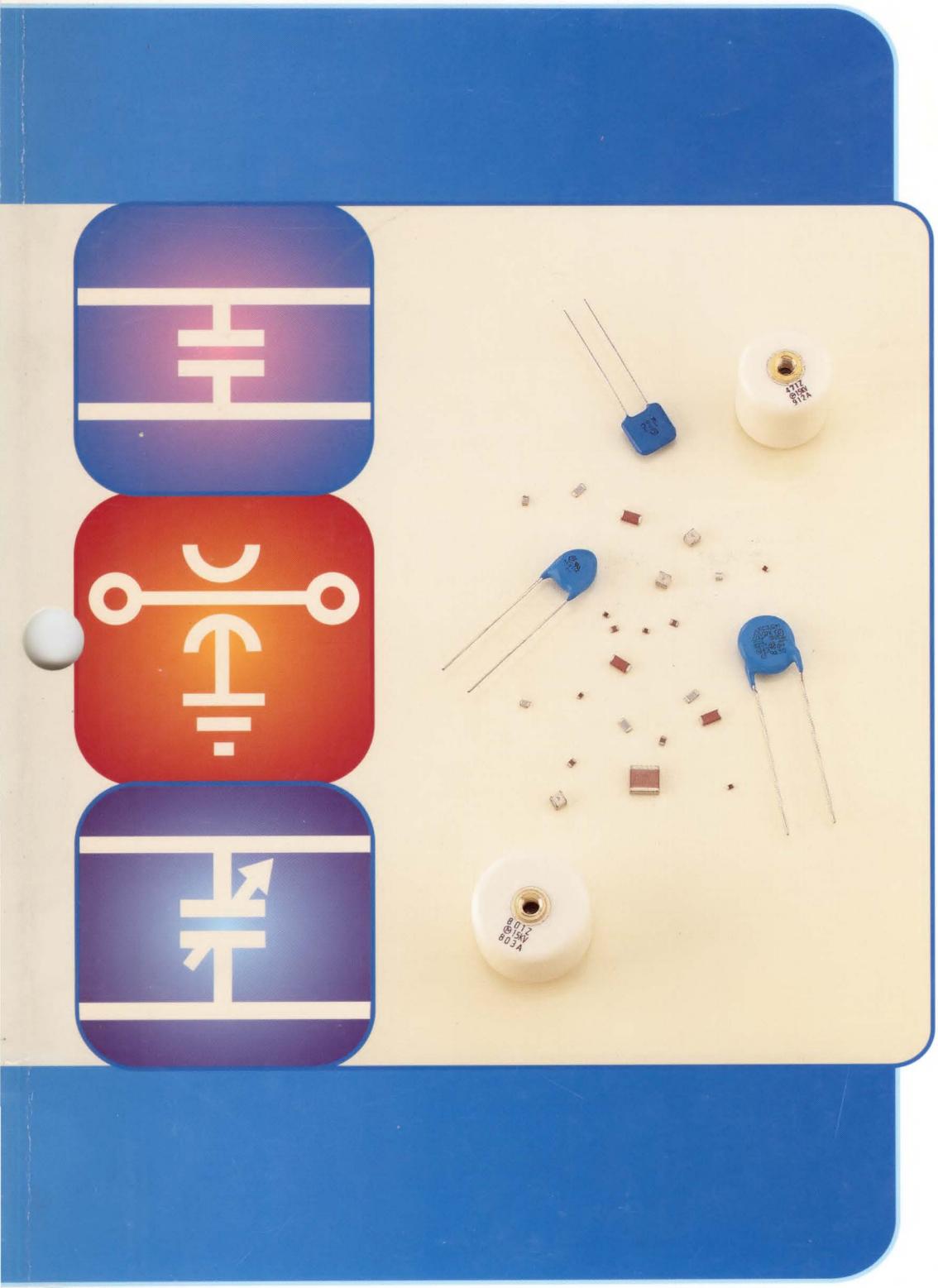
muRata®

CAPACITOR PRODUCTS CATALOG

CATALOG NO. C-22-A



Murata Electronics
North America, Inc.

MURATA ELECTRONICS

Murata Electronics represents the state-of-the-art in volume manufacturing of leaded and chip multilayer ceramic capacitors. With 50 years of design and manufacturing experience, Murata is the world's largest supplier of ceramic capacitors shipping in excess of 2.5 billion capacitors per month globally. At the same time we maintain one of the highest quality levels in the industry.

In addition to being a world class volume leader, Murata offers a large, comprehensive breadth of capacitor products to the electronics industry in order to meet the needs and range of changing applications today. As technology changes, Murata is a leader in offering the device and packaging format required for modern capacitor applications of today, as well as tomorrow.

Features of Murata ceramic capacitor facilities include:

- Highly automated manufacturing processes to ensure the reliability and repeatability of capacitor products offered to the industry.
- Class 10,000 or better clean room front end operations.
- 100% electrical testing of all components.
- Continuous QC inspection and audits of all materials and processes to ensure product consistency.
- A complete and modern test facility to monitor, maintain, and ensure one of the highest outgoing quality levels available in the industry.
- Dedicated employees who are committed to excellence in servicing our customers and follow the principles set forth in Murata's 1.0 QRS Quality Initiative.

If a capacitor device to meet your specific requirement is not illustrated in this catalog, contact your nearest Murata sales representative's office. Our trained Applications Engineers and sales personnel are ready to become "a small part in your success".

This literature is not intended to provide all essential information for proper product performance in specific circumstances. Murata Electronics may make improvements and changes to the products without notice. Although effort has been made to insure accuracy, the data in this literature is suggestive only and is not warranted.

Your further inquiry is required to obtain necessary data and warnings for performance in specific product applications and manufacturing circumstances. Please confirm detailed specifications by approving our individual drawings and specification sheets.

Murata Electronics offers these products only under a limited warranty and remedy, and a general exclusion of all other liability, particularly for consequential and incidental harm and for merchantability and fitness for specific use.

TABLE OF CONTENTS

THE MONOLITHIC CERAMIC CAPACITOR...

Multilayer monolithic ceramic capacitors represent the current state-of-the-art for providing high capacitance per unit volume in a variety of readily available form factors.

Radial devices are compatible with the high speed automatic insertion equipment used in the assembly of printed circuit boards. Unleaded, unencapsulated chip capacitors are also available in tape and reel packaging for high speed automatic placement in hybrid and printed circuit board assemblies.

All monolithic ceramic capacitor form factors begin as a basic chip which consists of alternating layers of ceramic dielectric on which electrodes are printed. The stacked layers are sintered (fired) at very high temperatures to form a single monolithic device. Internal, alternate electrode layers are connected thru common end terminations to form the basic chip capacitor. Leads are attached in radial form to the chip end termination. The bare leaded chip is then encapsulated with an epoxy contact compound, which meets UL94V-0.

Ceramic dielectric materials of various formulations are available with the most common being COG, X7R and Z5U/Y5V.

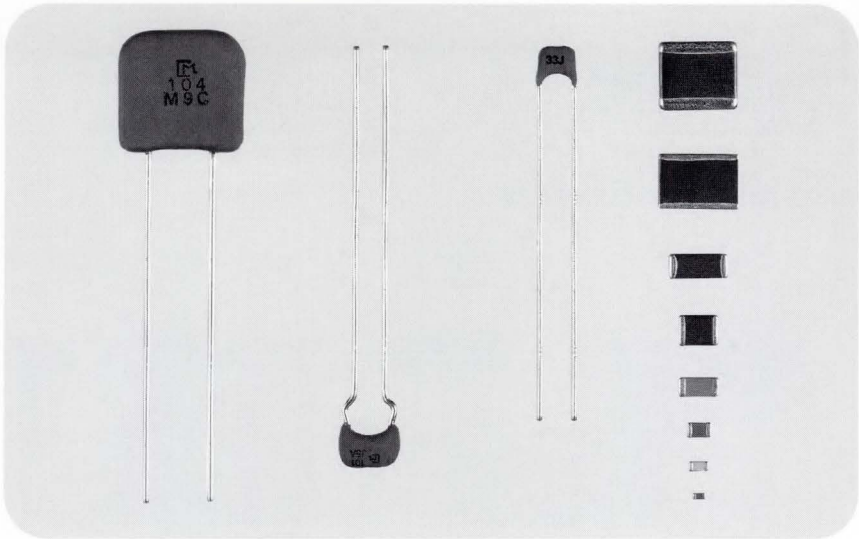


TABLE OF CONTENTS

CHIPS – GRM Series

COG AND TEMPERATURE COMPENSATING

FEATURES

- Miniature size
- No Polarity
- Nickel Barrier Termination Standard – highly resistant to metal migration
- Uniform dimensions and configuration
- Flow for GRM39, 40, 42-6 and Reflow Solderable
- Minimum series inductance
- Tape and Reel Packaging
- Wide selection of capacitance values and voltages
- Largest production capacity and volumn in the world

PART NUMBERING SYSTEM

GRM 40 --- COG 101 J 050 A D

CAPACITOR TYPE AND SIZE
See below and following pages.

3-digit code appears as necessary to indicate special thickness requirements. Please consult your local sales office for details.

TEMPERATURE CHARACTERISTICS
★COG
P2H
R2H
S2H
T2H
U2J
SL

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For fractional values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

CAPACITANCE TOLERANCE
(10pF or less)
★C=±.25pF
★D=±.5pF
(over 10pF)
★J=±5%

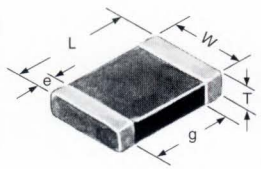
VOLTAGE
Identified by a three-digit number.

MARKING
★A=Unmarked
★B=EIA Marking
C=Non-standard Contact Factory.

PACKAGING

Reel Diameter/ Tape Material	Code
★7″ Paper Tape	D
★7″ Plastic Tape	L
★13″ Paper Tape	J
★13″ Plastic Tape	K
★Bulk	B
See pages 27-29 for additional marking and packaging information T/R per EIA-481-1	
Bulk Cassette	C
7″ Paper 2mm pitch	Q

CHIP DIMENSIONS

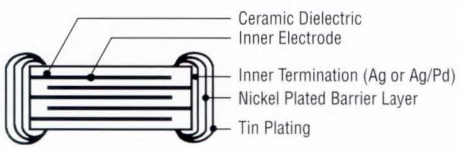
DIMENSIONS: in. (mm)	Size	EIA Code	L Length	W Width	T Thickness	g (Min.) Insulation	e Termination
	★GRM 36	0402	.040±.002 (1.0±0.05)	.020±.002 (0.5±0.05)	.020±.002 (0.5±0.05)	.012 (0.3)	.004 (0.1)
	★GRM 39	0603	.060±.006 (1.6±0.15)	.030±.006 (0.80±0.15)	Note 1: Thickness varies with capacitance value. See capacitance charts on following pages for thickness.	.020 (0.5)	.014±.006 (0.35±0.15)
	★GRM 40	0805	.080±.006 (2.0±0.15)	.050±.006 (1.25±0.15)		.030 (0.75)	.020±.010 (0.5±0.25)
	★GRM 42-6	1206	.125±.006 (3.2±0.15)	.063±.006 (1.6±0.15)		.040 (1.0)	.020±.010 (0.5±0.25)
	★GRM 42-2	1210	.125±.006 (3.2±0.15)	.100±.006 (2.5±0.15)		.040 (1.0)	.020±.010 (0.5±0.25)
	★GRM 43-2	1812	.180±.012 (4.6±0.3)	.125±.008 (3.2±0.2)		.080 (2.0)	.025±0.15 (0.63±0.38)
	★GRM 43-4	1825	.180±.012 (4.6±0.3)	.250±.016 (6.35±0.4)		.080 (2.0)	.025±0.15 (0.63±0.38)
	★GRM 44-1	2220*	.220±.012 (5.6±0.3)	.200+.010−.025 (5.1+0.25−0.5)		.080 (2.0)	.025±.015 (0.63±0.38)
	★GRM 44	2225*	.220±.012 (5.6±0.3)	.250±.016 (6.35±0.4)		.080 (2.0)	.025±.015 (0.63±0.38)

*Non EIA-Standard Size

CHIP TERMINATION DIAGRAMS

Nickel Barrier Layer (Standard)

GRM Series



★Available as standard through authorized Murata Electronics Distributors.

COG AND TEMPERATURE COMPENSATING

GENERAL

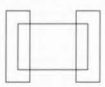
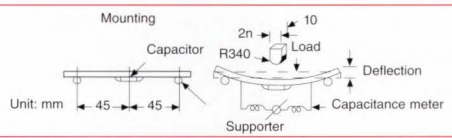
Temperature Coefficient	Temperature Range
C0G = 0 ± 30 ppm*	–55° to +125°C
P2H = N150 ± 60 ppm	–55° to +85°C
R2H = N220 ± 60 ppm	–55° to +85°C
S2H = N330 ± 60 ppm	–55° to +85°C
T2H = N470 ± 60 ppm	–55° to +85°C
U2J = N750 ± 120 ppm	–55° to +85°C
SL = N1000 to P350	–55° to +85°C

***TC Tolerance for COG**
Refer to EIA-RS198D for other limitations

ELECTRICAL

TEST	
Capacitance & Q (Frequency & Voltage):	≤ 1000pF 1 MHz ± 100 MHz @ 1.0 ± .2 Vrms > 1000pF 1 KHz ± 100 KHz @ 1.0 ± .2 Vrms
Q Limits	≤30pF: 400 + (20xC (pF)) >30pF: 1000 minimum
Insulation Resistance (I.R.)	100,000 megohms or 1000 megohms – mfd (whichever is less) with rated voltage applied for 2 minutes max with 50mA limiting current
Dielectric Strength (Flash)	250% of rated voltage for 5 seconds with series resistor limiting charging current to 50mA max.
Aging	Negligible

MECHANICAL

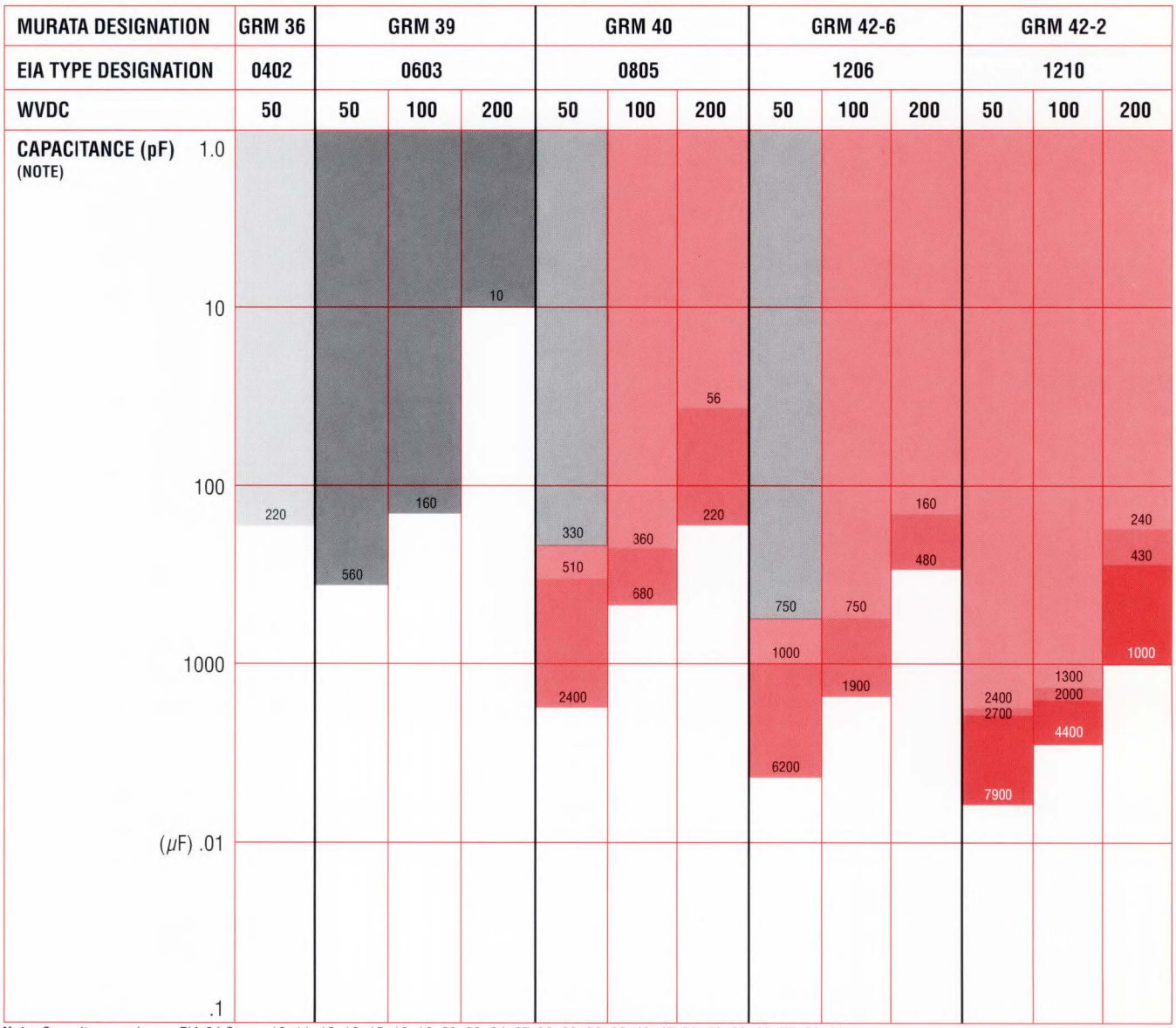
TEST	TEST METHOD	POST TEST LIMITS
Terminal Adhesion		≤0603 1.0 lbs. ≥0805 2.2 lbs. No evidence of termination peeling
Deflection		2 mm deflection (paper phenol board) 1mm deflection (Glass epoxy board) No mechanical damage Cap., DF, IR meet initial limits
Solderability	MIL-STD-202 Method 208F	Contact factory for test limits

ENVIRONMENTAL

TEST	TEST METHOD		POST TEST LIMITS
Thermal Shock (Air to Air)	MIL-STD-202, Method 107, Condition A Post thermal Shock measurement shall be taken after 24 hours stabilization.		Appearance: No visual damage ΔC : = ±2.0% or ±0.5pF (whichever is greater) Q : >30pF=1,000 min., ≤ 30pF = 400 + [20 x C(pF)] I.R. : = 100,000MΩ min. or 1,000MΩ•μF (whichever is less)
Humidity	**RATED VOLTAGE** Apply rated voltage for 500 ± 12 hours at 85°C and 85% relative humidity **See Note 1**	**LOW VOLTAGE** Apply .5 Vrms for 250 ± 12 hours at 85°C and 85% relative humidity **See Note 1**	Appearance: No defects Capacitance: ±3% or ±.3pF (whichever is less) Q : >30pF = 500 min., ≤30pF = 200 + [10 x C(pF)] I.R. : 10,000MΩ or 100MΩ-mfd. (whichever is less) Flash : 250% rated voltage
Life Test	Apply 200% of rated voltage for 1000 ± 12 hours at maximum operating temperature **See Note 2**		Appearance : No defects Capacitance : ±3% or ±.3pF (whichever is greater) Q : >30pF = 500 min., ≤30pF = 200 + [10 x C(pF)] I.R. : 10,000MΩ or 100MΩ-mfd. (whichever is less) Flash : 250% rated voltage

Note 1: Upon completion of either above test wait 24 hours prior to performing post testing.
Note 2: Upon completion of above test wait 24 hours prior to performing post testing.

COG



Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
For values under 1.0pF and other values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : 0.5 ± 0.05	1000	10000	N/A	N/A	N/A
T : $0.7^{+0}_{-0.2}$	1000	4000	4000	10000	10000
T : 0.8 ± 0.1	1000	4000	N/A	10000	N/A
T : $1.0^{+0}_{-0.2}$	1000	4000	3000	10000	10000
T : $1.25^{+0}_{-0.2}$ *	1000	N/A	3000	N/A	10000
T : $1.5^{+0}_{-0.2}$	1000	N/A	2000	N/A	8000

*GRM 40 T = 1.25 ± .1

CHIPS – GRM Series

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COG

MURATA DESIGNATION	GRM 43-2			GRM 43-4			GRM 44-1			GRM 44		
EIA TYPE DESIGNATION	1812			1825			2220			2225		
WVDC	50	100	200	50	100	200	50	100	200	50	100	200
CAPACITANCE (NOTE)												
(pF) 1.0												
10												
100			330			560			820			680
	1000	1000	620	1000	1000		1000	1000		1000	1300	
1000	3000	3000	2600			1800			1600			2200
	4700	3900				2400			3600			3000
						4700			6200			
				8200	8200		8200	8200		.01	.01	7500
(μF) .01	.011	.011		.016	.016		.018	.016		.022	.022	
							.036	.027		.033	.033	
.1												

Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
For values under 1.0pF and other values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS (mm)	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : 1.25 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : 1.5 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : 2.0 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	4000

TEMPERATURE COMPENSATING

MURATA DESIGNATION	GRM 39												GRM 40											
EIA TYPE DESIGNATION	0603												0805											
CHARACTERISTIC	P2H		R2H		S2H		T2H		U2H		SL		P2H		R2H		S2H		T2H		U2J		SL	
WVDC	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
CAPACITANCE (pF) (NOTE) 1.0																								
10								42												30				
100	160	120	160	150	220	120	400		750	440	750	440	160 360 620	360 470	180 470 750	470 560	240 470 820	470 620	130 390	220	750 1000	750	750 1000	750
1000																			1900		3500	2000	3500	2000
(μF) .01																								

Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
For values under 1.0pF and other values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS (mm)	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : $0.7^{+0}_{-0.2}$	1000	4000	4000	10000	10000
T : 0.8 ±0.1	1000	4000	N/A	10000	N/A
T : $1.0^{+0}_{-0.2}$	1000	4000	3000	10000	10000
T : $1.25^{+0}_{-0.2}$ *	1000	N/A	3000	N/A	10000
T : $1.5^{+0}_{-0.2}$	1000	N/A	2000	N/A	8000

*GRM 40 T = 1.25 ± .1

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TEMPERATURE COMPENSATING

MURATA DESIGNATION	GRM 42-6												GRM 42-2											
EIA TYPE DESIGNATION	1206												1210											
CHARACTERISTIC	P2H		R2H		S2H		T2H		U2J		SL		P2H		R2H		S2H		T2H		U2J		SL	
WVDC	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
CAPACITANCE (pF) (NOTE) 1.0																								
10													18	18	18	68	18	18	18	18	18		18	
100	330		390		510		390	91											360	130 200		330		330
	910	910	820	820			750	530											510					
1000	1600	1300	1600	1300	1100 2000	1100 1600	4600		1800 3300 8300	1800 4900	1800 3300 8300	1800 4900	1600 2200 2700	1600 2200 2700	2000 2700 3000	2000 2700 3000	2200 3000 3900	2200 3000 3900	8700	1100	5600 6200 .012	3300 4700 6800	5600 6200 .012	3300 4700 6800
(μF) .01																								

Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
For values under 1.0pF and other values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS (mm)	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : $0.7^{+0}_{-0.2}$	1000	4000	4000	10000	10000
T : 0.8 ±0.1	1000	4000	4000	10000	10000
T : $1.0^{+0}_{-0.2}$	1000	4000	3000	10000	10000
T : $1.25^{+0}_{-0.2}$ *	1000	N/A	3000	N/A	10000
T : $1.5^{+0}_{-0.2}$	1000	N/A	2000	N/A	8000

HIGH DIELECTRIC CONSTANT TYPE

PART NUMBERING SYSTEM

GRM 40 --- X7R 103 K 050 A D

CAPACITOR TYPE AND SIZE
See below and following pages.

3-digit code appears as necessary to indicate special thickness requirements. Please consult your local sales office for details.

TEMPERATURE CHARACTERISTICS
★X7R
★Z5U
★Y5V

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
X7R: ★K=±10%
★M=±20%
Z5U: ★M=±20%
★Z+80, –20%
Y5V: ★Z+80, –20%

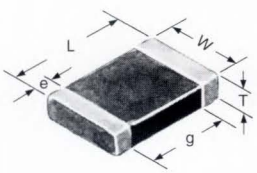
VOLTAGE
Identified by a three-digit number.

MARKING
★A=Unmarked
★B=EIA Marking
C=Non-standard Contact Factory.

PACKAGING

Reel Diameter/ Tape Material	Code
★7″ Paper Tape	D
★7″ Plastic Tape	L
★13″ Paper Tape	J
★13″ Plastic Tape	K
★Bulk	B
See pages 27-29 for additional marking and packaging information T/R per EIA-481-1	
Bulk Cassette	C
7″ Paper 2mm Pitch	Q

CHIP DIMENSIONS

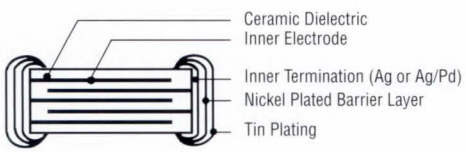
DIMENSIONS: in. (mm)	Size	EIA Code	L Length	W Width	T Thickness	g (Min.) Insulation	e Termination
	★GRM 36	0402	.040±.002 (1.0±0.05)	.020±.002 (0.5±0.05)	.020±.002 (0.5±0.05)	.012 (0.3)	.004 (0.1)
	★GRM 39	0603	.060±.006 (1.6±0.15)	.030±.006 (0.80±0.15)	Note 1: Thickness varies with capacitance value. See capacitance charts on following pages for thickness.	.020 (0.5)	.014±.006 (0.35±0.15)
	★GRM 40	0805	.080±.006 (2.0±0.15)	.050±.006 (1.25±0.15)		.030 (0.75)	.020±.010 (0.5±0.25)
	★GRM 42-6	1206	.125±.006 (3.2±0.15)	.063±.006 (1.6±0.15)		.040 (1.0)	.020±.010 (0.5±0.25)
	★GRM 42-2	1210	.125±.006 (3.2±0.15)	.100±.006 (2.5±0.15)		.040 (1.0)	.020±.010 (0.5±0.25)
	★GRM 43-2	1812	.180±.012 (4.6±0.3)	.125±.008 (3.2±0.2)		.080 (2.0)	.025±.015 (0.63±0.38)
	★GRM 43-4	1825	.180±.012 (4.6±0.3)	.250±.016 (6.35±0.4)		.080 (2.0)	.025±0.15 (0.63±0.38)
	★GRM 44-1	2220*	.220±.012 (5.6±0.3)	.200+.010–.025 (5.1+0.25–0.5)		.080 (2.0)	.025±.015 (0.63±0.38)
	★GRM 44	2225*	.220±.012 (5.6±0.3)	.250±.016 (6.35±0.4)		.080 (2.0)	.025±.015 (0.63±0.38)

*Non EIA-Standard Size

CHIP TERMINATION DIAGRAMS

Nickel Barrier Layer (Standard)

GRM Series



★Available as standard through authorized Murata Electronics Distributors.

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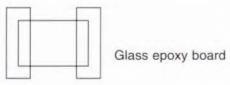
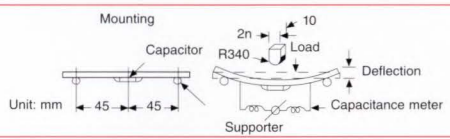
HIGH DIELECTRIC CONSTANT TYPE

GENERAL/ELECTRICAL

Capacitance Change with Temperature:	X7R : ±15% ΔCX −55°C to +125°C Z5U : $^{+22}_{-56}$% ΔCX +10°C to +85°C Y5V : $^{+22}_{-82}$% ΔCX −30°C to +85°C
Capacitance & D.F. (Frequency & Voltage)	X7R : 1KHz ±100Hz @ 1.0 ±.2Vrms Z5U : 1KHz ±100Hz @ .5 ±.1Vrms Y5V : 1KHz ±100Hz @ 1.0 ±.2Vrms
Dissipation Factor (D.F.)	25 to 100V / 16V X7R 2.5% / 3.5% Z5U 3.0% / (25V 5%) Y5V 5.0% / 9.0%

Insulation Resistance (I.R.)	X7R 100,000 megohms or 1000 megohms-mfd (whichever is less) Z5U/Y5V 10,000 megohms or 500 megohms–mfd (whichever is less)
Dielectric Strength (Flash)	250% of rated voltage for 5 seconds with series resistor limiting charge current to 50mA max.
Typ. Aging (per Decade)	X7R 3% Z5U 5% Y5V 7%

MECHANICAL

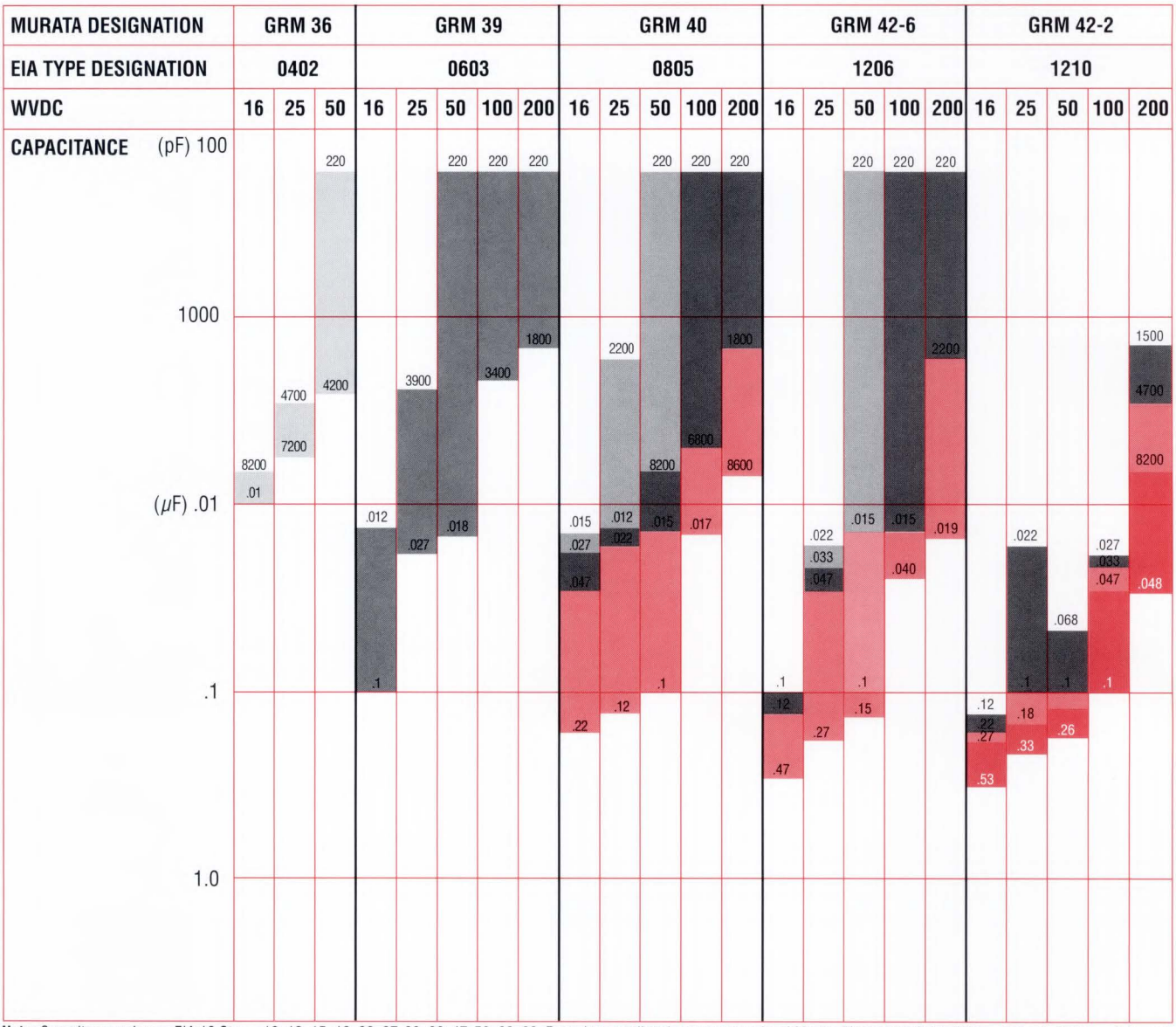
TEST	TEST METHOD	POST TEST LIMITS
Terminal Adhesion		<0603 1.0 lbs. ≥0805 2.2 lbs. No evidence of termination peeling
Deflection		2 mm deflection (paper phenol board) 1 mm deflection (Glass epoxy board) No mechanical damage Cap., DF, IR meet initial limits
Solderability	MIL-STD-202 Method 208F	Meets Requirement For specific details contact factory

ENVIRONMENTAL

TEST	TEST METHOD		POST TEST LIMITS
Thermal Shock (Air to Air)	MIL-STD-202, Method 107, Condition A Prior to starting Thermal Shock test, capacitors shall be heat treated (deaged) for one (1) hour at 150°C. Allow capacitors to stabilize at room temperature for 48 hours prior to taking initial measurements. Post thermal Shock measurement shall be taken after 48 hours stabilization.		Appearance: No visual damage ΔC : X7R=±12.5% Z5U=±20.0% Y5V=±30.0% D.F. : X7R=2.5% max. @ 25°C, (3.5% max. @ 25°C for 16V Series) Z5U=3.0% max. @ 25°C, (5.0% max. @ 25°C for 25V Series) Y5V=5.0% max. @ 25°C, (9.0% max. @ 25°C for 16V Series) I.R. : X7R=100,000MΩ min. of 1,000MΩ•μF (whichever is less) Z5U/Y5V=10,000Ω or 500MΩ•μF min. (whichever is less)
Humidity	**RATED VOLTAGE** Apply rated voltage for 500 ± 12 hours at 85°C and 85% relative humidity **See Note 1**	**LOW VOLTAGE** Apply .5Vrms for 250 ± 12 hours at 85°C and 85% relative humidity **See Note 1**	Appearance: No defects Capacitance: X7R ± 12.5% ΔCX, Z5U/Y5V ±30% ΔCX D.F. : X7R=3.0% max. @ 25°C, (5% max. @ 25°C for 16V Series) Z5U=3.5% max. @ 25°C, (7% max. @ 25°C for 16V Series) Y5V=7.5% max. @ 25°C, (10% max. @ 25°C for 16V Series) I.R. : X7R 10,000MΩ or 100MΩ-mfd. (whichever is less) Z5U/Y5V 1,000MΩ or 50MΩ-mfd. (whichever is less) Flash : 250% rated voltage
Life Test	Apply 200% of rated voltage for 1000 ± 12 hours at maximum operating temperature **See Note 2**		Appearance: No defects Capacitance: X7R ± 12.5% ΔCX, Z5U/Y5V ±30% ΔCX D.F. : X7R=3.0% max. @ 25°C, (5% max. @ 25°C for 16V Series) Z5U=3.5% max. @ 25°C, (7% max. @ 25°C for 16V Series) Y5V=7.5% max. @ 25°C, (10% max. @ 25°C for 16V Series) I.R. : X7R 1,000MΩ or 50MΩ-mfd. (whichever is less) Z5U/Y5V 1,000MΩ or 50MΩ-mfd. (whichever is less) Flash : 250% rated voltage

Note 1: Upon completion of either above test wait 48 hours prior to performing post testing.
Note 2: Upon completion of above test wait 48 hours prior to performing post testing.

HIGH DIELECTRIC CONSTANT TYPE X7R



Note: Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. For values not listed, contact your local Murata Electronics Sales Office. (*For .1 T Max. = 1.4 mm)

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : 0.5 ± 0.05	1000	10000	N/A	N/A	N/A
T : $0.7^{+0}_{-0.2}$	1000	4000	4000	10000	10000
T : 0.8 ±0.1	1000	4000	N/A	10000	N/A
T : $1.0^{+0}_{-0.2}$	1000	4000	3000	10000	10000
T : $1.25^{+0}_{-0.2}$ *	1000	N/A	3000	N/A	10000
T : $1.5^{+0}_{-0.2}$	1000	N/A	2000	N/A	8000

*GRM 40 T = 1.25 ± .1

HIGH DIELECTRIC CONSTANT TYPE X7R

MURATA DESIGNATION	GRM 43-2					GRM 43-4			GRM 44-1				GRM 44		
EIA TYPE DESIGNATION	1812					1825			2220				2225		
WVDC	16	25	50	100	200	50	100	200	25	50	100	200	50	100	200
CAPACITANCE (pF) 100															
1000															
(μF) .01			.01	.012	.01 .012 .056	.047	.033	.022 .033 .047		.056	.056	.022 .033 .047	.082	.056	.033 .082
.1	.39 .56	.1 .27 .39 .47	.12 .15 .47	.082 .1 .22	.1	.39 1.2	.15 .22 .33	.28	.47 1.2	.33 .39 1.2	.15 .27 .53	.27	.68 1.0 1.5	.27 .39 .68	.12 .36
1.0															

Note: Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. For values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : 1.25 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : 1.5 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : 2.0 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	4000

HIGH DIELECTRIC CONSTANT TYPE Z5U

Note: Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68. For values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : $0.7^{+0}_{-0.2}$	1000	4000	4000	10000	10000
T : 0.8 ± 0.1	1000	4000	N/A	10000	N/A
T : $1.0^{+0}_{-0.2}$	1000	4000	3000	10000	10000
T : $1.25^{+0}_{-0.2}$ *	1000	N/A	3000	N/A	10000
T : $1.5^{+0}_{-0.2}$	1000	N/A	2000	N/A	8000

*GRM 40 T = 1.25 ± .1

HIGH DIELECTRIC CONSTANT TYPE Z5U

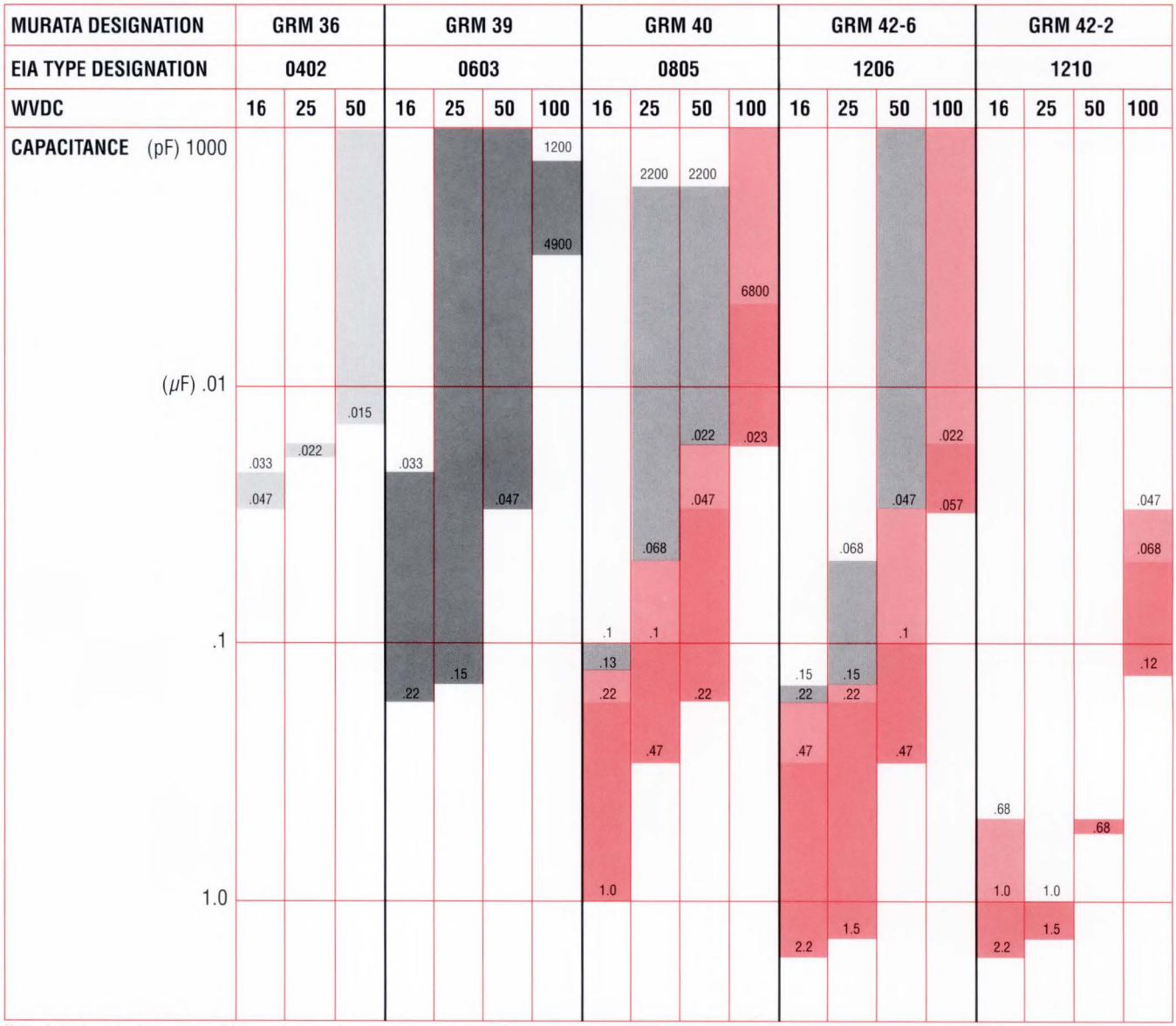
MURATA DESIGNATION	GRM 43-2			GRM 43-4			GRM 44-1			GRM 44		
EIA TYPE DESIGNATION	1812			1825			2220			2225		
WVDC	50	100	200	50	100	200	50	100	200	50	100	200
CAPACITANCE (pF) 1000												
(μF) .01			.039			.047 .068						
		.068 .1			.1	.1			.1			.1
.1	.33	.12 .22		.33	.22 .47		1.0	.39	.22	1.0	.33 .56	.3
	.68 1.0			2.2			1.5			1.5 3.0		
1.0												

Note: Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68. For values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : $1.25^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : $1.5^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : $2.0^{+0}_{-0.2}$	1000	N/A	1000	N/A	4000

HIGH DIELECTRIC CONSTANT TYPE Y5V



Note: Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68. For values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : 0.5 ± 0.5	1000	10000	N/A	N/A	N/A
T : $0.7^{+0}_{-0.2}$	1000	4000	4000	10000	10000
T : 0.8 ± 0.1	1000	4000	N/A	10000	N/A
T : $1.0^{+0}_{-0.2}$	1000	4000	3000	10000	10000
T : $1.25^{+0}_{-0.2}$ *	1000	N/A	3000	N/A	10000
T : $1.5^{+0}_{-0.2}$	1000	N/A	2000	N/A	8000

*GRM40 T = 1.25 ± .15

HIGH DIELECTRIC CONSTANT TYPE Y5V

MURATA DESIGNATION	GRM 43-2				GRM 43-4		GRM 44-1			GRM 44		
EIA TYPE DESIGNATION	1812				1825		2220			2225		
WVDC	16	25	50	100	50	100	25	50	100	25	50	100
CAPACITANCE (pF) 1000												
(μF) .01												
.1				.15 .27	.22 1.0	.1 .22 .33 .47			.33 .39 .68	.68	1.0	.47 .82
1.0	5.0	1.3	1.3		1.5		1.0 1.5 2.2	1.0 1.5 2.2			1.5 4.4	

Note: Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68. For values not listed, contact your local Murata Electronics Sales Office.

STANDARD THICKNESS/PACKAGING SPECIFICATIONS

DIMENSIONS: mm	Bulk	Tape			
	Pcs/bag (typical)	Pcs/7 inch (178 mm) reel		Pcs/13 inch (330 mm) reel	
	Plastic	Paper	Embossed	Paper	Embossed
T : 1.25 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : 1.5 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	5000
T : 2.0 $^{+0}_{-0.2}$	1000	N/A	1000	N/A	4000

CHIPS – GRM Series
FOR LOW PROFILE AND SUB-PLCC
HIGH DIELECTRIC CONSTANT TYPE X7R, Y5V

MURATA DESIGNATION	GRM 40-024						GRM 40-037						GRM 40-026					
EIA TYPE DESIGNATION	0805						0805						0805					
MAX THICKNESS	.020						.026						.028					
WVDC	16		25		50		16		25		50		16		25		50	
TEMPERATURE CHARACTERISTIC	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V
CAPACITANCE (pF) 100					220													
1000			2200	2200	6800	1000												
.01 (μF)	.01		.01			.01					.01							
.1	.027	.047		.039			.033	.15	.015	.056	.018	.027	.033		.015		.012	.033
1.0		.1					.059	.23	.033	.1		.052	.047	.15	.022	.1	.017	.1

PACKAGING = Bulk: 1,000pcs/bag **TAPE AND REEL:** 4,000 pcs/7″ (178mm) Reel, 10,000 pcs/13″ (330mm) Reel **Paper tape only.**

Note: For X7R, Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82
For Z5U and Y5V, Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68
For values not listed, please contact your local Murata Electronics Sales Office.

CHIPS – GRM Series
FOR LOW PROFILE AND SUB-PLCC
HIGH DIELECTRIC CONSTANT TYPE X7R, Z5U, Y5V

MURATA DESIGNATION	GRM 42-625				GRM 42-626		GRM 42-224				GRM 42-225				★GRM 42-221			GRM 42-226		
EIA TYPE DESIGNATION	1206				1206		1210				1210				1210			1210		
MAX THICKNESS	.024				.028		.020				.024				.026			.028		
WVDC	16	25			16	25	16	25			16	25			25			25		
TEMPERATURE CHARACTERISTIC	Y5V	X7R	Z5U	Y5V	Y5V	Y5V	Y5V	X7R	Z5U	Y5V	Y5V	X7R	Z5U	Y5V	X7R	Z5U	Y5V	X7R	Z5U	Y5V
CAPACITANCE (pF) 100																				
1000		N/A										1000			N/A		N/A			
.01 (μF)				.056				.018 .047		.068		.1	.022					.056 .082		
.1	.22		.1	.22	.33	.33	.47		.1	.15	.47 .68		.15	.15 .22		.22		.22 .33	.33	
1.0																				

PACKAGING = Bulk: 1,000pcs/bag **TAPE AND REEL:** 4,000 pcs/7″ (178mm) Reel, 10,000 pcs/13″ (330mm) Reel **Paper tape only.**

Note: For X7R, Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82
For Z5U and Y5V, Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68
For values not listed, please contact your local Murata Electronics Sales Office.

★Available as standard through authorized Murata Electronics Distributors.

MLC CAPACITORS
TO REPLACE TANTALUMS AND ELECTROLYTICS

These new monolithic ceramic chip capacitors are specifically designed to replace tantalum and aluminum electrolytic capacitors in a variety of applications. The high frequency performance of these devices make them particularly suitable for use in secondary suppression circuits in switching power supplies and other circuits with high frequency performance requirements.

Lower ESR yields lower net impedance at higher frequencies. Thus a lower value of ceramic capacitance may be sufficient in bypassing and decoupling circuits.

Greater surface mounting flexibility and long-term reliability of ceramic capacitors adds to their overall performance vs. cost ratio as compared to electrolytics.

FEATURES*

- Lower equivalent series resistance
- Lower dissipation factor
- Higher insulation resistance
- Higher break-down voltage
- No polarity considerations
- Long term dielectric stability
- Wider solder profile capability
- Solvent wash compatibilty

*When compared to electrolytic capacitors

BENEFITS*

- Better high frequency performance
- Reduces loss, heat dissipation
- Lower power consumption
- Increased reliability
  Less over-rating required
- Eliminates insertion mistakes
  Increases circuit design flexibility
  No D.C. bias voltage required
- Reduces field failures—increases equipment life
- Greater surface mount flexibility and durability

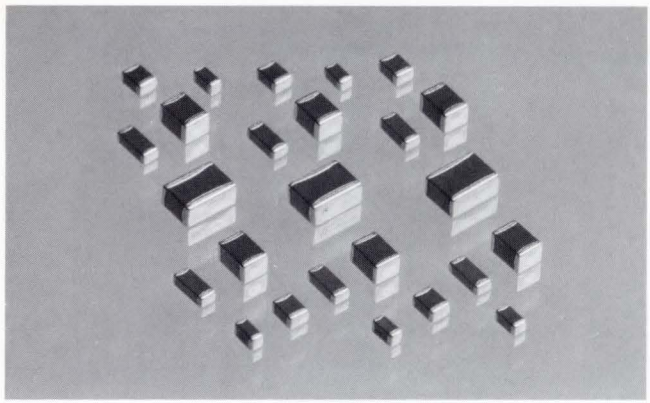
EIA Preferred Sizes – Nickel barrier terminations suitable for flow and reflow soldering

MURATA DESIGNATION		★GRM 39		★GRM 40		★GRM 42-6		★GRM 42-2		★★GRM 43-2	
EIA TYPE DESIGNATION		0603		0805		1206		1210		1812	
DIMENSIONS: in. (mm)	L	.060 ± .006 (1.6 ± 0.15)		.080 ± .006 (2.0 ± 0.15)		.125 ± .006 (3.2 ± 0.15)		.125 ± .006 (3.2 ± .015)		.180 ± .012 (4.6 ± 0.3)	
	W	.030 ± .008 (0.75 ± 0.2)		.050 ± .008 (1.25 ± 0.2)		.060 ± .008 (1.5 ± 0.2)		.100 ± .008 (2.5 ± 0.2)		.125 ± .008 (3.2 ± 0.2)	
	T max.	.035 (0.9)		.053 (1.35)		.060 (1.5)		.060 (1.5)		.080 (2.0)	
	g min.	.020 (0.5)		.030 (0.75)		.040 (1.0)		.040 (1.0)		.080 (2.0)	
	e	.014 ± .006 (0.35 ± 0.2)		.020 ± .010 (0.5 ± 0.25)		.020 ± .010 (0.5 ± 0.25)		.020 ± .010 (0.5 ± 0.25)		.025 ± .015 (0.63 ± 0.38)	
WVDC		16		16		16		16		16	
TEMPERATURE CHARACTERISTIC:		X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V	X7R	Y5V
CAPACITANCE (μF)	.01	.012 – .033	.027 – .1	.015	.1	.1					
	.1			.15	.15 – 1.0	.33	.15 – 2.2	.12 – .47	.68 – 2.2	.39 – .56	2.2
	1.0										

Note: For X7R, Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82
For Z5U and Y5V, Capacitance values = EIA 6 Step = 10, 15, 22, 33, 47, 68
For values not listed, please contact your local Murata Electronics Sales Office.

★Available as standard through authorized Murata Electronics Distributors.
★★Contact your local Murata Electronics Sales Office.

MLC CHIP CAPACITORS
500 & 1000V RATED
GRM Series



These new surface mount components are designed to meet the growing demand for miniature, reliable chip capacitors, especially where high volume automation is required. Applications include solid state relays, telecom, instrumentation, modems, computer peripherals, and others.

FEATURES
- Standard E.I.A. sizes
- Up to 2X rated voltage tested
- –55°C to +125°C rated

BENEFITS
- Compatible with SMT equipment
- Improves long term reliability
- Suitable for harsh environments

PART NUMBERING SYSTEM

★GRM 42-2 – X7R 103 K 500 A L

CAPACITOR TYPE AND SIZE
GRM-Nickel Barrier Plated Tin (Standard)
GR-Palladium-Silver (Non-preferred)

Two or 3-digit code appears as necessary to indicate special thickness requirements. Please consult your local MENA Sales Office for details.

TEMPERATURE CHARACTERISTICS
Standard TC's
COG=0±30ppm
X7R=±15%

CAPACITANCE VALUE
Indentified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For fractional values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

CAPACITANCE TOLERANCE
COG:
(10pF or less)
C=±.25pF
D=±.5pF
(Over 10pF)
J=±5%
K=±10%
X7R:
K=±10%

VOLTAGE
Identified by a three-digit number.
Others available upon request.
(1,000 volts codes as 1KV)

MARKING
★A=Unmarked
★B=EIA Marking
C=Non-standard Marking

PACKAGING

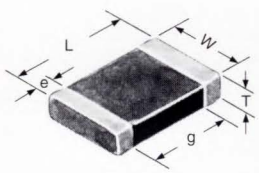
Reel Diameter/ Tape Material	EIA-481-A Standard
★7″ Plastic Tape	L
★13″ Plastic Tape	K
★Bulk	B

Some values cannot be taped. Consult your local MENA Sales Office for additional marking and packaging information.

★Contact your local Murata Sales Office for available standards.

CHIP DIMENSIONS

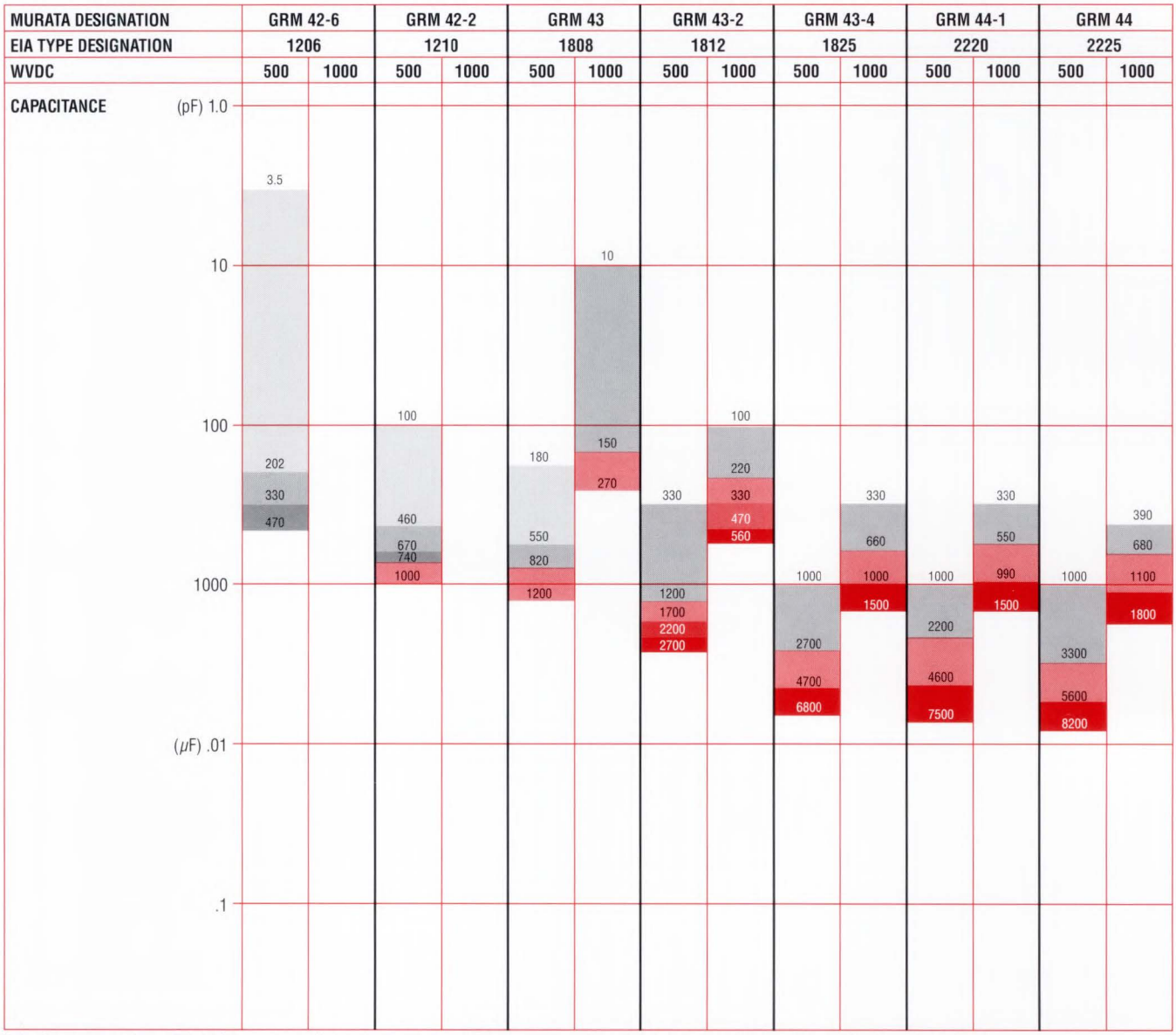
*EIA PREFERRED SIZE

DIMENSIONS: in. (mm)	Size	EIA Code	L Length	W Width	T Thickness	g Insulation	e Termination
	★GRM 42-6*	1206	.125±.008 (3.2±0.2)	.060±.008 (1.5±0.2)	Note 1: Thickness varies with capacitance value. See capacitance charts on following pages for thickness.	.040 (1.0) min.	.020±.010 (0.5±0.25)
	★GRM 42-2*	1210	.125±.008 (3.2±0.2)	.100±.008 (2.5±0.2)		.040 (1.0) min.	.020±.010 (0.5±0.25)
	★GRM 43	1808	.180±.012 (4.6±0.3)	.080±.008 (2.0±0.2)		.080 (2.0) min.	.020±.010 (0.5±0.25)
	★GRM 43-2*	1812	.180±.012 (4.6±0.3)	.125±.008 (3.2±0.2)		.080 (2.0) min.	.020±.010 (0.5±0.25)
	★GRM 43-4*	1825	.180±.012 (4.6±0.3)	.250±.016 (6.35±0.4)		.080 (2.0) min.	.020±.010 (0.5±0.25)
	★GRM 44-1	2220	.220±.012 (5.6±0.3)	$200^{+.010}_{-.020}$ $(5.1^{+0.25}_{-0.5})$		.080 min. (2.0)	.020±.010 (0.5±0.25)
	★GRM 44	2225	.220±.012 (5.6±0.3)	.250±.016 (6.35±0.4)		.080 min. (2.0)	.020±.010 (0.5±0.25)

★Available as standard through authorized Murata Electronics Distributors.

