

# DATA SHEET

## **TDA8564Q**

**2 × 24 W BTL or 2 × 12 W  
single-ended car radio power  
amplifier**

Product specification  
Supersedes data of February 1995  
File under Integrated Circuits, IC01

1995 Dec 13

## 2 × 24 W BTL or 2 × 12 W single-ended car radio power amplifier

### TDA8564Q

#### FEATURES

- Requires very few external components
- High output power
- Flexibility in use - Quad single-ended or stereo BTL
- Low output offset voltage
- Fixed gain
- Diagnostic facility (distortion, short-circuit and temperature detection)
- Good ripple rejection
- Mode select switch (operating, mute and standby)
- Load dump protection
- AC and DC short-circuit safe to ground and to  $V_P$
- Low power dissipation in any short-circuit condition
- Thermally protected
- Reverse polarity safe

- Electrostatic discharge protection
- No switch-on/switch-off plop
- Flexible leads
- Low thermal resistance
- Identical inputs (inverting and non-inverting).

#### GENERAL DESCRIPTION

The TDA8564Q is an integrated class-B output amplifier in a 17-lead DIL-bent-SIL power package. It contains 4 × 12 W single-ended or 2 × 24 W bridge amplifiers.

#### APPLICATIONS

- The device is primarily developed for car radio applications.

#### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_P$	operating supply voltage		6.0	14.4	18.0	V
$I_{ORM}$	repetitive peak output current		–	–	4	A
$I_{q(tot)}$	total quiescent current		–	80	–	mA
$I_{stb}$	standby current		–	0.1	100	$\mu$ A
<b>Stereo BTL application</b>						
$P_o$	output power	$R_L = 4 \Omega$ ; THD = 10%	–	24	–	W
SVRR	supply voltage ripple rejection		–	41	–	dB
$V_{no}$	noise output voltage	$R_s = 0 \Omega$	–	200	–	$\mu$ V
$ Z_i $	input impedance		25	–	–	k $\Omega$
$ \Delta V_O $	DC output offset voltage		–	–	250	mV
<b>Quad single-ended application</b>						
$P_o$	output power	$R_L = 4 \Omega$ ; THD = 10%	–	6.4	–	W
		$R_L = 2 \Omega$ ; THD = 10%	–	12	–	W
SVRR	supply voltage ripple rejection		–	41	–	dB
$V_{no}$	noise output voltage	$R_s = 0 \Omega$	–	200	–	$\mu$ V
$ Z_i $	input impedance		50	–	–	k $\Omega$

#### ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA8564Q	DBS17P	plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm)	SOT243-1

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BLOCK DIAGRAM

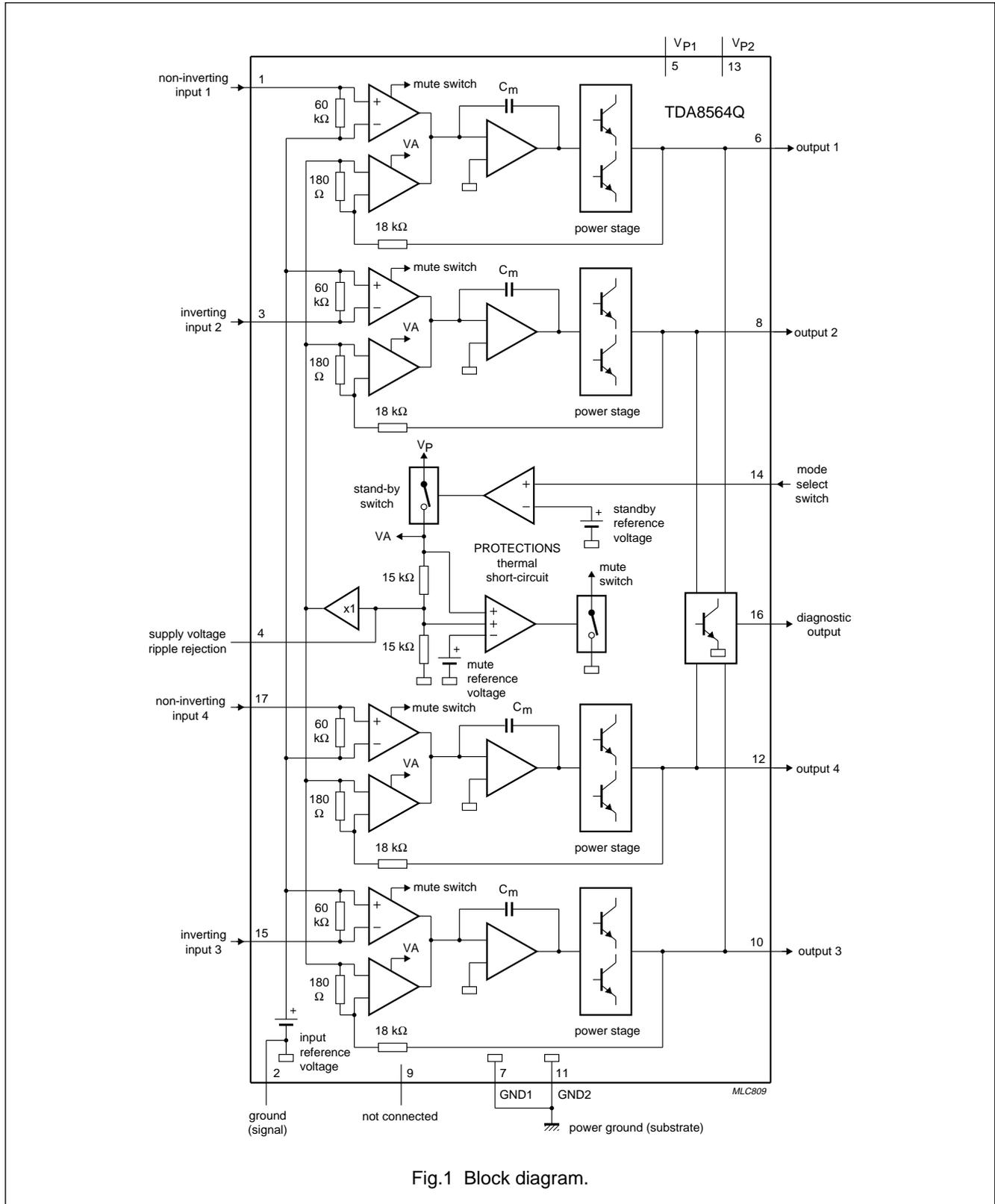


Fig.1 Block diagram.

2 × 24 W BTL or 2 × 12 W single-ended  
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**PINNING**

SYMBOL	PIN	DESCRIPTION
-INV1	1	non-inverting input 1
SGND	2	signal ground
INV2	3	inverting input 2
SVRR	4	supply voltage ripple rejection
V <sub>P1</sub>	5	supply voltage 1
OUT1	6	output 1
GND1	7	power ground 1
OUT2	8	output 2
n.c.	9	not connected
OUT3	10	output 3
GND2	11	power ground 2
OUT4	12	output 4
V <sub>P2</sub>	13	supply voltage 2
MODE	14	mode select switch input
INV3	15	inverting input 3
V <sub>DIAG</sub>	16	diagnostic output
-INV4	17	non-inverting input 4

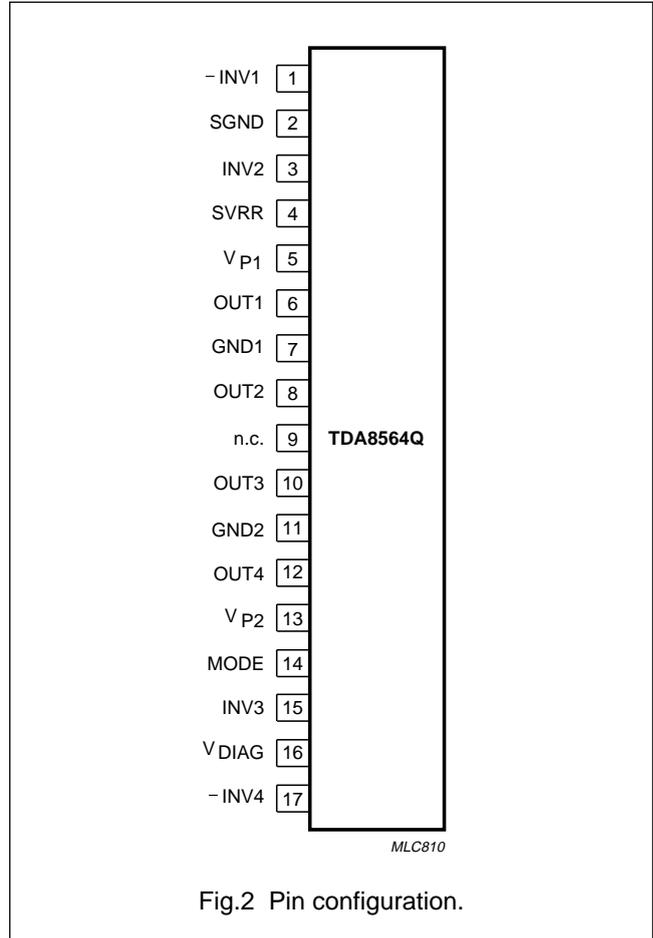


Fig.2 Pin configuration.

