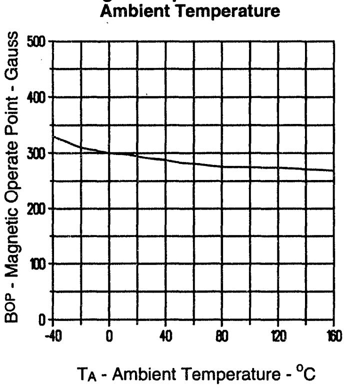
Types OHN3019U, OHS3019U

Electrical Characteristics (V_{CC} = 4.5 V to 24 VDC, T_A = 25°C unless otherwise noted)

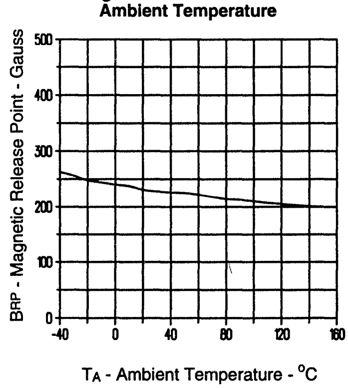
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point		300	500	Gauss	
B_{RP}	Magnetic Release Point	125	235		Gauss	
B_H	Magnetic Hysteresis	50	65		Gauss	
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 500 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT} = 24 V, B ≤ 100 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Typical Performance Curves

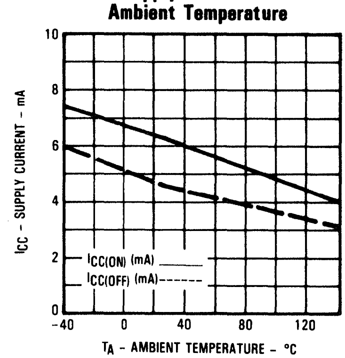
Magnetic Operate Point vs Ambient Temperature



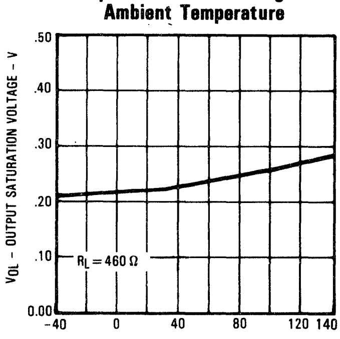
Magnetic Release Point vs Ambient Temperature



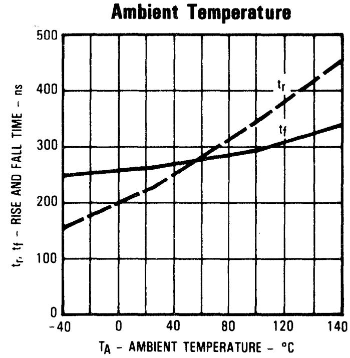
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

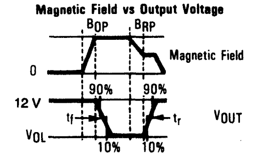


Rise and Fall Time vs Ambient Temperature

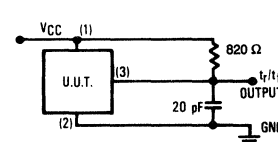


Rise and Fall Time Tests

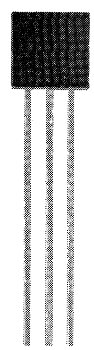
Magnetic Field vs Output Voltage

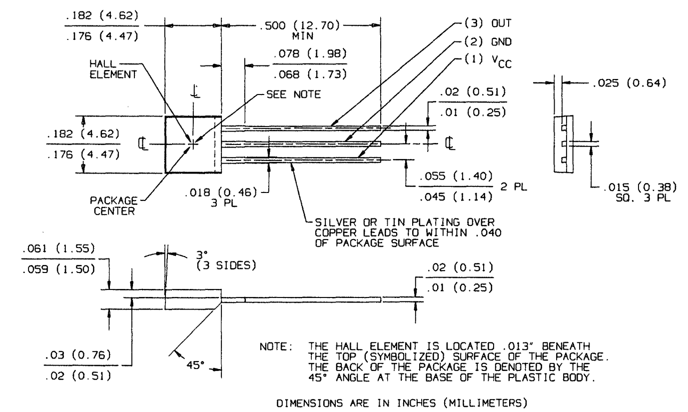


Rise and Fall Time Test Circuit



Hallogic™ Hall Effect Sensors
Types OHN3020U, OHS3020U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3020U and OHS3020U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range. The release point over the temperature range will always be greater than zero gauss.

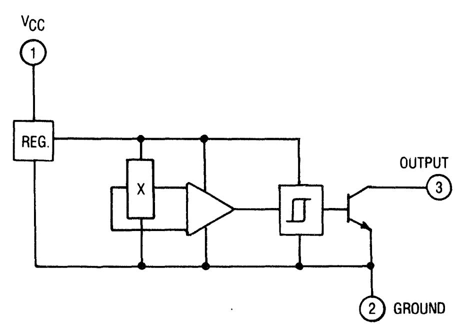
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A OHN3020U.......... -20°C to +85°C
OHS3020U .... -40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron].......... 260°C [(1)]
Output ON Current, I_{SINK}.......... 25mA
Output OFF Voltage, V_{OUT}.......... 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



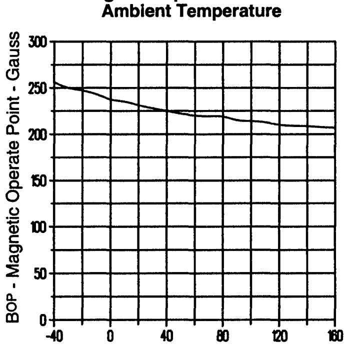
Types OHN3020U, OHS3020U

Electrical Characteristics (V_{CC} = 4.5 V to 24 VDC, T_A = 25°C unless otherwise noted)

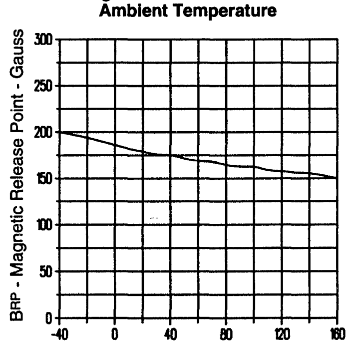
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point		230	350	Gauss	
B_{RP}	Magnetic Release Point	50	180		Gauss	
B_H	Magnetic Hysteresis	20	50		Gauss	
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 350 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT} = 24 V, B ≤ 50 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Typical Performance Curves

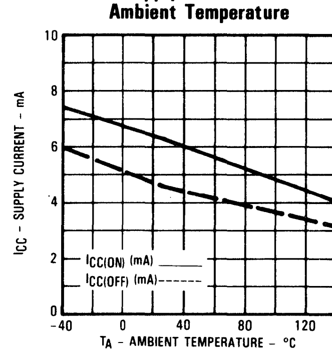
Magnetic Operate Point vs Ambient Temperature



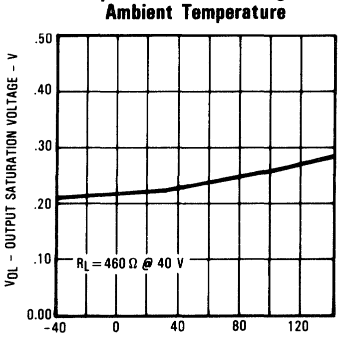
Magnetic Release Point vs Ambient Temperature



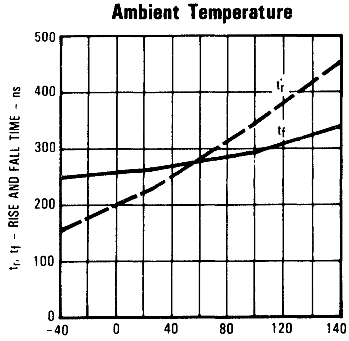
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

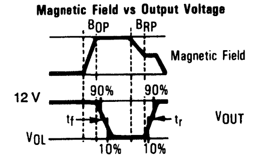


Rise and Fall Time vs Ambient Temperature

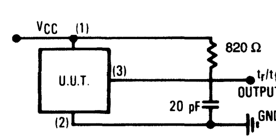


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit



HALL EFFECT SENSORS

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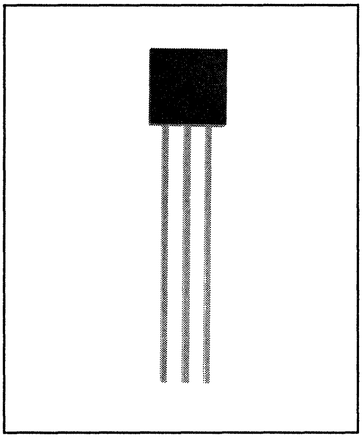
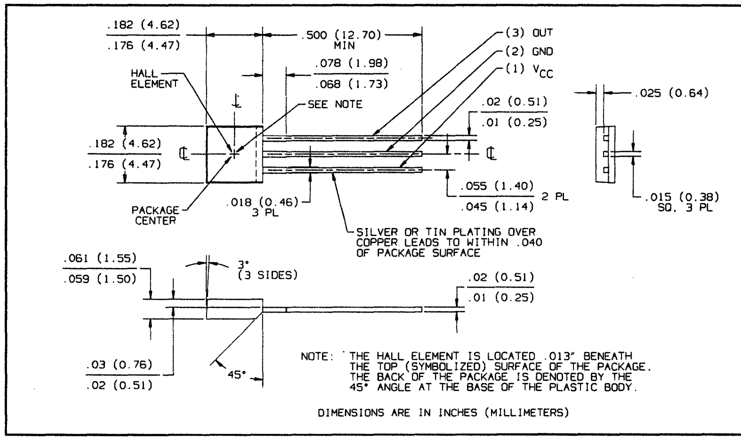
Product Bulletin OHN3030U
May 1993

Hallogic™ Hall Effect Sensors
Types OHN3030U, OHS3030U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3030U and OHS3030U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range.

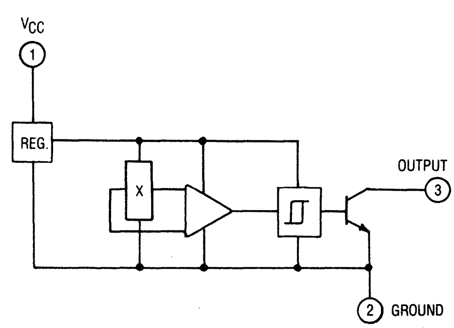
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +160°C
Operating Temperature Range, T_A OHN3030U .... -20°C to +85°C
OHS3030U .... -40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



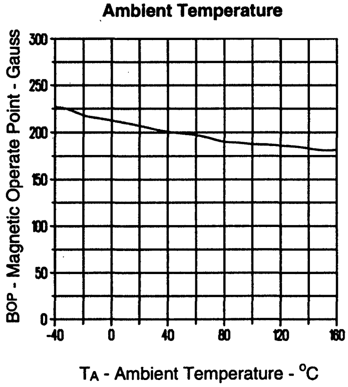
Types OHN3030U, OHS3030U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

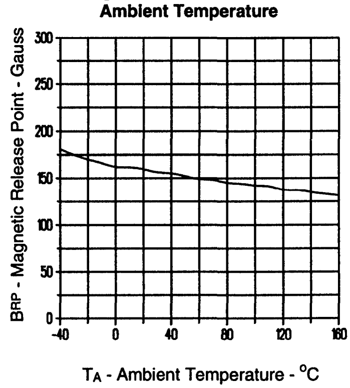
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point		205	250	Gauss	
B_{RP}	Magnetic Release Point	0	160		Gauss	
B_H	Magnetic Hysteresis	20	45		Gauss	
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 200 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT}=24 V, B ≤ 50 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Typical Performance Curves

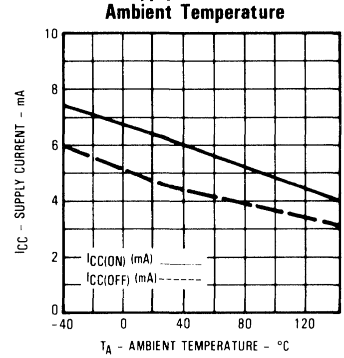
Magnetic Operate Point vs Ambient Temperature



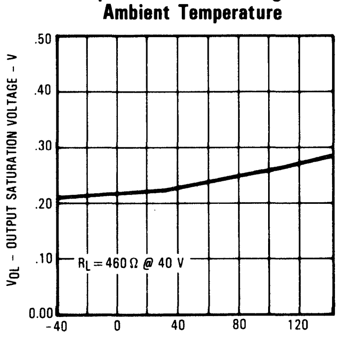
Magnetic Release Point vs Ambient Temperature



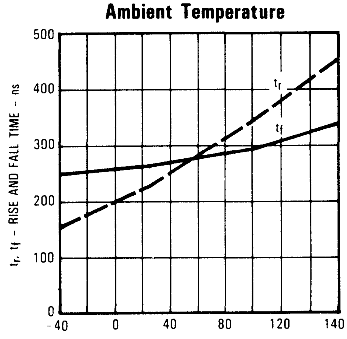
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

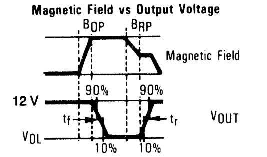


Rise and Fall Time vs Ambient Temperature

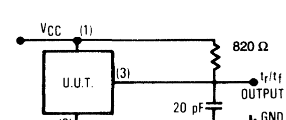


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit



HALL EFFECT SENSORS

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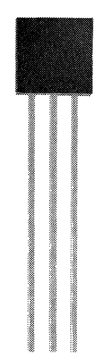
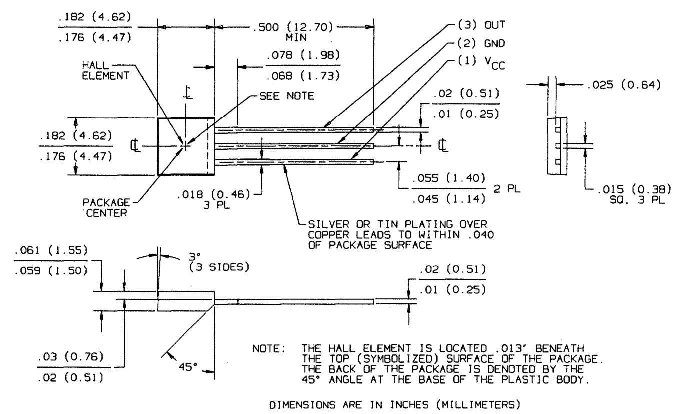
Product Bulletin OHN3040U
May 1993

Hallogic™ Hall Effect Sensors
Types OHN3040U, OHS3040U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3040U and OHS3040U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Stability of the magnetic operate and release points is excellent over this entire temperature range. The release point over the temperature range will always be greater than zero.

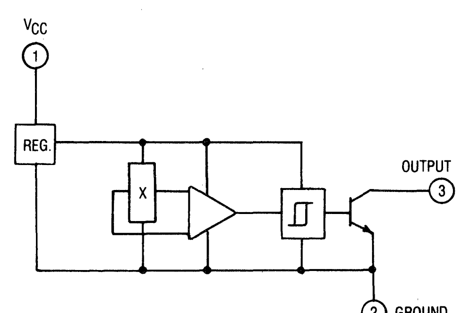
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC}	25V
Storage Temperature Range, T_S	-65°C to +150°C
Operating Temperature Range, T_A OHN3040U	-20°C to +85°C
OHS3040U	-40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron]	260°C[(1)]
Output ON Current, I_{SINK}	25mA
Output OFF Voltage, V_{OUT}	25V
Magnetic Flux Density, B	Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



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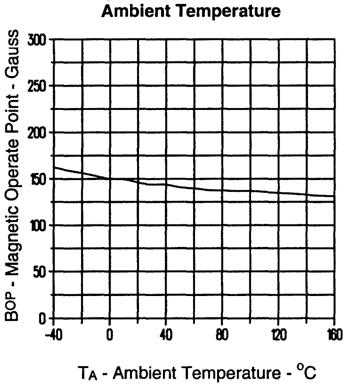
Types OHN3040U, OHS3040U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

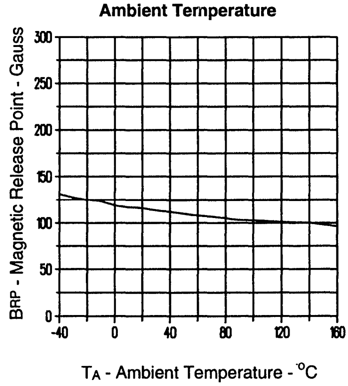
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point		150	200	Gauss	
B_{RP}	Magnetic Release Point	50	115		Gauss	
B_H	Magnetic Hysteresis	20	35		Gauss	
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 200 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	μA	V_{CC} = 24 V, V_{OUT} = 24 V, B ≤ 50 Gauss
t_r	Output Rise Time		0.21	1.00	μs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	μs	

Typical Performance Curves

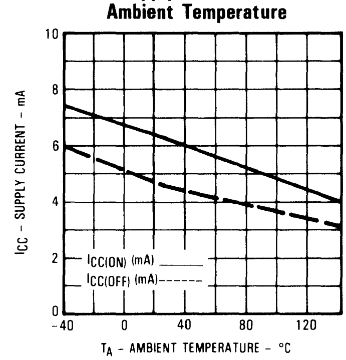
Magnetic Operate Point vs Ambient Temperature



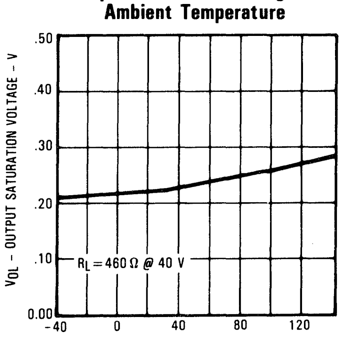
Magnetic Release Point vs Ambient Temperature



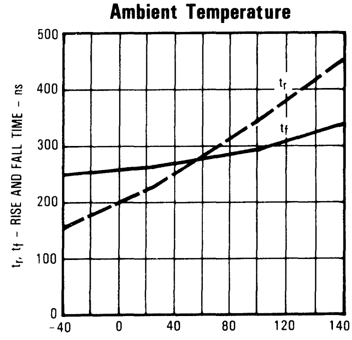
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

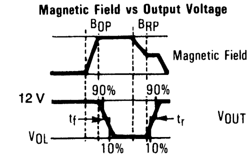


Rise and Fall Time vs Ambient Temperature

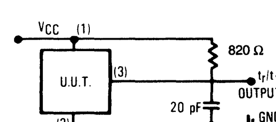


Rise and Fall Time Tests

Magnetic Field vs Output Voltage

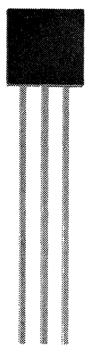


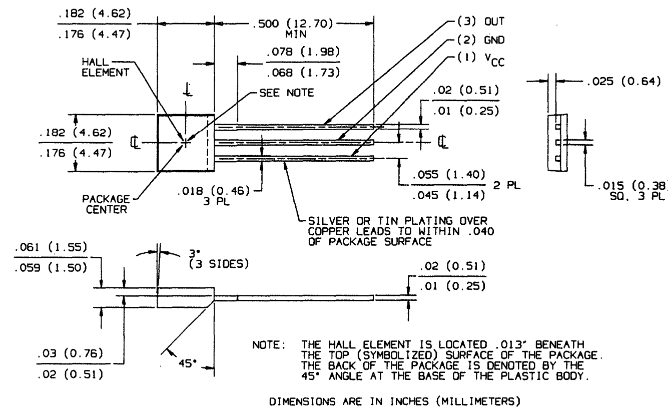
Rise and Fall Time Test Circuit



OPTEK

Hallogic™ Bipolar Hall Effect Sensors (Latches)
Types OHN3075U, OHS3075U





Features

- Designed for use in brushless DC motors
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads

Description

The OHN3075U and OHS3075U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single Hallogic™ silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

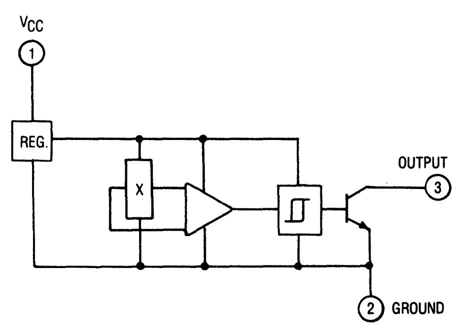
These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for applications in brushless DC motors and for use with multiple pole magnets.

Absolute Maximum Ratings (T_A=25°C unless otherwise noted)

Supply Voltage, V_{CC}	25V
Storage Temperature Range, T_S	-65°C to +160°C
Operating Temperature Range, T_A OHN3075U	-20°C to +85°C
OHS3075U	-40°C to +150°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron]	260°C[(1)]
Output ON Current, I_{SINK}	25mA
Output OFF Voltage, V_{OUT}	25V
Magnetic Flux Density, B	Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



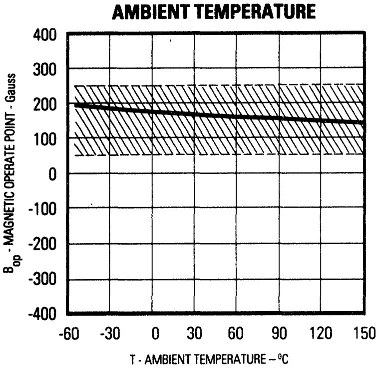
Types OHN3075U, OHS3075U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

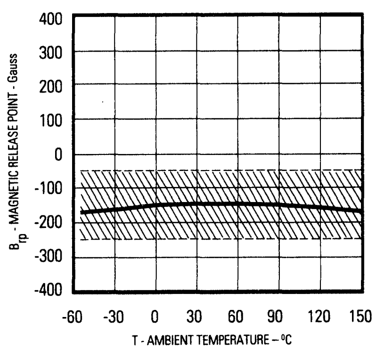
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	50	100	250	Gauss	
B_{RP}	Magnetic Release Point	-250	-100	-50	Gauss	
B_H	Magnetic Hysteresis	100	200	500	Gauss	
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off B ≤ -250 Gauss
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 250 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT} =24 V, B ≤ -250 Gauss
t_r	Output Rise Time		0.05	1.00	µs	R_L = 820 Ω, C_L = 20 pF,
t_f	Output Fall Time		0.10	1.00	µs	V_{CC} = 12 V

Typical Performance Curves

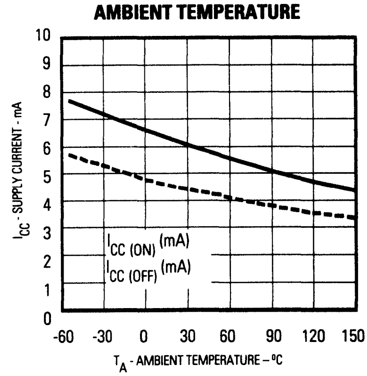
MAGNETIC OPERATE POINT vs AMBIENT TEMPERATURE



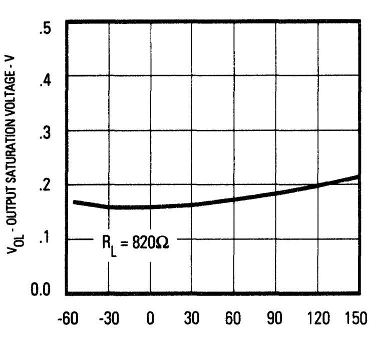
MAGNETIC RELEASE POINT vs AMBIENT TEMPERATURE



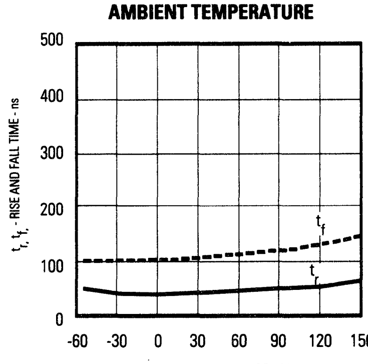
SUPPLY CURRENT vs AMBIENT TEMPERATURE



OUTPUT SATURATION VOLTAGE vs AMBIENT TEMPERATURE

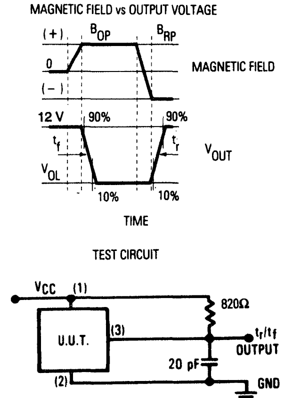


RISE AND FALL TIME vs AMBIENT TEMPERATURE



RISE AND FALL TIME TEST

MAGNETIC FIELD vs OUTPUT VOLTAGE



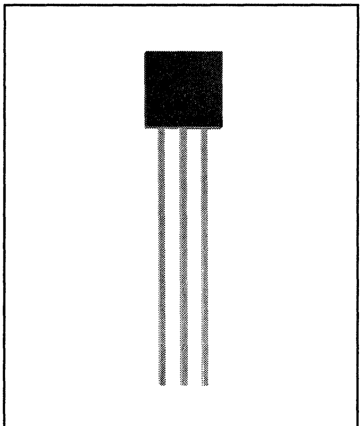
HALL EFFECT SENSORS

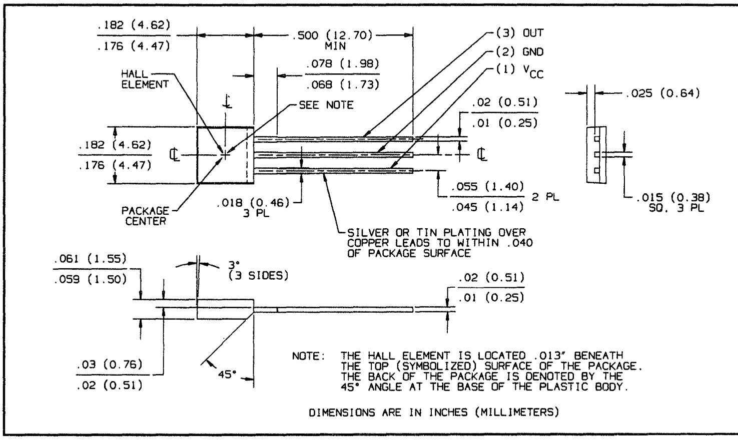
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Product Bulletin OHN3113U
May 1993

Hallogic™ Hall Effect Sensors
Type OHN3113U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3113U contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

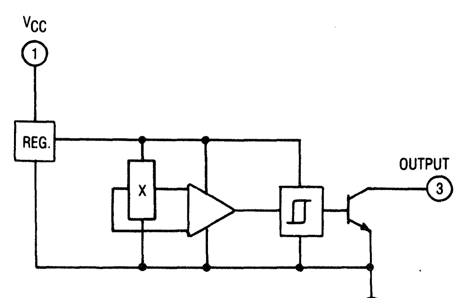
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -20°C to +85°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Type OHN3113U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

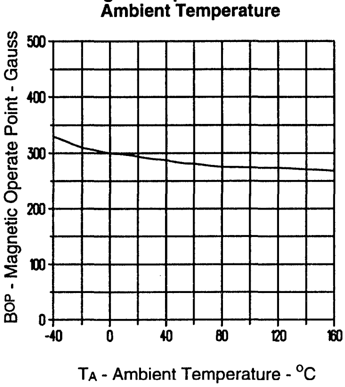
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 450 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 4.5 V, V_{OUT} = 24 V, B ≤ 30 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Magnetic Characteristics

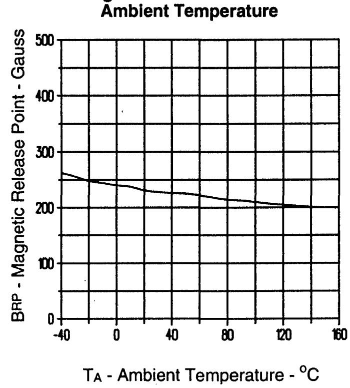
		T_A = 25°C		T_A = -20°C to 85°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}		450		510	G
Release Point	B_{RP}	30		20		G
Hysteresis	B_H	20		10		G

Typical Performance Curves

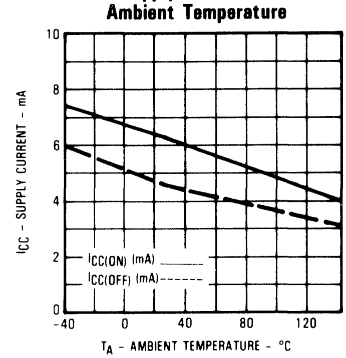
Magnetic Operate Point vs Ambient Temperature



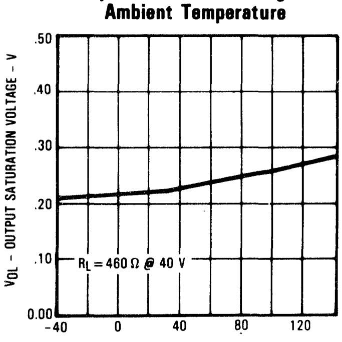
Magnetic Release Point vs Ambient Temperature



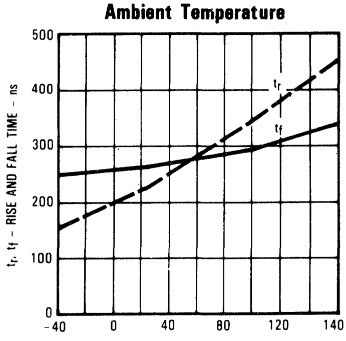
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

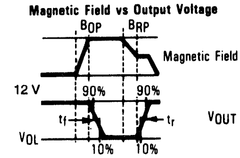


Rise and Fall Time vs Ambient Temperature

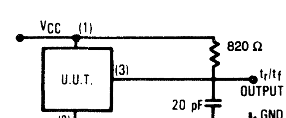


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit



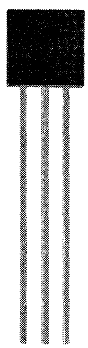
HALL EFFECT SENSORS

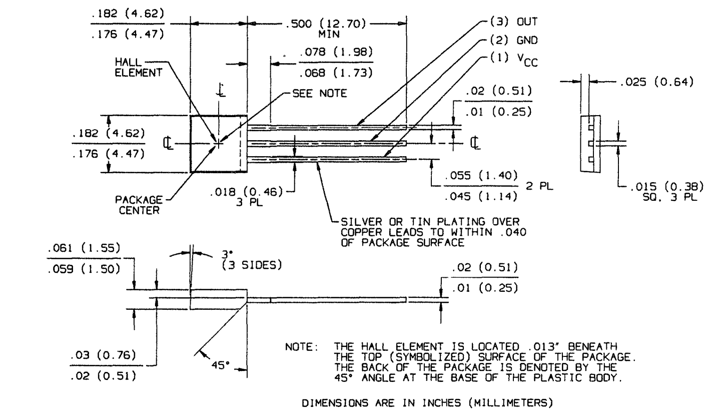
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OHN3119U
May 1993

OPTEK

Hallogic™ Hall Effect Sensors
Types OHN3119U, OHS3119U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3119U and OHS3119U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

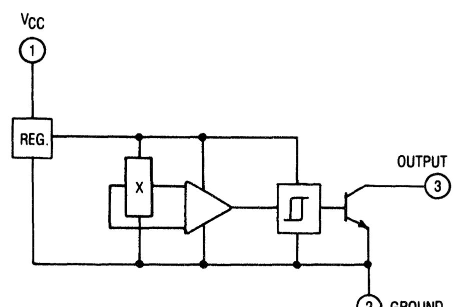
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC}	25V
Storage Temperature Range, T_S	-65°C to +150°C
Operating Temperature Range, T_A OHN3119U	-20°C to +85°C
OHS3119U	-40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron]	260°C (1)
Output ON Current, I_{SINK}	25mA
Output OFF Voltage, V_{OUT}	25V
Magnetic Flux Density, B	Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Types OHN3119U, OHS3119U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

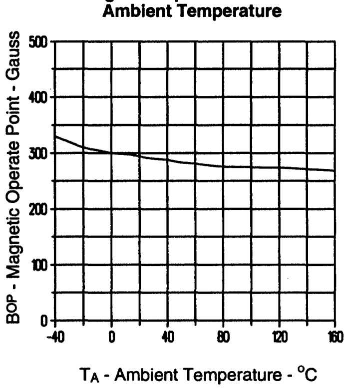
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 500 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 4.5 V, V_{OUT} = 24 V, B ≤ 50 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Magnetic Characteristics

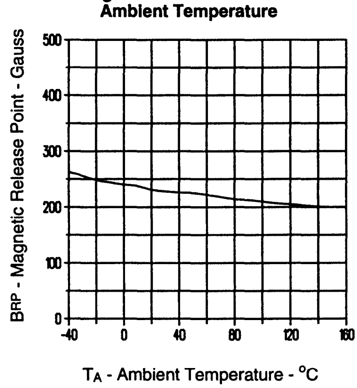
		T_A = 25°c		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}	175	500	100	545	45	575	G
Release Point	B_{RP}	125	450	50	495	25	555	G
Hysteresis	B_H	50		50		20		G

Typical Performance Curves

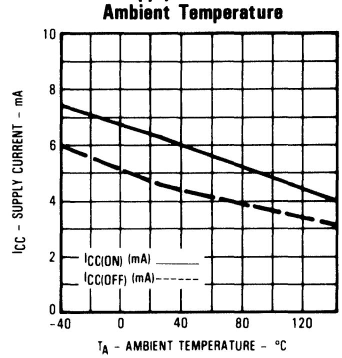
Magnetic Operate Point vs Ambient Temperature



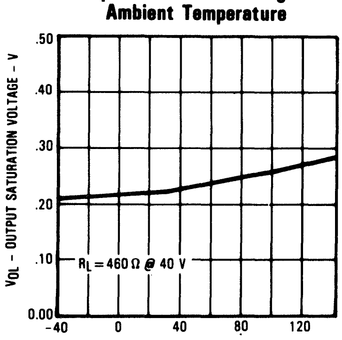
Magnetic Release Point vs Ambient Temperature



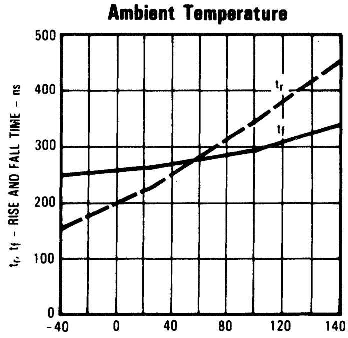
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

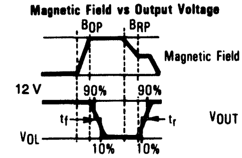


Rise and Fall Time vs Ambient Temperature

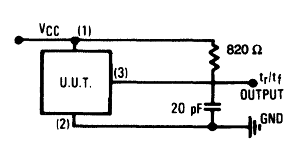


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit

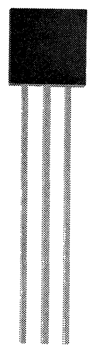


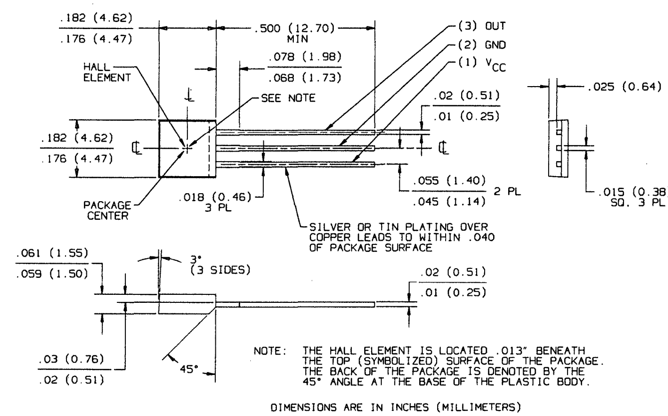
HALL EFFECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Hallogic™ Hall Effect Sensors
Types OHN3120U, OHS3120U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3120U and OHS3120U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

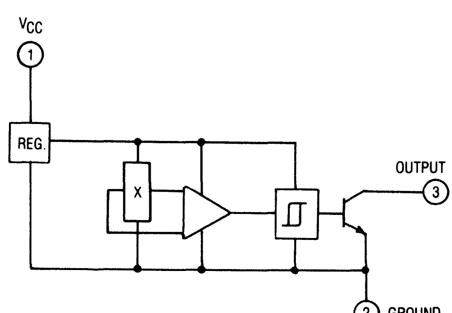
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A OHN3120U .... -20°C to +85°C
OHS3120U .... -40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C (1)
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Types OHN3120U, OHS3120U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

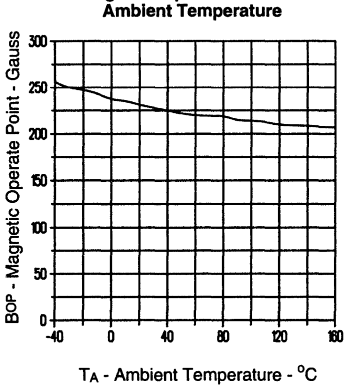
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 350 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 4.5 V, V_{OUT} = 24 V, B ≤ 50 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Magnetic Characteristics

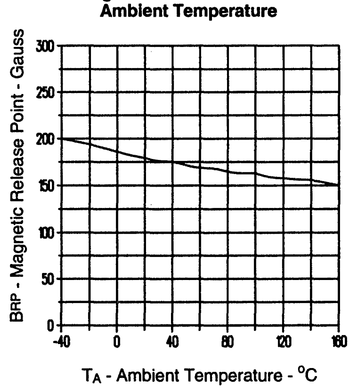
		T_A = 25°C		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}	70	350	70	425	35	450	G
Release Point	B_{RP}	50	330	50	405	25	430	G
Hysteresis	B_H	20		20		20		G

Typical Performance Curves

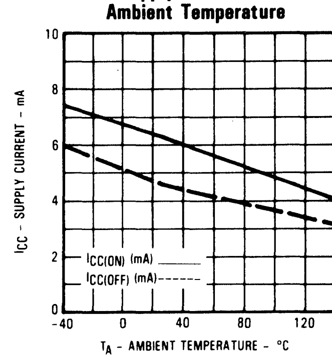
Magnetic Operate Point vs Ambient Temperature



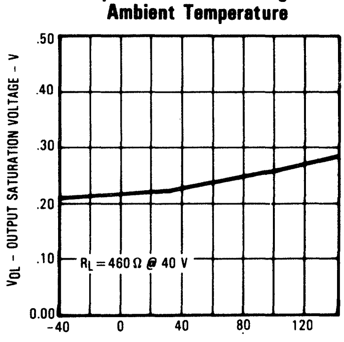
Magnetic Release Point vs Ambient Temperature



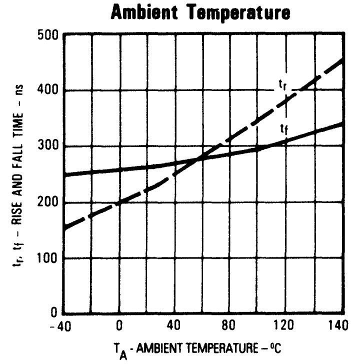
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

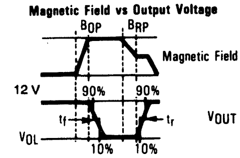


Rise and Fall Time vs Ambient Temperature

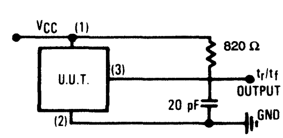


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



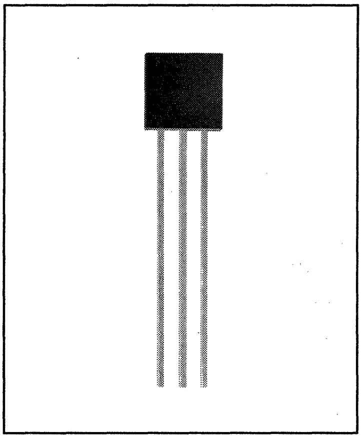
Rise and Fall Time Test Circuit

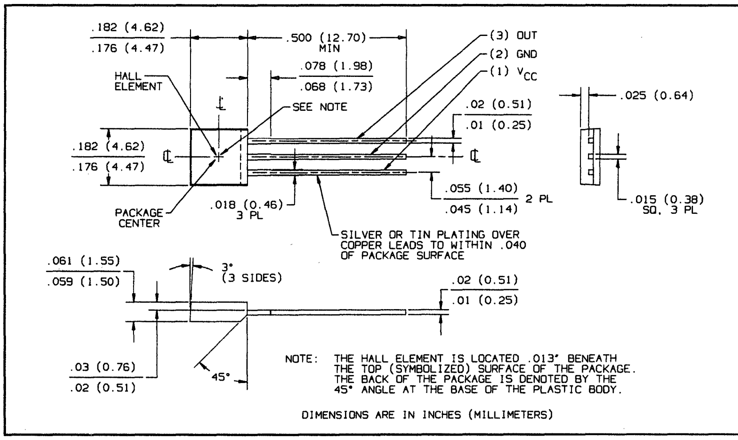


HALL EFFECT SENSORS

Product Bulletin OHN3130U
May 1993

Hallogic™ Hall Effect Sensors
Types OHN3130U, OHS3130U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3130U and OHS3130U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

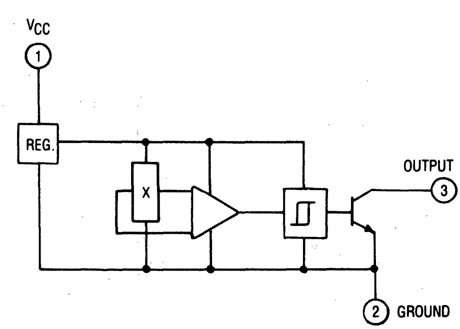
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC}	25V
Storage Temperature Range, T_S	-65°C to +160°C
Operating Temperature Range, T_A OHN3130U	-20°C to +85°C
OHS3130U	-40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron]	260°C[(1)]
Output ON Current, I_{SINK}	25mA
Output OFF Voltage, V_{OUT}	25V
Magnetic Flux Density, B	Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Types OHN3130U, OHS3130U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

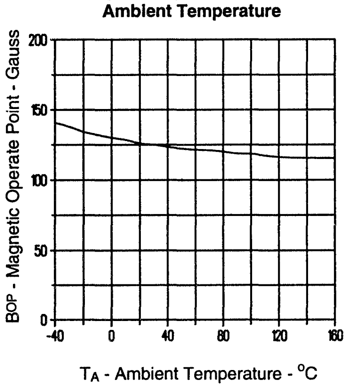
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 200 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 4.5 V, V_{OUT}=24 V, B ≤ -150 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Magnetic Characteristics

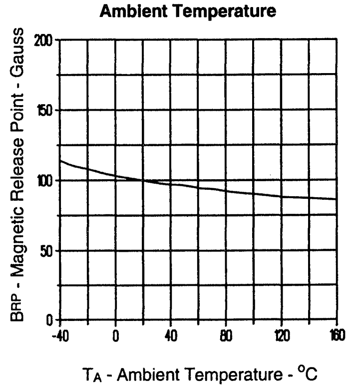
		T_A = 25°C		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}		150		175		200	G
Release Point	B_{RP}	-150		-175		-200		G
Hysteresis	B_H	20		20		20		G

Typical Performance Curves

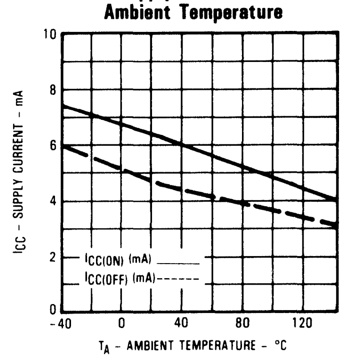
Magnetic Operate Point vs Ambient Temperature



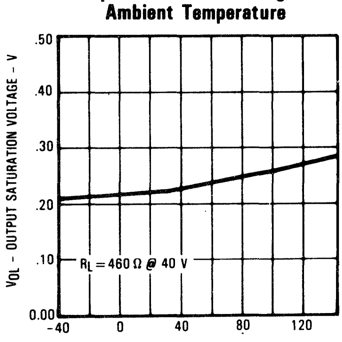
Magnetic Release Point vs Ambient Temperature



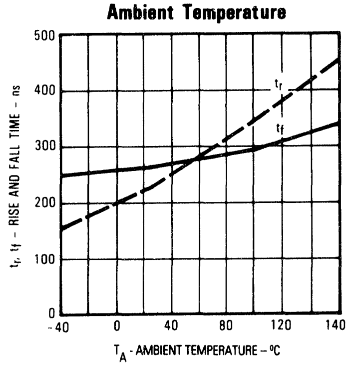
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

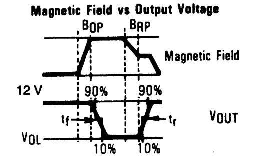


Rise and Fall Time vs Ambient Temperature

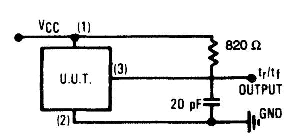


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



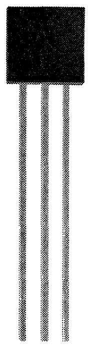
Rise and Fall Time Test Circuit

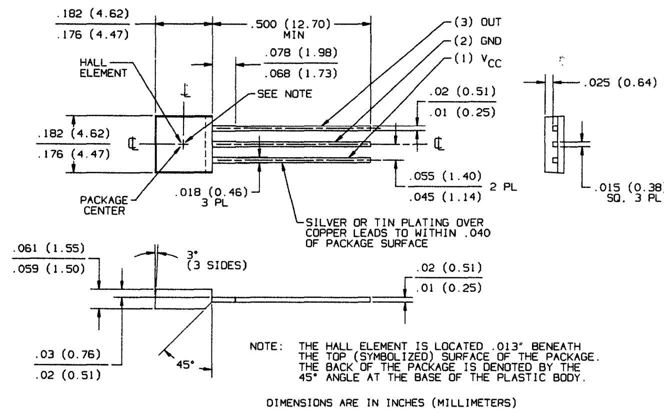


HALL EFFECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Ultra Sensitive Hallogic™ Hall Effect Sensors
Types OHN3131U, OHS3131U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

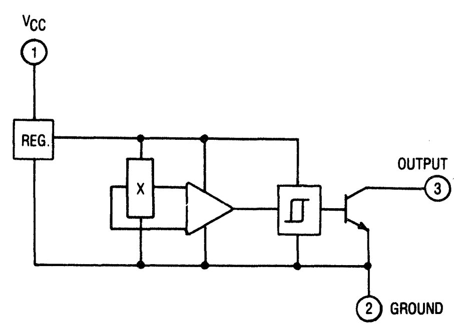
The OHN3131U and OHS3131U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A OHN3131U .... -20°C to +85°C
OHS3131U .... -40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C(1)
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Types OHN3131U, OHS3131U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

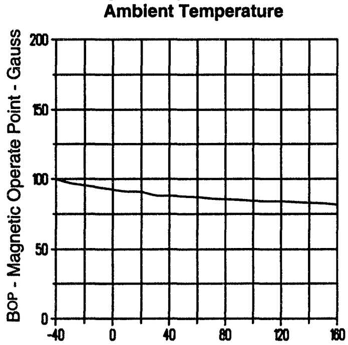
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4.0	7.0	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA B ≥ 95 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24 V, V_{OUT} = 24 V B ≤ -95 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF,
t_f	Output Fall Time		0.25	1.00	µs	V_{CC} = 12.0 V

Magnetic Characteristics

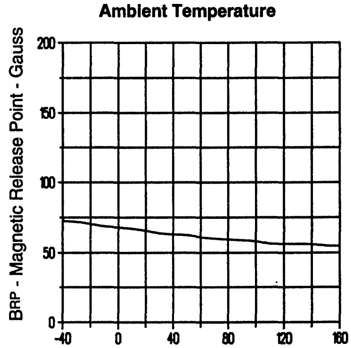
		T_A = 25°C		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}	-75	95	-75	95	-115	135	G
Release Point	B_{RP}	-95	85	-95	85	-135	125	G
Hysteresis	B_H	10		10		10		G

Typical Performance Curves

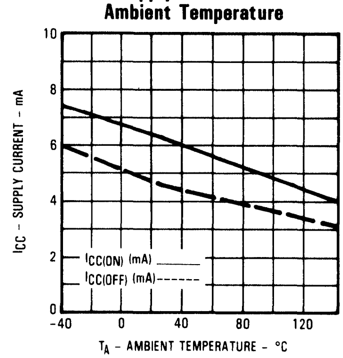
Magnetic Operate Point vs Ambient Temperature



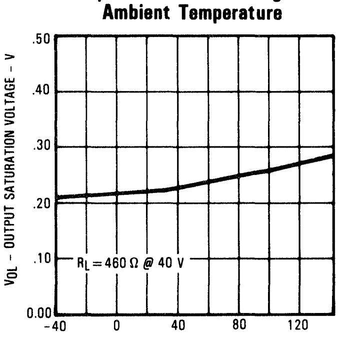
Magnetic Release Point vs Ambient Temperature



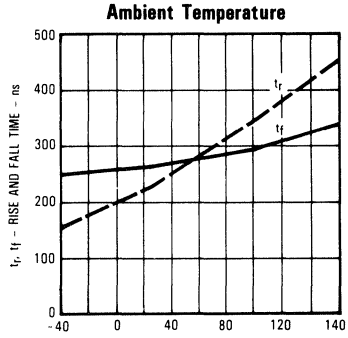
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

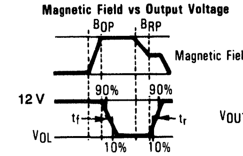


Rise and Fall Time vs Ambient Temperature

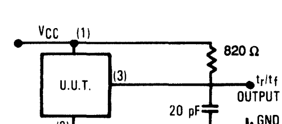


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit

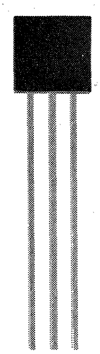


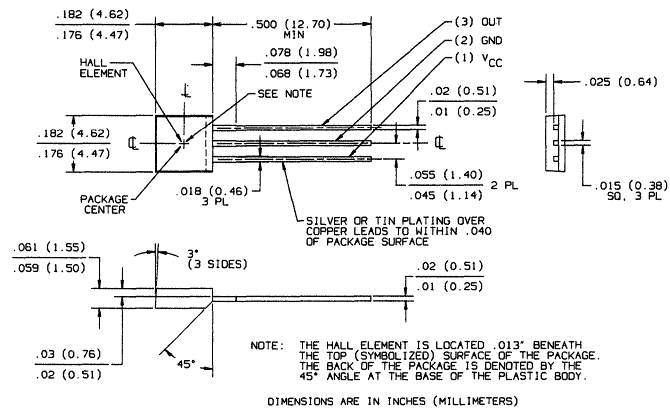
HALL EFFECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Hallogic™ Hall Effect Sensors
Types OHN3140U, OHS3140U





Features

- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip

Description

The OHN3140U and OHS3140U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

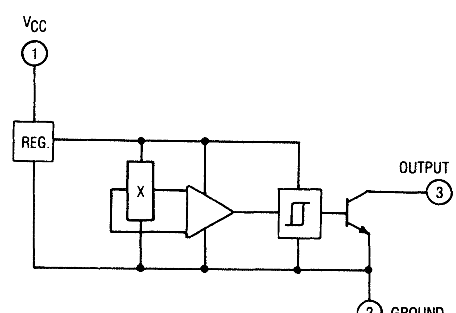
Package size has been kept to minimum, providing an advantage in applications where space is limited.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC}	25V
Storage Temperature Range, T_S	-65°C to +160°C
Operating Temperature Range, T_A OHN3140U	-20°C to +85°C
OHS3140U	-40°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron]	260°C[(1)]
Output ON Current, I_{SINK}	25mA
Output OFF Voltage, V_{OUT}	25V
Magnetic Flux Density, B	Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Types OHN3140U, OHS3140U

Electrical Characteristics (V_{CC} = 4.5V to 24V, T_A = 25°C unless otherwise noted)

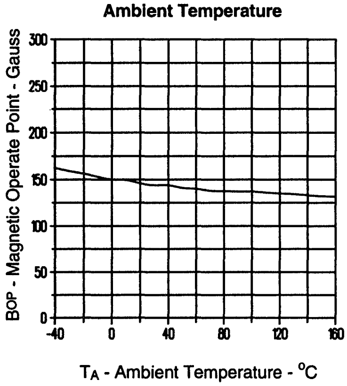
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 200 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 4.5 V, V_{OUT} = 24 V, B ≤ 50 Gauss
t_r	Output Rise Time		0.21	1.00	µs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.25	1.00	µs	

Magnetic Characteristics

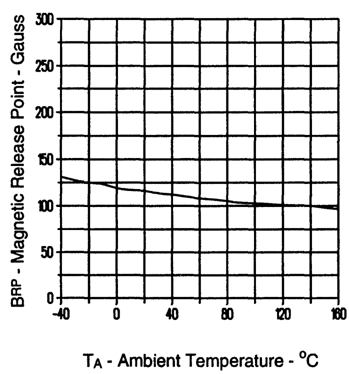
		T_A = 25°C		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}	70	200	45	260	45	270	G
Release Point	B_{RP}	50	180	25	240	25	250	G
Hysteresis	B_H	20		20		20		G

Typical Performance Curves

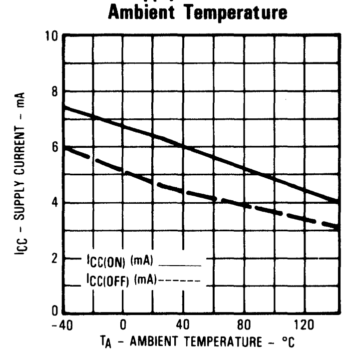
Magnetic Operate Point vs Ambient Temperature



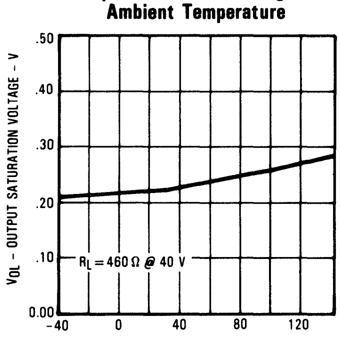
Magnetic Release Point vs



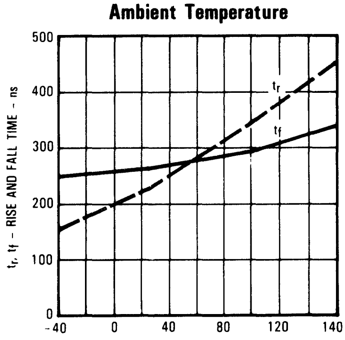
Supply Current vs Ambient Temperature



Output Saturation Voltage vs Ambient Temperature

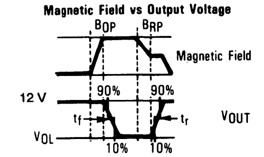


Rise and Fall Time vs Ambient Temperature

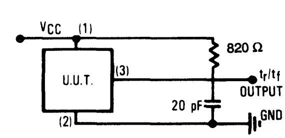


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



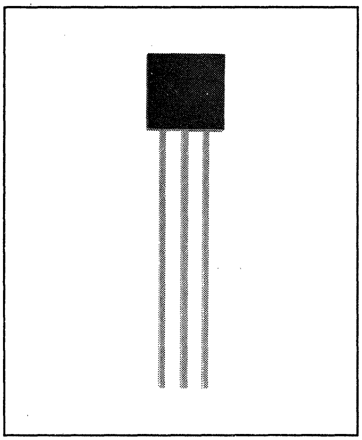
Rise and Fall Time Test Circuit

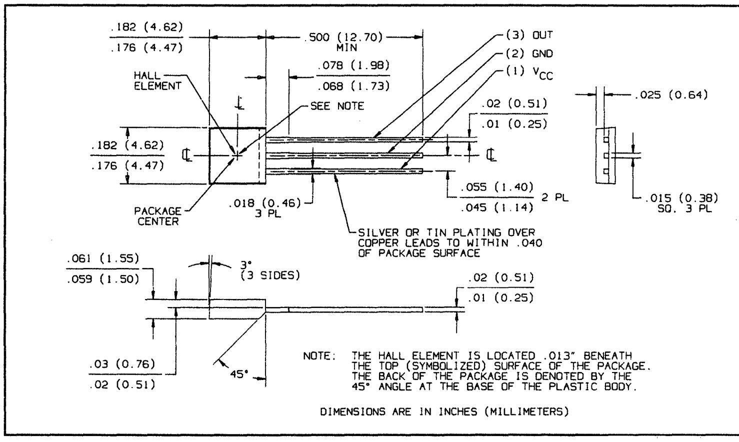


HALL EFFECT SENSORS

OPTEK

Hallogic™ Bipolar Hall Effect Sensors (Latches)
Types OHN3175U, OHS3175U





Features

- Designed for use in brushless DC motors
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads

Description

The OHN3175U and OHS3175U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single Hallogic™ silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

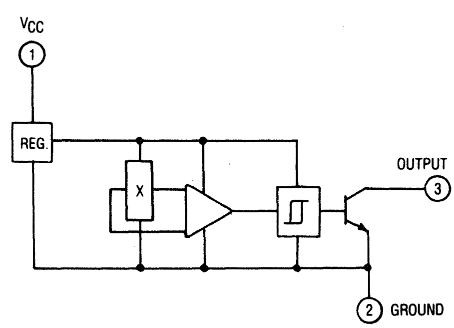
These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for applications in brushless DC motors and for use with multiple pole magnets.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC}	25V
Storage Temperature Range, T_S	-65°C to +150°C
Operating Temperature Range, T_A OHN3175U	-20°C to +85°C
OHS3175U	-40°C to +125°C
Lead soldering Temperature [1/8 inch (3.2 mm) from case for 5 sec. with soldering iron]	260°C(1)
Output ON current, I_{SINK}	25mA
Output OFF Voltage , V_{OUT}	25V
Magnetic Flux Density, B	Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Types OHN3175U, OHS3175U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 200 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	μA	V_{CC} = 4.5 V, V_{OUT} = 24 V, B ≤ -250 Gauss
t_r	Output Rise Time		0.05	1.00	μs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.10	1.00	μs	

Magnetic Characteristics

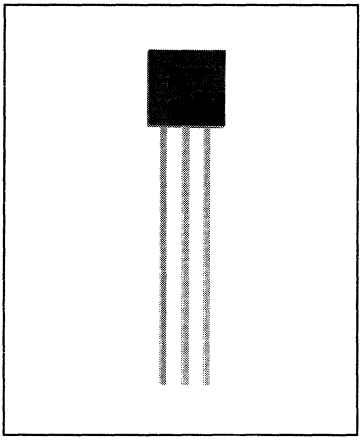
		T_A = 25°C		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	SYMBOL	MIN	MAX	MIN	MAX	MIN	MAX	UNITS
Operate Point	B_{OP}	25	170	15	180	10	260	G
Release Point	B_{RP}	-170	-25	-180	-15	-260	-10	G
Hysteresis	B_H	100		80		60		G

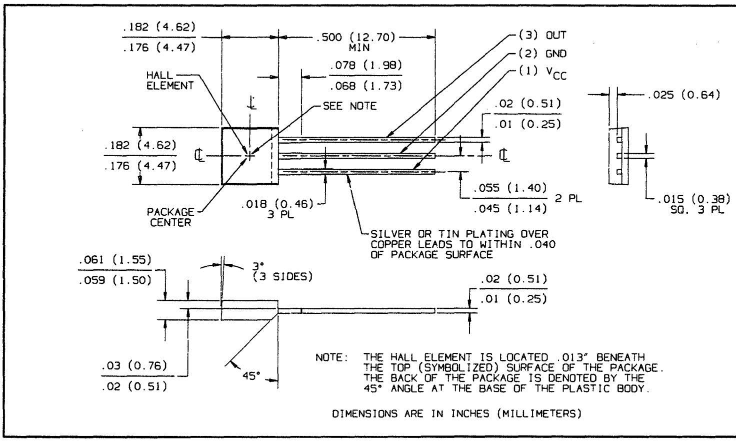
HALL EFFECT SENSORS

Product Bulletin OHN3177
May 1993

OPTEK

Hallogic™ Bipolar Hall Effect Sensors (Latches)
Types OHN3177U, OHS3177U





Features

- Designed for use in brushless DC motors
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Drive capability up to 7 TTL loads

Description

The OHN3177U and OHS3177U each contain a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, a threshold amplifier, and Schmitt trigger on a single Hallogic™ silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The devices feature logic level output and provides up to 21 mA of sink current. This allows direct driving of more than 7 TTL loads or any standard logic family using power supplies ranging from 4.5 to 24 volts. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

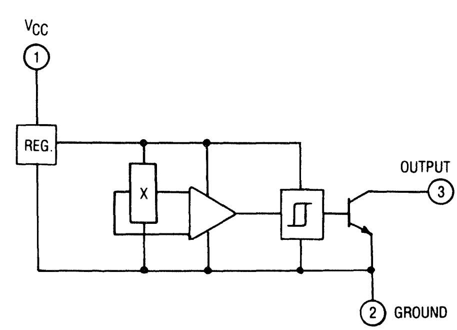
These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for applications in brushless DC motors and for use with multiple pole magnets.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +160°C
Operating Temperature Range, T_A OHN3177U.......... -20°C to +85°C
OHS3177U .... -40°C to +125°C
Lead soldering Temperature [1/8 inch (3.2 mm) from case for 5 sec. with soldering iron].......... 260°C(1)
Output ON current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT}.......... 25V
Magnetic Flux Density, B .... Unlimited

Note:
(1) Heat sink leads during hand soldering.

Functional Block Diagram



Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

Types OHN3177U, OHS3177U

Electrical Characteristics (V_{CC} = 4.5 V to 24 V, T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I_{CC}	Supply Current		4	7	mA	V_{CC} = 24 V, Output Off
V_{OL}	Output Saturation Voltage		100	400	mV	V_{CC} = 4.5 V, I_{OL} = 20 mA, B ≥ 200 Gauss
I_{OH}	Output Leakage Current		0.1	10.0	μA	V_{CC} = 4.5 V, V_{OUT} = 24 V, B ≤ -150 Gauss
t_r	Output Rise Time		0.05	1.00	μs	R_L = 820 Ω, C_L = 20 pF
t_f	Output Fall Time		0.10	1.00	μs	

Magnetic Characteristics

		T_A = 25°C		T_A = -20°C to 85°C		T_A = -40°C to 125°C		
CHARACTERISTICS	**SYMBOL**	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**UNITS**
Operate Point	B_{OP}	50	150	25	150	25	200	G
Release Point	B_{RP}	-150	-50	-150	-25	-200	-25	G
Hysteresis	B_H	100		50		50		G

HALL EFFECT SENSORS

OPTEK TECHNOLOGY, INC.

REFLECTIVE OBJECT SENSORS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Reflective assemblies are motion or position sensors that provide non-contact sensing of a reflective surface or a *change* in surface reflectivity. Such an assembly consists of an infrared emitting diode (IRED) and sensor (an NPN silicon phototransistor, photodarlington of Photologic™) in the same housing. The emitter and sensor are positioned on the same side of the assembly, facing the surface to be sensed, which can be a major mounting advantage in certain applications.

(Application Bulletin 204, printed in this data book, presents an in-depth discussion of reflective assemblies and possible problems involving mounting configurations, reflective surfaces, and sensing circuits. If you have further questions, please contact your local Optek representative, or Optek Technology, Inc. in Carrollton, Texas.)

An important consideration to keep in mind when using reflective assemblies is that the photosensor will not necessarily "see" infrared radiation in the same way that the human eye sees visible light. For example, a black surface and a white surface may, under certain conditions, have similar reflective properties when illuminated with infrared radiation.

Optek makes two types of reflective assemblies; focused and unfocused.

Focused Reflective Assemblies

Focused reflective assemblies are best for sensing specular or polished surfaces. They are made from discrete devices with convex lenses (see Figure 1). In such assemblies, the emitter and sensor are mounted on converging optical axes.

For the standard focused type, the on-state collector current, $I_{C(ON)}$, peaks when a reflective surface is placed between 0.100 and 0.200 inches (2.5 to 50. mm) in front of the reflective assembly. $I_{C(ON)}$ is the collector current created by the infrared radiation emitted by the IRED and detected by the photosensor from the reflective surface.

The IRED emits radiation which follows a diverging pattern, not a straight line, through its centerline. The sensor views a converging pattern rather than a straight line through its center.

Unfocused Reflective Assemblies

Unfocused reflective assemblies are best for sensing diffuse or rough surfaces. They are often manufactured from discrete devices utilizing plano or non-magnifying lenses (see Figure 2). In the standard assembly, the emitter and sensor are usually mounted on parallel optical axes.

For unfocused assemblies, the reflective surface generally must be placed closer to the assembly than when using a focused type. The reason is that $I_{C(ON)}$ peaks when the reflective surface is between 0.040 and 0.080 inches (1.00 to 2.0 mm) from the front of the assembly.

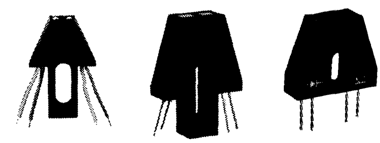
Consideration should be given to possible variations in signal level when designing the use of reflective assemblies. Such variations may occur for a variety of reasons:

- Inconsistency in placement of reflective surfaces, resulting in variation in distance between the surface and the reflective assembly.
- Variations in the reflective surfaces. In some instances, black and white surfaces can exhibit similar reflective properties.
- Using transmissive materials between the reflective assembly and the reflective surface.
- Variations from assembly to assembly. (Especially where the devices are tested to a minimum limit only.)

- Variation in size is another potential problem area. An optimum sized reflective surface is one in which no increase in $I_{C(ON)}$ is observed when the surface area is increased.
- Variations in signal level can be observed due to spurious illumination from outside sources.

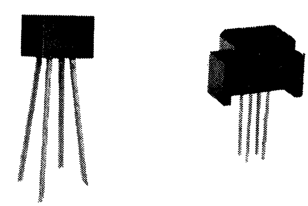
Optek makes reflective assemblies in a wide variety of sizes and shapes for many different applications. The customer can find suitable reflective assemblies to meet a wide variety of specifications. However, many times designers are faced with conditions that prevent the use of standard reflective assemblies, as specified by the manufacturer. Reflective surfaces may be different than specified and the distance between the reflective surface may be greater or closer than that specified, or cannot be consistently maintained. Various mounting requirements may make tighter control impractical and the contrast ratio may have to be improved. In many of these application-specific situations, Optek can design a custom reflective assembly to meet your needs.

Figure 1. Focused Reflective Assemblies



OPB700, 701 OPB704 OPB708, 709

Figure 2. Unfocused Reflective Assemblies



OPB706, 707 OPB711,712

Applications

Measuring surface roughness.

Sensing the level of liquids.

Detecting variations in surface locations.

Detecting presence or absence of paper in office machines.

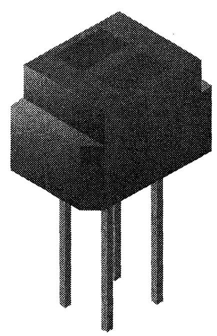
Controlling the shutter and/or flash in sophisticated cameras.

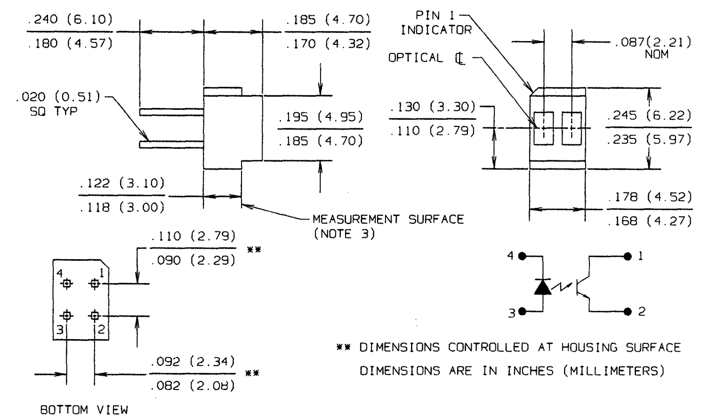
Triggering a high speed print cutting mechanism.

Plus many other applications in industrial controls, surveillance mechanisms, and elsewhere.

OPTEK

Reflective Object Sensors
Types OPB606A, OPB606B, OPB606C





Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

Description

The OPB606 consists of an infrared emitting diode and an NPN silicon phototransistor mounted "side-by-side" on parallel axes in a black opaque plastic housing. Both the emitting diode and phototransistor are encapsulated in a filtering epoxy to reduce ambient light noise. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode
Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 75mW(2)

Output Phototransistor
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation . . . . 75mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) d is the distance from the assembly measurement surface to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Off state collector current $I_{C(OFF)}$ is measured with no reflective surface in the optical path.
(6) Lower curve is a calculated worst case and not the conventional - 2σ limit.
(7) All parameters tested using pulse techniques.

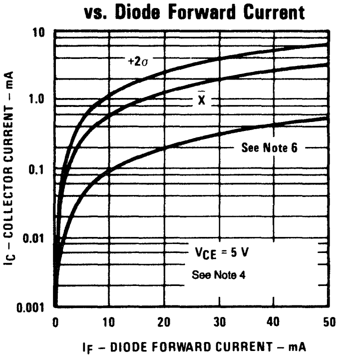
Types OPB606A, OPB606B, OPB606C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

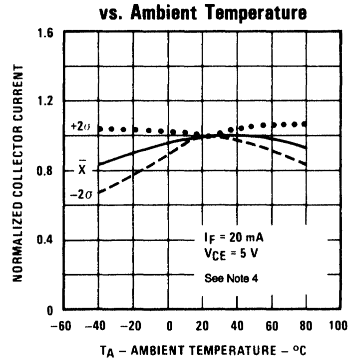
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 20 mA
I_R	Reverse Current			100	µA	V_R = 2.0 V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 100 µA,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100 µA,
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 5.0 V, I_F = 0, E_e = ≤ 0.10 µW/cm^2
Combined						
$I_{C(ON)}$	On-State Collector Current	OPB606A OPB606B OPB606C	500 350 200		µA µA µA	V_{CE} = 5.0 V, I_F = 20 mA, d = 0.110 in. (2.79 mm) (3)(4)
$I_{C(OFF)}$	Off-State Collector Current			200	nA	V_{CE} = 5.0 V, I_F = 20 mA, (5)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40	V	I_F = 20 mA, I_C = 100 µA, d = 0.110 in. (2.79 mm) (3)(4)

Typical Performance Curves

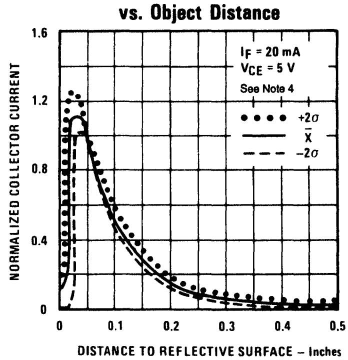
Collector Current vs. Diode Forward Current



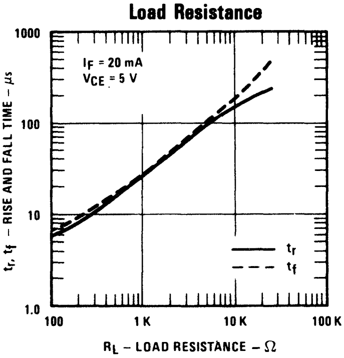
Normalized Collector Current vs. Ambient Temperature



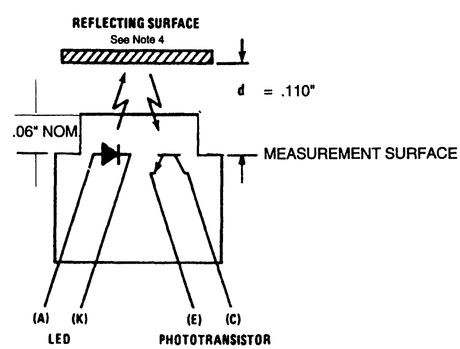
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



Test Condition



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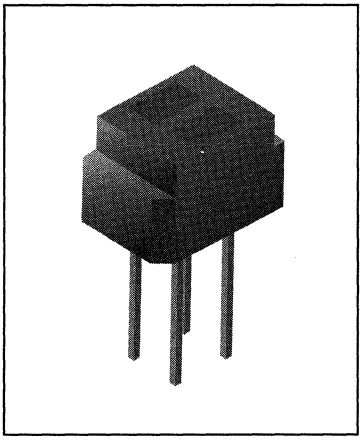
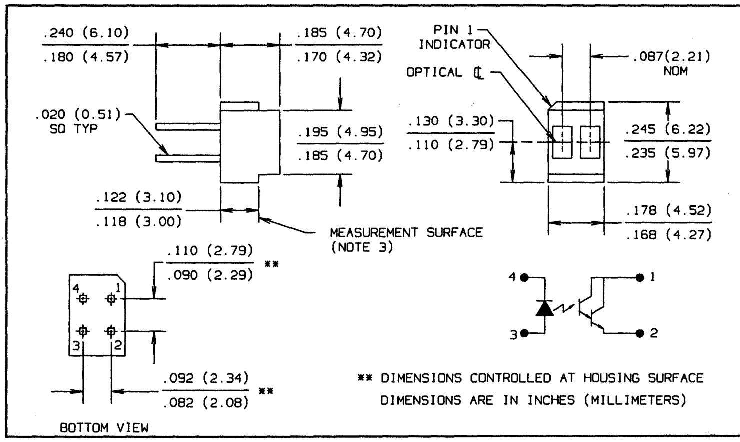
Product Bulletin OPB607
February 1993

OPTEK

Reflective Object Sensors
Types OPB607A, OPB607B, OPB607C





Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

Description

The OPB607 consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on parallel axes in a gray opaque plastic housing. Both the emitting diode and photodarlington are encapsulated in a filtering epoxy to reduce ambient light noise. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 75mW(2)

Output Photodarlington

Collector-Emitter Voltage 15V
Emitter-Collector Voltage 5.0V
Collector DC Current 125mA
Power Dissipation .... 75mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) d is the distance from the assembly measurement surface to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Off state collector current $I_{C(OFF)}$ is measured with no reflective surface in the optical path.
(6) Lower curve is a calculated worst case and not the conventional - 2σ limit.
(7) All parameters measured using pulse techniques.

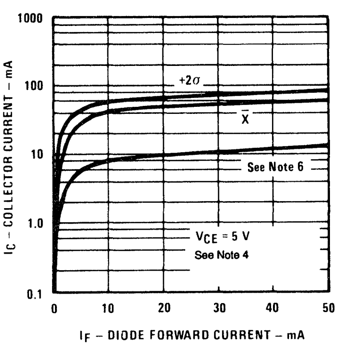
Types OPB607A, OPB607B, OPB607C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

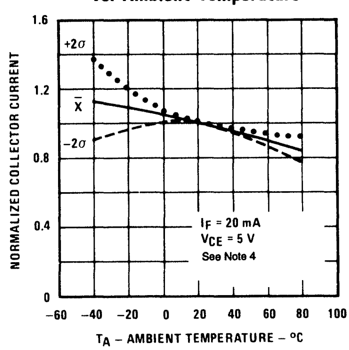
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 20 mA
I_R	Reverse Current		100	μA	V_R = 2.0 V
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15		V	I_C = 100 μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100 μA
I_{CEO}	Collector Dark Current		250	nA	V_{CE} = 5.0 V, I_F = 0, E_e = ≤ 0.10 μW/cm^2
Combined					
$I_{C(ON)}$	On-State Collector Current OPB607A OPB607B OPB607C	25 17 10		mA mA mA	V_{CE} = 5.0 V, I_F = 20 mA, d = 0.110 in. (2.79 mm)(3)(4)
$I_{C(OFF)}$	Off-State Collector Current		10	μA	V_{CE} = 5.0 V, I_F = 20 mA(5)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		1.10	V	I_F = 20 mA, I_C = 2 mA, d = 0.110 in. (2.79 mm)(3)(4)

Typical Performance Curves

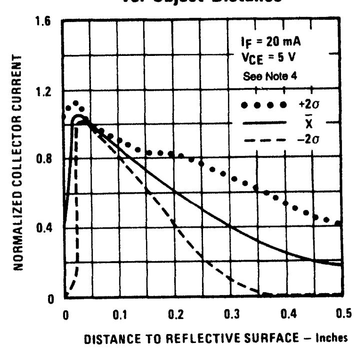
Collector Current vs. Diode Forward Current



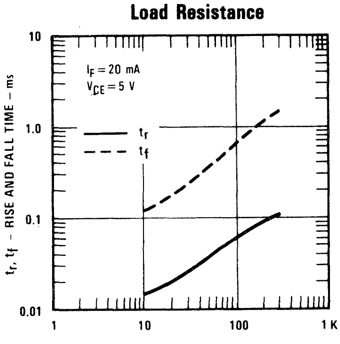
Normalized Collector Current vs. Ambient Temperature



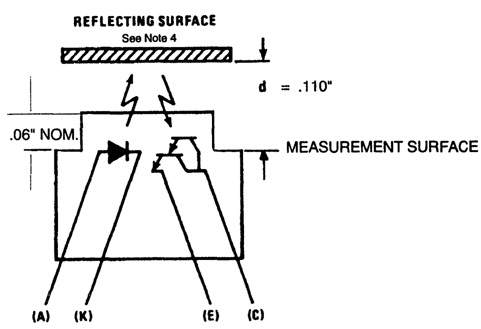
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



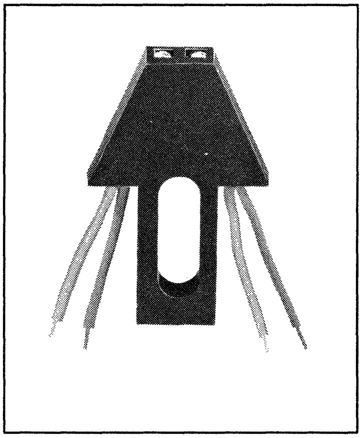
Test Condition

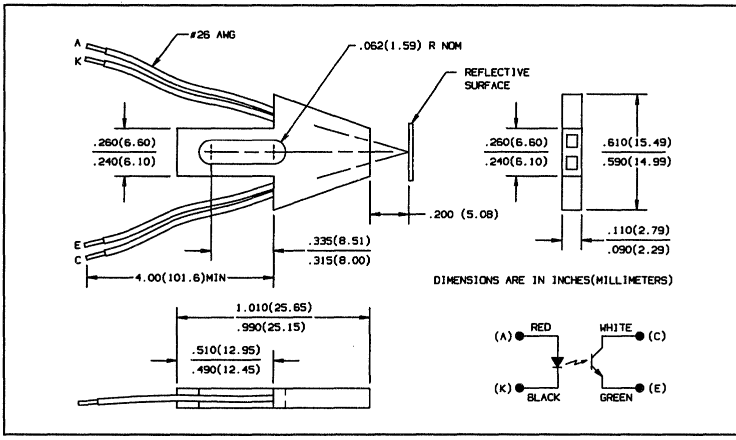


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Reflective Object Sensor
Types OPB700, OPB700AL





Features

- Phototransistor output
- Low profile to facilitate stacking
- Low cost plastic housing
- 4.0 inch minimum length lead wire (OPB700)
- 18.0 inch minimum length lead wire (OPB700AL)

Description

The OPB700 series sensor consists of an infrared emitting diode and an NPN silicon phototransistor, mounted "side-by-side" on converging optical axes, in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

Leads are #26 AWG, teflon insulation, 4.0" minimum length (OPB700) or 18.0" minimum length (OPB700AL), stripped and tinned.

Replaces

OPB700	OPB253A
OPB700AL	OPB253AL

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage TemperatureRange. . . . . -40°C to +125°C
Operating Temperature Range . . . . -40°C to +100°C

Input Diode

Continuous Forward Current 50mA
Reverse Voltage. 2.0V
Power Dissipation. . . . . 80mW[(1)]

Output Phototransistor

Collector-Emitter Voltage 25V
Emitter-Collector Voltage 5.0V
Power Dissipation. . . . . 50mW[(2)]

Notes:

(1) Derate linearly 1.07mW/°C above 25°C.
(2) Derate linearly 0.67mW/°C above 25°C.
(3) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(4) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(5) d is the distance from the assembly head to the reflective surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) All parameters tested using pulse technique.

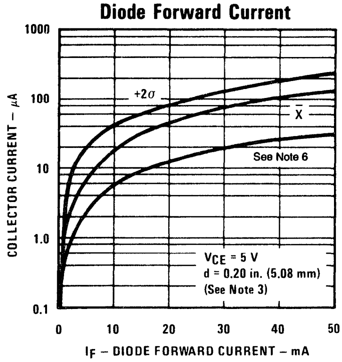
Type OPB700, OPB700AL

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

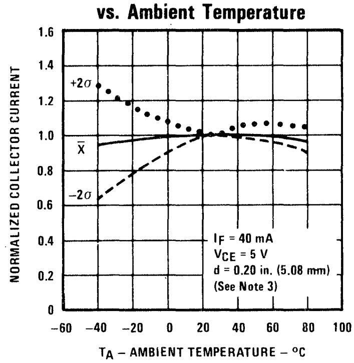
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 50mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	25		V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector Dark Current		100	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e \leq 0.10\ \mu W/cm^2$
Combined					
$I_{C(ON)}$	On-State Collector Current	25		μA	$V_{CE} = 5.0V$, $I_F = 40mA$, d = 0.200 in. (5.08mm)(3)(5)
I_{CX}	Crosstalk		2.0	μA	$V_{CE} = 5.0V$, $I_F = 40mA$, No Reflecting Surface(4)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	$I_F = 40mA$, $I_C = 10.0\mu A$, d = 0.200 in. (5.08mm)(3)(5)

Typical Performance Curves

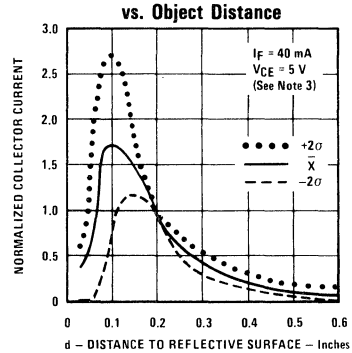
Collector Current vs. Diode Forward Current



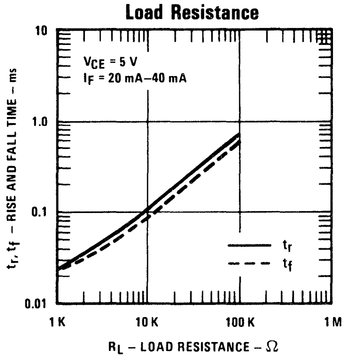
Normalized Collector Current vs. Ambient Temperature



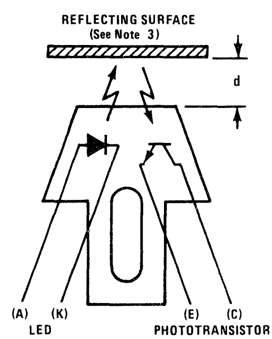
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



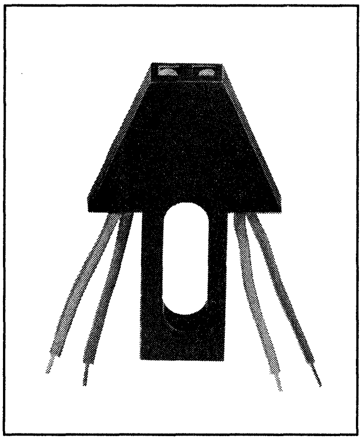
Test Condition

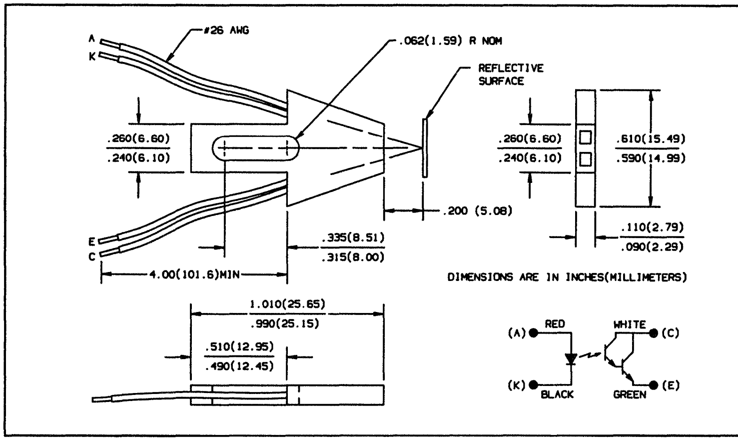


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Reflective Object Sensor
Type OPB701, OPB701AL





Features

- Photodarlington output
- Low profile to facilitate stacking
- Low cost plastic housing
- 4.0 inch minimum length lead wire (OPB701)
- 18.0 inch minimum length lead wire (OPB701AL)

Description

The OPB701 series consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on converging optical axes, in a black plastic housing. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Leads are #26 AWG, teflon insulation, 4.0" minimum length (OPB701) or 18.0" minimum length (OPB701AL), stripped and tinned.

Replaces

OPB701	OPB125A
OPB701AL	OPB125AL

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range .... -40°C to +125°C
Operating Temperature Range .... -40°C to +100°C

Input Diode

Continuous Forward Current 50mA
Reverse Voltage 2.0V
Power Dissipation .... 80mW(1)

Output Photodarlington

Collector-Emitter Voltage 15V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 50mW(2)

Notes:

(1) Derate linearly 1.07mW/°C above 25°C.
(2) Derate linearly 0.67mW/°C above 25°C.
(3) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(4) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(5) d is the distance from the assembly head to the reflective surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) All parameters tested using pulse technique.

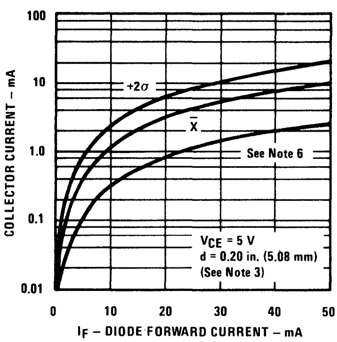
Type OPB701, OPB701AL

Electrical Characteristics (T_A = 25°C unless otherwise noted)

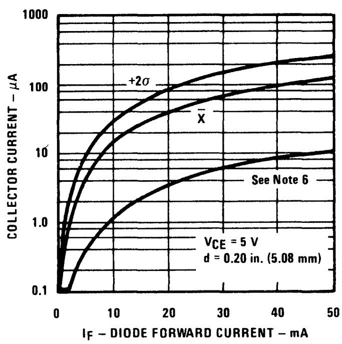
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 50mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15		V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA
I_{CEO}	Collector Dark Current		1.00	μA	V_{CE} = 10.0V, I_F = 0, $E_e \leq 0.100 \mu W/cm^2$
Combined					
$I_{C(ON)}$	On-State Collector Current	2.0		mA	V_{CE} = 5.0V, I_F = 40mA, d = 0.200 in. (5.08mm)(3)(5)
I_{CX}	Crosstalk		20	μA	V_{CE} = 5.0V, I_F = 40mA, No Reflecting Surface(4)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		1.10	V	I_F = 40mA, I_C = 1.0mA, d = 0.200 in. (5.08mm)(3)(5)

Typical Performance Curves

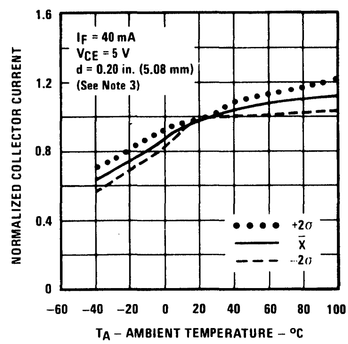
Reflective Surface Collector Current vs. Diode Forward Current



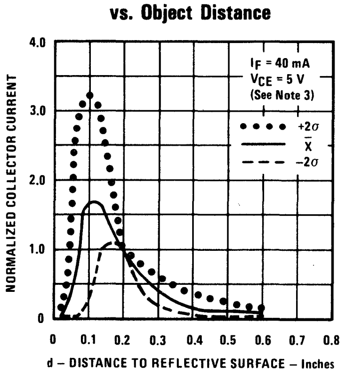
Diffused Surface Collector Current vs. Diode Forward Current



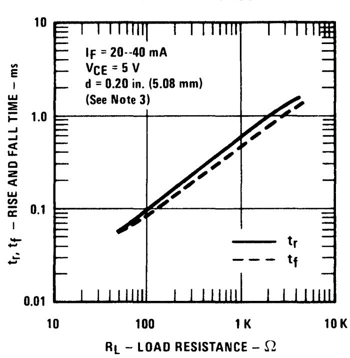
Normalized Collector Current vs. Ambient Temperature



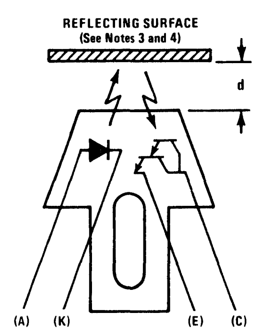
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



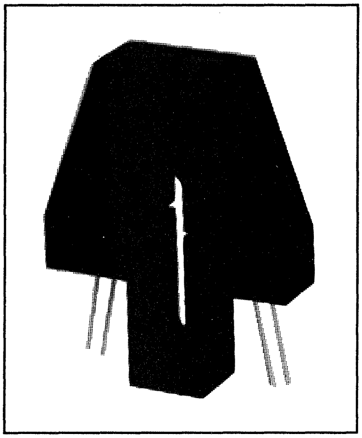
Test Condition

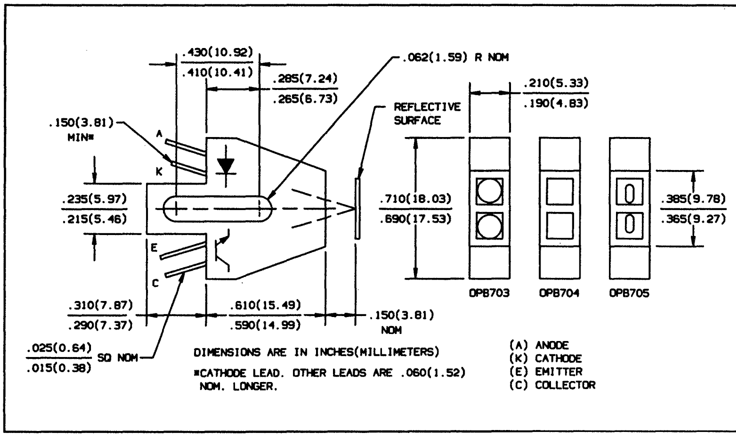


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB703
June 1994

Reflective Object Sensors
Types OPB703, OPB704, OPB705





Features

- Phototransistor output
- High sensitivity
- Low cost plastic housing
- Available with lenses for dust protection and ambient light filtration

Description

The OPB703, OPB704 and OPB705 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side-by-side on converging optical axes in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view. Various options allow no lens, blue polysulfone lens for dust protection or offset lens for improved resolution.

Replaces

OPB703 = KR8800
OPB704 = KR8801 and OPB703A
OPB705 = KR8802

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Forward DC Current 40mA
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(5) All parameters tested using pulse technique.
(6) Crosstalk is the photocurrent measured with current to the input diode and no reflecting surface.
(7) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.

DESCRIPTION

OPB703	No Lens
OPB704	Blue Polysulfone Lens
OPB705	Offset Lens

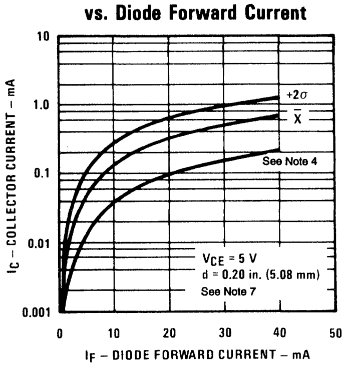
Types OPB703, OPB704, OPB705

Electrical Characteristics ($T_A = 25^{\circ}C$ unless otherwise noted)

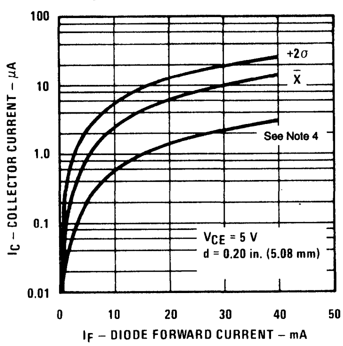
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Output Diode						
V_F	Forward Voltage			1.70	V	$I_F = 40$ mA
I_R	Reverse Current			100	μA	$V_R = 2.0$ V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	$I_{CE} = 100$ μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	$I_{EC} = 100$ μA
I_{CEO}	Collector Dark Current			100	nA	$V_{CE} = 10.0$ V, $I_F = 0$, $E_e = 0$
Combined						
$I_{C(ON)}$	On-State Collector Current	OPB703 OPB704 OPB705	200 200 100		μA μA μA	$V_{CE} = 5.0$ V, $I_F = 40$ mA, d = 0.15 inch (3.81 mm)(3)(7)
I_{CX}	Crosstalk	OPB703 OPB704 OPB705		20 20 10	μA μA μA	$V_{CE} = 5.0$ V, $I_F = 40$ mA(6)

Typical Performance Curves

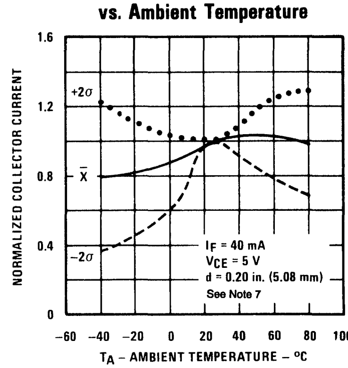
Reflective Surface Collector Current vs. Diode Forward Current



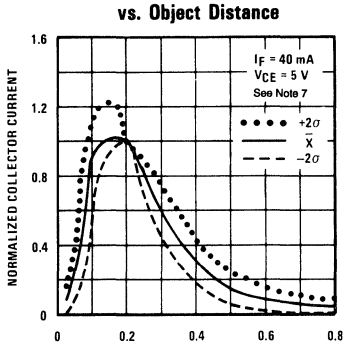
Diffused Surface Collector Current vs. Diode Forward Current



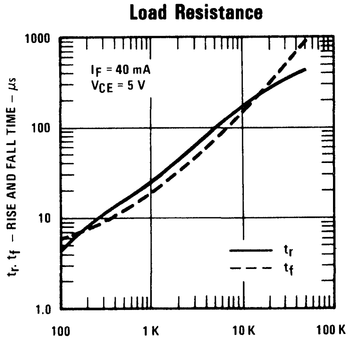
Normalized Collector Current vs. Ambient Temperature



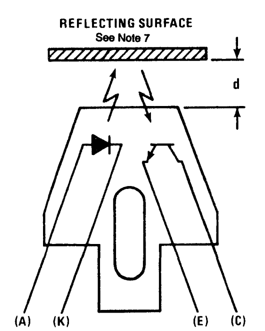
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

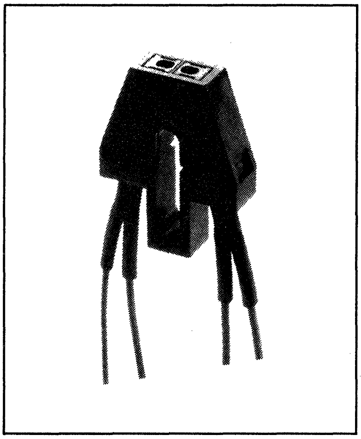


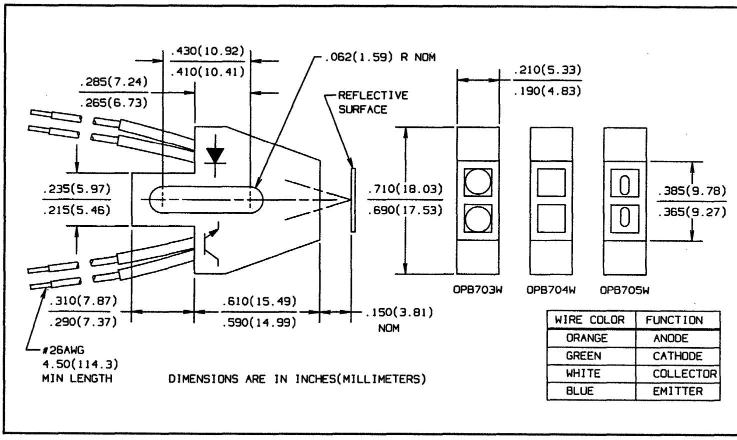
Test Condition



Product Bulletin OPB703W
June 1994

Reflective Object Sensors
Types OPB703W, OPB704W, OPB705W





WIRE COLOR	FUNCTION
ORANGE	ANODE
GREEN	CATHODE
WHITE	COLLECTOR
BLUE	EMITTER

Features

- Phototransistor output
- High sensitivity
- Low cost plastic housing
- Available with lenses for dust protection and ambient light filtration

Description

The OPB703W, OPB704W and OPB705W each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side-by-side on converging optical axes in a black plastic housing. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view. Various options allow no lens, blue polysulfone lens for dust protection or offset lens for improved resolution.

Leads are 26 AWG, PVC insulation, 4.5" (114.3mm) minimum length, stripped & tinned.

Replaces

OPB703W = KR8803
OPB704W = KR8804
OPB705W = KR8805

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 40mA
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation . . . . 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.82mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(5) All parameters tested using pulse technique.
(6) Crosstalk is the photocurrent measured with current to the input diode and no reflecting surface.
(7) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.

DESCRIPTION

OPB703W	No Lens
OPB704W	Blue Polysulfone Lens
OPB705W	Offset Lens

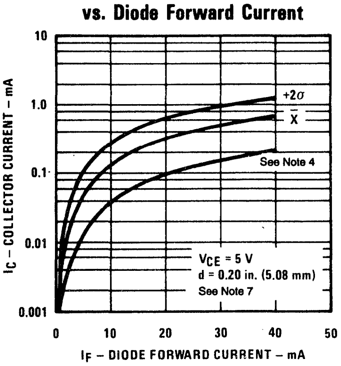
Types OPB703W, OPB704W, OPB705W

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

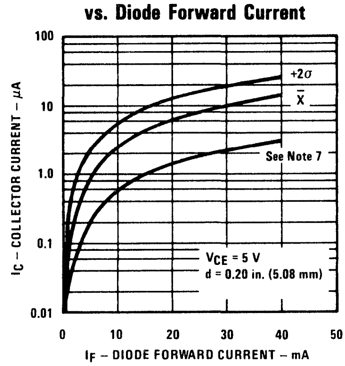
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	$I_F = 40mA$
I_R	Reverse Current			100	µA	$V_R = 2.0V$
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	$I_{CE} = 100µA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	$I_{EC} = 100µA$
I_{CEO}	Collector Dark Current			100	nA	$V_{CE} = 10.0V, I_F = 0, E_e = 0$
Combined						
$I_{C(ON)}$	On-State Collector Current	OPB703W	200		µA	$V_{CE} = 5.0V, I_F = 40mA$,
		OPB704W	200		µA	d = 0.15 in (3.81mm)(3)(7)
		OPB705W	100		µA	
I_{CX}	Crosstalk	OPB703W		20	µA	$V_{CE} = 5.0V, I_F = 40mA$(6)
		OPB704W		20	µA	
		OPB705W		10	µA	

Typical Performance Curves

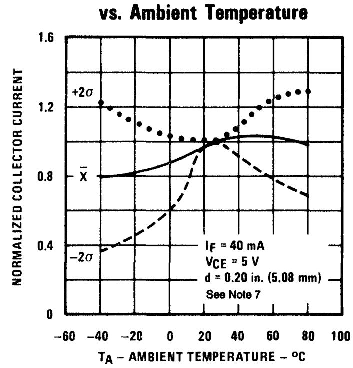
Reflective Surface Collector Current vs. Diode Forward Current



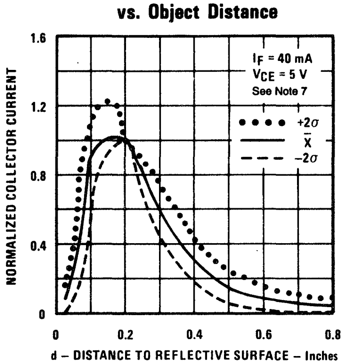
Diffused Surface Collector Current vs. Diode Forward Current



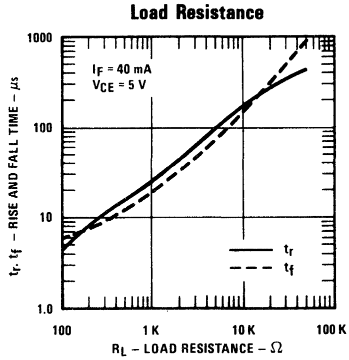
Normalized Collector Current vs. Ambient Temperature



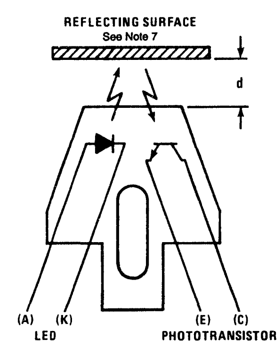
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



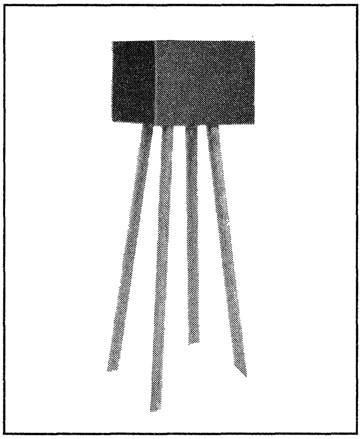
Test Condition

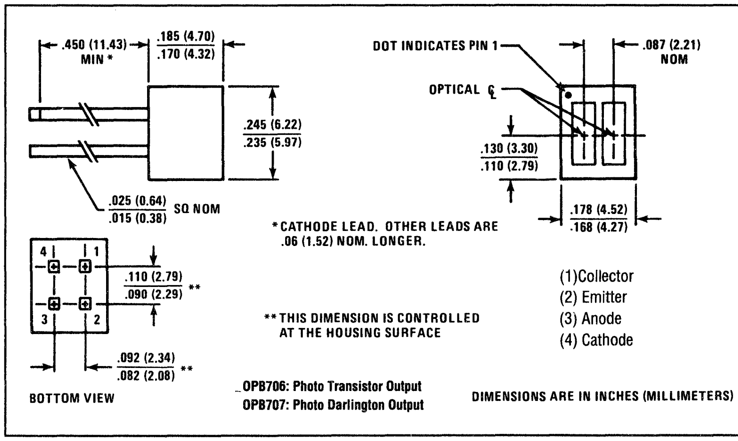


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Reflective Object Sensors
Types OPB706A, OPB706B, OPB706C





Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

Description

The OPB706 consists of an infrared emitting diode and an NPN silicon phototransistor mounted "side-by-side" on parallel axes in a black plastic housing. Both the emitting diode and phototransistor are molded out of black infrared transmissive plastic to reduce ambient light noise. The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 75mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation . . . . 75mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) d is the distance from the assembly face to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) All parameters tested using pulse technique.

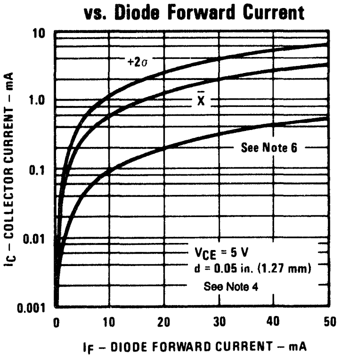
Types OPB706A, OPB706B, OPB706C

Electrical Characteristics (T_A = 25°C unless otherwise noted)

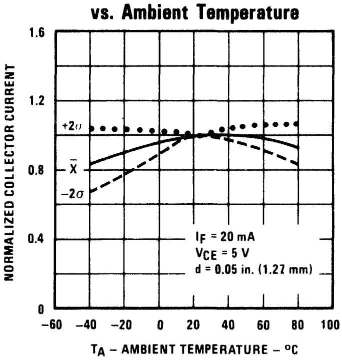
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100μA,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA,
I_{CEO}	Collector Dark Current		100	nA	V_{CE} = 5.0V, I_F = 0, $E_e \leq 0.1 \mu W/cm^2$
Combined					
$I_{C(ON)}$	On-State Collector Current OPB706A OPB706B OPB706C	500 350 200		μA μA μA	V_{CE} = 5.0V, I_F = 20mA, d = 0.050 in. (1.27mm) (3)(4)
I_{CX}	Crosstalk		200	nA	V_{CE} = 5.0V, I_F = 20mA, (5)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_F = 20mA, I_C = 100μA, d = 0.050 in. (1.27mm) (3)(4)

Typical Performance Curves

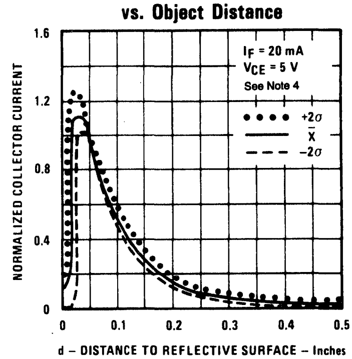
Collector Current vs. Diode Forward Current



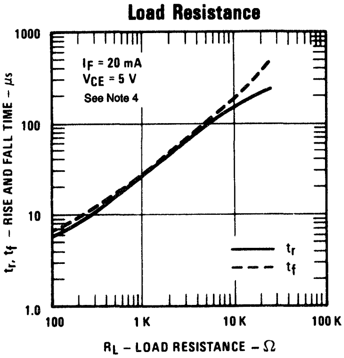
Normalized Collector Current vs. Ambient Temperature



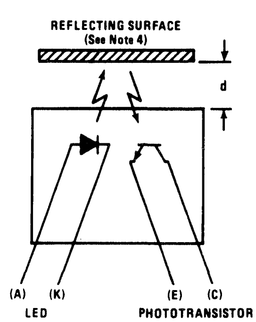
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

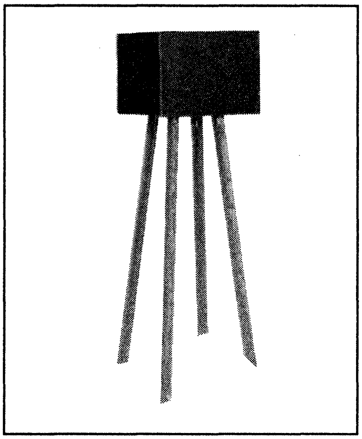


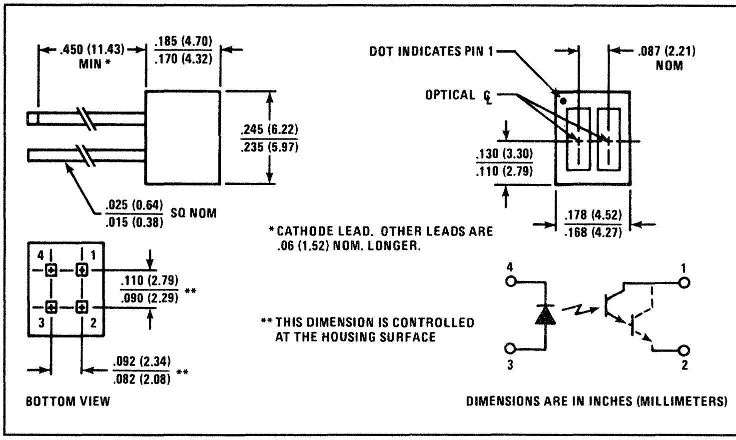
Test Condition



OPTEK

Reflective Object Sensors
Types OPB707A, OPB707B, OPB707C





Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

Description

The OPB707 consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on parallel axes in a black plastic housing. Both the emitting diode and photodarlington are molded out of black infrared transmissive plastic to reduce ambient light noise. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 75mW(2)

Output Photodarlington

Collector-Emitter Voltage 15.0
Emitter-Collector Voltage 5.0V
Collector DC Current 125mA
Power Dissipation . . . . 100mW(3)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.25mW/°C above 25°C.
(3) Derate linearly 1.67mW/°C above 25°C.
(4) d is the distance from the assembly face to the reflective surface.
(5) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(6) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(7) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(8) All parameters tested using pulse technique.

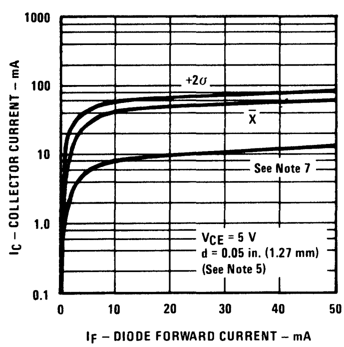
Types OPB707A, OPB707B, OPB707C

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

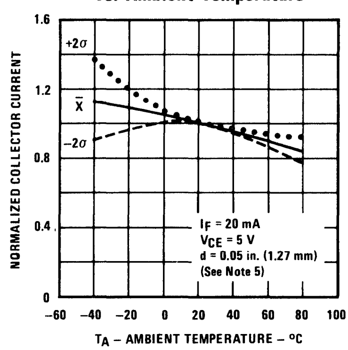
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20mA$
I_R	Reverse Current		100	µA	$V_R = 2.0V$
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0		V	$I_C = 100\mu A$,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$,
I_{CEO}	Collector Dark Current		250	nA	$V_{CE} = 5.0V$, $I_F = 0$, $E_e \leq 0.1\mu W/cm^2$
Combined					
$I_{C(ON)}$	On-State Collector Current OPB707A OPB707B OPB707C	25 17 10		mA mA mA	$V_{CE} = 5.0V$, $I_F = 20mA$, d = 0.050 in. (1.27mm)(4)(5)
I_{CX}	Crosstalk		10	µA	$V_{CE} = 5.0V$, $I_F = 20mA$,(6)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		1.10	V	$I_F = 20mA$, $I_C = 2mA$, d = 0.050 in. (1.27mm)(4)(5)

Typical Performance Curves

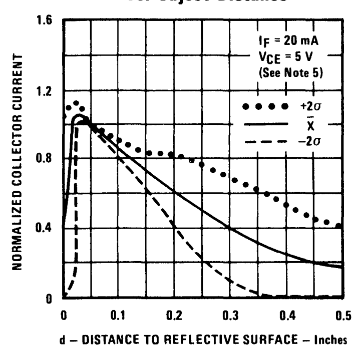
Collector Current vs. Diode Forward Current



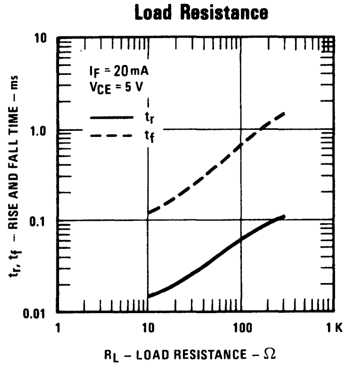
Normalized Collector Current vs. Ambient Temperature



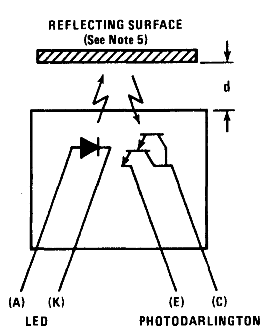
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

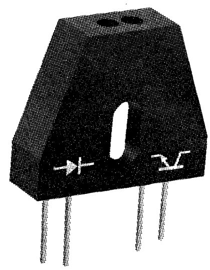


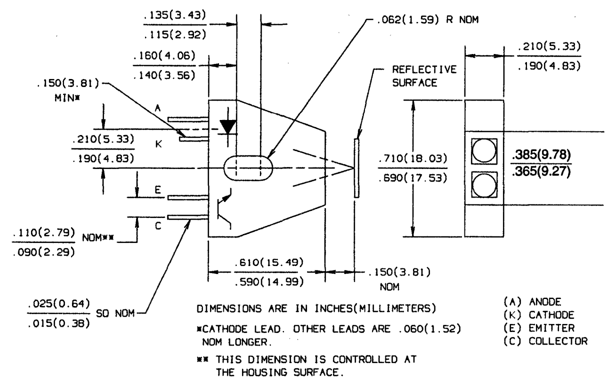
Test Condition



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Reflective Object Sensors
Types OPB708, OPB709





Features

- Focused for maximum sensitivity
- Phototransistor (OPB708) or photodarlington (OPB709) output
- Crosstalk does not exceed specified I_{CEO}
- Low cost plastic housing

Description

The OPB708 and OPB709 each consists of an infrared emitting diode and an NPN silicon phototransistor (OPB708) or photodarlington (OPB709), mounted side-by-side on converging optical axes, in a black plastic housing. Maximum sensitivity typically occurs 0.125 inches from the front of the housing.

The photosensor responds to radiation from the LED only when a reflective object passes within its field of view.

Both parts are constructed using either OP165 or OP265 series LEDs. The OPB708 uses an OP505 type phototransistor and the OPB709 uses an OP535 type photodarlington.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range . . . . -40°C to +85°C
Operating Temperature Range . . . . -40°C to +85°C
Lead soldering temperature (1/6 inch [1.6 mm] from case for 5 sec. with soldering iron) . . . . 240°C

Input Diode

Reverse Voltage . . . . 2.0 V
Continuous Forward Current . . . . 40 mA
Power Dissipation . . . . 60 mW(2)

Output Photosensor

Collector-Emitter Voltage - OPB708 . . . . 30 V
OPB709 . . . . 15 V
Emitter-Collector Voltage . . . . 5.0 V
Power Dissipation - OPB708 . . . . 50 mW(3)
OPB709 . . . . 125 mW(4)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.00 mW/°C above 25°C.
(3) Derate linearly 0.83 mW/°C above 25°C.
(4) Derate linearly 2.08 mW/°C above 25°C.
(5) d is the distance from the assembly face to the reflective surface.
(6) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(7) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.

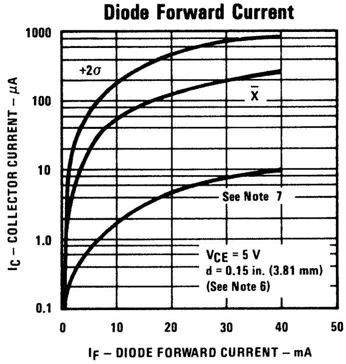
Types OPB708

Electrical Characteristics (T_A = 25°C unless otherwise noted)

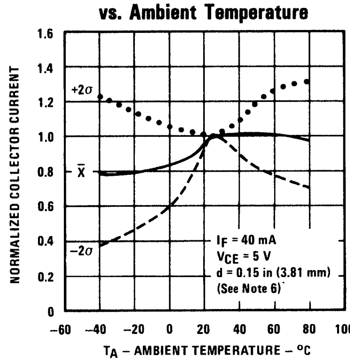
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 40 mA
I_R	Reverse Current		100	μA	V_R = 2.0 V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100 μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100 μA
I_{CEO}	Collector Dark Current		100	nA	V_{CE} = 10.0 V, I_F = 0, E_e = 0
Combined					
$I_{C(ON)}$	On-State Collector Current	10.0		μA	V_{CE} = 5.0 V, I_F = 40 mA, d = 0.150" (3.81 mm)(5)(6)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_F = 40 mA, I_C = 3.0 μA, d = 0.150" (3.81 mm)(5)(6)

Typical Performance Curves

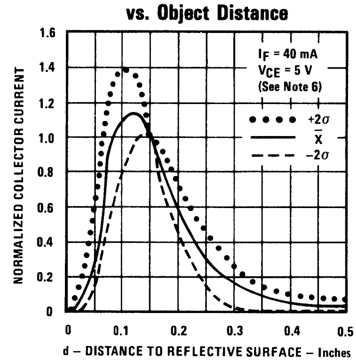
Collector Current vs. Diode Forward Current



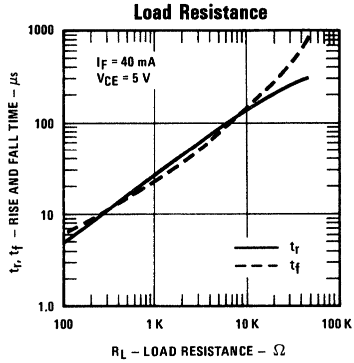
Normalized Collector Current vs. Ambient Temperature



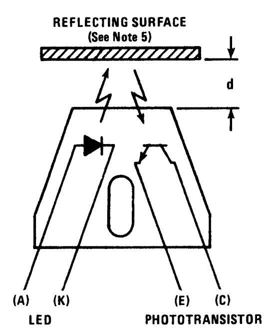
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



Test Condition



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

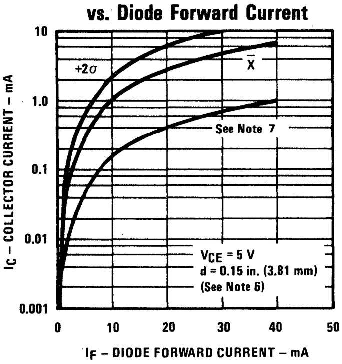
Types OPB709

Electrical Characcteristics (T_A = 25°C unless otherwise noted)

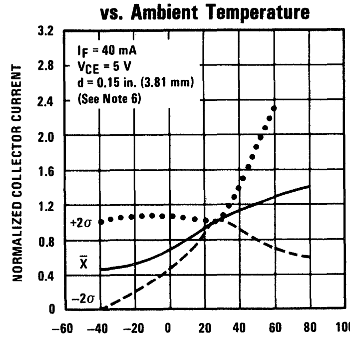
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 40 mA
I_R	Reverse Current		100	µA	V_R = 2.0 V
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0		V	I_C = 100 µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100 µA
I_{CEO}	Collector Dark Current		250	nA	V_{CE} = 10.0 V, I_F = 0, E_e = 0
Combined					
$I_{C(ON)}$	On-State Collector Current	1.00		mA	V_{CE} = 5.0 V, I_F = 40 mA, d = 0.150" (3.81 mm)(5)(6)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		1.10	V	I_F = 40 mA, I_C = 300 µA, d = 0.150" (3.81 mm)(5)(6)

Typical Performance Curves

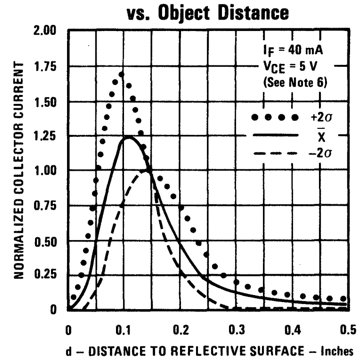
Collector Current vs. Diode Forward Current



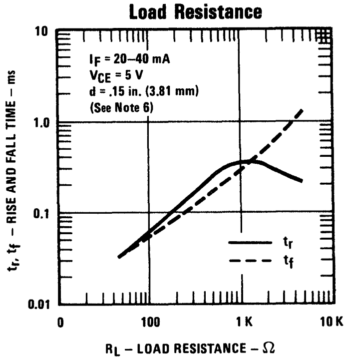
Normalized Collector Current vs. Ambient Temperature



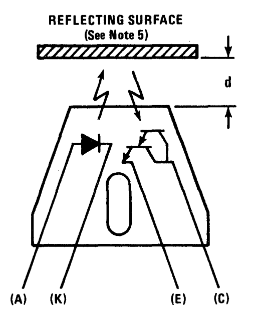
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

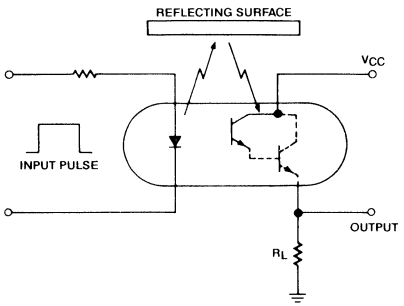


Test Condition

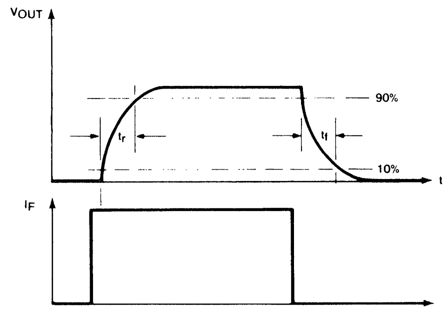


Types OPB708, OPB709

Response Time Test Circuit

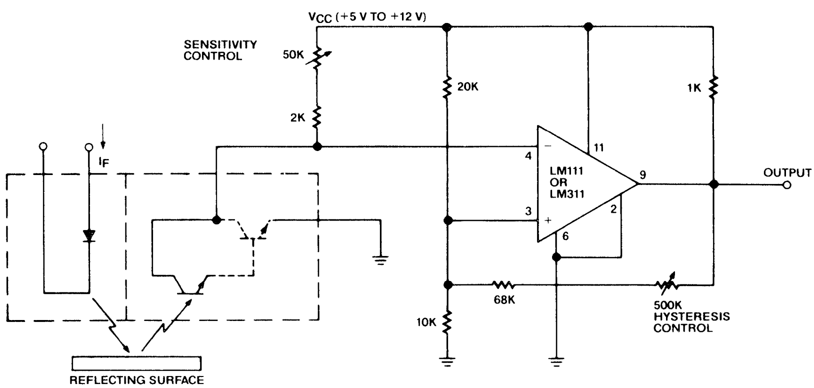


Switching Time Waveforms



Typical Interfacing Circuit

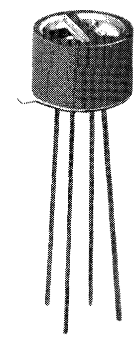
Recommended for applications requiring adjustments on both sensitivity and hysteresis.

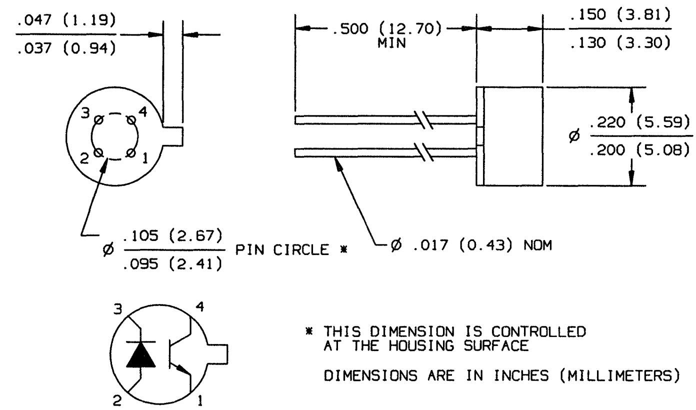


Optek assumes no responsibility for use of any circuits shown and makes no representation that they are free from patent infringement.

OPTEK

Reflective Object Sensors
Types OPB710, OPB710F





Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Mounted on standard TO-72 header
- Available in clear encapsulating epoxy (OPB710) or filtered (OPB710F) to reduce the effect of visible or fluorescent light.

Description

The OPB710 and OPB710F each consist of a gallium arsenide infrared emitting diode and an NPN silicon phototransistor.The emitting diode and detector are mounted side by side on parallel axes on a standard TO-72 header. A black plastic sleeve is attached and filled with encapsulating epoxy to cover the emitter and detector. The "F" version has a filtering material added to the epoxy to reduce the effect of ambient light. The package contains an internal barrier which prevents diode emissions from reaching the sensor directly.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature . . . . -20°C to +85°C
Operating Temperature Range . . . . 0°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 75mW(2)

Output Photosensor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation . . . . 150mW(3)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67 mW/°C above 25°C.
(3) Derate Linearly 3.33 mW/°C above 25°C.
(4) Measured using an Eastman Kodak neutral white test card having 90% diffuse reflectance located 0.250 inch (6.35mm) from the face of the OPB710.
(5) Crosstalk (I_{CX}) is the collector current measured with the indicated current on the input diode and with no reflecting surface. Ambient light is excluded with a black box.

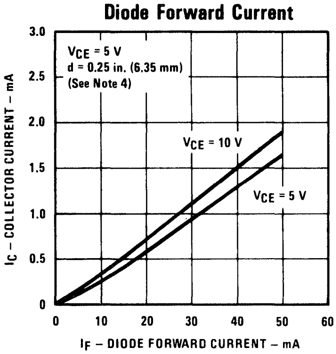
Types OPB710, OPB710F

Electrical Characteristics (T_A = 25°C unless otherwise noted)

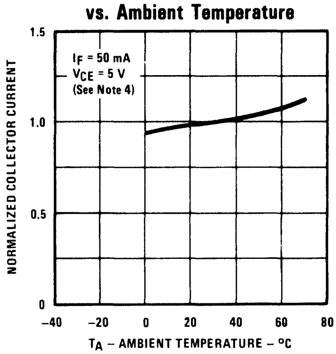
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.50	V	I_F = 50mA
I_R	Reverse Current			100	μA	V_R = 3.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	I_C = 1.00mA,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100μA,
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 5.0V, I_F = 0, $E_e \leq 0.1 \mu W/cm^2$
Combined						
$I_{C(ON)}$	On-State Collector Current	150			μA	V_{CE} = 5.0V, I_F = 50mA, d = 0.250 in. (6.35mm)(4)
I_{CX}	Crosstalk			100	nA	V_{CE} = 5.0V, I_F = 50mA, No Reflecting Surface(5)

Typical Performance Curves

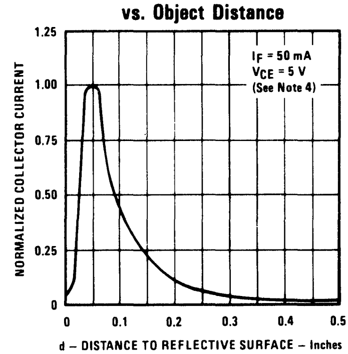
Collector Current vs. Diode Forward Current



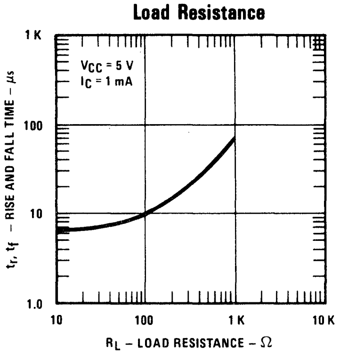
Normalized Collector Current vs. Ambient Temperature



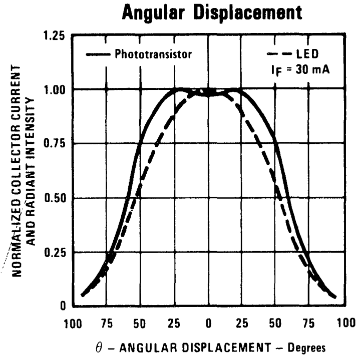
Normalized Collector Current vs. Object Distance



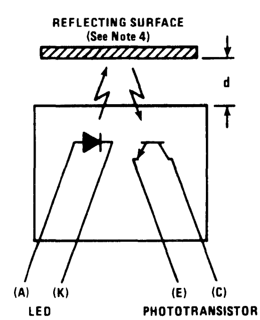
Rise and Fall Time vs. Load Resistance



LED and Phototransistor Angular Displacement



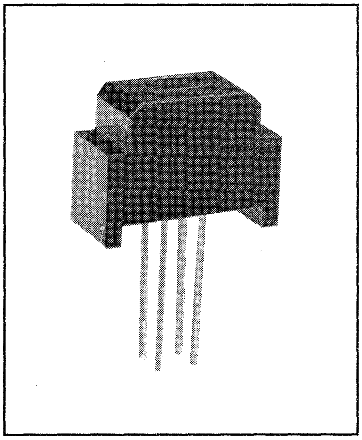
Test Condition

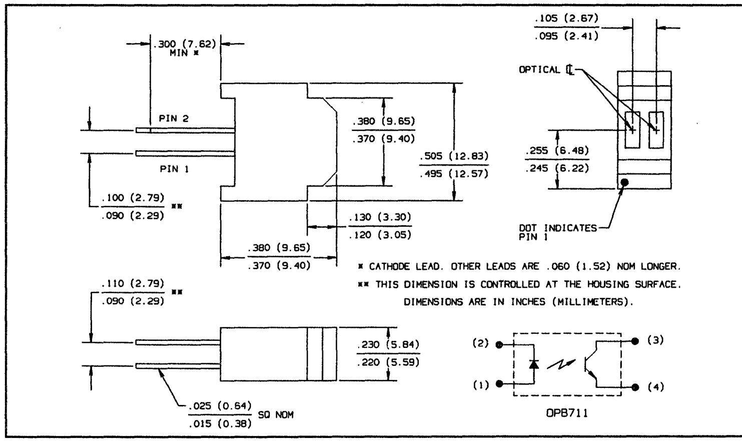


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB711
May 1993

Reflective Object Sensor
Type OPB711





Features

- Phototransistor output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

Description

The OPB711 consists of an infrared emitting diode and an NPN silicon phototransistor mounted "side-by-side" on parallel axes in a infrared transmissive plastic housing. Both the emitting diode and photosensor are molded out of black infrared transmissive plastic to reduce ambient light noise. The photosensor responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 80mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 25mA
Power Dissipation . . . . 80mW(2)

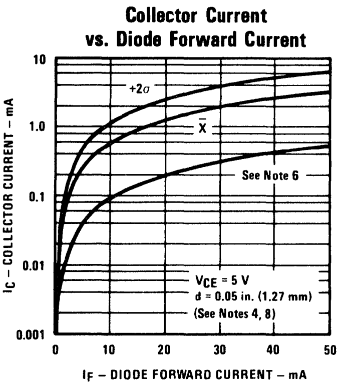
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) d is the distance from the assembly head to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) Performance curves are those of the OPB706. These curves represent the response of the OPB711 at the same conditions.
(8) All parameters tested using pulse technique.

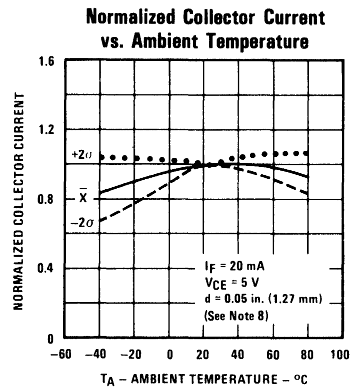
Type OPB711

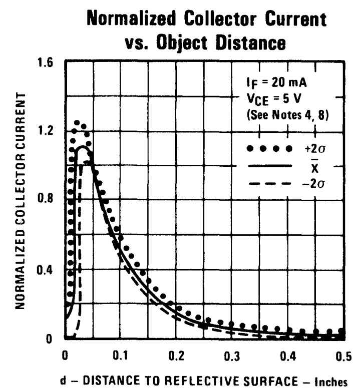
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

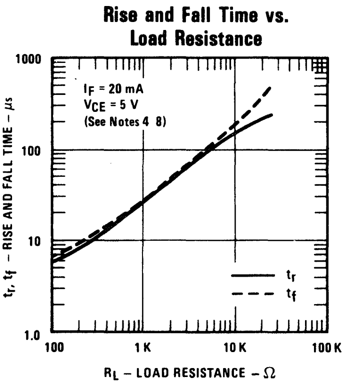
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 100\mu A$,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$,
I_{CEO}	Collector Dark Current		100	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e \leq 0.1\mu W/cm^2$
Combined					
$I_{C(ON)}$	On-State Collector Current	350		μA	$V_{CE} = 5.0V$, $I_F = 20mA$, d = 0.080 in. (2.03mm)(3)(4)
I_{CX}	Crosstalk		100	nA	$V_{CE} = 5.0V$, $I_F = 20mA$, No Reflecting Surface(5)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	$I_F = 20mA$, $I_C = 50\mu A$, d = 0.080 in. (2.03mm)(3)(4)

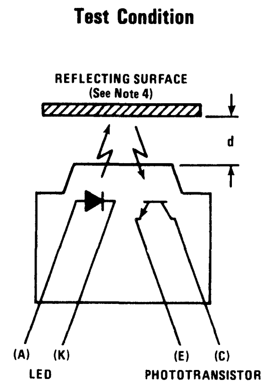
Typical Performance Curves











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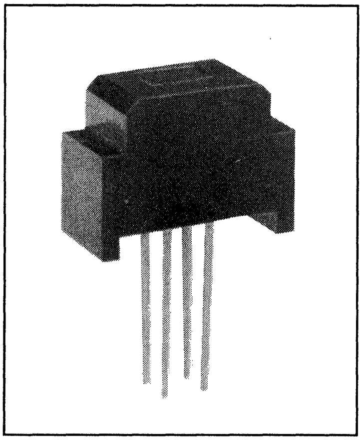
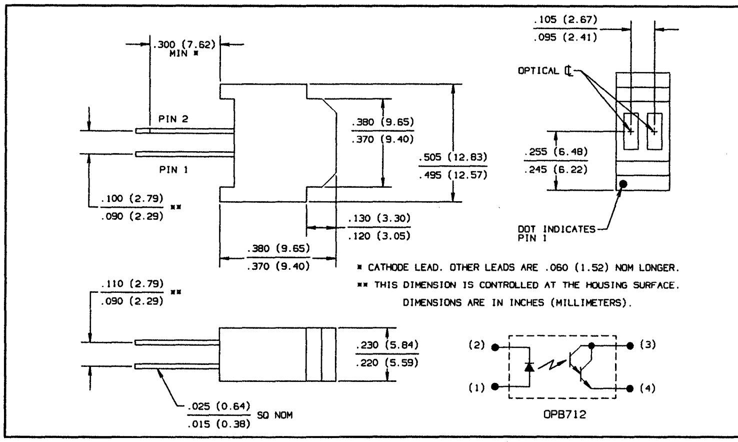
Reflective Object Sensor
Type OPB712





Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Low cost plastic housing

Description

The OPB712 consists of an infrared emitting diode and an NPN silicon photodarlington mounted "side-by-side" on parallel axes in a infrared transmissive plastic housing. Both the emitting diode and photodarlington are molded out of black infrared transmissive plastic to reduce ambient light noise. The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature	-40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	240°C(1)
Input Diode	
Forward DC Current	50mA
Peak Forward Current (1 µs pulse width, 300 pps)	3.0A
Reverse DC Voltage	2.0V
Power Dissipation	80mW(2)
Output Photodarlington	
Collector-Emitter Voltage	15.0
Emitter-Collector Voltage	5.0V
Collector DC Current	125mA
Power Dissipation	125mW(7)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.33mW/°C above 25°C.
(3) d is the distance from the assembly head to the reflective surface.
(4) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(6) Lower curve is based on a calculated worst case condition rather than the conventional -2σ limit.
(7) Derate linearly 2.08mW/°C above 25°C.
(8) Performance curves are those of the OPB707. These curves represent the response of the OPB712 at the same conditions.
(9) All parameters tested using pulse technique.

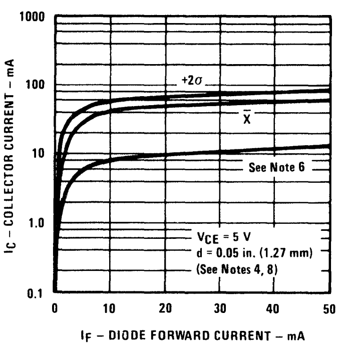
Type OPB712

Electrical Characteristics ($T_A = 25°C$ unless otherwise noted)

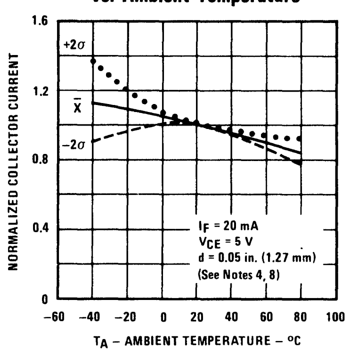
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20mA$
I_R	Reverse Current		100	µA	$V_R = 2.0V$
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15		V	$I_C = 100µA$,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100µA$,
I_{CEO}	Collector Dark Current		250	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e \leq 0.1µW/cm^2$
Combined					
$I_{C(ON)}$	On-State Collector Current	20		mA	$V_{CE} = 5.0V$, $I_F = 20mA$, d = 0.080 in. (2.03mm)(3)(4)
I_{CX}	Crosstalk		25	µA	$V_{CE} = 5.0V$, $I_F = 20mA$, No Reflecting Surface(5)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		1.10	V	$I_F = 20mA$, $I_C = 5.0mA$, d = 0.080 in. (2.03mm)(3)(4)

Typical Performance Curves

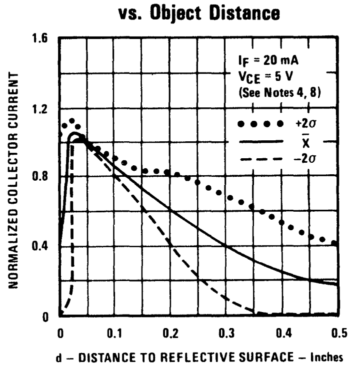
Collector Current vs. Diode Forward Current



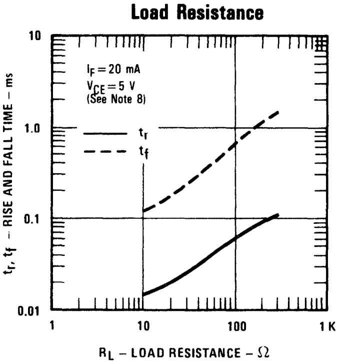
Normalized Collector Current vs. Ambient Temperature



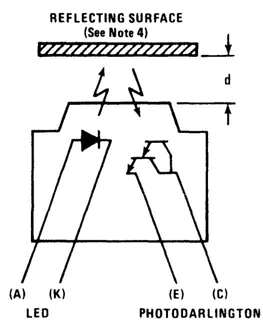
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



Test Condition

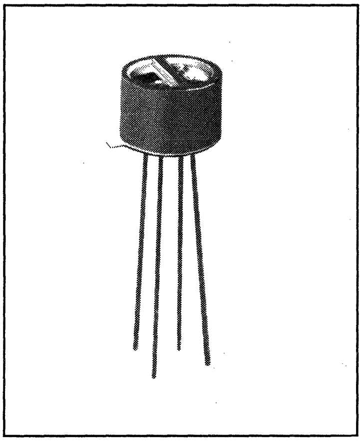


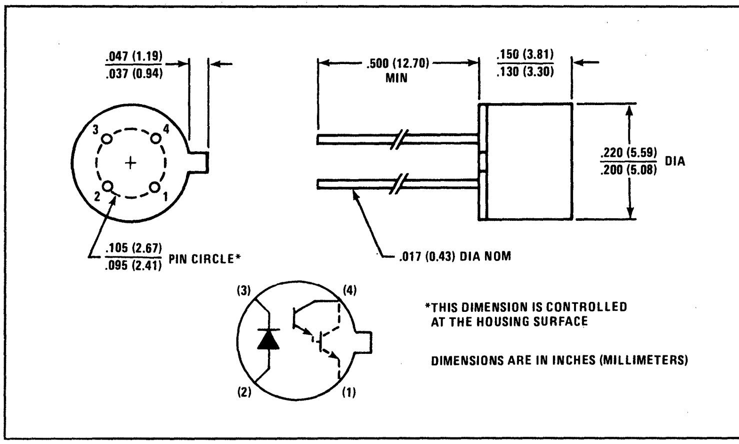
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB730
May 1993

OPTEK

Reflective Object Sensors
Types OPB730, OPB730F





Features

- Photodarlington output
- Unfocused for sensing diffuse surface
- Mounted on standard TO-72 header
- Available in clear encapsulating epoxy (OPB730) or filtered (OPB730F) to reduce the effect of visible or fluorescent light.

Description

The OPB730 and OPB730F each consist of a gallium arsenide infrared emitting diode and an NPN silicon photodarlington. The emitting diode and detector are mounted side by side on parallel axes on a standard TO-72 header. A black plastic sleeve is attached and filled with encapsulating epoxy to cover the emitter and detector. The "F" version has a filtering material added to the epoxy to reduce the effect of ambient light. An internal barrier prevents light from reaching the detector directly.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature	-20°C to +85°C
Operating Temperature Range	0°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	240°C(1)
Input Diode	
Forward DC Current	50mA
Peak Forward Current (1 µs pulse width, 300pps)	3.0A
Reverse DC Voltage	3.0V
Power Dissipation	75mW(2)
Output Photosensor	
Collector-Emitter Voltage	15V
Emitter-Collector Voltage	5.0V
Collector DC Current	25mA
Power Dissipation	150mW(3)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67 mW/°C above 25°C.
(3) Derate Linearly 3.33 mW/°C above 25°C.
(4) Measured using an Eastman Kodak neutral white test card having 90% diffuse reflectance located 0.250 inch (6.35mm) from the face of the OPB730.
(5) Crosstalk (I_{CX}) is the collector current measured with the indicated current on the input diode and with no reflecting surface. Ambient light is excluded with a black box.