CV CHIP CAPACITORS
500 & 1000V RATED
GRM Series

COG



Note: Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. For values not listed, contact your local Murata Electronics Sales Office.

COG 500/1KV

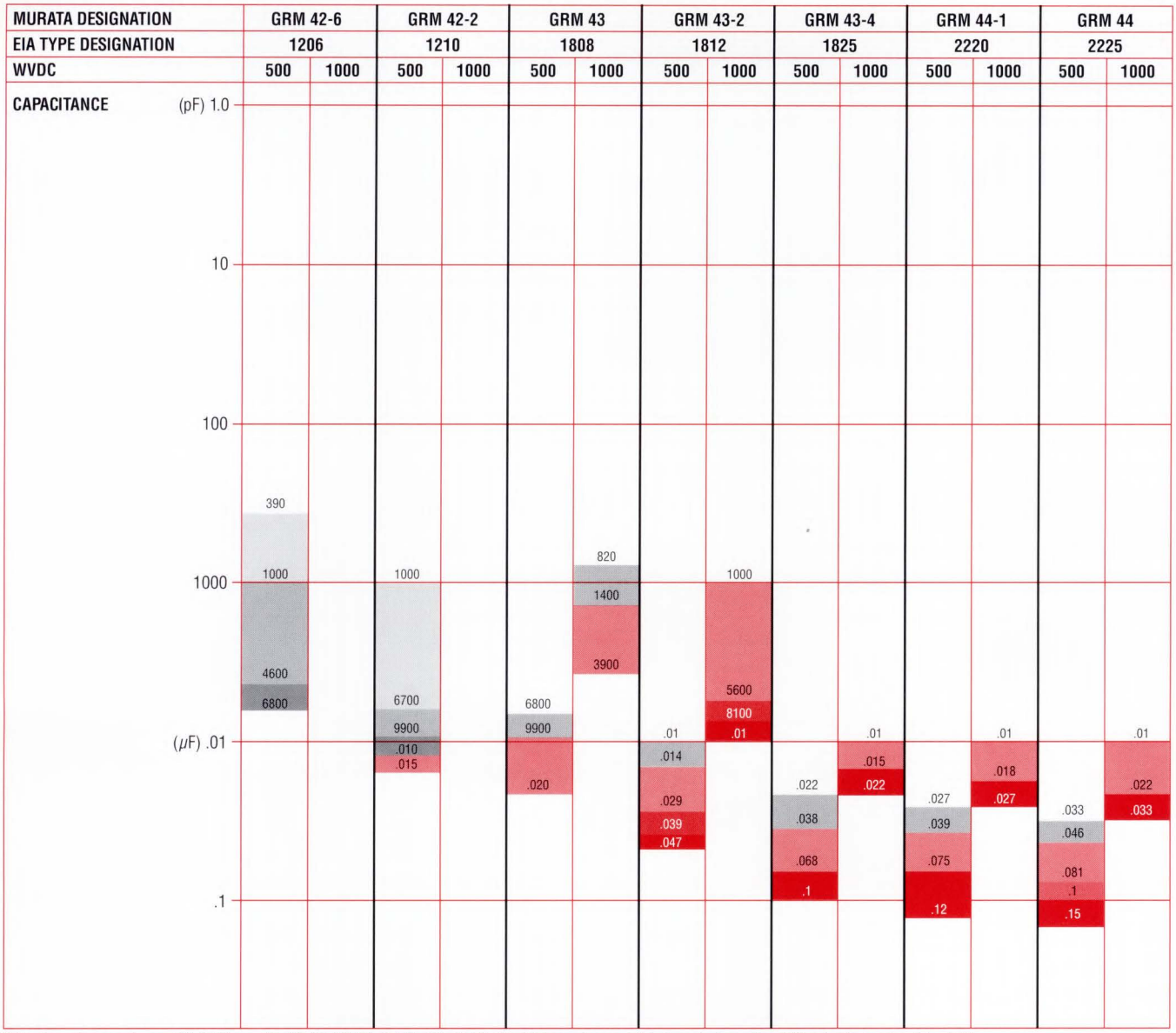
DIMENSIONS: mm	Bulk Pcs/bag (typical)	Tape and Reel Pcs/7 inch (178 mm) reel Embossed
T : 1.25 $^{+0}_{-0.2}$	1000	3000
T : 1.50 $^{+0}_{-0.2}$	1000 (GRM 42-6 & GRM 42-2) 1000 (GRM 43 to GRM 44-1)	2000 (GRM 42-6 & GRM 42-2) 1000 (GRM 43 to GRM 44-1)
T : 1.65 $^{+0}_{-0.2}$	1000	2000
T : 2.00 $^{+0}_{-0.2}$	1000	1000
T : 2.25 $^{+0}_{-0.2}$	1000	Not Available
T : 2.50 $^{+0}_{-0.2}$	1000	500
T : 2.76 ± 0.2	1000 (GRM 43 to 43-4, GRM 44-1) 1000 (GRM 44)	500 (GRM 43 to 43-4, GRM 44-1) Not Available (GRM 44)

Paper Tape is not available for 500/1KV. Consult your local Murata Electronics Sales Office for 13-inch reel availability.

CV CHIP CAPACITORS
500 & 1000V RATED
GRM Series

muRata

X7R



Note: Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. For values not listed, contact your local Murata Electronics Sales Office.

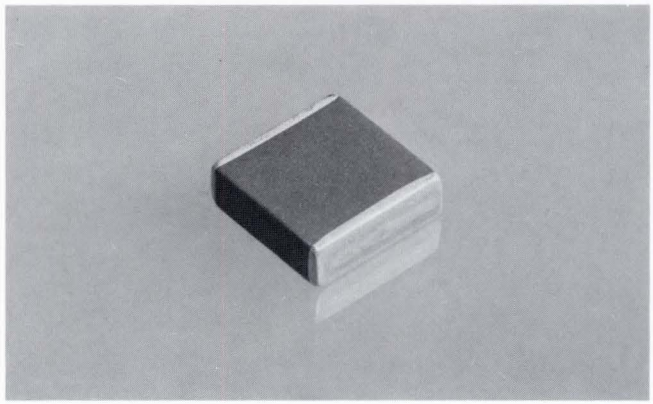
COG 500/1KV

DIMENSIONS: mm	Bulk Pcs/bag (typical)	Tape and Reel Pcs/7 inch (178 mm) reel Embossed
T : 1.25 $^{+0}_{-0.2}$	1000 (GRM 42-6 & GRM 42-2) 1000 (GRM 43)	3000 (GRM 42-6 & GRM 42-2) 1000 (GRM 43)
T : 1.50 $^{+0}_{-0.2}$	1000 (GRM 42-6 & GRM 42-2) 1000 (GRM 43 to GRM 44-1)	2000 (GRM 42-6 & GRM 42-2) 1000 (GRM 43 to GRM 44-1)
T : 1.65 $^{+0}_{-0.2}$	1000	2000
T : 2.00 $^{+0}_{-0.2}$	1000	1000
T : 2.25 $^{+0}_{-0.2}$	1000	1000
T : 2.50 $^{+0}_{-0.2}$	1000	GRM 44-1 500V Not Available GRM 44 1KV Not Available
T : 2.76 ± 0.2	1000 (GRM 43 to 43-4, GRM 44-1) 1000 (GRM 44)	500 (GRM 43 to 43-4, GRM 44-1) Not Available (GRM 44)

Paper Tape is not available for 500/1KV. Consult your local Murata Electronics Sales Office for 13-inch reel availability.

CV CHIP CAPACITORS
1000 TO 5000V RATED
GR900 SERIES

COG



These new surface mount components are designed for emerging requirements in high voltage power supplies, video display terminals, and others. Rugged construction improves reliability in environmental extremes, especially found in military/aerospace applications. Special configuration and high reliability screening, including corona testing, are available.

FEATURES*

- Voltage up to 5KV
- –55°C to +125°C rated

BENEFITS

- Improves long term reliability
- Suitable for harsh environments

MURATA DESIGNATION		GR940					GR950					GR960					GR970					GR980				
DIMENSIONS: in.	L	.285 ± .015					.380 ± .015					.480 ± .015					.590 ± .015					.690 ± .020				
	W	.270 ± .015					.360 ± .015					.460 ± .015					.605 ± .020					.675 ± .015				
	T	.200 Max.					.250 Max.					.250 Max.					.300 Max.					.325 Max.				
	g	.180 Min.					.200 Min.					.200 Min.					.200 Min.					.200 Min.				
	e	.025 ± .015					.025 ± .015					.025 ± .015					.025 ± .015					.025 ± .015				
WVDC		1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV
CAPACITANCE	(pF) 100					100																				
				220	220	180					220															
										270	390															
			680	680					680	680					820	560										
	1000	1200	1200												1000						1500					1800
		2200						1500						1500	1500					2200	2200				2200	2200
							2700	2700	1800				3300						2700	2700				2700		
							5600					6800	6800	3900				6800	6800							
	(μF) .010											.012					.012	.012				.018	.018	.010	.010	
																	.022					.027				

Note: Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. For values not listed, contact your local Murata Electronics Sales Office.

CV CHIP CAPACITORS
1000 TO 5000V RATED
GR900 SERIES

muRata

X7R

PART NUMBERING SYSTEM

GR950 — X7R 103 K 1KV A B

CAPACITOR TYPE AND SIZE
GR=Palladium-Silver (Standard)

Two or three-digit code appears as necessary to indicate special thickness requirements. Please consult your local factory for details.

TEMPERATURE CHARACTERISTICS
Standard TC's
COG=0±30ppm
X7R=±15%

CAPACITANCE VALUE
Identified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

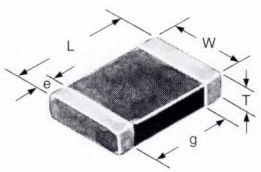
CAPACITANCE TOLERANCE
COG:
F=±1%
G=±2%
J=±5%
K=±10%
X7R:
K=±10%
M=±20%
J=±5% on special request

VOLTAGE
Identified by a three-digit number.
1000=1KV
2000=2KV
3000=3KV
4000=4KV
5000=5KV

MARKING
A=Unmarked
B=EIA Marking
C=Non-standard Marking

PACKAGING
Bulk=B
(Tape and Reel not available)

MURATA DESIGNATION		GR 940	GR 950	GR 960	GR 970	GR 980
DIMENSIONS: in.	L	.285 ± .015	.380 ± .015	.480 ± .015	.590 ± .015	.690 ± .020
	W	.270 ± .015	.360 ± .015	.460 ± .015	.605 ± .020	.675 ± .015
	T	.200 Max.	.250 Max.	.250 Max.	.300 Max.	.325 Max.
	g	.180 Min.	.200 Min.	.200 Min.	.200 Min.	.200 Min.
	e	.025 ± .015	.025 ± .015	.025 ± .015	.025 ± .015	.025 ± .015



WVDC		1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV
CAPACITANCE	(pF) 220					220																				
				390	270						390															
			1000							820						1000										
	1000	2200				1500			1200						1500					2200						
				4700	2200			3900			4700		8200	2700		8200			6800	3300				5600	3300
	(μF) .010	.068	.015				.010	.047	.018	8200		.018	.082	.033	.015		.039	.018	.068	.033	.018	.056	.022	8200	.047	.027
	.10						.18					.33					.68	.18				1.0	.22	.10		
	1.0																									

Note: Capacitance values = EIA 12 Step = 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. For values not listed, contact your local Murata Electronics Sales Office.

STANDARD BAR CODE FORMAT AND SPECIFICATIONS

MENA STANDARD INNER PACKAGE LABEL

CODE KEY

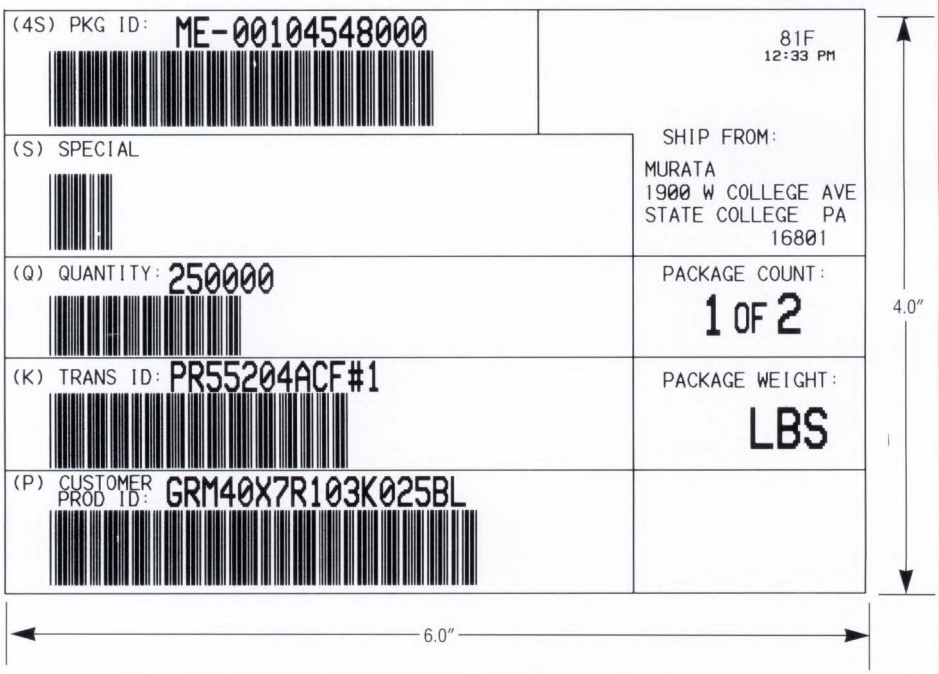
Customer Part Number
Quantity
MENA Part Number
Lot/Inspection Number

DIMENSIONS: inches

MENA STANDARD SHIPPING LABEL EIA-556 FORMAT

CODE KEY

Supplier/Pkg. I.D.
Special
Quantity
Transaction ID (P.O.)
Customer Product ID (No.)



DIMENSIONS: inches

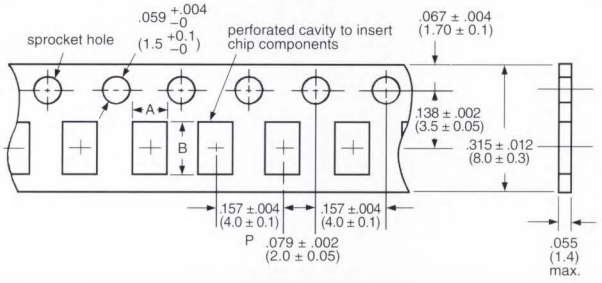
MENA STANDARD BULK CASE LABEL

CHIPS–GRM SERIES
TAPE CARRIER DIMENSIONS

muRata

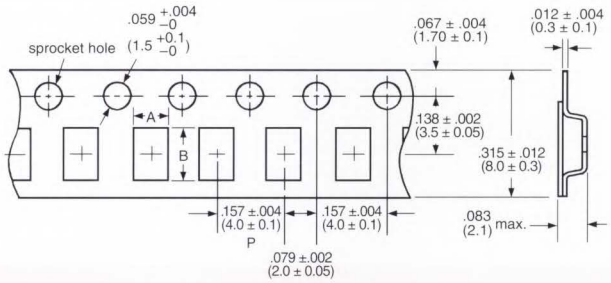
DIMENSIONS: in. (mm)

8 mm PUNCHED (PAPER)



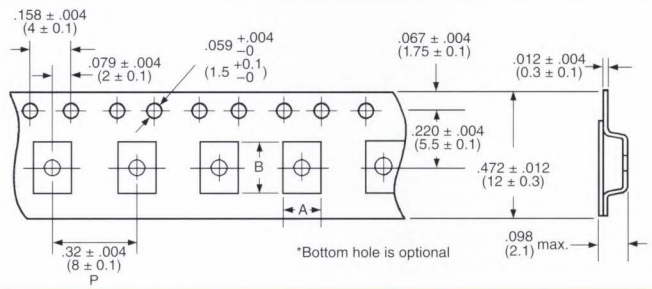
	GRM 36	GRM 39 0603	GRM 40 0805	GRM 42-6 1206	GRM 42-2 1210
Tape A max.	.024 ± .001 (.62 ± .04)	.047 (1.2)	.065 (1.65)	.087 (2.2)	.116 (2.95)
Tape B max.	.040 ± .001 (1.12 ± .04)	.079 (2.0)	.095 (2.4)	.150 (3.8)	.144 (3.65)
Chip T max.	.080 ± .002	.035 (0.9)	.040 (1.0)	.040 (1.0)	.040 (1.0)
Tape Pitch: P	(2.0 ± .05)	.157 ± .004 (4.0 ± 0.1)	.157 ± .004 (4.0 ± 0.1)	.157 ± .004 (4.0 ± 0.1)	.157 ± .004 (4.0 ± 0.1)

8 mm EMBOSSED (PLASTIC)



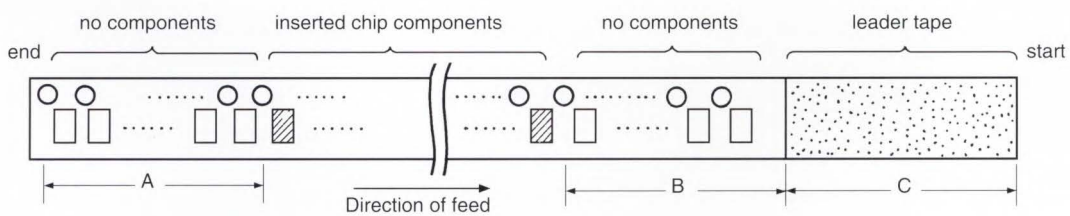
			GRM 40 0805	GRM 42-6 1206	GRM 42-2 1210
Tape A max.	N/A	N/A	.061 (1.55)	.079 (2.0)	.114 (2.9)
Tape B max.			.093 (2.35)	.142 (3.6)	.142 (3.6)
Chip T max.			.053 (1.35)	.060 (1.5)	.060 (1.5)
Tape Pitch: P			.157 ± .004 (4.0 ± 0.1)	.157 ± .004 (4.0 ± 0.1)	.157 ± .004 (4.0 ± 0.1)

12 mm EMBOSSED (PLASTIC)



		GRM 43-2 1812	GRM 43-4 1825	GRM 44-1 2220	GRM 44 2225
Tape A max.	N/A	.146 (3.7)	.197 (5.0)	.209 (5.3)	.264 (6.7)
Tape B max.		.197 (5.0)	.268 (6.8)	.244 (6.2)	.248 (6.3)
Chip T max.		.080 (2.0)	.080 (2.0)	.080 (2.0)	.080 (2.0)
Tape Pitch: P		.320 ± .004 (8 ± 0.1)	.320 ± .004 (8 ± 0.1)	.320 ± .004 (8 ± 0.1)	.320 ± .004 (8 ± 0.1)

TAIL AND LEADER TAPE DIMENSIONS: in. (mm)

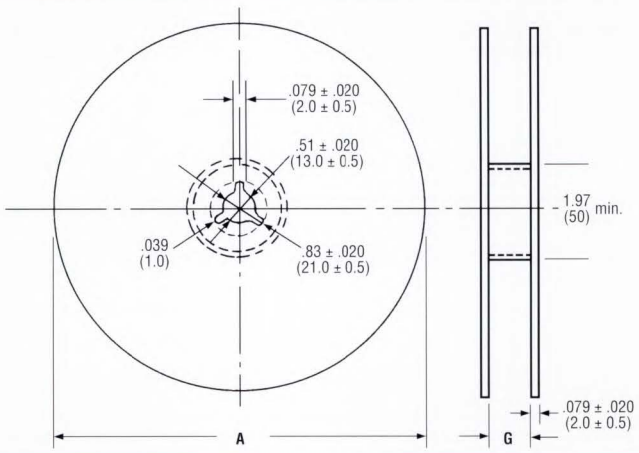


	Tail Tape (A)	Empty Cavities (B)	Leader Tape (C)
EIA-481-1	6.3 to 8.2 (160 to 200)	6.3 to 7.4 (160 to 188)*	9.0 to 9.8 (230 to 250)

*20 to 30mm must be unsealed with remaining portion of empty cavities sealed.

CHIPS – GRM SERIES
REEL AND BULK DIMENSIONS

REEL DIMENSIONS: in. (mm)



Reel Diameter A	Width of Tape Carrier G	
	For 8mm Tape	For 12mm Tape
7 ± .079 (178 ± 2.0)	$.331^{+.069}_{-0}$ ($8.4^{+1.5}_{-0}$)	$.488^{+.076}_{-0}$ ($12.4^{+2.0}_{-0}$)
13 ± .079 (330 ± 2.0)		

BULK CASE PACKAGING

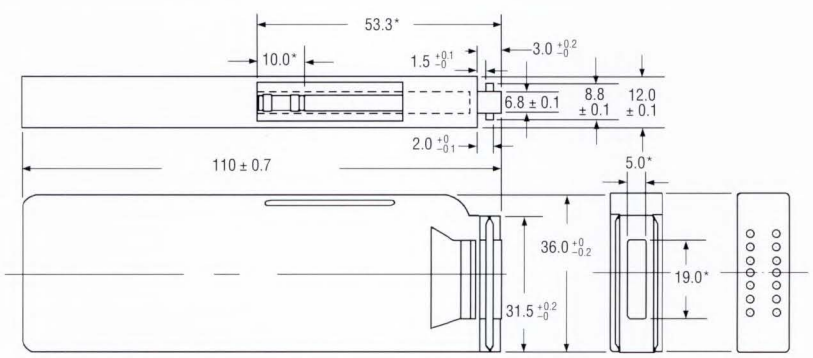
The state-of-the-art in automatic placement of surface mount monolithic ceramic chip capacitors has been greatly advanced with Murata Electronic's new bulk case packaging which offers an alternative to tape and reel. This new technique features a bulk case which can accommodate up to 50,000 pieces of GRM 36 (0402), up to 15,000 pieces of GRM 39 (EIA 0603), up to 10,000 pieces of GRM 40 (EIA 0805) and up to 5,000 pieces of GRM 42-6 (EIA 1206) capacitors which is considerably more than on a standard reel.

Additionally, this new packaging system facilitates standard bar coding and reduces storage and handling requirements. It also greatly reduces the possibility of mixing parts which is typical of other bulk packaging systems. Overall packaging placement costs are also greatly reduced. (Consult with placement equipment manufacturer to determine capability.)

FEATURES

- Prevents Mixture of Parts
- Reduces Labor Costs
- Reduces Stock Space
- Reduces Inventory Costs
- Improves Production Efficiency
- Reduces Waste
- Improved Inventory Control
- Bar Code Labeling
- Anti-Static Packaging
- Recyclable Packaging
- Placement Reliability
- Eliminates Leader/Tail Tape

BULK CASE DIMENSIONS: mm



Chip Size (EIA)	Dimensions: mm			Qty/Case
	L	W	T	
0402	1.0	0.5	0.5	50,000
0603	1.6	0.8	0.8	15,000
0805	2.0	1.25	0.7	10,000
0805	2.0	1.25	1.25	5,000

CHIPS – GRM SERIES
MARKING SPECIFICATIONS

muRata

CHIP MARKING SPECIFICATIONS

Alphabetic Character	Significant Figures	Alphabetic Character	Significant Figures	Alphabetic Character	Significant Figures
A	1.0	M	3.0	Y	8.2
B	1.1	N	3.3	Z	9.1
C	1.2	P	3.6	a	2.5
D	1.3	Q	3.9	b	3.5
E	1.5	R	4.3	d	4.0
F	1.6	S	4.7	e	4.5
G	1.8	T	5.1	f	5.0
H	2.0	U	5.6	m	6.0
J	2.2	V	6.2	n	7.0
K	2.4	W	6.8	t	8.0
L	2.7	X	7.5	y	9.0

Numeric Character	Decimal Multiplier
0	10^0
1	10^1
2	10^2
3	10^3
4	10^4
5	10^5
6	10^6
7	10^7
8	10^8
9	10^{-1}

MARKING

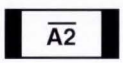
1. The capacitance value is expressed in pF.
2. A two character marking system will be used. The first character will be an alphabetic symbol and it will designate the 1st and 2nd figures of capacitance. The second character will be a numerical digit and it will designate the decimal multiplier of capacitance.

   Examples: A1 = 1 x 10^1 = 10pF
   J5 = 2.2 x 10^5 = 0.22μF
3. The marking shall appear in black or legible contrast. The orientation of the marking shall be illustrated.
4. Marking resistance to solvents per EIA-RS-198 Method 210.

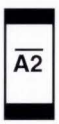
GRM 36/
GRM 39
No Marking

GRM 40

GRM 42-6, 42-2
43-2, 44-1, 44



GRM 43-4

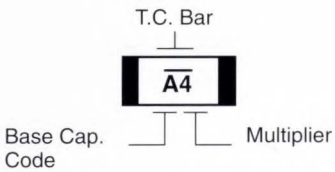


TC BAR CODE

Where chip marking is required, bar code designations for temperature coefficients (TC's) will be provided as listed below.

NPO = $\overline{\square\square}$, N150 = $\overline{\square}\square$, N220 = $\square\overline{\square}$,
N330 = $\underline{\square\square}$, N470 = $\underline{\square}\square$, N750 = $\square\underline{\square}$,
Y5V = $\square\square$, Z5U = $\underline{\square\square}$|, X7R = |$\square\square$

Other TC Designators are available. Contact Factory.



STORAGE LIFE

Chip component terminations should generally be protected from moisture. In addition, they should also be protected from materials containing chlorine, sulfer compounds or any harmful gases that could cause degradation of the solder. Nylon-polyethylene laminated bags are used for both bulk and reel packaging. These special bags have been developed to keep out moisture and harmful gases. However, the following recommendations should be adhered to:

1. All chip components, including tape and reel, should be kept in sealed bags until they are used, in an area where the temperature is less than 40°C and where the humidity is less than 70%.
2. The chip components should be used within six months.
3. The solderability of the chip components should be rechecked in the event that they are not used in six months.
4. Peel strength and shelf life of tape are guaranteed for 1 year when stored under afore said conditions.

MECHANICAL CONSIDERATIONS

COEFFICIENTS OF THERMAL EXPANSION (CTE)

Generally, the most critical components in a surface mount assembly on P.C.B. materials are the ceramic capacitors and resistors. Other passive and active components, although surface mountable, generally have leads or electrodes which are compliant. Ceramic chip capacitors and resistors are leadless.

Mismatches in CTE's between chip and board material will cause stress. Ceramic capacitors with CTE's higher than board materials (i.e. alumina ceramic) will shrink more than the substrate when cooling after solder (above 200 +°C). Lead end termination bonding or ceramic defects can lead to mechanical failures. When chips are mounted on boards with higher CTE's, repeated temperature cycling can contribute to failures by:

- cracks in solder fillets
- cracks in ceramic components
- separation of terminations from chip bodies

Typical ceramic component CTE's are: (IN/IN/°C)

COG Chip Capacitor	$8\text{-}10x10^{-6}$
X7R Chip Capacitor	$11\text{-}12x10^{-6}$
Z5U Chip Capacitor	$11\text{-}12x10^{-6}$
Recommended Expansion Range of P.C.B.:	$3\text{-}16x10^{-6}$

The recommended P.C.B. expansion range accounts for chip terminations which absorb a portion of the thermal stress mismatch.

RECOMMENDED SOLDER REQUIREMENTS

The chip components mounting pad or land should be designed to provide for an electrically and mechanically solid solder joint.

Land dimensions are generally determined by the size of the chips, placement accuracy and the amount of solder necessary to create a solid joint.

In particular, the ability of chips to withstand mechanical stress such as board flex and temperature cycling is influenced by the amount of solder applied.

The larger the amount of solder applied to the bonding of the chips, the greater the mechanical stress on the chips. In fact, excess solder may cause the chips to crack.

In order to prevent such defects, it is first necessary to consider the size of lands. This in turn determines the amount of solder necessary to form the fillet.

In wave soldering, the soldering area is fully immersed in molten solder. This provides enough solder to form the fillet. However, in reflow soldering, the solder fillet is largely controlled by the amount of solder paste lay down. Therefore, it is recommended that reflow soldering lands be the same or slightly larger than those designed for wave soldering.

Recommended Land Dimensions (P.C.B.) – Pad dimensions are determined by the mounting requirements, the amount and type of solder system used and the placement technique.

Ceramic Chip Capacitors are susceptible to stresses when applied on P.C.B. materials. Recommended pad dimensions are indicated.

Actual pad dimensions, within the specified range, will depend upon the type of assembly and soldering system employed:

Wave or Flow Soldering (with adhesive bonding) – Optimum pad width (c)is designated as 2/3 of the chip width (W). Pads larger than the chip width can lead to three (3) potential problems due to stress transfer:

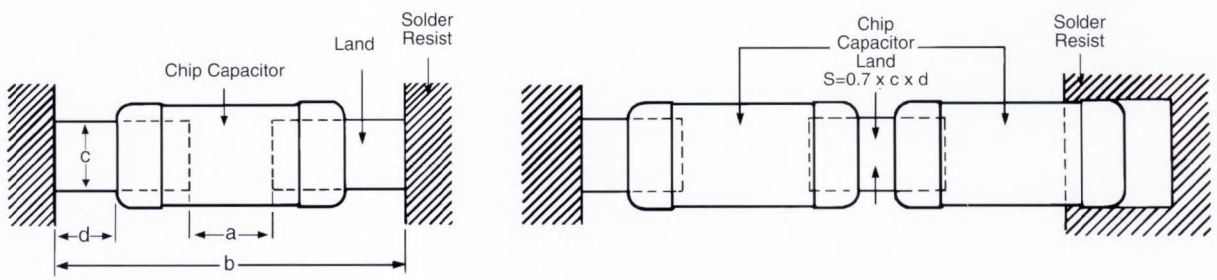
- peel away of chip end termination
- cracks in solder fillet
- cracks in ceramic chip

Stresses are more evenly transferred during wave solder by maintaining pad width as 2/3 width of chip.

Reflow or Vapor Phase Soldering (with solder paste) – Optimum pad is designated as the exact width of the chip.

Pad dimensions for all Murata Electronics chip components are indicated. Adherence to these guidelines will improve the solderability success rate and minimize component movement.

CHIP MONOLITHIC CERAMIC CAPACITOR – GRM – PAD DIMENSIONS



		REFLOW SOLDERING									WAVE SOLDERING*		
MURATA DESIGNATION		GRM 36	GRM 39	GRM 40	GRM 42-6	GRM 42-2	GRM 43-2	GRM 43-4	GRM 44-1	GRM 44	GRM 39	GRM 40	GRM 42-6
DIMENSIONS: in. (mm)	L	.040±.002 (1.0±.005)	.060±.008 (1.5±0.2)	.080±.008 (2.0±0.2)	.125±.008 (3.2±0.2)	.125±.008 (3.2±0.2)	.180±.012 (4.6±0.3)	.180±.012 (4.6±0.3)	.220±.012 (5.6±0.3)	.220±.012 (5.6±0.3)	.062 (1.6)	.080±.008 (2.0±0.2)	.125±.008 (3.2±0.2)
	W	.020±.002 (0.5±.005)	.030±.008 (0.75±0.2)	.050±.008 (1.25±0.2)	.060±.008 (1.5±0.2)	.100±.008 (2.5±0.2)	.125±.008 (3.2±0.2)	.250±.016 (6.35±0.4)	$.220^{+.010}_{-.020}$ $(5.1^{+0.25}_{-0.5})$	.250±.016 (6.35±0.4)	.031 (0.8)	.050±.008 (1.25±0.2)	.060±.008 (1.5±0.2)
a		(0.3 to 0.5)	.016 to .039 (0.4 to 1.0)	.039 to .055 (1.0 to 1.4)	.071 to .098 (1.8 to 2.5)	.071 to .098 (1.8 to 2.5)	.098 to .138 (2.5 to 3.5)	.098 to .138 (2.5 to 3.5)	.106 to .201 (2.7 to 4.7)	.106 to .185 (2.7 to 4.7)	.023 ~ .039 (0.6 ~ 1.0)	.039 to .055 (1.0 to 1.4)	.071 to .098 (1.8 to 2.5)
b		(0.35 to 0.6)	.098 to .161 (2.5 to 4.1)	.118 to .181 (3.0 to 4.6)	.165 to .228 (4.2 to 5.8)	.165 to .228 (4.2 to 5.8)	.217 to .240 (5.5 to 6.1)	.217 to .240 (5.5 to 6.1)	.264 to .327 (6.7 to 8.3)	.264 to .327 (6.7 to 8.3)	.086 ~ .110 (2.2 ~ 2.8)	.118 to .157 (3.0 to 4.0)	.165 to .205 (4.2 to 5.2)
c		(0.4 to 0.6)	.024 to .039 (0.6 to 1.0)	.035 to .063 (0.9 to 1.6)	.047 to .079 (1.2 to 2.0)	.071 to .126 (1.8 to 3.2)	.091 to .165 (2.3 to 4.2)	.157 to .295 (4.0 to 7.5)	.138 to .256 (3.5 to 6.5)	.157 to .295 (4.0 to 7.5)	.031 ~ .035 (0.8 ~ 0.9)	.035 to .047 (0.9 to 1.2)	.047 to .063 (1.2 to 1.6)
d			.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.020 to .051 (0.5 to 1.3)	.023 ~ .031 (0.6 ~ 0.8)	.020 to .039 (0.5 to 1.0)	.020 to .039 (0.5 to 1.0)

*Effective area of the land S should satisfy: $S \leqq c(MAX) \times d(MIN)$, c and d need not be within the range shown in this list.

P.C.B. Pattern Configurations for Ceramic Chip Capacitors and Resistors for Wave Soldering

Pattern configurations and orientation of ceramic leadless components can affect the resultant fillet during wave solder.

Ideally, ceramic chip terminations should be aligned perpendicular to the direction of wave flow in an end to end or staggered end to end configuration:

In this case a pass through the wave from bottom to top or from top to bottom will deposit sufficient solder on both individual chip terminations resulting in acceptable fillets.

On P.C.B. layouts where ceramic chips are rotated 90° in relation to each other in a body—centered or space—centered pattern, potential soldering problems may occur.

A wave solder pass from top to bottom of the P.C.B. will result in acceptable solder fillets at the chip and terminations which are perpendicular (horizontal in the figure below) to the direction of pass. However, adequate solder may not be deposited on the bottom termination of chips rotated 90° due to termination shadowing by the ceramic chip body. A cold joint could result.

Refinements have been incorporated in wave solder systems including dual waves where the first wave is turbulent and "forces" solder onto component terminations and pad areas. This equipment may reduce the incidence of cold joints in body centered board layouts.

P.C.B. layout and pattern configurations can affect solderability.

P.C.B. Deflection (Bending) and Ceramic Chip Capacitors and Resistors

All surface mount components, but in particular ceramic chip capacitors and resistors, are subject to the mechanical stresses generated during deflection or bending of the printed circuit board.

A test has been developed to establish the capacitors or resistors capability to withstand P.C.B. bending.

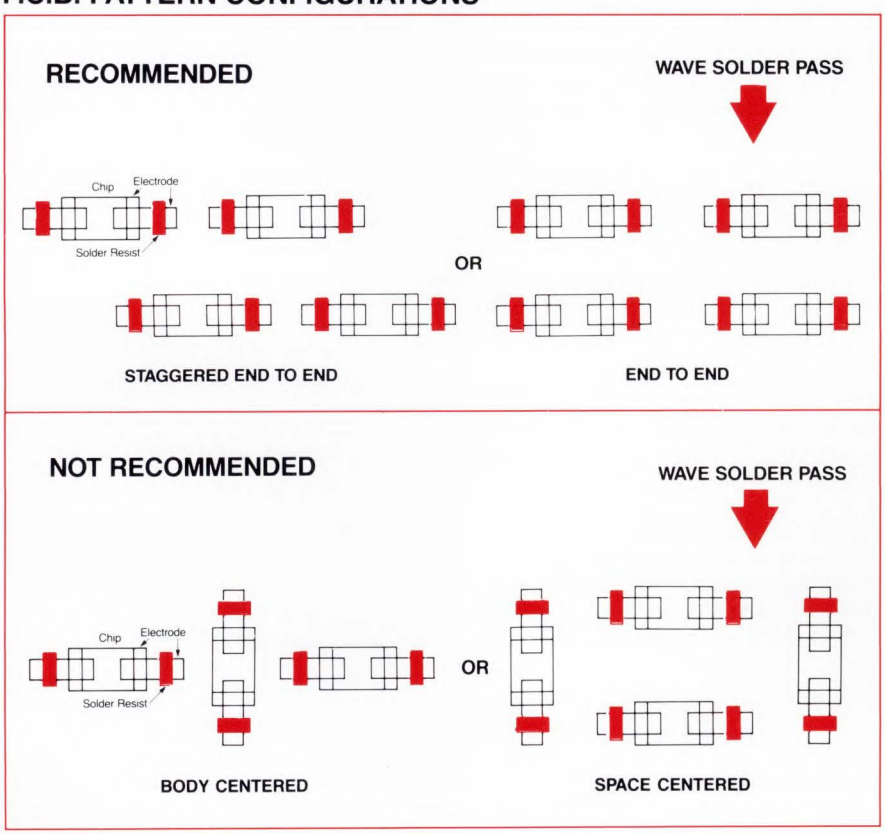
The capacitor or resistor is soldered onto the testing board with a eutectic solder. The soldering should be done with an iron or by reflow and should result in a uniform fillet with no thermal shock to the component. A stress is applied in order to depress the board at a rate of 0.5mm per second.

The component shall withstand deflection, dependent upon material of at least 1 mm.

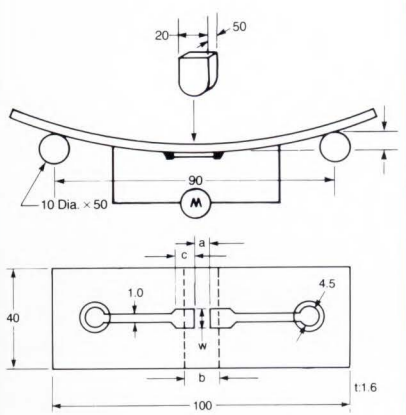
This guideline stresses the need for the user to exercise control in two areas:

1. Board warpage as received from the P.C.B. supplier
2. The amount of deflection the P.C.B. is subjected to after soldering

P.C.B. PATTERN CONFIGURATIONS



DIMENSIONS: (mm)



in. (mm)

Size	Type	a	b	c	w
0805	GR40	.047 (1.2)	.157 (4.0)	.118 (3.0)	.065 (1.65)
1206	GR42-6	.087 (2.2)	.197 (5.0)	.098 (2.5)	.079 (2.0)

SOLDERING CONSIDERATIONS

Soldering of Passive Surface Mount Components

Surface mount passive components may be soldered to P.C.B.'s and substrates in a variety of methods:

- wave/dual wave
- hot air/convection reflow
- vapor phase reflow
- infrared reflow
- bubble solder immersion
- other (laser, etc.)

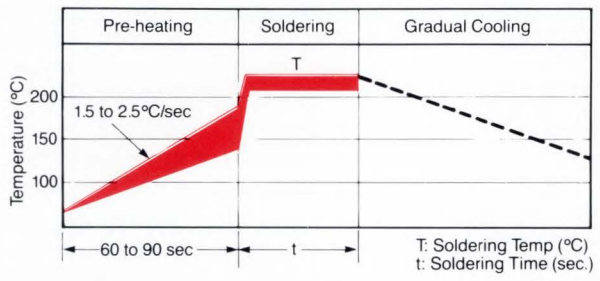
Ceramic devices, particularly chip capacitors and resistors, generally have a poor ability to withstand heat shock. Thermal shock may result during soldering and is a natural material characteristic. Chip capacitor failure mechanisms resulting from excessive thermal shock may include:

- micro cracks in the ceramic
- electrical shorts
- insulation resistance degradation in accelerated life test conditions

Users of ceramic chip components can minimize thermal shock by employing a basic process prior to soldering: *"WE RECOMMEND THAT YOU PREHEAT THE CERAMIC CHIP COMPONENTS AND BOARD TO WITHIN 100°C OF THE SOLDERING TEMPERATURE."* The time for preheat should be a minimum of one (1) minute.

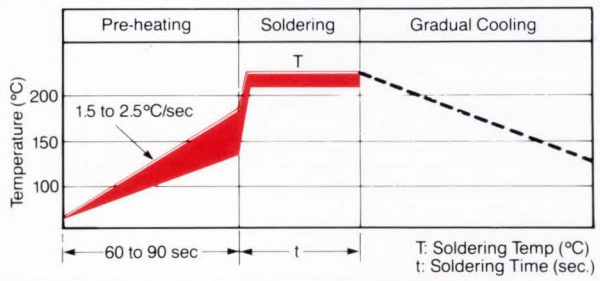
In addition, the recommended soldering process time-temperature profile for components should be followed. (See application manual for specific details.)

WAVE SOLDERING



Product Name		Soldering Temp. T (°C)	Soldering Time t (sec.)
Chip Monolithic Ceramic Capacitor	GRM	220 to 260°C	5 sec max.

INFRARED REFLOW SOLDERING



Product Name		Soldering Temp. T (°C)	Soldering Time t (sec.)
Chip Monolithic Ceramic Capacitor	GRM	220 to 250°C	30 sec. max.

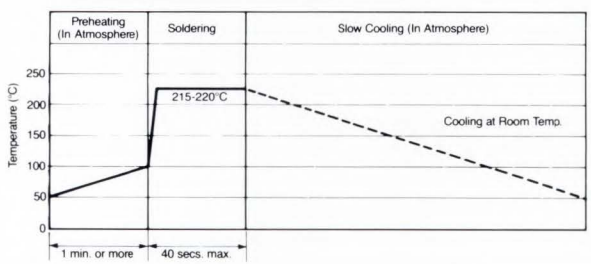
Note: For Sizes ≥ 1210, Wave Soldering Not Recommended.

VAPOR PHASE REFLOW SOLDERING

Vapor phase reflow soldering techniques may be used to attach many surface mount components onto a P.C.B. or substrate at one time. Solder temperatures are controlled precisely due to the known boiling point of the liquid.

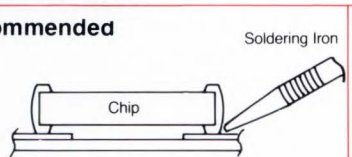
Vapor phase soldering involves condensation heating, whereby the latent heat of a vaporized liquid is released as the vapor condenses on metalization of the parts to be soldered. The phase change from liquid to vapor is rapid and occurs on all exposed surfaces of the part, resulting in uniform heating.

Murata Electronics surface mount components can be successfully attached to a P.C.B. or substrate using the vapor phase reflow technique. Due to the lower soldering temperature, the effect of heat on the components is not severe.

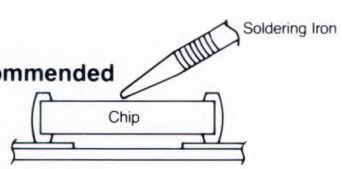


SOLDERING IRON

Recommended



Not Recommended



The soldering iron method is used primarily for rework or breadboarding. It is important that the solder iron tip *not touch* the ceramic component body. The iron should be applied only to the termination—solder fillet.

Note: The soldering iron shall be of the nichrome wire heater type with maximum tip diameter of 3.0mm.

Product Name		Soldering Iron Tip Temp.	Soldering Time	Iron Output
Chip Monolithic Ceramic Capacitor	GRM/GR	280°C max.	5 sec. max.	30W max.

RECOMMENDED FLUX AND SOLDER

Flux: Use a resin-based flux, however, do not use a strong acidic flux where the chlorine content exceeds 0.20%.

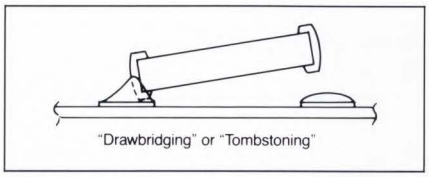
Solder: Eutectic solder or 60x40 solder should be used for all components, except GR, where 60x40 solder containing 2 to 2.5% silver should be used.

RECOMMENDED CLEANING CONDITIONS

Product Name		Cleaning Liquid	Immersion Cleaning	Ultrasonic Cleaning
Chip Monolithic Ceramic Capacitor	GRM	Consult Factory	5 min. max.	1 min. max.

"DRAWBRIDGING" OR "TOMBSTONING"

refers to the tendency of a chip capacitor or resistor to stand on end during the solder process:



This phenomenon is caused by the relief of surface tension forces during solder wetting.

An example is the failure to properly wet each chip end termination equally or at the same time. One end of the chip is raised above the pad and fails to bond to the land area.

Factors which contribute to "drawbridging" include:

A. Improper Pad or Land Design:
Unequal pad sizes for individual chips may result in the chip standing on end on the larger pad.

B. Improper or Unequal Solder on Pads:
A larger solder mass on one chip pad will also cause the chip to stand on end.

C. Misplacement of Chip:
If one component end termination is placed in solder paste and the other termination is not, the "pasted" end will stand up.

D. Poor Chip End Termination:
Component suppliers must evenly and equally control the termination on individual chips. One larger termination on a single chip can lead to "tombstoning."

E. Vibration of Chip Loaded P.C.B.'s Prior to Soldering:
P.C.B.'s with components mounted but not soldered must be handled carefully to not jar and move components.

F. Poor Quality Solder Paste:
Is a problem with surface mount and leaded assemblies. Compatible and high quality materials should be chosen.

G. Improper Solder Temperature:
Excessive and uneven temperature excursions as well as extended dwell times can detrimentally effect solderability and contribute to "drawbridging." Recommended soldering conditions should be followed.

The use of proper design guidelines and materials will minimize chip "drawbridging" and "tombstoning."

THE USE OF ADHESIVES

Bonding chips temporarily to the P.C.B. prior to wave soldering is used extensively in double sided board assembly with underside mounted chip capacitors and resistors.

It is necessary to control the amount of adhesive so that it does not interfere with chip termination and pad contact area and does not bridge between P.C.B. component pads.

The recommended adhesive pattern for 1206 size chips is shown.

A non-conductive, heat cure epoxy resin adhesive with maximum viscosity (10,000 cps or greater) is recommended. Chips should be mounted within 15 minutes of adhesive printing. A U.V. cure of the adhesive after chip placement is common.

Notes Concerning Adhesive Application

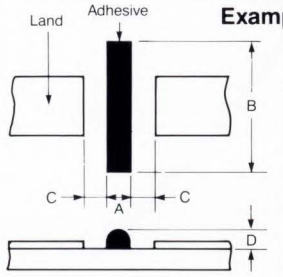
Adhesive that is supplied on the substrate tends to spread out and decrease in thickness. It is necessary to keep adhesive thickness constant.

In the case where there is insufficient adhesion, the chip components are apt to fall from the substrate during flow soldering.

Amount of adhesive

The proper amount of adhesive required depends on the size of the chip component.

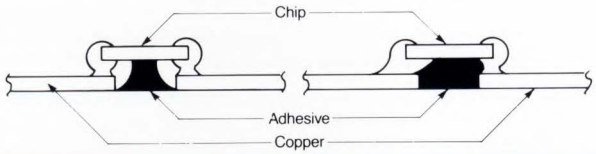
Example: Chip Monolithic Ceramic Capacitors



		GRM40	GRM42-6
Dimension	L	2.0	3.2
	W	1.25	1.6
A		0.6	0.8
B		1.8	2.1
C		0.3 min.	0.3 min.
D		0.12±0.02	0.12±0.02

Good Example

Bad Example



Consult factory for 0603-0402 information.

In the case where too much adhesive is applied, the adhesive is apt to flow onto the lands, which results in bad soldering.

Required Characteristics for Adhesive

The adhesive should be suitable for dispenser use.

After application to the substrate, the adhesive should not spread out excessively.

The adhesive should be strong enough to firmly hold the components despite the vibrations of the machine during mounting.

The adhesive should have sufficient strength at high temperatures.

The adhesive should have excellent insulation and humidity resistance.

SOLDERING CONSIDERATIONS

Chip Ceramic Capacitor End Terminations

The standard chip ceramic capacitor end termination has been palladium silver.

This termination system has good but limited capabilities to withstand various soldering techniques.

Historically, there have been two (2) primary problems associated with the palladium silver termination:

1. Silver leaching or removal from the termination due to high solder temperature excursions and/or long solder dwell times.
2. Silver dendrite growth across the external surface of small chip capacitors due to voltage and/or humidity conditions

These problems have resulted in the development of a barrier layer end termination (GRM Series) consisting of three (3) layers:

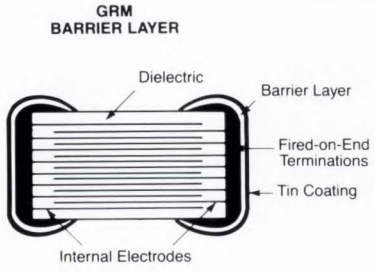
palladium silver inner layer
nickel barrier layer (plated)
outer tin layer (plated)

Final chip dimensions are identical to the GR palladium silver termination series. Both chips are available in tape and reel for automatic placement.

The barrier layer termination is superior in soldering performance to the palladium silver termination, and has become the industry standard.

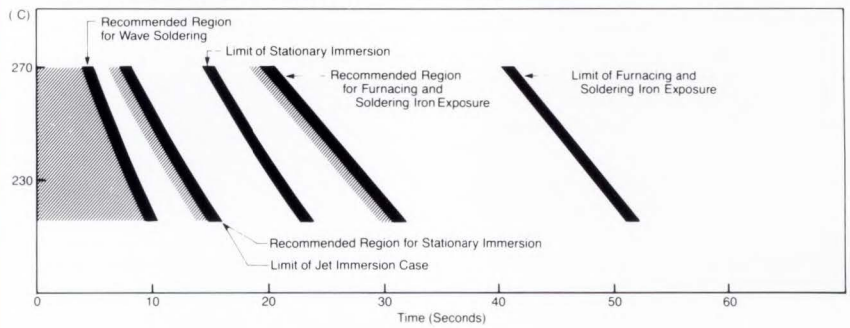
As an example, during wave soldering the 260°C, 3 to 5 second dwell recommended for the palladium silver termination can be increased to 35 to 40 seconds for the barrier layer termination.

The barrier layer termination GRM series is ideally suited for customers manufacturing a multitude of products utilizing vairous solder techniques or for customers who do not closely control the time temperature profile of the soldering process. Leaching of silver during soldering may be eliminated.

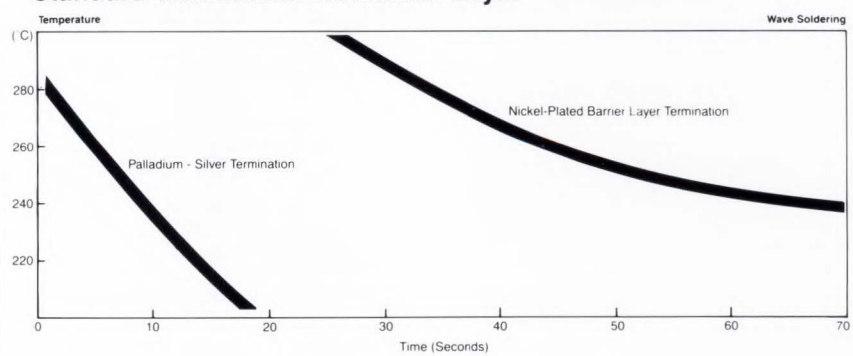


CUTAWAY CHIP CERAMIC CAPACITOR
MURATA GRM SERIES

Recommended Soldering Time — Temperature Profile Standard Palladium Silver End Termination



Silver Corrosion Time and Soldering Temperature Standard Termination vs. Barrier Layer



SOLDER MASS CONTROL

Ceramic chip capacitors and resistors, as noted previously, are susceptible to thermal and mechanical stresses when mounted on printed circuit boards.

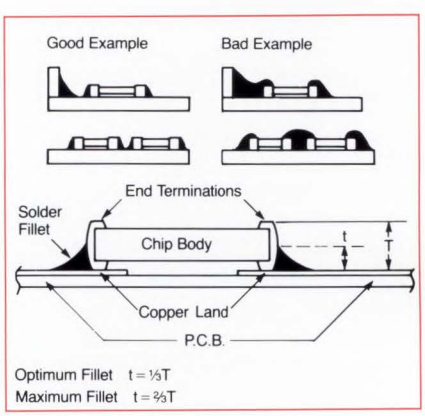
In an assembly operation which screen prints solder paste on land areas of the P.C.B., it is necessary to control the amount of solder paste to allow for adequate transfer of thermal and mechanical stresses from board to ceramic passive components.

In general, the solder mass should be controlled to result in a maximum fillet of ⅔ the overall thickness of the chip capacitor or resistor.

Larger fillets which extend above the component end terminations potentially can contribute to failure by:

Peel-away of the end termination
Fillet weld cracks at the top corners
Cracks in the ceramic chip

These problems can be minimized by adhering to the "⅔" design guideline for solder mass. (See example)

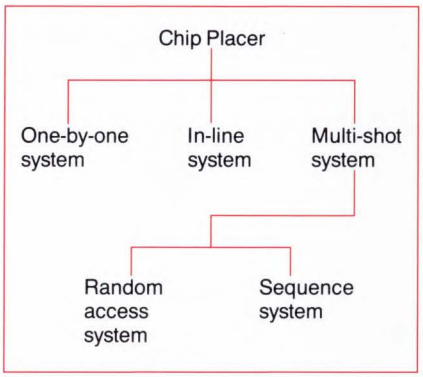


Optimum Fillet t = ⅓T
Maximum Fillet t = ⅔T

AUTOMATIC PLACEMENT EQUIPMENT CONSIDERATIONS

Classification of Chip Placers

There are various chip placers on the market today and are classified into three systems: One-by-one, In-line and Multi-shot.