**FUNCTIONAL DESCRIPTION**

The TDA8564Q contains four identical amplifiers which can be used for single-ended or bridge applications. The gain of each amplifier is fixed at 40 dB (46 dB in BTL). Special features of the device are as follows.

**Mode select switch (pin 14)**

- Low standby current (<100 μA)
- Low switching current (low cost supply switch)
- Mute facility.

To avoid switch-on plops, it is advised to keep the amplifier in the mute mode during ≥100 ms (charging of the input capacitors at pins 1, 3, 15 and 17).

This can be achieved by:

- Microcontroller control
- External timing circuit (see Fig.3).

The circuit in Fig.3 slowly ramps up the voltage at the mode select switch pin when switching on and results in fast muting when switching off.

In the event of fast switching at mode select pin it is advised to increase the 1/2V<sub>P</sub> decoupling capacitor (pin 4) to 150 μF to avoid switch plops.

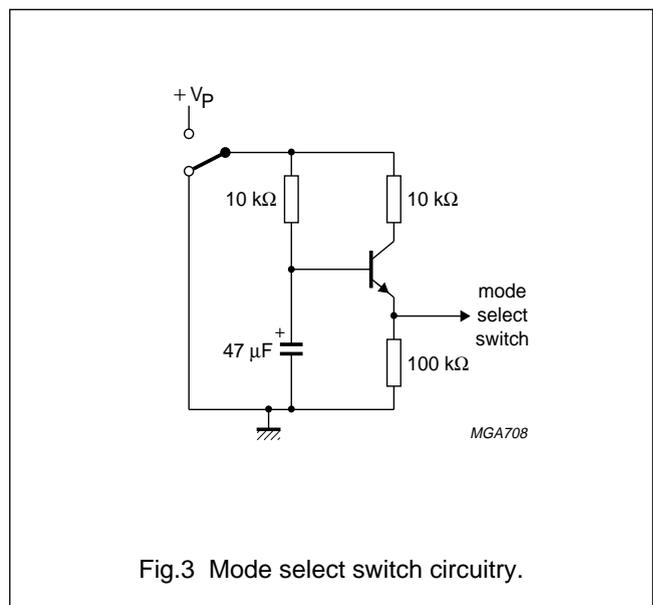


Fig.3 Mode select switch circuitry.

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**Diagnostic output (pin 16)**

**DYNAMIC DISTORTION DETECTOR (DDD)**

At the onset of clipping of one or more output stages, the dynamic distortion detector becomes active and pin 16 goes LOW. This information can be used to drive a sound processor or DC volume control to attenuate the input signal and thus limit the distortion. The output level of pin 16 is independent of the number of channels that are clipping (see Figs 4 and 5).

**SHORT-CIRCUIT PROTECTION**

When a short-circuit occurs at one or more outputs to ground or to the supply voltage, the output stages are switched off until the short-circuit is removed and the device is switched on again, with a delay of approximately 20 ms after removal of the short-circuit. During this short-circuit condition, pin 16 is continuously LOW.

When a short-circuit across the load of one or more channels occurs the output stages are switched off during

approximately 20 ms. After that time it is checked during approximately 50 μs to see whether the short-circuit is still present. Due to this duty cycle of 50 μs/20 ms the average current consumption during this short-circuit condition is very low (approximately 40 mA).

During this short-circuit condition, pin 16 is LOW for 20 ms and HIGH for 50 μs (see Fig.6).

The power dissipation in any short-circuit condition is very low.

**TEMPERATURE DETECTION**

When the virtual junction temperature  $T_{vj}$  reaches 150 °C, pin 16 will be active LOW.

**OPEN-COLLECTOR OUTPUT**

Pin 16 is an open-collector output, which allows pin 16 of more devices being tied together.

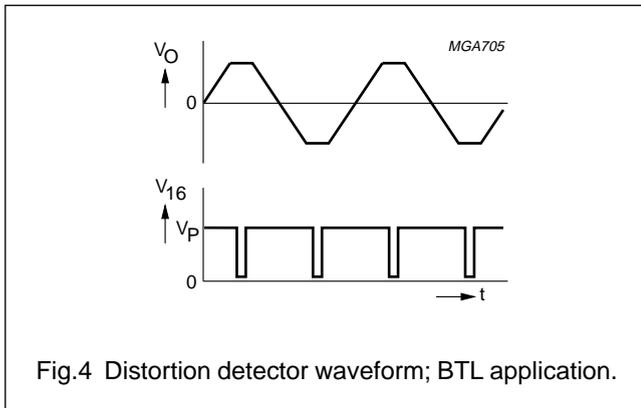


Fig.4 Distortion detector waveform; BTL application.

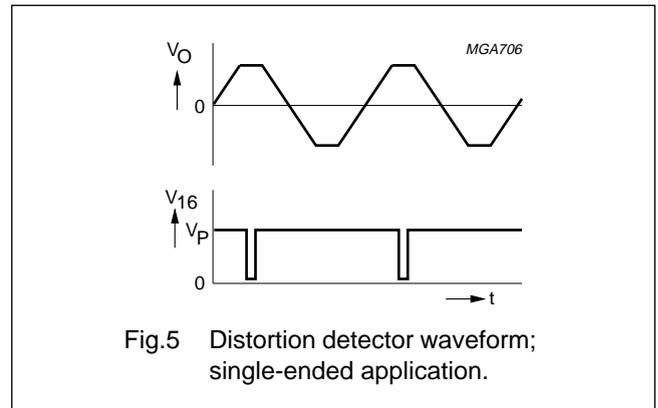


Fig.5 Distortion detector waveform; single-ended application.

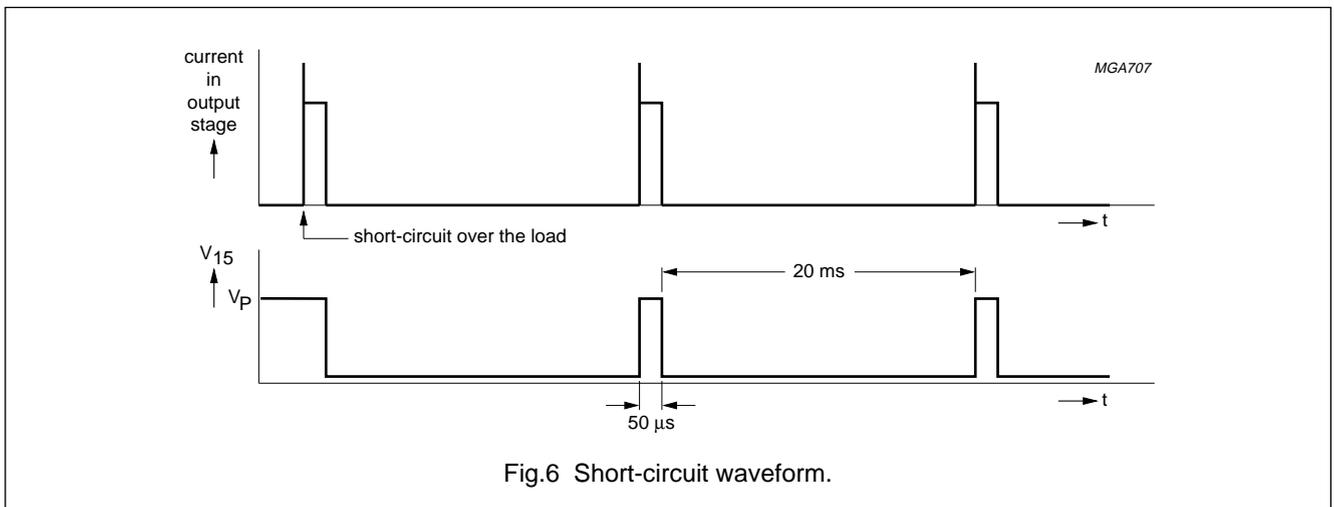


Fig.6 Short-circuit waveform.