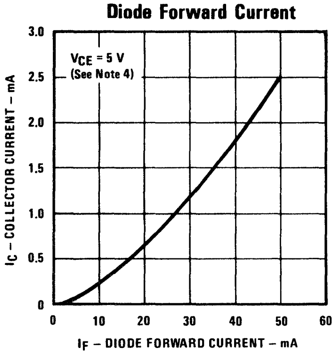
Types OPB730, OPB730F

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

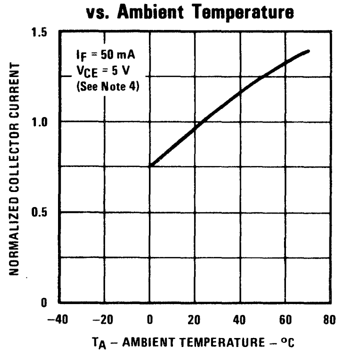
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.50	V	$I_F = 50mA$
I_R	Reverse Current			100	μA	$V_R = 3.0V$
Output Photodarlington						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15			V	$I_C = 1.00mA$,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	$I_E = 100\mu A$,
I_{CEO}	Collector Dark Current			250	nA	$V_{CE} = 5.0V$, $I_F = 0$, $E_e \leq 0.1\mu W/cm^2$
Combined						
$I_{C(ON)}$	On-State Collector Current	1.0			mA	$V_{CE} = 5.0V$, $I_F = 50mA$, d = 0.250 in. (6.35mm)(4)
I_{CX}	Crosstalk			500	nA	$V_{CE} = 5.0V$, $I_F = 50mA$, No Reflecting Surface(5)

Typical Performance Curves

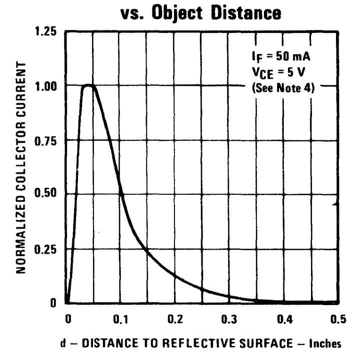
Collector Current vs. Diode Forward Current



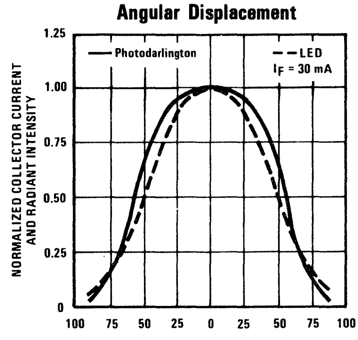
Normalized Collector Current vs. Ambient Temperature



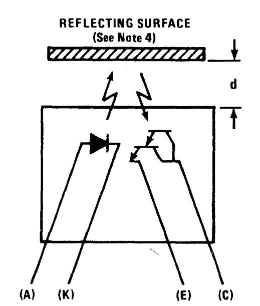
Normalized Collector Current vs. Object Distance



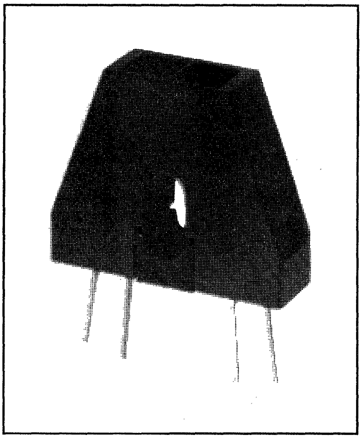
LED and Photodarlington Angular Displacement

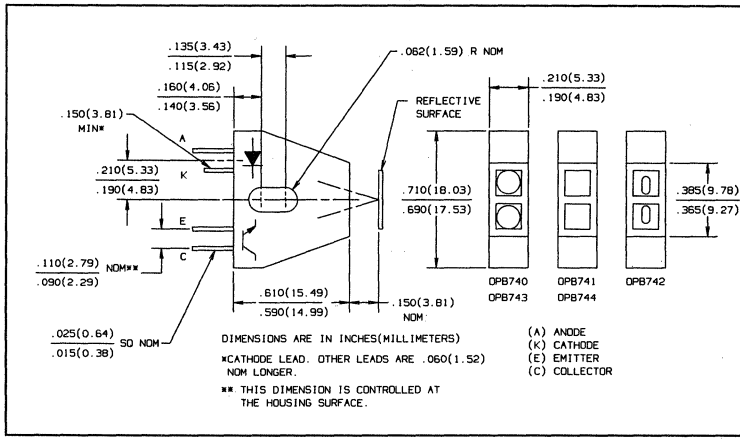


Test Condition



Reflective Object Sensors
Types OPB740, OPB741, OPB742, OPB743, OPB744





Features

- Focused for maximum sensitivity
- Phototransistor output
- PC board mounting

Description

The OPB740 through OPB744 reflective object sensors each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side by side on converging optical axes in a black plastic housing. Various options include choice of no windows, blue polysulfone windows for dust protection or opaque windows with offset openings for improved resolution. Available with wires as OPB740W/OPB744W series.

The phototransistor responds to radiation from the emitter only when a reflective object passes within its field of view.

Replaces

OPB740 = K8700
OPB741 = K8701
OPB742 = K8708
OPB743 = K8710
OPB744 = K8711

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 40mA
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

DESCRIPTION

OPB740	No windows
OPB741	Blue windows
OPB742	Offset windows
OPB743	No windows
OPB744	Blue windows

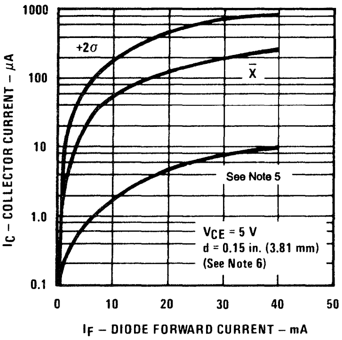
Types OPB740, OPB741, OPB742, OPB743, OPB744

Electrical Characteristics (T_A = 25°C unless otherwise noted)

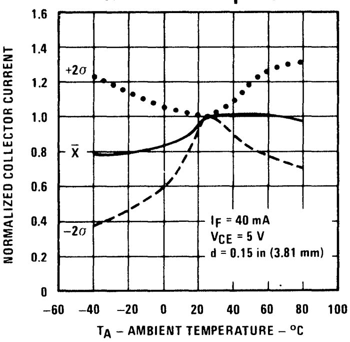
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 40mA
I_R	Reverse Current			100	μA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 100μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100μA
I_{CEO}	Collector Dark Current			100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled						
$I_{C(ON)}$(3)(4)	On-State Collector Current	OPB740/OPB741	50		μA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
		OPB742	10		μA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
		OPB743/OPB744	200		μA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
I_{CX}(6)	Crosstalk	OPB740/OPB741		10	μA	V_{CC} = 5V, I_F = 40mA
		OPB742		100	nA	V_{CC} = 5V, I_F = 40mA
		OPB743/OPB744		20	μA	V_{CC} = 5V, I_F = 40mA

Typical Performance Curves

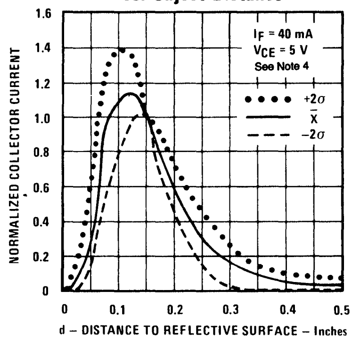
Collector Current vs. Diode Forward Current



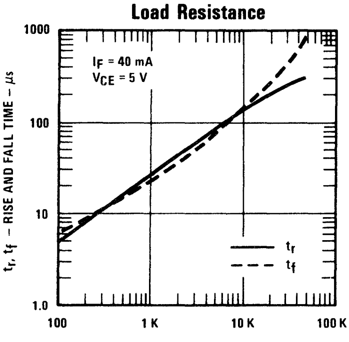
Normalized Collector Current vs. Ambient Temperature



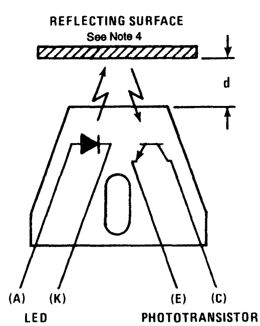
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

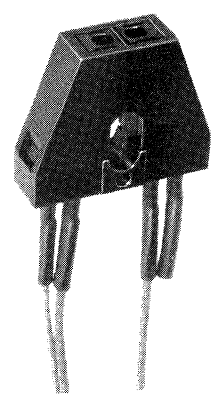


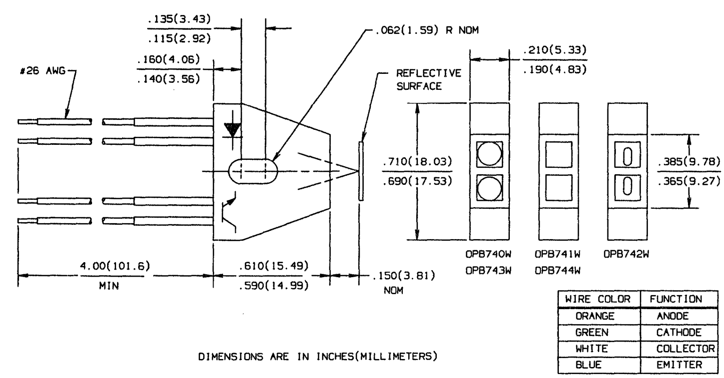
Test Condition



OPTEK

Reflective Object Sensors
Types OPB740W, OPB741W, OPB742W, OPB743W, OPB744W





WIRE COLOR	FUNCTION
ORANGE	ANODE
GREEN	CATHODE
WHITE	COLLECTOR
BLUE	EMITTER

Features

- Focused for maximum sensitivity
- Phototransistor output
- Low cost plastic housing
- 4.0" min 26 AWG wire leads

Description

The OPB740W through OPB744W reflective object sensors each consist of an infrared emitting diode and an NPN silicon phototransistor mounted side by side on converging optical axes in a black plastic housing. Various options include choice of no windows, blue polysulfone windows for dust protection or opaque windows with offset openings for improved resolution. Available with PC board mounting as OPB740/OPB744 series.

The photosensor responds to radiation from the emitter only when a reflective object passes within its field of view.

Replaces

OPB740W = K8702
OPB741W = K8703
OPB743W = K8712
OPB744W = K8713

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 40mA
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Photosensor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.82mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

DESCRIPTION

OPB740W	No windows
OPB741W	Blue windows
OPB742W	Offset windows
OPB743W	No windows
OPB744 W	Blue windows

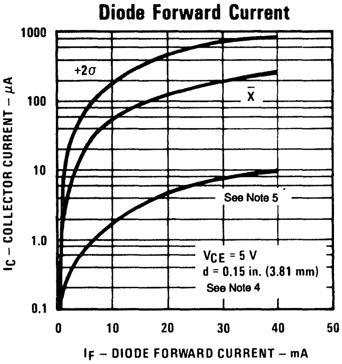
Types OPB740W, OPB741W, OPB742W, OPB743W, OPB744W

Electrical Characteristics (T_A = 25°C unless otherwise noted)

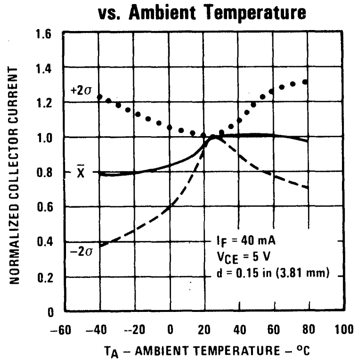
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 40mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100µA
I_{CEO}	Collector Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$I_{C(ON)}$ (3)(4)	On-State Collector Current OPB740W/OPB741W	50		µA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
	OPB742W	10		µA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
	OPB743W/OPB744W	200		µA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
I_{CX} (6)	Crosstalk OPB740W/OPB741W		10	µA	V_{CC} = 5V, I_F = 40mA
	OPB742W		100	nA	V_{CC} = 5V, I_F = 40mA
	OPB743W/OPB744W		20	µA	V_{CC} = 5V, I_F = 40mA

Typical Performance Curves

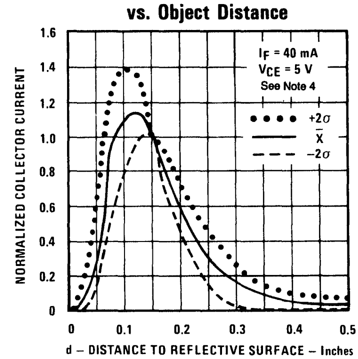
Collector Current vs. Diode Forward Current



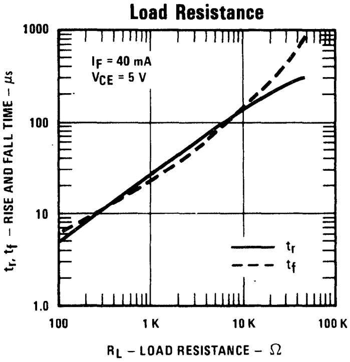
Normalized Collector Current vs. Ambient Temperature



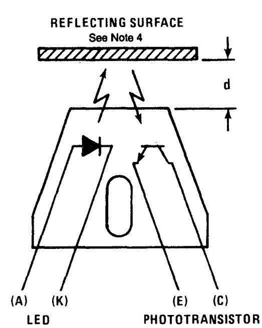
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



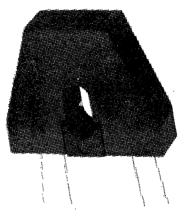
Test Condition

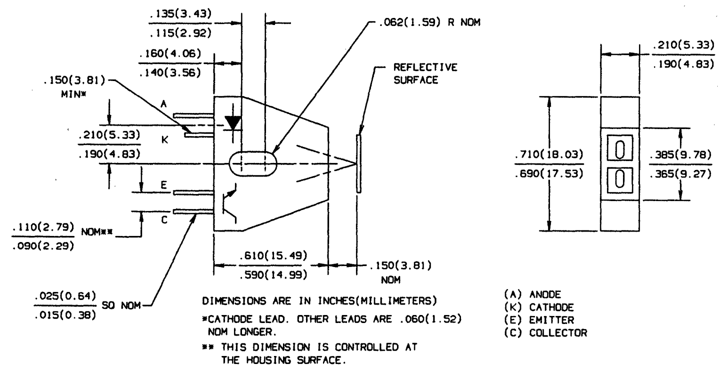


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Reflective Object Sensor
Type OPB745





Features

- Focused for maximum sensitivity
- Photodarlington output
- Crosstalk does not exceed specified I_{CEO}
- PC board mounting

Description

The OPB745 reflective object sensor consists of an infrared emitting diode and an NPN silicon photodarlington mounted side by side on converging optical axes in a black plastic housing.

The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Replaces

K8709

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 40mA
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Photodarlington

Collector-Emitter Voltage 15.0V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

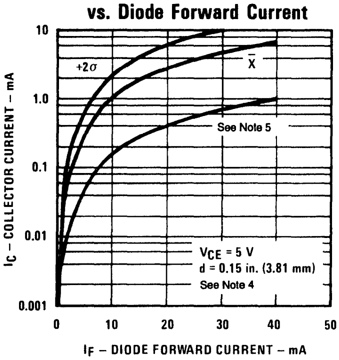
Type OPB745

Electrical Characteristics (T_A = 25°C unless otherwise noted)

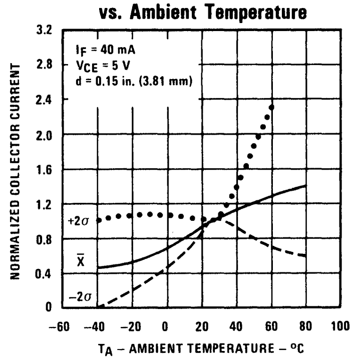
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 40mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15		V	I_C = 100µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100µA
I_{CEO}	Collector Dark Current		250	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$I_{C(ON)}$ (3)(4)	On-State Collector Current	1.00		mA	V_{CE} = 5V, I_F = 40mA, d = 0.15"
I_{CX} (2)	Crosstalk		250	nA	V_{CC} = 5V, I_F = 40mA

Typical Performance Curves

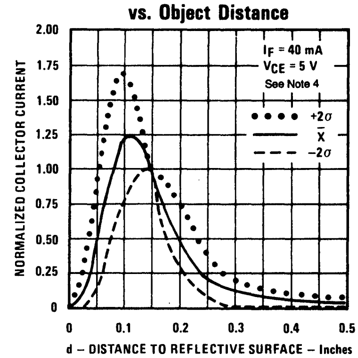
Collector Current vs. Diode Forward Current



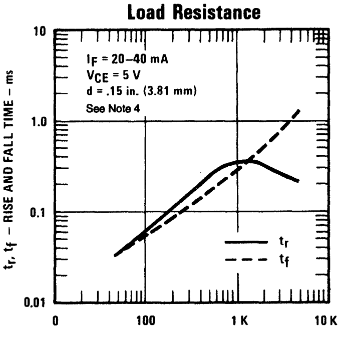
Normalized Collector Current vs. Ambient Temperature



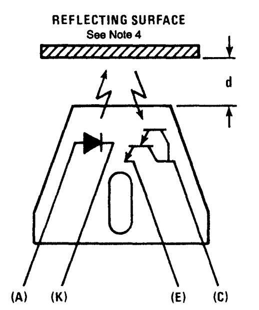
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance



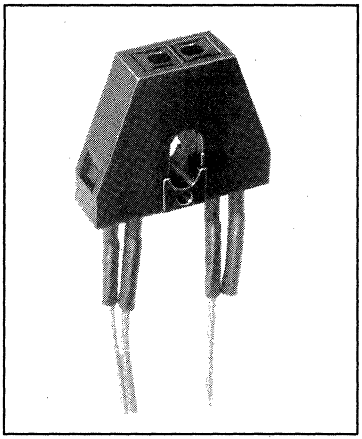
Test Condition

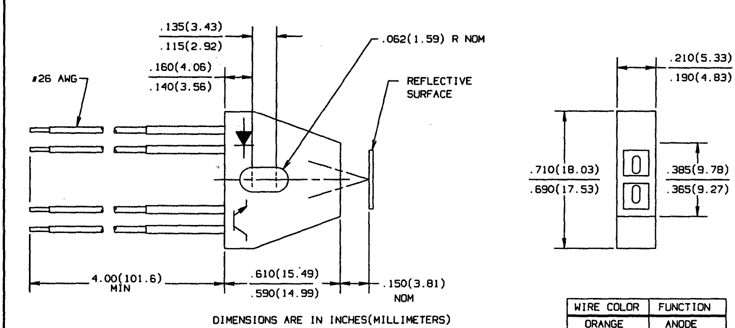


Product Bulletin OPB745W
May 1993

OPTEK

Reflective Object Sensor
Type OPB745W





WIRE COLOR	FUNCTION
ORANGE	ANODE
GREEN	CATHODE
WHITE	COLLECTOR
BLUE	EMITTER

Features

- Focused for maximum sensitivity
- Photodarlington output
- Crosstalk does not exceed specified I_{CEO}
- 4.0" min 26 AWG wire leads

Description

The OPB745W reflective object sensor consists of an infrared emitting diode and an NPN silicon photodarlington mounted side by side on converging optical axes in a black plastic housing. Available with PC board leads as OPB745.

The photodarlington responds to radiation from the emitter only when a reflective object passes within its field of view.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Continuous Forward Current 40mA
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Photodarlington

Collector-Emitter Voltage 15.0V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.82mW/°C above 25°C.
(3) d is distance from the assembly face to the reflective surface.
(4) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface.
(5) Lower curve is based on calculated worst case condition rather than the conventional -2σ limit.
(6) Crosstalk is the photocurrent measured with current to the input diode & no reflecting surface.
(7) All parameters tested using pulse technique.

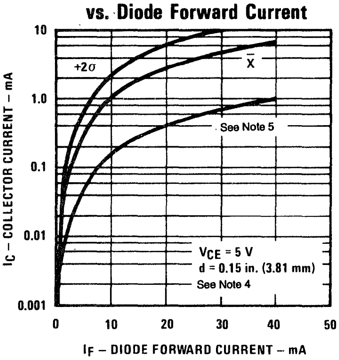
Type OPB745W

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

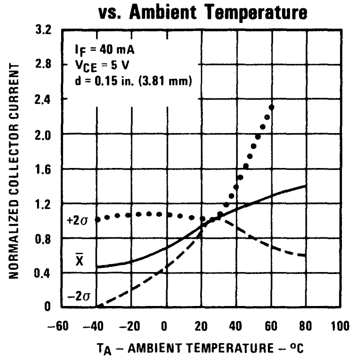
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 40mA$
I_R	Reverse Current		100	µA	$V_R = 2.0V$
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0		V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector Dark Current		250	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e = 0$
Coupled					
$I_{C(ON)}$ (3)(4)	On-State Collector Current	1.00		mA	$V_{CE} = 5V$, $I_F = 40mA$, d = 0.15"
I_{CX} (6)	Crosstalk		250	nA	$V_{CC} = 5V$, $I_F = 40mA$

Typical Performance Curves

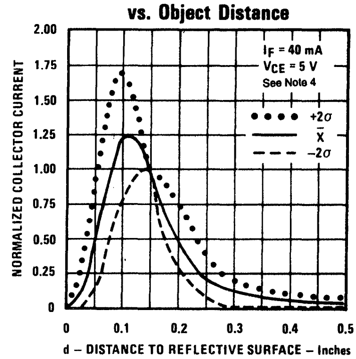
Collector Current vs. Diode Forward Current



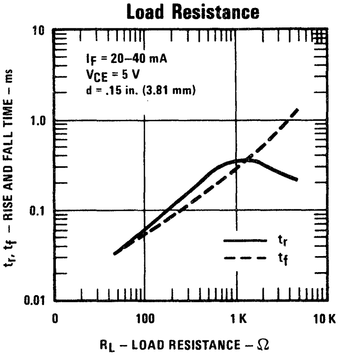
Normalized Collector Current vs. Ambient Temperature



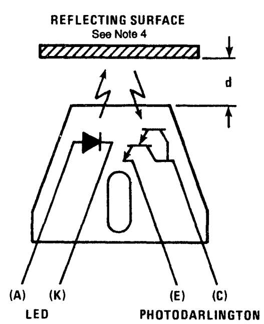
Normalized Collector Current vs. Object Distance



Rise and Fall Time vs. Load Resistance

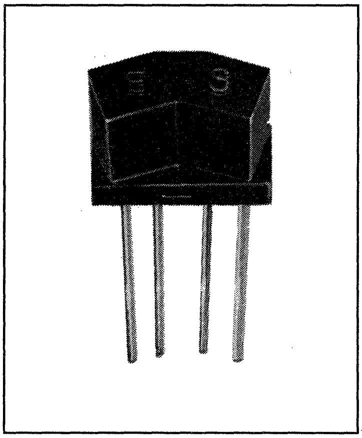


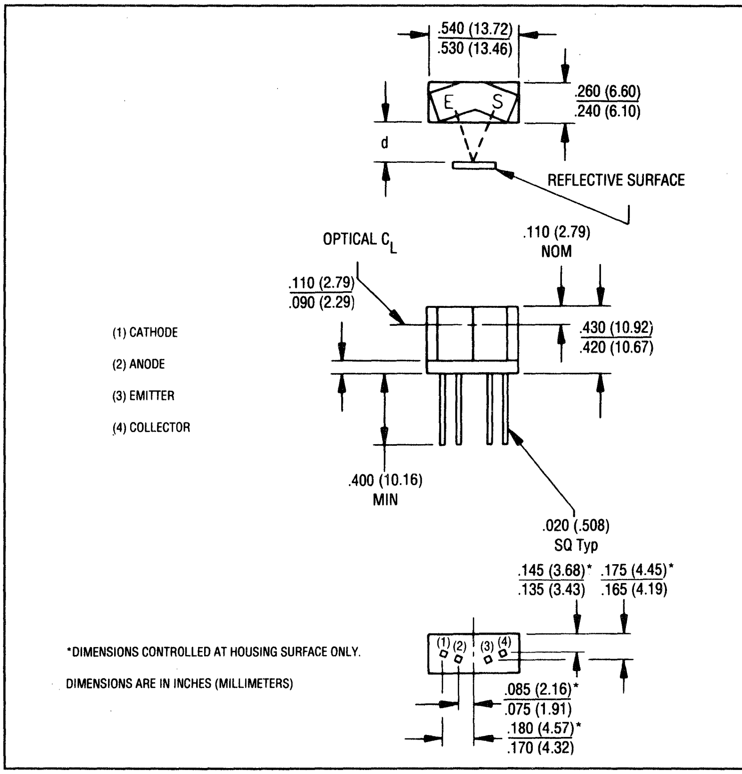
Test Condition



OPTEK

Reflective Object Sensor
Type OPB750N





Features

- High contrast ratio 1000 to 1 minimum
- Printed circuit board mount
- Low cost plastic housing

Description

The OPB750N reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available with two mounting tabs as OPB750T.

Available with 12", 26 AWG wire leads as OPB755 series. Photologic™ output sensors available in OPB760/OPB770 series.

Replaces

KR105

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation 100mW

Output Phototransistor

Collector-Emitter Voltage 30V
Collector DC Current 30mA
Power Dissipation 100mW

Notes:
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(5) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface.
(6) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

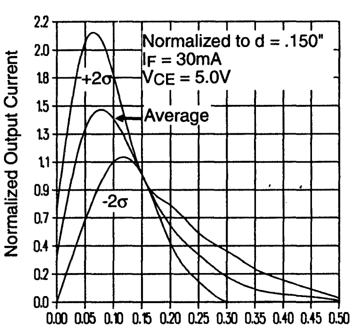
Type OPB750N

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.8	V	I_F = 40mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, H = 0
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.40	V	I_C=150μA, I_F= 30mA, d=0.22"
$I_{C(ON)}$	On-State Collector Current	500 375 250		μA μA μA	V_{CE}=5.0V, I_F=30mA, d=0.08"(5) V_{CE}=5.0V, I_F=30mA, d=0.15"(5) V_{CE}=5.0V, I_F=30mA, d=0.22"(5)
$I_{C(OFF)}$	Off-State Collector Current		250	nA	I_F = 30mA, V_{CE} = 5.0V,(6) d = 0.08", 0.15", 0.22"

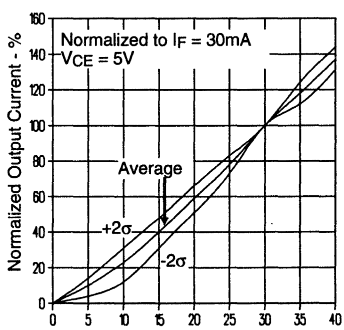
Typical Performance Curves

Normalized Collector Current vs. Object Distance



Distance to Reflective Surface - Inches

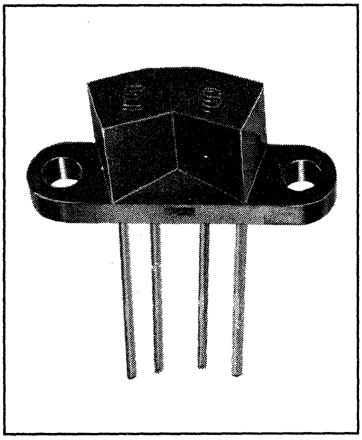
Normalized Ouput Current vs. Forward Current

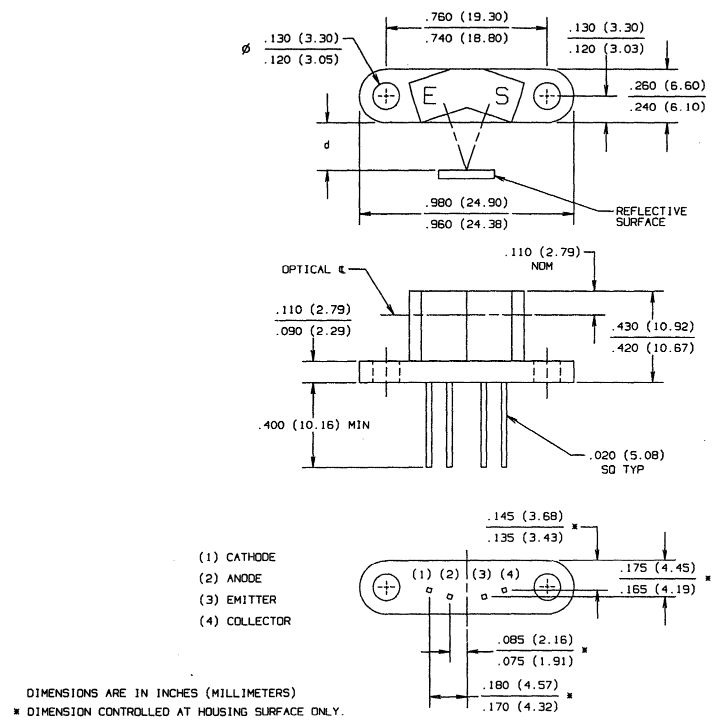


Forward Current - mA

OPTEK

Reflective Object Sensor
Type OPB750T





Features

- High contrast ratio, 1000 to 1 minimum
- Printed circuit board mount
- Low cost plastic housing

Description

The OPB750T reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available without mounting tabs as OPB750N.

Available with 12", 26 AWG wire leads as OPB750/OPB755 series. Photologic™ output sensors available in OPB760/OPB770 series.

Replaces

KR100

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C$^{(2)}$

Input Diode

Forward DC Current 50mA
Peak Forward Current (1µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW$^{(1)}$

Output Phototransistor

Collector-Emitter Voltage 30V
Collector DC Current 30mA
Power Dissipation . . . . 100mW$^{(1)}$

Notes:
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(5) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface .
(6) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

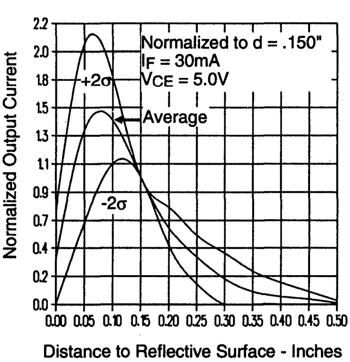
Type OPB750T

Electrical Characteristics (T_A = 25°C unless otherwise noted)

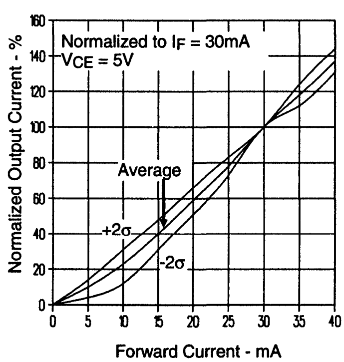
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.8	V	I_F = 40mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, H = 0
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.40	V	I_C=150µA, I_F= 30mA, d=0.22"
$I_{C(ON)}$	On-State Collector Current	500 375 250		µA µA µA	V_{CE}=5.0V, I_F=30mA, d=0.08"(5) V_{CE}=5.0V, I_F=30mA, d=0.15"(5) V_{CE}=5.0V, I_F=30mA, d=0.22"(5)
$I_{C(OFF)}$	Off-State Collector Current		250	nA	I_F = 30mA, V_{CC} = 5.0V, (6) d = 0.08", 0.15", 0.22"

Typical Performance Curves

Normalized Collector Current vs. Object Distance



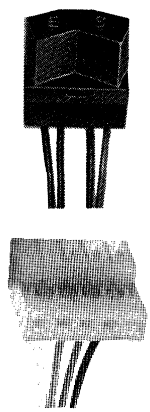
Normalized Ouput Current vs. Forward Current

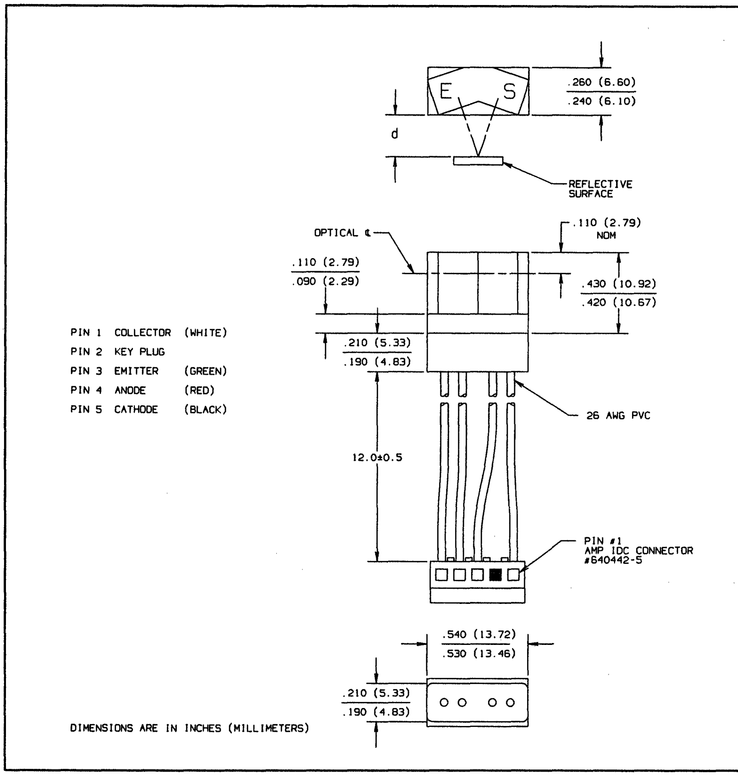


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Reflective Object Sensor
Type OPB755N





Features

- High contrast ratio 1000 to 1 minimum
- 12.0" ± 0.5" min. UL#1429 26 AWG wire leads terminated into an AMP #640442-5 connector
- Low cost plastic housing

Description

The OPB755N reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available with two mounting tabs as OPB755T.

Available with PC Board mountable leads as OPB750 series. Photologic™ output sensors available in OPB760/OPB770 series.

Replaces

KR105W

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation 100mW

Output Phototransistor

Collector-Emitter Voltage 30V
Collector DC Current 30mA
Power Dissipation 100mW

Notes:
(1) Derate Linearly 1.82mW/°C above 25°C.
(2) All parameters tested using pulse technique.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface.
(5) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

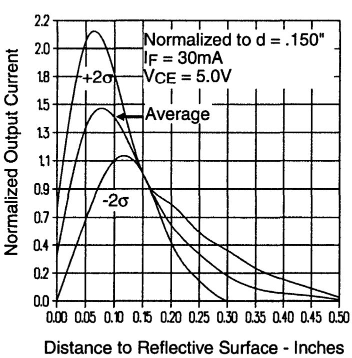
Type OPB755N

Electrical Characteristics (T_A = 25°C unless otherwise noted)

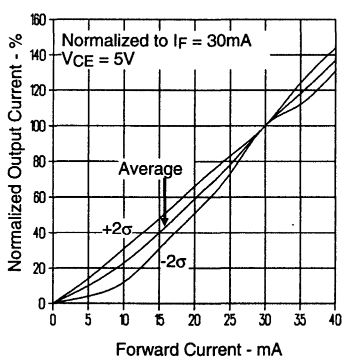
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.8	V	I_F = 40mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, H = 0
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.40	V	I_C=150µA, I_F= 30mA, d=0.22"
$I_{C(ON)}$	On-State Collector Current	500 375 250		µA µA µA	V_{CE}=5.0V, I_F=30mA, d=0.08"(4) V_{CE}=5.0V, I_F=30mA, d=0.15"(4) V_{CE}=5.0V, I_F=30mA, d=0.22"(4)
$I_{C(OFF)}$	Off-State Collector Current		250	nA	I_F = 30mA, V_{CE} = 5.0V, (5) d = 0.08", 0.15", 0.22"

Typical Performance Curves

Normalized Collector Current vs. Object Distance



Normalized Ouput Current vs. Forward Current



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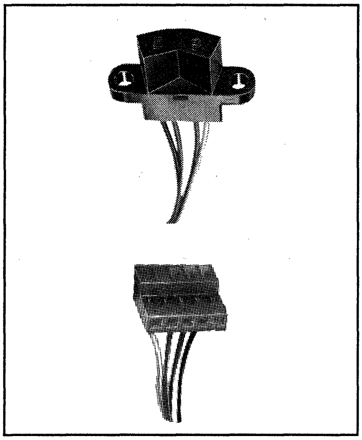
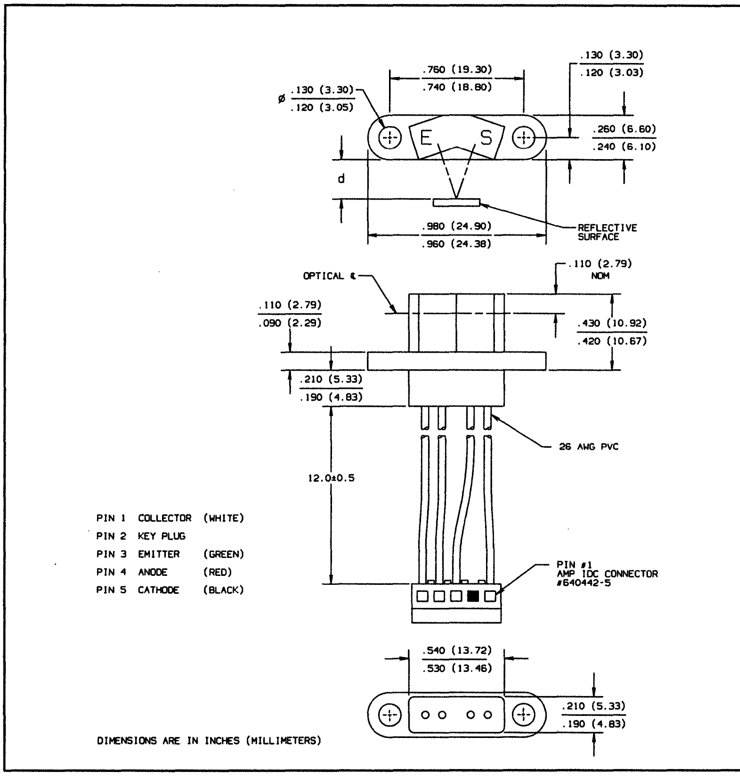
OPTEK

Reflective Object Sensor
Type OPB755T





Features

- High contrast ratio, 1000 to 1 minimum
- 12.0" ± .05" min. UL#1429 26 AWG wire leads terminated into an AMP #640442-5 connector
- Low cost plastic housing

Description

The OPB755T reflective assemby features a phototransistor output designed to decrease low-level light gain while not affecting the high-level light gain. Available without mounting tabs as OPB755N.

Available with PC Board mountable leads as OPB750 series. Logic output sensors available in the OPB760/OPB770 series.

Replaces

KR100W

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:
(1) Derate Linearly 1.82mW/°C above 25°C.
(2) All parameters tested using pulse technique.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) Photocurrent is measured using an Eastman Kodak Neutral White test card having a 90% diffuse reflectance as a reflecting surface.
(5) $I_{C(OFF)}$ is the photocurrent measured with current to the input diode and a 5% reflecting surface.

Type OPB755T

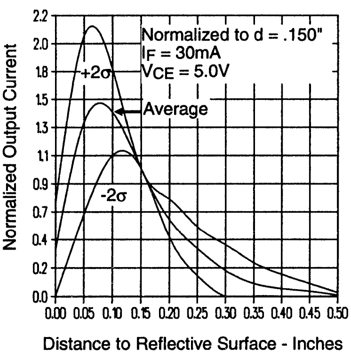
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.8	V	I_F = 40mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, H = 0
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.40	V	I_C=150µA, I_F= 30mA, d=0.22"
$I_{C(ON)}$	On-State Collector Current	500 375 250		µA µA µA	V_{CE}=5.0V, I_F=30mA, d=0.08"(4) V_{CE}=5.0V, I_F=30mA, d=0.15"(4) V_{CE}=5.0V, I_F=30mA, d=0.22"(4)
$I_{C(OFF)}$	Off-State Collector Current		250	nA	I_F = 30mA, V_{CE} = 5.0V, (5) d = 0.08", 0.15", 0.22"

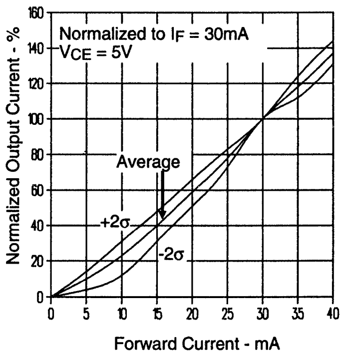
REFLECTIVE OBJECT SENSORS

Typical Performance Curves

Normalized Collector Current vs. Object Distance



Normalized Ouput Current vs. Forward Current



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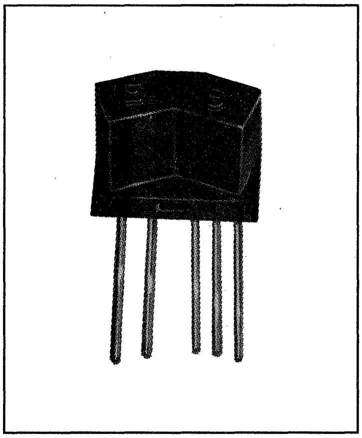
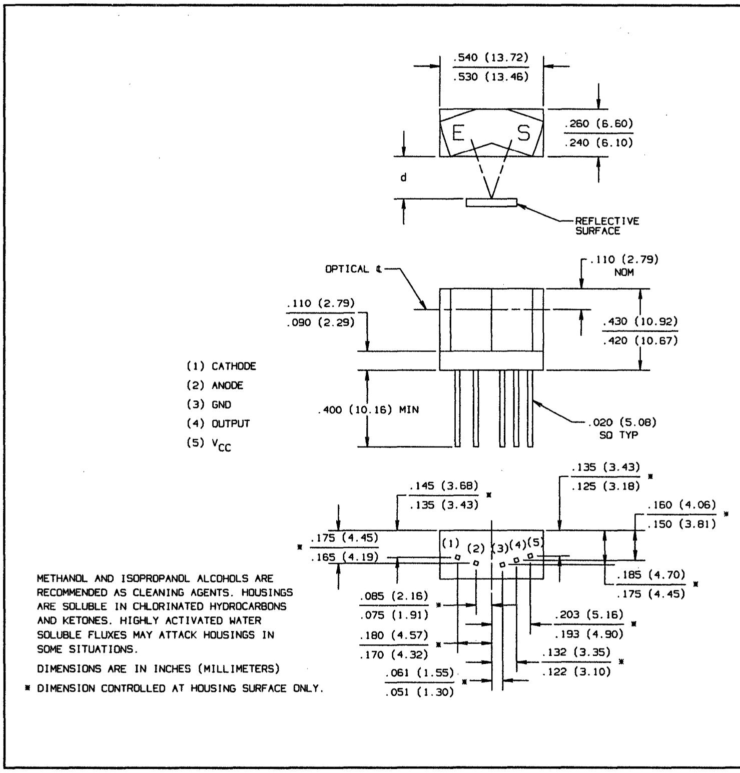
Photologic™ Reflective Object Sensors
Types OPB760N, OPB761N, OPB762N, OPB763N





Features

- Choice of mounting configurations
- Choice of output configurations

Description

The OPB760N series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

Mounting Options

OPB760N series PC board mount, without mounting tabs
OPB760T series PC board mount, with two mounting tabs
OPB770N series wire leads with connector, without mounting tabs
OPB770T series wire leads with connector, with two mounting tabs

Replaces

OPB760N	KLR305
OPB761N	KLR315
OPB762N	KLR325
OPB763N	KLR335

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range . . . . -40°C to +85°C
Operating Temperature Range . . . . -40°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)
Input Diode Power Dissipation . . . . 100mW(2)
Output Photologic™ Power Dissipation . . . . 200mW(3)
Total Device Power Dissipation . . . . 300mW(4)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 3V

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB760N thru OPB763N series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by I_F = 0mA.
(7) Tested at d = 0.080" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(9) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(10) All parameters tested using pulse technique.

Types OPB760N, OPB761N, OPB762N, OPB763N

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.8	V	I_F = 40mA, T_A = 25°C
I_R	Reverse Current			100	µA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(6)(7) Output Open
	Inverted Totem-Pole Output, Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(7) Output Open
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(7) Output Open
	Inverted Totem-Pole Output, Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(6)(7) Output Open
I_{OH}	High Level Output Voltage: Buffered Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 25mA, T_A = 25°C
	Inverted Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			25	mA	V_{CC} = 5.0V, T_A = 25°C(8)
$I_F(+)/I_F(-)$	Hysteresis		1.5			V_{CC} = 5.0V(8)
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 25mA(7) Output = GND
	Inverted Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 0mA(7) Output = GND
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output, Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(6)(7)
	Inverted Totem-Pole Output, Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 25mA(6)(7)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output, Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 30mA(9)
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 25mA(7)
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 0mA(6)(7)
V_{OH}	High Level Output Voltage: Inverted Totem-Pole Output, Inverted Open-Collector Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 30mA(9)

Types OPB760, OPB770 Series

PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Reflective Sensor Family

6 - PC Board Mounting

7 - Wire Leads with
Connector

Electrical Specification Variations

0 - Buffered Totem-Pole Output

1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

3 - Inverted Open-Collector Output

Mounting Configurations

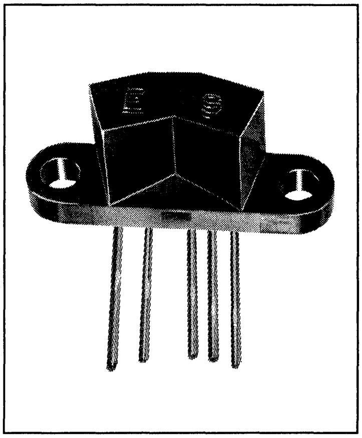
T - Two Mounting Tabs

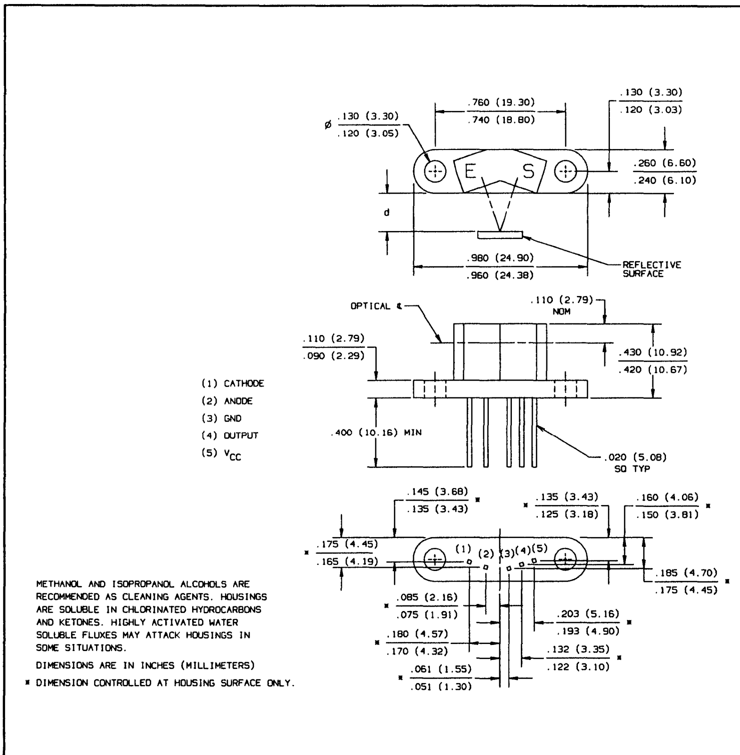
N - No Mounting Tabs

OPTEK

Product Bulletin OPB760T
May 1993

Photologic™ Reflective Object Sensors
Types OPB760T, OPB761T, OPB762T, OPB763T





Features

- Choice of mounting configurations
- Choice of output configurations

Description

The OPB760T series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

Mounting Options

OPB760N series PC board mount, without mounting tabs

OPB760T series PC board mount, with two mounting tabs

OPB770N series wire leads with connector, without mounting tabs

OPB770T series wire leads with connector, with two mounting tabs

Replaces

OPB760T	KLR300
OPB761T	KLR310
OPB762T	KLR320
OPB763T	KLR330

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range . . . . -40°C to +85°C
Operating Temperature Range . . . . -40°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)
Input Diode Power Dissipation . . . . 100mW(2)
Output Photologic™ Power Dissipation . . . . 200mW(3)
Total Device Power Dissipation . . . . 300mW(4)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 3V

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB760T thru OPB763T series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by I_F = 0mA.
(7) Tested at d = 0.080" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(9) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(10) All parameters tested using pulse technique.

Types OPB760T, OPB761T, OPB762T, OPB763T

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.8	V	I_F = 40mA, T_A = 25°C
I_R	Reverse Current			100	µA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(6)(7) Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(7) Output Open
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(7) Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(6)(7) Output Open
I_{OH}	High Level Output Voltage: Buffered Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 25mA, T_A = 25°C
	Inverted Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			25	mA	V_{CC} = 5.0V, T_A = 25°C(8)
$I_F(+)/I_F(-)$	Hysteresis		1.5			V_{CC} = 5.0V(8)
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 25mA(7) Output = GND
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(6)(7)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 25mA(6)(7)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 30mA(9)
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 25mA(7)
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 0mA(6)(7)
V_{OH}	High Level Output Voltage: Inverted Totem-Pole Output Inverted Open-Collector Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 30mA(9)

Types OPB760, OPB770 Series

PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly — OPB

Photologic™ Photo Integrated Circuit Reflective Sensor Family — 7

6 - PC Board Mounting

7 - Wire Leads with Connector

Electrical Specification Variations

0 - Buffered Totem-Pole Output

1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

3 - Inverted Open-Collector Output

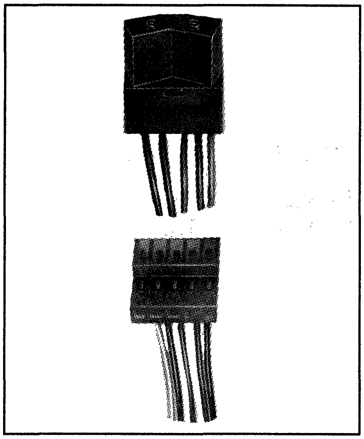
Mounting Configurations

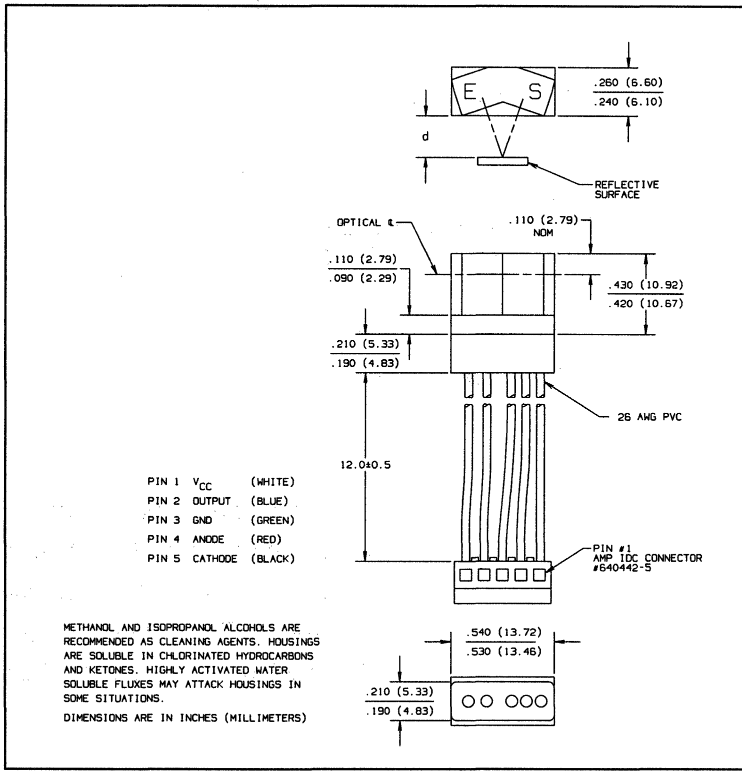
T - Two Mounting Tabs

N - No Mounting Tabs

OPTEK

Photologic™ Reflective Object Sensors
Types OPB770N, OPB771N, OPB772N, OPB773N





Features

- Choice of mounting configurations
- Choice of output configurations

Description

The OPB770N series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

Mounting Options

OPB760N series PC board mount, without mounting tabs
OPB760T series PC board mount, with two mounting tabs
OPB770N series wire leads with connector, without mounting tabs
OPB770T series wire leads with connector, with two mounting tabs

Replaces

OPB770N	KLR305W
OPB771N	KLR315W
OPB772N	KLR325W
OPB773N	KLR335W

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.)	10V
Storage Temperature Range	-40°C to +85°C
Operating Temperature Range	-40°C to +70°C
Input Diode Power Dissipation	100mW[(1)]
Output Photologic™ Power Dissipation	200mW[(2)]
Total Device Power Dissipation	300mW[(3)]
Voltage at Output Lead (Open Collector Output)	35V
Diode Forward D.C. Current	40mA
Diode Reverse D.C. Voltage	3V

Notes:
(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB770N thru OPB773N series are terminated with 12 inches of 7 strand 26AWG, UL1429 insulated wire on each terminal. A standard AMP No. 640442-5 connector has been attached to the lead wires to ease connection to wire harnesses.
(5) Normal application would be with light source blocked, simulated by I_F = 0mA.
(6) Tested at d = 0.080" from a 90% diffuse white test surface.
(7) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(9) All parameters tested using pulse technique.

Types OPB770N, OPB771N, OPB772N, OPB773N

REFLECTIVE OBJECT SENSORS

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.8	V	I_F = 40mA, T_A = 25°C
I_R	Reverse Current			100	μA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(5)(6) Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(6) Output Open
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(6) Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(5)(6) Output Open
I_{OH}	High Level Output Voltage: Buffered Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 25mA, T_A = 25°C
	Inverted Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			25	mA	V_{CC} = 5.0V, T_A = 25°C(7)
$I_F(+)/I_F(-)$	Hysteresis		1.5			V_{CC} = 5.0V(7)
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 25mA(6) Output = GND
	Inverted Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 0mA(6) Output = GND
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(5)(6)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 25mA(5)(6)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 30mA(8)
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800μA I_F = 25mA(6)
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800μA I_F = 0mA(5)(6)
V_{OH}	High Level Output Voltage: Inverted Totem-Pole Output Inverted Open-Collector Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800μA I_F = 30mA(8)

Types OPB760, OPB770 Series

PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Reflective Sensor Family

6 - PC Board Mounting

7 - Wire Leads with
Connector

Electrical Specification Variations

0 - Buffered Totem-Pole Output

1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

3 - Inverted Open-Collector Output

Mounting Configurations

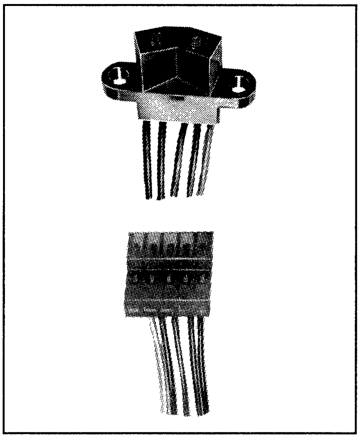
T - Two Mounting Tabs

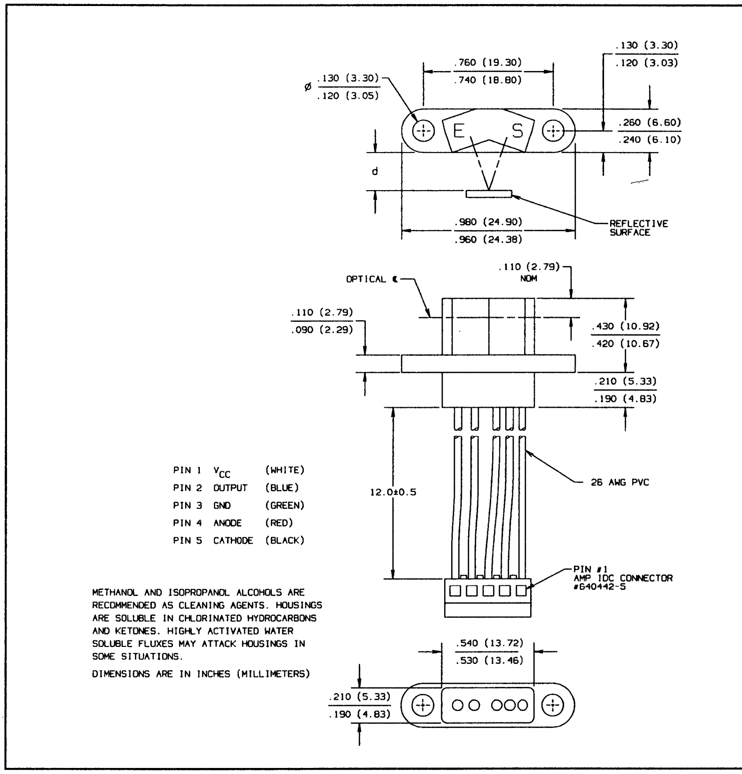
N - No Mounting Tabs

OPTEK

Product Bulletin OPB770T
May 1993

Photologic™ Reflective Object Sensors
Types OPB770T, OPB771T, OPB772T, OPB773T





Features

- Choice of mounting configurations
- Choice of output configurations

Description

The OPB770T series of reflective assemblies feature Photologic™ output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

Mounting Options

OPB760N series PC board mount, without mounting tabs
OPB760T series PC board mount, with two mounting tabs
OPB770N series wire leads with connector, without mounting tabs
OPB770T series wire leads with connector, with two mounting tabs

Replaces

OPB770T	KLR300W
OPB771T	KLR310W
OPB772T	KLR320W
OPB773T	KLR330W

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.)	10V
Storage Temperature Range	-40°C to +85°C
Operating Temperature Range	-40°C to +70°C
Input Diode Power Dissipation	100mW(1)
Output Photologic™ Power Dissipation	200mW(2)
Total Device Power Dissipation	300mW(3)
Voltage at Output Lead (Open Collector Output)	35V
Diode Forward D.C. Current	40mA
Diode Reverse D.C. Voltage	3V

Notes:
(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB770T thru OPB773T series are terminated with 12 inches of 7 strand 26AWG, UL1429 insulated wire on each terminal. A standard AMP No. 640442-5 connector has been attached to the lead wires to ease connection to wire harnesses.
(5) Normal application would be with light source blocked, simulated by I_F = 0mA.
(6) Tested at d = 0.080" from a 90% diffuse white test surface.
(7) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface.
(8) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
(9) All parameters tested using pulse technique.

Types OPB770T, OPB771T, OPB772T, OPB773T

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.8	V	I_F = 40mA, T_A = 25°C
I_R	Reverse Current			100	µA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(5)(6) Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(6) Output Open
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 25mA(6) Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	V_{CC} = 5.25V, I_F = 0mA(5)(6) Output Open
I_{OH}	High Level Output Voltage: Buffered Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 25mA, T_A = 25°C
	Inverted Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			25	mA	V_{CC} = 5.0V, T_A = 25°C(7)
$I_F(+)/I_F(-)$	Hysteresis		1.5			V_{CC} = 5.0V(7)
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 25mA(6) Output = GND
	Inverted Totem-Pole Output	-15		-100	mA	V_{CC} = 5.25V, I_F = 0mA(6) Output = GND
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(5)(6)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 25mA(5)(6)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 30mA(8)
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 25mA(6)
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 0mA(5)(6)
V_{OH}	High Level Output Voltage: Inverted Totem-Pole Output Inverted Open-Collector Output	2.4			V	V_{CC} = 4.75, I_{OH} = -800µA I_F = 30mA(8)

Types OPB760, OPB770 Series

PART NUMBER GUIDE

OPB 7 X X X

Optek Assembly — OPB

Photologic™
Photo Integrated Circuit
Reflective Sensor Family — 7

6 - PC Board Mounting
7 - Wire Leads with
Connector

Electrical Specification Variations
0 - Buffered Totem-Pole Output
1 - Buffered Open-Collector Output
2 - Inverted Totem-Pole Output
3 - Inverted Open-Collector Output

Mounting Configurations
T - Two Mounting Tabs
N - No Mounting Tabs

OPTEK TECHNOLOGY, INC.

SLOTTED OPTICAL SWITCHES

Slotted Optical Switches

Slotted optical switches, also known as transmissive assemblies or gap switches, are motion or position sensors. They operate on the principle that an object opaque to infrared light transmission will block light in the path between an infrared emitting diode (IRED) and a photosensor.

Slotted optical switches provide non-contact sensing of linear or rotary motion as in optical encoders. They find a variety of uses in industrial controls, computer peripherals and other instrumentation. They can signal:

- conveyor feed rates
- door positions on disk drives
- end-of-carriage return on data processing printers
- seating of tape cartridges

and they have many more applications.

An Optek slotted switch consists of an IRED and a silicon photosensor, each mounted on opposite sides of a slot in a molded plastic housing. When the gap is open or when material transparent to IR transmission passes through the slot, light reaches the photosensor allowing it to conduct current and the switch is "on." When an object opaque to IR transmission passes through the slot, the IR transmission is blocked, the photosensor does not conduct, and the switch is "off."

The speed of the switch is often an important application consideration. The overall switching time depends on the device chosen to serve as the photosensor. For example, a photodarlington switches in milliseconds; a phototransistor, in microseconds; and an Optek Photologic™ device (which is a photo-integrated circuit) in the low nanosecond range. In many designs, the mechanical turn-off and turn-on times for the equipment being controlled are much longer than the switching times of the photosensor.

Position Sensors

These sensors are electromechanical devices that detect the position or rate of change of position of a mechanism and translate the monitored information into useful output. A good example is the tachometer, which is a rotary encoder sensing slots in a wheel. The switch produces a pulse for every slot on the wheel. The number of pulses versus time provides a readout of the motor speed.

Standard switches can easily read 0.010 inch widths in etched metal or molded plastic disks. Typically, the slots are rectangular in shape. Maximum resolution is achieved by the narrowest of detectable apertures. Designs calling for narrower apertures than 0.010 inches are possible but may require custom designed and higher priced switches.

Application Bulletin 206, printed in this data book, discusses linear and rotary encoders in depth. Application Bulletins 203 and 209 discuss specific Optek interruptive assemblies for encoding and other functions.

Housing Material and Other Considerations

Housings for slotted optical switches do two things: they hold the IRED and photosensor in permanent fixed positions, and they contain mounting holes or other means of attachment to the equipment. The materials most commonly used for Optek slotted optical switch housings are polycarbonate and polysulfone, although other plastics may be used for specific applications. Injection molding techniques are used to form the plastic housing.

For applications that require special materials for the housings, Optek can custom design a housing part to match exact specifications.

Options for Selecting A Slotted Optical Switch

Design considerations of speed, resolution, length of optical path, environment, performance and cost impinge upon the proper selection of interruptive assemblies. Optek offers the engineer a wide selection of assemblies to meet exact design requirements. Optek offers slotted optical switches with the following options:

1. Phototransistor, photodarlington or Photologic™ output.
   a. Phototransistor output in various output ranges.
   b. Photologic™ output in four different output variations.
2. Gallium arsenide or gallium aluminum arsenide IREDs.
3. Dual channel devices in side-by-side or over/under configuration for speed, direction of movement and relative position sensing.
4. Various slot widths and depths.
5. Different sensor and emitter lead spacings.
6. Different aperture widths in front of sensor and emitter.
7. Different mounting configurations and housing styles.
8. Housing materials: opaque or transmissive.
9. Lead wires and connectors: standard leads of 24" (minimum length).

Custom Design of Interruptive Assemblies

In cases where unique specifications call for a custom design, Optek can work closely with the customer to produce the optimum interruptive slotted optical switch. Such designs can vary from slight adjustments to standard parts to completely new mechanical configurations.

Typical Applications

Printers

Electric watt-hour meters

Copying machines

Coin changers

Disk drives

Medical equipment

Paper sorting equipment

Typewriters

Amusement games

Liquid level sensing equiment

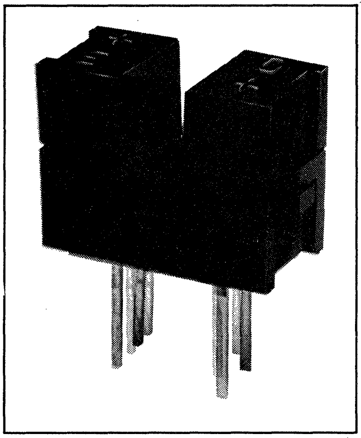
Touch panel applications

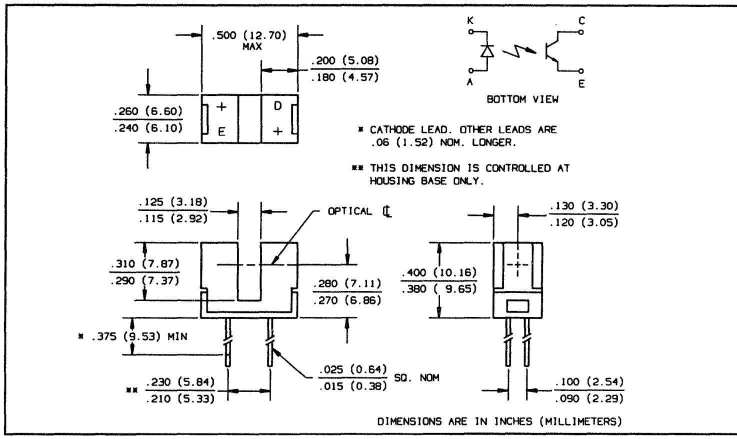
OPTEK

Product Bulletin CNY36
January 1995

Slotted Optical Switch
Type CNY36

Not recommended for new design. See OPB860





Features

- Non-contact switching
- Printed circuit board mounting
- 0.120" wide slot
- 0.220" lead spacing

Description

The CNY36 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost plastic housing on opposite sides of a 0.120" (3.05mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(2)

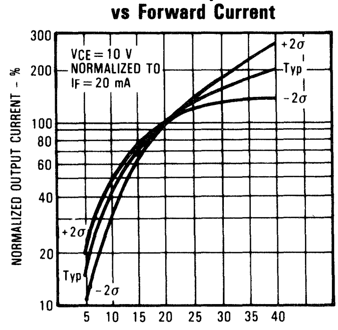
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(2)

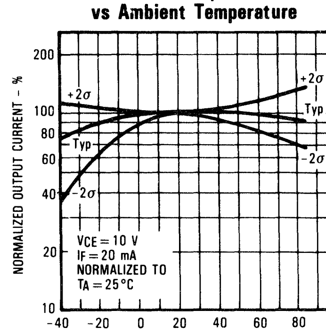
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Normalized Output Current vs Forward Current



Normalized Output Current vs Ambient Temperature



Type CNY36

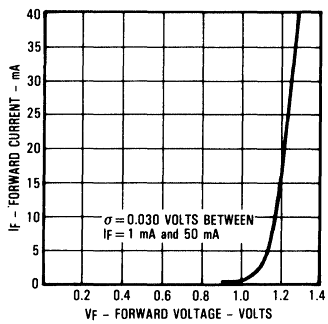
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.50	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_C = 25μA, I_F = 20mA
$I_{C(ON)}$	Collector Current	200		μA	V_{CE} = 10.0V, I_F = 20mA

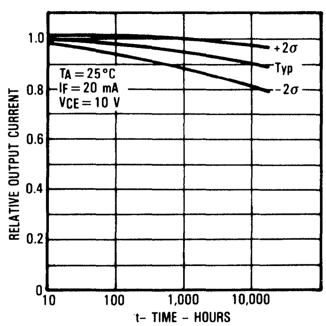
SLOTTED OPTICAL SWITCHES

Typical Performance Curves

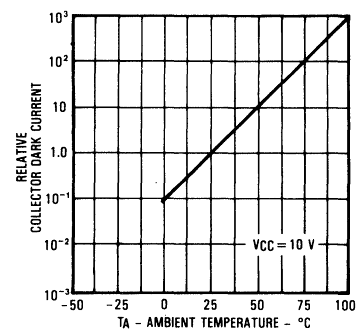
Forward Current vs Forward Voltage Input Diode



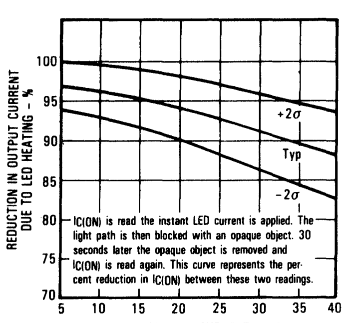
Relative Output Current vs Time



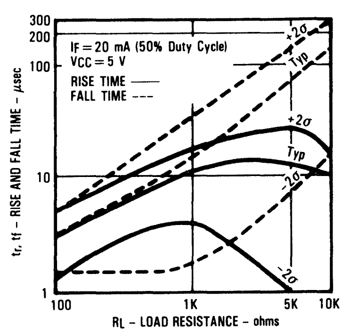
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current



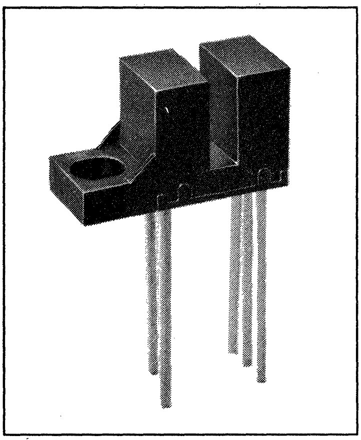
Rise and Fall Time vs vs Load Resistance

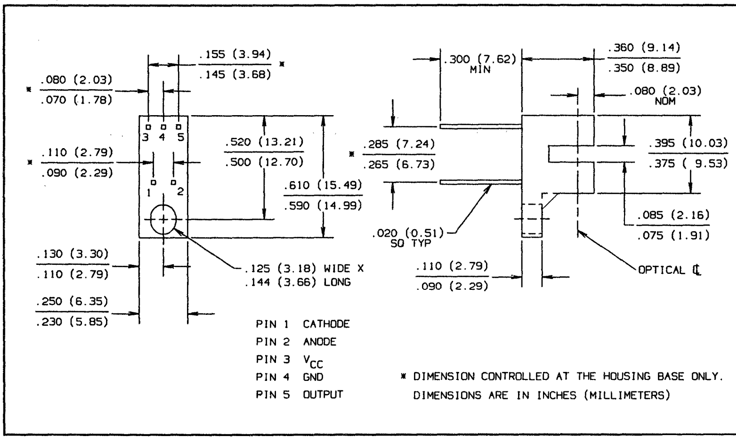


Product Bulletin OPB120A
May 1993

OPTEK

Photologic™ Slotted Optical Switches
Types OPB120A, OPB121A, OPB122A, OPB123A





Features

- Choice of output configuration
- Printed circuit board mounting
- 0.080" wide slot
- 0.275" lead spacing
- Opaque plastic housing
- Low profile

Description

The OPB120A through OPB123A each consist of an infrared emitting diode and a Photologic™ sensor (a monolithic integrated circuit which incorporates a linear amplifier and a Schmitt Trigger) mounted on opposite sides of a .080" wide gap opaque housing, with molded .040" wide apertures located over both emitter and Photologic™ sensor.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (not to exceed 3 sec.) . . . . +10.0V
Storage Temperature Range . . . . -40°C to +85°C
Operating Temperature Range . . . . -40°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)
Input Diode Power Dissipation . . . . 100mW(2)
Output Photologic™ Power Dissipation . . . . 200mW(4)
Total Device Power Dissipation . . . . 300mW(5)
Voltage at Output Lead (Open Collector Output) 35V
Forward D.C. Current 40mA
Reverse D.C. Voltage 2.0V

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 2.22mW/°C above 25°C.
(3) Normal application would be with light source blocked, simulated by I_F = 0.
(4) Derate Linearly 4.44mW/°C above 25°C.
(5) Derate Linearly 6.66mW/°C above 25°C.
(6) Applies to Totem Pole configurations only.
(7) All parameters tested using pulse technique.

Types OPB120A, OPB121A, OPB122A, OPB123A

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	μA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(3)
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 20mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 20mA
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(3)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(3)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 20mA
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	Vcc = 4.75, I_{OH} = -800μA I_F = 20mA
	Inverted Totem-Pole Output	2.4			V	Vcc = 4.75, I_{OH} = -800μA I_F = 0mA(3)
I_{OH}	High Level Output Voltage: Buffered Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 20mA, T_A = 25°C
	Inverted Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			15	mA	V_{CC} = 5.0V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2.0			V_{CC} = 5.0V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-20		-100	mA	V_{CC} = 5.25V, I_F = 20mA(6) Output = GND
	Inverted Totem-Pole Output	-20		-100	mA	V_{CC} = 5.25V, I_F = 0mA(6) Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	Vcc = 5.0V, T_A = 25°C I_F = 0 or 20mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5.0		μs	R_L = 8TTL Loads (Totem Pole) R_L = 360Ω (Open Collector)

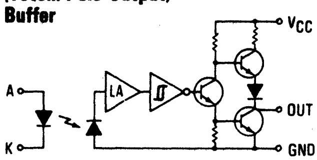
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Part Number Guide

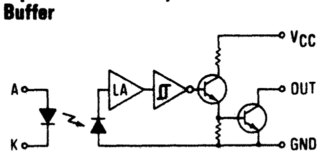
	Output	Aperture Emitter	Aperture Sensor
OPB120A	Buffer Totem-pole	0.040"	0.040"
OPB121A	Buffer Open-Collector	0.040"	0.040"
OPB122A	Inverter Totem-Pole	0.040"	0.040"
OPB123A	Inverter Open-Collector	0.040"	0.040"
OPB120B	Buffer Totem-pole	0.040"	0.010"
OPB121B	Buffer Open-Collector	0.040"	0.010"
OPB122B	Inverter Totem-Pole	0.040"	0.010"
OPB123B	Inverter Open-Collector	0.040"	0.010"

Schematics

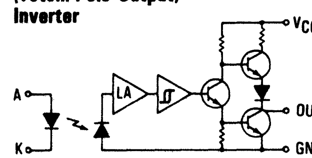
OPB120
(Totem-Pole Output)
Buffer



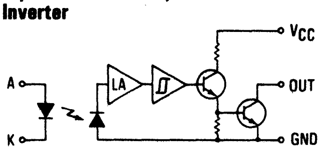
OPB121
(Open-Collector Output)
Buffer



OPB122
(Totem-Pole Output)
Inverter



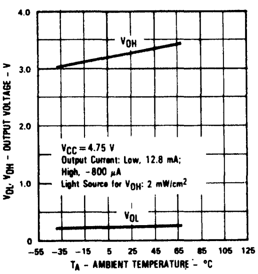
OPB123
(Open-Collector Output)
Inverter



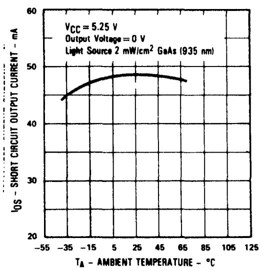
Typical Performance Curves

OPB120, OPB122

Output Voltage vs Ambient Temperature

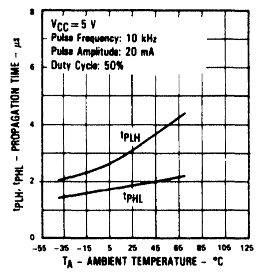


Short Circuit Output Current vs Ambient Temperature



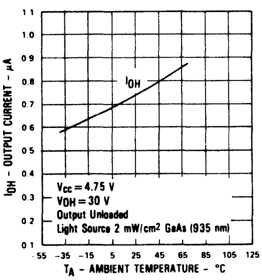
All Assemblies

Propagation Time vs Ambient Temperature

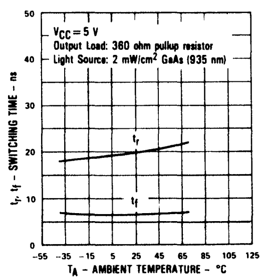


OPB121, OPB123

Output Current (High) vs Ambient Temperature

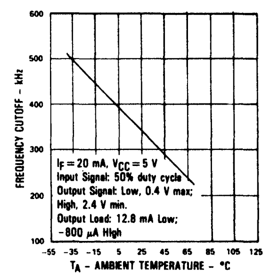


Rise Time and Fall Time vs Ambient Temperature



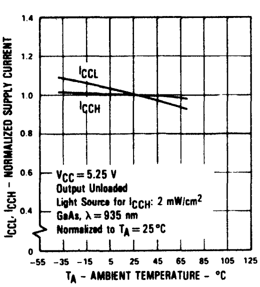
All Assemblies

Data Rate vs Ambient Temperature



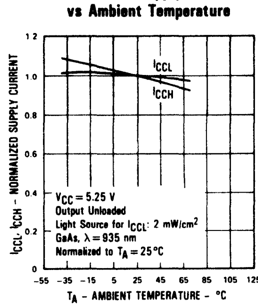
OPB120, OPB121

Normalized Supply Current vs Ambient Temperature



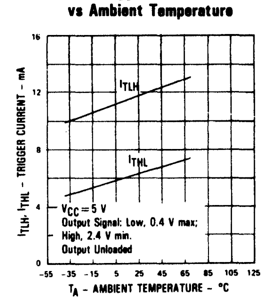
OPB122, OPB123

Normalized Supply Current vs Ambient Temperature

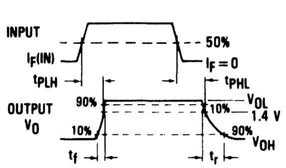


All Assemblies

Trigger Current vs Ambient Temperature

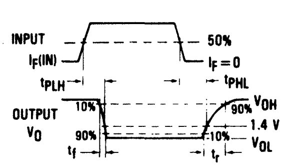


Switching Test Curve for Buffers



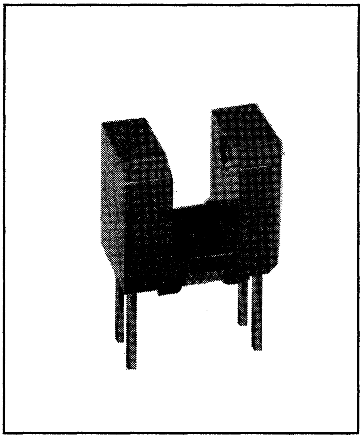
LED: f = 10 kHz, D.C. = 50%

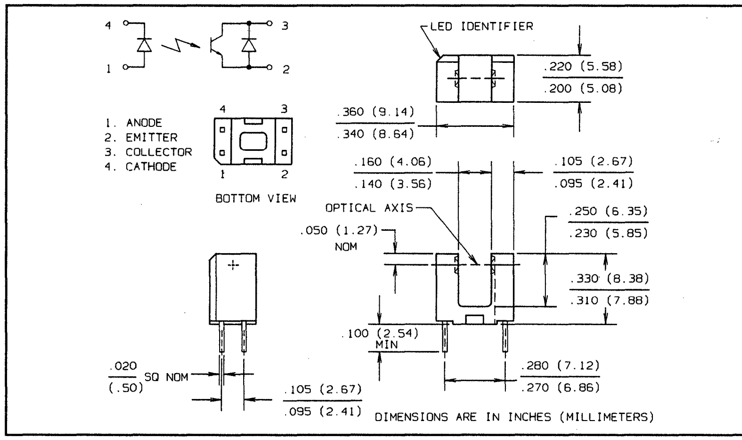
Switching Test Curve for Inverters



LED: f = 10 kHz, D.C. = 50%

Slotted Optical Switch
Type OPB610





Features

- Non-contact switching
- Printed circuit board mounting
- 0.275" Lead centers
- 0.150" Gap
- Enhanced signal to noise ratio

Description

The OPB610 slotted optical switch consists of an infrared emitting diode and an NPN silicon phototransistor with an enhanced low current roll-off to improve contrast ratio and immunity to background irradiance.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] . . . . 260°C[(1)]

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW[(2)]

Output Phototransistor

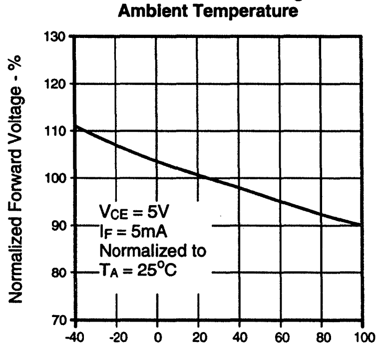
Collector-Emitter Voltage 30V
Emitter Reverse Current 10mA
Collector DC Current 30mA
Power Dissipation . . . . 200mW[(3)]

Notes:

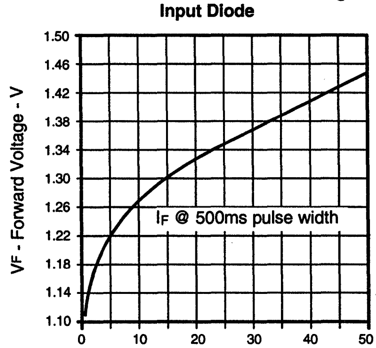
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

Typical Performance Curves

Normalized Forward Voltage vs Ambient Temperature



Forward Current vs Forward Voltage Input Diode



Types OPB610

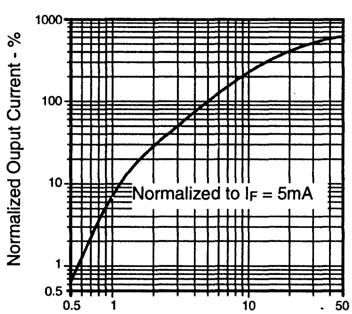
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.60	V	I_F = 10 mA
I_R	Reverse Current		100	µA	V_R = 3.0 V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100 µA
I_{ECO}	Emitter Reverse Current		100	µA	V_{EC} = 0.4 V
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 5 V
Coupled					
V_{SAT}	Saturation Voltage		0.40	V	I_F = 5 mA, I_C = 100 µA
$I_{C(ON)}$	On-State Collector Current	1.0		mA	I_F = 5 mA, V_{CE} = 5 V

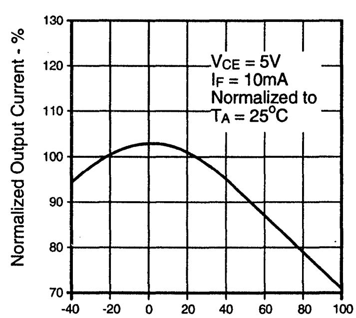
SLOTTED OPTICAL SWITCHES

Typical Performance Curves

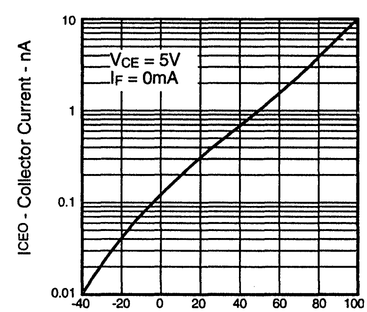
Normalized Output Current vs Forward Current



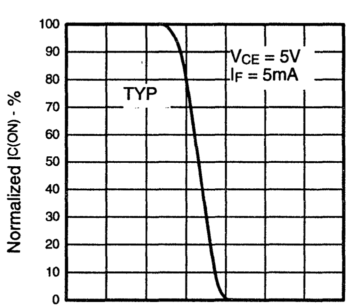
Normalized Output Current vs Ambient Temperature



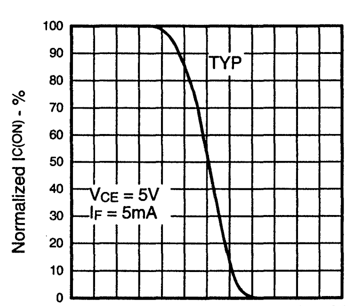
Collector Dark Current vs Ambient Temperature



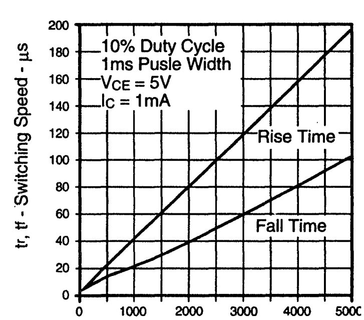
Normalized $I_{C(ON)}$ vs Distance (X Axis Blocked)



Normalized $I_{C(ON)}$ vs Distance (Y Axis Blocked)



Switching Speed vs Load

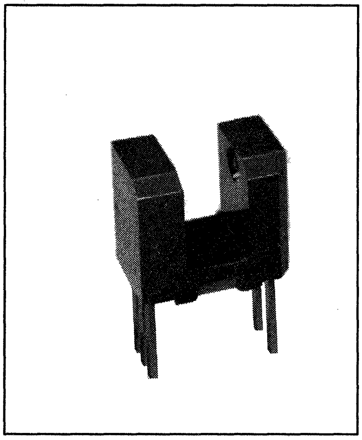


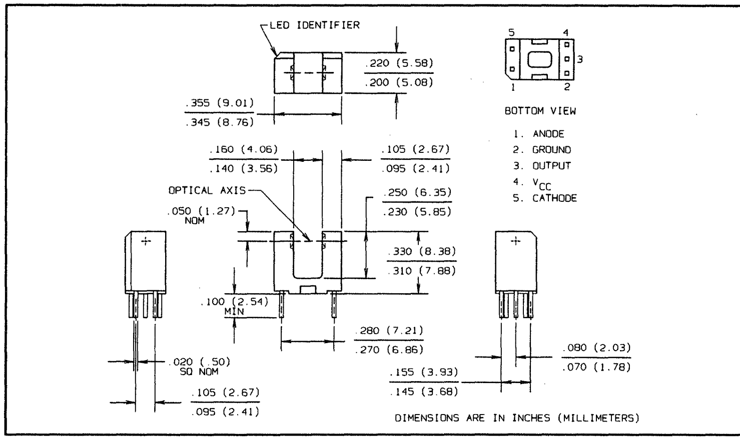
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB615
May 1993

OPTEK

Photologic™ Slotted Optical Switch
Types OPB615, OPB616, OPB617, OPB618





Features

- Non-contact switching
- Printed circuit board mounting
- 0.275" Lead centers
- 0.150" Gap
- Enhanced signal to noise ratio
- Four output options

Description

The OPB615 series slotted optical switches consist of an infrared emitting diode and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip.

The sensors feature TTL/LSTTL compatible logic level output. Open collector output versions can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1μs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(2)

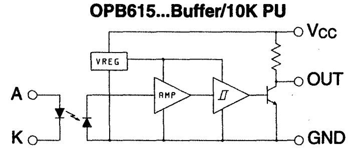
Output Photologic™

Supply Voltage, V_{CC} 18V
Duration of Output Short To V_{CC} 1.00sec
Voltage at Output 30V
Low Level Output Current (sinking) 16mA
Power Dissipation . . . . 240mW(3)

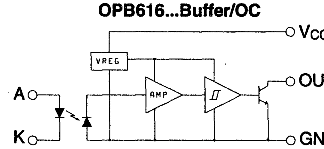
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

Schematics

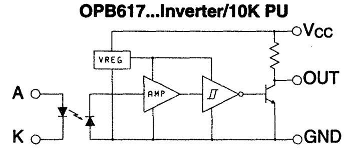
OPB615...Buffer/10K PU



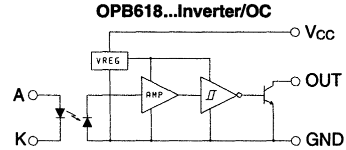
OPB616...Buffer/OC



OPB617...Inverter/10K PU



OPB618...Inverter/OC



Types OPB615, OPB616, OPB617, OPB618

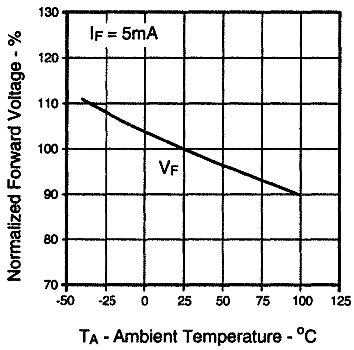
Electrical Characteristics (T_A = 25°C, V_{CC} = 4.5V to 16V unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.6	V	I_F = 10 mA
I_R	Reverse Current				100	μA	V_R = 3.0 V
Output Photologic™ Sensor							
V_{CC}	Operating D.C. Supply Voltage		4.5		16.0	V	
$I_F(+)$	LED Positive-Going Threshold Current		0.1	0.55	3.0	mA	
$I_F(+)/I_F(-)$	Hysteresis Ratio		1.05	1.20	1.60		
I_{CCH}	High Level Supply Current:						
	Buffer, 10K Pull-up	OPB615		5.0	12.0	mA	I_F = 5 mA, No Load On Output
	Buffer, Open-Collector	OPB616					
	Inverter, 10K Pull-up	OPB617		4.0	12.0	mA	I_F = 0 mA(4), No Load On Output
	Inverter, Open-Collector	OPB618					
I_{CCL}	Low Level Supply Current:						
	Buffer, 10K Pull-up	OPB615		5.5	12.0	mA	I_F = 0 mA(4), No Load On Output
	Buffer, Open-Collector	OPB616		4.0	12.0		
	Inverter, 10K Pull-up	OPB617		6.5	12.0	mA	I_F = 5 mA, No Load On Output
	Inverter, Open-Collector	OPB618		5.0	12.0		
V_{OH}	High Level Output Voltage:						
	Buffer, 10K Pull-up	OPB615	(V_{CC}-1.5)			V	I_F = 5 mA, I_{OH} = 100 μA
	Inverter, 10K Pull-up	OPB617	(V_{CC}-1.5)			V	I_F = 0 mA(4), I_{OH} = 100 μA
I_{OH}	High Level Output Current:						
	Buffer, Open-Collector	OPB616			100	μA	I_F = 5 mA, V_{OH} = 30 V
	Inverter, Open-Collector	OPB618			100	μA	I_F = 0 mA(4), V_{OH} = 30 V
V_{OL}	Low Level Output Voltage:						
	Buffer, 10K Pull-up	OPB615			0.4	V	I_F = 0 mA(4), I_{OL} = 16 mA
	Buffer, Open-Collector	OPB616					
	Inverter, 10K Pull-up	OPB617			0.4	V	I_F = 5 mA, I_{OL} = 16 mA
	Inverter, Open-Collector	OPB618					
t_r, t_f	Output Rise Time, Output Fall Time			30		ns	I_F = 0 or 5 mA, f = 10 KHz, D.C. = 50%, R_L = 300 Ω
t_{PLH}	Propagation Delay, Low-High						
	Buffer, 10K Pull-up	OPB615		0.6		μs	
	Buffer, Open-Collector	OPB616					
	Inverter, 10K Pull-up	OPB617		3.0		μs	
	Inverter, Open-Collector	OPB618					
t_{PHL}	Propagation Delay, High-Low						
	Buffer, 10K Pull-up	OPB615		3.0		μs	
	Buffer, Open-Collector	OPB616					
	Inverter, 10K Pull-up	OPB617		0.6		μs	
	Inverter, Open-Collector	OPB618					
Data Rate	Data Rate			100		KHz	I_F = 0 or 5 mA, D.C. = 50%, R_L = 300 Ω

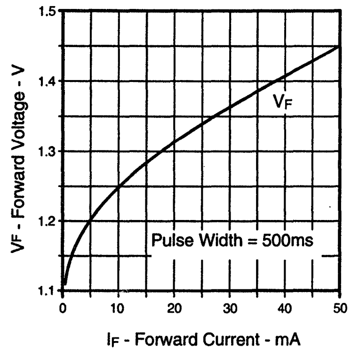
(4) Normal application would be with light source blocked, simulated by I_F = 0mA.

Typical Performance Curves

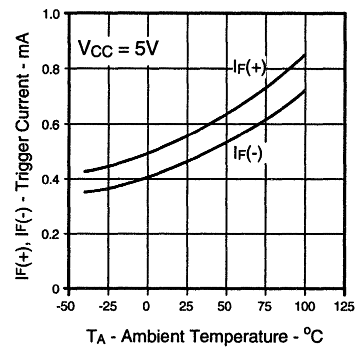
Normalized Forward Voltage vs Ambient Temperature



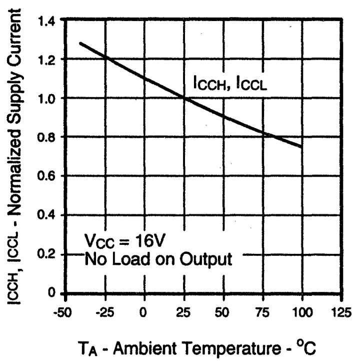
Forward Voltage vs Forward Current Input Diode



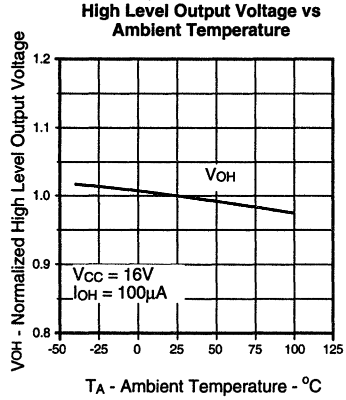
Trigger Current vs Ambient Temperature



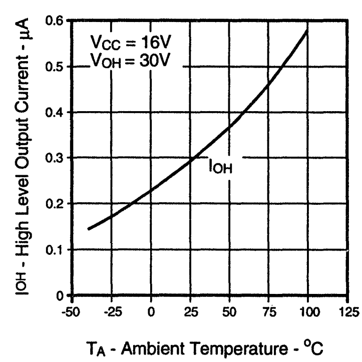
Normalized Supply Current vs Ambient Temperature



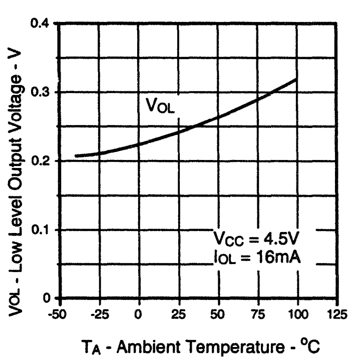
OPB615, OPB617 Normalized High Level Output Voltage vs Ambient Temperature



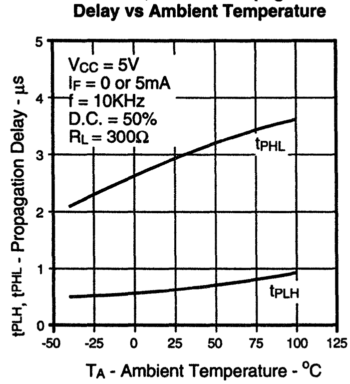
OPB616, OPB618 High Level Output Current vs Ambient Temperature



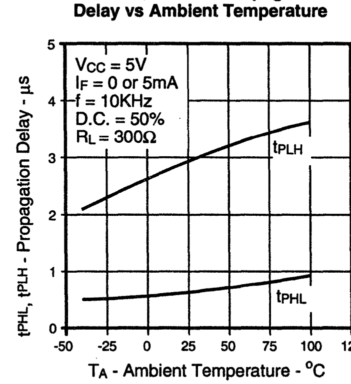
Low Level Output Voltage vs Ambient Temperature



OPB615, OPB616 Propagation Delay vs Ambient Temperature

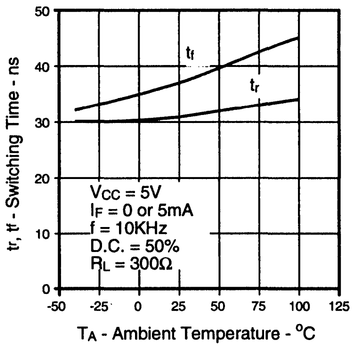


OPB617, OPB618 Propagation Delay vs Ambient Temperature

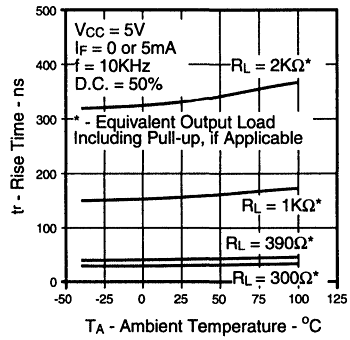


Typical Performance Curves

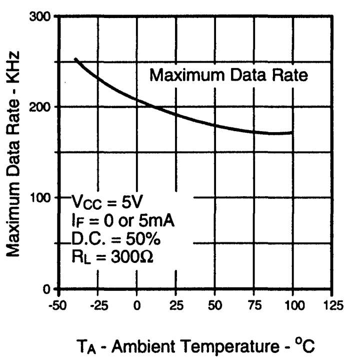
Rise Time and Fall Time vs Ambient Temperature



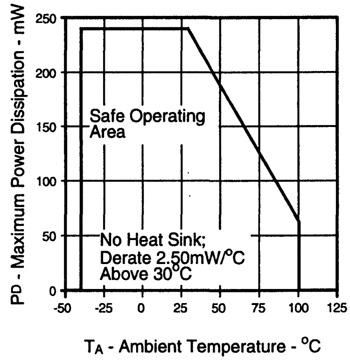
Rise Time vs Output Load vs Ambient Temperature



Maximum Data Rate vs Ambient Temperature

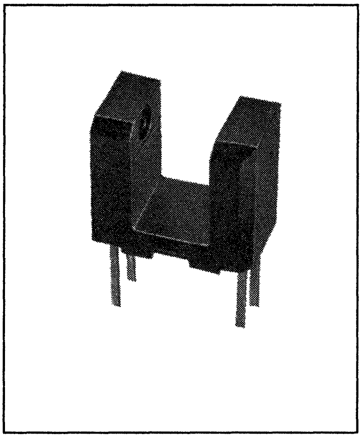


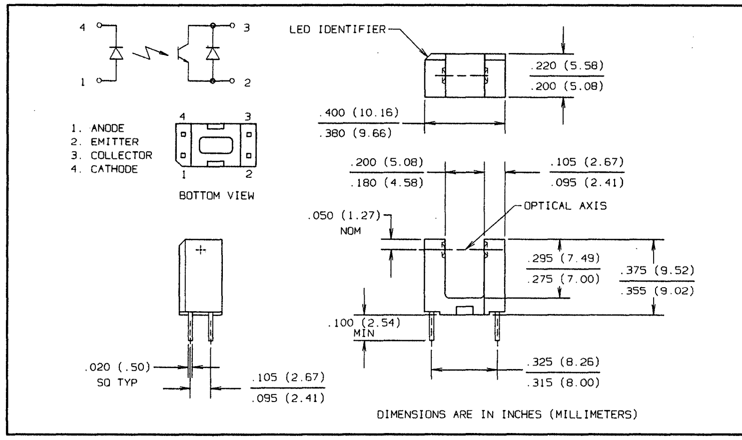
Typical Thermal Derating Curve



OPTEK

Slotted Optical Switch
Type OPB620





Features

- Non-contact switching
- Printed circuit board mounting
- 0.320" Lead centers
- 0.190" Gap
- Enhanced signal to noise ratio

Description

The OPB620 slotted optical switch consists of an infrared emitting diode and an NPN silicon phototransistor with an enhanced low current roll-off to improve contrast ratio and immunity to background irradiance.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] . . . . 260°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(2)

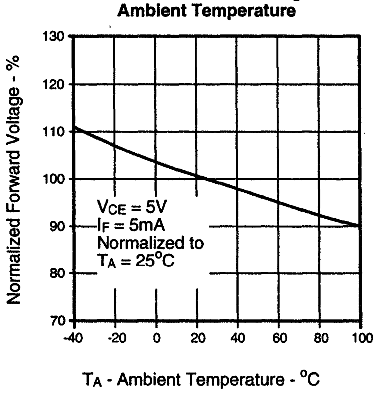
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter Reverse Current 10mA
Collector DC Current 30mA
Power Dissipation . . . . 200mW(3)

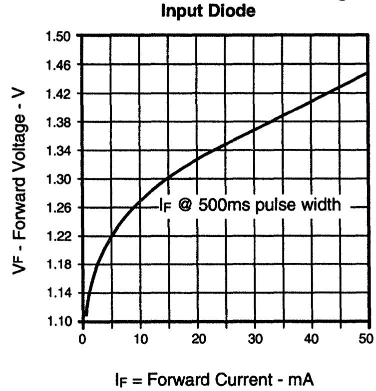
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

Typical Performance Curves

Normalized Forward Voltage vs Ambient Temperature



Forward Current vs Forward Voltage Input Diode



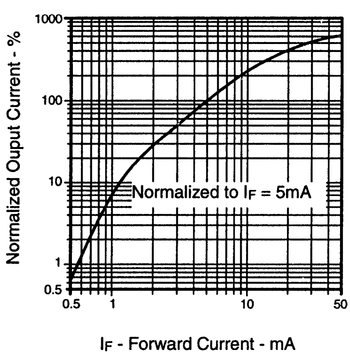
Types OPB620

Electrical Characteristics ($T_A = 25^{\circ}C$ unless otherwise noted)

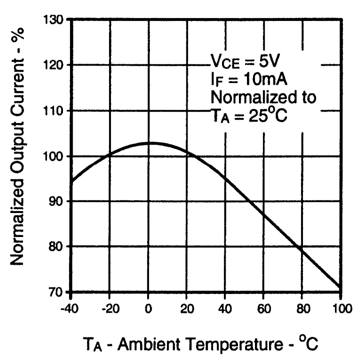
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.60	V	$I_F = 10$ mA
I_R	Reverse Current		100	μA	$V_R = 3.0$ V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 100$ μA
I_{ECO}	Emitter Reverse Current		100	μA	$V_{EC} = 0.4$ V
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 5$ V
Coupled					
V_{SAT}	Saturation Voltage		0.40	V	$I_F = 5$ mA, $I_C = 100$ μA
$I_{C(ON)}$	On-State Collector Current	1.0		mA	$I_F = 5$ mA, $V_{CE} = 5$ V

Typical Performance Curves

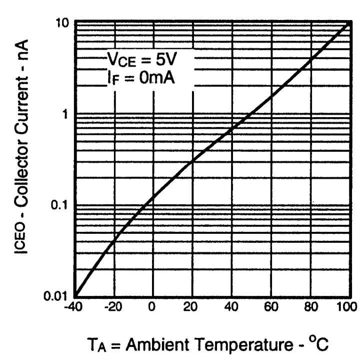
Normalized Output Current vs Forward Current



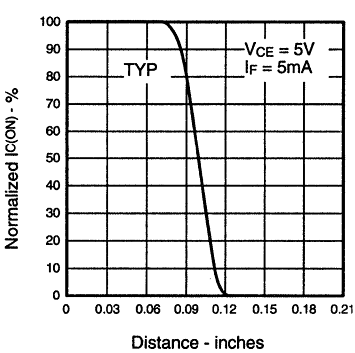
Normalized Output Current vs Ambient Temperature



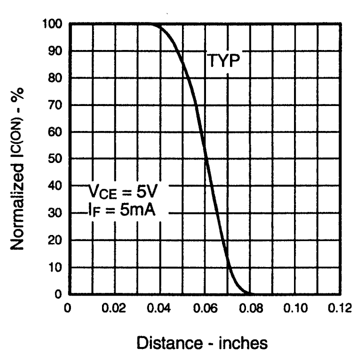
Collector Dark Current vs Ambient Temperature



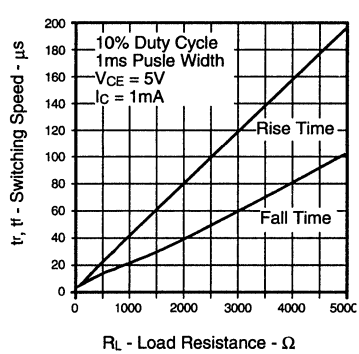
Normalized $I_{C(ON)}$ vs Distance (X Axis Blocked)



Normalized $I_{C(ON)}$ vs Distance (Y Axis Blocked)



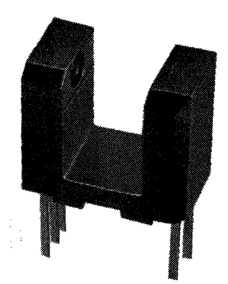
Switching Speed vs Load

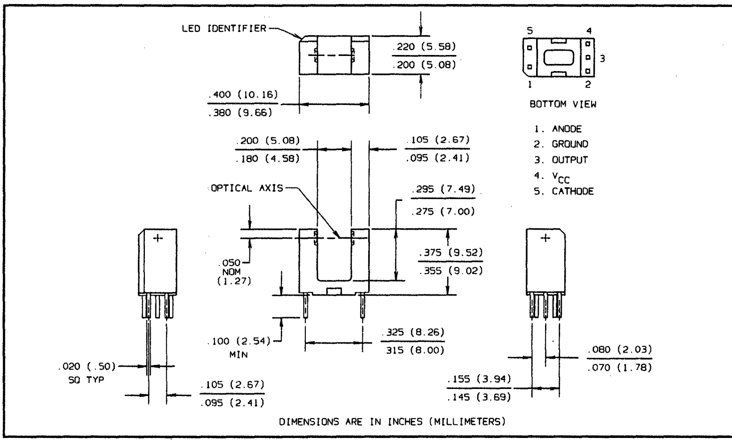


OPTEK

Product Bulletin OPB625
May 1993

Photologic™ Slotted Optical Switch
Types OPB625, OPB626, OPB627, OPB628





Features

- Non-contact switching
- Printed circuit board mounting
- 0.320" Lead centers
- 0.190" Gap
- Enhanced signal to noise ratio
- Four output options

Description

The OPB625 series slotted optical switches consist of an infrared emitting diode and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip.

The device features TTL/LSTTL compatible logic level output. Open collector output versions can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(2)

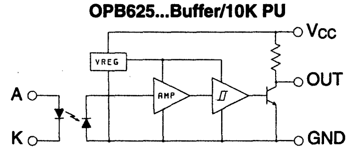
Output Photologic™

Supply Voltage, V_{CC} 18V
Duration of Output Short To V_{CC} 1.00sec
Voltage at Output 30V
Low Level Output Current (sinking) 16mA
Power Dissipation . . . . 240mW(3)

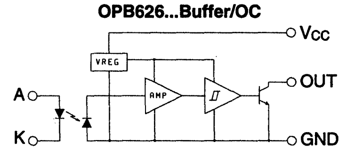
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

Schematics

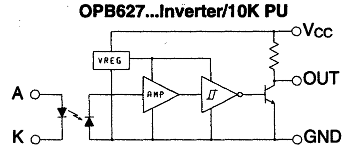
OPB625...Buffer/10K PU



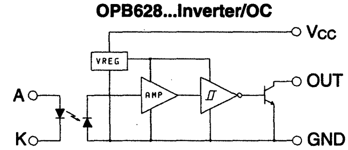
OPB626...Buffer/OC



OPB627...Inverter/10K PU



OPB628...Inverter/OC



Types OPB625, OPB626, OPB627, OPB628

Electrical Characteristics ($T_A = 25^oC$, V_{CC} = 4.5V to 16V unless otherwise noted)

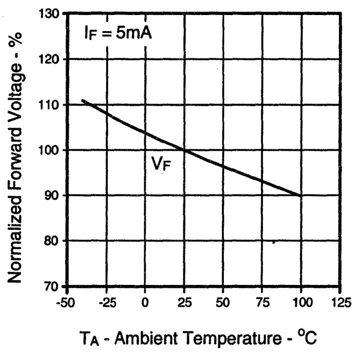
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.6	V	I_F = 10 mA
I_R	Reverse Current				100	μA	V_R = 3.0 V
Output Photologic™ Sensor							
V_{CC}	Operating D.C. Supply Voltage		4.5		16.0	V	
$I_F(+)$	LED Positive-Going Threshold Current		0.1	0.6	3.0	mA	
$I_F(+)/I_F(-)$	Hysteresis Ratio		1.05	1.20	1.60		
I_{CCH}	High Level Supply Current:						
	Buffer, 10K Pull-up	OPB625		5.0	12.0	mA	I_F = 5 mA, No Load On Output
	Buffer, Open-Collector	OPB626					
	Inverter, 10K Pull-up	OPB627		4.0	12.0	mA	I_F = 0 mA(4), No Load On Output
	Inverter, Open-Collector	OPB628					
I_{CCL}	Low Level Supply Current:						
	Buffer, 10K Pull-up	OPB625		5.5	12.0	mA	I_F = 0 mA(4), No Load On Output
	Buffer, Open-Collector	OPB626		4.0	12.0		
	Inverter, 10K Pull-up	OPB627		6.5	12.0	mA	I_F = 5 mA, No Load On Output
	Inverter, Open-Collector	OPB628		5.0	12.0		
V_{OH}	High Level Output Voltage:						
	Buffer, 10K Pull-up	OPB625	(V_{CC}-1.5)			V	I_F = 5 mA, I_{OH} = 100 μA
	Inverter, 10K Pull-up	OPB627	(V_{CC}-1.5)			V	I_F = 0 mA(4), I_{OH} = 100 μA
I_{OH}	High Level Output Current:						
	Buffer, Open-Collector	OPB626			100	μA	I_F = 5 mA, V_{OH} = 30 V
	Inverter, Open-Collector	OPB628			100	μA	I_F = 0 mA(4), V_{OH} = 30 V
V_{OL}	Low Level Output Voltage:						
	Buffer, 10K Pull-up	OPB625			0.4	V	I_F = 0 mA(4), I_{OL} = 16 mA
	Buffer, Open-Collector	OPB626					
	Inverter, 10K Pull-up	OPB627			0.4	V	I_F = 5 mA, I_{OL} = 16 mA
	Inverter, Open-Collector	OPB628					
t_r, t_f	Output Rise Time, Output Fall Time			30		ns	I_F = 0 or 5 mA, f = 10 KHz, D.C. = 50%, R_L = 300 Ω
t_{PLH}	Propagation Delay, Low-High						
	Buffer, 10K Pull-up	OPB625		0.6		μs	
	Buffer, Open-Collector	OPB626					
	Inverter, 10K Pull-up	OPB627		3.0		μs	
	Inverter, Open-Collector	OPB628					
t_{PHL}	Propagation Delay, High-Low						
	Buffer, 10K Pull-up	OPB625		3.0		μs	
	Buffer, Open-Collector	OPB626					
	Inverter, 10K Pull-up	OPB627		0.6		μs	
	Inverter, Open-Collector	OPB628					
Data Rate	Data Rate			100		KHz	I_F = 0 or 5 mA, D.C. = 50%, R_L = 300 Ω

(4) Normal application would be with light source blocked, simulated by I_F = 0mA.

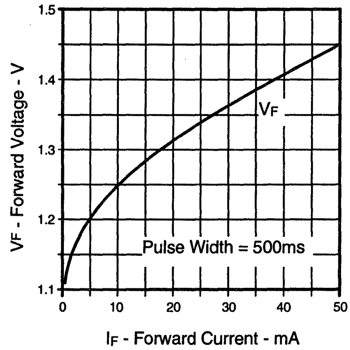
SLOTTED OPTICAL SWITCHES

Typical Performance Curves

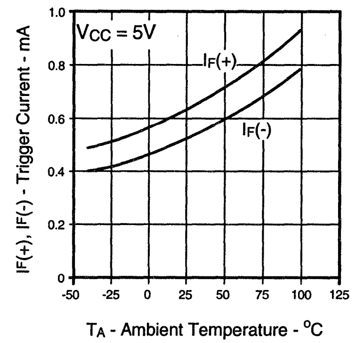
Normalized Forward Voltage vs Ambient Temperature



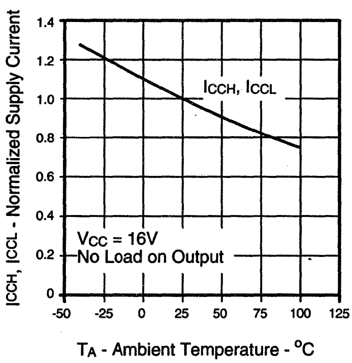
Forward Voltage vs Forward Current Input Diode



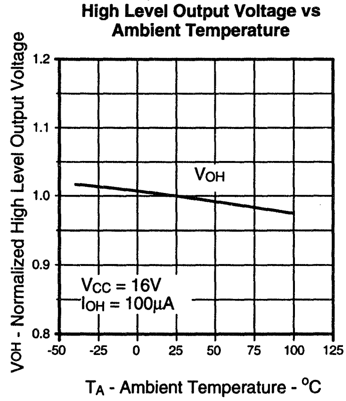
Trigger Current vs Ambient Temperature



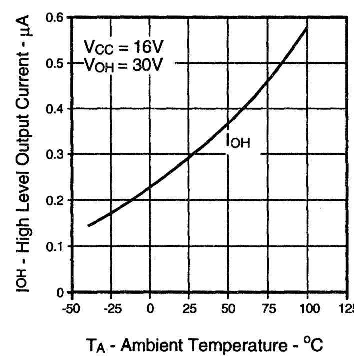
Normalized Supply Current vs Ambient Temperature



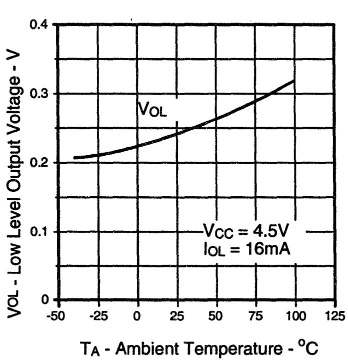
OPB625, OPB627 Normalized High Level Output Voltage vs Ambient Temperature



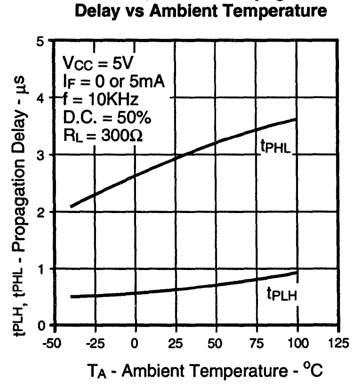
OPB626, OPB628 High Level Output Current vs Ambient Temperature



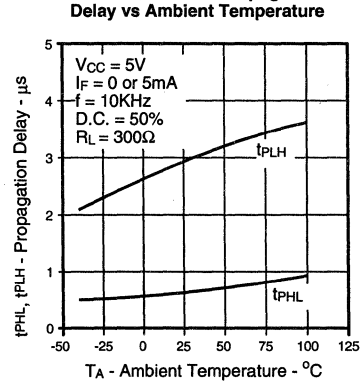
Low Level Output Voltage vs Ambient Temperature



OPB625, OPB626 Propagation Delay vs Ambient Temperature

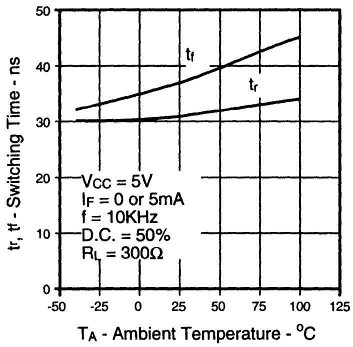


OPB627, OPB628 Propagation Delay vs Ambient Temperature

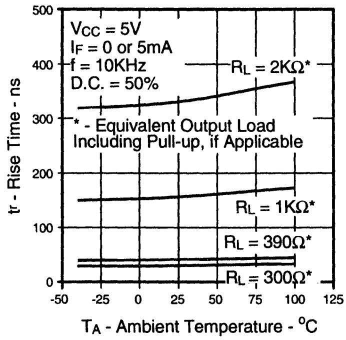


Typical Performance Curves

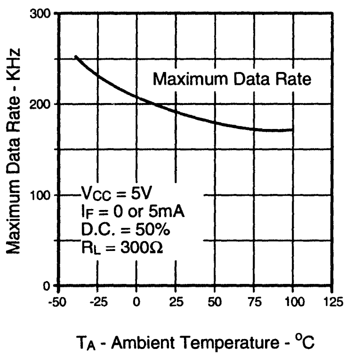
Rise Time and Fall Time vs Ambient Temperature



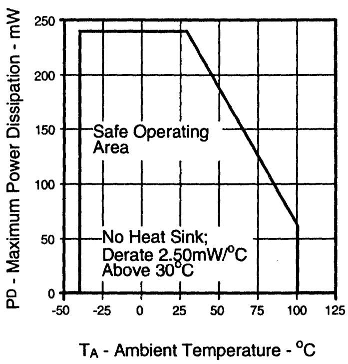
Rise Time vs Output Load vs Ambient Temperature



Maximum Data Rate vs Ambient Temperature



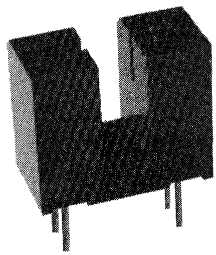
Typical Thermal Derating Curve



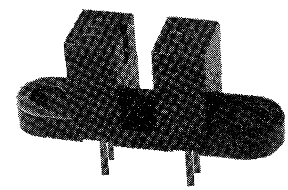
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB660
May 1993

Slotted Optical Switch
Types OPB660N, OPB660T



Package N



Package T

Features

- Non-contact switching
- 0.125" Wide gap
- 0.320" Lead spacing
- N or T package
- Printed circuit board mounting
- Enhanced signal to noise ratio

Description

The OPB660 series consists of an NPN phototransistor and an infrared emitting diode mounted on opposite sides of a 0.125" wide slot. The emitter has a 0.050" x 0.060" molded aperture while the phototransistor has a 0.010" x 0.060" molded aperture. The phototransistor has an enhanced low current roll-off which improves contrast ratio and immunity to background irradiance.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

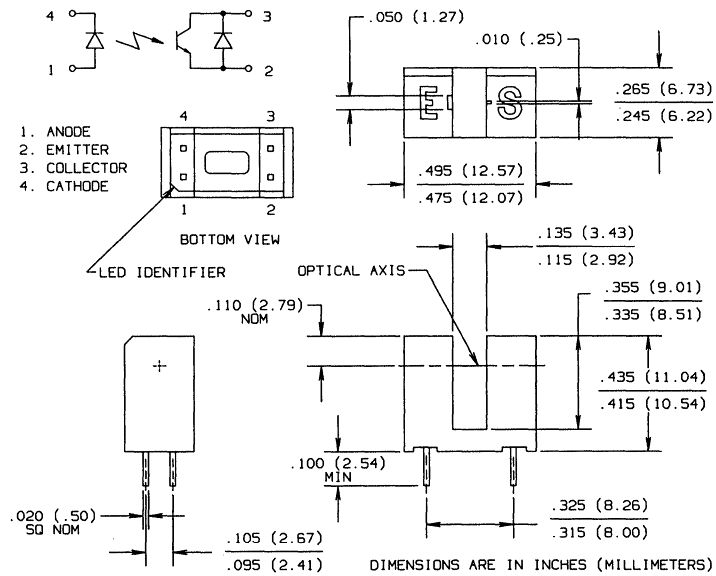
Storage and Operating Temperature . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] . . . . 260°C(1)

Input Diode
Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(2)

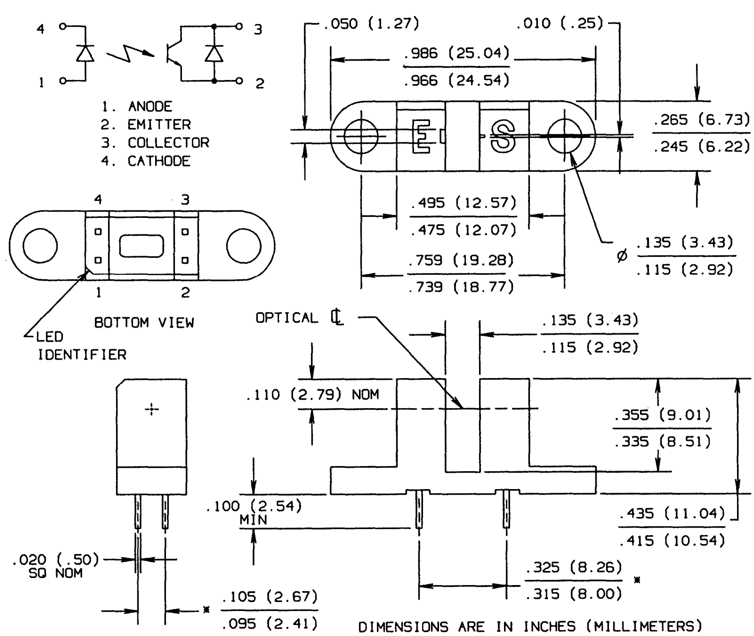
Output Phototransistor
Collector-Emitter Voltage 30V
Emitter Reverse Current 10mA
Collector DC Current 30mA
Power Dissipation . . . . 200mW(3)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

Types OPB660N, OPB660T



Package N



Package T

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Types OPB660N, OPB660T

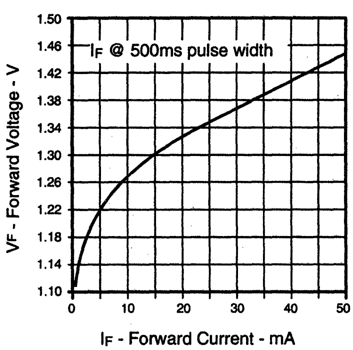
OPTEK

Electrical Characteristics (T_A = 25°C unless otherwise noted)

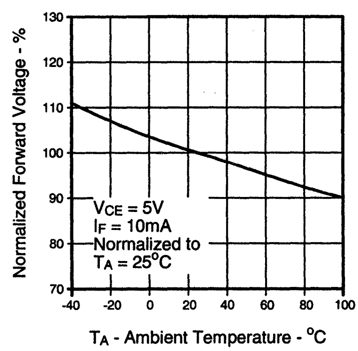
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.60	V	I_F = 10 mA
I_R	Reverse Current		100	µA	V_R = 3.0 V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100 µA
I_{ECO}	Emitter Reverse Current		100	µA	V_{EC} = 0.4 V
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 5 V
Coupled					
V_{SAT}	Saturation Voltage		0.40	V	I_F = 10 mA, I_C = 100 µA, Gap unblocked
$I_{C(ON)}$	On-State Collector Current	600		µA	I_F = 10 mA, V_{CE} = 5 V

Typical Performance Curves

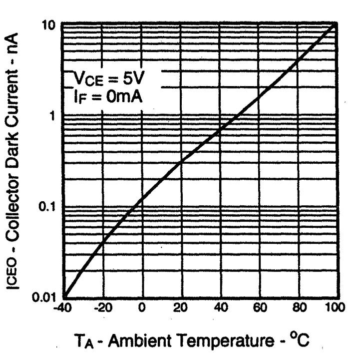
Forward Current vs Forward Voltage Input Diode



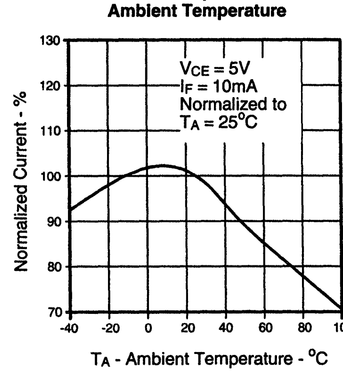
Normalized Forward Voltage vs Ambient Temperature



Collector Dark Current vs Ambient Temperature

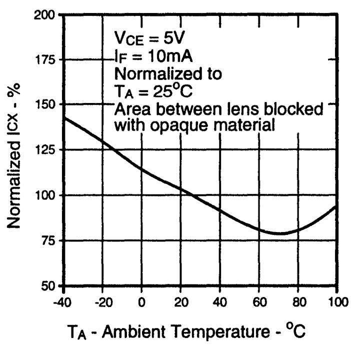


Normalized Output Current vs Ambient Temperature

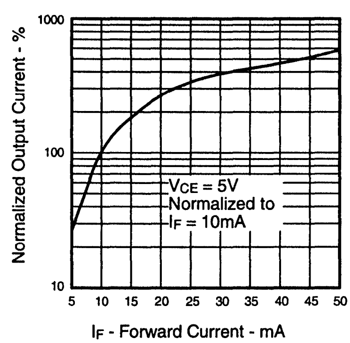


Typical Performance Curves

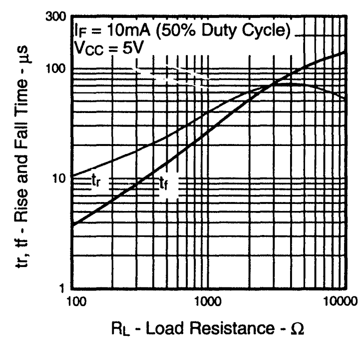
Normalized I_{CX} vs Ambient Temperature



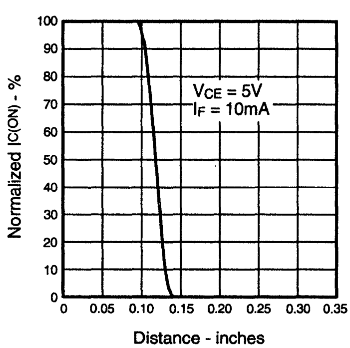
Normalized Output Current vs Forward Current



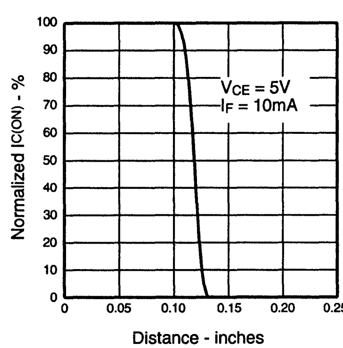
Rise and Fall Time vs Load Resistance



Normalized $I_{C(ON)}$ vs Distance (Y Axis Blocked)



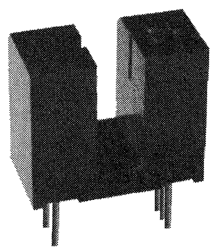
Normalized $I_{C(ON)}$ vs Distance (X Axis Blocked)



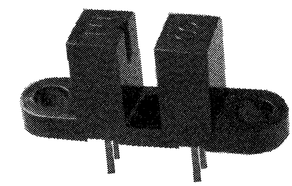
Product Bulletin OPB665
May 1993

OPTEK

Photologic™ Slotted Optical Switch
Types OPB665N/T, OPB666N/T, OPB667N/T, OPB668N/T



Package N



Package T

Features
- Four Output Options
- 0.125" Wide Gap
- 0.320" Lead Spacing
- N or T Package
- 0.010" Sensor Aperture

Description
The OPB665 series optical switches consist of a monolithic integrated circuit and an infrared emitting diode mounted on opposite sides of a 0.125" wide slot. The emitter has a 0.050" x 0.060" molded-in aperture while the sensor has a 0.010" x 0.060" molded-in aperture.

The device features TTL/LSTTL compatible logic level output, which can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

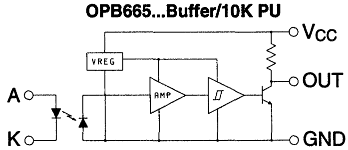
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range	-40°C to +100°C
Operating Temperature Range	-40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron]	240°C(1)
Input Diode	
Forward DC Current	50mA
Peak Forward Current (1µs pulse width, 300 pps)	3.0A
Reverse DC Voltage	3.0V
Power Dissipation	100mW(2)
Output Photologic™	
Supply Voltage, V_{CC}	18V
Duration of Output Short To V_{CC}	1.00sec
Voltage at Output	30V
Low Level Output Current (sinking)	16mA
Power Dissipation	240mW(3)

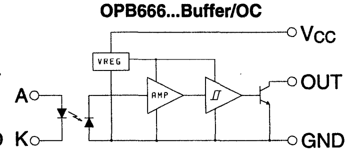
Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

Schematics

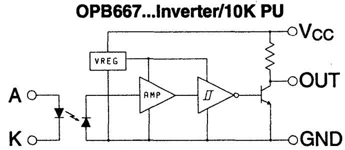
OPB665...Buffer/10K PU



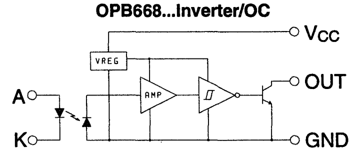
OPB666...Buffer/OC

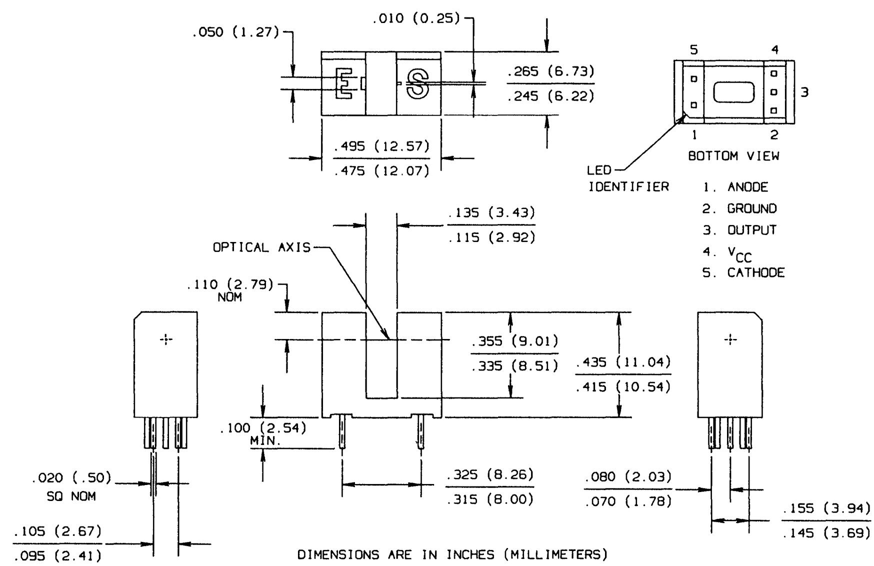


OPB667...Inverter/10K PU

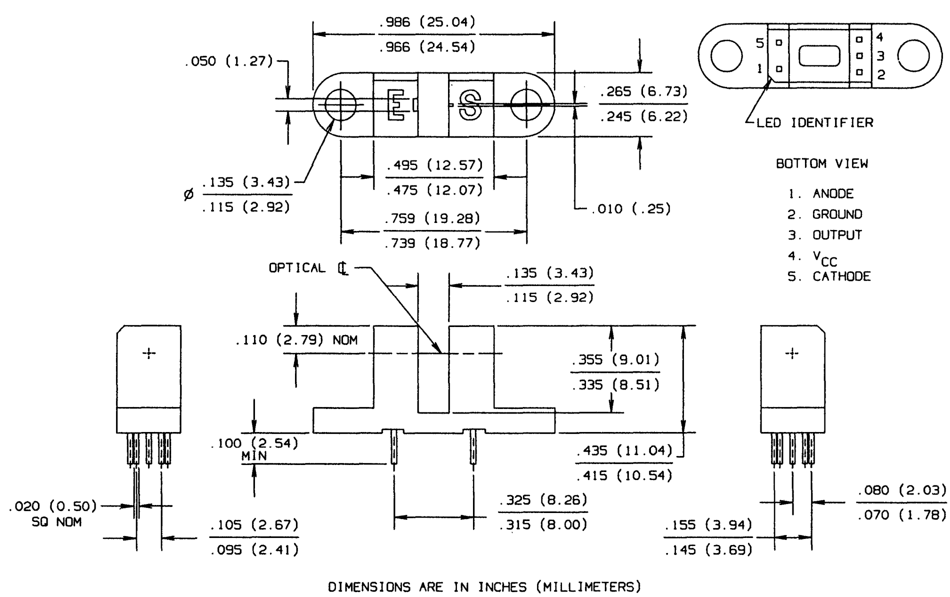


OPB668...Inverter/OC





Package N



Package T

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

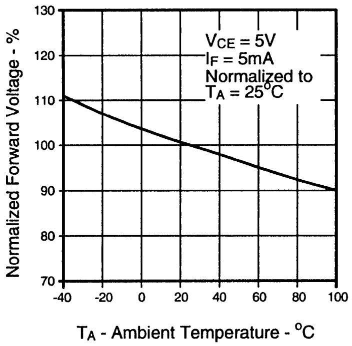
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.6	V	I_F = 10 mA
I_R	Reverse Current			100	µA	V_R = 3.0 V
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.5		16.0	V	
$I_F(+)$	LED Positive-Going Threshold Current	0.1	1.6	10	mA	V_{CC} = 5.0 V
$I_F(+)/I_F(-)$	Hysteresis Ratio	1.05	1.20	1.60		V_{CC} = 5.0 V
I_{CCH}	High Level Supply Current:					
	Buffer, 10K Pull-up OPB665 Buffer, Open-Collector OPB666		5.0	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 10 mA
	Inverter, 10K Pull-up OPB667 Inverter, Open-Collector OPB668		4.0	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 0 mA
I_{CCL}	Low Level Supply Current:					
	Buffer, 10K Pull-up OPB665		5.5	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 0 mA
	Buffer, Open-Collector OPB666		4.0	12.0		
	Inverter, 10K Pull-up OPB667		6.5	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 10 mA
	Inverter, Open-Collector OPB668		5.0	12.0		
V_{OH}	High Level Output Voltage:					
	Buffer, 10K Pull-up OPB665	(V_{CC}-1.5)(5)			V	I_{OH} = 100 µA, I_F = 10 mA
	Inverter, 10K Pull-up OPB667	(V_{CC}-1.5)(5)			V	I_{OH} = 100 µA, I_F = 0 mA(4)
I_{OH}	High Level Output Current:					
	Buffer, Open-Collector OPB666			100	µA	V_{CC} = 16 V, V_{OH} = 30 V, I_F = 10 mA
	Inverter, Open-Collector OPB668			100	µA	V_{CC} = 16 V, V_{OH} = 30 V, I_F = 0 mA
V_{OL}	Low Level Output Voltage:					
	Buffer, 10K Pull-up OPB665 Buffer, Open-Collector OPB666			0.4	V	V_{CC} = 4.5 V, I_{OL} = 16 mA, I_F = 0 mA(4)
	Inverter, 10K Pull-up OPB667 Inverter, Open-Collector OPB668			0.4	V	V_{CC} = 4.5 V, I_{OL} = 16 mA, I_F = 10 mA
t_r, t_f	Output Rise Time, Output Fall Time		30		ns	V_{CC} = 5 V, I_F = 0 or 10 mA, f = 10 kHz, D.C. = 50%, R_L = 300 Ω
t_{PLH}	Propagation Delay, Low-High					
	Buffer, 10K Pull-up OPB665 Buffer, Open-Collector OPB666		1.0		µs	
	Inverter, 10K Pull-up OPB667 Inverter, Open-Collector OPB668		2.0		µs	
t_{PHL}	Propagation Delay, High-Low					
	Buffer, 10K Pull-up OPB665 Buffer, Open-Collector OPB666		2.0		µs	
	Inverter, 10K Pull-up OPB667 Inverter, Open-Collector OPB668		1.0		µs	
Data Rate	Data Rate		100		KHz	V_{CC} = 5 V, I_F = 0 or 10 mA, D.C. = 50%, R_L = 300 Ω

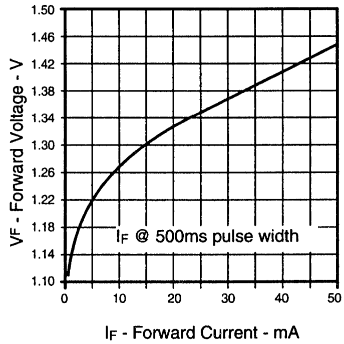
(4) Normal application would be with light source blocked, simulated by I_F = 0mA.
(5) V_{OH} = V_{CC}-1.5 for V_{CC} = 4.5V to 16V.

Typical Performance Curves

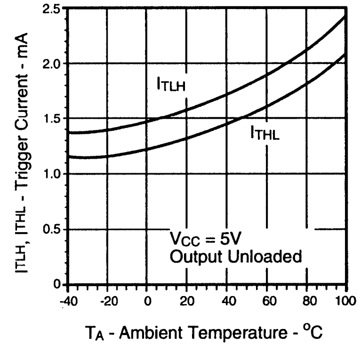
Normalized Forward Voltage vs Ambient Temperature



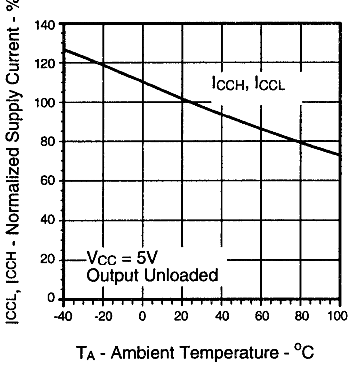
Forward Current vs Forward Voltage Input Diode



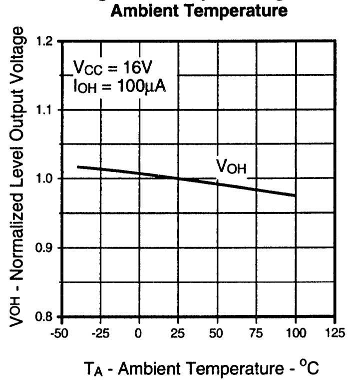
Trigger Current vs Ambient Temperature



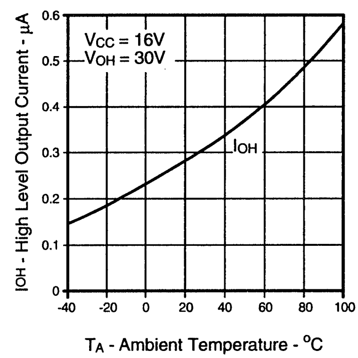
Normalized Supply Current vs Ambient Temperature



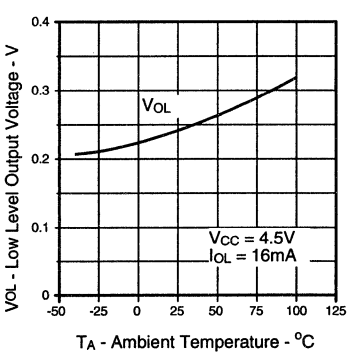
OPB665, OPB667 Normalized High Level Output Voltage vs Ambient Temperature



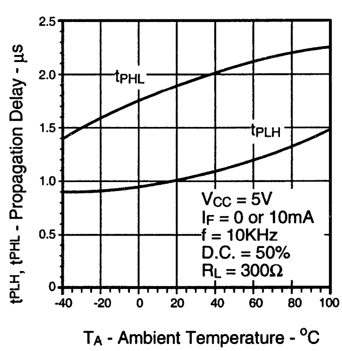
OPB666, OPB668 High Level Output Current vs Ambient Temperature



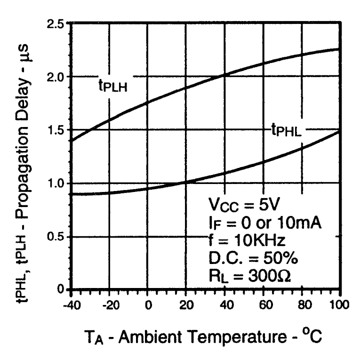
Low Level Output Voltage vs Ambient Temperature



OPB665, OPB666 Propagation Delay vs Ambient Temperature



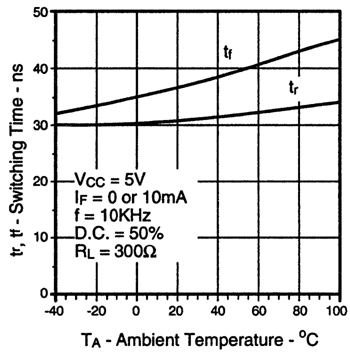
OPB667, OPB668 Propagation Delay vs Ambient Temperature



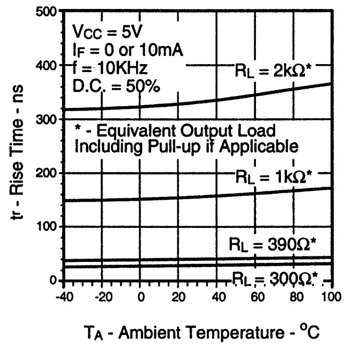
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Typical Performance Curves

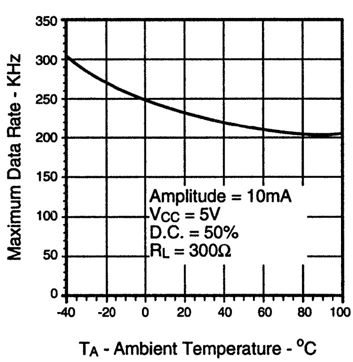
Switching Time vs Ambient Temperature



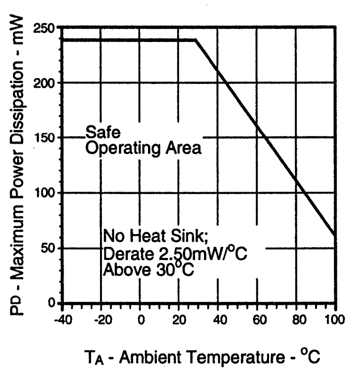
Rise Time vs Output Load vs Ambient Temperature



Maximum Data Rate vs Ambient Temperature

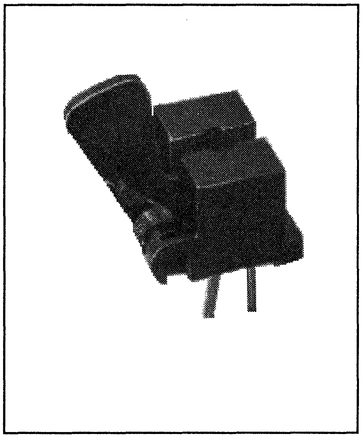


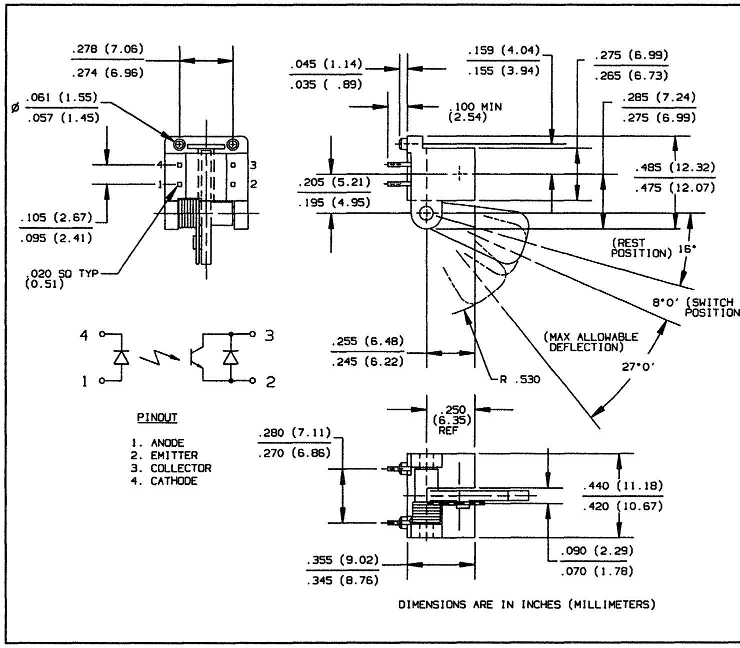
Typical Thermal Derating Curve



Product Bulletin OPB680
May 1993

Slotted Optical Flag Switch
Type OPB680





Features

- Phototransistor output
- Mechanical switch replacement
- Printed circuit board mounting
- Enhanced signal to noise ratio

Description

The OPB680 consists of an NPN phototransistor and an infrared emitting diode in a molded plastic housing. The phototransistor has an enhanced low current roll-off which improves contrast ratio and immunity to background irradiance. A lever arm actuated flag interrupts the light beam, switching the transistor output between states that can readily drive logic gates.

Customized lever arms and spring torques can be designed for specific applications.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec with soldering iron] . . . . 260°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter Reverse Current 10mA
Collector DC Current 30mA
Power Dissipation . . . . 200mW(3)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. Max. 20 grams force may be applied to leads when soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.
(4) "On" condition exists when the lever arm is in the rest position (16° from vertical) as shown in the figure.
(5) "Off" condition exists when the lever arm is deflected clockwise 8° ± 3° from the rest position (16° from vertical) as shown in the figure. Maximum allowable deflection is 35° from the rest position.
(6) From the rest position to the switch point, lever torque measured at the end of the arm is 1.5 grams max.