SYSTEM FEATURES

One-by-one system

This system places chip components one-by-one on PCB's. It is suitable for both small-lot production requiring product change-over and for mid-scale mass-production. This system is the most popular.

In-line system

This system places chip components continuously using multiple placing heads. Placing speed is higher than the one-by-one system because of its simultaneous placing capability. This system is suitable for production of PCB's with few chip components.

Multi-shot system

This system places many chip components at the same time on a PCB. Placing speed per component is the highest for available machinery. This system is suitable for mass-production of large quantities of the same product. Components are restricted in size, such as to chip ceramic capacitors, resistors and SOT's.

PLACING SPEED

One-by-one system

Placing speed differs due to dimensions and figures of components. Placing speed (in case of high speed type that can place from small to relatively large size chip components) is 0.2 to 0.4 seconds per component. Placing speed (in case of type that can place all chip components including SOIC) is 0.6 to a few seconds per component.

In-line system

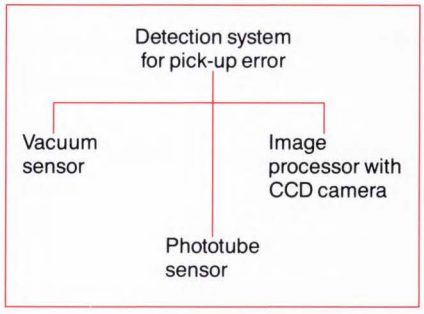
Although placing speed by individual heads is low, placing speed per component is the same speed as that of high speed type one-by-one system. This is due to the placement of chip components at the same time using multiple placing heads.

Multi-shot system

Placing speed is 5-20 seconds per PCB. Though placing speed per component differs, it is 0.025-0.1 seconds per component in case of 200 components on one PCB.

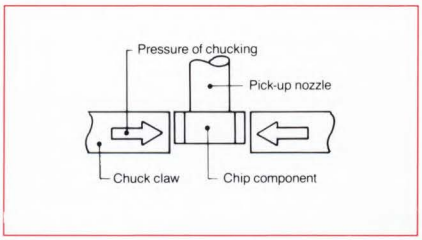
Machine Detection System for Chip Components

Detecting systems are mainly of two types: vacuum sensor and phototube sensor. Phototube sensors have become the preferred method to easily detect pick-up error (such as a component picked up vertically). There is also a newer system which uses an image processor with a CCD camera.



Positioning System of Chip Components

Chip placers (one-by-one and in-line) generally have chuck claws for positioning chip components. Multi-system placers have plate-like jigs for positioning. In case of one-by-one and in-line systems, normally several to 300 grams of pressure is applied to the sides of the chip component.



Cautions for Chip Placing

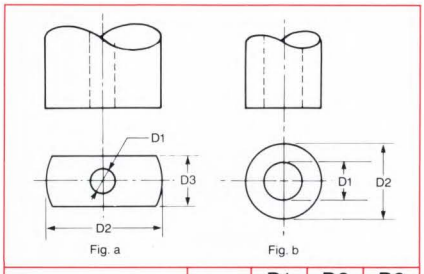
1. Prevention of PCB Warping. If there is a large warp in the PCB, there will be splitting, cracking or other damage to the chip components. It is necessary to prevent these defects by setting back-up pins under the PCB and holding close tolerance on board warpage.

2. Adjustment of Lower-Limit Point of Pick-up Nozzle. Usually 100-300 grams is applied by the pick-up nozzle to the top of the chip component during placing. If placing pressure is greater, there will be damage to the chip depending on chip type. It is necessary to prevent defects by adjusting the lower-limit point of the pick-up nozzle.

PICK AND PLACE HEAD

Pick-up nozzle size of chip placer

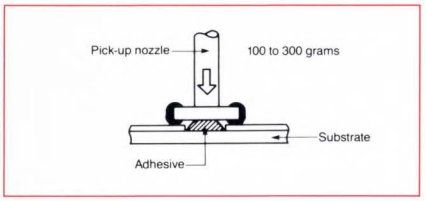
For small size chip components, a small pick-up nozzle is used. For larger chip components, a large pick-up nozzle is used. Examples of typical pick-up nozzle dimensions used are shown below.



		D1	D2	D3
Small size chip components for 8mm width tape	Fig. b	0.7	1.8	—
	Fig. a	1.3	2.4	1.6
	Fig. b	0.8	1.8	—
	Fig. b	1.0	1.8	—
	Fig. b	1.0	2.5	—
Large size chip components for 12mm width tapes	Fig. a	1.3	2.8	1.6
	Fig. a	1.8	4.5	2.6
	Fig. b	2.0	4.0	—

PLACEMENT PRESSURE

100 to 300 grams of pressure is applied to the surface of the chip component by the pick-up nozzle. Breakage of chip component may occur if the placement pressure is not properly adjusted.

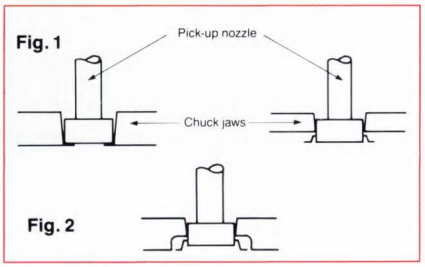


CHUCK JAWS

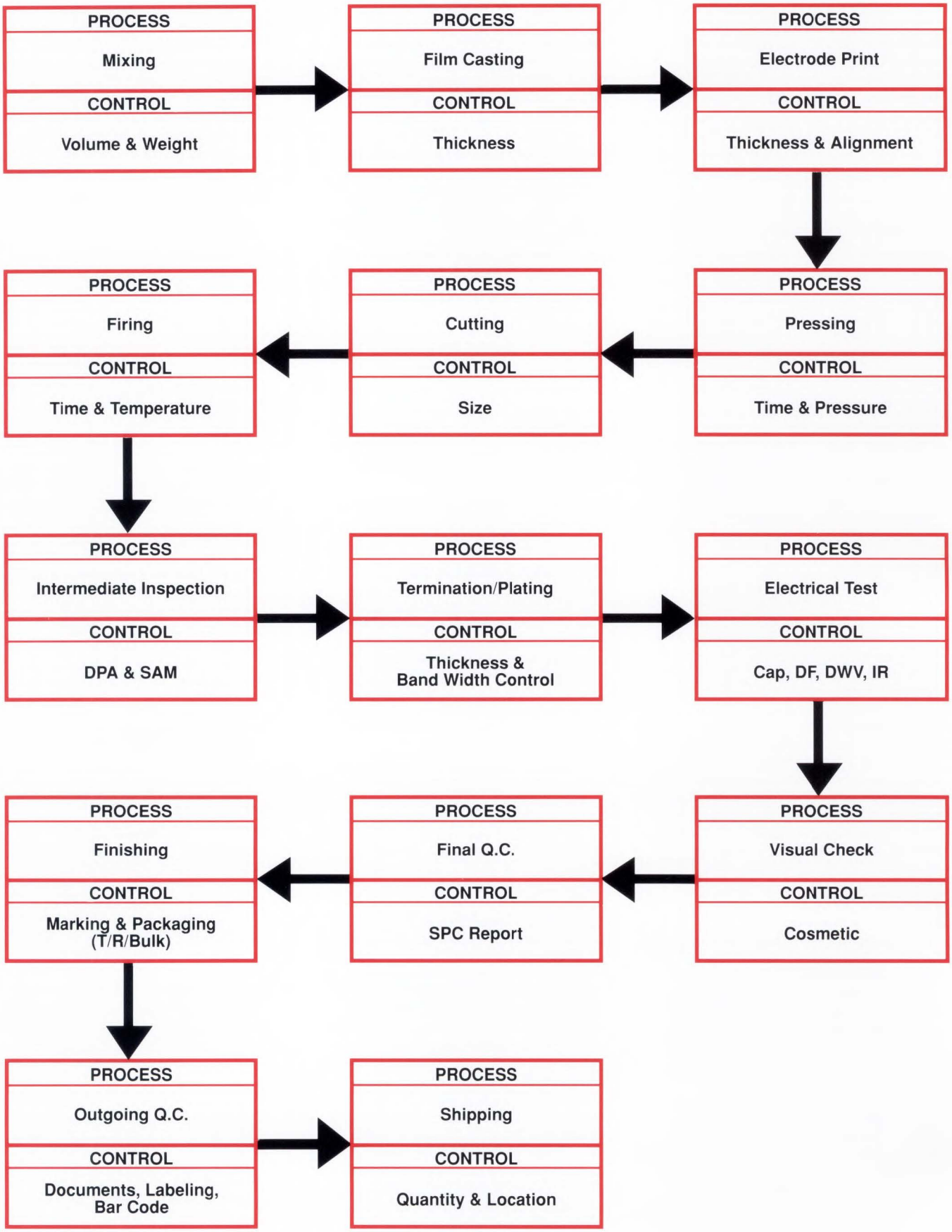
Generally, chuck jaws are shaped like those shown in Fig. 1. However, for chip components which have terminals that are bent outward, chuck jaws such as those shown in Fig. 2 are more appropriate. Chip components with outward bent terminals cannot be aligned properly by chuck jaws as shown in Fig. 1.

CHUCKING PRESSURE

Usually 100 to 300 grams of pressure is applied to the sides of the chip component.



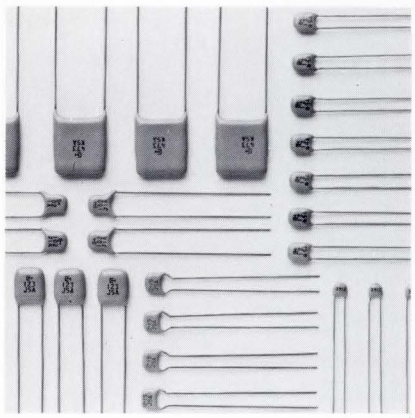
MANUFACTURING FLOW DIAGRAM



CONFORMAL COATED
RADIAL LEADS

muRata

RPE 110-123



FEATURES:

- **Wide capacitance, T.C., voltage and tolerance range**
- **Industry standard sizes**
- **Tape and Reel available for auto insertion**
- **Various lead spacing available**
- **Marking standard or to customer specification**
- **Epoxy coating meets UL94V-0**

PART NUMBERING SYSTEM

RPE110-XXX X7R 103 K 050V

CAPACITOR TYPE AND SIZE

Used only for tape and reel and other variations. See pages 44-45.

TEMPERATURE CHARACTERISTICS (Note 3)
COG=0 ±30ppm (Notes 1 & 2)
X7R=±15%
Z5U=+22, −56%
Y5V=+22, −82%
(See Note 2 below)
P2H=N150±60ppm
R2H=N220±60ppm
S2H=N330±60ppm
T2H=N470±60ppm
U2J=N750±120ppm

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For fractional values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

CAPACITANCE TOLERANCE (Note 2)
COG: (10pF or less)
B=±.1pF
C=±.25pF
D=±.5pF
(over 10pF)
F=±1%
G=±2%
J=±5%
K=±10%
X7R: K=±10%
M=±20%
J=±5% on special request
Z5U: M=±20%
Z=+80, −20%
Y5V: Z=+80, −20%

VOLTAGE
Identified by a three digit number.
50 and 100V standard
(200V and 500V on special request)

NOTES: T.C. Tolerance

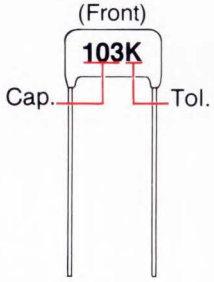
Capacitance (pF)	T.C. Tolerance (ppm)
10 or over	± 30 (G)
4.0-9.9	± 60 (H)
2.1-3.9	±120 (J)
4-2.0	±250 (K)

Refer to EIA RS-198 for limitations.

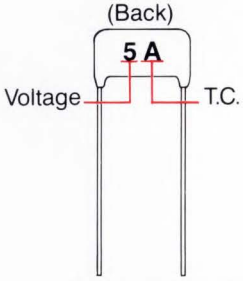
2. Refer to EIA-RS-198 for limitations.

MARKINGS

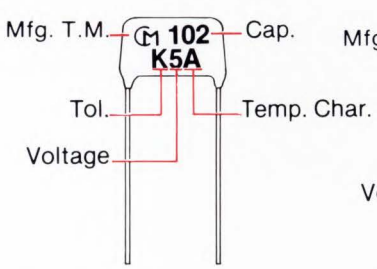
RPE 110* (Front)



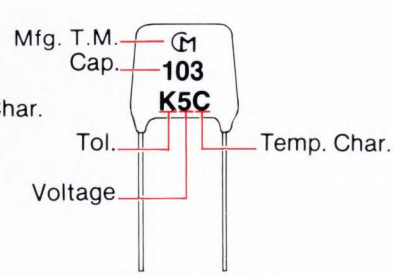
RPE 110 (Back)



RPE 121, 122, 123



RPE 113, 114, 117



Voltage Code
2=25V, 5=50V,
1=100V, 6=200V, 9=500V

RPE 110: Cap. and Tol. only for X7R, Z5U and Y5V materials.

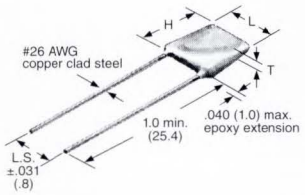
*Both sides marked for temperature compensating RPE 110 capacitors

Temp. Char. Code
A=COG, P=P2H, R=R2H,
S=S2H, T=T2H, U=U2J, C=X7R,
E=Z5U, F=Y5V

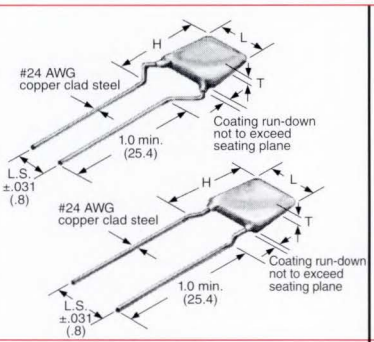
CONFORMAL COATED
RADIAL LEADS
RPE Series

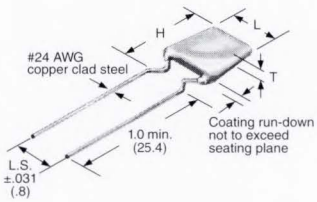
COG

DIMENSIONS: in. (mm)



NOTE: Lead length is measured from the bottom of the capacitor.





MURATA DESIGNATION	★RPE 110				★*RPE 121/RPE 122				★RPE 123			
L (Max.)	.138 (3.5)				.200 (5.1)				.300 (7.6)			
H (Max.)	.120 (3.1)				.250 (6.4)				.275 (7.0)			
T (Max.)	.100 (2.5)				.125 (3.2)				.125 (3.2)			
L.S.	.100 (2.5)				.100 (2.5)/.200 (5.1)				.200 (5.1)			
WVDC	50	100	200	500	50	100	200	500	50	100	200	500
CAPACITANCE												
1	1	1	1	N/A	1	1	1	1				N/A
(pF) 1.0												
10												
100			160					470				
		820					1100				1000	
1000	1400										1600	
					4700	4400			4700	2700		
										6800		
(μF) .01									.016			

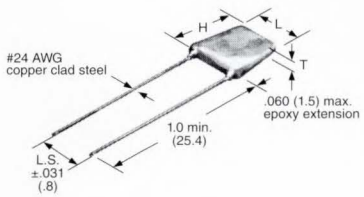
Note: Other values are available below 10pF. For requirements not shown, please contact your local Murata Electronics Sales Office.
*RPE 121 is not available at 500VDC.
★EIA values available as standard through authorized Murata Electronics Distributors.

CONFORMAL COATED
RADIAL LEADS
RPE Series

muRata

COG

DIMENSIONS:
in. (mm)



Standard package and lead configurations shown. Other variations and tape and reel data are displayed on pages 52-53. All RPE wire is tinned copper clad steel wire. For other requirements, please contact your local sales office.

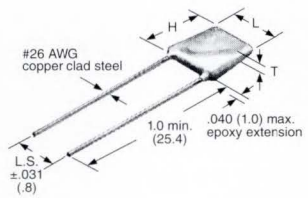
MURATA DESIGNATION	★RPE 113				★RPE 114				★RPE 117			
L (Max.)	.300 (7.6)				.400 (10.2)				.500 (12.7)			
H (Max.)	.300 (7.6)				.400 (10.2)				.500 (12.7)			
T (Max.)	.157 (4.0)				.157 (4.0)				.200 (5.1)			
L.S.	.200 (5.1)				.200 (5.1)				.400 (10.2)			
WVDC	50	100	200	500	50	100	200	500	50	100	200	500
CAPACITANCE												
(pF) 1.0												
10												
100				270								
			560					820				
1000	1200	1200		1500			3900	2200				1300
			3900				.01				.01	6200
(μF) .01	.020	.016			.015	.015			.027	.022		
					.039	.033			.068	.056	.030	

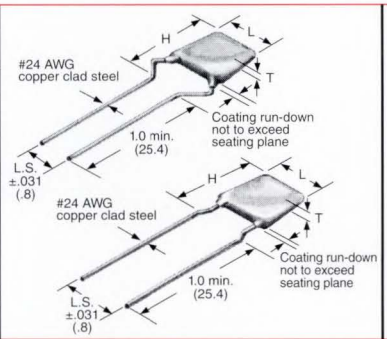
Note: Other values are available below 10pF. For requirements not shown, please contact your local Murata Electronics Sales Office.
★EIA values available as standard through authorized Murata Electronics Distributors.

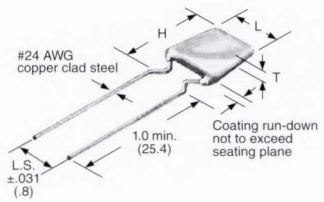
CONFORMAL COATED
RADIAL LEADS
RPE Series

X7R

DIMENSIONS: in. (mm)







MURATA DESIGNATION	★RPE 110				★*RPE 121/RPE 122				★RPE 123			
L (Max.)	.138 (3.5)				.200 (5.1)				.300 (7.6)			
H (Max.)	.120 (3.1)				.250 (6.4)				.275 (7.0)			
T (Max.)	.100 (2.5)				.125 (3.2)				.125 (3.2)			
L.S.	.100 (2.5)				.100 (2.5)/.200 (5.1)				.200 (5.1)			
WVDC	50	100	200	500	50	100	200	500	50	100	200	500
CAPACITANCE												
(pF) 100	220	220	150	N/A	220	220	220	220				N/A
1000			5600					.01			8200	
(μF) .01	.047	.012					.051			.056	.090	
.1					.27	.1			.15 .47	.16		
1.0												

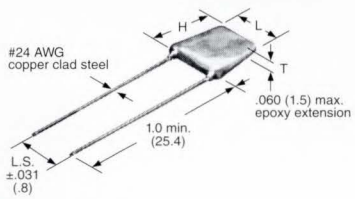
Note: For requirements not shown, please contact your local Murata Electronics Sales Office.
*RPE 121 is not available at 500VDC.
★EIA values available as standard through authorized Murata Electronics Distributors.

CONFORMAL COATED
RADIAL LEADS
RPE Series

muRata

X7R

DIMENSIONS:
in. (mm)



Standard package and lead configurations shown. Other variations and tape and reel data are displayed on pages 52-53. All RPE wire is tinned copper clad steel wire. For other requirements, please contact your local sales office.

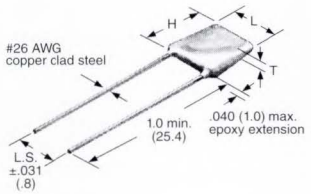
MURATA DESIGNATION	★RPE 113				★RPE 114				★RPE 117			
L (Max.)	.300 (7.6)				.400 (10.2)				.500 (12.7)			
H (Max.)	.300 (7.6)				.400 (10.2)				.500 (12.7)			
T (Max.)	.157 (4.0)				.157 (4.0)				.200 (5.1)			
L.S.	.200 (5.1)				.200 (5.1)				.400 (10.2)			
WVDC	50	100	200	500	50	100	200	500	50	100	200	500
CAPACITANCE												
(pF) 100												
1000				4700								
(μF) .01	.039	.039	.018	.033				.022				.068
.1	1.1	.51	.18		.33	.39	.22	.1	1.0	.68	.22	.22
1.0					2.2	1.0	.56		3.3	2.2	1.8	

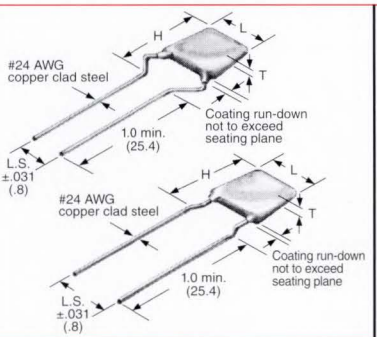
Note: For requirements not shown, please contact your local Murata Electronics Sales Office.
★EIA values available as standard through authorized Murata Electronics Distributors.

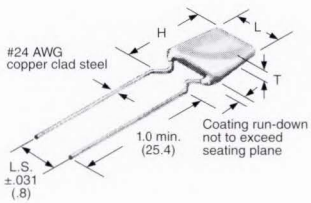
CONFORMAL COATED
RADIAL LEADS
RPE Series

Z5U

DIMENSIONS: in. (mm)



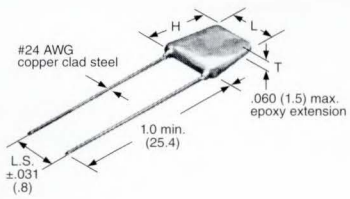




MURATA DESIGNATION	★RPE 110				★*RPE 121/RPE 122				★RPE 123			
L (Max.)	.138 (3.5)				.200 (5.1)				.300 (7.6)			
H (Max.)	.120 (3.1)				.250 (6.4)				.275 (7.0)			
T (Max.)	.100 (2.5)				.125 (3.2)				.125 (3.2)			
L.S.	.100 (2.5)				.100 (2.5)/.200 (5.1)				.200 (5.1)			
WVDC	50	100	200	500	50	100	200	500	50	100	200	500
CAPACITANCE												
(pF) 1000	1000	1000	1000	N/A	1000	1000	1000	1000				N/A
			3300					5600				
(μF) .01		.015									.018	
											.033	
	.1						.068			.068		
.1						.15				.15		
					.47				.39			
1.0									1.0			
10.0												

Note: For requirements not shown, please contact your local Murata Electronics Sales Office.
*RPE 121 is not available at 500VDC.
★EIA values available as standard through authorized Murata Electronics Distributors.

DIMENSIONS: in. (mm)



Standard package and lead configurations shown. Other variations and tape and reel data are displayed on pages 52-53. All RPE wire is tinned copper clad steel wire. For other requirements, please contact your local sales office.

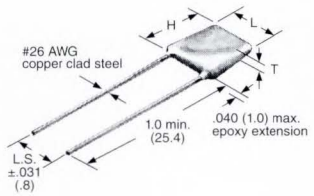
MURATA DESIGNATION	★RPE 113				★RPE 114				★RPE 117			
L (Max.)	.300 (7.6)				.400 (10.2)				.500 (12.7)			
H (Max.)	.300 (7.6)				.400 (10.2)				.500 (12.7)			
T (Max.)	.157 (4.0)				.157 (4.0)				.200 (5.1)			
L.S.	.200 (5.1)				.200 (5.1)				.400 (10.2)			
WVDC	50	100	200	500	50	100	200	500	50	100	200	500
CAPACITANCE												
(pF) 1000				5600								
(μF) .01		.1	.047	.033				.22				
.1	.22	.68	.15		.82	.33	.18	.56			.22	.12 .22
1.0	1.5				3.3	1.2			2.2 5.6	1.5 2.2	1.8	
10.0												

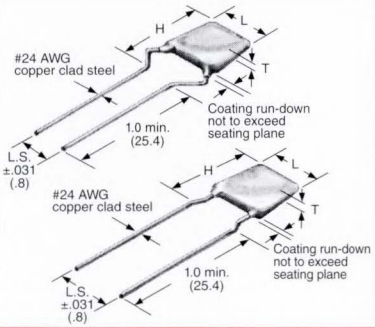
Note: For requirements not shown, please contact your local Murata Electronics Sales Office.
★EIA values available as standard through authorized Murata Electronics Distributors.

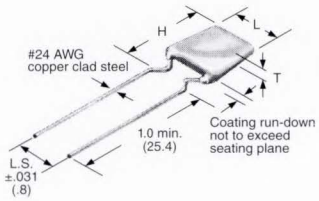
CONFORMAL COATED
RADIAL LEADS
RPE Series

Y5V

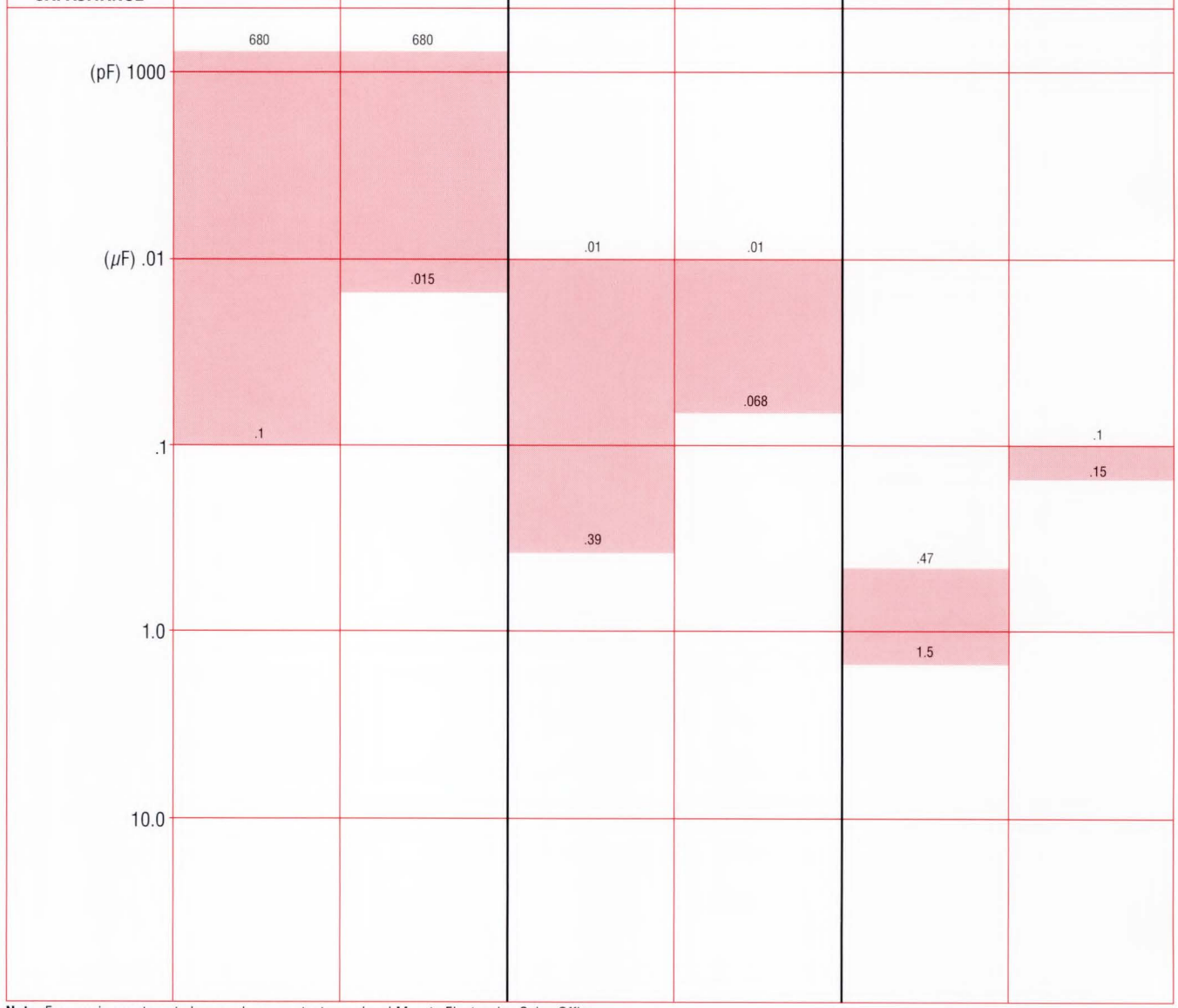
DIMENSIONS: in. (mm)







MURATA DESIGNATION	★RPE 110		★RPE 121/RPE 122		★RPE 123	
L (Max.)	.138 (3.5)		.200 (5.1)		.300 (7.6)	
H (Max.)	.120 (3.1)		.250 (6.4)		.275 (7.0)	
T (Max.)	.100 (2.5)		.125 (3.2)		.125 (3.2)	
L.S.	.100 (2.5)		.100 (2.5)/.200 (5.1)		.200 (5.1)	
WVDC	50	100	50	100	50	100
CAPACITANCE						



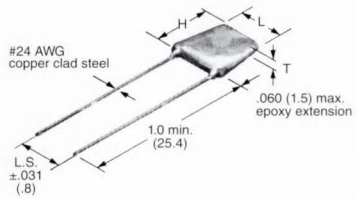
Note: For requirements not shown, please contact your local Murata Electronics Sales Office.
★EIA values available as standard through authorized Murata Electronics Distributors.

CONFORMAL COATED
RADIAL LEADS
RPE Series

muRata

Y5V

DIMENSIONS:
in. (mm)



Standard package and lead configurations shown. Other variations and tape and reel data are displayed on pages 52-53. All RPE wire is tinned copper clad steel wire. For other requirements, please contact your local sales office.

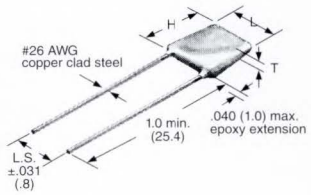
MURATA DESIGNATION	★RPE 113		★RPE 114		★RPE 117	
L (Max.)	.300 (7.6)		.400 (10.2)		.500 (12.7)	
H (Max.)	.300 (7.6)		.400 (10.2)		.500 (12.7)	
T (Max.)	.157 (4.0)		.157 (4.0)		.200 (5.1)	
L.S.	.200 (5.1)		.200 (5.1)		.400 (10.2)	
WVDC	50	100	50	100	50	100
CAPACITANCE						
(pF) 1000						
(μF) .01						
.1	.18	.15		.27		.68
1.0	1.8	.56	.56	1.2	1.2	3.3
10.0			3.3		6.8	

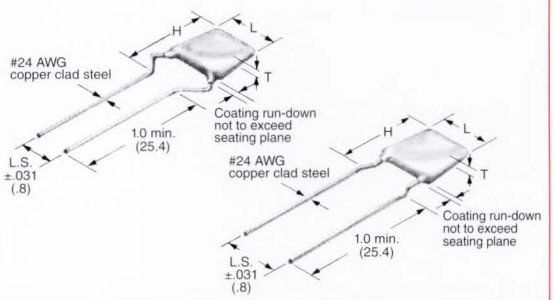
Note: For requirements not shown, please contact your local Murata Electronics Sales Office.
★EIA vaules available as standard through authorized Murata Electronics Distributors.

CONFORMAL COATED
RADIAL LEADS
RPE Series

TEMPERATURE COMPENSATING

DIMENSIONS: in. (mm)



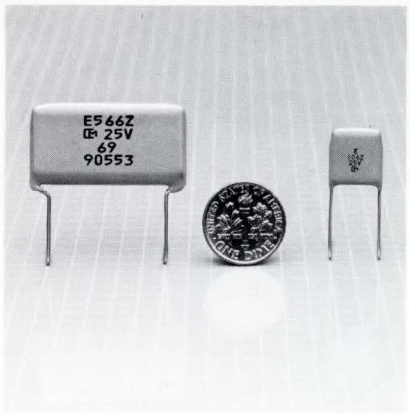


MURATA DESIGNATION	★RPE 110		★RPE 121/RPE 122	
L (Max.)	.138 (3.5)		.200 (5.1)	
H (Max.)	.120 (3.1)		.250 (6.4)	
T (Max.)	.100 (2.5)		.125 (3.2)	
L.S.	.100 (2.5)		.100 (2.5)/.200 (5.1) .	
WVDC	50	100	50	100
TC: N150 (P2H) Cap. Range: (pF)	1 – 360	1 – 360	1 – 2400	1 – 2200
TC: N220 (R2H) Cap. Range: (pF)	1 – 560	1 – 510	1 – 2700	1 – 2400
TC: N330 (S2H) Cap. Range: (pF)	1 – 470	1 – 430	1 – 3300	1 – 3000
TC N470 (T2H) Cap. Range: (pF)	1 – 390	1 – 510	1200	240
TC: N750 (U2J) Cap. Range: (pF)	1 – 1800	1 – 960	15 – 7500	15 – 4700

MONOLTIHIC CERAMIC CAPACITOR TO REPLACE ALUMINUM ELECTROLYTICS

muRata

RPE 210-260



FEATURES

- High long term reliability (10 to 20 years)
- Non-polarized
- Increased high frequency performance reduces total capacitance requirements for equivalent impedance
- Epoxy coating meets UL94V-0

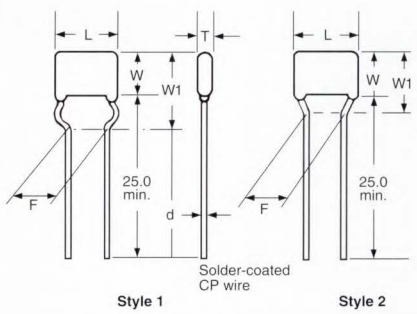
These new monolithic ceramic capacitors are specifically designed to replace aluminum electrolytic capacitors in a variety of applications. The high frequency performance of these devices makes them particularly suitable for use in the secondary suppression circuits in switching power supplies and other circuits with high frequency performance requirements.

PART NUMBERING SYSTEM

RPE230 Z5U 106 Z 050V

- RPE230 — Type
- Z5U — Temperature Characteristics
- 106 — Nominal Capacitance
- Z — Capacitance Tolerance
- 050V — Rated Voltage

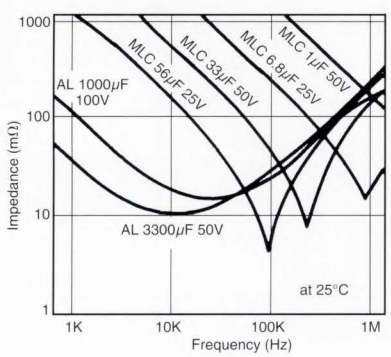
DIMENSIONS: in. (mm)

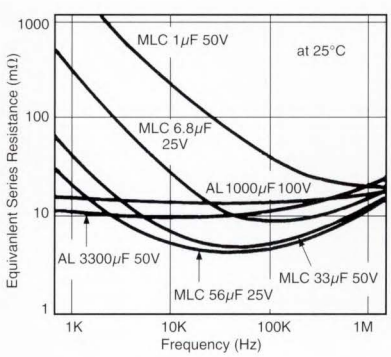


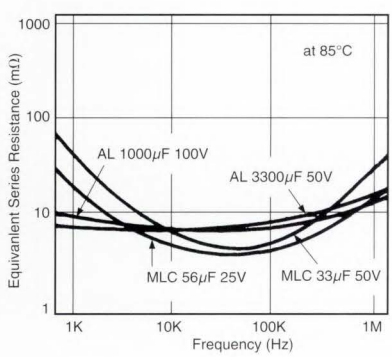
CAPACITANCE RANGE (μF)

Type (Lead Space)	Rated Voltage and Capacitance Range (μF)				Dimensions (mm)					Lead Style
	25VDC	50VDC	75VDC	100VDC	W1 max.	L	T max.	F	d	
★RPE210 (5.0 mm)	2.2, 3.3, 4.7	1.5, 2.2, 3.3	—	1.0, 1.5	10.0	7.5	4.0	5.0 ± 0.8	0.6 ± 0.05	1
★RPE220 (5.0 mm)	6.8, 10	4.7	—	2.2	12.0	10.0	4.0	5.0 ± 0.8	0.6 ± 0.05	2
★RPE230 (10.0 mm)	15	6.8, 10	—	3.3, 4.7	15.0	12.5	5.0	10.0 ± 0.8	$0.6^{+0.06}_{-0.05}$	1
★RPE240 (15.0 mm)	22, 33	15, 22	—	6.8	17.5	17.5	5.0	15.0 ± 0.8	$0.8^{+0.06}_{-0.05}$	1
★RPE250 (15.0 mm)	47	33	10	—	18.0	24.0	7.5	15.0 ± 0.8	$0.8^{+0.08}_{-0.05}$	2
★RPE260 (25.4 mm)	68, 100	47, 68	15, 22	—	21.0	35.0	7.5	25.4 ± 1.5	$0.8^{+0.08}_{-0.05}$	2

FREQUENCY PERFORMANCE CHARACTERISTICS



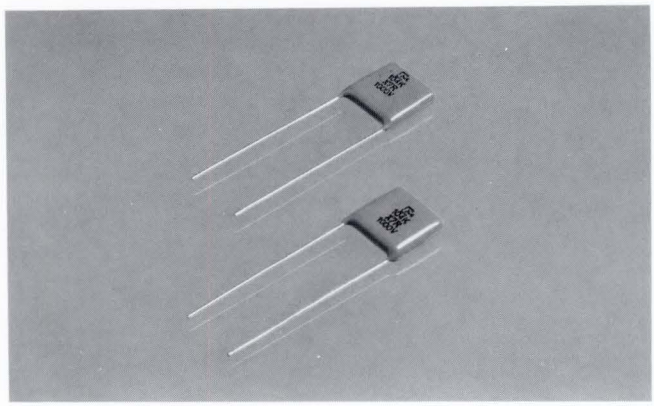




★Available as standard through authorized Murata Electronics Distributors.

CV LEADED CAPACITORS
1000 TO 5000V RATED
RPE900 SERIES

COG



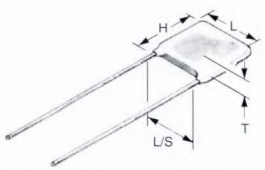
These new radial leaded epoxy encapsulated components are designed for emerging requirements in high voltage power supplies, video display terminals, and others. Rugged construction improves reliability in environmental extremes, especially found in military/aerospace applications. Special configuration and high reliability screening, including corona testing, are available.

FEATURES*

- Voltage up to 5KV
- –55°C to +125°C rated

BENEFITS

- Improves long term reliability
- Suitable for harsh environments

MURATA DESIGNATION		RPE 940					RPE 950					RPE 960					RPE 970					RPE 980				
DIMENSIONS: in.	L	.400 Max.					.500 Max.					.600 Max.					.700 Max.					.800 Max.				
	H	.355 Max.					.455 Max.					.555 Max.					.650 Max.					.750 Max.				
	T max.	.280 Max.					.327 Max.					.327 Max.					.375 Max.					.375 Max.				
	L/S	.300 ± .031					.400 ± .031					.500 ± .031					.600 ± .031					.700 ± .031				
	Lead Length	1.00 Min.					1.00 Min.					1.00 Min.					1.00 Min.					1.00 Min.				
WVDC		1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV	1KV	2KV	3KV	4KV	5KV
CAPACITANCE	(pF) 100					100																				
				220	220	180				270	220															
			680	680					680	680	390					560										
	1000														820	1000										
		1200	1200					1500						1500	1500						1500					1800
		2200					2700	2700	1800											2200	2200				2200	2200
							5600						3300	3900					2700	2700				2700	2700	
												6800	6800					6800	6800				.010	.010		
	(μF) .010											.012					.012	.012				.018	.018			
																	.022					.027				

CV LEADED CAPACITORS
1000 TO 5000V RATED
RPE900 SERIES

muRata

X7R

PART NUMBERING SYSTEM

RPE950 — X7R 103 K 1KV A B

CAPACITOR TYPE AND SIZE
RPE=Radial Leaded

Two or three-digit code appears as necessary to indicate special thickness requirements. Please consult your local factory for details.

TEMPERATURE CHARACTERISTIC
Standard TC's
COG=0±30ppm
X7R=±15%

CAPACITANCE VALUE
Identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

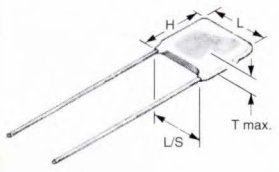
CAPACITANCE TOLERANCE
COG:
F=±1%
G=±2%
J=±5%
K=±10%
X7R:
K=±10%
M=±20%
J=±5% on special request

VOLTAGE
Identified by a three-digit number.
1000=1KV
2000=2KV
3000=3KV
4000=4KV
5000=5KV

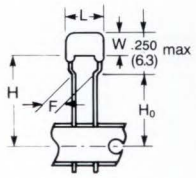
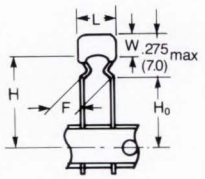
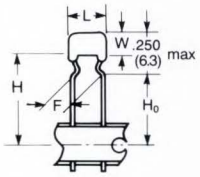
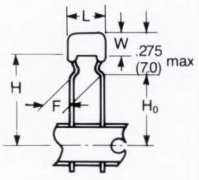
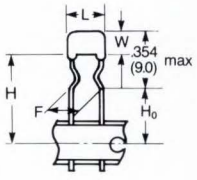
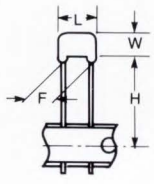
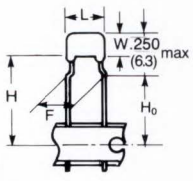
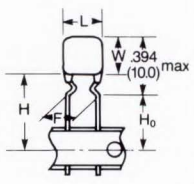
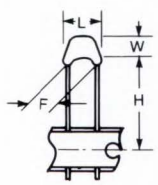
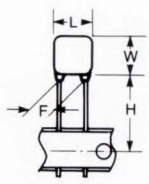
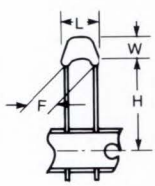
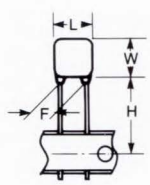
MARKING
A=Unmarked
B=EIA Marking
C=Non-standard Marking

PACKAGING
Bulk=B
(Tape and Reel not available)

Standard package and lead configurations shown. All RPE wire is 20Awg solder coated copper wire. For other requirements, please contact your local sales office.

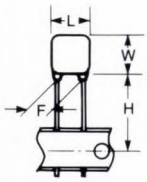
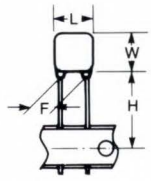
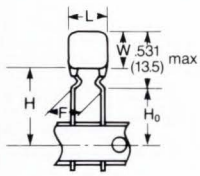
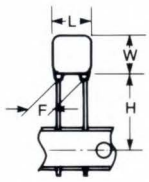
MURATA DESIGNATION		RPE 940					RPE 950					RPE 960					RPE 970					RPE 980				
DIMENSIONS: in.	**L**	.400 Max.					.500 Max.					.600 Max.					.700 Max.					.800 Max.				
	**H**	.355 Max.					.455 Max.					.555 Max.					.650 Max.					.750 Max.				
	T	.280 Max.					.327 Max.					.327 Max.					.375 Max.					.375 Max.				
	L/S	.300 ± .031					.400 ± .031					.500 ± .031					.600 ± .031					.700 ± .031				
	Lead Length	1.00 Min.					1.00 Min.					1.00 Min.					1.00 Min.					1.00 Min.				
WVDC		**1KV**	**2KV**	**3KV**	**4KV**	**5KV**	**1KV**	**2KV**	**3KV**	**4KV**	**5KV**	**1KV**	**2KV**	**3KV**	**4KV**	**5KV**	**1KV**	**2KV**	**3KV**	**4KV**	**5KV**	**1KV**	**2KV**	**3KV**	**4KV**	**5KV**
CAPACITANCE	(pF) 220				270	220					390															
			1000	390						820					1000										
	1000	2200			2200	1500		3900	1200		4700		8200	2700	1500				6800	3300	2200		8200		5600	3300
				4700			.010			8200						8200										
	(μF) .010	.068	.015					.047	.018			.018	.082	.033	.015		.039	.018		.033		.056	.022		.047	.027
	.10						.18					.33					.68	.18				1.0	.22	.10		
	1.0																									

CONFORMAL COATED
RADIAL LEADS
TAPE & REEL for AUTO INSERTION

DIMENSIONS: in. (mm)	Style/Variation Outline	DIMENSIONS: in. (mm)	Style/Variation Outline
★**RPE121-911** L: .200 (5.0) max. W: .200 (5.0) max. T: .125 (3.15) max. F: .100 (2.5) + .016 (0.4) − .008 (0.2) H_0: .630 (16.0) ± .020 (0.5) H: .709 (18.0) ± .039 (1.0)		★**RPE123-901** L: .300 (7.5) max. W: .216 (5.5) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H_0: .630 (16.0) ± .020 (0.5) H: .709 (18.0) ± .039 (1.0)	
★**RPE122-901** L: .200 (5.0) max. W: .200 (5.0) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H_0: .630 (16.0) ± .020 (0.5) H: .709 (18.0) ± .039 (1.0)		★**RPE 123-906** L: .300 (7.5) max. W: .216 (5.5) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H_0: .787 (20.0) ± .020 (0.5) H: .866 (22.0) ± .039 (1.0)	
★**RPE 122-905** L: .200 (5.0) max. W: .200 (5.0) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H_0: .630 (16.0) ± .020 (0.5) H: .787 (20.0) ± .039 (1.0)		★**RPE 123-977** L: .300 (7.5) max. W: .216 (5.5) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H: .787 (20.0) ± .020 (0.5)	
★**RPE 122-906** L: .200 (5.0) max. W: .200 (5.0) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H_0: .787 (20.0) ± .020 (0.5) H: .866 (22.0) ± .039 (1.0)		★**RPE113-901** L: .300 (7.5) max. W: .300 (7.5) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H_0: .630 (16.0) ± .020 (0.5) H: .748 (19.0) ± .039 (1.0)	
★**RPE 122-977** L: .200 (5.0) max. W: .200 (5.0) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H: .787 (20.0) ± .020 (0.5)		★**RPE 113-902** L: .300 (7.6) max. W: .300 (7.6) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H: .650 (16.5) ± .020 (0.5)	
★**RPE 122-978** L: .200 (5.0) max. W: .200 (5.0) max. T: .125 (3.15) max. F: .205 (5.2) ± .016 (0.4) H: .650 (16.5) ± .020 (0.5)		★**RPE 113-903** L: .300 (7.6) max. W: .300 (7.6) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H: .689 (17.5) ± .020 (0.5)	

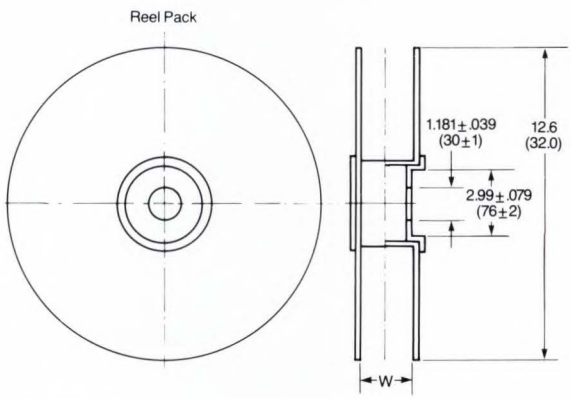
★ Available as standard through Authorized Murata Electronics Distributors.

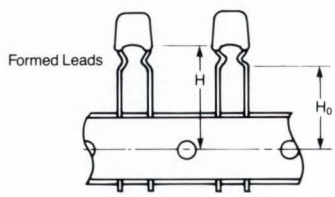
CONFORMAL COATED
RADIAL LEADS
TAPE & REEL for AUTO INSERTION

DIMENSIONS: in. (mm)	Style/Variation Outline	DIMENSIONS: in. (mm)	Style/Variation Outline
★**RPE 113-907** L: .300 (7.5) max. W: .300 (7.5) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H: .787 (20.0) ± .020 (0.5)		★**RPE 114-903** L: .40 (10.2) max. W: .40 (10.2) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H: .689 (17.5) ± .020 (0.5)	
★**RPE114-901** L: .40 (10.2) max. W: .40 (10.2) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H_0: .630 (16.0) ± .020 (0.5) H: .748 (19.0) ± .039 (1.0)		★**RPE 114-907** L: .400 (10.0) max. W: .400 (10.0) max. T: .157 (4.0) max. F: .205 (5.2) ± .016 (0.4) H: .787 (20.0) ± .020 (0.5)	

★Available as standard through Authorized Murata Electronics Distributors.

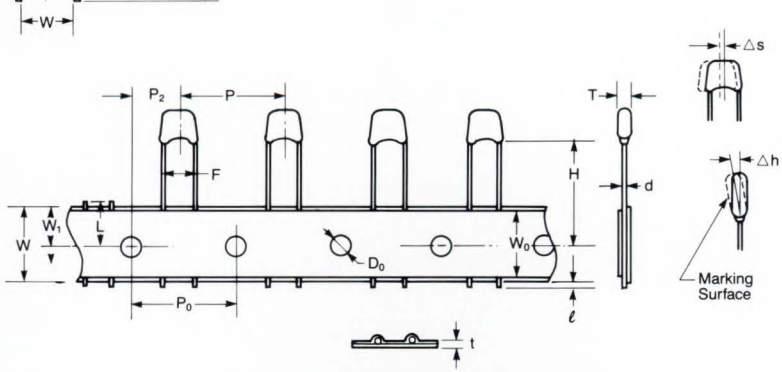
TAPE & REEL DIMENSIONS: in. (mm)





STANDARD QUANTITY PER REEL

Type & Size	Reel	Ammo
RPE 121	2500	2000
RPE 122	2500	2000
RPE 123	2000	2000
RPE 113	2000	2000
RPE 114	1500	1500



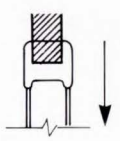
Taping Pitch P	Feed Hole Pitch P_0	Feed Hole Position P_2	Deviation Along Tape △S	Width of Tape Carrier W	Half Width of Tape Carrier W_1	Lead Protrusion ℓ	Diameter of Feed Hole D_0	Total Tape Thickness t	Deviation Across Tape △h	Cutting Position Failure L	Width of Masking Tape W_0	Margin Between Tape W_2
.500	.500 ±.008	.250 ±.051	±.079	.709 ±.020	$.354^{+0}_{-.020}$	−.039 to .020 (−1.0 to 0.5)	.157±.004 (4.0±0.1)	.028±.008 (0.7±0.2)	±.039 (±1.0)	$.433^{+0}_{-.039}$ ($11.0^{+0}_{-1.0}$)	.492 (12.5 min.)	.059±.059 (1.5±1.5)

SPECIFICATIONS

GENERAL

TEST	SPECIFICATIONS		
Operating Temperature Range	COG: –55°C to +125°C P2H: –55°C to +85°C R2H: –55°C to +85°C S2H: –55°C to +85°C T2H: –55°C to +85°C U2J: –55°C to +85°C X7R: –55°C to +125°C Z5U: +10°C to +85°C Y5V: –30°C to +85°C		
Temperature Coefficient	COG: 0±30ppm/°C over temp. range of –55°C to +125°C P2H: N150±60ppm/°C over temp. range of –55°C to +85°C R2H: N220±60ppm/°C over temp. range of –55°C to +85°C S2H: N330±60ppm/°C over temp. range of –55°C to +85°C T2H: N470±60ppm/°C over temp. range of –55°C to +85°C U2J: N750±120ppm/°C over temp. range of –55°C to +85°C	**T.C. Tolerance Capacitance (pF)***	**T.C. Tolerance (ppm)**
		10 and over	± 30(G)
		4.0-9.9	± 60(H)
		2.1-3.9	±120(J)
		.4-2.0	±250(K)
	X7R: ±15% over temp. range of –55°C to +125°C Z5U: +22, –56% over temp. range of –10°C to +85°C Y5V: +22, –82% over temp. range of –30°C to +85°C	*Refer to EIA RS198 for limitations.	