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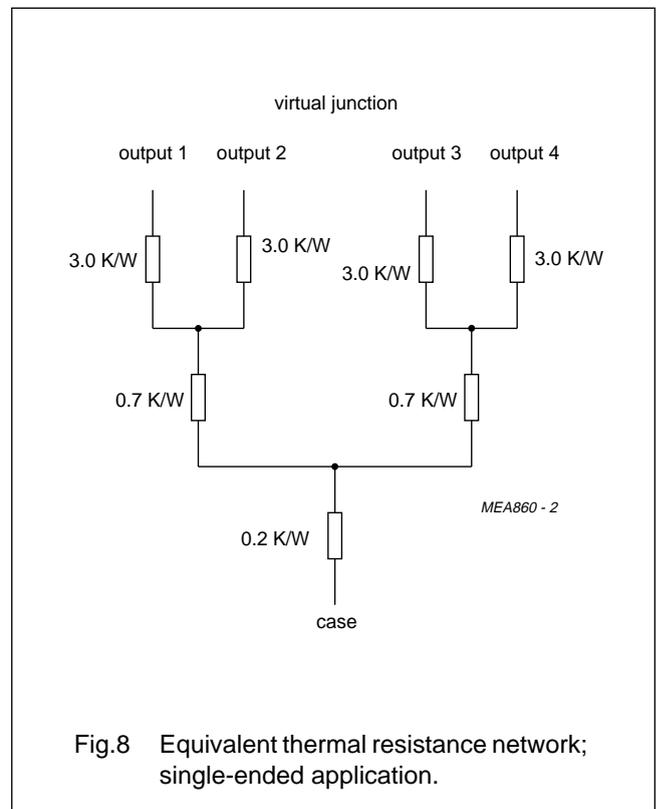
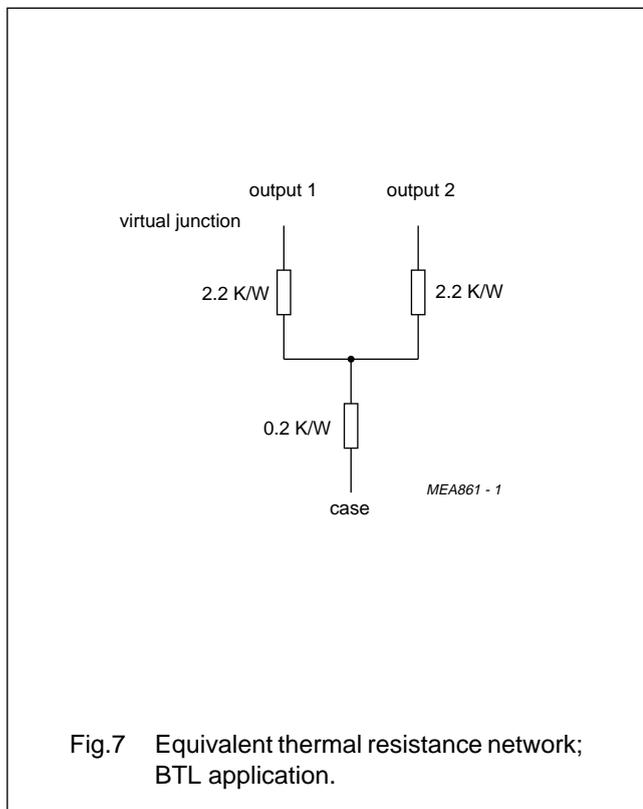
**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>P</sub>	supply voltage				
	operating		–	18	V
	non-operating		–	30	V
	load dump protection	during 50 ms; t <sub>r</sub> ≥ 2.5 ms	–	45	V
V <sub>pSC</sub>	AC and DC short-circuit safe voltage		–	18	V
V <sub>pr</sub>	reverse polarity		–	6	V
I <sub>OSM</sub>	non-repetitive peak output current		–	6	A
I <sub>ORM</sub>	repetitive peak output current		–	4	A
P <sub>tot</sub>	total power dissipation		–	60	W
T <sub>stg</sub>	storage temperature		–55	+150	°C
T <sub>amb</sub>	operating ambient temperature		–40	+85	°C
T <sub>vj</sub>	virtual junction temperature		–	150	°C

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	VALUE	UNIT
R <sub>th j-a</sub>	thermal resistance from junction to ambient in free air	40	K/W
R <sub>th j-c</sub>	thermal resistance from junction to case (see Figs 7 and 8)	1.3	K/W



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### DC CHARACTERISTICS

$V_P = 14.4$  V;  $T_{amb} = 25$  °C; measured in Fig.17; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Supply</b>						
$V_P$	supply voltage	note 1	6.0	14.4	18.0	V
$I_q$	quiescent current	see Fig.9	–	80	160	mA
$V_O$	DC output voltage	note 2	–	6.9	–	V
$ \Delta V_O $	DC output offset voltage		–	–	250	mV
<b>Mute select switch</b>						
$V_{14}$	switch-on voltage level		8.5	–	–	V
<b>MUTE CONDITION</b>						
$V_{mute}$	mute voltage		3.3	–	6.4	V
$V_O$	output signal in mute position	$V_{l(max)} = 1$ V; $f = 1$ kHz	–	–	20	mV
$ \Delta V_O $	DC output offset voltage		–	–	250	mV
<b>STANDBY CONDITION</b>						
$V_{stb}$	DC voltage in standby condition		0	–	2	V
$I_{stb}$	DC current in standby condition		–	–	100	μA
$I_{sw}$	switch-on current		–	12	40	μA
<b>Diagnostic output (pin 16)</b>						
$V_{DIAG}$	diagnostic output voltage	any short-circuit or clipping	–	–	0.6	V

### Notes

1. The circuit is DC adjusted at  $V_P = 6$  to 18 V and AC operating at  $V_P = 8.5$  to 18 V.
2. At  $18$  V <  $V_P$  < 30 V the DC output voltage  $\leq \frac{1}{2}V_P$ .

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**AC CHARACTERISTICS**

$V_P = 14.4\text{ V}$ ;  $R_L = 4\ \Omega$ ;  $f = 1\text{ kHz}$ ;  $T_{\text{amb}} = 25\text{ °C}$ ; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Stereo BTL application</b> (measured in Fig.17)						
$P_o$	output power	THD = 0.5%; note 1	15	19	–	W
		THD = 10%; note 1	20	24	–	W
$P_o$	output power	$V_P = 13.2\text{ V}$ ; THD = 0.5%; note 1	–	16	–	W
		$V_P = 13.2\text{ V}$ ; THD = 10%; note 1	–	20	–	W
THD	total harmonic distortion	$P_o = 1\text{ W}$	–	0.1	–	%
$f_{lr}$	low frequency roll-off	at –1 dB; note 2	–	45	–	Hz
$f_{hr}$	high frequency roll-off	at –1 dB	20	–	–	kHz
$G_v$	closed loop voltage gain		45	46	47	dB
SVRR	supply voltage ripple rejection					
	on	note 3	38	41	–	dB
	mute	note 3	42	48	–	dB
	standby	note 3	80	–	–	dB
$ Z_i $	input impedance		25	30	38	k $\Omega$
$V_{no}$	noise output voltage					
	on	$R_s = 0\ \Omega$ ; note 4	–	200	–	$\mu\text{V}$
	on	$R_s = 10\text{ k}\Omega$ ; note 4	–	350	700	$\mu\text{V}$
	mute	notes 4 and 5	–	180	–	$\mu\text{V}$
$\alpha_{cs}$	channel separation	$R_s = 10\text{ k}\Omega$	40	–	–	dB
$ \Delta G_v $	channel unbalance		–	–	1	dB
<b>DYNAMIC DISTORTION DETECTOR</b>						
THD	total harmonic distortion	$V_{16} \leq 0.6\text{ V}$ ; no short-circuit	–	10	–	%