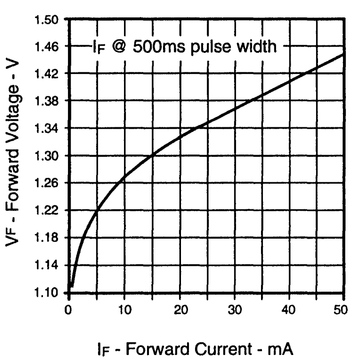
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

Type OPB680

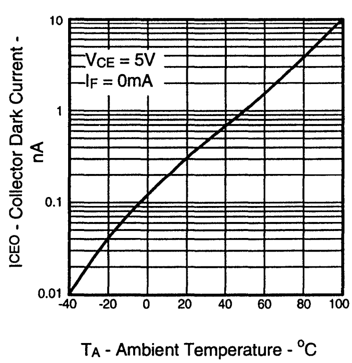
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.60	V	I_F = 10 mA
I_R	Reverse Current		100	µA	V_R = 3.0 V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100 µA
I_{ECO}	Emitter Reverse Current		100	µA	V_{EC} = 0.4 V
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 5V
Coupled					
V_{SAT}	Saturation Voltage		0.40	V	I_F = 10 mA, I_C = 100 µA, Gap unblocked
$I_{C(ON)}$	On-State Collector Current	600		µA	I_F = 10 mA, V_{CE} = 5 V

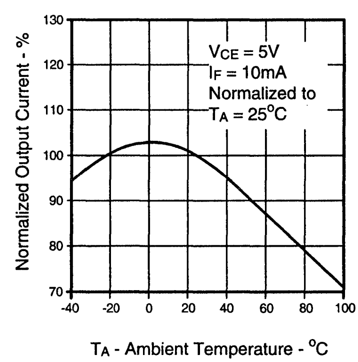
Forward Current vs Forward Voltage Input Diode



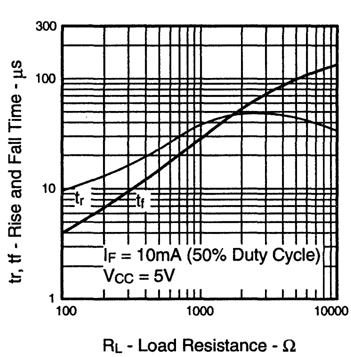
Collector Dark Current vs Ambient Temperature



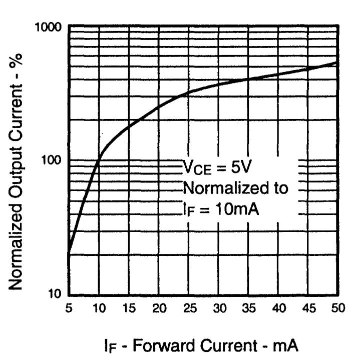
Normalized Output Current vs Ambient Temperature



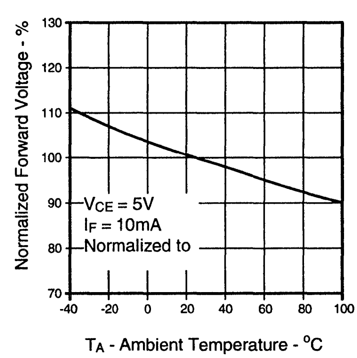
Rise and Fall Time vs Load Resistance



Normalized Output Current vs Forward Current



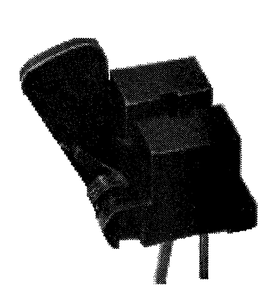
Normalized Forward Voltage vs Ambient Temperature

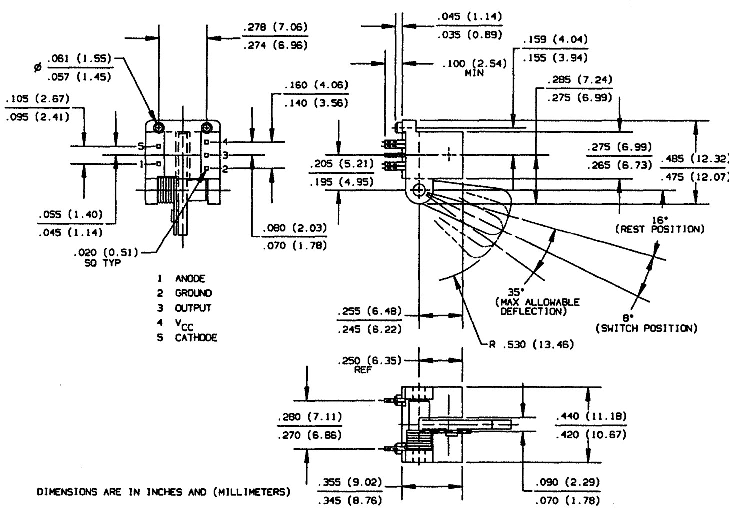


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Photologic™ Optical Flag Switch
Types OPB685, OPB686, OPB687, OPB688





Features

- Photologic™ output
- Four output options
- Mechanical switch replacement
- Printed circuit board mounting

Description

The OPB685 series flag switches consist of an infrared emitting diode and a monolithic integrated circuit, which incorporates a photodiode, a linear amplifier and a Schmitt trigger. A lever arm actuated flag interrupts the light beam switching the output between states that can readily drive logic gates.

Customized lever arms and spring torques can be designed for specific applications.

The device features TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +100°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 sec. with soldering iron] . . . . 240°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(2)

Output Photologic™

Supply Voltage, V_{CC} 18V
Duration of Output Short To V_{CC} 1.00sec
Voltage at Output 30V
Low Level Output Current (sinking) 16mA
Power Dissipation . . . . 240mW(3)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Derate linearly 2.50 mW/°C above 30°C.

Types OPB685, OPB686, OPB687, OPB688

Electrical Characteristics (T_A = 25°C unless otherwise noted)

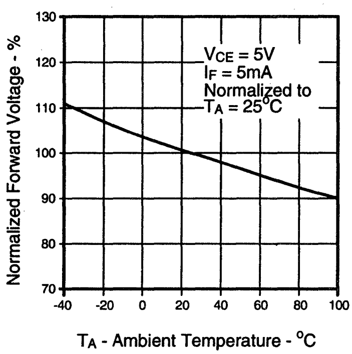
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.6	V	I_F = 10 mA
I_R	Reverse Current				100	μA	V_R = 3.0 V
Output Photologic™ Sensor							
V_{CC}	Operating D.C. Supply Voltage		4.5		16.0	V	
$I_F(+)$	LED Positive-Going Threshold Current		0.1	1.8	10.0	mA	V_{CC} = 5.0 V
$I_F(+)/I_F(-)$	Hysteresis Ratio		1.05	1.20	1.60		V_{CC} = 5.0 V
I_{CCH}	High Level Supply Current:						
	Buffer, 10K Pull-up	OPB685		5.0	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 10 mA
	Buffer, Open-Collector	OPB686					
	Inverter, 10K Pull-up	OPB687		4.0	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 0 mA
	Inverter, Open-Collector	OPB688					
I_{CCL}	Low Level Supply Current:						
	Buffer, 10K Pull-up	OPB685		5.5	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 0 mA
	Buffer, Open-Collector	OPB686		4.0	12.0		
	Inverter, 10K Pull-up	OPB687		6.5	12.0	mA	V_{CC} = 16 V, No Load On Output, I_F = 10 mA
	Inverter, Open-Collector	OPB688		5.0	12.0		
V_{OH}	High Level Output Voltage:						
	Buffer, 10K Pull-up	OPB685	$(V_{CC}-1.5)$(5)			V	I_{OH} = 100 μA, I_F = 10 mA
	Inverter, 10K Pull-up	OPB687	$(V_{CC}-1.5)$(5)			V	I_{OH} = 100 μA, I_F = 0 mA(4)
I_{OH}	High Level Output Current:						
	Buffer, Open-Collector	OPB686			100	μA	V_{CC} = 16 V, V_{OH} = 30 V, I_F = 10 mA
	Inverter, Open-Collector	OPB688			100	μA	V_{CC} = 16 V, V_{OH} = 30 V, I_F = 0 mA
V_{OL}	Low Level Output Voltage:						
	Buffer, 10K Pull-up	OPB685			0.4	V	V_{CC} = 4.5 V, I_{OL} = 16 mA, I_F = 0 mA(4)
	Buffer, Open-Collector	OPB686					
	Inverter, 10K Pull-up	OPB687			0.4	V	V_{CC} = 4.5 V, I_{OL} = 16 mA, I_F = 10 mA
	Inverter, Open-Collector	OPB688					
t_r, t_f	Output Rise Time, Output Fall Time			30		ns	V_{CC} = 5 V, I_F = 0 or 10 mA, f = 10 kHz, D.C. = 50%, R_L = 300 Ω
t_{PLH}	Propagation Delay, Low-High						
	Buffer, 10K Pull-up	OPB685		1.0		μs	
	Buffer, Open-Collector	OPB686					
	Inverter, 10K Pull-up	OPB687		2.0		μs	
	Inverter, Open-Collector	OPB688					
t_{PHL}	Propagation Delay, High-Low						
	Buffer, 10K Pull-up	OPB685		2.0		μs	
	Buffer, Open-Collector	OPB686					
	Inverter, 10K Pull-up	OPB687		1.0		μs	
	Inverter, Open-Collector	OPB688					

(4) Normal application would be with light source blocked, simulated by I_F = 0mA.
(5) $V_{OH} = V_{CC}$-1.5V for V_{CC} = 4.5V to 16V.

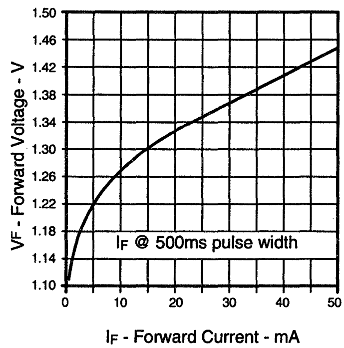
SLOTTED OPTICAL SWITCHES

Typical Performance Curves

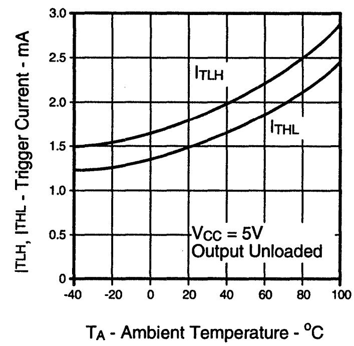
Normalized Forward Voltage vs Ambient Temperature



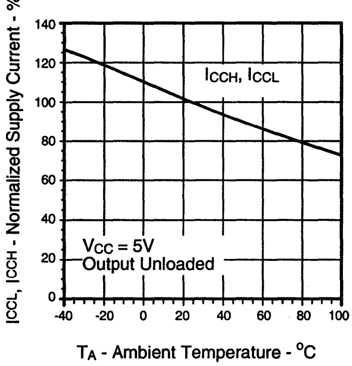
Forward Current vs Forward Voltage Input Diode



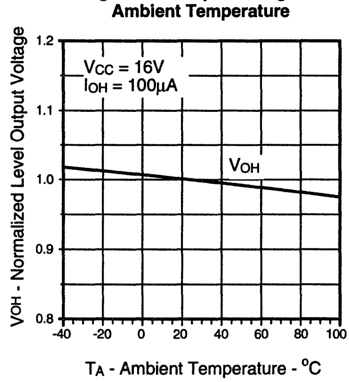
Trigger Current vs Ambient Temperature



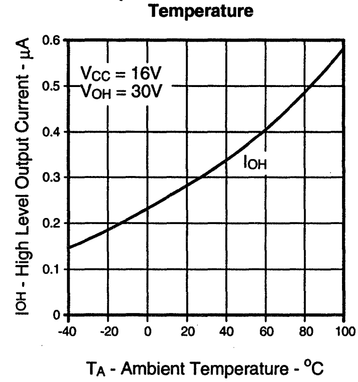
Normalized Supply Current vs Ambient Temperature



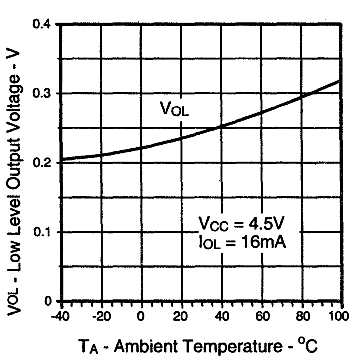
OPB685, OPB687 Normalized High Level Output Voltage vs Ambient Temperature



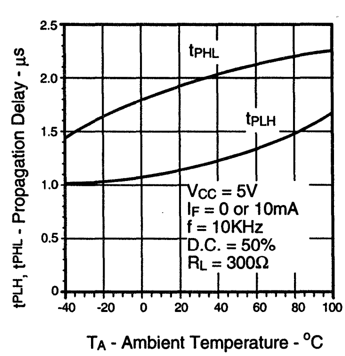
OPB686, OPB688 High Level Output Current vs Ambient Temperature



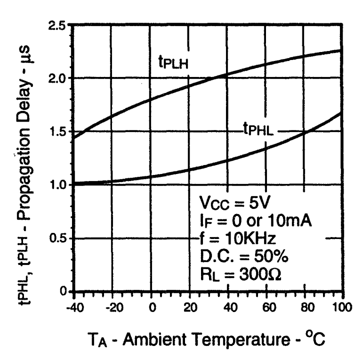
Low Level Output Voltage vs Ambient Temperature



OPB685, OPB686 Propagation Delay vs Ambient Temperature



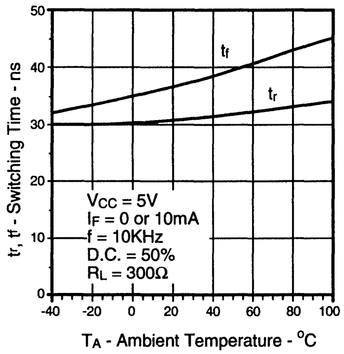
OPB687, OPB688 Propagation Delay vs Ambient Temperature



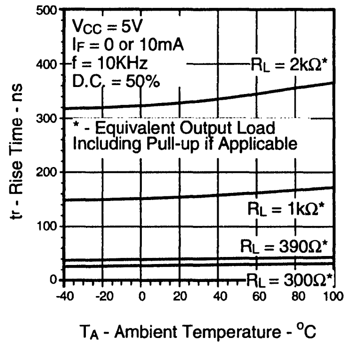
SLOTTED OPTICAL SWITCHES

Typical Performance Curves

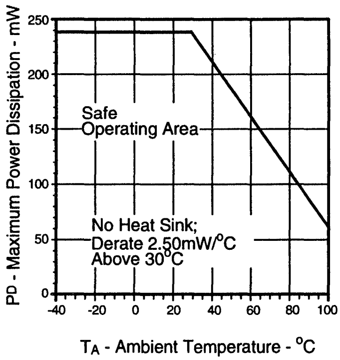
Switching Time vs Ambient Temperature



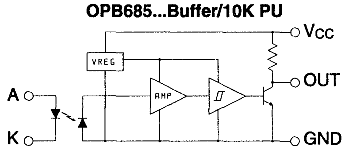
Rise Time vs Output Load vs Ambient Temperature



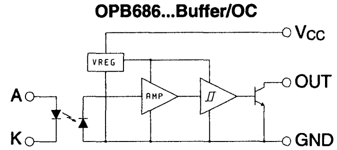
Typical Thermal Derating Curve



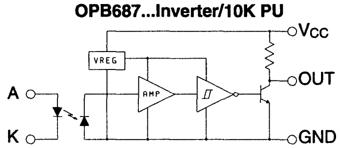
OPB685...Buffer/10K PU



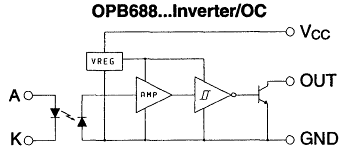
OPB686...Buffer/OC



OPB687...Inverter/10K PU



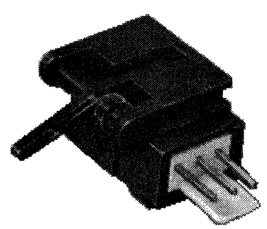
OPB688...Inverter/OC

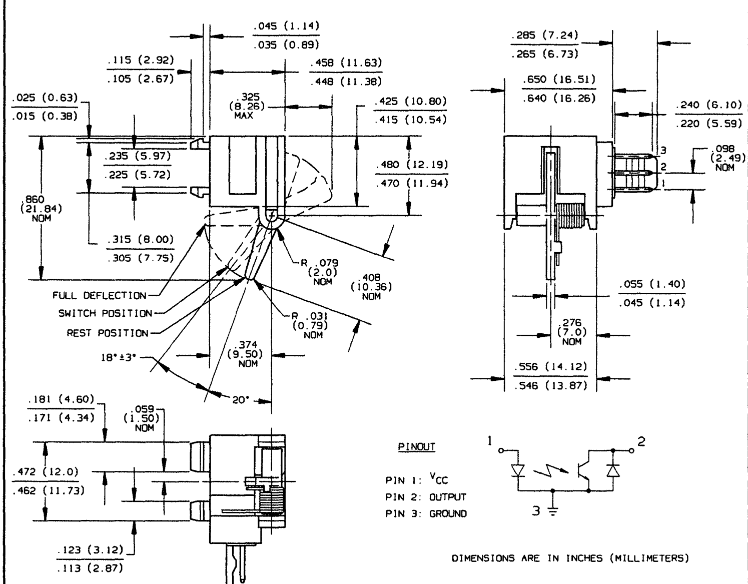


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB690
May 1993

Slotted Optical Flag Switch
Type OPB690





Features

- Phototransistor output
- Mechanical switch replacement
- 3-pin connector (Ho Tien L2561-03), Molex compatible connector 5102 series housing and 5103 series terminal
- Enhanced signal to noise ratio

Description

The OPB690 consists of an NPN phototransistor and an infrared emitting diode in a molded plastic housing. The phototransistor has an enhanced low current roll-off which improves contrast ratio and immunity to background irradiance. A lever arm actuated flag interrupts the light beam, switching the transistor output between states that can readily drive logic gates.

This switch is designed to easily snap mount into a 0.039" (1 mm) (19 ga) thick material with a rectangular opening of 0.315" x 0.472" (8 mm x 12 mm).

Customized lever arms and spring torques can be designed for specific applications.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -40°C to +100°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter Reverse Current 10mA
Collector DC Current 30mA
Power Dissipation .... 200mW(2)

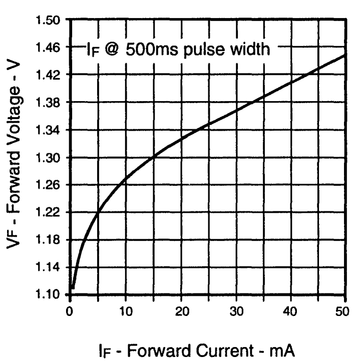
Notes:
(1) Derate linearly 1.33 mW/°C above 25°C.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) "Off" condition exists when the lever arm is in the rest position (20° from vertical) as shown in the figure.
(4) "On" condition exists when the lever arm is deflected clockwise 18° +/- 3° form the rest position (20° from vertical) as shown in the figure.
(5) From the rest position to the switch point, lever torque measured at the end of the arm is 1.5 grams max.

Type OPB690

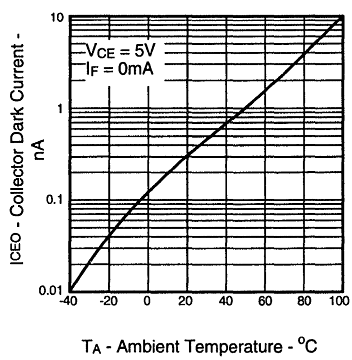
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.6	V	$I_F = 10$ mA
I_R	Reverse Current		100	µA	$V_R = 3.0$ V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 100$ µA
I_{ECO}	Emitter Reverse Current		100	µA	$V_{EC} = 0.4$ V
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 5$ V
Coupled					
V_{SAT}	Saturation Voltage		0.4	V	$I_F = 10$ mA, $I_C = 100$ µA, Gap unblocked
$I_{C(ON)}$	On-State Collector Current	600		µA	$I_F = 10$ mA, $V_{CE} = 5$ V

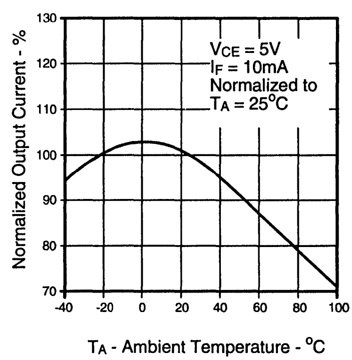
Forward Current vs Forward Voltage Input Diode



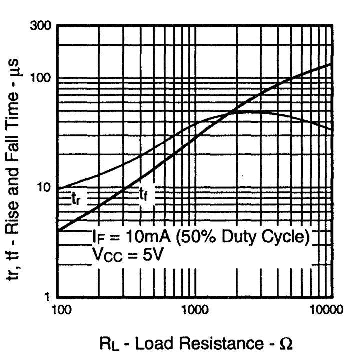
Collector Dark Current vs Ambient Temperature



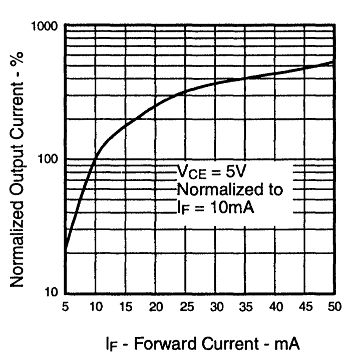
Normalized Output Current vs Ambient Temperature



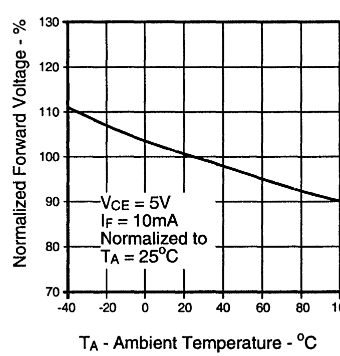
Rise and Fall Time vs Load Resistance



Normalized Output Current vs Forward Current



Normalized Forward Voltage vs Ambient Temperature



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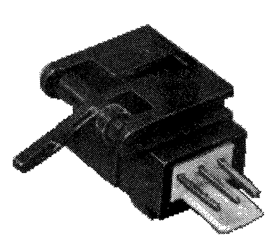
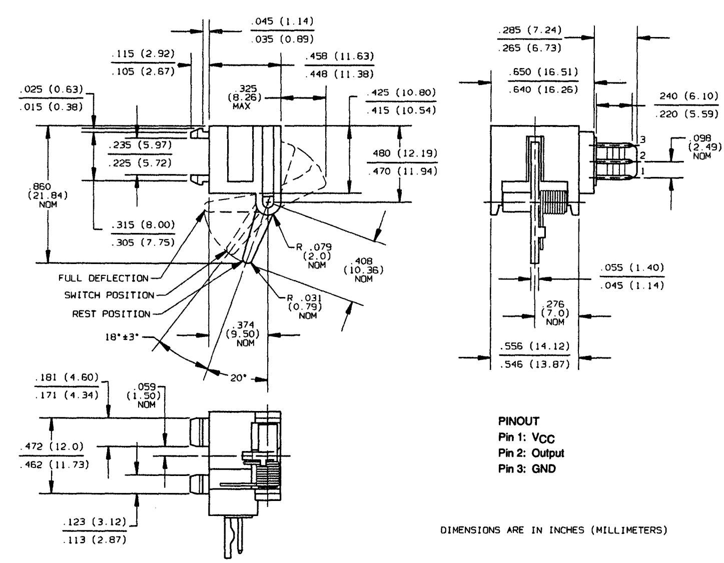
OPTEK

Photologic™ Optical Flag Switch
Types OPB695, OPB696, OPB697, OPB698 Series





Features

- Photologic™ output
- Four output options
- Mechanical switch replacement
- 3-pin connector (Ho Tien L2561-03), Molex compatible connector 5102 series housing and 5103 series terminal

Description

The OPB695 series flag switches consist of an infrared emitting diode and a monolithic integrated circuit, which incorporates a photodiode, a linear amplifier, and a Schmitt trigger. A lever arm actuated flag interrupts the light beam switching the output between states that can readily drive logic gates.

This switch is designed to easily snap mount into a 0.039" (1 mm) (19 ga) thick material with a rectangular opening of 0.315" x 0.472" (8 mm x 12 mm).

Customized lever arms and spring torques can be designed for specific applications.

The device features TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over a voltage range from 4.5V to 16V.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range . . . . -40°C to +100°C
Operating Temperature Range . . . . -40°C to +100°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 3.0V
Power Dissipation . . . . 100mW(1)

Output Photologic™

Supply Voltage, V_{CC} 18V
Duration of Output Short To V_{CC} 1.00sec
Voltage at Output 30V
Low Level Output Current (sinking) 16mA
Power Dissipation . . . . 240mW(2)

Notes:
(1) Derate linearly 1.33 mW/°C above 25°C.
(2) Derate linearly 2.50 mW/°C above 30°C.

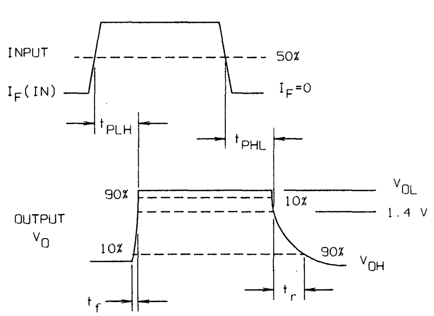
Types OPB695, OPB696, OPB697, OPB698 Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.6	V	I_F = 10mA
I_R	Reverse Current			100	µA	V_R = 3.0V
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage					
	OPB695A, 696A, 697A, 698A	4.5	5.0	8.0	V	
	OPB695B, 696B, 697B, 698B	8.0	12.0	13.5	V	
	OPB695C, 696C, 697C, 698C	13.5	15.0	16.0	V	
I_{CC}	Operating Supply Current		20.0	30.0	mA	
V_{OH}	High Level Output Voltage:					
	Buffer, 10K Pull-up OPB695A/B/C	V_{CC}-1.5			V	I_{OH} = 100µA, Unblocked
	Inverter, 10K Pull-up OPB697A/B/C	V_{CC}-1.5			V	I_{OH} = 100µA, Blocked(4)
I_{OH}	High Level Output Current:					
	Buffer, Open-Collector OPB696A			100	µA	V_{CC} = 4.5 to 8V, V_{OH} = 30V, Unblocked
	OPB696B			100	µA	V_{CC} = 8 to 13.5V, V_{OH} = 30V, Unblocked
	OPB696C			100	µA	V_{CC} = 13.5 to 16V, V_{OH} = 30V, Unblocked
	Inverter, Open-Collector OPB698A			100	µA	V_{CC} = 4.5 to 8V, V_{OH} = 30V, Blocked(4)
	OPB698B			100	µA	V_{CC} = 8 to 13.5V, V_{OH} = 30V, Blocked(4)
	OPB698C			100	µA	V_{CC} = 13.5 to 16V, V_{OH} = 30V, Blocked(4)
V_{OL}	Low Level Output Voltage: Buffer, 10K Pull-up OPB695A/B/C Buffer, Open-Collector OPB696A/B/C			0.4	V	V_{CC} = 4.5 to 8V, I_{OL} = 16mA, Blocked(4) V_{CC} = 8 to 13.5V, I_{OL} = 16mA, Blocked(4) V_{CC} = 13.5 to 16V, I_{OL} = 16mA, Blocked(4)
	Inverter, 10K Pull-up OPB697A/B/C Inverter, Open-Collector OPB698A/B/C			0.4	V	V_{CC} = 4.5 to 8V, I_{OL} = 16mA, Unblocked V_{CC} = 8 to 13.5V, I_{OL} = 16mA, Unblocked V_{CC} = 13.5 to 16V, I_{OL} = 16mA, Unblocked

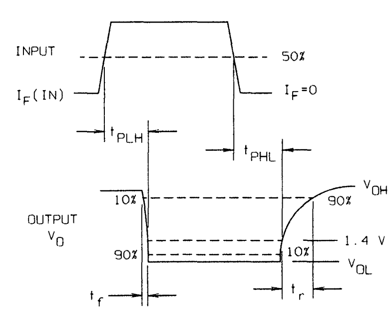
(4) Test requires lever arm in "blocked" position .

SWITCHING TEST CURVE FOR BUFFERS



LED: f=10 kHz. D.C.=50%

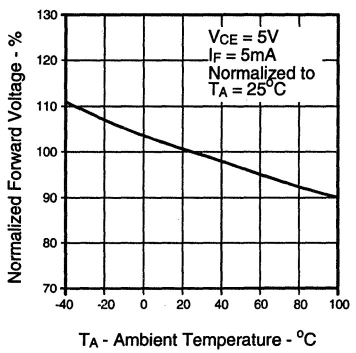
SWITCHING TEST CURVE FOR INVERTERS



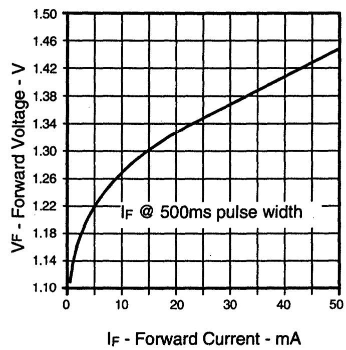
LED: f=10 kHz. D.C.=50%

Typical Performance Curves

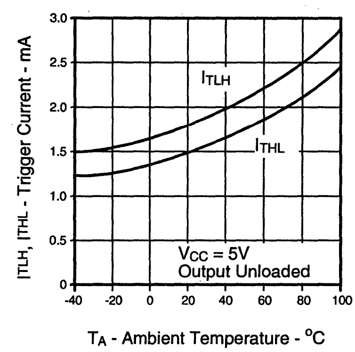
Normalized Forward Voltage vs Ambient Temperature



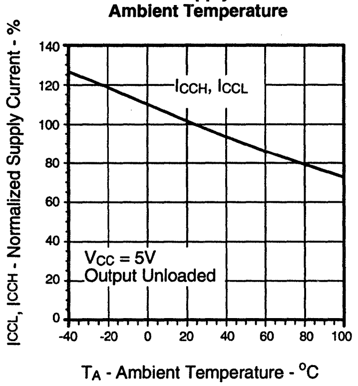
Forward Current vs Forward Voltage Input Diode



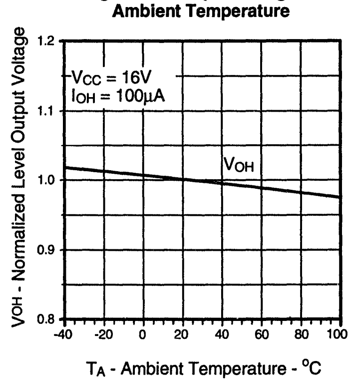
Trigger Current vs Ambient Temperature



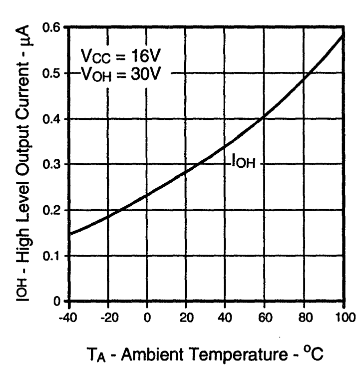
Normalized Supply Current vs Ambient Temperature



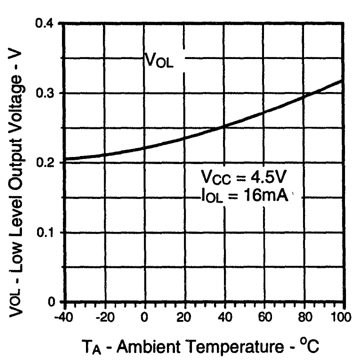
OPB695, OPB697 Normalized High Level Output Voltage vs Ambient Temperature



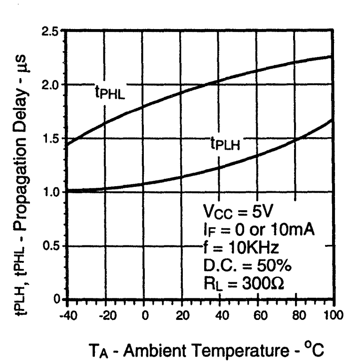
OPB696, OPB698 High Level Output Current vs Ambient



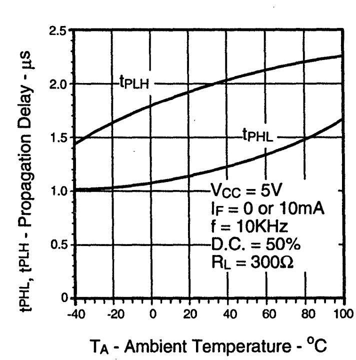
Low Level Output Voltage vs Ambient Temperature



OPB695, OPB696 Propagation Delay vs Ambient Temperature



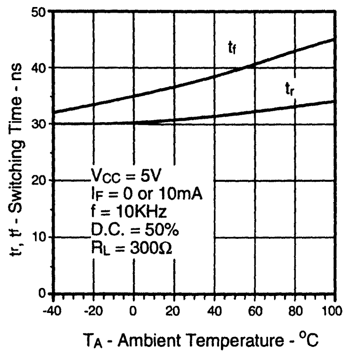
OPB697, OPB698 Propagation Delay vs Ambient Temperature



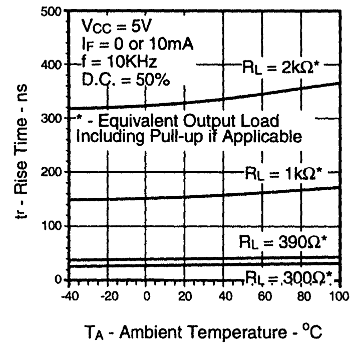
Types OPB695, OPB696, OPB697, OPB698 Series

Typical Performance Curves

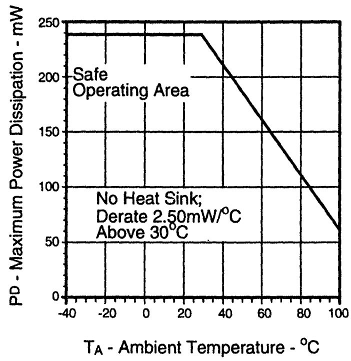
Switching Time vs Ambient Temperature



Rise Time vs Output Load vs Ambient Temperature



Typical Thermal Derating Curve



PART NUMBER GUIDE

OPB 6 9 X X

Operating D.C. Supply Voltage:

A - $4.5V \leq V_{CC} \leq 8.0V$
B - $8.0V \leq V_{CC} \leq 13.5V$
C - $13.5V \leq V_{CC} \leq 16.0V$

Electrical Specification Variations:

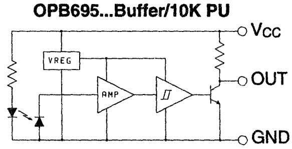
5 - Buffer, 10K Pull-up

6 - Buffer, Open-Collector

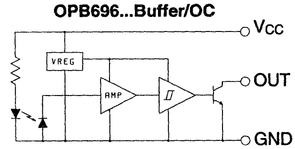
7 - Inverter, 10K Pull-up

8 - Inverter, Open-Collector

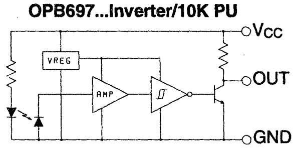
OPB695...Buffer/10K PU



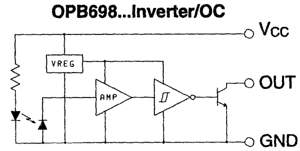
OPB696...Buffer/OC



OPB697...Inverter/10K PU



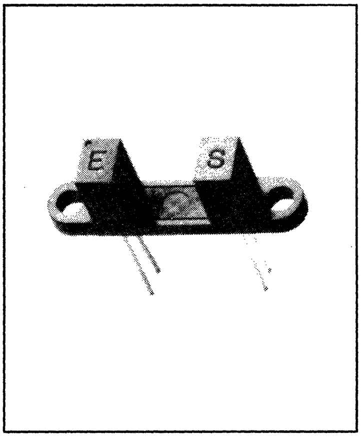
OPB698...Inverter/OC

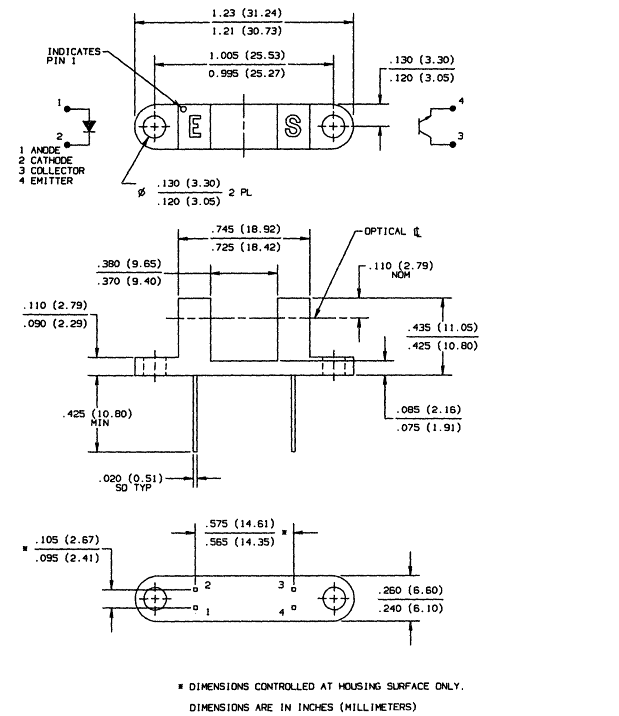


SLOTTED OPTICAL SWITCHES

OPTEK

Wide Gap Slotted Optical Switches
Types OPB800L, OPB810L Series





Features

- 0.375" wide gap
- Choice of aperture size
- Choice of minimum photocurrent
- Choice of opaque or IR transmissive shells
- 0.570" lead spacing

Description

The OPB800L/OPB810L series of wide gap slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing utilizing a .375" wide slot, the user can specify (1) electrical output parameters, (2) discrete shell material and (3) aperture width. Available with wire leads as OPB800W/OPB810W.

Replaces

KT800L - KT810L series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C(1)
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:
(1) Derate linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Types OPB800L, OPB810L Series

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	$I_F = 20mA$
I_R	Reverse Current			100	μA	$V_R = 2.0V$
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current			100	nA	$V_{CE} = 10.0V$
Coupled						
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage					
	Parameter A	OPB800L / OPB810L		0.4	V	$I_C = 250\mu A$, $I_F = 20mA$
	Parameter B	OPB801L / OPB811L		0.4	V	$I_C = 500\mu A$, $I_F = 10mA$
	Parameter C	OPB802L / OPB812L		0.6	V	$I_C = 1800\mu A$, $I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current					
	Parameter A	OPB800L / OPB810L	500		μA	$V_{CE} = 10.0V$, $I_F = 20.0mA$
	Parameter B	OPB801L / OPB811L	1000		μA	$V_{CE} = 5.0V$, $I_F = 10.0mA$
	Parameter C	OPB802L / OPB812L	1800		μA	$V_{CE} = 0.6V$, $I_F = 20.0mA$

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

PART NUMBER GUIDE

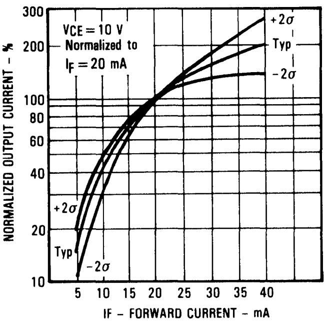
OPB 8 X X X X X

- Optek Assembly
- Phototransistor Output Family
- Discrete Shell Material Designation
  - 0 - Transmissive Plastic Discrete Shell
  - 1 - Opaque Plastic Discrete Shell
- Mechanical And Electrical Specification Variations
  - 0 - Electrical Parameter A
  - 1 - Electrical Parameter B
  - 2 - Electrical Parameter C
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter
  - 5 = 0.050"
- Aperture Width In Front of Sensor
  - 5 = 0.050" 1 = 0.010"*

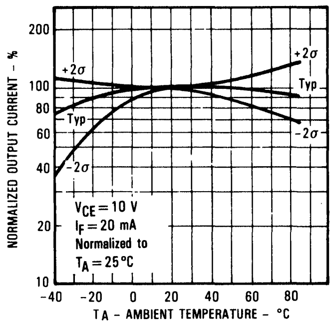
*Assemblies with 0.010" apertures are currently available with electrical parameter "A" only.

Typical Performance Curves

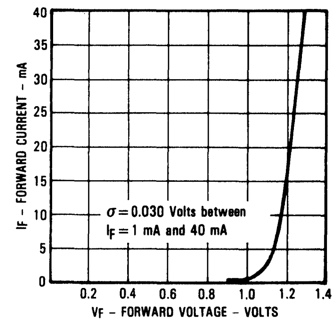
Normalized Output Current vs Forward Current



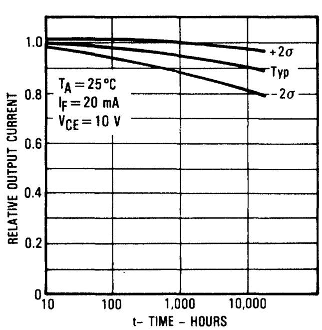
Normalized Output Current vs Ambient Temperature



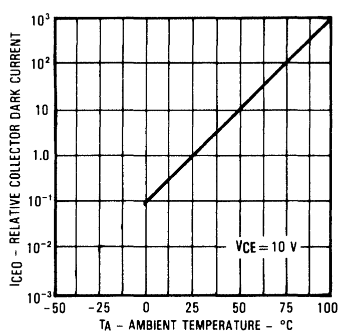
Forward Current vs Forward Voltage Input Diode



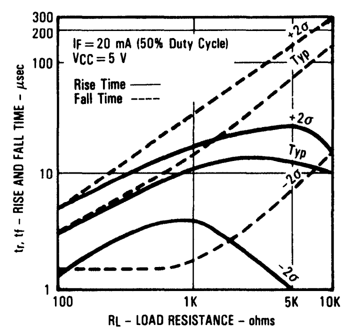
Relative Output Current vs Time



Collector Dark Current vs Ambient Temperature

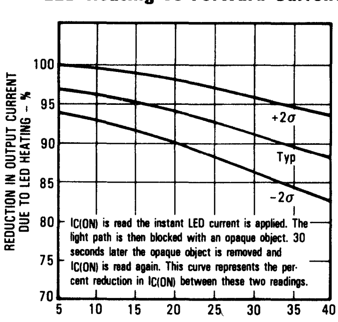


Rise and Fall Time vs Load Resistance

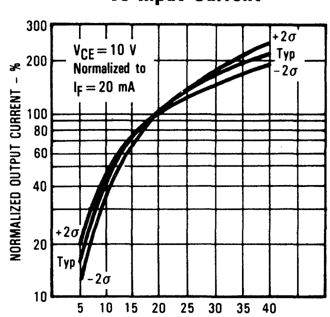


All Part Numbers Ending in "1"

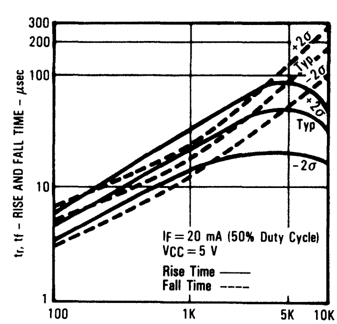
Reduction in Output Current Due to LED Heating vs Forward Current



Normalized Output Current vs Input Current

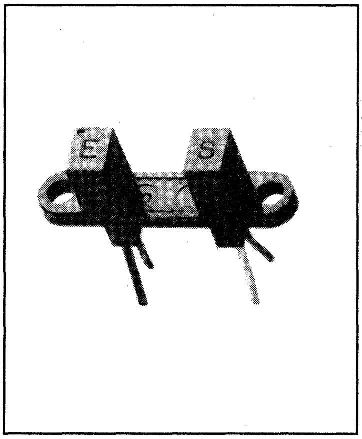


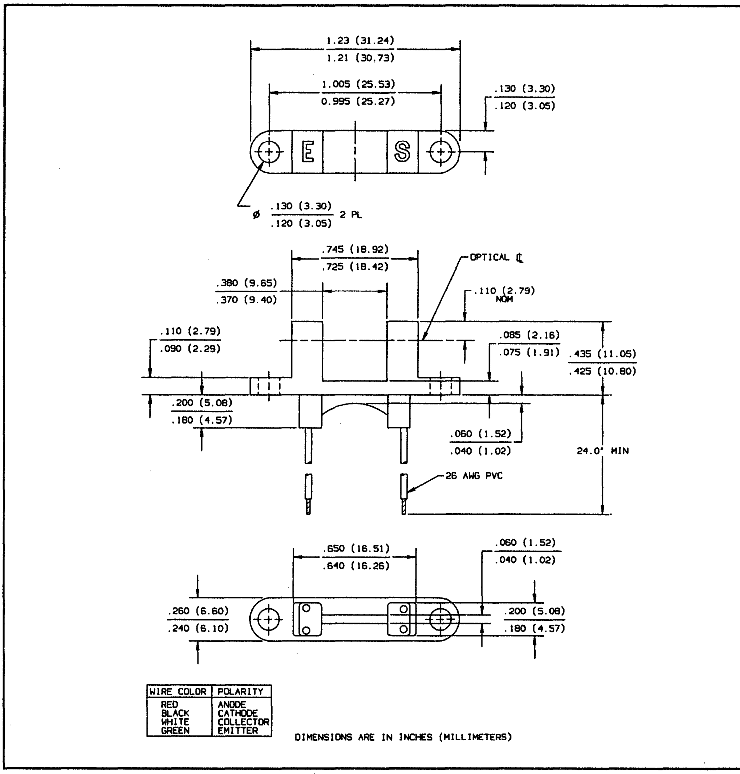
Rise and Fall Time vs Load Resistance



OPTEK

Wide Gap Slotted Optical Switches
Types OPB800W, OPB810W Series





Features

- Choice of aperture size
- Choice of minimum photocurrent
- Choice of opaque or IR transmissive shells
- 24" min 26 AWG PVC lead wires

Description

The OPB800W/OPB810W series of wide gap slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing utilizing a .375" wide slot, the user can specify (1) electrical output parameters, (2) discrete shell material and (3) aperture width. Available with PC board mountable leads as OPB800L/OPB810L.

Replaces

KT800W - KT810W series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation.. 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation.. 100mW(1)

Notes:
(1) Derate linearly 1.82mW/°C above 25°C.
(2) All parameters tested using pulse technique.
(3) Wire terminations 24" of 7 strand, 26 AWG, UL 1429 insulated wire on each terminal. The devices incorporate a wire strain relief at the housing surface. The insulation functions and colors are:

RED - IRED Anode	WHITE - Phototransistor Collector
BLACK - IRED Cathode	GREEN - Phototransistor Emitter

Other wire lengths and/or colors differing from the standard series are available.

Types OPB800W, OPB810W Series

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	$I_F = 20mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V$
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage				
	Parameter A OPB800W / OPB810W		0.4	V	$I_C = 250\mu A$, $I_F = 20mA$
	Parameter B OPB801W / OPB811W		0.4	V	$I_C = 500\mu A$, $I_F = 10mA$
	Parameter C OPB802W / OPB812W		0.6	V	$I_C = 1800\mu A$, $I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current				
	Parameter A OPB800W / OPB810W	500		μA	$V_{CE} = 10.0V$, $I_F = 20.0mA$
	Parameter B OPB801W / OPB811W	1000		μA	$V_{CE} = 5.0V$, $I_F = 10.0mA$
	Parameter C OPB802W / OPB812W	1800		μA	$V_{CE} = 0.6V$, $I_F = 20.0mA$

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation

0 - Transmissive Plastic Discrete Shell

1 - Opaque Plastic Discrete Shell

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"*

Aperture Width In Front of Emitter
5 = 0.050"

Mounting Configurations

L - Solder Leads Termination
W - Wire Termination

Mechanical And Electrical Specification Variations

0 - Electrical Parameter A

1 - Electrical Parameter B

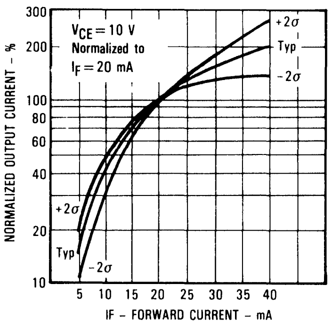
2 - Electrical Parameter C

*Assemblies with 0.010" apertures are currently available with electrical parameter "A" only.

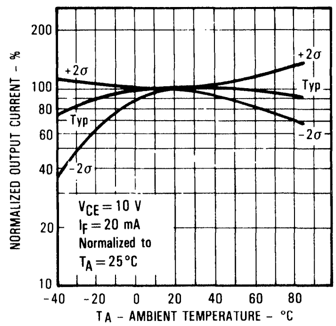
Types OPB800W, OPB810W Series

Typical Performance Curves

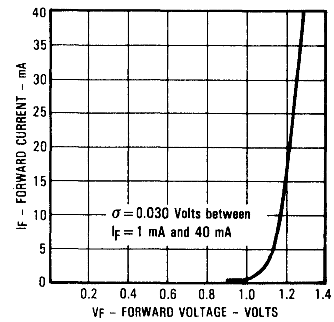
Normalized Output Current vs Forward Current



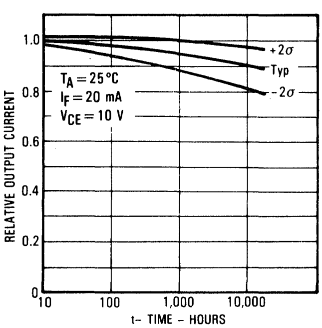
Normalized Output Current vs Ambient Temperature



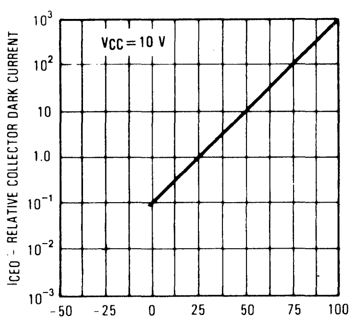
Forward Current vs Forward Voltage Input Diode



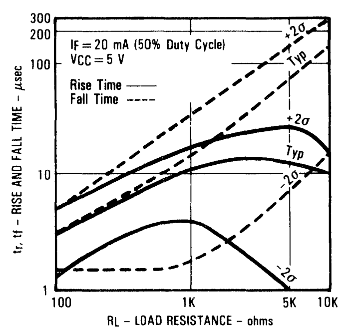
Relative Output Current vs Time



Collector Dark Current vs Ambient Temperature

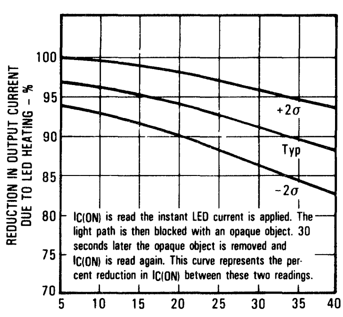


Rise and Fall Time vs Load Resistance

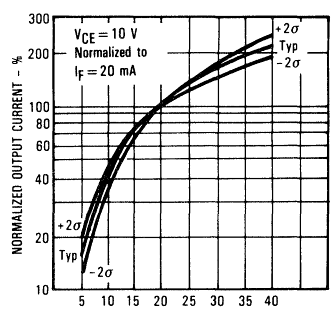


All Part Numbers Ending in "1"

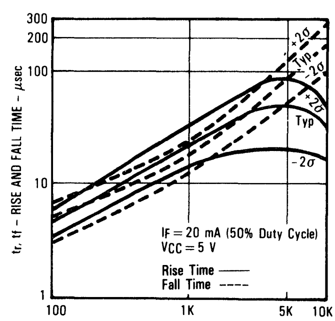
Reduction in Output Current Due to LED Heating vs Forward Current



Normalized Output Current vs Input Current



Rise and Fall Time vs Load Resistance

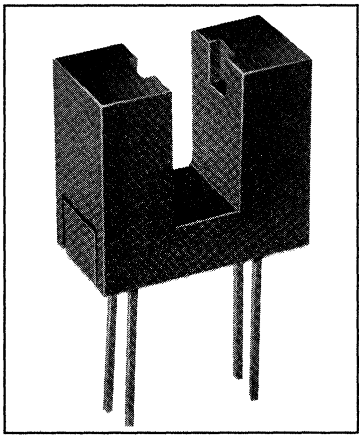


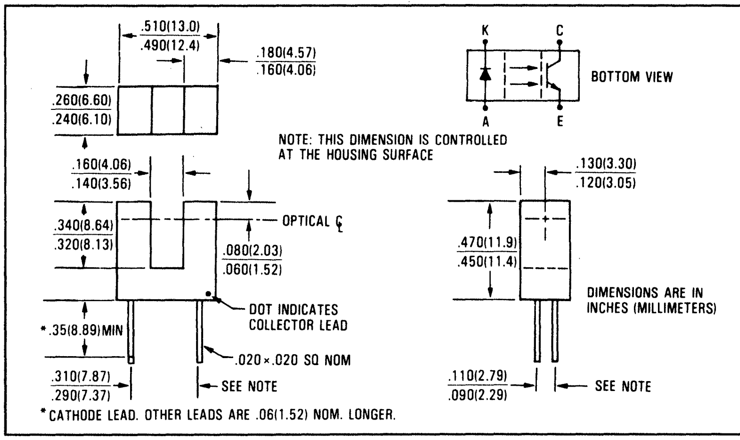
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB804
May 1993

OPTEK

Slotted Optical Switch
Type OPB804





Features

- Non-contact switching
- Printed circuit board mounting
- 0.155" wide slot
- 0.300" lead spacing

Description

The OPB804 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost plastic housing on opposite sides of a 0.155" (3.94mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C[(1)]

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW[(2)]

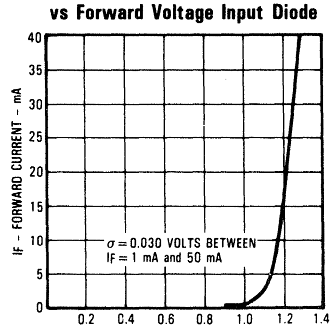
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW[(2)]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diode



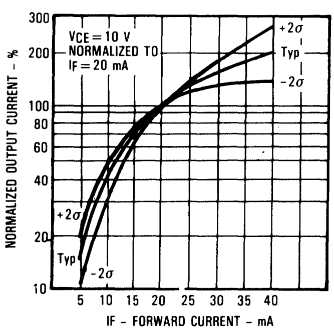
Type OPB804

Electrical Characteristics ($T_A = 25^{\circ}C$ unless otherwise noted)

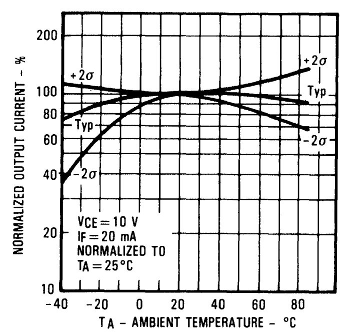
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20mA$
I_R	Reverse Current		100	µA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.00mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e = 0$
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	$I_C = 250\mu A$, $I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	500		µA	$V_{CE} = 10.0V$, $I_F = 20mA$

Typical Performance Curves

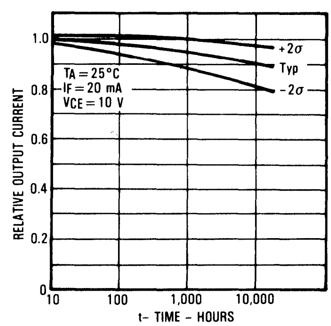
Normalized Output Current vs Forward Current



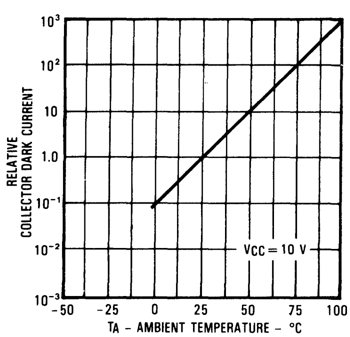
Normalized Output Current vs Ambient Temperature



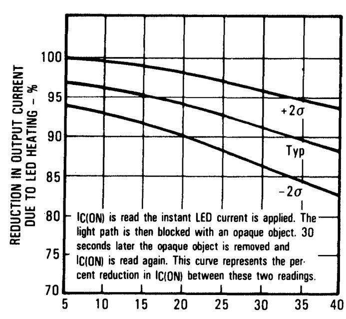
Relative Output Current vs Time



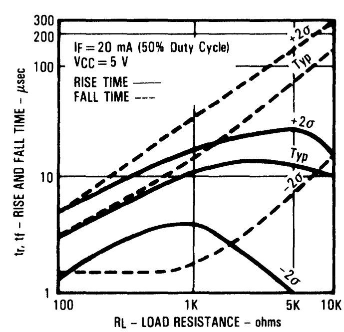
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current

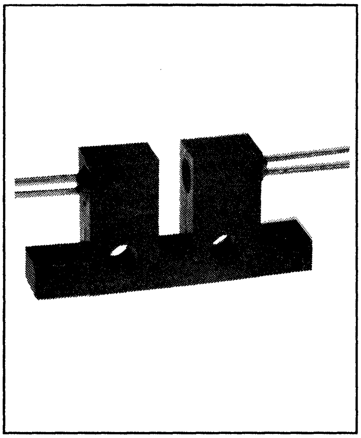


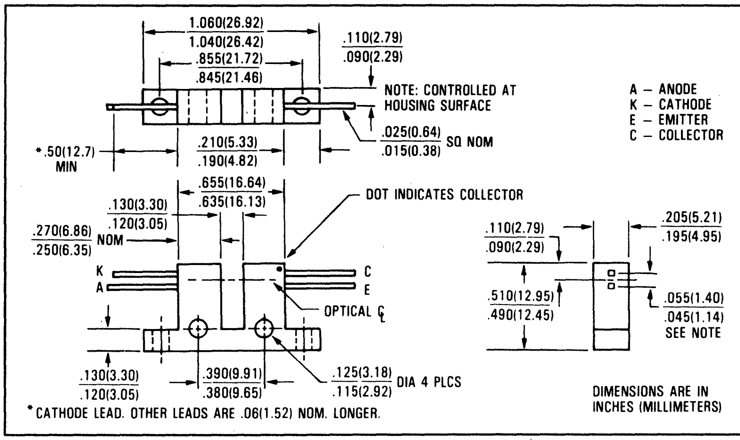
Rise and Fall Time vs Load Resistance



OPTEK

Slotted Optical Switch
Type OPB806





Features

- Non-contact switching
- Base or side mounting
- 0.125" wide slot
- Fast switching speed

Description

The OPB806 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost plastic housing on opposite sides of a 0.125" (3.18mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

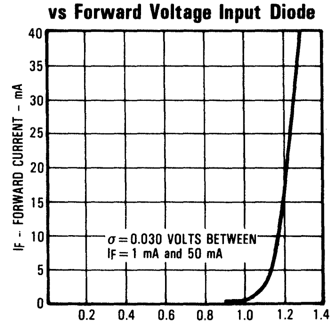
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diode



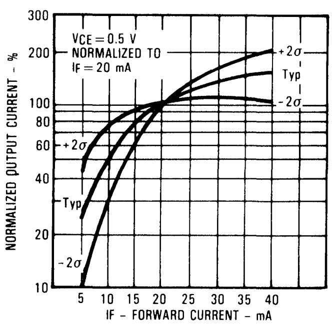
Type OPB806

Electrical Characteristics (T_A = 25°C unless otherwise noted)

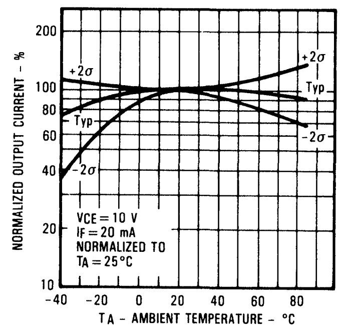
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100μA,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA,
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.50	V	I_C = 200μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	0.40		mA	V_{CE} = 0.5V, I_F = 20mA

Typical Performance Curves

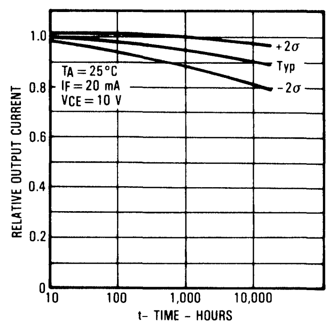
Normalized Output Current vs Forward Current



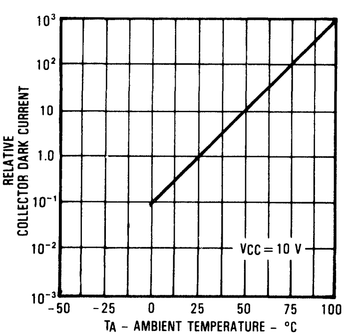
Normalized Output Current vs Ambient Temperature



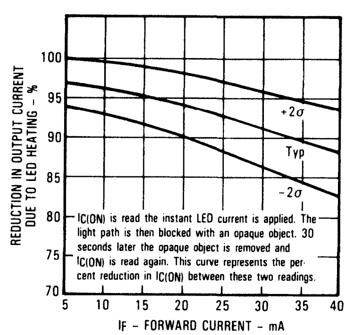
Relative Output Current vs Time



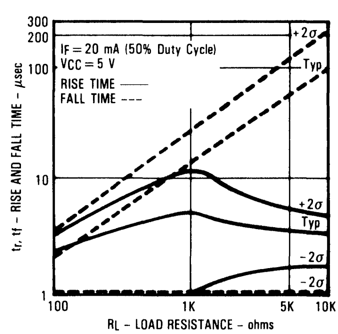
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current



Rise and Fall Time vs Load Resistance



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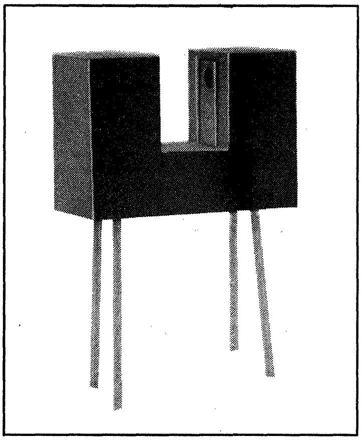
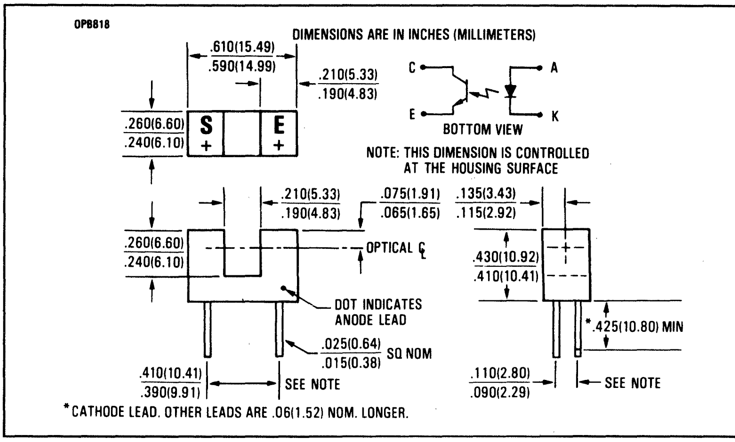
Product Bulletin OPB818
May 1993

Slotted Optical Switch
Type OPB818





Features

- Non-contacting switching
- For direct PC board or dual-in-line socket mounting
- 0.400" lead spacing
- 0.200" wide slot

Description

The OPB818 consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.200" (5.08mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. The OPB818 is designed for direct soldering into PC Boards or mounting in standard dual-in-line sockets.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . . 240°C[1]

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . . 100mW[2]

Output Phototransistor

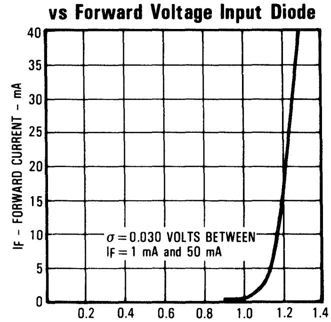
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . . 100mW[2]

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max when wave soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diode



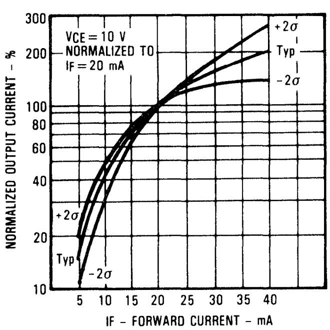
Type OPB818

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

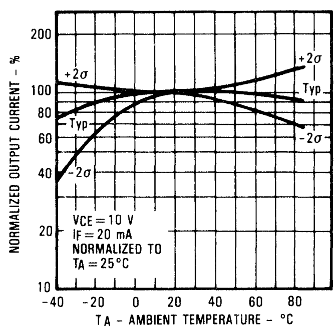
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.00mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V, I_F = 0, E_e = 0$
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	$I_C = 50\mu A, I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	100		μA	$V_{CE} = 10.0V, I_F = 20mA$

Typical Performance Curves

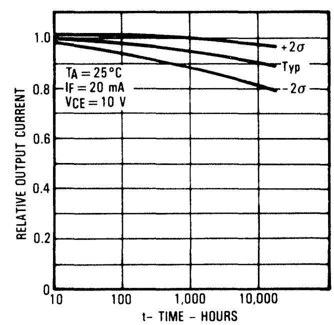
Normalized Output Current vs Forward Current



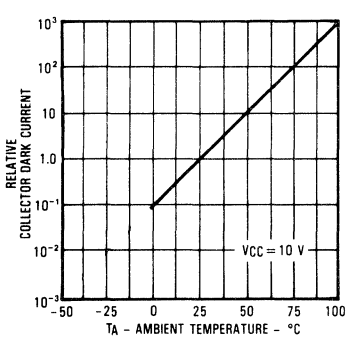
Normalized Output Current vs Ambient Temperature



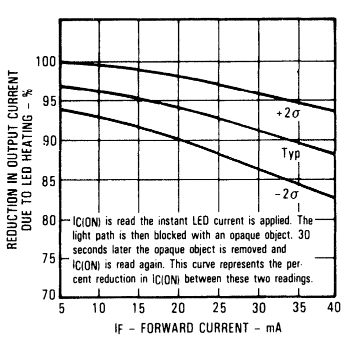
Relative Output Current vs Time



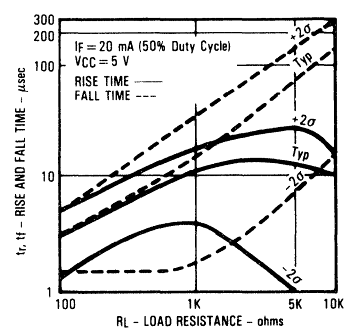
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current



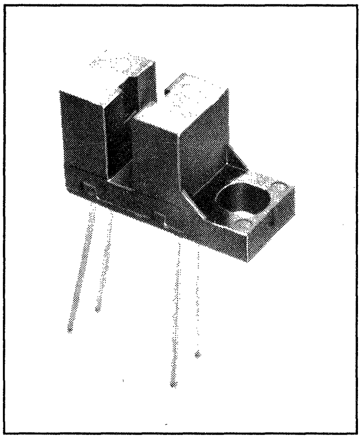
Rise and Fall Time vs Load Resistance

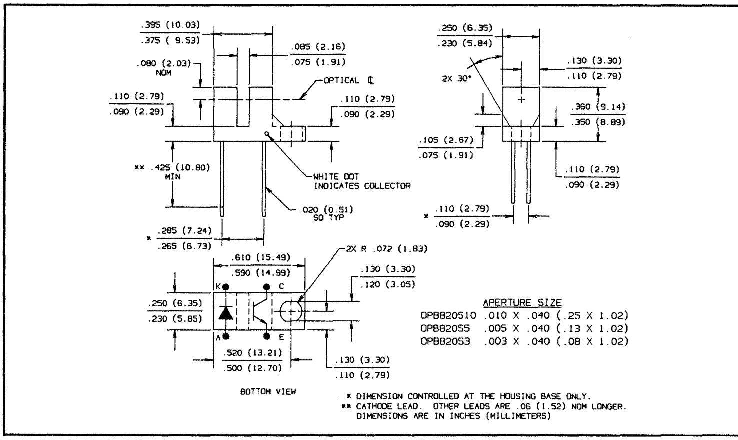


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Slotted Optical Switches
Types OPB820, OPB820S10, OPB820S5, OPB820S3





Features

- Non-contact switching
- Three standard aperture sizes for high resolution
- Low profile
- 0.080" wide gap
- 0.275" lead spacing

Description

The OPB820, OPB820S10, OPB820S5, and OPB820S3 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.080" (2.03mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. All assemblies have .040" wide apertures located in front of the infrared diode. For phototransistor side aperture size, see chart below. Available with 4.5" min, 26 AWG wires as OPB821 series.

OPB#	Phototransistor Aperture Width
OPB820	.040"
OPB820S10	.010"
OPB820S5	.005"
OPB820S3	.003"

Replaces

OPB820S12, OPB820S7, KT8155

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

Types OPB820, OPB820S10, OPB820S5, OPB820S3

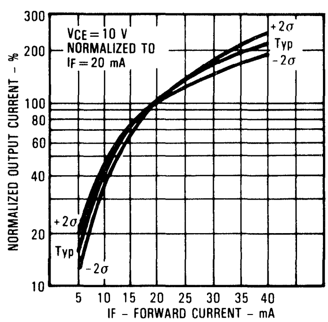
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage				1.70	V	$I_F = 20mA$
I_R	Reverse Current				100	μA	$V_R = 2.0V$
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage			30		V	$I_C = 1.00mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage			5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current				100	nA	$V_{CE} = 10.0V, I_F = 0, E_e = 0$
Coupled							
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB820			0.4	V	$I_C = 250\mu A, I_F = 20mA$
		OPB820S10			0.4	V	$I_C = 250\mu A, I_F = 20mA$
		OPB820S5			0.4	V	$I_C = 125\mu A, I_F = 20mA$
		OPB820S3			0.4	V	$I_C = 40\mu A, I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	OPB820	500			μA	$V_{CE} = 5.0V, I_F = 20mA$
		OPB820S10	400			μA	$V_{CE} = 5.0V, I_F = 20mA$
		OPB820S5	300			μA	$V_{CE} = 5.0V, I_F = 20mA$
		OPB820S3	60			μA	$V_{CE} = 5.0V, I_F = 20mA$

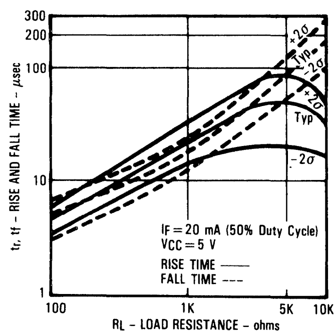
Typical Performance Curves

OPB820S12, OPB820S7, OPB820S5

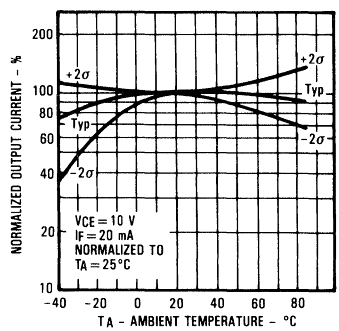
Normalized Output Current vs Input Current



Rise and Fall Time vs Load Resistance

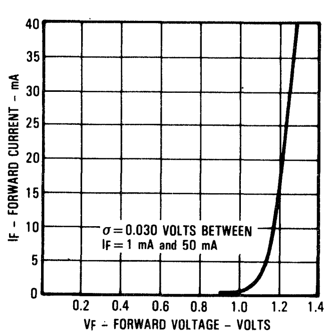


Normalized Output Current vs Ambient Temperature

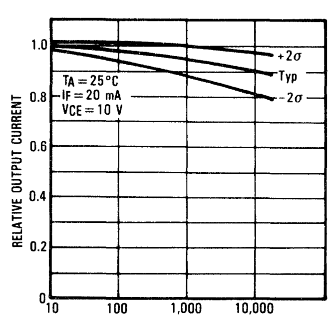


All Assemblies

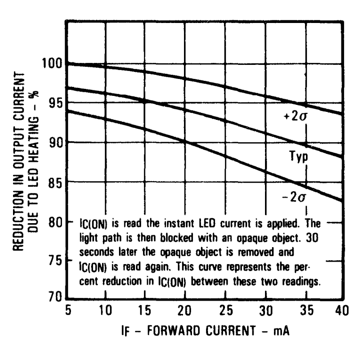
Forward Current vs Forward Voltage Input Diode



Relative Output Current vs Time

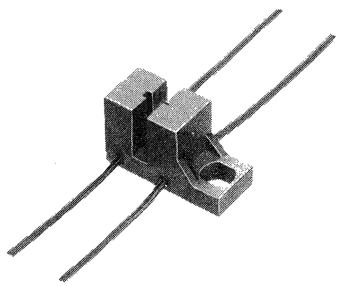


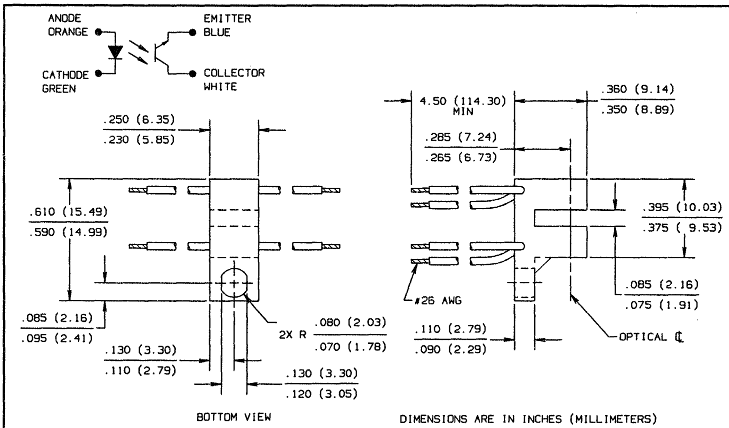
Reduction in Output Current Due to LED Heating vs Forward Current



Product Bulletin OPB821
May 1993

Slotted Optical Switches
Types OPB821, OPB821S10, OPB821S5, OPB821S3





Features

- Three standard aperture sizes for high resolution
- Low profile, 0.080" wide slot
- 4.5" min, 26 AWG wire leads
- TX-TXV process available (see Hi-Rel section)

Description

The OPB821series each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.080" (2.03mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. All assemblies have .040" wide apertures located in front of the infrared diode. For phototransistor side aperture size, see chart below. A minimum of 4.5" (114.3mm) lead wires ease assembly where PC board mounting is not practical. Available with PC board mountable leads as OPB820 series.

OPB#	Phototransistor Aperture Width
OPB821	.040"
OPB821S10	.010"
OPB821S5	.005"
OPB821S3	.003"

Replaces

OPB821S12, OPB821S7, KT8165

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.82mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Types OPB821, OPB821S10, OPB821S5, OPB821S3

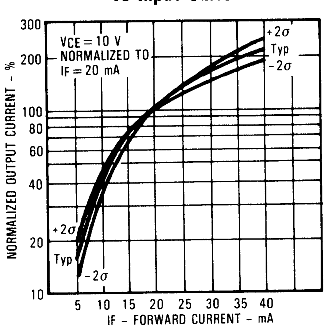
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 20mA
I_R	Reverse Current			100	μA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled						
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB821		0.4	V	I_C = 250μA, I_F = 20mA
		OPB821S10		0.4	V	I_C = 250μA, I_F = 20mA
		OPB821S5		0.4	V	I_C = 125μA, I_F = 20mA
		OPB821S3		0.4	V	I_C = 40μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	OPB821	500		μA	V_{CE} = 5.0V, I_F = 20mA
		OPB821S10	400		μA	V_{CE} = 5.0V, I_F = 20mA
		OPB821S5	300		μA	V_{CE} = 5.0V, I_F = 20mA
		OPB821S3	60		μA	V_{CE} = 5.0V, I_F = 20mA

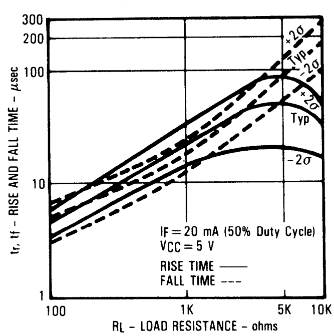
Typical Performance Curves

OPB821, OPB821S10, OPB821S5, OPB821S3

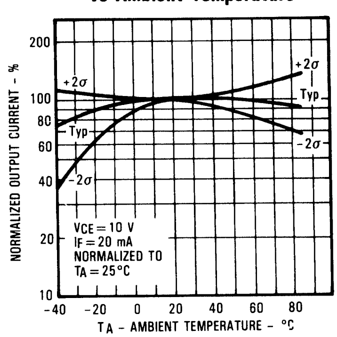
Normalized Output Current vs Input Current



Rise and Fall Time vs Load Resistance

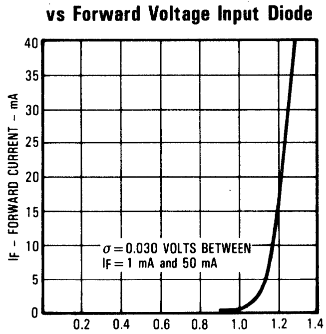


Normalized Output Current vs Ambient Temperature

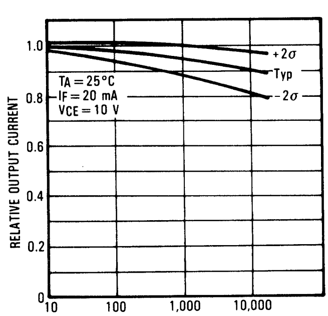


All Assemblies

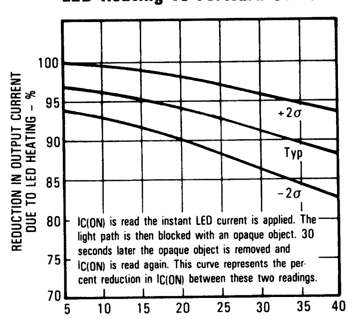
Forward Current vs Forward Voltage Input Diode



Relative Output Current vs Time



Reduction in Output Current Due to LED Heating vs Forward Current

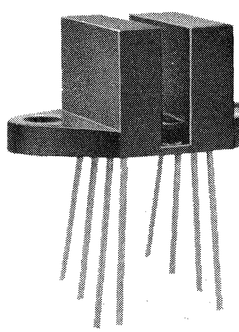


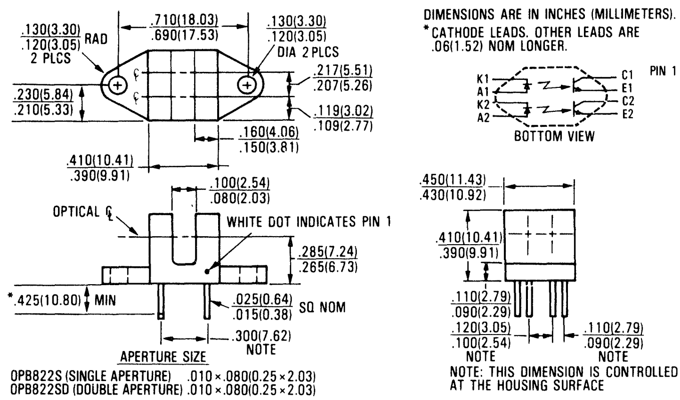
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB822S
May 1993

OPTEK

Dual Channel Slotted Optical Switches
Types OPB822S, OPB822SD





Features

- Dual channels side-by-side
- 0.090" wide slot
- Non-contact switching
- Single or double apertures for high resolution
- OPB822S (apertures on sensors only)
- OPB822SD (apertures on both emitters and sensors)

Description

The OPB822S and OPB822SD each consist of two infrared emitting diodes and two NPN silicon phototransistors mounted in a "side-by-side" configuration on opposite sides of a 0.090" (2.29mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the device slot. The OPB822S has 0.010" (.25mm) by 0.080" (2.03mm) apertures in front of both phototransistors. The OPB822SD has the same sized apertures in front of both phototransistors and both emitters. Dual channels enable direction of travel sensing. The low cost IR transmissive plastic housing reduces possible interference from ambient light and provides dust and dirt protection.

Dual channel (over/under) configuration available as OPB826 series.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor(s)

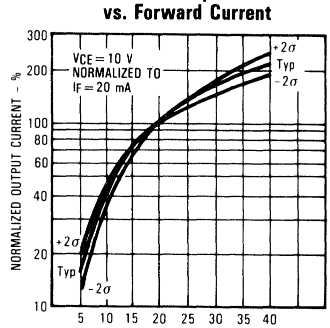
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 100mW(2)

Notes:

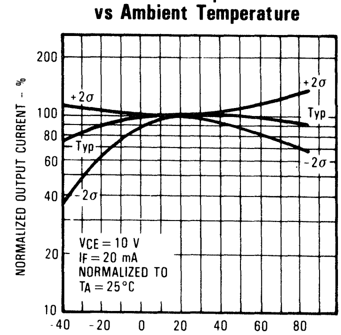
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Normalized Output Current vs. Forward Current



Normalized Output Current vs Ambient Temperature



Types OPB822S, OPB822SD

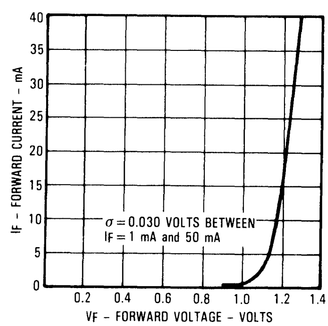
SLOTTED OPTICAL SWITCHES

Electrical Characteristics (T_A = 25°C unless otherwise noted)

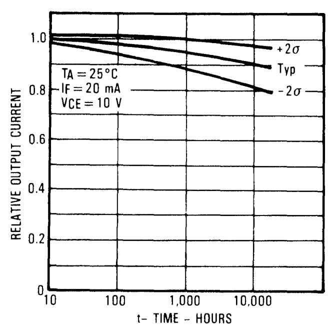
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 20mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage OPB822S OPB822SD		0.40 0.40	V V	I_C = 125µA, I_F = 20mA I_C = 50µA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current OPB822S OPB822SD	250 100		µA µA	V_{CE} = 10.0V, I_F = 20mA V_{CE} = 10.0V, I_F = 20mA

Typical Performance Curves (All Assemblies)

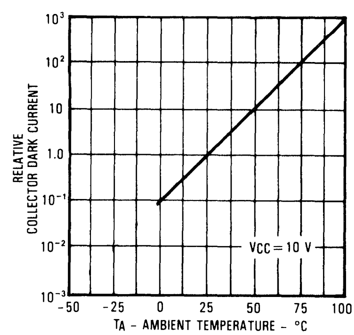
Forward Current vs Forward Voltage Input Diode



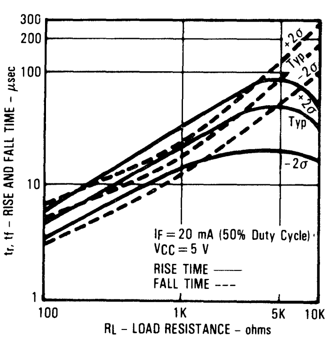
Relative Output Current vs Time



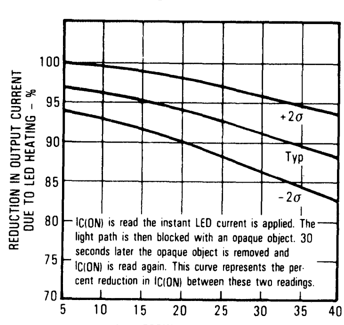
Relative Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance

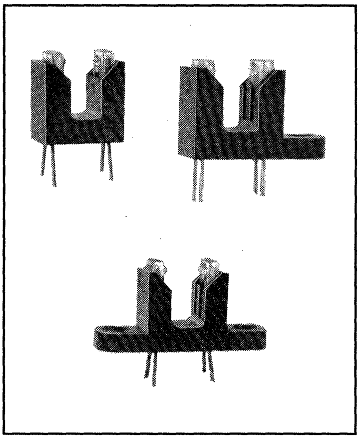


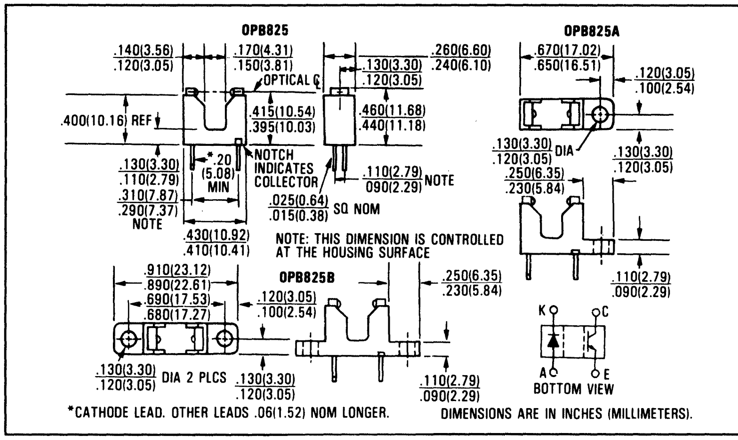
Reduction in Output Current Due to LED Heating vs Forward Current



OPTEK

Slotted Optical Switches
Types OPB825, OPB825A, OPB825B





Features

- Non-contact switching
- 0.160" wide slot
- 0.300" lead spacing
- Fast switching speed

Description

The OPB825, OPB825A, and OPB825B each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.160" (4.06mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. The OPB825 has no mounting tabs and is intended for direct insertion into PC boards or dual-in-line sockets. The OPB825A has a single mounting tab on the phototransistor side. The OPB825B has mounting tabs on both sides.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

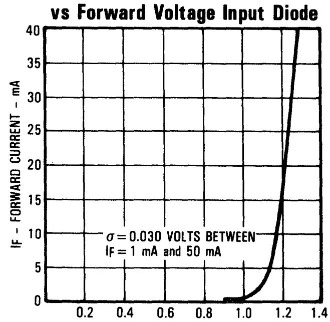
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diode



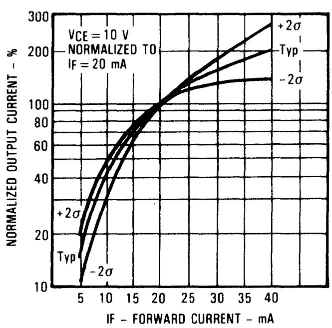
Types OPB825, OPB825A, OPB825B

Electrical Characteristics (T_A = 25°C unless otherwise noted)

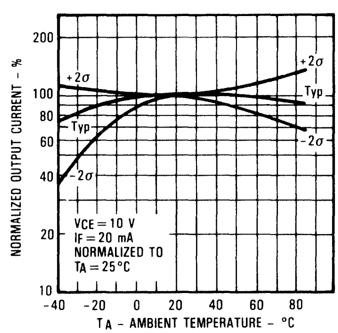
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_C = 250μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	500		μA	V_{CE} = 10.0V, I_F = 20mA

Typical Performance Curves

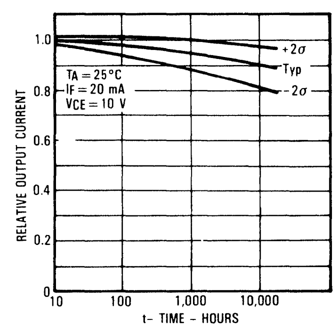
Normalized Output Current vs Forward Current



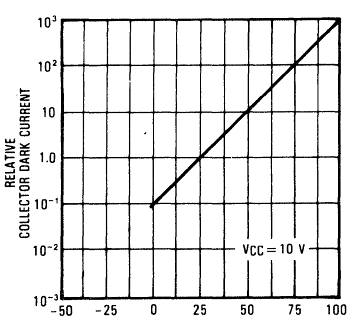
Normalized Output Current vs Ambient Temperature



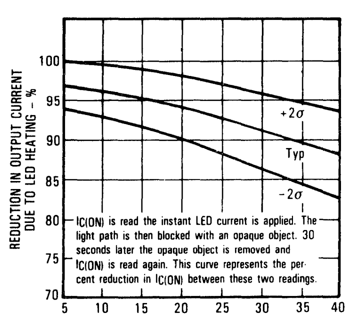
Relative Output Current vs Time



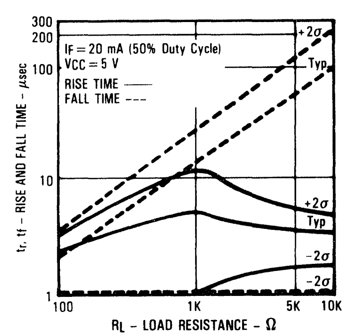
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current



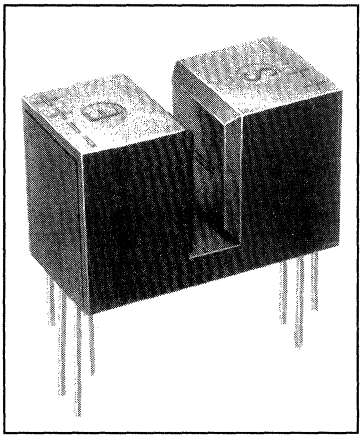
Rise and Fall Time vs Load Resistance

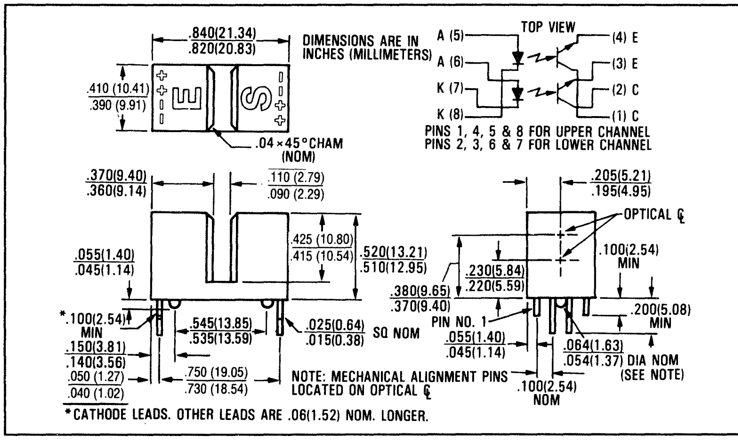


Product Bulletin OPB826
May 1993

OPTEK

Dual Channel Slotted Optical Switches
Types OPB826S, OPB826SD





Features

- Dual channels over/under
- Direction of travel sensing
- Single or double apertures for high resolution
- 0.100" wide slot
- OPB826S (apertures on sensors only)
- OPB826SD (apertures on both emitters and sensors)

Description

The OPB826S and OPB826SD each consist of two infrared emitting diodes and two NPN silicon phototransistors mounted in an over/under configuration on opposite sides of a 0.100" (2.54mm) wide slot. Phototransistor switching takes place when an opaque object passes through the slot. The OPB826S has 0.010" (.25mm) by 0.040" (1.02mm) apertures in front of both phototransistors. The OPB826SD has the same sized apertures in front of both phototransistors and both emitters. Dual channels enable direction of travel sensing. The low cost IR transmissive plastic housing reduces possible interference from ambient light and provides dust and dirt protection.

Dual channel (side-by-side) configuration available as OPB822 series.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 40mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

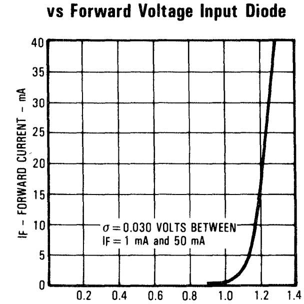
Output Phototransistor (s)

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diode



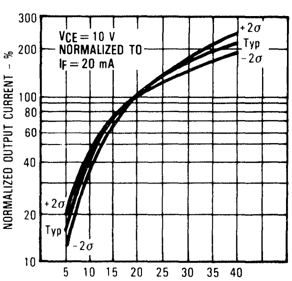
Types OPB826S, OPB826SD

Electrical Characteristics (T_A = 25°C unless otherwise noted)

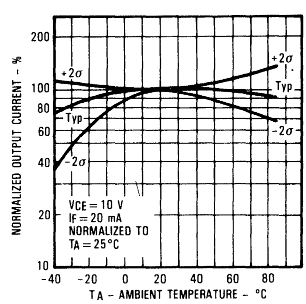
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 20mA
I_R	Reverse Current			100	μA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled						
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB826S OPB826SD		0.40 0.40	V V	I_C = 125μA, I_F = 20mA I_C = 50μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	OPB826S OPB826SD	250 100		μA μA	V_{CE} = 10.0V, I_F = 20mA V_{CE} = 10.0V, I_F = 20mA
I_{CX1}	Crosstalk	OPB826S		20	μA	I_{F1} = 0mA, I_{F2} = 20mA, V_{CE} = 10.0V
		OPB826SD		10	μA	I_{F1} = 0mA, I_{F2} = 20mA, V_{CE} = 10.0V
I_{CX2}	Crosstalk	OPB826S		20	μA	I_{F1} = 20mA, I_{F2} = 0mA, V_{CE} = 10.0V
		OPB826SD		10	μA	I_{F1} = 20mA, I_{F2} = 0mA, V_{CE} = 10.0V

Typical Performance Curves

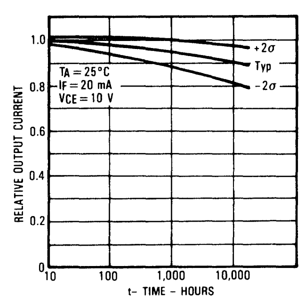
Normalized Output Current vs Input Current



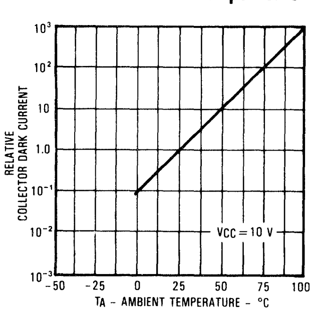
Normalized Output Current vs Ambient Temperature



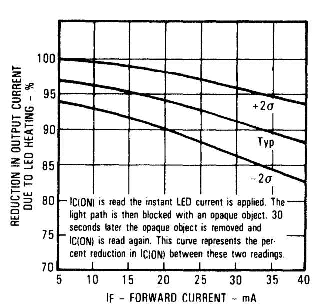
Relative Output Current vs Time



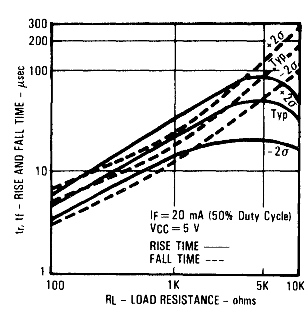
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current

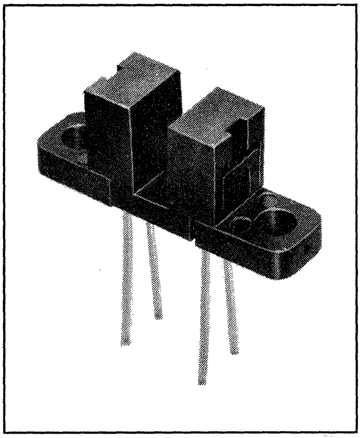


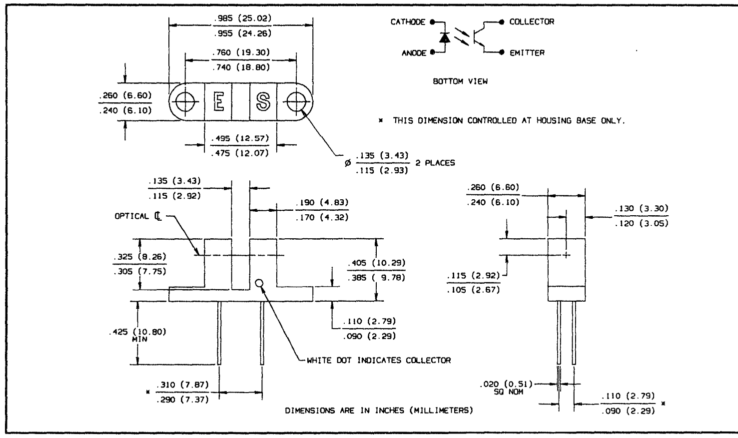
Rise and Fall Time vs Load Resistance



OPTEK

Slotted Optical Switches
Types OPB827A, OPB827B, OPB827C, OPB827D





Features

- Printed circuit board mounting
- 0.125" wide slot
- 0.300" lead spacing
- Inexpensive plastic housing

Description

The OPB827 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a 0.125" wide slot. The OPB827A has an IR transmissive housing. The OPB827B has an IR transmissive housing with an 0.010" aperture over the phototransistor. The OPB827C has an opaque housing with a molded 0.060" aperture located in front of the phototransistor. The OPB827D has an opaque housing with a molded 0.010" aperture located over the phototransistor. The apertures provide for improved resolution. Phototransistor switching takes place whenever an opaque object passes through the slot.

Other configurations available:
OPB828 = 0.220" lead spacing
OPB829 = 24", 26 AWG wire leads

Replaces

OPB827A	K8100
OPB827B	K8110
OPB827C	OPB816/817
OPB827D	K8140

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Descriptions

Type	Housing	Phototransistor Aperture
OPB827A	IR Transmissive	None
OPB827B	IR Transmissive	0.010"
OPB827C	Opaque	0.060"
OPB827D	Opaque	0.010"

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

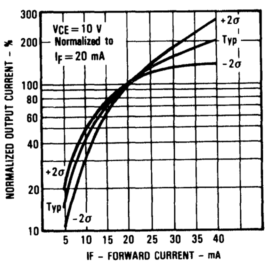
Types OPB827A, OPB827B, OPB827C, OPB827D

Electrical Characteristics (T_A = 25°C unless otherwise noted)

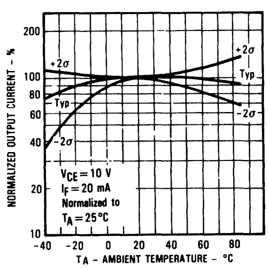
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.6	V	I_C = 1800μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	1800		μA	V_{CE} = 0.6V, I_F = 20mA

Typical Performance Curves

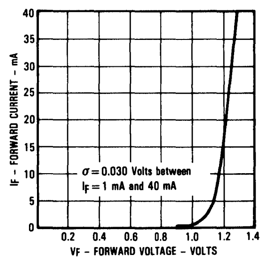
Normalized Output Current vs Forward Current



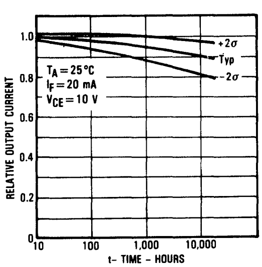
Normalized Output Current vs Ambient Temperature



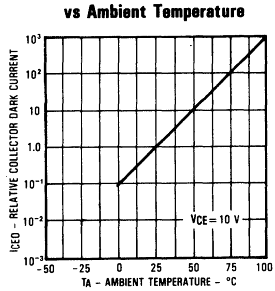
Forward Current vs Forward Voltage Input Diode



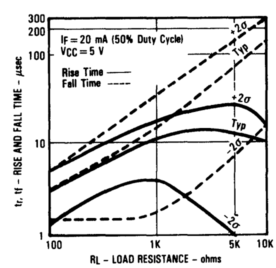
Relative Output Current vs Time



Collector Dark Current vs Ambient Temperature

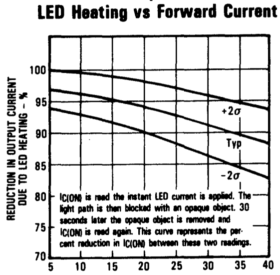


Rise and Fall Time vs Load Resistance

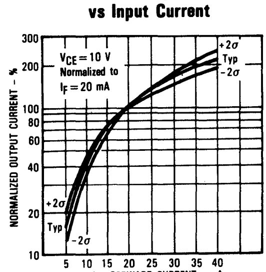


All Part Numbers Ending in "B and "D"

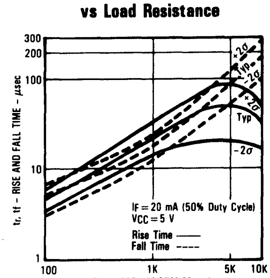
Reduction in Output Current Due to LED Heating vs Forward Current



Normalized Output Current vs Input Current



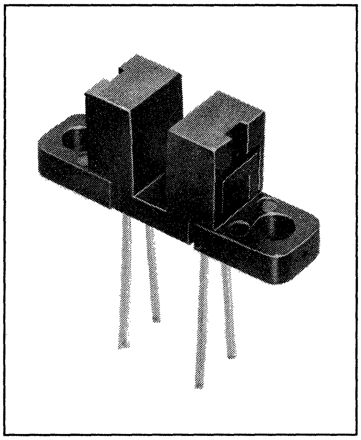
Rise and Fall Time vs Load Resistance

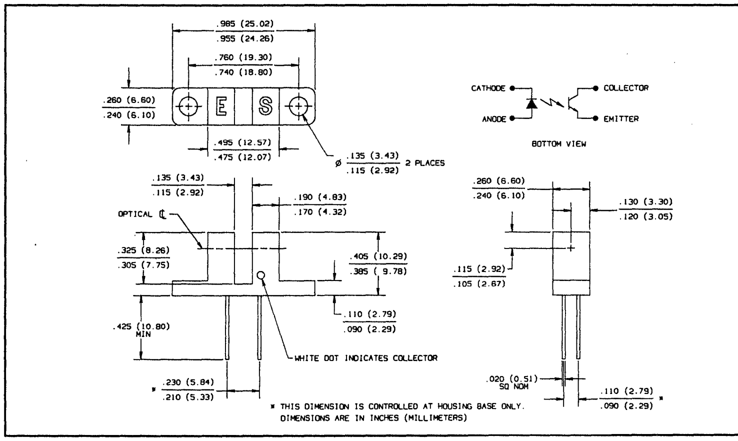


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Slotted Optical Switches
Types OPB828A, OPB828B, OPB828C, OPB828D





Features

- Printed circuit board mounting
- 0.125" wide slot
- 0.220" lead spacing
- Inexpensive plastic housing

Description

The OPB828 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The OPB828A has an IR transmissive housing. The OPB828B has an IR transmissive housing with an 0.010" aperture located in front of the phototransistor. The OPB828C has an opaque housing with a molded 0.060" aperture located in front of the phototransistor. The OPB828D has an opaque housing with a molded 0.010" aperture located in front of the phototransistor. Phototransistor switching takes place whenever an opaque object passes through the slot.

Other configurations available:
OPB827 = 0.300" lead spacing
OPB829 = 24" min. 26 AWG wire leads

Replaces

OPB828A	K8101
OPB828B	K8111
OPB828C	K8181
OPB828D	K8180

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Descriptions

Type	Housing	Phototransistor Aperture
OPB828A	IR Transmissive	None
OPB828B	IR Transmissive	0.010"
OPB828C	Opaque	0.060"
OPB828D	Opaque	0.010"

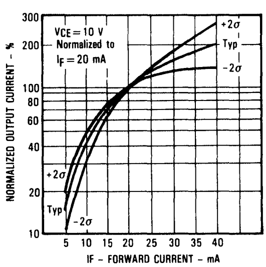
Types OPB828A, OPB828B, OPB828C, OPB828D

Electrical Characteristics ($T_A = 25^{\circ}C$ unless otherwise noted)

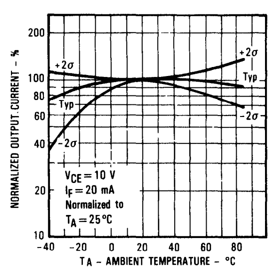
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	$I_F = 20mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e = 0$
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.6	V	$I_C = 1800\mu A$, $I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	1800		μA	$V_{CE} = 0.6V$, $I_F = 20mA$

Typical Performance Curves

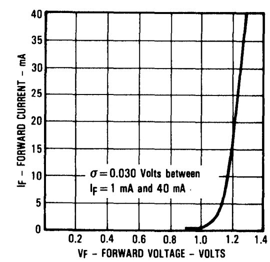
Normalized Output Current vs Forward Current



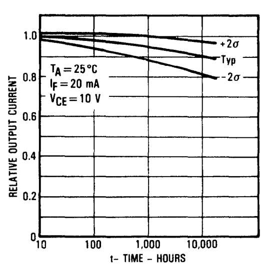
Normalized Output Current vs Ambient Temperature



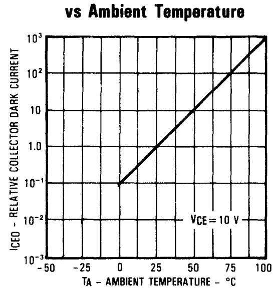
Forward Current vs Forward Voltage Input Diode



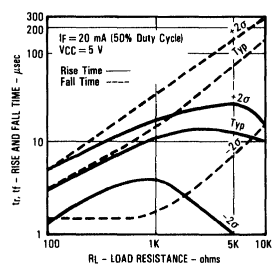
Relative Output Current vs Time



Collector Dark Current vs Ambient Temperature

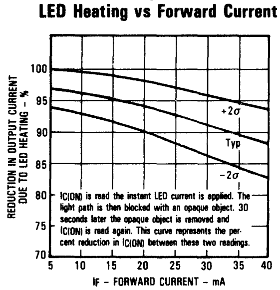


Rise and Fall Time vs Load Resistance

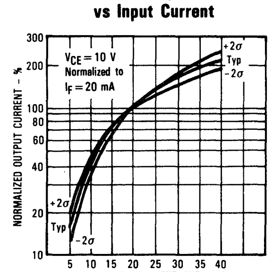


All Part Numbers Ending in "B and "D"

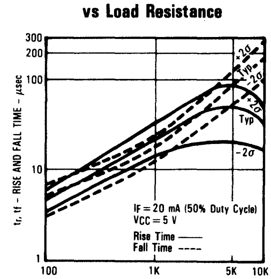
Reduction in Output Current Due to LED Heating vs Forward Current



Normalized Output Current vs Input Current



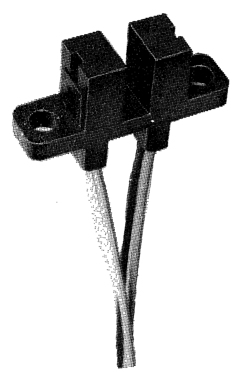
Rise and Fall Time vs Load Resistance

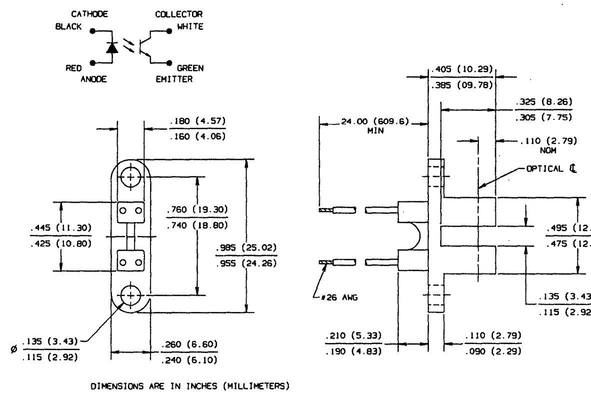


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Slotted Optical Switches
Types OPB829A, OPB829B, OPB829C, OPB829D





Features

- 24" min. #26 AWG wire leads
- 0.125" wide slot
- Inexpensive plastic housing

Description

The OPB829 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The OPB829A has an IR transmissive housing. The OPB829B has an IR transmissive housing with an 0.010" aperture located in front of the phototransistor. The OPB829C has an opaque housing with a molded 0.060" aperture located in front of the phototransistor. The OPB829D has an opaque housing with a molded 0.010" aperture located in front of the phototransistor. Phototransistor switching takes place whenever an opaque object passes through the slot.

Other configurations available:
OPB827 = 0.300 lead spacing
OPB828 = 0.220 lead spacing

Replaces

OPB829A	K8171
OPB829C	OPB823A/OPB824A

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width , 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:
(1) Derate Linearly 1.82mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

Descriptions

Type	Housing	Phototransistor Aperture
OPB829A	IR Transmissive	None
OPB829B	IR Transmissive	0.010"
OPB829C	Opaque	0.060"
OPB829D	Opaque	0.010"

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

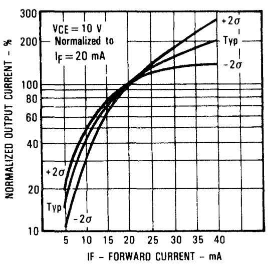
Types OPB829A, OPB829B, OPB829C, OPB829D

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

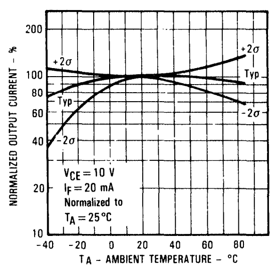
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	$I_F = 20mA$
I_R	Reverse Current		100	µA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V, I_F = 0, E_e = 0$
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.6	V	$I_C = 1800\mu A, I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	1800		µA	$V_{CE} = 0.6V, I_F = 20mA$

Typical Performance Curves

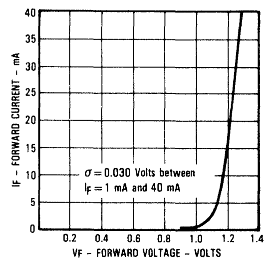
Normalized Output Current vs Forward Current



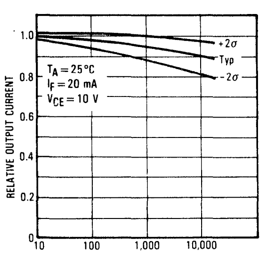
Normalized Output Current vs Ambient Temperature



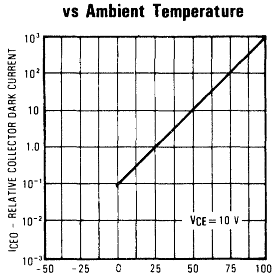
Forward Current vs Forward Voltage Input Diode



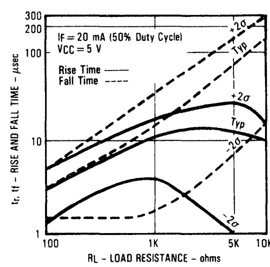
Relative Output Current vs Time



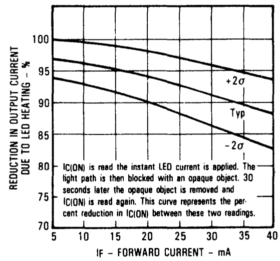
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current

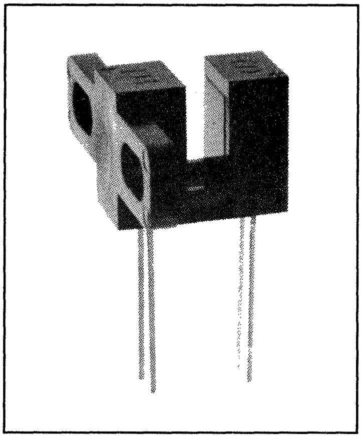


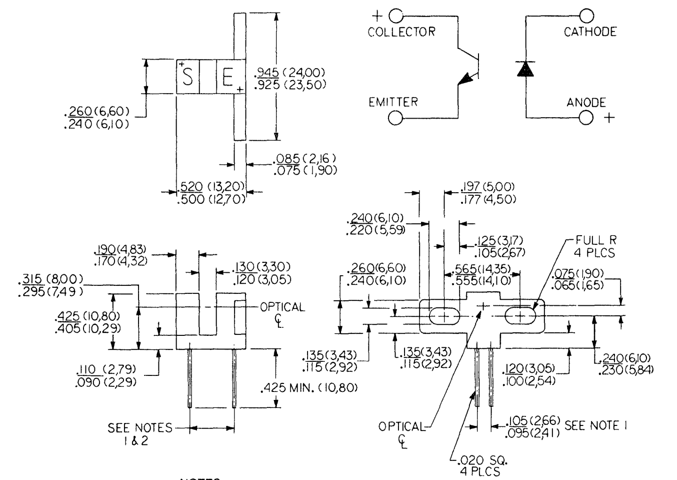
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB830
May 1993

OPTEK

Slotted Optical Switches
Types OPB830L, OPB840L Series





NOTES:
1. Dimensions controlled at housing surface only.
2. OPB830L thru OPB832L and OPB840L thru OPB842L Lead spacing: .325 (8.26) / .315 (8.00)
3. OPB835L thru OPB837L and OPB845L thru OPB847L Lead spacing: .225 (5.72) / .215 (5.46)
4. Dimensions are in inches (millimeters)

Features

- 0.125" wide slot
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Side mounting configuration
- Choice of lead spacing

Description

This series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) electrical output parameters, (2) choice of lead spacing, (3) discrete shell material and (4) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

Replaces

KT830/KT840 Series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +85°C(1)
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation . . . . 100mW(1)

Notes:
(1) Derate linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Lead spacing is .220" or .320". Leads are 0.20" sq and .425" long (min).
(5) Methyl or isopropyl alcohols are recommended cleaning agents. Plastic housing may be soluble in chlorinated hydrocarbons and ketones.

Types OPB830L, OPB840L Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	I_F = 20mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10V
Coupled					
$V_{CE(SAT)}$	Saturation Voltage: Parameter A OPB830L / OPB840L OPB835L / OPB845L		0.4	V	I_C = 400µA, I_F = 20mA
	Parameter B OPB831L / OPB841L OPB836L / OPB846L		0.4	V	I_C = 800µA, I_F = 10mA
	Parameter C OPB832L / OPB842L OPB837L / OPB847L		0.6	V	I_C = 1800µA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current: Parameter A OPB830L / OPB840L OPB835L / OPB845L	500		µA	V_{CE} = 10V, I_F = 20mA
	Parameter B OPB831L / OPB841L OPB836L / OPB846L	1000		µA	V_{CE} = 5V, I_F = 10mA
	Parameter C OPB832L / OPB842L OPB837L / OPB847L	1800		µA	V_{CE} = 0.6V, I_F = 20mA

PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation

3 - Side Mount IR Transmissive Plastic Discrete Shell

4 - Side Mount Opaque Plastic Discrete Shell

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*

Mounting Configurations

L - Solder Leads Termination
W - Wire Termination

Electrical Specification Variations

0 - Electrical Parameter A, 0.320" Lead Spacing

1 - Electrical Parameter B, 0.320" Lead Spacing

2 - Electrical Parameter C, 0.320" Lead Spacing

5 - Electrical Parameter A, 0.220" Lead Spacing

6 - Electrical Parameter B, 0.220" Lead Spacing

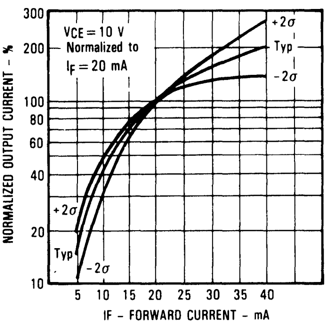
7 - Electrical Parameter C, 0.220" Lead Spacing

*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

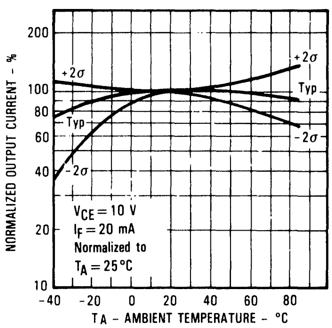
Types OPB830L, OPB840L Series

Typical Performance Curves

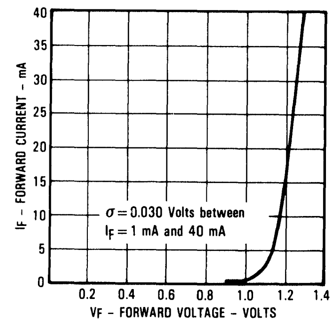
Normalized Output Current vs Forward Current



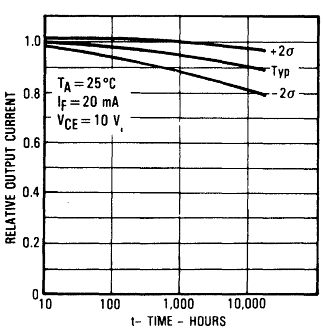
Normalized Output Current vs Ambient Temperature



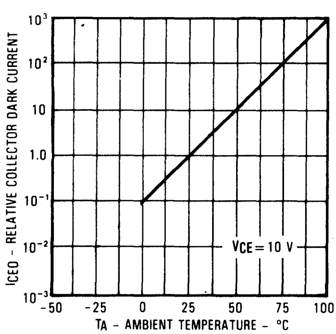
Forward Current vs Forward Voltage Input Diode



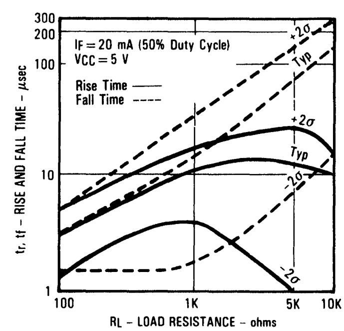
Relative Output Current vs Time



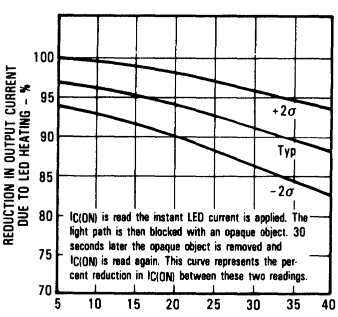
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance

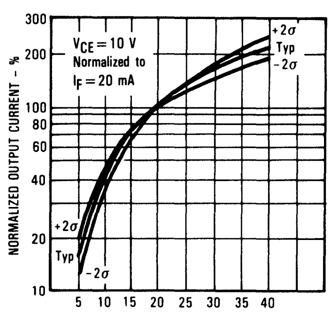


Reduction in Output Current Due to LED Heating vs Forward Current

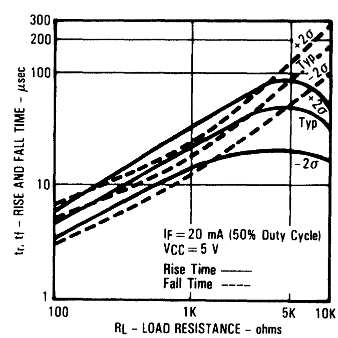


All Part Numbers Ending in "1"

Normalized Output Current vs Input Current



Rise and Fall Time vs Load Resistance

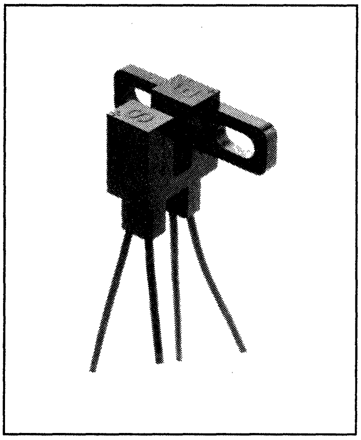


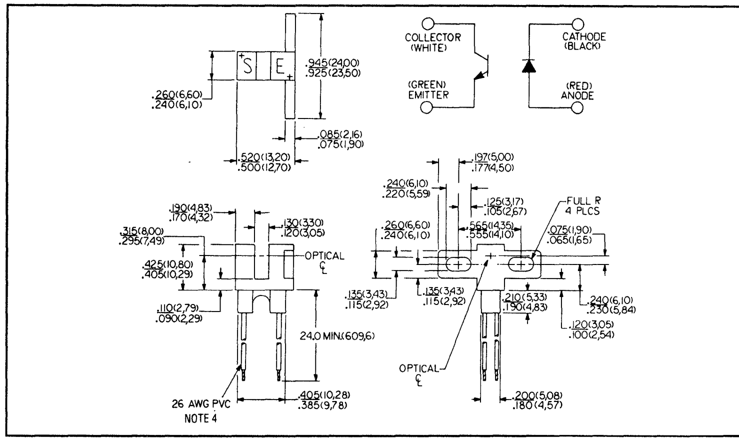
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB830W
May 1993

OPTEK

Slotted Optical Switches
Types OPB830W, OPB840W Series





Features

- 0.125" wide slot
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Side mount configuration
- 24", 26AWG wire leads

Description

This series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) Electrical output parameters, (2) discrete shell material and (3) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

Replaces

KT830W/KT840W Series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C(1)
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron].. 240°C(2)

Input Diode

Forward DC Current.. 50mA
Peak Forward Current (1 µs pulse width, 300 pps)........................ 3.0A
Reverse DC Voltage.. 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage.. 30V
Emitter-Collector Voltage.. 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:

(1) Derate linearly 1.82mW/°C above 25°C. (Maximum storage and operating temperature, limited by the temperature rating of the lead wires)
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) The OPB830W/OPB840W wire terminations are 24" of 7 strand, 26 AWG, UL 1429 insulated wire on each terminal. The devices incorporate a wire strain relief at the housing surface. The insulation colors and functions are:

Red - RED Anode	White - Phototransistor Collector
Black - Ired Cathode	Green - Phototransistor Emitter

Other wire and/or colors are available. Contact your local representative or call the factory.
(5) Methyl or isopropyl alcohols are recommended cleaning agents. Plastic housing may be soluble in chlorinated hydrocarbons and ketones.

Types OPB830W, OPB840W Series

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	$I_F = 20mA$
I_R	Reverse Current			100	μA	$V_R = 2.0V$
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current			100	nA	$V_{CE} = 10V$
Coupled						
$V_{CE(SAT)}$	Saturation Voltage:					
	Parameter A	OPB830W / OPB840W		0.4	V	$I_C = 400\mu A$, $I_F = 20mA$
	Parameter B	OPB831W / OPB841W		0.4	V	$I_C = 800\mu A$, $I_F = 10mA$
	Parameter C	OPB832W / OPB842W		0.6	V	$I_C = 1800\mu A$, $I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current:					
	Parameter A	OPB830W / OPB840W	500		μA	$V_{CE} = 10V$, $I_F = 20mA$
	Parameter B	OPB831W / OPB841W	1000		μA	$V_{CE} = 5V$, $I_F = 10mA$
	Parameter C	OPB832W / OPB842W	1800		μA	$V_{CE} = 0.6V$, $I_F = 20mA$

PART NUMBER GUIDE

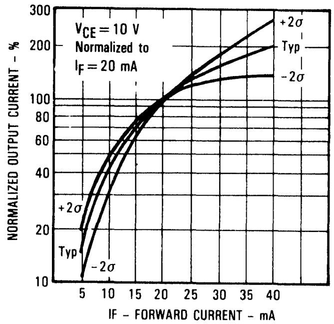
OPB 8 X X X X X

- Optek Assembly
- Phototransistor Output Family
- Discrete Shell Material Designation
  - 3 - Side Mount IR Transmissive Plastic Discrete Shell
  - 4 - Side Mount Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Electrical Parameter A
  - 1 - Electrical Parameter B
  - 2 - Electrical Parameter C
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter
  5 = 0.050" 1= 0.010"*
- Aperture Width In Front of Sensor
  5 = 0.050" 1 = 0.010"

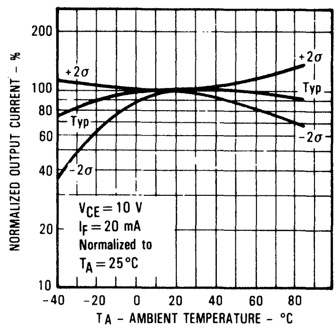
*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

Typical Performance Curves

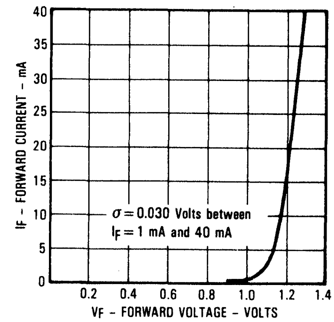
Normalized Output Current vs Forward Current



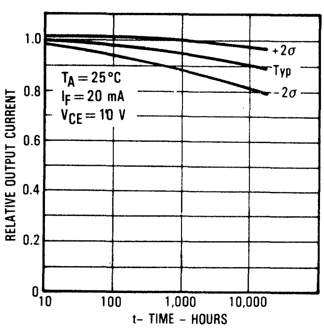
Normalized Output Current vs Ambient Temperature



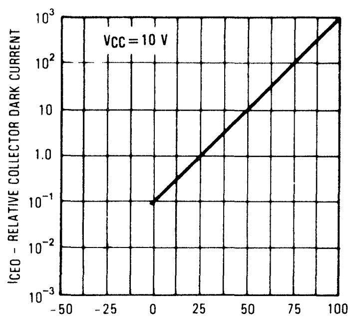
Forward Current vs Forward Voltage Input Diode



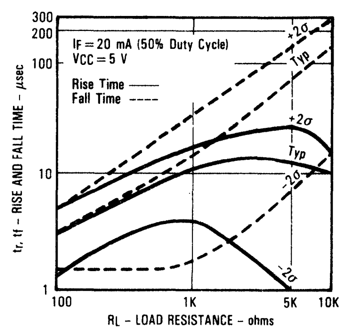
Relative Output Current vs Time



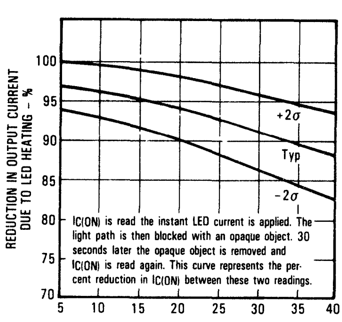
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance

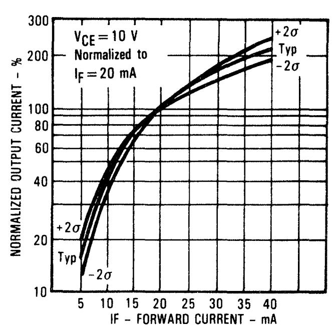


Reduction in Output Current Due to LED Heating vs Forward Current

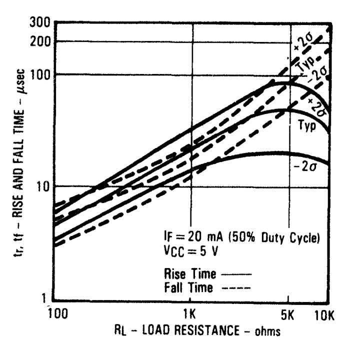


All Part Numbers Ending in "1"

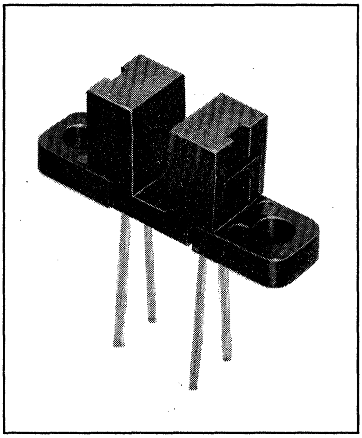
Normalized Output Current vs Input Current

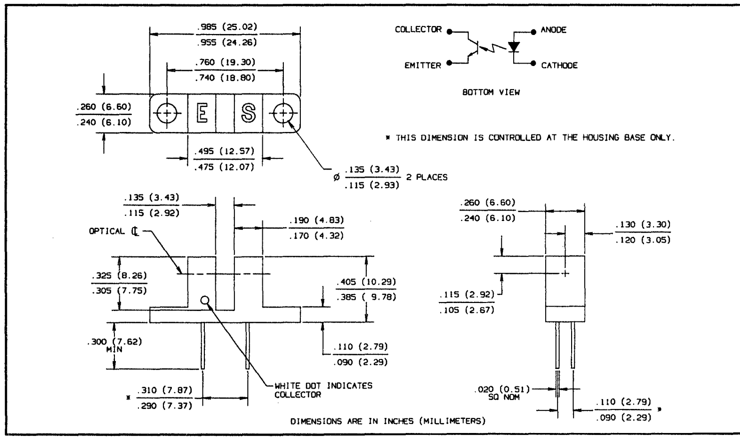


Rise and Fall Time vs Load Resistance



Slotted Optical Switches
Types OPB844A, OPB844B





Features

- Non-contact switching
- Printed circuit board mounting
- 0.125" wide slot
- 0.300" lead spacing
- Transmissive plastic housing

Description

The OPB844 series consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .125" wide slot. The inexpensive plastic housing is transmissive to infrared and provides for environmental protection from dust and contamination. The "A" option is unapertured, while the "B" version offers a .010" wide aperture located over the phototransistor for improved resolution. Phototransistor switching takes place whenever an opaque object passes through the slot.

OPB#	Phototransistor Aperture Width
OPB844A	.040"
OPB844B	.010"

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

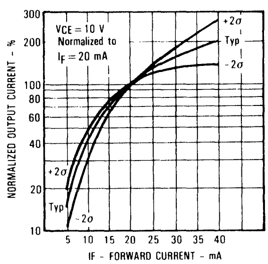
Types OPB844A, OPB844B

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

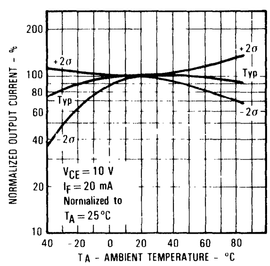
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	$I_F = 20mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V, I_F = 0, E_e = 0$
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.6	V	$I_C = 1800\mu A, I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	1800		μA	$V_{CE} = 0.6V, I_F = 20mA$

Typical Performance Curves

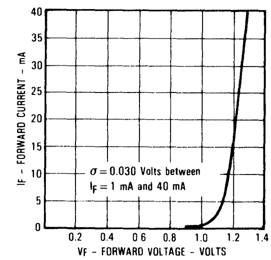
Normalized Output Current vs Forward Current



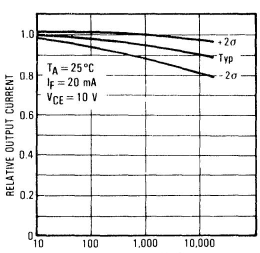
Normalized Output Current vs Ambient Temperature



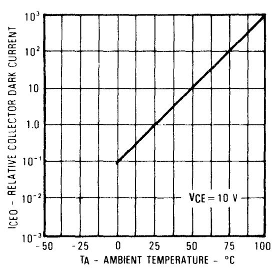
Forward Current vs Forward Voltage Input Diode



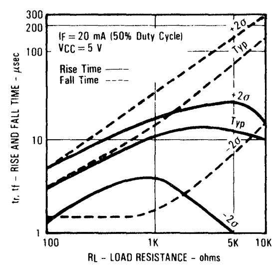
Relative Output Current vs Time



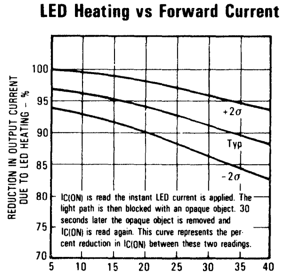
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



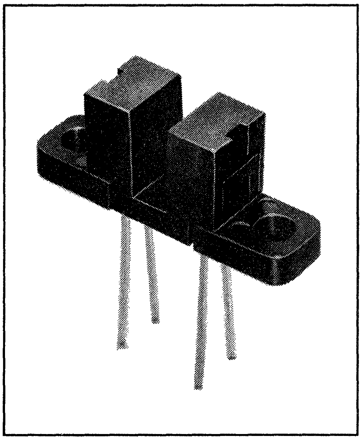
Reduction in Output Current Due to LED Heating vs Forward Current

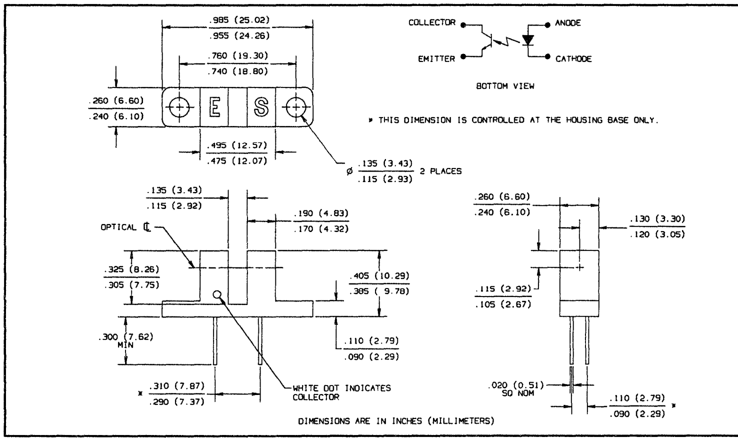


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Slotted Optical Switches
Types OPB845A, OPB845B





Features

- Non-contact switching
- Printed circuit board mounting
- 0.125" wide slot
- 0.300" lead spacing
- Opaque plastic housing

Description

The OPB845 series consists of an infrared emitting diode and an NPN silicon phototransistor encased in an opaque housing on opposite sides of a .125" wide slot. The opaque housing, with molded apertures, provides protection in areas where ambient radiation may be a concern. The "A" option offers a .050" wide aperture molded in front of the phototransistor while the "B" version offers a .010" wide aperture.

OPB#	Phototransistor Aperture Width
OPB845A	0.050"
OPB845B	0.010"

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation . . . . 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

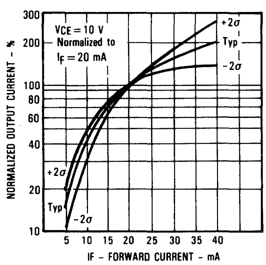
Types OPB845A, OPB845B

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

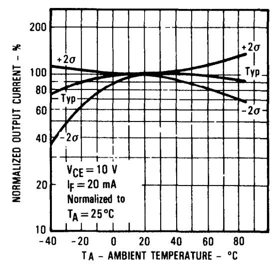
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	$I_F = 20mA$
I_R	Reverse Current		100	μA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0V$, $I_F = 0$, $E_e = 0$
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.6	V	$I_C = 1800\mu A$, $I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	1800		μA	$V_{CE} = 0.6V$, $I_F = 20mA$

Typical Performance Curves

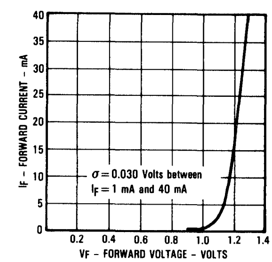
Normalized Output Current vs Forward Current



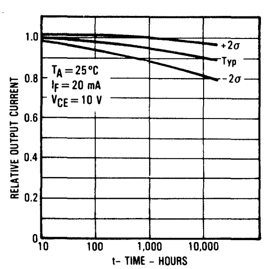
Normalized Output Current vs Ambient Temperature



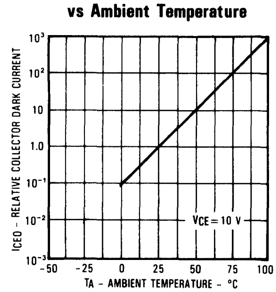
Forward Current vs Forward Voltage Input Diode



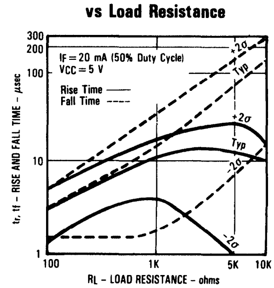
Relative Output Current vs Time



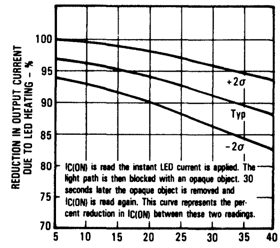
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current



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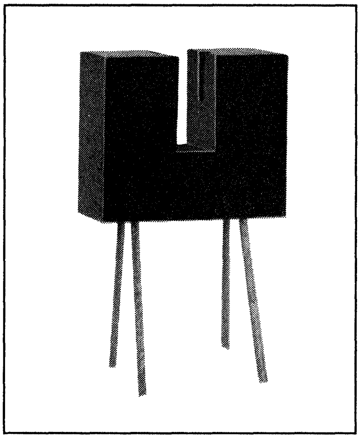
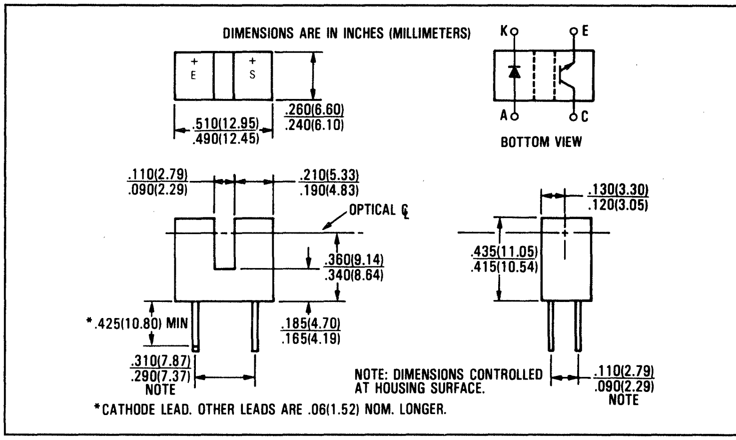
Slotted Optical Switches
Types OPB847, OPB848





Features

- Non-contact switching
- Apertured for high resolution
- Fast switching sped
- 0.300" lead spacing
- 0.100" wide slot
- TX-TXV process available (see Hi-Rel section)

Description

The OPB847 and OPB848 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted in a low cost black plastic housing on opposite sides of a 0.100" (2.54mm) wide slot. Both devices have a 0.025" (0.635mm) by 0.06" (1.52mm) aperture in front of the phototransistor for high resolution position sensing.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse Voltage 2.0V
Power Dissipation .... 100mW(2)

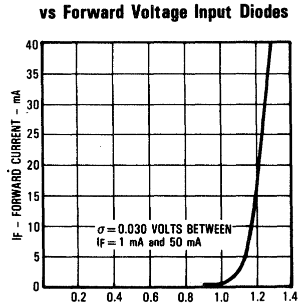
Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when wave soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) Methanol or isopropanol alcohols are recommended as cleaning agents.
(4) All parameters tested using pulse technique.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diodes



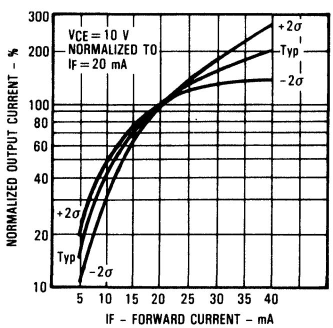
Types OPB847, OPB848

Electrical Characteristics (T_A = 25°C unless otherwise noted)

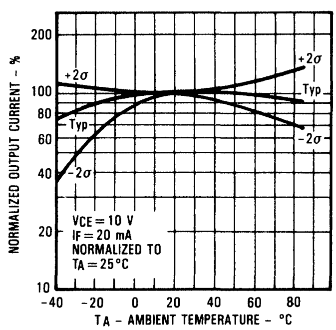
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10.0V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage OPB847		0.40	V	I_C = 2.0mA, I_F = 20mA
	OPB848		0.40	V	I_C = 0.50mA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current OPB847	4.0		mA	V_{CE} = 10.0V, I_F = 20mA
	OPB848	1.0		mA	V_{CE} = 10.0V, I_F = 20mA

Typical Performance Curves

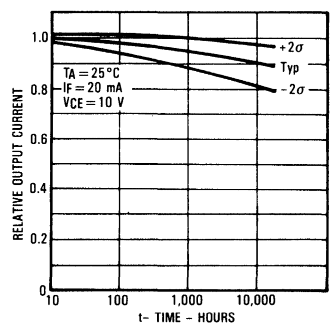
Normalized Output Current vs Forward Current



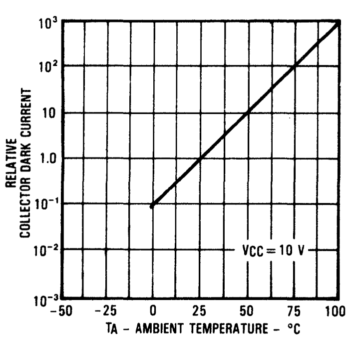
Normalized Output Current vs Ambient Temperature



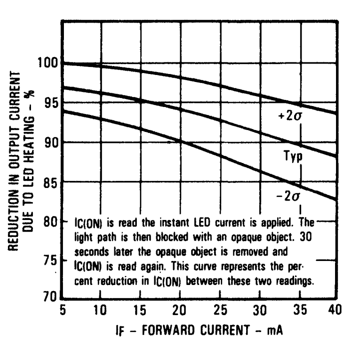
Relative Output Current vs Time



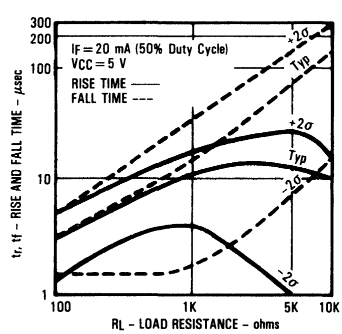
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current



Rise and Fall Time vs Load Resistance



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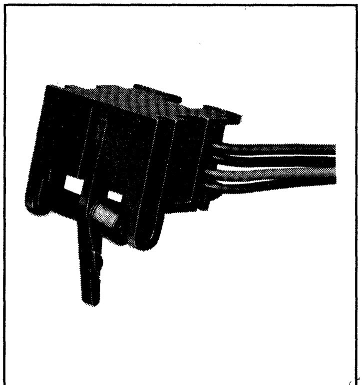
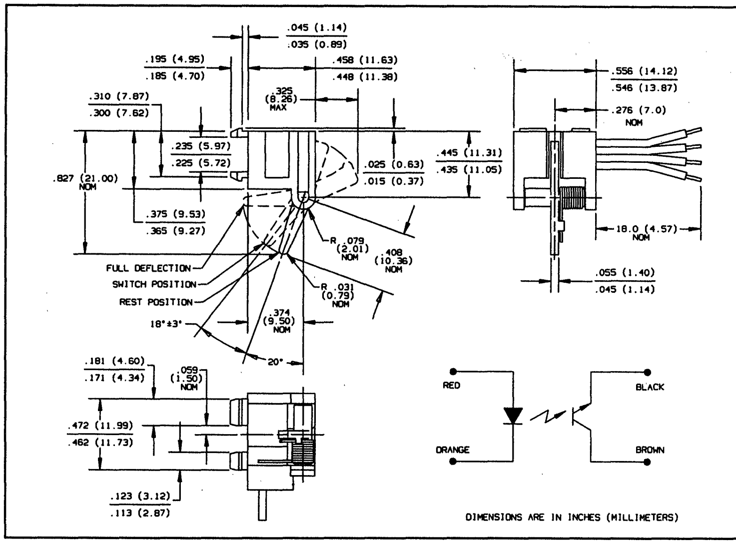
OPTEK

Optical Flag Switch
Type OPB850





Features

- Snap mounting
- Mechanical switch replacement
- Four wires for electrical connections

Description

The OPB850 consists of an NPN phototransistor coupled with a gallium arsenide or gallium aluminum arsenide infrared emitting diode in a molded plastic housing. A lever arm actuated flag interrupts the light beam switching the transistor output between states that can readily drive logic gates.

The OPB850 is designed to replace conventional mechanical limit switches where long life and reliability are critical. This switch is designed to easily snap mount into a 0.039 inch (1 mm) (19 ga) thick material with a rectangular opening of 0.315 X 0.472 inch (8 X 12 mm).

Customized lever arms and spring torques can be designed for specific applications.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C

Input Diode

Reverse Voltage 2.0V
Continuous Forward Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(1)

Notes:
(1) Derate linearly 1.82mW/°C above 25°C.
(2) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(3) "On" condition or switch point exists when the lever arm is deflected clockwise 18° ± 3° from the rest position (20° from vertical) as shown in the figure.
(4) "Off" condition exists when the lever arm is in the rest position (20° from vertical) as shown in the figure.
(5) From the rest position to the switch point, lever torque measured at the end of the arm is 1.5 grams max.
(6) Wires are 26AWG, UL1061. The unterminated ends are stripped and tinned .150 inch (3.81 mm) nominally.
(7) Flag clearance at maximum deflection.
(8) Spring retention ribs nominally .015 (.38 mm) higher.
(9) Holes in mounting bracket will accommodate 4/40 R.H.M.S.
(10) All parameters tested using pulse technique.