MECHANICAL

TEST	TEST METHOD	REQUIREMENT
Lead Pull Strength	MIL-STD-202, Method 211A, Test Condition A	Radial direction: RPE 110: 2 lb. min. others: 5 lb. min. 
Solderability	MIL-STD-202, Method 208F.	Lead wire will exhibit >95% coverage on conformal coated units.
Resistance to Soldering Heat	MIL-STD-202, 210A Parts are immersed in solder bath: RPE 110, 270±5°C for 3±0.5 sec. All other RPE types: 350±10°C for 3±0.5 sec.	Appearance: No Damage ΔC: COG=±0.25pF or ±2.5% (whichever is greater). X7R=±7.5% max. Z5U ±20% max. Y5V=±20% max. After 48±4 hour period, parts should satisfy all initial requirements for D.F., I.R., and Flash Voltage (2.5xWV). (500V=2xWV). 25% max. leaching on each edge.
Vibration	MIL-STD-202 method 204D condition B 10-2,000 Hz, 15 G's	Appearance: No Damage Initial value guarantee
Shock	MIL-STD-202 Method 213B, Condition I	Appearance: No Damage Initial value guarantee

SPECIFICATIONS

ELECTRICAL

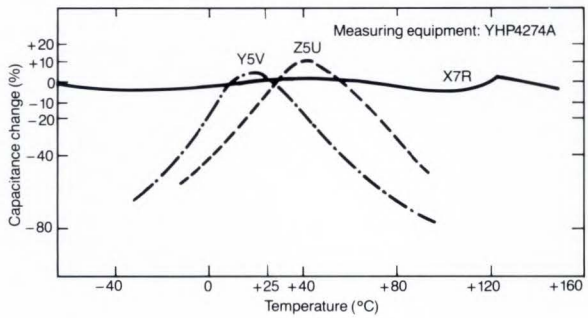
TEST	TEST METHOD	REQUIREMENT
Capacitance (Voltage and Frequency)	COG: over 1,000pF 1KHz±100Hz, 1±0.2Vrms up to 1,000pF 1MHz±100KHz, 1±0.2Vrms X7R: 1KHz±100Hz, 1±0.2Vrms Z5U/Y5V: 1KHz±100Hz, .5V±.1Vrms	
Q/Dissipation Factor (Volt. & Freq. same as Cap. Test)	COG: (less than 30pF), Q≥400+(20•C(pF)) @ 25°C (30pF and over), Q≥ 1,000 @ 25°C X7R: D.F. = 2.5% max. @ 25°C Z5U: D.F. = 3.0% max. @ 25°C, (5.0% max. @ 25°C for RPE200 Series) Y5V: D.F. = 3.5% max. @ 25°C	
Insulation Resistance	Apply rated voltage for max. of 2 min. with 50mA limiting current.	COG, X7R : 100,000MΩ or 1,000MΩ•μF (whichever is less). Z5U, Y5V : 10,000MΩ or 500MΩ•μF (whichever is less).
Dielectric Strength	2.5 x WV for 5 sec. with a series resistor limiting the charging current to 50 mA max. (500V=WV x 2) (1,000V = WV x 1.5) (2,000 – 5000V = WV x 1.2) (Please see p19, C-19-A)	No dielectric breakdown
Typical Aging Rate (ΔC per decade hour)	COG: negligible X7R : –3.0% Z5U : –5.0% Y5V : –7.0%	

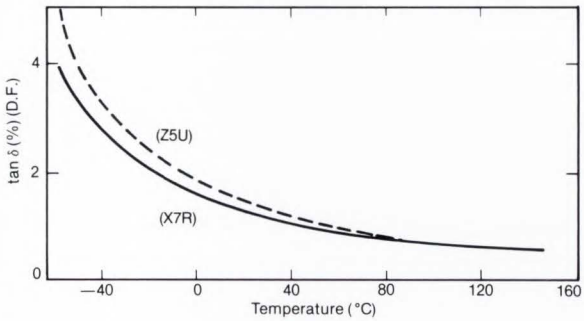
ENVIRONMENTAL

TEST	TEST METHOD	REQUIREMENT
Thermal Shock	MIL-STD-202, method 107, condition A Prior to starting Thermal Shock test, capacitors shall be heat treated (deaged) for one (1) hour at 150°C. Allow capacitors to stabilize at room temperature for 24 hours prior to taking initial measurements. Post thermal Shock measurement shall be taken after 24 hours stabilization.	Appearance: No visual damage ΔC : COG = ±2.0% or ±0.5pF (whichever is greater) X7R = ±12.5% Z5U = ± 20.0% Y5V = ± 30.0% Q : COG = 1,000 min. (>30pF), >400+(20•C(pF)) (≤30pF) D.F. : X7R = 2.5% max. @ 25°C, Z5U = 3.0% max. @25°C, (5.0% max. @25°C for RPE200 Series) Y5V = 5.0% max. @ 25°C I.R. : COG/X7R = 100,000MΩ min. or 1,000MΩ•μF (whichever is less) Z5U/Y5V = 10,000MΩ or 500Ω•μF min. (whichever is less)
Humidity (No Load) **Humidity (Load)** **Life Test**	500±12 hours at 40±2°C in 90 to 95% humidity 500±12 hours at 40±2°C in 90 to 95% humidity with rated voltage applied (max. current 50mA) 1,000±12 hours at max. rated temperature with 200% rated voltage applied. Prior to starting Life Test, capacitors shall be voltage treated for 1 hour with 200% rated voltage applied at max. rated temperature. Allow capacitors to stabilize for 24 hours prior to taking initial measurements. Post Life Test measurements shall be taken after 24 hours stabilization.	Appearance: No visual damage ΔC : COG = ±2.0% or ±0.5pF(whichever is greater) X7R = ±12.5% Z5U = ±30.0% Y5V = ±30.0% Q : COG = 500 min. (>30pF) 200+(10•C(pF)) (≤30pF) D.F. : X7R = 3.0% max. @ 25°C, Z5U = 3.5% max. @ 25°C, (7.5% max. @ 25°C for RPE200 Series) Y5V = 7.0% max. @ 25°C I.R.: COG/X7R = 10,000MΩ min. or 100MΩ•μF (whichever is less) Z5U/Y5V = 1,000MΩ min. or 500MΩ•μF min. (whichever is less)

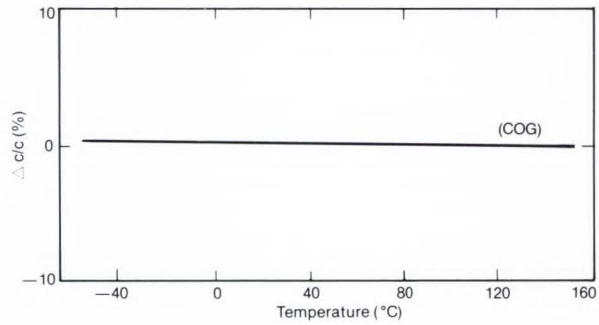
TYPICAL PERFORMANCE CHARACTERISTICS

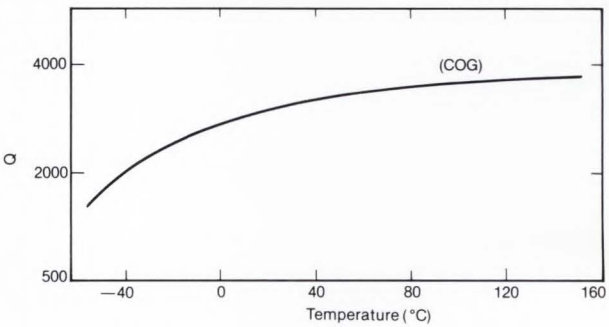
TEMPERATURE VS. CAPACITANCE AND DISSIPATION FACTOR: X7R, Z5U



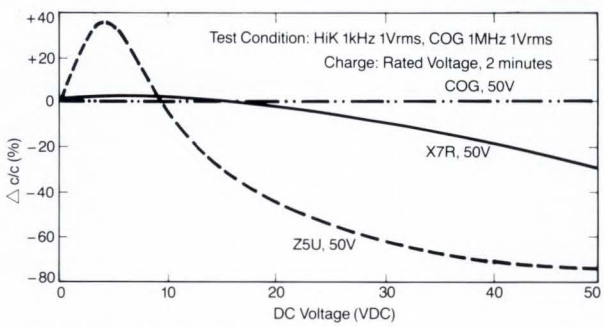


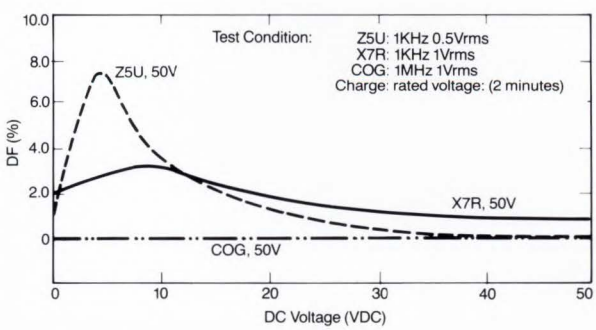
TEMPERATURE VS. CAPACITANCE AND Q:COG (NPO)



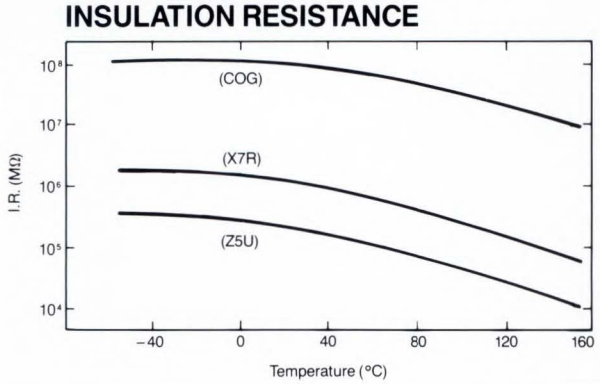


DC VOLTAGE VS. CAPACITANCE AND DISSIPATION FACTOR

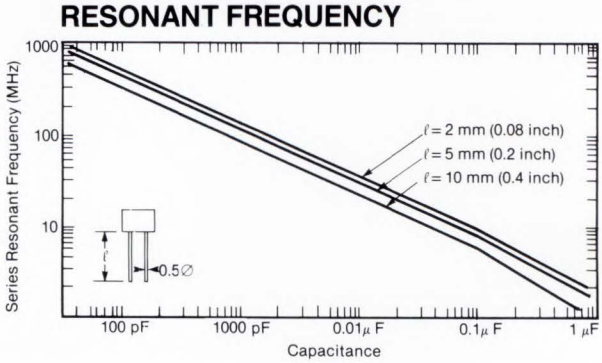




TEMPERATURE VS. INSULATION RESISTANCE

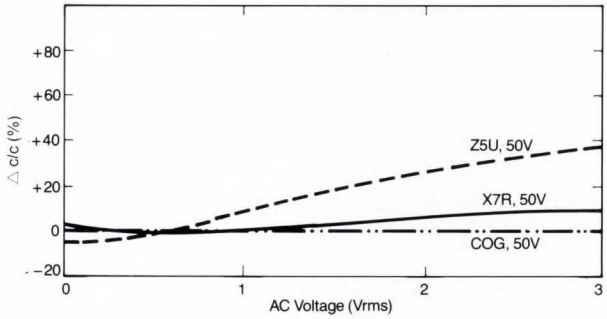


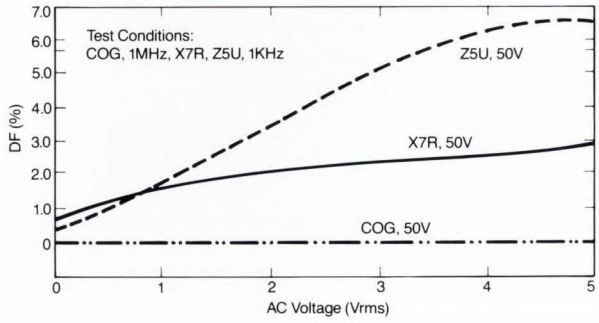
CAPACITANCE VS. SERIES RESONANT FREQUENCY



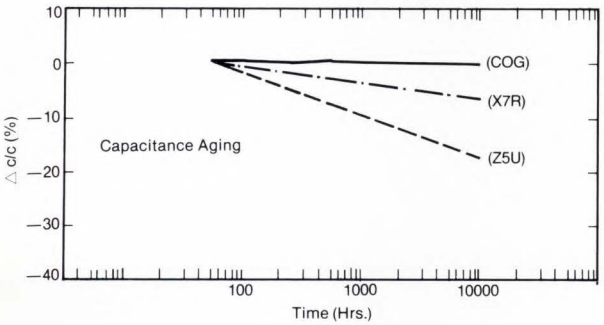
TYPICAL PERFORMANCE CHARACTERISTICS

AC VOLTAGE VS. CAPACITANCE AND DISSIPATION FACTOR

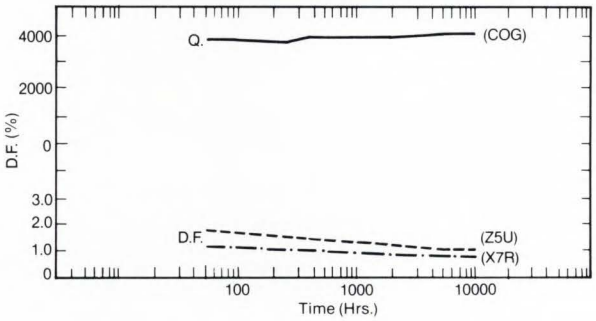




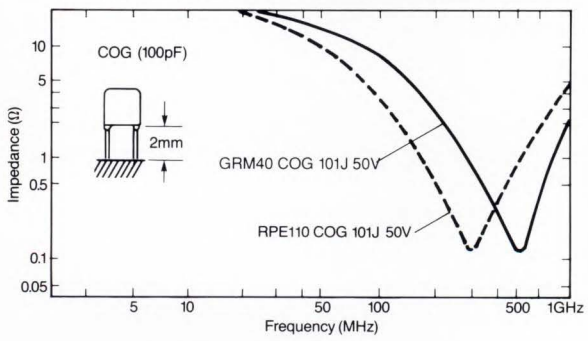
CAPACITANCE VS. TIME (Aging)



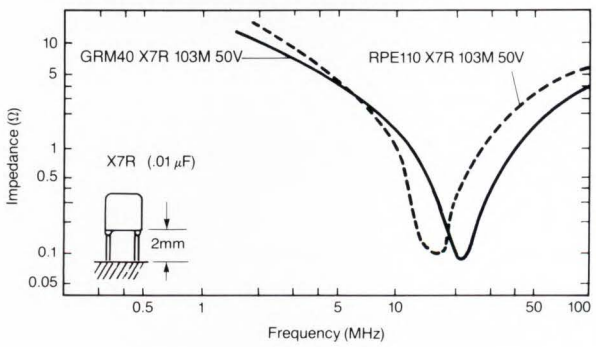
DISSIPATION FACTOR AND Q VS. TIME (Aging)



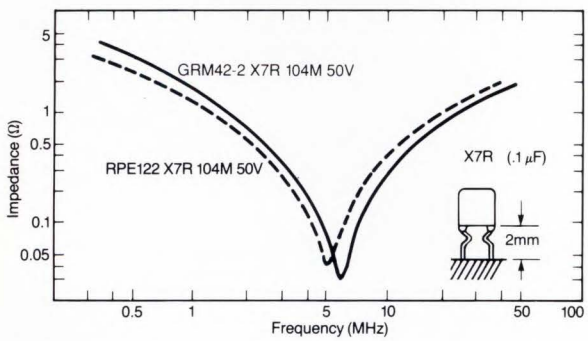
IMPEDANCE VS. FREQUENCY



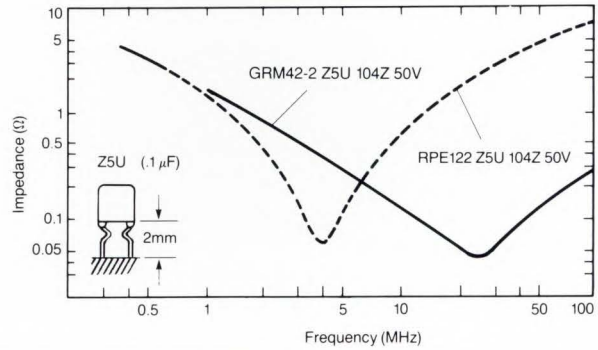
IMPEDANCE VS. FREQUENCY

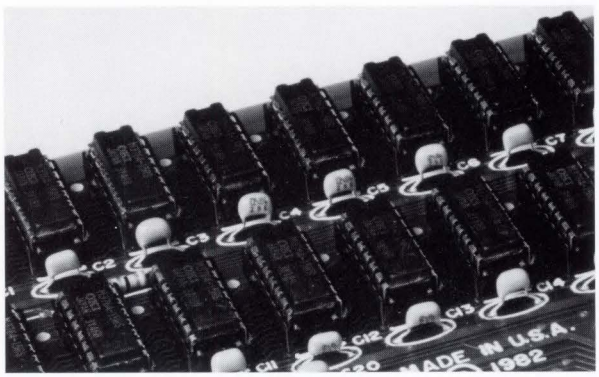


IMPEDANCE VS. FREQUENCY

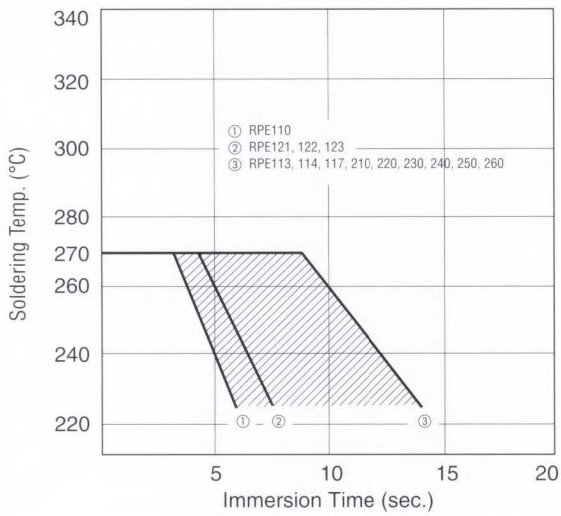


IMPEDANCE VS. FREQUENCY





1. Allowable conditions for Soldering Temperature vs. Time perform soldering within a tolerance range (shaded area).



2. A) When soldering, insert the lead wire into the PCB without mechanically stressing the lead wire.

B) Insert the lead wire into the PCB with a distance appropriate to the lead space.

GLOSSARY OF SPECIALIZED CAPACITOR TERMS

1–DIELECTRIC:

Sometimes called "Insulator," a dielectric is a material whose internal charges are bound and can therefore only move over atomic dimensions. It separates the conductive capacitor plates and is important in determining temperature characteristics, voltage rating, capacity/volume and other characteristics of a capacitor.

2–DISSIPATION FACTOR ("DF"):

The dissipation factor of an insulating material is defined as the ratio of energy dissipated to energy stored in the dielectric. The DF is frequency sensitive and must be specified at a given frequency.

3–QUALITY FACTOR ("Q"):

The Q factor is the ratio of energy stored to energy dissipated and is therefore often taken as the inverse of the DF at low frequency. Sometimes called "Figure of Merit," Q factors must be specified at a given frequency.

4–WORKING (OR "RATED") VOLTAGE:

Nominal continuous voltage which may be applied to a component with no derating of any kind.

5–DIELECTRIC WITHSTANDING VOLTAGE:

The peak voltage which the component is designed to withstand without damage for short periods of time. This value must be specified in terms of frequency, waveform, and time.

6–INSULATION RESISTANCE (IR):

I.R. is the terminal to terminal DC resistance of a capacitor, and must be specified in terms of voltage, temperature, and relative humidity.

Typically expressed as a minimum resistance or as an R•C product.

Example of IR expressed using R•C product: If a material is rated at 500 Ω•F, also expressed as 500MΩ•μF

For 1.0 μF IR ≥ 500 MΩ
0.1 μF ≥ 5000 MΩ
0.01 μF ≥ 50,000 MΩ

7–TEMPERATURE COEFFICIENT ("TC"):

"TC" is the decimal change in capacity per degree change in environmental temperature. Some dielectrics are very lossy and generate internal heat and for that reason this test is conventionally conducted under "no load" conditions. The standard definition for "TC" in parts per million per degree centigrade is...

$$TC = \frac{(Cx - Co)}{Co} \times \frac{(10^6)}{(Tx - To)} /°C$$

Where "Tx" is the test temperature, "To" is the reference temperature—usually 25°C. "Co" is the capacity measured at the reference temperature and "Cx" is the capacity measured at the test temperature.

8–DRIFT:

The extent in pF or % to which capacitor changes value as a result of temperature exposure. Sometimes called "Retrace," this measurement is usually made under nominal (i.e. room) conditions and is accomplished both before and after the conclusion of temperature excursion. (Note: "Drift" may occasionally be used in the test context of the simple passage of time).

9–TOLERANCE OF CAPACITANCE:

Is defined as the maximum percentage of deviation from the nominal capacitance value when measured at a standard temperature, voltage and frequency.

10–TERMINATION:

This term refers to the material and/or geometry of the terminals of the capacitor.

11–CHIP, MONOLITHIC OR MULTILAYER CAPACITOR (MLC):

All of these terms, and any combination of them, refer to a ceramic capacitor style which consists of alternate layers of ceramics and conductive (metallic) surfaces which are compressed and vitrified to form a single "monolithic" structure. Alternate metallic surfaces are then interconnected to form a two terminal capacitor.

12–ESR:

The sum of the equivalent series resistances of the electrode resistance and loss tangent of the dielectric, otherwise known as the real part of the capacitors equivalent circuit impedence (Note: The dielectric loss tangent is frequency dependent as is ESR).

13–AGING:

Aging is the change in the dielectric constant as a function of time. Aging is particularly noticeable in high dielectric materials and is measured as a percentage change per decade of time. Aging decreases logarithmically and becomes less apparent with time.

NOTES

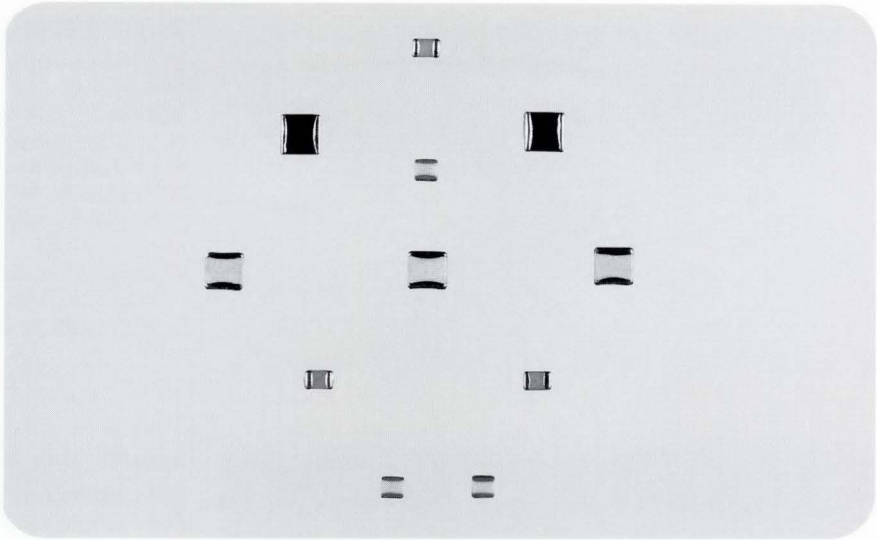
CERAMIC MICROWAVE CAPACITORS

Today's high frequency applications require stable, miniature, high Q, low noise capacitors in order to meet modern design objectives.

Murata Electronics meets those objectives by offering one of the world's largest varieties and capabilities of high frequency capacitors for the instrumentation and communications market place.

The MA series ceramic fixed capacitors are miniature, high performance precision components with extremely high Q and high power capabilities up to the gigahertz frequency ranges. The GRH700 series are high frequency chip capacitors popular for communications applications. The GRH700 series chip capacitors were designed for high volume applications where low cost is a primary design objective. This series is intended to bridge the gap between the standard COG chip capacitors and the high performance MA series.

Whether your application calls for the MA series or GRH700 series you can rely on Murata's expertise to supply a reliable, repeatable product for your high frequency applications.



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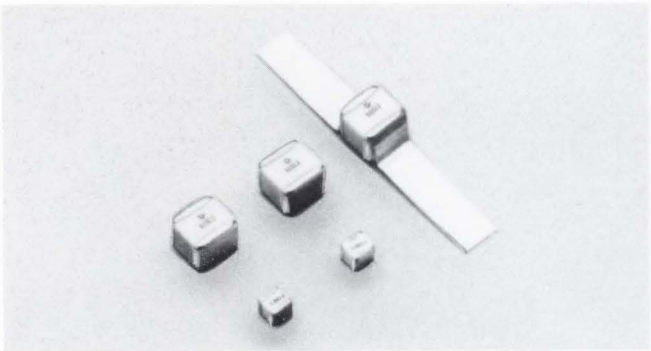
CERAMIC MICROWAVE CAPACITORS

MA Series



OUTSTANDING CHARACTERISTICS

- **Miniature size**
- **Very high Q at high frequencies**
- **High RF power capabilities**
- **Impervious to environmental conditions**
- **Low dissipation factors**
- **Excellent retrace capability (not applicable for X7R styles)**
- **High temperature stability**
- **Low noise**
- **Meets Mil-C-55681 with respect to: Shock, Vibration, Moisture Resistance, Solderability, Barometric Pressure, Temperature Cycling, Immersion and Salt Spray**

4X ACTUAL SIZE
(Illustrated with laser marking)

ADDITIONAL FEATURES

- **Standard and special marking available**
- **Packaging options**
- **Lot processing data available**

MA SERIES

For filtering, coupling and impedance matching in most RF circuits, the MA Series chips and leaded devices offer outstanding performance and reliability with the greatest range of values and configurations. MA Series capacitors are also available in military grade CDR styles, consult factory.

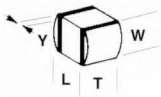
MA Series ceramic fixed capacitors are miniature, high performance precision components having extremely high Q and high power capabilities from low frequencies to gigahertz ranges. These "porcelain" multilayer capacitors are extremely stable with variations in temperature, voltage and frequency, and are capable of withstanding the environments encountered in space applications.

MA Series capacitors are designed for miniature state-of-the-art circuit applications. They are small, easy to apply and have extreme reliability. Units are available in ultra-miniature case size 1 (.055″ × .055″ × .055″) or miniature case size 2 (.110″ × .110″ × .100″). Standard case size 1 units are available as chips. Standard case size 2 units are available as chips and also in a leaded configuration.

Clean-room manufacturing technology assures product reliability and automated processing reduces costs and cycle time. Key stages of the operation are monitored and controlled with SPC techniques. Flexibility in design allows the production of non-standard values while maintaining consistent quality objectives.

Please contact the factory for availability of special configurations or high-reliability screening.

CONFIGURATIONS AND DIMENSIONS – CASE SIZE 1

Type			Configuration	Dimensions: in. (mm)			Band	Termination
P90±20 ppm/°C	COG±30 ppm/°C	X7R*		Length	W±.010 (.25)	T max.	Y +.010 −.005 (+.25/−.1)	
MA18	MA58	MA78*		.07 max. (1.8 max.)	.055 (1.4)	.055** (1.4)	.010 (.25)	Palladium Silver, Ni Interface & Solder (Sn 62)

**.065″ (1.65) Max. Thickness, X7R

PART NUMBERING SYSTEM – CASE SIZE 1

M A 1 8 101 J

CUBIC MONOLITHIC

A-STD SERIES

DIMENSIONAL AND T.C. CODE
1:P90

5:C0G

7:X7R

TERMINATION CODE:
8:Pd/Ag, Ni interface, Solder (Sn62)

CAPACITANCE CODE:
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

TOLERANCES:
*B:±0.1pF
*C:±0.25pF
*D:±0.5pF
F:±1%
G:±2%
J:±5%
**K:±10%
**M:±20%
**Z:+80%, −20%

*Available below 10pF only

**X7R Styles

CERAMIC MICROWAVE CAPACITORS

MA★ 18, 58 & 78 Series

MA 10 & 50 SERIES, P90 & COG – CASE SIZE 1

Cap. Code	Cap. pF	Cap. Tol.	WVDC*
0R1	0.1	B	150
0R2	0.2	"	150
0R3	0.3	B,C	150
0R4	0.4	"	150
★0R5	0.5	B,C,D	150
0R6	0.6	"	150
0R7	0.7	"	150
0R8	0.8	"	150
0R9	0.9	"	150
★1R0	1.0	"	150
1R1	1.1	"	150
★1R2	1.2	"	150
1R3	1.3	"	150
1R4	1.4	"	150
★1R5	1.5	"	150
1R6	1.6	"	150
1R7	1.7	"	150
★1R8	1.8	"	150
1R9	1.9	"	150
2R0	2.0	"	150
★2R2	2.2	"	150
2R4	2.4	"	150
★2R7	2.7	"	150
3R0	3.0	"	150
★3R3	3.3	"	150
3R6	3.6	"	150
★3R9	3.9	"	150
4R3	4.3	"	150

*@ 125°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC*
★4R7	4.7	B,C,D	150
5R1	5.1	"	150
★5R6	5.6	"	150
6R2	6.2	"	150
★6R8	6.8	B,C,J,K,M	150
7R5	7.5	"	150
★8R2	8.2	"	150
9R1	9.1	"	150
★100	10	F,G,J,K,M	150
110	11	"	150
★120	12	"	150
130	13	"	150
★150	15	"	150
160	16	"	150
★180	18	"	150
200	20	"	150
★220	22	"	150
240	24	"	150
★270	27	"	150
300	30	"	150
★330	33	"	150
360	36	"	150
★390	39	"	150
430	43	"	150
★470	47	"	150
510	51	"	150
★560	56	"	150
620	62	"	150

*@ 125°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC*
★680	68	F,G,J,K,M	150
750	75	"	150
★820	82	"	150
910	91	"	150
★101	100	"	150
111**	110	"	50
121**	120	"	50
131**	130	"	50
★151**	150	"	50
161**	160	"	50
★181**	180	"	50
201**	200	"	50
★221**	220	"	50
241**	240	"	50
★271**	270	"	50
301**	300	"	50
★331**	330	"	50
361**	360	"	50
★391**	390	"	50
431**	430	"	50
★471**	470	"	50
511**	510	"	50
★561**	560	"	50
621**	620	"	50
★681**	680	"	50
751**	750	"	50
★821**	820	"	50
911**	910	"	50
★102**	1000	"	50

*@ 125°C

★Available as standard through authorized Murata Electronics Distributors.

**Extended Cap Range, COG only

MA 70 SERIES, X7R – CASE SIZE 1

Cap. Code	Cap. pF	Cap. Tol.	WVDC***
511	510	K,M,Z	50
561	560	"	50
621	620	"	50
681	680	"	50
751	750	"	50
821	820	"	50
911	910	"	50
102	1000	"	50
112	1100	"	50
122	1200	"	50
132	1300	"	50

***@ 85°C

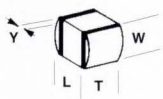
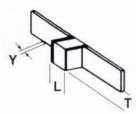
Cap. Code	Cap. pF	Cap. Tol.	WVDC***
152	1500	K,M,Z	50
162	1600	"	50
182	1800	"	50
202	2000	"	50
222	2200	"	50
242	2400	"	50
272	2700	"	50
302	3000	"	50
332	3300	"	50
362	3600	"	50
392	3900	"	50

***@ 85°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC***
432	4300	K,M,Z	50
472	4700	"	50
512	5100	"	50
562	5600	"	50
622	6200	"	50
682	6800	"	50
752	7500	"	50
822	8200	"	50
912	9100	"	50
103	10000	"	50

***@ 85°C

CONFIGURATIONS AND DIMENSIONS – CASE SIZE 2

Type				Configuration	Dimensions: in. (mm)			Band	Termination
P90±20 ppm/°C	P90±30 ppm/°C	COG±30 ppm/°C	X7R*		L±.020 (.5)***	W±.010 (.25)	T max.	Y±.010 (.25)	
MA28	MB28	MA68	MA88*		.130 max.	.110 (2.8)	.100** (2.5)	.015 (.4)	Palladium Silver, Ni Interface & Solder (Sn62)
MA22	MB22	MA62	MA82*		.135 (3.4)	—	—	—	Microstrip see note 1

NOTE: Ag ribbon .093(2.3) ± .005(.1) Wide x .004(.1) ± .001(.03) Thick x .250(6.35) Long (typical)

**.115(2.92) Max. Thickness, X7R T.C.

PART NUMBERING SYSTEM – CASE SIZE 2

M A 2 8 101 J

CUBIC MONOLITHIC

A-STD SERIES

DIMENSIONAL AND T.C. CODE
2:P90
6:COG
8:X7R

TERMINATION CODE:
8:Pd/Ag, Ni interface, Solder (Sn62) (Preffered)
2:MicroStrip

CAPACITANCE CODE:
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

TOLERANCES: ZEROS
*B:±0.1pF
*C:±0.25pF
*D:±0.5pF
F:±1%
G:±2%
J:±5%
**K:±10%
**M:±20%
**Z:+80%, –20%

*Available below 10pF only.

**X7R Styles

CERAMIC MICROWAVE CAPACITORS

MA★ 28, 68 & 88 Series

MA 20 & 60 SERIES, P90 & COG – CASE SIZE 2

Cap. Code	Cap. pF	Cap. Tol.	WVDC*
0R1	0.1	B	500
0R2	0.2	"	500
0R3	0.3	B,C	500
0R4	0.4	"	500
★0R5	0.5	B,C,D	500
0R6	0.6	"	500
0R7	0.7	"	500
0R8	0.8	"	500
0R9	0.9	"	500
★1R0	1.0	"	500
1R1	1.1	"	500
★1R2	1.2	"	500
1R3	1.3	"	500
1R4	1.4	"	500
★1R5	1.5	"	500
1R6	1.6	"	500
1R7	1.7	"	500
★1R8	1.8	"	500
1R9	1.9	"	500
2R0	2.0	"	500
2R1	2.1	"	500
★2R2	2.2	"	500
2R4	2.4	"	500
★2R7	2.7	"	500
3R0	3.0	"	500
★3R3	3.3	"	500
3R6	3.6	"	500
★3R9	3.9	"	500
4R3	4.3	"	500
★4R7	4.7	"	500
5R1	5.1	"	500
★5R6	5.6	"	500
6R2	6.2	"	500
★6R8	6.8	B,C,J,K,M	500
7R5	7.5	"	500

*@ 125°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC*
★8R2	8.2	B,C,J,K,M	500
9R1	9.1	"	500
★100	10	F,G,J,K,M	500
110	11	"	500
★120	12	"	500
130	13	"	500
★150	15	"	500
160	16	"	500
★180	18	"	500
200	20	"	500
★220	22	"	500
240	24	"	500
★270	27	"	500
300	30	"	500
★330	33	"	500
360	36	"	500
★390	39	"	500
430	43	"	500
★470	47	"	500
510	51	"	500
★560	56	"	500
620	62	"	500
★680	68	"	500
750	75	"	500
★820	82	"	500
910	91	"	500
★101	100	"	500
111	110	"	300
★121	120	"	300
131	130	"	300
★151	150	"	300
161	160	"	300
★181	180	"	300
201	200	"	300
★221	220	"	200

*@ 125°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC*
241	240	F,G,J,K,M	200
★271	270	"	200
301	300	"	200
★331	330	"	200
361	360	"	200
★391	390	"	200
431	430	"	200
★471	470	"	200
511	510	"	100
★561	560	"	100
621	620	"	100
★681	680	"	50
751	750	"	50
★821	820	"	50
911	910	"	50
★102	1000	"	50
112**	1100	"	50
122**	1200	"	50
132**	1300	"	50
152**	1500	"	50
162**	1600	"	50
182**	1800	"	50
202**	2000	"	50
222**	2200	"	50
242**	2400	"	50
272**	2700	"	50
302**	3000	"	50
332**	3300	"	50
362**	3600	"	50
392**	3900	"	50
432**	4300	"	50
472**	4700	"	50
502**	5000	"	50
512**	5100	"	50

*@ 125°C

★Available as standard through authorized Murata Electronics Distributors.

**Extended Cap Range, COG only

MA 80 SERIES, X7R – CASE SIZE 2

Cap. Code	Cap. pF	Cap. Tol.	WVDC**
512	5100	K,M,Z	100
562	5600	"	100
622	6200	"	100
682	6800	"	100
752	7500	"	100
822	8200	"	100
912	9100	"	100
103	10000	"	100
113	11000	"	100
123	12000	"	100
133	13000	"	100

**@ 85°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC**
153	15000	K,M,Z	100
163	16000	"	100
183	18000	"	100
203	20000	"	100
223	22000	"	100
243	24000	"	100
273	27000	"	100
303	30000	"	100
333	33000	"	100
363	36000	"	100
393	39000	"	100

**@ 85°C

Cap. Code	Cap. pF	Cap. Tol.	WVDC**
433	43000	K,M,Z	100
473	47000	"	100
513	51000	"	100
563	56000	"	100
623	62000	"	100
683	68000	"	100
753	75000	"	100
823	82000	"	100
913	91000	"	100
104	100000	"	100

**@ 85°C

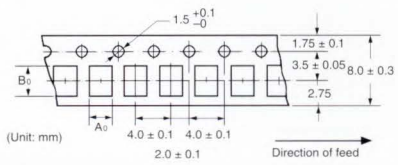
SPECIFICATIONS AND PACKAGING

MA Series

SPECIFICATIONS

Quality Factor	MA 18/28/58/68; Exceeds MIL-C-55681
Dissipation Factor	MA 78/88; 2.5% maximum @ 1.0VRMS maximum (f = 1KHz)
Temperature Coefficient	MA 18/28 Series P90 ±20ppm/°C, (–55°C to +125°C) MA 58/68 Series; COG (NPO ±30ppm/°C –55°C to +125°C) MA 78/88 Series; ±15% maximum (–55°C to +125°C)
Insulation Resistance	MA 18/28 1000K Megohms at +25°C, 100K Megohms at +125°C MA 58/68 1000K Megohms at +25°C, 100K Megohms at +125°C MA 78/88 100K Megohms or 1000 Megohm μF min., whichever is less (@ 25°C) 10K Megohms or 100 Megohms μF min., whichever is less (@ 125°C)
Dielectric Test Voltage	MA 18/28/58/68/78/88, 250% of WVDC for 5 seconds
Capacitance Drift	Meets or Exceeds MIL-C-55681 (Does not apply for MA 78/88)
Aging	Negligible for MA 18/28/58/68, MA 78/88; 2.5% per decade maximum
Environmental Tests	MIL-STD-202
Shock	Method 213, Condition J
Vibration	Method 204, Condition B
Moisture Resistance	Method 106
Solderability	Method 208
Immersion	Method 104, Condition B
Barometric Pressure	Method 105, Condition B
Resistance to Soldering Heat	Method 210, Condition B
Thermal Shock	Method 107, Condition A
Life	Method 108, Condition F
MARKING	MA 18/28/58/68; Laser mark Capacitance Code, Tolerance Code, Logo (where space permits) MA 78/88, Not Marked

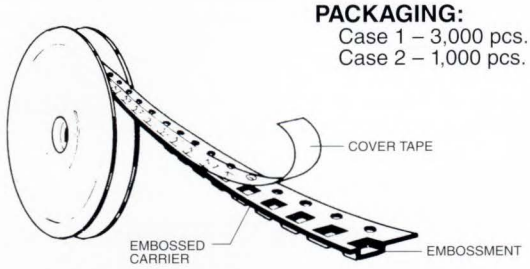
TAPE-AND-REEL PACKAGING



NOTE: 1 Ao & Bo ARE DETERMINED BY MAXIMUM SPECIFIED LENGTH AND WIDTH OF COMPONENTS PLUS 0.4 ± 0.2 (0.016 ± 0.008), PLUS THE ADDITIONAL REQUIREMENTS THAT COMPONENTS NOT BE ALLOWED TO ROTATE MORE THAN 20° WITHIN THE CAVITY CLEARANCE OR WHICHEVER CONDITION OCCURS FIRST.

DIMENSIONS: in. (mm)

PACKAGING:
Case 1 – 3,000 pcs.
Case 2 – 1,000 pcs.



CONDUCTIVE TAPE

Advantages	Benefits
Conductive	Prevents static charge build-up
Flexibility	Insures against crazing, cracking and brittleness
Dimensional strength	Drive loading will not elongate sprocket holes
Dimensional stability	Smooth, reliable running on pick and place machines

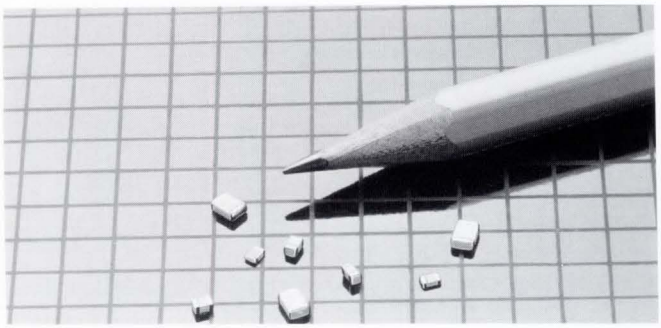
Other packaging options available — Consult Factory

ELECTRICAL PROPERTIES

Property	Value	Test Method
Surface Resistivity	1.8 x 10^3 ohm/square	ASTM D-257
Volume Resistivity	1.4 x 10^2 ohm-cm	ASTM D-257
Electrostatic Decay Time At 0% RH At 10% RH	 <1.25 sec (0% RH) <0.1 sec (10% RH)	Fed. Test Method Std. 101C Test Method 4046 (or) MIL B-81705B

LOW COST HIGH FREQUENCY CHIP CAPACITORS FOR COMMUNICATIONS APPLICATIONS

GRH708-710 Series



The GRH708-710 Series was designed specifically as an alternative to "cubic" chip capacitors in high-volume applications where low cost is a primary design objective. This product is manufactured with the same "porcelain" COG ceramic formulation and electrode material as are used in our MA Series. The rectangular shapes of this GRH708-710 Series allow for greater manufacturing automation resulting in lower cost. GRH708-710 capacitors bridge the gap between standard COG chips and the high performance MA Series, offering a low cost, high Q capacitor. Applications include cellular phone, GPS, and RF LAN.

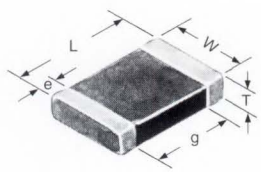
FEATURES

- Miniature sizes
- Stable COG temperature coefficient
- Very high Q at high frequencies
- High RF power handling capabilities
- Low noise
- Impervious to environmental conditions. Meets MIL-C 55681 with respect to: Thermal Shock, Moisture Resistance, Solderability, Resistance to soldering heat

SPECIFICATIONS

Operating Temperature Range	–55 to + 125°C
Temperature Coefficient	0 ± 30 ppm/°C
Working Voltage	See table, Pages 67 and 68
Dielectric Test Voltage (D.C.)	250% of rated working voltage (except 500 Volt rated @ 200%)
Capacitance Tolerance	C, D, G, J, K Available: Specials on request
Quality Factor (Q)/ESR	Consult Factory for Q/see table, page 67 and 68 for ESR
Insulation Resistance	@ 25°C: 0.1 to 470 pF: 1000K Megohms Min. over 470 pF: 100K Megohms Min. @ 125°C: 0.1 to 470 pF: 100K Megohms Min. over 470 pF: 10K Megohms Min.
Marking	All capacitors are marked with Logo, Capacitance Code and Tolerance Code (where space permits) Ink stamping or laser marking available

DIMENSIONS: in (mm)



	GRH708	GRH710
L	.080 ± 0.12 (2.0 ± 0.3)	.125 ± .016 (3.2 ± 0.7)
W	.050 + .012 (1.25 ± 0.3)	.100 ± .012 (2.5 ± 0.3)
T (max.)	.050 (1.25)	.060 (1.5)
g (min.)	.03 (0.7)	.04 (1.0)
e (min.)	.01 (0.25)	.012 (0.3)

PART NUMBERING

GRH 708 — COG — 220 — K — 100 — B — L

CAPACITOR TYPE AND SIZE
GRH = Nickel Barrier layer solder.

TEMPERATURE CHARACTERISTICS
Standard TC
COG = 0 ± 30ppm/°C
– 55°C to + 125°C

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For values below 10 pF, the letter "R" is used as the decimal point and the last digit becomes significant.

CAPACITANCE TOLERANCE
COG: (10pF or less)
C = ±.25pF
D = ±.5pF

(Over 10pF)
J = ±5%
K = ±10%

VOLTAGE
Identified by a three-digit number.

MARKING
A = No Marking
B = EIA Marking
C = Non-standard

PACKAGING
B =Bulk
L =7" Reel

LOW COST HIGH FREQUENCY CHIP CAPACITORS FOR COMMUNICATIONS APPLICATIONS

★GRH-708 Series

COG TEMPERATURE COEFFICIENT

Cap. & Tol. in pF	Ref. Freq. MHz	Effective Capacitance	Max ESR	Rated VDC
★1.0 ± .25	250	0.75/1.35	0.142	200
1.1 ± .25	248	0.85/1.46	0.140	200
★1.2 ± .25	245	0.95/1.57	0.138	200
1.3 ± .25	243	1.05/1.67	0.136	200
1.4 ± .25	242	1.15/1.78	0.135	200
★1.5 ± .25	242	1.25/1.89	0.134	200
1.6 ± .25	241	1.35/2.00	0.133	200
1.7 ± .25	241	1.45/2.11	0.133	200
★1.8 ± .25	240	1.55/2.21	0.132	200
1.9 ± .25	239	1.65/2.32	0.132	200
2.0 ± .25	238	1.75/2.43	0.131	200
2.1 ± .25	237	1.85/2.54	0.130	200
★2.2 ± .25	236	1.95/2.65	0.129	200
2.4 ± .25	235	2.15/2.85	0.127	200
★2.7 ± .25	233	2.45/3.19	0.125	200
3.0 ± .25	231	2.75/3.51	0.123	200
★3.3 ± .25	229	3.05/4.02	0.121	200
3.6 ± .25	228	3.35/4.18	0.120	200
★3.9 ± .25	227	3.65/4.53	0.119	200
4.3 ± .25	223	4.05/5.01	0.117	200
★4.7 ± .25	220	4.45/5.48	0.115	200
5.1 ± .25	218	4.85/5.88	0.113	200
★5.6 ± .50	215	5.35/6.49	0.111	200
6.2 ± .50	212	5.83/7.19	0.110	200
★6.8 ± .50	208	6.30/7.88	0.108	200
7.5 ± .50	206	7.00/8.60	0.106	200
★8.2 ± .50	203	7.70/9.36	0.104	200
9.1 ± .50	199	8.60/10.34	0.102	200
★10 ± .50	196	9.50/11.33	0.100	200
11 ± 5%	193	10.45/12.50	0.098	200
★12 ± 5%	190	11.40/13.61	0.096	200
13 ± 5%	185	12.35/14.75	0.094	200
14 ± 5%	183	13.30/15.89	0.094	200
★15 ± 5%	182	14.25/17.02	0.092	200
16 ± 5%	180	15.20/18.16	0.090	200
★18 ± 5%	176	17.10/20.42	0.088	200
20 ± 5%	173	19.00/22.70	0.087	200
★22 ± 5%	171	20.90/24.95	0.085	200
25 ± 5%	166	23.76/28.39	0.083	200
24 ± 5%	168	22.80/27.20	0.084	200
★27 ± 5%	164	25.69/30.78	0.082	200
28 ± 5%	163	26.63/31.93	0.081	200
30 ± 5%	163	28.50/34.23	0.080	200
32 ± 5%	161	30.40/36.51	0.079	200
★33 ± 5%	159	31.35/37.65	0.079	200
34 ± 5%	158	32.30/38.83	0.078	200
36 ± 5%	157	34.20/41.19	0.077	200
★39 ± 5%	155	37.05/44.79	0.075	200
43 ± 5%	153	40.85/49.99	0.073	200
★47 ± 5%	152	44.65/55.19	0.071	200
51 ± 5%	151	48.09/59.86	0.070	200
★56 ± 5%	148	52.40/65.70	0.068	200
62 ± 5%	147	58.50/72.85	0.067	200
★68 ± 5%	146	64.60/80.00	0.065	200
75 ± 5%	145	71.85/88.90	0.063	200
★82 ± 5%	144	78.78/97.30	0.062	200
91 ± 5%	143	86.70/106.80	0.060	200
★100 ± 5%	141	96.80/118.30	0.058	200
110 ± 5%	140	106.90/132.80	0.057	100
★120 ± 5%	139	117.00/147.40	0.057	100
130 ± 5%	138	127.10/162.10	0.056	100
140 ± 5%	138	137.20/177.90	0.056	100
★150 ± 5%	138	147.23/190.93	0.056	50
160 ± 5%	137	157.32/205.24	0.055	50

★Available as standard through authorized Murata Electronics Distributors.

LOW COST HIGH FREQUENCY CHIP CAPACITORS FOR COMMUNICATIONS APPLICATIONS

★GRH–710 Series

COG TEMPERATURE COEFFICIENT

Cap. & Tol. in pF	Ref. Freq. MHz	Effective Capacitance	Max ESR	Rated VDC
★3.3 ± .25	229	3.05/4.02	0.121	500
3.6 ± .25	228	3.35/4.18	0.120	500
★3.9 ± .25	227	3.65/4.53	0.119	500
4.3 ± .25	223	4.05/5.01	0.117	500
★4.7 ± .25	220	4.45/5.48	0.115	500
5.1 ± .25	218	4.85/5.88	0.113	500
★5.6 ± .50	215	5.35/6.49	0.111	500
6.2 ± .50	212	5.83/7.19	0.110	500
★6.8 ± .50	208	6.30/7.88	0.108	500
7.5 ± .50	206	7.00/8.60	0.106	500
★8.2 ± .50	203	7.70/9.36	0.104	500
9.1 ± .50	199	8.60/10.34	0.102	500
★10 ± .50	196	9.50/11.33	0.100	500
11 ± 5%	193	10.45/12.50	0.098	500
★12 ± 5%	190	11.40/13.61	0.096	500
13 ± 5%	185	12.35/14.75	0.094	500
14 ± 5%	183	13.30/15.89	0.094	500
★15 ± 5%	182	14.25/17.02	0.092	500
16 ± 5%	180	15.20/18.16	0.090	500
★18 ± 5%	176	17.10/20.42	0.088	500
20 ± 5%	173	19.00/22.70	0.087	500
★22 ± 5%	171	20.90/24.95	0.085	500
25 ± 5%	166	23.76/28.39	0.083	500
24 ± 5%	168	22.80/27.20	0.084	500
★27 ± 5%	164	25.69/30.78	0.082	500
28 ± 5%	163	26.63/31.93	0.081	500
30 ± 5%	163	28.50/34.23	0.080	500
32 ± 5%	161	30.40/36.51	0.079	500
★33 ± 5%	159	31.35/37.65	0.079	500
34 ± 5%	158	32.30/38.83	0.078	500
36 ± 5%	157	34.20/41.19	0.077	500
★39 ± 5%	155	37.05/44.79	0.075	500
43 ± 5%	153	40.85/49.99	0.073	500
★47 ± 5%	152	44.65/55.19	0.071	500
51 ± 5%	151	48.09/59.86	0.070	500
★56 ± 5%	148	52.40/65.70	0.068	500
62 ± 5%	147	58.50/72.85	0.067	500
★68 ± 5%	146	64.60/80.00	0.065	500
75 ± 5%	145	71.85/88.90	0.063	500
★82 ± 5%	144	78.78/97.30	0.062	500
91 ± 5%	143	86.70/106.80	0.060	500
★100 ± 5%	141	96.80/118.30	0.058	500
110 ± 5%	140	106.90/132.80	0.057	500
120 ± 5%	139	117.00/147.40	0.057	500
130 ± 5%	138	127.10/162.10	0.056	300
140 ± 5%	138	137.20/177.90	0.056	300
★150 ± 5%	138	147.23/190.93	0.056	300
160 ± 5%	137	157.32/205.24	0.055	200
180 ± 5%	137	177.76/235.70	0.055	200
200 ± 5%	137	198.38/267.02	0.055	200
★220 ± 5%	137	219.03/297.79	0.055	200
240 ± 5%	137	239.99/330.21	0.055	100
★270 ± 5%	137	271.77/379.63	0.055	100
300 ± 5%	137	303.68/427.27	0.055	100
★330 ± 5%	137	336.25/476.70	0.055	100
360 ± 5%	137	369.26/525.42	0.055	100
★390 ± 5%	137	402.71/572.84	0.055	100
430 ± 5%	137	447.37/629.26	0.055	100
★470 ± 5%	137	590.96/782.05	0.055	100
510 ± 5%	134	NOT SPECIFIED	0.055	50
620 ± 5%	133	NOT SPECIFIED	0.055	50
★820 ± 5%	131	NOT SPECIFIED	0.055	50
910 ± 5%	131	NOT SPECIFIED	0.055	50
★1000 ± 5%	130	NOT SPECIFIED	0.055	50

★Available as standard through authorized Murata Electronics Distributors.

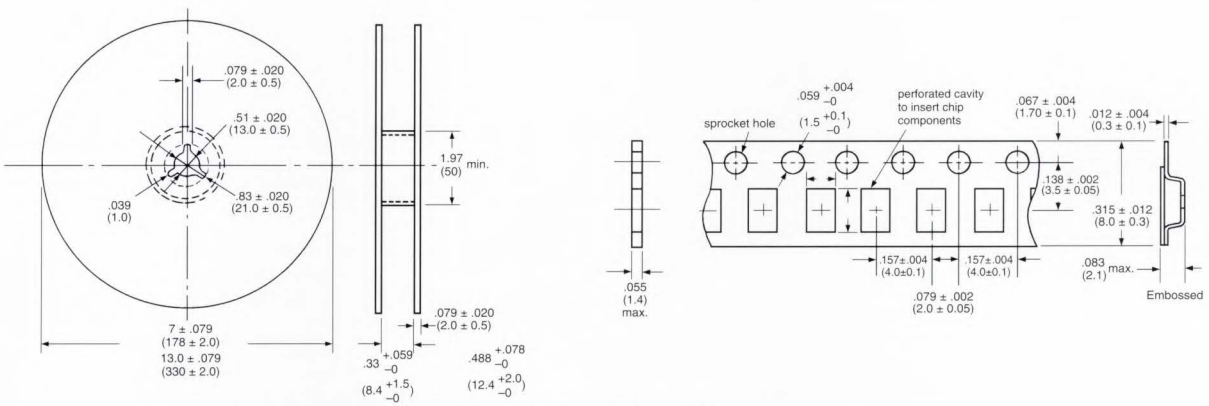
LOW COST HIGH FREQUENCY CHIP CAPACITORS FOR COMMUNICATIONS APPLICATIONS

GRH708-710 Series

ENVIRONMENTAL

Aging	Negligible
Environmental Tests	MIL-STD-202
Shock	Method 213, Condition J
Vibration	Method 204, Condition B
Moisture Resistance	Method 106
Solderability	Method 208
Immersion	Method 104, Condition B
Barometric Pressure	Method 105, Condition B
Resistance to Soldering Heat	Method 210, Condition B
Thermal Shock	Method 107, Condition A
Life	Method 108, Condition F

DIMENSIONS: in (mm)



Tape Dimensions: in (mm) per E.I.A. Standard RS-481

	A	B	QUANTITY PER 7″ REEL	QUANTITY PER 13″ REEL
GRH708	0.65 (1.65)	.094 (2.4)	3,000	10,000
GRH710	.114 (2.9)	.146 (3.7)	2,000	8,000

CHIP MARKING: NORMAL – EIA STANDARD

1. Chip capacitor marking is available upon request.
2. Standard marking is a two character alpha numeric designation to indicate capacitor value. Letter indicates index value. Number indicates multiplier as $2 = 10^2 = 100$. Example: K2 indicates $2.4 \times 10^2 = 240$pF

Letter Code

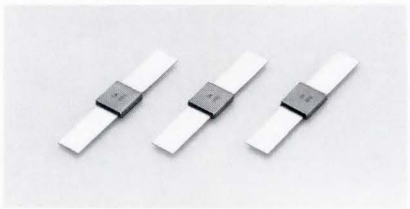
A 1	G 1.8	N 3.3	U 5.6	a 2.5	n 7
B 1.1	H 2	P 3.6	V 6.2	b 3.5	t 8
C 1.2	J 2.2	Q 3.9	W 6.8	d 4	y 9
D 1.3	K 2.4	R 4.3	X 7.5	e 4.5	
E 1.5	L 2.7	S 4.7	Y 8.2	f 5	
F 1.6	M 3	T 5.1	Z 9.1	m 6	

Number Character

0	10^0
1	10^1
2	10^2
3	10^3
4	10^4
5	10^5
6	10^6
7	10^7
8	10^8
9	10^9

3. Color: High Frequency chips marking is BLUE (for ink marking only)
4. Bar Mark: i.e., $\overline{K2}$ signifies COG, 240pF

GLASS ENCAPSULATED MINIATURE RF POWER MULTILAYER CAPACITORS



Miniature UFP fixed ceramic capacitors are specifically designed for high voltage and high RF current high frequency applications. They are ideally suited to the latest aerospace and commercial mobile and fixed communication equipment.

Glass encapsulation protects UFP capacitors against corona, contaminants and other environmental factors. Wide, fine silver lead terminations assure minimum inductance and high RF current capabilities. They can withstand temperatures far in excess of soldered units due to solderless lead attachment.

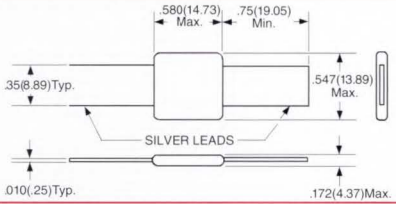
PART NUMBERING SYSTEM

UFP	1	7	15	1	K

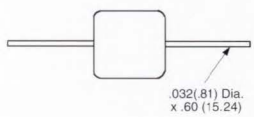
UFP	CASE SIZE	TERMINATION	CAPACITANCE CODE	NO. OF ZEROES	CAPACITANCE TOLERANCE
		Blank = Ribbon 7 = Wire	First two digits of Capacitance Value in pF Note: R signifies decimal point	Following the first two digits of the capacitance value in pF	J = ±5% (standard) K = ±10% (standard) Other tolerances are available,contact factory.

DIMENSIONS: in. (mm)

UFP1



UFP17



SPECIFICATIONS

Current: 8 amperes at 25°C (Derated for higher temperatures)
Q: 5,000 min. at 1 MHz and 25°C for values 1,000pF and smaller
Tolerances: ±0.5pF for values below 10pF
±5%, ±10% for higher values

*NPOC T.C. also available. Consult your local Murata Electronics Sales Office.