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Quad single-ended application</b> (measured in Fig.18)						
P <sub>o</sub>	output power	THD = 0.5%; note 1	4	5	–	W
		THD = 10%; note 1	5.5	6.4	–	W
P <sub>o</sub>	output power	R <sub>L</sub> = 2 Ω; THD = 0.5%; note 1	7.5	8.5	–	W
		R <sub>L</sub> = 2 Ω; THD = 10%; note 1	10	12	–	W
THD	total harmonic distortion	P <sub>o</sub> = 1 W	–	0.15	–	%
f <sub>lr</sub>	low frequency roll-off	at –3 dB; note 2	–	45	–	Hz
f <sub>hr</sub>	high frequency roll-off	at –1 dB	20	–	–	kHz
G <sub>v</sub>	closed loop voltage gain		39	40	41	dB
SVRR	supply voltage ripple rejection					
	on	note 3	38	41	–	dB
	mute	note 3	42	48	–	dB
	standby	note 3	80	90	–	dB
Z <sub>i</sub>	input impedance		50	60	75	kΩ
V <sub>no</sub>	noise output voltage					
	on	R <sub>s</sub> = 0 Ω; note 4	–	200	300	μV
	on	R <sub>s</sub> = 10 kΩ; note 4	–	250	–	μV
	mute	notes 4 and 5	–	175	–	μV
α <sub>cs</sub>	channel separation	R <sub>s</sub> = 10 kΩ	40	52	–	dB
ΔG <sub>v</sub>	channel unbalance		–	–	1	dB
<b>DYNAMIC DISTORTION DETECTOR</b>						
THD	total harmonic distortion	V <sub>16</sub> ≤ 0.6 V; no short-circuit	–	10	–	%

**Notes**

- Output power is measured directly at the output pins of the IC.
- Frequency response externally fixed.
- Ripple rejection measured at the output with a source impedance of 0 Ω, maximum ripple amplitude of 2 V (p-p).
- Noise voltage measured in a bandwidth of 20 Hz to 20 kHz.
- Noise output voltage independent of R<sub>s</sub> (V<sub>I</sub> = 0 V).

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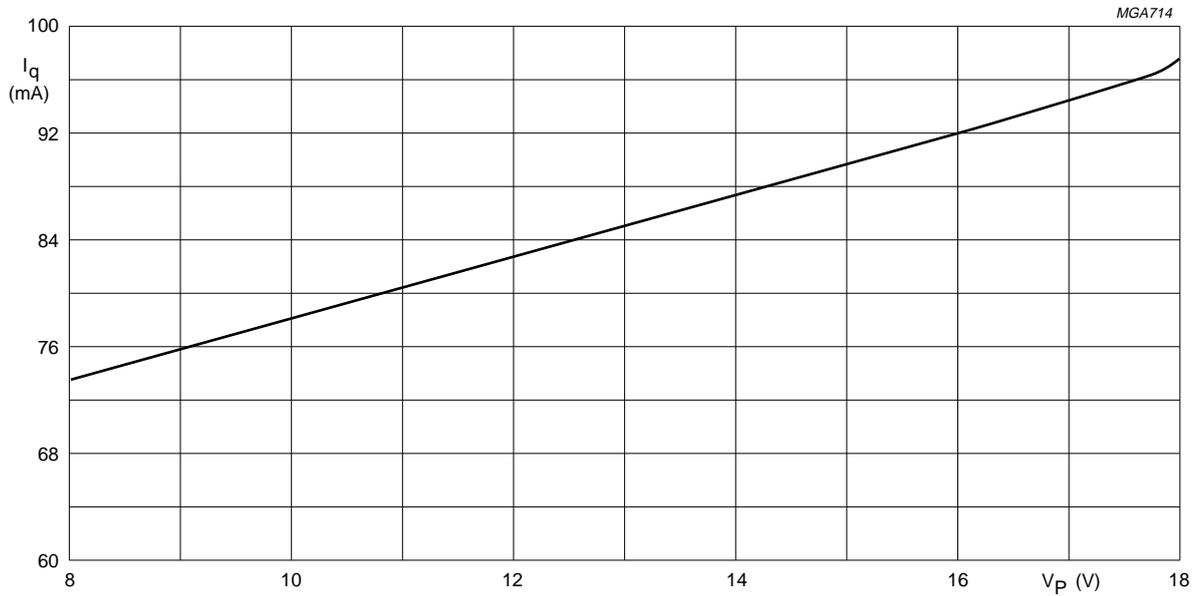
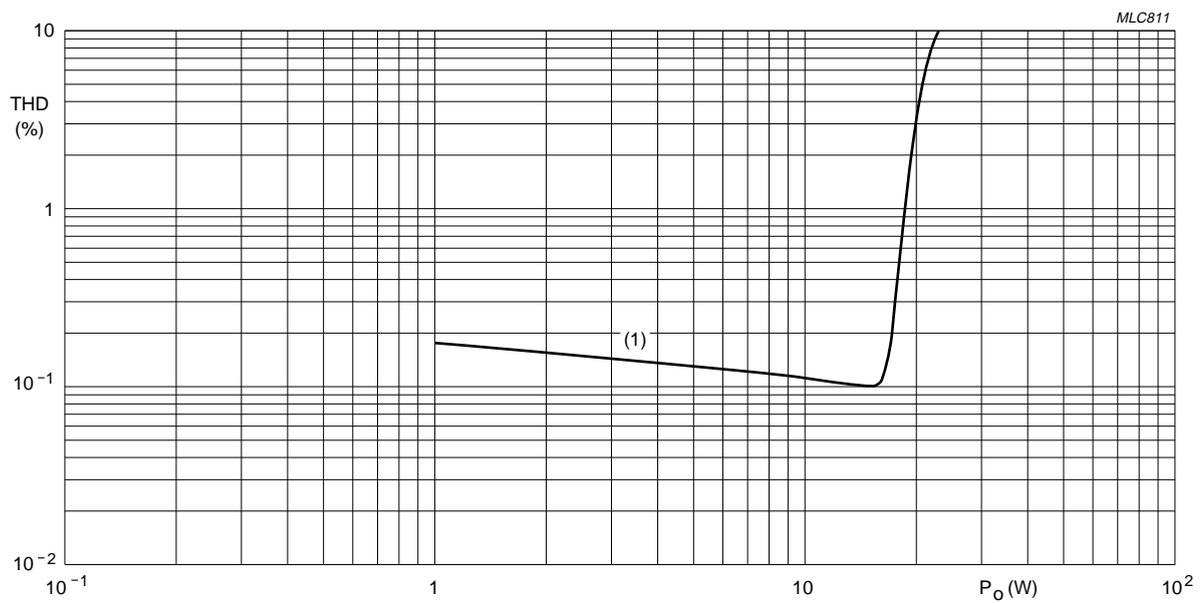


Fig.9 Quiescent current as a function of supply voltage;  $R_L = \infty$ .