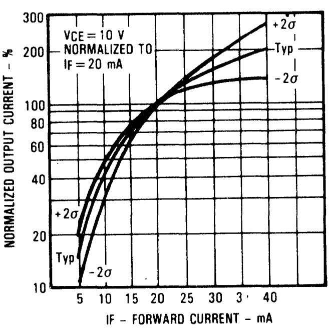
Type OPB850

Electrical Characteristics (T_A = 25°C unless otherwise noted)

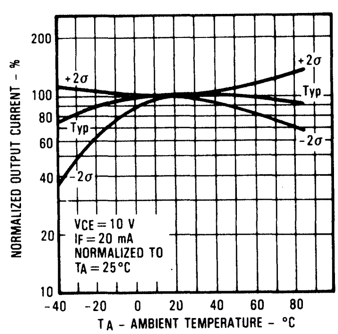
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	I_F = 20mA
I_R	Reverse Current		100	µA	V_R = 2V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 100µA,
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100µA,
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.4	V	I_C = 500µA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	500		µA	V_{CE} = 10V, I_F = 20mA(3)(5)
$I_{C(OFF)}$	Off-State Collector Current		10	µA	V_{CE} = 10V, I_F = 20mA(4)

Typical Performance Curves

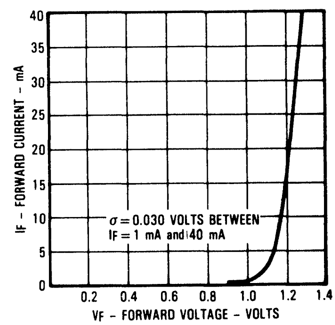
Normalized Output Current vs. Forward Current



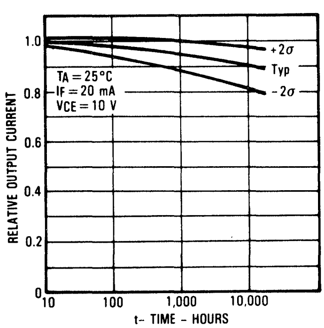
Normalized Output Current vs. Ambient Temperature



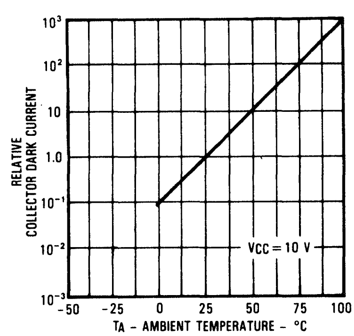
Forward Current vs. Forward Voltage



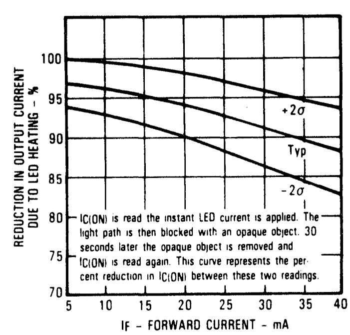
Relative Output Current vs. Time



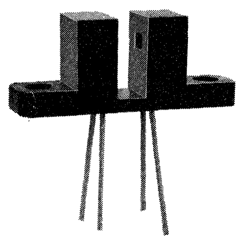
Relative Collector Dark Current vs. Ambient Temperature

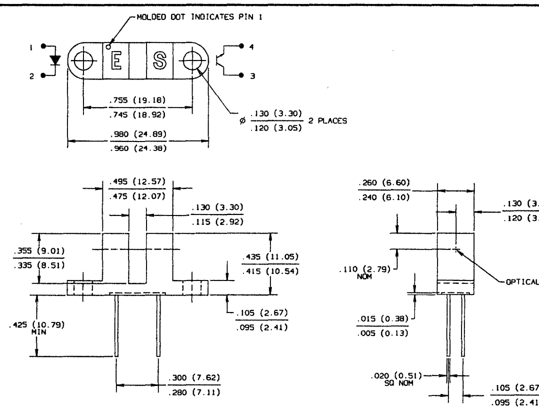


Reduction in Output Current Due to LED Heating vs. Forward Current



Slotted Optical Switches
Types OPB852A1, OPB852A2, OPB852A3





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Inexpensive opaque plastic housing
- 0.125" wide slot
- 0.290" lead spacing
- Apertured for high resolution

Description

The OPB852A series of slotted optical switches consist of an infrared emitting diode and an NPN silicon phototransistor. They are mounted on opposite sides of a .125" wide slot. The emitter has a .050" X .050" molded-in aperture while the phototransistor has a .010" X .050" molded-in aperture.

Replaces

KT852A1, KT852A2, KT852A3

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Forward DC Current 40mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(2)

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones. Highly activated, water soluble fluxes may attack housings in some situations.

Types OPB852A1, OPB852A2, OPB852A3

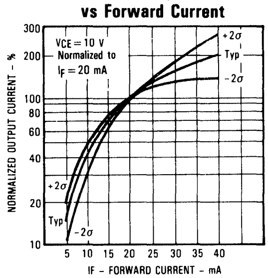
SLOTTED OPTICAL SWITCHES

Electrical Characteristics (T_A = 25°C unless otherwise noted)

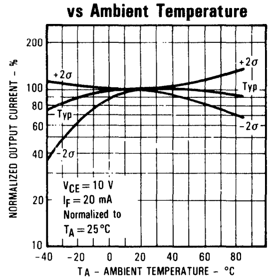
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA
I_R	Reverse Current			100	µA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100µA
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10V
Coupled						
$V_{CE(SAT)}$	Saturation Voltage	OPB852A1		0.40	V	I_C = 500µA, I_F = 20mA
		OPB852A2		0.40	V	I_C = 500µA, I_F = 20mA
		OPB852A3		0.40	V	I_C = 1.8mA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	OPB852A1	1.0		mA	V_{CE} = 5.0V, I_F = 20mA
		OPB852A2	2.0		mA	V_{CE} = 5.0V, I_F = 20mA
		OPB852A3	4.0		mA	V_{CE} = 5.0V, I_F = 20mA

Typical Performance Curves

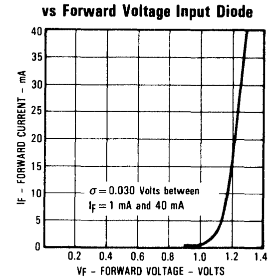
Normalized Output Current vs Forward Current



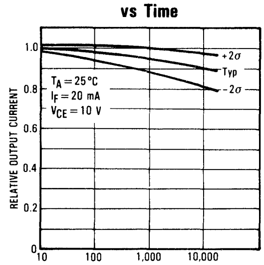
Normalized Output Current vs Ambient Temperature



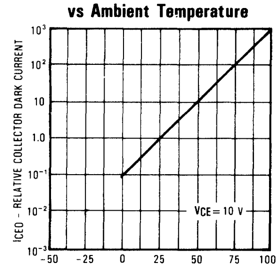
Forward Current vs Forward Voltage Input Diode



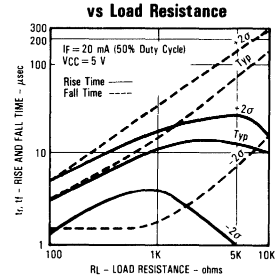
Relative Output Current vs Time



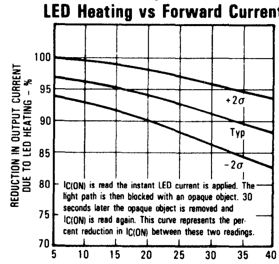
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current

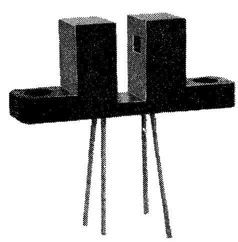


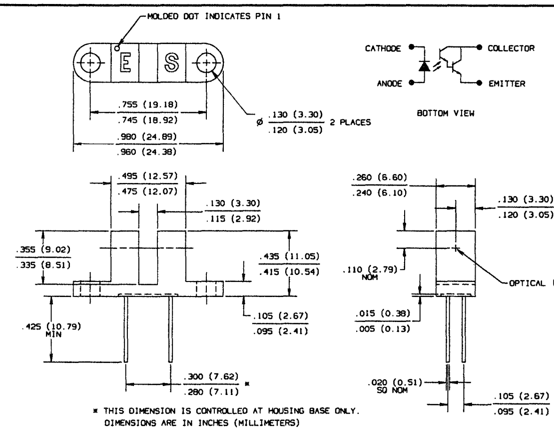
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB853A
May 1993

OPTEK

Slotted Optical Switches
Types OPB853A1, OPB853A2, OPB853A3





Features

- Inexpensive opaque plastic housing
- 0.125" wide slot
- 0.290" lead spacing
- Apertured for high resolution
- Photodarlington output

Description

The OPB853A series of slotted optical switches consist of an infrared emitting diode and an NPN silicon photodarlington. They are mounted on opposite sides of a .125" wide slot. The emitter has a .050" X .050" molded-in aperture while the photodarlington has a .010" X .050" molded-in aperture.

Replaces

KT853A1, KT853A2, KT853A3

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C[(1)]

Input Diode

Forward DC Current 40mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW[(2)]

Output Photodarlington

Collector-Emitter Voltage 15V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW[(2)]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones. Highly activated, water soluble fluxes may attack housings in some situations.

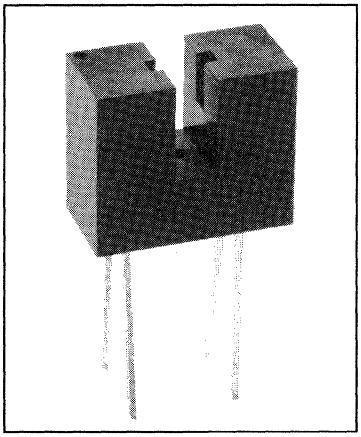
Types OPB853A1, OPB853A2, OPB853A3

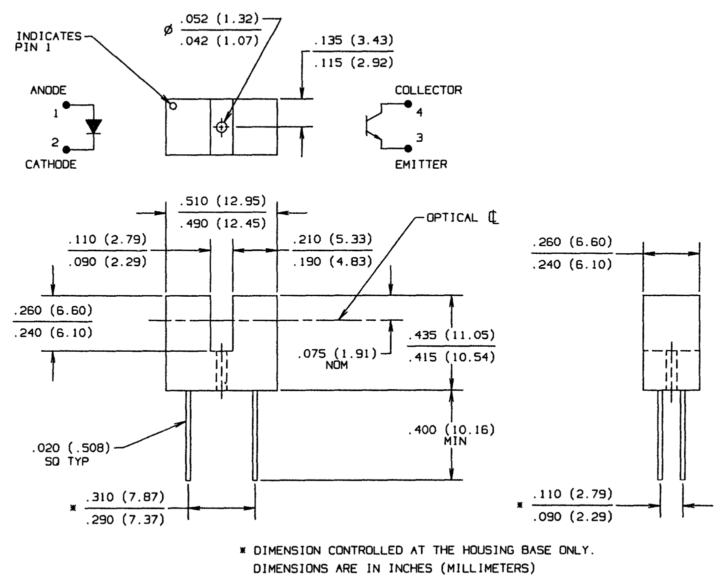
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	I_F = 20mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Photodarlington					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10V
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		1.0	V	I_C = 1.8mA, I_F = 10mA
$I_{C(ON)}$	On-State Collector Current OPB853A1	2.5		mA	V_{CE} = 1.5V, I_F = 5mA
	OPB853A2	5.0		mA	V_{CE} = 1.5V, I_F = 5mA
	OPB853A3	10.0		mA	V_{CE} = 1.5V, I_F = 5mA

OPTEK

Slotted Optical Switches
Types OPB854A1, OPB854B1





Features

- Non-contact switching
- Printed circuit board mounting
- 0.100" wide slot
- 0.300" lead spacing
- Opaque plastic housing

Description

The OPB854A1 and OPB854B1 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .100" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot. Also available with one mounting tab as OPB854A2 and OPB854B2, or with two mounting tabs as OPB854A3 and OPB854B3.

Replaces

KT850A, KT851A

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation 100mW

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

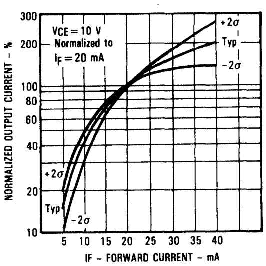
Types OPB854A1, OPB854B1

Electrical Characteristics ($T_A = 25^{\circ}C$ unless otherwise noted)

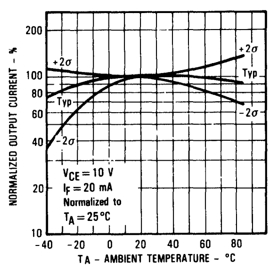
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	$I_F = 20mA$
I_R	Reverse Current			10	μA	$V_R = 2.0V$
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	$I_C = 1.0mA$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector-Emitter Dark Current			100	nA	$V_{CE} = 10V, I_F = 0, E_e = 0$
Coupled						
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB854A1 OPB854B1		0.6 0.4	V V	$I_C = 2.0mA, I_F = 16mA$ $I_C = 250\mu A, I_F = 20mA$
$I_{C(ON)}$	On-State Collector Current	OPB854A1 OPB854B1	3.0 1.0		mA mA	$V_{CE} = 1.0V, I_F = 16mA$ $V_{CE} = 10.0V, I_F = 20mA$

Typical Performance Curves

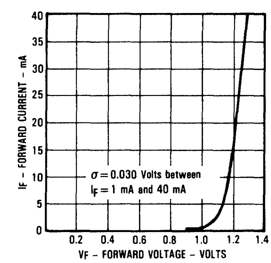
Normalized Output Current vs Forward Current



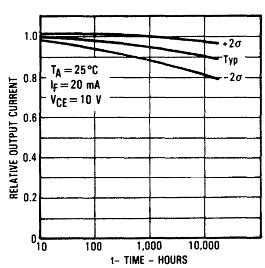
Normalized Output Current vs Ambient Temperature



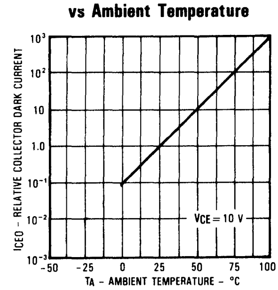
Forward Current vs Forward Voltage Input Diode



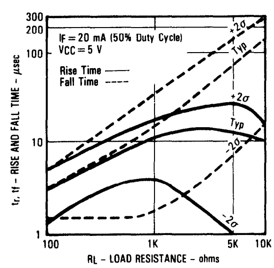
Relative Output Current vs Time



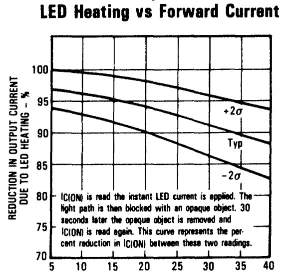
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



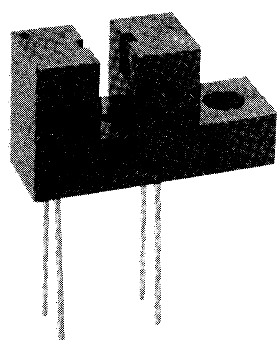
Reduction in Output Current Due to LED Heating vs Forward Current

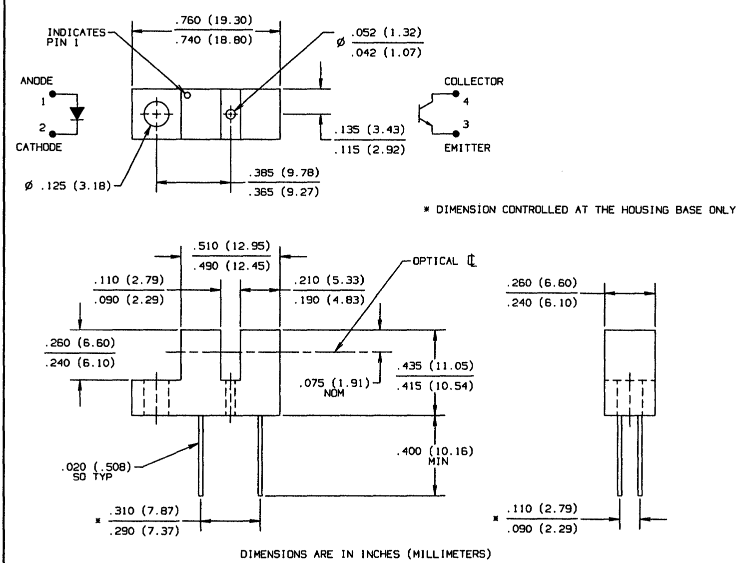


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Slotted Optical Switches
Types OPB854A2, OPB854B2





Features

- Non-contact switching
- Printed circuit board mounting
- 0.100" wide slot
- 0.300" lead spacing
- Opaque plastic housing

Description

The OPB854A2 and OPB854B2 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .100" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot. Also available without mounting tab as OPB854A1 and OPB854B1, or with two mounting tabs as OPB854A3 and OPB854B3.

Replaces

KT850B, KT851B

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation .... 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation .... 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

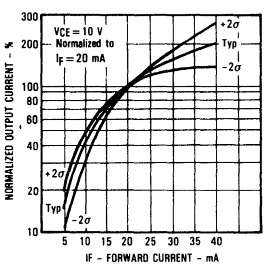
Types OPB854A2, OPB854B2

Electrical Characteristics (T_A = 25°C unless otherwise noted)

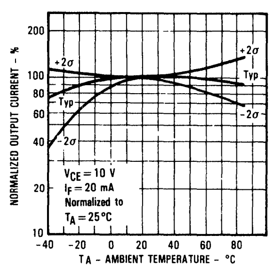
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA
I_R	Reverse Current			10	μA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10V, I_F = 0, E_e = 0
Coupled						
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB854A2 OPB854B2		0.6 0.4	V V	I_C = 2.0mA, I_F = 16mA I_C = 250μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	OPB854A2 OPB854B2	3.0 1.0		mA mA	V_{CE} = 1.0V, I_F = 16mA V_{CE} = 10.0V, I_F = 20mA

Typical Performance Curves

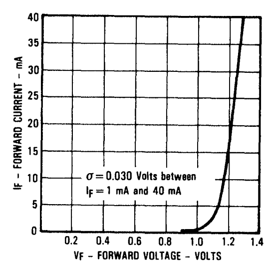
Normalized Output Current vs Forward Current



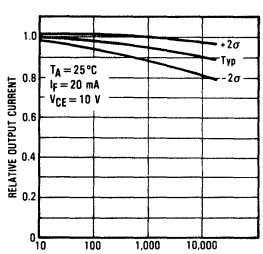
Normalized Output Current vs Ambient Temperature



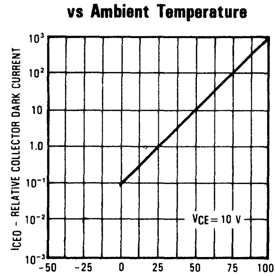
Forward Current vs Forward Voltage Input Diode



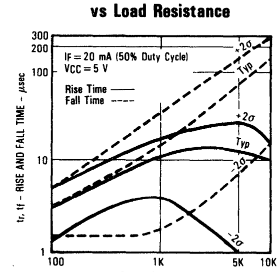
Relative Output Current vs Time



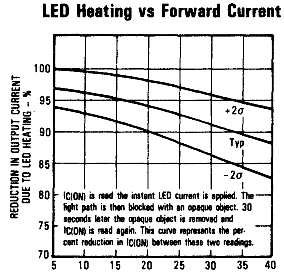
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current

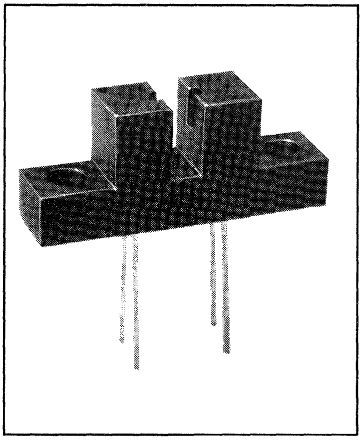


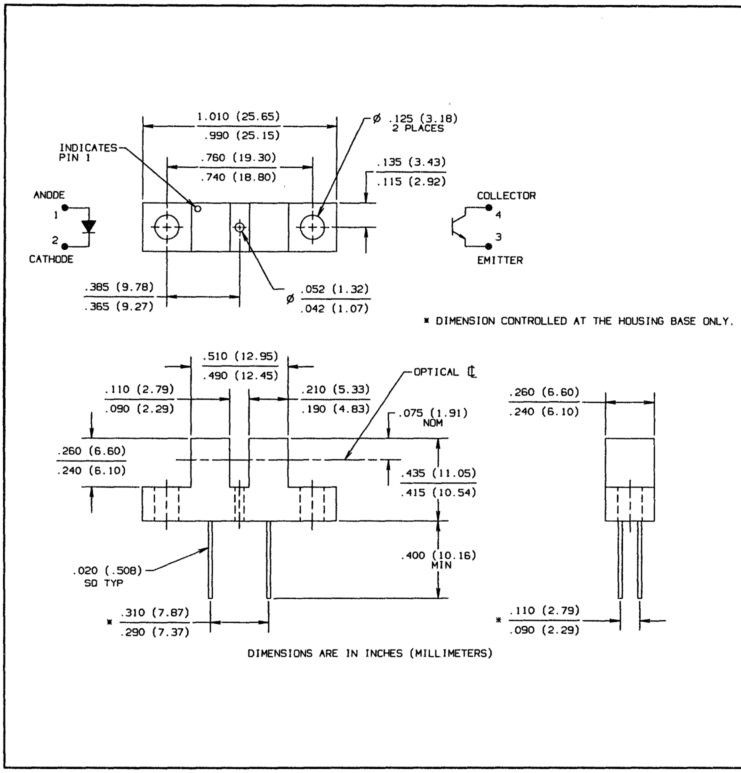
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB854A3
May 1993

OPTEK

Slotted Optical Switches
Types OPB854A3, OPB854B3





Features

- Non-contact switching
- Printed circuit board mounting
- 0.100" wide slot
- 0.300" lead spacing
- Opaque plastic housing

Description

The OPB854A3 and OPB854B3 each consist of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .100" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot. Also available without mounting tab as OPB854A1 and OPB854B1, or with one mounting tab as OPB854A2 and OPB854B2.

Replaces

KT850C, KT851C

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation 100mW

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

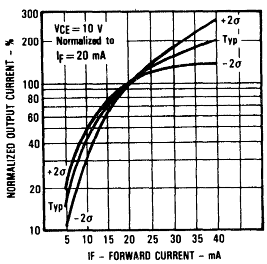
Types OPB854A3, OPB854B3

Electrical Characteristics (T_A = 25°C unless otherwise noted)

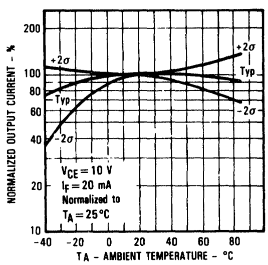
SYMBOL	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA
I_R	Reverse Current			10	µA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0		V	I_E = 100µA
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10V, I_F = 0, E_e = 0
Coupled						
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB854A3 OPB854B3		0.6 0.4	V V	I_C = 2.0mA, I_F = 16mA I_C = 250µA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	OPB854A3 OPB854B3	3.0 1.0		mA mA	V_{CE} = 1.0V, I_F = 16mA V_{CE} = 10.0V, I_F = 20mA

Typical Performance Curves

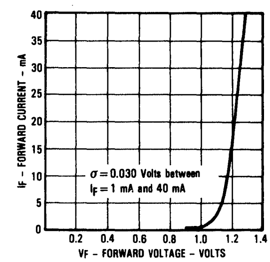
Normalized Output Current vs Forward Current



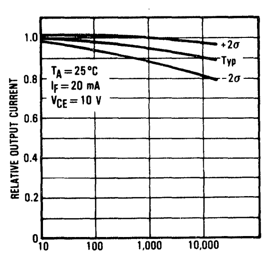
Normalized Output Current vs Ambient Temperature



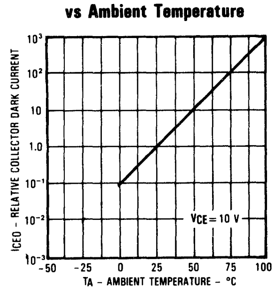
Forward Current vs Forward Voltage Input Diode



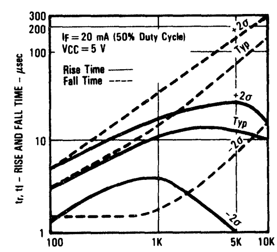
Relative Output Current vs Time



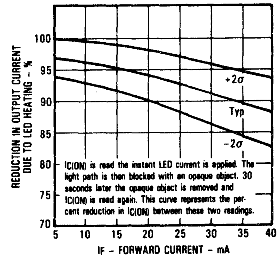
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current

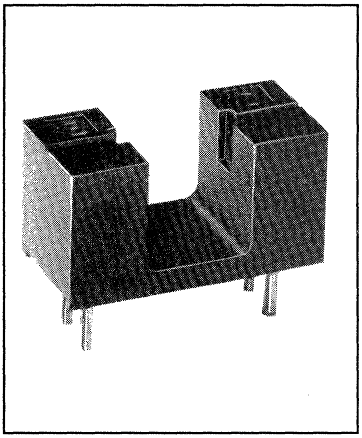


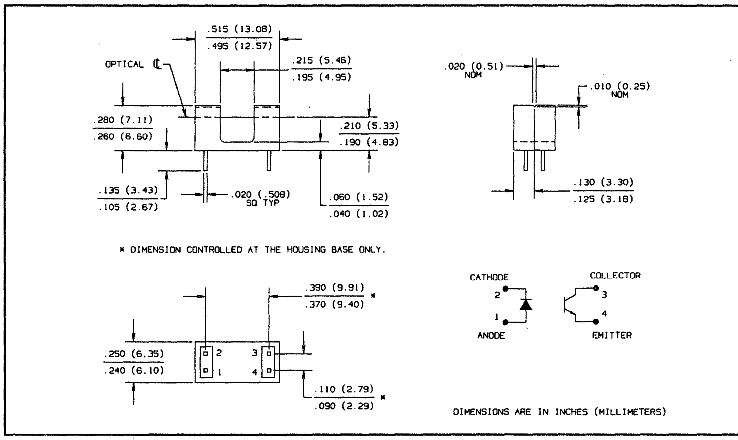
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB855
May 1993

OPTEK

Slotted Optical Switch
Type OPB855





Features

- Low profile .270" overall height
- Printed circuit board mounting
- 0.205" wide slot
- 0.380" lead spacing
- Opaque plastic housing

Description

The OPB855 low profile optical switch consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a .200" wide slot in an inexpensive plastic housing. Switching of the phototransistor occurs whenever an opaque object passes through the slot.

Replaces

KT855

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation . . . . 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate Linearly 1.67mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) Methanol or isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.

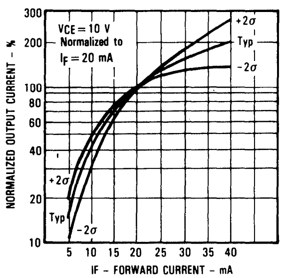
Type OPB855

Electrical Characteristics (T_A = 25°C unless otherwise noted)

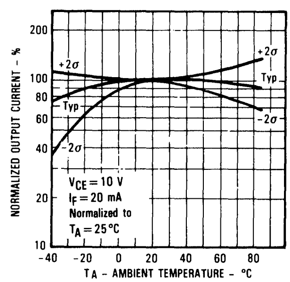
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.5	V	I_F = 40mA
I_R	Reverse Current		100	μA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5		V	I_E = 100μA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.4	V	I_C = 400μA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current	500		μA	V_{CE} = 5.0V, I_F = 20mA

Typical Performance Curves

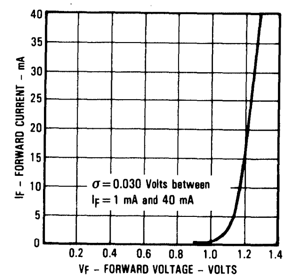
Normalized Output Current vs Forward Current



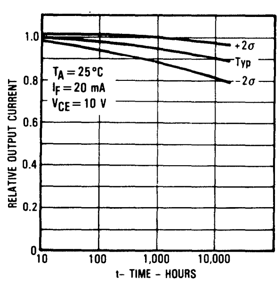
Normalized Output Current vs Ambient Temperature



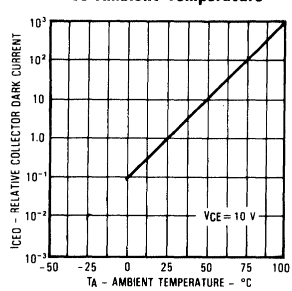
Forward Current vs Forward Voltage Input Diode



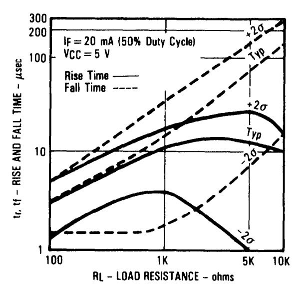
Relative Output Current vs Time



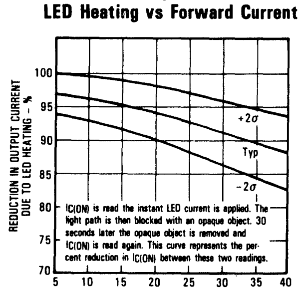
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current

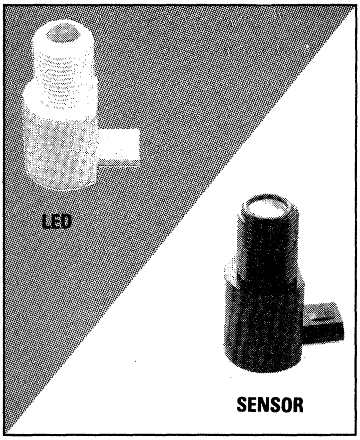


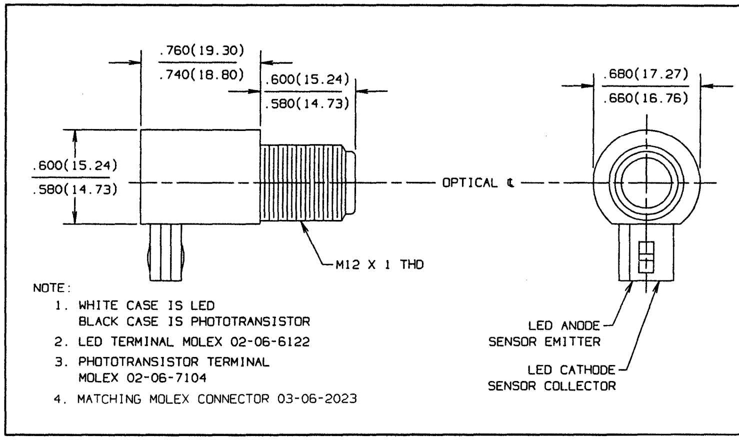
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB856
May 1993

OPTEK

Wide Gap Optical Sensor
Type OPB856





Features

- Industrial package
- Threaded housing
- Molded connectors

Description

The OPB856 consists of an LED and a phototransistor each mounted in a threaded (M12x1TH) color coded housing. The LED is white, and the phototransistor is black. Both have a molded Molex connector for ease of installation. For cable and connector operations, contact the factory.

Replaces

K-8050

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C

Input Diode

Continuous Forward Current 40mA
Reverse Voltage 2.0V
Power Dissipation .... 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 100mW(1)

Notes:
(1) Derate Linearly 1.67mW/°C above 25°C.
(2) d is the distance between lenses along the optical axis.
(3) All parameters tested using pulse technique.

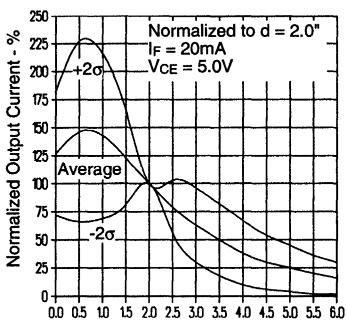
Type OPB856

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20mA$
I_R	Reverse Current		100	µA	$V_R = 2.0V$
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 100\mu A$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100\mu A$
I_{CEO}	Collector Dark Current		100	nA	$V_{CE} = 10.0V, I_F = 0, E_e = 0$
Coupled					
$I_{C(ON)}$	On-State Collector Current(3)	1.8		mA	$V_{CE} = 5V, I_F = 20mA$, d = 2" (2)

SLOTTED OPTICAL SWITCHES

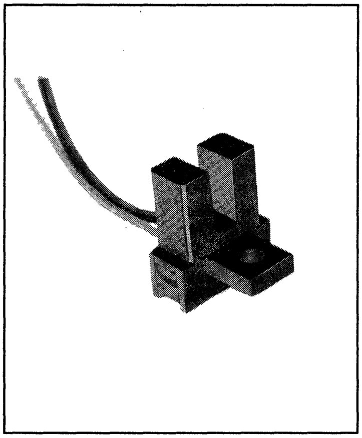
Normalized Output Current vs. Distance

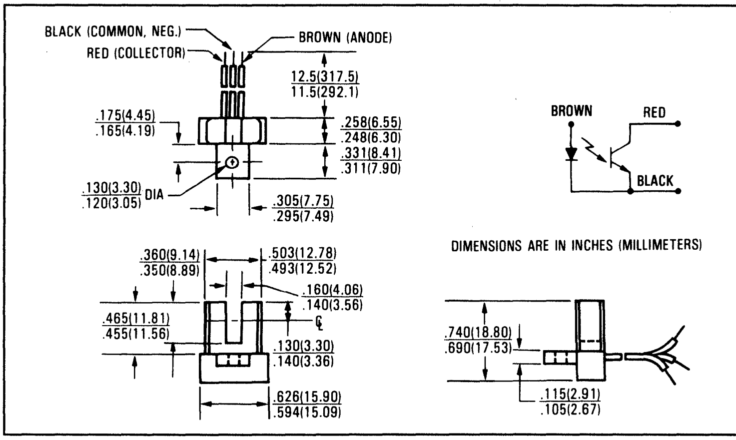


d - Distance Between LED and Sensor Housings - Inches

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Slotted Optical Switch
Type OPB857





Features

- Non-contact switching
- Three lead wires for electrical connection
- Sealed plastic housing
- Fast switching speed

Description

The OPB857 consists of an infrared emitting diode and an NPN silicon phototransistor mounted on opposite sides of a 0.15" (3.81 mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. The low cost plastic housing reduces possible interference from ambient light and provides dirt and dust protection. 11.5" (292.1 mm) minimum length lead wires ease assembly where PC board mounting is not practical.

The OPB857 uses an OP140 or OP240 LED and OP550 family sensor.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +80°C(1)

Input Diode

Reverse Voltage .... 2.0 V
Continuous Forward Current .... 50 mA
Peak Forward Current (1 us pulse width, 300 pps) .... 3.0 A
Power Dissipation .... 100 mW(2)

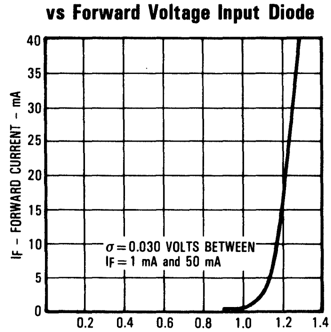
Phototransistor

Collector-Emitter Voltage .... 30 V
Emitter-Collector Voltage .... 5.0 V
Power Dissipation .... 100 mW(2)

Notes:
(1) Maximum storage and operating temperature are limited by the temperature rating of the lead wires.
(2) Derate linearly 1.82 mW/°C above 25°C.
(3) Plastic housing is soluble in chlorinated hydrocarbons and ketones. Methanol or isopropanol alcohols are recommended as cleaning agents.

Typical Performance Curves

Forward Current vs Forward Voltage Input Diode



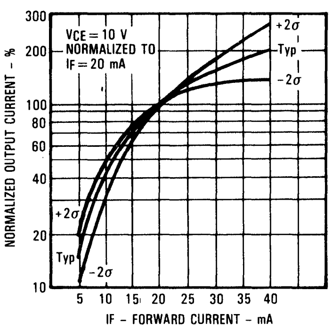
Type OPB857

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

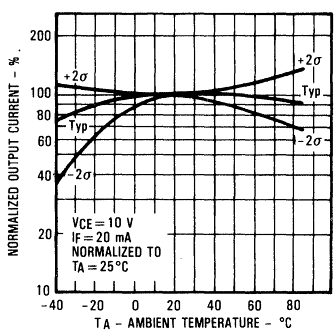
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.70	V	$I_F = 20$ mA
I_R	Reverse Current		100	µA	$V_R = 2.0$ V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	$I_C = 1.00$ mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	$I_E = 100$ µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	$V_{CE} = 10.0$ V, $I_F = 0$, $E_e = 0$
Coupled					
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	$I_C = 1.50$ mA, $I_F = 20$ mA
$I_{C(ON)}$	On-State Collector Current	1.50		mA	$V_{CE} = 10.0$ V, $I_F = 20$ mA

Typical Performance Curves

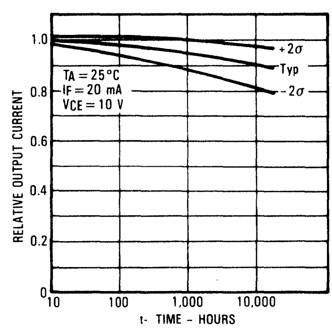
Normalized Output Current vs Forward Current



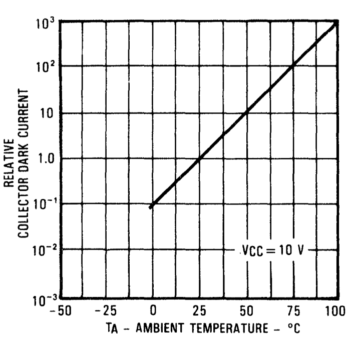
Normalized Output Current vs Ambient Temperature



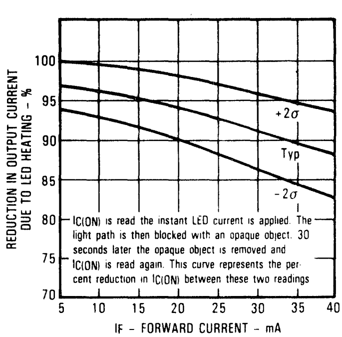
Relative Output Current vs Time



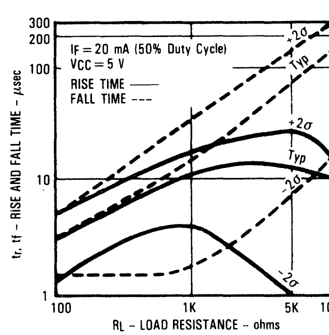
Relative Collector Dark Current vs Ambient Temperature



Reduction in Output Current Due to LED Heating vs Forward Current



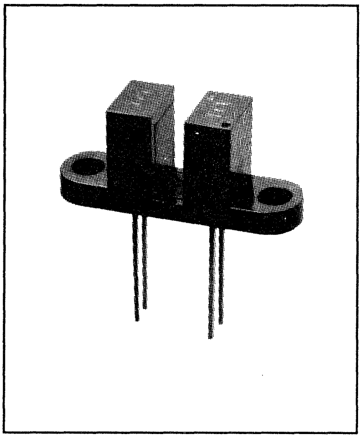
Rise and Fall Time vs Load Resistance

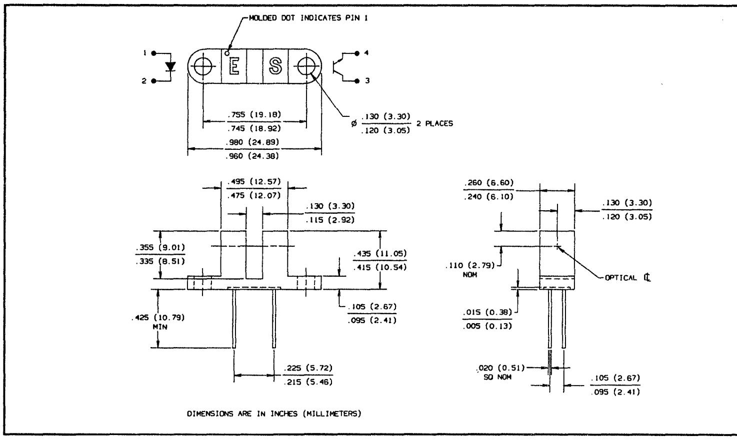


Product Bulletin OPB859
May 1993

OPTEK

High Resolution Slotted Optical Switch
Type OPB859





Features

- Inexpensive opaque plastic housing
- 0.125" wide slot
- 0.220" lead spacing
- Apertured for high resolution

Description

The OPB859 slotted optical switch consists of an infrared emitting diode and an NPN silicon phototransistor. They are mounted on opposite sides of a .125" wide slot. The emitter has a .050" x .050" aperture while the phototransistor has a .005" x .050" aperture.

Replaces

OPB813S5

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range .... -40°C to +85°C
Lead Soldering Temperature (1/16 inch [1.6 mm] from case for 5 sec. with soldering iron).. 240°C(1)

Input Diode

Forward DC Current.. 40mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage... 2.0V
Power Dissipation.. 100mW(2)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation.. 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.67 mW/°C above 25°C.
(3) All parameters tested using pulse technique.
(4) This dimension controlled at housing surface only.
(5) Methyl or isopropyl alcohols are recommended as cleaning agents. Plastic housings are soluble in chlorinated hydrocarbons and ketones.

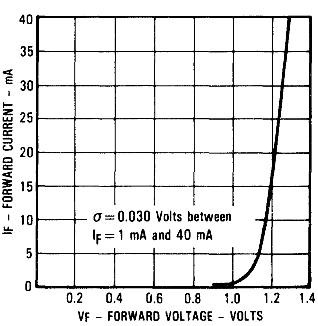
Type OPB859

Electrical Characteristics (T_A = 25°C unless otherwise noted)

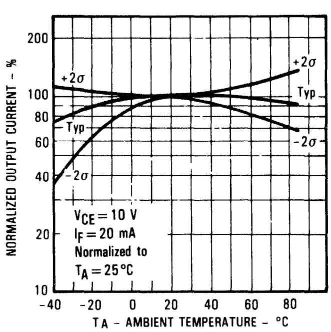
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	I_F = 20 mA
I_R	Reverse Current		100	µA	V_R = 2.0 V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakjdown Voltage	30		V	I_C = 1.0 mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100 µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10 V
Coupled					
$V_{CE(SAT)}$	Saturation Voltage		0.40	V	I_C = 125 µA, I_F = 20 mA
$I_{C(ON)}$	On-State Collector Current	250		µA	V_{CE} = 10.0 V, I_F = 20 mA

Typical Performance Curves

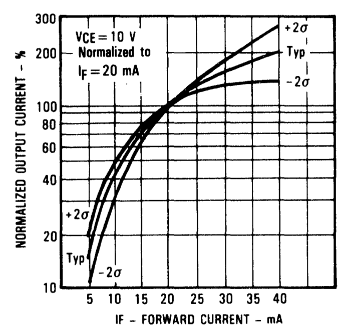
Forward Current vs Forward Voltage Input Diode



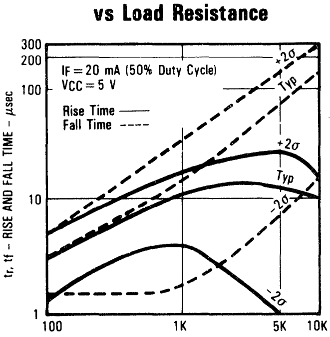
Normalized Output Current vs Ambient Temperature



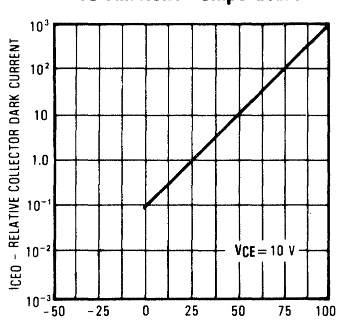
Normalized Output Current vs Forward Current



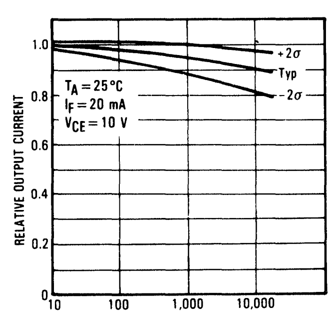
Rise and Fall Time vs Load Resistance



Collector Dark Current vs Ambient Temperature

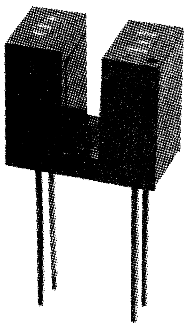


Relative Output Current vs Time

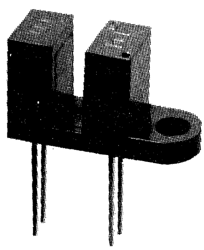


OPTEK

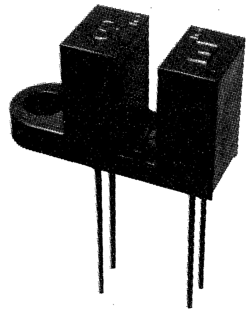
Slotted Optical Switches
Types OPB860, OPB870 Series



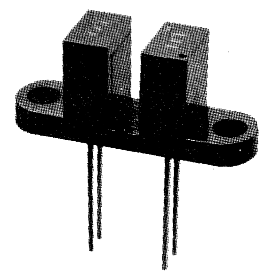
Package N



Package L



Package P



Package T

Features

- 0.125" wide gap
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Choice of mounting configuration
- Choice of lead spacing

Description

The OPB860/870 series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) electrical output parameters, (2) mounting tab configuration, (3) choice of lead spacing, (4) discrete shell material, and (5) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +85°C
Lead Soldering Temperature Range [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 μs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation . . . . 100mW(1)

Notes:
(1) Derate linearly 1.67mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) All parameters tested using pulse technique.
(4) Lead spacing of .220" or .320" is available. Leads are 0.20" sq and .425" long (min).
(5) Methyl and isopropyl alcohols are recommended as cleaning agents. Plastic housings are soluble in chlorinated hydrocarbons and ketones.

Types OPB860, OPB870 Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA
I_R	Reverse Current			100	µA	V_R = 2.0V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			V	I_E = 100µA
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10V, I_F = 0, E_e = 0
Coupled						
$V_{CE(SAT)}$	Saturation Voltage: Parameter A OPB860 / OPB870 OPB865 / OPB875			0.4	V	I_C = 400µA, I_F = 20mA
	Parameter B OPB861 / OPB871 OPB866 / OPB876			0.4	V	I_C = 800µA, I_F = 10mA
	Parameter C OPB862 / OPB872 OPB867 / OPB877			0.6	V	I_C = 1800µA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current: Parameter A OPB860 / OPB870 OPB865 / OPB875	500			µA	V_{CE} = 10V, I_F = 20mA
	Parameter B OPB861 / OPB871 OPB866 / OPB876	1000			µA	V_{CE} = 5V, I_F = 10mA
	Parameter C OPB862 / OPB872 OPB867 / OPB877	1800			µA	V_{CE} = 0.6V, I_F = 20mA

PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation
6 - Base Mount IR Transmissive Plastic Discrete Shell PC Mountable Leads
7 - Base Mount Opaque Plastic Discrete Shell PC Mountable Leads

Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*

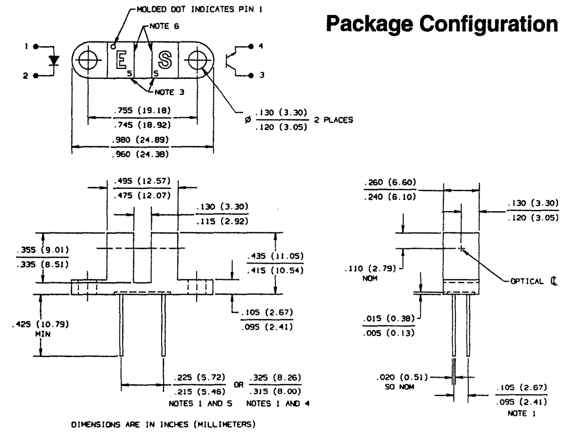
Mounting Configurations
T - Both Mounting Tabs
N - No Mounting Tabs
L - Single Mounting Tab Emitter Side
P - Single Mounting Tab Phototransistor Side

Electrical Specification Variations
0 - Electrical Parameter A, Lead Spacing 0.320"
1 - Electrical Parameter B, Lead Spacing 0.320"
2 - Electrical Parameter C, Lead Spacing 0.320"
5 - Electrical Parameter A, Lead Spacing 0.220"
6 - Electrical Parameter B, Lead Spacing 0.220"
7 - Electrical Parameter C, Lead Spacing 0.220"
*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

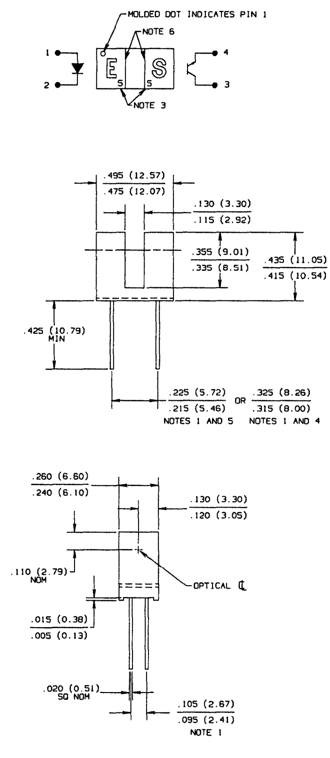
TX-TXV Process Available See Hi-Rel Section

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

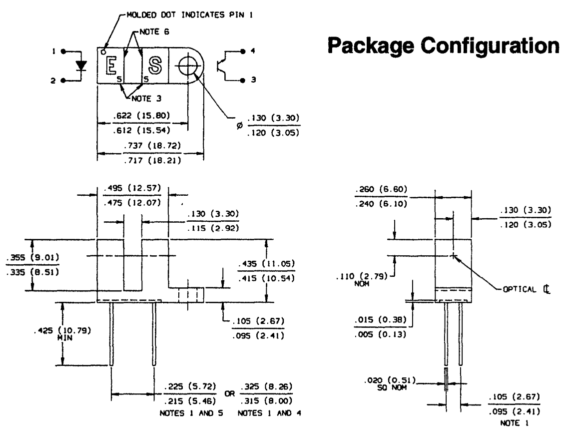
Package Configuration T



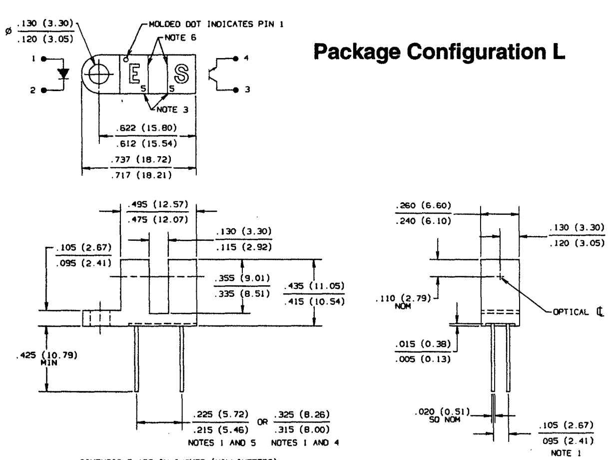
Package Configuration N



Package Configuration P



Package Configuration L

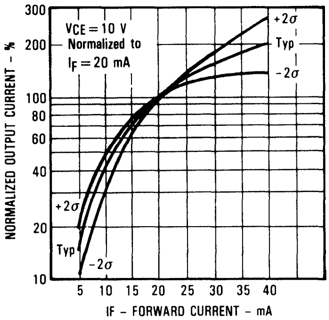


Notes:

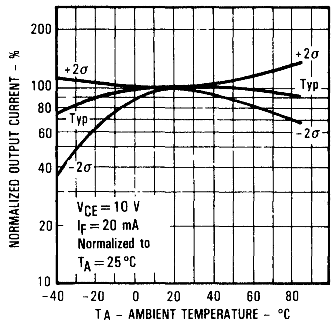
(1) Dimension controlled at housing surace only.
(2) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones. Highly activated, water soluble fluxes may attack housings in some situations.
(3) Molded number to identify aperture size. See part number guide.
(4) OPB860, OPB861, OPB862, OPB870, OPB871, OPB872.
(5) OPB865, OPB866, OPB867, OPB875, OPB876, OPB877.
(6) Dimensions of aperture opening dependent on housing. See part number guide.

Typical Performance Curves

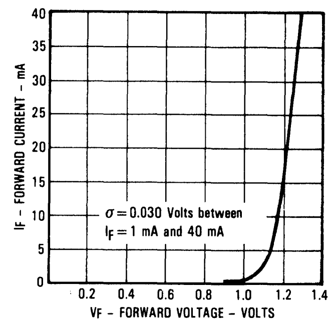
Normalized Output Current vs Forward Current



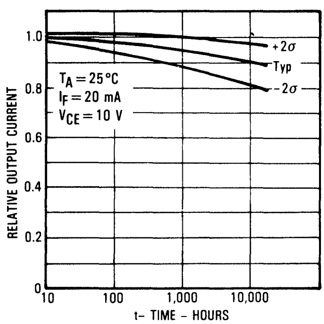
Normalized Output Current vs Ambient Temperature



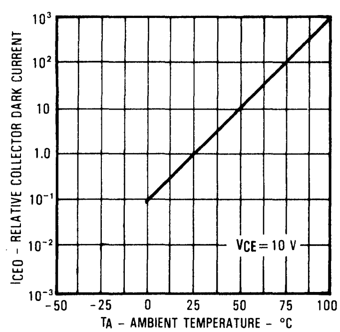
Forward Current vs Forward Voltage Input Diode



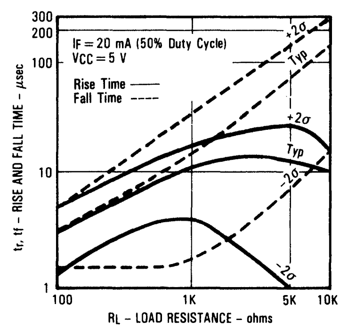
Relative Output Current vs Time



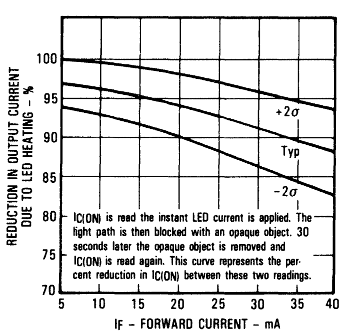
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance

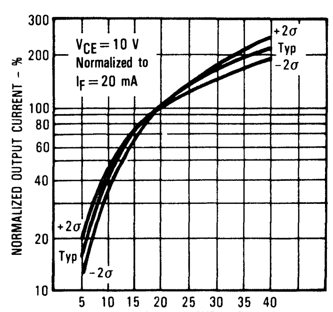


Reduction in Output Current Due to LED Heating vs Forward Current

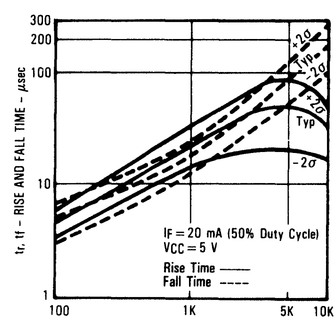


All Part Numbers Ending in "1"

Normalized Output Current vs Input Current



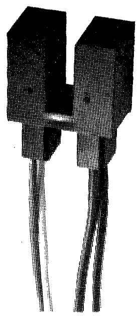
Rise and Fall Time vs Load Resistance



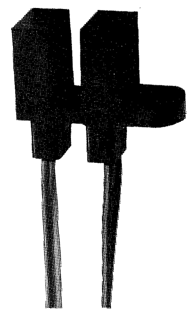
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

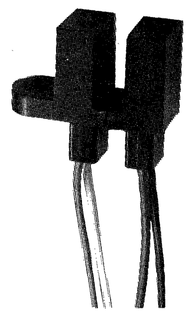
Slotted Optical Switches
Types OPB880, OPB890 Series



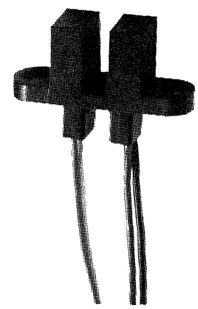
Package N



Package L



Package P



Package T

Features

- 0.125" wide gap
- 24" minimum, 26 AWG wire leads
- Choice of aperture
- Choice of opaque or IR transmissive shell material
- Choice of mounting configuration
- Choice of lead spacing

Description

The OPB880/890 series of slotted switches provides the design engineer with the flexibility of a custom device from a standard product line. Building from a standard housing with a .125" wide slot, the user can specify (1) electrical output parameters, (2) mounting tab configuration, (3) discrete shell material, and (4) aperture width.

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed only on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic with aperture openings for maximum protection against ambient light.

Replaces KT880/KT890 Series
Upgrades OPB880/OPB890 Series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage and Operating Temperature Range . . . . -40°C to +80°C(1)

Input Diode

Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 3.0A
Reverse DC Voltage 2.0V
Power Dissipation . . . . 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Collector DC Current 30mA
Power Dissipation . . . . 100mW(1)

Notes:

(1) Derate linearly 1.82mW/°C above 25°C (Maximum storage and operating temperature is limited by the temperature rating of the lead wires)
(2) All parameters tested using pulse technique.
(3) The OPB880/OPB890 wire terminations are 24" of 7 strand, 26 AWG, UL 1429 insulated wire on each terminal. The devices incorporate a wire strain relief at the housing surface. The insulation colors and functions are:

RED - IRED Anode	WHITE - Phototransistor Collector
BLACK - IRED Cathode	GREEN - Phototransistor Emitter

Other wire lengths and/or colors are available. Contact your local representative or call the factory.

Types OPB880, OPB890 Series

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Input Diode					
V_F	Forward Voltage		1.7	V	I_F = 20mA
I_R	Reverse Current		100	µA	V_R = 2.0V
Output Phototransistor					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30		V	I_C = 1.0mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0		V	I_E = 100µA
I_{CEO}	Collector-Emitter Dark Current		100	nA	V_{CE} = 10V, I_F = 0, E_e = 0
Coupled					
$V_{CE(SAT)}$	Saturation Voltage:				
	Parameter A OPB880 / OPB890		0.4	V	I_C = 400µA, I_F = 20mA
	Parameter B OPB881 / OPB891		0.4	V	I_C = 800µA, I_F = 10mA
	Parameter C OPB882 / OPB892		0.6	V	I_C = 1800µA, I_F = 20mA
$I_{C(ON)}$	On-State Collector Current:				
	Parameter A OPB880 / OPB890	500		µA	V_{CE} = 10V, I_F = 20mA
	Parameter B OPB881 / OPB891	1000		µA	V_{CE} = 5V, I_F = 10mA
	Parameter C OPB882 / OPB892	1800		µA	V_{CE} = 0.6V, I_F = 20mA

PART NUMBER GUIDE

OPB 8 X X X X X

Optek Assembly

Phototransistor Output Family

Discrete Shell Material Designation
- 8 - Base Mount IR Transmissive Plastic Discrete Shell With Wire Termination
- 9 - Base Mount Opaque Plastic Discrete Shell With Wire Termination

Electrical Specification Variations
- 0 - Electrical Parameter A
- 1 - Electrical Parameter B
- 2 - Electrical Parameter C

Mounting Configurations
- T - Both Mounting Tabs
- N - No Mounting Tabs
- L - Single Mounting Tab Emitter Side
- P - Single Mounting Tab Phototransistor Side

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"*

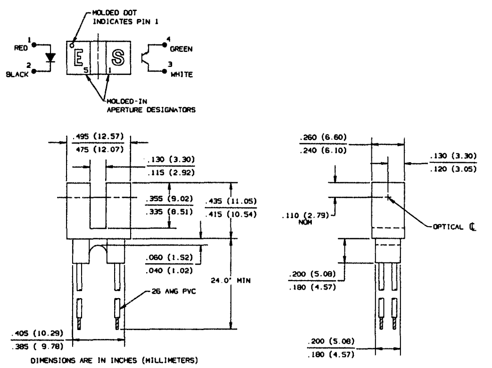
Aperture Width In Front of Sensor
5 = 0.050" 1 = 0.010"

*Assemblies with dual 0.010" apertures are currently available with electrical parameter "A" only.

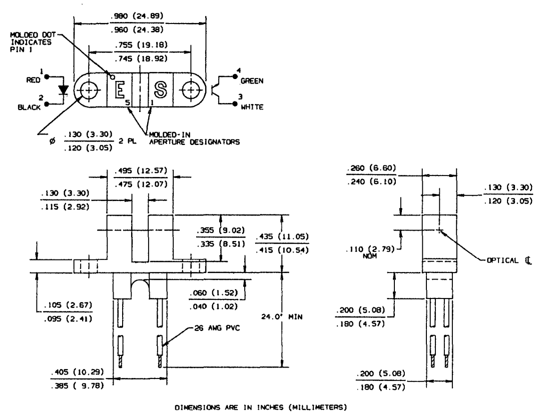
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

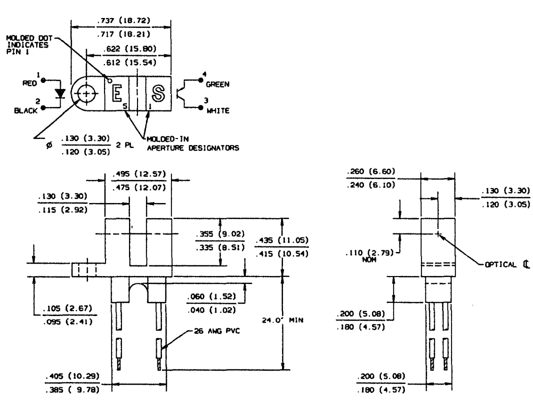
Package N



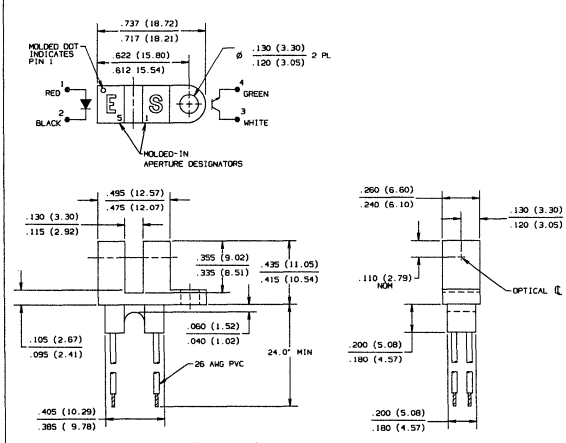
Package T



Package L



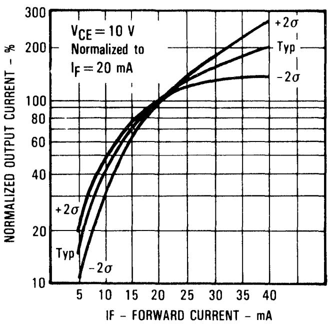
Package P



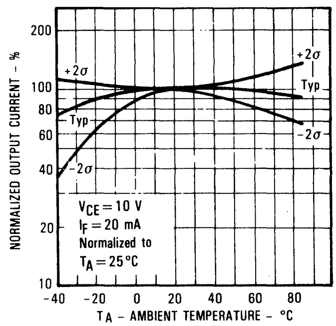
Types OPB880, OPB890 Series

Typical Performance Curves

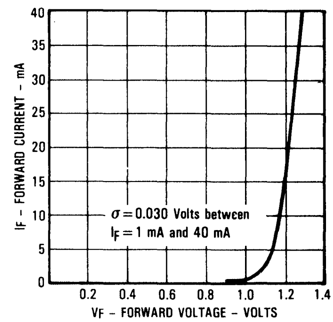
Normalized Output Current vs Forward Current



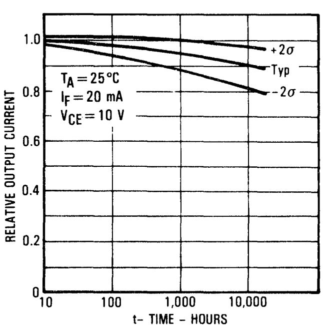
Normalized Output Current vs Ambient Temperature



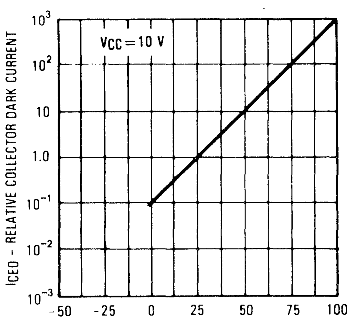
Forward Current vs Forward Voltage Input Diode



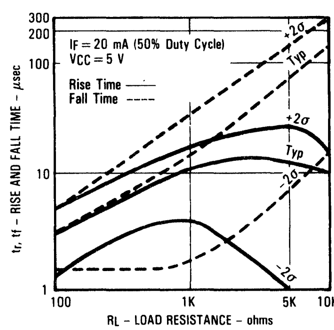
Relative Output Current vs Time



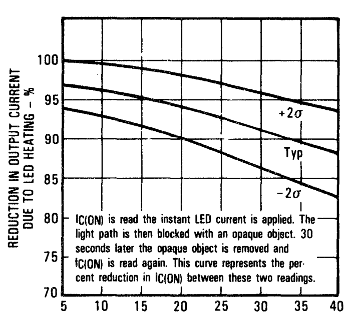
Collector Dark Current vs Ambient Temperature



Rise and Fall Time vs Load Resistance

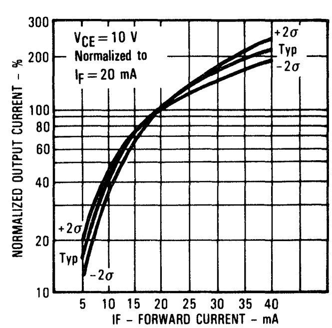


Reduction in Output Current Due to LED Heating vs Forward Current

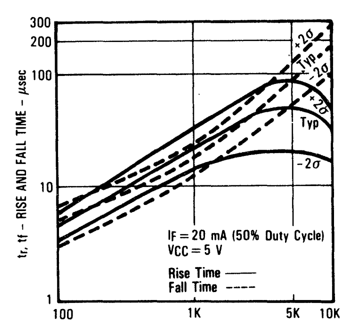


All Part Numbers Ending in "1"

Normalized Output Current vs Input Current



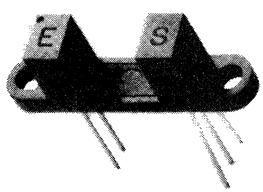
Rise and Fall Time vs Load Resistance

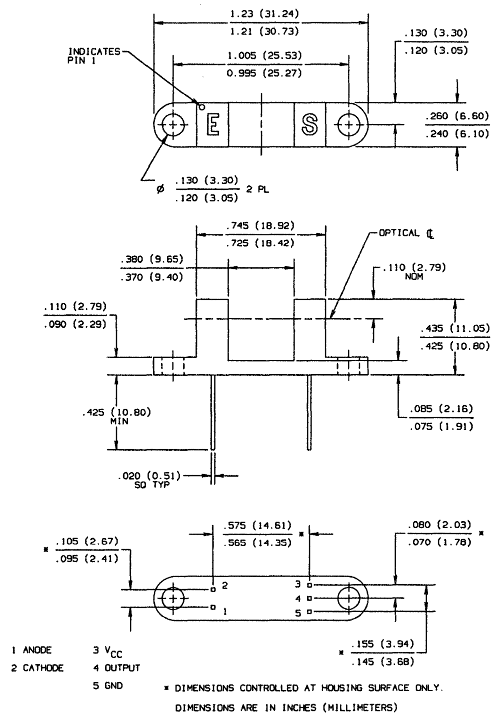


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Photologic™ Slotted Optical Switches
Types OPB900L, OPB910L "Wide Gap" Series





Features

- 0.375" wide gap
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 0.570" lead spacing

Description

The OPB900L and OPB910L series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .375" wide slot, the user can specify (1) type and polarity of TTL output and (2) discrete shell material. Available with wire leads as OPB900W/OPB910W series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

Replaces

KT900L/KT910L, KLT100L/KLT110L series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range . . . . -40°C to +85°C
Operating Temperature Range . . . . -40°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)
Input Diode Power Dissipation . . . . 100mW(2)
Output Photologic™ Power Dissipation . . . . 200mW(3)
Total Device Power Dissipation . . . . 300mW(4)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 2V

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB900L/OPB910L series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by I_F = 0mA.
(7) All parameters tested using pulse technique.
(8) Methyl or isopropyl alcohols are recommended as cleaning agents. Plastic housings are soluble in chlorinated hydrocabons and ketones.

Types OPB900L, OPB910L Series

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	µA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(6)
	Inverted Totem-Pole Output, Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 20mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 20mA
	Inverted Totem-Pole Output, Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(6)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output, Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA, I_F = 0mA(6)
	Inverted Totem-Pole Output, Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA, I_F = 20mA
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800µA, I_F = 20mA
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800µA, I_F = 0mA(6)
I_{OH}	High Level Output Current: Buffered Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 20mA, T_A = 25°C
	Inverted Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			20	mA	V_{CC} = 5V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2.0			V_{CC} = 5V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 20mA, Output = GND
	Inverted Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 0mA, Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5V, T_A = 25°C, I_F = 0 or 20mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5.0		µs	R_L = 8TTL Loads (Totem Pole), R_L = 360Ω (Open Collector)

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Types OPB900L, OPB910L Series

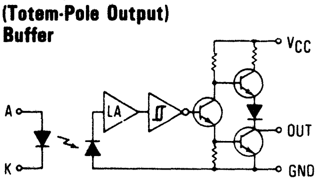
PART NUMBER GUIDE

OPB 9 X X X X X

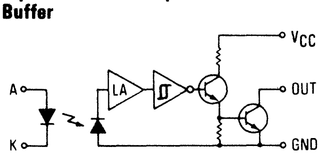
- Optek Assembly (OPB)
- Photologic™ Photo Integrated Circuit Sensor Family (9)
- Discrete Shell Material Designation
  - 0 - Wide Gap IR Transmissive Plastic Discrete Shell
  - 1 - Wide Gap Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter
  - 5 = 0.050"
- Aperture Width In Front of Sensor
  - 5 = 0.050"

Schematics

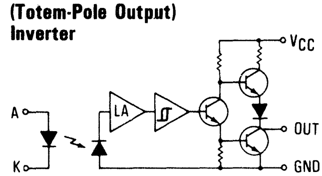
OPB900/OPB910
(Totem-Pole Output)
Buffer



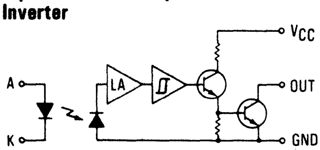
OPB901/OPB911
(Open-Collector Output)
Buffer



OPB902/OPB912
(Totem-Pole Output)
Inverter

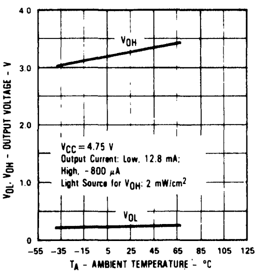


OPB903/OPB913
(Open-Collector Output)
Inverter



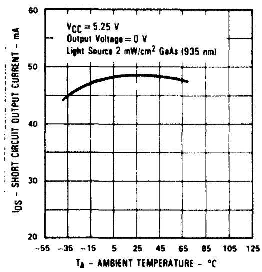
Typical Performance Curves

Output Voltage vs Ambient Temperature



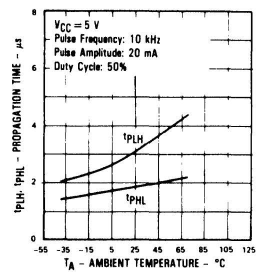
OPB900L, OPB902L, OPB910L, OPB912L

Short Circuit Output Current vs Ambient Temperature



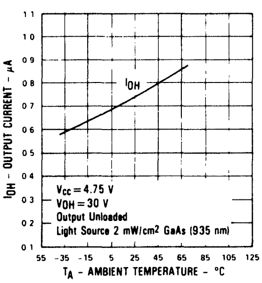
All Assemblies

Propagation Time vs Ambient Temperature

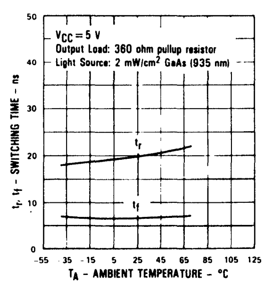


OPB901L, OPB903L, OPB911L, OPB913L

Output Current (High) vs Ambient Temperature

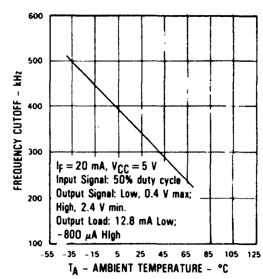


Rise Time and Fall Time vs Ambient Temperature



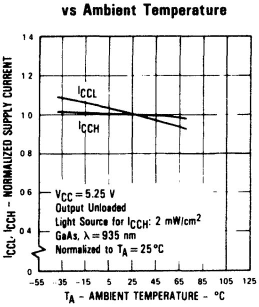
All Assemblies

Data Rate vs Ambient Temperature



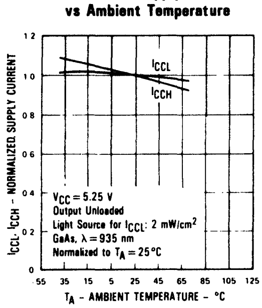
OPB902L, OPB903L, OPB912L, OPB913L

Normalized Supply Current vs Ambient Temperature



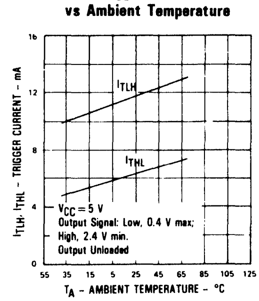
OPB900L, OPB901L, OPB910L, OPB911L

Normalized Supply Current vs Ambient Temperature

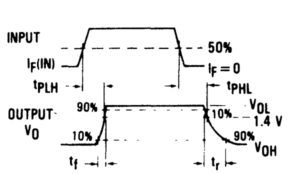


All Assemblies

Trigger Current vs Ambient Temperature

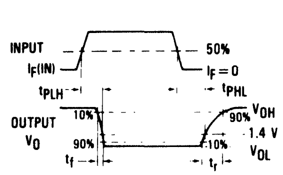


Switching Test Curve for Buffers



LED: f = 10 kHz, D.C. = 50%

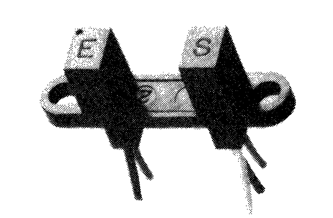
Switching Test Curve for Inverters

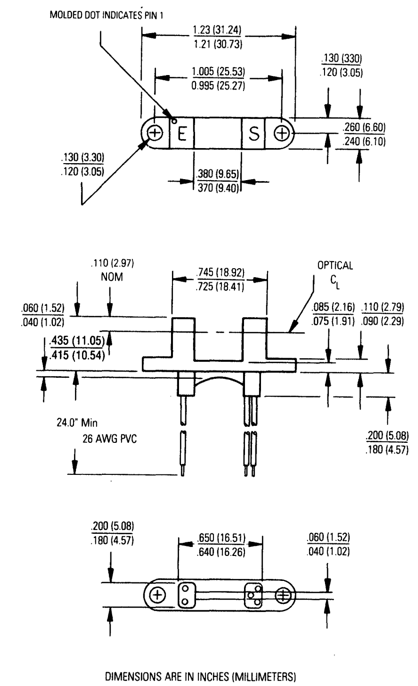


LED: f = 10 kHz, D.C. = 50%

OPTEK

Photologic™ Slotted Optical Switches
Types OPB900W, OPB910W "Wide Gap" Series





WIRE COLOR	FUNCTION
GREEN	GROUND
BLUE	OUTPUT
WHITE	V_{CC}
BLACK	CATHODE
RED	ANODE

Features

- 0.375" wide gap
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 24" min, 26AWG wire leads

Description

The OPB900W and OPB910W series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .375" wide slot, the user can specify (1) type and polarity of TTL output and (2) discrete shell material.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

Replaces

KT900W/KT910W KLT100W/KLT100W series.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range .... -40°C to +80°C
Operating Temperature Range .... -40°C to +70°C
Input Diode Power Dissipation .... 100mW(1)
Output Photologic™ Power Dissipation .... 200mW(2)
Total Device Power Dissipation .... 300mW(3)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 2V

Notes:

(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB900W/OPB910W series are terminated with 24 inches of 7 strand 26 AWG, UL 1429 insulated wire on each terminal. Insulation function and colors are :

Red - IRED Anode	White - V_{cc}
Black - IRED Cathode	Blue - Output
	Green - Ground

Other wire lengths and/or colors in addition to customer selected connectors are available. Contact your local representative or call the factory.
(5) Normal application would be with light source blocked, simulated by I_F = 0mA.
(6) All parameters tested using pulse technique.
(7) Methanol and isopropanol alcohols are recommended as cleaning agents. Housings are soluble in chlorinated hydrocarbons and ketones.

Types OPB900W, OPB910W Series

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	µA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating DC Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(5)
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 20mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 20mA
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(5)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(5)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 20mA
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800µA I_F = 20mA
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800µA I_F = 0mA(5)
I_{OH}	High Level Output Current: Buffered Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 20mA, T_A = 25°C
	Inverted Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			20	mA	V_{CC} = 5V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2.0			V_{CC} = 5V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 20mA Output = GND
	Inverted Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 0mA Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5V, T_A = 25°C I_F = 0 or 20mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5.0		µs	R_L = 8TTL Loads (Totem Pole) R_L = 360Ω (Open Collector)

SLOTTED OPTICAL SWITCHES

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Types OPB900W, OPB910W Series

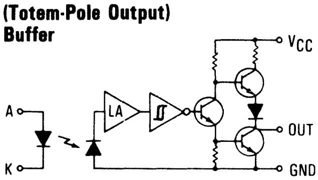
PART NUMBER GUIDE

OPB 9 X X X X X

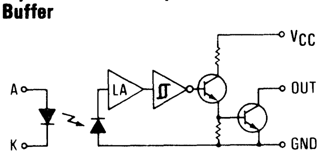
- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 0 - Wide Gap IR Transmissive Plastic Discrete Shell
  - 1 - Wide Gap Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter
  5 = 0.050"
- Aperture Width In Front of Sensor
  5 = 0.050"

Schematics

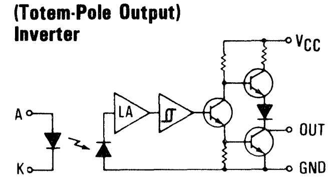
OPB900/OPB910
(Totem-Pole Output)
Buffer



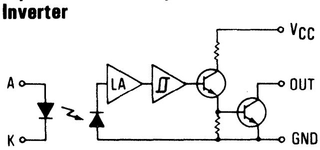
OPB901/OPB911
(Open-Collector Output)
Buffer



OPB902/OPB912
(Totem-Pole Output)
Inverter



OPB903/OPB913
(Open-Collector Output)
Inverter

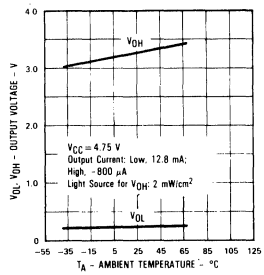


Types OPB900W, OPB910W Series

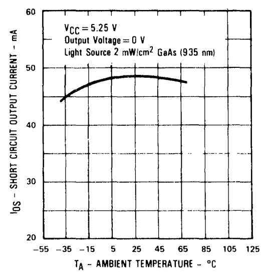
Typical Performance Curves

OPB900L, OPB902L, OPB910L, OPB912L

Output Voltage vs Ambient Temperature

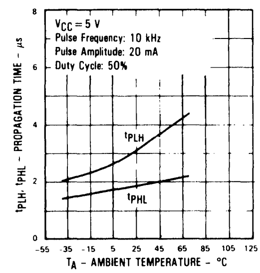


Short Circuit Output Current vs Ambient Temperature



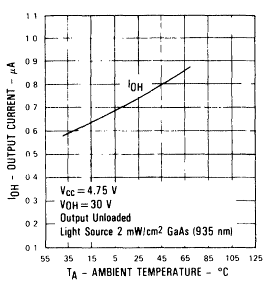
All Assemblies

Propagation Time vs Ambient Temperature

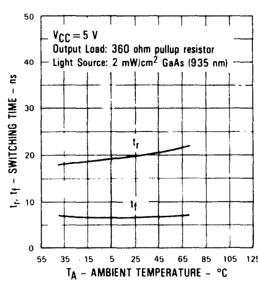


OPB901L, OPB903L, OPB911L, OPB913L

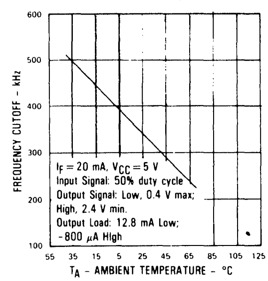
Output Current (High) vs Ambient Temperature



Rise Time and Fall Time vs Ambient Temperature

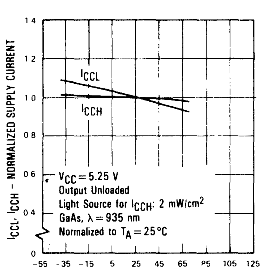


Data Rate vs Ambient Temperature



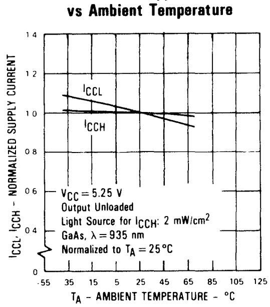
OPB900L, OPB901L, OPB910L, OPB911L

Normalized Supply Current vs Ambient Temperature



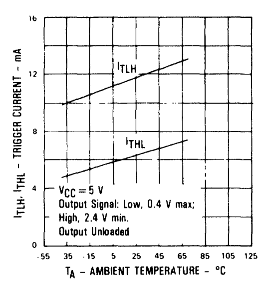
OPB902L, OPB903L, OPB912L, OPB913L

Normalized Supply Current vs Ambient Temperature

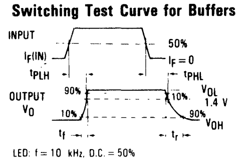


All Assemblies

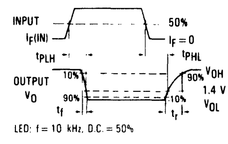
Trigger Current vs Ambient Temperature



Switching Test Curve for Buffers

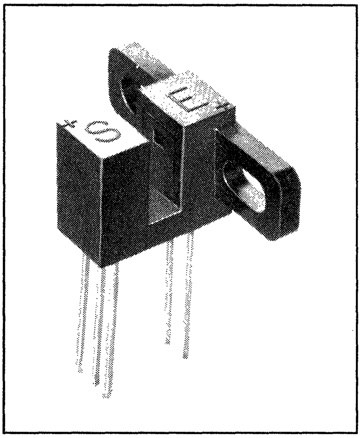


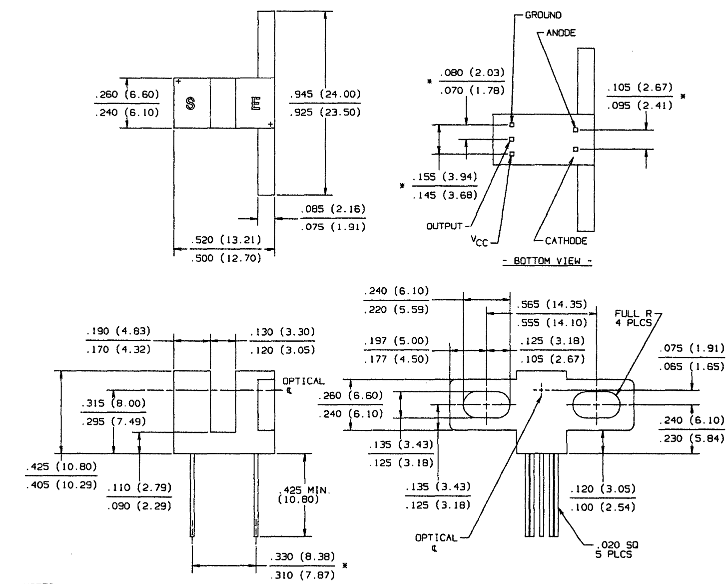
Switching Test Curve for Inverters



OPTEK

Photologic™ Slotted Optical Switches
Types OPB930L, OPB940L Series





NOTES:
1. * DIMENSIONCONTROLLED AT HOUSING SURFACE ONLY.
2. METHANOL AND ISOPROPANOL ALCOHLS ARE RECOMMENDED AS CLEANING AGENTS. HOUSINGS ARE SOLUBLE IN CHLORINATED HYDROCARBONS AND KETONES. HIGHLY ACTIVATED, WATER SOLUBLE FLUXES MAY ATTACK HOUSINGS IN SOME SITUATIONS.
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- .320" lead space for PC board mount
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- Side mount configuration

Description

The OPB930L and OPB940L series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2)discrete shell material, and (3) aperture width. Available with wire leads as OPB930W/OPB940W series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

Replaces

KT930L/940L, KLT130L/140L series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range .... -40°C to +85°C
Operating Temperature Range .... -40°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)
Input Diode Power Dissipation .... 100mW(2)
Output Photologic™ Power Dissipation .... 200mW(3)
Total Device Power Dissipation .... 300mW(4)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 2V

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB930L/OPB940L series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Methanol and isopropanol alcohols are recommended as cleaning agents. Plastic housing is soluble in chlorinated hydrocarbons and ketones.
(7) Normal application would be with light source blocked, simulated by I_F = 0mA.
(8) All parameters tested using pulse technique.

Types OPB930L, OPB940L Series

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	μA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(7)
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(7)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(7)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 15mA
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800μA I_F = 15mA
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800μA I_F = 0mA(7)
I_{OH}	High Level Output Current: Buffered Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 15mA, T_A = 25°C
	Inverted Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			15	mA	V_{CC} = 5.0V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2			V_{CC} = 5.0V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 15mA Output = GND
	Inverted Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 0mA Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5.0V, T_A = 25°C I_F = 0 or 15mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5		μs	R_L = 8TTL Loads (Totem Pole) R_L = 360Ω (Open Collector)

SLOTTED OPTICAL SWITCHES

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Types OPB930L, OPB940L Series

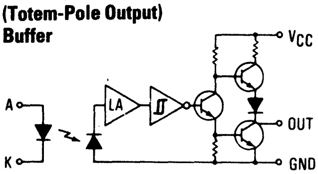
PART NUMBER GUIDE

OPB 9 X X X X X

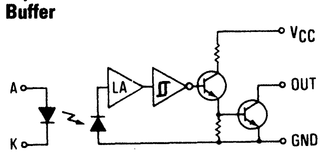
- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 3 - Side Mount IR Transmissive Plastic Discrete Shell
  - 4 - Side Mount Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter
  - 5 = 0.050"
- Aperture Width In Front of Sensor
  - 5 = 0.050" 1 = 0.010"

Schematics

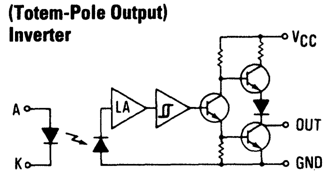
OPB930, OPB940
(Totem-Pole Output)
Buffer



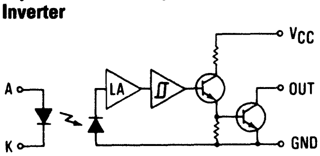
OPB931, OPB941
(Open-Collector Output)
Buffer



OPB932, OPB942
(Totem-Pole Output)
Inverter



OPB933, OPB943
(Open-Collector Output)
Inverter

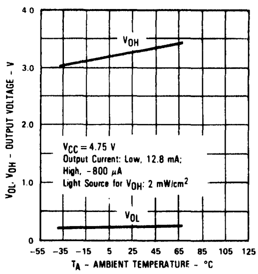


Types OPB930L, OPB940L Series

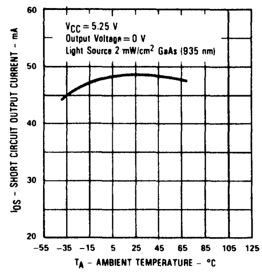
Typical Performance Curves

OPB930, OPB932, OPB940, OPB942

Output Voltage vs Ambient Temperature

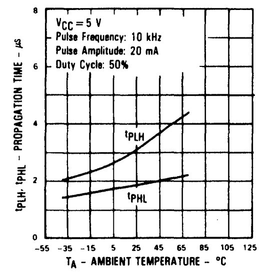


Short Circuit Output Current vs Ambient Temperature



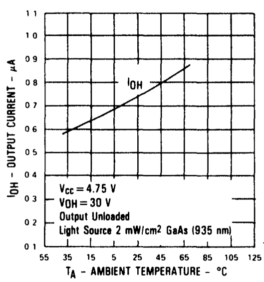
All Assemblies

Propagation Time vs Ambient Temperature

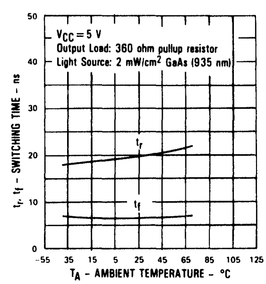


OPB931, OPB933, OPB941, OPB943

Output Current (High) vs Ambient Temperature

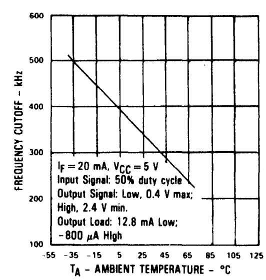


Rise Time and Fall Time vs Ambient Temperature



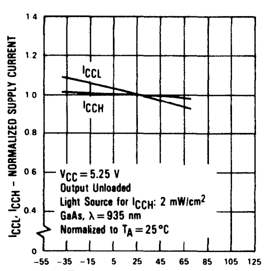
All Assemblies

Data Rate vs Ambient Temperature



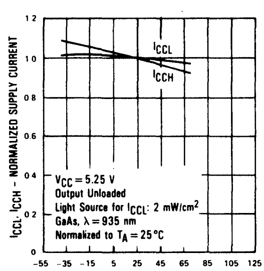
OPB930, OPB931, OPB940, OPB941

Normalized Supply Current vs Ambient Temperature



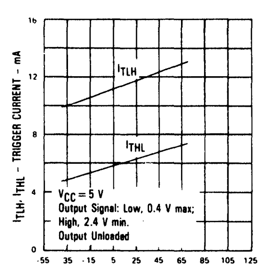
OPB932, OPB933, OPB942, OPB943

Normalized Supply Current vs Ambient Temperature

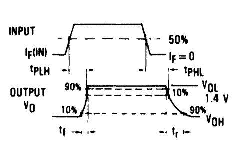


All Assemblies

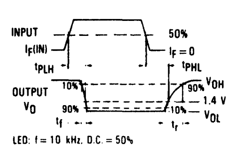
Trigger Current vs Ambient Temperature



Switching Test Curve for Buffers



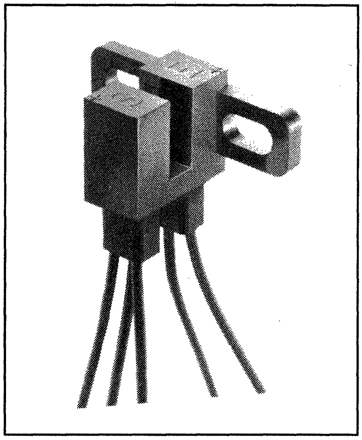
Switching Test Curve for Inverters

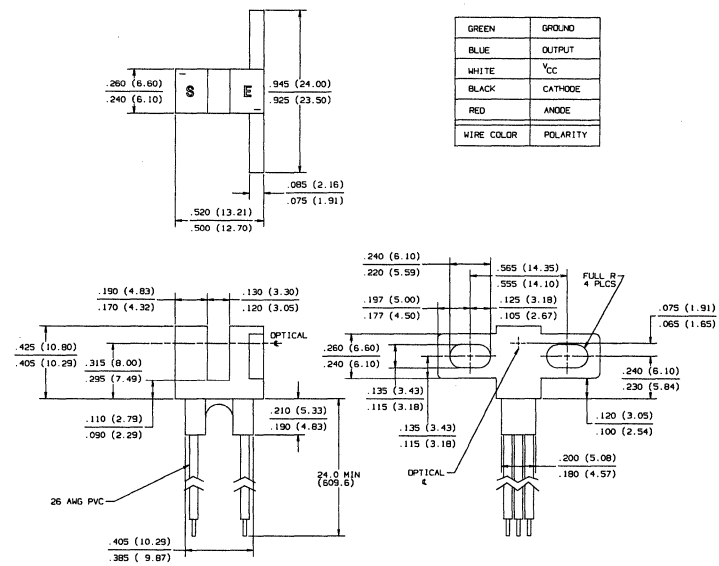


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Photologic™ Slotted Optical Switches
Types OPB930W, OPB940W Series





METHANOL AND ISOPROPANOL ALCOHLS ARE RECOMMENDED AS CLEANING AGENTS. HOUSINGS ARE SOLUBLE IN CHLORINATED HYDROCARBONS AND KETONES. HIGHLY ACTIVATED, WATER SOLUBLE FLUXES MAY ATTACK HOUSINGS IN SOME SITUATIONS.

DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- 24" min 26AWG wire leads
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- Side mount configuration

Description

The OPB930W and OPB940W series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2) discrete shell material, and (3) aperture width. Available with PC board mountable leads as OPB930L/OPB940L series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

Replaces

KT930W/940W, KLT130W/140W series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range .... -40°C to +80°C
Operating Temperature Range .... -40°C to +70°C
Input Diode Power Dissipation .... 100mW(1)
Output Photologic™ Power Dissipation .... 200mW(2)
Total Device Power Dissipation .... 300mW(3)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 2V

Notes:

(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB930W/OPB940W series of switches are terminated with 24 inches of 7 strand 26 AWG, UL 1429 insulated wire on each terminal. Insulation colors and functions are:

RED - IRED Anode	WHITE - V_{CC}
BLACK -IRED Cathode	BLUE - Output
	GREEN - Ground

Other wire lengths and/or colors in addition to customer selected connectors are available. Contact your local representative or call the factory.

(5) Normal application would be with light source blocked, simulated by I_F = 0mA.
(6) All parameters tested using pulse technique.

Types OPB930W, OPB940W Series

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	μA	V_R = 2.0V, T_A = 25°C
Output Photologic Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(5)
	Inverted Totem-Pole Output, Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output, Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
	Inverted Totem-Pole Output, Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(5)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output, Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA, I_F = 0mA(5)
	Inverted Totem-Pole Output, Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA, I_F = 15mA
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800μA, I_F = 15mA
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800μA, I_F = 0mA(5)
I_{OH}	High Level Output Current: Buffered Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 15mA, T_A = 25°C
	Inverted Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			15	mA	V_{CC} = 5.0V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2.0			V_{CC} = 5.0V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 15mA, Output = GND
	Inverted Totem-Pole Output	-30		-100	mA	V_{CC} = 5.25V, I_F = 0mA, Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5V, T_A = 25°C, I_F = 0 or 15mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5.0		μs	R_L = 8TTL Loads (Totem Pole), R_L = 360Ω (Open Collector)

SLOTTED OPTICAL SWITCHES

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

Types OPB930W, OPB940W Series

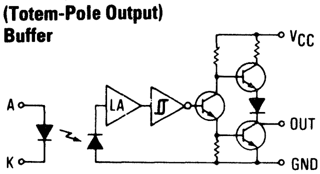
PART NUMBER GUIDE

OPB 9 X X X X X

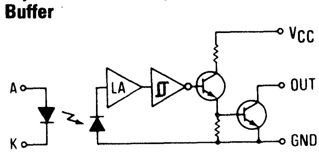
- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 3 - Side Mount IR Transmissive Plastic Discrete Shell
  - 4 - Side Mount Opaque Plastic Discrete Shell
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - L - Solder Leads Termination
  - W - Wire Termination
- Aperture Width In Front of Emitter
  - 5 = 0.050"
- Aperture Width In Front of Sensor
  - 5 = 0.050" 1 = 0.010"

Schematics

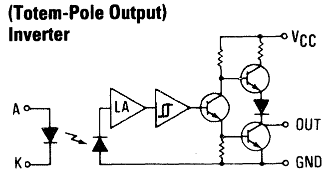
OPB930, OPB940
(Totem-Pole Output)
Buffer



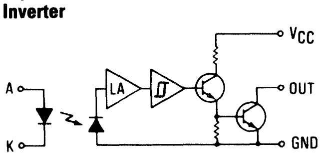
OPB931, OPB941
(Open-Collector Output)
Buffer



OPB932, OPB942
(Totem-Pole Output)
Inverter



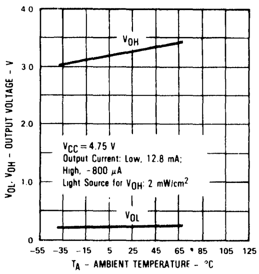
OPB933, OPB943
(Open-Collector Output)
Inverter



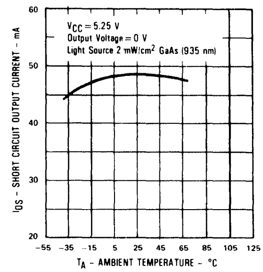
Typical Performance Curves

OPB930, OPB932, OPB940, OPB942

Output Voltage vs Ambient Temperature

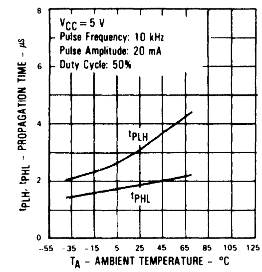


Short Circuit Output Current vs Ambient Temperature



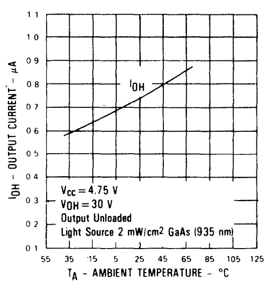
All Assemblies

Propagation Time vs Ambient Temperature

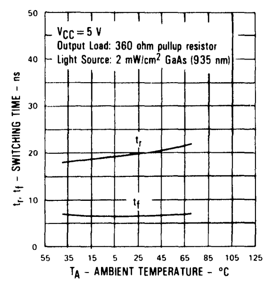


OPB931, OPB933, OPB941, OPB943

Output Current (High) vs Ambient Temperature

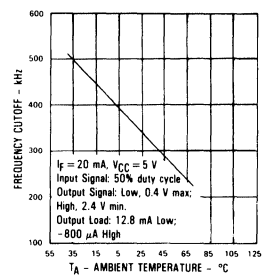


Rise Time and Fall Time vs Ambient Temperature



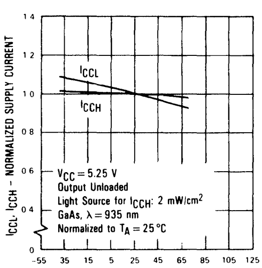
All Assemblies

Data Rate vs Ambient Temperature



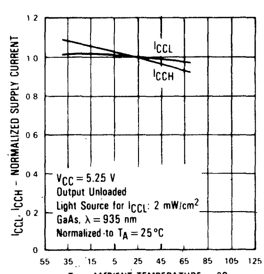
OPB930, OPB931, OPB940, OPB941

Normalized Supply Current vs Ambient Temperature



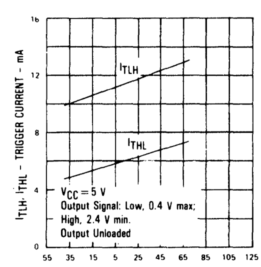
OPB932, OPB933, OPB942, OPB943

Normalized Supply Current vs Ambient Temperature

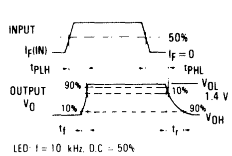


All Assemblies

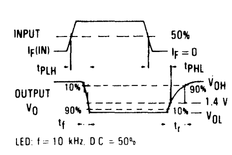
Trigger Current vs Ambient Temperature



Switching Test Curve for Buffers

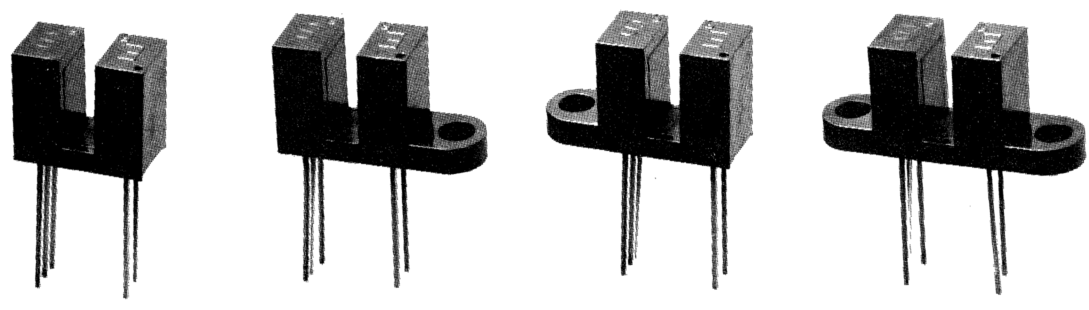


Switching Test Curve for Inverters



OPTEK

Photologic™ Slotted Optical Switches
Types OPB960, OPB970 Series



PACKAGE N　PACKAGE L　PACKAGE P　PACKAGE T

Features

- Choice of mounting configuration
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 0.320" lead spacing for PC board mount

Description

The OPB960 and OPB970 series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2) discrete shell material, (3) aperture width, and (4) type of mounting configuration. Available with 24", 26AWG wire leads as OPB980/OPB990 series.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

Replaces

KT960/970 series, KLT160/170 series. Upgrades OPB960/970 series.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range . . . . . -40°C to +85°C
Operating Temperature Range . . . . . -40°C to +70°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . . 240°C(1)
Input Diode Power Dissipation . . . . . 100mW(2)
Output Photologic™ Power Dissipation . . . . . 200mW(3)
Total Device Power Dissipation . . . . . 300mW(4)
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 2V

Notes:

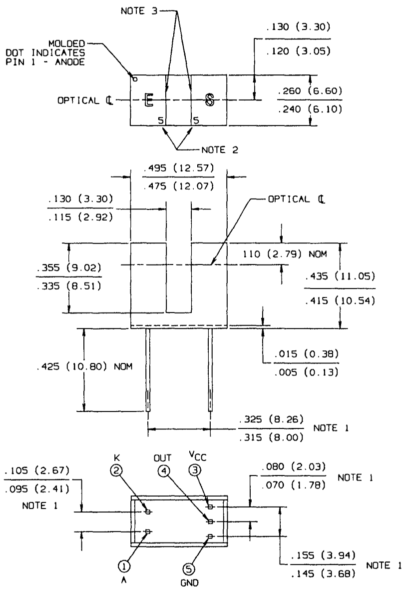
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.22mW/°C above 25°C.
(3) Derate linearly 4.44mW/°C above 25°C.
(4) Derate linearly 6.66mW/°C above 25°C.
(5) The OPB960/OPB970 series are terminated with .020" square leads designed for printed circuit board mounting.
(6) Normal application would be with light source blocked, simulated by I_F = 0mA.
(7) All parameters tested using pulse technique.

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

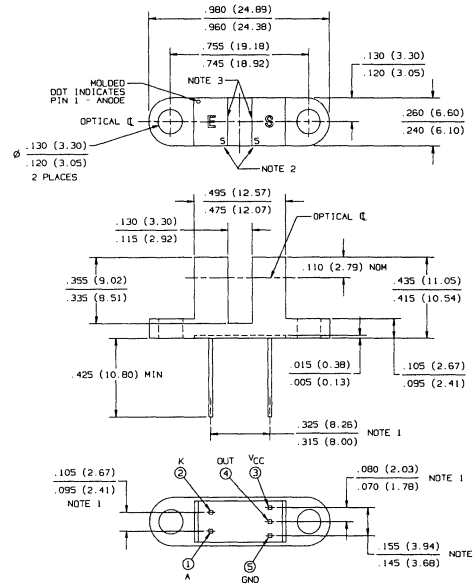
Types OPB960, OPB970 Series

Package N



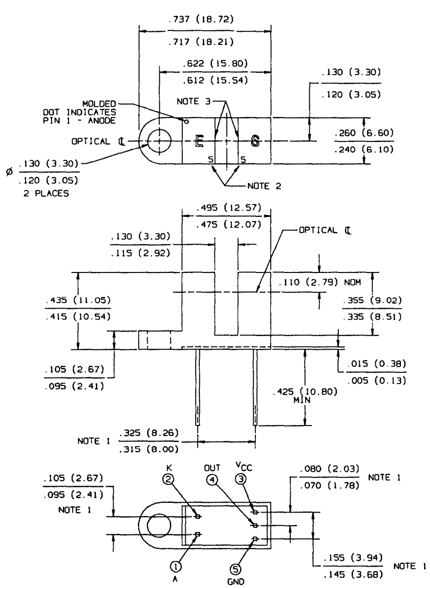
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package T



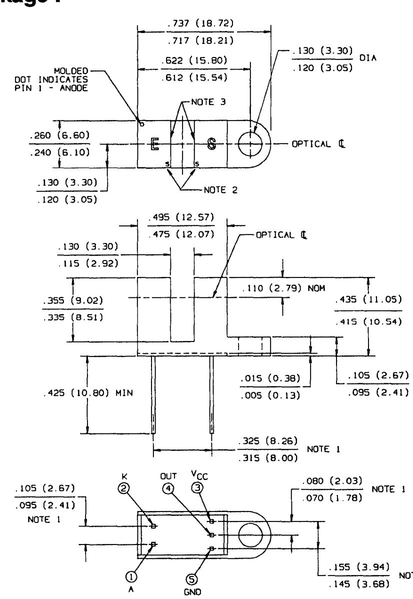
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package L



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package P



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Types OPB960, OPB970 Series

OPTEK

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	μA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA[(6)]
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA[(6)]
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA[(6)]
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 15mA[(6)]
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800μA I_F = 15mA
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800μA I_F = 0mA[(6)]
I_{OH}	High Level Output Current: Buffered Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 15mA, T_A = 25°C
	Inverted Open-Collector Output			100	μA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			15	mA	V_{CC} = 5.0V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2.0			V_{CC} = 5.0V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-60	mA	V_{CC} = 5.25V, I_F = 15mA Output = GND
	Inverted Totem-Pole Output	-15		-60	mA	V_{CC} = 5.25V, I_F = 0mA Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5.0V, T_A = 25°C I_F = 0 or 15mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5.0		μs	R_L = 8TTL Loads (Totem Pole) R_L = 360Ω (Open Collector)

PART NUMBER GUIDE

OPB 9 X X X X X

Optek Assembly

Photologic™
Photo Integrated Circuit
Sensor Family

Discrete Shell Material Designation

6 - Base Mount IR Transmissive Plastic Discrete Shell PC Mountable Leads

7 - Base Mount Opaque Plastic Discrete Shell PC Mountable Leads

Aperture Width In Front of Sensor
5 = 0.050" 1= 0.010"

Aperture Width In Front of Emitter
5 = 0.050" 1= 0.010"

Mounting Configurations

T - Both Mounting Tabs
N - No Mounting Tabs
L - Single Mounting Tab Emitter Side
P - Single Mounting Tab Photologic™ Side

Electrical Specification Variations

0 - Buffered Totem-Pole Output

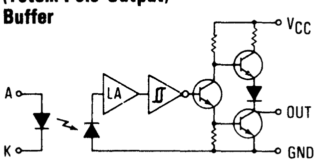
1 - Buffered Open-Collector Output

2 - Inverted Totem-Pole Output

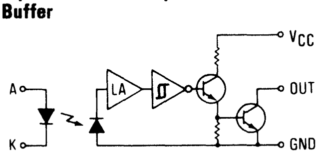
3 - Inverted Open-Collector Output

Schematics

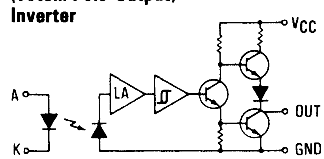
OPB960/OPB970
(Totem-Pole Output)
Buffer



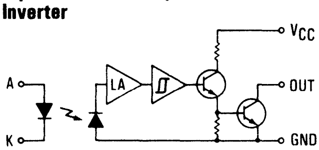
OPB961/OPB971
(Open-Collector Output)
Buffer



OPB962/OPB972
(Totem-Pole Output)
Inverter



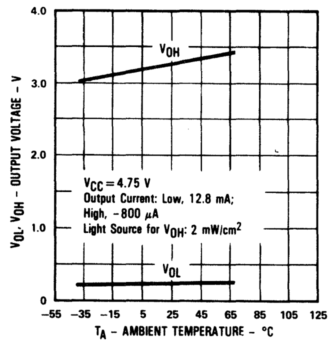
OPB963/OPB973
(Open-Collector Output)
Inverter



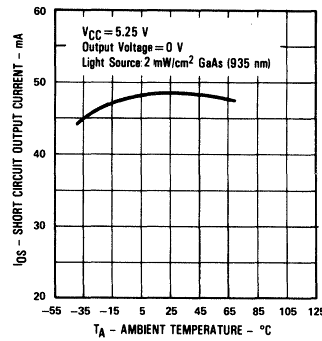
Typical Performance Curves

OPB960, OPB962, OPB970, OPB972

Output Voltage vs Ambient Temperature

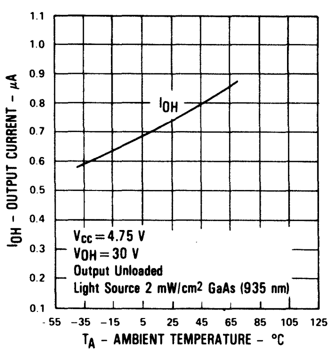


Short Circuit Output Current vs Ambient Temperature

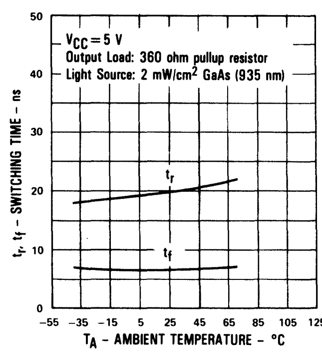


OPB961, OPB963, OPB971, OPB973

Output Current (High) vs Ambient Temperature

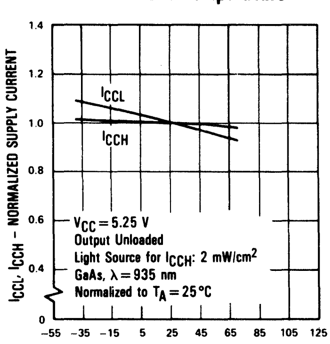


Rise Time and Fall Time vs Ambient Temperature



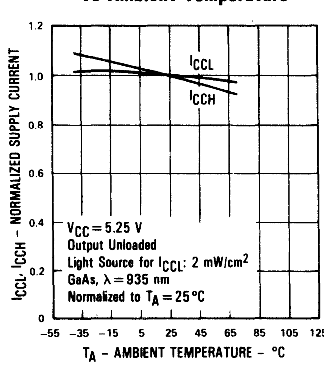
OPB960, OPB961, OPB970, OPB971

Normalized Supply Current vs Ambient Temperature



OPB962, OPB963, OPB972, OPB973

Normalized Supply Current vs Ambient Temperature



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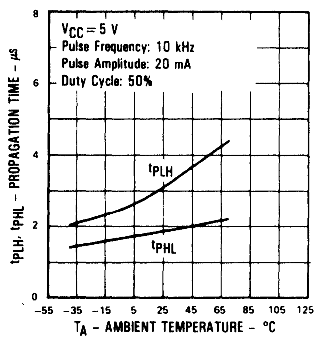
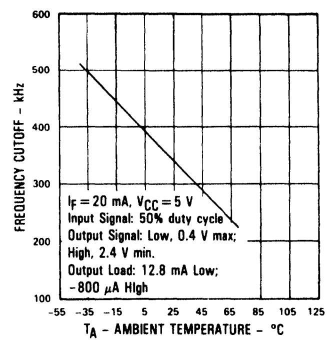
Typical Performance Curves

All Assemblies

Propagation Time vs Ambient Temperature

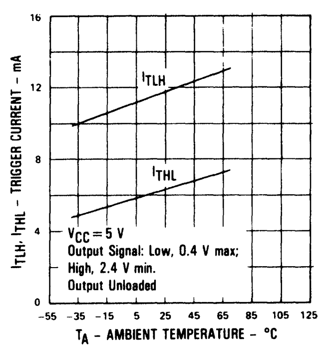


Data Rate vs Ambient Temperature

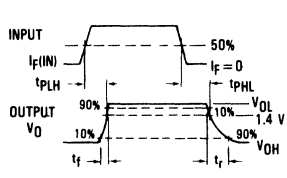


All Assemblies

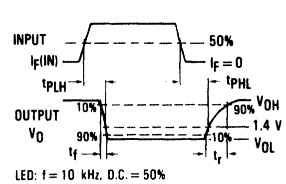
Trigger Current vs Ambient Temperature



Switching Test Curve for Buffers



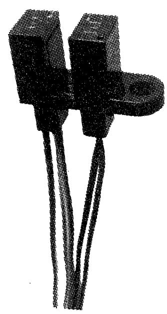
Switching Test Curve for Inverters



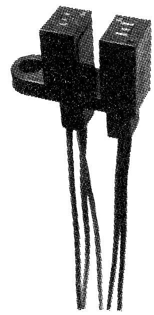
Product Bulletin OPB980
May 1993

Photologic™ Slotted Optical Switches
Types OPB980, OPB990 Series

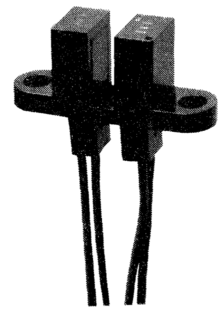
Package N



Package L



Package P



Package T

Features

- Choice of mounting configuration
- Choice of aperture
- Choice of output configuration
- Choice of opaque or IR transmissive shell material
- Data rates to 250 kBaud
- 24" min 26AWG wire leads

Description

The OPB980 and OPB990 series of Photologic™ Photo Integrated Circuit Switches provide optimum flexibility for the design engineer. Building from a standard housing with a .125" wide slot, the user can specify (1) type and polarity of TTL output, (2) discrete shell material, (3) aperture width, and (4) choice of mounting configuration.

The electrical output can be specified as either TTL totem pole or TTL open collector. Either may be supplied with inverter or buffer output polarity. All have added stability of a built-in hysteresis amplifier.

Replaces

KT980/990, KLT180/190 series.
Upgrades OPB980/OPB990 series

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (Not to exceed 3 sec.) 10V
Storage Temperature Range .... -40°C to +80°C
Operating Temperature Range .... -40°C to +70°C
Input Diode Power Dissipation .... 100mW[(1)]
Output Photologic™ Power Dissipation .... 200mW[(2)]
Total Device Power Dissipation .... 300mW[(3)]
Voltage at Output Lead (Open Collector Output) 35V
Diode Forward D.C. Current 40mA
Diode Reverse D.C. Voltage 2V

Notes:
(1) Derate linearly 2.22mW/°C above 25°C.
(2) Derate linearly 4.44mW/°C above 25°C.
(3) Derate linearly 6.66mW/°C above 25°C.
(4) The OPB980/OPB990 series of switches are terminated with 24 inches of 7 strand 26 AWG, UL 1429 insulated wire on each terminal. Insulation colors and functions are:

RED - IRED Anode	WHITE - V_{CC}
BLACK - IRED Cathode	BLUE - Output
	GREEN - Ground

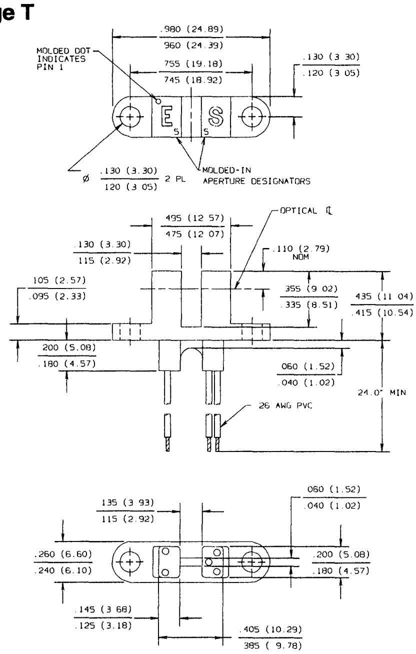
Other wire lengths and/or colors in addition to customer selected connectors are available. Contact your local representative or call the factory.
(5) Normal application would be with light source blocked, simulated by I_F = 0mA.
(6) All parameters tested using pulse techniques.

Housing

All housings are an opaque grade of injection-molded plastic to minimize the assembly's sensitivity to ambient radiation, both visible and near-infrared. Discrete shells (exposed on the parallel faces inside the device throat) are either IR transmissive plastic for applications where aperture contamination may occur or opaque plastic for maximum protection against ambient light.

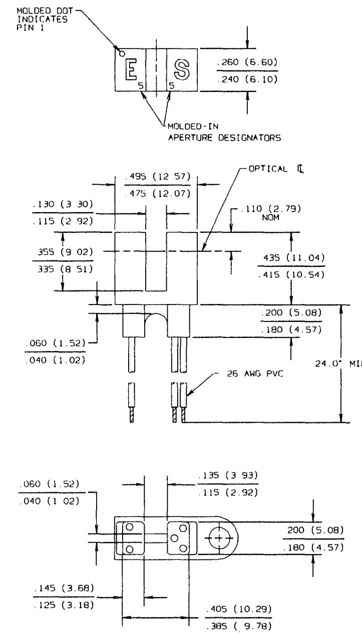
Types OPB980, OPB990 Series

Package T



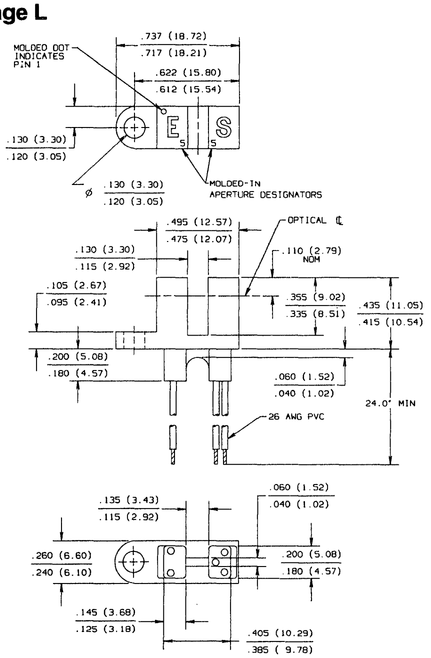
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package N



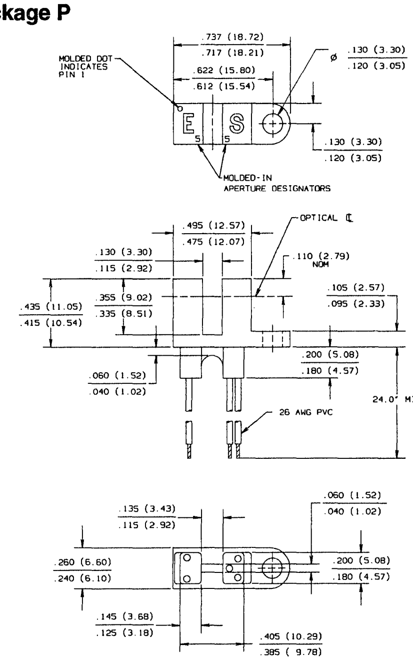
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package L



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package P



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Electrical Characteristics (T_A = -40°C to +70°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.7	V	I_F = 20mA, T_A = 25°C
I_R	Reverse Current			100	µA	V_R = 2.0V, T_A = 25°C
Output Photologic™ Sensor						
V_{CC}	Operating D.C. Supply Voltage	4.75		5.25	V	
I_{CCL}	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(5)
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
I_{CCH}	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 15mA
	Inverted Totem-Pole Output Inverted Open-Collector Output			15	mA	V_{CC} = 5.25V, I_F = 0mA(5)
V_{OL}	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 0mA(5)
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	V_{CC} = 4.75V, I_{OL} = 12.8mA I_F = 15mA
V_{OH}	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800µA I_F = 15mA
	Inverted Totem-Pole Output	2.4			V	V_{CC} = 4.75V, I_{OH} = -800µA I_F = 0mA(5)
I_{OH}	High Level Output Current: Buffered Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V I_F = 15mA, T_A = 25°C
	Inverted Open-Collector Output			100	µA	V_{CC} = 4.75V, V_{OH} = 30V, I_F = 0mA, T_A = 25°C
$I_F(+)$	LED Positive-Going Threshold Current			15	mA	V_{CC} = 5.0V, T_A = 25°C
$I_F(+)/I_F(-)$	Hysteresis		2.0			V_{CC} = 5.0V
I_{OS}	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-60	mA	V_{CC} = 5.25V, I_F = 15mA Output = GND
	Inverted Totem-Pole Output	-15		-60	mA	V_{CC} = 5.25V, I_F = 0mA Output = GND
t_r, t_f	Output Rise Time, Output Fall Time		70		ns	V_{CC} = 5V, T_A = 25°C I_F = 0 or 15mA
t_{PLH}, t_{PHL}	Propagation Delay Low-High & High-Low		5.0		µs	R_L = 8TTL Loads (Totem Pole) R_L = 360Ω (Open Collector)

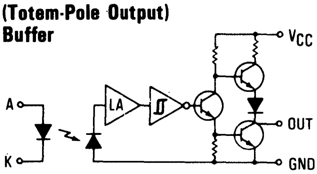
PART NUMBER GUIDE

OPB 9 X X X X X

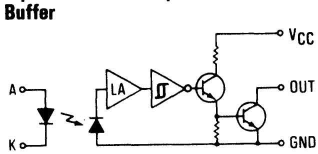
- Optek Assembly
- Photologic™ Photo Integrated Circuit Sensor Family
- Discrete Shell Material Designation
  - 8 - Base Mount IR Transmissive Plastic Discrete Shell With Wire Termination
  - 9 - Base Mount Opaque Plastic Discrete Shell With Wire Termination
- Electrical Specification Variations
  - 0 - Buffered Totem-Pole Output
  - 1 - Buffered Open-Collector Output
  - 2 - Inverted Totem-Pole Output
  - 3 - Inverted Open-Collector Output
- Mounting Configurations
  - T - Both Mounting Tabs
  - N - No Mounting Tabs
  - L - Single Mounting Tab Emitter Side
  - P - Single Mounting Tab Photologic™ Side
- Aperture Width In Front of Emitter
  5 = 0.050" 1= 0.010"
- Aperture Width In Front of Sensor
  5 = 0.050" 1= 0.010"

Schematics

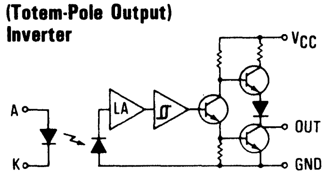
OPB980/OPB990
(Totem-Pole Output)
Buffer



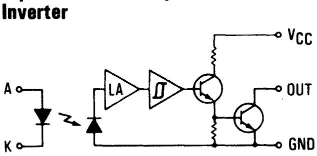
OPB981/OPB991
(Open-Collector Output)
Buffer



OPB982/OPB992
(Totem-Pole Output)
Inverter



OPB983/OPB993
(Open-Collector Output)
Inverter



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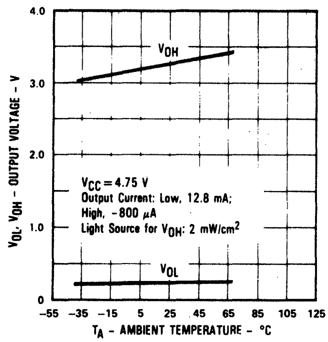
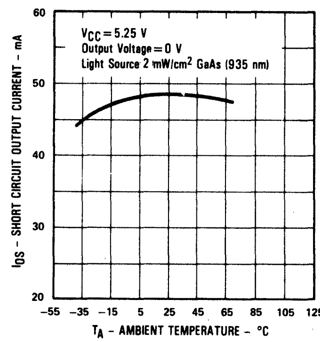
Typical Performance Curves

OPB980, OPB982, OPB990, OPB992

Output Voltage vs Ambient Temperature

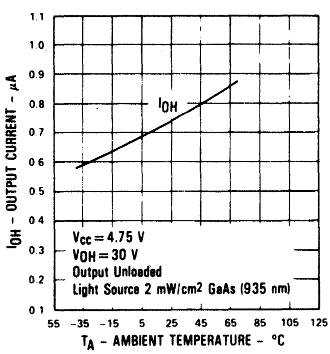


Short Circuit Output Current vs Ambient Temperature

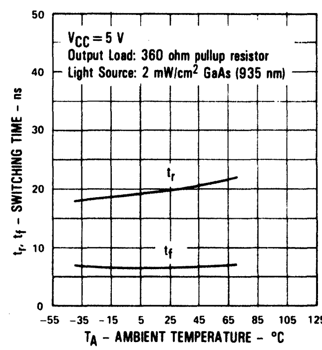


OPB981, OPB983, OPB991, OPB993

Output Current (High) vs Ambient Temperature

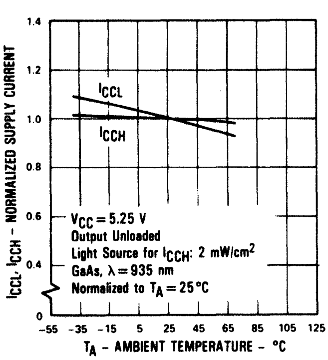


Rise Time and Fall Time vs Ambient Temperature



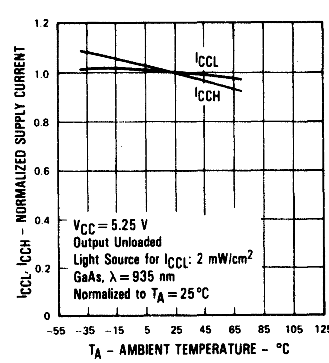
OPB980, OPB981, OPB990, OPB991

Normalized Supply Current vs Ambient Temperature



OPB982, OPB983, OPB992, OPB993

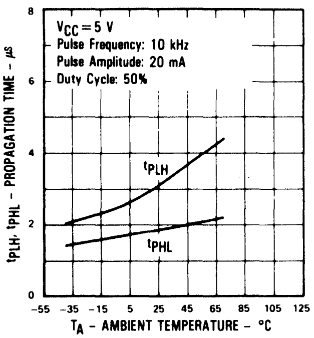
Normalized Supply Current vs Ambient Temperature



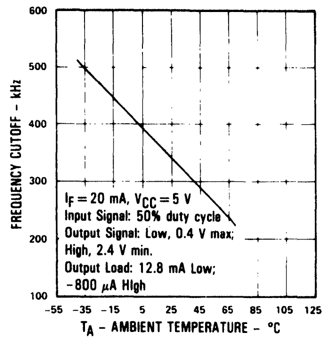
Typical Performance Curves

All Assemblies

Propagation Time vs Ambient Temperature

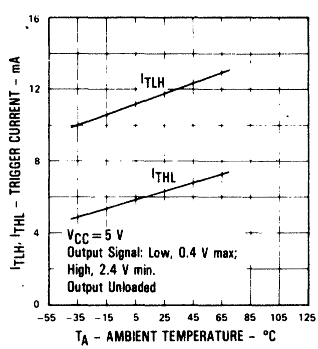


Data Rate vs Ambient Temperature

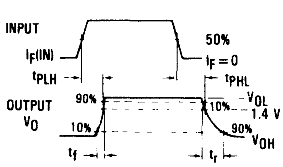


All Assemblies

Trigger Current vs Ambient Temperature

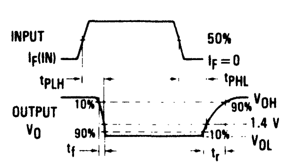


Switching Test Curve for Buffers



LED: f = 10 kHz, D.C. = 50%

Switching Test Curve for Inverters



LED: f = 10 kHz, D.C. = 50%

OPTEK TECHNOLOGY, INC.

HI-REL OPTOELECTRONIC COMPONENTS

High-Reliability Optoelectronic Devices

High-reliability requirements demand that products be able to function under abnormally severe levels of mechanical, environmental, and electrical stress. This challenge has been met by Optek with product designs and process control techniques that ensure high reliability and, thus, long life.

Capabilities

Optek maintains a well equipped high-reliability lab for conducting electrical, mechanical, and environmental tests. All testing is performed in-house, with engineering, manufacturing, and quality control facilities located within the continental United States.

Optek's calibration system complies with the requirements of MIL-45662, which incorporates both MIL-Q-9858 and MIL-1-45208.

High reliability optoelectronic devices from Optek are currently in use in a wide variety of space and defense programs.

Certifications

Optek is an QPL supplier, approved by D.E.S.C. to provide products in accordance with Military Specification MIL-S-19500. Electrical, environmental, and mechanical testing is done by experienced Optek employees based on MIL-STD-750 and MIL-STD-883 test methods and procedures. Military screening to as high as JANTXV is performed.

Optek has certified technicians in many areas such as x-ray and soldering. Any internal soldering, if required, is done in compliance with MIL-S-45743/WS6536.

High-Reliability Couplers

Optek's offering of high-reliability, optically coupled isolators consist of D.E.S.C. qualified devices to MIL-S-19500/486 and components processed to Optek's own military screening program. The 4N22A through 4N24A, and 4N47 through 4N49 series (pending) of D.E.S.C. qualified couplers are processed to JAN, JANTX, and JANTXV reliability levels per MIL-S-19500/486. (See Figure 1 for details.)

Although the 3N243TX through 3N245TX series of optically isolators are not military qualified, they are processed to Optek's own military screening program. Each device in the series receives process conditioning which includes a 160-hour power burn-in.

High-Reliability Sensors and Emitters

A large selection of discrete emitters and sensors are offered that are processed to Optek's own military screening program patterned after MIL-S19500. These devices are identified by "TX" and "TXV" suffixes. Although not military qualified devices, they receive 100% screening that parallels JANTX and JANTXV reliability requirements. (See Figure 2.)

For discrete sensors, the 100% screening includes both a 48-hour, high temperature reverse bias at $T_A = 125^oC$, and a 160-hour power burn-in at ambient temperature ($T_A = 25^oC$). For emitters, the 100% screening includes a burn-in in the forward direction for 96 or 160 hours, depending on the series.

One of the key advantages of purchasing part types to an in-house high-reliability screening program is that Group B and C lot charges may be avoided, since the manufacturer frequently spreads these costs over large groups of orders. For high-reliability emitters and sensors with "TX" and "TXV" suffixes, generic Group B and C data can be supplied with each order. Customers requiring Group B and C testing on their individual orders can also be accommodated, but these orders have to be run under special part numbers for control purposes.

High-Reliability Assemblies

In addition to the standard discrete optoelectronic components, Optek manufactures a wide variety of standard (off-the-shelf) and custom (built-to-print) assemblies. Most assemblies can be classified into one of two groups: slotted optical switches or reflective assemblies. Slotted optical switches are designed to provide non-contact sensing of linear or rotary motion. Reflective assemblies, in turn, are designed to provide non-contact sensing of reflective surfaces, or a change in surface reflectivity of an object. Both slotted optical switches and reflective assemblies can be purchased to high-reliability requirements.

High reliability assemblies are generally made with plastic housings and hermetically sealed discrete sensors and emitters. Before being placed in the housing, the discrete components are subjected to high-reliability processing. Frequently, this processing on the discrete devices is similar to what is specified on the individual high-reliability sensor and emitter data sheets.

Custom Prints

Sometimes, it is necessary to have special electrical selections, screening requirements, or package configurations that are different from the standard offerings shown in the data sheets. Optek's custom capability is enormous. Assembly and test areas were designed with a great deal of flexibility, which allows the product to be built and tested on an order-to-order basis. The Quality Control Department's environmental testing areas are set up similarly, allowing many orders to be handled, each requiring different tests, screens, and conditions.

Definitions of Common Reliability Terms

Group A: Consists of electrical tests and external visual inspection done on a sample basis by Q.C. At Optek, prior to submittal to Q.C. for Group A inspection, all devices in the lot are 100% electrically tested in manufacturing.

Group B: Consists of tests conducted on a sample basis to verify production lot conformance to package integrity, environmental extremes, and long-term reliability. The Group B samples are normally selected from lots that are manufactured within a six week time period, based on the date of final package sealing.

Group C: Is further environmental testing-similar to Group B, but sample testing is performed on a periodic basis (typically at six month intervals).

Hi-Rel Processing, 100% Processing, TX Processing: Same as Processing Conditioning.

High Temperature Reverse Bias (HTRB): Devices are reverse biased in a non-conduction mode at a high temperature for a period of time in this test. This test is used primarily to screen out those devices with inferior semiconductor die characteristics, such as poor voltage breakdown or leakage current. Ambient temperature is usually specified somewhere between +100°C to +175°C.

JANTX: All JANTX units receive process conditioning prior to quality conformance inspection. (See Figure 1)

JANTXV: Same as JANTX, plus 100% internal visual inspection. (See Figure 1)

JANS: An ultra-high-reliability version of JAN devices with very strict quality assurance and manufacturing controls imposed. JANS was designed with space applications in mind, and is the highest product assurance reliability level.

MIL-S-19500: Military document that establishes the general requirements for semiconductor devices for JAN, JANTX, JANTXV, and JANS reliability levels. Specific part type requirements and characteristics are specified in detail specifications for a particular series (e.g., 4N22A military series is spelled out in MIL-S-19500/486).

MIL-STD-750: Military specification that depicts electrical, mechanical, and environmental test procedures and methods for discrete semiconductors.

Operating Life: Also known as burn-in, life testing, and power age. Operating the device in a conduction mode (turned on) to simulate what the part will encounter in actual service. As a very common test in process conditioning, operating life is used to screen out those parts with potential short service life.

Process Conditioning: Tests (sometimes referred to as screens) that are performed on 100% of the devices in the lot to assure long-term reliability characteristics. (See Figure 2.)

Qualification (Qual): All testing performed to qualify a new part, traditionally consisting of Groups A, B, and C. Individual tests or requirements are sometimes added or deleted for qualification.

Qualified Products List (QPL): Semiconductor device types that are qualified under military specification MIL-S-19500 for JANTX, JANTXV, and JANS procurements.

Quality Conformance Inspection: Those tests performed to verify a given lot's conformance to a military document or a customer's specification. Quality conformance inspection consists of Group A, but may include Group B or C, depending on the requirements for the formulation of these groups of tests.

Figure 1. Simplified JAN Product Flow

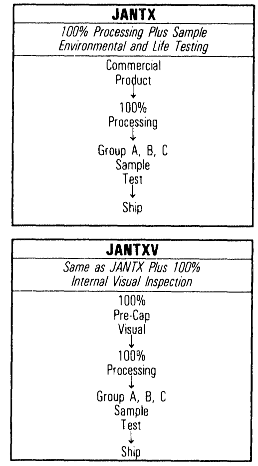
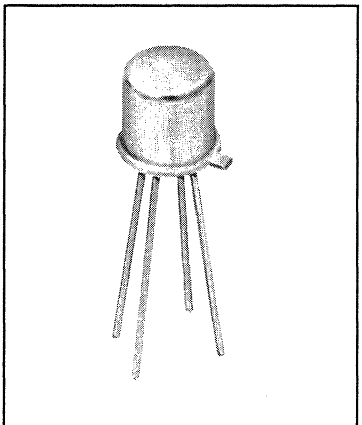


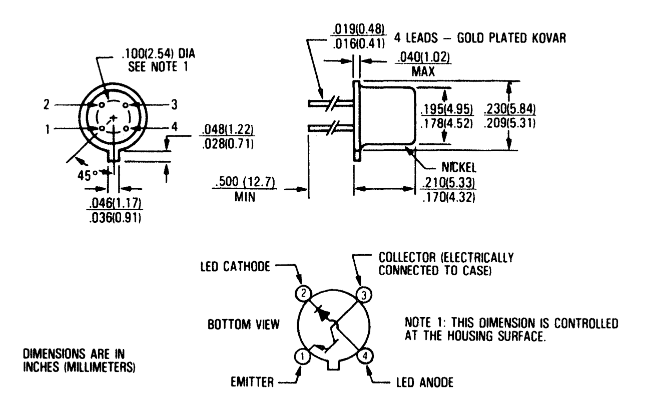
Figure 2. 100% Processing (Typical)

Pre-Cap Visual	
High Temperature Storage	
Temperature Cycle	
Constant Acceleration	
Hermetic Seal	Fine: Gross:
High Temperature Reverse Bias	
Power Burn-in	

OPTEK

Optically Coupled Isolators
Types 3N243, 3N244, 3N245





Features

- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- TX-TXV process available (see Hi-Rel section)

Description

The 3N243, 3N244, and 3N245 are JEDEC registered optically coupled isolators each consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage .... ± 1.00kVDC(1)
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Input Diode

Forward DC Current 40mA
Reverse Voltage 2.0V
Power Dissipation .... 60mW(3)

Output Phototransistor

Continuous Collector Current 30mA
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 200mW(4)

Notes:

(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.6mW/°C above 25°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics:
Z_{OUT} = 50Ω, tr ≤ 15ns, duty cycle ≅ 1%.

Types 3N243, 3N244, 3N245

Electrical Characteristics (T_A = 25°C unless otherwise noted)

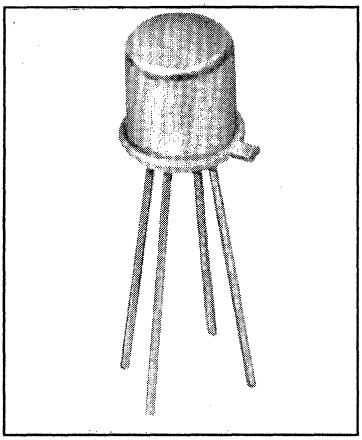
		3N243			3N244			3N245				
Symbol	**Parameter**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
Input Diode												
V_F	Forward Voltage	0.80		1.30	0.80		1.30	0.80		1.30	V	I_F = 10.0mA
		1.00		1.50	1.00		1.50	1.00		1.50	V	I_F = 10.0mA, T_A = -55°C
		0.70		1.20	0.70		1.20	0.70		1.20	V	I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current			100			100			100	µA	V_R = 2.0V
Output Phototransistor												
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			30			30			V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			5.0			5.0			V	I_E = 100µA
I_{CEO}	Collector Dark Current			100			100			100	nA	V_{CE} = 10.0V
				100			100			100	µA	V_{CE} = 10.0V, T_A = 100°C
Coupled												
$I_{C(on)}$	On-State Collector Current	1.50			3.0			6.0			mA	I_F = 10.0mA, V_{CE} = 10.0V
		0.30			0.80			1.50			mA	I_F = 3.0mA, V_{CE} = 10.0V
		0.50			1.00			1.50			mA	I_F = 10.0mA, V_{CE} = 10.0V, T_A = -55°C
		0.50			1.00			1.50			mA	I_F = 10.0mA, V_{CE} = 10.0V, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.30							V	I_F = 20mA, I_C = 1.50mA
							0.30				V	I_F = 20mA, I_C = 3.0mA
										0.30	V	I_F = 20mA, I_C = 6.0mA
I_{IO}	Leakage Input-to-Output			100			100			100	nA	V_{IO} = ± 1.00kVDC(1)
C_{IO}	Capacitance Input-to-Output			5.0			5.0			5.0	pF	V_{IO} = 0V, f = 1.00MHz(1)
t_r	Output Rise Time			10.0			10.0			10.0	µs	V_{CC} = 10.0V, I_F = 10.0mA,(5) R_L = 100Ω
t_f	Output Fall Time			10.0			10.0			10.0	µs	

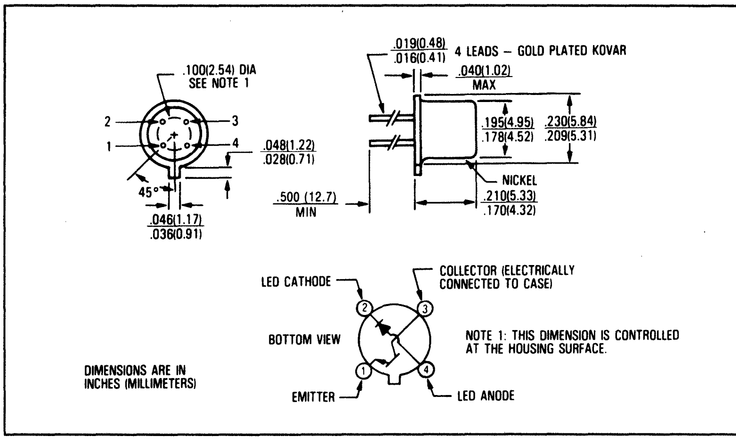
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin 3N243TX
April 1993

OPTEK

High Reliability Optically Coupled Isolators
Types 3N243TX, 3N244TX, 3N245TX





Features

- High-Reliability processed to Optek's military screening program patterned after MIL-S-19500
- TO-72 hermetically sealed package
- 1 kVDC electrical isolation

Description

Each device in the series is a high reliability optically coupled isolator consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

This series is identical to the JEDEC registered optically coupled isolators 3N243, 3N244, and 3N245 with additional high-reliability processing. This processing is patterned after MIL-S-19500 as shown in the accompanying table.

Replaces

3N243R, 3N244R, 3N245R

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage	± 1.00kVDC(1)
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	240°C(2)
Input Diode	
Forward DC Current	40mA
Reverse Voltage	2.0V
Power Dissipation	60mW(3)
Output Phototransistor	
Continuous Collector Current	30mA
Collector-Emitter Voltage	30V
Emitter-Collector Voltage	5.0V
Power Dissipation	200mW(4)

Notes:
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.60mW/°C above 65°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics:
Z_{OUT} = 50Ω, $t_r \leq$ 15ns, duty cycle ≅ 1%, pulse width ≅ 100μs.