Power: 12 KVAR at 25°C typical
Voltage: See chart below
***Temperature Coefficient:** +90, ±20ppm/°C at 1 MHz (–55°C to +125°C)
Testing: RF tested to rated specifications
Marking: All capacitors stamp marked with company I.D., cap. code and tolerance

Models	Range of Values (pF)	WVDC	Test Voltage DC	RF Current Amps. RMS at +25°C	RF Voltage RMS at +25°C	KVAR* Rating at +25°C	Voltage Limiting Impedance (ohms)	Current Limiting Impedance (ohms)
UFP1	10 to 150	3,600	7,000	8	3,000	12	750	187.5
	160 to 330	2,500	4,500	8	2,000	12	333.3	187.5
	360 to 620	1,200	2,400	8	1,000	6	166.7	93.75
	680 to 1,300	600	1,200	8	500	3	83.3	46.88
	1,500 to 3,000	300	600	8	250	1.5	41.67	23.44

*NOTE
1. When the impedance of the capacitor is higher than the value shown, the limiting factor is the RF voltage shown.
2. When the impedance of the capacitor is below the value shown, the limiting factor is the RF current shown.
3. Between these two impedance limits, the KVAR rating is the limiting factor. Formulas for voltage and current are:

$$V = (1{,}000 \times KVAR \times IMPEDANCE)^{1/2} \qquad I = \left(\frac{1{,}000 \times KVAR}{IMPEDANCE}\right)^{1/2}$$

4. RF current rating derates 0.4%/°C from +25°C rating at all higher temperatures to +125°C.
5. KVAR rating derates 0.5%/°C from +25°C rating at all higher temperatures to +125°C.
6. RF voltage derates 0.16%/°C from +25°C rating at all higher temperatures to +125°C.

PREFERRED VALUES

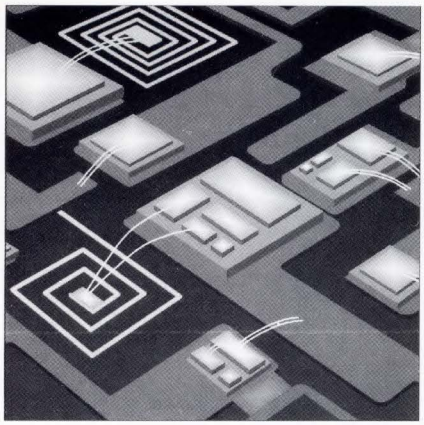
Case Code	Cap.pF	Cap. Code	Tol.
UFP1	10	100★	J,K
	11	110	J,K
	12	120★	J,K
	13	130★	J,K
	15	150★	J,K
	16	160	J,K
	18	180★	J,K
	20	200★	J,K
	22	220★	J,K
	24	240★	J,K
	27	270★	J,K
	30	300★	J,K
	33	330★	J,K
	36	360★	J,K
	39	390★	J,K
	43	430	J,K
	47	470★	J,K
	51	510	J,K
	56	560★	J,K
	62	620	J,K
	68	680★	J,K
	75	750★	J,K

Case Code	Cap.pF	Cap. Code	Tol.
UFP1	82	820	J,K
	91	910★	J,K
	100	101★	J,K
	110	111	J,K
	120	121★	J,K
	130	131★	J,K
	150	151★	J,K
	160	161	J,K
	180	181★	J,K
	200	201★	J,K
	220	221★	J,K
	240	241	J,K
	270	271★	J,K
	300	301★	J,K
	330	331★	J,K
	360	361	J,K
	390	391★	J,K
	430	431	J,K
	470	471★	J,K
	510	511	J,K
	560	561	J,K
	620	621	J,K

Case Code	Cap.pF	Cap. Code	Tol.
UFP1	680	681	J,K
	750	751	J,K
	820	821	J,K
	910	911★	J,K
	1,000	102★	J,K
	1,100	112	J,K
	1,200	122	J,K
	1,300	132	J,K
	1,500	152	J,K
	1,600	162	J,K
	1,800	182	J,K
	2,000	202	J,K
	2,200	222	J,K
	2,400	242	J,K
	2,700	272	J,K
	3,000	302	J,K

★Available as standard through authorized Murata Electronics Distributors: J Tol.

CLB SERIES
SINGLE LAYER
CERAMIC CAPACITORS FOR MICROWAVE INTEGRATED CIRCUITS



The CLB series of capacitors has been developed to meet the demand for a high reliability capacitor with the ability to withstand high voltages in microwave applications. They are a result of the development of a high density ceramic material and state-of-the-art thin film technology. With CLB single and multiplate ultra-miniature capacitors, manufacturers of microwave products can improve both production yield and quality. The multi-plate series provides the option of using a single device for varied capacitance requirements, effectively minimizing material preparation while reducing time and cost.

FEATURES

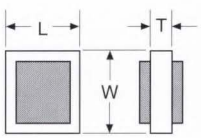
- Operation to over 20GHz.
- Ultra-reliable performance and dielectric strength under high temperature and moisture conditions.
- 100 micro inch minimum, gold plated electrode, provides superior adhesion for die bonding and thermocompression wire bonding.
- Safety margin around plate areas eliminates the possibility of electrical shorts.
- Multi-plate designs (binary-segmented capacitance values on one chip) provide a variety of capacitance values for fine tuning.

PART NUMBERING

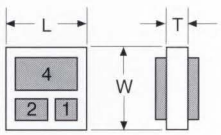
CLB	1	2	B	390	K
TYPE	NUMBER OF ELECTRODES	DIMENSIONS	TEMP. CHAR.	CAPACITANCE VALUE	TOLERANCE
	1 3 4 5	See Below	CG : 0 ± 30ppm/°C UJ : −750±120ppm/°C XL : −2200±500ppm/°C B : ±10% F : +30, −80% (−25°C to +85°C)	eg: 390 = 39pF 131 = 130pF 1R2 = 1.2pF	B = ±0.1pF C = ±0.25pF D = ±0.5pF K = ±10% M= ±20%

DIMENSIONS: in. (mm)

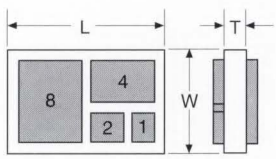
CLB11, 15, 12, 16, 17 13, 18, 19, 10



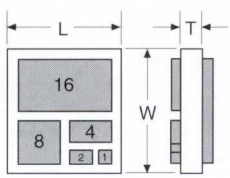
CLB32



CLB44



CLB53



TYPE	L	W	T Max.
CLB11	0.010 (0.25) ± 0.002 (0.05)	0.010 (0.25) ± 0.005 (0.13)	0.007 (0.18)
15	0.015 (0.38) ± 0.002 (0.05)	0.015 (0.38) + 0.015 (0.38), −0.005 (0.13)	0.008 (0.2)
12	0.020 (0.51) ± 0.002 (0.05)	0.020 (0.51) ± 0.01 (0.25)	0.010 (0.25)
16	0.025 (0.64) ± 0.002 (0.05)	0.025 (0.64) + 0.02 (0.51), −0.01 (0.25)	0.010 (0.25)
17	0.030 (0.76) ± 0.002 (0.05)	0.030 (0.76) ± 0.015 (0.38)	0.010 (0.25)
13	0.035 (0.90) ± 0.002 (0.05)	0.035 (0.90) + 0.025 (0.64) −0.015 (0.38)	0.010 (0.25)
18	0.050 (1.27) ± 0.004 (0.10)	0.050 (1.27) + 0.04 (1.02), −0.02 (0.51)	0.010 (0.25)
19	0.070 (1.78) ± 0.004 (0.10)	0.070 (1.78) + 0.05 (1.27), −0.03 (0.76)	0.012 (0.3)
10	0.090 (2.29) ± 0.004 (0.10)	0.090 (2.29) + 0.06 (1.52), −0.04 (1.02)	0.014 (0.35)
32	0.020 (0.51) ± 0.002 (0.05)	0.020 (0.51) ± 0.002 (0.05)	0.010 (0.25)
44	0.035 (0.90) ± 0.002 (0.05)	0.020 (0.51) ± 0.002 (0.05)	0.010 (0.25)
53	0.035 (0.90) ± 0.002 (0.05)	0.035 (0.90) ± 0.002 (0.05)	0.010 (0.25)

CAPACITANCE RANGE

SINGLE ELECTRODE

Type		CG	UJ	XL	B	F
CLB11	Cap. Range	0.1-0.2	0.3-0.9	0.8-1.8	2.0-18	27-51
	Tolerance	B, C, D, K	B, C, D, K	B, C, D	C, D, K	K, M
CLB15	Cap. Range	0.2-0.8	0.9-2.7	1.8-5.1	5.1-56	62-150
	Tolerance	B, C, D	C, D	C, D	D, K, M	K, M
CLB12	Cap. Range	0.3-1.0	1.0-3.0	2.2-5.6	5.6-68	75-200
	Tolerance	B, C, D	C, D, K	C, D, K	K, M	M
CLB16	Cap. Range	0.3-1.6	2.0-6.2	3.6-11	10-120	130-360
	Tolerance	B, C, D	D, K	D	K, M	M
CLB17	Cap. Range	0.4-2.0	3.0-7.5	5.6-15	15-130	200-390
	Tolerance	B, C, D	D, K	D, K	K, M	M
CLB13	Cap. Range	0.5-2.7	3.3-9.1	6.2-18	16-180	200-560
	Tolerance	B, C, D	D, K	K	K, M	M
CLB18	Cap. Range	1.0-5.1	7.5-20	15-36	33-390	430-1300
	Tolerance	C, D	K	K, M	K, M	M
CLB19	Cap. Range	1.8-10.0	13-39	27-75	62-750	750-1800
	Tolerance	C, D, K	K, M	K, M	K, M	M
CLB10	Cap. Range	3.0-16	20-56	39-110	91-1200	1200-3000
	Tolerance	D, K	K, M	K, M	K, M	M

NOTE 1: All Capacitance values in pF
NOTE 2: Capacitance values available within the ranges shown above are in EIA E24 steps as denoted below.

MULTI-ELECTRODE

Part Number	Cap. Value (Largest plate) pF
CLB32UJ0R7K	0.7
CLB32XL1R5K	1.5
CLB44UJ1R5K	1.5
CLB44XL3R0K	3.0
CLB53UJ3R0K	3.0
CLB53XL5R9K	5.9

E24 STEP

1.0	3.3
1.1	3.6
1.2	3.9
1.3	4.3
1.5	4.7
1.6	5.1
1.8	5.6
2.0	6.2
2.2	6.8
2.4	7.5
2.7	8.2
3.0	9.1

TOLERANCE

B: ± 0.1 pF
C: ± 0.25pF
D: ± 0.5 pF
K: ± 10%
M: ± 20%

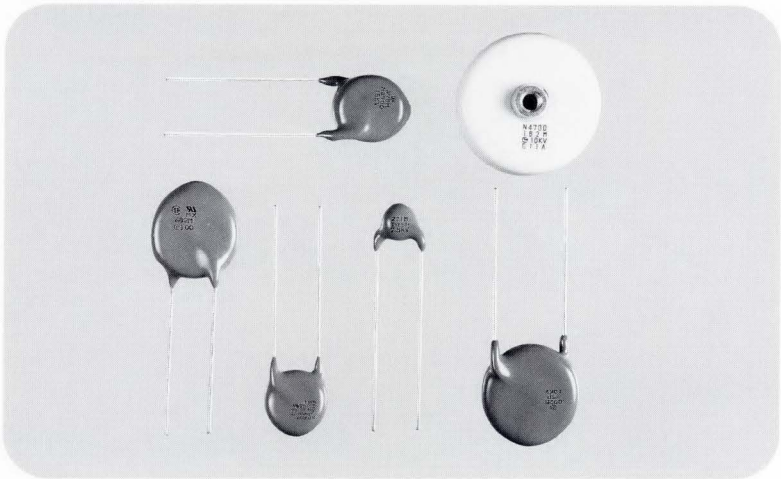
TEMPERATURE CHARACTERISTICS

CG: 0 ± 30ppm/°C
UJ: – 750 ± 120ppm/°C
XL: – 2200 ± 500ppm/°C
B: ± 10%
F: + 30, – 80%
(– 25°C to +85°C)

Murata Electronics' extensive line of ceramic disc and high voltage capacitors, described in this catalog, is backed by over 50 years of experience in the design and manufacture of units for every conceivable application. Murata has a manufacturing capability second to none and is the world's largest supplier of ceramic capacitors.

These products are manufactured from the finest ceramic raw materials and on the most efficient auto-assembly machines ever devised for low unit cost, product consistency, and exceptional long-term reliability.

For further information on any Murata product or for application assistance, Murata maintains an experienced staff of application engineers in Smyrna, Georgia who can provide any technical support you may require.



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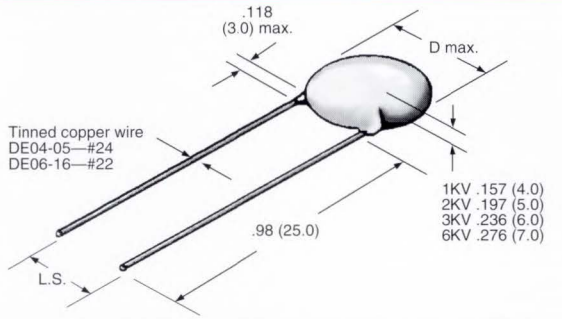
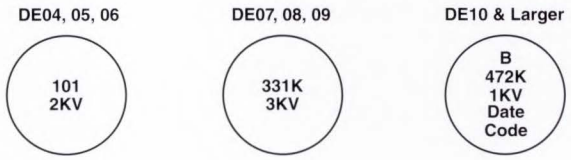
MINIATURE MEDIUM VOLTAGE CERAMIC DISC CAPACITOR E.I.A. CLASS I, II & III

1-6K VDC

DIMENSIONS: in. (mm)



MARKING*



*Three-digit capacitance code for values of 100pF and larger.
SL and F have no temperature characteristic marking.

PART NUMBERING SYSTEM

TYPE	LEADS	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE
DE04	05	B	101	K	1KV
CAPACITOR TYPE AND SIZE	**LEAD SPACING** 05=.197 (5) 07=.300 (7.5) 10=.394 (10)	**TEMPERATURE CHARACTERISTICS** **Class I:** Per standard EIA specifications. **Class II & III:** **TEMPERATURE RANGE:** –25°C to +85°C **MAX. CAP. CHANGE OVER TEMP. RANGE:** B=±10% E=+20, –55% F=+30, –80%	**CAPACITANCE VALUE**	**CAPACITANCE TOLERANCE** J=±5% K=±10% Z=+80, –20%	**VOLTAGE** Identified by a one-digit number

NOTE: B, E, F are JIS codes that are similar to EIA temperature characteristics Y5P, Y5U and Y5V.

★1KV – SL

PART NUMBER	DIA (mm)	LS (mm)	CAP (pF)
DE0405SL100D1KV	4	5	10
DE0405SL120J1KV	4	5	12
DE0405SL150J1KV	4	5	15
DE0405SL180J1KV	4	5	18
DE0405SL220J1KV	4	5	22
DE0405SL270J1KV	4	5	27
DE0405SL330J1KV	4	5	33
DE0405SL390J1KV	4	5	39
DE0405SL470J1KV	4	5	47
DE0505SL560J1KV	5	5	56
DE0505SL680J1KV	5	5	68
DE0605SL820J1KV	6	5	82
DE0605SL101J1KV	6	5	100
DE0605SL121J1KV	6	5	120
DE0705SL151J1KV	7	5	150
DE0705SL181J1KV	7	5	180
DE0805SL221J1KV	8	5	220
DE0905SL271J1KV	9	5	270
DE1005SL331J1KV	10	5	330
DE1005SL391J1KV	10	5	390
DE1105SL471J1KV	11	5	470
DE1205SL561J1KV	12	5	560

★2KV – SL

PART NUMBER	DIA (mm)	LS (mm)	CAP (pF)
DE0405SL100D2KV	4	5	10
DE0405SL120J2KV	4	5	12
DE0405SL150J2KV	4	5	15
DE0405SL180J2KV	4	5	18
DE0405SL220J2KV	4	5	22
DE0405SL270J2KV	4	5	27
DE0405SL330J2KV	4	5	33
DE0505SL390J2KV	5	5	39
DE0605SL470J2KV	6	5	47
DE0605SL560J2KV	6	5	56
DE0605SL680J2KV	6	5	68
DE0705SL820J2KV	7	5	82
DE0705SL101J2KV	7	5	100
DE0805SL121J2KV	8	5	120
DE0805SL151J2KV	8	5	150
DE0905SL181J2KV	9	5	180
DE1005SL221J2KV	10	5	220
DE1105SL271J2KV	11	5	270
DE1205SL331J2KV	12	5	330
DE1307SL391J2KV	13	7.5	390
DE1410SL471J2KV	14	10	470
DE1510SL561J2KV	15	10	560

★3KV – SL

DE0507SL100D3KV	5	7.5	10
DE0507SL120J3KV	5	7.5	12
DE0507SL150J3KV	5	7.5	15
DE0507SL180J3KV	5	7.5	18
DE0507SL220J3KV	5	7.5	22
DE0607SL270J3KV	6	7.5	27
DE0607SL330J3KV	6	7.5	33
DE0607SL390J3KV	6	7.5	39
DE0707SL470J3KV	7	7.5	47
DE0707SL560J3KV	7	7.5	56
DE0807SL680J3KV	8	7.5	68
DE0807SL820J3KV	8	7.5	82
DE0907SL101J3KV	9	7.5	100
DE1007SL121J3KV	10	7.5	120
DE1107SL151J3KV	11	7.5	150
DE1107SL181J3KV	11	7.5	180
DE1207SL221J3KV	12	7.5	220
DE1410SL271J3KV	14	10	270
DE1510SL331J3KV	15	10	330
DE1610SL391J3KV	16	10	390

★6KV – SL

DE0910SL220J6KV	9	10	22
DE0910SL270J6KV	9	10	27
DE0910SL330J6KV	9	10	33
DE0910SL390J6KV	9	10	39
DE0910SL470J6KV	9	10	47
DE1010SL560J6KV	10	10	56
DE1210SL680J6KV	12	10	68
DE1210SL820J6KV	12	10	82
DE1310SL101J6KV	13	10	100
DE1410SL121J6KV	14	10	120
DE1510SL151J6KV	15	10	150

★Available as standard through authorized Murata Electronics Distributors.

MINIATURE MEDIUM VOLTAGE CERAMIC DISC CAPACITORS E.I.A. CLASS I, II & III

muRata

1-6K VDC

★1KV – B

PART NUMBER	DIA (mm)	LS (mm)	CAP (pF)
DE0405B101K1KV	4	5	100
DE0405B151K1KV	4	5	150
DE0405B221K1KV	4	5	220
DE0405B331K1KV	4	5	330
DE0505B471K1KV	5	5	470
DE0605B681K1KV	6	5	680
DE0605B102K1KV	6	5	1000
DE0805B152K1KV	8	5	1500
DE0905B222K1KV	9	5	2200
DE1005B332K1KV	10	5	3300
DE1205B472K1KV	12	5	4700
DE1510B682K1KV	15	10	6800

★2KV – B

DE0405B101K2KV	4	5	100
DE0405B151K2KV	4	5	150
DE0405B221K2KV	4	5	220
DE0505B331K2KV	5	5	330
DE0605B471K2KV	6	5	470
DE0705B681K2KV	7	5	680
DE0805B102K2KV	8	5	1000
DE0905B152K2KV	9	5	1500
DE1005B222K2KV	10	5	2200
DE1205B332K2KV	12	5	3300
DE1510B472K2KV	15	10	4700

★3KV – B

DE0507B101K3KV	5	7.5	100
DE0507B151K3KV	5	7.5	150
DE0507B221K3KV	5	7.5	220
DE0607B331K3KV	6	7.5	330
DE0707B471K3KV	7	7.5	470
DE0807B681K3KV	8	7.5	680
DE0907B102K3KV	9	7.5	1000
DE1107B152K3KV	11	7.5	1500
DE1307B222K3KV	13	7.5	2200
DE1510B332K3KV	15	10	3300

★6KV – B

DE0910B101K6KV	9	10	100
DE0910B151K6KV	9	10	150
DE0910B221K6KV	9	10	220
DE0910B331K6KV	9	10	330
DE1010B471K6KV	10	10	470
DE1110B681K6KV	11	10	680
DE1310B102K6KV	13	10	1000

★1KV – E

DE0505E102Z1KV	5	5	1000
DE0705E222Z1KV	7	5	2200
DE0905E472Z1KV	9	5	4700
DE1307E103Z1KV	13	7.5	10000

★2KV – E

DE0605E102Z2KV	6	5	1000
DE0805E222Z2KV	8	5	2200
DE1105E472Z2KV	11	5	4700
DE1610E103Z2KV	16	10	10000

★3KV – E

DE0707E102Z3KV	7	7.5	1000
DE1007E222Z3KV	10	7.5	2200
DE1307E472Z3KV	13	7.5	4700

★6KV – E

DE1110E102Z6KV	11	10	1000
DE1510E222Z6KV	15	10	2200

★1KV – F

DE0605F222Z1KV	6	5	2200
DE0705F472Z1KV	7	5	4700
DE1005F103Z1KV	10	5	10000

★2KV – F

DE0505F102Z2KV	5	5	1000
DE0705F222Z2KV	7	5	2200
DE0905F472Z2KV	9	5	4700
DE1205F103Z2KV	12	5	10000

★Available as standard through authorized Murata Electronics Distributors.

MINIATURE & CONVENTIONAL CERAMIC DISC CAPACITORS SPECIFICATIONS: CLASS I

Test Conditions: Unless otherwise specified, measurements shall be made at +25°C, ±5°C, a relative humidity no greater than 70%, and normal atmospheric pressure.

Capacitance: Capacitance shall be within the specified limits when measured at, or corrected to, a temperature of +20°C, a RMS voltage between .05 and 5.0, and a frequency of 1MHz.

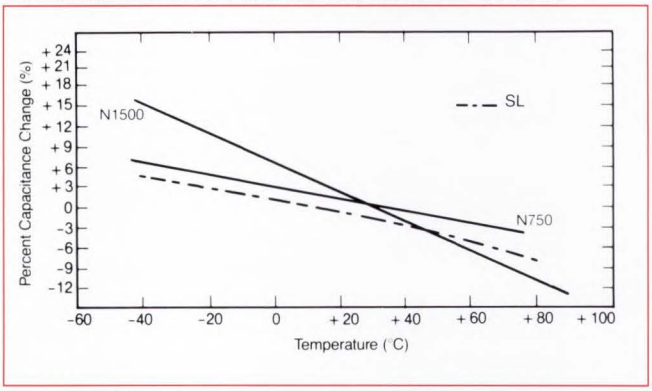
"Q", (or Ratio of Reactance to Equivalent Series Resistance): "Q" shall not be less than the limits shown below when measured at +25°C, a RMS voltage between 0.5 and 5.0 and a frequency of 1MHz. Q=30pF and over, ≥ 1000 less than 30pF, ≥ 400 + 20 × nominal capacitance.

Insulation Resistance: 10,000MΩ minimum when measured between terminals of capacitor 1 minute after application of a test voltage of 500VDC applied through a protective resistance which will limit the charging current to 50mA.

Dielectric Strength: Capacitors shall be subjected to a DC voltage equal to 200% of their rated working voltage, and the voltage shall be applied through a protective resistance that will limit the charging current to 50mA.

Temperature Coefficient and Capacitance Drift: T.C. shall not exceed limits defined in Figure 2 when determined by a single run from +25°C to +85°C. Capacitance drift shall not exceed .3% or .25pF whichever is greater, as determined by the greatest difference between 2 measurements, at +25°C and at +85°C. Each measurement made in determination of temperature coefficient or capacitance drift shall be made after the capacitor has reached thermal stability. Care should be taken to compensate for lead capacitance for extreme accuracy with low capacitance units.

TYPICAL TEMPERATURE CHARACTERISTICS



Humidity Resistance: After exposure for a period of 500 hours to an atmosphere of 95% relative humidity at a temperature of 40°C, capacitor shall have a minimum insulation resistance of 1,000MΩ.

Life: After accurately measuring capacitance as specified in paragraph #1, the capacitor shall be subjected to application of a DC voltage equal to 150% of the rated working voltage for 1,000 hours at +85°C. 24 hours after completion of the test, the capacitance drift shall not be more than 1% or .5pF, whichever is greater. "Q" shall not be less than shown above, and insulation resistance shall not be less than 2000MΩ. All units shall be subjected to a DC voltage equal to 150% of the rated working voltage.

Encapsulation: Ceramic disc is coated in an epoxy resin which conforms to UL94V-0.

MINIATURE & CONVENTIONAL CERAMIC DISC CAPACITORS SPECIFICATIONS: CLASS II & III

Test Conditions: Unless otherwise specified, measurements shall be made at +25°C, ±5°C, a relative humidity no greater than 70%, and normal atmospheric pressure.

Capacitance: Capacitance shall be within the specified limits when measured at, or corrected to, a temperature of +20°C, a RMS voltage between .05 and 5.0, and a frequency of 1KHz.

Dissipation Factor, or (Ratio of Equivalent Series Resistance to Reactance): Dissipation Factor shall not be greater than 2.5% for B and E characteristics, or greater than 5% for F.

Insulation Resistance: 10,000MΩ minimum when measured between terminals of capacitor 1 minute after application of a DC test voltage of 500 applied through a protective resistance which will limit the charging current to 50mA.

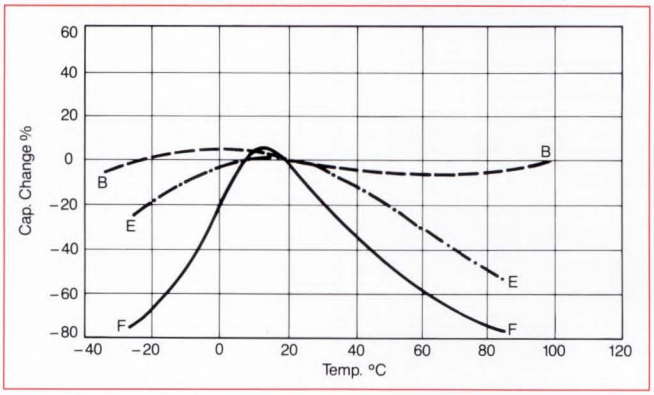
Dielectric Strength: Capacitors shall be subjected to a DC voltage equal to 200% of their rated working voltage. This voltage shall be applied for 5, ±1 seconds through a protective resistance that will limit the charging current to 50mA.

Humidity Resistance: After exposure for a period of 500 hours to an atmosphere of 95% relative humidity at a temperature of 40°C, capacitor shall have a minimum insulation resistance of 1,000MΩ.

Life: Capacitors shall be subjected to a DC voltage equal to 150% of the rated working voltage for 1,000 hours at +85°C. After this test, dissipation factor shall not be more than twice the stated initial value, and insulation resistance shall not be less than 2,000MΩ.

Encapsulation: Ceramic disc is coated in an epoxy resin which conforms to UL94V-0.

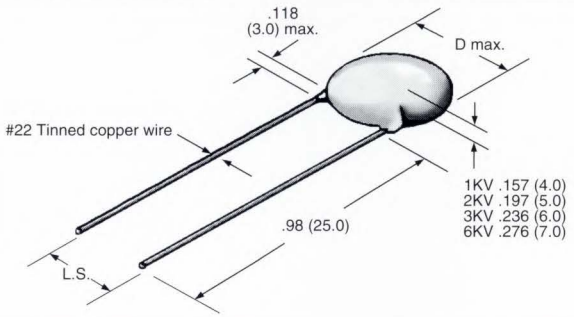
TYPICAL TEMPERATURE CHARACTERISTICS



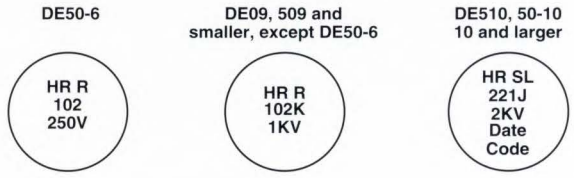
HR SERIES, HIGH TEMPERATURE (+125°)/ LOW LOSS .3% DISSIPATION FACTOR
E.I.A. CLASS I & II

250-6K VDC

DIMENSIONS: in. (mm)



MARKING*



*HR=High Temperature Guaranteed code SL has no temperature characteristic marking. Working Voltage not marked for 500V. Three-digit capacitance code for values 100pF and higher.

PART NUMBERING SYSTEM

TYPE	LEADS	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE
DE07	05	R	221	K	1KV

CAPACITOR TYPE AND SIZE

LEAD SPACING
5, 05 = .197 (5)
7, 07 = .300 (7.5)
0, 10 = .394 (10)
16 = .630 (16)

TEMPERATURE CHARACTERISTICS
–25°C to +125°C
MAX. CAP. CHANGE OVER TEMP. RANGE
SL= +350-1000ppm/°C

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
J = ± 5% (SL only)
K= ± 10%

VOLTAGE
Identified by a one, two or three digit number.

	–25°C to +85°C	+85°C to +125°C
R=	±15%	+15, –30%
C=	±20%	+15, –30%

★1KV – SL

PART NUMBER	DIA (mm)	LS (mm)	CAP (pF)
DE507–5SL100D1KV	7	5	10
DE507–5SL120J1KV	7	5	12
DE507–5SL150J1KV	7	5	15
DE507–5SL180J1KV	7	5	18
DE507–5SL220J1KV	7	5	22
DE507–5SL270J1KV	7	5	27
DE507–5SL330J1KV	7	5	33
DE507–5SL390J1KV	7	5	39
DE507–5SL470J1KV	7	5	47
DE507–5SL560J1KV	7	5	56
DE507–5SL680J1KV	7	5	68
DE507–5SL820J1KV	7	5	82
DE507–5SL101J1KV	7	5	100
DE507–5SL121J1KV	7	5	120
DE508–5SL151J1KV	8	5	150
DE508–5SL181J1KV	8	5	180
DE509–5SL221J1KV	9	5	220
DE510–5SL271J1KV	10	5	270
DE511–5SL331J1KV	11	5	330

★2KV – SL

DE507–7SL100D2KV	7	7.5	10
DE507–7SL120J2KV	7	7.5	12
DE507–7SL150J2KV	7	7.5	15
DE507–7SL180J2KV	7	7.5	18
DE507–7SL220J2KV	7	7.5	22
DE507–7SL270J2KV	7	7.5	27
DE507–7SL330J2KV	7	7.5	33
DE507–7SL390J2KV	7	7.5	39
DE507–7SL470J2KV	7	7.5	47
DE507–7SL560J2KV	7	7.5	56
DE507–7SL680J2KV	7	7.5	68
DE507–7SL820J2KV	7	7.5	82
DE508–7SL101J2KV	8	7.5	100
DE508–7SL121J2KV	8	7.5	120
DE509–7SL151J2KV	9	7.5	150
DE510–7SL181J2KV	10	7.5	180
DE511–7SL221J2KV	11	7.5	220

★3KV – SL

PART NUMBER	DIA (mm)	LS (mm)	CAP (pF)
DE507–7SL100D3KV	7	7.5	10
DE507–7SL120J3KV	7	7.5	12
DE507–7SL150J3KV	7	7.5	15
DE507–7SL180J3KV	7	7.5	18
DE507–7SL220J3KV	7	7.5	22
DE507–7SL270J3KV	7	7.5	27
DE507–7SL330J3KV	7	7.5	33
DE507–7SL390J3KV	7	7.5	39
DE507–7SL470J3KV	7	7.5	47
DE508–7SL560J3KV	8	7.5	56
DE508–7SL680J3KV	8	7.5	68
DE509–7SL820J3KV	9	7.5	82
DE510–7SL101J3KV	10	7.5	100
DE511–7SL121J3KV	11	7.5	120

★Available as standard through authorized Murata Electronics Distributors.

HR SERIES, HIGH TEMPERATURE (+125°)/ LOW LOSS .3% DISSIPATION FACTOR
E.I.A. CLASS I & II

250-6K VDC

★**250V – R** All values standard through Murata Electronics Distributors.

PART NUMBER	DIA (mm)	LS (mm)	CAP (pF)
DE50–6R221K250V	6	5	220
DE50–6R331K250V	6	5	330
DE50–6R471K250V	6	5	470
DE50–6R681K250V	6	5	680
DE50–6R102K250V	6	5	1000
DE50–7R152K250V	7	5	1500
DE50–8R222K250V	8	5	2200
DE50–9R332K250V	9	5	3300
DE51–0R472K250V	10	5	4700
DE51–2R682K250V	12	5	6800
DE51–2R103K250V	12	5	10000

★**500V – C**

DE50–6C331K500V	6	5	330
DE50–6C471K500V	6	5	470
DE50–7C681K500V	7	5	680
DE50–8C102K500V	8	5	1000
DE50–9C152K500V	9	5	1500
DE51–0C222K500V	10	5	2200
DE51–2C332K500V	12	5	3300
DE51–4C472K500V	14	10	4700

★**1KV – R**

DE0705R221K1KV	7	5	220
DE0705R331K1KV	7	5	330
DE0705R471K1KV	7	5	470
DE0805R681K1KV	8	5	680
DE0905R102K1KV	9	5	1000
DE1105R152K1KV	11	5	1500
DE1310R222K1KV	13	10	2200
DE1510R332K1KV	15	10	3300
DE1710R472K1KV	17	10	4700

★**2KV – R**

DE0707R221K2KV	7	7.5	220
DE0707R271K2KV	7	7.5	270
DE0807R331K2KV	8	7.5	330
DE0807R391K2KV	8	7.5	390
DE0907R471K2KV	9	7.5	470
DE0907R561K2KV	9	7.5	560
DE1007R681K2KV	10	7.5	680
DE1107R821K2KV	11	7.5	820
DE1207R102K2KV	12	7.5	1000
DE1207R122K2KV	12	7.5	1200
DE1207R152K2KV	12	7.5	1500
DE1410R182K2KV	14	10	1800
DE1510R222K2KV	15	10	2200
DE1710R272K2KV	17	10	2700
DE1910R332K2KV	19	10	3300
DE2010R392K2KV	20	10	3900
DE2110R472K2KV	21	10	4700

★**3KV – R**

DE0707R101K3KV	7	7.5	100
DE0707R151K3KV	7	7.5	150
DE0707R181K3KV	7	7.5	180
DE0707R221K3KV	7	7.5	220
DE0707R271K3KV	7	7.5	270
DE0807R331K3KV	8	7.5	330
DE0907R391K3KV	9	7.5	390
DE1007R471K3KV	10	7.5	470
DE1007R561K3KV	10	7.5	560
DE1107R681K3KV	11	7.5	680
DE1207R821K3KV	12	7.5	820
DE1310R102K3KV	13	10	1000
DE1410R122K3KV	14	10	1200
DE1510R152K3KV	15	10	1500
DE1610R182K3KV	16	10	1800
DE1710R222K3KV	17	10	2200
DE1910R272K3KV	19	10	2700

★**6KV – R**

DE0915R221K6KV	9	10	220
DE1010R331K6KV	10	10	330
DE1210R471K6KV	12	10	470
DE1310R681K6KV	13	10	680
DE1716R102K6KV	17	16	1000
DE1916R152K6KV	19	16	1500
DE2116R222K6KV	21	16	2200

★Available as standard through authorized Murata Electronics Distributors.

HR SERIES, HIGH TEMPERATURE (+125°) CERAMIC DISC CAPACITORS
SPECIFICATIONS: CLASS I, II & III

Operating Temperature Range: −25°C to +125°C.

Test Conditions: Unless otherwise specified, measurements shall be made at +25°C, ±5°C, a relative humidity no greater than 70%, and normal atmospheric pressure.

Capacitance: Capacitance shall be within the specified limits when measured at, or corrected to, a temperature of +20°C, an RMS voltage 3.0 max, and a frequency of 1MHz. (5.0V max. and 1KHz for Class II & III.)

"Q", (or Ratio of Reactance to Equivalent Series Resistance, Class I only): Less than 30pF, Q>400 +20C in pF. >30pF, Q≥1000.

Dissipation Factor (Class II & III only): Dissipation Factor (tanδ) shall be less than 0.2% (R), 0.3% (C) when measured at temperature of 20°C and 1 ± 0.1 KHz with 1.0 to 3.0Vrms.

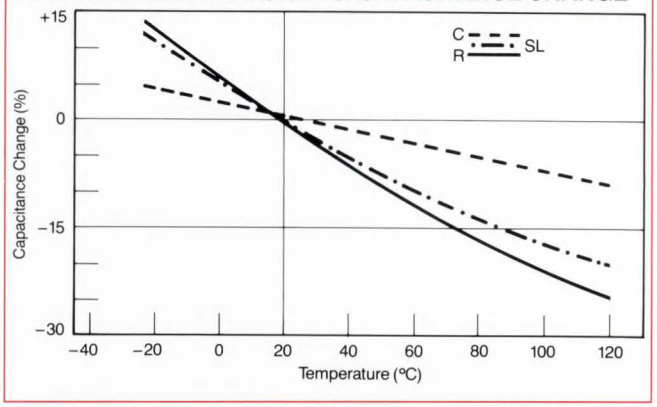
Insulation Resistance: 10,000MΩ minimum when measured between terminals of capacitor 1 minute after application of a test voltage of 500VDC applied through a protective resistance which will limit the charging current to 50mA.

Dielectric Strength: Capacitors shall be subjected to a DC voltage equal to 200% of their rated working voltage, and the voltage shall be applied through a protective resistance that will limit the charging current to 50mA.

Temperature Coefficient and Capacitance Drift: Per T.C. graph.

Humidity Resistance: After exposure for a period of 500 hours to an atmosphere of 95% relative humidity at a temperature of 40°C, capacitor shall have a minimum insulation resistance of 1,000MΩ min.

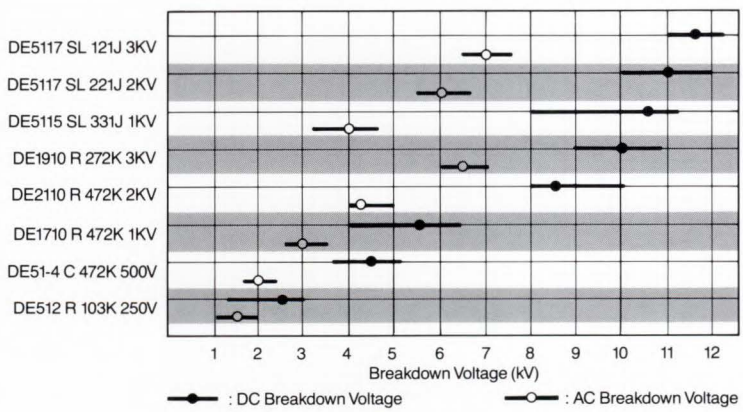
TYPICAL TEMPERATURE VS. CAPACITANCE CHANGE



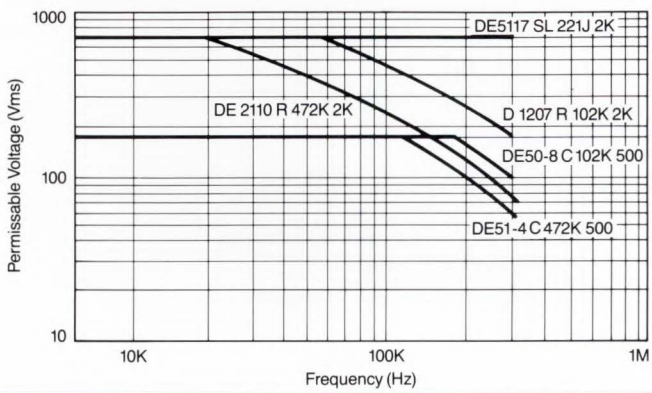
Life: After accurately measuring capacitance as specified in paragraph #1, the capacitor shall be subjected to application of a DC voltage equal to 150% of the rated working voltage for 1,000 hours at +85°C (Class I), +125°C (Class II & III). 24 hours after completion of the test, the capacitance drift shall not be more than ±3%. "Q" shall not be less than 350 (Class I), and DF shall not be less than 0.4% (Class II & III). Insulation resistance shall not be less than 2000MΩ.
All units shall be subjected to a DC voltage equal to 150% of the rated working voltage.

Encapsulation: Ceramic disc is coated in an epoxy resin which conforms to UL94V-0.

TYPICAL AC/DC BREAKDOWN VOLTAGE



TYPICAL POWER CAPACITY

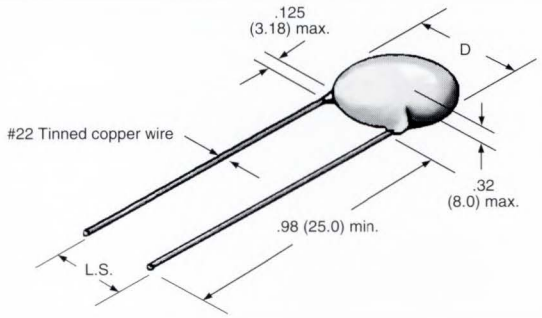


CERAMIC CAPACITORS

SAFETY RECOGNIZED
CERAMIC DISC CAPACITORS

VA1-KC
AC125-MY

DIMENSIONS: in. (mm)



PART NUMBERING SYSTEM

TYPE	TEMP. CHAR.*	CAPACITANCE	TOL.	VOLTAGE	
DE7150	FZ	103	P	VA1	KC/MY

CAPACITOR TYPE AND SIZE

TEMPERATURE CHARACTERISTICS
Temperature Range
B =25°C to +85°C
F =25°C to +85°C
FZ=10°C to +60°C
MAX. CAP. CHANGE OVER TEMP. RANGE:
B =±10%
F =+30, –80%
FZ=+30, –85%

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digits specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
K =±10%
M=±20%
P =+100%, –0%

VOLTAGE
VA1 =400VAC Europe
250 VAC North America & Europe
125 VAC North America
AC125=125 VAC North America only

LISTED TYPE DESIGNATION

*B, F, FZ are JIS TC codes that are similar to EIA Temperature Characteristics Y5P, Y5V, Z5V.

PART NUMBER	DIMENSIONS: in. (mm)		Cap.(pF)
	D max.	L.S.	
★DE7090 B 101K VA1-KC	.394 (10)	.300 (7.5)	100
★DE7090 B 151K VA1-KC	.394 (10)	.300 (7.5)	150
★DE7090 B 221K VA1-KC	.394 (10)	.300 (7.5)	220
★DE7090 B 331K VA1-KC	.394 (10)	.300 (7.5)	330
★DE7090 B 471K VA1-KC	.394 (10)	.300 (7.5)	470
★DE7090 B 681K AC125-MY	.394 (10)	.300 (7.5)	680
★DE7090 B 102K VA1-KC	.394 (10)	.300 (7.5)	1000
DE7090 F 152M VA1-KC	.472 (12)	.300 (7.5)	1500
★DE7100 F 222M VA1-KC	.472 (12)	.300 (7.5)	2200
★DE7100 FZ 472P VA1-KC	.472 (12)	.300 (7.5)	4700
★DE7120 F 332M VA1-KC	.551 (14)	.394 (10.0)	3300
DE7120 F 392M VA1-KC	.551 (14)	.394 (10.0)	3900
★DE7150 F 472M VA1-KC	.669 (17)	.394 (10.0)	4700
★DE7150 FZ 103P VA1-KC	.669 (17)	.394 (10.0)	10000
★DE7150 F 103M VA1-KC	.669 (17)	.394 (10.0)	10000

TYPICAL MARKING

1. **Capacitance by three-digit code**
2. **Cap. tolerance by E.I.A. lettercode**
3. **Safety recognition markings**
4. **Type Designation**
5. **Manufacturer's trademark**

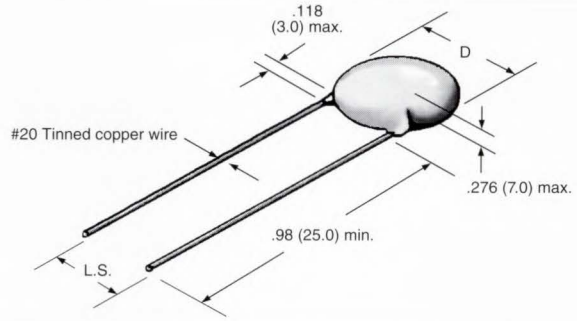
NOTE: Please refer to page 82 for Standard Recognitions by Part Number.
★Available as standard through authorized Murata Electronics Distributors.

SAFETY RECOGNIZED
CERAMIC DISC CAPACITORS

muRata

ACT4K-KD

DIMENSIONS: in. (mm)



PART NUMBERING SYSTEM

TYPE	TEMP. CHAR.*	CAPACITANCE	TOL.	TEST VOLTAGE	
DE 1010	B	101	K	ACT4K	KD

CAPACITOR TYPE AND SIZE

TEMPERATURE CHARACTERISTICS
Temperature Range
–25°C to +85°C
MAX. CAP. CHANGE OVER TEMP. RANGE:
B = ±10%
E = +20%, –55%

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digits specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
K =±10%
M=±20%

TEST VOLTAGE
4 KVAC

LISTED TYPE DESIGNATION

*B and E are JIS T.C. codes that are similar to EIA Temperature Characteristics Y5P and Y5U.

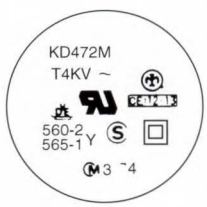
PART NUMBER	D Max. in.: (mm)	L.S.	Cap. Value (pF)
★DE1010 B 101K ACT4K-KD	.394 (10.0)	.394 (10)	100
★DE1010 B 151K ACT4K-KD	.394 (10.0)	.394 (10)	150
★DE1010 B 221K ACT4K-KD	.394 (10.0)	.394 (10)	220
★DE1010 B 331K ACT4K-KD	.394 (10.0)	.394 (10)	330
★DE1010 B 471K ACT4K-KD	.394 (10.0)	.394 (10)	470
★DE1010 E 681M ACT4K-KD	.394 (10.0)	.394 (10)	680
★DE1110 E 102M ACT4K-KD	.433 (11.0)	.394 (10)	1000
★DE1410 E 222M ACT4K-KD	.551 (14.0)	.394 (10)	2200
★DE1610 E 332M ACT4K-KD	.630 (16.0)	.394 (10)	3300
★DE1710 E 392M ACT4K-KD	.669 (17.0)	.394 (10)	3900
★DE1910 E 472M ACT4K-KD	.748 (19.0)	.394 (10)	4700

NOTE: Please refer to page 82 for Standard Recognitions by Part Number.
★Available as standard through authorized Murata Electronics Distributors.

TYPICAL MARKING

Item		Example
UL Recognized Mark		
VDE Approval Mark		
SEMKO Approval Mark		
Reinforced Insulation Mark		
IMQ Approval Mark		
Type Designation	KD	
Nominal Capacitance	—	
Capacitance Tolerance	—	
Testing Voltage	T4KV	
Manufacturer's Name	M3	
Manufactured Date Code	—	

Marking on one side



For DE1910E472MACT4K-KD

CERAMIC CAPACITORS

SAFETY RECOGNIZED CERAMIC DISC CAPACITORS RECOGNIZED STANDARDS

TYPE MY, KD, & KC

TYPE KC

	Recognized Standard No.																	
	VDE0560-2 BS415 AS3250	VDE0565-1 — —		SEV1055/SEV1016				SEMKO101/ SS443 04-14		UL 1414	EI E101-82	EI E384/14-82	NEMKO NEMX0661/77 NEMX0132/85		DEMKO Section 201		DEMKO Section 21	CSA C22.2 No. 0 No. 1
Part Number	—	X	Y	X	Y	X	Y	X	Y	—	Y	X, Y	X	Y	X	Y	X, Y	—
DE7090 B 101K VA1-KC	○	○	○	○	○	—	○	○	○	○	○	○	○	○	○	○	—	○
DE7090 B 151K VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7090 B 221K VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7090 B 331K VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7090 B 471K VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7090 B 102K VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7090 F 152M VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7100 F 222M VA1-KC	○	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7120 F 332M VA1-KC	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○
DE7120 F 392M VA1-KC	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○
DE7150 F 472M VA1-KC	○	○	○	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○
DE7150 F 103M VA1-KC	○	○	—	○	○	—	—	○	—	○	○	—	○	—	○	—	—	○
DE7100 FZ 472P VA1-KC	○	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○
DE7150 FZ 103P VA1-KC	○	—	—	—	—	—	—	○	—	○	○	—	○	—	○	—	—	○
AC Rated Voltage	400	250		400		250		400/250		125/250	400	250	250		400		250	125

TYPE KD

	Recognized Standard No.													
Part Number	UL1414	CSA C22.2 No. 0 No. 1	BS 415	SEMKO 101	SS443 04-14	IMQ CEI 12-13	SEV 1016	VDE 0560-2	VDE 0565-1	EI E101 -82	EI E384/ 12-82	NEMKO 661/74	DEMKO Section 101	DEMKO Section 21
DE1010 B 101K ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1010 B 151K ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1010 B 221K ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1010 B 331K ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1010 B 471K ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1010 E 681M ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1110 E 102M ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1410 E 222M ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1610 E 332M ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1710 E 392M ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DE1910 E 472M ACT4K-KD	○	○	○	○	○	○	○	○	○	○	○	○	○	○
AC Rated Voltage	250V	125V	400V	400V	250V	400V	250V	250V	400V	250V		250V	250V	

*Non-Standard Items Available Upon Request

(1) ○: Recognized -: Not Recognized.

(2) X capacitors are for use only in positions where failure of the capacitor would not expose anyone to electrical shock. UL/CSA designates the "X" type capacitor for "Across-The-Line" applications.

(3) Y capacitors are for use in positions where failure of the capacitor may expose someone to dangerous electrical shock. UL/CSA designates the "Y" type capacitor for "Antenna Coupling" and "Line-By-Pass" applications.

TYPE MY

	Recognized Standard No.	
Part Number	UL 1414	CSA C22.2 NO. 1
DE7090 B 681K AC125-MY	○	○
AC Rated Voltage	125/250V	125V

SAFETY RECOGNIZED CERAMIC DISC CAPACITORS SPECIFICATIONS

1. Operating Temperature Range
–25°C to +85°C (FZ: –10°C to +60°C)

2. Capacitance
Measured at 1 ± 0.1KHz, 5Vrms max. and 20°C

3. Dissipation Factor (D.F.)
Measured at 1 ± 0.1KHz, 5Vrms max. and 20°C

TC	D.F.
B	≤2.5%
E	≤2.5%
F, FZ	≤5.0%

4. Insulation Resistance (I.R.)
10,000 MΩ min. (at 500V DC for 1 minute).

5. Dielectric Strength
Between both leads:
KC, MY Type : 2,600 VAC for 1 minute.
KD Type : 4,000 VAC for 1 minute.

6. Temperature Characteristics

TC	Change Over Temp. Range
B	±10%
E	+20, –55%
F	+30, –80%
FZ	+30, –85%

7. Humidity
Capacitor shall be subjected to 40 ± 2°C and a relative humidity of 90 to 95% for 500 ± 12 hours. After placing at room temperature for 1 or 2 hours, conditions shall be as in Table 1.

TABLE 1

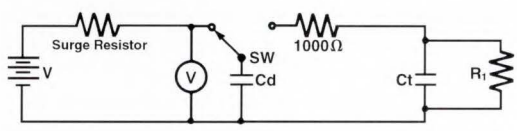
Item	Series	
	KC, MY	KD
Appearance	No physical damage	No physical damage
I.R.	1500 MΩ min.	1500 MΩ min.
Dielectric Strength	Per Item 5	

8. Life Test
Capacitor shall be placed in a circulating air chamber at 85 $^{+2}_{-0}$°C, 50% RH max. under the following conditions and meet the parameters of Table 2 after measured 4 to 24 hours after testing:
KD, KC, MY Type : Apply 800 VAC for 1500 hours increasing to 1600 VAC for 0.1 seconds once each hour

TABLE 2

Item	Series	
	KC, MY	KD
Appearance	No physical damage	No physical damage
I.R.	1500 MΩ min.	1500 MΩ min.
Dielectric Strength	Per Item 5	
Discharge Test II	Per Item 10	

9. Discharge Test 1
As in Figure 1, discharge is made 50 times at 5 second intervals from Cd charged to 10kV DC (KC, MY, KD type); the measured results shall meet the parameters of Table 3.



Ct : Capacitor under test
Cd : KC, KD & MY, 1000pF, MX, 500pF
R_1 : KC, 4MΩ, KD, MY, 100MΩ, MX, 5.2MΩ
V : KC, KD & MY, 10KVDC, MX, 20KVDC

Fig. 1

TABLE 3

Item	Series	
	KC, MY	KD
Appearance	No physical damage	No physical damage
Dielectric Strength	Per Item 5	
I.R.	1000 MΩ min.	1000 MΩ min.

10. Discharge Test II

A single layer of cheesecloth is to be placed around the body of the test capacitor. Each sample is to be subjected to 4 discharges from a dump capacitor charged to a voltage that, when discharged, places 5KV (KC, MY, KD type) across Ct. The interval between succesive discharges is to be 5 seconds. A 240V, 60Hz potential is to be applied across Ct and is to be maintained for 30 seconds after the fourth discharge, unless the circuit is otherwise opened sooner due to breakdown of Ct. The test circuit is shown as Figure 2 and the test results shall meet the parameters of Table 3.

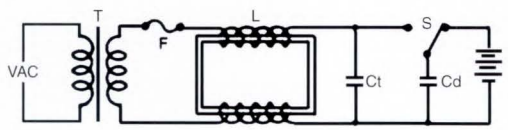


Fig. 2

The direct current supply is to be adjusted to provide a potential in accordance with the following.

$$VDC = \frac{5000(Cd + Ct)}{Cd} \quad (V)$$

VDC :Variable direct-current voltage source
S :High-voltage switch
L :Choke coil of approximately 3mil and 0.03Ω
F :Plug fuse rate 30A and 125V
VAC :Supply source rated 120V, 60Hz and 30A
Ct :Capacitor under test
Cd :Dump capacitor

Capacitance Value(s) and Dissipation Factor(s) are as follows:

TABLE 3

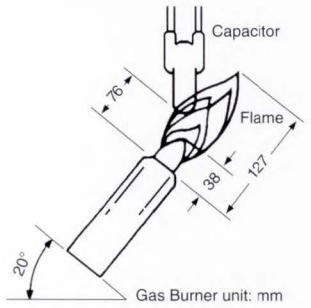
Item	Series		
	KC, MY		KD
Cap. Value of Ct	0 to 0.005μF	0.0051 to 0.05μF	0 to 0.005μF
Cap. Value of Cd	0.005μF	0.05μF	0.005μF
D.F.	0.5% max.		0.5%

TABLE 4

Item	Series
	KC, MY, KD
Appearance	The cheesecloth around capacitor shall not glow or flame.

11. Flame Test

Capacitor shall be subjected to Figure 3 for 15 sec. and then removed for 15 sec. for 5 cycles.
1st to 4th cycles: 30 sec. max.
5th cycle :60 sec. max. with flame extinguished



Dimensions: mm

Fig. 3

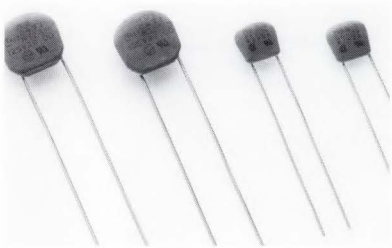
12. Encapsulation

Conformally coated in epoxy resin, which conforms to UL94V-6.