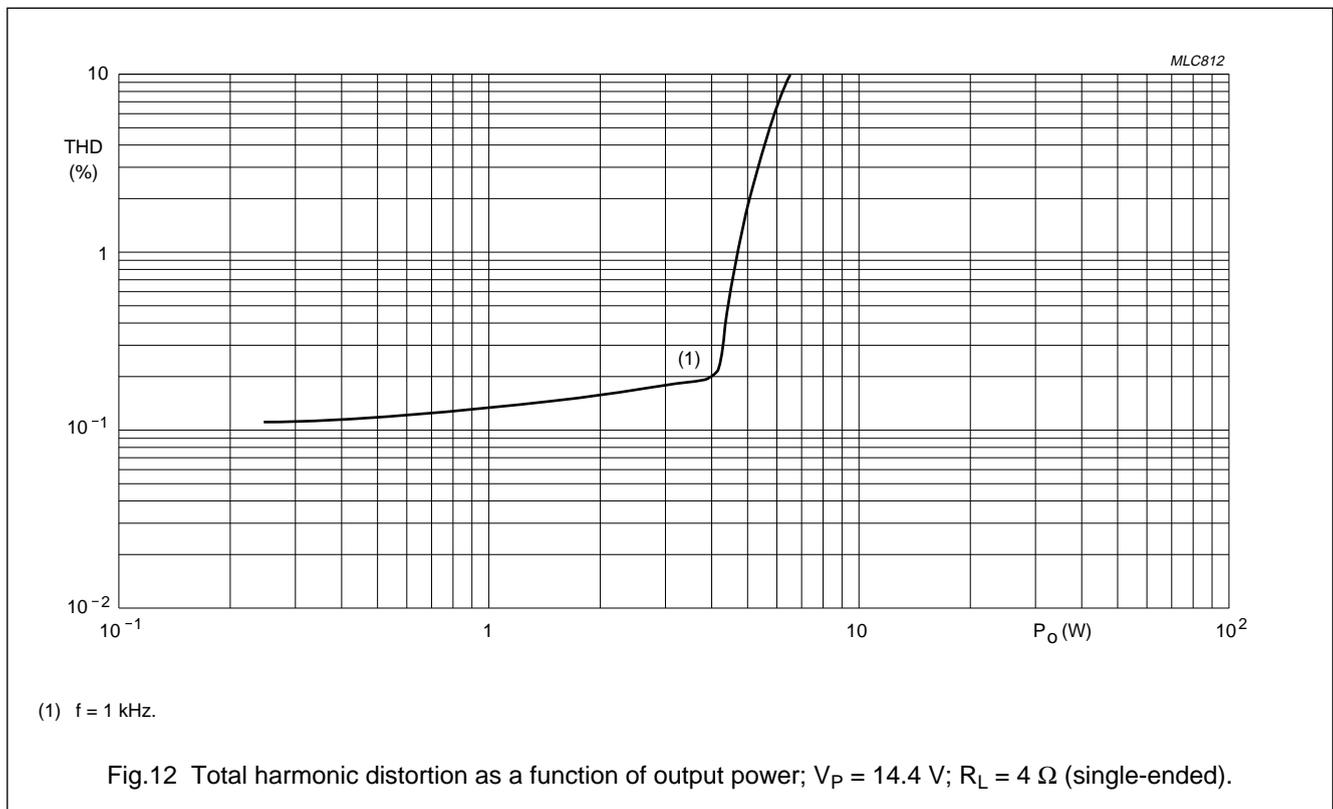
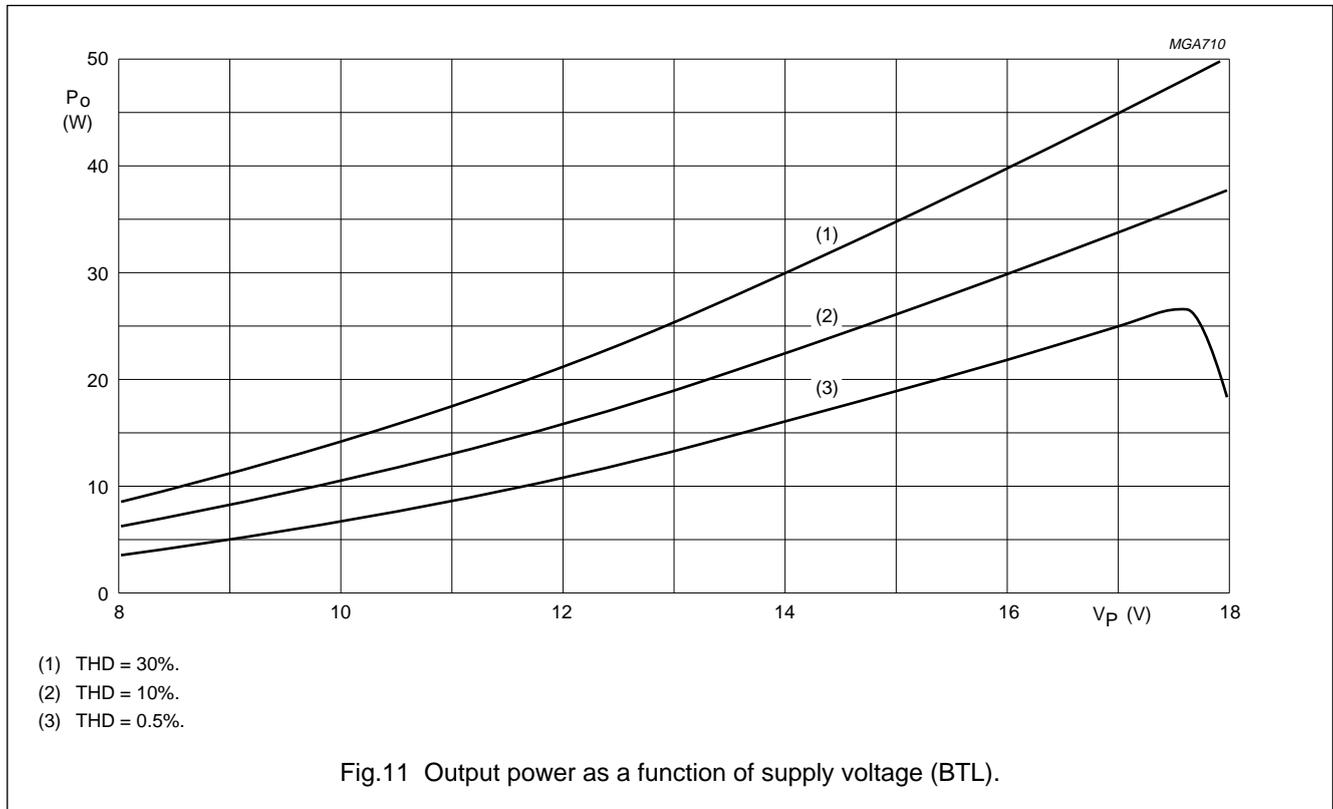


(1)  $f = 1$  kHz.

Fig.10 Total harmonic distortion as a function of output power;  $V_P = 14.4$  V;  $R_L = 4 \Omega$  (BTL).