Types 3N243TX, 3N244TX, 3N245TX

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	3N243TX			3N244TX			3N245TX			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Input Diode												
V_F	Forward Voltage	0.80		1.30	0.80		1.30	0.80		1.30	V	I_F = 10.0mA
		1.00		1.50	1.00		1.50	1.00		1.50	V	I_F = 10.0mA, T_A = -55°C
		0.70		1.20	0.70		1.20	0.70		1.20	V	I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current			100			100			100	µA	V_R = 2.0V
Output Phototransistor												
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			30			30			V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0			5.0			5.0			V	I_E = 100µA
I_{CEO}	Collector Dark Current			100 100			100 100			100 100	nA µA	V_{CE} = 10.0V V_{CE} = 10.0V, T_A = 100°C
Coupled												
$I_{C(on)}$	On-State Collector Current	1.50			3.00			6.00			mA	I_F = 10.0mA, V_{CE} = 10.0V
		0.30			0.80			1.50			mA	I_F = 3.0mA, V_{CE} = 10.0V
		0.50			1.00			1.50			mA	I_F = 10.0mA, V_{CE} = 10.0V, T_A = -55°C
		0.50			1.00			1.50			mA	I_F = 10.0mA, V_{CE} = 10.0V, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.30							V	I_F = 20mA, I_C = 1.50mA
							0.30				V	I_F = 20mA, I_C = 3.0mA
										0.30	V	I_F = 20mA, I_C = 6.0mA
I_{IO}	Leakage Input-to-Output			100			100			100	nA	V_{IO} = ± 1.00kVDC(1)
C_{IO}	Capacitance Input-to-Output			5.0			5.0			5.0	pF	V_{IO} = 0V, f = 1.00MHz(1)
t_r	Output Rise Time			10.0			10.0			10.0	µs	V_{CC} = 10.0V, I_F = 10.0mA,(5) R_L = 100Ω
t_f	Output Fall Time			10.0			10.0			10.0	µs	

OPTEK

100% Processing

Screen	Mil-STD-750 Method	Conditions	3N243TX 3N244TX 3N245TX
Pre-Cap Visual		Optek's pre-cap visual	100%
High Temperature Storage	1032	$T_A = 150^oC$, t = 24hrs.	100%
Temperature Cycle	1051	Condition C, 20 cycles, 15 min. each extreme	100%
Constant Acceleration	2006	20K G, Y_1 only	100%
High Temperature Reverse Bias	1039	Condition A, $T_A = 125^oC$, V_{CE} = 24Vdc, I_F = 0, t = 96hrs. min	100%
Power Burn-In	1039	Condition B, P_{DT} = 175-200mW, $T_A = 25^oC$, I_F = 40mA, t = 160hrs. min	100%
Hermetic Seal	1071	Fine: Condition H, 5 X 10^{-8}atm cc/sec Gross: Condition C	100%

Group B Inspection (performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Solderability	2026		
Resistance to Solvents	1022		
Subgroup 2			10
Thermal Shock (temperature cycling)	1051	Condition C, 15 min at extremes, 20 cycles	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
End Points		Group A, Subgroup 2	
Subgroup 3			5
Steady-State Operation Life	1027	P_{DT} = 175-200mW, I_F = 20mA, $T_A = 25^oC$	
End Points		Group A, Subgroup 2	
Bond Strength	2037	All internal wires of each device shall be pulled separately.	20 (c=0)
Subgroup 4			
Decap Internal Visual Inspection	2075	Visual criteria in accordance with qualified design.	1 device
Subgroup 6			7
High Temperature Life (non-operating)	1032	t = 340hrs., $T_A = 150^oC$	

Types 3N243TX, 3N244TX, 3N245TX

Group C Inspection (performed every six months while in production)

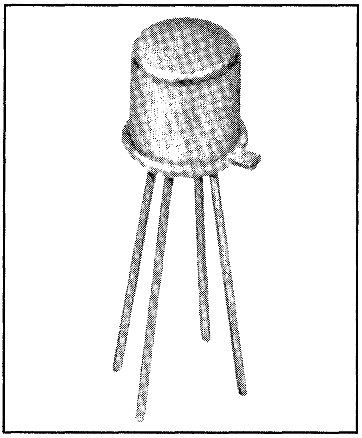
Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2066		
Subgroup 2			10
Thermal Shock (glass strain)	1056	Condition A	
Terminal Strength	2036	Condition E	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
Moisture Resistance	1021	Omit initial conditioning	
End Points		Group A, Subgroup 2	
Subgroup 3			10
Shock	2016	Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, X_1, Y_1, Z_1	
Vibration, Variable Frequency	2056		
Consistant Acceleration	2006	1 min in each orientation, X_1, Y_1, & Z_1 at 20K G's min	
End Points		Group A, Subgroup 2	
Subgroup 4			15
Salt Atmosphere (corrosion)	1041		
Subgroup 5			15
Not Applicable			
Subgroup 6			10
Steady-State Operational Life	1026	P_{DT} = 175-200mW, I_F = 20mA, T_A = 25°C, t = 1000hrs.	
End Points		Group A, Subgroup 2	

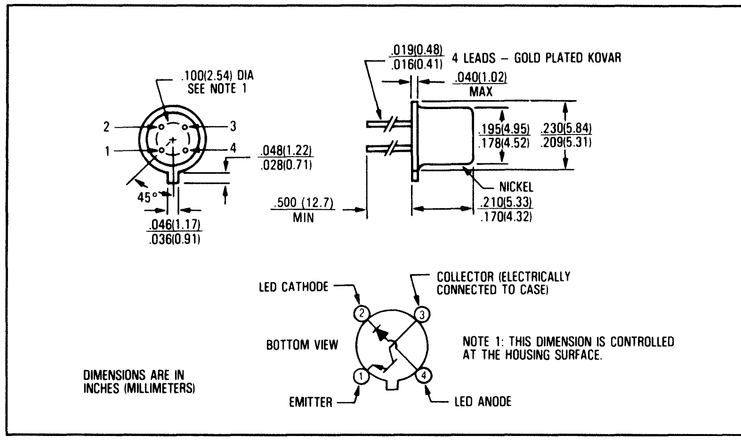
HI REL OPTO COMPONENTS

Product Bulletin 3N261
June 1993

OPTEK

Optically Coupled Isolators
Types 3N261, 3N262, 3N263





Features

- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- High current transfer ratio at low diode current drive
- TX-TXV process available (see Hi-Rel section)

Description

The 3N261, 3N262, and 3N263 are JEDEC registered optically coupled isolators each consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage .... ± 1.00kVDC[1]
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C[2]

Input Diode

Forward DC Current 40mA
Reverse Voltage 2.0V
Power Dissipation .... 60mW[3]

Output Phototransistor

Continuous Collector Current 30mA
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation .... 200mW[4]

Notes:
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.6mW/°C above 25°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics:
$Z_{OUT} = 50\Omega$, $t_r \leq 15ns$, duty cycle ≅ 1%.

Types 3N261, 3N262, 3N263

Electrical Characteristics (T_A = 25°C unless otherwise noted)

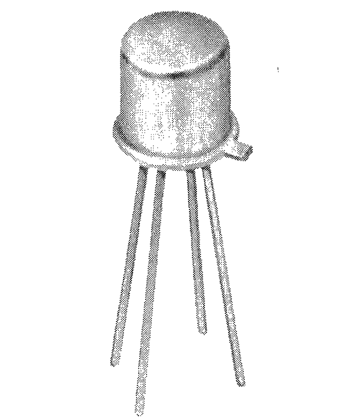
Symbol	Parameter	3N261			3N262			3N263			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Input Diode												
V_F	Forward Voltage	0.80		1.50	0.80		1.50	0.80		1.50	V	I_F = 10.0mA
		1.00		1.70	1.00		1.70	1.00		1.70	V	I_F = 10.0mA, T_A = -55°C
		0.70		1.30	0.70		1.30	0.70		1.30	V	I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current			100			100			100	µA	V_R = 2.0V
Output Phototransistor												
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	40			40			40			V	I_C = 1.00mA, I_F = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0			7.0			7.0			V	I_E = 100µA, I_F = 0
I_{CEO}	Collector Dark Current			100 100			100 100			100 100	nA µA	V_{CE} = 20.0V, I_F = 0 V_{CE} = 20.0V, T_A = 100°C
Coupled												
$I_{C(on)}$	On-State Collector Current	0.50			1.00		5.00	2.00		10.00	mA	I_F = 1.0mA, V_{CE} = 5.0V
		0.70			1.40			2.80			mA	I_F = 2.0mA, V_{CE} = 5.0V, T_A = -55°C
		0.50			1.00			2.00			mA	I_F = 2.0mA, V_{CE} = 5.0V, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.30							V	I_F = 2.0mA, I_C = 0.5mA
							0.30				V	I_F = 2.0mA, I_C = 1.0mA
										0.30	V	I_F = 2.0mA, I_C = 2.0mA
I_{IO}	Leakage Input-to-Output			100			100			100	nA	V_{IO} = ± 1.00kVDC(1)
C_{IO}	Capacitance Input-to-Output			5.0			5.0			5.0	pF	V_{IO} = 0V, f = 1.00MHz(1)
t_r	Output Rise Time			20.0			20.0			25.0	µs	V_{CC} = 10.0V, I_F = 5.0mA,(5) R_L = 100Ω
t_f	Output Fall Time			20.0			20.0			25.0	µs	

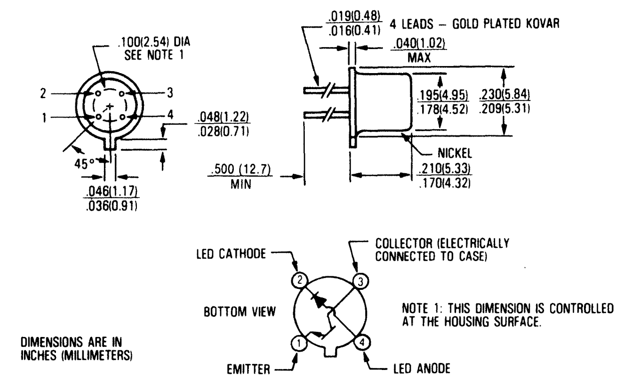
HI REL OPTO COMPONENTS

Product Bulletin 3N261TX
April 1993

OPTEK

High Reliability Optically Coupled Isolators
Types 3N261TX, 3N262TX, 3N263TX





Features

- Processed to Optek's military screening program patterned after MIL-S-19500
- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- High current transfer ratio at low diode current drive

Description

Each device in the series is a high reliability optically coupled isolator consisting of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed TO-72 package.

This series is identical to the JEDEC registered optically coupled isolators with additional high-reliability processing. This processing is patterned after MIL-S-19500 as shown in the accompanying table.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ± 1.00kVDC[1]
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]. . . . . 240°C[2]

Input Diode

Forward DC Current. 40mA
Reverse Voltage. 2.0V
Power Dissipation. . . . . 60mW[3]

Output Phototransistor

Continuous Collector Current. 30mA
Collector-Emitter Voltage 30V
Emitter-Collector Voltage 5.0V
Power Dissipation. . . . . 200mW[4]

Notes:
(1) Measured with input leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 0.60mW/°C above 25°C.
(4) Derate linearly 2.0mW/°C above 25°C.
(5) The input waveform is supplied by a generator with the following characteristics:
Z_{OUT} = 50Ω, $t_r \leq$ 15ns, duty cycle ≅ 1%, pulse width ≅ 100μs.

Types 3N261TX, 3N262TX, 3N263TX

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	3N261TX			3N262TX			3N263TX			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Input Diode												
V_F	Forward Voltage	0.80		1.50	0.80		1.50	0.80		1.50	V	I_F = 10.0mA
		1.00		1.70	1.00		1.70	1.00		1.70	V	I_F = 10.0mA, T_A = -55°C
		0.70		1.30	0.70		1.30	0.70		1.30	V	I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current			100			100			100	µA	V_R = 2.0V
Output Phototransistor												
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	40			40			40			V	I_C = 1.00mA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0			7.0			7.0			V	I_E = 100µA
I_{CEO}	Collector Dark Current			100 100			100 100			100 100	nA µA	V_{CE} = 10.0V V_{CE} = 10.0V, T_A = 100°C
Coupled												
$I_{C(on)}$	On-State Collector Current	0.50			1.00		5.0	2.00		10.0	mA	I_F = 1.0mA, V_{CE} = 5.0V
		0.70			1.40			2.80			mA	I_F = 2.0mA, V_{CE} = 5.0V, T_A = -55°C
		0.50			1.00			2.00			mA	I_F = 2.0mA, V_{CE} = 5.0V, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.30							V	I_F = 2.0mA, I_C = 0.50mA
							0.30				V	I_F = 2.0mA, I_C = 1.0mA
										0.30	V	I_F = 2.0mA, I_C = 2.0mA
I_{IO}	Leakage Input-to-Output			10			10			10	nA	V_{IO} = ± 1.00kVDC[(1)]
C_{IO}	Capacitance Input-to-Output			5.0			5.0			5.0	pF	V_{IO} = 0V, f = 1.00MHz[(1)]
t_r	Output Rise Time			20.0			20.0			25.0	µs	V_{CC} = 10.0V, I_F = 5.0mA,[(5)] R_L = 100Ω
t_f	Output Fall Time			20.0			20.0			25.0	µs	

100% Processing

Screen	Mil-STD-750 Method	Conditions	3N261TX 3N262TX 3N263TX
Pre-Cap Visual		Optek's pre-cap visual(6)	100%
High Temperature Storage	1032	$T_A = 150^oC$, t = 24hrs.	100%
Temperature Cycle	1051	Condition C, 20 cycles, 15 min each extreme	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%
High Temperature Reverse Bias	1039	Condition A, $T_A = 125^oC$, V_{CE} = 24Vdc, I_F = 0, t = 96hrs. min	100%
Power Burn-In	1039	Condition B, P_{DT} = 175-200mW, $T_A = 25^oC$, I_F = 40mA, t = 160hrs. min	100%
Hermetic Seal	1071	Fine: Condition H, 5 X 10^{-8}atm cc/sec Gross: Condition C	100%

(6) Visual inspection based upon Optek's interpretation of the requirements of a JANTX device per MIL-S-19500/548 specification.

Group B Inspection (performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Solderability	2026		
Resistance to Solvents	1022		
Subgroup 2			10
Thermal Shock (temperature cycling)	1051	Condition C, 15 min at extremes, 20 cycles	
Hermetic Seal Fine Leak Gross Leak	1071	Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
End Points		Group A, Subgroup 2	
Subgroup 3			5
Steady-State Operation Life	1027	P_{DT} = 175-200mW, I_F = 20mA, $T_A = 25^oC$	
End Points		Group A, Subgroup 2	
Bond Strength	2037	All internal wires of each device shall be pulled separately.	20 (c=0)
Subgroup 4			
Decap Internal Visual Inspection	2075	Visual criteria in accordance with qualified design.	1 device
Subgroup 6			7
High Temperature Life (non-operating)	1032	t = 340hrs., $T_A = 150^oC$	

Types 3N261TX, 3N262TX, 3N263TX

Group C Inspection (performed every six months while in production)

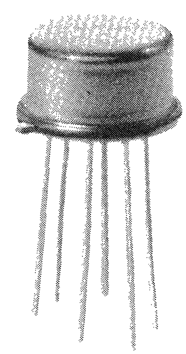
Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2066		
Subgroup 2			10
Thermal Shock (glass strain)	1056	Condition A	
Terminal Strength	2036	Condition E	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
Moisture Resistance	1021	Omit initial conditioning	
End Points		Group A, Subgroup 2	
Subgroup 3			10
Shock	2016	Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, X_1, Y_1, Z_1	
Vibration, Variable Frequency	2056		
Constant Acceleration	2006	1 min in each orientation, X_1, Y_1, & Z_1 at 20K G's min	
End Points		Group A, Subgroup 2	
Subgroup 4			15
Salt Atmosphere (corrosion)	1041		
Subgroup 5			15
Barometric Pressure	1001	Not Applicable	
Subgroup 6			10
Steady-State Operational Life	1026	P_{DT} = 175-200mW, I_F = 20mA, T_A = 25°C, t = 1000hrs.	
End Points		Group A, Subgroup 2	

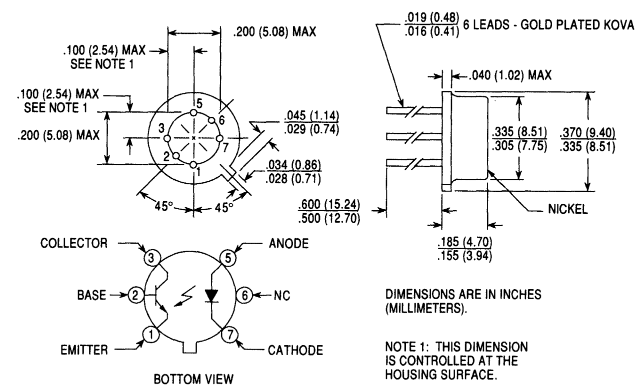
HI REL OPTO COMPONENTS

Product Bulletin 4N22A
May 1993

OPTEK

Optically Coupled Isolators
Types 4N22A, 4N23A, 4N24A





Features

- High current transfer ratio
- TO-78 hermetic package
- 1.0 kV electrical isolation
- Base lead provided for conventional transistor biasing
- JANTX version available per MIL-S-19500/486
- Higher breakdown voltage devices available as the "HV" series
- Patent number 4124860

Description

The 4N22A, 4N23A, and 4N24A are optically coupled isolators each consisting of a gallium arsenide LED and a silicon phototransistor mounted side by side and coupled on a ceramic substrate in a hermetic TO-78 package. All electrical characteristics for the 4N22A, 4N23A, and 4N24A are per the JEDEC registered test conditions. The 4N22AHV, 4N23AHV, and 4N24AHV series of optoisolators are available when higher breakdown voltages are required.

The TO-78 package offers high power dissipation, ease of heat sinking and superior operation in hostile environments.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ± 1.00 kVDC(1)
Storage and Operating Temperature Range . . . . -65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Input Diode

Forward DC Current (65°C or below) 40mA
Reverse Voltage 2.0V
Peak Forward Current (1 µs pulse width, 300 pps) 1.00A
Power Dissipation . . . . 60mW(3)

Output Sensor

Continuous Collector Current 50mA
Collector-Emitter Voltage 35V
Collector-Base Voltage 35V
Emitter-Base Voltage 4.0V
Power Dissipation . . . . 300mW(4)

Notes:
(1) Measured with input diode leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.0mW/°C above 65°C.
(4) Derate linearly 3.0mW/°C above 25°C.
(5) Not 100% tested.

Types 4N22A, 4N23A, 4N24A

Electrical Characteristics (T_A = 25°C unless otherwise noted)

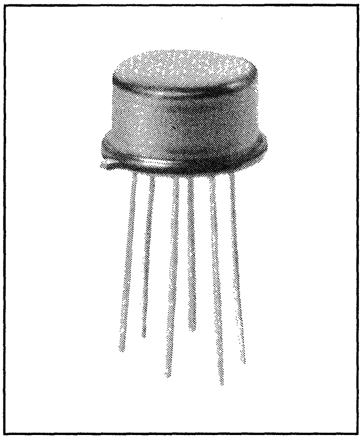
Symbol	Parameter	Type	Min	Typ	Max	Units	Test Conditions
Input Diode							
V_F	Forward Voltage		0.80		1.30	V	I_F = 10.0mA
			1.00		1.50	V	I_F = 10.0mA, T_A = -55°C(5)
			0.70		1.20	V	I_F = 10.0mA, T_A = 100°C(5)
I_R	Reverse Current				100	µA	V_R = 2.0V
Output Phototransistor							
$V_{(BR)CBO}$	Collector-Base Breakdown		35			V	I_C = 100µA, I_E = 0, I_F = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown		35			V	I_C = 1.0mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown		4.0			V	I_E = 100µA, I_C = 0, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current				100 100	nA µA	V_{CE} = 20V, I_B = 0, I_F = 0 V_{CE} = 20V, I_B = 0, I_F = 0, T_A = 100°C
Coupled							
$I_{C(ON)}$	On-State Collector Current	4N22A	0.15 2.50 1.00 1.00			mA mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = 100°C
		4N23A	0.20 6.00 2.50 2.50			mA mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = 100°C
		4N24A	0.40 10.0 4.00 4.00			mA mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation	4N22A 4N23A 4N24A			0.30 0.30 0.30	V	I_C = 2.5mA, I_B = 0, I_F = 20.0mA I_C = 5.0mA, I_B = 0, I_F = 20.0mA I_C = 10.0mA, I_B = 0, I_F = 20.0mA
h_{FE}	DC Current Gain	4N22A 4N23A 4N24A	200 300 400				V_{CE} = 5.0V, I_C = 10.0mA, I_F = 0mA
R_{IO}	Resistance (Input to Output)		10^{11}			Ω	V_{IO} = ± 1000Vdc(1)
C_{IO}	Capacitance (Input to Output)				5.0	pF	V_{IO} = 0.0V, f = 1.0MHz(1)
t_r	Output Rise Time	4N22A 4N23A 4N24A			15.0 15.0 20.0	µs µs µs	V_{CC} = 10.0V, I_F = 10.0mA, R_L = 100Ω
t_f	Output Fall Time	4N22A 4N23A 4N24A			15.0 15.0 20.0	µs µs µs	

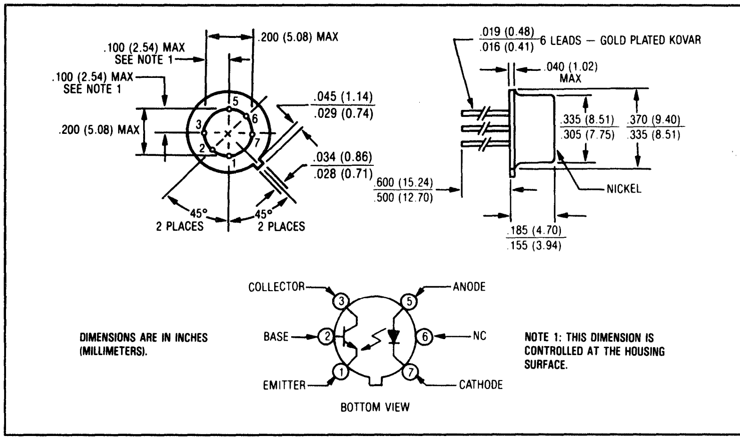
HI REL OPTO COMPONENTS

Product Bulletin 4N22AJAN
April 1993

OPTEK

Optically Coupled Isolators
Types JANTX, JANTXV-4N22A, 4N23A, 4N24A





Features

- High-Reliability processed to MIL-S-19500/486
- 1 kV electrical isolation
- Base contact is provided for conventional transistor biasing
- JANTX, JANTXV qualified
- Patent number 4124860

Description

The JANTX and JANTXV series of the 4N22A, 4N23A and 4N24A are JEDEC registered, DESC qualified, optically coupled isolators. High reliability processing on the devices is performed in accordance with MIL-S-19500/486.

Each device in the series consists of an infrared emitting diode and a NPN silicon phototransistor mounted in a hermetically sealed TO-78 package. The suffix letter "A" denotes the collector is electrically isolated from the case.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Input-to-Output Isolation Voltage	± 1.00 kVDC(1)
Storage and Operating Temperature Range	-65°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron]	240°C(2)
Input Diode	
Forward DC Current (65°C or below)	40mA
Reverse Voltage	2.0V
Peak Forward Current (1 µs pulse width, 300 pps)	1.00A
Power Dissipation	60mW(3)
Output Sensor	
Continuous Collector Current	50mA
Collector-Emitter Voltage	35V
Collector-Base Voltage	35V
Emitter-Base Voltage	4.0V
Power Dissipation	300mW(4)

Notes:
(1) Measured with input diode leads shorted together and output leads shorted together.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(3) Derate linearly 1.0mW/°C above 65°C.
(4) Derate linearly 3.0mW/°C above 25°C.
(5) Not 100% tested.

Types JANTX, JANTXV - 4N22A, 4N23A, 4N24A

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	JANTX, JANTXV						Units	Test Conditions
		4N22A		4N23A		4N24A			
		Min	Max	Min	Max	Min	Max		
Input Diode									
V_F	Forward Voltage	0.80 1.00 0.70	1.30 1.50 1.20	0.80 1.00 0.70	1.30 1.50 1.20	0.80 1.00 0.70	1.30 1.50 1.20	V V V	I_F = 10.0mA I_F = 10.0mA, T_A = -55°C(5) I_F = 10.0mA, T_A = 100°C(5)
I_R	Reverse Current		100		100		100	μA	V_R = 2.0V
Output Phototransistor									
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	35		35		35		V	I_C = 1.0mA, I_B = 0, I_F = 0
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	35		35		35		V	I_C = 100μA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	4.0		4.0		4.0		V	I_E = 100μA, I_C = 0, I_F = 0
I_{CEO}	Collector-Emitter Dark Current		100 100		100 100		100 100	nA μA	V_{CE} = 20V, I_B = 0, I_F = 0 V_{CE} = 20V, I_B = 0, I_F = 0, T_A = 100°C
Coupled									
$I_{C(ON)}$	On-State Collector Current	0.15 2.50 1.00 1.00		0.20 6.00 2.50 2.50		0.40 10.0 4.00 4.00		mA mA mA mA	I_F = 2.0mA, V_{CE} = 5V, I_B = 0 I_F = 10.0mA, V_{CE} = 5V, I_B = 0 I_F = 10.0mA, V_{CE} = 5V, I_B = 0, T_A = -55°C I_F = 10.0mA, V_{CE} = 5V, I_B = 0, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.30		0.30		0.30	V	I_F = 20mA, I_C = 2.5mA, I_B = 0 I_F = 20mA, I_C = 5.0mA, I_B = 0 I_F = 20mA, I_C = 10.0mA, I_B = 0
h_{FE}	DC Current Gain	200		300		400			V_{CE} = 5.0V, I_C = 10.0mA, I_F = 0mA
R_{IO}	Resistance (Input-to-Output)	10^{11}		10^{11}		10^{11}		Ω	V_{IO} = ± 1.0VDC(1)
C_{IO}	Capacitance (Input to Output)		5.0		5.0		5.0	pF	V_{IO} = 0V, f = 1.0MHz(1)
t_r t_f	Output Rise Time Output Fall Time		15.0 15.0		15.0 15.0		20.0 20.0	μs μs	V_{CC} = 10.0V, I_F = 10.0mA, R_L = 100Ω

HI REL OPTO COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Simplified JANTX Product Flow

JANTX	JANTXV
100% Processing Pluse Sample Environmental and Life Testing	Same as JANTX Plus 100% Internal Visual Inspection
Commercial Product ↓ 100% Processing ↓ Group A, B, C Sample Test ↓ Ship	100% Pre-Cap Visual ↓ 100% Processing ↓ Group A, B, C Sample Test ↓ Ship

100% Processing

Screen	MIL-STD-750 Method	Conditions	JANTX4N22A JANTX4N23A JANTX4N24A	JANTXV4N22A JANTXV4N23A JANTXV4N24A
Pre-Cap Visual		Per Mil-S-19500/486	——	100%
High Temperature Storage		$T_A = 125^oC$, t = 72hrs.	100%	100%
Temperature Cycle	1051	Condition B, 10 Cycles, 15 min @ extreme	100%	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%	100%
High Temperature Reverse Bias	1039	Condition A, $T_A = 125^oC$, $V_{CB} = 20V$, $I_F = 0$, t = 96hrs. min	100%	100%
Power Burn-In	1039	Condition B, $V_{CC} = 20V$, $V_{CE} = 10 \pm 5V$, $Pt = 275 \pm 25mW$, $T_A = 25^oC$, $I_F = 40mA$, t = 168hrs. min	100%	100%
Monitored Temperature Cycle	1051	Condition B, Monitored, 1 Cycle, 15 min @ extreme	100%	100%
Hermetic Seal	1071	Fine: Condition G or H, 1 x 10^{-7}atm cc/sec Gross: Condition C	100%	100%
External Visual Examination	2071		100%	100%

Types JANTX, JANTXV - 4N22A, 4N23A, 4N24A

Quality and Reliability Lot Acceptance Testing

Subgroup	Examination or Test	Method MIL-STD-750	Sample size or LTPD
Group A MIL-S-19500/486			
1	Visual & Mechanical	2071	LTPD = 5
2	DC Electrical	Table 1 (/486)	116, C = 0
3	Temperature Tests	Table 1 (/486)	116, C = 0
4	Dynamic Tests	Table 1 (/486)	116, C = 0
5	Not Applicable		
6	Not Applicable		
7	Monitored Temp Cycle (1 Cycle)	1051	116, C = 0
Group B MIL-S-19500/486			
Subgroup	**Examination or Test**	**Method MIL-STD-750**	**Sample Size or LTPD**
1	Solderability Resistance to Solvents	2026 1022	LTPD = 15 LTPD = 15
2	Thermal Shock Hermetic Seal (Condition H and C) End Points	1051 1071 Table IV (/486)	LTPD = 10
3	Steady State Life End Points	1027 Table IV (/486)	LTPD = 5
4	Decap Internal Visual Bond Strength	2075 2037	1, C = 0 20 Wires
5	Not Applicable		
6	High Temp Life (Non-Operating) End Points	1032 Table IV (/486)	LTPD = 7
Group C Mil-S-19500/486 (Performed Every 6 Months)			
Subgroup	**Examination or Test**	**Method MIL-STD-750**	**Sample Size or LTPD**
1	Physical Dimensions	2066	LTPD = 15
2	Thermal Shock (Glass Strain) Terminal Strength (Not Applicable) Hermetic Seal (Condition H and C) Moisture Resistance External Visual End Points	1056 — 1071 1021 2071 Table IV (/486)	LTPD = 10
3	Shock Vibration, Variable Frequency Constant Acceleration End Points	2016 2056 2006 Table IV (/486)	LTPD = 10
4	Salt Atmosphere	1041	LTPD = 15
5	Not Applicable		
6	Steady State Operation Life (1000 hrs.) End Points	1026 Table IV (/486)	LTPD = 10

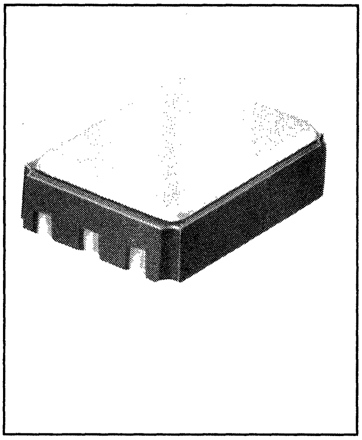
HI REL OPTO COMPONENTS

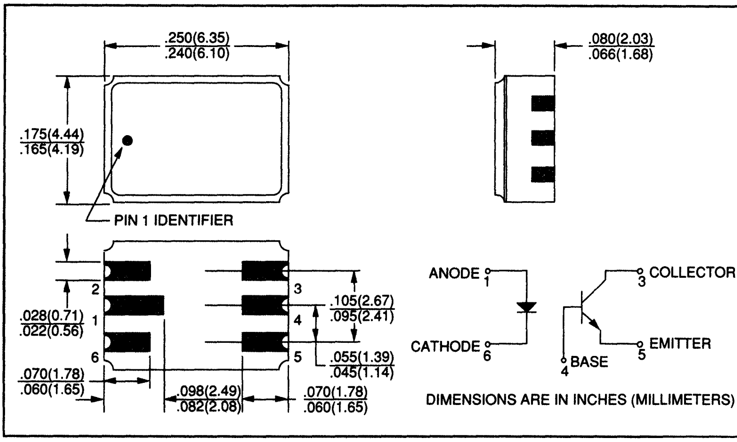
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin JANTX4N22AU
May 1993

OPTEK

Surface Mount Optically Coupled Isolators
Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU





Features

- JANTX, JANTXV qualified per MIL-S-19500/486
- Surface Mountable
- 1 kV Electrical Isolation
- Base contact provided for conventional transistor biasing

Description

The JANTX and JANTXV series 4N22AU, 4N23AU, and 4N24AU are DESC qualified, surface mount optically coupled isolators. High reliability processing on the devices is performed in accordance with MIL-S-19500/486.

Each device in the series consists of an infrared emitting diode and an NPN silicon phototransistor mounted in a hermetically sealed ceramic surface mount package. The suffix letter "A" denotes the collector is electrically isolated from the case and "U" denotes surface mount package.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/486 for complete requirements.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage	± 1.0 kVDC(1)
Storage and Operating Temperature Range	-65°C to +125°C
Soldering Temperature (vapor phase reflow)	215°C
Soldering Temperature (heated collet for 5 sec)	260°C
Input Diode	
Forward DC Current (65°C or below)	40mA(2)
Reverse Voltage	2.0V
Peak Forward Current (1 µs pulse width, 300 pps)	1.00A
Output Sensor	
Continuous Collector Current	50mA
Collector-Emitter Voltage	35V
Collector-Base Voltage	35V
Emitter-Base Voltage	4.0V
Power Dissipation	300mW(3)

Notes:
(1) Measured with input diode leads shorted together and output leads shorted together.
(2) Derate linearly 0.67mA/°C above 65°C.
(3) Derate linearly 3.0mW/°C above 25°C.

Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Type	Min	Typ	Max	Units	Test Conditions
Input Diode							
V_F	Forward Voltage		0.80		1.30	V	I_F = 10.0mA
			1.00		1.50	V	I_F = 10.0mA, T_A = -55°C
			0.70		1.20	V	I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current				100	μA	V_R = 2.0V
Output Phototransistor							
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		35			V	I_C = 100μA, I_E = 0, I_F = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		35			V	I_C = 1.0mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		4.0			V	I_E = 100μA, I_C = 0, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current				100	nA	V_{CE} = 20V, I_B = 0, I_F = 0
					100	μA	V_{CE} = 20V, I_B = 0, I_F = 0, T_A = 100°C
Coupled							
$I_{C(ON)}$	On-State Collector Current	4N22AU	0.15			mA	V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA
			2.50			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA
			1.00			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = -55°C
			1.00			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = 100°C
		4N23AU	0.20			mA	V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA
			6.00			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA
			2.50			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = -55°C
			2.50			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = 100°C
		4N24AU	0.40			mA	V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA
			10.00			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA
			4.00			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = -55°C
			4.00			mA	V_{CE} = 5.0V, I_B = 0, I_F = 10.0mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	4N22AU			0.30	V	I_C = 2.5mA, I_B = 0, I_F = 20.0mA
		4N23AU			0.30		I_C = 5.0mA, I_B = 0, I_F = 20.0mA
		4N24AU			0.30		I_C = 10.0mA, I_B = 0, I_F = 20.0mA
h_{FE}	DC Current Gain	4N22AU	200				
		4N23AU	300				V_{CE} = 5.0V, I_C = 10.0mA, I_F = 0mA
		4N24AU	400				
R_{IO}	Resistance (Input to Output)		10^{11}			Ω	V_{IO} = ± 1000Vdc(1)
C_{IO}	Capacitance (Input to Output)				5.0	pF	V_{IO} = 0.0V, f = 1.0MHz(1)
t_r	Output Rise Time	4N22AU			15.0	μs	
		4N23AU			15.0	μs	
		4N24AU			20.0	μs	V_{CC} = 10.0V, I_F = 10.0mA, R_L = 100Ω
t_f	Output Fall Time	4N22AU			15.0	μs	
		4N23AU			15.0	μs	
		4N24AU			20.0	μs	

HI REL OPTO COMPONENTS

Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU

Simplified JANTX Product Flow

JANTX	JANTXV
100% Processing, Plus Sample Environmental and Life Testing	Same as JANTX Plus 100% Internal Visual Inspection
JAN Qualified Build ↓ 100% Processing ↓ Group A, B, C Sample Test ↓ Ship	100% Pre-Cap Visual ↓ 100% Processing ↓ Group A, B, C Sample Test ↓ Ship

100% Processing

Screen	MIL-STD-750 Method	Conditions	JANTX4N22AU JANTX4N23AU JANTX4N24AU	JANTXV4N22AU JANTXV4N23AU JANTXV4N24AU
Pre-Cap Visual	2072		—	100%
High Temperature Storage		$T_A = 125^oC$, t = 24hrs.	100%	100%
Temperature Cycle	1051	Condition B, 10 Cycles, 15 min @ -55°C to +125°C	100%	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%	100%
Hermetic Seal	1071	Fine: Condition H, 5×10^{-8}atm cc/sec Gross: Condition C	100%	100%
High Temperature Reverse Bias	1039	Condition A, $T_A = 125^oC$, $V_{CB} = 28V$, $I_F = 0$, t = 48hrs. min	100%	100%
Interim Electrical	—		100%	100%
Power Burn-In	1039	Condition B, $V_{CC} = 20V$, $V_{CE} = 10 \pm 5V$, $Pt = 275 \pm 25mW$, $T_A = 25^oC$, $I_F = 40mA$, t = 168hrs. min	100%	100%
Final Electrical	—		100%	100%

Types JANTX, JANTXV - 4N22AU, 4N23AU, 4N24AU

Quality and Reliability Lot Acceptance Testing

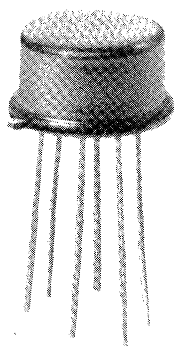
Subgroup	Examination or Test	Method MIL-STD-750	Sample size or LTPD
Group A MIL-S-19500/486			
1	Visual & Mechanical	2071	LTPD = 5
2	DC Electrical	Table 1 (/486)	116, C = 0
3	Temperature Tests	Table 1 (/486)	116, C = 0
4	Dynamic Tests	Table 1 (/486)	116, C = 0
5	Not Applicable		
6	Not Applicable		
7	Monitored Temp Cycle (1 Cycle)	1051	116, C = 0
Group B MIL-S-19500/486			
Subgroup	**Examination or Test**	**Method MIL-STD-750**	**Sample Size or LTPD**
1	Solderability Resistance to Solvents	2026 1022	LTPD = 15 LTPD = 15
2	Thermal Shock Hermetic Seal (Condition H and C) End Points	1051 1071 Table IV (/486)	LTPD = 10
3	Steady State Life End Points	1027 Table IV (/486)	LTPD = 5
4	Decap Internal Visual Bond Strength	2075 2037	1, C = 0 20 Wires
5	Not Applicable		
6	High Temp Life (Non-Operating) End Points	1032 Table IV (/486)	LTPD = 7
Group C Mil-S-19500/486 (Performed Every 6 Months)			
Subgroup	**Examination or Test**	**Method MIL-STD-750**	**Sample Size or LTPD**
1	Physical Dimensions	2066	LTPD = 15
2	Thermal Shock (Glass Strain) Terminal Strength (Not Applicable) Hermetic Seal (Condition H and C) Moisture Resistance External Visual End Points	1056 — 1071 1021 2071 Table IV (/486)	LTPD = 10
3	Shock Vibration, Variable Frequency Constant Acceleration End Points	2016 2056 2006 Table IV (/486)	LTPD = 10
4	Salt Atmosphere	1041	LTPD = 15
5	Not Applicable		
6	Steady State Operation Life (1000 hrs.) End Points	1026 Table IV (/486)	LTPD = 10

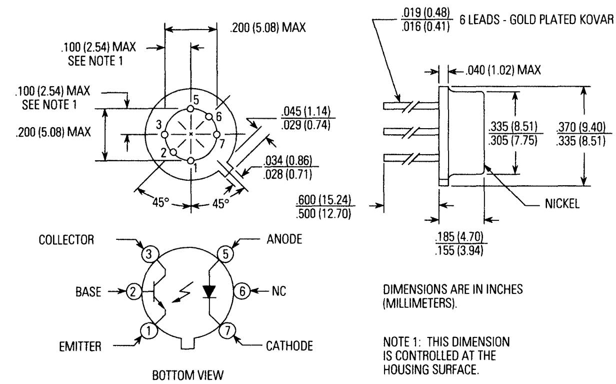
HI REL OPTO COMPONENTS

Product Bulletin 4N47
May 1993

OPTEK

Optically Coupled Isolators
Types 4N47, 4N48, 4N49





Features

- High current transfer ratio
- TO-78 hermetic package
- 1.0 kV electrical isolation
- Base lead provided for conventional transistor biasing
- JANTX version available per MIL-S-19500/548
- Higher breakdown voltage devices available as the "HV" series
- Patent number 4124860

Description

The 4N47, 4N48, and 4N49 are optically coupled isolators each consisting of an infrared light emitting diode and a silicon phototransistor mounted side by side on a ceramic substrate and coupled in a hermetic TO-78 package. All electrical characteristics are according to the JEDEC registered 4N47, 4N48, and 4N49 test conditions. The 4N47HV, 4N48HV, and 4N49HV series of optoisolators are available when higher breakdown voltages are required.

The TO-78 package offers high power dissipation, ease of heat sinking and superior operation in hostile environments.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage	± 1.00kVDC(1)
Storage Temperature Range	-55°C to +150°C
Operating Temperature Range	-55°C to +125°C
Soldering Temperature [1/16 in. (1.6mm)) from case for 5 sec. with soldering iron]	240°C
Input Diode	
Forward DC Current (65°C or below)	40mA
Reverse Voltage	2.0V
Power Dissipation	60mW(2)
Output Phototransistor	
Continuous Collector Current	50mA
Collector-Base Voltage	45V(3)
Collector-Emitter Voltage	40V
Emitter-Base Voltage	7.0V
Power Dissipation	300mW(4)

Notes:
(1) Measured with input leads shorted together and output leads shorted together.
(2) Derate linearly 1.00mW/°C above 65°C.
(3) 4N47HV, 4N48HV, and 4N49HV are available rated at 55V minimum.
(4) Derate linearly 3.0mW/°C above 25°C.

Types 4N47, 4N48, 4N49

Electrical Characteristics (T_A = 25°C unless otherwise noted)

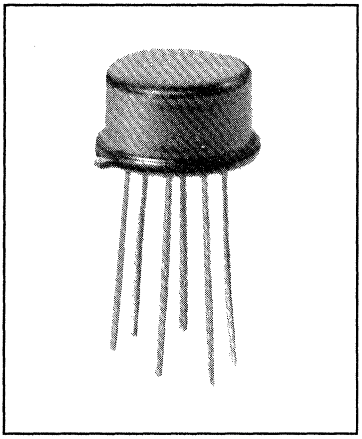
Symbol	Parameter	Type	Min	Typ	Max	Units	Test Conditions
Input Diode							
V_F	Forward Voltage		0.80 1.00 0.70		1.50 1.70 1.30	V V V	I_F = 10.0mA I_F = 10.0mA, T_A = -55°C I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current				100	µA	V_R = 2.0V
Output Phototransistor							
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage(3)		45			V	I_C = 100µA, I_E = 0, I_F = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage(3)		40			V	I_C = 1.0mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		7.0			V	I_E = 100µA, I_C = 0, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current				100 100	nA µA	V_{CE} = 20V, I_B = 0, I_F = 0 V_{CE} = 20V, I_B = 0, I_F = 0, T_A = 100°C
$I_{CB(OFF)}$	Collector-Base Dark Current				100	nA	V_{CB} = 20V, I_B = 0, I_F = 0
Coupled							
$I_{C(ON)}$	On-State Collector Current	4N47	0.5 0.7 0.5			mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 1.0mA V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = 100°C
		4N48	1.0 1.4 1.0		5.0	mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 1.0mA V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = 100°C
		4N49	2.0 2.8 2.0		10.0	mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 1.0mA V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = 100°C
$I_{CB(ON)}$	On-State Collector Base		30			µA	V_{CB} = 5.0V, I_E = 0, I_F = 10mA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	4N47 4N48 4N49			0.30 0.30 0.30	V V V	I_C = 0.5mA, I_B = 0, I_F = 2.0mA I_C = 1.0mA, I_B = 0, I_F = 2.0mA I_C = 2.0mA, I_B = 0, I_F = 2.0mA
h_{FE}	DC Current Gain	4N47 4N48 4N49	100 100 100				V_{CE} = 5.0V, I_C = 10.0mA, I_F = 0mA
R_{IO}	Resistance (Input to Output)		10^{11}			Ω	V_{IO} = ± 1000Vdc(1)
C_{IO}	Capacitance (Input to Output)				5.0	pF	V_{IO} = 0.0V, f = 1.0MHz(1)
t_r	Output Rise Time	4N47 4N48 4N49			20.0 20.0 25.0	µs µs µs	V_{CC} = 10.0V, I_F = 5.0mA, R_L = 100Ω
t_f	Output Fall Time	4N47 4N48 4N49			20.0 20.0 25.0	µs µs µs	

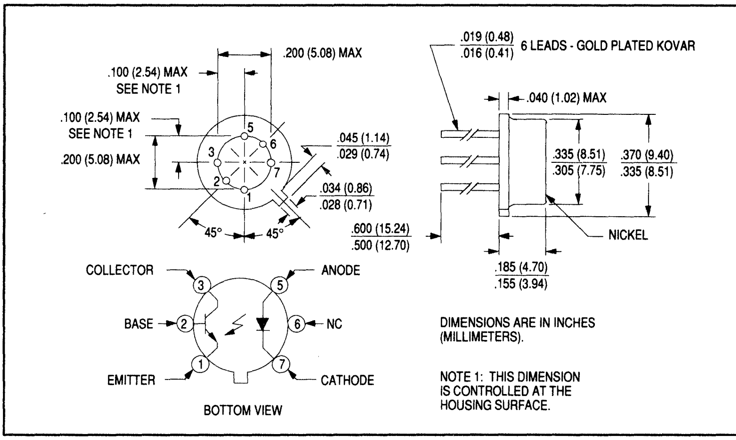
HI REL OPTO COMPONENTS

Product Bulletin 4N47JANTX
May 1993

OPTEK

Optically Coupled Isolators
Types JANTX, JANTXV - 4N47, 4N48, 4N49





Features

- High current transfer ratio
- TO-78 hermetic package
- 1.0 kV electrical isolation
- Base lead provided for conventional transistor biasing
- JANTX qualified per MIL-S-19500/548
- Patent number 4124860

Description

The JANTX and JANTXV series of the 4N47, 4N48, and 4N49 are JEDEC registered, DESC qualified, optically coupled isolators. High reliability processing on devices is performed in accordance with MIL-S-19500/548.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage .... ± 1.00kVDC(1)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -55°C to +125°C
Soldering Temperature [1/16 in. (1.6mm)) from case for 5 sec. with soldering iron] .... 240°C

Input Diode

Forward DC Current (65°C or below) 40mA
Reverse Voltage 2.0V
Power Dissipation .... 60mW(2)

Output Phototransistor

Continuous Collector Current 50mA
Collector-Base Voltage 45V
Collector-Emitter Voltage 40V
Emitter-Base Voltage 7.0V
Power Dissipation .... 300mW(3)

Notes:
(1) Measured with input leads shorted together and output leads shorted together.
(2) Derate linearly 1.0mW/°C above 65°C.
(3) Derate linearly 3.0mW/°C above 25°C.

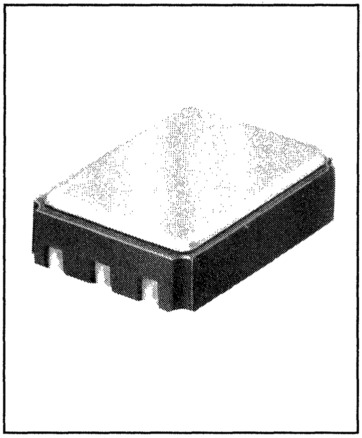
Types JANTX, JANTXV - 4N47, 4N48, 4N49

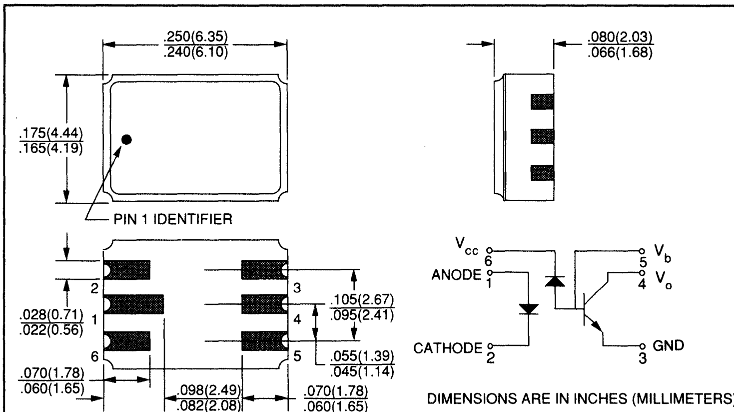
Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Type	Min	Typ	Max	Units	Test Conditions
Input Diode							
V_F	Forward Voltage		0.80 1.00 0.70		1.50 1.70 1.30	V V V	I_F = 10.0mA I_F = 10.0mA, T_A = -55°C I_F = 10.0mA, T_A = 100°C
I_R	Reverse Current				100	µA	V_R = 2.0V
Output Phototransistor							
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		45			V	I_C = 100µA, I_E = 0, I_F = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		40			V	I_C = 1.0mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		7.0			V	I_E = 100µA, I_C = 0, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current				100 100	nA µA	V_{CE} = 20V, I_B = 0, I_F = 0 V_{CE} = 20V, I_B = 0, I_F = 0, T_A = 100°C
$I_{CB(OFF)}$	Collector-Base Dark Current				10.0	nA	V_{CB} = 20V, I_E = 0, I_F = 0
Coupled							
$I_{C(ON)}$	On-State Collector Current	4N47	0.5 0.7 0.5			mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 1.0mA V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = 100°C
		4N48	1.0 1.4 1.0		5.0	mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 1.0mA V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = 100°C
		4N49	2.0 2.8 2.0		10.0	mA mA mA	V_{CE} = 5.0V, I_B = 0, I_F = 1.0mA V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = -55°C V_{CE} = 5.0V, I_B = 0, I_F = 2.0mA, T_A = 100°C
$I_{CB(ON)}$	On-State Collector Base		30			µA	V_{CB} = 5.0V, I_E = 0, I_F = 10mA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	4N47 4N48 4N49			0.30 0.30 0.30	V V V	I_C = 0.5mA, I_B = 0, I_F = 2.0mA I_C = 1.0mA, I_B = 0, I_F = 2.0mA I_C = 2.0mA, I_B = 0, I_F = 2.0mA
h_{FE}	DC Current Gain	4N47 4N48 4N49	100 100 100				V_{CE} = 5.0V, I_C = 10.0mA, I_F = 0mA
R_{IO}	Resistance (Input-to-Output)		10^{11}			Ω	V_{I-O} = ± 1000Vdc(1)
C_{IO}	Capacitance (Input to Output)				5.0	pF	V_{I-O} = 0V, f = 1.0MHz(1)
t_r	Output Rise Time	4N47 4N48 4N49			20.0 20.0 25.0	µs µs µs	V_{CC} = 10.0V, I_F = 5.0mA, R_L = 100Ω
t_f	Output Fall Time	4N47 4N48 4N49			20.0 20.0 25.0	µs µs µs	

OPTEK

High Speed Optocouplers
Types HCC135, HCC136, HCC135TXV, HCC136TXV





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- High speed - 1 megabit/second
- TTL compatible
- High common mode transient immunity
- Wide bandwidth
- Open collector output
- Hermetic surface mount

Description

Optek's HCC135 and HCC136 are high speed optocouplers consisting of IR emitters and integrated photodetectors. Their electrical characteristics are such that they can be substituted for 6N135 and 6N136 in applications where hermetic devices are required and board space is at a premium.

The HCC package is a ceramic surface mount leadless chip carrier which is compatible with epoxy and reflow solder mounting technologies.

The HCC135TXV and HCC136TXV are high reliability optocouplers with 100% processeing and Group Testing patterned after MIL-STD-883 Method 5008.

Absolute Maximum Ratings (No derating required up to 70°C)

Storage Temperature	-55°C to +150°C
Operating Temperature	-55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 10 seconds]	260°C
Average Input Current - I_F	25mA(1)
Peak Output Current - I_F (50% duty cycle, 1ms pulse width)	50mA(2)
Peak Transient Input Current - I_F (≤ 1µs pulse width, 300pps)	1.0A
Reverse Input Voltage - V_R	5.0V
Input Power Dissipation	45mW(3)
Average Output Current - I_O	8.0mA
Peak Output Current	16.0mA
Emitter-Base Reverse Voltage	5.0V
Supply and Output Voltage - V_{CC}, V_O	-0.5V to 15V
Base Current - I_B	5.0mA
Output Power Dissipation	100mW(4)

Caution: This component is susceptible to damage from electrostatic discharge. Normal static prevention procedures should be used in handling.

Notes:
(1) Derate linearly above 70°C free-air temperature at a rate of 0.45mA/°C.
(2) Derate linearly above 70°C free-air temperature at a rate of 0.9mA/°C.
(3) Derate linearly above 70°C free-air temperature at a rate of 0.8mW/°C.
(4) Derate linearly above 70°C free-air temperature at a rate of 1.8mW/°C.
(5) CMH is the maximum allowable dV/dt on the leading edge of a common mode pulse to assure that the output will not switch from high to low.
(6) CML is the maximum negative dV/dt allowable on the trailing edge of a common mode pulse to assure that the output will not switch from low to high.
(7) Test conditions represents 1 TTL unit load with 5.6 kΩ pull-up resistor.
(8) Test conditions represents 1 LSTTL unit load with a 6.1 kΩ pull-up resistor.
(9) Device considered a two-terminal device: pins 1 and 2 shorted together and pins 3, 4, 5 and 6 shorted together.

Types HCC135, HCC136, HCC135TXV, HCC136TXV

Electrical Characteristics (Over recommended temperature T_A = -55°C to 125°C, unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP*	MAX	UNITS	TEST CONDITIONS
CTR	Current Transfer Ratio	HCC135 HCC136	7.0 19.0	19.0 25.0		% %	I_F = 16.0mA, V_O = 0.40V, V_{CC} = 4.5V, T_A = 25°C
		HCC135 HCC136	5.0 15.0	15.0 23.0		% %	I_F = 16.0mA, V_O = 0.50V V_{CC} = 4.5V
V_{OL}	Logic Low Output Voltage	HCC135		0.100	0.40	V	I_F = 16.0mA, I_O = 1.10mA, V_{CC} = 4.5V
		HCC136		0.100	0.40	V	I_F = 16.0mA, I_O = 2.4mA, V_{CC} = 4.5V
I_{OH}	Logic High Output Current			3.0	500	nA	I_F = 0mA, V_O = V_{CC} = 5.5V, T_A = 25°C
				0.010	1.00	µA	I_F = 0mA, V_O = V_{CC} = 15.0V, T_A = 25°C
					50	µA	I_F = 0mA, V_O = V_{CC} = 15.0V
I_{CCL}	Logic Low Supply Current			40		µA	I_F = 16.0mA, V_O = open, V_{CC} = 15.0V
I_{CCH}	Logic High Supply Current			0.020	1.00	µA	I_F = 0mA, V_O = open, V_{CC} = 15.0V, T_A = 25°C
					2.0	µA	I_F = 0mA, V_O = open, V_{CC} = 15.0V
V_F	Input Forward Voltage			1.50	1.70	V	I_F = 16.0mA, T_A = 25°C
$\frac{\Delta V_F}{\Delta T_A}$	Temperature Coefficient of Forward Voltage			-1.80		mV/°C	I_F = 16.0mA
BV_R	Input Reverse Breakdown Voltage		5.0			V	I_R = 10.0µA, T_A = 25°C
C_{IN}	Input Capacitance			42		pF	f = 1.00MHz, V_F = 0
I_{IO}	Input-Output Insulation Leakage Current				1.00	µA	45% Relative Humidity, t = 5.0 sec, V_{IO} = 1000Vdc, T_A = 25°C (Note 9)
R_{IO}	Input-Output Resistance			10^{12}		Ω	V_{IO} = 500 Vdc (Note 9)
C_{IO}	Input-Output Capacitance			0.50		pF	f = 1.00MHz (Note 9)
h_{FE}	Transistor DC Current Gain			150		—	V_O = 5.0V, I_O = 3.0mA

Switching Specifications (T_A = 25°C) V_{CC} = 5.0V, I_F = 16.0mA unless otherwise noted

t_{PHL}	Propagation Delay Time to Logic Low at Output	HCC135 HCC136		0.50 0.20	1.50 0.80	µs µs	R_L = 4.1kΩ (Note 8) R_L = 1.90kΩ (Note 7)
t_{PLH}	Propagation Delay Time to Logic High at Output	HCC135 HCC156		0.40 0.30	1.50 0.80	µs µs	R_L = 4.1kΩ (Note 8) R_L = 1.90kΩ (Note 7)
CM_H	Common Mode Transient Immunity at Logic High Level Output	HCC135 HCC136		1000 1000		V/µs V/µs	I_F = 0mA, V_{CM} = 10.0Vp-p, R_L = 4.1kΩ (Notes 6,8) I_F = 0mA, V_{CM} = 10.0Vp-p, R_L = 1.90kΩ (Notes 6, 7)
CM_L	Common Mode Transient Immunity at Logic Low Level Output	HCC135 HCC136		-1000 -1000		V/µs V/µs	V_{CM} =10.0Vp-p, R_L =4.1kΩ, (Notes 5, 8) V_{CM} =10.0Vp-p, R_L =1.90kΩ, (Notes 5, 7)

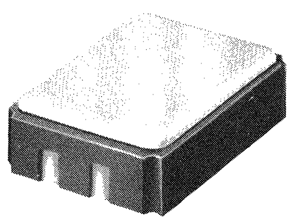
*All typicals at T_A = 25°C and V_{CC} = 5.0V, unless otherwise noted.

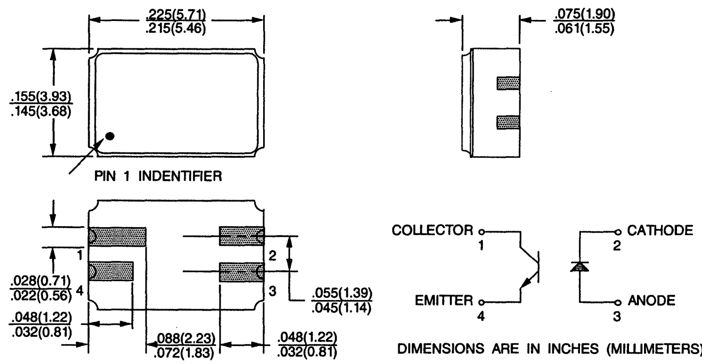
HI REL OPTO COMPONENTS

OPTEK

Product Bulletin HCC240
May 1993

Surface Mount Optically Coupled Isolator
Types HCC240, HCC242





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Surface mountable on ceramic or printed circuit board
- Miniature package saves circuit board area
- Electrical performance similar to 4N22A and 4N24A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV equivalent levels on request
- Higher breakdown voltage devices available as the "HV" series

Description

The HCC240 and HCC242 are optically coupled isolators, consisting of a gallium aluminum arsenide LED and a silicon phototransistor mounted and coupled in a miniature surface mount hermetic leadless chip carrier. The HCC240 and HCC242 are identical except for the DC current transfer ratio. All measurable electrical parameters are identical to the JEDEC registered 4N22A and 4N24A. HCC240HV and HCC242HV series optoisolators are available where higher breakdown voltages are required. These solid state couplers are ideal for designs where board space and device weight are important design considerations.

Absolute Maximum Ratings ($T_A = 25^\circ C$ unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ±1.0 kVDC[(1)]
Operating Temperature . . . . -55°C to +125°C
Storage Temperature . . . . -65°C to +150°C
Soldering Temperature (vapor phase reflow for 30 sec.) . . . . 215°C
Soldering Temperature (heated collet for 5 sec.) . . . . 260°C

Input Diode

Forward DC Current (65°C or below) . . . . 40 mA
Reverse Voltage . . . . 2.0 V
Power Dissipation . . . . 60 mW[(2)]

Output Phototransistor

Continuous Collector Current . . . . 50 mA
Collector-Emitter Voltage . . . . 30 V[(3)]
Emitter-Collector Voltage . . . . 5.0 V[(4)]
Power Dissipation . . . . 300 mW[(5)]

Notes:

(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) HCC240HV and HCC242HV are available rated at 55 V minimum.
(4) HCC240HV and HCC242HV are available rated at 7.0 V minimum.
(5) Derate linearly 3.0 mW/°C above 25°C.

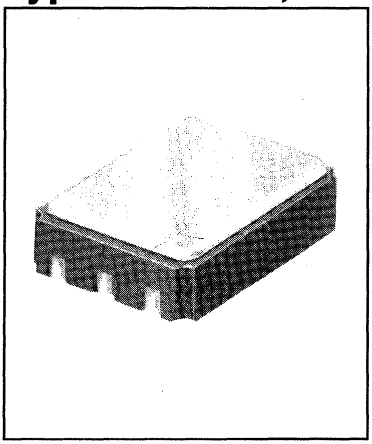
Types HCC240, HCC242

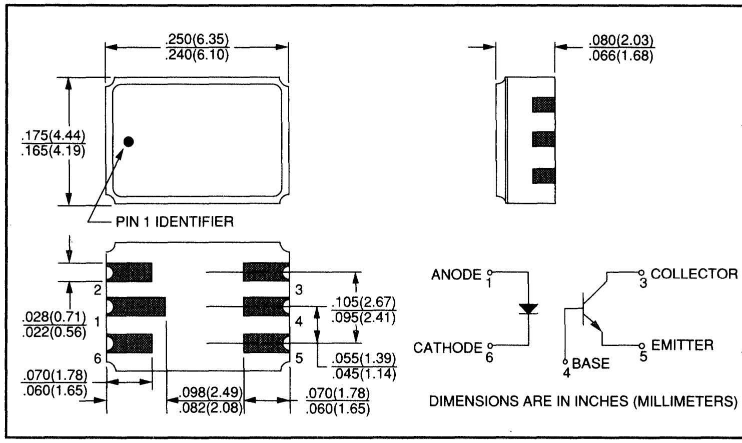
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage		0.80		1.30	V	I_F = 10.0 mA
			1.00		1.50	V	I_F = 10.0 mA, T_A = -55°C
			0.70		1.20	V	I_F = 10.0 mA, T_A = 100°C
I_R	Reverse Current				100	µA	V_R = 2.0 V
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage(3)		30			V	I_C = 1.0 mA, I_F = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage(4)		5.0			V	I_E = 100 µA, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current				100	nA	V_{CE} = 20 V, I_F = 0
					100	µA	V_{CE} = 20 V, I_F = 0, T_A = 100°C
Coupled							
$I_{C(ON)}$	On-State Collector Current	HCC240	0.15			mA	V_{CE} = 5.0 V, I_F = 2.0 mA
			2.5	6.0		mA	V_{CE} = 5.0 V, I_F = 10.0 mA
			1.0			mA	V_{CE} = 5.0 V, I_F = 10.0 mA, T_A = -55°C
			1.0			mA	V_{CE} = 5.0 V, I_F = 10.0 mA, T_A = 100°C
		HCC242	0.40			mA	V_{CE} = 5.0 V, I_F = 2.0 mA
			10.0	15.0		mA	V_{CE} = 5.0 V, I_F = 10.0 mA
			4.0			mA	V_{CE} = 5.0 V, I_F = 10.0 mA, T_A = -55°C
			4.0			mA	V_{CE} = 5.0 V, I_F = 10.0 mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	HCC240			0.30	V	I_C = 2.5 mA, I_F = 20.0 mA
		HCC242			0.30	V	I_C = 10.0 mA, I_F = 20.0 mA
R_{I-O}	Resistance (Input to Output)		10^{11}			Ω	V_{I-O} = ±1000 Vdc(1)
C_{I-O}	Capacitance (Input to Output)				5.0	pF	V_{I-O} = 0.0 V, f = 1.0 MHz(1)
t_r	Output Rise Time	HCC240			15.0	µs	V_{CC} = 10.0 V, I_F = 10.0 mA,
		HCC242			20.0	µs	R_L = 100 Ω
t_f	Output Fall Time	HCC240			15.0	µs	V_{CC} = 10.0 V, I_F = 10.0 mA,
		HCC242			20.0	µs	R_L = 100 Ω

Product Bulletin HCC247
May 1993

Surface Mount Optically Coupled Isolator
Types HCC247, HCC248, HCC249





Features

- Surface mountable on ceramic or printed circuit board
- Miniature package saves circuit board area
- Electrical performance similar to 4N47, 4N48, and 4N49
- Hermetically sealed
- Base pad provided for conventional transistor biasing
- Screened per MIL-S-19500 TX or TXV equivalent levels on request
- Higher breakdown voltage devices available as the "HV" series

Description

The HCC247, HCC248, and HCC249 are optically coupled isolators, consisting of a gallium aluminum arsenide LED and a silicon phototransistor mounted and coupled in a miniature surface mount hermetic leadless chip carrier. All electrical characteristics are identical to the JEDEC registered 4N47, 4N48, and 4N49. HCC247HV, HCC248HV, and HCC249HV series optoisolators are available where higher breakdown voltages are required.

These solid state couplers are ideal for designs where board space and device weight are important design considerations.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ±1.0 kVDC(1)
Operating Temperature . . . . -55°C to +125°C
Storage Temperature . . . . -65°C to +150°C
Soldering Temperature (vapor phase reflow for 30 sec.) . . . . 215°C
Soldering Temperature (heated collet for 5 sec.) . . . . 260°C

Input Diode

Forward DC Current (65°C or below) . . . . 40 mA
Reverse Voltage . . . . 3.0 V
Power Dissipation . . . . 60 mW(2)

Output Phototransistor

Continuous Collector Current . . . . 50 mA
Collector-Base Voltage . . . . 45 V(3)
Collector-Emitter Voltage . . . . 40 V(3)
Emitter-Base Voltage . . . . 7.0 V
Power Dissipation . . . . 300 mW(4)

Notes:
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) HCC247HV, HCC248HV, and HCC249HV are available rated at 55 V minimum.
(4) Derate linearly 3.0 mW/°C above 25°C.

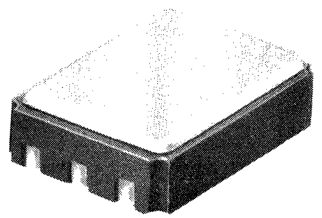
Types HCC247, HCC248, HCC249

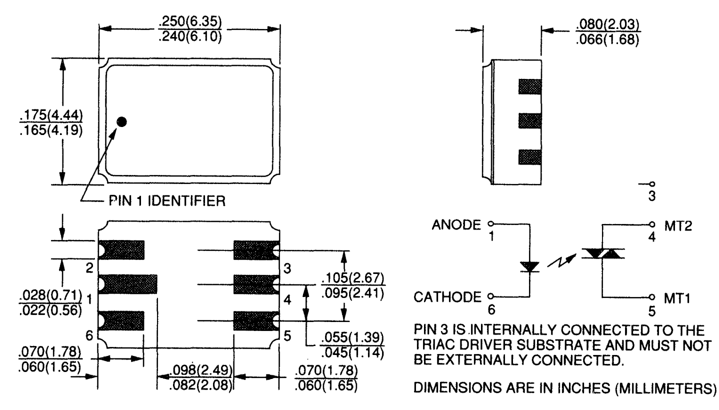
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
		0.80		1.50	V	I_F = 10.0 mA
V_F	Forward Voltage	1.00		1.70	V	I_F = 10.0 mA, T_A = -55°C
		0.70		1.30	V	I_F = 10.0 mA, T_A = 100°C
I_R	Reverse Current			100	μA	V_R = 3.0 V
Output Phototransistor						
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage(3)	45			V	I_C = 100 μA, I_E = 0, I_F = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage(3)	40			V	I_C = 1.0 mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	7.0			V	I_E = 100 μA, I_C = 0, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current			100	nA	V_{CE} = 20 V, I_B = 0, I_F = 0
				100	μA	V_{CE} = 20 V, I_B = 0, I_F = 0, T_A = 100°C
$I_{CB(OFF)}$	Collector-Base Dark Current			10.0	nA	V_{CB} = 20 V, I_E = 0, I_F = 0
Coupled						
$I_{C(ON)}$	On-State Collector Current HCC247	0.5			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 1.0 mA
		0.7			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 2.0 mA , T_A = -55°C
		0.5			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 2.0 mA, T_A = 100°C
	HCC248	1.0		5.0	mA	V_{CE} = 5.0 V, I_B = 0, I_F = 1.0 mA
		1.4			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 2.0 mA, T_A = -55°C
		1.0			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 2.0 mA, T_A = 100°C
	HCC249	2.0		10.0	mA	V_{CE} = 5.0 V, I_B = 0, I_F = 1.0 mA
		2.8			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 2.0 mA, T_A = -55°C
		2.0			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 2.0 mA, T_A = 100°C
$I_{CB(ON)}$	On-State Collector-Base Current	30			μA	V_{CB} = 5.0 V, I_E = 0, I_F = 10 mA
	HCC247			0.30	V	I_C = 0.5 mA, I_B = 0, I_F = 2.0 mA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage HCC248			0.30	V	I_C = 1.0 mA, I_B = 0, I_F = 2.0 mA
	HCC249			0.30	V	I_C = 2.0 mA, I_B = 0, I_F = 2.0 mA
R_{I-O}	Resistance (Input to Output)	10^{11}			Ω	V_{I-O} = ±1000 Vdc(1)
C_{I-O}	Capacitance (Input to Output)			5.0	pF	V_{I-O} = 0.0 V, f = 1.0 MHz(1)
	HCC247			20.0	μs	V_{CC} = 10.0 V,
t_r	Output Rise Time HCC248			20.0	μs	I_F = 5.0 mA,
	HCC249			25.0	μs	R_L = 100 Ω
	HCC247			20.0	μs	V_{CC} = 10.0 V,
t_f	Output Fall Time HCC248			20.0	μs	I_F = 5.0 mA,
	HCC249			25.0	μs	R_L = 100 Ω

Product Bulletin HCC340
May 1993

Zero Voltage Crossing Optically Coupled Triac Driver
Type HCC340





Features
- For 220 VAC operation
- 1500 VDC electrical isolation
- Zero voltage crossing for reduced EMI, line noise, and improved static dV/dt
- Surface mountable on ceramic or printed circuit board
- Miniature package saves circuit board area
- Hermetically sealed package

Description
The HCC340 consists of a gallium aluminum arsenide infrared emitting diode and a monolithic integrated circuit containing a photodiode and a zero voltage bidirectional triac driver mounted in a miniature six pin hermetic leadless chip carrier. The device is for low power DC controlling of power triacs which in turn control resistive, inductive, or capacitive loads powered from 220 VAC. Zero voltage crossing ensures that the device will not turn on until the line voltage reduces to 15 volts, typical.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)
Input-to-Output Isolation Voltage .... ±1.5 kVDC(1)
Operating Temperature .... -55°C to +125°C
Storage Temperature .... -65°C to +150°C
Soldering Temperature (vapor phase reflow for 30 sec.) .... 215°C
Soldering Temperature (heated collet for 5 sec.) .... 260°C

Input Diode
Forward DC Current (65°C or below) .... 40 mA
Reverse Voltage .... 3.0 V
Power Dissipation .... 60 mW(2)

Output Photosensor
Off-State Terminal Voltage .... 400 V
On-State RMS Current (Full Cycle, 50-60 Hz, T_A = 25°C) .... 100 mA
On-State RMS Current (Full Cycle, 50-60 Hz, T_A = 70°C) .... 50 mA
Peak Non-Repetitive Surge Current (PW = 10 ms, duty cycle = 10%) .... 1.20 A
Power Dissipation .... 300 mW(3)

Notes:
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) Derate linearly 3.0 mW/°C above 25°C.

Type HCC340

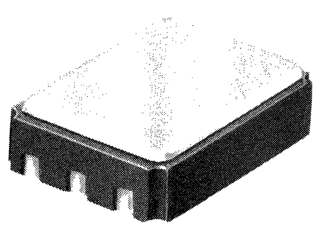
Electrical Characteristics (T_A = 25°C unless otherwise noted)

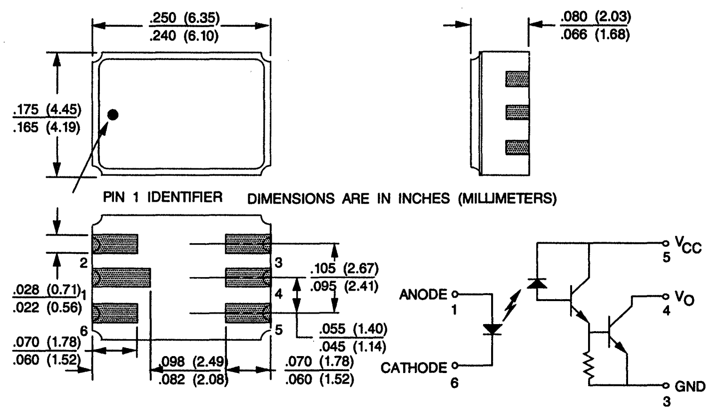
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage	1.20		1.60	V	I_F = 10.0 mA
		1.00		1.80	V	I_F = 10.0 mA, T_A = -55°C
		0.80		1.40	V	I_F = 10.0 mA, T_A = 125°C
I_R	Reverse Current			100	μA	V_R = 3.0 V
Output Phototransistor						
I_{DRM}	Peak Blocking Current, Either Direction		10.0	100	nA	V_{DRM} = 400 V
				6.0	μA	V_{DRM} = 400 V, T_A = 85°C
				6.0	μA	V_{DRM} = 300 V, T_A = 125°C
V_{TM}	Peak On-State Voltage, Either Direction		1.75	3.0	V	I_{TM} = 100 mA, I_F = 10.0 mA
				3.0	V	I_{TM} = 100 mA, I_F = 10.0 mA, T_A = -55°C
				5.0	V	I_{TM} = 100 mA, I_F = 10.0 mA, T_A = 125°C
dV/dt	Critical Rate of Rise of Off-State Voltage	100			V/μs	R_L = 2.5 kΩ
Coupled						
I_{FT}	LED Trigger Current Required to Latch			10.0	mA	V_{TM} = 3.0 V, R_L = 150 Ω
				15.0	mA	V_{TM} = 5.0 V, R_L = 150 Ω, T_A = -55°C
				20.0	mA	V_{TM} = 5.0 V, R_L = 150 Ω, T_A = 125°C
I_H	Holding Current, Either Direction		200		μA	
V_{ISO}	Isolation Voltage	1500			VDC	See Note (1)
$V_{I(TH)}$	Zero Voltage Crossing Inhibit Voltage Threshold			40	V	I_{FT} = 10.0 mA
				40	V	I_{FT} = 10.0 mA, T_A = -55°C
				40	V	I_{FT} = 10.0 mA, T_A = 125°C
$I_{R(I)}$	Leakage Current in Inhibit State			300	μA	I_{FT} = 10.0 mA, V_{MT} = 400 V
				600	μA	I_{FT} = 10.0 mA, V_{MT} = 400 V, T_A = -55°C
				300	μA	I_{FT} = 10.0 mA, V_{MT} = 300 V, T_A = 125°C

OPTEK

Product Bulletin HCC640
May 1993

Surface Mount Optically Coupled Isolator
Type HCC640





Features

- Surface mountable on ceramic or PC board
- 6N140A operating compatibility
- Key parameters guaranteed over -55°C to 125°C ambient temperature range
- Hermetically sealed
- Low power consumption
- High current transfer ratio
- Low input current requirement
- 1500 VDC isolation voltage

Description

The HCC640 is a hermetically sealed, ceramic surface-mount optocoupler, consisting of a GaAIAs IRED coupled to an integrated high gain photodiode. The HCC640 is electrically equivalent to a single channel of the Optek's HDA140A (6N140A) quad-channel device. The high gain, open-collector output provides both lower output saturation voltage and faster switching speeds than possible with standard photodarlington optocouplers. The high current transfer ratio at very low input currents makes the HCC640 ideal for use in MOS, CMOS and low power logic interfacing. The HCC640 is capable of operation and storage over the full military temperature range and can be supplied with full processing per Optek's Military screening procedure (based on MIL-STD-883) upon request.

For Hi-Rel order HCC640TXV.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Operating Temperature . . . . -55°C to +125°C
Storage Temperature . . . . -65°C to +150°C
Soldering Temperature (vapor phase reflow for 30 sec.) . . . . 215°C
Soldering Temperature (heated collet for 5 sec.) . . . . 260°C

Input Diode

Peak Input Current (≤1 ms duration, 500 pps) . . . . 20 mA
Average Input Current, I_F (each channel) . . . . 10.0 mA(1)
Reverse Input Voltage, V_R . . . . 5.0 V

Output Photodetector

Output Current, I_O . . . . 40 mA
Output Voltage, V_O . . . . -0.5 to 20 V(2)
Supply Voltage, V_{CC} . . . . -0.5 to 20 V(2)
Output Power Dissipation . . . . 75 mW(3)

Notes:
(1) Derate I_F at 0.66 mA/°C above 110°C.
(2) Pin 3 (Ground) should be the most negative voltage at the detector side. Keeping V_{CC} as low as possible, but greater than 2.0 volts, will provide lowest total I_{OH} over temperature.
(3) Output power is collector output power plus one half of the total supply power. Derate at 5.0 mW/°C above 110°C.

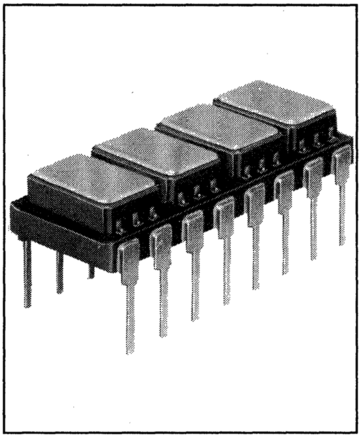
Type HCC640

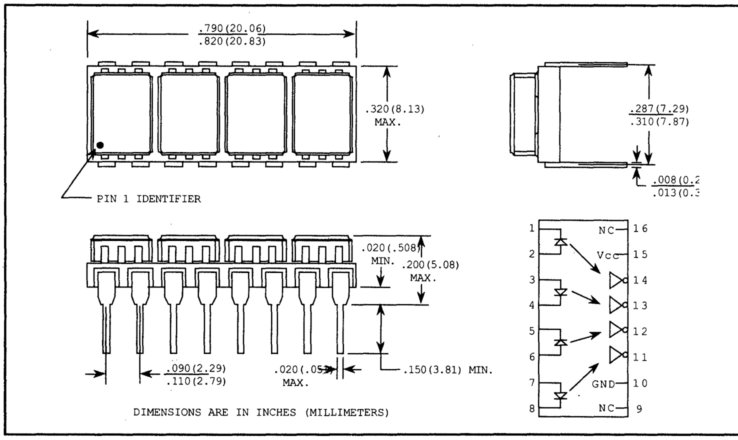
Electrical Characteristics (T_A = -55°C to 125°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage			1.70	V	I_F = 1.60 mA, T_A = 25°C
BV_R	Reverse Breakdown Voltage	5.0			V	I_R = 10.0 μA, T_A = 25°C
$\frac{\Delta V_F}{\Delta T_A}$	Temperature Coefficient of Forward Voltage		-1.80		mV/°C	I_F = 1.60 mA
Coupled						
CTR	Current Transfer Ratio	300	1500		%	I_F = 0.5 mA, V_O = 0.4 V, V_{CC} = 4.5 V
		300	1000		%	I_F = 1.60 mA, V_O = 0.4 V, V_{CC} = 4.5 V
		200	500		%	I_F = 5.0 mA, V_O = 0.4 V, V_{CC} = 4.5 V
V_{OL}	Logic Low Output Voltage		0.1	0.4	V	I_F = 0.5 mA, I_{OL} = 1.50 mA, V_{CC} = 4.5 V
V_{OL}	Logic Low Output Voltage		0.2	0.4	V	I_F = 5.0 mA, I_{OL} = 10.0 mA, V_{CC} = 4.5 V
I_{OH}	Logic High Output Current		0.001	250	μA	V_O = V_{CC} = 18 V
I_{CCL}	Logic Low Supply Current		0.40	1.0	mA	I_F = 1.60 mA, V_{CC} = 18 V
I_{CCH}	Logic High Supply Current		0.001	10	μA	I_F = 0, V_{CC} = 18 V
I_{I-O}	Input-Output Insulation Leakage Current			1.0	μA	45% Relative Humidity, T_A = 25°C t = 5 sec, V_{I-O} = 1500 Vdc
R_{I-O}	Resistance (Input-Output)		10^{12}		Ω	V_{I-O} = 500 Vdc
C_{I-O}	Capacitance (Input-Outout)		1.5		pF	f = 1.0 MHz, T_A = 25°C
C_{I-I}	Capacitance (Input-Input)		1.0		pF	f = 1.0 MHz, T_A = 25°C
C_{IN}	Input Capacitance		60		pF	f = 1.0 MHz, V_F = 0, T_A = 25°C
I_{I-I}	Input-Input Insulation Leakage Current		0.5		nA	45% Relative Humidity, V_{I-I} = 500 V T_A = 25°C, t = 5 sec
R_{I-I}	Resistance (Input-Input)		10^{12}		Ω	V_{I-I} = 500 V, T_A = 25°C
Switching Specification (T_A = 25°C)						
t_{PLH}	Propagation Delay Time		6.0	60	μs	I_F = 0.5 mA, R_L = 4.7 kΩ, V_{CC} = 5.0 V
	To Logic High At Output		4.0	20	μs	I_F = 5.0 mA, R_L = 680 Ω, V_{CC} = 5.0 V
t_{PHL}	Propagation Delay Time		30	100	μs	I_F = 0.5 mA, R_L = 4.7 kΩ, V_{CC} = 5.0 V
	To Logic Low At Output		2.0	5.0	μs	I_F = 5.0 mA, R_L = 680 Ω, V_{CC} = 5.0 V
CM_H	Common Mode Transient Immunity At Logic High Level Level Output	500	1000		V/μs	I_F = 0, R_L = 1.5 kΩ $\lvert V_{CM}\rvert$ = 50 $V_{p-p'}$ V_{CC} = 5.0 V
CM_L	Common Mode Transient Immunity At Logic Low Level Level Output	-500	-1000		V/μs	I_F = 1.60 mA, R_L = 1.5 kΩ $\lvert V_{CM}\rvert$ = 50 $V_{p-p'}$ V_{CC} = 5.0 V

HI REL OPTO COMPONENTS

Four Channel Low Input Current Optocoupler Type HDA140A





Functions

- Key parameters guaranteed over temperature
- Hermetically sealed
- High density packaging
- Low power consumption
- High current transfer ratio
- Low input current requirement

Description

The HDA140A consists of four ceramic surface mount optocouplers attached to a dual in-line leaded mother board. This package is superior to single cavity construction because it eliminates any possibility of crosstalk between channels while still meeting the 6N140A JEDEC physical and electrical requirements. The photodiode and the first stage transistor of each channel are connected in common, permitting lower output saturation voltage and higher speed operation than possible with conventional photodarlington optocouplers.

Custom tested HDA140A devices for programs requiring special military processing can be supplied in accordance with Optek's own special environmental, electrical screening and quality conformance testing.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Operating Temperature .... -55°C to +150°C
Storage Temperature .... -65°C to +150°C
Lead Solder Temperature (1.6mm below seating plane for 10 sec.).......... 260°C

Input Diode

Peak Input Current (each channel, ≤ 1ms duration, 500 pps) 20mA
Average Input Current, I_F (each channel) .... 10.0mA(1)
Reverse Input Voltage, V_R (each channel) 5.0V

Output Photodetector

Output Current, I_O (each channel) 40mA
Output Voltage, V_O (each channel) .... -0.5 to 20V(2)
Supply Voltage, V_{CC} .... -0.5 to 20V(2)
Output Power Dissipation (each channel) .... 50mW(3)

Notes:

(1) Derate I_F at 0.25mA/°C above 110°C.
(2) Pin 10 (Ground) should be most negative voltage at the detector side. Keeping V_{CC} as low as possible, greater than 2.0 volts, will provide the lowest total I_{OH} over temperature.
(3) Output power is collector output power plus one fourth of the total supply power. Derate at 1.25mW/°C above 110°C.
(4) I_{OHX} is leakage current resulting from channel to channel optical crosstalk. I_F = 2.0μA for channel under test. For all other channels I_F = 10.0mA.

Type HDA140A

Electrical Characteristics (T_A = -55°C to 125°C, unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
Input Diode						
V_F*	Forward Voltage			1.70	V	I_F = 1.60mA, T_A = 25°C
BV_R*	Reverse Breakdown Voltage	5.0			V	I_R = 10.0µA, T_A = 25°C
$\frac{\Delta V_F}{\Delta T_A}$	Temperature Coefficient of Forward Voltage		-1.80		mV/°C	I_F = 1.60mA
Coupled						
CTR*	Current Transfer Ratio	300	1500		%	I_F = 0.50mA, V_O = 0.4V, V_{CC} = 4.5V
		300	1000		%	I_F = 1.60mA, V_O = 0.4V, V_{CC} = 4.5V
		200	500		%	I_F = 5.0mA, V_O = 0.4V, V_{CC} = 4.5V
V_{OL}	Logic Low Output Voltage		0.1	0.4	V	I_F = 0.50mA, I_{OL} = 1.50mA, V_{CC} = 4.5V
V_{OL}	Logic Low Output Voltage		0.2	0.4	V	I_F = 5.0mA, I_{OL} = 10.0mA, V_{CC} = 4.5V
I_{OHX}	Logic High Output Current		.001	250	µA	I_F = 2.0mA (channel under test)
I_{OH}*	Logic High Output Current		.001	250	µA	V_O = V_{CC} = 18V (see note 4)
I_{CCL}*	Logic Low Supply Current		1.70	4.0	mA	I_{F1} = I_{F2} = I_{F3} = I_{F4} =1.60mA, V_{CC} = 18V
I_{CCH}*	Logic High Supply Current		.001	40	µA	I_{F1} = I_{F2} = I_{F3} = I_{F4} = 0mA, V_{CC} = 18V
I_{I-O}*	Input-Output Insulation Leakage Current			1.0	µA	45% Relative Humidity, T_A = 25°C, t = 5sec, V_{I-O} = 1500VDC
R_{I-O}	Resistance (input-output)		10^{12}		Ω	V_{I-O} = 500VDC
C_{I-O}	Capacitance (input-output)		1.50		pF	f = 1.00MHz, T_A = 25°C
C_{I-I}	Capacitance (input-input)		1.00		pF	f = 1.00MHz, T_A = 25°C
C_{IN}	Input Capacitance		60		pF	f = 1.00MHz, V_F = 0, T_A = 25°C
I_{I-I}	Input-Input Insulation Leakage Current		0.50		nA	45% Relative Humidity, V_H = 500V, T_A = 25°C, t = 5 sec
R_{I-I}	Resistance (input-input)		10^{12}		Ω	V_{I-I} = 500V, T_A = 25°C
Switching Specification (T_A = 25°C)						
t_{PLH}*	Propagation Delay Time to Logic High at Output		6.0	60	µs	I_F = 0.50mA, R_L = 4.7kΩ, V_{CC} = 5.0V
			4.0	20	µs	I_F = 5.0mA, R_L = 680kΩ, V_{CC} = 5.0V
t_{PHL}*	Propagation Delay Time to Logic Low at Output		30	100	µs	I_F = 0.50mA, R_L = 4.7kΩ, V_{CC} = 5.0V
			2.0	5.0	µs	I_F = 5.0mA, R_L = 680kΩ, V_{CC} = 5.0V
CM_H	Common Mode Transient Immunity at Logic High Level Level Output	500	1000		V/µs	I_F = 0, R_L = 1.5kΩ, $\|V_{CM}\|$ = 50V_{p-p}, V_{CC} = 5.0V
CM_L	Common Mode Transient Immunity at Logic Low Level Level Output	-500	-1000		V/µs	I_F = 1.60mA, R_L = 1.5kΩ, $\|V_{CM}\|$ = 50V_{p-p}, V_{CC} = 5.0V

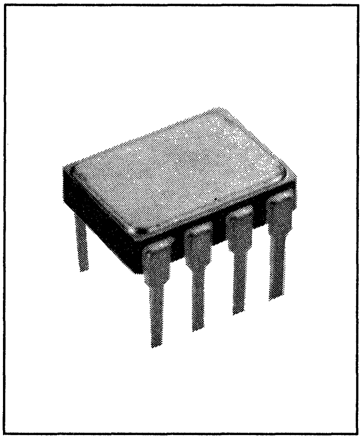
*JEDEC Registered Data

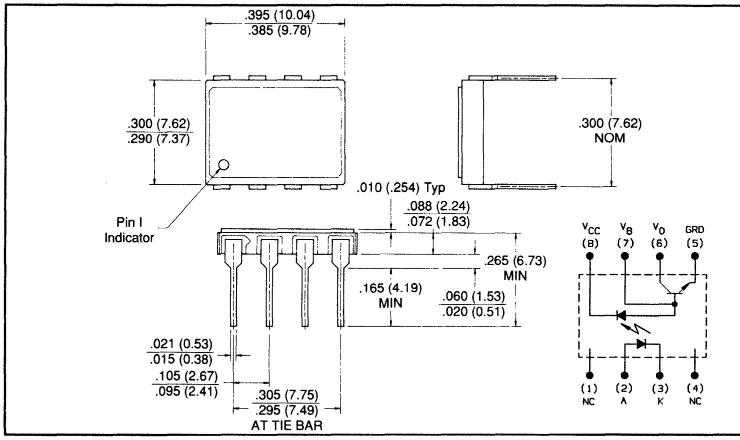
HI REL OPTO COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Speed Optocouplers
Types HDC135, HDC136, HDC135TXV, HDC136TXV





Features

- High speed - 1 megabit/second
- TTL compatible
- High common mode transient immunity
- Wide bandwidth
- Open collector output

Description

Optek's HDC135 and HDC136 are high speed optocouplers, consisting of IR emitters and integrated photodetectors in hermetic side brazed dual-in-line 8 pin packages. Electrical characteristics are similar to the 6N135 and 6N136 optocouplers but with full military temperature range operation.

The HDC135TXV and HDC136TXV are high reliability optocouplers with 100% processing and Group Testing patterned after MIL-STD-883 Method 5008.

Absolute Maximum Ratings (No derating required up to 70°C)

Storage Temperature . . . . -55°C to +150°C
Operating Temperature . . . . -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 10 seconds) . . . 260°C
Average Input Current - I_F . . . . 25mA(1)
Peak Output Current - I_F (50% duty cycle, 1ms pulse width). . . . . 50mA(2)
Peak Transient Input Current - I_F (≤ 1µs pulse width, 300pps) 1.0A
Reverse Input Voltage - V_R 5.0V
Input Power Dissipation . . . . 45mW(3)
Average Output Current - I_O 8.0mA
Peak Output Current 16.0mA
Emitter-Base Reverse Voltage 5.0V
Supply and Output Voltage - V_{CC}, V_O . . . . -0.5V to 15V
Base Current - I_B 5.0mA
Output Power Dissipation . . . . 100mW(4)

Caution: This component is susceptible to damage from electrostatic discharge. Normal static prevention procedures should be used in handling.

Notes:
(1) Derate linearly above 70°C free-air temperature at a rate of 0.45mA/°C.
(2) Derate linearly above 70°C free-air temperature at a rate of 0.9mA/°C.
(3) Derate linearly above 70°C free-air temperature at a rate of 0.8mW/°C.
(4) Derate linearly above 70°C free-air temperature at a rate of 1.8mW/°C.
(5) CMH is the maximum allowable dV/dt on the leading edge of a common mode pulse to assure that the output will not switch from high to low.
(6) CML is the maximum negative dV/dt allowable on the trailing edge of a common mode pulse to assure that the output will not switch from low to high.
(7) Test conditions represents 1 TTL unit load with 5.6 kΩ pull-up resistor.
(8) Test conditions represents 1 LSTTL unit load with a 6.1 kΩ pull-up resistor.
(9) Device considered a two-terminal device: pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

Electrical Characteristics (Over recommended temperature T_A = -55°C to 125°C, unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP*	MAX	UNITS	TEST CONDITIONS
CTR	Current Transfer Ratio	HDC135 HDC136	7.0 19.0	19.0 25.0		% %	I_F = 16.0mA, V_O = 0.40V, V_{CC} = 4.5V, T_A = 25°C
		HDC135 HDC136	5.0 15.0	15.0 23.0		% %	I_F = 16.0mA, V_O = 0.50V V_{CC} = 4.5V
V_{OL}	Logic Low Output Voltage	HDC135		0.100	0.40	V	I_F = 16.0mA, I_O = 1.10mA, V_{CC} = 4.5V
		HDC136		0.100	0.40	V	I_F = 16.0mA, I_O = 2.4mA, V_{CC} = 4.5V
I_{OH}	Logic High Output Current			3.0	500	nA	I_F = 0mA, V_O = V_{CC} = 5.5V, T_A = 25°C
				0.010	1.00	µA	I_F = 0mA, V_O = V_{CC} = 15.0V, T_A = 25°C
					50	µA	I_F = 0mA, V_O = V_{CC} = 15.0V
I_{CCL}	Logic Low Supply Current			40		µA	I_F = 16.0mA, V_O = Open, V_{CC} = 15.0V
I_{CCH}	Logic High Supply Current			0.020	1.00	µA	I_F = 0mA, V_O = open, V_{CC} = 15.0V, T_A = 25°C
					2.0	µA	I_F = 0mA, V_O = Open, V_{CC} = 15.0V
V_F	Input Forward Voltage			1.50	1.70	V	I_F = 16.0mA, T_A = 25°C
$\frac{\Delta V_F}{\Delta T_A}$	Temperature Coefficient of Forward Voltage			-1.80		mV/°C	I_F = 16.0mA
BV_R	Input Reverse Breakdown Voltage		5.0			V	I_R = 10.0µA, T_A = 25°C
C_{IN}	Input Capacitance			42		pF	f = 1.00MHz, V_F = 0
I_{IO}	Input-Output Insulation Leakage Current				1.00	µA	45% Relative Humidity, t = 5.0 sec, V_{IO} = 1000Vdc, T_A = 25°C (Note 9)
R_{IO}	Input-Output Resistance			10^{12}		Ω	V_{IO} = 500 Vdc (Note 9)
C_{IO}	Input-Output Capacitance			0.50		pF	f = 1.00MHz (Note 9)
h_{FE}	Transistor DC Current Gain			150		—	V_O = 5.0V, I_O = 3.0mA

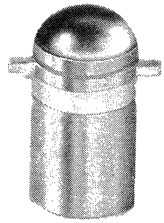
Switching Specifications (T_A = 25°C) V_{CC} = 5.0V, I_F = 16.0mA unless otherwise noted

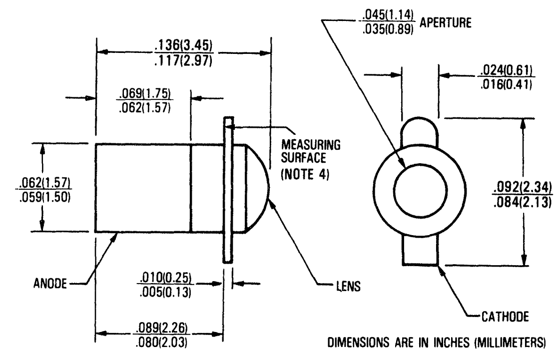
t_{PHL}	Propagation Delay Time to Logic Low at Output	HDC135 HDC136		0.50 0.20	1.50 0.80	µs µs	R_L = 4.1kΩ (Note 8) R_L = 1.90kΩ (Note 7)
t_{PLH}	Propagation Delay Time to Logic High at Output	HDC135 HDC136		0.40 0.30	1.50 0.80	µs µs	R_L = 4.1kΩ (Note 8) R_L = 1.90kΩ (Note 7)
CM_H	Common Mode Transient Immunity at Logic High Level Output	HDC135 HDC136		1000 1000		V/µs V/µs	I_F = 0mA, V_{CM} = 10.0Vp-p, R_L = 4.1kΩ (Notes 6,8) I_F = 0mA, V_{CM} = 10.0Vp-p, R_L = 1.90kΩ (Notes 6, 7)
CM_L	Common Mode Transient Immunity at Logic Low Level Output	HDC135 HDC136		-1000 -1000		V/µs V/µs	V_{CM} =10.0Vp-p, R_L =4.1kΩ, (Notes 5, 8) V_{CM} =10.0Vp-p, R_L =1.90kΩ, (Notes 5, 7)

*All typicals at T_A = 25°C and V_{CC} = 5.0V, unless otherwise noted.

Product Bulletin OP223TX
June 1993

Hi-Reliability GaAIAs Infrared Emitting Diodes
Types OP223TX, OP223TXV, OP224TX, OP224TXV





Features

- Processed to Optek's Military screening program patterned after MIL-S-19500
- Miniature hermetically sealed "pill" package
- Twice the power output of GaAs at the same drive current
- Mechanically and spectrally matched to the OP600 series phototransistor
- S level screening available

Description

The OP223TX,TXV and OP224TX,TXV are high reliability gallium aluminum arsenide infrared emitting diodes mounted in miniature "pill" type hermetically sealed packages. This package style is intended for direct mounting into PC boards.

After electrical testing by manufacturing, all devices are processed to Optek's 100 percent screening program patterned after MIL-S-19500. After completion of Group A, sample tests are performed for Group B & C inspections.

Gallium aluminum arsenide features twice the radiated output of gallium arsenide at the same forward current. With a wavelength centered at 890 nanometers, it closely matches the spectral response of silicon phototransistors.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -55°C to +125°C
Soldering Temperature (for 5 sec. with soldering iron) . . . . 240°C(1)
Reverse Voltage 2.0V
Continuous Foward Current 100mA
Power Dissipation . . . . 100mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 1.00mW/°C above 25°C.

Types OP223TX, OP223TXV, OP224TX, OP224TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output OP223TX,TXV OP224TX,TXV	1.00 1.50			mW mW	I_F = 50mA I_F = 50mA
V_F	Forward Voltage	0.80		1.80	V	I_F = 50mA
I_R	Reverse Current			100	µA	V_R = 2.0V
λp	Wavelength at Peak Emission		890		nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points		80		nm	I_F = 50mA
$\Delta\lambda p/\Delta T$	Spectral Shift with Temperature		0.18		nm/°C	I_F = Constant
θ_{HP}	Emission Angle at Half Power Points		18		Deg.	I_F = 50mA

HI REL OPTO COMPONENTS

100% Processing

Screen	Mil-STD-750 Method	Conditions	OP223TX OP224TX	OP223TXV OP224TXV
Pre-Cap Visual		Optek's pre-cap visual(3)	—	100%
High Temperature Storage	1032	T_A = 150°C, t = 24hrs.	100%	100%
Temperature Cycle	1051	Condition C, 20 cycles, 15 min. each extreme	100%	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%	100%
Hermetic Seal	1071	Fine: Condition H, 5 X 10^{-8}atm cc/sec Gross: Condition E	100%	100%
Power Burn-In(4)	1038	Condition B, T_A = 25°C, I_F = 50mA, t = 168hrs. min	100%	100%

(3) Visual inspection based upon Optek's interpretation of pre-cap inspection as specified in MIL-S-19500/548 as applicable for LED's.

(4) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after burn-in. ΔP_O = ± 15%; ΔV_F = ± 10%; PDA = 10%.

Types OP223TX, OP223TXV, OP224TX, OP224TXV

Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

Symbol	Examination or Test	MIL-STD-750		n/c	Limit		Units
		Method	Conditions		Min	Max	
Subgroup 1							
	Visual and Mechanical Examination	2071	LTPD = 5				
Subgroup 2				116/0			
P_O	Radiant Power Output OP223TX,TXV OP224TX,TXV		I_F = 50mADC I_F = 50mADC		1.00 1.50		mW mW
V_F	Forward Voltage	4011	I_F = 50mADC		0.80	1.80	V
I_R	Reverse Current	4016	V_R = 2.0V			100	μA
Subgroup 3				116/0			
V_F	Forward Voltage	4011	I_F = 50mADC, T_A = -55°C		1.00	2.00	V
I_R	Reverse Current	4016	V_R = 2.0V, T_A = 100°C			1.00	mA

Group B Inspection

(Performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Solderability	2026		
Subgroup 2			10
Thermal Shock (temperature cycling)	1051	Condition C, 15 min at extremes, 20 cycles	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition E	
End Points		Group A, Subgroup 2	
Subgroup 3			5
Steady-State Operation Life	1027	I_F = 50mADC, t = 340hrs, T_A = 25°C	
End Points		Group A, Subgroup 2(6)	
Subgroup 4			
Internal Visual Inspection	2075	Per pre-seal criteria	1 Device (0 Failure)
Bond Strength	2037	Performed at pre-seal	20 (c=1)
Subgroup 6			7
High Temperature Life (non-operating)	1032	t = 340hrs., T_A = 150°C	
End Points		Group A, Subgroup 2(5)	

(5) Devices electrically tested before and after life tests to the following limits: 340hrs test, $\Delta P_O = \pm 10\%$; 1000hrs test; $\Delta P_O = \pm 15\%$.

Types OP223TX, OP223TXV, OP224TX, OP224TXV

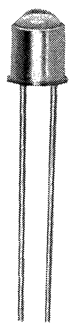
Group C Inspection

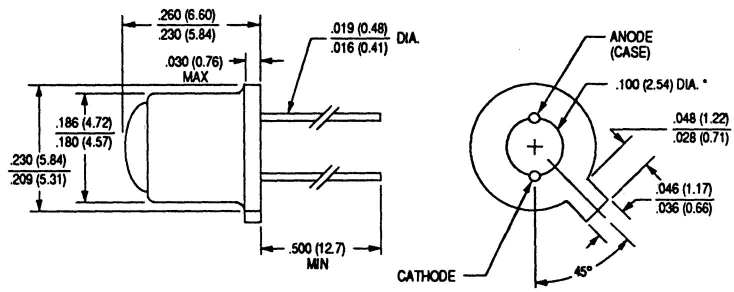
(Performed every six months while in production)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2066		
Subgroup 2			10
Thermal Shock (glass strain)	1056	Condition A	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
Moisture Resistance	1021	Omit initial conditioning	
End Points		Group A, Subgroup 2	
Subgroup 3			10
Shock	2016	Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, X_1, Y_1, Z_1	
Vibration, Variable Frequency	2056		
Constant Acceleration	2006	1 minute in each orientation, X_1, Y_1, & Z_1 at 20K G's min	
End Points		Group A, Subgroup 2	
Subgroup 4			15
Salt Atmosphere (corrosion)	1041		
Subgroup 5			
Barometric Pressure	1001	Not performed	
Subgroup 6			10
Steady-State Operational Life	1026	I_F = 50mA, t = 1000hrs, T_A = 25°C	
End Points		Group A, Subgroup 2	

OPTEK

Hi-Reliability GaAlAs Infrared Emitting Diodes
Types OP235TX, OP235TXV, OP236TX, OP236TXV





DIMENSIONS ARE IN INCHES (MILLIMETERS)
THIS DIMENSION CONTROLLED AT HOUSING SURFACE.

Features

- Twice the power output of GaAs at the same drive current
- Characterized to define infrared energy along the mechanical axis of the device
- Mechanically and spectrally matched to the OP804TX/TXV and OP805TX/TXV phototransistors
- Screened per MIL-S-19500 TX or TXV equivalent levels

Description

The OP235TX, TXV and OP236TX, TXV are high reliability gallium aluminum arsenide infrared emitting diodes mounted in hermetic TO-46 packages. The wavelength is centered at 890 nanometers to closely match the spectral response of silicon photoransistors. Devices are processed to Optek's 100% screening and quality conformance program patterned after MIL-S-19500. After 100% screening, Group A and B are performed on every lot, and a Group C test is performed every six months.

The OP235TX, TXV and OP236TX, TXV have lens cans providing a narrow beam angle (18° between half power points). The narrow beam angle and the specified radiant intensity allow ease of design in beam interrupt applications with the OP804TX, TXV and OP805TX, TXV series of high reliability phototransistors.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Forward DC Current 100mA
Reverse Voltage 2.0V
Operating Temperature . . . . -55°C to +125°C
Storage Temperature . . . . -65°C to +150°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)
Power Dissipation . . . . 200mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 2.00mW/°C above 25°C.
(3) $E_{e(APT)}$ is a measurement of the average radiant intensity within the cone formed by the measurement surface. The cone is outlined by a radius of 1.429 inches (36.30 mm) measured from the lens side of the tab to the sensing surface and a sensing surface of .250 inches (6.35mm) in diameter forming a 10° cone. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Recommended replacements for OP231TX, OP231TXV, OP232TX, OP232TXV

Types OP235TX, OP235TXV, OP236TX, OP236TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions (3)
$E_{e(APT)}$	Apertured Radiant Incidence(3,4)					
	OP235TX,TXV	1.5			mW/cm^2	I_F = 100mA
	OP236TX,TXV	3.5			mW/cm^2	I_F = 100mA
V_F	Forward Voltage(6)	1.1		2.0	V	I_F = 100mA
		1.3		2.2	V	I_F = 100mA, T_A = -55°C
		0.9		1.8	V	I_F = 100mA, T_A = 100°C
I_R	Reverse Current			100	µA	V_R = 2.0V
λp	Wavelength at Peak Emission		890		nm	I_F = 100mA
B	Spectral Bandwidth Between Half Power Points		50		nm	I_F = 100mA
θ_{HP}	Emission Angle at Half Power Points		18.0		Deg.	I_F = 100mA

HI REL OPTO COMPONENTS

100% Processing

Screen	Mil-STD-750 Method	Conditions	OP235TX OP236TX	OP235TXV OP236TXV
Pre-Cap Visual Inspection		Optek's pre-cap visual inspection(7)	—	100%
High Temperature Storage	1032	T_A = 150°C, t = 24hrs.	100%	100%
Temperature Cycle	1051	Condition C, 20 cycles, -65°C to +150°C, 15 minutes min. each extreme	100%	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%	100%
Hermetic Seal	1071	Fine: Condition H, 5 X 10^{-8}atm cc/sec Gross: Condition C	100%	100%
Power Burn-In(6)	1038	Condition B, T_A = 25°C, I_F = 100mA, t = 96hrs. min	100%	100%

(4) Measurement is taken during the last 500µs of a single 1.0ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measured results.

(5) Visual inspection based on Optek's interpretation of the requirements of pre-cap inspection as specified in MIL-S-19500/548 as applicable for LED's.

(6) 100% electrically tested to the limits in Subgroup 2 of Group A table before and after Power Burn-in. ΔV_F = ± 100mV and $\Delta\theta_e$ = ± 15% of pre power Burn-in reading (drift calculations are based on total radiant flux measurements of the device); PDA 10%.

(7) Acceptance of the lot is determined by the drift measurement (D%*e) and not the radiant intensity measurement.

Types OP235TX, OP235TXV, OP236TX, OP236TXV

Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

Symbol	Examination or Test	MIL-STD-750		LTPD	Limit		Units
		Method	Conditions		Min	Max	
Subgroup 1				5			
	Visual and Mechanical Examination	2071					
Subgroup 2				2			
$E_{e(APT)}$	Apertured Radiant Incidence OP235TX,TXV OP236TX,TXV		I_F = 100mA(3) I_F = 100mA(3)		1.5 3.5		mW/cm^2 mW/cm^2
V_F	Forward Voltage	4011	I_F = 100mA		1.00	2.00	V
I_R	Reverse Current	4016	V_R = 5.0Vdc			10	μA
Subgroup 3				2			
V_F	Forward Voltage @ T_A = -55°C	4011	I_F = 100mA		1.30	2.20	V
V_F	Forward Voltage @ TA = 100°C	4011	I_F = 100mA		0.90	1.80	V

Group B Inspection

(Performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Solderability	2026		
Resistance to Solvents	1022		
Subgroup 2			10
Thermal Shock (temperature cycling)	1051	Condition C, 15 min at extremes, 20 cycles	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
End Points		Group A, Subgroup 2	
Subgroup 3			5
Steady-State Operation Life	1027	I_F = 100mA, t = 340hrs, T_A = 25°C	
End Points		Group A, Subgroup 2(7), $\Delta\theta_e = \pm$ 10%, $\Delta V_F = \pm$ 100mV	
Bond Strength	2037	All internal wires of each device shall be pulled separately.	20 (c=1)
Subgroup 4			
Internal Visual Inspection	2075	Visual criteria in accordance with qualified design.	1 Device (0 Failure)
Subgroup 6			7
High Temperature Life (non-operating)	1032	t = 340hrs., T_A = 150°C	
End Points		Group A, Subgroup 2(7), $\Delta\theta_e = \pm$ 10%, $\Delta V_F = \pm$ 100mV	

Types OP235TX, OP235TXV, OP236TX, OP236TXV

Group C Inspection

(Performed every six months while in production)

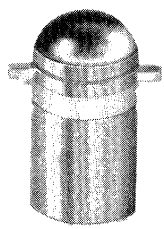
Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2066		
Subgroup 2			10
Thermal Shock (glass strain)	1056	Condition A	
Terminal Strength	2036	Condition B	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
Moisture Resistance	1021	Omit initial conditioning	
End Points		Group A, Subgroup 2	
Subgroup 3			10
Shock	2016	Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, X_1, Y_1, Z_1	
Vibration, Variable Frequency	2056		
Constant Acceleration	2006	1 min in each orientation, X_1, Y_1, & Z_1 at 20K G's min	
End Points		Group A, Subgroup 2	
Subgroup 4			15
Salt Atmosphere (corrosion)	1041		
Subgroup 6			10
Steady-State Operational Life	1032	I_F = 100mA, t = 1000hrs, T_A = 25°C	
End Points		Group A, Subgroup 2(6), $\Delta\theta_e$ = ± 15%, ΔV_F = ± 100mV	

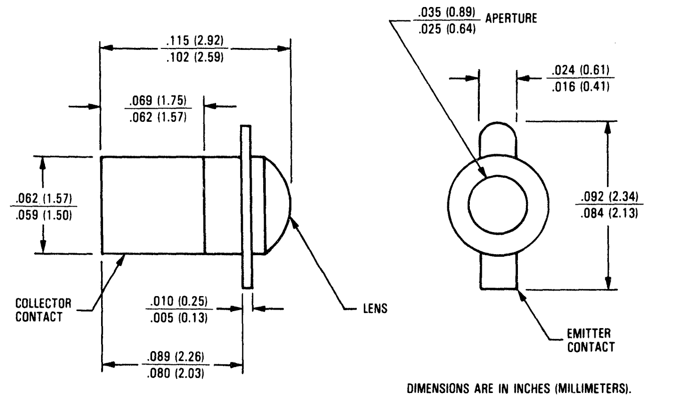
HI REL OPTO COMPONENTS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

Hi-Reliability NPN Silicon Phototransistors
Types OP602TX/V, OP603TX/V, OP604TX/V





Features

- Processed to Optek's military screening program patterned after MIL-S-19500
- Miniature hermetically sealed package
- Wide range of collector currents
- Ideal for direct mounting in PC boards

Description

Each device in this series consists of a high reliability NPN silicon phototransistor mounted in a miniature glass lensed, hermetically sealed, "Pill" package.

After electrical testing by manufacturing, all devices are processed to Optek's 100% screening program patterned after MIL-S-19500. After completion of Group A, sample tests are performed for Group B & C inspections.

This device type is lensed and has an acceptance half angle of 18° measured from the optical axis to the half power point. The series is also mechanically and spectrally matched to the OP223 and OP224 high reliability series of infrared emitting diodes.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-55°C to +125°C
Collector-Emitter Voltage	50V
Emitter-Collector Voltage	7.0V
Soldering Temperature (for 5 seconds with soldering iron)	240°C(1)
Power Dissipation	50mW(2)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when wave soldering.
(2) Derate linearly 0.5mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten lamp operating at CT = 2870 K or equivalent source.

Types OP602TX/V, OP603TX/V, OP604TX/V

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
$I_{C(on)}$	On-State Collector Current					
	OP602TX,TXV	2.0		5.0	mA	V_{CE} = 5.0V, E_e = 20mW/cm[2(3)(4)]
	OP603TX,TXV	4.0		8.0	mA	V_{CE} = 5.0V, E_e = 20mW/cm[2(3)(4)]
	OP604TX,TXV	7.0			mA	V_{CE} = 5.0V, E_e = 20mW/cm[2(3)(4)]
I_{CEO}	Collector Dark Current			25	nA	V_{CE} = 10.0V, E_e = 0
				100	μA	V_{CE} = 30.0V, E_e = 0, T_A = 100°C
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50			V	I_C = 100μA, E_e = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0			V	I_E = 100μA, E_e = 0
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40	V	I_C = 0.4mA, E_e = 20mW/cm[2(3)(4)]
t_r	Rise Time			20.0	μs	V_{CC} = 30V, I_C = 1.00mA,
t_f	Fall Time			20.0	μs	R_L = 100Ω

HI REL OPTO COMPONENTS

100% Processing

Screen	Mil-STD-750 Method	Conditions	OP602TX OP603TX OP604TX	OP602TXV OP603TXV OP604TX
Pre-Cap Visual	2072	Optek's pre-cap visual	—	100%
High Temperature Storage	1032	T_A = 150°C, t = 24hrs.	100%	100%
Temperature Cycle	1051	Condition C, 20 cycles, 15 min. each extreme	100%	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%	100%
Hermetic Seal	1071	Fine: Condition H, 5 X 10^{-8}atm cc/sec Gross: Condition E	100%	100%
High Temperature Reverse Bias[5]	1039	Condition A, T_A = 125°C, V_{CE} = 30Vdc, E_e = 0, t = 48hrs min.	100%	100%
Power Burn-In[6]	1039	Condition B, PT = 50mW min., T_A = 25°C, t = 168hrs. min	100%	100%

(5) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after HTRB.

(6) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after burn-in. ΔI_{CEO} = ± 100% of initial reading or ± 15nA, whichever is greater; $\Delta I_{C(on)}$ = ± 20%, PDA = 10%.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

Symbol	Examination or Test	MIL-STD-750		n/c	Limit		Units
		Method	Conditions		Min	Max	
Subgroup 1							
	Visual and Mechanical Examination	2071	LTPD = 5				
Subgroup 2				116/0			
I_{CEO}	Dark Current	3041	V_{CE} = 10.0Vdc			25	nA
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	3011	I_C = 100μAdc, E_e = 0		50		V
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	3001	I_E = 100μAdc, E_e = 0		7.0		V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage(4)		I_C = 0.40mAdc, E_e = 20mW/cm^2			0.40	V
$I_{C(on)}$	ON-State Collector Current(4)		V_{CE} = 5.0Vdc, E_e = 20mW/cm^2				
	OP602TX,TXV				2.0	5.0	mA
	OP603TX,TXV				4.0	8.0	mA
	OP604TX,TXV				7.0		mA
Subgroup 3				116/0			
I_{CEO}	Dark Current	3041	V_{CE} = 30Vdc, E_e = 0, T_A = 100°C			100	μA
Subgroup 4				116/0			
t_r, t_f	Rise and Fall Time		V_{CC} = 30Vdc, R_L = 100Ω, I_C = 1.0mA			20.0	μs

Group B Inspection

(Performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Solderability	2026		
Subgroup 2			10
Thermal Shock (temperature cycling)	1051	Condition C, 15 min at extremes, 20 cycles	
Hermetic Seal	1071		
Fine Leak		Condition H, max leak rate = 5 x 10^{-8}atm cc/sec	
Gross Leak		Condition E	
End Points		Group A, Subgroup 2	
Subgroup 3			5
Steady-State Operation Life	1027	P_D = 50mW, t = 340hrs, T_A = 25°C	
End Points		Group A, Subgroup 2	
Subgroup 4			
Internal Visual Inspection	2075	Per design criteria	1 Device (0 Failure)
Subgroup 6			5
High Temperature Life (non-operating)	1032	t = 340hrs., T_A = 150°C	
End Points		Group A, Subgroup 2	

(6) Devices electrically tested before and after life tests to the following limits: 340hrs test, ΔPO = ± 10%; 1000hrs test; ΔPO = ± 15%.

Types OP602TX/V, OP603TX/V, OP604TX/V

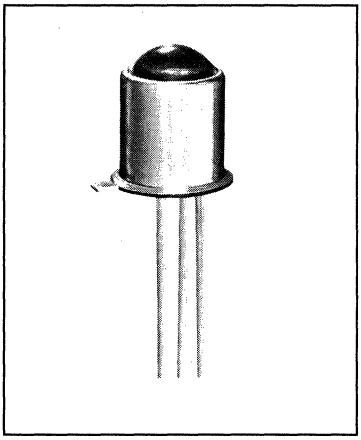
Group C Inspection

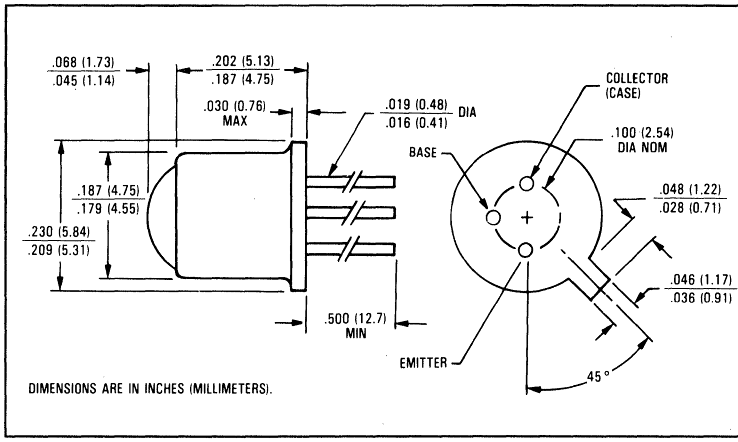
(Performed every six months while in production)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2066		
Subgroup 2			10
Thermal Shock (glass strain)	1056	Condition A	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition H, max leak rate = 5×10^{-8}atm cc/sec Condition E	
Moisture Resistance	1021	Omit initial conditioning	
End Points		Group A, Subgroup 2	
Subgroup 3			10
Shock	2016	Non-operating 1.5K G's, 0.5ms, 5 blows in each orientation, X_1, Y_1, Z_1	
Vibration, Variable Frequency	2056		
Constant Acceleration	2006	1 min in each orientation, X_1, Y_1, & Z_1 at 20K G's min	
End Points		Group A, Subgroup 2	
Subgroup 4			15
Salt Atmosphere (corrosion)	1041		
Subgroup 6			10
Steady-State Operational Life	1026	Power Dissipation = 50mW, t = 1000hrs, $T_A = 25^oC$	
End Points		Group A, Subgroup 2	

OPTEK

Hi-Reliability NPN Silicon Phototransistor
Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV





Features

- High reliability screening patterned after MIL-S-19500
- Each lot subjected to Group A & B Lot Acceptance
- Lensed for high sensitivity
- Mechanically and spectrally matched to the OP235TX/TXV and OP236TX/TXV series IREDs

Description

Each device in the OP803, OP804 and OP805TX/TXV series consists of a high reliability NPN phototransistor mounted in a lensed, hermetically sealed, TO-18 package. The TXV devices are subject to a visual inspection per Method 2072 of MIL-STD-750 prior to seal. All devices (both TX and TXV) are 100% screened per Table II of MIL-STD-19500. After completion of the screening, every lot has Group A and B lot acceptance performed. Group C requirements are performed on a lot every six months.

The OP803, OP804 and OP805 TX/TXV series lensing creates an acceptance half angle of 12° measured from the optical axis to the half power point. The series can be matched with either a solid state infrared source, such as the OP235 and OP236 TX/TXV series IREDs, or can be used to sense infrared content in a visible light source, such as a tungsten bulb or sunlight for automatic brightness control.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C[(1)]
Collector-Emitter Voltage 30V
Collector-Base Voltage 30V
Emitter-Base Voltage 5.0V
Emitter-Collector Voltage 5.0V
Power Dissipation . . . . 250mW[(2)]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 2.5mW/°C above 25°C.

Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
$I_{C(on)}$	On-State Collector Current					
	OP803TX,TXV	4.0		8.0	mA	V_{CE} = 5.0V, E_e = 5.0mW/cm$^{2(3)}$
	OP804TX,TXV	7.0		22.0	mA	V_{CE} = 5.0V, E_e = 5.0mW/cm$^{2(3)}$
	OP805TX,TXV	15.0			mA	V_{CE} = 5.0V, E_e = 20mW/cm$^{2(3)}$
I_{CEO}	Collector-Emitter Dark Current			100	nA	V_{CE} = 10.0V, E_e = 0
				100	µA	V_{CE} = 10.0V, E_e = 0, T_A = 100°C
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	30			V	I_C = 100µA, I_E = 0, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30			V	I_C = 100µA, I_B = 0, E_e = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0			V	I_E = 100µA, I_C = 0, E_e = 0
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.40	V	I_C = 0.4mA, E_e = 5.0mW/cm$^{2(3)}$
t_r	Rise Time OP804TX,TXV			10.0	µs	V_{CC} = 30V, I_C = 1.00mA,
	OP805TX,TXV			15.0		R_L = 100Ω
t_f	Fall Time OP804TX,TXV			10.0	µs	
	OP805TX,TXV			15.0		

(3) Light source is an unfiltered tungsten lamp operated at a temperature of 2870 K.

HI REL OPTO COMPONENTS

100% Processing

Screen	Mil-STD-750 Method	Conditions	OP803TX OP804TX OP805TX	OP803TXV OP804TXV OP805TXV
Pre-Cap Visual	2072	Optek's pre-cap visual	—	100%
High Temperature Storage	1032	T_A = 150°C, t = 24hrs.	100%	100%
Temperature Cycle	1051	Condition C, 20 cycles, -65°C to +150°C, 15 min. each extreme	100%	100%
Constant Acceleration	2006	20K G's, Y_1 only	100%	100%
Hermetic Seal	1071	Fine: Condition G or H, 5 X 10^{-8}atm cc/sec Gross: Condition C	100%	100%
High Temperature Reverse Bias(4)	1039	Condition A, T_A = 125°C, V_{CB} = 24Vdc, E_e = 0, t = 48hrs min.	100%	100%
Power Burn-In(5)	1039	Condition B, PT = 275mW ± 25mW, T_A = 25°C, t = 168hrs. min	100%	100%

(4) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after HTRB.

(5) 100% electrically tested to the limits in Subgroup 2 of the Group A table before and after burn-in. ΔI_{CEO} = ± 100% of initial reading or ± 20nA, whichever is greater; $\Delta I_{C(on)}$ = ± 20%, PDA = 10%.

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Types OP803TX/TXV, OP804TX/TXV, OP805TX/TXV

Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

Symbol	Examination or Test	MIL-STD-750		n/c	Limit		Units
		Method	Conditions		Min	Max	
Subgroup 1							
	Visual and Mechanical Examination	2071	LTPD = 5				
Subgroup 2				116/0			
I_{CEO}	Collector-Emitter Dark Current	3041	V_{CE} = 10.0Vdc, E_e = 0			100	nA
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	3001	I_C = 100μA, I_E = 0, E_e = 0		30		
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	3011	I_C = 1.00mA, I_B = 0, E_e = 0		30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	3026	I_E = 100μA, I_C = 0, E_e = 0		5.0		V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		I_C = 0.40mA, E_e = 5.0mW/cm^2			0.40	V
$I_{C(on)}$	On-State Collector Current		V_{CE} = 5.0Vdc, E_e = 5.0mW/cm^2				
	OP803TX,TXV				4.0	8.0	mA
	OP804TX,TXV				7.0	22.0	mA
	OP805TX,TXV				15.0		mA
Subgroup 3				116/0			
I_{CEO}	Collector Emitter Dark Current	3041	V_{CE} = 10.0Vdc, E_e = 0, T_A = 100°C			100	μA
Subgroup 4				116/0			
t_r, t_f	Rise and Fall Time OP803TX,TXV		V_{CC} = 5.0Vdc, I_C = 1.00mAdc			10.0	μs
	OP804TX,TXV		R_L = 100Ω			10.0	
	OP805TX,TXV					15.0	

Group B Inspection

(Performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Solderability	2026		
Resistance To Solvents	1022		
Subgroup 2			10
Thermal Shock (temperature cycling)	1051	Condition C, 20 cycles, 15 minutes at extremes	
Hermetic Seal	1071		
Fine Leak		Condition G or H, max leak rate = 5 x 10^{-8}atm cc/sec	
Gross Leak		Condition C	
End Points		Group A, Subgroup 2	
Subgroup 3			5
Steady-State Operation Life	1027	P_D = 250mW, t = 340hrs, T_A = 25°C	
End Points		Group A, Subgroup 2	
Subgroup 4			
Internal Visual Inspection	2075	Per design criteria	1 device (0 failure)
Bond Strength	2037	All internal wires of each device shall be pulled separately	20

Group B Inspection

(Performed on each inspection lot)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 5			15
Thermal Resistance	4081	Not performed	
Subgroup 6			7
High Temperature Life (non-operating)	1032	t = 340hrs., T_A = 150°C	
End Points		Group A, Subgroup 2	

Group C Inspection

(Performed every six months while in production)

Examination or Test	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2066		
Subgroup 2			10
Thermal Shock (glass strain)	1056	Condition A	
Hermetic Seal Fine Leak Gross Leak	1071	 Condition G or H, max leak rate = 5 x 10^{-8}atm cc/sec Condition C	
Moisture Resistance	1021	Omit initial conditioning	
End Points		Group A, Subgroup 2	
Subgroup 3			10
Shock	2016	Non-operating 1.5K G's 0.5ms, 5 blows in each orientation, X_1, Y_1, Z_1	
Vibration, Variable Frequency	2056		
Constant Acceleration	2006	1 minute in each orientation, X_1, Y_1, & Z_1 at 20K G's min	
End Points		Group A, Subgroup 2	
Subgroup 4			15
Salt Atmosphere (corrosion)	1041		
Subgroup 5			
Barometric Pressure	1001	Not performed	
Subgroup 6			10
Steady-State Operational Life	1026	P_D = 250mW, t = 1000hrs, T_A = 25°C	
End Points		Group A, Subgroup 2	

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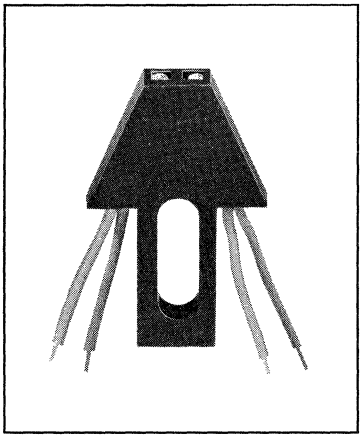
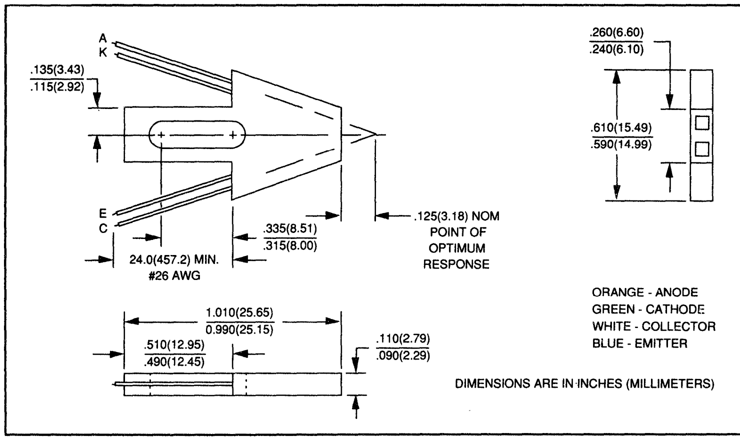
Product Bulletin OPB700TX
June 1993

OPTEK

Hi-Reliability Reflective Object Sensor
Types OPB700TX, OPB700TXV





Features

- Non-contact switching
- Low profile to facilitate stacking
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices
- 24.0 inches (457.2mm) minimum length lead wires conforming to MIL-W-16878

Description

The OPB700TX and OPB700TXV consist of gallium aluminum arsenide LED's and silicon phototransistors mounted side-by side on converging optical axes in a high temperature black plastic housing. The phototransistor responds to the radiation from the LED only when a reflective object passes within its field of view. Lead wires are #26 AWG polytetraflouroethylene (PTEF) insulated conforming to MIL-W-16878.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Operating Temperature . . . . -65°C to +125°C
Storage Temperature . . . . -65°C to +150°C

Input Diode

Forward DC Current 50mA
Reverse Voltage 2.0V
Power Dissipation . . . . 100mW(1)

Output Phototransistor

Collector-Emitter Voltage 50V
Emitter-Collector Voltage 7.0V
Power Dissipation . . . . 100mW(1)

Notes:

(1) Derate linearly 1.00mW/°C above 25°C.
(2) Measured using an Eastman Kodak neutral white test card having 90% diffuse reflectance as a reflective surface.
(3) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and no reflecting surface.
(4) "d" is the distance from the assembly head to the reflective surface.
(5) Methanol or isopropyl alcohols are recommended as cleaning agents.

Types OPB700TX, OPB700TXV

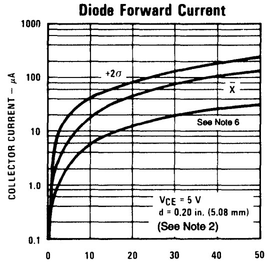
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
Input Diode						
V_F	Forward Voltage(6)	1.10	1.60	1.80	V	$I_F = 50.0mA$
		1.30	1.80	2.00	V	$I_F = 50.0mA$, $T_A = -55^oC$
		0.90	1.40	1.70	V	$I_F = 50.0mA$, $T_A = 100^oC$
I_R	Reverse Current		0.1	100	µA	$V_R = 2.0V$
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50	110		V	$I_C = 1.0mA$, $I_F = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0	10.0		V	$I_E = 100\mu A$, $I_F = 0$
$I_{C(off)}$	Collector-Emitter Dark Current			100	nA	$V_{CE} = 10.0V$, $I_F = 0$
			10	100	µA	$V_{CE} = 10.0V$, $I_F = 0$, $T_A = 100^oC$
Combined						
$I_{C(on)}$	On-State Collector Current d = 0.20 in. (5.08mm)(2,3,6)	50	200		µA	$V_{CE} = 5.0V$, $I_F = 40.0mA$
		25			µA	$V_{CE} = 5.0V$, $I_F = 40.0mA$, $T_A = -55^oC$
		25			µA	$V_{CE} = 5.0V$, $I_F = 40.0mA$, $T_A = 100^oC$
I_{CX}	Crosstalk (No Reflective Surface(3)		2.0		µA	$V_{CE} = 5.0V$, $I_F = 40.0mA$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage d = 0.20 in. (5.08mm)(2,3)			0.40	V	$I_C = 10.0\mu A$, $I_F = 40.0mA$
t_r	Output Rise Time		12.0	20.0	µs	$V_{CC} = 10.0V$, $I_F = 20.0mA$, $R_L = 1{,}000\Omega$
t_f	Output Fall Time		12.0	20.0	µs	

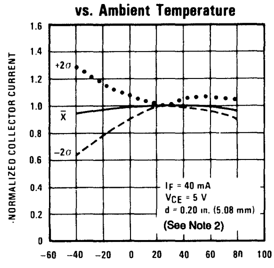
(6) Measurement is taken during the last 500µs of a single 1.0ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

Typical Performance Curves

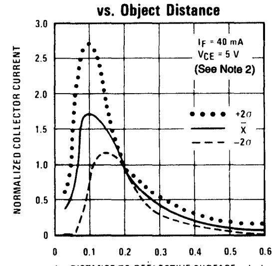
Collector Current vs. Diode Forward Current



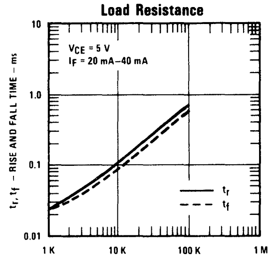
Normalized Collector Current vs. Ambient Temperature



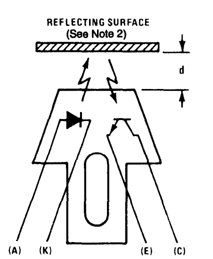
Normalized Collector Current vs. Object Distance



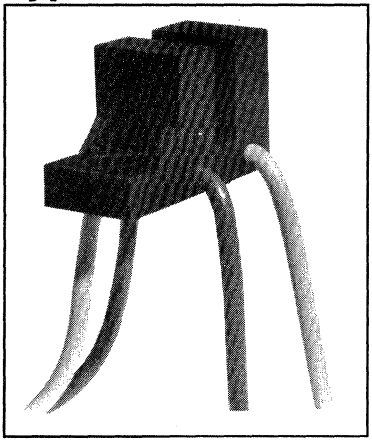
Rise and Fall Time vs. Load Resistance

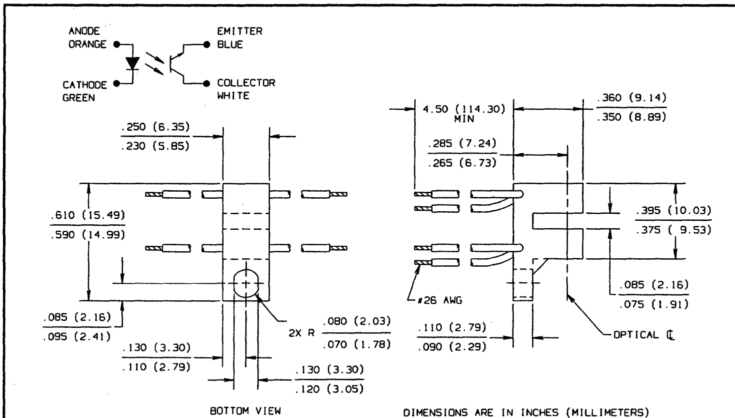


Test Condition



Hi-Rel Slotted Optical Switches
Types OPB821TX, OPB821TXV





Features
- Non-contact switching
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices

Description
The OPB821TX or OPB821TXV consists of a gallium aluminum arsenide LED and a silicon phototransistor soldered into a printed circuit board, then mounted in a high temperature plastic housing on opposite sides of a 0.080 inch (2.03 mm) wide slot. Lead wires are #24 AWG polytetraflouroethylene (PTFE) insulated conforming to MIL-W-16878. Phototransistor switching takes place whenever an opaque object passes through the slot. For maximum output signal, neither the LED or the phototransistor in the OPB821TX or the OPB821TXV is apertured.

The OPB821TX and OPB821TXV use optoelectronic components that have been processed and tested as either TX or TXV components per MIL-S-19500.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)
Operating Temperature . . . . -65°C to +125°C
Storage Temperature . . . . -65°C to +150°C

Input Diode
Forward DC Current . . . . 50 mA
Reverse Voltage . . . . 2.0 V
Power Dissipation . . . . 100 mW(1)

Output Phototransistor
Collector-Emitter Voltage . . . . 50 V
Emitter-Collector Voltage . . . . 7.0 V
Power Dissipation . . . . 100 mW(1)

Notes:
(1) Derate linearly 1.00 mW/°C above 25°C.
(2) Methanol or isopropyl alcohols are recommended as cleaning agents.

Types OPB821TX, OPB821TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

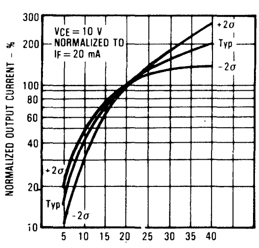
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage(3)	1.00	1.35	1.70	V	I_F = 20.0 mA
		1.20	1.55	1.90	V	I_F = 20.0 mA, T_A = -55°C
		0.80	1.20	1.60	V	I_F = 20.0 mA, T_A = 100°C
I_R	Reverse Current		0.1	100	µA	V_R = 2.0 V
Output Phototransistor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50	110		V	I_C = 1.0 mA, I_F = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0	10.0		V	I_E = 100 µA, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current		0.2	100	nA	V_{CE} = 10 V, I_F = 0
			10	100	µA	V_{CE} = 10 V, I_F = 0, T_A = 100°C
Coupled						
$I_{C(ON)}$	On-State Collector Current(3)	800			µA	V_{CE} = 10.0 V, I_F = 20.0 mA
		500			µA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = -55°C
		500			µA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.20	0.30	V	I_C = 250 µA, I_F = 20.0 mA
t_r	Output Rise Time		12.0	20.0	µs	V_{CC} = 10.0 V, I_F = 20.0 mA,
t_f	Output Fall Time		12.0	20.0	µs	R_L = 1,000 Ω

(3) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

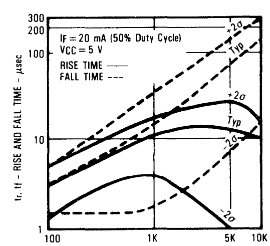
HI REL OPTO COMPONENTS

Typical Performance Curves

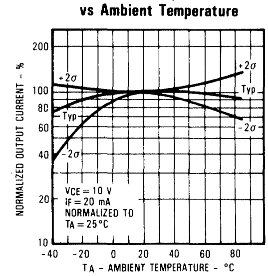
Normalized Output Current vs Forward Current



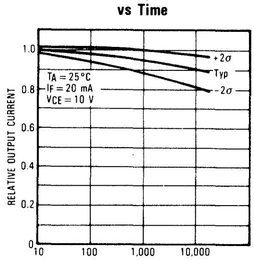
Rise and Fall Time vs Load Resistance



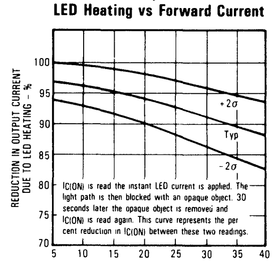
Normalized Output Current vs Ambient Temperature



Relative Output Current vs Time



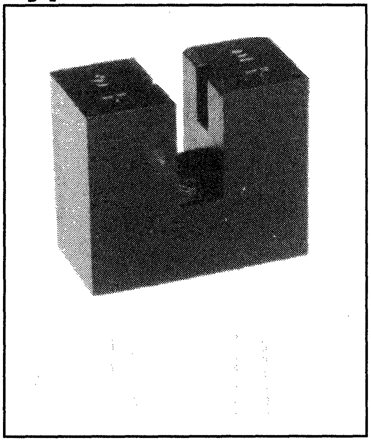
Reduction in Output Current Due to LED Heating vs Forward Current

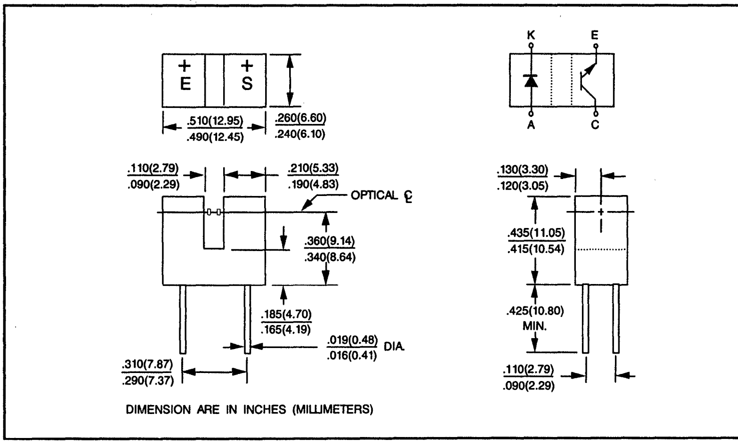


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OPB847TX/TXV
May 1993

Hi-Rel Slotted Optical Switches
Types OPB847TX, OPB847TXV, OPB848TX, OPB848TXV





Features

- Non-contact switching
- Apertured for high resolution
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices

Description

The OPB847TX, OPB847TXV, OPB848TX and OPB848TXV each consist of a gallium aluminum arsenide LED and a silicon phototransistor soldered into a printed circuit board then mounted in a high temperature plastic housing on opposite sides of a 0.100 inch (2.54 mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. Both device types have a 0.025 inch (0.635 mm) by 0.06 inch (1.52 mm) aperture in front of the phototransistor for high resolution positioning sensing.

The OPB847TX, OPB847TXV, OPB848TX and OPB848TXV use optoelectronic components that have been processed and tested as either TX or TXV components per MIL-S-19500.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Operating Temperature .... -65°C to +125°C
Storage Temperature .... -65°C to +150°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case 5 sec. with soldering iron] .... 240°C[1]

Input Diode

Forward DC Current .... 50 mA
Reverse Voltage .... 2.0 V
Power Dissipation .... 100 mW[2]

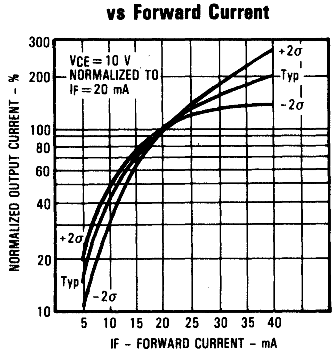
Output Phototransistor

Collector-Emitter Voltage .... 50 V
Emitter-Collector Voltage .... 7.0 V
Power Dissipation .... 100 mW[2]

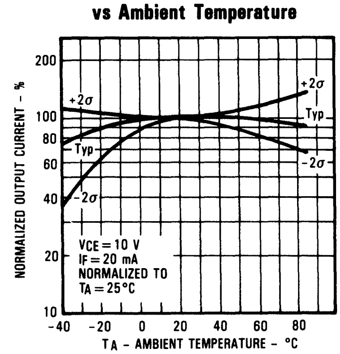
Notes:
(1) Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.00 mW/°C above 25°C.
(3) Methanol or isopropyl alcohols are recommended as cleaning agents.