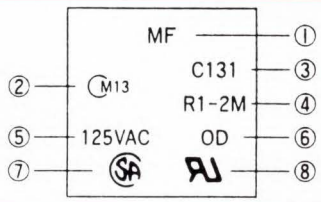
CAPRISTORS
UL-CSA RECOGNIZED

muRata

125 VAC



TYPICAL MARKINGS



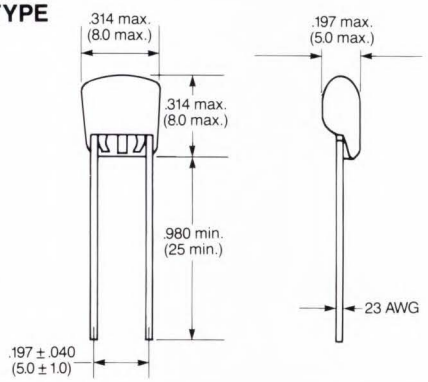
Item	Code
① Recognized Type	MF,MG
② Manufacturer's Identification	M13
③ Capacitance : Marked with 3 figures	Ex. : C131
④ Resistance Range : R□—□M	Ex. : R1-2M
⑤ Rated Voltage : (MB type not marked)	125VAC
⑥ Manufacturer's Date Code : Abbreviation	Ex. : 0D
⑦ CSA Monogram	
⑧ UL Recognized Mark	

PART NUMBERING SYSTEM

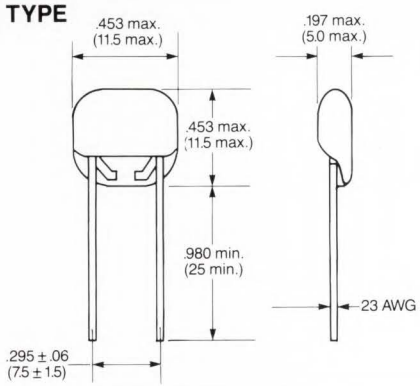
B2R6	31	C	131	R1-2M	–193	MB
Capristor Type and Size	Lead Configuration	With Spark Gap	Capacitance Value (pF)	Resistance Value (MΩ)	Production Codes	UL/CSA Recognized Type

DIMENSIONS: in. (mm)

MB TYPE



MF/MG TYPE



SPECIFICATIONS

Part Number	Type Name	Capacitor				Resistor		Circuit
		Nominal Capacitance	Cap. Tol.	Rated Voltage	Temperature Characteristic	Resistance Range	Rated Power	
B2R631C131R1-2M-193MB	MB	130pF	+100% −0%	125 VAC	Y5P	1-2MΩ	½W	
B2R631C131R2.5-4M-193MB						2.5-4MΩ		
B2R631C271R1-2M-193MB		270pF			Y5U	1-2MΩ		
B2R631C271R2.5-4M-193MB						2.5-4MΩ		
B2R131C131R1-2M-121MF	MF	130pF			Y5P	1-2MΩ		
B2R131C271R1-2M-121MF		270pF			Y5U			
B2R131C471R1-2M-121MF		470pF						
B2R131C131R2.5-4M-141MG	MG	130pF			Y5P	2.5-4MΩ		
B2R131C131R3.2-5.2M-141MG						3.2-5.2MΩ		
B2R131C271R2.5-4M-141MG		270pF			Y5U	2.5-4MΩ		
B2R131C271R3.2-5.2M-141MG						3.2-5.2MΩ		
B2R131C471R2.5-4M-141MG		470pF				2.5-4MΩ		
B2R131C471R3.2-5.2M-141MG						3.2-5.2MΩ		

Y5P: ±10% (–30- +85°C), Y5U: +22, –56% (–30- +85°C)

SAFETY STANDARDS / APPROVAL

	(File No. E37921)	UL 1414 Across-the-Line Capacitor Antenna-Coupling and Line-by-Pass Capacitor	(MB/MF/MG type) (MB/MF/MG type)
	(File No. LR92026)	C22.2 No. 0 C22.2 No. 1 Across-the-Line Capacitor Antenna Isolation Capacitors	(MG type) (MB/MF/MG type)

CAPRISTORS
UL-CSA RECOGNIZED

Test Conditions: Unless otherwise specified, measurements shall be made at +20°C, ±5°C, a relative humidity of 65%, and normal atmospheric pressure.

Operating Temperature Range: −30°C to +85°C.

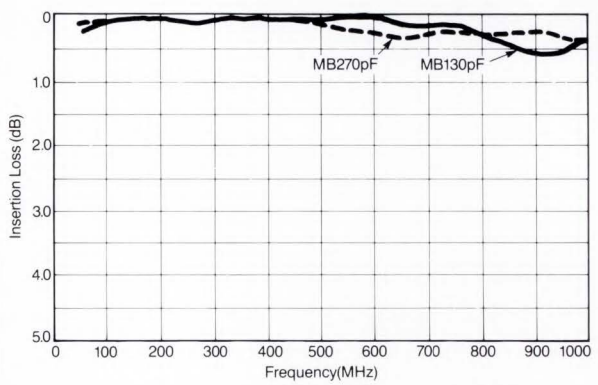
Capacitance: Less than 470pF measured at 1 ± 0.1 MHz, 5Vrms max, and 20°C. 470pF and over measured at 1 ± 0.1 KHz, 5Vrms max, and 20°C.

Resistance: Measured with applied voltage between 5 to 50VDC with a resistance bridge or other test method not having a combined limit error exceeding 0.5%.

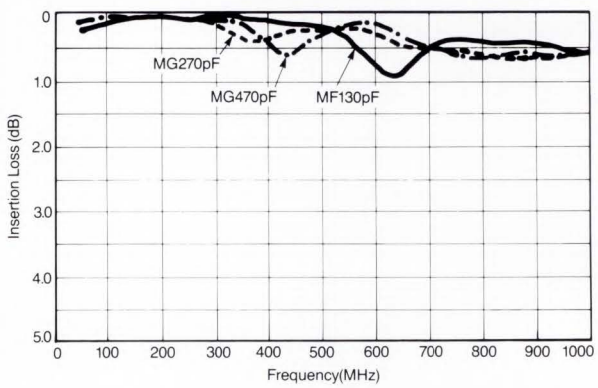
Dielectric Strength: Between both leads; 1250Vrms, 50 or 60 Hz for 1 minute max. Flash Test; 1300 Vrms, 50 or 60 Hz for 1 sec with current limited to 30 mA.

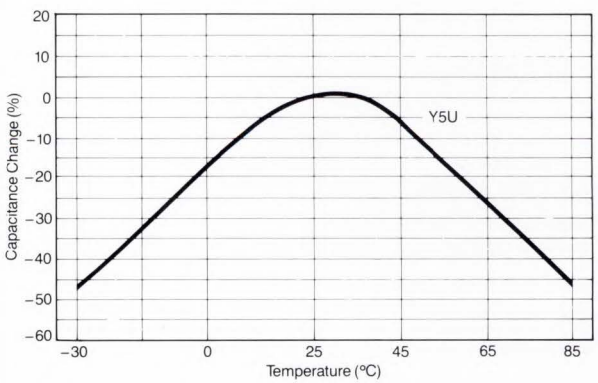
Terminal Strength: Lead wire shall not be severed nor capristor damaged when a load of 2.19 pounds is applied and held for 1 to 5 seconds.

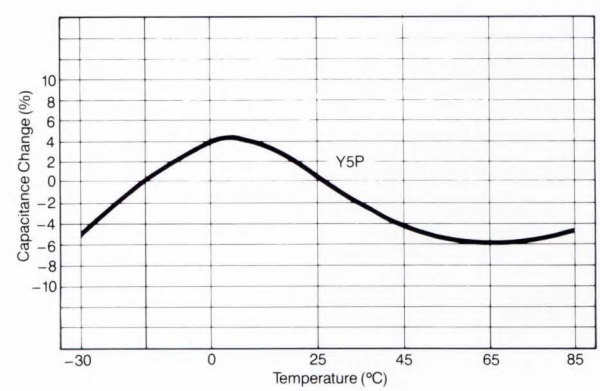
Solderability: Lead wire shall be soldered and uniformly coated on all axial direction over ¾ (75%) of the circumference direction when dipped into molten solder of 230 ± 5°C for 2 ± 0.5 seconds.



As shown in the above diagram, insertion loss is very small at VHF and UHF frequencies and excellent performance can be obtained in antenna coupling application.

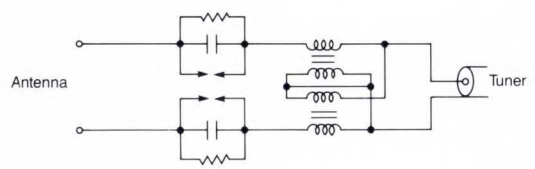




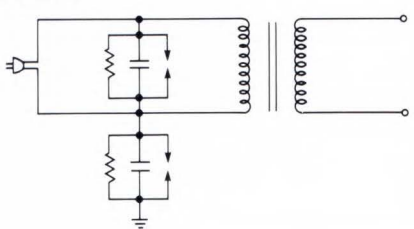


TYPICAL APPLICATIONS

Antenna Circuit



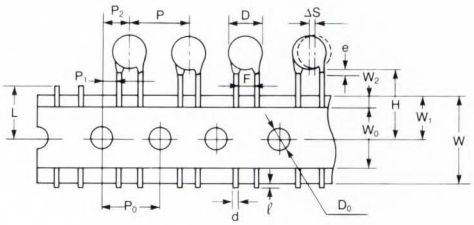
Power Circuit



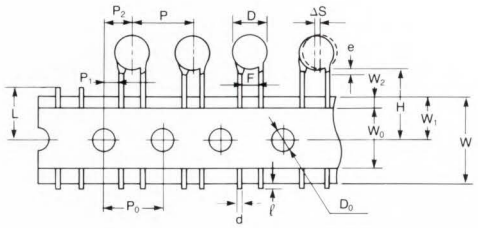
TAPED PACKAGING
MKV & SAFETY CAPACITORS
DE SERIES

muRata

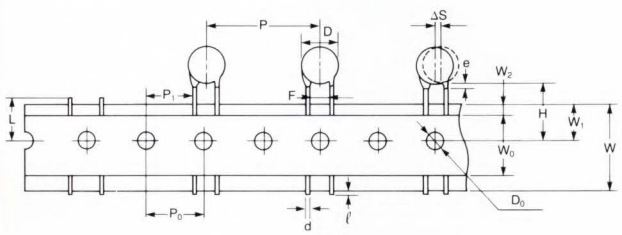
For MKV to 2KV DC, ≤ 11 mm Dia.
- 12.7mm pitch/lead spacing 5mm
  (Lead Code: - 979)



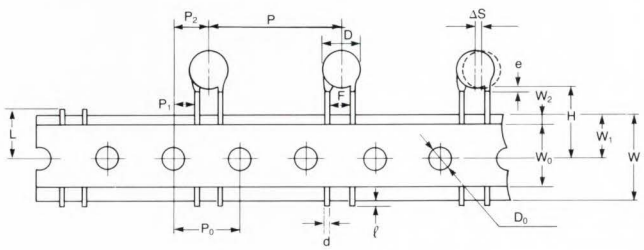
For UP to 13mm Dia., 1-3KV DC &
Safety Caps (DE7090 & DE7100)
- 15mm pitch/lead spacing 7.5mm
  (Lead Code: - 486)



For MKV ≥ 14mm Dia., 1-3KV DC &
Safety Caps (DE7120 & DE7150)
- 30mm pitch/lead spacing 7.5mm
  (Lead Code: - 477)



For 10mm Lead Spacing
- 25.4mm pitch/lead spacing 10.0mm
  (Lead Code: - 487)



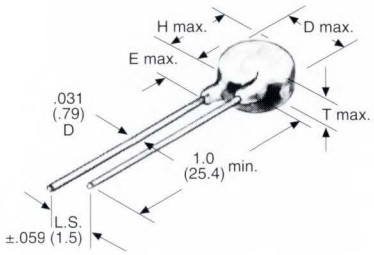
DIMENSIONS: mm

ITEM	CODE	-979	-486	-487	-477
Pitch of component	P	12.7	15.0	25.4	30.0
Pitch of sprocket hole	P_0	12.7 ± 0.3	15.0 ± 0.3	12.7 ± 0.3	15.0 ± 0.3
Lead spacing	F	$5.0^{+0.8}_{-0.2}$	7.5 ± 1.0	10.0 ± 1.0	7.5 ± 1.0
Length from hole center to component center	P_2	6.35 ± 1.3	7.5 ± 1.5	—	7.5 ± 1.5
Length from hole center to lead	P_1	3.85 ± 0.7	3.75 ± 1.0	7.7 ± 1.5	3.75 ± 1.0
Body diameter	D	See individual product specifications			
Deviation along tape, left or right	ΔS	0 ± 1.0	0 ± 2.0		
Carrier tape width	W	18.0 ± 0.5			
Position of sprocket hole	W_1	9.0 ± 0.5			
Lead distance between reference and bottom planes	H	$20.0^{+1.5}_{-1.0}$		$18.0^{+2.0}_{-0}$	$20.0^{+1.5}_{-1.0}$
Protusion length	ℓ	+0.5 / −1.0			
Diameter of sprocket hole	D_0	4.0 ± 0.1			
Lead Diameter	d	$.6 \pm 0.05$	$.65 \pm 0.05$		
Total tape thickness	t_1	0.6 ± 0.3			
Total thickness, tape and lead wire	t_2	1.5 max.			
Portion to cut in case of defect	L	$11.0^{+0}_{-1.0}$			
Hold down tape width	W_0	11.5 min.			
Hold down tape position	W_2	1.5 ± 1.5			
Coating extension on lead	e	3.0 max.			

HIGH VOLTAGE, RADIAL LEADED
CERAMIC DISC CAPACITORS
E.I.A. CLASS I

10 & 15 KVDC

DIMENSIONS: in. (mm)



PART NUMBERING SYSTEM

TYPE	TEMP. CHAR.	CAPACITANCE	TOL	VOLTAGE
DHR19	N4700	102	M	10KV

CAPACITOR TYPE AND SIZE

TEMPERATURE CHARACTERISTICS AND T.C. TOLERANCES
See T.C. graph

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
M= ±20%

VOLTAGE
Identified by a two-digit number.

PREFFERED VALUES 10 AND 15 KVDC

PART NUMBER	CAPACITANCE (pF)	WORKING VOLTAGE (KVDC)	DIMENSIONS in.: (mm)				
			D max.	H max.	T max.	L.S.	E max.
★DHR12 N4700 221M 10KV	220	10	.472 (12)	.512 (13)	.275 (7)	.375 (9.5)	.197 (5)
★DHR15 N4700 331M 10KV	330	10	.590 (15)	.630 (16)	.275 (7)	.375 (9.5)	.197 (5)
★DHR15 N4700 471M 10KV	470	10	.590 (15)	.630 (16)	.275 (7)	.375 (9.5)	.197 (5)
★DHR17 N4700 681M 10KV	680	10	.669 (17)	.700 (17.8)	.275 (7)	.375 (9.5)	.197 (5)
★DHR19 N4700 102M 10KV	1,000	10	.748 (19)	.791 (20.1)	.275 (7)	.500 (12.7)	.197 (5)
★DHR9 N4700 820M 15KV	82	15	.354 (9)	.394 (10)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR9 N4700 101M 15KV	100	15	.354 (9)	.394 (10)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR12 N4700 151M 15KV	150	15	.472 (12)	.512 (13)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR12 N4700 221M 15KV	220	15	.472 (12)	.512 (13)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR15 N4700 331M 15KV	330	15	.590 (15)	.630 (16)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR17 N4700 471M 15KV	470	15	.669 (17)	.697 (17.7)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR19 N4700 681M 15KV	680	15	.748 (19)	.787 (20)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR22 N4700 102M 15KV	1,000	15	.866 (22)	.909 (23.1)	.330 (8.4)	.500 (12.7)	.197 (5)

TYPICAL MARKING

Manufacturer's Identification
Capacitance (in 3-digit code)
Tolerance (EIA Code)
T.C.
Rated Voltage

★All preferred values available as standard from authorized Murata Electronics Distributors.

HIGH VOLTAGE, RADIAL LEADED CERAMIC DISC CAPACITORS SPECIFICATIONS: CLASS I

Temperature Range
−30 to +85°C.

Capacitance
Capacitance shall be within the specified tolerance when measured at temperature of 25°C and 1±0.1KHz with 1.0 to 5.0Vrms.

Dissipation Factor
Dissipation Factor shall be less than 1.0% when measured at temperature of 20°C and 1±0.1KHz with 1.0 to 5.0Vrms.

Insulation Resistance
Insulation resistance shall exceed 10,000 MΩ when measured after 1.0 minute electrification time with 500VDC through the resistor at 1 MΩ.

Dielectric Strength (between terminals)
Capacitor shall not be damaged when 1.5 times of rated DC voltage applied between terminals for 30 seconds through a suitable resistor in a series to limit the charging current to 50mA max.

Encapsulation
Ceramic disc is conformally coated in an epoxy resin which conforms to UL94V-0.

Life Test

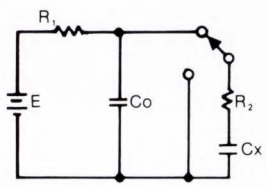
Appearance	:	no visible damage.
Capacitance Change	:	to be within ±10%
D.F.	:	2.5% max.
Insulation resistance	:	1,000 MΩ min.
Dielectric strength	:	no failure
When tested as follows,		
Temperature	:	85±3°
Applied voltage	:	1.25 times rated voltage
Period of test	:	1000 $^{+48}_{-0}$ hours

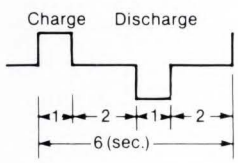
To be measured at 4 hours after placed at room condition.

Charge-Discharge Test

Appearance	:	no visible damage
Capacitance Change	:	to be within ±10%
D.F.	:	2.5% max.
Insulation resistance	:	1,000 MΩ min.
When tested as follows,		
Temperature	:	room condition
Applied voltage	:	rated voltage
Period time	:	charge for 1 sec. discharge for 1 sec. after 2 sec.
Cycle numbers	:	20,000 cycles
Circuit	:	see below

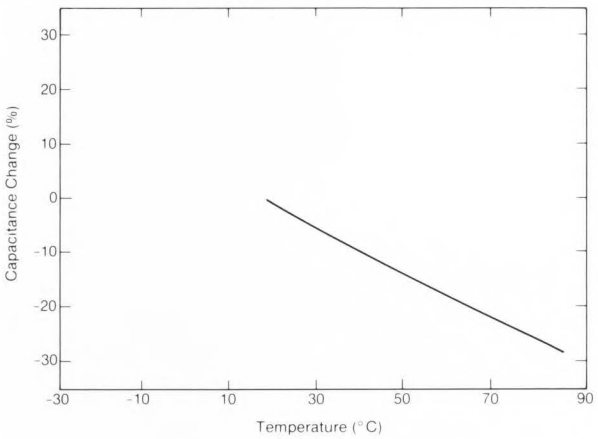
To be measured at 1-2 hours after placed at room condition.



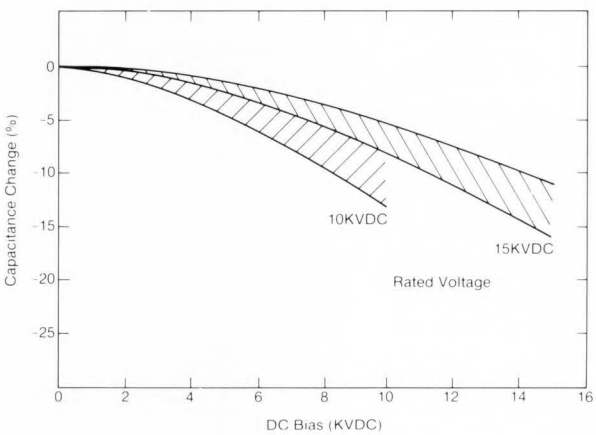


E : rated voltage
R1 : circuit protecvtive resistor
R2 : current limiting resistor (10 Amp.)
Co : supplied energy for Cx. Co = 10Cx
Cx : specimen

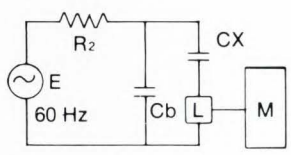
TEMPERATURE CHARACTERISTICS



CAPACITANCE VS. DC BIAS



Corona Test
Corona shall be measured in the following test circuit. Corona shall be 50 picocoulomb max. in direct reading at 2KVrms (for 10KV rated voltage) or 3KVrms (for 15KV rated voltage).



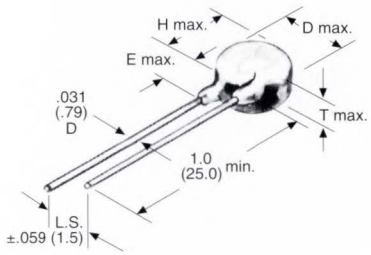
E : power supply (corona free)
R : circuit protective resistor
CB : by-pass capacitor
Cx : specimen
L : corona pulse pick-up coil
M : corona detector; tuning type

CERAMIC CAPACITORS

HIGH VOLTAGE, RADIAL LEADED
CERAMIC DISC CAPACITORS
E.I.A. CLASS II & III

7.5, 10 & 15 KVDC

DIMENSIONS: in. (mm)



PART NUMBERING SYSTEM

TYPE	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE
DHR17	Y5P	102	M	10KV

CAPACITOR TYPE AND SIZE

TEMPERATURE CHARACTERISTICS
Temperature Range
Y5= –30°C to +85°C; Z5= +10°C to +85°C
MAX. CAP. CHANGE OVER TEMP. RANGE
P= ±10%; U= +22, –56%

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
M= ±20%
Z= +80%, –20%

VOLTAGE
Identified by a two-digit number.

PREFFERED VALUES – 7.5, 10 AND 15 KVDC

PART NUMBER	CAPACITANCE (pF)	WORKING VOLTAGE (KVDC)	DIMENSIONS in.: (mm)				
			D max.	H max.	T max.	L.S.	E max.
★DHR9 Y5P 101M 7.5KV	100	7.5	.354 (9)	.394 (10)	.275 (7)	.375 (9.5)	.157 (4)
★DHR9 Y5P 151M 7.5KV	150		.354 (9)	.394 (10)	.275 (7)	.375 (9.5)	.157 (4)
★DHR9 Y5P 221M 7.5KV	220		.354 (9)	.394 (10)	.275 (7)	.375 (9.5)	.157 (4)
★DHR10 Y5P 331M 7.5KV	330		.394 (10)	.433 (11)	.275 (7)	.375 (9.5)	.157 (4)
★DHR12 Y5P 471M 7.5KV	470		.472 (12)	.512 (13)	.275 (7)	.375 (9.5)	.157 (4)
★DHR13 Y5P 681M 7.5KV	680		.512 (13)	.551 (14)	.275 (7)	.375 (9.5)	.157 (4)
★DHR15 Y5P 102M 7.5KV	1,000		.590 (15)	.631 (16)	.275 (7)	.375 (9.5)	.157 (4)
★DHR9 Z5U 471Z 7.5KV	470		.354 (9)	.394 (10)	.275 (7)	.375 (9.5)	.157 (4)
★DHR10 Z5U 681Z 7.5KV	680		.394 (10)	.433 (11)	.275 (7)	.375 (9.5)	.157 (4)
★DHR11 Z5U 102Z 7.5KV	1,000		.433 (11)	.472 (12)	.275 (7)	.375 (9.5)	.157 (4)
★DHR13 Z5U 152Z 7.5KV	1,500		.512 (13)	.551 (14)	.275 (7)	.375 (9.5)	.157 (4)
★DHR15 Z5U 222Z 7.5KV	2,200		.590 (15)	.631 (16)	.275 (7)	.375 (9.5)	.157 (4)
★DHR9 Y5P 151M 10KV	150	10	.354 (9)	.394 (10)	.275 (7)	.375 (9.5)	.197 (5)
★DHR9 Y5P 221M 10KV	220		.354 (9)	.394 (10)	.275 (7)	.375 (9.5)	.197 (5)
★DHR12 Y5P 331M 10KV	330		.472 (12)	.512 (13)	.275 (7)	.375 (9.5)	.197 (5)
★DHR15 Y5P 471M 10KV	470		.590 (15)	.630 (16)	.275 (7)	.375 (9.5)	.197 (5)
★DHR15 Y5P 681M 10KV	680		.590 (15)	.630 (16)	.275 (7)	.375 (9.5)	.197 (5)
★DHR17 Y5P 102M 10KV	1,000		.669 (17)	.700 (17.8)	.275 (7)	.500 (12.7)	.197 (5)
★DHR24 Y5P 202M 10KV	2,000		.945 (24)	.984 (25)	.275 (7)	.622 (15.8)	.197 (5)
★DHR9 Y5P 101M 15KV	100	15	.354 (9)	.394 (10)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR9 Y5P 151M 15KV	150		.354 (9)	.394 (10)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR12 Y5P 221M 15KV	220		.472 (12)	.512 (13)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR12 Y5P 331M 15KV	330		.472 (12)	.512 (13)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR15 Y5P 471M 15KV	470		.590 (15)	.630 (16)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR17 Y5P 681M 15KV	680		.669 (17)	.700 (17.8)	.330 (8.4)	.500 (12.7)	.197 (5)
★DHR20 Y5P 102M 15KV	1,000		.787 (20)	.830 (21.1)	.330 (8.4)	.500 (12.7)	.197 (5)

TYPICAL MARKING

Manufacturer's Identification
Capacitance (in pF)
Tolerance (EIA Code)
T.C.
Rated Voltage

★All preferred values available as standard from authorized Murata Electronics Distributors.

HIGH VOLTAGE, RADIAL LEADED CERAMIC DISC CAPACITORS SPECIFICATIONS: CLASS II & III

Temperature Range
–30 to +85°C.

Capacitance
Capacitance shall be within the specified tolerance when measured at temperature of 25°C and 1 ± 0.1KHz with 1.0 to 5.0Vrms.

Dissipation Factor
Dissipation Factor shall be less than 2.5% when measured at temperature of 25°C and 1 ± 0.1KHz with 1.0 to 5.0Vrms.

Insulation Resistance
Insulation resistance shall exceed 10,000MΩ when measured after 1.0 minute electrification time with 500VDC through the resistor at 1MΩ.

Dielectric Strength (between terminals)
Capacitor shall not be damaged when 1.5 times of rated DC voltage applied between terminals for 30 seconds through a suitable resistor in a series to limit the charging current to 50mA max.

Encapsulation
Ceramic disc is conformally coated in an epoxy resin which conforms to UL94V-0.

Life Test (Conditions)
When tested as follows:

Temperature	:	85 ± 3°
Applied voltage	:	1.25 times rated voltage
Period of test	:	$1{,}000^{+48}_{-0}$ hours

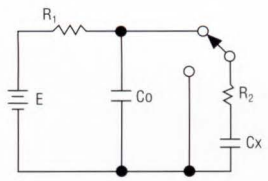
To be measured at 4 hours after placed at room condition.

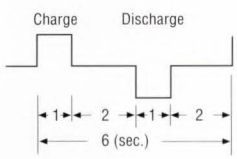
Appearance	:	no visible damage
Capacitance Change	:	± 10% max. for char. Y5P
	:	± 20% max. for char. Z5U
D.F.	:	5% max.
Insulation resistance	:	1,000MΩ min.
Dielectric strength	:	no failure

Charge-Discharge Test
tested as follows:

Temperature	:	25°C
Applied voltage	:	rated voltage
Period time	:	charge for 1 sec.
		after 2 sec.
Cycle numbers	:	20,000 cycles
Circuit	:	see below

To be measured at 1-2 hours after test at room condition.

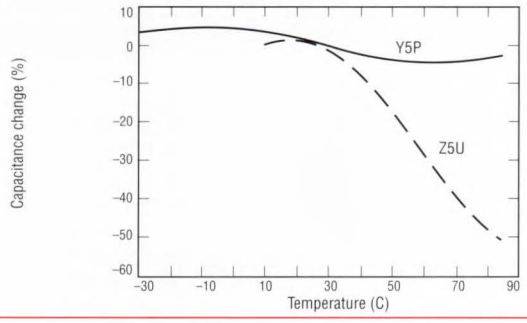




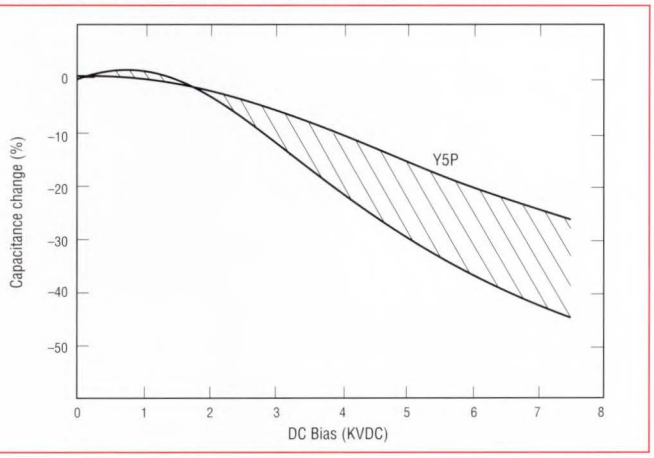
E : rated voltage
R1 : circuit protective resistor
R2 : current limiting resistor (10 Amp.)
Co : supplied energy for Cx. Co = 10Cx
Cx : specimen

Appearance	:	no visible damage
Capacitance Change	:	± 10% max. for char. Y5P
	:	± 20% max. for char. Z5U
Dissipation Factor	:	5% max.
Insulation Resistance	:	1,000MΩ min.

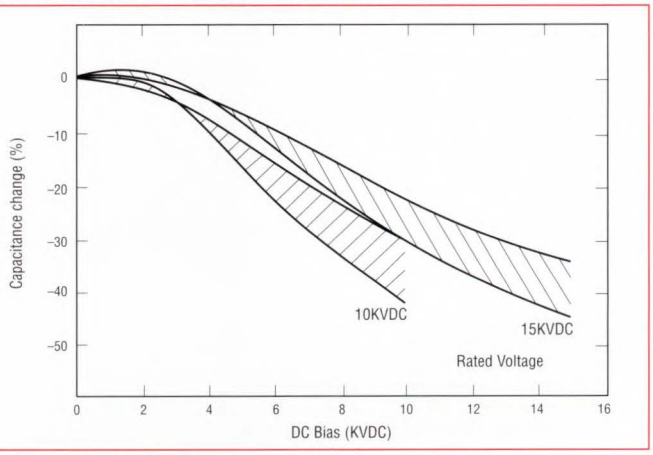
TYPICAL TEMPERATURE CHARACTERISTICS



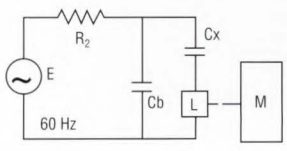
CAPACITANCE VS. DC BIAS 7.5 KV



CAPACITANCE VS. DC BIAS 10 & 15 KV



Corona Test
Corona shall be measured in the following test circuit. Corona shall be 50 picocoulomb max. in direct reading at 2KVrms (for 10KV rated voltage) or 3KVrms (for 15KV rated voltage).

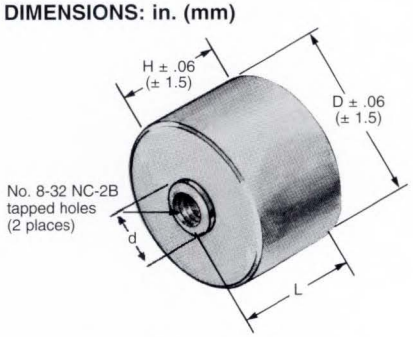


E : power supply (corona free)
R : circuit protective resistor
Cb : by-pass capacitor
Cx : specimen
L : corona pulse pick-up coil
M : corona detector; tuning type

HIGH VOLTAGE CERAMIC CAPACITORS
DHS SERIES E.I.A. CLASS I

10 to 40 KVDC

DIMENSIONS: in. (mm)



Murata Electronic's new High Voltage Ceramic Capacitors DHS N4700 series is designed to meet the stringent requirements of high voltage applications and feature a low dissipation factor and a low voltage coefficient.

FEATURES

- Epoxy resin encapsulated
- Small size
- Low dissipation factor and low heating value
- Linear temperature characteristic
- Low DC, AC-voltage coefficient

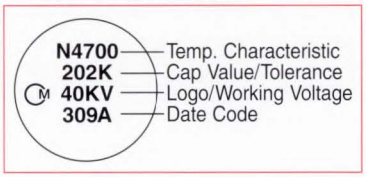
APPLICATIONS

- HV DC power supplies
- Lightning arrestor voltage distribution systems
- Electron microscopes, synchroscopes
- Lasers (CO_2, Excimer,etc.)
- Electrostatic copying machines

PART NUMBERING SYSTEM

DHS60	—	120	N4700	202	K	40KV
CAPACITOR TYPE AND SIZE		OTHER SPECIFICATION 120: Large terminal No code: Std. Terminal	TEMPERATURE CHARACTERISTIC	CAPACITANCE VALUE 3-digit code (pf)	CAPACITANCE TOLERANCE K: ±10% M: ±20%	RATED VOLTAGE

TYPICAL MARKING



STANDARD TERMINAL STYLE

Part Number	Capacitance (pF)	Rated Voltage		Test Voltage (KVDC)	Dimensions: in. (mm)			Thread Size
		KVDC	KVAC(60Hz)		D	L	H	
★ DHS20 N4700 561M 10KV	560	10	4	15	.787 (20)	.63 (16)	.47 (12)	NO 8-32 NC-2B taped holes (2 places) Dia: .260 (6.6mm) Hole Depth: 10,15KV: 4mm 20,30KV: 6mm 40KV: 8mm
★ DHS30 N4700 122M 10KV	1200				1.18 (30)			
★ DHS30 N4700 182M 10KV	1800				1.18 (30)			
★ DHS38 N4700 282M 10KV	2800				1.49 (38)			
★ DHS52 N4700 502M 10KV	5000				2.04 (52)			
★ DHS60 N4700 802M 10KV	8000				2.36 (60)			
★ DHS20 N4700 371M 15KV	370	15	6	23	.787 (20)	.71 (18)	.55 (14)	
★ DHS30 N4700 801M 15KV	800				1.18 (30)			
★ DHS30 N4700 112M 15KV	1100				1.18 (30)			
★ DHS38 N4700 192M 15KV	1900				1.49 (38)			
★ DHS52 N4700 342M 15KV	3400				2.04 (52)			
★ DHS60 N4700 532M 15KV	5300				2.36 (60)			
★ DHS20 N4700 281M 20KV	280	20	8	30	.787 (20)	.95 (24)	.787 (20)	
★ DHS30 N4700 601M 20KV	600				1.18 (30)			
★ DHS30 N4700 881M 20KV	880				1.18 (30)			
★ DHS38 N4700 142M 20KV	1400				1.49 (38)			
★ DHS52 N4700 252M 20KV	2500				2.04 (52)			
★ DHS60 N4700 402M 20KV	4000				2.36 (60)			
★ DHS20 N4700 191M 30KV	190	30	12	45	.787 (20)	1.10 (28)	.95 (24)	
★ DHS30 N4700 401M 30KV	400				1.18 (30)			
★ DHS30 N4700 591M 30KV	590				1.18 (30)			
★ DHS38 N4700 941M 30KV	940				1.49 (38)			
★ DHS52 N4700 172M 30KV	1700				2.04 (52)			
★ DHS60 N4700 272M 30KV	2700				2.36 (60)			
★ DHS20 N4700 141M 40KV	140	40	16	60	.787 (20)	1.42 (36)	1.26 (32)	
★ DHS30 N4700 301M 40KV	300				1.18 (30)			
★ DHS30 N4700 441M 40KV	440				1.18 (30)			
★ DHS38 N4700 701M 40KV	700				1.49 (38)			
★ DHS52 N4700 132M 40KV	1300				2.04 (52)			
★ DHS60 N4700 202M 40KV	2000				2.36 (60)			

LARGE TERMINAL STYLE

Part Number	Capacitance (pF)	Rated Voltage		Test Voltage (KVDC)	Dimensions: in. (mm)				Thread Size
		KVDC	KVAC(60Hz)		D	L	d	H	
DHS48-120 N4700 502K 10K	5000	10	4	15	1.89 (48)	0.71 (18)	0.59 (15)	0.55 (14)	ISO M5 Depth: 0.2 Dia: 0.59 (15)
DHS60-120 N4700 802K 10K	8000	10	4	15	2.78 (60)	0.71 (18)		0.55 (14)	
DHS48-120 N4700 342K 15K	3400	15	6	23	1.89 (48)	0.79 (20)		0.63 (16)	
DHS60-120 N4700 532K 15K	5300	15	6	23	2.36 (60)	0.79 (20)		0.63 (16)	
DHS48-120 N4700 252K 20K	2500	20	8	30	1.89 (48)	0.90 (23)		0.75 (19)	
DHS60-120 N4700 402K 20K	4000	20	8	30	2.78 (60)	0.90 (23)		0.75 (19)	
DHS48-120 N4700 172K 30K	1700	30	12	45	1.89 (48)	1.02 (26)		0.86 (22)	
DHS60-120 N4700 272K 30K	2700	30	12	45	2.36 (60)	1.02 (26)		0.86 (22)	
DHS48-120 N4700 132K 40K	1300	40	16	60	1.89 (48)	1.26 (32)		1.10 (28)	
DHS60-120 N4700 202K 40K	2000	40	16	60	2.78 (60)	1.26 (32)		1.10 (28)	
DHS48-120 N4700 102K 50K	1000	50	20	75	1.89 (48)	1.38 (35)		1.22 (31)	
DHS60-120 N4700 172K 50K	1700	50	20	75	2.36 (60)	1.38 (35)		1.22 (31)	

★Available as standard through authorized Murata Electronics Distributors.

HIGH VOLTAGE CERAMIC CAPACITORS
DHS SERIES SPECIFICATIONS

Temperature Range
Operating: −20°C to +85°C
Storage: −30°C to +125°C

Capacitance and Tolerance
Capacitance change shall exceed ±20% when measured at 1KHz ± 0.1KHz at 25°C with not more than 5±0.05Vrms, AC applied during measurement.

Dissipation Factor
The maximum dissipation factor for these capacitors shall be 0.5%.
Dissipation factor shall be measured at a frequency of 1KHz ± 0.1KHz at 25°C with not more than 5 ± 0.5Vrms, AC applied during measurements.

Temperature Characteristics

Characteristic	Temp. Range	Base Temp.	Temp. Coeff.
N4700	−30°C to +85°C	20°	(−4,700 ± 1,000) × 10^{-6}/°C

Dielectric Strength Test
These capacitors shall withstand the specified test voltage for 1 minute through a current-limiting resistor of 1,000Ω.

Insulation Resistance
The minimum value of insulation resistance shall be not less than 10,000MΩ at 25°C.
Measurements shall be made after a 1 minute charge at 1,000VDC voltage through a current limiting resistor which shall be not greater than 10MΩ.

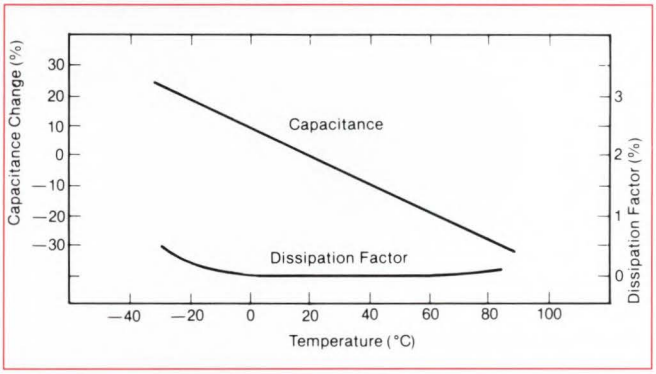
Humidity Resistance
After exposure for a period of 100 hours to an atmosphere of 95% relative humidity at a temperature of +40°C, capacitors shall have a minimum insulation resistance of 5,000MΩ and a maximum dissipation factor of 1.5%. Twenty-four hours after removal from the test chamber, capacitors shall be measured in accordance with section 3 and 6.

Life Test
These capacitors shall withstand a test potential of 1.5 times the rated DC voltage for a period of 1,000 hours at an ambient temperature of +85°C.

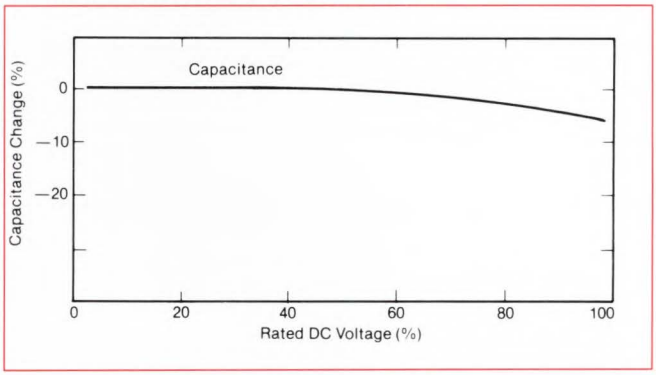
Encapsulation
Ceramic is enclosed in a molded epoxy resin.

Caution for Use
Some chemicals may be harmful to the DHS Series when used as an insulating medium. Please consult with Murata Electronics Product Engineering before exposing these capacitors to chemicals such as Freon, oil, etc.

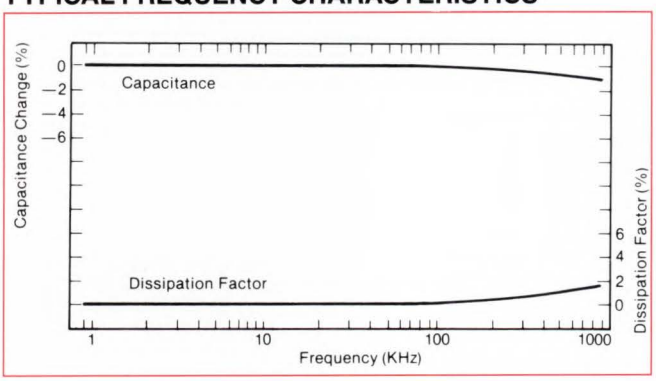
TYPICAL TEMPERATURE CHARACTERISTICS



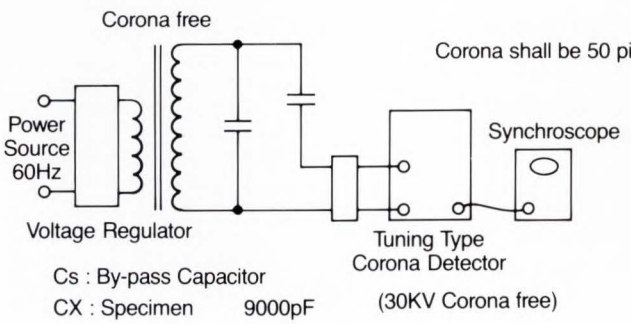
TYPICAL VOLTAGE COEFFICIENT



TYPICAL FREQUENCY CHARACTERISTICS



CORONA TEST

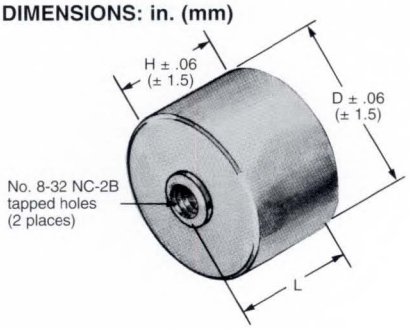


Corona shall be 50 picocoulomb max. in direct reading at
2KVrms (10KV rated voltage)
3KVrms (15KV rated voltage)
4KVrms (20KV rated voltage)
6KVrms (30KV rated voltage)
8KVrms (40KV rated voltage)

HIGH VOLTAGE CERAMIC CAPACITORS
DHS SERIES E.I.A. CLASS III

10 to 40 KVDC

DIMENSIONS: in. (mm)



FEATURES

- Epoxy resin encapsulated
- Small size
- Highly reliable internal construction
- Wide selection of values
- Up to 40 KVDC working voltage

APPLICATIONS

- Electrostatic copying machines
- Electron microscopes, synchroscopes
- CRT power supplies
- Lightning arrestor voltage distribution systems
- HVDC power supplies
- Lasers (CO_2, Excimer, etc.)

PART NUMBERING SYSTEM

TYPE	TEMP. CHAR.	CAPACITANCE	TOLERANCE	VOLTAGE
DHS20	Z5V	681	Z	10KV

CAPACITOR TYPE AND SIZE

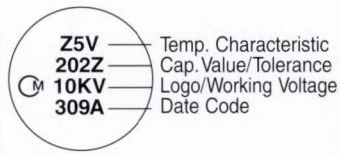
TEMPERATURE CHARACTERISTIC
Temperature Range Z5 = + 10°C to +85°C
MAX. CAP. CHANGE OVER TEMP. RANGE
V = +22%, –82%

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digits specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
Z = +80%, –20%

VOLTAGE
Identified by a two-digit number in KVDC.

TYPICAL MARKING



★ PREFERRED VALUES–10, 15, 20, 30 & 40 KVDC

Part Number	Capacitance (pF)	Rated Voltage KVDC	Test Voltage KVDC	Dimensions: in. (mm) D max.	L	H	Thread Size
DHS20 Z5V 681Z 10KV	680			.787(20)	.75(19)	.66(17)	
DHS24 Z5V 122Z 10KV	1,200			.94 (24)	.74(19)	.66(17)	
DHS30 Z5V 202Z 10KV	2,000			1.18 (30)	.75(19)	.66(17)	
DHS38 Z5V 322Z 10KV	3,200	10	15	1.49 (38)	.74(19)	.66(17)	
DHS43 Z5V 472Z 10KV	4,700			1.69 (43)	.75(19)	.66(17)	
DHS52 Z5V 652Z 10KV	6,500			2.04 (52)	.74(19)	.66(17)	
DHS57 Z5V 832Z 10KV	8,300			2.24 (57)	.75(19)	.66(17)	
DHS60 Z5V 932Z 10KV	9,300			2.36 (60)	.74(19)	.66(17)	
DHS20 Z5V 471Z 15KV	470			.787(20)	.90(23)	.82(21)	
DHS24 Z5V 801Z 15KV	800			.94 (24)	.90(23)	.82(21)	
DHS30 Z5V 132Z 15KV	1,300			1.18 (30)	.90(23)	.82(21)	
DHS38 Z5V 222Z 15KV	2,200	15	23	1.49 (38)	.90(23)	.82(21)	
DHS43 Z5V 322Z 15KV	3,200			1.69 (43)	.90(23)	.82(21)	
DHS52 Z5V 462Z 15KV	4,600			2.04 (52)	.90(23)	.82(21)	
DHS57 Z5V 582Z 15KV	5,800			2.24 (57)	.90(23)	.82(21)	
DHS60 Z5V 652Z 15KV	6,500			2.36 (60)	.90(23)	.82(21)	
DHS20 Z5V 351Z 20KV	350			.787(20)	1.02(26)	.94(24)	
DHS24 Z5V 601Z 20KV	600			.94 (24)	1.02(26)	.94(24)	
DHS30 Z5V 102Z 20KV	1,000			1.18 (30)	1.02(26)	.94(24)	No. 8-32
DHS38 Z5V 162Z 20KV	1,600	20	30	1.49 (38)	1.02(26)	.94(24)	NC-2B taped holes
DHS43 Z5V 242Z 20KV	2,400			1.69 (43)	1.02(26)	.94(24)	Depth: 4mm
DHS52 Z5V 332Z 20KV	3,300			2.04 (52)	1.02(26)	.94(24)	
DHS57 Z5V 432Z 20KV	4,300			2.24 (57)	1.02(26)	.94(24)	
DHS60 Z5V 482Z 20KV	4,800			2.36 (60)	1.02(26)	.94(24	
DHS20 Z5V 261Z 30KV	260			.787(20)	1.33(34)	1.25(32)	
DHS24 Z5V 461Z 30KV	460			.94 (24)	1.33(34)	1.25(32)	
DHS30 Z5V 781Z 30KV	780			1.18 (30)	1.33(34)	1.25(32)	
DHS38 Z5V 122Z 30KV	1,200	30	45	1.49 (38)	1.33(34)	1.25(32)	
DHS43 Z5V 182Z 30KV	1,800			1.69 (43)	1.33(34)	1.25(32)	
DHS52 Z5V 252Z 30KV	2,500			2.04 (52)	1.33(34)	1.25(32)	
DHS57 Z5V 332Z 30KV	3,300			2.24 (57)	1.33(34)	1.25(32)	
DHS60 Z5V 362Z 30KV	3,600			2.36 (60)	1.33(34)	1.25(32)	
DHS20 Z5V 181Z 40KV	180			.787(20)	1.61(41)	1.53(39)	
DHS24 Z5V 341Z 40KV	340			.94 (24)	1.61(41)	1.53(39)	
DHS30 Z5V 571Z 40KV	570			1.18 (30)	1.61(41)	1.53(39)	
DHS38 Z5V 921Z 40KV	920	40	60	1.49 (38)	1.61(41)	1.53(39)	
DHS43 Z5V 132Z 40KV	1,300			1.69 (43)	1.61(41)	1.53(39)	
DHS52 Z5V 192Z 40KV	1,900			2.04 (52)	1.61(41)	1.53(39)	
DHS57 Z5V 242Z 40KV	2,400			2.24 (57)	1.61(41)	1.53(39)	
DHS60 Z5V 272Z 40KV	2,700			2.36 (60)	1.61(41)	1.53(39)	

★Available as standard through authorized Murata Electronics Distributors.

HIGH VOLTAGE CERAMIC CAPACITORS
DHS SERIES SPECIFICATIONS

Temperature Range
Operating: −20°C to +85°C
Storage: −30°C to +125°C

Capacitance and Tolerance
Characteristic: Z5V
Temp. Range: −10°C to +85°C
Cap. Change: Within +22%, −82% of 25°C value (Within a given lot, ±10% of the mean value is typical)
Capacitance shall be measured at a frequency of 1KHz ± 0.1KHz at 25°C with not more than 5 ± 0.5Vrms AC applied during measurement.

Dissipation Factor
The maximum dissipation factor for these capacitors shall be 1.5%.
Dissipation factor shall be measured at a frequency of 1KHz ± 0.1KHz at 25°C with not more than 5 ± 0.5Vrms AC applied during measurements.

Dielectric Strength Test
These capacitors shall withstand the specified test voltage for 1 minute through a current-limiting resistor of 1000Ω.

Ultimate Voltage Breakdown Test
These capacitors shall be capable of withstanding a DC potential of twice the rated DC voltage for a period of 10 seconds. The test voltage shall be applied at a rate not greater than 10KV/second.

Insulation Resistance
The minimum value of insulation resistance shall be not less than 10,000MΩ.

Measurements shall be made after a 1 minute charge at 1,000V DC voltage through a current limiting resistor which shall be not greater than 10MΩ.

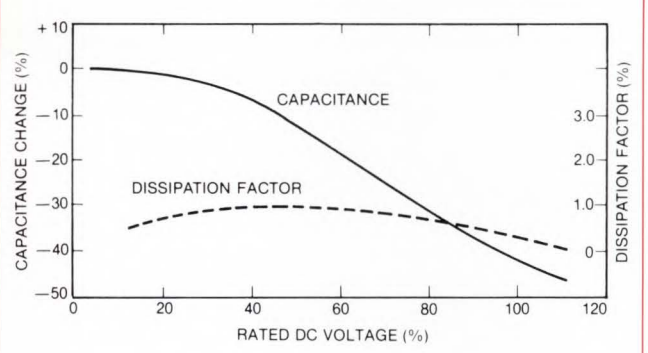
Humidity Resistance
After exposure for a period of 100 hours to an atmosphere of 95% relative humidity at a temperature of +40°C, capacitors shall have a minimum insulation resistance of 5000MΩ and a maximum dissipation factor of 2%. Twenty-four hours after removed from the test chamber, capacitors shall be measured in accordance with section 3 and 6.

Life Test
These capacitors shall withstand a test potential of 1.5 times the rated DC voltage for a period of 1000 hours at an ambient temperature of +85°C.

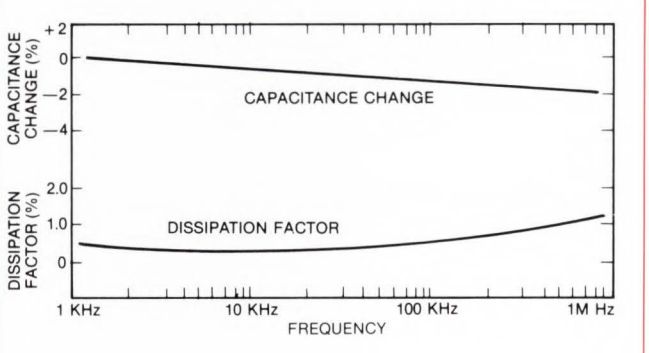
Encapsulation
Ceramic is enclosed in a molded epoxy resin.

Caution for Use
Some chemicals may be harmful to the DHS Series when used as an insulating medium. Please consult with Murata Erie Product Engineering before exposing these capacitors to chemicals such as Freon, oil, etc.