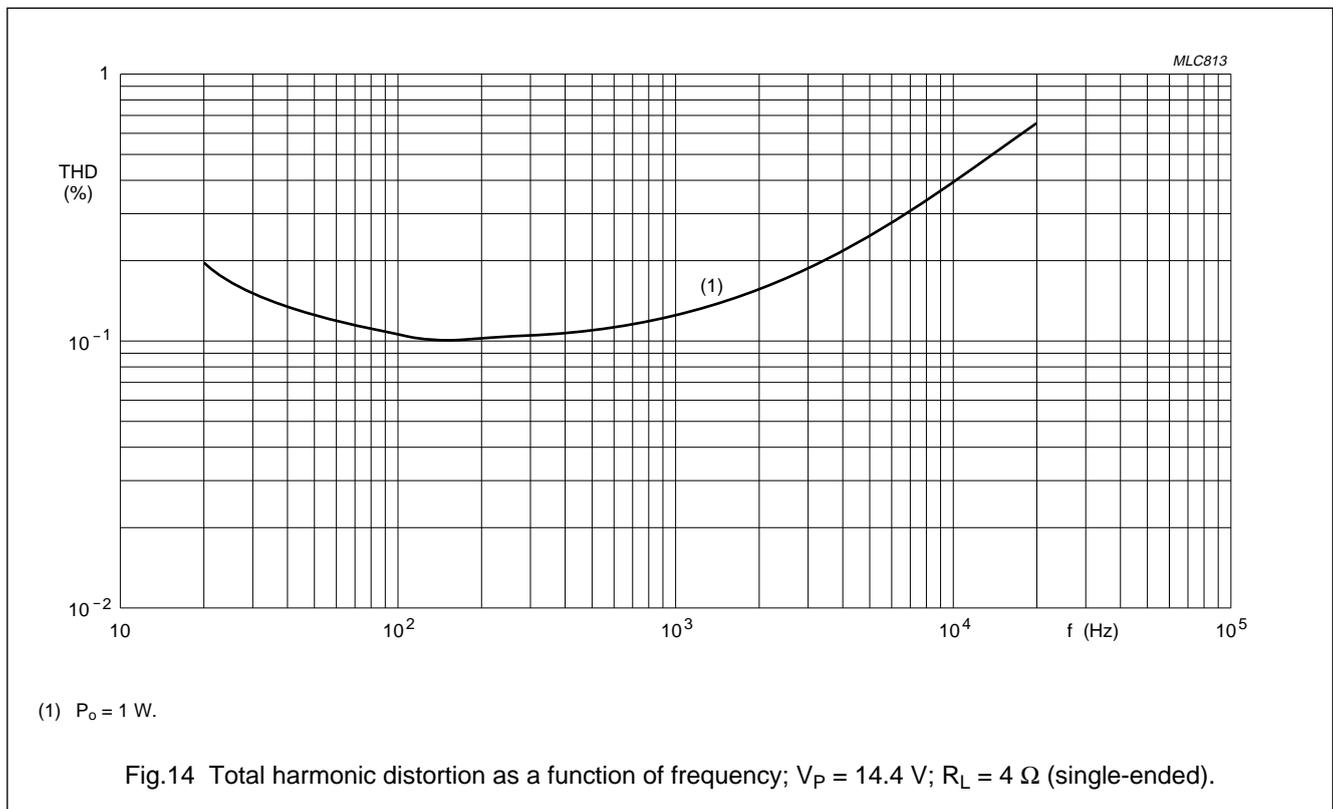
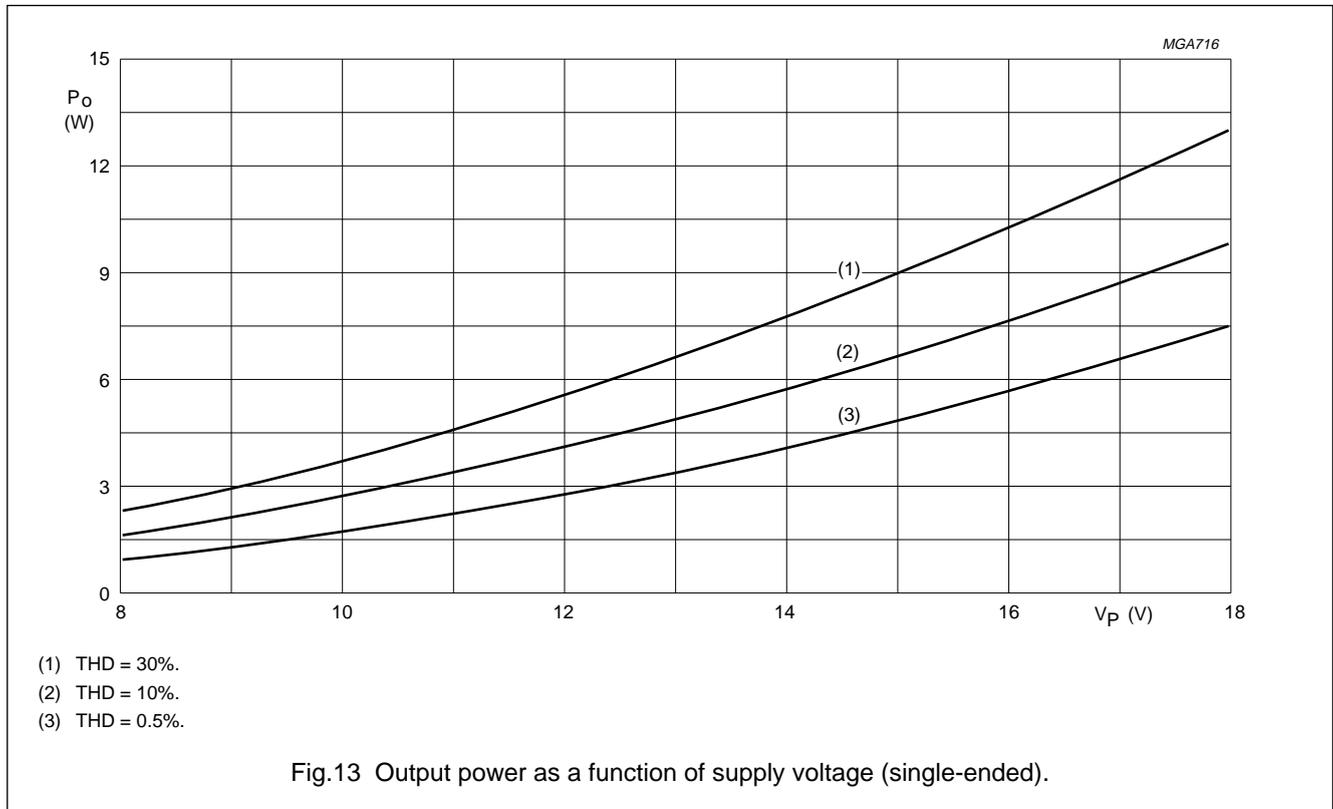
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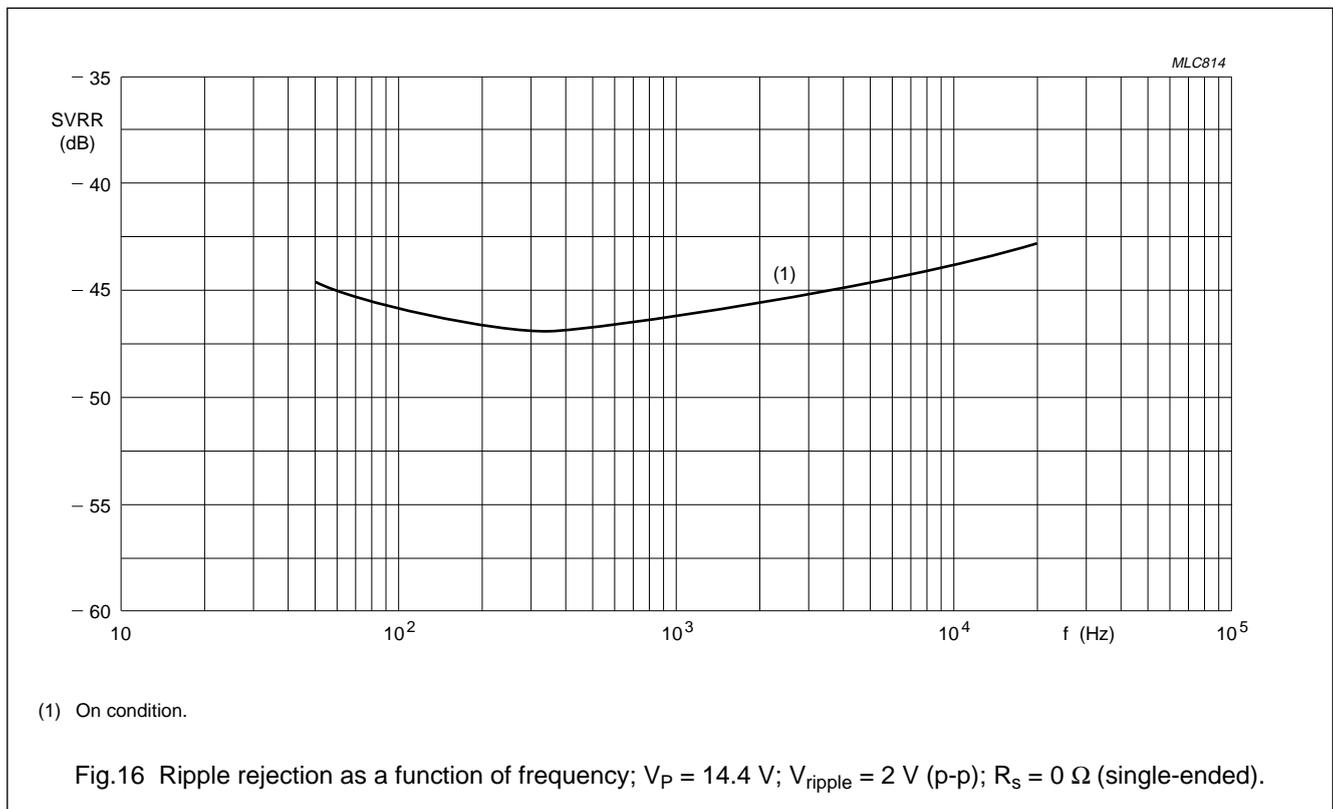
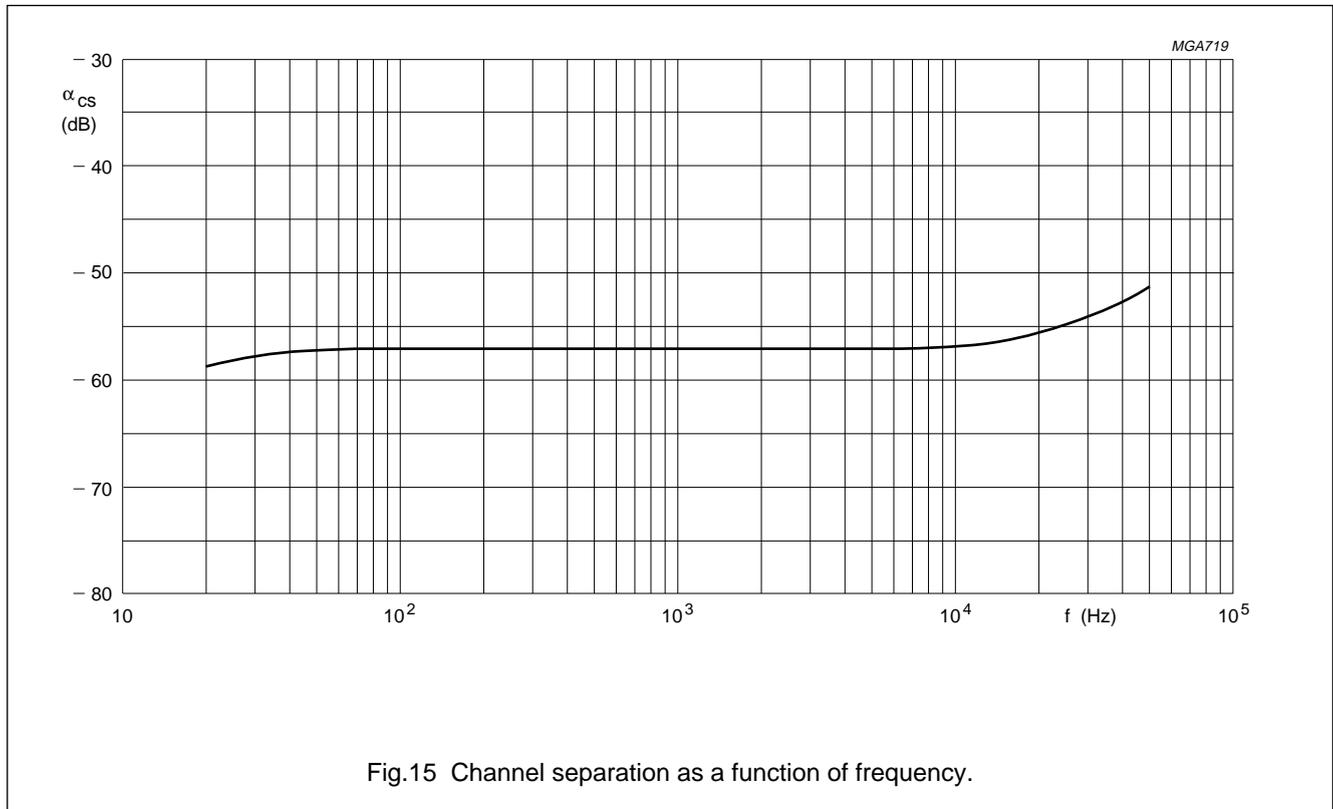
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**TEST AND APPLICATION INFORMATION**