Typical Performance Curves

Normalized Output Current vs Forward Current



Normalized Output Current vs Ambient Temperature



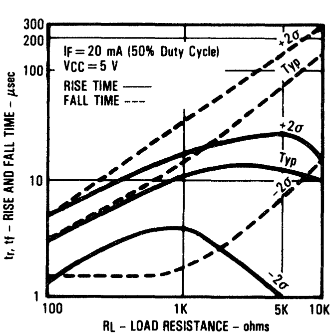
Types OPB847TX, OPB847TXV, OPB848TX, OPB848TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

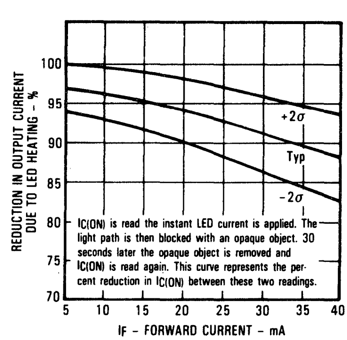
SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage(4)		1.00	1.35	1.70	V	I_F = 20.0 mA
			1.20	1.55	1.90	V	I_F = 20.0 mA, T_A = -55°C
			0.80	1.20	1.60	V	I_F = 20.0 mA, T_A = 100°C
I_R	Reverse Current			0.1	100	µA	V_R = 2.0 V
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		50	110		V	I_C = 1.0 mA, I_F = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		7.0	10.0		V	I_E = 100 µA, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current			0.2	100	nA	V_{CE} = 10 V, I_F = 0
				10	100	µA	V_{CE} = 10 V, I_F = 0, T_A = 100°C
Coupled							
$I_{C(ON)}$	On-State Collector Current(4)	OPB847	4.0			mA	V_{CE} = 10.0 V, I_F = 20.0 mA
		OPB847	2.5			mA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = -55°C
		OPB847	2.5			mA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = 100°C
		OPB848	1.0			mA	V_{CE} = 10.0 V, I_F = 20.0 mA
		OPB848	0.6			mA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = -55°C
		OPB848	0.6			mA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB847		0.20	0.30	V	I_C = 2.0 mA, I_F = 20.0 mA
		OPB848		0.20	0.30	V	I_C = 500 µA, I_F = 20.0 mA
t_r	Output Rise Time	OPB847		12.0	20.0	µs	V_{CC} = 10.0 V, I_F = 20.0 mA,
		OPB848		8.0	15.0	µs	R_L = 1,000 Ω
t_f	Output Fall Time	OPB847		12.0	20.0	µs	V_{CC} = 10.0 V, I_F = 20.0 mA,
		OPB848		8.0	15.0	µs	R_L = 1,000 Ω

(4) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

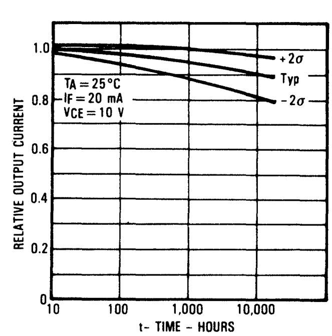
Rise and Fall Time vs Load Resistance



Reduction in Output Current Due to LED Heating vs Forward Current

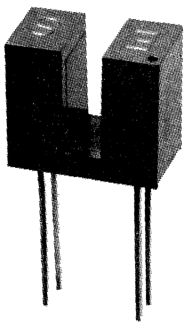


Relative Output Current vs Time

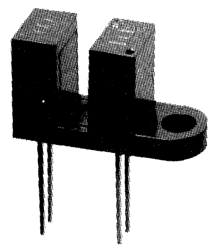


Product Bulletin OPB870
May 1993

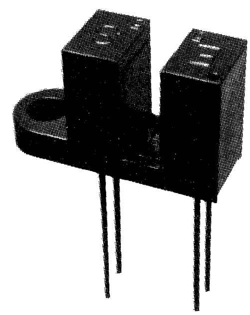
Hi-Rel Slotted Optical Switches
Types OPB870N, OPB870L, OPB870P, OPB870T Series



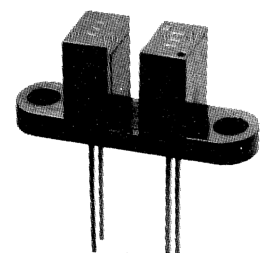
Package N



Package L



Package P



Package T

Features
- Non-contact switching
- Choice of apertures
- Choice of minimum $I_{C(ON)}$
- Hermetically sealed components
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices
- S level processing available
- Plastic meets NASA publication 1124

Description
The OPB870 series slotted optical switch consists of a gallium aluminum arsenide LED and a silicon phototransistor soldered into a printed circuit board then mounted in a high temperature plastic housing on opposite sides of a 0.125 inch (3.18 mm) wide slot. Phototransistor switching takes place whenever an opaque object passes through the slot. Options include phototransistor aperture widths of 0.050 inches (1.27 mm) or 0.010 inches (0.25 mm) for high resolution positioning sensing.

The OPB870 hi-rel series uses optoelectronic components that have been processed and tested as either TX or TXV components per MIL-S-19500.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)
Operating Temperature .... -65°C to +125°C
Storage Temperature .... -65°C to +150°C
Lead Soldering Temperature [1/16 inch (1.6 mm) from case 5 sec. with soldering iron] .... 240°C[(1)]

Input Diode
Forward DC Current .... 50 mA
Reverse Voltage .... 2.0 V
Power Dissipation .... 100 mW[(2)]

Output Phototransistor
Collector-Emitter Voltage .... 50 V
Emitter-Collector Voltage .... 7.0 V
Power Dissipation .... 100 mW[(2)]

Notes:
(1) Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.00 mW/°C above 25°C.
(3) Methanol or isopropyl alcohols are recommended as cleaning agents.

Part Numbering Guide

OPB 87X X 5X XX

Optek Assembly Prefix — OPB

Electrical Specification Variation
0 = Electrical Parameter A
1 = Electrical Parameter B
2 = Electrical Parameter C

Mounting Configuration
T = Both mounting tabs
N = No tabs
L = Single mounting tab, LED side
P = Single mounting tab, phototransistor side

Component Product Assurance Level
TX = Patterned Around TX of MIL-S-19500
TV = Patterned Around TXV of MIL-S-19500

Aperture width in front of phototransistor
5 = .050" (1.27 mm) 1 = .010" (0.25 mm)*
Aperture length is .060" (1.52 mm)

Aperture width in front of LED
5 = .050" (1.27 mm)
Aperture length is .060" (1.52 mm)

*Parameter "A" only

Type OPB870 Series

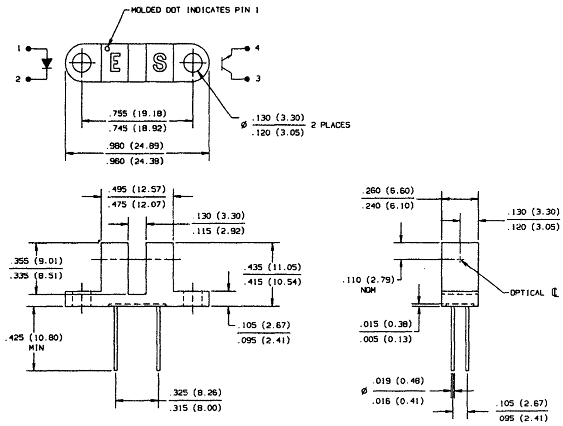
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode							
V_F	Forward Voltage[4]		1.00	1.35	1.70	V	I_F = 20.0 mA
			1.20	1.55	1.90	V	I_F = 20.0 mA, T_A = -55°C
			0.80	1.20	1.60	V	I_F = 20.0 mA, T_A = 100°C
I_R	Reverse Current			0.1	10	µA	V_R = 2.0 V
Output Phototransistor							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		50	110		V	I_C = 1.0 mA, I_F = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		7.0	10.0		V	I_E = 100 µA, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current			0.2	100	nA	V_{CE} = 10 V, I_F = 0
				10	100	µA	V_{CE} = 10 V, I_F = 0, T_A = 100°C
Coupled							
$I_{C(ON)}$	On-State Collector Current[4]						
	Parameter A	OPB870	500			µA	V_{CE} = 10.0 V, I_F = 20.0 mA
		OPB870	200			µA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = -55°C
		OPB870	200			µA	V_{CE} = 10.0 V, I_F = 20.0 mA, T_A = 100°C
	Parameter B	OPB871	1000			µA	V_{CE} = 5.0 V, I_F = 10.0 mA
		OPB871	400			µA	V_{CE} = 5.0 V, I_F = 10.0 mA, T_A = -55°C
		OPB871	400			µA	V_{CE} = 5.0 V, I_F = 10.0 mA, T_A = 100°C
	Parameter C	OPB872	1800			µA	V_{CE} = 0.4 V, I_F = 20.0 mA
		OPB872	800			µA	V_{CE} = 0.4 V, I_F = 20.0 mA, T_A = -55°C
		OPB872	800			µA	V_{CE} = 0.4 V, I_F = 20.0 mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	OPB870		0.20	0.30	V	I_C = 400 µA, I_F = 20.0 mA
		OPB871		0.20	0.30	V	I_C = 800 µA, I_F = 10.0 mA
		OPB872		0.20	0.30	V	I_C = 1,800 µA, I_F = 20.0 mA
t_r	Output Rise Time	OPB870		8.0	15.0	µs	V_{CC} = 10.0 V,
		OPB871		12.0	20.0	µs	I_F = 20.0 mA,
		OPB872		12.0	20.0	µs	R_L = 1,000 Ω
t_f	Output Fall Time	OPB870		8.0	15.0	µs	V_{CC} = 10.0 V,
		OPB871		12.0	20.0	µs	I_F = 20.0 mA,
		OPB872		12.0	20.0	µs	R_L = 1,000 Ω

(4) Measurement is taken during the last 500µs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

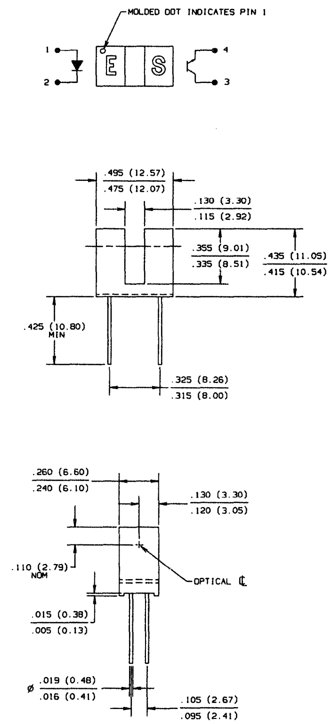
HI REL OPTO COMPONENTS

Package Configuration T



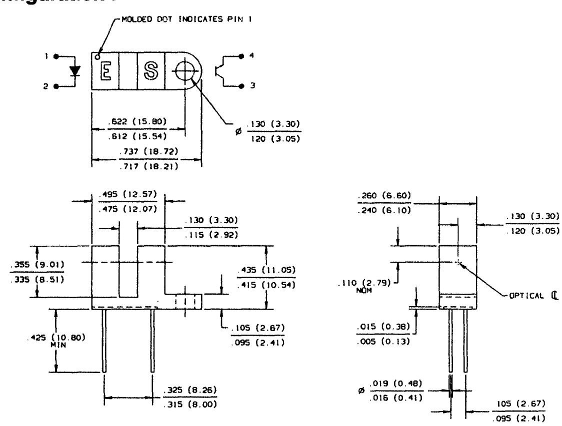
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package Configuration N



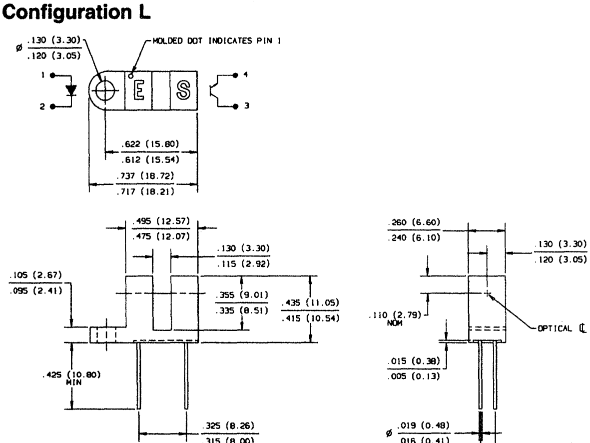
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Package Configuration P



DIMENSIONS ARE IN INCHES (MILLIMETERS)

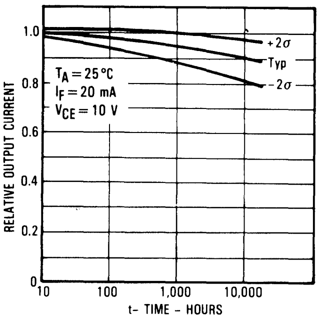
Package Configuration L



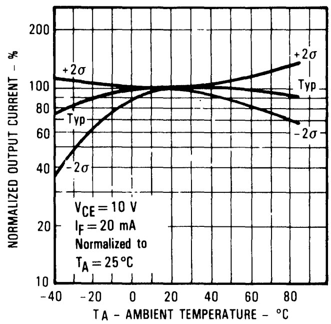
DIMENSIONS ARE IN INCHES (MILLIMETERS)

Typical Performance Curves

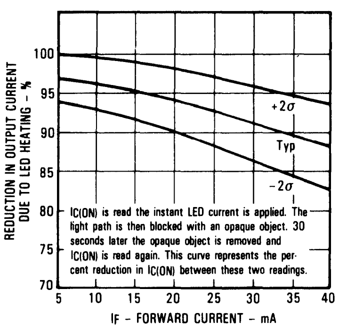
Relative Output Current vs Time



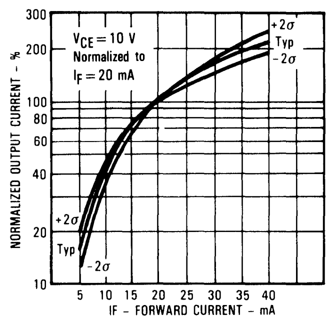
Normalized Output Current vs Ambient Temperature



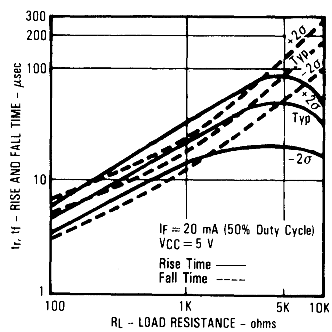
Reduction in Output Current Due to LED Heating vs Forward Current



Normalized Output Current vs Input Current

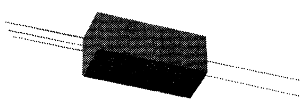


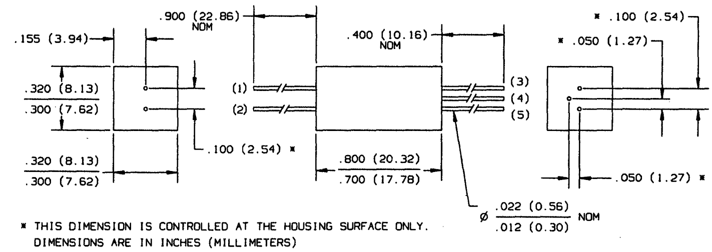
Rise and Fall Time vs Load Resistance

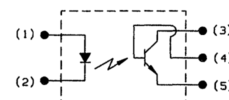


Product Bulletin OPI120TX/TXV
May 1993

Hi-Rel Optically Coupled Isolator
Types OPI120TX, OPI120TXV







OPI120TX

Features

- High current transfer ratio
- 15 kV electrical isolation
- Base lead provided for conventional transistor biasing
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices

Description

The OPI120TX and OPI120TXV are optically coupled isolators, consisting of a gallium aluminum arsenide infrared light emitting diode (OP235TX or OP235TXV) and an NPN silicon phototransistor (OP804TX or OP804TXV) sealed in a high dielectric plastic housing. This series is designed for applications requiring high voltage isolation between input and output.

High reliability processing is performed in accordance with MIL-S-19500 for both the infrared light emitting diode and the NPN silicon phototransistor at the component level.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Input-to-Output Isolation Voltage	±15 kVDC(1)
Operating Temperature	-65°C to +125°C
Storage Temperature	-65°C to +150°C
Soldering Temperature [1/16 in. (1.6 mm) from case for 5 sec. with soldering iron]	240°C
Input Diode	
Forward DC Current	100 mA
Reverse Voltage	2.0 V
Power Dissipation	200 mW(2)
Output Phototransistor	
Continuous Collector Current	50 mA
Collector-Base Voltage	50 V
Collector-Emitter Voltage	50 V
Emitter-Base Voltage	7.0 V
Power Dissipation	250 mW(3)

Notes:
(1) Measured with input leads shorted together and output leads shorted together in air with a maximum relative humidity of 50%. If suitably encapsulated or oil immersed, the isolation voltage is increased to at least 25 kV.
(2) Derate linearly 2.0 mW/°C above 25°C.
(3) Derate linearly 2.5 mW/°C above 25°C.
(4) Methanol or isopropyl alcohols are recommended as cleaning agents.

Types OPI120TX, OPI120TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

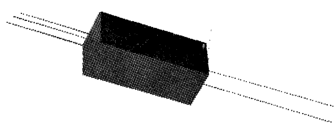
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage[5]	1.00	1.40	1.70	V	I_F = 30.0 mA
		1.20	1.60	1.90	V	I_F = 30.0 mA, T_A = -55°C
		0.90	1.15	1.50	V	I_F = 30.0 mA, T_A = 100°C
I_R	Reverse Current		0.1	10	μA	V_R = 2.0 V
Output Phototransistor						
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	50	80		V	I_C = 100 μA, I_E = 0, I_F = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50	110		V	I_C = 1.0 mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	7.0	10.0		V	I_E = 100 μA, I_C = 0, I_F = 0
$I_{C(OFF)}$	Collector-Emitter Dark Current		0.2	100	nA	V_{CE} = 10 V, I_B = 0, I_F = 0
			10	100	μA	V_{CE} = 10 V, I_B = 0, I_F = 0, T_A = 100°C
$I_{CB(OFF)}$	Collector-Base Dark Current		0.1	10.0	nA	V_{CB} = 10 V, I_E = 0, I_F = 0
Coupled						
$I_{C(ON)}$	On-State Collector Current[5]	2.0			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 10.0 mA
		1.2			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 10.0 mA, T_A = -55°C
		1.2			mA	V_{CE} = 5.0 V, I_B = 0, I_F = 10.0 mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.25	0.30	V	I_C = 2.0 mA, I_B = 0, I_F = 20.0 mA
V_{ISO}	Isolation Voltage (Input to Output)	15.0	30.0		kV	See Note 1
t_r	Output Rise Time		8.0	15.0	μs	V_{CC} = 10.0 V, I_C = 2.0 mA, R_L = 100 Ω
t_f	Output Fall Time		8.0	15.0	μs	V_{CC} = 10.0 V, I_C = 2.0 mA, R_L = 100 Ω

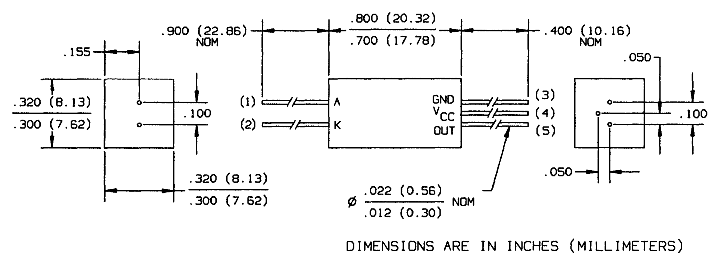
(5) Measurement is taken during the last 500μs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

HI REL OPTO COMPONENTS

Product Bulletin OPI125TXV
May 1993

Hi-Rel Photologic™ Optically Coupled Isolator
Type OPI125TXV





Features

- High current transfer ratio
- 15 kV electrical isolation
- Direct TTL/LSTTL interface
- High noise immunity
- Data rates to 250 KBaud
- Components processed to Optek's Hi-Rel screening program

Description

The OPI125TXV is an optically coupled isolator consisting of a gallium aluminum arsenide infrared light emitting diode (OP235TXV) and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single die (OPL800TXV) sealed in a high dielectric plastic housing. The device features TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads directly without additional circuitry. Also featured are medium speed data rates to 250 KBaud with typical rise and fall times of 70 nsec. This device is designed for applications requiring high voltage isolation between input and output. High reliability processing is performed in accordance with MIL-S-19500 and MIL-S-883.

Absolute Maximum Ratings ($T_A = 25°C$ unless otherwise noted)

Input-to-Output Isolation Voltage . . . . ±15 kVDC(1)
Operating Temperature . . . . -65°C to +125°C
Storage Temperature . . . . -65°C to +150°C
Soldering Temperature [1/16 in. (1.6 mm) from case for 5 sec. with soldering iron] . . . . 240°C

Input Diode

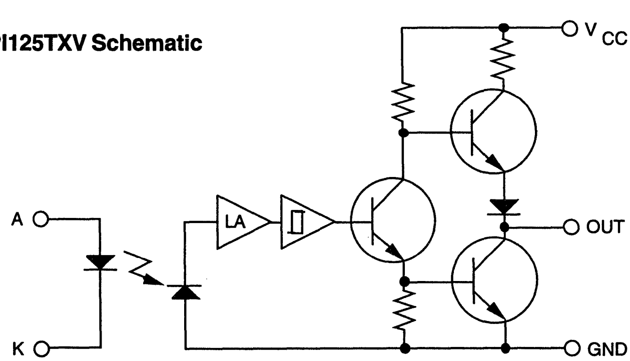
Forward DC Current . . . . 100 mA
Reverse Voltage . . . . 2.0 V
Power Dissipation . . . . 200 mW(2)

Output Photologic™

Supply Voltage, V_{CC} (not to exceed 3 seconds) . . . . +10.0 V
Duration of Output Short to V_{CC} or Ground . . . . 1.00 sec.
Power Dissipation . . . . 200 mW(3)

Notes:
(1) Measured with input leads shorted together and output leads shorted together in air with a maximum relative humidity of 50%. If suitably encapsulated or oil immersed, the isolation voltage is increased to at least 25 kV.
(2) Derate linearly 2.00 mW/°C above 25°C.
(3) Derate linearly 2.0 mW/°C above 25°C.

OPI125TXV Schematic



Type OPI125TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

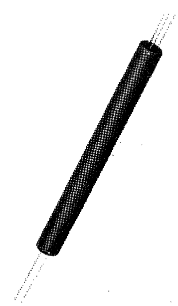
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage[5]	0.90	1.25	1.50	V	I_F = 10.0 mA
		1.00	1.45	1.70	V	I_F = 10.0 mA, T_A = -55°C
		0.70	1.10	1.30	V	I_F = 10.0 mA, T_A = 100°C
I_R	Reverse Current		0.1	10	μA	V_R = 2.0 V
Photologic™						
V_{CC}	Operating Supply Voltage	4.8		5.2	V	
I_{CC}	Supply Current		7.0	15.0	mA	V_{CC} = 5.2 V, I_F = 0 or 7.5 mA
Coupled						
$I_{F(+)}$	LED Positive-Going Threshold Current[5]			7.5	mA	V_{CC} = 5.0 V
				7.5	mA	V_{CC} = 5.0 V, T_A = -55°C
				7.5	mA	V_{CC} = 5.0 V, T_A = 100°C
$I_{F(+)}/I_{F(-)}$	Hysteresis Ratio		2.0			
V_{OL}	Low Level Output Voltage			0.40	V	V_{CC} = 4.8 V, I_{OL} = 13.0 mA, I_F = 0
V_{OH}	High Level Output Voltage	2.4			V	V_{CC} = 4.8 V, I_{OH} = -800 μA, I_F = 7.5 mA
I_{OS}	Short Circuit Output Current	-30.0		-120	mA	V_{CC} = 5.2 V, I_F = 7.5 mA, Output = GND
V_{ISO}	Isolation Voltage (Input to Output)	15.0			kV	See Note 1
t_r, t_f	Output Rise Time and Fall Time		70.0	100	ns	V_{CC} = 5.0 V, T_A = 25°C, I_F = 0 or 10.0 mA
t_{PLH}, t_{PHL}	Propagation Delay and Low to High & High to Low		5.0	10.0	μs	f = 10.0 kHz, D.C. = 50%, R_L = 8 TTL Loads

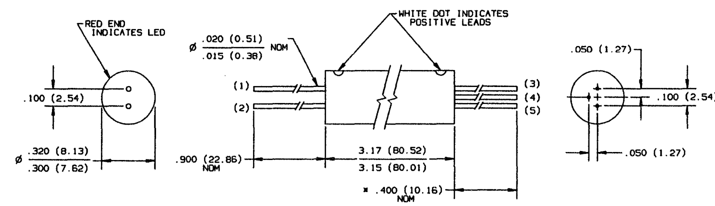
(4) Methanol or isopropyl alcohols are recommended as cleaning agents.
(5) Measurement is taken during the last 500μs of a single 1.0 ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

HI REL OPTO COMPONENTS

OPTEK

Optically Coupled Isolators
Types OPI150TX, OPI150TXV





* CATHODE LEAD. OTHER LEADS ARE .060 (1.52) NOM LONGER.
DIMENSIONS ARE IN INCHES (MILLIMETERS)
** THIS DIMENSION IS CONTROLLED AT THE HOUSING SURFACE

Features

- High current transfer ratio
- 50kV electrical isolation
- Base contact lead for conventional transistor biasing
- Components processed to Optek's screening program patterned after MIL-S-19500 for TX and TXV devices.

Description

The OPI150TX and OPI150TXV are optically coupled isolators, consisting of a gallium aluminum arsenide infrared light emitting diode component (OP235TX or OP235TXV) and optically coupled to an NPN silicon phototransistor component (OP804TX or OP804TXV) by means of a light pipe and sealed in a high dielectric plastic housing. This series is designed for applications requiring very high voltage isolation between input and output.

High reliability processing is performed in accordance with MIL-S-19500 for both the infrared light emitting diode and the NPN silicon phototransistor at the component level.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Voltage . . . . ± 50kVDC(1)
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -65°C to +125°C
Lead Soldering Temperature[1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C

Input Diode

Continuous Forward Current 100mA
Reverse Voltage 2.0V
Power Dissipation . . . . 200mW(2)

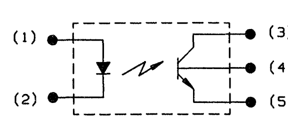
Output Photosensor

Continuous Collector Current 50mA
Collector-Emitter Voltage 50V
Emitter-Base Voltage 7.0V
Collector-Base Voltage 50V
Power Dissipation . . . . 250mW(3)

Notes:

(1) Measured with input and output leads shored together in air with maximum relative humidity of 50%.
(2) Derate linearly 2.00mW/°C above 25°C.
(3) Derate linearly 2.50mW/°C above 25°C.
(4) Methanol or isopropanol are recommended as cleaning agents.

Schematic



OPI150

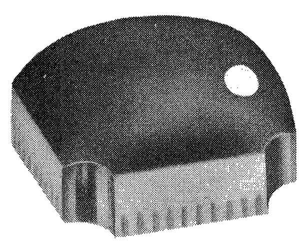
Types OPI150TX, OPI150TXV

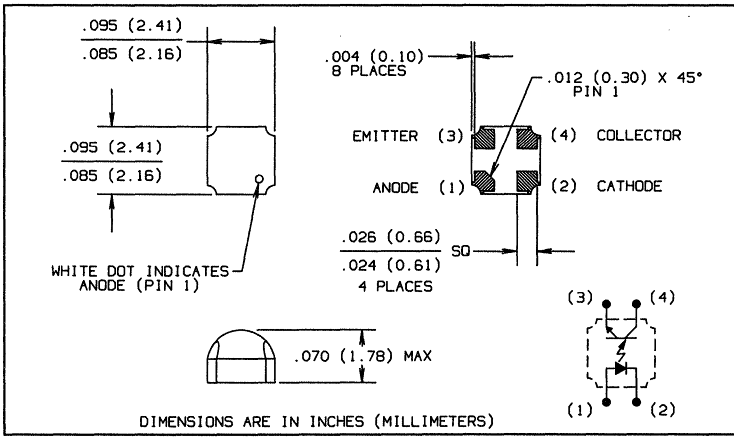
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage(5)	1.0 1.2 0.9	1.4 1.6 1.15	1.7 1.9 1.5	V V V	I_F = 30 mA I_F = 30 mA, T_A = -55°C I_F = 30 mA, T_A = 100°C
I_R	Reverse Current		0.1	10	μA	V_R = 2.0 V
Output Photosensor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50	80		V	I_C = 1.0 mA, I_B = 0, I_F = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	7.0	110		V	I_E = 100 μA, I_C = 0, I_F = 0
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	50	10.0		V	I_C = 100 μA, I_E = 0, I_F = 0
I_{CEO}	Collector-Emitter Dark Current		0.2 10	100 100	nA μA	V_{CE} = 10.0 V, I_B = 0, I_F = 0 V_{CE} = 10.0 V, I_B = 0, I_F = 0, T_A = 100°C
I_{CBO}	Collector-Base Dark Current		0.1	10	nA	V_{CB} = 10.0 V, I_E = 0, I_F = 0
Coupled						
$I_{C(ON)}$	On-State Collector Current(5)	1.0 0.6 0.6			mA mA mA	V_{CE} = 5 V, I_B = 0, I_F = 10 mA V_{CE} = 5 V, I_B = 0, I_F = 10 mA, T_A = -55°C V_{CE} = 5 V, I_B = 0, I_F = 10 mA, T_A = 100°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.20	0.30	V	I_C = 1.0 mA, I_B = 0, I_F = 16.0 mA
V_{ISO}	Isolation Voltage (Input-to-Output)	50.0			kV	See Note 1
t_r	Output Rise Time		8.0	15.0	μs	V_{CC} = 10.0 V, I_C = 2.0 mA, R_L = 100 Ω
t_f	Output Fall time		8.0	15.0	μs	V_{CC} = 10.0 V, I_C = 2.0 mA, R_L = 100 Ω

(5) Measurement is taken during last 500μs of a single ms test pulse. Heating due to increased pulse rate or pulse width can cause change in measurement results.

Surface Mount Optically Coupled Isolators
Types OPI210, OPI211





Features

- Micro-miniature package ideal for hybrid applications
- TTL, DTL compatible
- High DC current transfer ratio
- Four bonding pads for attaching to hybrid substrates
- 1kV electrical isolation
- High efficiency gallium aluminum arsenide emitter

Description

The OPI210 and OPI211 are optically coupled isolators each consisting of a gallium aluminum arsenide LED and a silicon phototransistor mounted and coupled on a thick film ceramic substrate. These solid-state optocouplers are ideal for hybrid applications. Four thick film bonding pads make electrical connections easy.

The OPI210 and OPI211 are identical except for the DC current transfer ratio. Both were designed with high reliability in mind and are ideally suited for use in MIL-STD-883 hybrid applications.

Device mounting may be achieved using silver or gold filled epoxies. The OPI210 and OPI211 are sensitive to some hybrid cleaning processes. Consult factory for details.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage .... ±1000VDC(1)
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -55°C to +125°C

Input Diode

Continuous Forward DC Current 50mA
Peak Forward Current (1 µs pulse width, 300 pps) 1.00A
Reverse Voltage 3.0V
Power Dissipation .... 60mW(2)

Output Sensor

Continuous Collector Current 50mA
Collector-Emitter Voltage 35V
Emitter-Collector Voltage 7.0V
Power Dissipation .... 100mW(3)

Notes:
(1) Measured with input diode bond pads shorted together and output bond pads shorted together.
(2) Derate linearly above 65°C free air temperature at the rate 1.0mW/°C.
(3) Derate linearly above 25°C free air temperature at the rate of 1.0mW/°C.

Types OPI210, OPI211

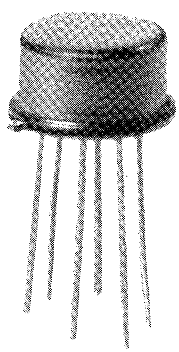
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

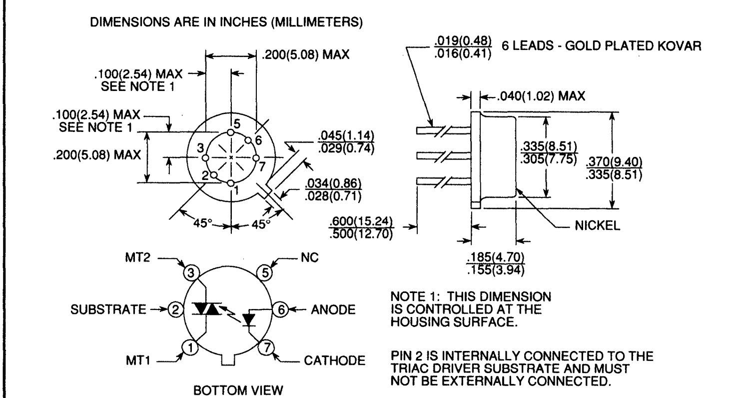
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage		1.15	1.50	V	$I_F = 10.0mA$
I_R	Reverse Current		0.1	100	µA	$V_R = 2.0V$
Output Sensor						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	35	80		V	$I_C = 100\mu A$, $I_F = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	7.0	10.0		V	$I_E = 100\mu A$, $I_F = 0$
I_{CEO}	Collector-Emitter Dark Current		20	100	nA	$V_{CE} = 20V$, $I_F = 0$
Coupled						
I_C/I_F	DC Current Transfer Ratio OPI210 OPI211	50 200	200 350		% %	$V_{CE} = 5.0V$, $I_F = 10.0mA$ $V_{CE} = 5.0V$, $I_F = 10.0mA$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.2	0.30	V	$I_C = 2.0mA$, $I_F = 20mA$
t_r t_f	Output Rise Time Output Fall Time		3.0 3.0	10.0 10.0	µs µs	$V_{CC} = 10.0V$, $R_L = 100\Omega$ Pulse width = 100ms, duty cycle = 1%

OPTEK

Product Bulletin OPI340
May 1993

Zero Voltage Crossing Optically Coupled Triac Driver
Type OPI340





Features
- For 220 VAC operation
- 1000 VDC electrical isolation
- Zero voltage crossing for reduced EMI, line noise, and improved static dV/dt
- TO-78 hermetically sealed package
- Optek's Military screened version available on request
- -55°C to +125°C operating range

Description
The OPI340 consists of a gallium aluminum arsenide infrared emitting diode and a monolithic integrated circuit containing a photodiode and a zero voltage bidirectional triac driver, mounted in a six pin TO-78 hermetic package. The device is intended to be used for low power DC controlling of power triacs which in turn control resistive, inductive, or capacitive loads powered from 220 VAC. Zero voltage crossing ensures that the device will not turn on until the line voltage reduces to 15 volts, typical.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Input-to-Output Isolation Voltage	±1.0 kVDC(1)
Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Soldering Temperature (1/16 inch from case for 5 sec. w/soldering iron)	240°C
Input Diode	
Forward DC Current (65°C or below)	40 mA
Reverse Voltage	3.0 V
Power Dissipation	60 mW(2)
Output Photosensor	
Off-State Terminal Voltage	400 V
On-State RMS Current (Full Cycle, 50-60 Hz, T_A = 25°C)	100 mA
On-State RMS Current (Full Cycle, 50-60 Hz, T_A = 70°C)	50 mA
Peak Non-Repetitive Surge Current (PW = 10 ms, duty cycle = 10%)	1.20 A
Power Dissipation	300 mW(3)

Notes:
(1) Measured with inputs shorted together and outputs shorted together.
(2) Derate linearly 1.0 mW/°C above 65°C.
(3) Derate linearly 3.0 mW/°C above 25°C.

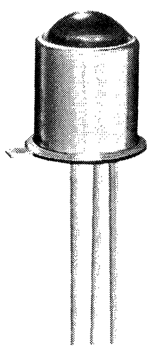
Type OPI340

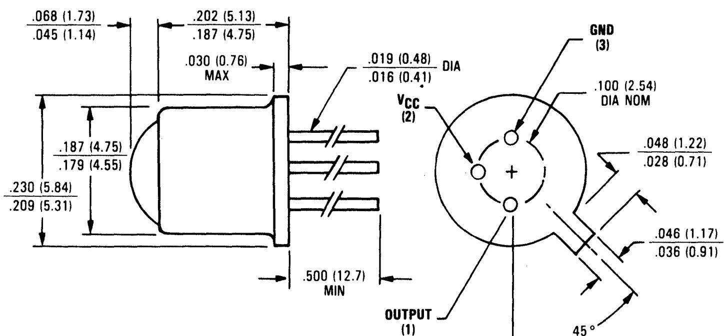
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage	1.20		1.80	V	I_F = 40.0 mA
		1.00		2.20	V	I_F = 40.0 mA, T_A = -55°C
		0.80		1.50	V	I_F = 40.0 mA, T_A = 125°C
I_R	Reverse Current			100	µA	V_R = 3.0 V
Output Phototransistor						
I_{DRM}	Peak Blocking Current, Either Direction		10.0	100	nA	V_{DRM} = 400 V
				6.0	µA	V_{DRM} = 400 V, T_A = 85°C
				6.0	µA	V_{DRM} = 300 V, T_A = 125°C
V_{TM}	Peak On-State Voltage, Either Direction		1.75	3.0	V	I_{TM} = 100 mA, I_F = 15.0 mA
				3.0	V	I_{TM} = 100 mA, I_F = 15.0 mA, T_A = -55°C
				5.0	V	I_{TM} = 100 mA, I_F = 15.0 mA, T_A = 125°C
dV/dt	Critical Rate of Rise of Off-State Voltage	100			V/µs	R_L = 2.5 kΩ
Coupled						
I_{FT}	LED Trigger Current Required to Latch			15.0	mA	V_{TM} = 3.0 V, R_L = 150 Ω
				20.0	mA	V_{TM} = 5.0 V, R_L = 150 Ω, T_A = -55°C
				22.0	mA	V_{TM} = 5.0 V, R_L = 150 Ω, T_A = 125°C
I_H	Holding Current, Either Direction		200		µA	
V_{ISO}	Isolation Voltage	1000			VDC	See Note (1)
$V_{I(TH)}$	Zero Voltage Crossing Inhibit Voltage Threshold			40	V	I_{FT} = 15.0 mA
				40	V	I_{FT} = 15.0 mA, T_A = -55°C
				40	V	I_{FT} = 15.0 mA, T_A = 125°C
$I_{R(I)}$	Leakage Current in Inhibit State			300	µA	I_{FT} = 15.0 mA, V_{MT} = 400 V
				600	µA	I_{FT} = 20.0 mA, V_{MT} = 400 V, T_A = -55°C
				300	µA	I_{FT} = 22.0 mA, V_{MT} = 300 V, T_A = 125°C

OPTEK

Hi-Reliability Photologic™ Hermetic Sensors
Type OPL800TXV





DIMENSIONS ARE IN INCHES (MILLIMETERS).

Features

- 100% screened and quality conformance tested to Optek's Hi-Rel program
- Direct TTL/STTL interface
- Hermetic, lensed TO-18 package
- Mechanically and spectrally matched OP235/OP236TX/TXV LEDs

Description

The OPL800TXV is a high reliability optoelectronic microcircuit that incorporates a photodiode, linear amplifier, and Schmitt trigger on a single silicon chip. The device features TTL/STTL compatible logic level output which can drive up to 8 TTL loads without additional interface circuitry. The Photologic™ chip is mounted on a standard TO-18 header which is hermetically sealed in a lensed metal can. These devices are mechanically and spectrally matched to the OP235TX/TXV and 236TX/TXV infrared emitting diodes. All parts are processed to Optek's 100 percent screening program patterned after Method 5004 of MIL-STD-883 and the quality conformance testing in Method 5005 for Class B devices. Complete details of the Hi-Rel program are given on the following pages.

Typical characteristic curves are shown on the commercial OPL800 data sheet.

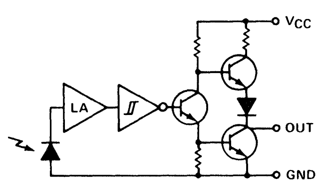
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} (not to exceed 3 sec.) .... +10.0V
Storage Temperature Range .... -65°C to +150°C
Operating Temperature Range .... -55°C to +125°C
Lead Soldering Temperature [1/16 (1.6mm) inch from case for 5 sec. with soldering iron] .... 240°C(1)
Power Dissipation .... 250mW(2)
Duration of Output Short to V_{CC} or Ground .... 1.00 sec.

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when wave soldering.
(2) Derate linearly 2.5mW/°C above 25°C.
(3) Light measurements are made with λ = 935nm.

Schematics

OPL800TXV (Totem-Pole Output Buffer)



Type OPL800TXV

100% Processing

Screen	Mil-STD-883 Method	Conditions	OPL800TXV
Internal Visual	2010	Condition B	100%
High Temperature Storage	1008	Condition C, $T_A = 150^oC$, t = 24hrs.	100%
Temperature Cycle	1010	Condition C, 10 Cycles, -65^oC to 150^oC, 15 min. each extreme	100%
Constant Acceleration	2001	Condition E, Y_1 orientation, 5K G's for 1 min.	100%
Hermetic Seal	1014	Fine: Condition A or B, 5 X 10^{-8}atm cc/sec Gross: Condition C, D, or E	100%
Power Burn-In(4)	1015	Condition B, $T_A = 25^oC$, $V_{CC} = 5.25V$, t = 168hrs. min	100%
Seal	1014	Fine leak, Gross leak	100%
External Visual Examination	2009		100%

(4) 100% electrically tested to the limits in Subgroups 1 and 9 of the Group A table before and after burn-in.

Group A Inspection-Electrical Tests

(Performed on each inspection lot after all devices have been subject to the 100% processing requirements.)

Symbol	Examination or Test	MIL-STD-883		n/c	Limit		Units
		Method	Conditions		Min	Max	
Subgroup 1(5)				2			
I_{CCH}	Supply Current, High	3005	$V_{CC} = 5.25V$, $E_e = 2.0mW/cm^2$			15.0	mA
I_{CCL}	Supply Current, Low	3005	$V_{CC} = 5.25V$, $E_e = 0$			15.0	mA
V_{OL}	Low Level Output Voltage	3007	$V_{CC} = 4.75$, $I_{OL} = 12.8mA$, $E_e = 0$			0.40	V
V_{OH}	High Level Output Voltage	3006	$V_{CC} = 4.75$, $I_{OH} = -800\mu A$, $E_e = 2.0mW/cm^2$		2.4		V
I_{OS}	Short Circuit Output Voltage	3011	$V_{CC} = 4.75$, $E_e = 2.0mW/cm^2$, Output = GND		-30	-120	mA
Subgroup 2(5)			$T_A = +125^oC$	2			
I_{CCH}	Supply Current, High	3005	$V_{CC} = 5.25V$, $E_e = 2.0mW/cm^2$			15.0	mA
I_{CCL}	Supply Current, Low	3005	$V_{CC} = 5.25V$, $E_e = 0$			15.0	mA
V_{OL}	Low Level Output Voltage	3007	$V_{CC} = 4.75V$, $I_{OL} = 12.8mA$, $E_e = 0$			0.40	V
V_{OH}	High Level Output Voltage	3006	$V_{CC} = 4.75V$, $I_{OH} = -800\mu A$, $E_e = 2.0mW/cm^2$		2.4		V
Subgroup 3(5)			$T_A = -55^oC$	2			
I_{CCH}·	Supply Current, High	3005	$V_{CC} = 5.25V$, $E_e = 2.0mW/cm^2$			15.0	mA
I_{CCL}	Supply Current, Low	3005	$V_{CC} = 5.25V$, $E_e = 0$			15.0	mA
V_{OL}	Low Level Output Voltage	3007	$V_{CC} = 4.75V$, $I_{OL} = 12.8mA$, $E_e = 0$			0.40	V
V_{OH}	High Level Output Voltage	3006	$V_{CC} = 4.75V$, $I_{OH} = -800\mu A$, $E_e = 2.0mW/cm^2$		2.4		V
Subgroup 4(5)				2			
t_r, t_f	Rise and Fall Time	3004	$V_{CC} = 5.0V$, R_L = 8TTL loads			70.0	ns
t_{PHL}	Propagation Delay, Low-High	3003	$V_{CC} = 5.0V$, R_L = 8TTL loads			10.0	µs
t_{PHL}	Propagation Delay, High-Low	3003	$V_{CC} = 5.0V$, R_L = 8TTL loads			10.0	µs

(5) Light Source is a gallium arsenide light emitting diode with a typical rise time of 500 nanoseconds.

HI REL OPTO COMPONENTS

OPTEK

Group B Inspection

(Performed on each inspection lot)

Examination or Test	MIL-STD-883		LTPD
	Method	Conditions	
Subgroup 1			2 devices 0 failures
Physical Dimensions	2016		
Subgroup 2			4 devices 0 failures
Resistance To Solvents	2015		
Subgroup 3			1 device 0 failures
Solderability	2003	Soldering Temperature = 260°C ± 10°C	
Subgroup 5			2 devices 0 failures
Bond Strength	2011	Condition C or D	
Subgroup 7			5

Group C Inspection Die Related Tests

(Performed every 3 months)

Examination or Test	MIL-STD-883		LTPD
	Method	Conditions	
Subgroup 1			15
Temperature Cycling	1010	Condition C, 10 cycles, -65°C to +150°C, 10 minutes max @ extremes, 5 minutes max transfer time	
Constant Acceleration	2001	Condition E, 30K G's, Y_1 only for 1 minute	
Hermetic Seal Fine Leak Gross Leak	1014	 Condition A or B, 5 x 10^{-8}atm cc/sec Condition C, D or E	
End Points		Group A, Subgroup 1	
Subgroup 2			5
Steady State Life	1005	V_{CC} = 5.0V, T_A = 150°C, t = 1000hrs	
End Points		Group A, Subgroup 1	

Type OPL800TXV

Group D Package Related Tests (performed every 6 months while in production)

Examination or Test	MIL-STD-883		LTPD
	Method	Conditions	
Subgroup 1			15
Physical Dimensions	2016		
Subgroup 2			15
Lead Integrity	2004	Condition B2 (Lead Fatique)	
Hermetic Seal Fine Leak Gross Leak	1014	 Condition A or B, 5 X 10^{-8} atm cc/sec Condition C, D, or E	
Subgroup 3			15
Thermal Shock	1011	Condition B, 15 cycles, 125°C to -55°C, 5 minutes minimum @ extremes, 10 sec maximum transfer time	
Temperature Cycling	1010	Condition C, 100 cycles, -65°C to +150°C, 10 minutes minimum @ extremes, 5 minimum transfer time	
Moisture Resistance	1004		
Hermetic Seal Fine Leak Gross Leak	1014	 Condition A or B, 5 X 10^{-7} atm cc/sec Condition C, D, or E	
End Points		Group A, Subgroup 1	
Subgroup 4			15
Mechanical Shock	2002	Condition B	
Vibration, Variable Frequency	2007	Condition A	
Constant Acceleration	2001	Condition E, 30K G's, Y1 only for 1 minute	
Hermetic Seal Fine Leak Gross Leak	1014	 Condition A or B, 5 X 10^{-8} atm cc/sec Condition C, D, or E	
End Points		Group A, Subgroup 1	
Subgroup 5			15
Salt Atmosphere	1009	Condition A	
Hermetic Seal Fine Leak Gross Leak	1014	 Condition A or B, 5 X 10^{-8} atm cc/sec Condition C, D, or E	

HI REL OPTO COMPONENTS

OPTEK TECHNOLOGY, INC.

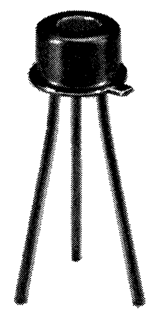
HI REL FIBER OPTICS

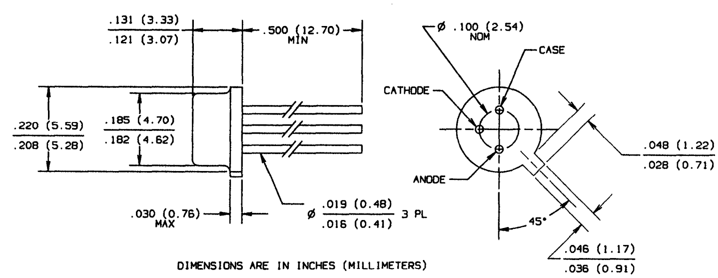
HI-REL FIBER OPTIC COMPONENTS

Product Bulletin OMF320TX/TXV
April 1993

OPTEK

High Reliability
Fiber Optic GaAlAs LED
Types OMF320TX, OMF320TXV





Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case
- Processing patterned after JANTX or JANTXV of MIL-S-19500

Description

The OMF320 LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted hermetic package.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50μm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C .
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Indexs**	**N.A.**	**OMF320TX/TXV**
50/125μm	Graded	0.20	19μW
62.5/125μm	Graded	0.28	34μW
100/140μm	Graded	0.29	96μW
200/300μm*	Step	0.41	360μW

*PCS - Plastic Clad Silica

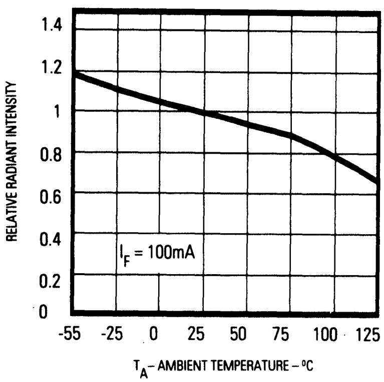
Types OMF32OTX, OMF320TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

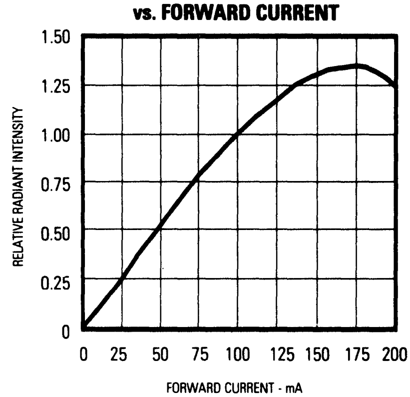
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	15.0	19.0		µW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		6.0	8.0	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		6.0	10.0	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

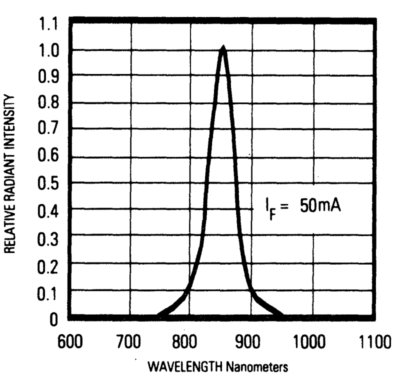
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



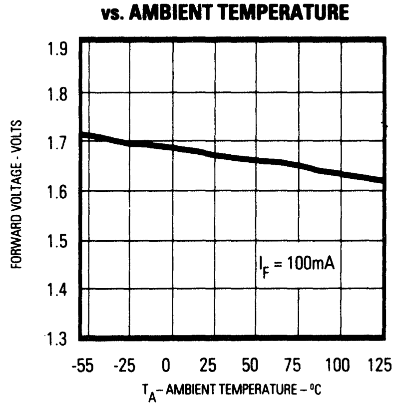
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

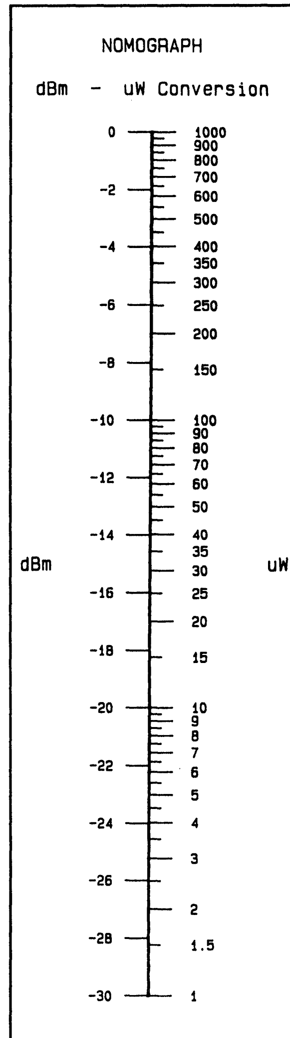


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

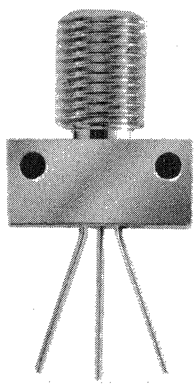


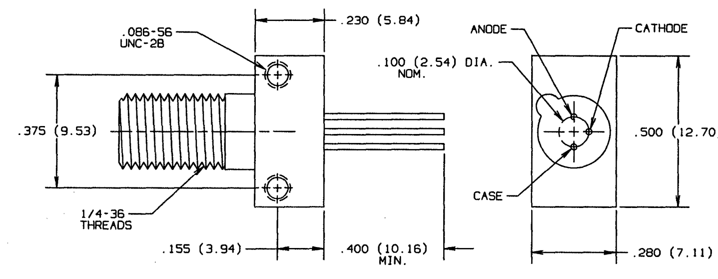


Product Bulletin OMF321TX/TXV
April 1993

OPTEK

High Reliability
Fiber Optic GaAlAs LED in SMA Receptacle
Types OMF321TX, OMF321TXV





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- Processing patterned after JANTX or JANTXV of MIL-S-19500

Description

The OMF321 consists of a hermetic LED pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA[4]
Storage Temperature Range .... -55°Co +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C[1]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Pre Bias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF321TX/TXV**
50/125µm	Graded	0.20	19µW
62.5/125µm	Graded	0.28	34µW
100/140µm	Graded	0.29	96µW
200/300µm*	Step	0.41	360µW

*PCS - Plastic Clad Silica

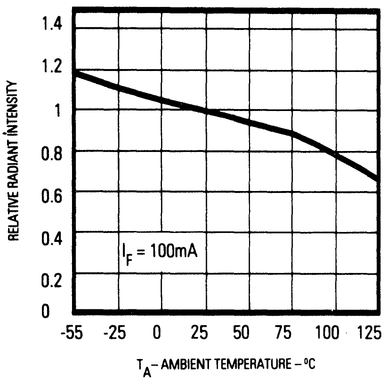
Types OMF321TX, OMF321TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

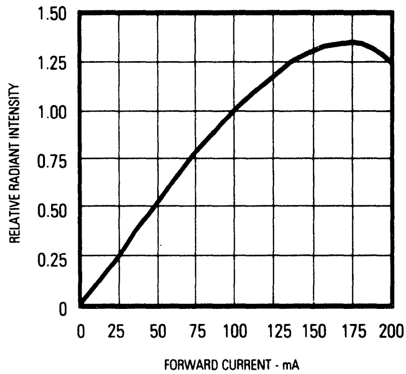
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	15.0	19.0		μW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		6.0	8.0	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		6.0	10.0	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

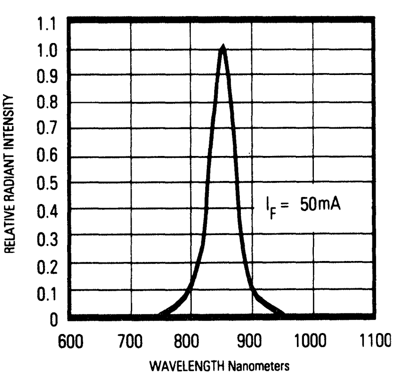
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



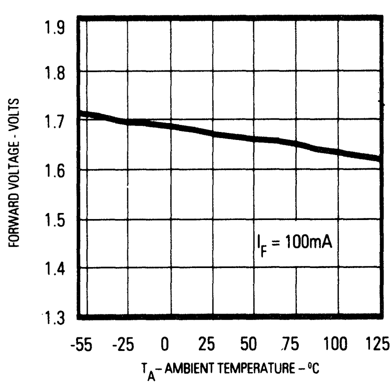
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

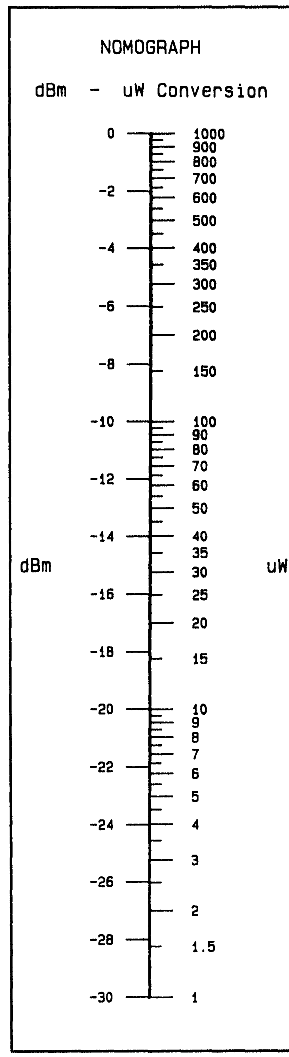


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

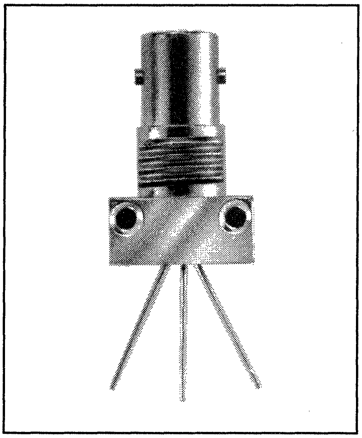


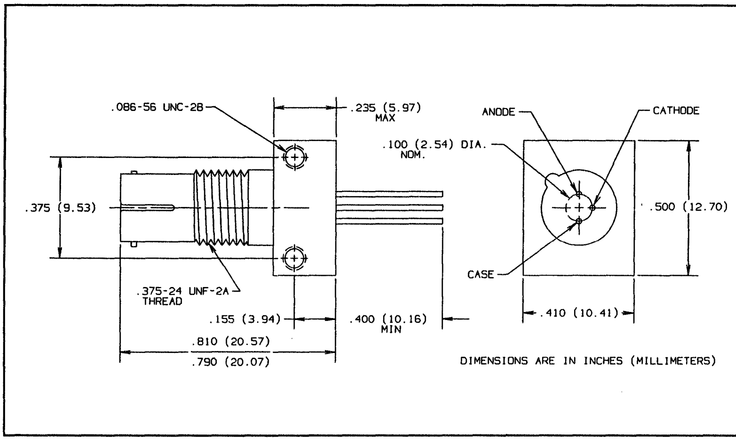


Product Bulletin OMF322TX/TXV
April 1993

OPTEK

High Reliability
Fiber Optic GaAlAs LED in ST* Compatible Receptacle
Types OMF322TX, OMF322TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Processing patterned after JANTX or JANTXV of MIL-S-19500

Description

The OMF322 consists of a hermetic LED pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S 19500.

*ST is a registered trademark of AT&T

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power IF = 100 mA @ 25oC			
Fiber	**Refractive Index**	**N.A.**	**OMF322TX/TXV**
50/125µm	Graded	0.20	19µW
62.5/125µm	Graded	0.28	34µW
100/140µm	Graded	0.29	95µW
200/300µm*	Step	0.41	360µW

*PCS - Plastic Clad Silica

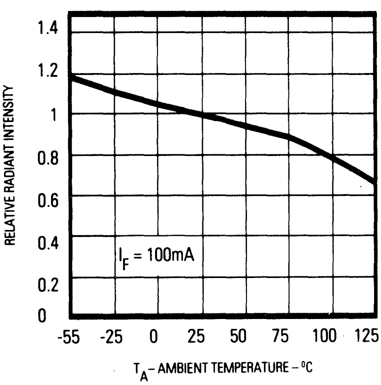
Types OMF322TX, OMF322TXV

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

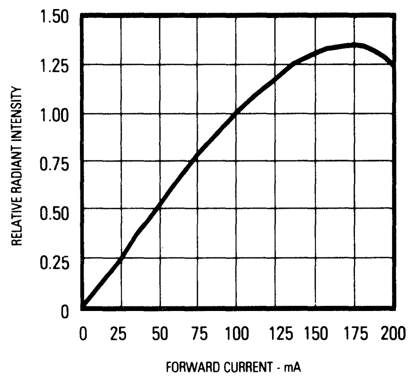
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
P_O	Radiant Power Output	15.0	19.0		μW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		6.0	8.0	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		6.0	10.0	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

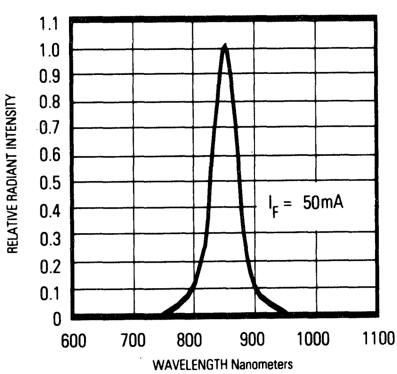
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



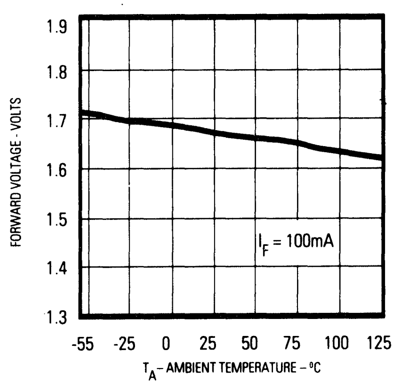
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

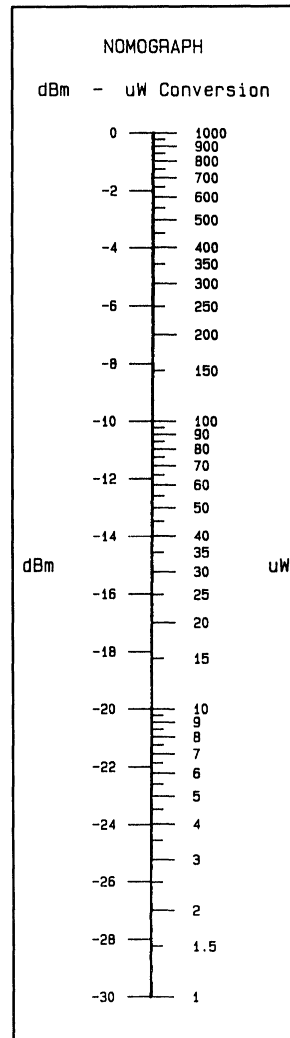


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

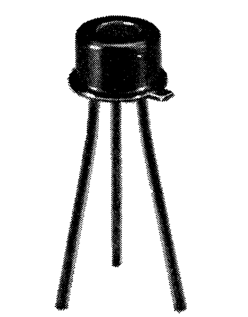


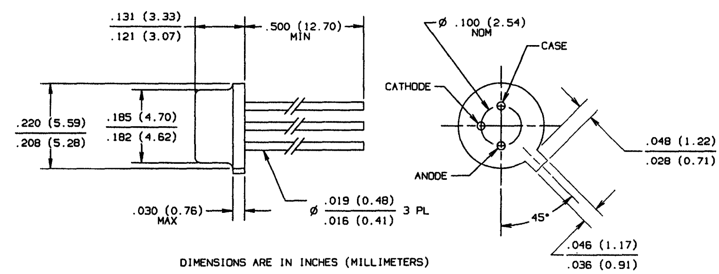


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability
Fiber Optic GaAlAs High Speed LED
Types OMF340TX, OMF340TXV





Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF340 LED provides fiber optic users high coupled power and wide bandwidth in an easily mounted package.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50μm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF340TX/TXV**
50/125μm	Graded	0.20	25μW
62.5/125μm	Graded	0.28	45μW
100/140μm	Graded	0.29	125μW
200/300μm*	Step	0.41	475μW

*PCS - Plastic Clad Silica

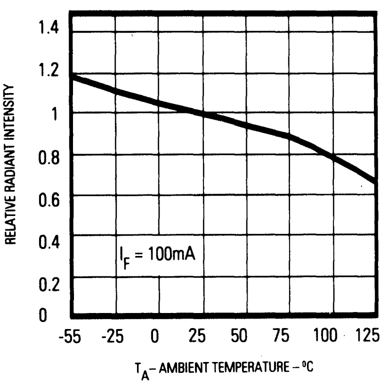
Types OMF340TX, OMF340TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

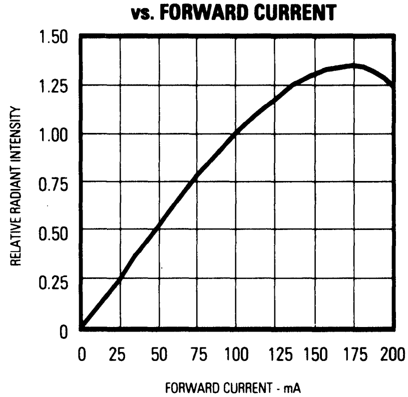
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	20.0	25.0		μW	I_F = 100mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50mA
t_r	Output Rise Time		4.5	6.0	ns	I_F = 100mA, 10%-90%(5)
t_f	Output Fall Time		4.5	6.0	ns	I_F = 100mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

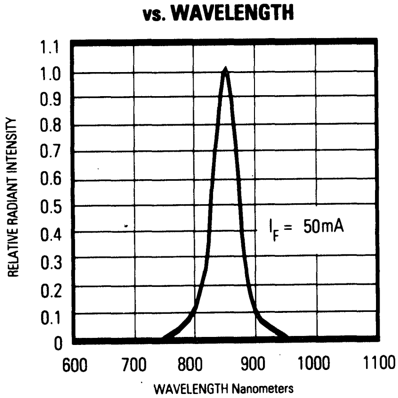
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



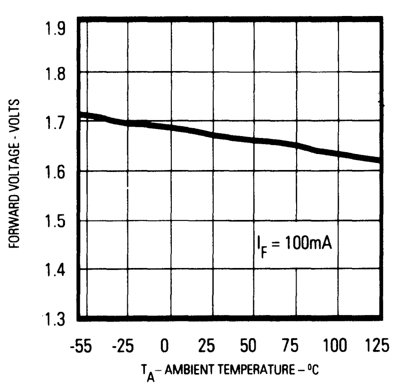
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

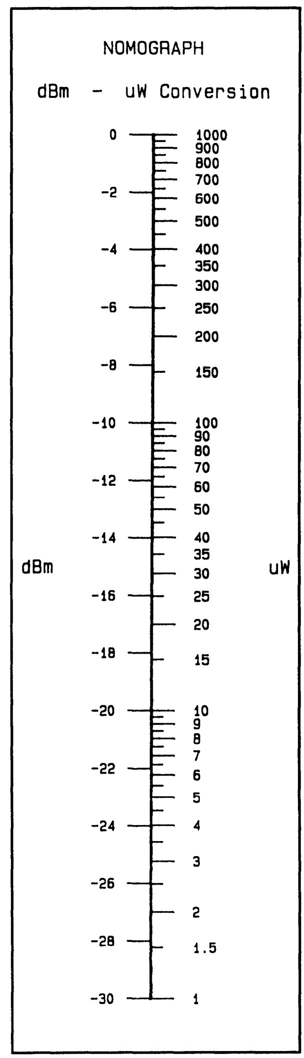


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

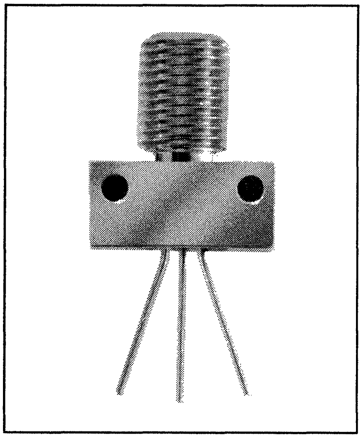


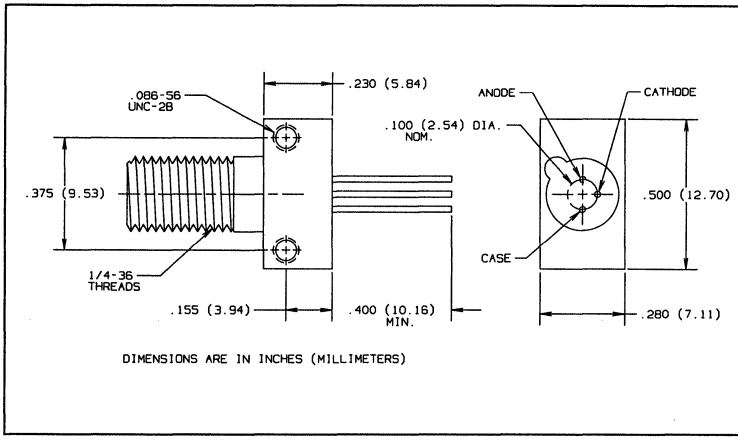


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability
Fiber Optic GaAlAs High Speed LED in SMA Receptacle
Types OMF341TX, OMF341TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular SMA style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF341 consists of a hermetic LED pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage.. 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron].. 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF341TX/TXV**
50/125µm	Graded	0.20	25µW
62.5/125µm	Graded	0.28	45µW
100/140µm	Graded	0.29	125µW
200/300µm*	Step	0.41	475µW

*PCS - Plastic Clad Silica

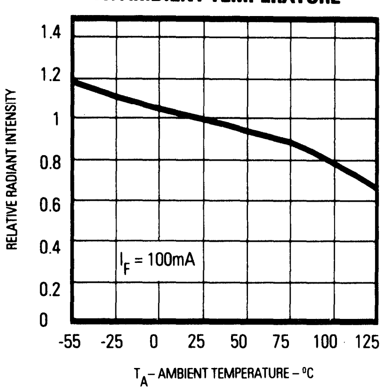
Types OMF341TX, OMF341TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

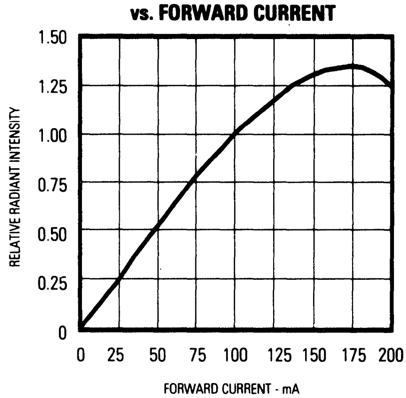
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	20.0	25.0		µW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		4.5	6.0	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		4.5	6.0	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

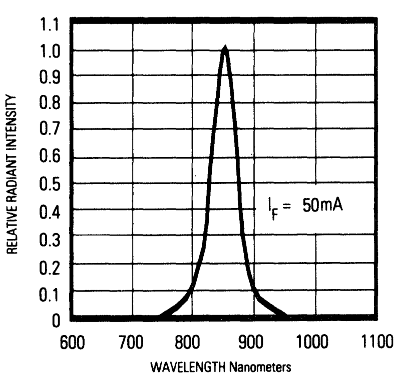
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



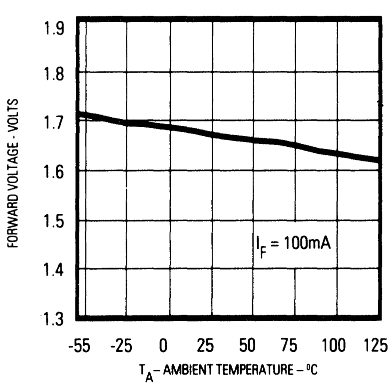
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

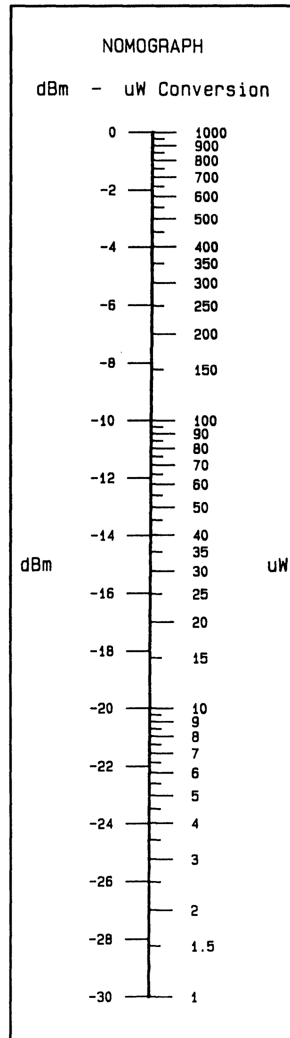


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

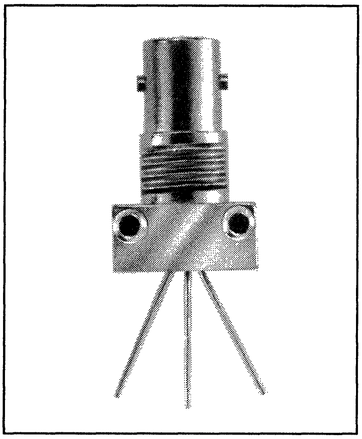


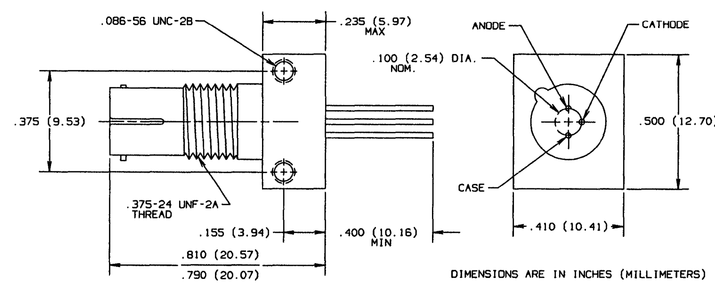


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability
Fiber Optic GaAlAs High Speed LED in ST* Compatible Receptacle
Types OMF342TX, OMF342TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF342 consists of a hermetic LED pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50μm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF342TX/TXV**
50/125μm	Graded	0.20	25μW
62.5/125μm	Graded	0.28	45μW
100/140μm	Graded	0.29	125μW
200/300μm*	Step	0.41	475μW

*PCS - Plastic Clad Silica

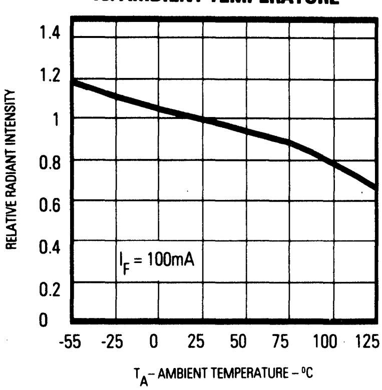
Types OMF342TX, OMF342TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

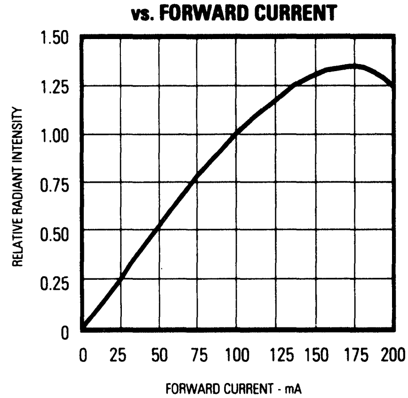
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	20.0	25.0		μW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		4.5	6.0	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		4.5	6.0	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

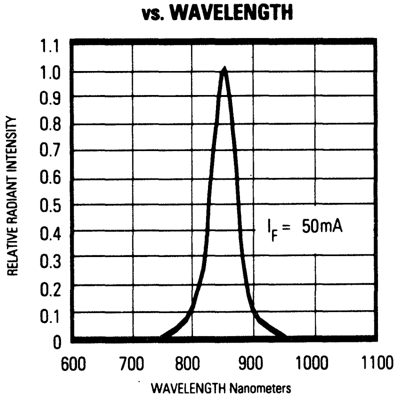
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



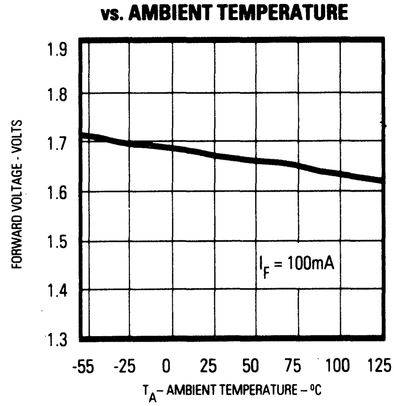
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

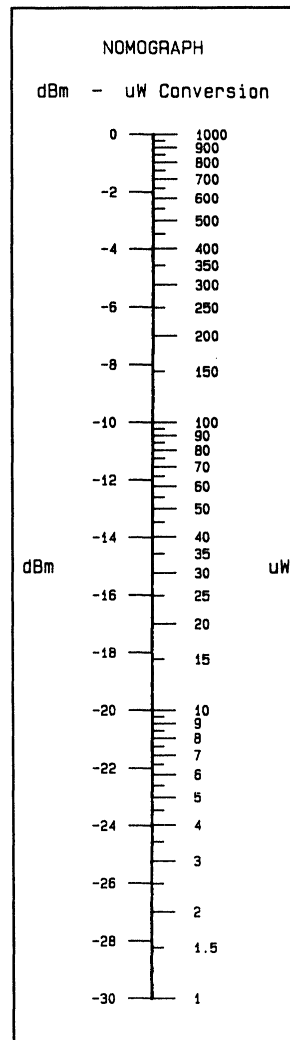


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



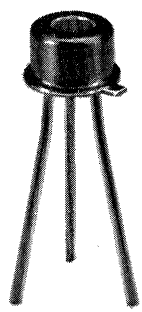
FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

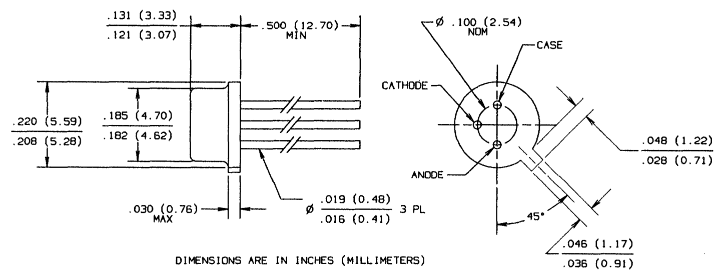




OPTEK

High Reliability
Fiber Optic GaAlAs High Speed LED Types OMF345TX, OMF345TXV





Features

- High radiant output for fiber optic applications
- High speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF345 LED provides fiber optic users with high coupled power and wide bandwidth in an easily mounted hermetic package.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current . . . . 100mA(4)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF345TX/TXV**
50/125µm	Graded	0.20	25µW
62.5/125µm	Graded	0.28	45µW
100/140µm	Graded	0.29	125µW
200/300µm*	Step	0.41	475µW

*PCS - Plastic Clad Silica

Types OMF345TX, OMF345TXV

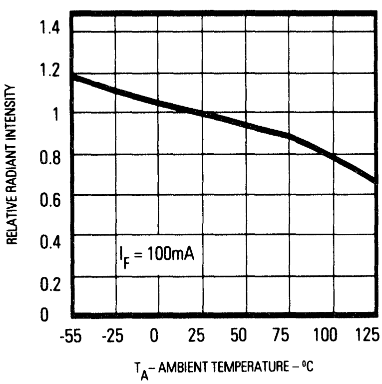
Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	20.0	25.0		µW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		3.5	4.5	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		3.5	4.5	ns	I_F = 100 mA, 90%-10%(5)

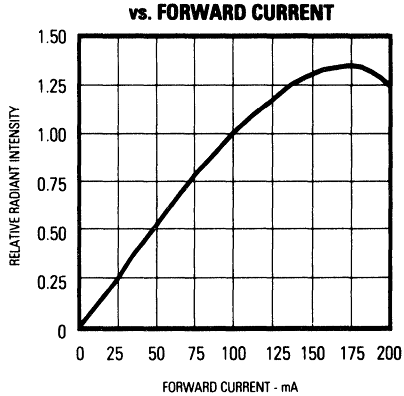
HI REL FIBER OPTICS

TYPICAL PERFORMANCE CURVES

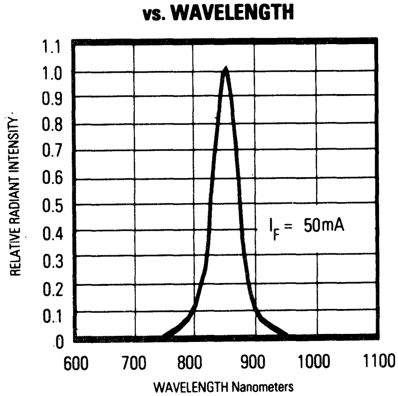
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



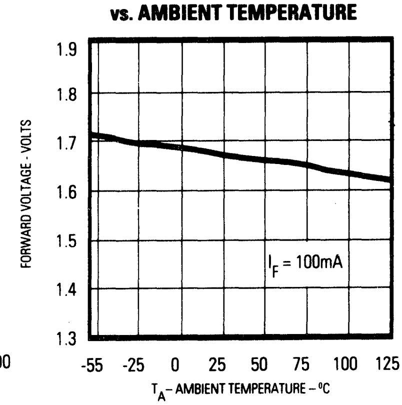
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT

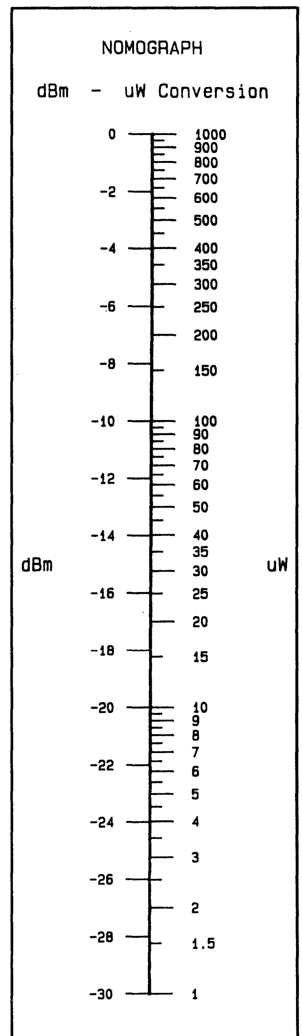


RELATIVE RADIANT INTENSITY vs. WAVELENGTH



FORWARD VOLTAGE vs. AMBIENT TEMPERATURE

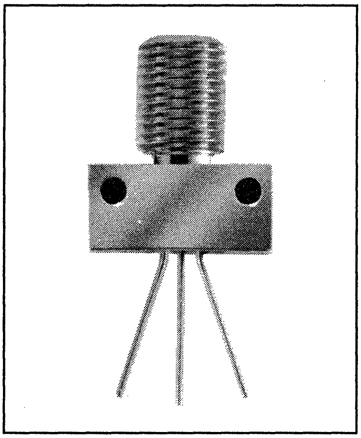


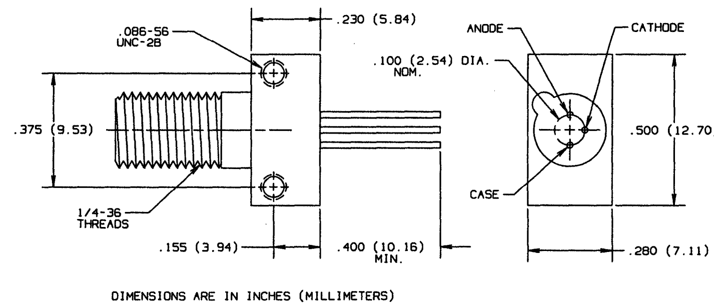


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability
Fiber Optic GaAIAs High Speed LED in SMA Receptacle
Types OMF346TX, OMF346TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF346 consists of a hermetic LED pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°Cto +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50µm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (µW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF346TX/TXV**
50/125µm	Graded	0.20	25µW
62.5/125µm	Graded	0.28	45µW
100/140µm	Graded	0.29	125µW
200/300µm*	Step	0.41	475µW

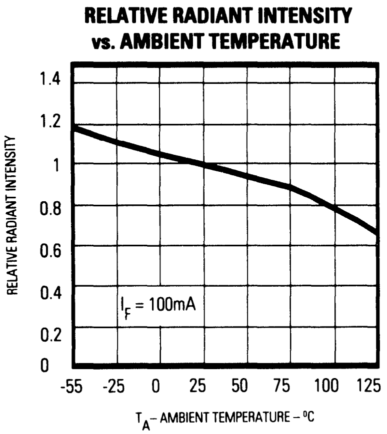
*PCS - Plastic Clad Silica

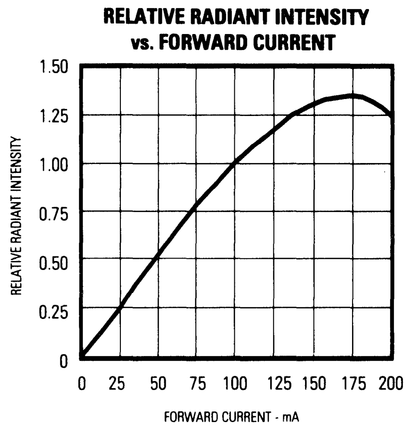
Types OMF346TX, OMF346TXV

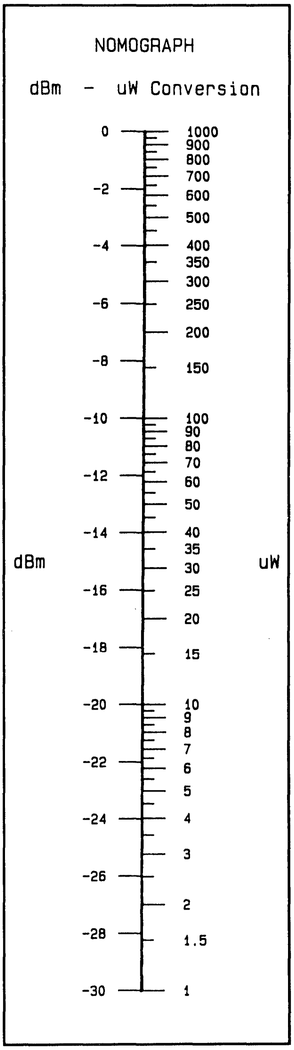
Electrical Characteristics (T_A = 25°C unless otherwise noted)

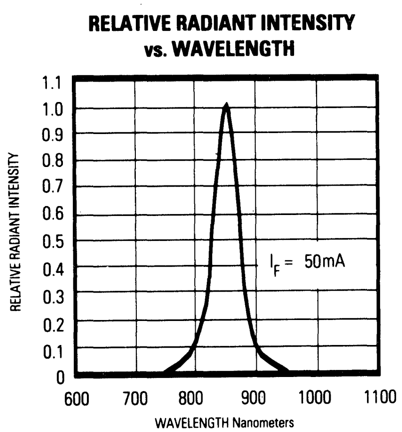
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	20.0	25.0		µW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		3.5	4.5	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		3.5	4.5	ns	I_F = 100 mA, 90%-10%(5)

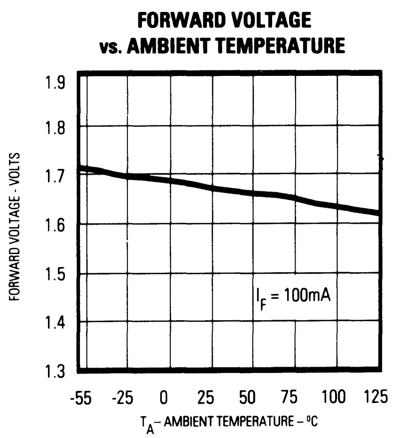
TYPICAL PERFORMANCE CURVES







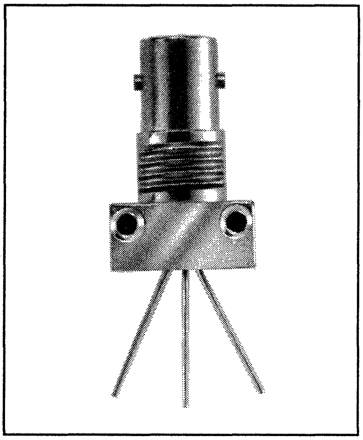


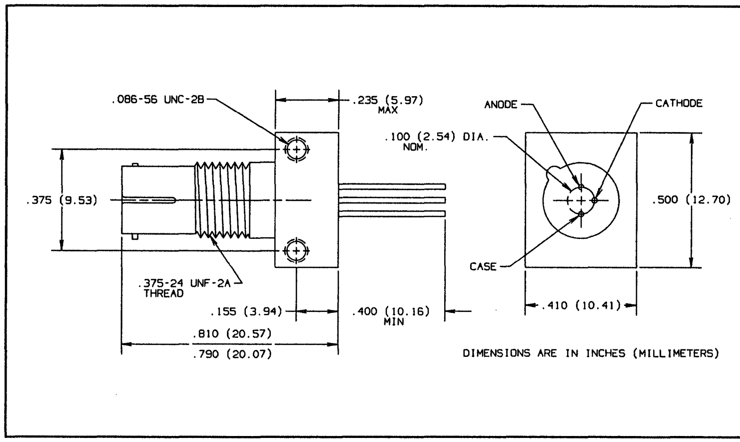


HI REL FIBER OPTICS

OPTEK

High Reliability
Fiber Optic GaAlAs High Speed LED in ST* Compatible Receptacle
Types OMF347TX, OMF347TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- High Speed
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF347 consists of a hermetic LED pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and a dust cap.

The LEDs are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 1.0V
Continuous Forward Current .... 100mA(4)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(1)

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(2) Graded index fiber 50μm core: N.A. = 0.20.
(3) To convert radiant power output to dBm, use the following expression: -dBm = 10 log (μW/1000).
(4) Derate linearly @ 1.0mA/°C above 25°C.
(5) Prebias @ 5mA current.

TYPICAL COUPLED POWER into OPTICAL FIBER

Typical Coupled Power I_F = 100 mA @ 25°C			
Fiber	**Refractive Index**	**N.A.**	**OMF347TX/TXV**
50/125μm	Graded	0.20	25μW
62.5/125μm	Graded	0.28	45μW
100/140μm	Graded	0.29	125μW
200/300μm*	Step	0.41	475μW

*PCS - Plastic Clad Silica

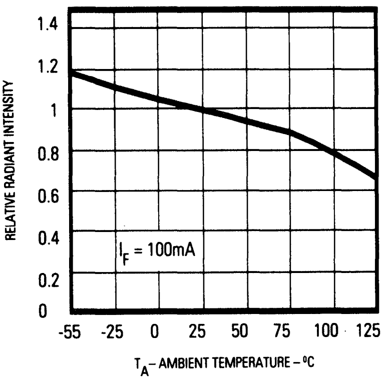
Types OMF347TX, OMF347TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

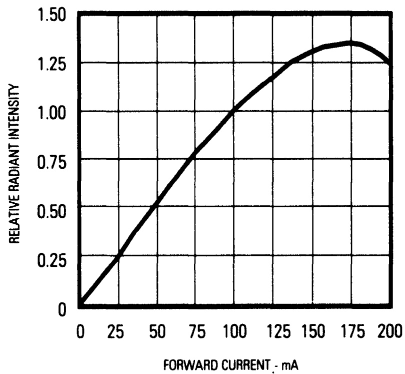
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
P_O	Radiant Power Output	20.0	25.0		μW	I_F = 100 mA(2)
V_F	Forward Voltage		1.7	2.0	V	I_F = 100 mA
λp	Peak Output Wavelength	830	850	870	nm	I_F = 50 mA
B	Spectral Bandwidth Between Half Power Points		35		nm	I_F = 50 mA
t_r	Output Rise Time		3.5	4.5	ns	I_F = 100 mA, 10%-90%(5)
t_f	Output Fall Time		3.5	4.5	ns	I_F = 100 mA, 90%-10%(5)

TYPICAL PERFORMANCE CURVES

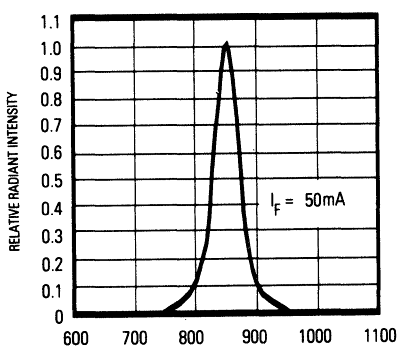
RELATIVE RADIANT INTENSITY vs. AMBIENT TEMPERATURE



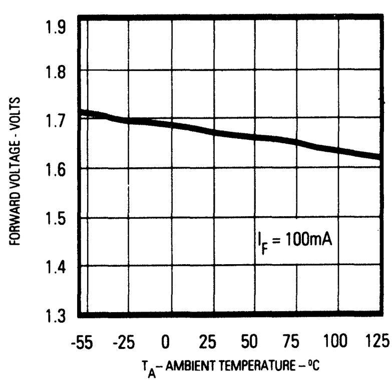
RELATIVE RADIANT INTENSITY vs. FORWARD CURRENT



RELATIVE RADIANT INTENSITY vs. WAVELENGTH

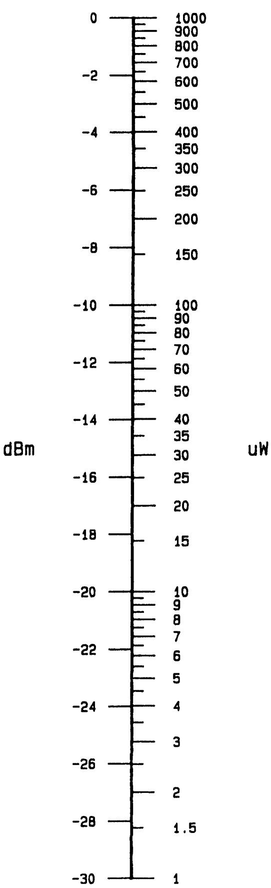


FORWARD VOLTAGE vs. AMBIENT TEMPERATURE



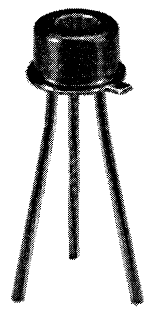
NOMOGRAPH

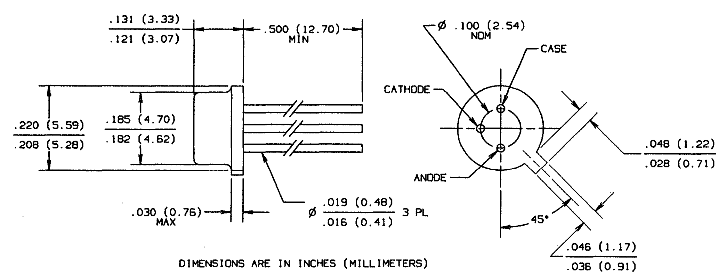
dBm - uW Conversion



Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

High Reliability
Fiber Optic High Speed PIN Photodiode
Type OMF420TX, OMF420TXV





Features

- Electrically isolated TO-46 Package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 200 micron fiber
- Processing patterned after JANTX or JANTXV of MIL-S-19500

Description

The OMF420 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optics applications. It offers fast response at moderate bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

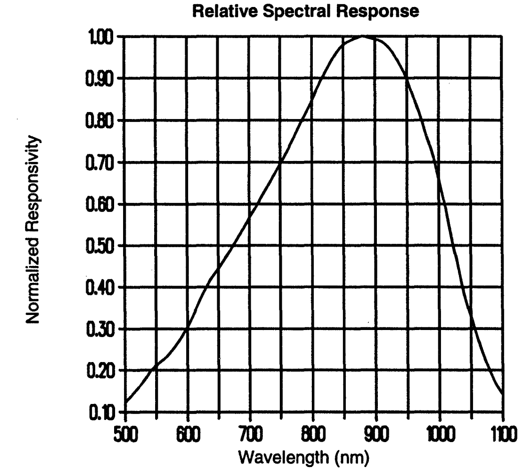
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) R_L = 50 Ω 10%-90%.

Typical Performance Curves

Relative Spectral Response

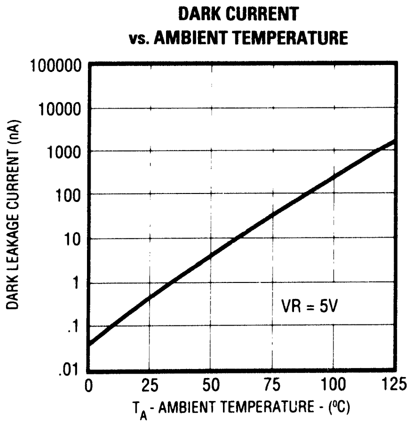


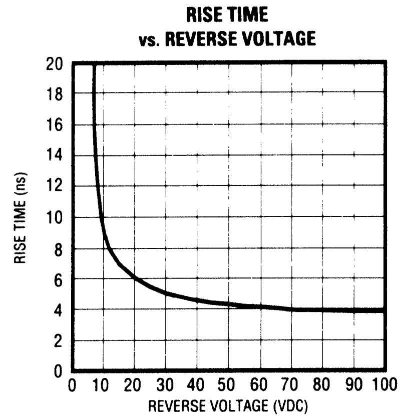
Type OMF420TX, OMF420TXV

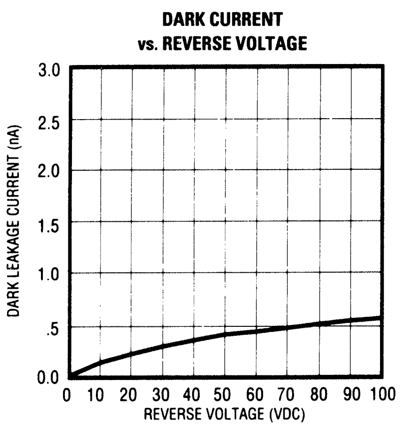
Electrical Characteristics (T_A = 25°C unless otherwise noted)

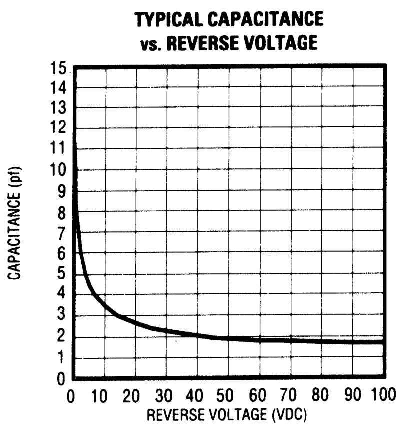
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0 V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0 V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0 V (4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0 V
FoV	Field of View		80		Deg.	

Typical Performance Curves









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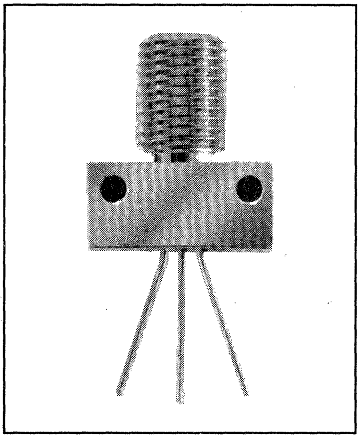
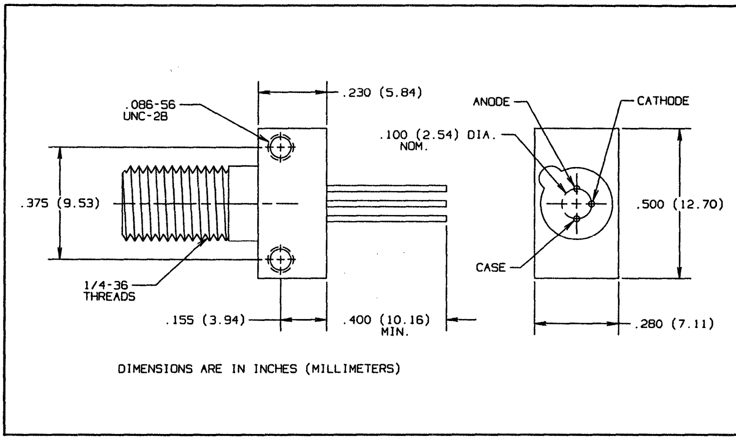
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OMF421TX/TXV
April 1993

OPTEK

High Reliability
Fiber Optic High Speed PIN Photodiode in SMA Receptacle
Type OMF421TX, OMF421TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF421 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

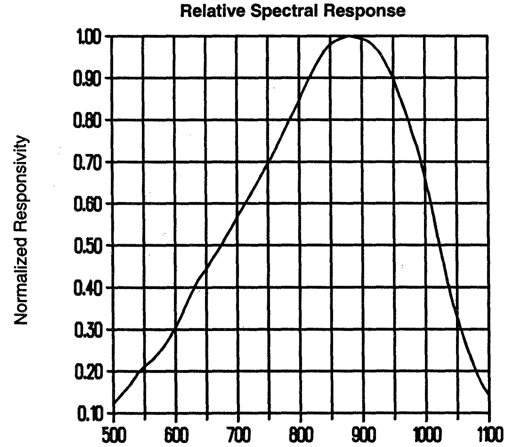
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) R_L = 50 Ω 10%-90%.

Typical Performance Curves

Relative Spectral Response



Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

Type OMF421TX, OMF421TXV

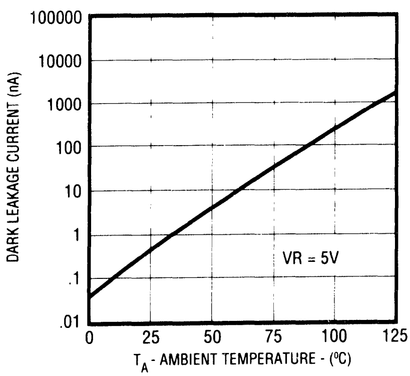
Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	$V_R = 5.0\ V^{(3)}$
I_D	Dark Current		0.1	5.0	nA	$V_R = 5.0\ V$
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	$V_R = 15.0\ V^{(4)}$
C_T	Total Capacitance		3.0		pF	$V_R = 20.0\ V$

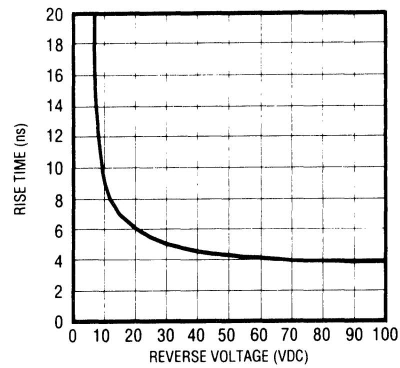
HI REL FIBER OPTICS

Typical Performance Curves

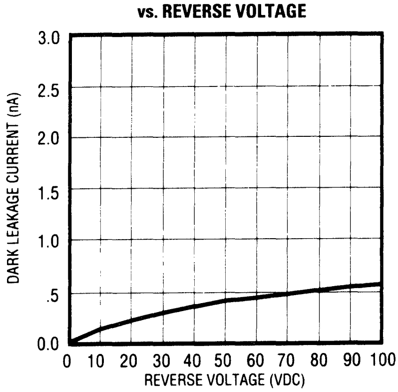
DARK CURRENT vs. AMBIENT TEMPERATURE



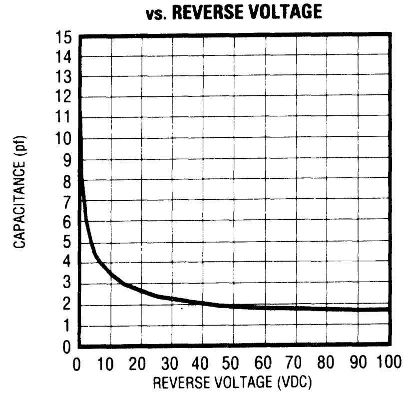
RISE TIME vs. REVERSE VOLTAGE



DARK CURRENT vs. REVERSE VOLTAGE

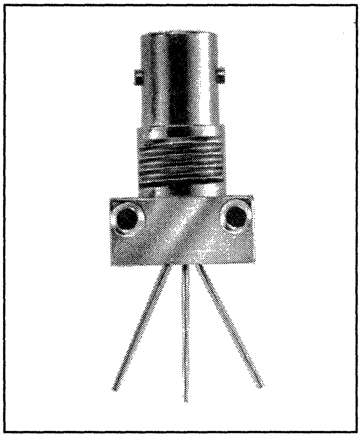


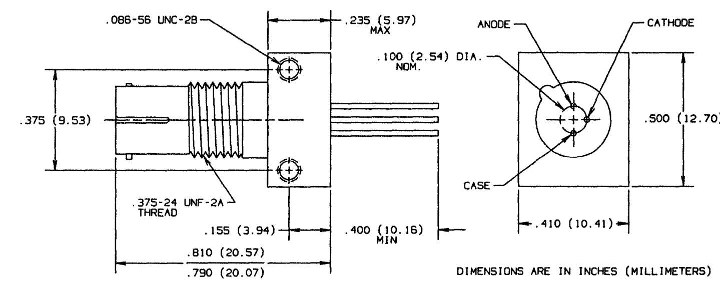
TYPICAL CAPACITANCE vs. REVERSE VOLTAGE



OPTEK

High Reliability
Fiber Optic High Speed PIN Photodiode in ST* Compatible Receptacle
Type OMF422TX, OMF422TXV





Features

- Component pre-mounted and ready for use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF422 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 200/230 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

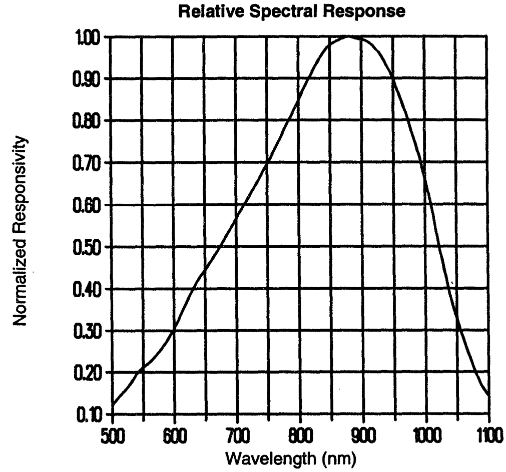
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.
(4) R_L = 50 Ω 10%-90%.

Typical Performance Curves

Relative Spectral Response

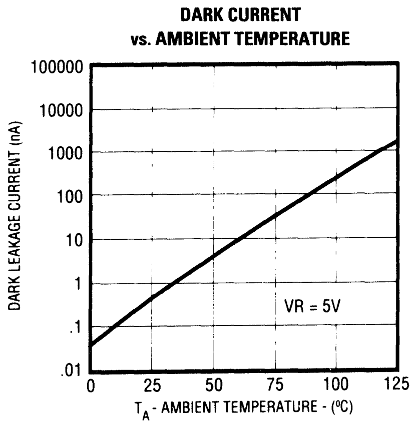


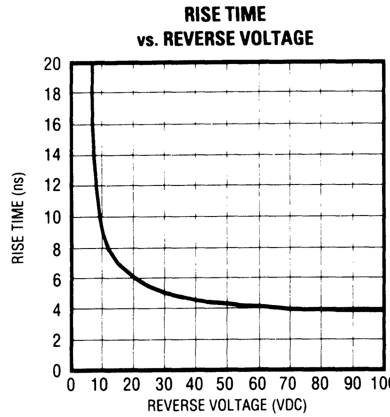
Type OMF422TX, OMF422TXV

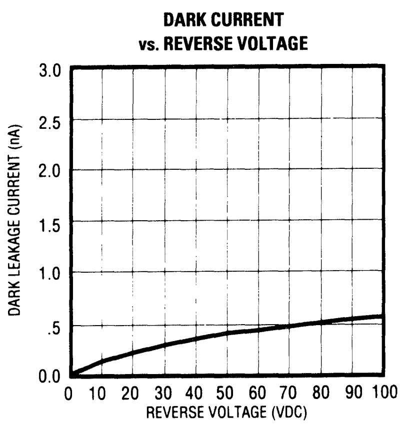
Electrical Characteristics (T_A = 25°C unless otherwise noted)

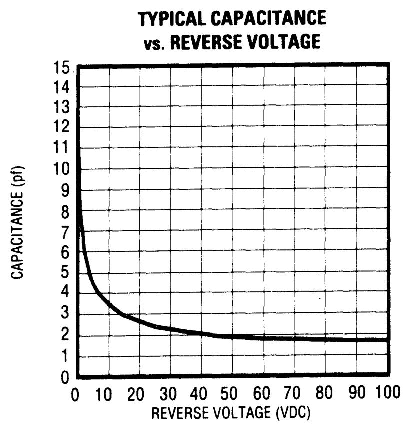
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0 V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0 V
λp	Peak Response Wavelength		880		nm	
t_r	Output Rise Time		6.0		ns	V_R = 15.0 V (4)
C_T	Total Capacitance		3.0		pF	V_R = 20.0 V

Typical Performance Curves







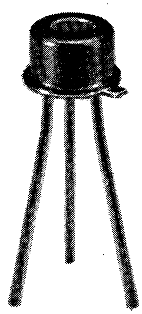


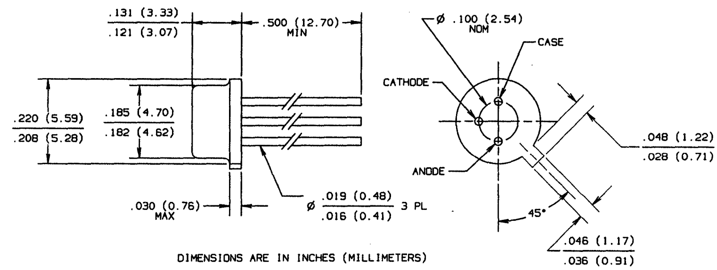
HI REL FIBER OPTICS

Product Bulletin OMF430TX/TXV
April 1993

OPTEK

High Reliability
Fiber Optic High Speed PIN Photodiode
Type OMF430TX, OMF430TXV





Features

- Electrically isolated TO-46 Package
- High speed, low capacitance
- Optimized for fiber optic applications using 50 to 100 micron fiber
- Processing patterned after JANTX or JANTXV of MIL-S-19500

Description

The OMF430 is a low noise silicon PIN photodiode mounted in a special TO-46 package for fiber optics applications. It offers fast response at low bias and is compatible with LED and laser diode sources in the 800-900 nm wavelength region. Low capacitance improves signal to noise performance in typical short haul LAN applications.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW[1]
Storage Temperature Range . . . . -65°C to +150°C
Operating Temperature Range . . . . -55°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C[2]

Notes:
(1) Derate linearly @ 2.0 mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

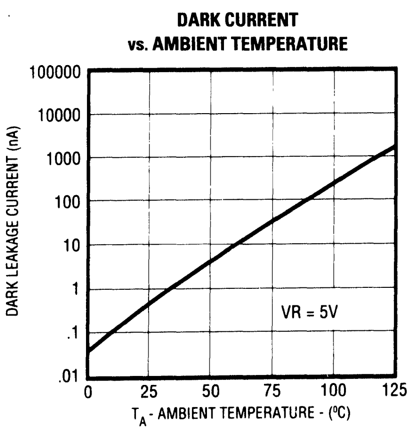
Type OMF430TX, OMF430TXV

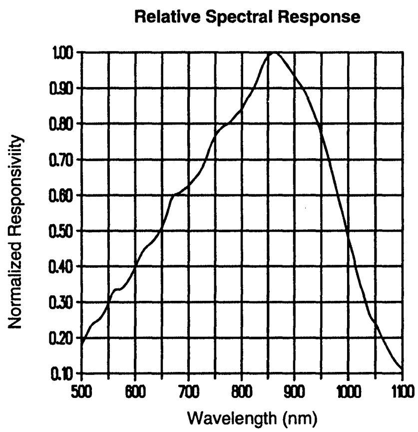
Electrical Characteristics (T_A = 25°C unless otherwise noted)

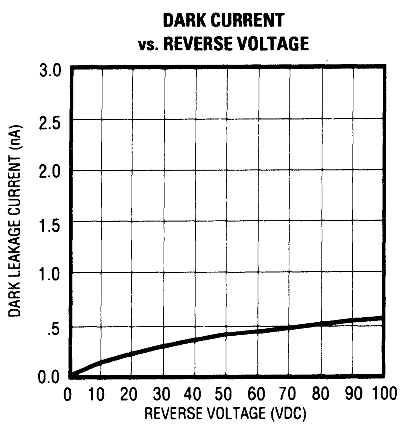
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
tr	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V
FoV	Field of View		80		Deg.	

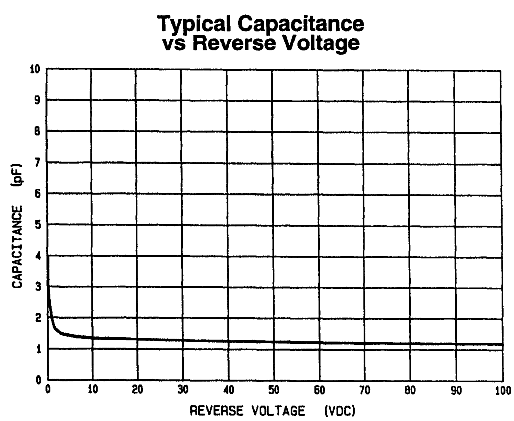
HI REL
FIBER OPTICS

Typical Performance Curves





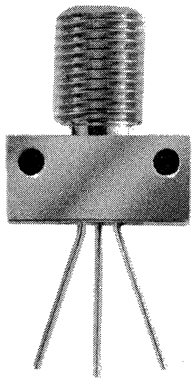


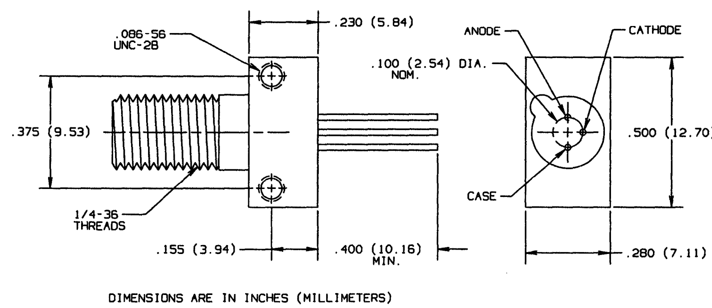


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability
Fiber Optic High Speed PIN Photodiode in SMA Receptacle
Type OMF431TX, OMF431TXV





Features

- Component pre-mounted and ready to use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Electrically isolated from case
- Processing patterned after JANTX or JANTXV of MIL-S-19500

Description

The OMF431 consists of a hermetic PIN photodiode pre-mounted and aligned in an SMA receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation .... 200mW(1)
Storage Temperature Range .... -55°C to +150°C
Operating Temperature Range .... -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] .... 240°C(2)

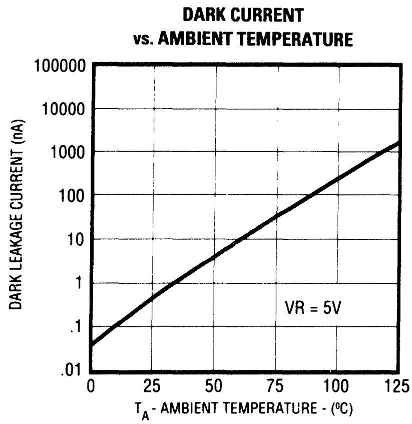
Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 μW optical power @ 850 nm. Responsivity levels apply to 50 μm, 62.5 μm and 100 μm core optical fibers.

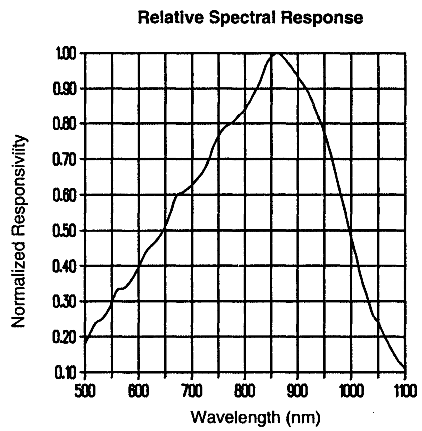
Type OMF431TX, OMF431TXV

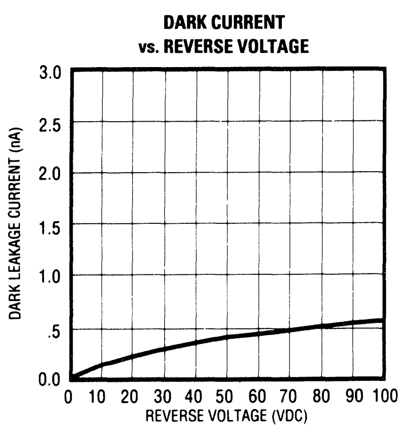
Electrical Characteristics (T_A = 25°C unless otherwise noted)

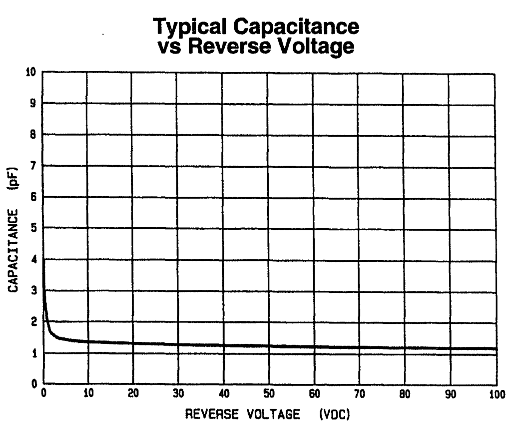
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V

Typical Performance Curves







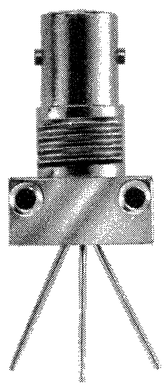


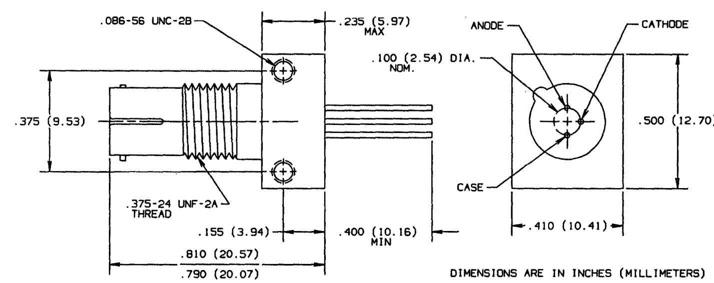
HI REL FIBER OPTICS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OMF432TX/TXV
April 1993

High Reliability
Fiber Optic High Speed PIN Photodiode in ST* Compatible Receptacle
Type OMF432TX, OMF432TXV





Features

- Component pre-mounted and ready for use
- Pre-tested with fiber to assure performance
- Popular style receptacle
- Electrically isolated from case
- Processing patterned after JANTX and JANTXV of MIL-S-19500

Description

The OMF432 consists of a hermetic PIN photodiode pre-mounted and aligned in an ST* receptacle. This configuration is designed for PC board or panel mounting. Includes lock washer and jam nut, two 2-56 screws, and dust cap.

The PIN Photodiodes are designed to interface with multimode optical fibers from 50/125 to 100/140 microns.

The TX and TXV suffix indicates that the device is processed to Optek's screening and conformance test plan patterned after MIL-S-19500.

*ST is a registered trademark of AT&T

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Reverse Voltage 100VDC
Continuous Power Dissipation . . . . 200mW(1)
Storage Temperature Range . . . . -55°C to +150°C
Operating Temperature Range . . . . -40°C to +125°C
Lead Soldering Temperature [1/16 inch (1.6mm) from case for 5 sec. with soldering iron] . . . . 240°C(2)

Notes:
(1) Derate linearly @ 2.0mW/°C above 25°C.
(2) RMA flux is recommended. Duration can be extended to 10 sec. max when flow soldering.
(3) Test @ V_R = 5V with 50/125 micron, 0.20 N.A. fiber, @ 10 µW optical power @ 850 nm. Responsivity levels apply to 50 µm, 62.5 µm and 100 µm core optical fibers.

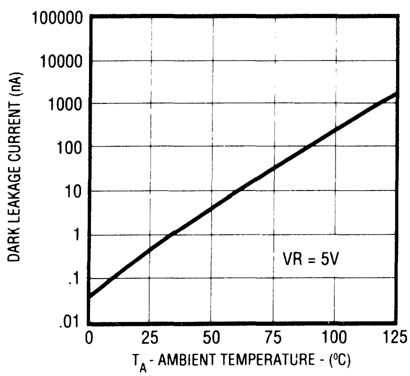
Type OMF432TX, OMF432TXV

Electrical Characteristics (T_A = 25°C unless otherwise noted)

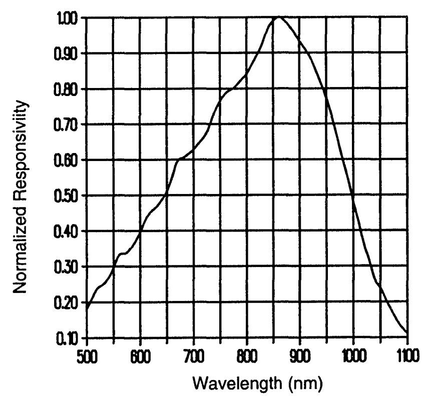
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
R	Flux Responsivity	0.45	0.55		A/W	V_R = 5.0V(3)
I_D	Dark Current		0.1	5.0	nA	V_R = 5.0V
λp	Peak Response Wavelength		860		nm	
t_r	Output Rise Time		0.6		ns	V_R = 50.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		1.0		ns	V_R = 15.0V, R_L = 50Ω, 10%-90%
t_r	Output Rise Time		2.0		ns	V_R = 5.0V, R_L = 50Ω, 10%-90%
C_T	Total Capacitance		1.5	2.0	pF	V_R = 5.0V

Typical Performance Curves

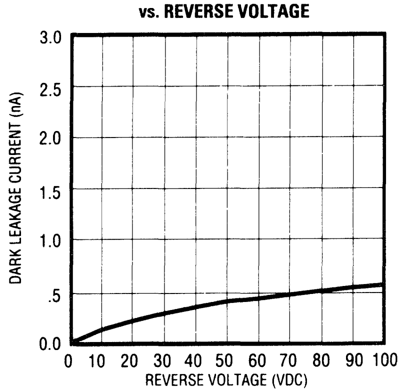
DARK CURRENT vs. AMBIENT TEMPERATURE



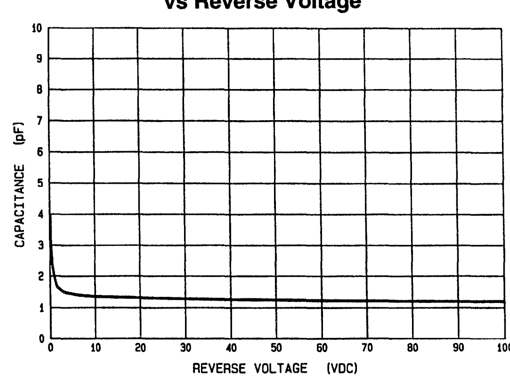
Relative Spectral Response



DARK CURRENT vs. REVERSE VOLTAGE



Typical Capacitance vs Reverse Voltage



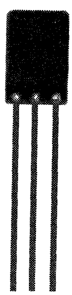
OPTEK TECHNOLOGY, INC.

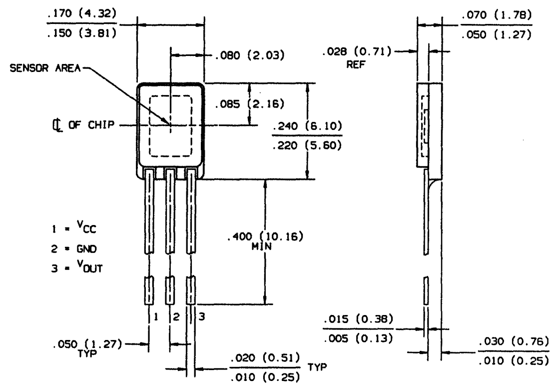
HI-REL HALL EFFECT SENSORS

HI REL HALL EFFECT

Product Bulletin OMH090
January 1995

High Reliability Hallogic™ Hall Effect Sensor
Types OMH090B, OMH090S





Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

Description

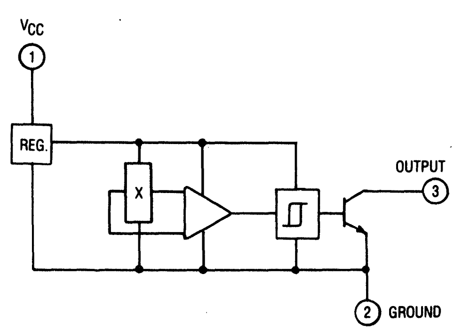
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH090B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH090S is patterned after class S.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Functional Block Diagram



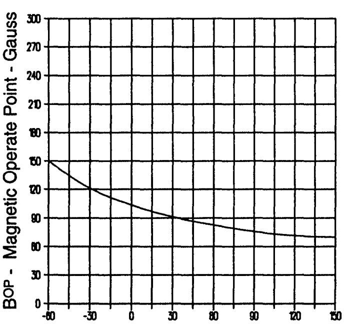
Types OMH090B, OMH090S

Electrical Characteristics (T_A = 25°C, V_{CC} = 4.5V to 24V unless otherwise noted)

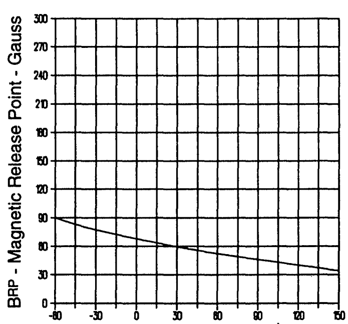
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	50	90	180	Gauss	
B_{RP}	Magnetic Release Point	30	60	160	Gauss	
B_H	Magnetic Hysteresis	5	30	70	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		125	300	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.50	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

Typical Performance Curves

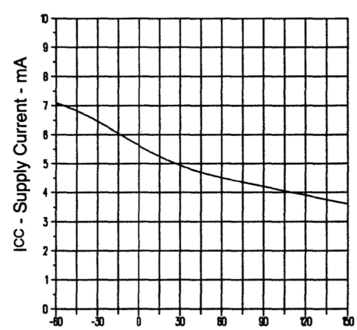
Magnetic Operate Point vs. Ambient Temperature



Magnetic Release Point vs. Ambient Temperature



Supply Current vs. Ambient Temperature



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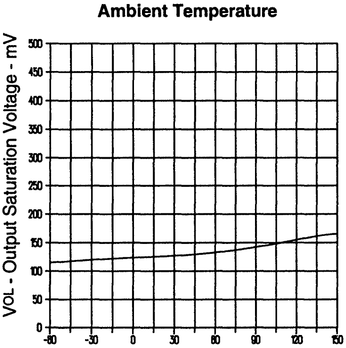
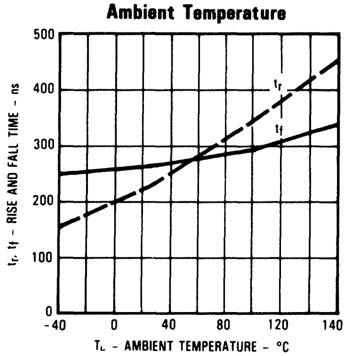
Output Saturation Voltage vs. Ambient Temperature

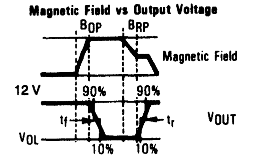


Rise and Fall Time vs Ambient Temperature

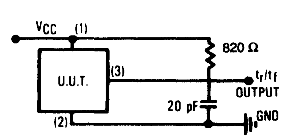


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



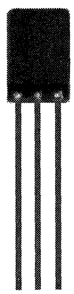
Rise and Fall Time Test Circuit

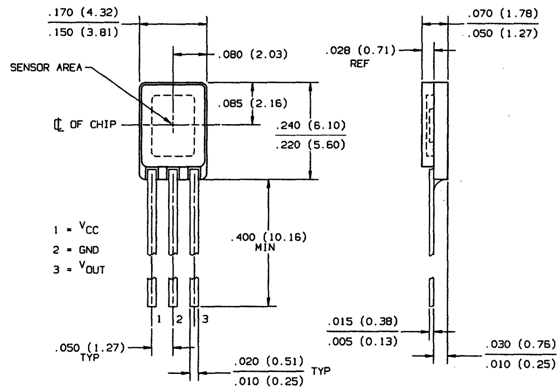


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability Hallogic™ Hall Effect Sensor
Types OMH3019B, OMH3019S





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

Description

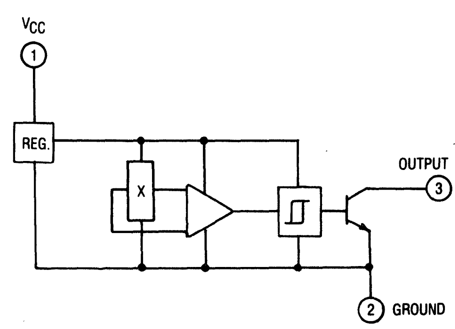
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3019B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3019S is patterned after class S.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Functional Block Diagram



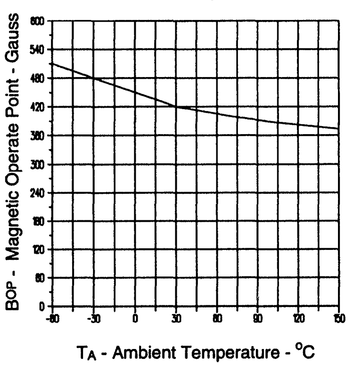
Types OMH3019B, OMH3019S

Electrical Characteristics ($T_A = 25^oC$, V_{CC} = 4.5V to 24VDC unless otherwise noted)

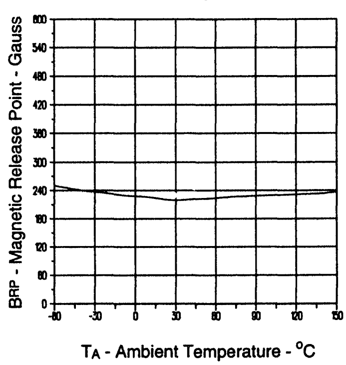
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	175	420	500	Gauss	
B_{RP}	Magnetic Release Point	125	220	420	Gauss	
B_H	Magnetic Hysteresis	30	100	155	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		125	300	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

Typical Performance Curves

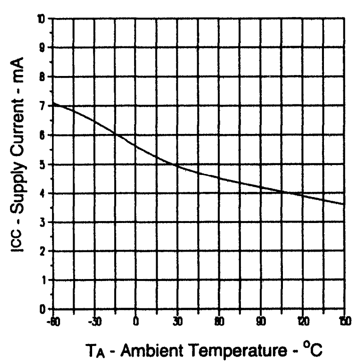
Magnetic Operate Point vs. Ambient Temperature



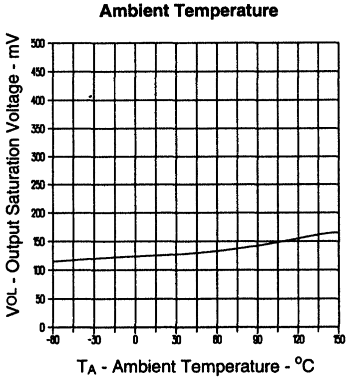
Magnetic Release Point vs. Ambient Temperature



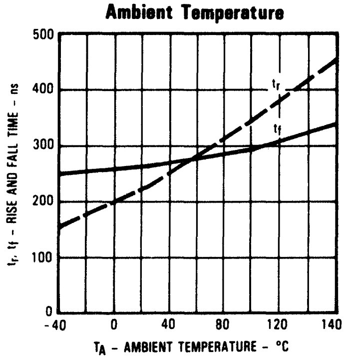
Supply Current vs. Ambient Temperature



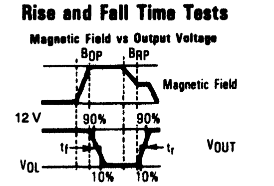
Output Saturation Voltage vs. Ambient Temperature



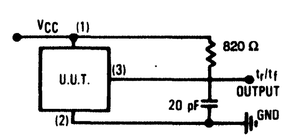
Rise and Fall Time vs Ambient Temperature



Rise and Fall Time Tests



Rise and Fall Time Test Circuit



HI REL
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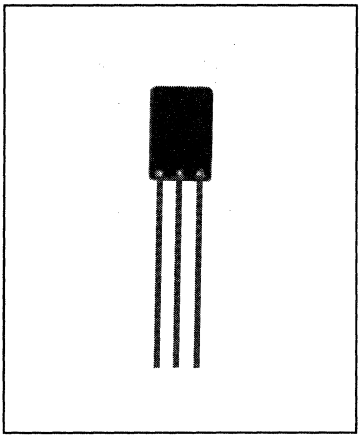
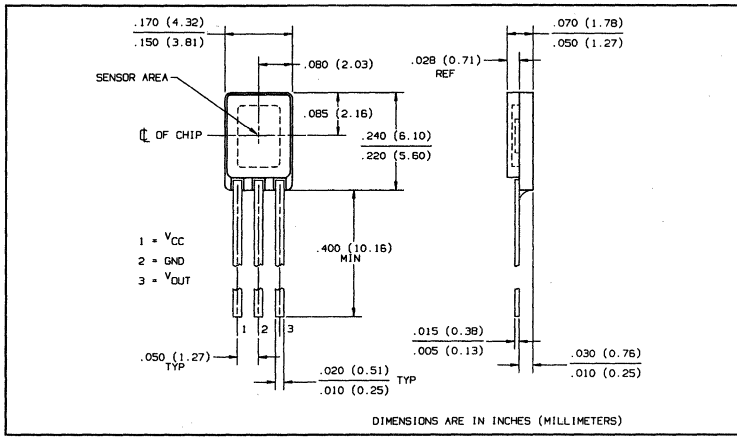
OPTEK

High Reliability Hallogic™ Hall Effect Sensor
Types OMH3020B, OMH3020S





Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

Description

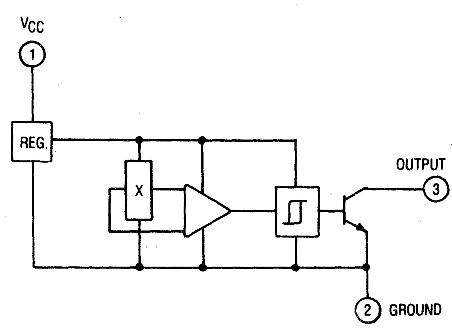
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3020B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3020S is patterned after class S.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Functional Block Diagram



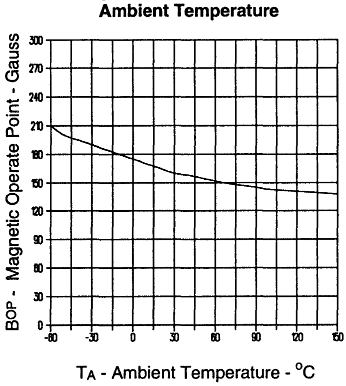
Types OMH3020B, OMH3020S

Electrical Characteristics (V_{CC} = 4.5V to 24VDC, T_A = 25°C unless otherwise noted)

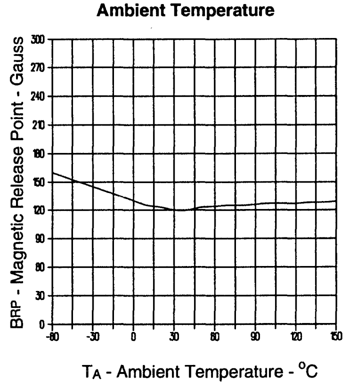
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	70	220	350	Gauss	
B_{RP}	Magnetic Release Point	50	165	330	Gauss	
B_H	Magnetic Hysteresis	15	55	200	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		125	300	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

Typical Performance Curves

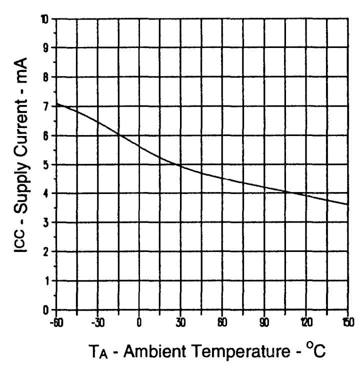
Magnetic Operate Point vs. Ambient Temperature



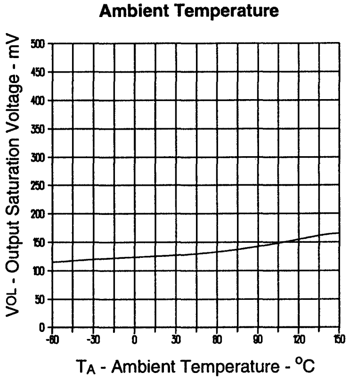
Magnetic Release Point vs. Ambient Temperature



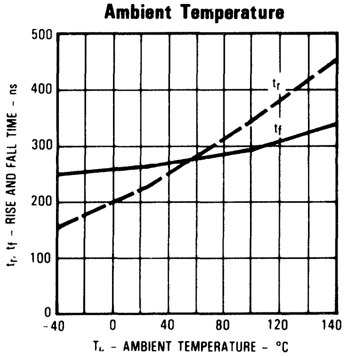
Supply Current vs. Ambient Temperature



Output Saturation Voltage vs. Ambient Temperature

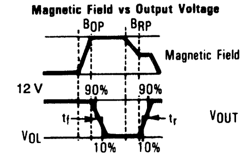


Rise and Fall Time vs Ambient Temperature

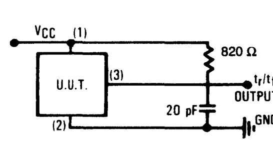


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



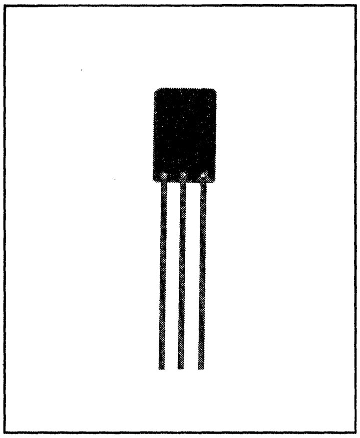
Rise and Fall Time Test Circuit

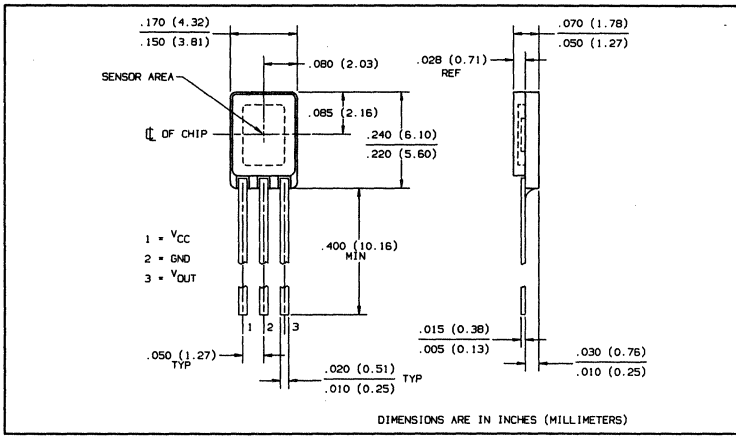


Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPTEK

High Reliability Hallogic™ Hall Effect Sensor
Types OMH3040B, OMH3040S





Features

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Description

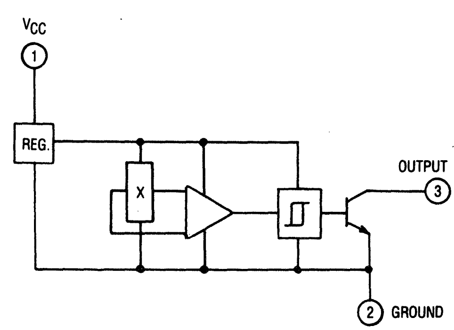
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3040B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3040S is patterned after class S.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Functional Block Diagram



Types OMH3040B, OMH3040S

Electrical Characteristics (V_{CC} = 4.5V to 24V, T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	70	150	200	Gauss	
B_{RP}	Magnetic Release Point	50	115	180	Gauss	
B_H	Magnetic Hysteresis	10	35	60	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		125	300	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

Typical Performance Curves

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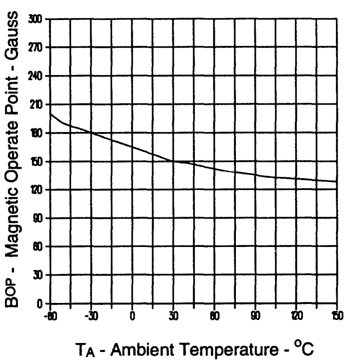
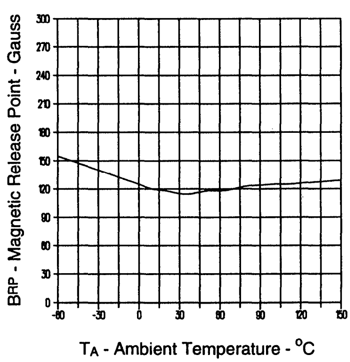
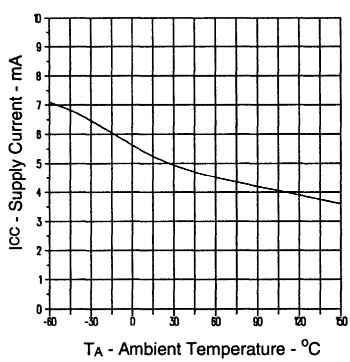
Magnetic Operate Point vs. Ambient Temperature



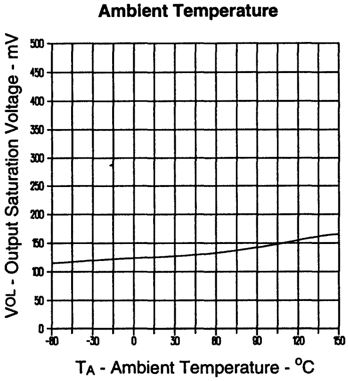
Magnetic Release Point vs. Ambient Temperature



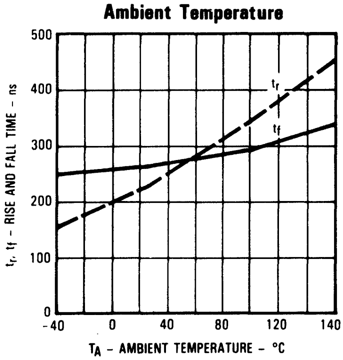
Supply Current vs. Ambient Temperature



Output Saturation Voltage vs. Ambient Temperature

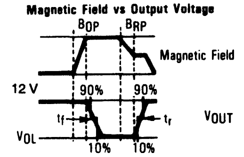


Rise and Fall Time vs Ambient Temperature

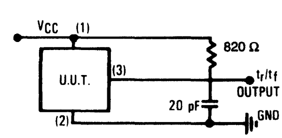


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



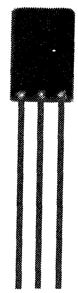
Rise and Fall Time Test Circuit

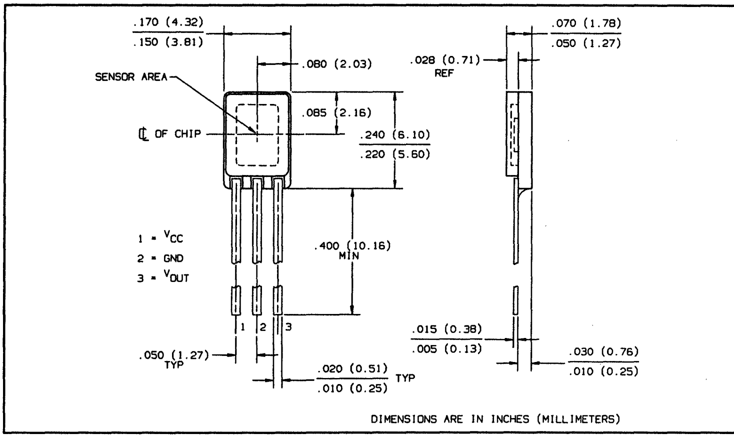


Product Bulletin OMH3075
January 1995

OPTEK

High Reliability Hallogic™ Hall Effect Sensor
Types OMH3075B, OMH3075S (Bi-Polar Latching)





Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

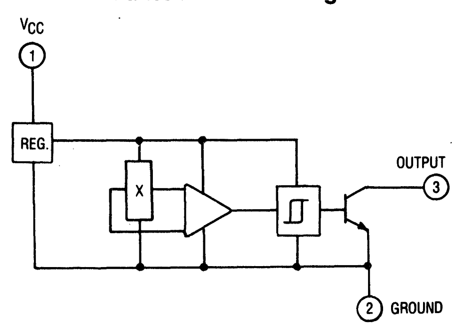
Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Description

The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 100 kHz.