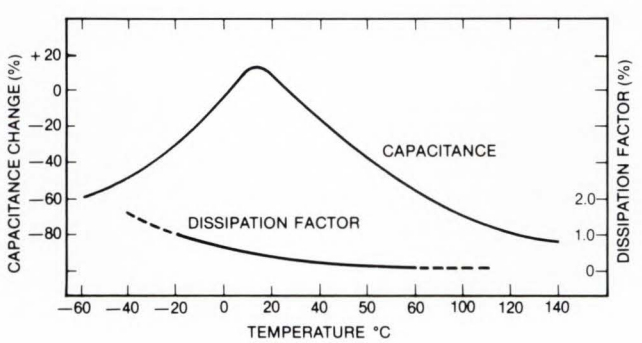
TYPICAL VOLTAGE COEFFICIENT



TYPICAL FREQUENCY CHARACTERISTICS



TYPICAL TEMPERATURE CHARACTERISTICS



CERAMIC CAPACITORS

POWER CERAMIC CAPACITORS
DC SERIES

FEATURES
- **Rugged construction, small size and light weight**
- **High voltage and power capability**
- **High "Q" and IR**
- **Low series inductance**

APPLICATIONS
- Radio communication equipment
- Small broadcasting equipment
- High frequency power supplies for high-frequency heating equipment and ultrasonic appliances
- Testing and measuring instruments

PART NUMBERING SYSTEM

DC510 UJ 101 K

TYPE
DC

TEMP. CHARACTERISTICS

Code		Temp. Coeff.
JIS	EIA	
CH	NPO	0±60ppm/°C
UJ	N750	−750±120 ppm/°C
YL	N3300	−3300±500 ppm/°C
F	Y5V	+30 to −80%

CAPACITANCE

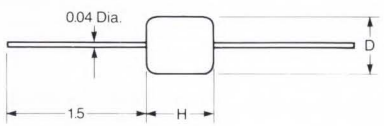
Code	Cap. Value (pF)
030	3
100	10
101	100
102	1000

CAPACITANCE TOLERANCE

Code	Cap. Tol.
D	±0.5pF
K	±10%
M	±20%

DIMENSIONS: inches

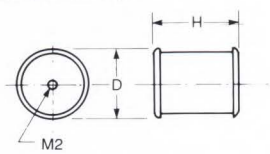
DC505, DC504, DC503 Series



TYPE	H±0.05	D±0.05
DC505	.343	.250
DC504	.375	.375
DC503	.473	.500

Fig. 1

DC515, DC514, DC513 Series



TYPE	H±0.05	D±0.05
DC515	.390	.312
DC514	.422	.437
DC513	.484	.562

Fig. 2

DC510, DC518 Series

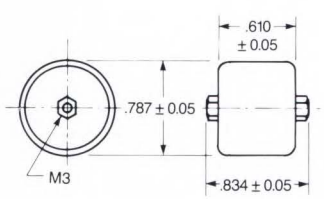


Fig. 3

DC507 Series

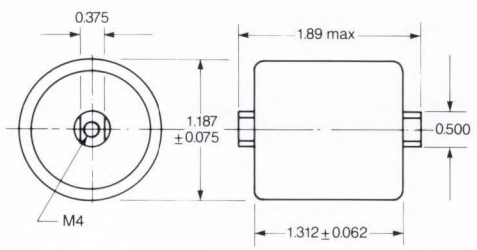


Fig. 4

DC517 Series

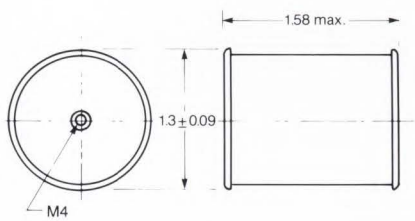


Fig. 5

DC509 Series

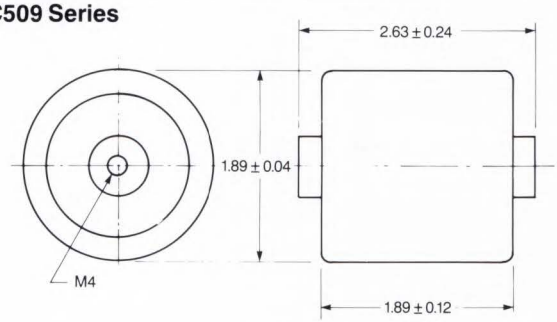


Fig. 6

POWER CERAMIC CAPACITORS
DC SERIES

SPECIFICATIONS

1. **Operating temperature range**
   −25°C to +85°C
2. **Storage temperature**
   −25°C to +100°C
3. **Capacitance**
   - T.C. Series
     Capacitance shall be measured at a frequency of 1MHz±100KHz at 25°C with not more than 5Vrms. Capacitance shall be within the specified capacitance tolerance.
   - Hi-K Series
     Capacitance shall be measured at a frequency of 1000Hz±100Hz at 25°C with not more than 5Vrms. Capacitance shall be within the specified capacitance tolerance.
4. **Capacitance Tolerance**
   Capacitance tolerance as shown below.
5. **Rated Voltage**
   Rated voltage as shown below.
6. **Withstanding Voltage**
   There shall be no damage when the specified test voltage is applied for 60 sec. at room temperature.
7. **Insulation Resistance**
   Insulation resistance shall be measured at 1,000V DC for 60 sec. through a resistor of less than 1MΩ. Insulation resistance shall be 10000 MΩ min.
8. **Q Factor or Dissipation Factor**
   - T.C. Series
     Q factor shall be measured at a frequency of 1000KHz±100KHz at 25°C with not more than 5Vrms. Q factor shall be the following specified values.
     Capacitance: 30pF and less
     Q=400+20•C (C=nominal capacitance)
     Capacitance: Over 30pF
     Q above 1000
   - Hi-K Series
     Dissipation factor shall be measured at a frequency of 1000Hz±100Hz at 25°C with not more than 5Vrms. Dissipation factor shall be 5% max.
9. **R.F. Current Rating**
   R.F. current ratings are to limit the I^2R losses and are in rms amperes. Temperature rise of these capacitors shall be 30°C max. above 25°C ambient.
10. **Temperature Coefficient**
    Temperature coefficient shall be the following specified values:

CH	0±60	ppm/°C
UJ	−750±120	ppm/°C
YL	−3300±500	ppm/°C
F	−25°C to +85°C	+30% to −80%

11. **Humidity Test**
    Capacitors will withstand 95% relative humidity for 100 hours at +40°C and then dried in room for one hour and measured. Capacitor shall meet specification.
12. **Life Test**
    Capacitors will withstand a 1000 hour test at +85°C at 140% of rated DC voltage.
13. **Standard Test Condition**
    Temperature: 25°C Relative humidity: 65% The test temperature may range from +5°C to +35°C and test relative humidity from 45% to 85%.
14. **Torque Limit**
    20 in.-lbs.

STANDARD VALUES

DC 500 Series	Nom. Cap. (pF)	Cap. Tol.	Temp. Coeff. (ppm/°C)	Rated Volt. (KV DC)	Test Volt. (KV DC)	R.F. Max. Amps. 1MHz (A)	R.F. Max. Amps. 10MHz (A)	R.F. Max. Amps. 30MHz (A)	R.F. Load for 30°C Temp. Rise Above 25°C 1MHz (KVA)	R.F. Load for 30°C Temp. Rise Above 25°C 10MHz (KVA)	R.F. Load for 30°C Temp. Rise Above 25°C 30MHz (KVA)	Fig.
DC505CH030D	3	±0.5pF	CH	5.0	7.5	0.07	0.7	1.4	0.23	2.3	3.2	
DC505CH050D	5	±0.5pF	CH	5.0	7.5	0.11	1.1	1.6	0.38	3.8	2.8	
DC505UJ100K	10	±10%	UJ	5.0	7.5	0.22	1.7	2.3	0.78	4.2	2.9	
DC504CH100K	10	±10%	CH	5.0	7.5	0.22	1.8	2.1	0.78	5.4	2.3	
DC504UJ200K	20	±10%	UJ	5.0	7.5	0.44	3.1	3.4	1.55	7.5	3.0	1
DC503CH100K	10	±10%	CH	5.0	7.5	0.22	1.8	2.4	0.78	5.4	3.0	
DC503CH200K	20	±10%	CH	5.0	7.5	0.44	2.7	2.8	1.5	5.6	2.0	
DC503UJ300K	30	±10%	UJ	5.0	7.5	0.66	3.6	3.2	2.3	6.7	1.8	
DC503UJ400K	40	±10%	UJ	5.0	7.5	0.89	4.4	3.5	3.1	7.7	1.7	
DC515CH030D	3	±0.5pF	CH	5.0	7.5	0.77	0.7	1.4	0.23	2.3	3.2	
DC515CH050D	5	±0.5pF	CH	5.0	7.5	0.11	1.1	1.6	0.38	3.8	2.8	
DC515UJ100K	10	±10%	UJ	5.0	7.5	0.22	1.7	2.3	0.78	4.2	2.9	
DC514CH100K	10	±10%	CH	5.0	7.5	0.22	1.8	2.1	0.78	5.4	2.3	
DC514UJ200K	20	±10%	UJ	5.0	7.5	0.44	3.1	3.4	1.55	7.5	3.0	2
DC513CH100K	10	±10%	CH	5.0	7.5	0.22	1.8	2.4	0.78	5.4	3.0	
DC513CH200K	20	±10%	CH	5.0	7.5	0.44	2.7	2.8	1.5	5.6	2.0	
DC513UJ300K	30	±10%	UJ	5.0	7.5	0.66	3.6	3.2	2.3	6.7	1.8	
DC513UJ400K	40	±10%	UJ	5.0	7.5	0.89	4.4	3.5	3.1	7.7	1.7	
DC510CH100K	10	±10%	CH	7.5	11.25	0.47	1.9	2.2	3.5	5.6	2.5	
DC510CH150K	15	±10%	CH	7.5	11.25	0.61	2.3	3.4	4.0	5.8	3.9	
DC510CH250K	25	±10%	CH	7.5	11.25	0.89	3.1	5.6	5.0	6.1	6.6	
DC510CH400K	40	±10%	CH	7.5	11.25	1.38	3.8	6.8	5.6	5.8	6.3	
DC510CH500K	50	±10%	CH	7.5	11.25	1.7	4.2	7.6	8.9	5.6	6.0	
DC510UJ500K	50	±10%	UJ	7.5	11.25	1.7	5.0	8.5	8.9	7.9	7.7	3
DC510UJ750K	75	±10%	UJ	7.5	11.25	2.5	6.2	9.0	13.2	8.1	5.6	
DC510UJ101K	100	±10%	UJ	5.0	7.5	3.4	7.3	9.2	19.0	8.7	4.6	
DC518F501M	500	±20%	F	5.0	7.5	1.1	2.5	3.0	0.4	0.2	0.1	
DC518F102M	1000	±20%	F	5.0	7.5	1.4	3.1	3.7	0.3	0.15	0.08	
DC507CH250K	25	±10%	CH	15.0	22.5	1.7	6.2	6.7	18.5	22.0	8.6	
DC507CH500K	50	±10%	CH	15.0	22.5	3.3	7.4	8.1	35.0	18.0	7.1	
DC507UJ500K	50	±10%	UJ	15.0	22.5	3.3	8.8	9.0	35.0	25.0	9.1	4
DC507UJ101K	100	±10%	UJ	15.0	22.5	4.6	12.0	15.0	35.0	22.0	11.1	
DC507UJ201K	200	±10%	UJ	7.5	11.25	5.1	8.5	15.0	23.0	6.2	6.0	
DC517CH250K	25	±10%	CH	15.0	22.5	1.7	6.2	6.7	18.5	22.0	8.6	
DC517CH500K	50	±10%	CH	15.0	22.5	3.3	7.4	8.1	35.0	18.0	7.1	5
DC517UJ500K	50	±10%	UJ	15.0	22.5	3.3	8.8	9.0	35.0	25.0	9.1	
DC509CH500K	50	±10%	CH	20.0	30.0	3.1	10.4	16.2	31.5	36.0	28.8	
DC509CH101K	100	±10%	CH	20.0	30.0	3.8	12.9	19.4	23.5	27.4	20.6	6
DC509UJ251K	250	±10%	UJ	20.0	30.0	9.2	13.0	35.0	40.0	11.0	25.0	
DC509YL501K	500	±10%	YL	15.0	22.5	6.7	14.0	23.0	14.0	5.9	5.4	

POWER CERAMIC CAPACITORS
DCT & DAT SERIES

These units are designed for such applications as high frequency heating equipment to which high frequency power or high DC or AC voltage is applied.

FEATURES

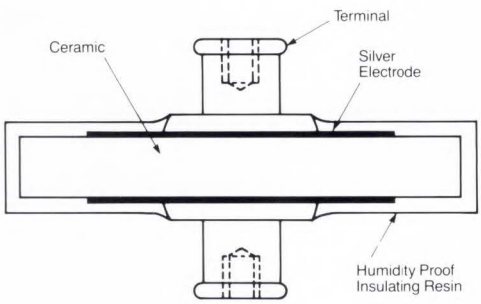
- **Small size and high capacitance**
- **Linear and reversible temperature characteristics**
- **Very high "Q" and high insulation resistance from low to high frequencies**
- **No performance deterioration after extended life – excellent humidity and thermal resistance**
- **Low series inductance and operable to high frequencies**
- **Large power capability in small packages due to low dielectric loss when high voltage and high frequency is applied**

APPLICATIONS

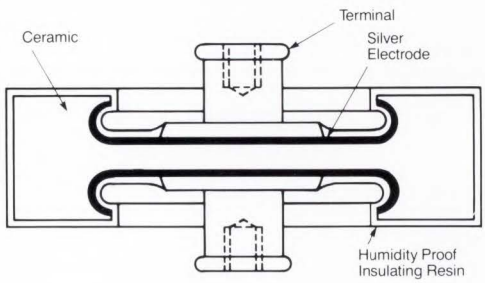
- Oscillator matching, coupling or bypass circuits in broadcast or radio communication equipments, etc.
- Oscillators, coupling circuit or bypass capacitors in industrial or medical high frequency appliances such as high frequency heating equipments or ultrasonic instruments.
- Coupling capacitors for transmission lines and carrier frequency equipment.

CONSTRUCTION

DAT Series



DCT Series



PART NUMBERING

DCT200 UJ 501 K

TYPE

DAT
DCT

TEMPERATURE CHARACTERISTICS

Code	Temp. Coeff.
UJ	−750±120ppm/°C
CH	0± 60ppm/°C
AH	+100± 60ppm/°C

CAPACITANCE

Code	Cap. Value
500	50pF
501	500pF
102	1000pF
202	2000pF
252	2500pF

CAPACITANCE TOLERANCE

Code	Cap. Tol.
K	±10%

POWER CERAMIC CAPACITORS
DCT & DAT SERIES

muRata

DIMENSIONS: inches

DAT	DCT	

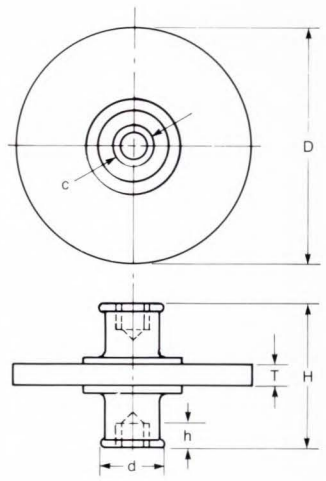
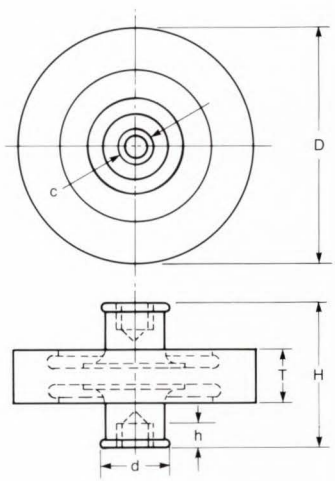
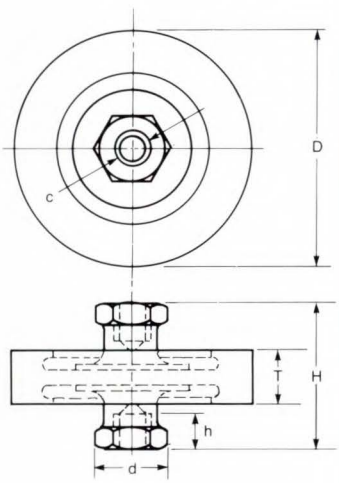

		

Fig. 1	Fig. 2	Fig. 3

DIM: inches	TYPE									
	DAT40	DAT60	DAT80	DCT40	DCT60	DCT80	DCT110	DCT140	DCT160	DCT200
C	.157	.236	.236	.157	.236	.236	.315	.315	.315	.394
d	.394	.472	.709	.394	.472	.709	.748	.945	.945	1.575
h	.315	.315	.315	.315	.315	.315	.591	.591	.591	.787
Thread Size	M4	M6	M6	M4	M6	M6	M8	M8	M8	M10

NOTE: Other dimensions are on following page.

SPECIFICATIONS

Char.	Cap. Tolerance (at 25°C)	Q (at 1MHz)	I.R. (MΩ)	Temp. Rise (at 1MHz)		Cap. Temp. Coeff.	Operating Temp. Range
				50°C	70°C		
UJ	10%	5×10^{-4} max. (Q > 2,000)	10,000 min.	50°C max.	30°C max.	$(-750\pm120)\times10^{-6}$/°C	−10 to 100°C
CH	10%	5×10^{-4} max. (Q > 2,000)	10,000 min.	50°C max.	30°C max.	$(0\pm60)\times10^{-6}$/°C	−10 to 100°C
AH	10%	5×10^{-4} max. (Q > 2,000)	10,000 min.	50°C max.	30°C max.	$(+100\pm60)\times10^{-6}$/°C	−10 to 100°C

MARKING

1. Type
2. Normal capacitance and tolerance
3. Rated voltage (RF)
4. Rated voltage (DC) at 50°C and 70°C
5. Rated power capacity at 50°C
6. Prod. lot no.
7. Manufacturer identification

INSULATION COATING

Capacitor surface is coated with insulating resin except terminals. Temp. coefficient is shown by the following color marking.
UJ: Green, CH: Orange, AH: Blue.

POWER CERAMIC CAPACITORS
DCT & DAT SERIES
STANDARD VALUES

Part Number	Cap. (pF)	Rated Volt. (KV)			Rated Allowable Power (KVA)		Allowable Max. Current (A)	Dimensions: inches			Fig.
		R.F. Peak Value	DC								
			50°C	70°C	50°C	70°C		D ± 10%	T ± .079	H ± .079	
DCT200UJ501K	500	30	25	20	300	200	60	7.874	1.299	2.874	3
DCT200UJ102K	1000	30	25	20	300	200	60	7.874	1.299	2.874	
DCT160UJ152K	1500	25	21	17	110	75	40	6.299	1.142	1.929	
DCT140UJ501K	500	30	25	20	90	60	35	5.512	.984	2.087	
DCT140UJ601K	600	30	25	20	90	60	35	5.512	.984	2.087	
DCT140UJ801K	800	30	25	20	90	60	35	5.512	.984	2.087	
DCT140UJ102K	1000	25	21	17	90	60	35	5.512	.866	1.969	
DCT140UJ152K	1500	15	13	10	90	60	35	5.512	.748	1.850	
DCT110UJ301K	300	30	25	20	90	60	27	4.331	1.063	2.087	
DCT110UJ401K	400	30	25	20	90	60	27	4.331	1.063	2.087	
DCT110UJ501K	500	16	13	11	30	20	27	4.331	.748	1.850	
DCT110UJ102K	1000	10	8	7	30	20	27	4.331	.669	1.772	
DCT110UJ152K	1500	9	7	6	22	14	27	4.331	.630	1.732	
DCT110UJ252K	2500	7	6	5	22	14	27	4.331	.591	1.693	
DCT 80UJ301K	300	16	13	11	30	20	20	3.150	.709	1.299	2
DCT 80UJ501K	500	14	12	10	15	10	20	3.150	.630	1.220	
DCT 80UJ601K	600	9	8	7	15	10	20	3.150	.551	1.142	
DCT 80UJ801K	800	7	6	5	15	10	20	3.150	.472	1.102	
DCT 80UJ102K	1000	7	6	5	15	10	20	3.150	.551	1.102	
DCT 60UJ101K	100	14	12	10	15	10	15	2.362	.630	1.063	
DCT 60UJ201K	200	14	12	10	15	10	15	2.362	.630	1.063	
DCT 60UJ301K	300	12	10	8.5	7.5	5	15	2.362	.591	1.024	
DCT 60UJ501K	500	6	5	4	7.5	5	15	2.362	.472	.945	
DCT 40UJ500K	50	12	10	8	6	4	10	1.575	.591	1.142	
DCT 40UJ201K	200	6	5	4	4.5	3	10	1.575	.433	.984	
DCT 40UJ301K	300	6	5	4	4.5	3	10	1.575	.374	.945	
DAT 80UJ102K	1000	2	6	5	7	4.5	18	3.150	.118[1]	1.063	1
DAT 80UJ152K	1500	2	6	5	7	4.5	18	3.150	.118[1]	1.063	
DAT 60UJ501K	500	2	6	5	5	3	14	2.362	.118[1]	.906	
DAT 60UJ102K	1000	2	6	5	5	3	14	2.362	.118[1]	.906	
DAT 40UJ301K	300	2	3.5	3	2.2	1.5	8.5	1.575	.079[1]	.945	
DAT 40UJ501K	500	2	3.5	3	2.2	1.5	8.5	1.575	.079[1]	.906	
DCT160CH301K	300	36	42	38	225	150	40	6.299	1.142	1.929	3
DCT140CH101K	100	31.5	37	34	135	90	35	5.512	1.024	2.047	
DCT140CH201K	200	27	32	28	135	90	35	5.512	.945	1.929	
DCT110CH101K	100	22.5	26	24	67.5	45	27	4.331	.866	1.811	
DCT110CH201K	200	22.5	26	24	67.5	45	27	4.331	.866	1.811	
DCT 80CH101K	100	16	19	17	30	20	20	3.150	.669	1.260	2
DCT140AH201K	200	24	24	19	60	45	35	5.512	.957	1.819	3
DCT140AH101K	100	30	32	25	90	60	35	5.512	1.024	1.929	
DCT110AH101K	100	22	24	19	45	30	27	4.331	.866	1.811	

1=±.02

CAUTION For DCT80 thru DCT160 styles, there are two different versions:
DCT140 : tapped terminal.
DCT140-3 : tripod terminals with tapped hole. (Contact your local Murata Erie Sales Office.)

Tapped terminals are suitable in cases where banks of capacitors (series-parallel connection) are required. When operating at frequency above 3MHz, it is advisable to use DCT140-3 style because of the improved current distribution of tripod terminals.

POWER CERAMIC CAPACITORS
DCT & DAT SERIES

SPECIFICATIONS

1. **Operating Temperature Range:**
   −10°C to +100°C
2. **Storage Temperature Range:**
   −10°C to +100°C
3. **Temperature Coefficient** (Capacitance Change):
   AH: +100, ± 60 ppm/°C
   CH: ±60 ppm/°C
   UJ: −750, ± 120 ppm/°C
4. **Capacitance:**
   Capacitance shall be within the specified limits when measuring to 1MHZ±100KHz and 25°C with not more than 5Vrms. Capacitance shall be within the specified capacitance tolerance.
5. **Capacitance Tolerance:**
   Tolerance: ±10% (Code: K)
6. **Rated Voltage:**
   Rated voltage as specified.
7. **Withstanding Voltage:**
   (1) DC Withstanding Voltage
   There shall be no damage when the test voltage is applied between terminals for 3 minutes after 2 hour (min.) exposure at a constant temperature of 100°C.
   (2) High Frequency Withstanding Voltage
   There shall be no damage when the test voltage (H.F. peak) of 100KHz to 1,000KHz is applied between terminals for 1 minute.
8. **Insulation Resistance:**
   Insulation resistance shall be 10,000MΩ min. after voltage application of 1,000V DC between terminals.
9. **Q (Measured at 1MHz):**
   UJ, CH, AH: 2,000 min.
   *CH, AH Char.: Cap. ≦30pF. See figure below.
10. **Power:**
    Rated power capacity means continuously useable power. This value is specified by 2 types as follows:

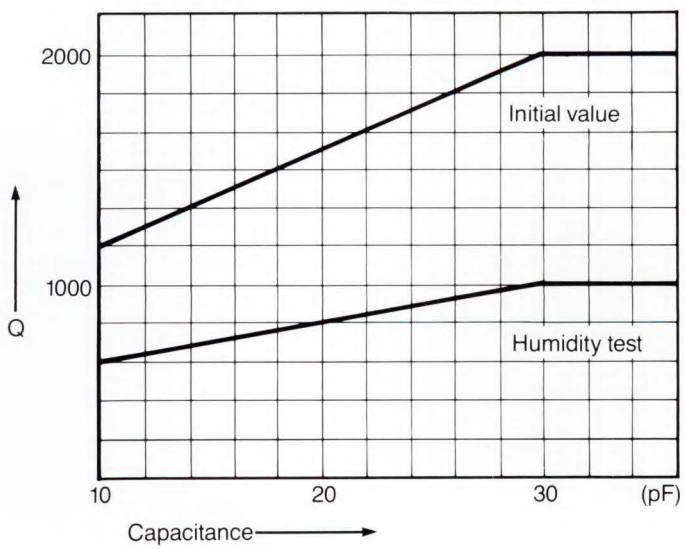
Ambient Temp.	Allowable Temp. Rise
50°C	50°C

11. **Humidity Test:**
    After 100 hour exposure to 95% R.H. and 40°C±2°C and 1 hour exposure to a room temperature, the following values shall be guaranteed.

Char.	Q	I.R.	Withstanding Volt.
UJ	1,000 min.	5,000MΩ min.	No damage
CH	1,000 min.	5,000MΩ min.	No damage
AH	1,000 min.	5,000MΩ min.	No damage

*Q: CH, AH Char.: Cap. ≦30pF

12. **Marking:**
    1. Type
    2. Normal capacitance and tolerance
    3. Rated voltage (H.F.)
    4. Rated voltage (DC) (at 50°C)
    5. Rated power capacity (at 50°C)
    6. Prod. lot no.
    7. Manufacturer identification
13. **Insulation Coating:**
    Surface of the capacitor (except terminals) is coated with insulating resin.
14. **Standard Test Conditions:**
    Temperature: 25°C, Relative humidity: 65%
    The test temperature may range from +5°C to +35°C and test relative humidity from 45% to 85%.
15. **Maximum current rated at below 20MHz and 70°C.**



POWER CERAMIC CAPACITORS
DCF & DAF SERIES
FEED-THRU TYPE

FEATURES
- Small size, large power handling capability
- Linear and reversible temperature characteristics
- Excellent "Q" and I.R. performance over a wide frequency range
- Superior humidity and extended life performance

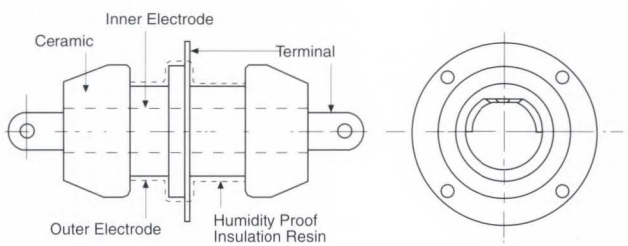
APPLICATIONS
- Antenna coupling
- Bypasses for medical and industrial applications
- Transmission line couplers

STANDARD VALUES

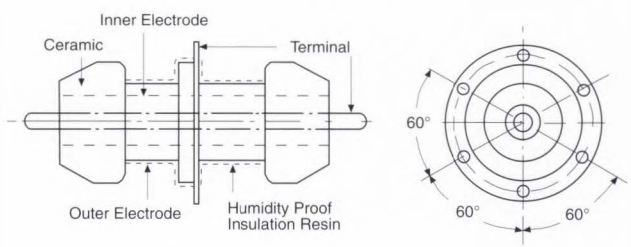
Part Number	Note	Rated Volt. (KVp)	Nom. Cap. (pF)	Rated Power (KVA)	Rated Reactive Current (A) rms	Dimensions: inches		NOTES
						D+10%	L±0.08	
DAF20 N750 501M	1	3	500	2.5	2.8	.630	1.575	1 : Feed-thru current 6A 2 : Feed-thru current 10A 3 : Feed-thru current 20A 4 : Feed-thru current 50A 5 : Feed-thru current 70A For low frequency current below 20 KHz, the rated reactive power may be increased 25% if the ambient temperature of 30°C and the upper temperature of 75°C are not exceeded.
DAF20 N750 801M	1	3	800	3.6	4.3	.630	1.575	
DAF20 N750 102M	1	3	1000	5.0	5.6	.654	2.362	
DCF20 N750 801M	2	3	800	3.6	4.3	.630	1.575	
DCF45 N750 801M	3	8	800	9.6	7.0	1.181	3.543	
DCF45 N750 102M	3	8	1000	12	8.7	1.181	3.543	
DCF65 N750 102M	4	10	1000	40	15.9	1.772	6.122	
DCF80 N750 102M	5	20	1000	50	17.7	2.165	6.299	

CONSTRUCTION

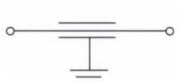
DAF



DCF



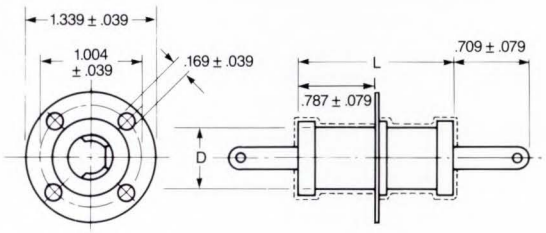
Circuit



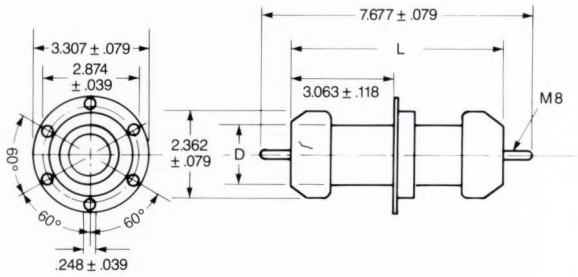
POWER CERAMIC CAPACITORS
DCF & DAF SERIES
FEED-THRU TYPE

DIMENSIONS: inches

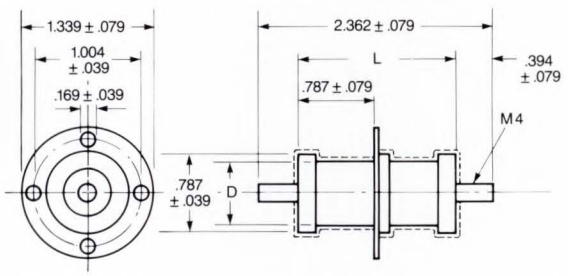
DAF20 N750 501M (801M-102M)



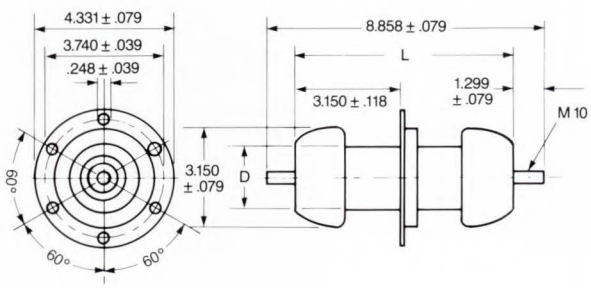
DCF65 N750 102M



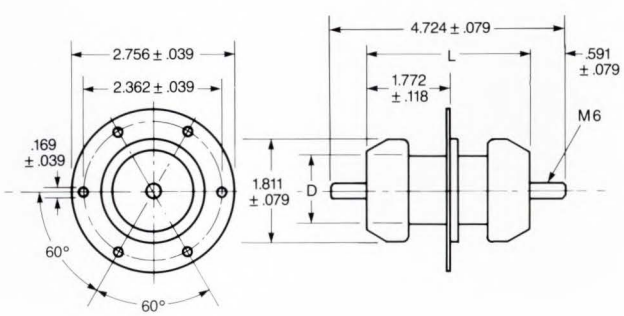
DCF20 N750 801M



DCF80 N750 102M



DCF45 N750 801M (102M)



POWER CERAMIC CAPACITORS
DE SERIES

These units for extremely high power applications VHF frequency range.

FEATURES
- **High volume metric efficiency and small size for their KVA rating**
- **Linear and reversible temperature characteristics**
- **High "Q" and I.R.**
- **Excellent humidity and thermal characteristics**
- **No performance degradation over extended life**

APPLICATIONS
- Radio transmitters
- High power induction heaters
- High power matching, coupling and bypassing
- High power welders

WATER-COOLED CERAMIC R.F. POWER

SPECIFICATIONS

Electrical and Mechanical Tests

Capacitance
Capacitance shall be within the specified limits when measuring to 1MHz±100KHz and 25°C within AC 5Vrms. Capacitance shall be the specified capacitance tolerance.

Insulation Resistance
Insulation resistance shall be 10,000MΩ min. after voltage application of 1 KVDC between terminal.

Withstanding Voltage
There shall be no damage when the test voltage (peak value of double the rated voltage) of 60Hz is applied between terminals for 3 minutes.

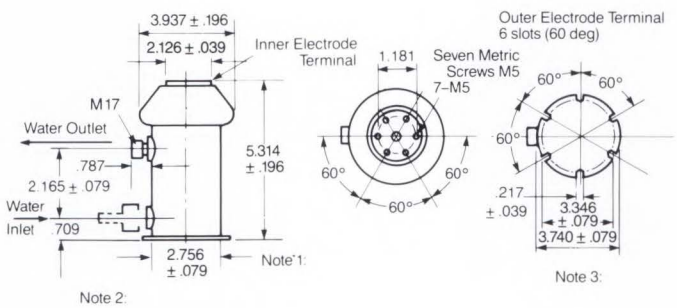
Pressure Test
There shall be no damage when the water pressure of 84 psi (6kg/cm²) applied between cooling system for 5 minutes at 25°C.

STANDARD VALUES

Part Number	Temp. Coefficient	Nom. Cap. (pF)	Cap. Tol. (%)	Rated Volt.		Rated Power (KVA)	Rated Current (Arms)	Min. Water Flow Rate (1/min)
				HF Peak (KVP)	DC (KV)			
DE100UJ252M-HF15K	(−750±120) × 10^{-6}/°C	2500	±20	15	17	1000	100	1.0
DE125UJ502M-HF14K	(−750±120) × 10^{-6}/°C	5000	±20	14	16	2000	200	1.0
DE150UJ502M-HF20K	(−750±120) × 10^{-6}/°C	5000	±20	20	22	2500	250	1.5

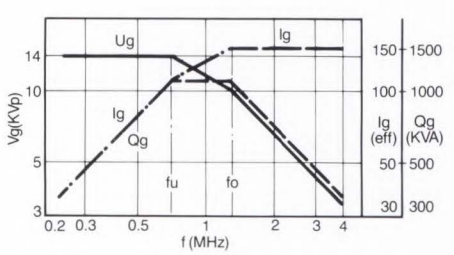
DIMENSIONS: inches

DE100UJ252M-HF15K



Limits – continuous values of voltage (Ug), current (Ig) and power (Qg) as function of frequency.

DE100UJ252M-HF15K



Note 1: Axes of water nipple and 3 terminal screws in one plane within ±2 deg

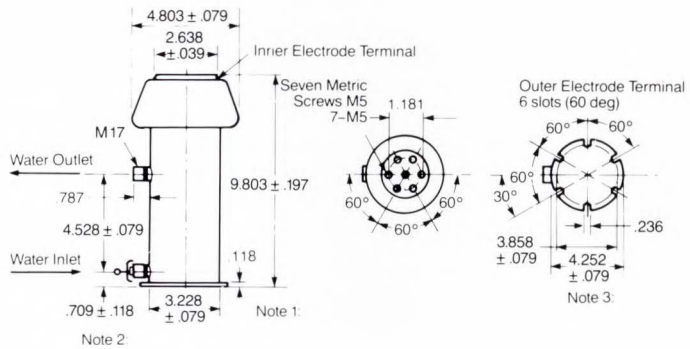
Note 2: Accessories: 2 ferules 2 metric sleeve nuts M17

Note 3: Axes of water nipples are perpendicular to axes of capacitor in one common plane with ±2 deg

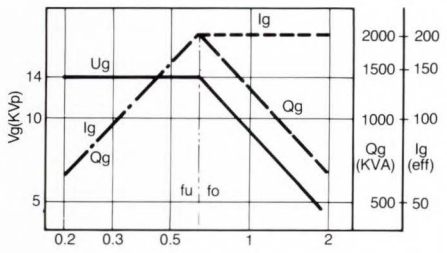
DIMENSIONS: inches

Limits – continuous values of voltage (Ug), current (Ig) and power (Qg) as function of frequency.

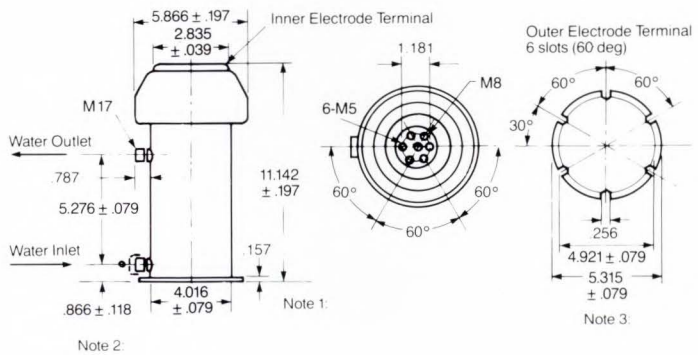
DE125UJ502M-HF14K



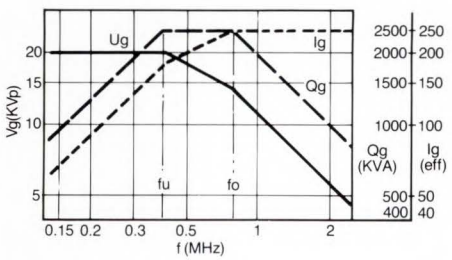
DE125UJ502M-HF14K



DE150UJ502M-HF20K



DE150UJ502M-HF20K



Note 1: Axes of water nipple and 3 terminal screws in one plane within ±2 deg

Note 2: Accessories: 2 ferules 2 metric sleeve nuts M17

Note 3: Axes of water nipples are perpendicular to axes of capacitor in one common plane with ±2 deg

APPLICATION NOTES:

1. Do not allow insulated portion to be exposed to water or moisture. In these cases, electricity may discharge and the ceramic may fail as a result of heat generation.
2. Permissible electric power load is influenced by the quantity of refrigerated water. Keep the temperature of displaced water under 50°C at all times.
3. Water pressure can withstand a peak of (6 kg/cm²). Use a maximum of (4 kg/cm²) when in continuous use.
4. The metallic case for water-cooled parts is connected to the electrode.
5. When temperatures go below freezing, there is potential for capacitor breakage due to ice. As a precaution, remove water.
6. To protect the capacitor from accidents in the refrigeration system, incorporate protective measures such as a water pressure relay, running water relay and safety valve.

NOTES

VARIABLE CAPACITORS

Murata Electronics offers a comprehensive line of trimmer capacitors which are miniature in size and combine the High Q and stability with excellent electrical characteristics.

Murata trimmer products feature low cost and high performance and cover the frequency spectrum from the low RF to the Gigahertz range and high resolution devices.

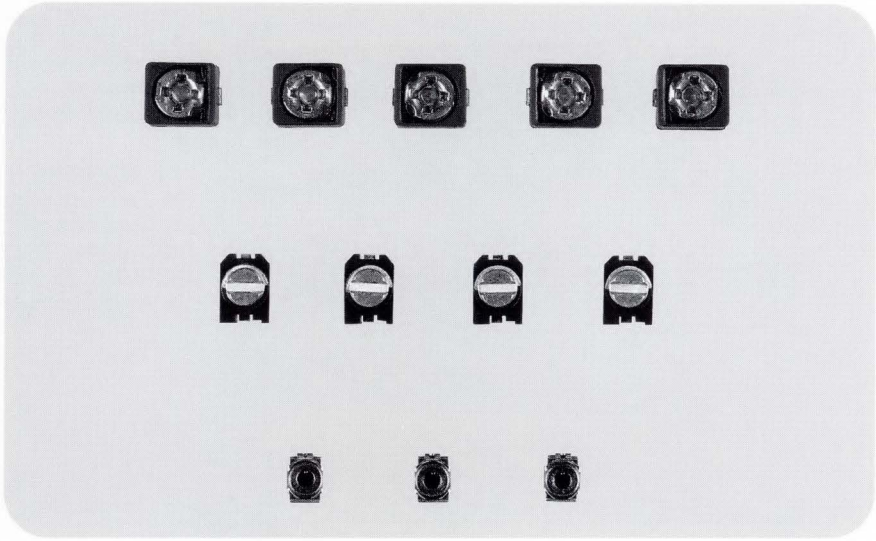
FEATURES:

- High Q's and excellent frequency characteristics
- Linear rotation-capacity characteristics
- Excellent and repetitive temperature characteristics
- Outstanding shock and vibration characteristics

SPECIALS:

It is Murata's policy to automate production procedures, wherever possible, for the purpose of cost and price reduction as well as quality improvement and repeatability. We recognize that many trimmer applications require non-standard assemblies, mounting considerations, or test and packaging needs. For that reason, our trimmer tooling and general procedures have been developed with a unique capability–adaptability.

Contact your local Murata sales office or the Murata application engineering staff for help on specific design problems.



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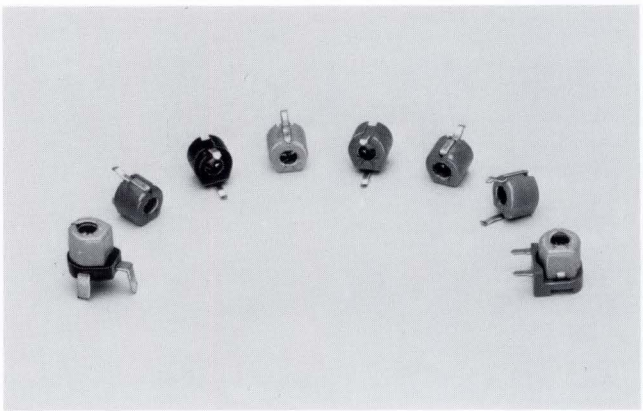
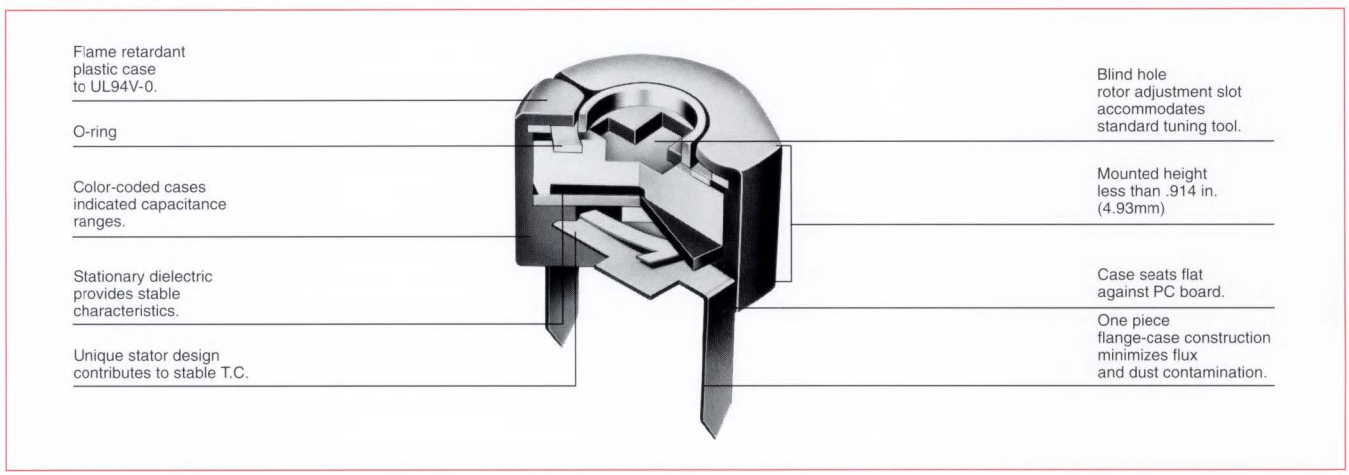
TRIMCAP® AXLE-LESS CERAMIC TRIMMER CAPACITORS TZ03 SERIES



The TZ Series ceramic trimmer capacitors are built into and protected by a color coded plastic case. This unique, axle-less and solder-less construction protects the unit from damages during assembly and provides exceptionally linear temperature coefficient at low cost.

FEATURES

- Excellent shock and vibration resistance
- Exceptionally linear TC
- Dust and flux resistant construction
- Plastic case meets UL94V-0
- Available on tape and reel for automatic insertion



SPECIFICATIONS

Working Voltage: 100VDC or 50VDC
Withstanding Voltage: 220VDC (100V units) or 110VDC (50V units)
Insulation Resistance: 10^4MΩ min. (50VDC, C max.)
Operating Torque: .3 to 2 in. –oz.

Part Number	Capacitance (pF)		Temp. Coeff. (ppm/°C)	Q (1MHz, °C max.)	Temperature (°C)	Case Color
	Min.	Max.				
SINGLE CERAMIC PLATE TYPE, 100V SERIES						
★**TZ03Z2R3□□169**	1.25	2.3 $^{-0}_{+50}$%	NPO ± 200	300 min.	–55 to +85	Black
★**TZ03Z050□□169**	1.8	5.0 $^{-0}_{+50}$%	NPO ± 200	300 min.	–55 to +85	Blue
★**TZ03Z070□□169**	2.0	7.0 $^{-0}_{+50}$%	NPO ± 200	300 min.	–55 to +85	Blue
★**TZ03Z100□□169**	2.7	10.0 $^{-0}_{+50}$%	NPO ± 200	500 min.	–55 to +85	Blue
★**TZ03N100□□169**	2.1	10.0 $^{-0}_{+50}$%	N220 ± 200	500 min.	–55 to +85	White
★**TZ03T110□□169**	3.0	11.0 $^{-0}_{+50}$%	N450 ± 300	500 min.	–55 to +85	White
★**TZ03T200□□169**	4.2	20.0 $^{-0}_{+50}$%	N450 ± 300	500 min.	–55 to +85	Pink
★**TZ03R200□□169**	4.2	20.0 $^{-0}_{+50}$%	N750 ± 300	500 min.	–55 to +85	Red
★**TZ03R300□□169**	5.2	30.0 $^{-0}_{+50}$%	N750 ± 300	500 min.	–55 to +85	Green
★**TZ03P450□□169**	6.8	45.0 $^{-0}_{+50}$%	N1200 ± 500	300 min.	–55 to +85	Yellow
★**TZ03P600□□169**	9.8	60.0 $^{-0}_{+50}$%	N1200 ± 500	300 min.	–55 to +85	Brown
★**TZ03P700□□169**	12.0	70.0 $^{-0}_{+50}$%	N1200 ± 500	300 min.	–55 to +85	Brown
MONOLITHIC CERAMIC PLATE TYPE, 50V SERIES						
★**TZ03Z500□□169**	6	50 $^{-0}_{+100}$%	NPO ± 300	300 min.	–55 to +85	Orange
★**TZ03R900□□169**	9	90 $^{-0}_{+100}$%	N750 ± 300	300 min.	–55 to +85	Black
★**TZ03R121□□169**	10	120 $^{-0}_{+100}$%	N750 ± 300	300 min.	–55 to +85	Black

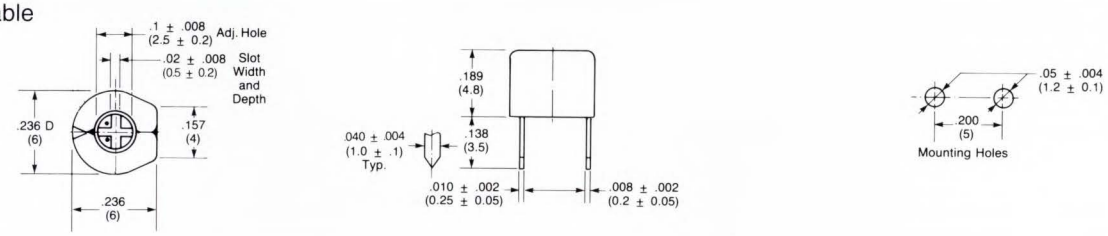
□□ : Terminal Shape Stray capacitance for side adjustment (YR type) adaptor is .2pF.
★Available as standard through authorized Murata Electronics Distributors.

TRIMCAP® AXLE-LESS CERAMIC TRIMMER CAPACITORS TZ03 SERIES

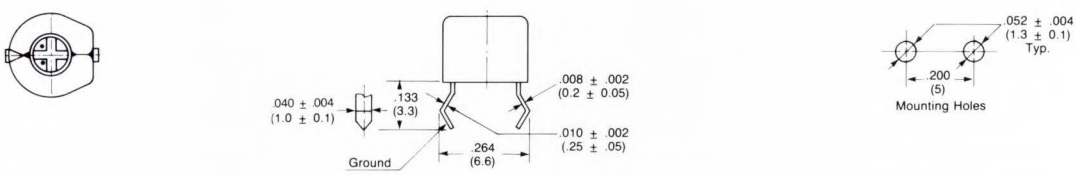
muRata

DIMENSIONS: in. (mm)

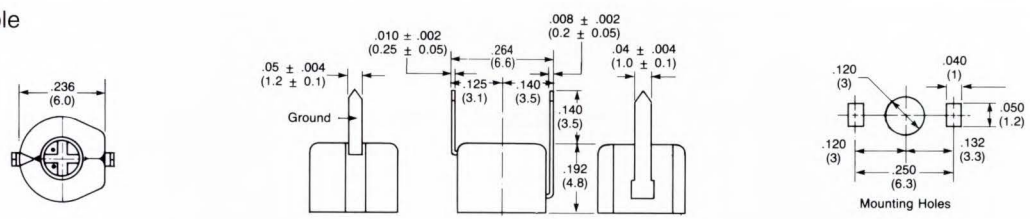
ER TYPE
Top Adjustable



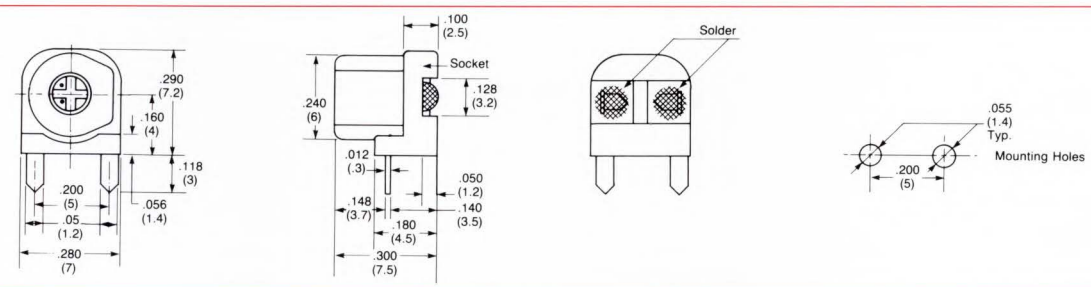
FR TYPE
Self-Standing



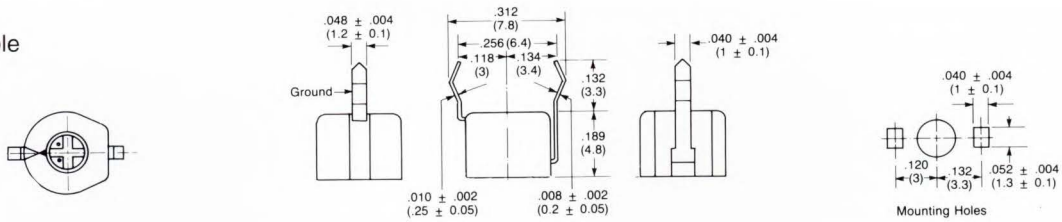
BR TYPE
Bottom Adjustable



YR TYPE
Side Adjustable



NR TYPE
Self-Standing
Bottom Adjustable



Notes: Common dimensions shown on ER Style
Tolerances (unless otherwise shown) ±0.02" and ±0.5mm

PART NUMBERING SYSTEM

TZ03	Z	070	ER	169	△△△
TYPE	TEMPERATURE CHARACTERISTIC	CAPACITANCE	TERMINAL TYPE	OTHER SPECIFICATIONS	OPTIONAL TAPING

TERMINAL TYPE
ER: Top Adjustable
FR: Self-Standing
BR: Bottom Adustable
YR: Side Adjustable
NR: Self-Standing/Bottom Adjustable
TR: ER version on tape and ammo pack

OTHER SPECIFICATIONS
169: Standard

OPTIONAL TAPING
T00: Tape and Ammo Pack (1000pcs/ammo pack)
No Code: Bulk (1000pcs/bag)

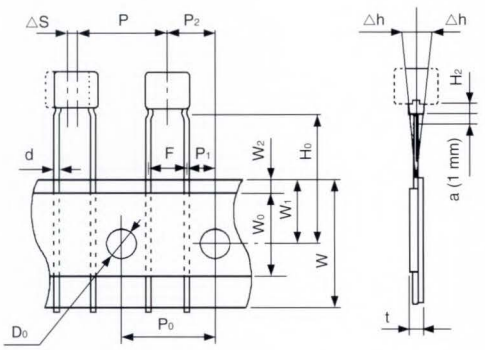
Caution: Do not water wash.

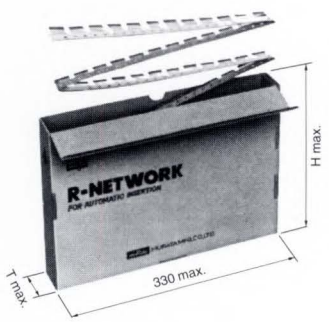
Note: When ordering, ER, FR, BR, YR and NR are all bulk parts. If tape and ammo pack is desired, then an example part number would be TZ03Z070TR169T00.

TRIMCAP® AXLE-LESS
CERAMIC TRIMMER CAPACITORS
TZ03 SERIES

DIMENSIONS OF TAPE AND AMMO PACK (Unit: mm)

TZ03△△△△TR169T00





Item	Code	Dimensions (mm)	Remark
Pitch of Component	P	12.7	
Pitch of Sprocket Hole	P_0	12.7 ± 0.3	
Length from Hole Center to Lead	P_1	3.85 ± 0.7	
	P_2	6.35 ± 1.3	
Lead Spacing	F	$5.0^{+0.8}_{-0.2}$	
Carrier Tape Width	W	18.0 ± 0.5	
Hold Down Tape Width	W_0	10.0 min.	
Position of Sprocket Hole	W_1	9.0 ± 0.5	
Hold Down Tape Position	W_2	1.5 ± 1.5	
Lead Distance between Reference and Bottom Planes	H_0	18.0 ± 0.5	
Stand-off	H_2	1.3 ± 0.5	
Diameter of Sprocket Hole	D_0	4.0 ± 0.1	
Total Thickness, Tape and Lead Wire	t	1.7 max.	
Deviation across Tape	△h	1.5 max.	
Deviation along Tape, Left or Right	△S	0 ± 1.5	
Lead Diameter	d	ϕ0.6 ± 0.1	Except 'a' part

Cautions In Handling:

1. Do not use in water wash process.
2. Do not use water soluable flux for soldering.
3. When hand soldering, avoid contact of the soldering iron to the plastic case.
4. Do not use locking adhesives to secure rotor in place.
5. Avoid applying excessive force to terminals.

TRIMCAP® AXLE-LESS CERAMIC TRIMMER CAPACITORS TZ03 SERIES

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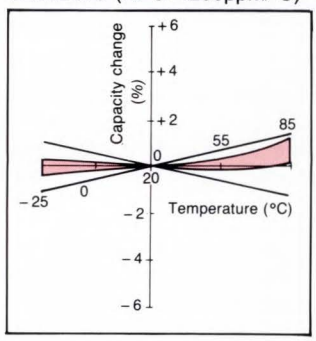
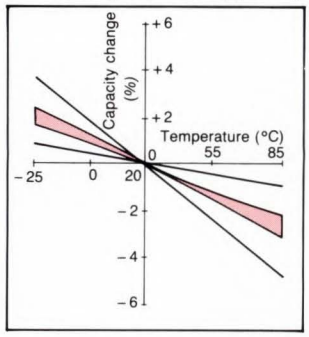
TECHNICAL DATA

Temperature Characteristics

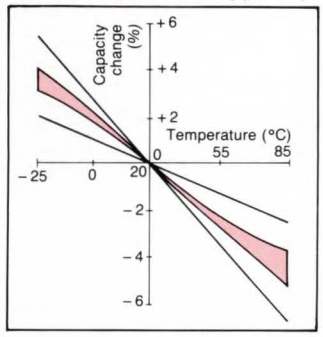
TZ03Z070 (NPO ± 200ppm/°C)



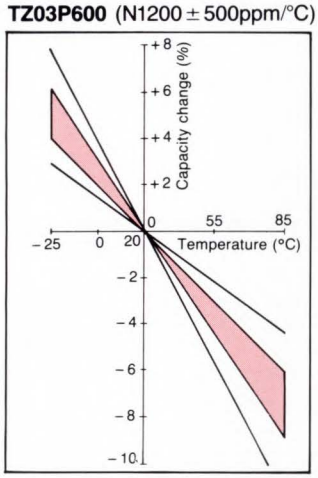
TZ03T110 (N450 ± 300ppm/°C)



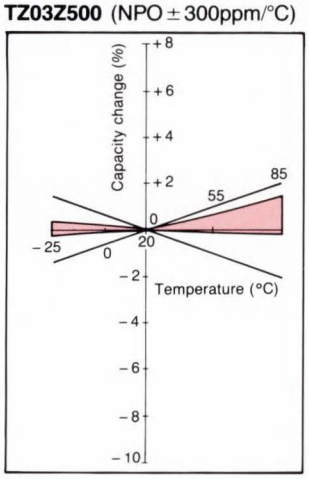
TZ03R200 (N750 ± 300ppm/°C)



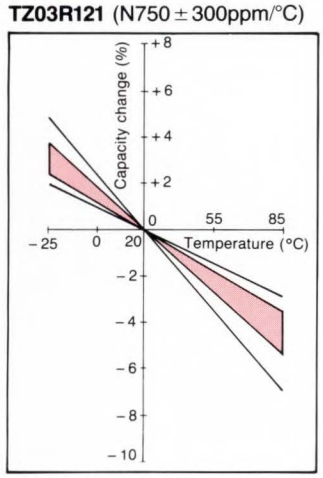
TZ03P600 (N1200 ± 500ppm/°C)



TZ03Z500 (NPO ± 300ppm/°C)



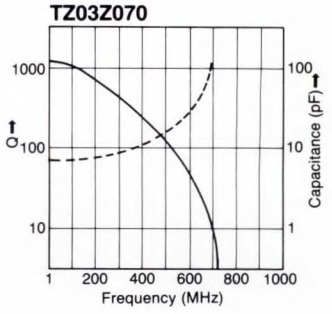
TZ03R121 (N750 ± 300ppm/°C)



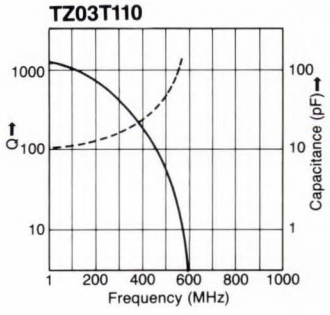
Q AND CAPACITANCE VS FREQUENCY CHARACTERISTICS

Characteristics on curves are measured at the position of maximum rated capacitance value using RF impedance analyzer.