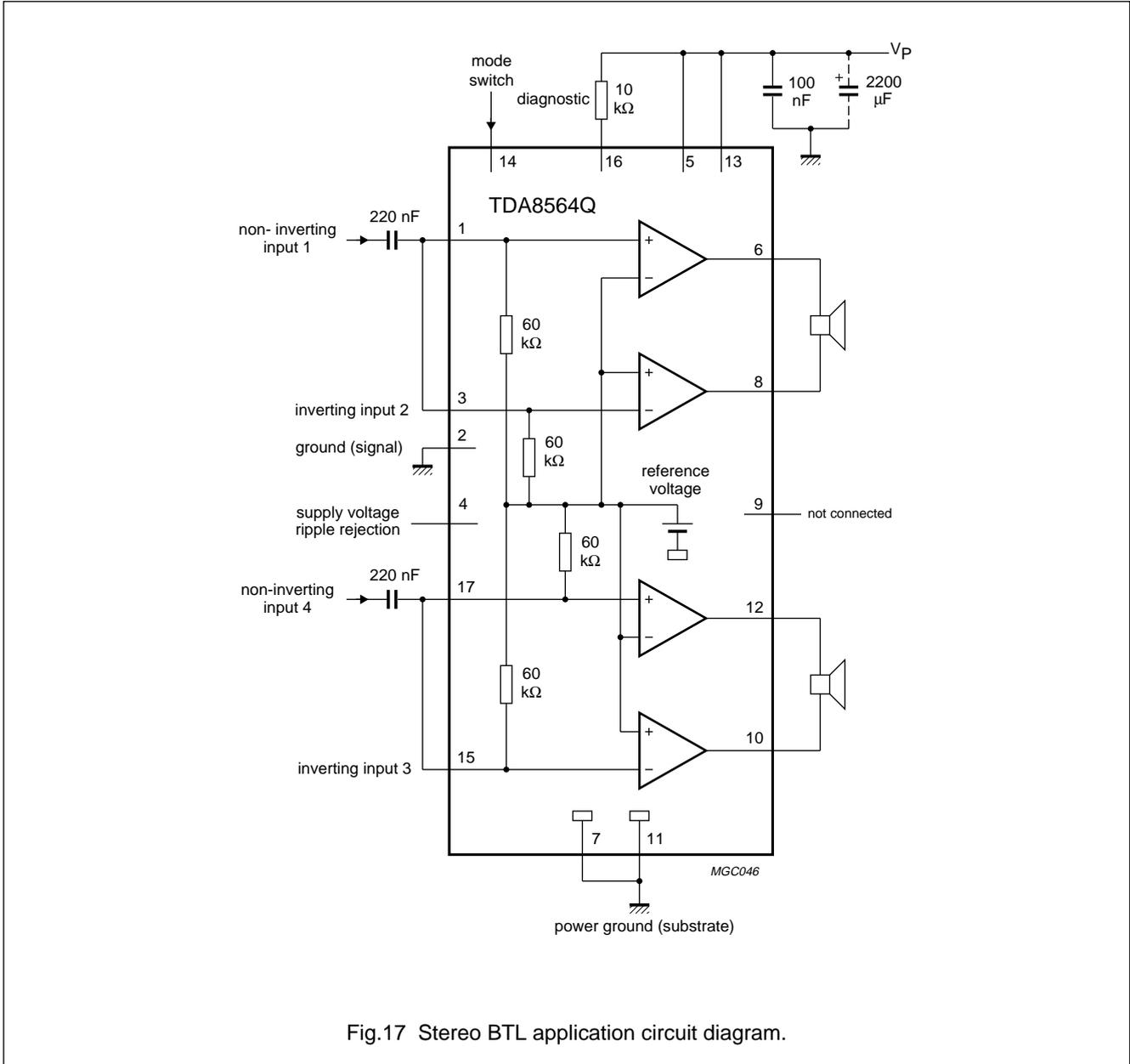


Fig.17 Stereo BTL application circuit diagram.