The OMH3075B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3075S is patterned after class S.

Functional Block Diagram



These devices turn on (logic level "0") in the presence of a magnetic south pole and turn off (logic level "1") when subjected to a magnetic north pole. Both magnetic poles are necessary for operation so they are referred to as Bipolar or Latching. This feature makes these sensors ideal for application in brushless DC motors and for use with multiple pole magnets.

Types OMH3075B, OMH3075S

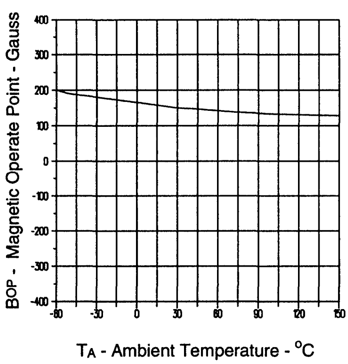
Electrical Characteristics (V_{CC} = 4.5V to 24V, T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	50	150	250	Gauss	
B_{RP}	Magnetic Release Point	-250	-150	-50	Gauss	
B_H	Magnetic Hysteresis	100	300	500	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		190	400	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

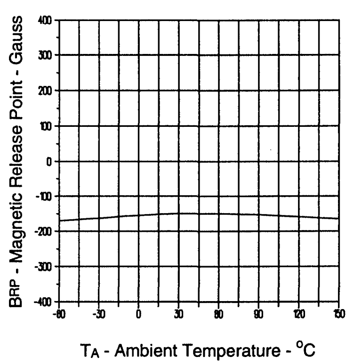
HI REL
HALL EFFECT

Typical Performance Curves

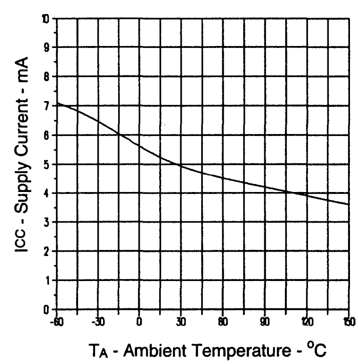
Magnetic Operate Point vs. Ambient Temperature



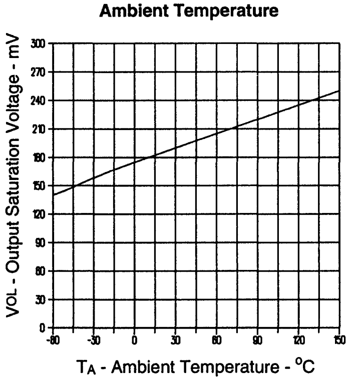
Magnetic Release Point vs. Ambient Temperature



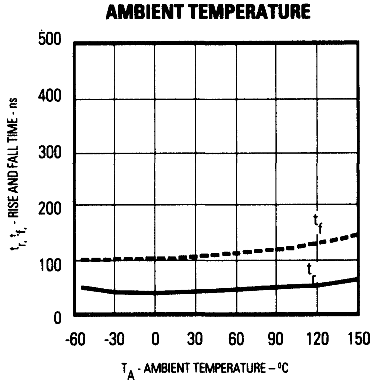
Supply Current vs. Ambient Temperature



Output Saturation Voltage vs. Ambient Temperature

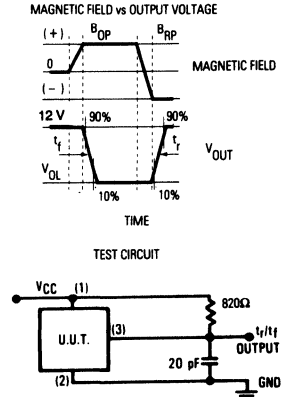


RISE AND FALL TIME vs AMBIENT TEMPERATURE



RISE AND FALL TIME TEST

MAGNETIC FIELD vs OUTPUT VOLTAGE

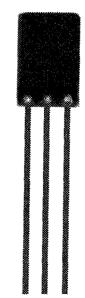


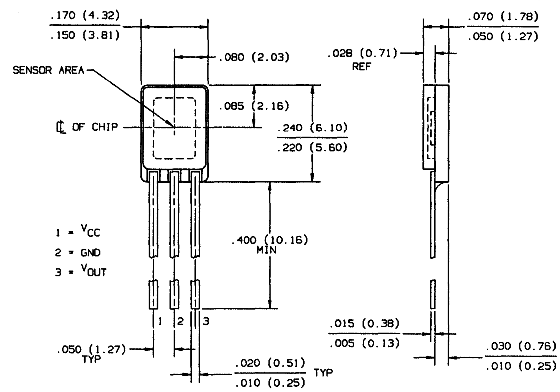
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Product Bulletin OMH3131
January 1995

OPTEK

High Reliability Ultra Sensitive Hallogic™ Sensor Types OMH3131B, OMH3131S





Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

Description

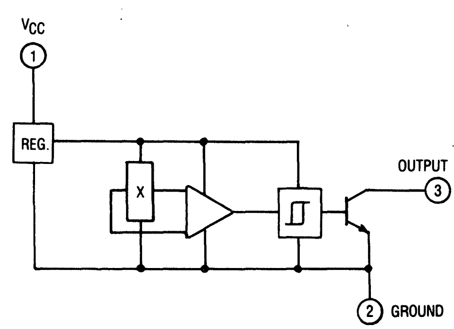
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH3131B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH3131S is patterned after class S.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Functional Block Diagram



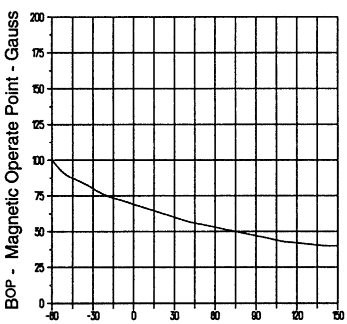
Types OMH3131B, OMH3131S

Electrical Characteristics (V_{CC} = 4.5V to 24V, T_A = 25°C unless otherwise noted)

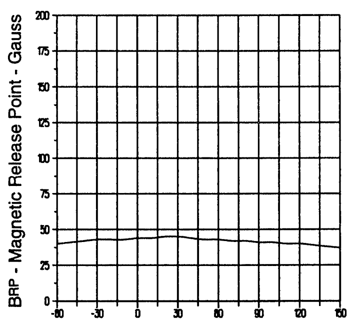
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	20	60	95	Gauss	
B_{RP}	Magnetic Release Point	10	45	85	Gauss	
B_H	Magnetic Hysteresis	5	15	40	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		125	300	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

Typical Performance Curves

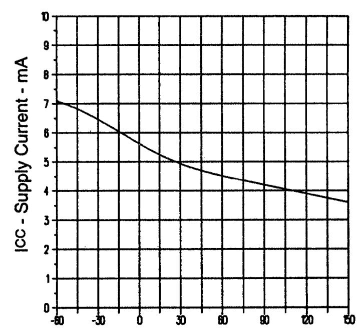
Magnetic Operate Point vs. Ambient Temperature



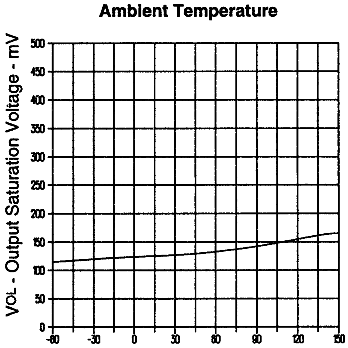
Magnetic Release Point vs. Ambient Temperature



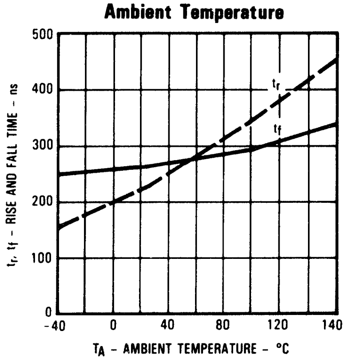
Supply Current vs. Ambient Temperature



Output Saturation Voltage vs. Ambient Temperature

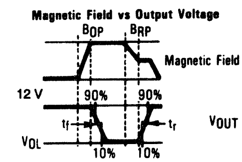


Rise and Fall Time vs Ambient Temperature

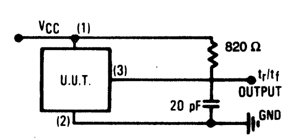


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



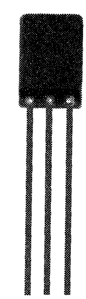
Rise and Fall Time Test Circuit

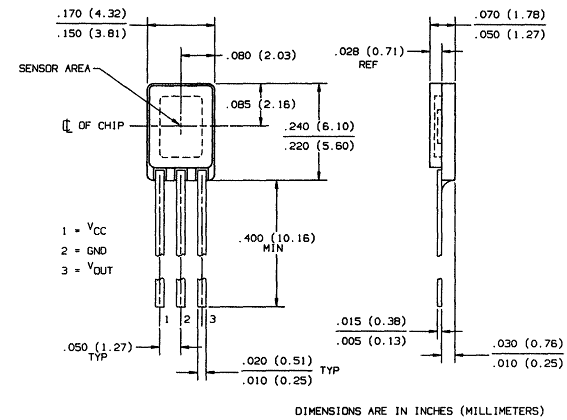


Product Bulletin OMH360
January 1995

OPTEK

High Reliability Hallogic™ Hall Effect Sensor
Types OMH360B, OMH360S





Features

- Lead finish is hot solder dip
- Hermetic ceramic package
- Operates over a broad range of supply voltages
- Excellent temperature stability to operate in harsh environments
- Hall element, linear amplifier, and Schmitt trigger on a single Hallogic™ silicon chip
- Processing patterned after class B or class S of MIL-STD-883
- Suitable for military and space applications

Description

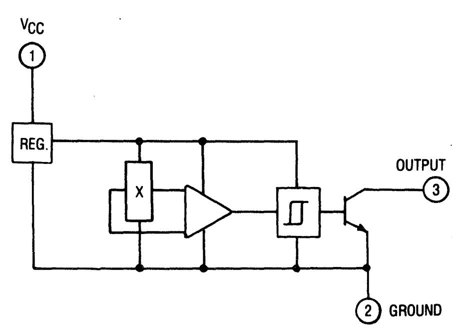
The chip contains a monolithic integrated circuit which incorporates a Hall element, a linear amplifier, and Schmitt trigger on a single silicon chip. Included on-chip is a bandgap voltage regulator to allow operation with a wide range of supply voltages. The device features logic level output and is capable of 25 mA of sink current. Output amplitude is constant at switching frequencies from DC to over 200 kHz.

The OMH360B is processed to Optek's own screening procedures patterned after class B of MIL-STD-883. OMH360S is patterned after class S.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Supply Voltage, V_{CC} 25V
Storage Temperature Range, T_S .... -65°C to +150°C
Operating Temperature Range, T_A .... -55°C to +125°C
Lead Soldering Temperature [1/8 inch (3.2mm) from case for 5 sec. with soldering iron] .... 260°C
Output ON Current, I_{SINK} 25mA
Output OFF Voltage, V_{OUT} 25V
Magnetic Flux Density, B .... Unlimited

Functional Block Diagram



Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

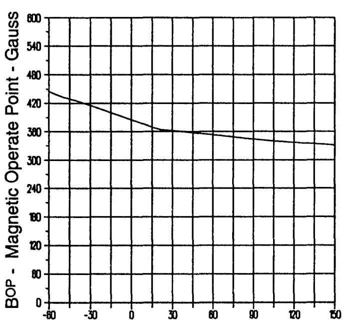
Types OMH360B, OMH360S

Electrical Characteristics (T_A = 25°C, V_{CC} = 4.5V to 24V unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
B_{OP}	Magnetic Operate Point	235	360	465	Gauss	
B_{RP}	Magnetic Release Point	170	280	360	Gauss	
B_H	Magnetic Hysteresis	30	80	150	Gauss	
I_{CC}	Supply Current		5.0	9.0	mA	V_{CC} = 24V, Output On
V_{OL}	Output Saturation Voltage		125	300	mV	V_{CC} = 4.5V, I_{OL} = 15mA
I_{OH}	Output Leakage Current		0.1	10.0	µA	V_{CC} = 24V, V_{OUT} = 24V
t_r	Output Rise Time		0.13	1.00	µs	R_L = 820Ω, C_L = 20pF
t_f	Output Fall Time		0.19	1.00	µs	R_L = 820Ω, C_L = 20pF

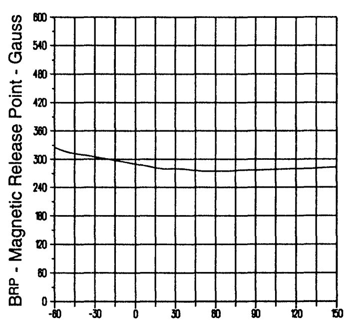
Typical Performance Curves

Magnetic Operate Point vs. Ambient Temperature



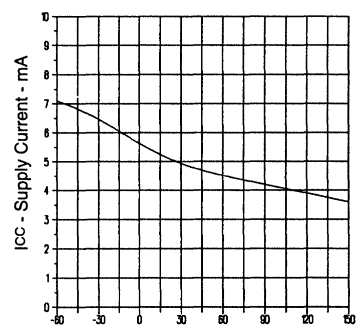
T_A - Ambient Temperature - °C

Magnetic Release Point vs. Ambient Temperature



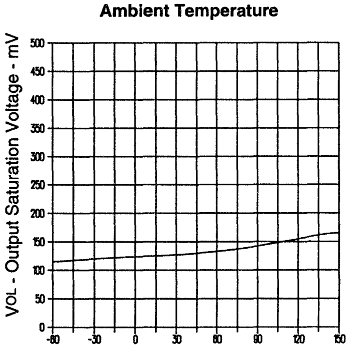
T_A - Ambient Temperature - °C

Supply Current vs. Ambient Temperature



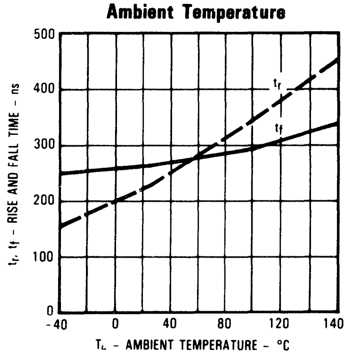
T_A - Ambient Temperature - °C

Output Saturation Voltage vs. Ambient Temperature



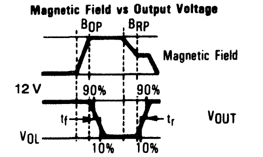
T_A - Ambient Temperature - °C

Rise and Fall Time vs Ambient Temperature

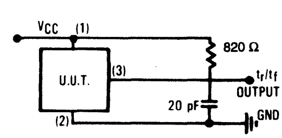


Rise and Fall Time Tests

Magnetic Field vs Output Voltage



Rise and Fall Time Test Circuit



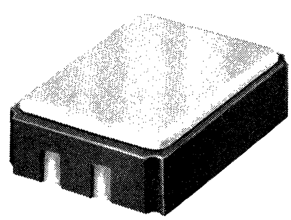
Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

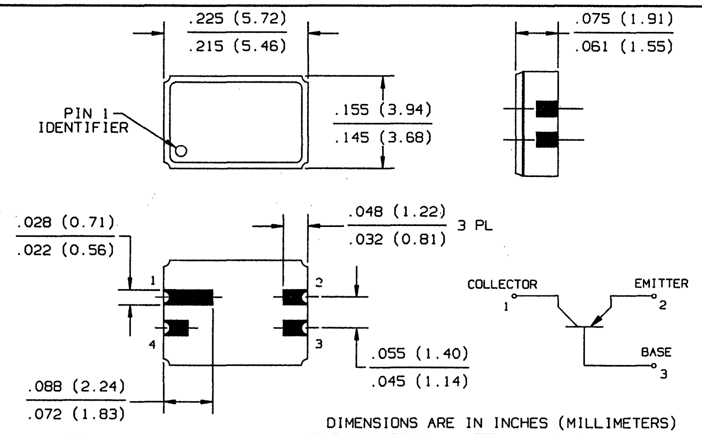
OPTEK TECHNOLOGY, INC.

HI-REL SURFACE MOUNT SEMICONDUCTORS

OPTEK

Surface Mount PNP General Purpose Transistor
Type JANTX, JANTXV-2N2907AUA





Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Hermetically sealed
- Qualification per MIL-S-19500/291

Description

The JANTX/TXV2N2907AUA is a hermetically sealed ceramic surface mount general purpose switching transistor. The miniature four pin ceramic package is ideal for designs where board space and device weight are important design considerations. The "UA" suffix denotes the 4 terminal leadless chip carrier package, type "A" per MIL-S-19500/291.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/291 for complete requirements.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Base voltage	60V
Collector-Emitter Voltage	60V
Emitter-Base Voltage	5.0V
Collector Current-Continuous	600mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C	0.4W
Power Dissipation @ T_C = 25°C	1.16W(1)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated collet for 5 sec.)	260°C

Notes:
(1) Derate linearly 6.6mW/°C above 25°C.

Types JANTX, JANTXV-2N2907AUA

Electrical Characteristics (T_A = 25°C unless otherwise noted)

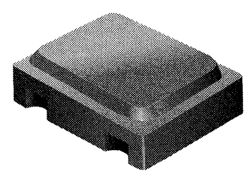
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	60		V	I_C = 10 μA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	60		V	I_C = 10 mA, I_B = 0(2)
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0		V	I_E = 10 μA, I_C = 0
I_{CBO}	Collector-Base Cutoff Current		10	nA	V_{CB} = 50 V, I_E = 0
			10	μA	V_{CB} = 50 V, I_E = 0, T_A = 150°C
I_{CES}	Collector-Emitter Cutoff Current		50	nA	V_{CE} = 30 V
I_{EBO}	Emitter-Base Cutoff Current		50	nA	V_{EB} = 3.5 V, I_C = 0
On Characteristics					
h_{FE}	Forward-Current Transfer Ratio	75		-	V_{CE} = 10 V, I_C = 0.1 mA
		100	450	-	V_{CE} = 10 V, I_C = 1.0 mA
		100		-	V_{CE} = 10 V, I_C = 10 mA
		100	300	-	V_{CE} = 10 V, I_C = 150 mA(2)
		50		-	V_{CE} = 10 V, I_C = 500 mA(2)
		50		-	V_{CE} = 10 V, I_C = 1.0 mA, T_A = -55°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_C = 150 mA, I_B = 15 mA(2)
			1.60	V	I_C = 500 mA, I_B = 50 mA(2)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage		1.30	V	I_C = 150 mA, I_B = 15 mA(2)
			2.60	V	I_C = 500 mA, I_B = 50 mA(2)
Small-Signal Characteristics					
h_{fe}	Small Signal Forward Current Transfer Ratio	100		-	V_{CE} = 10 V, I_C = 1.0 mA, f = 1.0 kHz
$\lvert h_{fe}\rvert$	Small Signal Forward Current Transfer Ratio	2.0		-	V_{CE} = 20 V, I_C = 50 mA, f = 100 MHz
C_{obo}	Open Circuit Output Capacitance		8.0	pF	V_{CB} = 10 V, 100 kHz ≤ f ≤ 1.0 MHz
C_{ibo}	Input Capacitance (Output Open Capacitance)		30	pF	V_{EB} = 2.0 V, 100 kHz ≤ f ≤ 1.0 MHz
Switching Characteristics					
t_{on}	Turn-On Time		45	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA
t_{off}	Turn-Off Time		300	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA

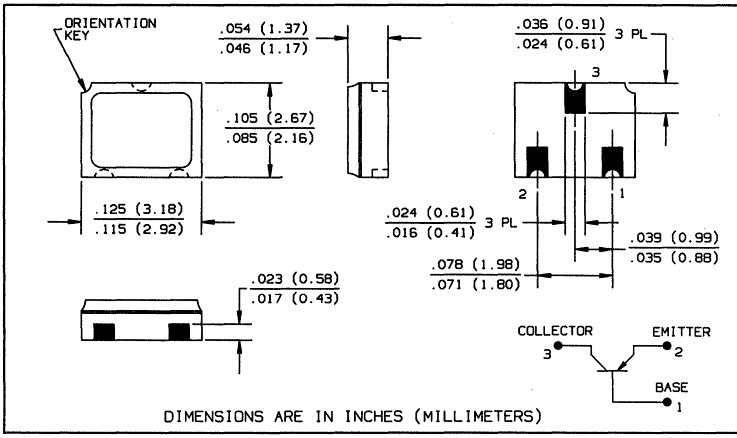
(2) Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

OPTEK

Surface Mount PNP General Purpose Transistor
Type JANTX, JANTXV-2N2907AUB





Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Hermetically sealed
- Footprint and pin-out matches SOT-23 packaged transistors
- Qualification per MIL-S-19500/291

Description

The JANTX/TXV2N2907AUB is a miniature, hermetically sealed, ceramic surface mount general purpose switching transistor. The miniature three pin ceramic package is ideal for upgrading commercial grade circuits to military reliability levels where plastic SOT-23 devices have been used. The "UB" suffix denotes the 3 terminal chip carrier package, type "B" per MIL-S-19500/291.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/291 for complete requirements.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Base Voltage	60V
Collector-Emitter Voltage	60V
Emitter-Base Voltage	5.0V
Collector Current-Continuous	600mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C	0.3W
Power Dissipation @ T_C = 25°C	1.16W(1)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated collet for 5 sec.)	260°C

Notes:
(1) Derate linearly 6.6mW/°C above 25°C.

Types JANTX, JANTXV-2N2907AUB

Electrical Characteristics (T_A = 25°C unless otherwise noted)

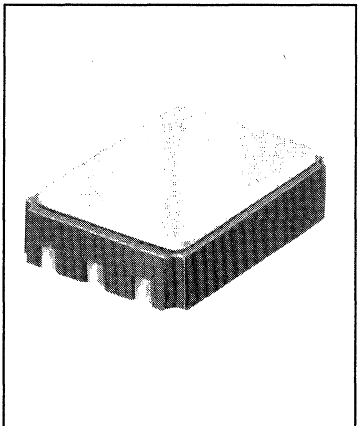
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITION
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	60		V	I_C = 10 µA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	60		V	I_C = 10 mA, I_B = 0(2)
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0		V	I_E = 10 µA, I_C = 0
I_{CBO}	Collector-Base Cutoff Current		10	nA	V_{CB} = 50 V, I_E = 0
			10	µA	V_{CB} = 50 V, I_E = 0, T_A = 150°C
I_{CES}	Collector-Emitter Cutoff Current		50	nA	V_{CE} = 30 V
I_{EBO}	Emitter-Base Cutoff Current		50	nA	V_{EB} = 3.5 V, I_C = 0
On Characteristics					
h_{FE}	Forward-Current transfer Ratio	75		-	V_{CE} = 10 V, I_C = 0.1 mA
		100	450	-	V_{CE} = 10 V, I_C = 1.0 mA
		100		-	V_{CE} = 10 V, I_C = 10 mA
		100	300	-	V_{CE} = 10 V, I_C = 150 mA(2)
		50		-	V_{CE} = 10 V, I_C = 500 mA(2)
		50		-	V_{CE} = 10 V, I_C = 1.0 mA, T_A = -55°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_C = 150 mA, I_B = 15 mA(2)
			1.60	V	I_C = 500 mA, I_B = 50 mA(2)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage		1.30	V	I_C = 150 mA, I_B = 15 mA(2)
			2.60	V	I_C = 500 mA, I_B = 50 mA(2)
Small-Signal Characteristics					
h_{fe}	Forward-Current Transfer Ratio	100		-	V_{CE} = 10 V, I_C = 1.0 mA, f = 1.0 kHz
$\lvert h_{fe}\rvert$	Forward-Current Transfer Ratio	2.0		-	V_{CE} = 20 V, I_C = 50 mA, f = 100 MHz
C_{obo}	Open Circuit Output Capacitance		8.0	pF	V_{CB} = 10 V, 100 kHz ≤ f ≤ 1.0 MHz
C_{ibo}	Input Capacitance (Output Open)		30	pF	V_{EB} = 2.0 V, 100 kHz ≤ f ≤ 1.0 MHz
Switching Characteristics					
t_{on}	Turn-On Time		45	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA
t_{off}	Turn-Off Time		300	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA

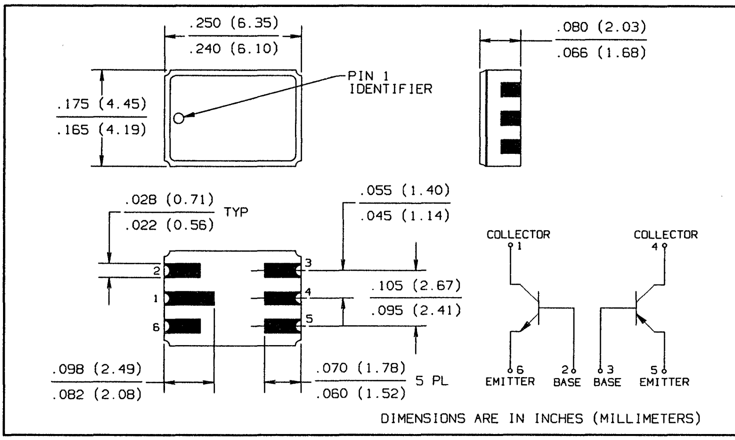
(2) Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

OPTEK

Surface Mount NPN/PNP Complementary Transistors Type JANTX, JANTXV-2N4854U





Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area required
- Hermetically sealed
- Per MIL-S-19500/421

Description

The JANTX2N4854U is a hermetically sealed, ceramic surface mount, complementary transistor pair. The JANTX2N4854U consists of an NPN transistor die and PNP transistor die. This surface mount package is the most recent addition to MIL-S-19500/421. The "U" designator denotes the 6 terminal (C-6) leadless chip carrier package option. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations. For non JAN versions, the Optek HCT700 can be used as a similar replacement.

This data sheet is provided as a summary reference. Refer to MIL-S-19500/421 for complete requirements.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

NPN to PNP Isolation Voltage	500VDC
Collector-Base Voltage	60V
Collector-Emitter Voltage	40V
Emitter-Base Voltage	5.0V
Collector Current-Continuous	600mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C (both transistors driven equally)	0.6W
Power Dissipation @ T_C = 25°C (both transistors driven equally)	2.0W(1)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated Collet for 5 sec.)	260°C

Notes:
(1) Derate linearly 11.4mW/°C above 25°C.

Types JANTX, JANTXV-2N4854U

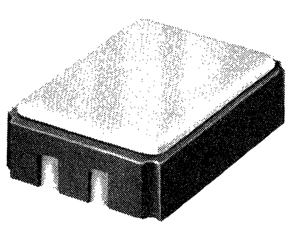
Electrical Characteristics (T_A = 25°C unless otherwise noted) **See Note 3**

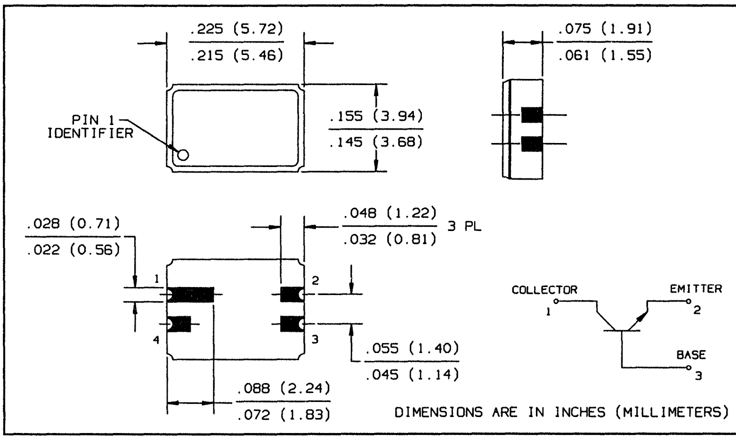
SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	60		V	I_C = 10.0 µA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	40		V	I_C = 10.0 mA, I_B = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0		V	I_E = 10.0 µA, I_C = 0
I_{CBO}	Collector-Base Cutoff Current		10.0	nA	V_{CB} = 50 V, I_E = 0
			10.0	µA	V_{CB} = 50 V, I_E = 0, T_A = 150°C
I_{EBO}	Emitter-Base Cutoff Current		10.0	nA	V_{EB} = 3.0 V, I_C = 0
On Characteristics					
h_{FE}	DC Current Transfer Ratio	50		-	V_{CE} = 1 V, I_C = 150 mA(2)
		35		-	V_{CE} = 10.0 V, I_C = 0.1 mA
		50		-	V_{CE} = 10.0 V, I_C = 1.0 mA
		75		-	V_{CE} = 10.0 V, I_C = 10 mA(2)
		100	300	-	V_{CE} = 10.0 V, I_C = 150 mA(2)
		35		-	V_{CE} = 10.0 V, I_C = 300 mA(2)
		12		-	V_{CE} = 10.0 V, I_C = 10 mA, T_A = -55°C(2)
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_C = 150 mA, I_B = 15 mA(2)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	0.8		V	I_C = 150 mA, I_B = 15 mA(2)
Small-Signal Characteristics					
h_{ie}	Small Signal Common Emitter Input Impedance	1.5	9	kΩ	V_{CE} = 10 V, I_C = 1.0 mA, f = 1.0 kHz
h_{oe}	Small Signal Common Emitter Output Admittance		50	µmho	
h_{fe}	Small Signal Current Transfer Ratio	60	300	-	
NF	Noise Figure		8	db	f = 1.0 kHz, R_G = 1.0 kΩ, I_C = 0.1 mA, V_{CE} = 10 V
$\lvert h_{fe} \rvert$	Small Signal Current Transfer Ratio	2.0	8.0	-	V_{CE} = 20 V, I_C = 20 mA, f = 100 MHz
C_{obo}	Output Capacitance		8.0	pF	V_{CB} = 10 V, 100 kHz ≤ f ≤ 1.0 MHz
Switching Characteristics					
t_{on}	Turn-On Time		45	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA
t_{off}	Turn-Off Time		300	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA

(2) Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%
(3) Polarities given are for the NPN device. Reverse polarity on limits and conditions as applicable for the PNP side.

HI REL
SURFACE
MOUNT

Surface Mount NPN General Purpose Transistor
Type HCT2222A





Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Electrical performance similar to 2N2222A
- Hermetically sealed package
- Screened per Mil-S-19500 TX or TXV equivalent levels on request

Description

The HCT2222A is a hermetically sealed ceramic surface-mount general purpose switching transistor, consisting of a 2N2222A silicon NPN transistor die. The HCT2222A electrical characteristics are similar to the MIL-S-19500/255 specification for the JAN2N2222A. The miniature four pin ceramic package is ideal for designs where board space and device weight are important design considerations.

High reliability processing per MIL-S-19500 TX or TXV equivalent levels on request.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Base Voltage	75V
Collector-Emitter Voltage	50V
Emitter-Base Voltage	6.0V
Collector Current-Continuous	800mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C	0.4W
Power Dissipation @ T_S[(1)] = 25°C	1.0W[(2)]
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated Collet for 5 sec.)	260°C

Notes:
(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 5.7mW/°C above 25°C.

Type HCT2222A

Electrical Characteristics (T_A = 25°C unless otherwise noted)

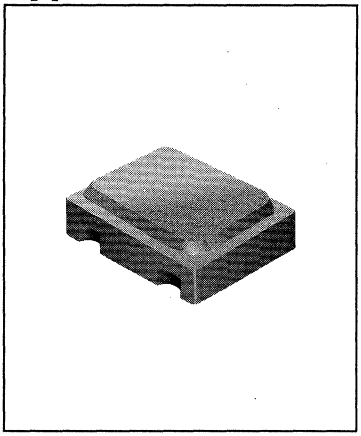
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Off Characteristics						
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	75			V	I_C = 10.0 μA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50			V	I_C = 10.0 mA, I_B = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	6.0			V	I_E = 10.0 μA, I_C = 0
I_{CBO}	Collector-Base Cuttoff Current			10.0	nA	V_{CB} = 60 V, I_E = 0
				10.0	μA	V_{CB} = 60 V, I_E = 0, T_A = 150°C
I_{EBO}	Emitter-Base Cutoff Current			10.0	nA	V_{EB} = 4.0 V, I_C = 0
I_{CES}	Collector-Emitter Cutoff Current			1.0	μA	V_{CE} = 50 V
On Characteristics						
h_{FE}	Forward Current Transfer Ratio	50			-	V_{CE} = 10.0 V, I_C = 0.1 mA
		75		325	-	V_{CE} = 10.0 V, I_C = 1.0 mA
		100			-	V_{CE} = 10.0 V, I_C = 10.0 mA
		100		300	-	V_{CE} = 10.0 V, I_C = 150 mA(3)
		30			-	V_{CE} = 10.0 V, I_C = 500 mA(3)
		35			-	V_{CE} = 10.0 V, I_C = 10.0 mA, T_A = -55°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage			0.30	V	I_C = 150 mA, I_B = 15 mA(3)
				1.0	V	I_C = 500 mA, I_B = 50 mA(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	0.60		1.20	V	I_C = 150 mA, I_B = 15 mA(3)
				2.0	V	I_C = 500 mA, I_B = 50 mA(3)
Small-Signal Characteristics						
h_{fe}	Small-Signal Forward Current Transfer Ratio	50			-	V_{CE} = 10.0 V, I_C = 1.0 mA, f = 1.0 kHz
$\|h_{fe}\|$	Small-Signal Forward Current Transfer Ratio	2.5			-	V_{CE} = 20 V, I_C = 20 mA, f = 100 MHz
C_{obo}	Open Circuit Output Capacitance			8.0	pF	V_{CB} = 10.0 V, 100 kHz ≤ f ≤ 1.0 MHz
C_{ibo}	Input Capacitance (Output Open Capacitance)			33	pF	V_{EB} = 0.5 V, 100 kHz ≤ f ≤ 1.0 MHz
Switching Characteristics						
t_{on}	Turn-On Time			35	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA
t_{off}	Turn-Off Time			300	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA

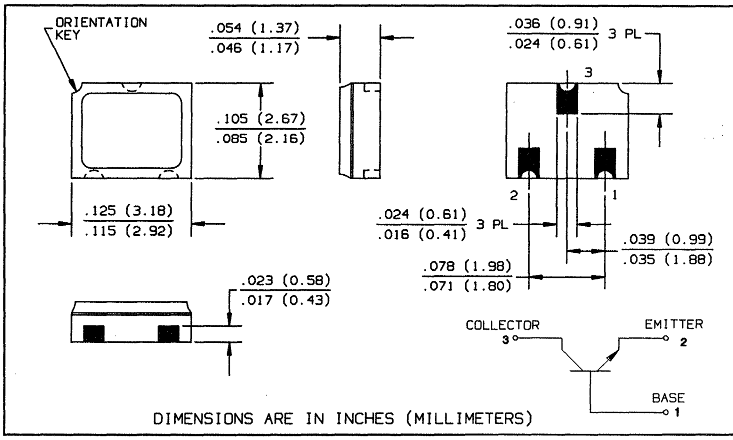
(3) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

OPTEK

Surface Mount NPN General Purpose Transistor
Type HCT2222M





Feature

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Electrical performance similar to a JAN2N2222A
- Hermetically sealed package
- Screened per MIL-S-19500 TX or TXV equivalent levels on request
- Same footprint and pin-out as many SOT-23 package transistors

Description

The HCT2222M is a miniature hermetically sealed ceramic surface-mount general purpose switching transistor, consisting of a 2N2222A silicon NPN transistor die. The HCT2222M electrical characteristics are similar to the MIL-S-19500/255 specification for the JANTX2N2222A. The miniature three pin ceramic package is ideal for upgrading commercial grade circuits to military reliability levels where plastic SOT-23 devices have been used.

High reliability processing available per MIL-S-19500 TX or TXV equivalent levels on request.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Base Voltage	75V
Collector-Emitter Voltage	50V
Emitter-Base Voltage	6.0V
Collector Current-Continuous	800mA
Operating Junction Temperature(T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C	0.3W
Power Dissipation @ T_S(1) = 25°C	0.75W(2)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated collet for 5 sec.)	260°C

Notes
(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 4.2mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods, and is not measureable as an outgoing test.

Type HCT2222M

Electrical Characteristics (T_A = 25°C unless otherwise noted)

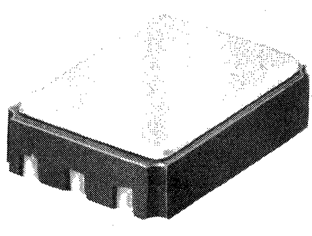
Symbol	Parameter	Min.	Max.	Units	Test Conditions
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	75		V	I_C = 10.0μA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50		V	I_C = 10.0mA, I_B = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	6.0		V	I_E = 10.0μA, I_C = 0
I_{CBO}	Collector-Base Cutoff Current		10.0	nA	V_{CB} = 60V, I_E = 0
			10.0	μA	V_{CB} = 60V, I_E = 0, T_A = 150°C
I_{EBO}	Emitter-Base Cutoff Current		10.0	nA	V_{EB} = 4.0V, I_C = 0
I_{CES}	Collector-Emitter Cutoff Current		1.00	μA	V_{CE} = 50V
On Characteristics					
h_{FE}	Forward-Current Transfer Ratio	50		-	V_{CE} = 10.0V, I_C = 0.1mA
		75	325	-	V_{CE} = 10.0V, I_C = 1.0mA
		100		-	V_{CE} = 10.0V, I_C = 10mA
		100	300	-	V_{CE} = 10.0V, I_C = 150mA(3)
		30		-	V_{CE} = 10.0V, I_C = 500mA(3)
		35		-	V_{CE} = 10.0V, I_C = 10mA, T_A = -55°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.30	V	I_C = 150mA, I_B = 15mA(3)
			1.00	V	I_C = 500mA, I_B = 50mA(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	0.60	1.20	V	I_C = 150mA, I_B = 15mA(3)
			2.00	V	I_C = 500mA, I_B = 50mA(3)
Small-Signal Characteristics					
h_{fe}	Small-Signal Forward Current Transfer Ratio	50		-	V_{CE} = 10.0V, I_C = 1.0mA, f = 1.0kHz
$\lvert h_{fe} \rvert$	Small-Signal Forward Current Transfer Ratio	2.5		-	V_{CE} = 20V, I_C = 20mA, f = 100MHz
C_{obo}	Open Circuit Output Capacitance		8.0	pF	V_{CB} = 10.0V, 100kHz ≤ f≤ 1.0MHz
C_{ibo}	Input Capacitance (Output Open)		33	pF	V_{EB} = 0.5V, 100kHz ≤ f≤ 1.0MHz
Switching Characteristics					
t_{on}	Turn-On Time		35	ns	V_{CC} = 30V, I_C = 150mA, I_{B1} = 15mA
t_{off}	Turn-Off Time		300	ns	V_{CC} = 30V, I_C = 150mA, I_{B1} = I_{B2} = 15mA

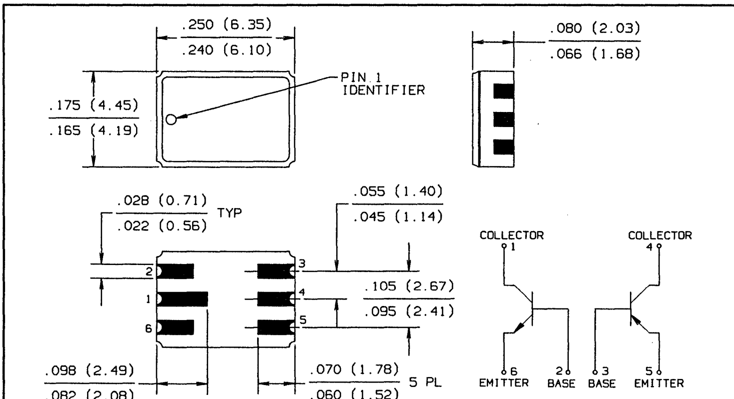
(3) Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

OPTEK

Surface Mount NPN/PNP Complementary Transistors Type HCT700





DIMENSIONS ARE IN INCHES (MILLIMETERS)

Features

- Ceramic surface mount package
- Miniature package to minimize circuit board area
- Electrical performance similar to 2N2222A and 2N2907A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV (See JANTX2N4854U)

Description

The HCT700 is a hermetically sealed, ceramic surface-mount, complementary transistor pair. The HCT700 consists of an NPN transistor die and PNP transisitor die. The HCT700 electrical characteristics for the NPN side are similar to the MIL-S-19500/255 specification for JAN2N2222A and on the PNP side are similar to the MIL-S-10500/291 specification for the JAN2N2907A. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations.

Order HCT700TX or HCT700TXV for TX or TXV processing per MIl-S-19500.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

NPN to PNP Isolation Voltage	500VDC
Collector-Base Voltage (NPN)	75V
Collector-Base Voltage (PNP)	60V
Collector-Emitter Voltage (NPN)	50V
Collector-Emitter Voltage (PNP)	60V
Emitter-Base Voltage (NPN)	6.0V
Emitter-Base Voltage (PNP)	5.0V
Collector Current-Continuous (NPN)	800mA
Collector Current-Continuous (PNP)	600mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C	0.4W
Power Dissipation @ T_S(1) = 25°C	2.0W(2)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated Collet for 5 sec.)	260°C

Notes:
(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 11.4mW/°C above 25°C.

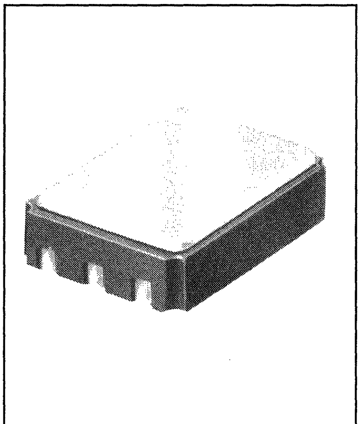
Type HCT700

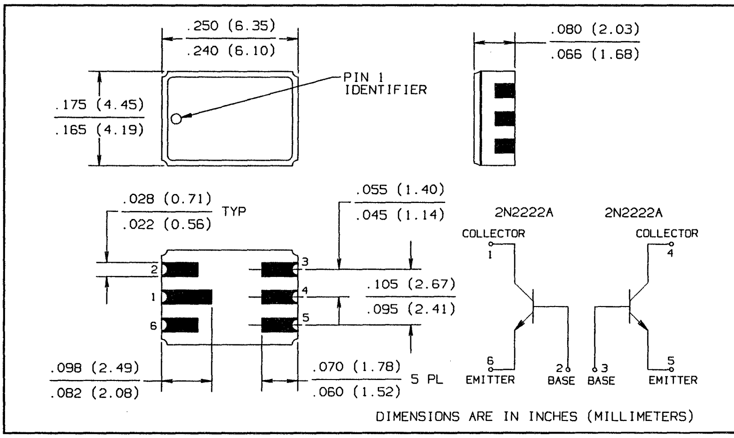
Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	NPN MIN	NPN MAX	PNP MIN	PNP MAX	UNITS	TEST CONDITIONS
Off Characteristics							
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	75		60		V	I_C = 10.0 µA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50		60		V	I_C = 10.0 mA, I_B = 0
$V_{(BR)EBO}$	Emitter-Base Beakdown Voltage	6.0		5.0		V	I_E = 10.0 µA, I_C = 0
I_{CBO}	Collector-Base Cutoff Current		10.0			nA	V_{CB} = 60 V, I_E = 0
					10.0	nA	V_{CB} = 50 V, I_E = 0
			10.0			µA	V_{CB} = 60 V, I_E = 0, T_A = 150°C
					10.0	µA	V_{CB} = 50 V, I_E = 0, T_A = 150°C
I_{EBO}	Emitter-Base Cutoff Current		10.0			nA	V_{EB} = 4.0 V, I_C = 0
					50.0	nA	V_{EB} = 3.5 V, I_C = 0
I_{CES}	Collector-Emitter Cutoff Current		1.00			µA	V_{CE} = 50 V
On Characteristics							
h_{FE}	DC Current Transfer Ratio	50		75		-	V_{CE} = 10.0 V, I_C = 0.1 mA
		75	325	100	450	-	V_{CE} = 10.0 V, I_C = 1.0 mA
		100		100		-	V_{CE} = 10.0 V, I_C = 10.0 mA
		100	300	100	300	-	V_{CE} = 10.0 V, I_C = 150.0 mA(3)
		30		50		-	V_{CE} = 10.0 V, I_C = 500.0 mA(3)
		35				-	V_{CE} = 10.0 V, I_C = 10.0 mA, T_A = -55°C
				50		-	V_{CE} = 10.0 V, I_C = 1.0 mA, T_A = -55°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.30		0.40	V	I_C = 150 mA, I_B = 15 mA(3)
			1.00		1.60	V	I_C = 500 mA, I_B = 50 mA(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	0.60	1.20		1.30	V	I_C = 150 mA, I_B = 15 mA(3)
			2.00		2.60	V	I_C = 500 mA, I_B = 50 mA(3)
Small-Signal Characteristics							
h_{fe}	Small-Signal Current Transfer Ratio	50		100		-	V_{CE} = 10.0 V, I_C = 1.0 mA, f = 1.0 kHz
$\vert h_{fe}\vert$	Small-Signal Current Transfer Ratio	2.5				-	V_{CE} = 20 V, I_C = 20 mA, f = 100 MHz
				2.0		-	V_{CE} = 20 V, I_C = 50 mA, f = 100 MHz
C_{obo}	Output Capacitance		8.0		8.0	pF	V_{CE} = 10.0 V, 100 kHz ≤ f ≤ 1.0 MHz
C_{ibo}	Input Capacitance		25			pF	V_{EB} = 2.0 V, 100 kHz ≤ f ≤ 1.0 MHz
					30	pF	V_{EB} = 0.5 V, 100 kHz ≤ f ≤ 1.0 MHz
Switching Characteristics							
t_{on}	Turn-On Time		35		45	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA
t_{off}	Turn-Off Time		300		300	ns	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA

(3) Pulse Test: Pulse Width ≤ 300 ms, duty cycle ≤ 2.0%

Surface Mount Dual NPN Transistor
Type HCT720





Features

- Surface mountable on ceramic or printed circuit board
- Miniature package to minimize circuit board area required
- Electrical performance similar to 2N2222A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

Description

The HCT720 is a hermetically sealed, ceramic surface-mount device, consisting of two 2N2222A silicon NPN transistor die. The HCT720 electrical characteristics for each transistor are similar to MIL-S-19500/255 specification for the 2N2222A. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/495 per 2N5794 conditions. Order HCT720TX or HCT720TXV.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Isolation Voltage	500VDC
Collector-Base Voltage	75V
Collector-Emitter Voltage	50V
Emitter-Base Voltage	6.0V
Collector Current - Continuous	800mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C (both sides driven equally)	0.65W
Power Dissipation @ T_S(1) = 25°C (both sides driven equally)	1.25W(2)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated collet for 5 sec.)	260°C

Notes

(1) T_S = Substrate temperature that the chip carrier is mounted on.

(2) Derate linearly 7.1mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as and outgoing test.

Type HCT720

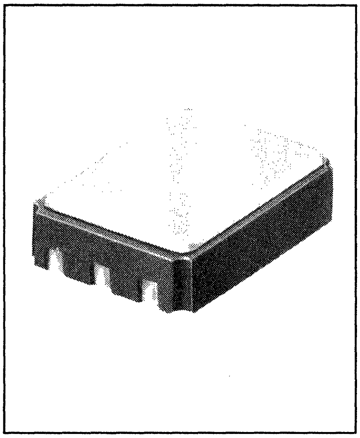
Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

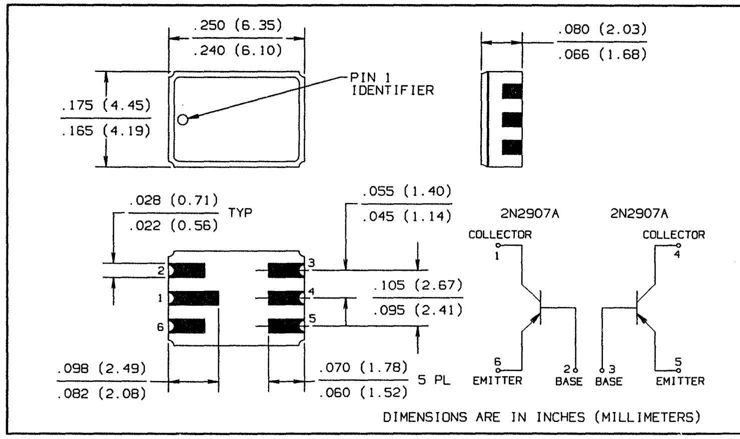
Symbol	Parameter	Min.	Max.	Units	Test Conditions
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	75		V	$I_C = 10.0\mu A$, $I_E = 0$
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50		V	$I_C = 10.0mA$, $I_B = 0$
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	6.0		V	$I_E = 10.0\mu A$, $I_C = 0$
I_{CBO}	Collector-Base Cutoff Current		10.0	nA	$V_{CB} = 60V$, $I_E = 0$
			10.0	µA	$V_{CB} = 60V$, $I_E = 0$, $T_A = 150^oC$
I_{EBO}	Emitter-Base Cutoff Current		10.0	nA	$V_{EB} = 4.0V$, $I_C = 0$
I_{CES}	Collector-Emitter Cutoff Current		1.00	µA	$V_{CE} = 50V$
On Characteristics					
h_{FE}	Forward-Current Transfer Ratio	50		—	$V_{CE} = 10.0V$, $I_C = 0.1mA$
		75	325	—	$V_{CE} = 10.0V$, $I_C = 1.0mA$
		100		—	$V_{CE} = 10.0V$, $I_C = 10.0mA$
		100	300	—	$V_{CE} = 10.0V$, $I_C = 150mA$(3)
		30		—	$V_{CE} = 10.0V$, $I_C = 500mA$(3)
		35		—	$V_{CE} = 10.0V$, $I_C = 10.0mA$, $T_A = -55^oC$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.30	V	$I_C = 150mA$, $I_B = 15mA$(3)
			1.00	V	$I_C = 500mA$, $I_B = 50mA$(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	0.6	1.20	V	$I_C = 150mA$, $I_B = 15mA$(3)
			2.00	V	$I_C = 500mA$, $I_B = 50mA$(3)
Small-Signal Characteristics					
h_{fe}	Forward Current Transfer Ratio	50		—	$V_{CE} = 10.0V$, $I_C = 1.00mA$, $f = 1.0kHz$
$\|h_{fe}\|$	Forward Current Transfer Ratio	2.5		—	$V_{CE} = 20V$, $I_C = 20mA$, $f = 100MHz$
C_{obo}	Open Circuit Output Capacitance		8.0	pF	$V_{CB} = 10.0V$, $100kHz \leq f \leq 1.0MHz$
C_{ibo}	Input Capacitance (Output Open)		33	pF	$V_{EB} = 0.5V$, $100kHz \leq f \leq 1.0MHz$
Switching Characteristics					
t_{on}	Turn-On Time		35	ns	$V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = 15mA$
t_{off}	Turn-Off Time		300	ns	$V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = I_{B2} = 15mA$

(3) Pulse Test: Pulse Width ≤ 300µs. Duty Cycle ≤ 2.0%

OPTEK

Surface Mount Dual PNP Transistor
Type HCT740





Features

- Surface mountable on ceramic or printed circuit board
- Miniature package to minimize circuit board area required
- Electrical performance similar to 2N2907A
- Hermetically sealed
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

Description

The HCT740 is a hermetically sealed, ceramic surface-mount device, consisting of two 2N2907A silicon PNP transistor die. The HCT740 electrical characteristics are similar to the MIL-S-19500/291 specification for the 2N2907A. The miniature six pin ceramic package is ideal for designs where board space and device weight are important design considerations.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/496 per 2N5796 conditions. Order HCT740TX or HCT740TXV.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Isolation Voltage	500VDC
Collector-Base Voltage	60V
Collector-Emitter Voltage	60V
Emitter-Base Voltage	5.0V
Collector Current - Continuous	600mA
Operating Junction Temperature (T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C (Both sides driven equally)	0 .65W
Power Dissipation @ T_S(1) = 25°C (Both sides driven equally)	1.25W(2)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated collet for 5 sec.)	260°C

Notes

(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 7.1mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.

Type HCT740

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

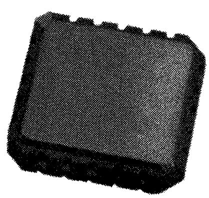
Symbol	Parameter	Min.	Max.	Units	Test Conditions
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	60		V	$I_C = 10.0\mu A$, $I_E = 0$
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	60		V	$I_C = 10.0mA$, $I_B = 0$
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0		V	$I_E = 10.0\mu A$, $I_C = 0$
I_{CBO}	Collector-Base Cutoff Current		10.0	nA	$V_{CB} = 50V$, $I_E = 0$
			10.0	µA	$V_{CB} = 50V$, $I_E = 0$, $T_A = 150^oC$
I_{EBO}	Emitter-Base Cutoff Current		50.0	nA	$V_{EB} = 3.5V$, $I_C = 0$
On Characteristics					
h_{FE}	Forward-Current Transfer Ratio	75		—	$V_{CE} = 10.0V$, $I_C = 0.1mA$
		100	450	—	$V_{CE} = 10.0V$, $I_C = 1.0mA$
		100		—	$V_{CE} = 10.0V$, $I_C = 10.0mA$
		100	300	—	$V_{CE} = 10.0V$, $I_C = 150mA$(3)
		50		—	$V_{CE} = 10.0V$, $I_C = 500mA$(3)
		50		—	$V_{CE} = 10.0V$, $I_C = 1.00mA$, $T_A = -55^oC$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	$I_C = 150mA$, $I_B = 15mA$(3)
			1.60	V	$I_C = 500mA$, $I_B = 50mA$(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage		1.30	V	$I_C = 150mA$, $I_B = 15mA$(3)
			2.60	V	$I_C = 500mA$, $I_B = 50mA$(3)
Small-Signal Characteristics					
hfe	Forward Current Transfer Ratio	100		—	$V_{CE} = 10.0V$, $I_C = 1.00mA$, f = 1.0kHz
lhfel	Forward Current Transfer Ratio	2.0		—	$V_{CE} = 20V$, $I_C = 50mA$, f = 100MHz
C_{obo}	Open Circuit Output Capacitance		8.0	pF	$V_{CB} = 10.0V$, $100kHz \leq f \leq 1.0MHz$
C_{ibo}	Input Capacitance (Output Open)		30	pF	$V_{EB} = 2.0V$, $100kHz \leq f \leq 1.0MHz$
Switching Characteristics					
t_{on}	Turn-On Time		45	ns	$V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = 15mA$
t_{off}	Turn-Off Time		300	ns	$V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = I_{B2} = 15mA$

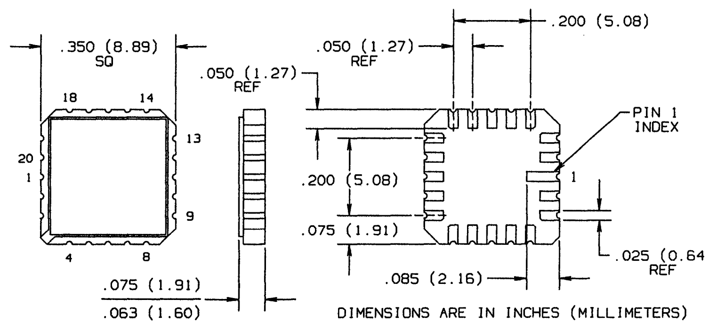
(3) Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2.0%

Product Bulletin HCT780
May 1993

OPTEK

Surface Mount Quad NPN Transistor
Type HCT780





Feature

- Four independent transistors in a 0.35 inch, square ceramic package
- Surface mountable on ceramic or printed circuit board
- Electrical performance similar to a 2N2222A
- Hermetically sealed package
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

Description

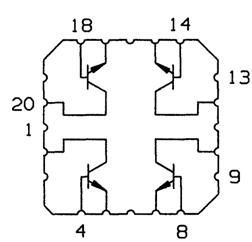
The HCT780 is a 20 pad, hermetically sealed, ceramic surface-mount transistor array, consisting of four 2N2222A silicon NPN transistor die. The HCT780 electrical characteristics are similar to the MIL-S-19500/255 specification for the 2N2222A.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/559 per 2N6989 conditions. Order HCT780TX or HCT780TXV.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Collector-Base Voltage	75V
Collector-Emitter Voltage	50V
Emitter-Base Voltage	6.0V
Collector Current-Continuous	800mA
Isolation Voltage	500V_{dc}
Operating Junction Temperature(T_J)	-65°C to +200°C
Storage Junction Temperature (T_{stg})	-65°C to +200°C
Power Dissipation @ T_A = 25°C (four devices driven equally)	1.0W
Power Dissipation @ T_S(1) = 25°C (four devices driven equally)	2.0W(2)
Soldering Temperature (vapor phase reflow for 30 sec.)	215°C
Soldering Temperature (heated collet for 5 sec.)	260°C

Notes
(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 11.4mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.



TOP VIEW

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214) 323-2200 Fax (214) 323-2396

Type HCT780

Electrical Characteristics ($T_A = 25^oC$ unless otherwise noted)

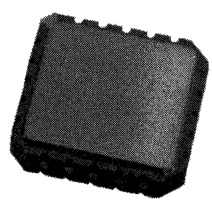
Symbol	Parameter	Min.	Max.	Units	Test Conditions
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	75		V	$I_C = 10.0\mu A$, $I_E = 0$
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	50		V	$I_C = 10.0mA$, $I_B = 0$
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	6.0		V	$I_E = 10.0\mu A$, $I_C = 0$
I_{CBO}	Collector-Base Cutoff Current		10.0	nA	$V_{CB} = 60V$, $I_E = 0$
			10.0	µA	$V_{CB} = 60V$, $I_E = 0$, $T_A = 150^oC$
I_{EBO}	Emitter-Base Cutoff Current		10.0	nA	$V_{EB} = 4.0V$, $I_C = 0$
I_{CES}	Collector-Emitter Cutoff Current		1.00	µA	$V_{CE} = 50V$
On Characteristics					
h_{FE}	Forward-Current Transfer Ratio	50		—	$V_{CE} = 10.0V$, $I_C = 0.1mA$
		75	325	—	$V_{CE} = 10.0V$, $I_C = 1.0mA$
		100		—	$V_{CE} = 10.0V$, $I_C = 10mA$
		100	300	—	$V_{CE} = 10.0V$, $I_C = 150mA$(3)
		30		—	$V_{CE} = 10.0V$, $I_C = 500mA$(3)
		35		—	$V_{CE} = 10.0V$, $I_C = 10mA$, $T_A = -55^oC$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.30	V	$I_C = 150mA$, $I_B = 15mA$(3)
			1.00	V	$I_C = 500mA$, $I_B = 50mA$(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	0.60	1.20	V	$I_C = 150mA$, $I_B = 15mA$(3)
			2.00	V	$I_C = 500mA$, $I_B = 50mA$(3)
Small-Signal Characteristics					
h_{fe}	Forward Current Transfer Ratio	50		—	$V_{CE} = 10.0V$, $I_C = 1.0mA$, f = 1.0kHz
$\lvert h_{fe} \rvert$	Forward Current Transfer Ratio	2.5		—	$V_{CE} = 20V$, $I_C = 20mA$, f = 100MHz
C_{obo}	Open Circuit Output Capacitance		8.0	pF	$V_{CB} = 10.0V$, $100kHz \le f \le 1.0MHz$
C_{ibo}	Input Capacitance (Output Open)		25	pF	$V_{EB} = 0.5V$, $100kHz \le f \le 1.0MHz$
Switching Characteristics					
t_{on}	Turn-On Time		35	ns	$V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = 15mA$
t_{off}	Turn-Off Time		300	ns	$V_{CC} = 30V$, $I_C = 150mA$, $I_{B1} = I_{B2} = 15mA$

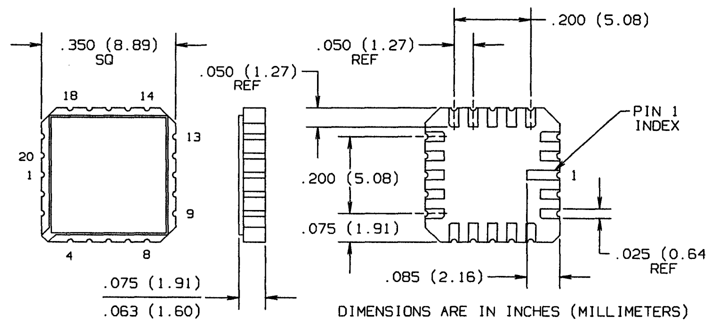
(3) Pulse Test: Pulse width ≤ 300µs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

OPTEK

Surface Mount Quad PNP Transistor
Type HCT790





Feature

- Four independent transistors in a 0.35 inch, square ceramic package
- Surface mountable on ceramic or printed circuit board
- Electrical performance similar to a 2N2907A
- Hermetically sealed package
- Screened per MIL-S-19500 TX or TXV equivalent levels on request

Description

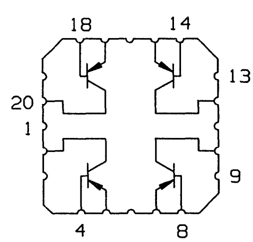
The HCT790 is a 20 pad, hermetically sealed, ceramic surface-mount transistor array, consisting of a 2N2907A silicon PNP transistor die. The HCT790 electrical characteristics are similar to the MIL-S-19500/291 specification for the 2N2907A.

TX and TXV screening, if requested, will be performed similar to MIL-S-19500/558 per 2N6987 conditions. Order HCT790TX or HCT790TXV.

Absolute Maximum Ratings ($T_A = 25^oC$ unless otherwise noted)

Collector-Base Voltage	60V
Collector-Emitter Voltage	60V
Emitter-Base Voltage	5.0V
Collector Current-Continuous	600mA
Isolation Voltage	$500V_{DC}$
Operating Junction Temperature(T_J)	-65^oC to $+200^oC$
Storage Junction Temperature (T_{stg})	-65^oC to $+200^oC$
Power Dissipation @ $T_A = 25^oC$ (four devices driven equally)	1.0W
Power Dissipation @ $T_S^{(1)} = 25^oC$ (four devices driven equally)	$2.0W^{(2)}$
Soldering Temperature (vapor phase reflow for 30 sec.)	215^oC
Soldering Temperature (heated collet for 5 sec.)	260^oC

Notes
(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) Derate linearly 11.4mW/°C above 25°C. This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.



TOP VIEW

Type HCT790

Electrical Characteristics (T_A = 25°C unless otherwise noted)

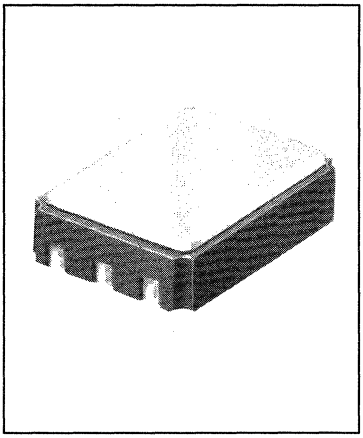
Symbol	Parameter	Min.	Max.	Units	Test Conditions
Off Characteristics					
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	60		V	I_C = 10.0μA, I_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	60		V	I_C = 10.0mA, I_B = 0
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0		V	I_E = 10.0μA, I_C = 0
I_{CBO}	Collector-Base Cutoff Current		10.0	nA	V_{CB} = 50V, I_E = 0
			10.0	μA	V_{CB} = 50V, I_E = 0, T_A = 150°C
I_{EBO}	Emitter-Base Cutoff Current		50	nA	V_{EB} = 3.5V, I_C = 0
On Characteristics					
h_{FE}	Forward-Current Transfer Ratio	75		—	V_{CE} = 10.0V, I_C = 0.1mA
		100	450	—	V_{CE} = 10.0V, I_C = 1.0mA
		100		—	V_{CE} = 10.0V, I_C = 10.0mA
		100	300	—	V_{CE} = 10.0V, I_C = 150mA(3)
		50		—	V_{CE} = 10.0V, I_C = 500mA(3)
		50		—	V_{CE} = 10.0V, I_C = 1.0mA, T_A = -55°C
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage		0.40	V	I_C = 150mA, I_B = 15mA(3)
			1.60	V	I_C = 500mA, I_B = 50mA(3)
$V_{BE(SAT)}$	Base-Emitter Saturation Voltage		1.30	V	I_C = 150mA, I_B = 15mA(3)
			2.60	V	I_C = 500mA, I_B = 50mA(3)
Small-Signal Characteristics					
hfe	Forward Current Transfer Ratio	100		—	V_{CE} = 10.0V, I_C = 1.0mA, f = 1.0kHz
lhfel	Forward Current Transfer Ratio	2.0		—	V_{CE} = 20V, I_C = 50mA, f = 100MHz
C_{obo}	Open Circuit Output Capacitance		8.0	pF	V_{CB} = 10.0V, 100kHz ≤ f≤ 1.0MHz
C_{ibo}	Input Capacitance (Output Open)		30	pF	V_{EB} = 2.0V, 100kHz ≤ f≤ 1.0MHz
Switching Characteristics					
t_{on}	Turn-On Time		45	ns	V_{CC} = 30V, I_C = 150mA, I_{B1} = 15mA
t_{off}	Turn-Off Time		300	ns	V_{CC} = 30V, I_C = 150mA, I_{B1} = I_{B2} = 15mA

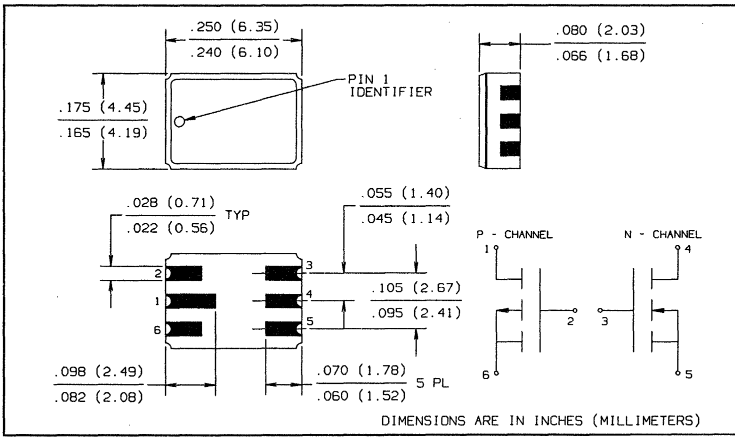
(3) Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%

HI REL SURFACE MOUNT

OPTEK

Dual Enhancement Mode MOSFET
Type HCT801





Features

- 6 pad surface mount package
- V_{DS} = 90V
- $I_{D(on)}$ N-Channel = 1.9A
  P-Channel = 0.5A
- Two devices selected for V_{DS}, switching time, and capacitance similarity
- Full TX processing available
- Gold plated contacts

Description

The HCT801 offers an N-Channel and P-Channel MOS transistor packaged in a hermetic ceramic surface mount package. The two devices are similar in performance to the popular VN0109 N-Channel device and VP0109 P-Channel device. These two transistors are particularly well matched for V_{DS}, switch time, and capacitance. For closer matching of $I_{D(on)}$, $R_{DS(on)}$ and G_{fs}, see the HCT802 data sheet.

Order HCT801TX for processing per MIL-S-19500.

Absolute Maximum Ratings

Drain-Source Voltage 90V
Gate-Source Voltage .... ±20V
Drain Current (Limited by Tj max) N-Channel 2A
P-Channel 0.8A
Operating and Storage Temperature .... -55 to 150°C

Power Dissipation

T_A=25°C(Both devices equally driven) .... 0.5W Total
T_S=25°C (Both devices equally driven) .... 1.25W Total(1)
(T_S=Substrate temperature that the package is soldered to)

Notes

(1) This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.

Type HCT801

Electrical Characteristics (T_A = 25°C unless specified otherwise)

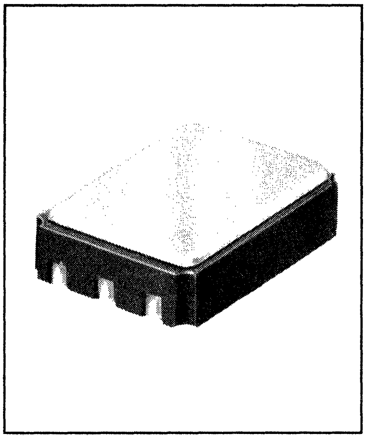
Symbol	Parameters	Device B=BOTH	Min	Max	Units	Test Condition
BV_{DSS}	Drain-Source Breakdown	B	90		V	I_D = 1mA*, V_{GS} = 0
V_{TH}	Gate Threshold Voltage	N	0.75	2.5	V	V_{GS} = V_{DS}, I_D = 1mA
		P	-1.4	-3.7	V	I_D = -1mA
I_{GSS}	Gate-body Leakage	B		±100	nA	V_{GS} = ±20V, V_{DS} = 0
I_{DSS}	Zero Gate Voltage Drain Current	B		10*	µA	V_{GS} = 0V, V_{DS} = 90V*
$I_{D(on)}$	ON-state Drain Current	N	0.5		A	V_{GS} = 5V*, V_{DS} = 25V*
		P	-0.15		A	
		N	1.9		A	V_{GS} = 10V*, V_{DS} = 25V*
		P	-0.5		A	
$R_{DS(on)}$	Drain-Source On-Resistance	N		5.2	Ω	V_{GS} = 5V, I_D = 250mA
		N		3.2	Ω	V_{GS} = 10V, I_D = 1A
		P		15	Ω	V_{GS} = -5V, I_D = -0.1A
		P		8	Ω	V_{GS} = -10V, I_D = -0.5A
	High Temperature Drain-Source On Resistance	N		0.9	Ω	V_{GS} = 10V, I_D = 1A, T_A = 125°C
		P		14	Ω	V_{GS} = -10V, I_D = -0.5A, T_A = 125°C
G_{fs}	Forward Transconductance	N	250		mmho	V_{DS} = 25V*, I_D = 0.5A*
		P	150		mmho	
C_{ISS}	Input Capacitance	B		70	pf	V_{GS} = 0V, V_{DS} = 25V*, f = 1MHz
C_{OSS}	Common Source Output Capacitance	B		35	pf	
C_{RSS}	Reverse Transfer Capacitance	B		10	pf	
$t_{(on)}$	Turn-on-time	B		16	ns	V_{DD} = 25V*, I_D = 1A*, R_S=R_L=50Ω
$t_{(off)}$	Turn-off-time	B		17	ns	

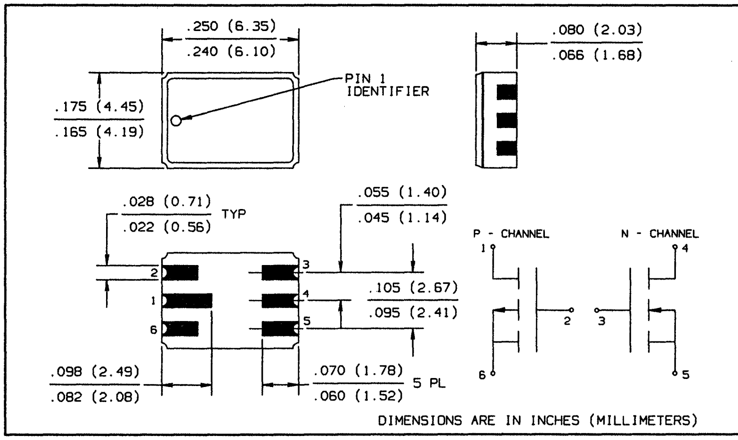
* Reverse polarity for the P-Channel device.

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

OPTEK

Dual Enhancement Mode MOSFET
Type HCT802





Features

- 6 pad surface mount package
- V_{DS} = 90V
- $R_{DS(on)}$ <5Ω
- $I_{D(on)}$ N-Channel = 1.5A
  P-Channel = 1.1A
- Two devices selected for V_{DS}, $I_{D(on)}$ and $R_{DS(on)}$ similarity
- Full TX Processing Available
- Gold plated contacts

Description

HCT802 offers an N-Channel and P-Channel MOS transistor in a hermetic ceramic surface mount package. The devices used are similar to industry standards VN0109 N-Channel device and VP1008 P-Channel device. These two enhancement mode MOSFETS are particularly well matched for V_{DS}, $I_{DS(on)}$, $R_{DS(on)}$ and G_{fs}. For closer matching of switching speed and capacitance see the HCT801 data sheet.

Order HCT802TX for processing per MIl-S-19500.

Absolute Maximum Ratings

Drain-Source Voltage 90V
Gate-Source Voltage . . . . . ±20V
Drain Current (Limited by Tj max) N-Channel 2A
P-Channel. 1.1A
Operating and Storage Temperature . . . . . -55 to 150°C

Power Dissipation

T_A = 25°C (Both devices equally driven) . . . . . 0.5W Total
T_S = 25°C (Both devices equally driven) . . . . . 1.5W Total(1)
(Ts = Substrate that the package is soldered to)

Notes

(1) This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measureable as an outgoing test.

Type HCT802

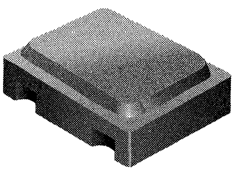
Electrical Characteristics (T_A = 25°C unless specified otherwise)

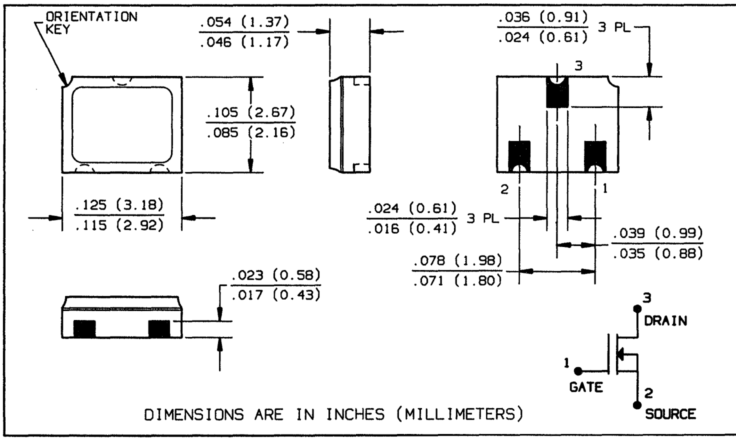
Symbol	Parameters	Device B=Both	Min	Max	Units	Test Conditions
BV_{DSS}	Drain-Source Breakdown	B	90*		V	I_D = 1mA*, V_{GS} = 0
V_{TH}	Gate Threshold Voltage	N	0.75	2.5	V	V_{GS} = V_{DS}, I_D = 1mA
		P	-2.0	-4.5	V	I_D = -1mA
I_{GSS}	Gate-Body Leakage	B		±100	nA	V_{GS} = ± 20V, V_{DS} = 0
I_{DSS}	Zero Gate Voltage Drain Current	B		10*	μA	V_{DS} = 90V*, V_{GS} = 0V
		B		500*	μA	Tj = 150°C
$I_{D(on)}$	On-State Drain Current	N	1.5		A	V_{DS} = 25V, V_{GS} = 10V
		P	-1.1		A	V_{DS} = -15V, V_{GS} = -10V
$R_{DS(on)}$	Drain-Source on Resistance	B		5	Ω	V_{GS} = 10V*, I_D = 1A*
G_{fs}	Forward Transconductance	N	250		mmho	V_{DS} = 25V, I_D = 0.5A
		P	200		mmho	V_{DS} = -10V, I_D = -0.5A
C_{ISS}	Input Capacitance	N		70	pf	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz
		P		150	pf	V_{DS} = -25V, V_{GS} = 0V, f = 1MHz
C_{OSS}	Common Source Output Capacitance	N		35	pf	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz
		P		60	pf	V_{DS} = -25V, V_{GS} = 0V, f = 1MHz
C_{RSS}	Reverse Transfer Capacitance	N		10	pf	V_{DS} = 25V, V_{GS} = 0A, f = 1MHz
		P		25	pf	V_{DS} = -25V, V_{GS} = 0A, f = 1MHz
$t_{(on)}$	Turn-on-time	N		15	ns	V_{DD} = 25V, I_D = 1A, R_L = 50Ω
		P		50	ns	V_{DD} = -25V, I_D = -0.5A, R_L = 50Ω
$t_{(off)}$	Turn-off-time	N		17	ns	V_{DD} = 25V, I_D = 1A, R_L = 50Ω
		P		50	ns	V_{DD} = -25V, I_D = -0.5A, R_L = 50Ω

* Reverse polarity for P-Channel device

OPTEK

N-Channel Enhancement Mode MOS Transistor
Type HCT7000M





Features

- 200mA I_D
- Ultra small surface mount package
- $R_{DS(ON)} < 5\Omega$
- Pin-out compatible with most SOT23 MOSFETS

Description

The HCT7000M is a high performance enhancement mode N-channel MOS transistor chip packaged in the ultra small 3 pin ceramic LCC package. Electrical characteristics are similar to those of the JEDEC 2N7000. The pin-out and footprint matches that of most enhancement mode MOS transistors built in SOT23 plastic packages.

The HCT7000M is available processed to TX and TXV levels per MIL-S-19500. Order HCT7000MTX or HCT7000MTXV.

Absolute Maximum Ratings

Drain-Source Voltage	60V
Gate-Source Voltage	±40V
Drain Current	200mA
Power Dissipation (T_A = 25°C)	300mW
Power Dissipation (T_S(1) = 25°C)	600mW(2)
Operating and Storage Temperature	-55°C to +150°C
Thermal Resistance $R_{\varnothing JC}$	100°C/W
Thermal Resistance $R_{\varnothing JA}$	583°C/W

Notes:
(1) T_S = Substrate temperature that the chip carrier is mounted on.
(2) This rating is provided as an aid to designers. It is dependent upon mounting material and methods and is not measurable as an outgoing test.

Types HCT7000M

Electrical Characteristics (T_A = 25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	TEST CONDITION
V_{DSS}	Drain-Source Voltage	60		V	V_{GS} = 0 V, I_D = 10 μA
$V_{GS(TH)}$	Gate Threshold Voltage	.8	3.0	V	V_{DS} = V_{GS}, I_D = 1 mA
I_{GSS}	Gate Leakage		±10	nA	V_{DS} = 0 V, V_{GS} = ±15 V
I_{DSS}	Zero Gate Voltage Drain Current		1	μA	V_{GS} = 0 V, V_{DS} = 48 V
$I_{D(ON)}$	On-State Drain Current	75		mA	V_{DS} = 10 V, V_{GS} = 4.5 V
$R_{DS(ON)}$	Drain-Source on-Resistance		5	Ω	V_{GS} = 10 V, I_D = .5 A
$V_{DS(ON)}$	Drain-Source on-Voltage		2.5	V	V_{GS} = 10 V, I_D = .5 A
G_{fs}	Forward Transconductance	100		mS	V_{DS} = 10 V, I_D = .2 A
C_{iss}	Input Capacitance		60	pF	V_{DS} = 25 V, V_{GS} = 0 V, f = 1MHz
C_{oss}	Output Capacitance		25	pF	
C_{rss}	Reverse Transfer Capacitance		5	pF	
$t_{(on)}$	Turn-on Time		10	ns	V_{DD} = 15 V, I_D = .5 A, V_{gen} = 10 V, R_g = 25 Ω
$t_{(off)}$	Turn-off Time		10	ns	

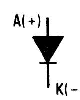
HI REL SURFACE MOUNT

OPTEK TECHNOLOGY, INC.

GLOSSARY

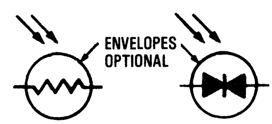
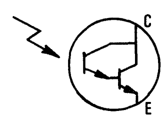
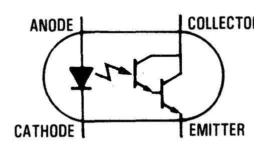
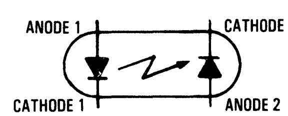
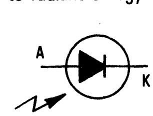
GLOSSARY

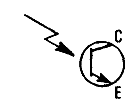
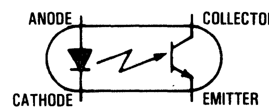
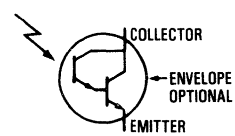
Term	Symbol	Description
Acceptance Angle	Θ	The maximum angle which a ray may traverse and still be detected by a photosensor, usually measured from the optical axis.
Acceptance Cone	—	A cone with an included angle such that any ray within the cone will be detected by the sensor and any ray outside will not.
Ambient Temperature	T_A	Temperature of air or liquid surrounding any electrical part or device.
Angstrom	Å	10^{-10} meter; a unit of length sometimes used to describe wavelength of optical radiation.
Anode	A	The positive terminal of a diode, i.e., the terminal which must have a positive voltage relative to the other terminal (cathode) before the device will conduct.
Aperture	—	A hole or window in an opaque material, used to control the transmission of light.
Aperture Angle	Θ	For radiation sources, the angle between the half power points. See Beam Angle.
Axis of Measurement	—	The direction from the source of radiant energy, relative to the optical axis, in which the measurement of radiometric and/or spectroradiometric characteristics is preferred.
Base	B	The control terminal of a transistor. In a phototransistor, control is provided by light or infrared energy which falls on the transistor and generates a current in the base.
Beam Angle	Θ	A measure of the angular displacement of emitted energy, usually measured as the included angle from one half power point to the other.
Beam Half Angle	—	A measure of the angular displacement of emitted energy, generally measured from the optical axis to the half power point. See Emission Angle.
Blackbody	—	Ideally, a body that would absorb all and reflect none of the radiant energy falling upon it; its reflectivity would be zero and its absorbency (and consequently its emissivity) would be 100%. In practice, a radiator of uniform temperature whose radiant emittance in all parts of the spectrum is the maximum obtainable from any temperature radiation at the same temperature, or a radiator whose spectral radiant emittance conforms with Planck's law of radiation.
Buffer Amp Linearity, Low Voltage	V_{LL}	Output voltage from the buffer of the ABC sensor with a specified input voltage applied to the buffer.
Cathode	K	The negative terminal of a diode, i.e., the terminal which must have a negative voltage relative to the other terminal (anode) before the device will conduct.
Collector	C	The positive current carrying terminal of an NPN transistor.
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	The reverse bias voltage at which the collector-base junction of a transistor will conduct a specified (non-destructive) current much higher than the normal leakage currents that occur at lower voltages. In an NPN transistor, it is measured with the collector positive, the base negative, and the emitter open.
Collector Current	I_C	The amount of current flowing into the collector terminal of a transistor.
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	The voltage at which a transistor, biased in the normal direction with no optical or electrical input to the base, will conduct a specified (non-destructive) current much higher than the normal leakage currents which occur at lower voltages.
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	The collector-emitter voltage of a transistor which is turned "on" by an optical or electrical input to the base, measured under specified conditions of input level and output current load.
Color Temperature	—	The temperature of a blackbody having the same visible color as that of a given non-blackbody radiator.

Term	Symbol	Description
Common Emitter	—	A circuit configuration in which the emitter terminal is common to both input and output current loops; also called grounded emitter.
Commutating dV/dt	—	A changing voltage. In a triac the ability to block this rapidly changing voltage.
Conversion Efficiency, Photovoltaic Diode	—	The ratio of maximum available power output resulting from photovoltaic operation to total incident radiant flux.
Critical Angle	θ_C	The maximum angle of incidence for which light will be transmitted from one medium to another. Light approaching at a greater angle of incidence will be reflected.
Current Transfer Ratio	CTR	In an optically coupled isolator, the ratio of output (transistor) current to input (LED) current under specified conditions.
Dark Condition	—	The condition attained when the electrical parameter under consideration approaches a value which cannot be altered by further irradiation shielding.
Dark Current	I_D	The current that flows through a photodetector when there is no optical input; usually used in reference to photodiodes.
DC Current Gain	H_{FE}	The ratio of collector current to base current in a transistor biased in the common emitter configuration.
DC or AC Input-to-Output Current; Isolation Voltage	I_{IO}	The current between all input terminals shorted together and all output terminals shorted together at a specified voltage.
DC or AC Input-to-Output Voltage; Isolation Voltage	V_{IO}	The voltage applied between all input terminals shorted together and all output terminals shorted together.
Delay Time	t_d	The time elapsed between a step increase in the input and a change in the output equal to 10% of its maximum change.
Detector Noise Current	I_n	The broadband output noise current.
Diode	—	A two terminal device (usually semiconductor) which freely conducts current in one direction and blocks it in the other. 
Duty Cycle	dc	In a signal composed of regularly recurring pulses, the product of the pulse width and the repetition frequency multiplied by 100 to give a percentage.
Duty Factor	—	In a signal composed of regularly recurring pulses, the product of the pulse width and the repetition frequency. Same as duty cycle except that it is expressed as a ratio rather than a percentage.
Emission Angle	—	For radiation sources, the angle with respect to the optical axis at which the radiant power is half the maximum.
Emitter	E	The negative current carrying terminal of an NPN transistor.
Emitter (Radiometric)	—	In radiometrics, a source of radiation.
Emitter-Collector Breakdown Voltage	$V_{(BR)ECO}$	The voltage at which a transistor, biased opposite its normal direction with no optical or electrical input to the base, will conduct a specified (non-destructive) current much higher than the normal leakage currents which occur at lower voltages.
Emitter Current	I_E	The value of current flowing in the emitter terminal of a transistor.
Fall Time	t_f	The time that elapses while a pulse waveform decreases from 90% to 10% of its maximum value.

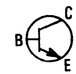
Term	Symbol	Description
Fiber Optics	—	Generally, the technology of using transparent glass or plastic fibers which carry light. Signals can be sent over large distances at high speed by coupling optoelectronic devices via fiber optics.
Flux Density, Luminous or Radiant Intensity	—	The quotient of (1) the respective luminous or radiant flux at a surface divided by (2) the area of the surface.
Forward Bias Voltage	V_F	An external voltage applied in the conducting direction of a PN junction. The positive terminal is connected to the P-type region, and the negative terminal to the N-type region.
Forward Current	I_F	The current which flows across a semiconductor junction when a forward-bias voltage is applied.
Forward Voltage	V_F	The voltage across a diode when it is forward biased at a specified current.
Frequency	f	The number of recurrences of a periodic phenomenon in a unit of time. Usually expressed in hertz (Hz), which is the number of recurrences per second.
Gallium Aluminum Arsenide	GaAlAs	A crystalline compound used to make IREDs. Note: the addition of aluminum to the GaAs roughly doubles the power output of the device at the same input current.
Gallium Arsenide	GaAs	A crystalline compound used to make IREDs.
Half-Density Beam Angle	Θ	The full-cone angle within which the radiant intensity is not less than half of the maximum intensity. See also Beam Angle.
Half Power Point	HP	For radiation sources, the point in the radiation pattern at which the radiant intensity is half the maximum.
High Level Output Voltage	V_{OH}	The voltage on the output terminal of a logic circuit with input level and output load applied that, according to the product specification, will establish a high level at the output.
High Level Supply Current	I_{CCH}	In a logic circuit, the supply current required to operate the circuit when input conditions are such that the output is in the high logic state.
Holding Current	I_H	In a triac, the minimum current through the main terminals which will maintain the device in the on-state in the absence of an input to the gate.
Illuminance (Illumination); Irradiance	E	The respective luminous or radiant flux density incidence on a surface; quotient of the flux divided by the area of illuminated or irradiated surface.
Infrared	IR	Optical radiation that is characterized by wavelength longer than normally pereceived by the eye, but shorter than radio waves. Optek emitters radiate in the infrared range.
Infrared Emitting Diode	IRED	A diode which emits infrared radiation when forward biased.
Input-to-Output Capacitance	C_{IO}	The capacitance between the output of the photosensitive element and the input of the photoemitter element, called coupling capacitance.
Input-to-Output Resistance	R_{IO}	The resistance between the input and output of an optoisolator when the input leads are shorted together and the output leads are shorted together.
Interrupter Assembly	—	Same as Transmissive Assembly.
Irradiance	E_e	The radiant flux density incident on a surface; the quotient of the flux divided by the area of the irradiated surface. Units: watts/square meter, milliwatts/square cm.
Isolation Leakage Current	I_{ISO}	The current produced in an optoisolator when the input leads are shorted together, the output leads are shorted together, and a specified voltage is applied between the input and output.

Term	Symbol	Description
Isolation Voltage	V_{ISO}	The input-to-output voltage withstanding capability of an optically coupled isolator.
Junction Temperature	T_J	The temperature at the PN junction within a semiconductor device.
Light	—	Optical radiation in the range of wavelengths which can be perceived by the human eye.
Light Current	I_L	Current flow through a photosensitive device when exposed to radiant energy.
Light-Emitting Diode (LED)	—	A device capable of emitting luminous energy resulting from the recombination of electrons and holes
Low Level Output Voltage	V_{OL}	The voltage on the output terminal of a logic circuit with input level and output loading applied such that, according to the product specification, a low level at the output will be established.
Low Level Supply Current	I_{CCL}	In a logic circuit, the supply current required to operate the circuit when the input conditions are such that the output is in the low logic state.
Lower Ramp Threshold Voltage	V_{RL}	The lower threshold voltage of the RC pin on the ABC sensor. The circuit discharges a capacitor connected to this pin until the voltage on the capacitor reaches the lower threshold voltage.
Luminous Energy	Q, (Q_V)	Energy traveling in the form of visible radiation.
Luminous Flux, Radiant Flux	—	The respective time rate of flow of luminous or radiant energy.
Maximum Power Dissipation	$P_{D(MAX)}$	Maximum power that a device can safely dissipate under specified conditions which include ambient temperature, heat sinking, and air circulation.
Micron	—	10^{-6} meter.
Nanometer	nm	10^{-9} meter; equal to 10 angstroms or 10^{-3} micron.
Noise Equivalent Bandwidth	B_n	The equivalent bandwidth of a flat (or white) noise spectrum with sharp cutoff and the same maximum value that contains the same noise power as the actual broadband output noise power of the device or current.
Noise Equivalent Power	NEP	The radiant flux at a specific wavelength incident on a detector which gives a signal-to-noise ratio of unity. Unit: watts.
Off-State Collector Current	I_{CEO}	The collector current in a transistor with no optical or electrical input to the base.
Off Time	t_{off}	Storage time plus fall time.
On-State Collector Current	$I_{C(ON)}$	The output (collector) current of a transistor when there is a specified optical or electrical input to the base.
On Time	t_{on}	Delay time plus rise time.
Operating Temperature	T_O	The temperature or range of temperatures over which a device is expected to operate within specified performance limits.
Optical Axis	—	A line about which the radiant energy pattern is centered; usually perpendicular to the active area.
Optical Radiation	—	Electromagnetic radiation in the range of wavelengths from 10 nanometers (extreme ultraviolet) to 1 millimeter (extreme infrared).
Optically Coupled Isolator	—	A device that is designed for transferring electrical signals by utilizing optical energy to provide coupling, with electrical isolation between input and output. Optically coupled isolators usually consist of an IRED coupled to one of a variety of sensor types, shielded from ambient light.

Term	Symbol	Description
Optically Coupled Triac Driver	—	An optically coupled isolator whose output is designed to control the gate of a power triac.
Optocoupler	—	See Optically Coupled Isolator.
Optoelectronic Device	—	A device which responds to, emits, or modifies electromagnetic radiation in the visible, infrared, and/or ultraviolet spectral regions, or a device that utilizes such radiation for its internal operation.
Optoisolator	—	See Optically Coupled Isolator.
Peak On-State Surge Current	$I_{TM(SURGE)}$	An on-state current of short duration and specified waveshape which represents the maximum current surge capacity of a triac.
Peak Wavelength	λp	The wavelength at which the power output of an emitter is maximum.
Photoconductive Diode	—	A photodiode that is intended to be used as a photoconductive transducer.
Photoconductive Transducer	—	A device that is intended to change its conductance as a function of incident light or radiation. 
Photocoupler	—	See Optically Coupled Isolator.
Photocurrent	—	The difference between light current and dark current in a photodetector.
Photodarlington	—	A photosensor consisting of two transistors on a single chip, configured such that the current from the first (photosensitive) transistor is amplified by the gain of the second transistor. Note: photodarlingtons have very high current output compared to phototransistors but speed and linearity are relatively poor. 
Photodarlington Coupler	—	An optocoupler in which the photosensitive element is a darlington-connected phototransistor. 
Photodiode, Avalanche	—	A photodiode that is intended to take advantage of avalanche multiplication of photocurrent.
Photodiode Coupler	—	An optocoupler in which the photosensitive element is a photodiode. 
Photodetector	—	A device that responds electrically when exposed to radiant energy.
Photodiode	—	A diode which is sensitive to incident radiation. Incident photons cause the diode to conduct (if reverse biased) or to generate a current. Note: photodiodes typically have much less output current than phototransistors but are faster and more linear. 

Term	Symbol	Description
Photoemissive Device	—	Synonym for a photoemitter.
Photoemitter	—	A device that emits electromagnetic radiation in the visible, infrared, and/or ultraviolet spectral regions.
Photologic™ Coupler	—	An optocoupler in which the photosensitive element is a digital output integrated circuit.
Photon	—	A quantum (the smallest possible unit) of radiant energy; a photon carries a quantity of energy equal to Planck's constant times the frequency.
Photosensitive Device	—	A device that is responsible to electro-magnetic radiation in the visible, infrared, and/or ultraviolet spectral regions.
Photosensor	—	A device which controls or generates an electric current when irradiated by light.
Phototransistor	—	A transistor which is sensitive to incident radiation. The incident photons result in a base current which is then amplified by the gain of the transistor. 
Phototransistor Coupler	—	An optocoupler in which the photosensitive element is a phototransistor.  Note: The base region may or may not be brought out as an electrical terminal.
Phototransistor, Darlington Connected	—	A phototransistor, the collector and emitter of which are connected to the collector and base, respectively, of a second transistor.  Note: The base regions may or may not be brought out as electrical terminals.
Phototriac Driver Coupler	—	An optocoupler in which the photosensitive element is either a zero current crossing triac driver or a zero voltage crossing driver.
Point Source	—	A radiation source with a maximum diameter less than $\frac{1}{10}$ the distance between source and detector.
Propagation Delay	t_{PLH}, t_{PHL}	In a logic circuit, the time delay between a specified change in input and a corresponding change in the output logic state. t_{PLH} is measured with the output changing from low to high and t_{PHL} with the output changing from high to low.
Radiance	N, L_e	The radiant intensity of the energy leaving or passing through a surface, divided by its area.
Radiant Efficiency	—	The ratio of the total radiant flux emitted to the total input power.
Radiant Flux	Φ_e	Rate of flow of radiant energy, expressed in watts.
Radiant Intensity	I_e	The radiant flux generated per unit solid angle in a given direction, expressed in milliwatts per steradian (mW/sr).
Radiation Pattern	—	The representation of the intensity of emission as a function of direction, in a given plane.
Radiometric	—	Of or pertaining to radiation in all wavelengths.

Term	Symbol	Description
Ramp Leakage Current	I_{RL}	In the ABC sensor, the current that flows through the RC pin (pins) when the device is operated under specified conditions.
Reflective Assembly	—	A device in which an IRED and a photosensor are mounted side by side, such that the photosensor is only irradiated when a reflective object passes in front of the device. Reflective assemblies are used to sense the presence of reflective objects.
Repetitive Peak Off-State Current	I_{DRM}	In a triac, the maximum instantaneous value of the off-state current that results from the application of repetitive peak off-state voltage.
Responsivity	R	A description of the optical sensitivity of a photosensor. It is the ratio of the output current or voltage to the input radiant flux, typically expressed as amps per watt or volts per watt.
Reverse Breakdown Voltage	$V_{(BR)R}$	The reverse bias voltage at which a diode will conduct a specified (non-destructive) current much higher than the normal leakage currents which occur at lower voltages.
Reverse Current	I_R	The current that flows when a reverse bias voltage is applied to a semiconductor junction.
Rise Time	t_r	The time that elapses while a pulse waveform increases from 10% to 90% of its maximum value.
RMS On-State Current	$I_{T(RMS)}$	In a triac, the principal current when the device is in the on-state.
Silicon	Si	An element, abundant in the earth's crust, which is used in highly purified form to make most of the semiconductors used in the modern electronics industry (including all Optek photodetectors). Pure crystalline silicon is carefully "doped" with very small amounts of impurities to control its electrical characteristics.
Snell's Law	—	The law of refraction which predicts the behavior of electromagnetic radiation as it passes from one homogeneous isotropic media to another; expressed as $n1 \sin\Theta1 = n2 \sin\Theta2$ where n1 and n2 are refractive indices and $\Theta1$, $\Theta2$, refer to the angles between the rays and the normal to the interface.
Spectral Bandwidth	BW	The wavelength interval in which a photometric or radiometric spectral quantity is not less than half of its maximum value.
Spectral Response	—	A description of the electrical output characteristic versus wavelength of radiation incident upon a device, usually expressed by a curve.
Static dV/dt	dV/dt	The measure of the ability of a triac or SCR to block a rapidly rising voltage. Static dV/dt is usually measured with application of full rated voltage to the device in a very short but controlled time period. It is expressed in volts/microsecond.
Static Gate Trigger Current	I_{GT}	In a triac, the minimum gate current required to switch the device from the off-state to the on-state.
Steradian	sr	The solid angle subtending an area on the surface of a sphere equal to the square of the sphere's radius. There are 4π steradians in a sphere.
Storage Temperature	T_{STG}	The maximum temperature at which a device may be stored with no power applied.
Storage Time	t_s	The time elapsed between a step decrease in the input and a change in the output equal to 10% of its maximum change.
Supply Voltage	V_{CC}	The power supply voltage required to operate a circuit.
Total Power Output	P_O	The total power that is radiated by a device, expressed in watts or milliwatts.

Term	Symbol	Description
Transistor	–	A three terminal active semiconductor device which is capable of providing power amplification. 
Transmissive Assembly	–	A device in which an IRED and a photosensor are mounted facing each other on either side of a slot, such that an opaque object passing through the slot will interrupt the I_R radiation path and be detected by the photosensor.
Triac	–	A five layer semiconductor device which provides switching action for either polarity of applied voltage and can be controlled in either polarity by a single gate electrode. Triacs are usually used in power control applications. 
Trigger Leakage	I_{T1}, I_{T2}	The current that flows in the trigger terminal of the ABC sensor. I_{T1} is measured with the trigger pin at ground potential and I_{T2} with the trigger pin at V_{CC} potential.
Trigger Voltage	V_T	The minimum voltage which, when applied to the trigger pin of the ABC sensor, will force the RC pin to sink current. Once triggered by a rising edge of this minimum amplitude, the RC pin sinks current until the voltage on the capacitor reaches the lower ramp threshold voltage.
Upper Ramp Threshold Voltage	V_{RU}	The upper threshold voltage of the RC pin on the ABC sensor. The circuit charges a capacitor connected to this pin until the voltage on the capacitor reaches the upper threshold voltage.
Visible-Light-Emitting Diode	VLED	Synonym for light-emitting diode.
Wavelength	λ	The velocity of a wave divided by its frequency. The wavelength of infrared radiation is usually expressed in nanometers.

GLOSSARY

OPTEK TECHNOLOGY, INC.

APPLICATION BULLETINS

APPLICATION BULLETINS

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Thermal behavior of GaAs LEDs

Table of Contents

Introduction

The output power (P_O) of a GaAs LED is a function of forward current (I_F). As this forward current increases, the output power will also increase. This forward current flowing through the LED generates heat (P_D) which causes the junction temperature (θ_j) of the diode to increase. As the junction temperature increases, the output power decreases.

To obtain optimum operating conditions for a GaAs LED, the knowledge of the different thermal parameters and their influence on the major electro-optical parameters must be known. The purpose of this bulletin is to introduce these thermal parameters to the reader and provide a way to use them. Data will be presented and formulae will be given that will allow readers to determine if their system meets manufacturer's guidelines in both a DC mode and a pulsed mode.

Mathematical assumptions have been made to simplify derivations and provide useful formulae in simple terms; empirical data has verified that the resulting error is less than 5%.

Care should be taken in making use of the information presented. For example:

> A current pulse could be short enough to cause no apparent problem within the presented material. However, it could be of sufficient magnitude and duration to exceed the allowable current density of the bond wire interconnect causing it to fail.

Thermal Parameters

The thermal behavior of a GaAs LED can be considered in a simple way by using the analogy of an electrical circuit. In this circuit, the heat power generator, the temperature differences, the thermal capacitors, and thermal resistors replace the conventional current or voltage generators, voltage differences, capacitors, and resistors respectively. Figure 1 shows this equivalent thermal circuit.

Figure 1—Equivalent Thermal Circuit

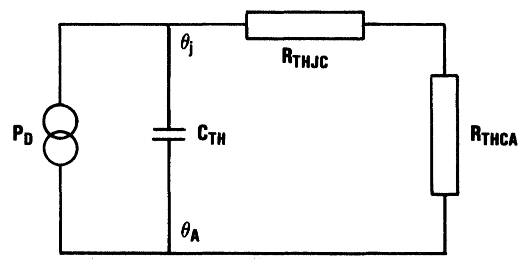


Table 1 defines the various thermal parameters we will be exploring in this bulletin.

Table 1

Table 1
Thermal Parameters

Symbol	Parameter	Units
P_O	Output Power	W
P_D	Dissipated power	W
θ_j	Junction Temperature	°C
θ_A	Ambient Temperature	°C
C_{TH}	Thermal Capacitor	Ws °C^{-1}
R_{THJC}	Junction to Case Thermal Resistance	°CW^{-1}
R_{THCA}	Case to Ambient Air Thermal Resistance	°CW^{-1}
R_{THJA}	Junction to Ambient Air Thermal Resistance	°CW^{-1}
τ_{TH}	Thermal Time Constant ($R_{THJA} \times C_{TH}$)	s
K	Thermal Rating Factor	None
K_{eff}	Effective Duty cycle	None

When forward current (I_F) flows through the GaAs LED, heat or power (P_D) is generated. Most of this heat is generated within:

(a) The upper section of the chip away from the mount area; the "N" area; the cathode.
(b) The mid section of the chip; the junction between the "N" and "P" regions.
(c) The lower section of the chip, the "P" area, the anode.

Heat is also generated in the contact interfaces and the conductors but this is considered negligible. This heat propagates through the chip and the mount surface primarily by thermal conduction. It is then transferred to the ambient air by thermal convection. All of the measurements and data presented in this bulletin were made with the air temperature in the room fairly constant throughout the test period and zero air velocity in the volume surrounding the device except for convection currents. Further, there were no extraneous thermal paths. Normal mounting of the devices in PC boards or adding heat sinks will improve the heat path. This is not considered in this bulletin with the exception of the last four (4) line items in Table 2. R_{THJA} should be considered as R_{THJX} in these cases. Table 2 lists several thermal parameters.

Table 2 - Thermal Parameters of Optek GaAs LEDs

GaAs LED Type	R_{THJA} (°CW^{-1})	C_{TH} (10^{-5}Ws °C^{-1})	τ_{TH} (10^{-2}s)	K
OP123/124, OP223/224	980	1.6	1.5	0.008
OP131-133(W), OP231-233(W)	490	3.0	1.5	0.008
OP140/240	740	4.3	2.0	0.008
OP160/260	740	5.3	3.9	0.008
OP290/295 C, B, A	188	1.4	0.3	0.008
OP291/296 C, B, A	188	1.4	0.3	0.008
OP292/297 C, B, A	188	1.4	0.3	0.008
OP293/298 C, B, A	**500**	**4.0**	**1.5**	0.008
OPB706 (LED)	700	5.2	3.6	0.008
OP123/124, OP223/224(1)	240	4.6	1.1	0.008
OP123/124, OP223/224(2)	400	4.5	1.8	0.008

(1) OP123/124 mounted on 0.062" double-sided PC board.
(2) OP123/124 mounted in OPB125/253 housing.

The first four (OP123 through OP136) GaAs LED's are all hermetic packages. The maximum allowable junction temperature is 125°C. See the example below for one use of Table 2.

(1) OP123/124 has $R_{THJA} = 980°CW^{-1}$

With $\Delta T_j = (125°C - 25°C) = 100°C$.

The maximum power that can be dissipated is:

$$P_{D(max)} = \frac{\Delta T_j}{R_{THJA}} = \frac{100°C}{980°CW^{-1}} = 102 \text{ mW}$$

The next three of the units listed are plastic packages. The maximum allowable junction temperature is 85°C.

OP140 has $R_{THJA} = 740°CW^{-1}$

With $\Delta T_j = (85°C - 25°C) = 60°C$

The maximum power that can be dissipated is:

$$P_{D(max)} = \frac{\Delta T_j}{R_{THJA}} = \frac{60°C}{740°CW^{-1}} = 81 \text{ mW}$$

The derating factor above 25°C can be readily calculated from this information.

(2) OP123/124

$$\text{Derating Factor} = \frac{\Delta P_D}{\Delta T_j} = \frac{102 \text{ mW}}{100°C} = 1.02 \text{ mW}°C^{-1}$$

OP140

$$\text{Derating Factor} = \frac{81 \text{ mW}}{60°C} = 1.35 \text{ mW}°C^{-1}$$

Most manufacturers will give more conservative deratings than these numbers. This is normally due to the devices being used in a quasi heat sink. For example, the OP123/124 is normally mounted in a double sided PC board. The OP140 is normally soldered into a PC board. This would improve the R_{THJA} numbers. This becomes readily apparent by referring to the R_{THJA} number of 980°CW^{-1} for the OP123/124 in free air and the R_{THJX} number of 240°CW^{-1} when the units are mounted in a double sided PC board as shown in Table 2 or the 400°CW^{-1} when they are mounted in the OPB700 or OPB701 housing. There is also a variation in R_{THJA} brought about by a variation in the integrity of the thermal bond between the GaAs LED and the mount surface. This is not easy to measure and is not adaptable to 100% production testing.

Temperature Response to a Thermal Power Step

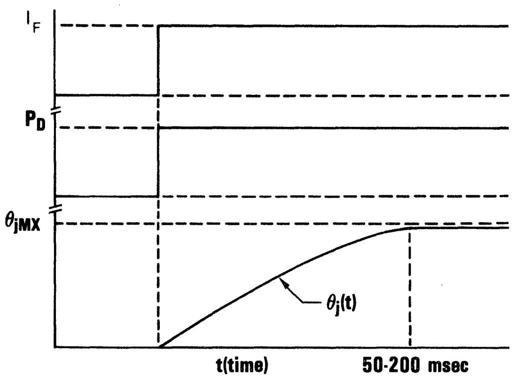
A forward current step is introduced into a GaAs LED causing heat to be generated in the unit and causing the junction temperature to rise. The rise in junction temperature follows the formula shown below:

(3) $$\theta_j(t) = \theta_A + P_D \times R_{THJA}\left(1 - e^{-\frac{t}{\tau_{TH}}}\right)$$

Where t is time in seconds
P_D is dissipated power
τ_{TH} is thermal time constant
R_{THJA} is junction to ambient air thermal resistance
θ_A is ambient temperature.

The junction temperature will approach its maximum value after $t = 5\ \tau_{TH}$ or 5 thermal time constants which approximates 50 to 200 milliseconds. Figure 2 shows the forward current step, the resulting power generated within the chip itself, and the rise in junction temperature versus time.

Figure 2—I_F, P_D, and Junction Temperature Versus Time



Practically, P_O will decrease slightly as soon as the junction temperature of the chip starts to rise and will stabilize 50 to 200 milliseconds after the power is applied. This is discussed in more detail in the section on power droop.

At temperature equilibrium, the maximum junction temperature (θ_{jMX}) is:

(4) $\theta_{jMX} = \theta_A + P_D^* \times R_{THJA}$

Where $P_D^* = V_F \times I_F$

V_F = Forward Voltage @ θ_{jMX}

θ_A = Ambient Temperature.

*For purpose of calculation, $P_D = P$ @ 25°C. The resulting error will have minor impact on the answer. Since V_F decreases with increasing temperature, the resulting answers will be conservative.

Example: Using an OP133 which has a measured output of 5.3 mW @ θ_A = 25°C, calculated the output in a system where I_F = 40 mA and θ_A = 50°C. The I_F versus P_O without heating is relatively linear above 5 mA.

$$P_O\ (40\ \text{mA} @ 25°C) = P_O\ (100\ \text{mA}) \times 40/100 = 5.3\ \text{mW} \times 0.4 = 2.12\ \text{mW}$$

The power generated within the LED causing the junction temperature to rise is:

$$P_D = V_F \times I_F = 1.5\ \text{volts} \times 0.04\text{A} = 0.06\ \text{watts}$$

The final junction temperature is:

$$\theta_j = \theta_A + P_D R_{THJA} = 50°C + (0.06 \times 490) = 79.4°C$$

The output power of the OP133 is:

(5) $P_O(\theta_j) = P_O(25°C) \times e^{-K(\theta_j - 25°C)}$

$$P_O(79.4°C) = 2.12 \times e^{-0.008(79.4 - 25)} = 1.38\ \text{mW}$$

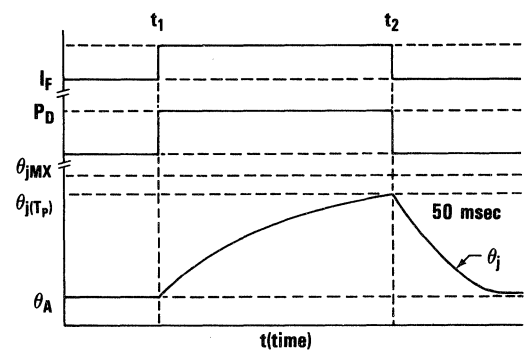
This constitutes a 35% decrease in output power from the 25°C level. The value of K was taken from Table 2.

Temperature Response to a Thermal Power Pulse

A forward current pulse is introduced into a GaAs LED. This pulse is shorter than the 50 to 200 milliseconds required for the junction temperature to approach its highest value.

Figure 3 shows the relationship of the current pulse to the power pulse to the junction temperature versus time.

Figure 3—Current Pulse, Power Pulse, and $\theta_{j(T_P)}$ Versus Time



When I_F begins to flow, the power generated within the LED causes $\theta_{j(t)}$ to follow the relationship:

(6) $$\theta_{j(t)} = \theta_A + P_D R_{THJA}\left(1 - e^{-\frac{t}{\tau_{TH}}}\right) \qquad t_1 \leq t \leq t_2$$

When I_F stops @ time t_2, the P_D will stop and the junction temperature θ_j will start to decrease. This will follow the relationship:

(7) $$\theta_{j(t)} = \theta_A + \left[P_D R_{THJA}\left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right]\left(e^{-\frac{t}{\tau_{TH}}}\right) \qquad t > t_2$$

Example: A single 1A pulse 100 sec wide is applied to an OP136. What will the junction temperature be at the end of the 100 μsec pulse?

$$\theta_{jMX}(100\ \mu sec) = \theta_A + P_D R_{THJA} \left(1 - e^{-\frac{t}{\tau_{TH}}}\right)$$

$$\theta_{jMX}(100\ \mu sec) = 25°C + (2V \times 1A) \times 470 \left(1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}\right)$$

$$= 25°C + 4.6°C = 29.6°C$$

Same as above except t = 1 msec

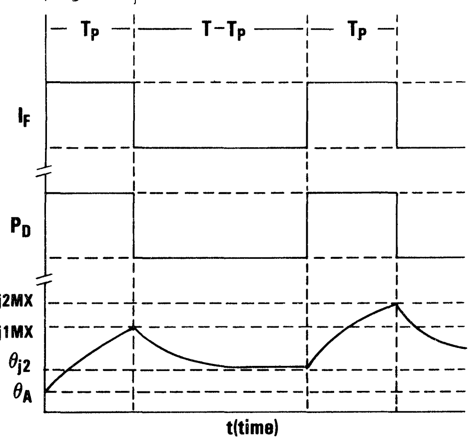
$$\theta_{jMX}(1\ msec) = 25°C + 2 \times 470 \left(1 - e^{-\frac{10^{-3}}{2 \times 10^{-2}}}\right)$$

$$= 25°C + 45.5°C = 70.5°C$$

Temperature Response to Recurrent Thermal Pulses

A forward current pulse is introduced into a GaAs LED. At some later time, the pulse is repeated. Figure 4 shows the relationship of I_F to P_D to θ_j.

Figure 4—I_F, P_D, and θ_j Versus Time



The junction temperature θ_j rises during the first power pulse from θ_A to θ_{j1MX}.

Refer to Equation (3).

$$\theta_{j1MX} = \theta_A + P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

The junction temperature θ_j decreases during the off time of the power pulse from θ_{j1MX} to θ_{j2}.

Refer to Equation (7).

$$\theta_{j2} = \theta_A + \left[P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right]\left(e^{-\frac{(T - T_P)}{\tau_{TH}}}\right)$$

During the second pulse, the junction temperature will rise from θ_{j2} to θ_{j2MX}.

Refer to Equation (3), (6).

$$\theta_{j2MX} = \theta_{j2} + P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

After the second pulse is removed, the junction temperature will decrease to a new minimum temperature θ_{j3}.

Refer to Equation (7).

$$\theta_{j3} = \left[\theta_{j2} + P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right]\left(e^{-\frac{(T - T_P)}{\tau_{TH}}}\right)$$

This swinging movement of θ_j goes on and on with $\theta_{jMX(n)}$ and $\theta_{j(n)}$ gradually rising to a stabilized value. At the end of the n^{th} pulse, the junction temperature is $\theta_{jn}MX$.

$$(8)\quad \theta_{jnMX} = \theta_A + \left[P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)\right] \times \left[\sum_{i=0}^{i=n-1} \left(e^{-\frac{(T - T_P)}{\tau_{TH}}}\right)\right]$$

When the temperature stabilization point is finally reached, the θ_{jMX} becomes:

$$(9)\quad \theta_{jMX} = \theta_A + P_D R_{THJA} \left(\frac{1 - e^{-\frac{T_P}{\tau_{TH}}}}{1 - e^{-\frac{T_P}{\tau_{TH}\left(\frac{n}{1-n}\right)}}}\right)$$

Where $n = \frac{T_P}{T}$ or duty cycle

For small values of (n), the equation simplifies to:

$$(10)\quad \theta_{jMX} = \theta_A + P_D R_{THJA} K_{eff}$$

Where $K_{eff} = \dfrac{1 - e^{-\frac{T_P}{\tau_{TH}}}}{1 - e^{-\frac{T_P}{n\tau_{TH}}}}$ = effective duty cycle

The minimum junction temperature becomes:

$$(11)\quad \theta_{jMIN} = \theta_A + P_D R_{THJA} K_{eff} \left(e^{-\frac{T_P}{n\tau_{TH}}}\right)$$

The delta temperature or the difference between θ_{jMX} and θ_{jMIN} becomes:

$$(12)\quad \Delta\theta_j = \theta_{jMX} - \theta_{jMIN}$$

$$\Delta\theta_j = P_D R_{THJA} K_{eff} \left(1 - e^{-\frac{T_P}{n\tau_{TH}}}\right)$$

$$= P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

Example: An OP136 is operated at I_F = 1A, n = 1%, T_P = 100 μsec. What is θ_{jMX}? θ_{jMIN}? $\Delta\theta_j$?

$$OP136\ R_{THJA} = 470°CW^{-1}$$

$$P_D = 1A \times 2V = 2W$$

$$K_{eff} = \frac{1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}}{1 - e^{-\frac{10^{-4}}{2 \times 10^{-4}}}} = 1.26 \times 10^{-2}$$

Refer to Equation (10).

$$\theta_{jMX} = 25°C + (2 \times 470 \times 1.26 \times 10^{-2}) = 36.7°C$$

Refer to Equation (11).

$$\theta_{jMIN} = 25°C + (2 \times 470 \times 1.26 \times 10^{-2}) \left(e^{-\frac{10^{-4}}{2 \times 10^{-4}}}\right) = 32.1°C$$

Refer to Equation (12).

$$\Delta\theta_j = 36.7° - 32.1 = 4.6°C$$

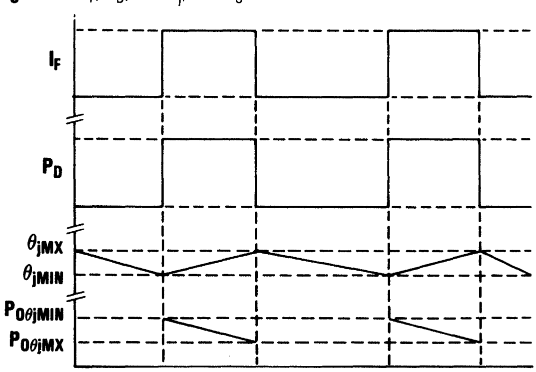
Verifying, refer to Equation (12).

$$\Delta\theta_j = 2 \times 470 \left(1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}\right) = 4.6°C$$

Power Droop

The junction temperature of an LED will oscillate between θ_{jMX} and θ_{jMIN} under recurrent pulses after the pulses have been on for a period of time. The radiant power output (P_O) will decrease during the "ON" time as the junction temperature rises from θ_{jMIN} to θ_{jMX}. This is shown in Figure 5 and is called power droop.

Figure 5— I_F, P_D, and θ_j, and P_O Versus Time



This decrease in power out or power droop during the "ON" cycle is dependent on θ_{jMX} and θ_{jMIN}. Most systems desire this droop to be kept below 5-10% in order to limit the influence on system operation. The major factors that control this are the forward current (I_F), forward voltage drop (V_F), pulse duration (T_P), duty cycle (n), and thermal resistance (R_{THJA}).

$$P_O(\theta_{jMIN}) = P_O(25°C) \times e^{-K(\theta_{jMIN} - 25°C)}$$

$$P_O(\theta_{jMX}) = P_O(25°C) \times e^{-K(\theta_{jMX} - 25°C)}$$

By definition, the power droop is:

$$P_{Droop} = \frac{P_O(\theta_{jMIN}) - P_O(\theta_{jMX})}{P_O(\theta_{jMIN})}$$

$$(13)\quad P_{Droop} = 1 - e^{-K(\theta_{jMX} - \theta_{jMIN})}$$

Example: An OP136 is being operated at I_F = 1A and n = 1%. What is the maximum pulse width for a droop of 5%?

$$P_{Droop} = 1 - e^{-K(\theta_{jMX} - \theta_{jMIN})}$$

$$0.05 = 1 - e^{-0.008(\theta_{jMX} - \theta_{jMIN})}$$

$$\theta_{jMX} - \theta_{jMIN} = 6.41°C$$

Refer to Equation (12) for $\Delta\theta_j$.

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

$$6.41 = 2 \times 470 \left(1 - e^{-\frac{T_P}{2 \times 10^{-2}}}\right)$$

$$T_P = 138\ \mu sec$$

Example: What is the power droop if T_P is changed to 100 μsec?

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right) = 2 \times 470 \left(1 - e^{-\frac{10^{-4}}{2 \times 10^{-2}}}\right) = 4.6°C$$

$$P_{Droop} = 1 - e^{-0.008(4.6°C)} = 3.6\%$$

Example: What is the power droop on the OP133 under the same conditions as the OP136?

$$I_F = 1A,\ n = 1\%,\ T_P = 100\ \mu sec$$

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right) = (1A \times 2.5\ V) \times 490 \left(1 - e^{-\frac{10^{-4}}{1.5 \times 10^{-2}}}\right) = 8.07$$

$$P_{Droop} = 1 - e^{-0.008(8.07)}$$

$$P_{Droop} = 0.0625 = 6.25\%$$

Example: What is the maximum power that can be dissipated in the OPB950 when T_P is 20 μsec, duty cycle is 1%, and droop is restricted to 5% maximum?

$$P_{Droop} = 1 - e^{-K(\theta_{jMX} - \theta_{jMIN})}$$

$$0.05 = 1 - e^{-0.008(\theta_{jMX} - \theta_{jMIN})}$$

$$(\theta_{jMX} - \theta_{jMIN}) = 6.41°C$$

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

$$6.41 = P_D \times 250 \left(1 - e^{-\frac{20 \times 10^{-6}}{3.24 \times 10^{-3}}}\right)$$

$$P_D = 4.23$$

With a V_F of approximately 2.5 volts, the maximum I_F under the above conditions would be 1.7 amps.

7. Conclusion

The data presented will allow calculations that effect various power levels, pulse widths, and duty cycles on Optek GaAs LEDs. All standard products are covered. The pertinent thermal formulae are included as a separate section for easy reference. These formulae coupled with the information given in Table 2 will allow designers to optimize their design utilizing Optek LEDs in the pulse mode.

Daniel Cognard

William Nunley

8. Thermal Formulae

1. Maximum Power Dissipation

$$P_{D(MAX)} = \frac{T_j}{R_{THJA}}$$

2. Derating Factor

$$\frac{\Delta P_D}{\Delta T_j}$$

3. Effective Duty Cycle (Square current pulses)

$$K_{eff} = \frac{1 - e^{-\frac{T_P}{\tau_{TH}}}}{1 - e^{-\frac{T_P}{n\tau_{TH}}}}$$

4. Maximum Junction Temperature (Repetitive Pulses)

$$\theta_{jMX} = \theta_A + P_D R_{THJA} K_{eff}$$

5. Minimum Junction Temperature (Repetitive Pulses)

$$\theta_{jMIN} = \theta_A + P_D R_{THJA} K_{eff} \left(e^{-\frac{T_P}{n\tau_{TH}}}\right)$$

6. Junction Temperature Swing

$$\Delta\theta_j = P_D R_{THJA} \left(1 - e^{-\frac{T_P}{\tau_{TH}}}\right)$$

7. Power Droop

$$P_{Droop} = 1 - e^{-0.008(\Delta\theta_j)}$$

OPTEK

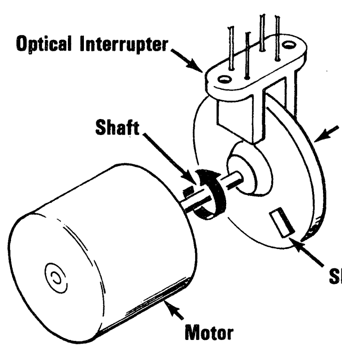
Motion sensing with optical interrupters—selecting the proper sensor for optimum system design.

This application bulletin will discuss many of the variables associated with single channel encoding. This will include design considerations for using both non-apertured and apertured transistors or Photologic™ output devices. Refer to application bulletins 203 and 206 for additional information.

General Discussion

The most common application of optoelectronics is the sensing of motion with an optical interrupter. The normal single channel optical interrupter module consists of an emitter or energy source and a receiver or energy sensor separated by a slot or air gap. The interruption of this beam causes an on/off signal from the sensor. When the energy path is blocked, the sensor will be "off" allowing only leakage current to flow. When the energy path is open, the sensor will be "on," causing significantly higher currents to flow. This is often accomplished by placing a rotating plate (or encoder disc) in the slot between the LED and energy sensor as shown in Figure 1.

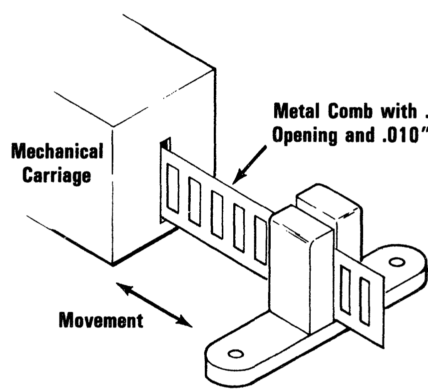
Figure 1 – Tachometer or Motor Speed Monitor



There is usually an opening or slot in the encoder disc that allows the photosensor to be exposed to energy from the LED once each revolution. The energy through the slot will cause the sensor to turn "on" when the slot is present and turn "off" after the slot goes by. This energy pulse will relate the mechanical motion of the encoder disc to the electrical signal by giving one pulse per revolution. By counting these pulses for a given time interval, the speed of rotation may be determined. This gives rise to the "Tachometer" or motor speed monitor.

This encoder disc may be replaced with a fence or comb that passes through the same slot. The same logic presented for the encoder disc will hold true. One electrical pulse is formed for each opening in the fence or comb that passes the LED/sensor pair. Thus the linear motion of the fence or comb can be related to an electrical series of pulses. Figure 2 shows this mechanical system pictorially.

Figure 2 – Linear Encoder Relating Distance Versus Pulses

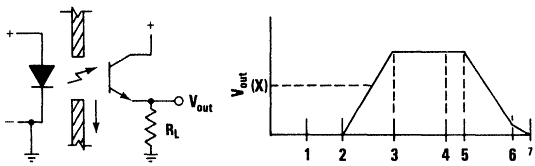


Analysis of the use of an optical interrupter module for a specific application requires several considerations to be analyzed. Most design engineers consider cost, functionality, and reliability as goals in their design. Most important, however, is total application performance. The part must be designed so that minimum support is required in a production type environment. This production environment begins with the fabrication of the basic design and continues through the design performance in subsequent sub-assemblies until the final product is complete. The design is considered successful if, once implementation is complete, the system runs so smoothly, the designer receives no negative feedback. This requires "luck" or a systematic approach to understanding and consideration of all major variables. This application bulletin will use a tachometer design as the mechanism to apply the philosophy of "the successful designer approach."

Non-apertured Encoding

Most tachometer applications require a digital signal which can be easily processed to determine the speed at which a mechanical motion is taking place. There are several variables that need to be discussed that control this digital signal. Figure 3 pictorially represents the general wave shape that will appear across the load resistor as the slot goes by the sensor.

Figure 3 – Pictorial Representation of Signal Pulse



POINTS		DESCRIPTION
Turn on delay time	1	Sensor starts to be uncovered
Gain + turn on time	2	Sensor starts to turn "on"
Slot Width	3	Sensor reaches maximum turn "on" or saturation
Turn off delay time	4	Sensor starts to be covered
	5	Sensor starts to turn "off"
Turn off time	6	Sensor is completely covered
	7	Sensor output of signal current decreases to leakage

As the slot starts to open up the energy path between the sensor and the LED, the sensor will start to turn "on." If the system has adequate gain, the sensor will saturate prior to the trailing edge of the slot reaching the leading edge of the sensor. The signal level will diminish as the slot goes by reducing the energy level to the sensor.

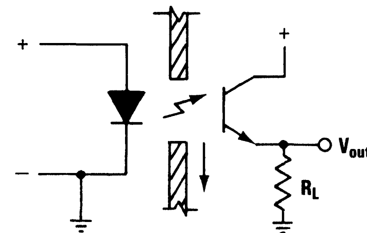
This time interval from 1 through 7 will remain fairly consistent for a given setup. As different units from various production runs are substituted, the main variations that will be viewed are:

a. Variations in slope between 2 and 3
b. Variations in slope between 5 and 7

As the system gain increases, the turn on time will decrease and the flat portion between 3 and 5 will get wider. In other words, 3 will move to the left and 5 will move to the right. The turn on delay will decrease slightly, moving 2 to the left. The point labeled 7 will move to the right showing the sensor turn off time has increased. This will cause the voltage reading at point 6 to increase. As the system gain decreases, the inverse will happen. Points 3, 4, and 5 will become one point and start to decrease. Points 1 and 6 never move. If the circuit is desired to turn on or off at level "X," the "X" will move as these slopes change.

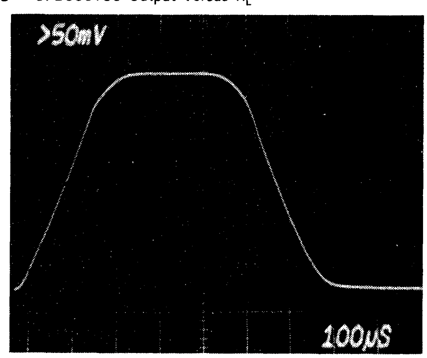
The OPB860T55 is a commercially available optical interrupter from Optek Technology. It has no built-in aperture. It will be used as an example for the discussion of the choice of a specified load resistor. Figure 4 shows a typical circuit where V_{out} will drive the input of a TTL gate such as the SN7414 Schmitt trigger.

Figure 4 – Optical Beam Interrupter

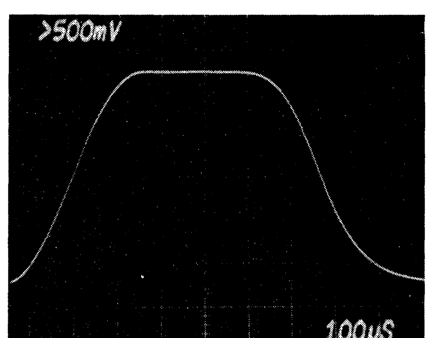


The choice of this load resistor is usually the first parameter the design engineer must consider. The end result is a TTL compatible analog voltage generated across this load resistor. The minimum allowed on-state current and the maximum allowed off-state current of the OPB860T55 become the first two restrictions on the choice of this load resistor. In order to be able to generate a reliable digital output, the system must guarantee the analog voltage will swing above and below the positive and negative going thresholds, respectively, of the TTL gate. Figure 5 shows the output of the OPB860T55 with the resistive load of 1000 ohms, and 10,000 ohms.

Figure 5 – OPB860T55 Output Versus R_L



R_L = 1000 ohms



R_L = 10,000 ohms

APPLICATION BULLETINS

A study of these photographs will quickly show a positive and a negative aspect. As you increase the value of the load resistor, the analog voltage swing across it quickly increases. The standard product guarantees 500 microamperes of output with a 20-milliampere input. This corresponds to 500 millivolts across 1000 ohms and 5 volts across 10,000 ohms. The maximum turn on voltage required to trip the SN7414 is 2.0 volts. It also becomes apparent that as you increase the value of the load resistance, the rise and fall time is adversely affected. The rise time (10% to 90%) is 160 microseconds with the 1000-ohm load increasing to 180 microseconds with the 10,000-ohm load. The fall time (90% to 10%) is 170 microseconds with the 1000-ohm load increasing to 200 microseconds with the 10,000-ohm load. The frequency response is significantly decreased with increased load resistance. Keep in mind that the measured rise times and fall times are a combination of the electrical rise and fall time of the sensor as well as the mechanical rise and fall time of the system. The sensor gradually is exposed to the light as it is uncovered and the light is gradually removed as it is covered. This increase in load resistance may lead to a secondary problem.

As the magnitude of the load resistor is increased, greater care must be taken in the mechanical design to prevent off-state problems. This means guarding against spurious light signals that may create noise or unwanted signal levels adequate to give a signal pulse when none is there.

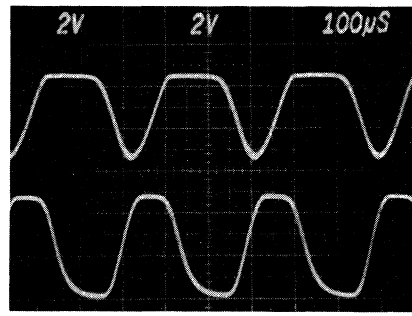
Two other options become potential problem solvers. Increasing the LED drive current will increase the output current. Care must be taken as increasing the drive current will also decrease reliability. The supplier may be asked to select units that will give a higher output. This will increase the cost in inverse proportion to the amount of units meeting the new requirements that lie within the production distribution.

Apertured Encoding

The OPB860 series are available with sensor apertures of .010″ and .050″. The OPB860T51 which has a .010″ × .040″ sensor aperture will be discussed. It offers a good alternative to the OPB860T55 when resolution becomes more critical. Figure 6 shows the comparison of the wave shapes across the 1000-ohm R_L of the OPB860T55 and OPB860T51.

The waveforms shown in Figure 6 are made with an apertured disc that had .025″ openings and .038″ opaque areas for its total periphery. This causes the OPB860T55 (top trace) not to go completely to ground potential which is the cross hatched "x" line on the scope faceplate. This is due to the "light bleed" around the .038″ opaque area causing the sensor to continue conduction. This would not be present in single pulses per revolution. Minimization of the "light bleeding" can be obtained by making the encoder disc (50% opaque-50% open) 25% larger than the width of the sensor aperture. The turn on and turn off times are about 60 microseconds for the OPB860T51 and 80 microseconds for the OPB860T55. This is due to the mechanical turn on and turn off

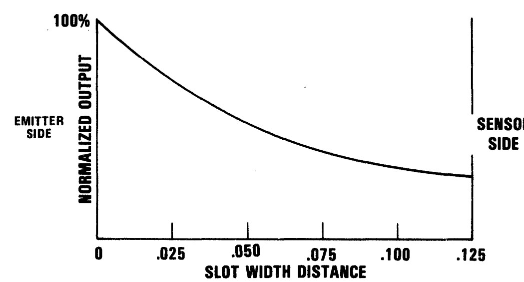
Figure 6 – OPB860T55 (upper) Versus OPB860T51 (lower)



times being limited to .010″ in the OPB860T51 while going as long as .060″ on the OPB860T55.

In addition, it is important to keep the encoder disc as close to the sensor as possible to further decrease "light bleeding." Note that the output level of the sensor in an individual unit will decrease as the encoder wheel moves laterally from the LED or emitter side toward the sensor side of the unit. This is shown in Figure 7.

Figure 7 – Normalized Sensor Output Versus Lateral Slot Opening



This is brought about because the energy from the LED is not collimated and does not have a point source radiation pattern. In addition to the encoder position relative to the sensor, the effect can be minimized by minimizing wobble of the encoder wheel within the interrupter slot. In more complex applications where much greater resolution is needed, i.e., the width of the LED and sensor apertures are decreased to the point that energy from the LED cannot be detected by the sensor, the use of a multi-slotted aperture called a reticle with a pattern identical to the encoder disk is used. (See Application Bulletin 206 for more information.) The effect is a shuttering of light. It allows more energy to be sensed by the sensor while maintaining high resolution.

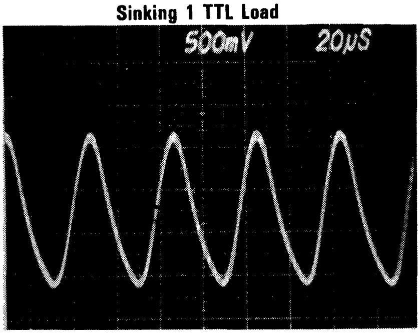
Another solution to the higher resolution requirements is to use Photologic™. This improves timing accuracy when it is not convenient to have amplification circuitry in close physical proximity to the optical interrupter module. This amplification guards against noise causing spurious signals which could upset system performance.

Apertured Function Encoding

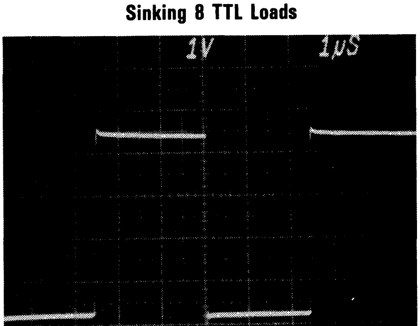
The solution to the problems presented before is a sensor function. The OPB960T51 is similar in appearance to the OPB860T51. It requires three leads for the sensor rather than two leads. The sensor function is a Photologic™ chip consisting of a photo sensitive element and a Schmitt trigger buffer integrated on a common chip. The housing contains a .010″ aperture in front of the Photologic™ sensor to allow for high resolution encoding. The frequency response of the OPB960T51 is improved over the OPB860T51 to 250 kHz with typical rise and fall times of 70 nanoseconds. The output is capable of driving 8 TTL loads over the temperature range of −40 °C to +70 °C. Figure 8 clearly shows the suitability of the OPB960T51 when compared to the OPB860T51.

Figure 8

OPB860T51 @ 25 kHz
Sinking 1 TTL Load



OPB960T51 @ 200 kHz
Sinking 8 TTL Loads



As long as the required frequency response is slow enough and the output is adequate, the OPB860T51 is the best choice from a system cost. This is further supported if unused logic gates exist for the designer to process the opto signal into a digital output. As the applications become more sophisticated and importance is shifted to improved performance and simplification of complex processing circuits, the OPB960T51 becomes the best choice for the designer. A major advantage to the designer is the guaranteed performance from −40 °C to +70 °C. The result is a much more reliable design in terms of degradation and system performance.

Conclusion

The OPB860T55 (non-apertured optical interrupter) will perform quite reliably in low speed, low resolution encoding. The OPB860 family offers an improvement in resolution. The narrow aperture offers superior resolution in linear encoders. The OPB960T51 is the choice where higher output levels, speed, and precise resolution are required.

Refer to Application Bulletins 203 and 206 for additional information.

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WILLIAM NUNLEY

OPTEK

Soldering to semiconductor leads – a supplement to manufacturer's specifications.

Normal lead soldering information furnished on semiconductor product data sheets is limited to the maximum temperature, the maximum time at this temperature and the minimum distance from the temperature to the case of the unit. This bulletin discusses some of the aspects of soldering using an iron, a pot, or a flow bath. This will involve discussions of both hermetic or metal packaged parts and plastic encapsulated parts.

GENERAL DISCUSSION

A variety of different methods are used to make a solder joint between a semiconductor product and the circuit to which it is wired. Care and expertise are required to minimize unit loss and maximize unit yield. A few technique improvements, and suggestions as to proper solder and flux selections are discussed. Familiarization with the points brought out in this bulletin will assist the user to minimize solder problems.

PERFORMANCE CHARACTERISTICS

A typical data sheet will have the following information in the absolute maximum ratings:

Lead Soldering Temperature . . . . 240°C
(1/16 inch from case for 3 seconds)

These conditions except for "time" are readily controlled in flow soldering and solder pot applications. It becomes difficult to control the maximum temperature in solder iron applications. The normal solder used is 60/40 lead tin which softens at 180°C and flows at 220°C. If the temperature of the iron or the time it is in contact with the solder lead interface is not controlled, the 240°C can be significantly exceeded. Several techniques or controls are helpful in preventing this overheating.

1. Limiting the maximum temperature of the iron by controlling the power to the iron. The slower the operator is, the cooler the iron should be.
2. Careful selection of proper solder, flux, iron, tip and surface preparation can minimize problems.
3. Verbal explanation, knowledgeable tutoring and assistance, and pictorial examples can also be helpful.
4. Proper design of the work station to minimize fatigue and encourage repeatable operator steps such that the solder operation is done in the same sequence by the same motions.
5. Once the technique is learned, it is very important to encourage speed. Normally, the higher the output, the higher the quality level once the basic technique has been mastered.
6. Design of the PC board land patterns with the unit and method of soldering of uppermost importance can be of significant help. The subsequent discussion on soldering of the pill package will illustrate this.

Table 1 lists the solder, flux, dwell times and distances recommended by Optek on their hermetic and plastic encapsulated components.

TABLE I – Soldering Components Listing

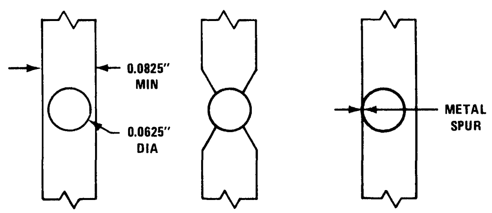
PACKAGE	TYPE OF SOLDER	TYPE OF FLUX	MAX DWELL TIME	DISTANCE FROM CASE	COMMENTS
Flow Soldering					
Hermetic	63/37 Tin Lead Bar	Active Rosin foaming flux (Kester 197 is suitable)	10 Sec	1/16"	Except for "pill" packages
Plastic	63/37 Tin Lead Bar		10 Sec	1/16"	
Solder Pot					
Hermetic	63/37 Tin Lead Bar	Kester 1544 is suitable	10 Sec	1/16"	Use water white rosin flux on pills (Alpha 100 is suitable)
Plastic	63/37 Tin Lead Bar		10 Sec	1/16"	
Solder Iron					
Hermetic	60/40 Tin Lead Wire Rosin Core, as small a diameter as possible		3 Sec	1/16"	If fluxing is required, use mildly activated rosin flux dispensed from hypodermic needle. Kester 1544 is suitable.
Plastic			3 Sec	1/16"	

All rosin flux residue can be removed with isopropyl alcohol and water rinses. (All recommended fluxes are rosin base.)

The pill package (OP 600—OP 123 types) requires more care than any other package. The unit is designed for solder contact on either side of a PC board by any of the three techniques. It is not normally flow soldered since two passes must be made through the machine, and tooling can be complicated. Care must be taken in the PC board design to prevent subsequent problems. The mounting hole should be drilled to 0.0625" ±0.001". The following should be considered when designing the land area for the lens side of the device:

FIGURE I

PC Land Pattern Design



1. If space permits, allow a minimum of 0.010" on either side of mounting holes.
2. Design with cutaways when lands are narrow or consistent orientation of tabs is desired.
3. Hole off center with narrow lands will create fingers of land pattern due to "undercut" that may short the unit as the package is inserted into the hole.

The two desirable factors are: To have as much surface area of land pattern adjacent to the unit as possible to ensure support of both lens mounting tabs to prevent tilting, and to provide mechanical strength of land pattern when unit is being reworked or removed.

HAND SOLDERING

Once the packages are inserted into the PC board, the board should be turned so lens side is down and resting on a hard rubber or similar surface that will prevent damage to the glass lens but firmly support it. The operator will then press firmly down on the board with one hand. The iron is held in the other hand with the tip resting on the land pattern approximately 1/4" from the unit. The tip is slowly moved toward the unit; while watching the land pattern melt ahead of the tip. The speed of travel is as fast as the operator can handle the movement comfortably ensuring the land pattern melts. At the time the tip reaches the unit, solder is fed by the hand resting on the board without removing the downward pressure. The iron is wiped around the unit at the same rate of travel as was used on the land pattern. Once the 360° circle is complete, the solder wire is removed. The operator may make another 360° turn with the iron. Experience will show the best way. After all the plug sides are soldered, the board will be inverted and the lens tabs will be soldered to the two land patterns. The same technique is used except omit the 360° circle. The tabs are soldered in two operations.