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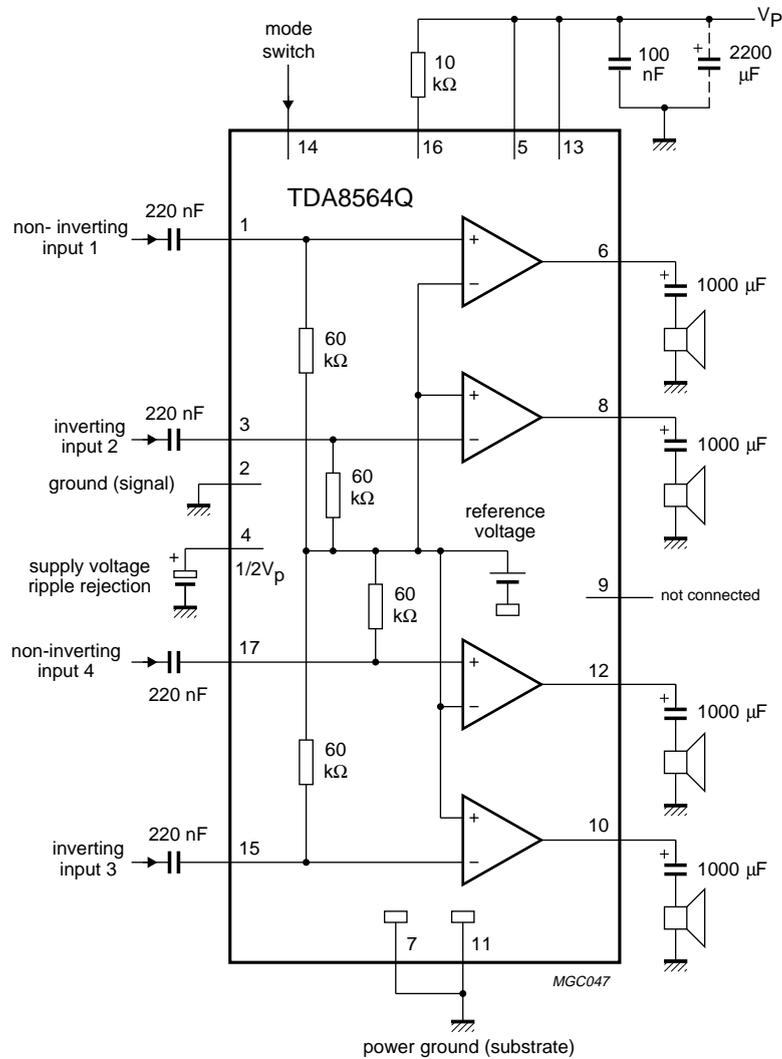
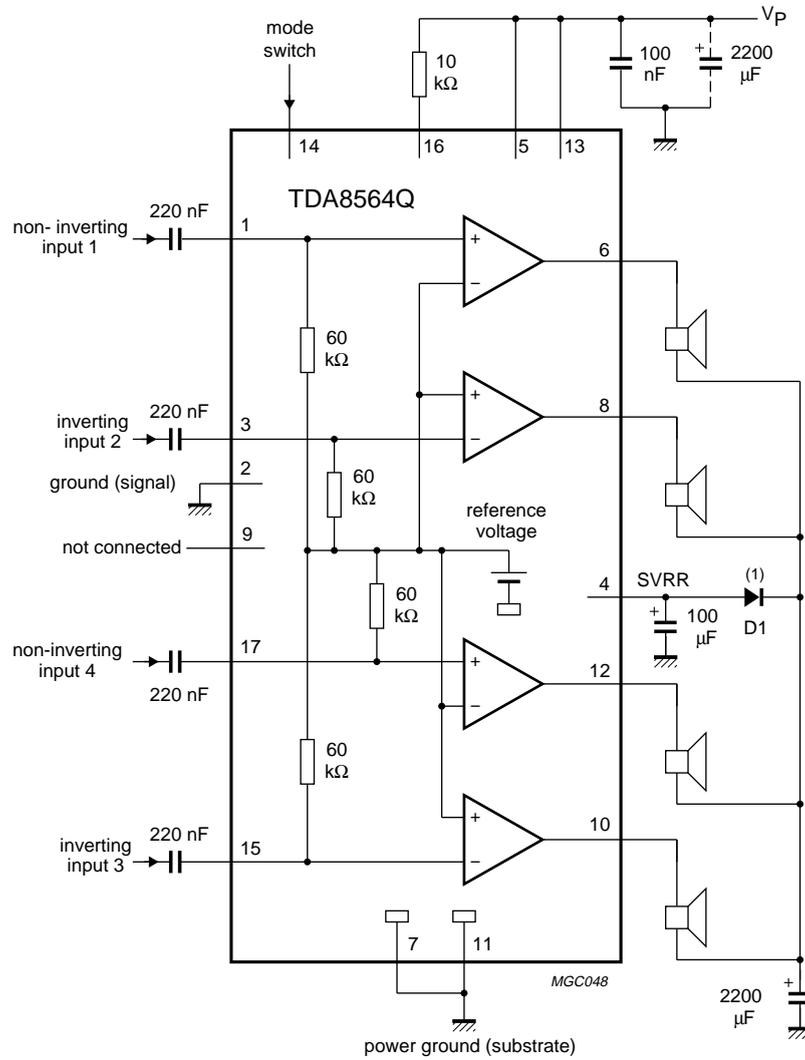


Fig.18 Quad single-ended application circuit diagram 1.

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(1) When short-circuiting the single-ended capacitor, the dissipation will be reduced due diode D1.

Fig.19 Quad single-ended application circuit diagram 2.

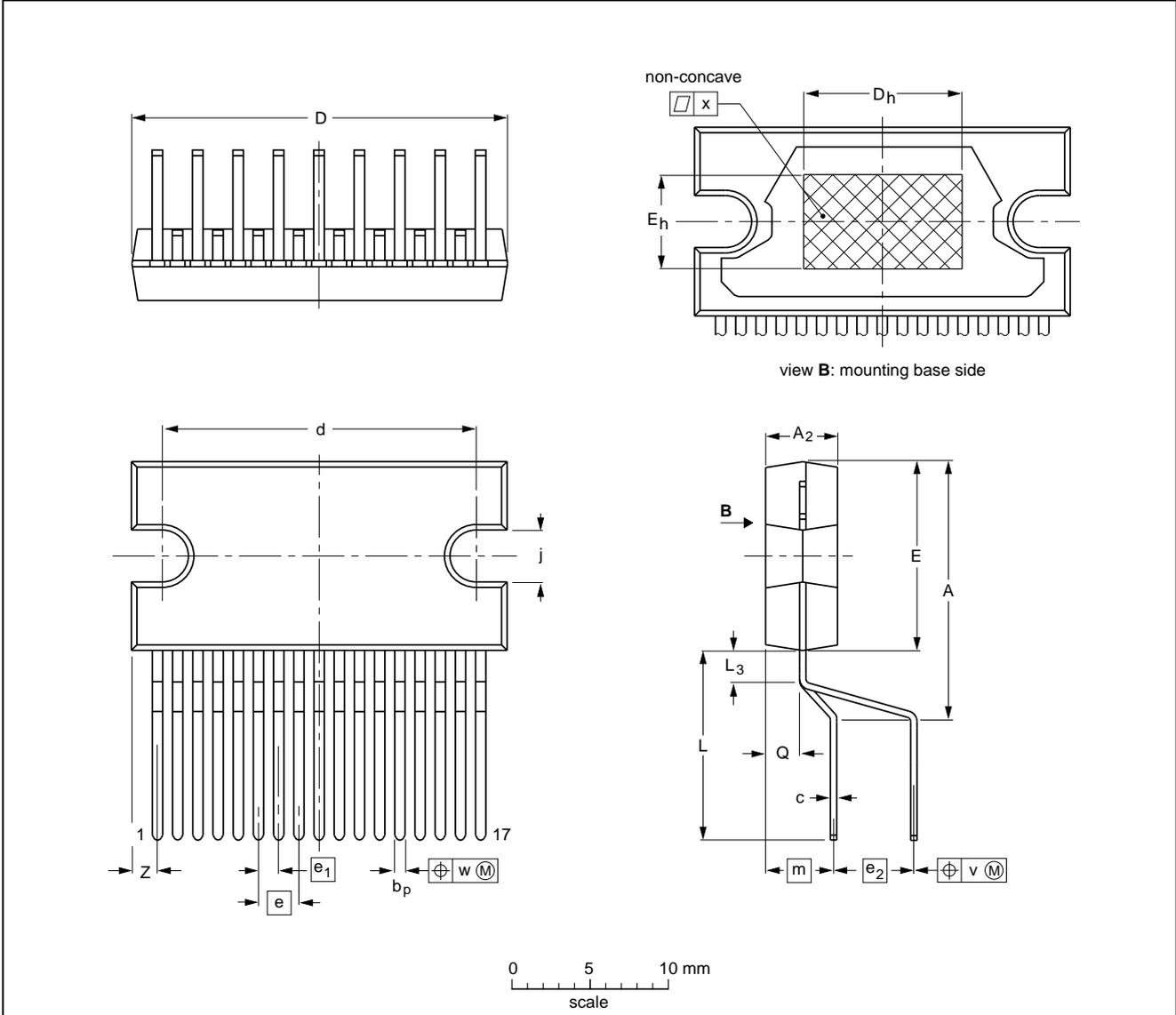
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PACKAGE OUTLINE

DBS17P: plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm)

SOT243-1



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>2</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	d	D <sub>h</sub>	E <sup>(1)</sup>	e	e <sub>1</sub>	e <sub>2</sub>	E <sub>h</sub>	j	L	L <sub>3</sub>	m	Q	v	w	x	z <sup>(1)</sup>
mm	17.0 15.5	4.6 4.2	0.75 0.60	0.48 0.38	24.0 23.6	20.0 19.6	10	12.2 11.8	2.54	1.27	5.08	6	3.4 3.1	12.4 11.0	2.4 1.6	4.3	2.1 1.8	0.8	0.4	0.03	2.00 1.45

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT243-1					92-11-17 95-03-11

## 2 × 24 W BTL or 2 × 12 W single-ended car radio power amplifier

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### SOLDERING

#### Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "IC Package Databook" (order code 9398 652 90011).

#### Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ( $T_{stg\ max}$ ). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

#### Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

### DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

### LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.