SOLDER POT or DIP SOLDERING

A popular method of soldering pills in PC boards, when the design permits, is dip soldering or immersing the pill in the PC board in molten solder. The following conditions called out in Table II should be used.

TABLE II – Dip Soldering

Temperature of solder	230°C ±5°C
Insertion or retraction rate	0.25 inches/second
Dwell Time	3—5 seconds
Flux	"R" type (non-activated)
Flux Dilution	Methanol

CAUTION: After removing from the solder pot, the unit should be held still until the solder has hardened. Vertical insertion and removal with minimum lateral movement is required for minimum problems (inadequate coverage or shorts). There should be a minimum of 0.025" clearance between lands to prevent bridging.

All solder joints on all other packages in 0.062" PC boards should be soldered on the side away from the component. This guarantees the minimum distance of 1/16" from device to heat source. On open air solder joints, a pair of long nose pliers or some other heat sink gripping the lead between the joint and the unit can prevent problems. By following the information given above and exercising good judgement and common sense, the user will encounter very few problems related to solder joints on Optek components.

WILLIAM NUNLEY

HOWARD BROWN

Application Bulletin 203
July 1989

OPTEK

TWO CHANNEL OPTICAL INTERRUPTERS MAY BE USED FOR DETERMINING DIRECTION OF ROTATION, SPEED, AND THE RELATIVE LOCATION OF A ROTATING SHAFT

Optek has two types of dual channel optical interrupters available. The OPB 822 family has two side-by-side channels on 0.212" centers and the OPB 826 family has two vertical channels on 0.150" centers. These standard parts may be used for determining direction of rotation, speed, and relative location of a rotating shaft. This bulletin will discuss some of the design aspects of two channel encoding along with circuit concepts and unit performance.

GENERAL DISCUSSION

Rotational direction of a shaft can be readily determined by utilizing the two channels of an optical interrupter, an encoder disc with a number of openings around the circumference, and some simple electronics. The speed and relative shaft location information is available as a by-product and requires some additional electronics.

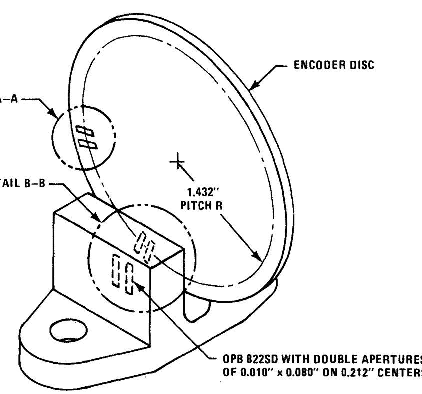
Figure 1 is a pictorial definition of terms used in this bulletin and should be referred to for clarification. A period is defined as 360 electrical degrees or the mechanical width of one opening plus one closure at the central point of the slot near the circumference of the encoder disc. When using a vertical, dual-channel unit, the outer row of periods are normally offset by 90 electrical degrees, or 1/4 period, from the inner row of periods. This will cause one channel to turn on approximately 90 electrical degrees ahead of the other as a function of rotation. In shaft encoding terminology, quadrature is the term defining determination of rotational direction by the phase relationship between the outputs of the two channels. System design normally uses 90° for this phase shift. Speed can be determined by accumulating the number of signal pulses for a fixed period of time, dividing by the number of periods per revolution thus obtaining the revolutions for this time period. Relative location is determined by dividing 360 by the number of periods around the circumference. A pulse is generated for each of these rotational segments. Counters may be used to relate a certain number of pulses to a desired action. This bulletin will describe the method of obtaining the three pieces of information (rotation direction, speed, and relative location) rather than what is done with the information.

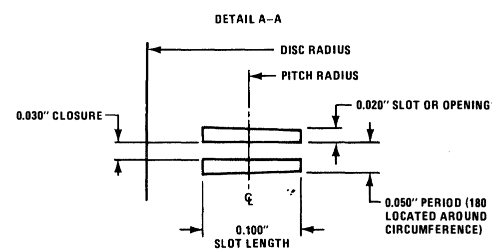
PERFORMANCE CHARACTERISTICS

The OPB 822SD is used as the demonstration interrupter to describe method and operation. Apertures (0.010" x 0.080") are mounted in front of both sensors and LED's. The 0.010" dimension is perpendicular to the rotational vector of the encoder disc at the slot between the sensor and LED. A system is desired with 2° mechanical resolution of rotational movement, thus 360°/2 or 180 cycles or periods around the circumference. Each cycle or period corresponds to an opening and a closure in the encoder disc passing a sensor and LED combination.

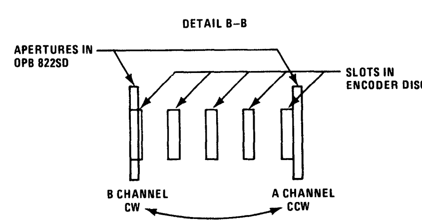
FIGURE 1

Pictorial Definition of Terms





* The sides of the slots lie on the extension of the two radii that are 1.432" long and 0.020" apart at the chord that defines the width of the center of the slot. The contained ∠ at that point is 0.8°.



An off-multiple of periods between the center line of the sensor apertures (0.212") is required for the 90° phase shift. This off-multiple can be 1/4, 3/4, 1-1/4, 1-3/4, 2-1/4, 2-3/4 etc. periods. For example, a period of 0.050" will yield 4-1/4 cycles or periods in the 0.212" distance between these apertures.* The radius of the encoder disc is determined to be 1.432". (0.050" period x 180 periods per revolution x 1/2 π = radius). The opening in the disc should not be less than 0.010" as this would decrease the guaranteed output signal. A good rule for designing encoders is to keep the ratio of the opening to the closure at 2/3's. The disc can now be specified as:

Pitch radius — 1.432" (From center of wheel to ℄ of slots and apertures)

Slot length — 0.100" (0.020" tolerance above 0.080" aperture)

Disc radius — 1.562" (0.025" tolerance between disc and bottom of slot)

Openings — 0.020" on chord @ 1.432" radius (180 required)

Closure — 0.030" on chord @ 1.432" radius (180 required)

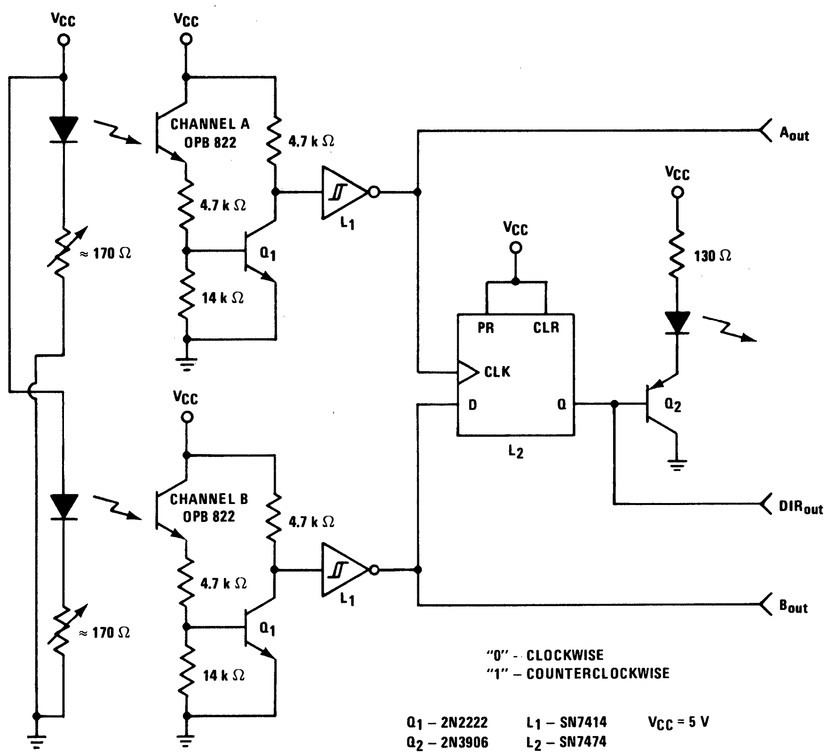
Disc material and thickness — Polycarbonate plastic, 0.060" thick

Crosstalk will not occur due to the narrow apertures (0.010") on both sensor and LED. This disc was then paired with the circuit shown in Figure 2.

* $\frac{0.212}{\text{off-multiple}}$ x mechanical resolution (pulses/revolution) x 1/2 π = pitch radius.

As shown in Figure 2, channel "B" provides the "D" input and channel "A" provides the "clock" input to the SN7414. (The SN7414 converts the relatively slow transitions from the mechanical motion to TTL compatible rise and fall times.) Since channel "A" clocks the latch at its positive transition, the state of channel "B" at "D" determines the state of the latch. If the "Q" output of the latch is high (1 state) then the "D" input was high when channel "A" turned "ON". Thus channel "B" turned "ON" prior to channel "A". This implies counterclockwise direction of

FIGURE 2 — Schematic for Determination of Rotation Direction, Relative Position and Speed



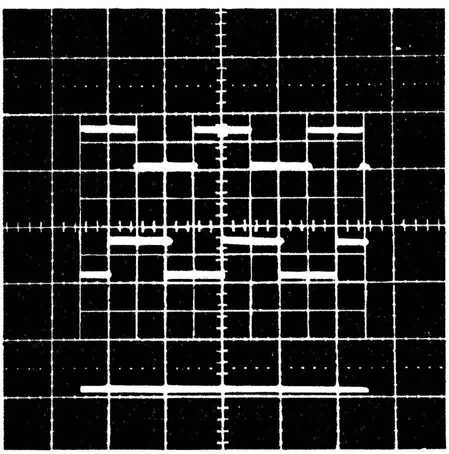
rotation. For clockwise rotation, channel "A" turns on prior to channel "B" and the "Q" output of the latch will be low (0 state). The pulses at A out or B out may be used for speed and/or relative location. Speed may be determined by counting the output pulses for a given time period and dividing the total count by 180 (pulses per revolution). Relative event location may be controlled within approximate 2° accuracy $\left(\frac{360^{\circ}}{180}\right)$ by specifying the number of pulses between related events. For example, 45 pulses would correspond to 1/4 rotation or 90 mechanical rotational degrees.

The photographs shown in Figure 3 demonstrate the "0" and "1" level for clockwise and counterclockwise rotation.

The left photograph shows a "0" level denoting clockwise rotation. The right photograph shows the opposite. Additional circuitry may be added using the time base pulses already present. If a third interrupter channel were added that could relate back to a fixed location of the shaft, then the relative location could be changed to true location. This might become the left margin control, right margin control and/or index for next line control. All of these functions could be performed quite easily. The same technique may be used in linear motion where the encoder disc is replaced by a comb with a series of openings and closures. The direction of movement, speed, and the relative location of the comb could be used as discussed before by molding the comb with the openings 0.020" wide by 0.100" high every 0.050" length along the comb.

FIGURE 3

50 μsec/Div 5 V/Div



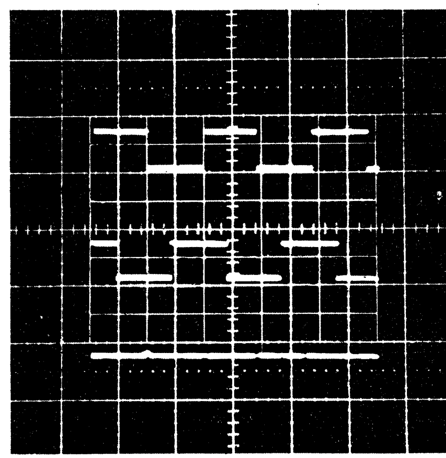
Clockwise Direction

Channel "A" Output

Channel "B" Output

Direction Output

50 μsec/Div 5 V/Div



Counterclockwise Direction

Operating Frequency 10 kHz

CONCLUSION

In summary, this is a very versatile technique for relating electrical signals to linear or rotational motion, speed and either relative or true location of that motion.

RICHARD DAHLBERG

WILLIAM NUNLEY

Reflective Assemblies – Design considerations for single-sided sensing applications.

General Discussion

A reflective assembly generally consists of a single emitter and sensor in the same housing. This provides a major mounting advantage because optical access to the surface to be sensed is required from only one side. However, this can lead to a wide variety of design variables involving mounting configurations, reflective surfaces, and sensing circuits.

Designers are often faced with conditions that prevent reflective assemblies from being used as specified by the manufacturer. Reflective surfaces may be different than specified, or the gap between the assembly and the reflective surface may be greater or less than specified and/or cannot be consistently maintained. The mounting requirements may make tight control impractical and/or the "contrast ratio"[(1)] may have to be improved.

Optek offers several reflective assemblies providing the designer with alternative solutions to these problems.

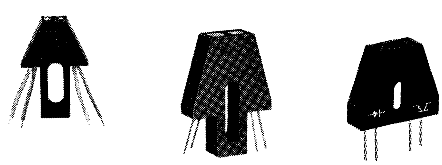
Performance Characteristics

Optek makes two types of reflective assemblies; focused and unfocused.

A. Focused Reflective Assemblies

The focused version is made from discrete devices with convex lenses. Figure 1 shows three versions of this configuration. (Discrete devices are internal to the housing and are not shown.)

Figure 1 – Focused Reflective Assemblies



OPB700,701 OPB704 OPB742,745

In this device type, the on-state collector current, $I_{C(ON)}$, peaks when a reflective surface is placed 0.100" to 0.200" (2.5 to 5.0 mm) in front of the assembly.

$I_{C(ON)}$ is the collector current created from the reflected infrared radiation emitted from the LED and detected by the sensor from a reflective surface. $I_{C(ON)}$ maximum is 75% of the distance to the intersection of the optical axes of the LED and photosensor. In other words, discretes focused to a reflective surface at a distance from the housing of .200" would have an approximate peak $I_{C(ON)}$ at .150". This is due to the emitted radiation following a diverging pattern rather than a straight line through its center line and the sensor viewing a converging pattern rather than a straight line through its center line. The angular mountings of the discretes are ideal for detecting the presence of a polished or specular surface.

(1) The ratio between the minimum and the maximum amount of reflected infrared radiation seen by the sensor.

B. Unfocused Reflective Assemblies

The unfocused version is made from discrete devices with plano or non-magnifying lenses. Figure 2 shows two versions of this configuration.

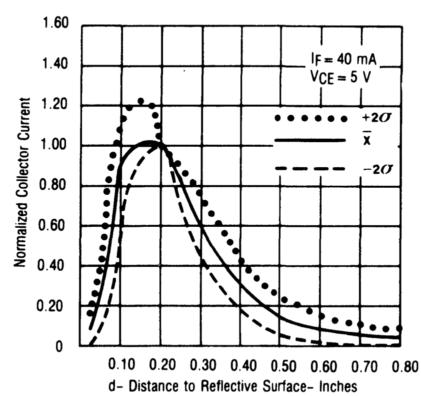
Figure 2

OPB706, 707 OPB711, 712

In this type of device the $I_{C(ON)}$ peaks when a reflective surface is placed 0.050" to 0.080" (1.25 to 2.0 mm) in front of the assembly. The units are designed for mounting in sockets or printed circuit boards. Plano lenses make unfocused assemblies ideal for detecting the presence of diffuse surfaces.

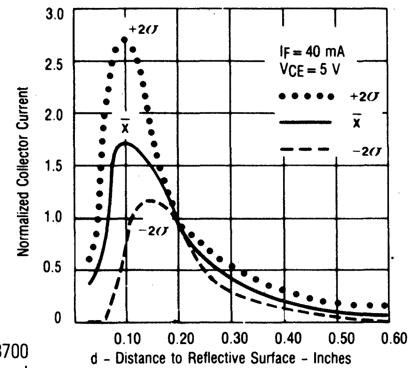
Figure 3 shows variation in output versus distance from a given reflective surface for both focused and unfocused devices.

Figure 3 – Normalized Collector Current vs. Distance to Reflective Surface

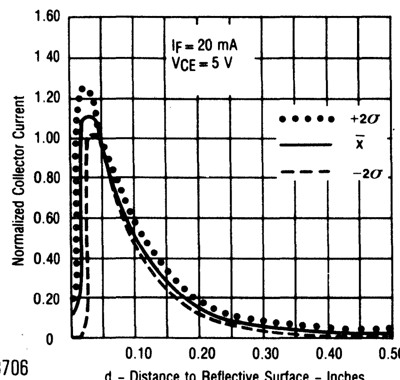


OPB704
Focused

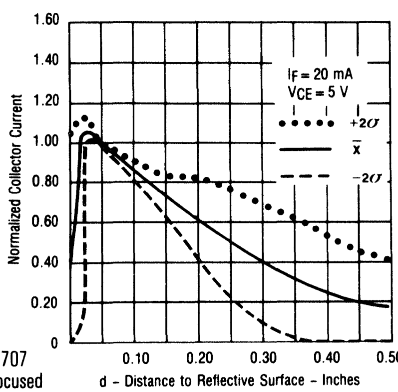
APPLICATION BULLETINS



OPB700
Focused



OPB706
Unfocused



OPB707
Unfocused

C. Variations in Signal Level

The signal level from the reflective assembly can vary for a variety of other reasons. An understanding of these variables is necessary for successful design:

1. Variations in Distance (or inconsistency in placement of reflective surfaces). Since the output from the sensor will decrease (see Figure 3) as the distance between the reflective surface and the assembly increases, the designer must either minimize the physical variation or compensate for it in the electrical design. Table 1 shows the magnitude of signal changes at various distances.

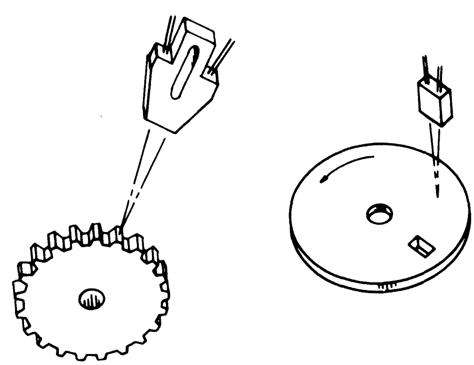
Table I – Typical Variation in Signal Level with Distance Changes (Data Sheet Conditions for $I_{C(ON)}$)

D (a) (b)	OPB700	OPB704	OPB706	OPB742	OPB711
.025	12 μA	35 μA	1270 μA	34 μA	855 μA
.050	89 μA	89 μA	1111 μA	175 μA	726 μA
.100	345 μA	233 μA	552 μA	537 μA	523 μA
.200	254 μA	277 μA	202 μA	359 μA	185 μA
.300	135 μA	159 μA	81 μA	100 μA	83 μA
.450	63 μA	59 μA	34 μA	23 μA	34 μA
.500	54 μA	44 μA	26 μA	17 μA	26 μA

Notes:
(a) D is distance from assembly face to reflective surface.
(b) Reflective surface is 90% diffuse reflectance Kodak neutral white test card.

This phenomenon can be used to an advantage in certain reflective applications. Figure 4 shows an OPB704 sensing gear teeth. Good contrast ratios are obtained since the distance to the reflective surface significantly varies. Figure 4 also shows an OPB706 used as a tachometer. The cutout in the encoder wheel allows one pulse per revolution. The OPB704 uses sensitivity vs. distance while the OPB706 uses sensitivity vs. reflective surface at a given distance.

Figure 4 – Applications vs. Contrast Ratios



OPB700 OPB706

2. Variation in Reflectivity of Surfaces–Many designers make the initial mistake of assuming that a photosensor will see infrared radiation the same way the human eye sees visible light. This frequently is not the case. In fact, a black surface and a white surface can have similar reflective properties when illuminated with infrared radiation. Tables 2 and 3 show the variation in signal level with different reflective surfaces.

Table 2 – Focused Reflective Assemblies
Typical $I_{C(ON)}$ (Signal) vs. Reflective Surfaces
(Standard Data Sheet Conditions used for distance, LED forward current and sensor supply voltage)

Focused Reflective Assemblies

Surface	OPB700 D[a]=.20"	OPB701 D=.20"	OPB742 D=.150"	OPB704 D=.20"	OPB745 D=.150"
1	689 µA	33390 µA	6160 µA	6260 µA	41180 µA
2	680 µA	33850 µA	5890 µA	6340 µA	39120 µA
3	1.59 µA	34.55 µA	6.39 µA	13.23 µA	22940 µA
4	115 µA	5420 µA	420 µA	750 µA	3720 µA
5	85 µA	4330 µA	320 µA	580 µA	2920 µA
6	51 µA	2250 µA	230 µA	400 µA	1810 µA
7	42 µA	1660 µA	410 µA	460 µA	3010 µA
8	123 µA	7920 µA	728 µA	1090 µA	5040 µA
9	90 µA	4850 µA	351 µA	688 µA	2750 µA
10	118 µA	7330 µA	648 µA	1020 µA	4850 µA
11	100 µA	5760 µA	439 µA	799 µA	3290 µA
12	116 µA	7010 µA	614 µA	984 µA	4620 µA
13	106 µA	6080 µA	471 µA	845 µA	3600 µA
14	67 µA	3490 µA	430 µA	605 µA	2690 µA
15	1.39 µA	36.07 µA	6.76 µA	13.50 µA	24.76 µA
16	0.24 µA	9.17 µA	1.55 µA	3.87 µA	1.08 µA

Notes:
(a) D is distance from assembly face to reflective surface.
1. Aluminum foil tape (shiny, efficient reflective surface).
2. Alzak (similar to 1).
3. Alzak painted with Flat Black Velvet (3M #101-C10 Black). Painted surface destroys shiny reflective surface and gives velvety matte finish.
4. Kodak 90% diffuse reflectance neutral white paper.
5. White bond paper.
6. No. 3 graphite pencil on white bond with entire viewing of sensor shaded by graphite mark.
7. Mylar magnetic tape.
8. Clear, smooth plastic tape finish.
9. Same as (8) except matte finish.
10. Same as (8) except blue color.
11. Same as (10) except matte finish.
12. Same as (8) except red color.
13. Same as (12) except matte finish.
14. Same as (8) except gray color.
15. 3M Tape No. 476 (a dull black surface).
16. No reflective surface.

Several interesting observations can be made.

I. The shiny metallic surfaces of (1) and (2) give the best reflectance.

II. The black velvet paint gives excellent contrast between (2) and (3).

III. The signal level drops when using diffuse reflectance, (4) neutral white paper, bond paper (5), or mylar magnetic tape (7).

IV. The graphite pencil mark gives relatively small change since it both improves the reflectivity (smeared shiny graphite) and disrupts the pore fibers of the paper.

V. Plastic surfaces do not reflect as well as polished surfaces. Examples: (8), (10), (12), (13)

VI. Plastic matte reflects almost as well as plastic smooth surfaces. Examples: (8) versus (9); (10) versus (11); (12) versus (13).

VII. Color makes very little difference. Examples: (8), (10), (12), and (14), or (9), (11), and (13).

VIII. The 3M tape #476 is an excellent non-reflecting surface (15).

IX. The best non-reflecting surface is no surface (16).

Table 3 – Unfocused Reflective Assemblies
Typical $I_{C(ON)}$ (Signal) vs. Reflective Surfaces
(Standard data sheet conditions used for distance, LED forward current and sensor supply voltage)

Unfocused Reflective Assemblies

Surface	OPB706 D[a]=.05"	OPB707A D=.05"	OPB711 D=.08"	OPB712 D=.08"
1	1950 µA	53990 µA	1430 µA	31630 µA
2	1000 µA	54250 µA	1220 µA	29930 µA
3	960 µA	52350 µA	1220 µA	29160 µA
4	21 µA	3400 µA	31 µA	1160 µA
5	860 µA	52330 µA	1050 µA	28700 µA
6	390 µA	41920 µA	520 µA	21900 µA
7	95 µA	17260 µA	130 µA	5670 µA
8	964 µA	52990 µA	1360 µA	31330 µA
9	913 µA	47570 µA	1230 µA	31400 µA
10	985 µA	52260 µA	1300 µA	31100 µA
11	961 µA	52270 µA	1280 µA	30800 µA
12	996 µA	52810 µA	1310 µA	31500 µA
13	972 µA	52520 µA	1380 µA	31200 µA
14	4740 µA	39340 µA	650 µA	24260 µA
15	.02 µA	4250 µA	34 µA	1400 µA
16	.751 µA	.51 µA	4.32 µA	.2 µA

Notes:
(a) D is distance from assembly face to reflective surface.
1. Kodak 90% diffuse reflectance neutral white paper.
2. Aluminum foil tape (shiny reflective surface).
3. Alzak tape (similar to 2).
4. Alzak painted with Flat Black Velvet (3M #101-C10 Black) paint.
5. White bond paper.
6. No. 3 graphite pencil on white bond with entire viewing area of sensor shaded by graphite mark.
7. Mylar magnetic tape.
8. Clear, smooth plastic tape finish.
9. Same as (8) except matte finish.
10. Same as (8) except blue color.
11. Same as (10) except matte finish.
12. Same as (8) except red color.
13. Same as (12) except matte finish.
14. Same as (8) except gray color.
15. 3M Tape #476 (a dull black surface).
16. No reflective surface.

OPTEK

The same type of observation can be made about unfocused assemblies as were made on focused assemblies with one exception:

The Kodak 90% diffused reflectance neutral white paper offers the best reflective surface.

The information in Table 2 and Table 3 can be used to design the surface in your system.

3. Variations in Reflective Surface Size–Another problem may arise as a result of the size of the reflective area. An optimum sized reflective surface would be one which will yield no increase in $I_{C(ON)}$ when its size is increased. Then as the size of the reflective surface shrinks from the optimum size the signal level will decrease. As a result, these units are better used as surface detectors than as mark or line detectors.

4. Variations in $I_{C(ON)}$ from Assembly to Assembly–There is a wide $I_{C(ON)}$ variation from assembly to assembly. Table 4 shows this variation.

Table 4 – Minimum, Typical, and Maximum $I_{C(ON)}$(1)
(Data Sheet Conditions for $I_{C(ON)}$)

Sensor	$I_{C(ON)}$ Min.	$I_{C(ON)}$ Typ.	$I_{C(ON)}$ Max. (2)
OPB701	2000 μA	8400 μA	14500 μA
OPB700	25 μA	125 μA	168 μA
OPB704	200 μA	500 μA	1100 μA
OPB742	10 μA	25 μA	1100 μA
OPB745	1000 μA	8000 μA	12000 μA
OPB706A	500 μA	1000 μA	2500 μA
OPB706B	350 μA	700 μA	1920 μA
OPB706C	200 μA	400 μA	1820 μA
OPB707A	25000 μA	50000 μA	59400 μA
OPB707B	17000 μA	34000 μA	43500 μA
OPB707C	10000 μA	20000 μA	39300 μA
OPB711	350 μA	700 μA	1950 μA
OPB712	20000 μA	40000 μA	60000 μA

Notes: (1) Measurements taken using an Eastman Kodak neutral white test card having 90% diffuse reflectance as a reflective surface placed at the optimum distance from the assembly head.

(2) The maximums are not a guaranteed specification as they are calculated from the two sigma points based on the distribution.

5. Variations in Signal Levels Due to Sporadic Problems–Spurious reflections due to illumination from outside sources may cause false triggering. Also foreign material can decrease the desired "on" signal, depending on what it is and where it is located. Consideration must be given to these sources.

D. Applications

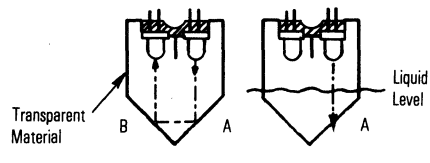
A variety of applications are well suited to reflective assemblies.

a) The variability in output versus distance can be used to detect variations in surface location.

b) The variability in reflectivity can be used to measure surface roughness.

c) Liquid level sensors are easily fabricated as shown by the illustration in Figure 5. The radiation normally would be reflected from surface "A" to surface "B". When liquid covers surfaces A and B, the change in the index of refraction causes the radiation to continue through surface "A", and not to be reflected back to the receiving sensor.

Figure 5 – Liquid Level Sensor

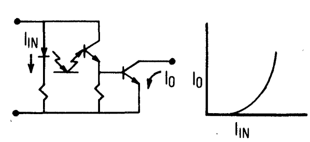


d) Reflective assemblies have wide applications in industrial controls and surveillance applications where a retro-reflective surface sends the light back to the sensor. This normally requires a custom assembly as the distances covered may span up to 50 feet.

e) Reflective assemblies have wide applications in office machines for detecting the presence or absence of paper as it moves through the machine. A variety of special techniques are used to improve the contrast ratio. Many of these designs use custom packages. Figure 6 shows some of these special techniques.

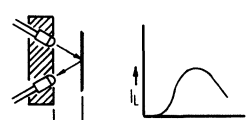
Figure 6 – Special Techniques for Improving Contrast Ratios

Non-Linear Transfer Function Improves Contrast Ratio



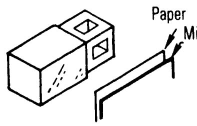
- Customer requirements for electrical performance and mechanical configuration are met exactly.

Optical Techniques Used to Reject Reflections from Close Objects

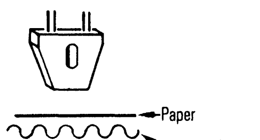


- Development costs vary depending on complexity.

Figure 6 – Special Techniques for Improving Contrast Ratios (continued)



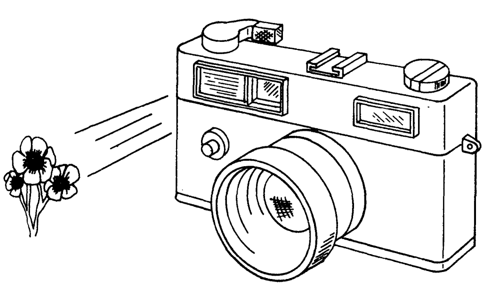
- Paper interruptive is less reflective than the mirror background



- Paper interruptive is more reflective than non-reflective background.

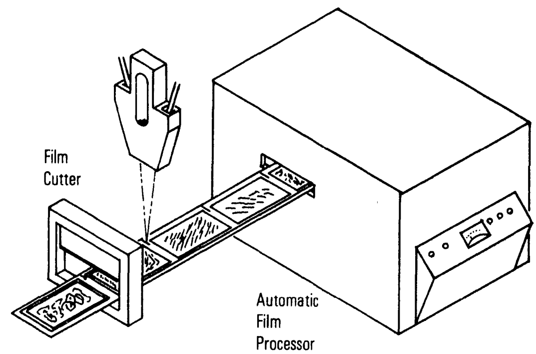
f) A sophisticated camera application is shown in Figure 7. The system can work as either a flash control or a shutter control. When used as a shutter control the photosensor receives outside light when the shutter is open. When the amount of outside light reaches a predetermined level (adequate for film exposure), the shutter is closed. The flash control is similar except the photosensor shuts off the flash when a predetermined amount of light is reflected from the subject to the sensor.

Figure 7 – Automatic Shutter or Flash Control



g) Reflective sensors can also be used in high speed print cutting. Figure 8 shows this application. The machine processor prints a thin black line on the white border between each print. The black line causes a small decrease in the amount of light reflected back into the photosensor which causes the print cutter mechanism to trigger.

Figure 8 – OPB701 – High Speed Print Cutting



Conclusion

The information presented should allow the designer to understand the basic variables that exist in reflective assemblies. An understanding of these variables will allow the designer to decide on the best reflective assembly for his application and how to choose other system piece parts for a successful design and implementation.

Tom Sward

APPLICATION BULLETINS

OPTEK

Gallium aluminum arsenide – a new generation of infrared LEDs superior to gallium arsenide.

The first light source for actuating an optoelectronic photosensor was the tungsten filament or incandescent lamp. It was eventually replaced by the GaAs infrared emitting diode which offered longer life, smaller size, less power to operate and less heat generated. The GaAs LED is still the workhorse of the industry and will continue to be used in steadily decreasing numbers for the next few years. It will eventually be replaced by GaAlAs as the industry standard for two major reasons: GaAlAs offers at least twice the power output at the same input current (I_F) level and significantly improved coupling efficiency.

GENERAL DESCRIPTION

Typically, a GaAs LED mounted on a TO-46 header with a flat window can will emit 5 milliwatts total radiant flux at an I_F = 100 mA. At the same I_F, a GaAlAs LED will typically emit 10 milliwatts total radiant flux. Similar increases are possible in other packages. This allows the designer some options which have not been available before.

In addition, silicon doped GaAs has a spectral emission centered at approximately 935 nanometers. GaAlAs has a spectral emission at approximately 890 nanometers which is very close to the peak response of silicon phototransistors. This improves coupling efficiency by approximately 30%.

FIGURE 1

Photodiode Collector Current Versus LED Forward Current With Both GaAlAs and GaAs

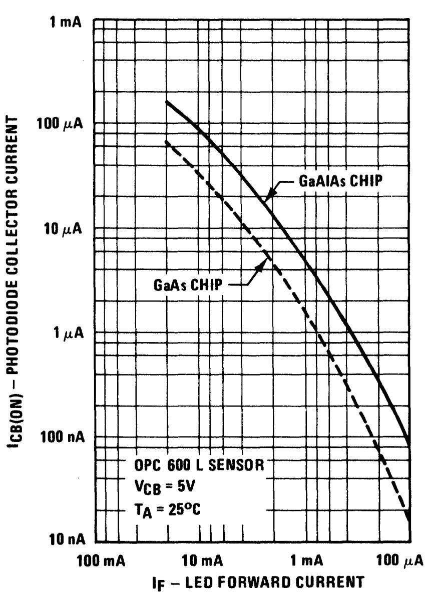
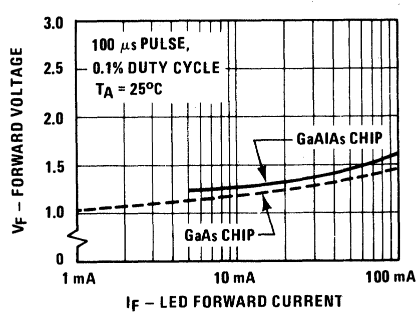


Figure 1 graphically illustrates the improvement in photodiode collector current as a result of both the higher radiant flux and the optimized spectral emission.

The only negatives to GaAlAs are a slightly higher forward voltage (V_F) (see Figure 2) and a slightly higher initial cost. With process improvements and higher volumes, this cost difference whould eventually disappear.

FIGURE 2

Forward Voltage Versus LED Forward Current



CHIP FABRICATION

All Optek GaAlAs LED's are made by means of a straightforward single step solution grown liquid phase epitaxial (LPE) preparation technique. Initially it is much the same process as making GaAs LED's. N type GaAs substrates approximately 16 mils thick are placed in a furnace and heated to around 920° C. A melted mixture of gallium, gallium arsenide and silicon (called the "melt") is then placed on top of the substrates. In the case of GaAlAs, aluminum (Al) is added to the melt. The furnace then starts cooling, and an epitaxial N type layer begins to grow on top of the substrates. As the cooling continues, the silicon in the melt which is amphoteric changes polarity or "flips" to P type material at approximately 900° C, forming the PN junction. The growth process continues until the epi layer reaches a thickness of 7-8 mils. (See Figure 3.)

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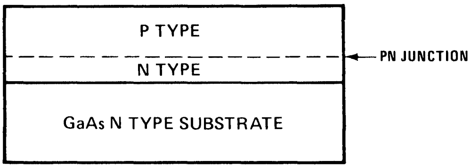
FIGURE 3

Typical Epitaxial Layer Growth



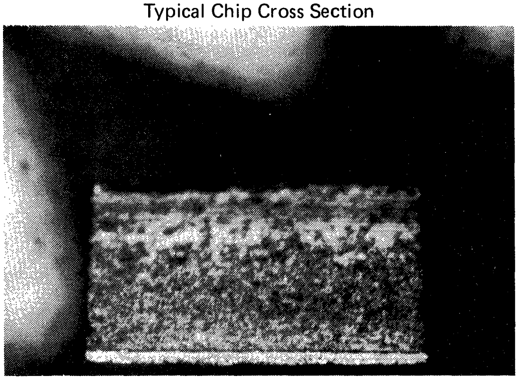
The nature of the Al in the melt is such that it is depleted or used up rapidly in the early stages of the epi growth. Concentration is virtually zero at the top of the P layer.

The substrate is then etched away with an etchant that readily dissolves GaAs. As the etchant contacts the N layer, the aluminum causes the etch rate to be slowed to 1/100th of the initial rate. This is convenient because it helps to ensure that the N layer is not materially etched.

After etching, appropriate ohmic contacts are added by evaporation techniques. A gold contact completely covers the P layer or backside, and a dot matrix contact is put on the N layer or topside. The chips are then sawed into their final size. A final etching is done to remove saw damage and to roughen the surface of the N layer which enhances light output. (See Figure 4.)

FIGURE 4

Typical Chip Cross Section



WHAT MAKES GaAlAs SUPERIOR?

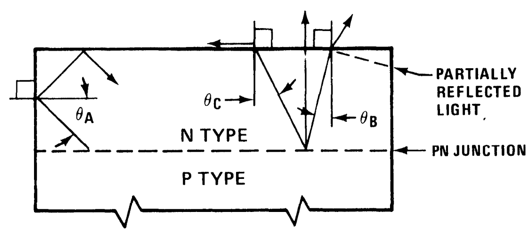
The wavelength of the emitted light of an LED is related to the energy in the photons of light it emits. Also the higher the band gap energy of the semiconductor material, the higher the photon energy. Al atoms increase the band gap energy in proportion to the concentration which allows adjustment of the photon wavelength. By controlling this concentration, the wavelength can be varied to approximate the peak spectral response of a silicon phototransistor or 890 nanometers.

GaAlAs also has an improved radiation window. In order for an LED to emit more light, absorption of photons traveling through the material must be as low as possible. In other words, there must be a high probability that the photons generated at the junction will reach a surface and escape. For this to happen effectively, the photon energy must be less than the band gap energy of the material. In previous discussions, it was mentioned that Al atoms increase the band gap energy. The heaviest concentration of Al atoms is at the N layer surface with rapidly decreasing concentration toward the PN junction. Photons generated at the junction then travel a path through steadily increasing band gap energy levels until they reach the surface. This property ensures a much reduced chance of re-absorption of photons than does a material in which the band gap energy is constant from junction to surface such as GaAs.

One final plus, GaAlAs has an index of refraction which is slightly lower than GaAs. This affects the critical angle which defines the angle at which there is total internal reflection. (See Figure 5.)

FIGURE 5

Definition of Critical Angle



The critical angle is determined by the formula:

$\text{SIN } \theta_C = \frac{n_1}{n_2}$ Where n_1 is the index of refraction of air, or 1, and n_2 is the index of refraction of the chip material.

With GaAs, $n_2 = 3.6$

$$\text{SIN } \theta_C = \frac{1}{3.6}$$

$$\theta_C = 16^\circ$$

With GaAlAs, $n_2 = 3.4$

$$\text{SIN } \theta_C = \frac{1}{3.4}$$

$$\theta_C = 17^\circ$$

At angles less than the critical angle, there is partial reflection. (See angle θ_B in Figure 5.) At angles greater than the critical angle, there is total internal reflection. (See angle θ_A in Figure 5.)

There are ways of improving surface emission. One, mentioned earlier, is the post-dicing etch cleanup which roughens the chip surface. This increases the likelihood of photons striking the surface at less than the critical angle. Another improvement is the addition of a clear epoxy, anti-reflective, domed lens placed over the chip which actually enlarges the critical angle to approximately 24°.

RELIABILITY

Since GaAlAs and GaAs junctions are formed in the same manner, the chips should have the same reliability. Life tests to date indicate that this is true. Data shows that both GaAlAs and GaAs have from 5 to 8% degradation after 1,000 hours of maximum rated operation.

DRAWBACKS

GaAlAs has inherently high V_F. The higher the band gap energy, the higher the V_F must be to impart adequate energy to the electrons. Typical V_F for Optek's GaAs LED's at 100 mA is 1.5V vs. 1.75V for GaAlAs. This difference increases slightly at higher current levels.

CONCLUSION

Many power-starved optical assembly packages will be helped immediately by using GaAlAs. Special optosensor assemblies such as card readers, paper tape readers, paper sensors and precision shaft encoders will become easier to design.

Electronic assemblies which operated with an LED/sensor pair will benefit immediately.

- With optocouplers, higher current transfer ratios will be available, and the LED and sensor will not need to be mounted as close to each other which will allow higher isolation voltages.
- With reflective assemblies, reflective objects will be able to be sensed at greater distances than before.
- With interrupter assemblies, precise alignment and gap width will not be as critical. Since there is more light available, aperturing can be reduced for higher resolution or photosensor gain can be reduced for better signal-to-noise ratio and improved gain-bandwidth product.
- In battery-operated applications, a GaAlAs LED can replace a GaAs LED and provide the same light output at ½ the current drive.
- Since the same light output can be produced at ½ the current drive, GaAlAs LED's will have much longer operating life.

GaAlAs, with its superior performance, will give the designer more options and design flexibilities than were previously available.

DEAN WOLFE

Linear and rotary encoders are evolving to meet the demands of new system requirements, higher performance requirements, harsh environmental conditions and lower cost.

Table of Contents

Introduction

Linear and rotary encoders have come in a wide variety of design styles over the years, the most common being rotary switches, potentiometers, capacitive, magnetic, and optical types. The optical encoder has become the most popular of these encoding methods due to its long life, simplicity of construction, versatility, high accuracy and high resolution. This application bulletin will briefly define an optical encoder, and bring the designer up to date on encoder terminology, design techniques and limitations. Refer to Application Bulletins 201 and 203 for additional information.

General Discussion

An encoder is an electromechanical device used to monitor the motion or position of an operating mechanism, and to translate that information into a useful output. We define an optical encoder as an optoelectronic device which translates rotational or linear movement into some usable electronic waveform. Encoders generally consist of two parts; a "moving unit" which is attached to and moves with the device being monitored. The moving unit contains information to be sensed by the "stationary unit." The stationary unit consists of an LED and a photosensor (or a combination of LEDs and photosensors) mounted on opposite sides of a slot through which the moving unit passes, thereby modulating the light path(s).

The types of output information available are speed, velocity (speed with direction) and relative or absolute positioning. The output can be either analog or digital depending on the type of photosensor used. For a more thorough description of encoding techniques, refer to Optek Bulletin 201.

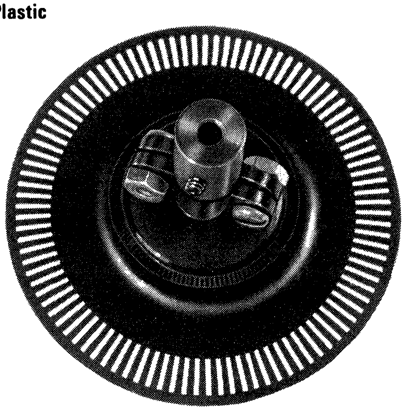
Encoder Components

a. The Moving Unit

The modulation of the light path(s) in the optical encoder is accomplished by the moving unit which is a "scale" (linear encoder) or a "disc" (rotational encoder). The scale or disc is attached to the operating mechanism and contains alternating areas of transparency and opacity to the light path. The size, shape, and frequency of these areas is the basis of the output information supplied by the encoder.

A number of materials are currently being used in the fabrication of scale and disc components. A few examples are given below and on page 2 with the advantages and disadvantages of each.

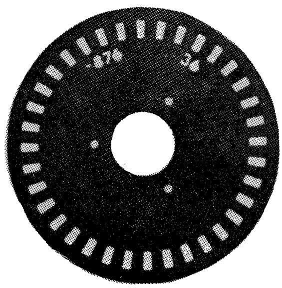
Molded Plastic



Advantages	Disadvantages
Low cost	Resolution of < 50 lines per inch
Durable	Relative mechanical and thermal instability

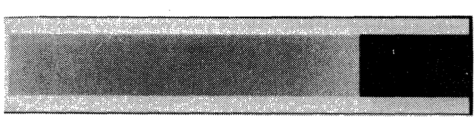
OPTEK

Etched Metal



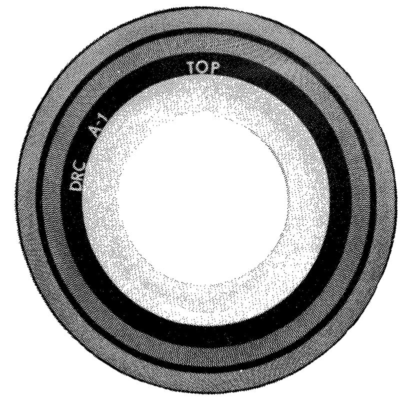
Advantages	Disadvantages
Reasonable cost	Resolution of < 150 lines per inch
Resistant to shock and vibration	
Good thermal stability	

Mylar Film



Advantages	Disadvantages
Reasonable cost	Mechanical, thermal, and humidity instability
Resolution of < 1000 lines per inch	Can be damaged in handling

Chrome on Glass



Advantages	Disadvantages
Resolution of > 2500 lines per inch	High cost
Excellent optical quality	Can be damaged in handling
Excellent mechanical, thermal and humidity stability	

b. The Stationary Unit

The stationary unit contains all the components necessary to generate the light source and sense its intensity as it is being modulated by the scale or disc. It sometimes contains the signal conditioning electronics required to amplify and/or digitize the output of the encoder. The light source consists of one or more incandescent lamps or light emitting diodes and may include lensing to improve the collimation of the light source. Most recent optical encoders use LEDs because of their lower cost, longer life, better shock resistance, and lower power consumption.

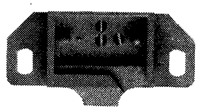
(1) Sensing Elements
Solar cells, photodiodes, phototransistors, and photosensitive integrated circuits are all used in optical encoders. The Optek Photologic™ series of photosensors was developed to enable the stationary unit to provide a digital output which can be directly interfaced with TTL, LSTTL, CMOS, and other standard logic families.

(2) Apertures and Reticles
One method of improving encoder resolution is the "sizing down" of the photosensitive area. This is done by placing a reticle with

a certain aperture size in front of the photosensor. The reticle contains a pattern of transparent and opaque areas which are optically mated to the scale or disc being "read." The transparent areas are referred to as apertures, and one or more apertures may be placed in the reticle over the photosensor in high resolution designs. Some examples of reticles made of the same materials, and intended to be used with the scale and disc samples discussed earlier, are shown in figure 1. The same advantages and disadvantages apply. In the case of molded plastic, apertures are molded right into the housing.

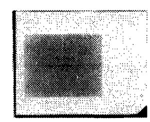
Figure 1 – Examples of Reticles

Molded Plastic

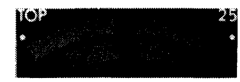


Etched Metal

Mylar Film



Chrome on Glass



(3) Signal Conditioning Electronics
Resistors, capacitors, integrated circuits, input/output connectors, and additional components are often contained on a printed circuit board in the stationary unit. These components are used to amplify the photosensor output and interface the encoder to the system in which it is used.

(4) Housing
The components used in the construction of the stationary unit are usually held in position by mounting them into a metal or plastic housing. The housing is then mounted to the operating mechanism (motor, etc.) to optimize the interface between the moving and stationary units. In some cases, the moving and stationary units are packaged together and external linkages are provided for coupling the packaged encoder to the operating mechanism.

Operating Principles

a. Modulating the Light Source

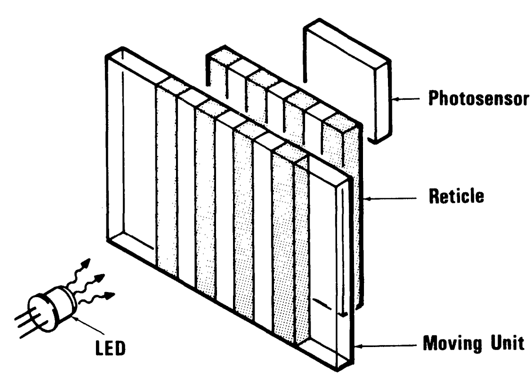
The movement of the scale or disc in the light path is the source of modulation of the light in an optical encoder. A simple example of modulation would be the interruption of the light beam in a burglar alarm. The momentary interruption or reduction of light is easily detected. As resolution requirements increase, apertures become smaller and detection becomes more difficult. An improvement over standard aperturing is the light shutter.

b. The Light Shutter

The reticles used in optical encoders may contain 20 or more alternating transparent/opaque areas in front of each sensor. If the moving unit and the reticle have identically matched patterns of 50% duty cycle (transparent and opaque areas are the same width) then the emitted light received by the sensor will be at a maximum when all the transparent areas of the reticle are exactly superimposed with those of the moving unit, as illustrated in figure 2.

When the moving unit moves one area width, the emitted light received by the sensor will be at a minimum, but not zero since in this type of light modulation there is some slight light leakage around the opaque areas in the moving unit. This sequence repeats for each cycle of movement, and is referred to as the "light-shutter" because of the similarity of operation to a camera shutter.

Figure 2 – Light Shutter

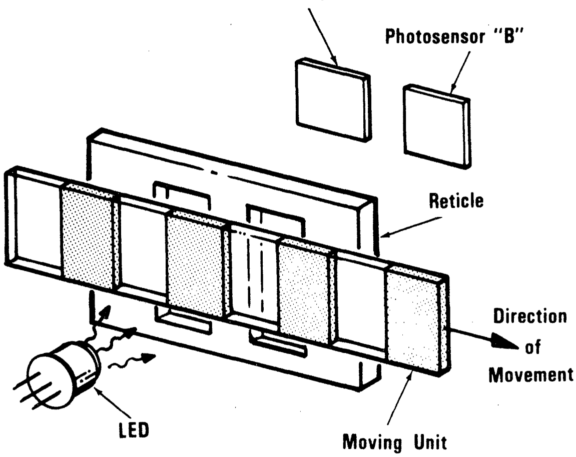


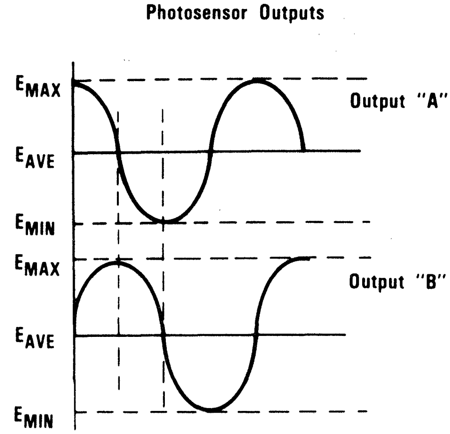
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (214)323-2200 Fax (214)323-2396

c. Quadrature

Determination of direction of movement of the moving unit is also possible by locating two photosensors in the encoder and mechanically shifting the aperture pattern in the reticle over one photosensor, ¼ cycle from the aperture pattern in the reticle over the other photosensor as shown below. This causes a "phase shift" in the output of one photosensor relative to the other and indicates direction of motion. This phase relationship is called "Quadrature," and is illustrated in figure 3.

Figure 3 - Quadrature





The output from photosensor "A" rises 90° ahead of the output from photosensor "B" indicating that the moving unit is moving to the right. If the moving unit were moving to the left, the output from "B" would be 90° ahead of "A." For more information on dual channel encoding refer to Application Bulletin 203.

Sensing Circuit Techniques

The use of the light shutter permits the design of an optical encoder capable of very high resolution. However, electrical and mechanical errors must be considered and compensated for in the design to allow full use of this capability.

a. Single-Ended Encoders

The use of a single photosensor to generate each output in an optical encoder is inherently limited. LEDs will degrade with time and temperature resulting in changes in the output signal shape and level. However, if performance requirements are not severe, the single ended approach offers the simplest design approach and lowest cost.

b. Convoluted Duty Cycle Encoders

The use of 50% duty cycle components in a single-ended encoder does not necessarily guarantee the optimum in performance. A reduction in the duty cycle of the reticle (making the opaque area wider than the transparent area) and an increase in LED drive current will improve the output performance of an encoder that is being digitized by a comparator. Operating a phototransistor at very high light conditions will tend to reduce its frequency response. The use of convoluted duty cycle usually requires the use of a photodiode type of photosensor. Opteks Photologic™ series of photosensors are ideally suited for this type of application.

c. Automatic Gain Control

An unmodulated photosensor channel can be incorporated exclusively to monitor the intensity of the emitted light from the LED. Feedback is then provided to a drive circuit powering the LED. This compensates for degradation from all causes and will enhance the long term performance of the encoder. The trade-off is in increased cost and circuit complexity.

d. Differential Circuitry

By generating quadrature in "complementary format" (i.e., 0°/180°, 90°/270°), the complementary phases may be differentially amplified or compared to generate the required quadrature output (generally 0° and 90°). This approach allows noise reduction and drift compensation. An additional advantage is the ability to operate high gain phototransistors in the nonsaturated mode, thereby improving frequency response. The negatives are increased cost and circuit complexity.

e. Zero Referencing

Many encoders provide speed, velocity, and relative position data, but a starting position must be known to derive true position. An extra photosensor is sometimes provided to look for a single point of transparency or opacity at a specific place on the scale or disc. The sensing of this point is used to zero the counting circuitry driven by the encoder during power-up, or any time an error in count is detected.

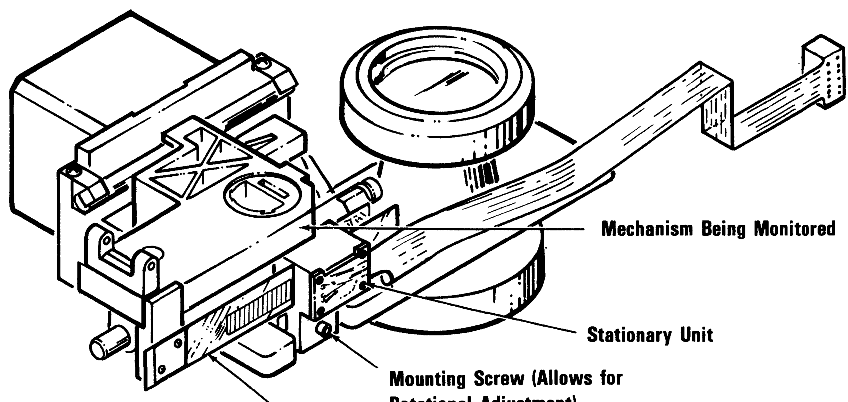
Mechanical Interfacing

The best possible performance from an optical encoder is dependent on the proper selection of materials, circuit design and the integrity with which the encoder is attached to the operating mechanism. The space between the scale or disc and the reticle must be as narrow as possible and consistently maintained throughout the travel of the moving unit. Variations will result in degraded performance.

a. Mounting The Moving Unit

A properly designed housing provides for flatness across the surface of the reticle at some absolute height from the mounting surface of the stationary unit. This allows the positioning of the moving unit to be performed as a separate operation. Disc mounting requires two steps: (1) affixing the disc to a hub using adhesive and/or a clamp ring; (2) mounting the hub/disc to the device being monitored using adhesives and/or set screws located 90° apart on the hub. Linear scales are mounted to a bracket on the operating mechanism at one or both ends. The entire scale must travel evenly and precisely through both end extremes. A typical encoder mounting application is illustrated in figure 4.

Figure 4 – Encoder Mounting



b. Mounting the Stationary Unit

The stationary unit should be designed to allow rotational or displacement adjustments. These adjustments compensate for mechanical tolerances in fabrication of the stationary and moving units that could prohibit the final fine tuning needed by the light shutter.

c. Maintaining the Gap

The distance between the scale or disc, and the reticle is referred to as the "gap." In photo-emulsion type light shutter components, the emulsion sides should be facing each other and a minimum space maintained to prevent abrasive damage. If the properties of the

APPLICATION BULLETINS

operating mechanism and the housing are known (thermal expansion, end play, eccentricity, etc.) the moving unit can be mounted using a spacer. Then the fixed unit is simply inserted, adjusted and locked in place. Another solution is a sliding bearing inserted between the shutter components to prevent wear damage.

d. Error Related to the Gap

A gap of zero width allows for complete modulation of the emitted light shutter. Any increase in gap width will result in reduced modulation where:

$$\%\ \text{Modulation} = \frac{\text{Signal Output (ACVpp)}}{\text{Max. Achievable Undistorted Signal Output}} \times 100$$

The reduced modulation is caused by non-collimated light from the LED (i.e., leakage around the shutter components) and becomes substantial as the gap width approaches the aperture width in size.

Variations in the gap during the travel of the moving unit result in amplitude modulation. These variations affect the interface circuitry driven by the encoder during signal conditioning or digitizing and can cause clipping, positive pulse width modulation or variation in time between output pulses (in a pulse output encoder).

The quadrature relationship between the output channels will vary as the sum of the error on each individual channel.

e. Performance Limits

The optical encoder provides direction information only as long as the quadrature related signals occur in proper sequence. Any phase, duty cycle, or modulation error that interrupts or reverses this sequence defines the ultimate limit of an incremental encoder.

Conclusion

Optical sensing is currently the most versatile method of motion sensing in rotary and linear applications. LED and photosensitive integrated circuit technology, along with innovative sensing techniques are keeping pace with today's sensing requirements so that the advantages of long life, high resolution, reliable operation in harsh environments, and low cost are available in almost any motion sensing application.

J. W. Davidson, III
Lowell Johnson

Application Bulletin 207
July 1989

OPTEK

Understanding infrared diode power ratings.

Introduction

Infrared emitting diode power measurement is dependent upon a number of variables which must be precisely defined in order for design engineers to utilize data sheet information. Manufacturers differ not only in the techniques used in measuring power, but also in their interpretations of the definitions of the parameters which are measured. This application bulletin is intended to clarify this misunderstanding, especially for GaAs and GaAlAs solution grown epitaxial devices.

General Discussion

Power is measured in units of energy per unit of time, and the conventional MKS unit is the Watt. Some factors which must be controlled to make accurate power measurements are discussed below.

The energy an LED emits is in the form of photons, and a photon's energy is inversely proportional to its wavelength. To measure the power emitted, the technique must take into account both the rate of photon emission and the average wavelength of the photons. Both the rate emission of the LED chip and the average wavelength of the emitted photons change as functions of chip temperature. See Figures 1 and 2 for examples of this change.

Figure 1. Output Power vs. Ambient Temperature for both GaAs and GaAlAs IR LEDs

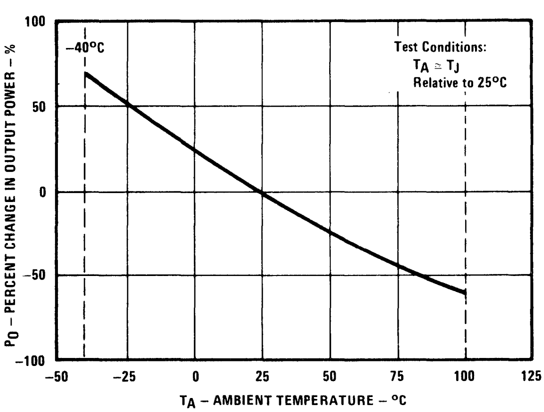
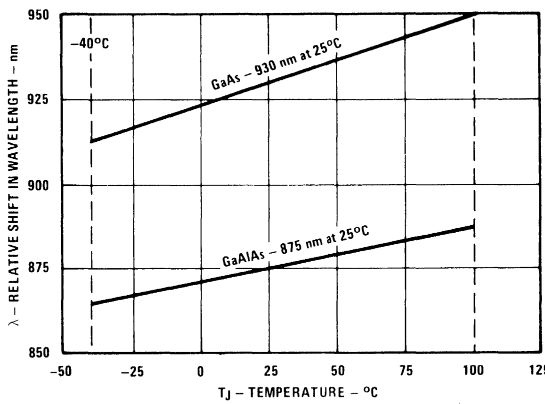


Figure 2. Peak Wavelength vs. Ambient Temperature for both GaAs and GaAlAs IR LEDs



Stress on the chip will cause any defects in the chip to expand along the planes of the crystalline structure in a process called dark line defect formation. This degrades the chip, and power output decreases as a function of time. Measurements made after the chip has been stressed mechanically, thermally, or electrically will be lower than initial readings. Figures 3, 4, and 5 illustrate the magnitude of this change due to applied DC current for variations of ambient temperature, current level, and different materials used as emitters.

Figure 3. Percent Change in GaAs IR LED Mounted in Metal TO-46 Package vs. Time at 25°C and 55°C

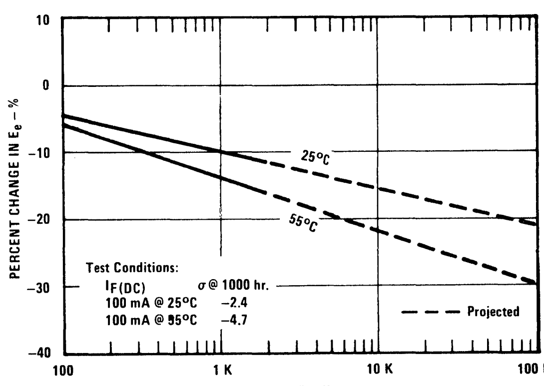


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Figure 4. Percent Change in GaAlAs IR LED Mounted in Plastic TO-46 Package vs. Time at Various Current Levels

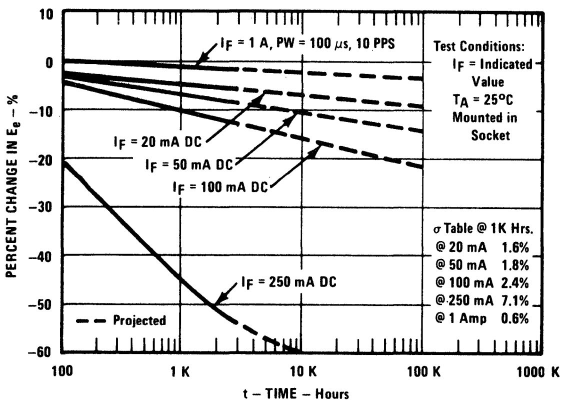
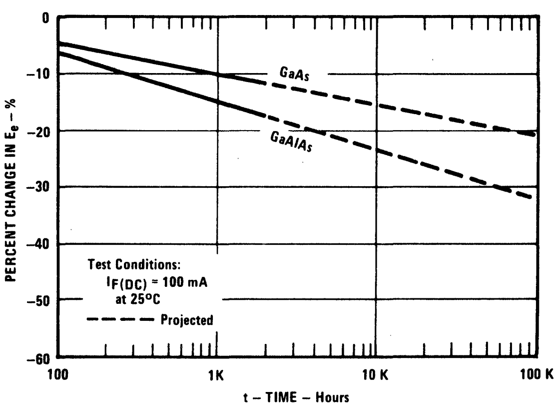


Figure 5. Percent Change in GaAs and GaAlAs IR LED Mounted in Metal TO-46 Package vs. Time under Same Conditions

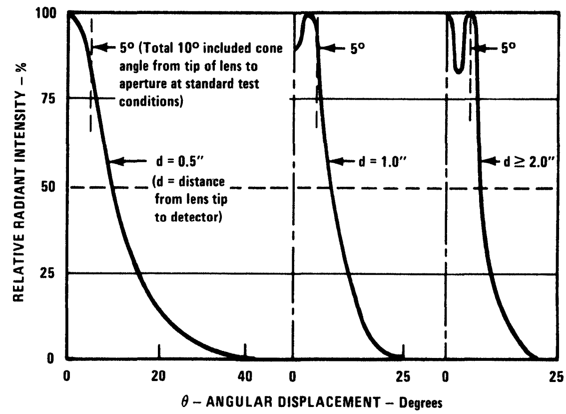


The response of most detectors is also wavelength and temperature dependent. The surface of the detector can reflect photons depending upon the wavelength, the angle of incidence, and the type of protective coating on the detector surface. The range of linearity in power detection can be exceeded by some emitting devices. Also, there are other minor characteristics of detectors which must be considered. Obviously, the accuracy of the detection system is critically important.

Any measurement of directed output is dependent upon complex optics which include chip centering in the reflective cup, reflector design, chip to lens centering, bubbles or contaminants in the packaging, and the fact that approximately half of the emitted photons exit the chip from the side walls rather than the top surface.

Many devices have radiation patterns which change as the distance from the device to the detector is varied, so this distance can be important in directed output measurement. See Figure 6:

Figure 6. OP295/OP296/OP297 Relative Radiant Intensity vs. Angular Displacement



It is essential that these variables be exactly specified in order for users to extract necessary information from data sheets. Separate application bulletins address the thermal behavior of LEDs (Bulletins 105 and 121) and the characteristics of GaAs and GaAlAs LEDs (Bulletin 114). Power measurement is integrally tied to the information contained in these bulletins, and even a basic understanding is difficult without understanding the information they contain.

Parameter Definitions and Measurement Techniques

There have traditionally been two methods of defining power measurement, but there have been different interpretations for each.

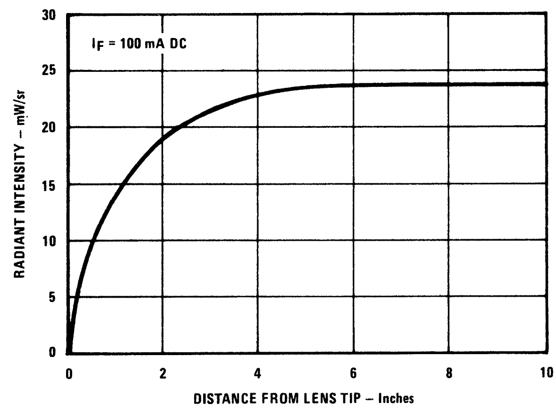
The first method is radiant power output (P_O or E_e), sometimes called total power. A strict interpretation of P_O is that the total amount of radiation exiting the package in any direction should be measured. Optek has interpreted radiant power output to be only that radiation which exits the package in a direction useful to most customers. The measurement includes only that radiation collected by a flat surface detector near the lens tip and orthogonal to the lens axis. Radiation emitted from the sides or back of the package and surface reflections from the detector are not collected. Therefore, Optek devices are conservatively rated (sometimes by a factor of 2 depending on the device type) when compared to devices which are measured differently by other manufacturers. For instance, P_O readings for the narrow (15° between half power points) radiation pattern OP295 are typically 60% higher when using a parabolic reflector than when using the standard Optek P_O test fixture.

P_O measurements are normally useful only for devices which have wide radiation patterns because the primary application is in providing a relatively even intensity over a large area. Radiation which exits the side or back of the package is not useful without external reflectors; and if external reflectors are added, there are intensity peaks in the radiation pattern which are detrimental in most applications.

The second major way to measure power is on-axis intensity. This is done by measuring the power incident upon a specified area. The most common method is to provide a fixture which has a fixed distance from the device to an aperture of precisely known area which is placed in front of a detector. This measured power can then be specified as average power per unit area (both $E_{e(APT)}$ and P_A are equivalent and the unit of measure is normally mW/cm^2) or as average power per unit cone angle (I_e; where the unit of measure is mW/sr).

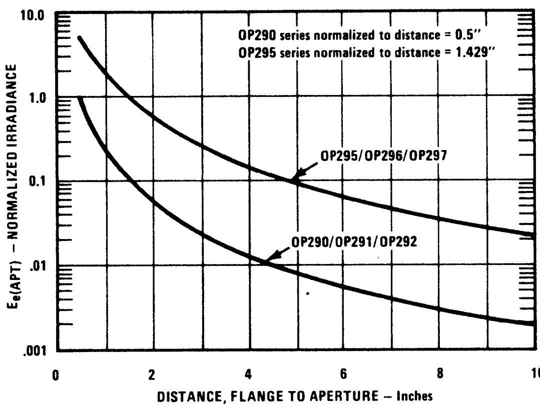
Most LEDs cannot be modeled as a point or discrete source except at distances which are very large compared to the package dimensions and/or optical dimensions. Thus, the foundation assumption in spherical calcaulations (using mW/sr) is invalid and attempts to use this model can lead to errors. Therefore, the calculated value of I_e is dependent upon distance for most applications, and a design engineer can be misled by the mathematical model into assuming that I_e is a constant regardless of distance. Note in Figure 7 how the mW/sr becomes consistent at approximately 6 inch separation.

Figure 7. Output Intensity in mW/sr vs. Distance from Lens Side of Mount Flange on T–1 3/4 Package



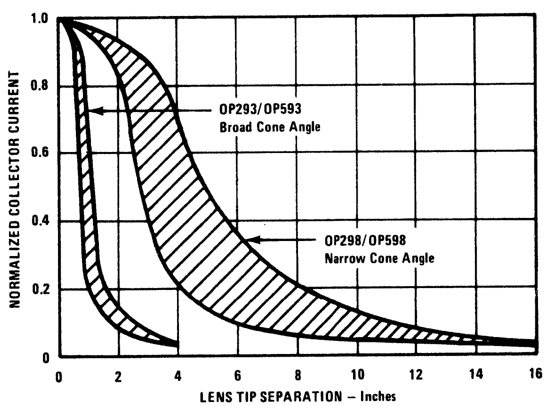
Optek has chosen to use $E_{e(APT)}$ or P_A rather than I_e for devices which don't have a virtual source that is distance independent. This is the preferred parameter because a simple performance graph can then show how $E_{e(APT)}$ varies with distance as shown in Figure 8.

Figure 8. Output Intensity in mW/cm^2 vs. Distance from Lens Tip on T–1 3/4 Package



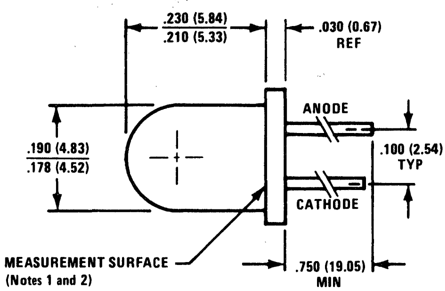
$E_{e(APT)}$ measurements have historically been made only for narrow radiation pattern devices because their major application is to have a high on-axis intensity for good coupling efficiency with a small sensing area photodetector (see Figure 9).

Figure 9. Coupling Characteristics of Plastic TO-46 Phototransistor and GaAlAs IR LED vs. Separation Between Lens Tips



However, Optek is now using the measurement parameter with wide radiation pattern devices also. $E_{e(APT)}$ is a key design parameter when the distance and aperture are chosen to give maximum useful information. The distance is chosen so two criteria are met: first, all intensity peaks should fall within the aperture opening for devices with normal optics; and second, the distance should be at a maximum with the constraint that the intensity does not vary more than 10% from point to point within the aperture opening for normal devices. Aperture size is typically chosen so that it is slightly larger than the lens diameter of a detector which is mechanically matched to the dimensions of the LED. This provides the user with a mechanical alignment tolerance as well as the average power intensity within the aperture. Figures 10A,10B, and 10C show information from the T–1 3/4 data sheet.

Figure 10A. Outline Drawing from OP293/298 GaAlAs Data Sheet



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Figure 10B. Beam Pattern of OP293

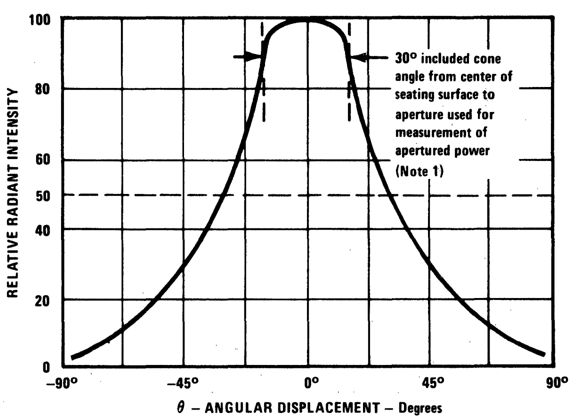
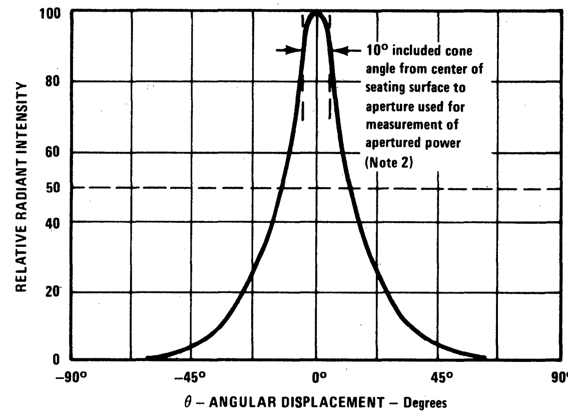


Figure 10C. Beam Pattern of OP298



Notes to Figures 10A, 10B, and 10C:

(1) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250″ (6.35 mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 0.500″ (1.27 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

(2) $E_{e(APT)}$ is a measurement of the average apertured radiant energy incident upon a sensing area 0.250″ (6.35 mm) in diameter perpendicular to and centered on the mechanical axis of the lens and 1.429″ (36.30 mm) from the measurement surface. $E_{e(APT)}$ is not necessarily uniform within the measured area.

Conclusion

Power measurement of LEDs varies more than any other parameter between different manufacturers. Part of the difference is in interpretation of the definitions of the parameters measured and part is the technique used. Users should be able to predict how devices will work in their application by using data sheet information, and this bulletin should be useful to that end.

Kirk Bailey

Application Bulletin 208
January 1985

OPTEK

A comparison of plastic versus metal packaging for infrared sensors and emitters.

Introduction

Recent advances in optoelectronic packaging technology have resulted in the development of plastic infrared sensors and emitters which are in many ways superior to their metal counterparts. While the metal package is still the right choice for some applications, plastic devices offer decided advantages in cost, output power, reliability, power dissipation, and optical quality. This application bulletin will compare the two packages and show how the better performance of the plastic part is obtained.

Cost

The lower cost of the plastic package is a result of reduced labor costs (due mainly to automation of the assembly process) and reduced materials cost. Plastic device construction lends itself to automation, and the expensively tooled piece parts characteristic of metal devices are simply not required.

Mounting the chip and attaching the bond wire are two of the most labor intensive phases in the manual assembly of optoelectronic semiconductors. The problem is especially acute for LEDs as the chips are small and relatively delicate, and they must be mounted in a reflective well to utilize their lateral emission. Automation of these processes requires extremely precise mechanical placement, which is difficult with the individual headers used in metal devices. In contrast, the "strip" lead frame (Figure 1) used in making plastic devices can be stepped through automatic chip mount and wire bond machines so that precision locating of the mounting surface is readily performed.

Figure 1A. IR LED 20 Unit Lead Frame

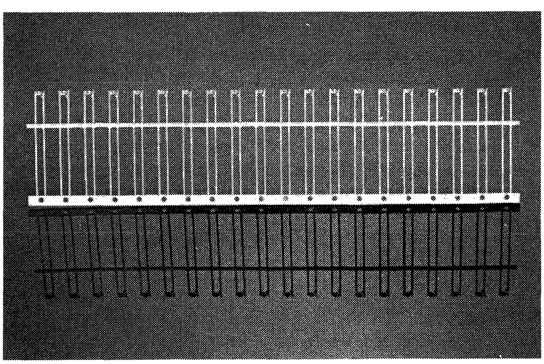


Figure 1B. Detail Enlargement of LED Chip Mounting Area

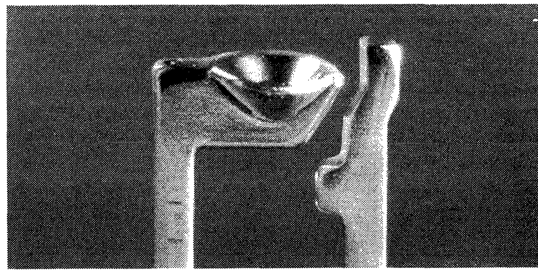


Figure 2A shows the detail of an IR LED that has been mounted, bonded and coated with the silicone gel that enhances the energy emitted. Figures 2B, 2C, and 2D show examples of the production machines used for hand mounting, semiautomatic mounting, and fully automated mounting of the IR LED chips on different headers or lead frames.

Figure 2A. Detail of Mounted and Bonded Chip

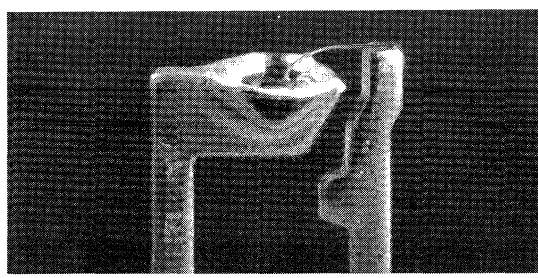
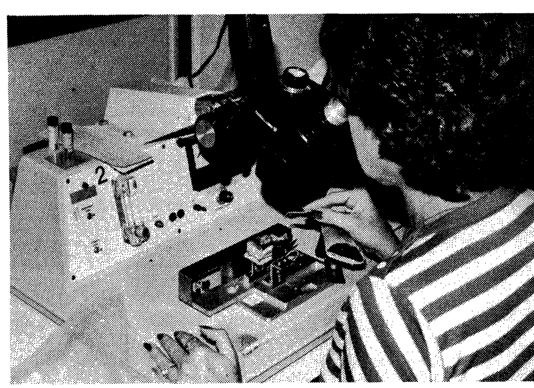


Figure 2B. Hand Mount Station ≈ 100 units/hour



APPLICATION BULLETINS

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Figure 2C. Semi-automated Mount Station ≈ 500 units/hour

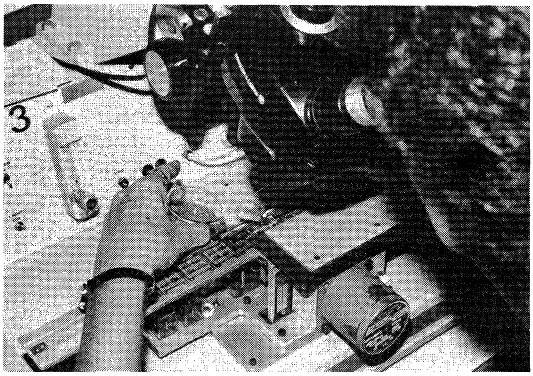
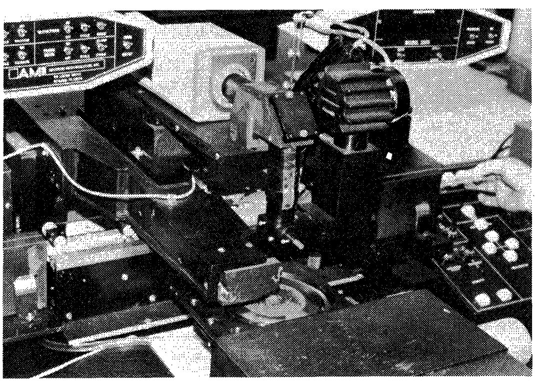


Figure 2D. Fully Automated Mount Station ≈ 5000 units/hour

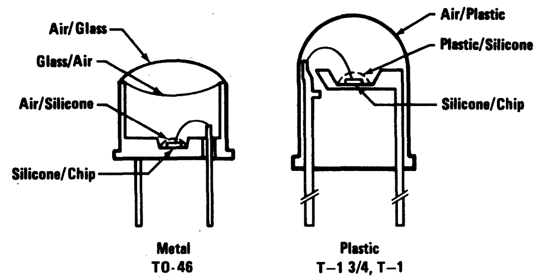


The initial cost of an automatic chip mount machine (Figure 2) or automatic bonder is high but the dramatic increase in throughput results in an overall cost reduction for the finished part. For example, manually dispensing conductive epoxy onto the lead frame and mounting the chip with tweezers produces typically 100 units per hour. Partial automation, by mechanically indexing the lead frame into position for a manual mount operation, increases this to about 500 units per hour. Fully automating the process results in 5000 to 6000 units per hour.

Output Power

A typical plastic LED has approximately 40% more output power than its metal equivalent (see Table I). There are two reasons for this. One is that metal LED headers allow some of the chip's output power to be radiated into the opaque wall of the package. Perfect reflectivity at these surfaces is not attainable and much of this radiation is absorbed before it can escape through the lens. The other problem with the metal package is that the lens has two surfaces. Some of the optical radiation which does reach the lens is reflected back into the package and absorbed. Figure 3 shows a comparison of the optical properties of the two package types.

Figure 3. Optical Interfaces in Metal and Plastic Packages for IR LED



The following table shows a comparison of total output power on the metal package and the mechanically equivalent plastic package.

Table 1. Output Power (P_O) in Metal and Plastic Packages @ I_F = 100 mA

Device Type		P_O
Metal TO-46	Low Range	8.0 mW
	Mid Range	10.0 mW
	High Range	12.0 mW
Plastic TO-46	Low Range	12.0 mW
	Mid Range	15.0 mW
	High Range	18.0 mW

Power Dissipation

The power dissipation rating for a device is a function of its thermal impedance, which is the ability of the package to get rid of heat generated by the chip. This varies from a maximum with an infinite heat sink to a minimum with no heat sink. (Applications Bulletin 121 covers in detail the techniques used to measure these quantities.) In practice, TO-46 LEDs, TO-18 sensors, and their plastic equivalents are used in a socket or soldered in a PC board; this results in a thermal impedance somewhere between the two extremes. The primary heat flow path for a device under these conditions is via the leads, and some heat sinking is provided by the socket or PC board.

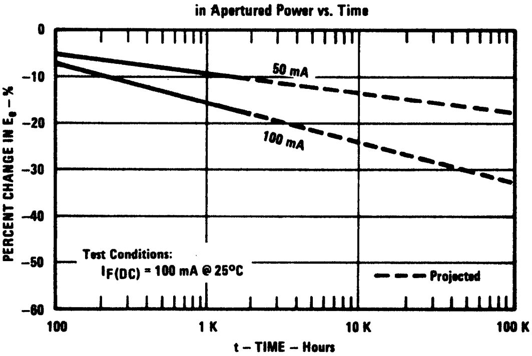
Since the leads of plastic devices have a larger cross-sectional area (.020" x .020" vs. .017" dia.) and are made from a more thermally conductive material (copper-silver vs. nickel-iron alloy), the thermal path of the plastic part is normally about 40% better than that of its metal equivalent. This results in significantly improved power dissipation ratings for the plastic part. Infinite heat sink ratings will show the metal part to be equal or superior since these ratings take advantage of the better thermal conductivity of the metal package body; however, since a heat sink is rarely used, the plastic part usually offers better thermal performance.

Reliability

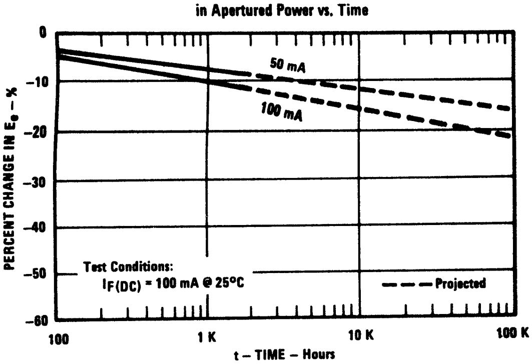
In optoelectronic technology the two main reliability considerations are long term LED degradation and catastrophic failure of LEDs or sensors due to thermal and mechanical stress. In the case of long term LED degradation, the plastic device has a definite advantage due to its improved power dissipation characteristics and the lower junction temperatures which result. Figure 4 shows life test data for the metal OP231 and the plastic equivalent OP298 operated at 100 mA.

Figure 4. Operating Life Test Data on Metal and Plastic TO-46 Packages

Metal TO-46 OP230 Series Percent Change in Apertured Power vs. Time



Plastic TO-46 OP293/OP298 Percent Change in Apertured Power vs. Time



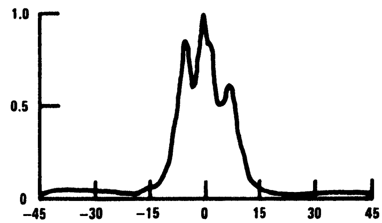
Catastrophic failure due to thermal or mechanical stress, which usually occurs early in the operating life of a device, results from forces on the chip or bond wire which can dismount or delaminate that chip, disconnect the wire bond, or break the bond wire. The design of the metal part gives it the advantage here as there are no such forces on the chip or bond wire. However, the machine fabrication of the plastic part is very repeatable and mechanically accurate so that there are fewer failures due to assembly variables. In the end, neither part has a clear cut advantage with respect to catastrophic failures.

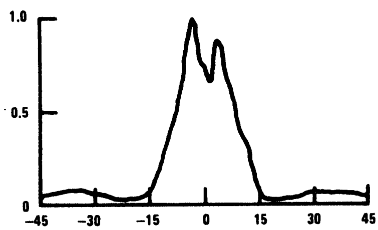
Optical Quality

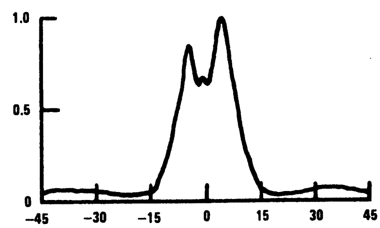
Lens performance is especially important for LEDs and in this respect the plastic part is distinctly superior. The automated chip placement is a contributing factor since inaccurate placement of the LED chip in its reflective well can cause power loss and a deviation between the optical and mechanical axes of the finished part. However, the most significant factor is the lens itself. In the plastic lens there is only one surface, which is controlled by the precisely machined and polished surface in which it is cast or molded. The glass lens used in metal packages is flame polished from a molded glass pellet, and the resulting lens exhibits variations in focal length and surface curvature so that the radiation pattern of the finished part is difficult to control. Figure 5 shows typical radiation patterns for OP131/OP231 metal parts and OP293 plastic parts. This illustrates the improved consistency of the plastic lens.

Figure 5. Radiation Patterns on Metal and Plastic TO-46 Packages

OP131/OP231 Metal TO-46



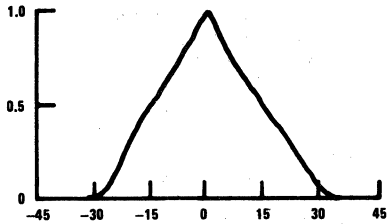


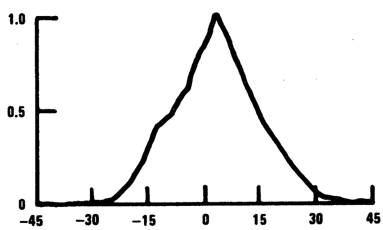


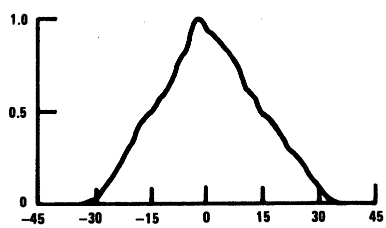
APPLICATION BULLETINS

OPTEK

OP298 Plastic TO-46







Hermeticity

The metal packages of the TO-18 or TO-46 type can be leak tested utilizing the helium or radioactive systems and show a decided advantage in that they are hermetic. The seal or leak rate on the plastic parts is primarily a function of leak path. The moisture or harmful material must traverse along the lead/plastic interface from the outside world to the junction of the chip. Normally moisture is considered the culprit since increased leakage is the problem. The problem is much more severe on a phototransistor since it is operated with a reverse bias on the collector-base junction; increased leakage will result in a higher "off" level, with a decrease in gain in the "on" level. The small leakage due to non-hermeticity is not as big a problem on LEDs since they operate in the forward mode and increased leakage will appear as a very slight reduction in energy transmitted. Metal units offer an advantage in hermeticity. This primarily pertains to the receiver or sensor and is not a major factor in the LED.

Temperature Range

The normal temperature range for metal can type parts has been set from –55°C to +150°C. These limits are somewhat arbitrary but will satisfy what is required. They primarily come from limitations in a silicon transistor in that h_{FE} decreases with decreasing temperature and I_{CEO} increases with incr3asing temperature. The same temperature characteristics were utilized on metal can LEDs.

The primary stress mechanism with plastic parts is the result of "glass transition". This is the temperature at which plastic starts a recure cycle. The stresses that result are thermal expansion mismatches which can shear the chip from mount or shear the bond wire. In early plastics utilized in opto components, this "glass transition" occurred in the 100–110°C range. The maximum temperature was specified at 85°C, and sometimes to 100°C range. Improvement in plastics has now raised this to the 125-130°C range. Recent ratings reflect this in allowing a maximum package temperature of 100°C while allowing the chip to attain a 125°C temperature. The poor thermal conductivity of the plastic keeps it well below 125°C. In the future, this trend should continue, eventually allowing metal and plastic parts to carry the same ratings. At the present time, however, the advantage on temperature range remains with the metal can.

Solvents Affecting Plastic

Methanol and isopropanol alcohols are recommended cleaning agents. Plastic discrete components and assembly housings are soluble in chlorinated hydrocarbons and keynotes. Highly activated water soluble fluxes can attack discrete components and housings in some situations.

For purposes of cleaning or similar short term exposures, the plastic devices may be considered tolerant of standard chemicals that do not show obvious attack on a test sample. For long term exposures, such as immersed applications, or specific chemicals, contact the factory for more information.

Conclusion

A thorough analysis of the evidence shows that improved materials, processes, and automation give plastic housings a decided advantage over their metal counterparts for opto sensors and LEDs in most applications. Their use can reduce costs, provide improved reliability through longer life, and offer increased infrared power output. In summary, the plastic packages represent a significant technological advantage over their metal can predecessors.

Martin McCrorey

Application Bulletin 209
July 1989

OPTEK

Designing a "Wide-Gap Optical Switch" using an OP293/OP298 (plastic TO-46 equivalent) LED and OP593/OP598 (plastic TO-18 equivalent) phototransistor.

Introduction

The application described here is commonly referred to as "object presence" sensing. It is the use of a single pair of active components, (LED and sensor) to sense the interruption of an optical path by an "opaque" object. This type of beam interrupt switch is applied in industrial controls and computer peripherals to signal:

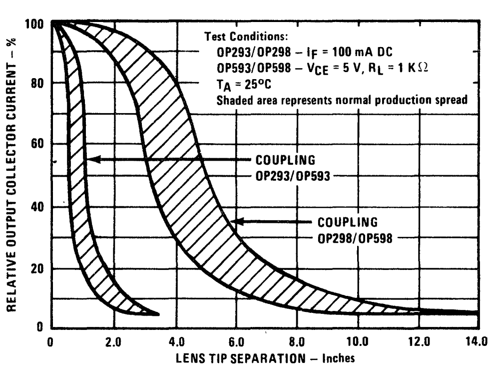
- seating of tape cartridge
- door position on disk drives
- obstructions of document paths
- conveyor feed rates

Compared to many encoder type switches this application is simpler from the standpoint of speed and resolution requirements. It can, however, have its own set of challenging design considerations depending on the length of the optical path and the constraints of performance, environment, and cost. This example is intended to illustrate the major design variables of a relatively long optical path switch and how the information of the component data sheet can be used to choose and apply the parts.

"The Gap"

Many off-the-shelf optical components are easily applied in short-gap switches because their inherent coupling characteristics produce a useable signal over a wide range of drive and mounting conditions. As the gap widens, the coupling of light between the emitter and sensor drops off rapidly and an appreciation of techniques for optimizing performance is critical. The coupling curve from the OP293/OP298 data sheet illustrates the relationship between signal strength and gap width.

Figure 1 – Coupling Characteristics of OP293/OP298 and OP593/OP598 vs. Lens Tip Separation



The more rapid decrease in coupling vs. distance of the OP293/OP593 pair is due to the differences in package lenses which produce a wider beam angle.

Other package types have similar coupling curves, most decreasing with distance more rapidly than this family of parts. The OP298/OP598 pair will be used for the example because of the superior coupling at longer distances.

All the performance optimizing techniques are tied to the clear definition of system constraints and minimizing both electrical and mechanical tolerances.

"Black Box"

The "system" level of the application should be as clearly defined as possible to enable definition of mechanical tolerances, ambient conditions, and output limits.

The "Black Box" is defined by a package outline, an electrical schematic and some environmental conditions.

Figures 2, 3 and 4 completely define the requirements of the system.

Figure 2 – Package Outline

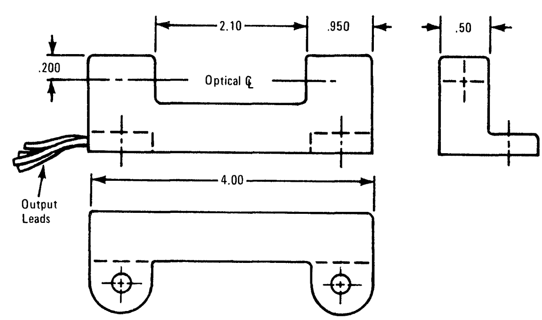


Figure 3 – Schematic/Drive

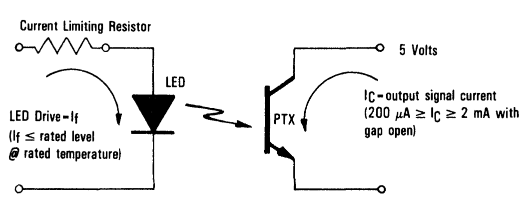


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Figure 4 – Operating Conditions

Operating Temperature Range . . . . (0°C to 55°C)
Voltage Supply Tolerance . . . . (±10%)
Required Operating Life . . . . 50K Hours

Other ambient conditions: To simplify the example, assume a relatively clean environment and one in which ambient light conditions will not produce errors in the output signal. Both of these conditions can be addressed with filters over the devices and additional performance tolerances.

Basic Guidelines

To ensure that the system will work over the full range of operating conditions and will also be manufacturable, some trade-offs and tolerances must be introduced. As with every other circuit, the performance variations versus temperature, life, and supply voltage are considered. The optically coupled circuit has the additional tolerance associated with the beam alignment of the LED and sensor.

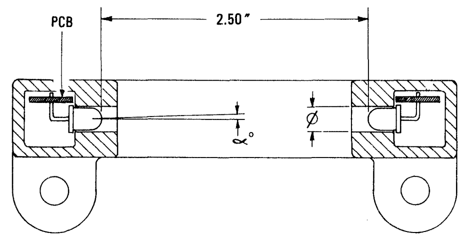
Oftentimes the single largest tolerance of the optical (infrared) switch design is associated with the degradation of LED power output over time. By nature, the efficiency of either GaAs or GaAlAs LEDs decreases with use and is directly proportional to both drive current and operating temperature. Since the "Black Box" definition fixed the temperature range, the degradation tolerance can be minimized only by minimizing the drive level. The other system components can be considered to have virtually no performance change with time in a clean environment.

The Coupled Pair

The basic tasks of the switch design are selection of a component pair which will meet the black box conditions and encasing the pair in a manner which will optimize long-term performance. The packaging scheme will define the exact lens-to-lens spacing, the beam alignment accuracy, and the components' heat sinking conditions that dictate power dissipation.

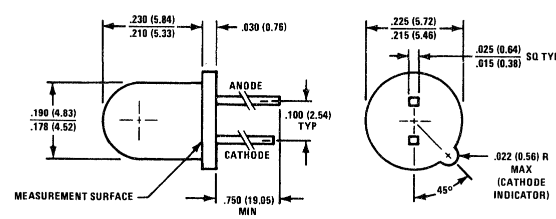
Figure 5 shows a section view of the switch with the components mounted on a printed circuit board and held in alignment by cylindrical plastic cavities. The lenses of the parts are recessed in the cavities. This increase in the lens-to-lens spacing will decrease the coupling slightly; but, the aperturing effect of the cylinders will limit the beam angle of the parts and help reduce reflections or the sensing of light from other sources which could give erroneous signals. Additional stray light protection could be provided if required by making changes in interfering surfaces or by aperturing.

Figure 5 – Mechanical Design



The mechanical alignment of the components will depend primarily on three tolerances, (1) the diameter of the LED and sensor package, (2) the diameter of the cylindrical cavities, and (3) the straightness or flatness of the housing which maintains the beam axis.

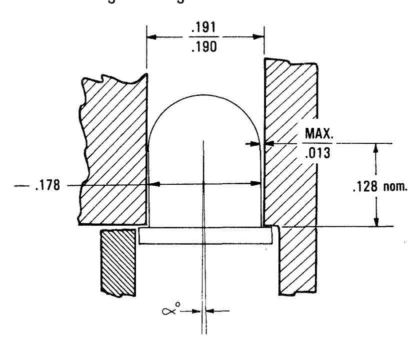
Figure 6 – Package Tolerance



DIMENSIONS ARE IN INCHES (MILLIMETERS)

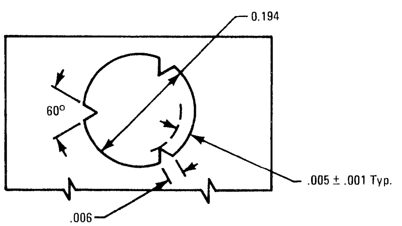
From the data sheet of the OP298 and OP598 (figure 6), the discrete package tolerance is ±.006 inches for both LED and sensor. Figure 7 shows the possible beam misalignment attributable to the worst case dimensions of the component and housing if the cavity is made to fit the largest possible package. It is assumed the cylindrical cavity can be molded to a tolerance of ±.0005 inches.

Figure 7 – Package Misalignment



In practice, an improvement can be made on the fit of the components by introducing details in the cavities which make use of the plastic's flexibility. Even with glass filled material, the addition of small ribs along the cavity walls will hold the smaller diameter components in better alignment and can compress to allow a press fit of the larger parts.

Figure 8 – Tightening Ribs



The tightening ribs shown in figure 8, reduce the diameter mismatch to (.184 – .178) = .006 max. reducing the optical axis displacement to:

$$\tan^{-1} \frac{.006}{.128} \approx 2.9°$$

The misalignment associated with curvature of the housing will depend on the method of construction; however, for a molded plastic housing of this size it would be fair to assume a flatness of .005 inch. Over the optical path of (2.50 inches) this warp should not contribute more than $\approx \tan^{-1} \frac{.005}{2.50} \approx .11°$ shift off axis. With this addition to the shift from the cavity tolerance, it can be assumed the LED or sensor could be misaligned as much as four degrees (3°).

Power Requirements

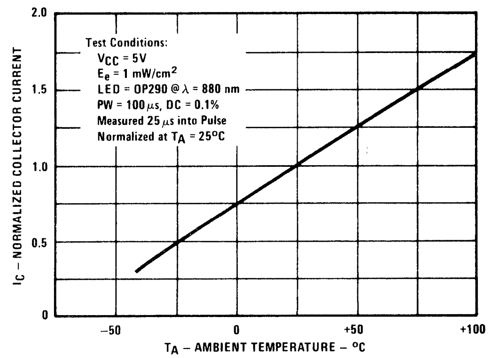
The ratings of the OP598 are given in terms of milliamps (mA) of collector current when irradiated by a tungsten source of 5 mW/cm² and supply voltage of 5 volts. The data sheet characteristics, together with the "black box" constraints, enable calculation of the power required from the LED.

The tolerances to be considered for the transistor's power requirements are associated with collector current changes with temperature and optical axis alignment.

The shift in spectral response of the transistor and spectral emission of the LED over temperature are relatively minor tolerances here but may need to be considered in designs with broader temperature ranges.

The data sheet curve for normalized collector current vs. temperature (figure 9), indicates an increase of one percent per degree Celsius, in a pulsed mode. The low current requirements of this design will not contribute enough heating to warrant adjustments to this curve. However, in a conservative design, this temperature characteristic should not be used as a factor that completely compensates for the opposite temperature effect of the LED. The temperature sensitivity is dependent on the transistor's electrical gain and can vary significantly. The curve can be used as a worst-case tolerance, (25%) at the low temperature of this design.

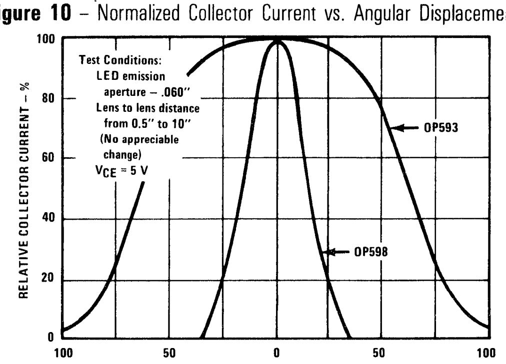
Figure 9 – Normalized Collector Current vs. Ambient Temperature



The worst-case optical axis misalignment has already been calculated to be four degrees (3°). Its effect can be estimated from the curve of normalized collector current vs. angular displacement, figure 10. The narrow beam of the OP598 makes the part more sensitive than the OP593 to misalignment (dropping ≈ 15%) but this does not outweigh the rated performance advantage of more than two to one.

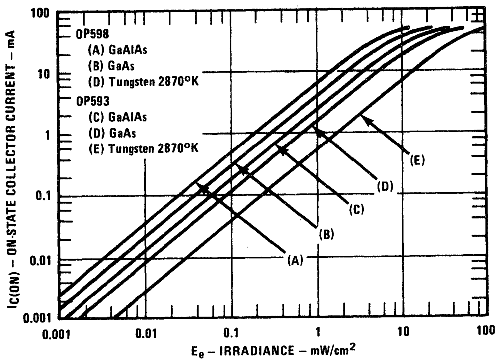
In contrast to many hermetic devices, the molded optics of the OP598 is very consistent. The beam pattern graph, therefore, accurately represents performance and requires no additional tolerancing.

Figure 10 – Normalized Collector Current vs. Angular Displacement



To find the basic radiant power requirement, the data sheet's tungsten test rating must be converted to one which reflects the transistor's sensitivity to the GaAlAs emission of the OP298. Figure 11 shows how the collector current varies with power intensity and the type of source used.

Figure 11 – OP593/OP598 IC vs. Irradiance



Curves A, B and D represent the typical response of the OP598 to GaAlAs, GaAs and tungsten sources respectively.

Curves C, D and E show the OP593 collector current variation vs. power for each source.

The tungsten response curve of the OP598 (curve D), intersects the irradiance level of 5 mW/cm² at a current level of between seven and eight milliamps. This curve, therefore, reflects the minimum response of the highest range part (OP598A), or the middle of the rated response range for the OP598B. Direct calculation from the data of the curve, therefore, will insure performance estimates that are representative of a relatively wide distribution of the available components.

The parallel relationship of these curves can be translated into a convenient conversion ratio between each source. To determine the required power from each source for a given current level, the following conversions apply:

- tungsten to GaAs – divide by 1.50,
- tungsten to GaAlAs – divide by 2.55,
- GaAs to GaAlAs – divide by 1.70.

The power required to drive the transistor at the system's minimum limit of 200 μA can now be calculated.

Applying the initial tolerances to the minimum limit

- 25% for temperature effects,
- 15% for axis misalignment,
- 10% power supply and measurement accuracies,

establishes a new limit of (200 μA) (1.75) = 350 μA.

The curve of figure 11 for tungsten intersects 350 μA at a radiant power level of about 250 μW/cm².

Applying the conversion factor for GaAlAs, the power requirement is reduced to approximately 100 μW/cm², which corresponds closely to the top curve of figure 11.

LED Drive

The ratings for the OP298 LED, like that of the OP598, establish performance limits at one set of conditions. The calculated power requirement of the transistor, together with the data sheet information, will be used to determine the minimum drive current for the OP298.

Tolerances we can apply to the LED without knowing how it will be operated, include:

- coupling vs. gap width,
- If vs. supply tolerance,
- axis misalignment,
- effects of ambient temperature.

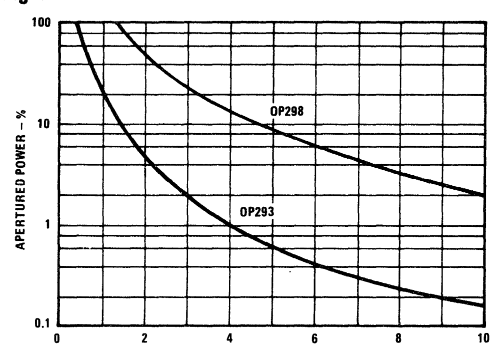
The effects of power degradation with life and device heating require some knowledge of the operating current level.

Figure 12, Normalized Power vs. Distance, provides a conversion factor from the data sheet test distance to the applications gap distance. Since the curves reflect the spacing from the sensor to the LED flange, add the package length of .22 inches to the optical path length of 2.50 inches for conversion.

At the distance of 2.72 inches, the OP298 retains about 30% of its rated power intensity. The similarity in size between the data sheet aperture (.25") and the applications sensor diameter should make this conversion very accurate.

It is obvious from this figure why the narrow beam OP298 was chosen over the wider beam OP293. With the gap separation of this system, the OP293 retains only 2.5% of its rated power.

Figure 12 – Normalized Power vs. Distance

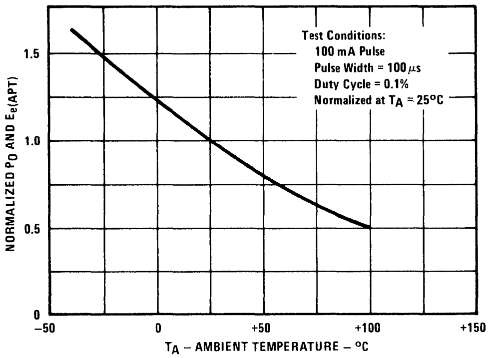


Assuming the LED current will be controlled by the five (5) volt supply and a limiting resistor, a notable tolerance results. Even with a quality resistor, the variation of the LED's forward voltage vs. current can produce a 15% drive current tolerance for a 10% voltage supply tolerance.

The axis misalignment from the mechanical design has been calculated to be 3° worst case. As with OP598, the effect on coupling will be in the range of 15%.

The system's ambient temperature range contributes a power tolerance of 25% at the upper limit of 55°C, as shown in figure 13.

Figure 13 – Normalized P_O and $E_{e(APT)}$ vs. Ambient Temperature



With these tolerance factors (15% axis misalignment; 15% power supply tolerance; and, 25% ambient temperature limit) and the power requirement of 100 $\mu W/cm^2$, the data sheet ratings can now be used.

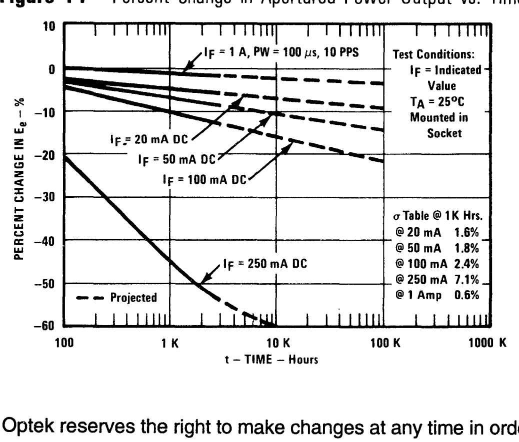
Taking the initial estimate of power required by the sensor (100 $\mu W/cm^2$), we can apply these first tolerances.

$100\ \mu W/cm^2 \times (85\% \times 85\% \times 75\%)^{-1} = 100\ \mu W/cm^2 \times (1.85) = 185\ \mu W/cm^2$

This is the amount of power intensity which would be required at the data sheet's test distance of 1.425 inches. As was shown on figure 12, an IRLED at the designed gap would have only 30% of power measured at 1.425 inches. To convert for this 70% drop with distance, divide by 0.3. Thus
P min @ (2.75") = 617 $\mu W/cm^2$

Referring to figure 14, it is evident from the curves of "Apertured Power Output vs. Time" that regardless of drive level, some decrease in available power must be accommodated as the unit is operated. To minimize this degradation effect, it will be important to select the lowest useable drive.

Figure 14 – Percent Change in Apertured Power Output vs. Time



In another application with more demanding temperature requirements or less available heat sinking capacity, the upper limit of the LED drive may be dictated by the power dissipation rating. Note 1 of the data sheet shows, however, that the maximum continuous current can be applied up to 62.5°C with PC board heat sinking.

To get a rough idea of the design tolerance for degradation, follow the curve labeled 50 mA DC to the intersection at 50,000 hours (or approximately six years) of operation. The average unit will show a decrease in power of roughly 14% if operated at 25°C. The sigma (σ) table at the side of the curve indicates an additional 1.8% degradation for each standard deviation of distribution from this average. Each curve will run approximately parallel to the average curve through the 50,000 hour point.

Add three standard deviation percentages (3σ) to the 14% to estimate the degradation of the full distribution of components.
$14\% + (3) \times (1.8) = 19.4\%$

To again take a conservative approach, assume the average temperature is 40°C rather than the 25°C illustrated by the curves of figure 14.

Characteristic data has shown that less degradation will occur from conditions of low current/high temperature than from high current/low temperature. Therefore, use the later condition as a model for the former and build in some safety factor. It should be kept in mind, however, that making degradation calculations with a higher current model is a very conservative approach, especially when working from the minimum ratings of the device.

From the thermal parameters of the OP298 data sheet, find the "normal" heat sinked thermal resistance of
$R_{THJA} = 188°C/Watt$.

With an average ambient temperature of 40°C, it is necessary to reflect a temperature rise of
$40°C - 25°C = 15°C$.

To raise the junction temperature by 15°C it is necessary to have a power dissipation increase of
$15°C/188°C/watt \approx .080$ watts.

With an LED forward voltage of 1.6 volts, the increase in forward current associated with this power would be
80 mW/1.6 volts = 50 mA.

Therefore, use the 100 mA degradation curve to simulate the system if the average ambient temperature is 40°C and the drive current is 50 mA.

At the 50,000 hour point, the 100 mA curve shows an average degradation of 20% and each standard deviation produces an additional 2.4%.

For the full distribution of components, therefore, the maximum degradation should be $20\% + (3)\ (2.4\%) = 27.2\%$.

An additional temperature related power tolerance needs to be included in the calculation which will enable the conversion from the pulsed power rating at 25°C to a direct continuous current rating at the upper operating limit of 55°C.

Refer to the curve of figure 13, "Normalized Apertured Power vs. Temperature," and the thermal resistance rating to make this conversion.

Choosing again an operating point of 50 mA and noting that the worst-case forward voltage is 2.0 volts, the maximum power dissipation would be
$P_d = (.050)\ (2.0) = .100$ watts.

Using the thermal resistance of 188°C/watt, the temperature rise of the junction would be
$T_{JA} = (.100)\ (188°C) = 18.8°C$.

It can be assumed that this junction temperature rise at an ambient temperature of 25°C and 100 mA DC would have essentially the same effect as an ambient rise of 18.8°C in the pulsed condition.

From the curve of figure 13, we can see the effect is to reduce the available power by approximately 18%.

Combination of all these tolerances allows calculation of a drive level which accommodates six years of continuous operation over the full temperature range. Adding these tolerances, 27.2 percent for degradation, and 18 percent for junction temperature rise indicates that at least 60 percent of the initial power will be available at "end of life."

The baseline power must first be calculated at the selected drive level of 50 mA using the minimum ratings of the data sheet.

IRLED is rated at 3.6 mW/cm^2 with a drive of 100 mA. Since the relationship between current and power is relatively linear in this range of operation, the power at 50 mA drive will be about one-half that at 100 mA, or 1.8 mW/cm^2.

Then applying the tolerances from heat and degradation
$(1.8\ mW/cm^2) \times (60\%) = 1080\ \mu W/cm^2$

This is the minimum power the LED will provide over its full life and under worst-case conditions.

We can compare this figure with the power we calculated as the minimum required by the sensor, 617 μW/cm^2. Even with all the conservative design assumptions, the 50 mA drive level provides more than the necessary power.

The designer can, at this point, choose to further reduce the drive of the LED to enhance the operating life or maintain the margin for the sake of broadening the distribution of useable components. This can oftentimes be a cost consideration since price is usually directly proportional to power rating.

Conclusions

It should be kept in mind that throughout these calculations, most worst-case conditions were applied simultaneously, resulting in a very conservative design. The example shows that under certain conditions these components can be easily applied in switches which span several inches without straining the limits of performance.

The narrow beam components OP598/OP298 in particular are applicable in a wide range of configurations.

T. E. Eichenberger

OPTEK

The successful design engineer has a clear understanding of the thermal impedance of the optical semiconductor. This understanding allows reliable system design that encompasses the dissipation rating of the optical semiconductor.

Introduction

The maximum power dissipation rating for a semiconductor device is usually defined as the largest amount of power which can be dissipated by the device without exceeding safe operating conditions. This quantity of power is a function of:

1. Ambient temperature
2. The maximum junction temperature considered safe for the particular device
3. The increase in junction temperature above ambient temperature per unit of power dissipation for the device package in a given mounting configuration

Item 3 is called thermal impedance and is determined in the lab with techniques such as those described in this bulletin. Item 2 is determined from reliability experiments and is usually considered to be 150°C, although it may be lower due to temperature limits imposed by the package material. Item 1 results in lower power dissipation ratings at higher ambient temperatures as described by derating curves, also described in this bulletin.

Thermal Impedance Calculations

The formula for calculating thermal impedance is

$$R_{THJA} = \frac{T_J - T_A}{P_D}$$

where: R_{THJA} = thermal impedance, junction to ambient (also called θ_{JA}); units are $\frac{°C}{Watt}$

T_J = junction temperature of the device under test
T_A = ambient air temperature
P_D = device power dissipation

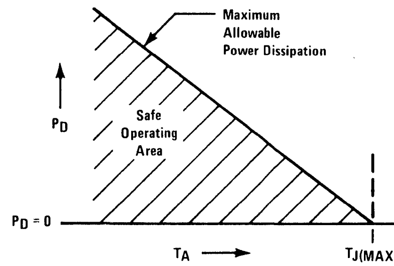
R_{THJA} refers to the thermal impedance of a device with no heat sink, suspended in still air on thermally non-conductive leads. This is the worst case (highest value) for thermal impedance.

To calculate the maximum allowable power dissipation, we substitute numbers for R_{THJA} (measured in the lab) and T_J (using the maximum value determined from reliability experiments) then rearrange terms to get

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{R_{THJA}}$$

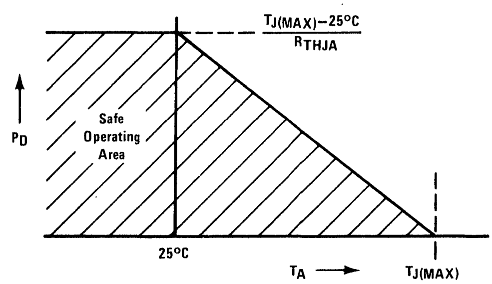
This results in a linear power dissipation rating curve which intercepts zero power dissipation at $T_A = T_{J(MAX)}$, and with a slope which is $-1/R_{THJA}$ as shown in Figure 1A:

Figure 1A. Initial Thermal Derating Curve



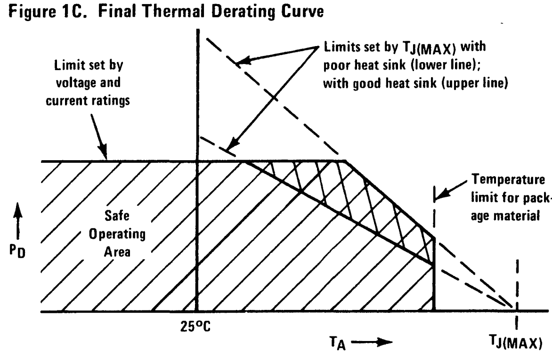
The usual (and conservative) method of rating power dissipation is to limit the curve to the safe value for normal room temperature, which is 25°C. The result is a curve shaped like Figure 1B:

Figure 1B. Thermal Operating Curve from 25°C



Since there are voltage, current, and ambient temperature limitations which are not related to chip temperature, the final power dissipation rating curve (often called a "derating" curve) for a given device might look like the curve shown in Figure 1C:

Figure 1C. Final Thermal Derating Curve



APPLICATION BULLETINS

Since thermal impedance is very nearly constant for different levels of power dissipation, we merely have to measure the junction temperature at a known quantity of power dissipation, then substitute into the right side of the formula:

$$R_{THJA} = \frac{T_J - T_A}{P_D}$$

to find the thermal impedance of the device.

It is important to define the ambient conditions since air movement, lead length, and contact with thermal conductors all affect the measured T_J. The best case (lowest value) of thermal impedance is obtained with an infinite heat sink, i.e. by keeping the entire outside of the device at ambient temperature. Since case temperature equals ambient temperature under these conditions, infinite heat sink thermal impedance is called R_{THJC}, defined as:

$$R_{THJC} = \frac{T_J - T_C}{P_D}$$

where T_C = case temperature. The worst case encountered in real applications involves a device with full-length leads, mounted in a socket with no air movement. Thermal impedance under these conditions is called R_{THJX} and is calculated using the same formula as R_{THJA}. R_{THJX} is used to calculate actual worst case derating curves.

Junction Temperature Measurement

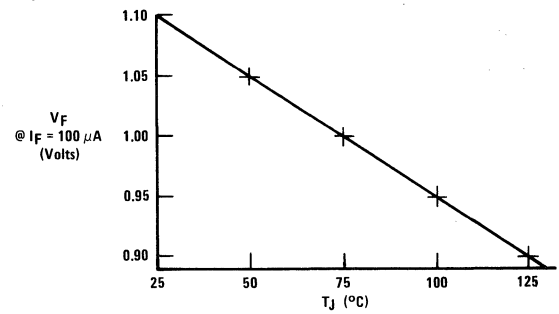
All these calculations depend on having a way to measure junction temperature in a chip while the device is dissipating power. This is done by using the chip as its own thermometer. Forward biased PN junctions have a voltage drop which decreases with temperature; by using a forward current small enough that no significant chip heating occurs, we can measure this voltage drop at known chip temperature simply by varying the ambient temperature of the package. Under these conditions, T_J approximately equals T_A, and we can control and measure T_A. See Table 1 for the junctions used for this measurement.

Table 1. Junctions Used for Measuring Temperature – T_J

Device Type	Junction Biased
LEDs, Diodes	Anode to Cathode
Transistors	Base-emitter or base-collector. If the device normally has no base lead as in phototransistors, special samples must be made with the base bonded out instead of the emitter.
ICs	Reverse bias the substrate (negative to V_{CC} lead, positive to ground).

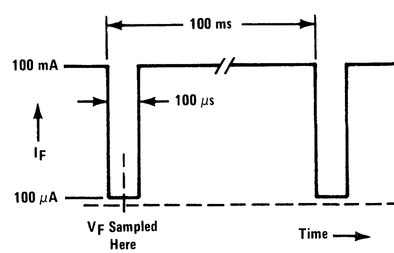
As a result of these measurements, we have a graphic representation of voltage drop versus junction temperature at a known low current. Figure 2A might be typical for an LED:

Figure 2A. Voltage Drop vs. Junction Temperature for IR LED



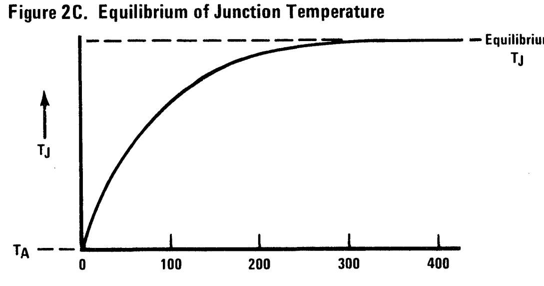
Now to find R_{THJA}, R_{THJX}, or R_{THJC} we place the device in the desired mounting configuration and apply a specific amount of power dissipation to the device, sufficient to provide significant chip heating. The junction temperature is monitored by interrupting the power and substituting the low forward bias current (our "thermometer"), 100 μA for the LED described in Figure 2A. The voltage drop must be measured before the junction has time to cool significantly. We use a 100 μs interruption which is consistent with the thermal time constant of the devices being measured; a sample and hold circuit maintains the reading so it can be recorded with a voltmeter. The applied waveform for the above LED would appear as shown in Figure 2B:

Figure 2B. Timing Cycle for Device Heating and Monitoring of Junction Temperature



Because of the sample and hold circuit, the voltmeter reading reflects the junction temperature of the chip as shown graphically in Figure 2A. For a typical plastic LED, the temperature rises after application of DC power for several minutes as shown in Figure 2C.

Figure 2C. Equilibrium of Junction Temperature



When the voltmeter reading has stopped changing, we (1) substitute the reading back into the graph to get the actual T_J; (2) multiply the large forward current, in this case 100 mA, by the voltage drop on the diode with 100 mA applied, to get the power dissipation; (3) measure the actual T_A; and (4) substitute into the R_{THJA} formula to get a value for thermal impedance.

Example

A typical OP290 infrared emitting diode is found to have V_F characteristics as shown at an I_F Of 100 μA:

T_A (°C)	V_F (Volts)
25	1.080
50	1.030
75	0.980
100	0.930

It is then connected to a test circuit and immersed in agitated silicone dielectric fluid at a temperature of 25°C; this is a good approximation of an infinite heat sink for a low power device. An I_F of 100 mA is applied. Every 100 ms the I_F is reduced to 100 μA for a period of 100 μs, after which the I_F returns to 100 mA. Using a sample and hold circuit we observe that the V_F of the device during the low current intervals starts out at 1.080 Volts but rapidly decreases, eventually stabilizing at 1.050 Volts. Interpolating between 1.080 Volts (25°C) and 1.030 Volts (50°C) we find that junction temperature is now 40°C.

The V_F is measured during the 100 mA I_F period and found to be 1.50 Volts. Thus, the power dissipation is 150 mW (99.9 percent of the time). Substituting into the formula,

$$R_{THJA} \text{ (infinite heat sink)} = R_{THJC} = \frac{40-25}{.150} = 100°C/W$$

When the same test is conducted with the device in still air, mounted in a PC board socket, the final values of V_F are 1.024 at 100 μA and 1.40 at 100 mA. Thus T_J = 53°C and

$$R_{THJX} = \frac{53-25}{.140} = 200°C/W$$

The power derating curves are:

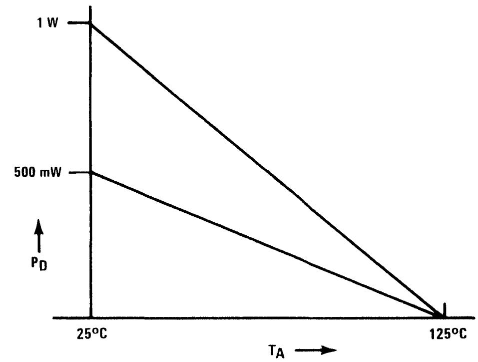
$$P_D = \frac{T_{J(MAX)} - T_X}{R_{THJA}} = \frac{125 - T_A}{100} \text{ with infinite heat sink , and}$$

$$P_D = \frac{125 - T_A}{200} \cdot \text{ with no heat sink.}$$

Martin McCrorey

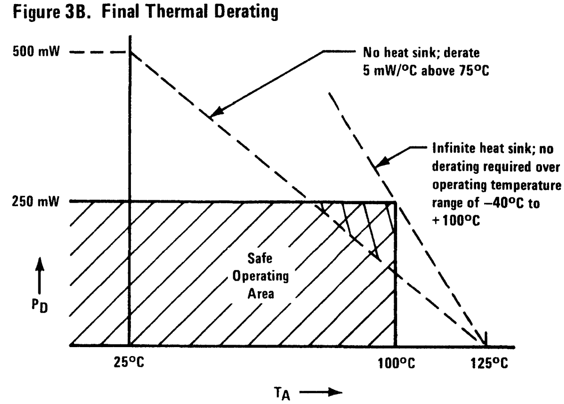
Graphing the derating curve gives two lines as shown in Figure 3A:

Figure 3A. Thermal Derating for "Infinite" and "No" Heat Sink



But the device is limited to 250 mW for reliability reasons, and the plastic package can withstand only 100°C due to the glass transistion temperature of the plastic. Thus, the final power derating curve is shown in Figure 3B:

Figure 3B. Final Thermal Derating



The entire shaded area can be used with an infinite heat sink; the cross-hatched area is forbidden for a device with no heat sink.

Conclusions

Power dissipation ratings for DC operating conditions are calculated with the techniques just described. For a device operated under steady state conditions, these procedures provide a method of establishing operating limits which are consistent with good device reliability. However, under pulsed conditions, the thermal time constants of the device must be considered. For information on the subject of junction heating under pulsed conditions, refer to Optek Application Bulletin 200, "Thermal Behavior of GaAs LEDs".

Application Bulletin 211
July 1989

OPTEK

Recommendations for Soldering T-1 3/4 Plastic Encapsulated Discrete Components

Plastic encapsulated components such as T-1 3/4 LEDs and phototransistors are very sensitive to soldering techniques. The body is molded around a copper lead frame using an optical grade epoxy. Because of the need for optical transmissivity, the epoxy cannot be manufactured using the fillers and additives that allow epoxies to withstand the high temperatures found in IC packages.

The copper lead frame is an excellent material for both heat and electrical conductivity. This property provides benefits such as higher allowable forward currents (therefore higher output power), which are more easily formed and bent. There is also a major disadvantage in that the heat from soldering operations is conducted inside the plastic body .

This combination of the relatively low temperature softening point of the plastic and the high temperatures required for successful solder joints makes the leads susceptible to movement inside the encapsulant. If the cathode lead is moved at the gold bond wire (.001" dia.)/cathode lead interconnect point, then there can be an open caused by a wire bond break. This can be detected in some cases immediately; in other cases the device will open intermittently or fail in operation.

The precautions that substantially reduce this failure mechanism, in their order of importance, are:

Solder Iron

1. The overwhelming cause of failure is lead movement inside the encapsulating epoxy at the gold bond wire/cathode lead interconnect. The force exerted by the iron while the epoxy is plasticized is the critical control parameter. The smaller the force, the less likely a solder-induced open will occur. In no case should the iron exert more than 20 grams weight on the leads.

2. Keep soldering temperature as low as possible; 260°C is the maximum allowable.

3. Keep soldering time as low as possible; 5 seconds is the maximum allowable.

4. Solder as far from the package as possible. In no case should the solder joint be closer than 1/16" to the epoxy.

5. Keep leads at full length when possible and trim after soldering.

6. There are several recommended procedures or tools that can aid in the precautions listed above.

a) Use a heat sink between the plastic body and the solder iron.

b) Clamp the device leads next to the plastic body to prevent lead movement.

c) Load the solder onto the iron prior to making contact in order to reduce contact time.

d) Insure devices have not been stored for a long time in an oxidizing environment. Oxidized leads are not a severe problem, but can occur. If leads show signs of oxidation, they can be cleaned without damage to the plastic. Please call for directions.

e) If devices are to be inserted into PCB holes, insure the holes are at the nominal device lead spacing so there is no stress or spring tension on the leads during solder.

Flow Soldering

1. As long as leads are not under any stress or spring tension, 260°C for ten seconds maximum will not induce failures.

2. If units need to have formed leads prior to soldering, insure forming forces the lead spacing to match the PCB hole spacing.

3. If possible, leave leads intact until after flow solder, then clip them.

Danny Johnson
Kirk Bailey

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OPTEK

Hall Effect Liquid Level Sensing

Have you ever had a customer that wanted to sense a liquid level? One method would be to take advantage of Snell's Law and use an optical reflective device (see Application Bulletin 204). The IR light from the LED is reflected by a conical plastic or glass surface. However, when this reflecting surface is immersed in a liquid who's index of refraction matches the plastic or glass, it will not act as a good reflector. In some cases the liquid characteristics or the operating environment will not permit the use of optical sensing. An alternative is the Hall Effect sensor. Assuming the liquid is in a non ferrous container, a small float and magnet would be placed in the liquid container as shown in Figure 1. The float must be constructed or constrained so the magnet path will be known. An OH090U, OH180U or OH360U Hall Effect sensor would then be placed on the wall just outside the container. When the float with the magnet is close enough to the Hall Effect sensor, its output will change state.

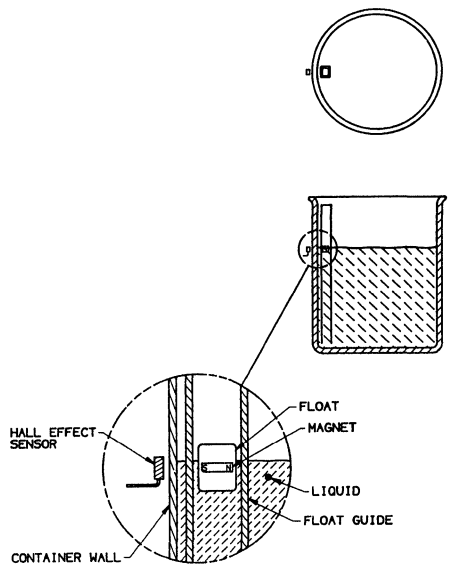

Figure 1

The particular sensor used will be determined by several factors. Both the strength of the magnet and the distance from the Hall Effect sensor to the magnet are critical. The designer is faced with selecting a magnet which is not affected by the liquid and sizing the magnet to produce the needed flux density cost effectively. A common magnetic material to use is Alenco 8. A magnet of this material which is .250 inch in diameter and 0.5 inches long will produce a magnetic field of 500 gauss at a distance of about 0.1 inches. An OH360U will work in this field. The exact location at which the digital sensor will activate will vary with sensor sensitivity and will change along with the magnet characteristics over temperature. The designer may want to include a means of adjusting the sensor position to move the trip point locations.

Hall Effect sensors are well suited for high temperature applications because they operate up to 150 degrees centigrade. They are also immune to dirt and other contamination if the electrical connections are protected. Also, ambient light will not be a factor as it is with optical sensors.

Liquid level sensors are used in dishwashers, washing machines, the oil and gas industry, vending machines, medical equipment, and many other places.

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Basic Design Ideas for Emitters and Sensors

There are some basic steps required to design-in a simple optoelectronics sensor. The first step is to get the LED to produce light. This is done by connecting the LED to a power supply using a resistor to establish the current flow. Figure 1 illustrates this schematically.

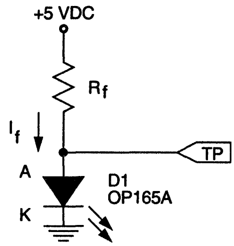

Figure 1

The LED V_F can be predicted by reviewing the forward voltage versus forward current curve in this catalog. Let's say we want to set the LED current for an OP165 at 20 mA. The V_F at this level, from the curve, will be about 1.2 V. Therefore, we must drop 3.8 V across the resistor R_f if the supply voltage is 5.0 V. From Ohm's law this calculates to be a 190 Ohm resistor. The power to the resistor will be 76 mW, so a 1/8 watt or larger resistor will work in this application. To be sure everything is connected properly, measure the voltage at TP with power applied. The V_F should be, as predicted, about 1.2 V. If it is 5 V, the LED is open or connected backwards, or there is a wiring error. If the voltage is 0 V, the LED is shorted, or a wiring problem may exist. At these currents, the LED output will be linear. Increase the current by 20%, the light output will increase by 20%. Ideally, the LED should be operated at a low drive current to conserve power and to minimize the effects of LED degradation. A good operating current for most applications is 20 mA.

Now that the LED is generating light, a phototransistor is used to sense it. A phototransistor functions just like a transistor except the base current is produced by an integral photodiode. Therefore, we only have to connect the collector and the emitter of the transistor. The current conducted by the transistor will be proportional to the incident light. If an OP505 phototransistor is coupled with an OP165 LED and the spacing between the lens tips is 0.2", the photo current will be greater than 1 mA. This current can be detected by using the circuit shown in Figure 2.

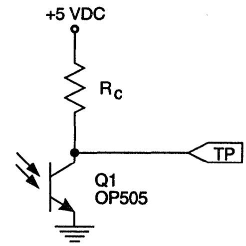

Figure 2

Assuming the phototransistor is operating in a saturated condition, the voltage drop across the phototransistor will be less than 0.4 V. Therefore, we must drop 4.6 V across R_C when the LED is on. From Ohm's law, the resistor R_C must be greater than 4600 Ohms. Therefore, a 10K Ohm resistor would be a conservative choice. This combination results in a voltage swing from less than 0.4 V to over 4.9 V when the LED is turned on and off at the test point. This is a suitable interface for a CMOS input or a voltage comparator.

There are other factors to be considered including aperture size or resolution of the sensor, effects of ambient light, switching speed and more. However, this application note is designed to assist someone who has little experience with optoelectronics.

OPTEK

Interfacing Sensors with a Microprocessor

This application note addresses a method for monitoring multiple sensor channels with a single analog-to-digital channel. The application might be an eight-channel reflective or a transmissive bar code reader. By using an A/D converter an analog level of the sensor can be measured. This analog voltage can provide more information than a digital sensor.

This system would be controlled by one of the single chip microprocessors like the Motorola 68HC11. Referring to Figure 1 on the next page, let's review the details of operation. The sensors will be configured to operate one channel at a time. This is accomplished by illuminating the LEDs with a microprocessor and connecting the sensors in parallel. The LEDs will be illuminated one by one, and the resulting phototransistor current will be measured by the microprocessor analog-to-digital converter.

This type of operation consumes very little current. Each LED is only on long enough to collect a sensor reading. The microprocessor can also be programmed to have sleep periods and operate only long enough to check all the sensors. The net average current consumption would be less than 25 mA without modulating the CPU on time. This approach is ideal for applications requiring battery operation or those trying to minimize power supply requirements.

When connecting several sensors in parallel as shown, the leakage current of each sensor and its associated solder connections must be very low (200 nA). The ambient light incident on all the sensors must also be low. If these conditions are not met, the leakage currents or off currents (noise) may exceed the on current (signal). Minimizing the off state currents will also produce the greatest dynamic range for the sensing system.

The OPAMP shown is one of a CMOS series produced by National Semiconductor. It is a single supply device with an output that can be driven rail-to-rail. Any OPAMP with equivalent characteristics is acceptable. You may even find it desirable to use one with a balance adjustment which can be used to adjust OPAMP offset and any quiescent noise or leakage out of the sensing system.

Another consideration is the analog-to-digital range and resolution. If the sensor conditions vary, attempt to balance them by adjusting each LED current-limiting resistor. Keep in mind that if you have an eight-bit A/D you will have 256 different possible sensor levels. Make sure the sensor off state falls at the low end of the A/D and the on state falls near the upper end by picking good A/D reference voltages and carefully selecting the proper gain of the final amplifier or buffer. This will probably require prototyping and testing of your circuit to select the proper values.

With regard to LED current, the 7445 shown in Figure 1 is rated for operation with 80 mA of sink current. However, try to limit the LED current to about 40 mA. Normally a lower LED drive current is recommended but this system will be pulsing the LEDs at a low duty cycle, so heating and LED degradation will not be a long term factor in most applications. If you have problems with ambient light, operate the LEDs at a higher current level. Also, if you find you can work with 10 mA or less and you have the extra CPU outputs, you may want to drive the LEDs directly from the CPU and save a chip. Check the specification of your CPU. Most CPUs have a particular eight-bit port which is rated to sink more current.

Timing is another consideration. If the 68HC11 is clocked at 8 MHz, the A/D will complete a single conversion in 32 clock cycles or 16 µs. A few more instructions will be needed to turn on the LED and to allow the signal to stabilize so a channel read time of about 30 µs will be needed. All of these factors can be adjusted and fine tuned for a particular design.

The 68HC11 includes a serial port option. This port can be used to communicate with another computer or CPU for sensor status and control.

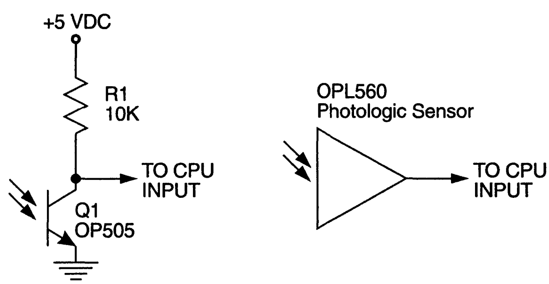

Figure 2

Another application might be to have eight different sensor locations operate as digital inputs. This can be accomplished by using phototransistors and a pull-up resistor or a Photologic sensor as shown in Figure 2. These devices would be connected directly to a CPU input. This approach would be much faster but it will not provide as much information about the state of the sensor channel.

Once you have introduced an CPU into your sensing application, the door is open for all sorts of possibilities. For instance, you may want to dynamically adjust the LED drive current for sensing conditions. Another possibility would be to monitor the signals while watching for a particular sensor signature which signals the occurrence of an event. Finally, you may want to add a temperature sensor to the system and use this data to factor out the temperature effects on the sensor.

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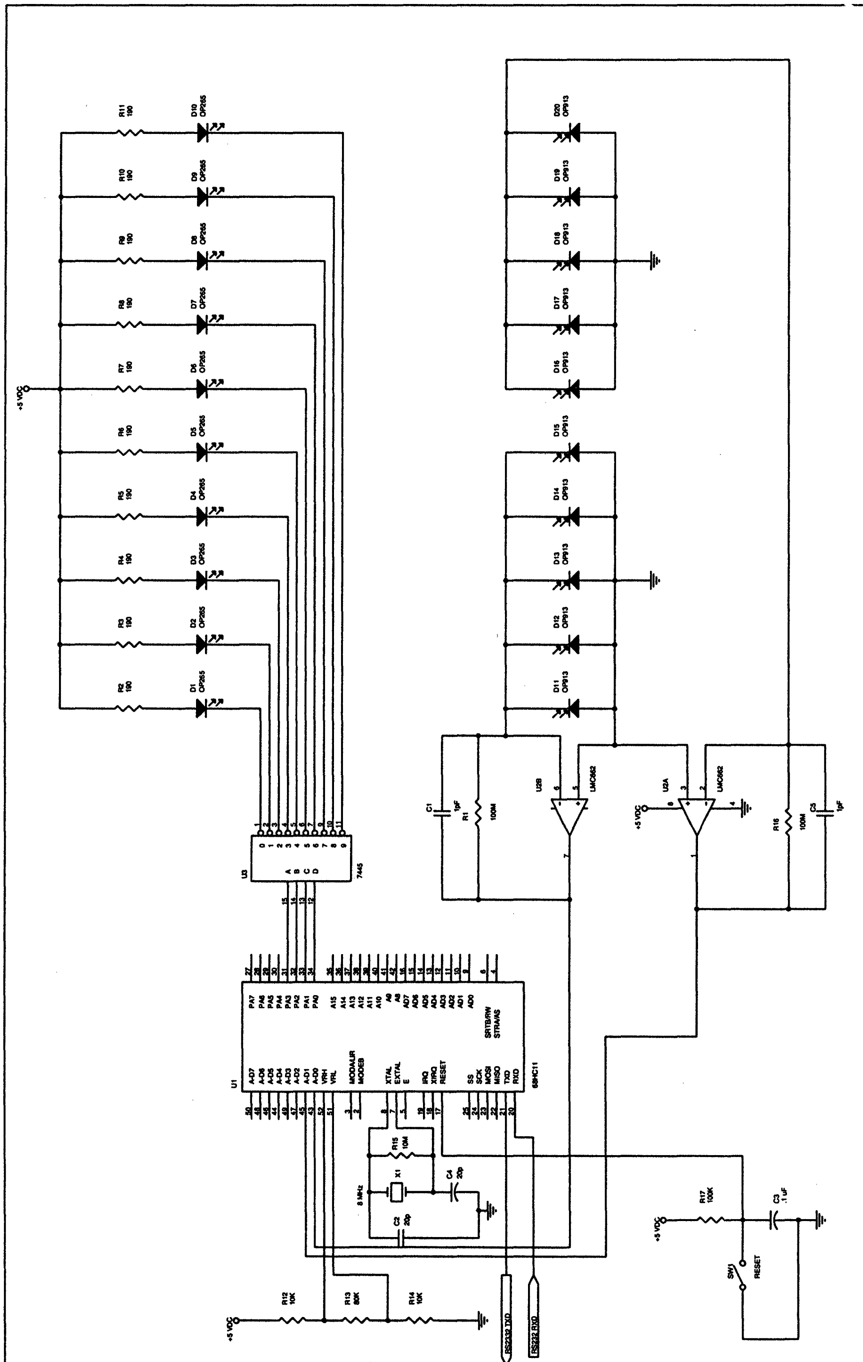


Figure 1

OPTEK

Maximizing Power Output Using the OP232W

What can Optek offer the customer that was using the OP233W in high power output applications? There are too many possible variations of design for there to be a simple answer. Following are a few suggestions:

The simplest option may be to increase the forward current to obtain the same output from the OP232W. Although the data sheet ratings have not been modified over the years, current production is significantly more reliable at higher drive currents than when the OP230W series was first produced in 1980. Provided the customer's circuitry can support the higher power supply loading, this may only require changing the value of a single resistor.

As another option, many customers will find that the OP293 series plastic components are easily substituted for the OP233W. Both are wide angle radiators (50 degree ½ angle for the OP233W, 60 degrees for the OP293), and in many applications the OP293 can fit into the same boards and sockets with no modifications. For those who can use this substitution, the higher on axis intensity available in the plastic component may actually offer improved performance. The main differences to be considered are the plastic versus hermetic construction and the overall package height of the OP293 product series.

Depending on the application it may be reasonable to adopt a pulsed mode operation utilizing the fact that the instantaneous power output can be very high while the average power is low. The circuitry involved is more complex than for a DC operating condition but need not be prohibitively complex or expensive. If the detector can be operated synchronously with the LED drive pulse there need be no loss of speed or sensitivity. Should synchronous operation not be practical but system response speed not be an issue, the detector can be used in an integrating mode with no loss in signal levels. See the following example.

Example: Replacing a DC circuit with a pulsed circuit

Assumptions:

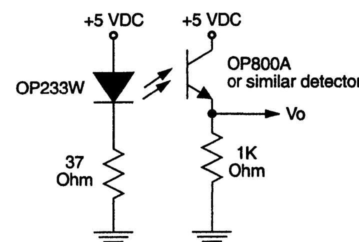
Application is an interrupter sensing whether an object is present in the optical path.

Response speed is not a critical issue.

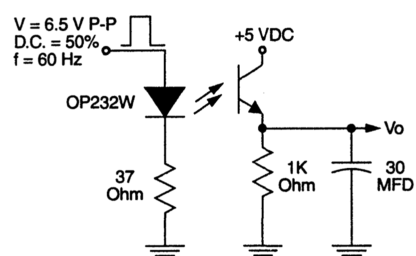
Required output is $V_O > 1$ V unblocked, $V_O < .1$ V blocked.

The optical path is such that an OP233W with $E_e(APT) = 6\ mW/cm^2$ is adequate but an OP232W with $E_e(APT) = 4\ mW/cm^2$ is not.

Original circuit with DC current drive to LED:



Replacement pulsed drive current circuit:



For the example, the value of V_O would be approximately the same for both circuits in either the blocked or open optical path condition. However, the response time is approximately 10 microseconds for the DC circuit and 10 milliseconds for the pulsed circuit. The speed of the pulsed circuit could be increased by raising the input frequency and reducing the RC product at the output. To maintain a low ripple on the output the RC product should be at least 2x the period of the input pulse waveform.

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OPTEK TECHNOLOGY, INC.

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January 1995

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Printed in U.S.A.