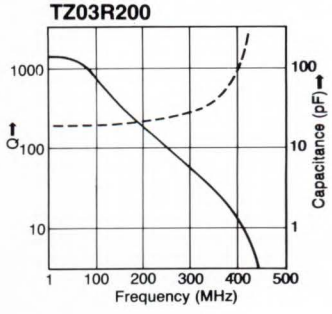
TZ03Z070



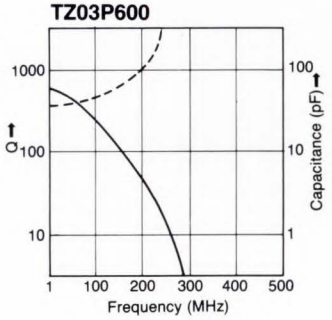
TZ03T110



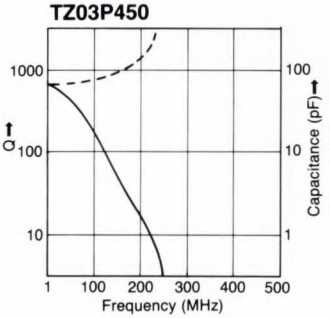
TZ03R200



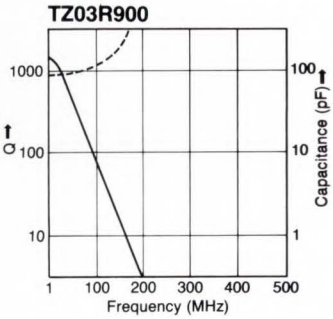
TZ03P600



TZ03P450



TZ03R900



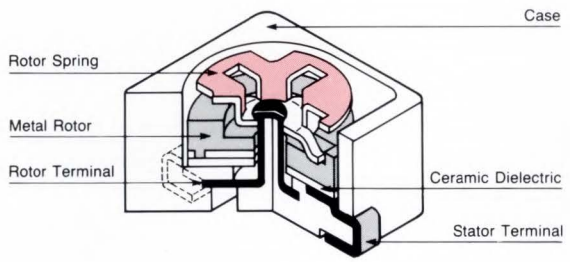
CHIP TRIMMER CAPACITORS
TZBX4 SERIES

Murata Electronic's chip trimmer capacitors are specifically designed for automatic surface mount placement. The small size and outstanding performance over a wide frequency spectrum make them entirely compatible with other types of surface mounted components.

FEATURES

- **Miniature rectangular shape just 0.16 (4.0) x 0.18 (4.5) x 0.12 (3.0) in. (mm)**
- **Specifically designed for auto surface placement. Designed to withstand solder bath (260 °C, 5 sec.) and flux baths**
- **Can be reflow soldered**
- **Conventional snap-in configuration available**
- **Stable characteristics are a wide frequency range**
- **Color coded cases makes distinguishing easy**

CONSTRUCTION



APPLICATIONS

- Transceiver
- VTR System
- Audio Equipment
- Radio
- Clock
- Pagers

PACKAGING FORMS

- Tape and Reel
- Bulk

ORDERING INFORMATION

TZBX4 Z 060 B A 110 □□□

Type	Temperature Coefficient	Capacitance Value	Cover Film	Terminal Type	Other Specifications	Packaging Unit
TZBX4	Z	060	B	A	110	□□□
			A=Without B=With		110: Standard	No Code = Bulk T00 = 500 pcs/reel T02 = 2500 pcs/reel

CAUTION: Do not use in water wash process.

NOTE: Taping available for A, B, and E Terminal types only.

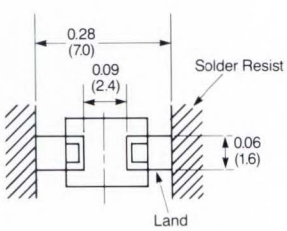
SPECIFICATIONS

Part Number	Capacitance (pF) Min.	Capacitance (pF) Max.	Temperature Coefficient (ppm/°C)	Q (Min.) (1MHz, Cmax)	Temperature (°C)	Case Color
*TZBX4Z030□□110	1.4	3.0 (+ 50% −0%)	NPO ±200	300	−55 to +85	Brown
*TZBX4Z060□□110	2.0	6.0 (+ 50% −0%)	NPO ±200	500	−55 to +85	Blue
*TZBX4Z100□□110	3.0	10.0 (+ 50% −0%)	NPO ±300	500	−55 to +85	White
*TZBX4R200□□110	4.5	20.0 (+ 50% −0%)	N750 ±300	500	−55 to +85	Red
*TZBX4P300□□110	6.5	30.0 (+ 50% −0%)	N1200±500	300	−55 to +85	Green
*TZBX4P400□□110	8.5	40.0 (+ 50% −0%)	N1200±500	300	−55 to +85	Yellow
*TZBX4Z250□□110	4.0	25.0 (+100% −0%)	NPO ±300	300	−55 to +85	Black
*TZBX4R500□□110	7.0	50.0 (+100% −0%)	N750 ±300	300	−55 to +85	Black

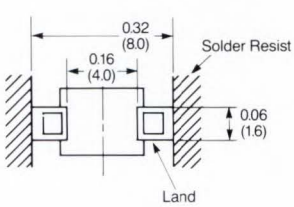
• **Rated voltage**...100VDC • **Withstand voltage**...220 VDC • **Insulation resistance**...10^4MΩmin. • **Torque**...15 to 100g-cm
50VDC for Z250, R500

LAND DIMENSIONS: in. (mm)

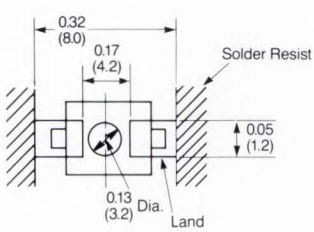
A TYPE TERMINAL



B TYPE TERMINAL



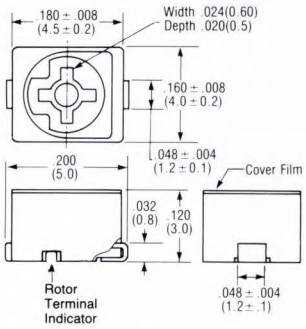
E TYPE TERMINAL



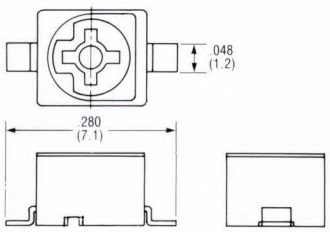
*Contact local Murata Electronics Sales Office for standard values in these series.

DIMENSIONS: in. (mm)

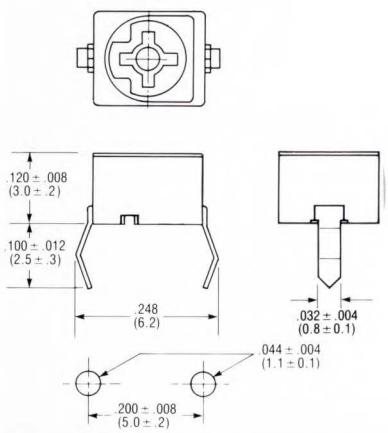
A Type Terminal



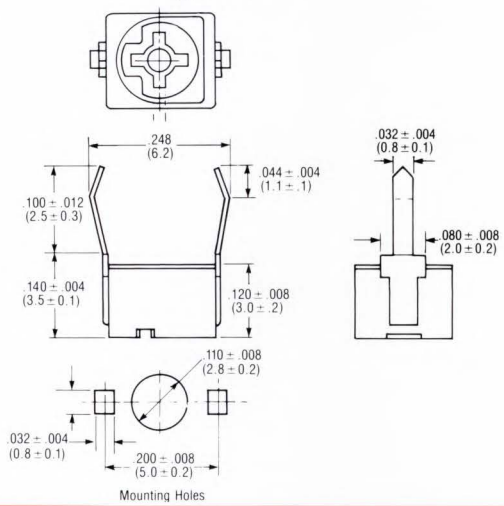
B Type Terminal



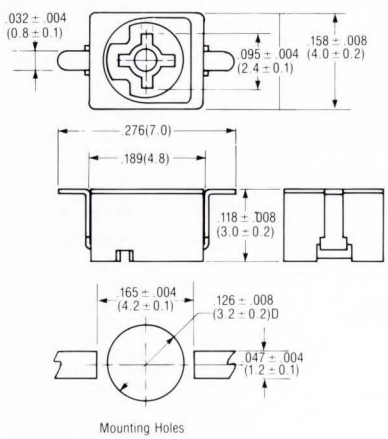
C Type Terminal



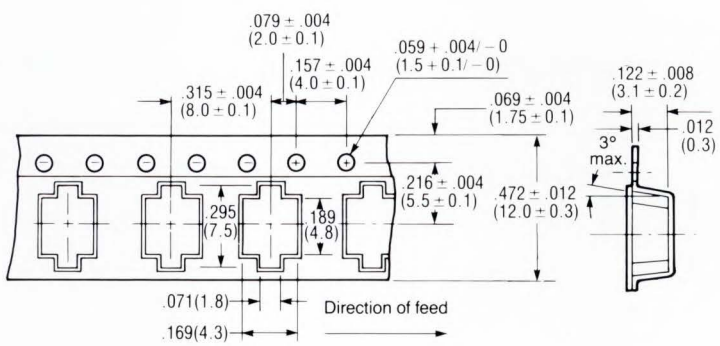
D Type Terminal



E Type Terminal



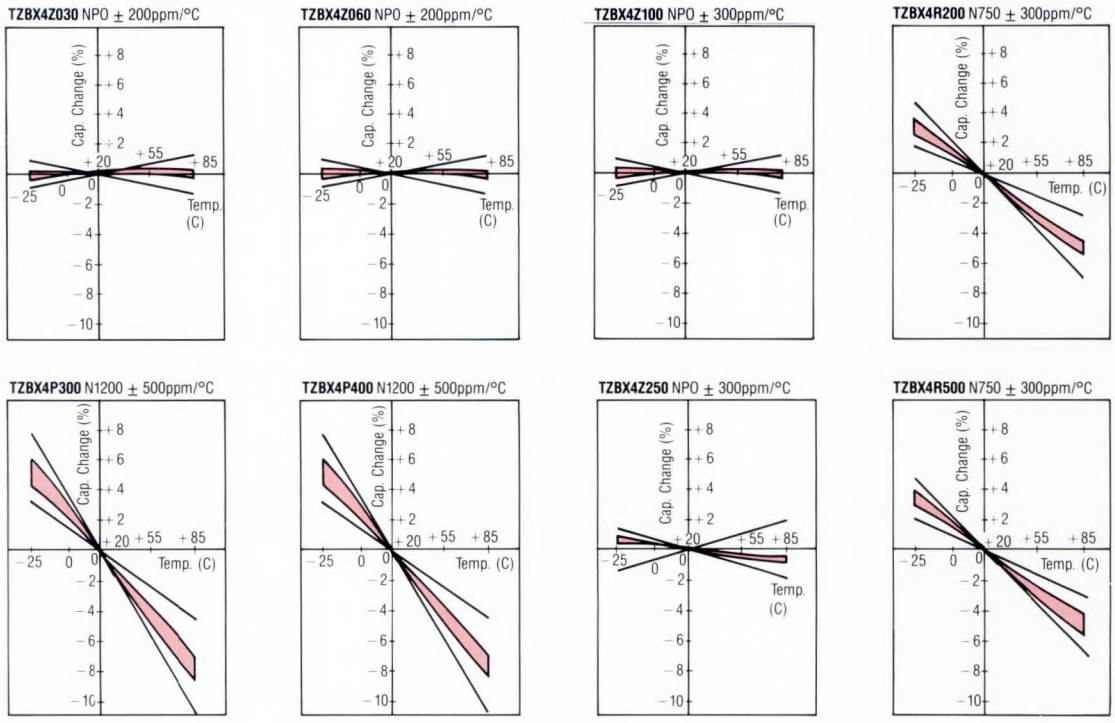
DIMENSIONS OF PLASTIC TAPING



Reel Size: T00: (180mm) Dia.
T02: (330mm) Dia.

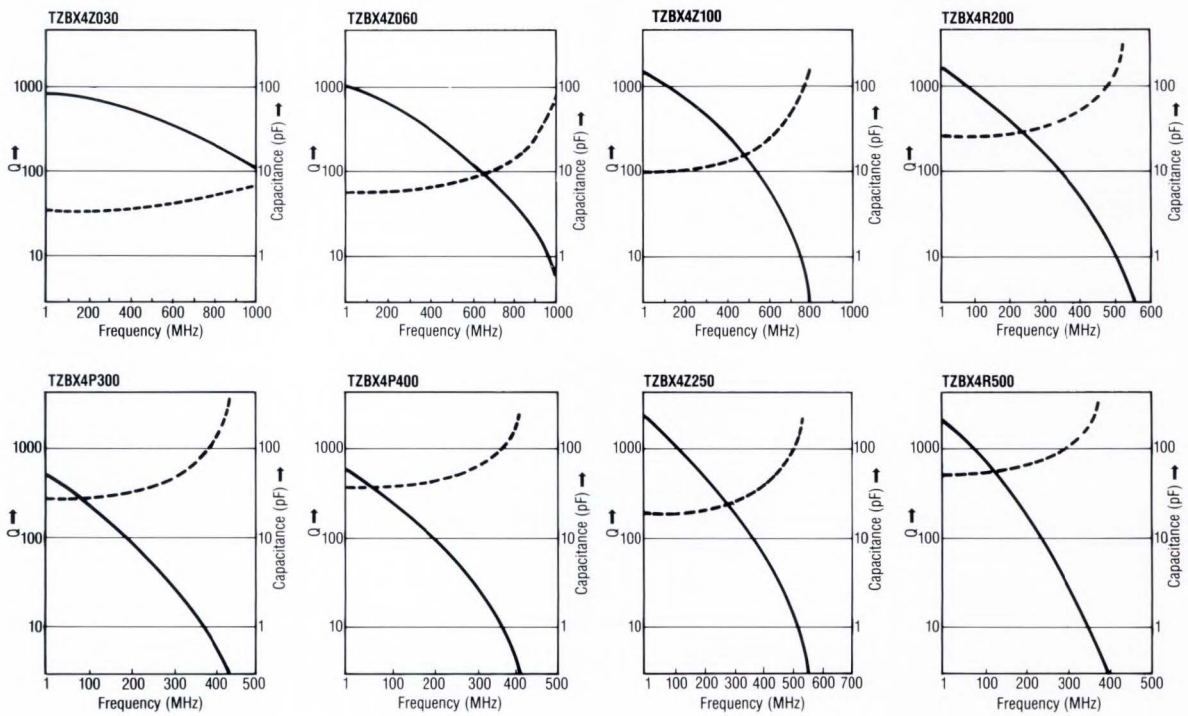
CHIP TRIMMER CAPACITORS
TZBX4 SERIES

TEMPERATURE COEFFICIENT CHARACTERISTICS



Q AND CAPACITANCE VS FREQUENCY CHARACTERISTICS

Characteristics are measured at the position of maximum rated capacitance value using an RF impedance analyzer.



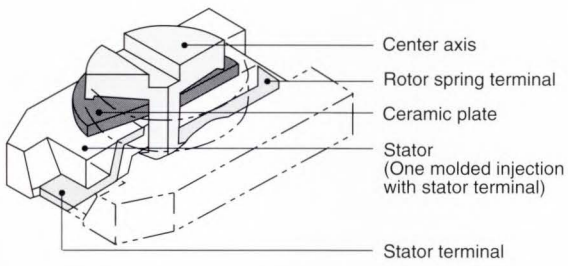
CHIP TRIMMER CAPACITORS
TZC03 SERIES

This new low profile chip trimming capacitor is specifically designed to meet the requirements of high density surface mount applications and automated placement equipment.

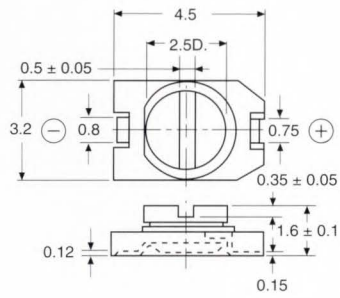
FEATURES

- Extremely small size—just 3.2mm x 4.5mm x 1.6mm
- Designed for auto-placement in surface mount applications
- Color-coded
- Heat-resistant resin withstands reflow soldering temperatures
- Can be adjusted with standard adjustment tools

CONSTRUCTION



DIMENSIONS: mm



PART NUMBERING SYSTEM

TZC03	Z	060	A	110	T00
CHIP CERAMIC TRIMMER CAPACITOR	TEMPERATURE CHARACTERISTIC	CAPACITANCE	TERMINAL TYPE	OTHER SPECIFICATIONS 110: Standard	PACKAGING UNIT T00: 180D.mm Taping (1000 pcs/reel) T01: 330D.mm Taping (4000 pcs/reel) No code: Bulk (500 pcs/bulk)

CAUTION: Do not wash.

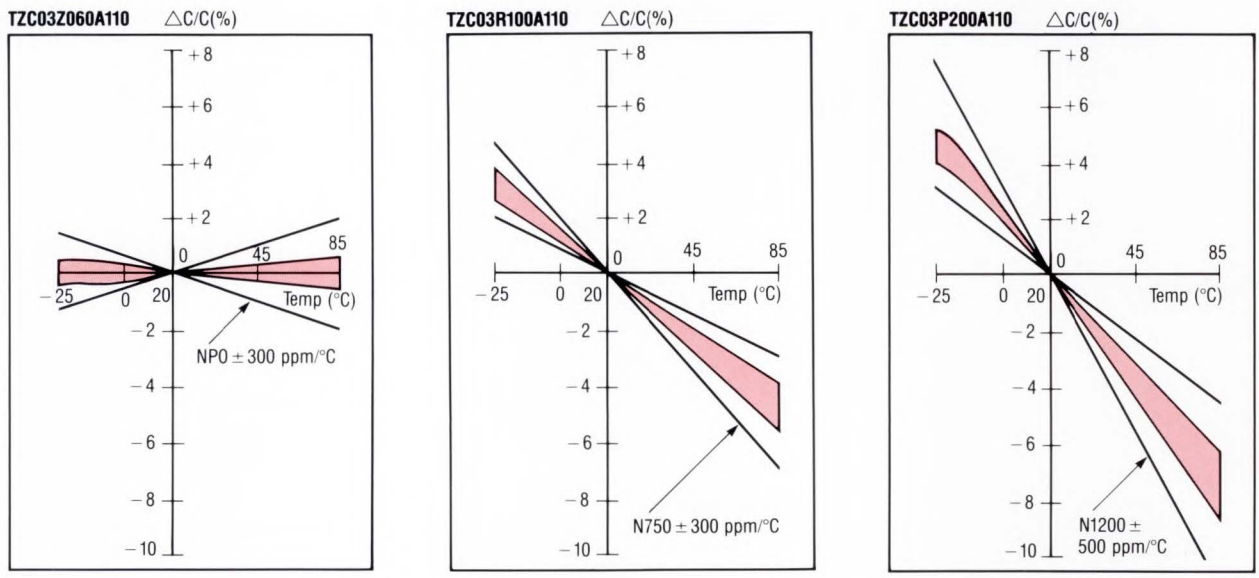
SPECIFICATIONS

Part Number	Capacitance (pF)		Temperature Coefficient (ppm/°C)	Q (1MHz, C max.)	Working Temperature Range (°C)	Stator Color
	Min. (max.)	Max. (+50%,–0%)				
*TZC03Z030A110	1.4	3.0	NPO ± 300	300 min.	–25 to +85	White
*TZC03Z060A110	2.0	6.0	NPO ± 300	500 min.	–25 to +85	Blue
*TZC03R100A110	3.0	10.0	N750 ± 300	500 min.	–25 to +85	White
*TZC03P200A110	5.0	20.0	N1200 ± 500	300 min.	–25 to +85	Red
*TZC03P300A110	6.5	30.0	N1200 ± 500	300 min.	–25 to +85	Green

• **Rated Voltage**...100VDC • **Withstand Voltage**...220VDC • **Insulation Resistance**...10^4 MΩmin. • **Torque**...15 to 100g•cm

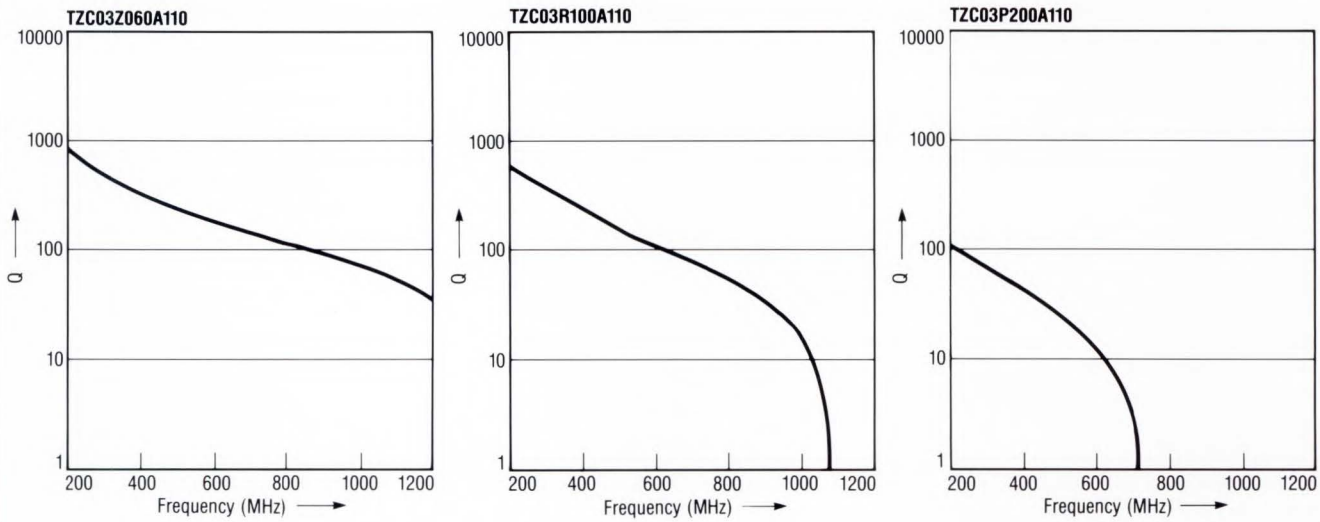
*Available as standard through authorized Murata Electronics Distributors.

TEMPERATURE COEFFICIENT CHARACTERISTICS



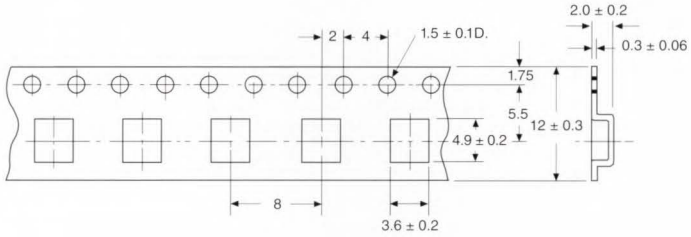
Q VS FREQUENCY CHARACTERISTICS

Characteristics are measured at the position of maximum rated capacitance value using an RF impedance analyzer.



CHIP TRIMMER CAPACITORS
TZC03 SERIES

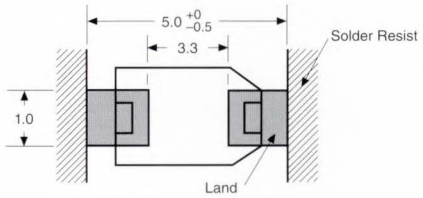
DIMENSIONS: mm FOR PLASTIC TAPE CARRIER



Conforming to EIAJ standard RC-1009B
Packaging unit: 1000pcs/reel (180mm D.)
4000pcs/reel (330mm D.)

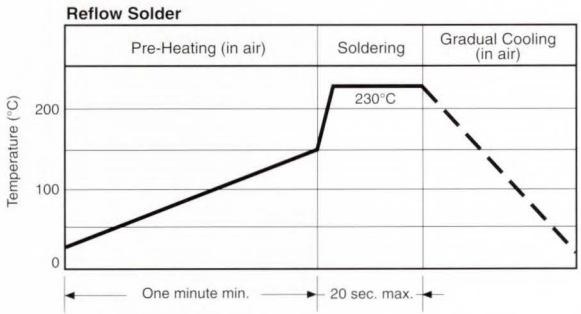
MOUNTING INFORMATION

Standard Land Dimensions



STANDARD SOLDERING CONDITIONS

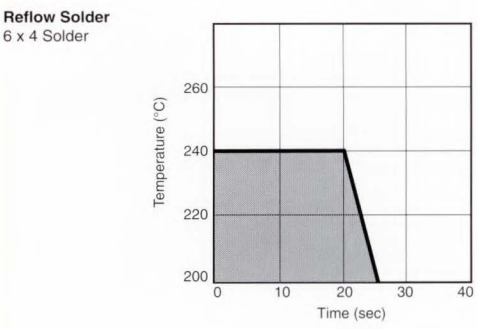
Reflow Solder



SOLDERING CONDITIONS

Soldering temperature and time

Solder within the range indicated by the graph below. If soldering is repeated, note that the allowed time is accumulated.



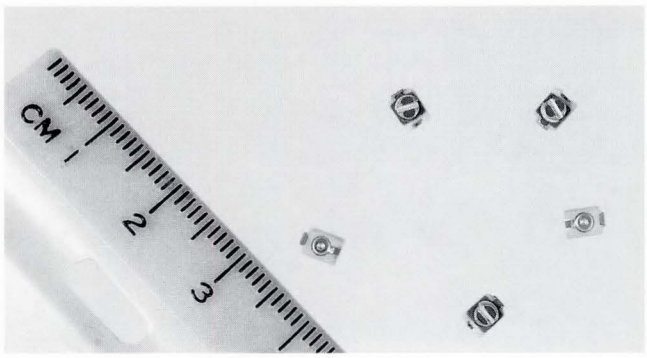
Soldering with Iron

Use a soldering iron of less than 30W. Complete soldering within 4 seconds at soldering tip temperature of 270°C.

CAUTIONS IN HANDLING

1. Do not allow excessive force to be applied to the trimmer capacitor when mounting it on the P.C.B.
2. Polarity is noted in dimensional diagram (+ . . . Hot, – . . . Ground).
3. Do not clean with solvents.
4. Minimal downward pressure should be applied when tuning.
5. Non-metallic screwdriver tips may be necessary in some applications. These screwdrivers are available from Murata Electronics (Part Number ME502).
6. Locking adhesives are not recommend.

CHIP TRIMMER CAPACITORS
TZCX3 SERIES

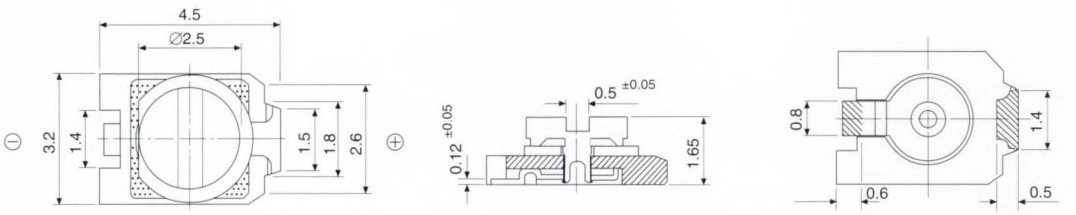


This new low profile, ultra stable chip trimming capacitor is specifically designed to provide excellent heat resistant characteristics against conventional trimming capacitors. The TZCX3 is best suited for applications where stability and size are of the essence.

FEATURES

- Excellent stability – less than ±1% setting drift for capacitance value.
- Alumina stator provides superior heat resistance against severe reflow soldering processes.
- Color coded.
- Wide adjustment slot.
- Designed for auto-placement in surface mount applications.

DIMENSIONS



Unit: mm
Tolerance: ±0.1

PART NUMBERING SYSTEM

TZCX3	Z	060	A	110	T00
CHIP TRIMMER CAPACITOR	TEMPERATURE CHARACTERISTIC	CAPACITANCE	TERMINAL TYPE	OTHER SPECIFICATIONS	PACKAGING UNIT

110: Standard

T00: 180D.mm Taping (1000 pcs/reel)
T01: 330D.mm Taping (4000 pcs/reel)
No code: Bulk (500 pcs/bag)

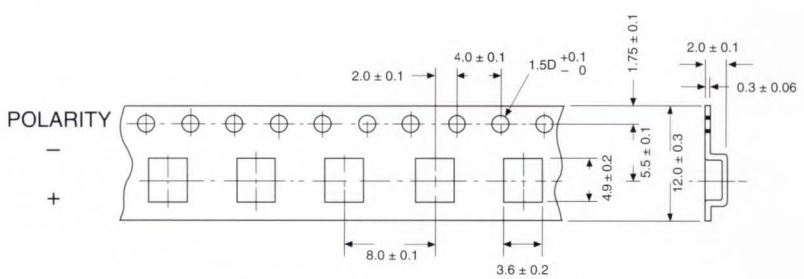
Caution: Do not wash

SPECIFICATIONS

Part Number	Capacitance (pF)		Temperature Coefficient (ppm/°C)	Q (1MHz, C max.)	Stator Color
	Min.(max.)	Max.(+70%,–0%)			
TZCX3Z030A110	1.5	3.0	NP0 ± 200	500 min.	Brown
TZCX3Z060A110	2.5	6.0	NP0 ± 300	500 min.	Blue
TZCX3R100A110	3.5	10.0	N750 ± 300	500 min.	—
TZCX3P200A110	5.5	20.0	N1200 ± 500	300 min.	Red

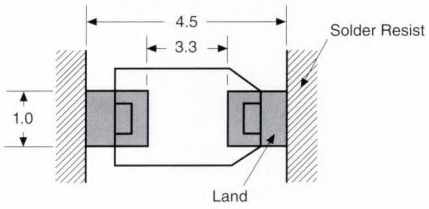
• **Rated Voltage**. . .50VDC • **Withstanding Voltage**. . .110VDC • **Insulation Resistance**. . .10^4 MΩmin. • **Torque**. . .15~100g•cm • **Operating Temperature**. . .–25~+85°C

DIMENSIONS: PLASTIC TAPE CARRIER (Unit: mm)



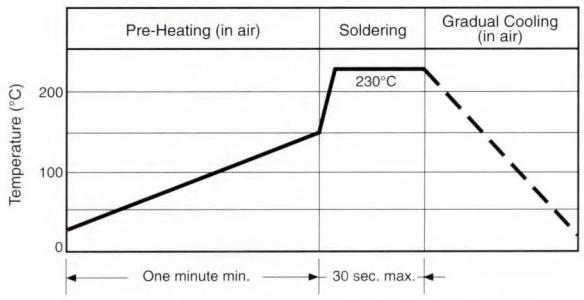
Caution: Do not wash.

STANDARD LAND DIMENSIONS (Unit: mm)



Tolerance: ± 0.1

STANDARD SOLDERING CONDITIONS (Reflow)



Soldering with Iron
Use a soldering iron of less than 20W. Complete soldering within 4 seconds at soldering tip temperature of 260°C.

Note: Recommended solder cream thickness is 200~250μm

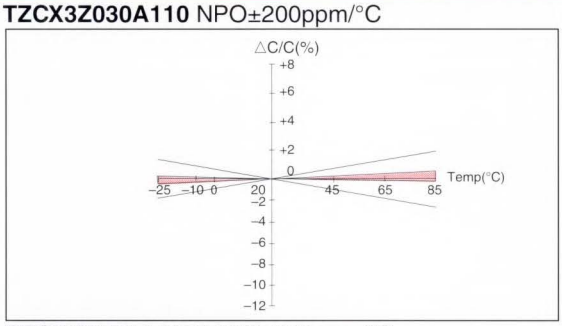
CAUTIONS IN HANDLING

1. Do not apply excessive force to trimmer when mounting on PCB.
2. Locking adhesives are not recommended to lock rotor of trimmer in place.
3. Do not clean by water or solvents.
4. Downward force applied during adjustment should not exceed 100g.f.
5. Adhesives should not be used to mount the trimmer to PCB.
6. Silicone oil is used internal to the trimmer capacitor. As this unit is not sealed, the oil may become evident on the outside. This will not influence the characteristics or the soldering of the trimmer capacitor.

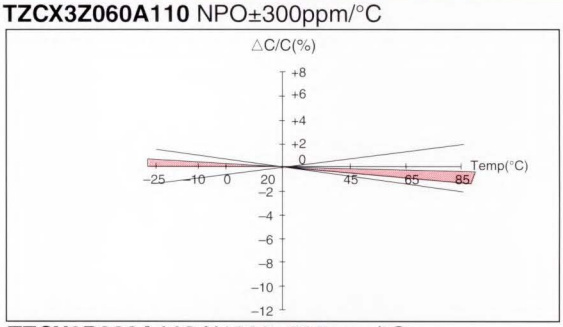
CHIP TRIMMER CAPACITORS
TZCX3 SERIES

TEMPERATURE COEFFICIENT CHARACTERISTICS

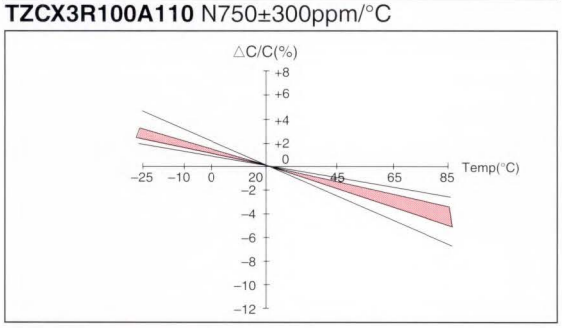
TZCX3Z030A110 NPO±200ppm/°C



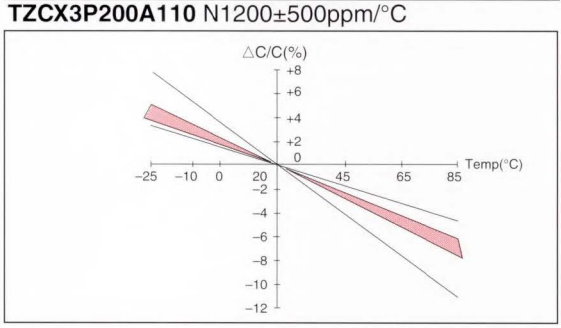
TZCX3Z060A110 NPO±300ppm/°C



TZCX3R100A110 N750±300ppm/°C



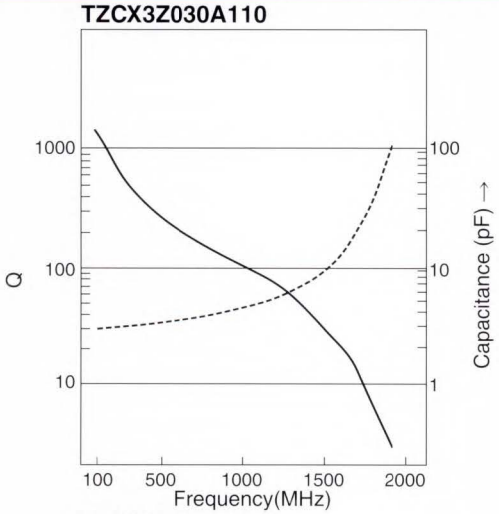
TZCX3P200A110 N1200±500ppm/°C



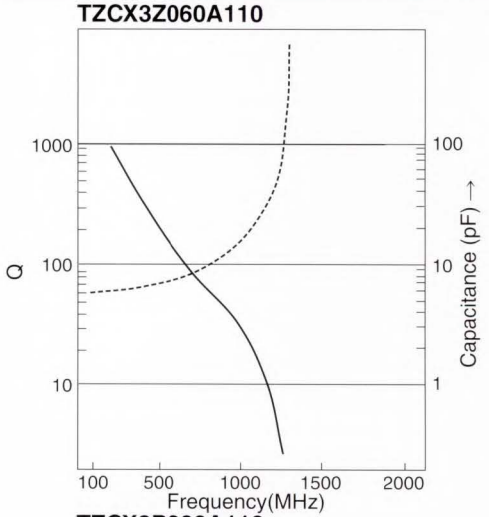
Q AND CAPACITANCE VS. FREQUENCY CHARACTERISTICS

Characteristics are measured at the maximum rated capacitance value using an RF impedance analyzer.

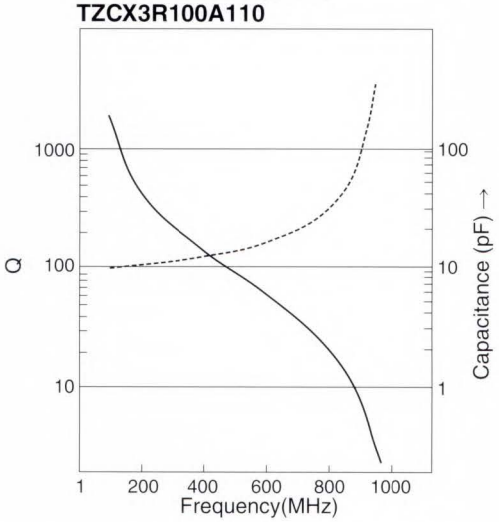
TZCX3Z030A110



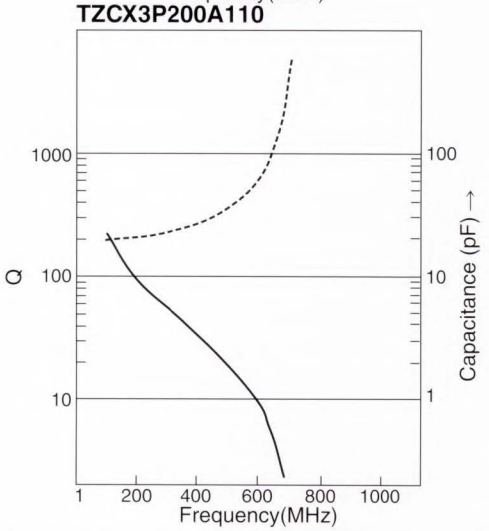
TZCX3Z060A110



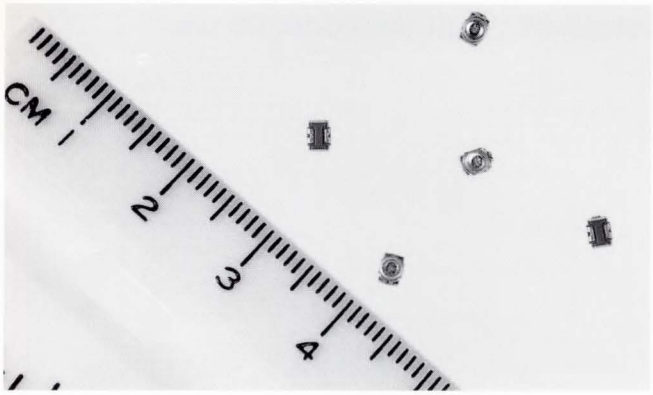
TZCX3R100A110



TZCX3P200A110



CHIP TRIMMER CAPACITORS
TZV02 SERIES

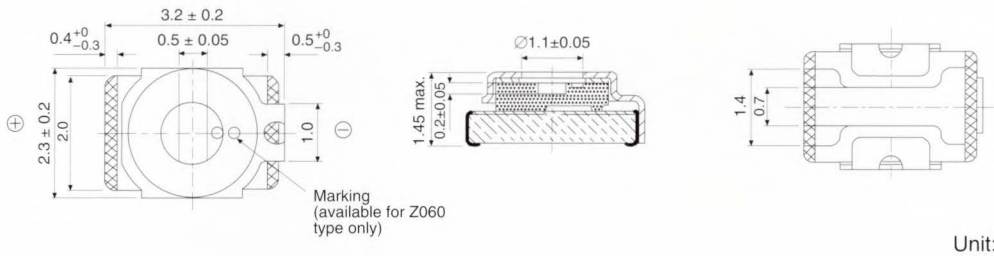


The latest generation of chip trimming capacitors uses Murata Electronic's technology advancements in monolithic construction to obtain an ultra stable, ultra small package with a maximum height of only 1.45mm. The TZV02 is best suited for applications where package size and high reliability are the foremost concerns.

FEATURES

- Smallest size available – just 2.3mm x 3.2mm x 1.45mm.
- Designed for auto-placement in surface mount applications.
- Superior heat resistant characteristics against reflow soldering temperatures.
- Rugged construction provides minimized capacitance drift after adjusting.

DIMENSIONS



Unit: mm
Tolerance: ±0.1

PART NUMBERING SYSTEM

TZV02	Z	060	A	110	T00
CHIP TRIMMER CAPACITOR	TEMPERATURE CHARACTERISTIC	CAPACITANCE	TERMINAL TYPE	OTHER SPECIFICATIONS 110: Standard	PACKAGING UNIT T00: 180D.mm Taping (2000 pcs/reel) T01: 330D.mm Taping (8000 pcs/reel) No code: Bulk (500 pcs/plastic bag)

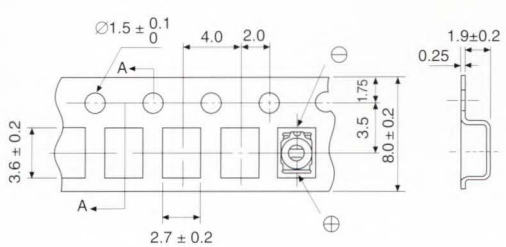
Caution: Do not wash.

SPECIFICATIONS

Part Number	Capacitance (pF)		Temperature Coefficient (ppm/°C)	Q (1MHz, C max)	Stator Color
	Min. (+0%)	Max. ($^{+100}_{0}$%)			
TZV02Z030A110	1.4	3.0	NP0 ± 500	300 min.	White
TZV02Z060A110	2.5	6.0	NP0 ± 500	500 min.	Light Green
TZV02Z100A110	3.0	10.0	NP0 ± 500	500 min.	Light Green
TZV02R200A110	4.5	20.0	N750 ± 500	500 min.	Brown

- **Rated Voltage**...25VDC
- **Withstanding Voltage**...55VDC
- **Insulation Resistance**...10^4MΩmin.
- **Driving Torque**...15~100g•cm
- **Operating Temperature Range**...–25~+85°C

DIMENSIONS OF PLASTIC TAPE

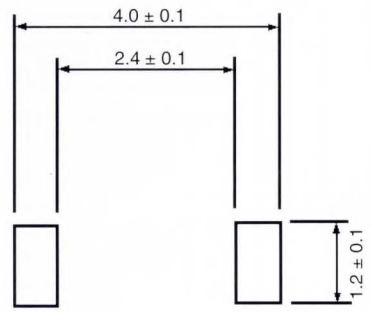


Unit: mm

- Packing unit: 2000pcs/reel (∅180mm)
  8000pcs/reel (∅330mm)

CHIP TRIMMER CAPACITORS
TZV02 SERIES

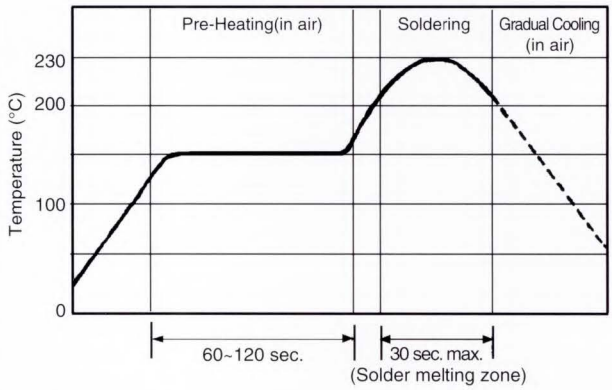
STANDARD LAND PATTERN



Unit: mm

STANDARD SOLDERING CONDITIONS

• Reflow solder



• Soldering with iron

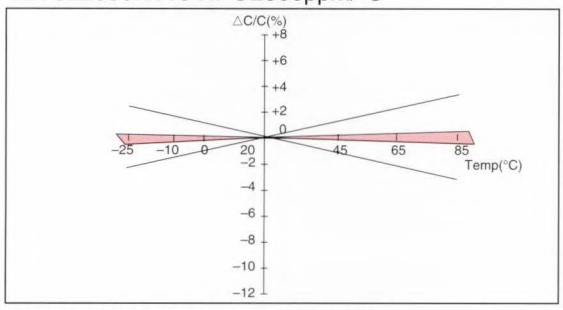
(1) Tip temperature: 270°C max.
(2) Soldering time: 4 sec. max.

CAUTIONS IN HANDLING

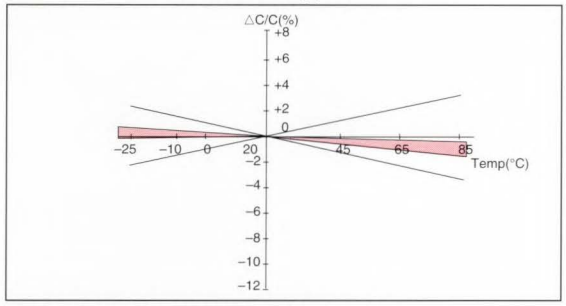
1. Do not clean by water or solvents.
2. Do not exceed 500gf of force when mounting on PCB.
3. Polarity is indicated in the dimensional diagram (+...Hot, –...Ground).
4. Do not flow solder.
5. When adjusting, a downward force of 300gf should not be exceeded.
6. Locking adhesives are not recommended.
7. Apply flux to terminal area only.
8. Do not store or use in a corrosive gaseous environment.

TEMPERATURE COEFFICIENT CHARACTERISTICS

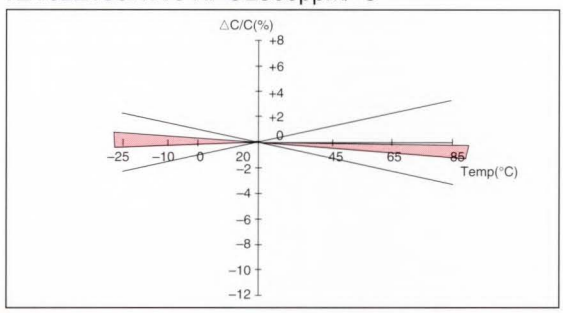
TZV02Z030A110 NPO±500ppm/°C



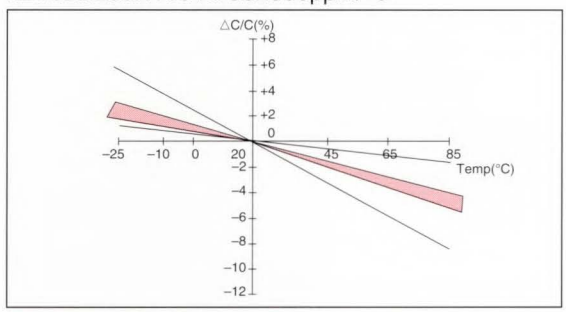
TZV02Z060A110 NPO±500ppm/°C



TZV02Z100A110 NPO±500ppm/°C



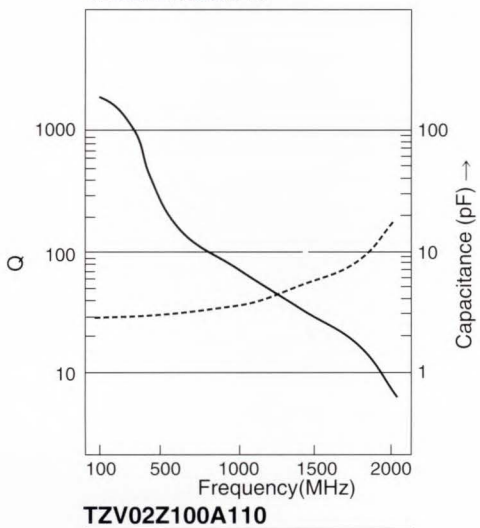
TZV02R200A110 N750±500ppm/°C



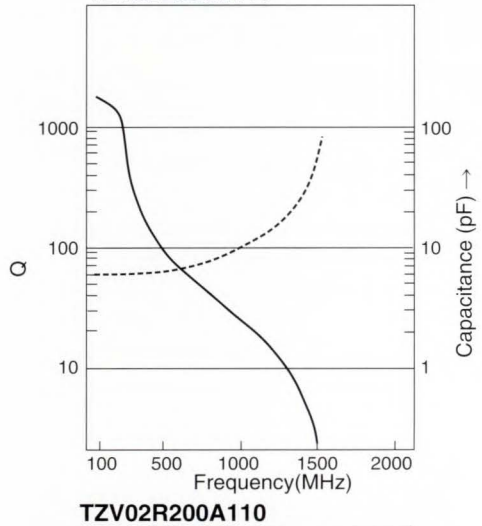
Q AND CAPACITANCE VS. FREQUENCY CHARACTERISTICS

Characteristics are measured at the maximum rated capacitance value position using an RF impedance analyzer.

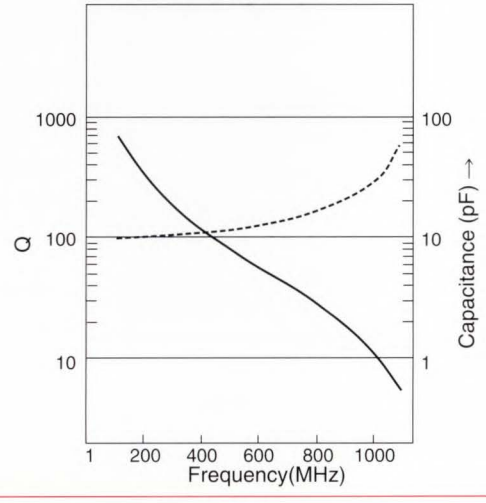
TZV02Z030A110



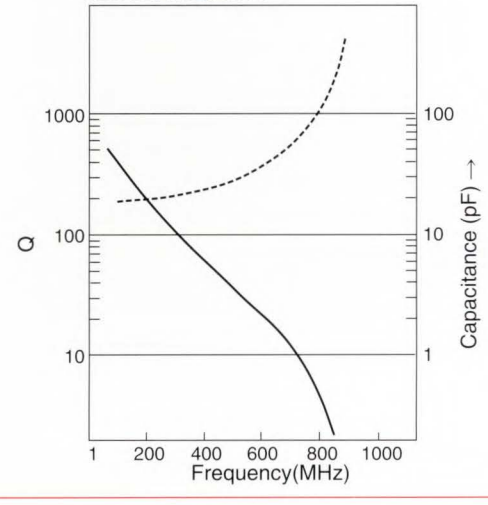
TZV02Z060A110



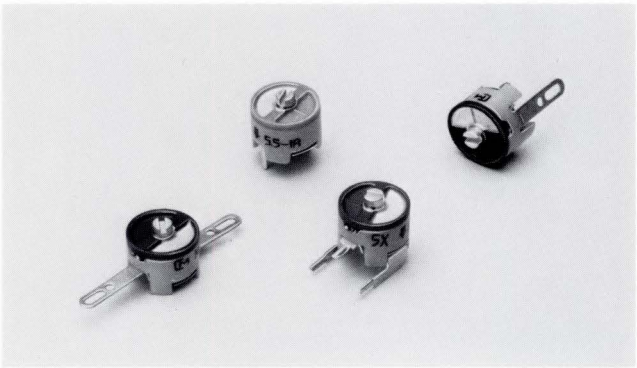
TZV02Z100A110



TZV02R200A110



TRIMMING CAPACITORS
DV11 SERIES



The DV11 Series of ceramic trimmer capacitors is the basic "standard" of the industry. It is extremely rugged and provides exceptional performance into the UHF frequency range. It is particularly applicable where space is not an important problem and where tuning ease is of utmost importance.

FEATURES

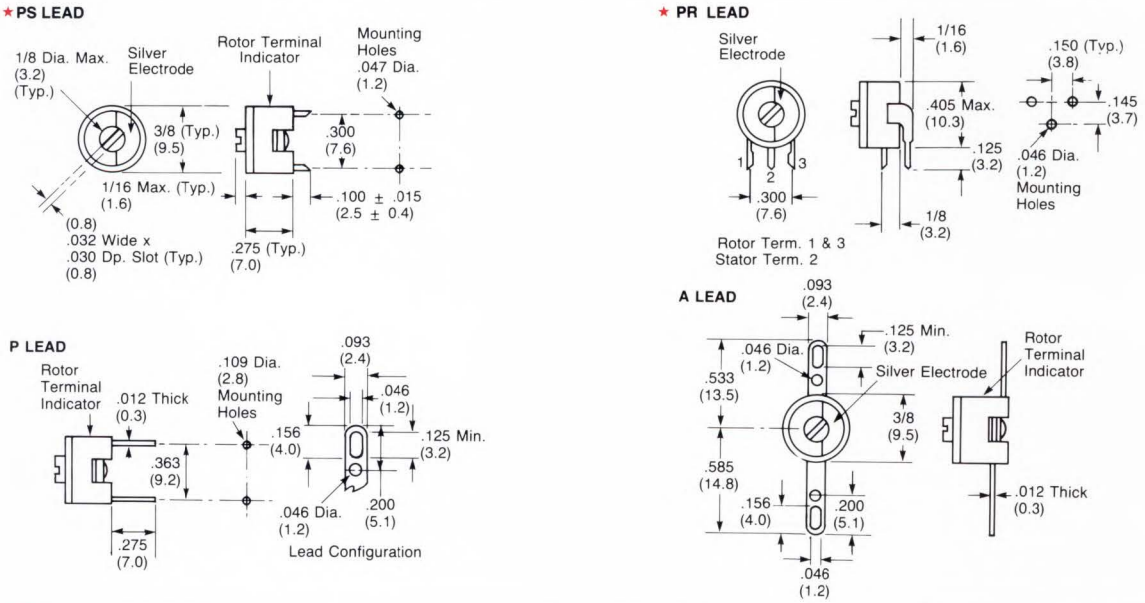
- **Wide selection of capacitance ranges to 60 pF max.**
- **Exceptionally linear TC**
- **Low cost**
- **Excellent resistance to shock and vibration**

SPECIFICATIONS

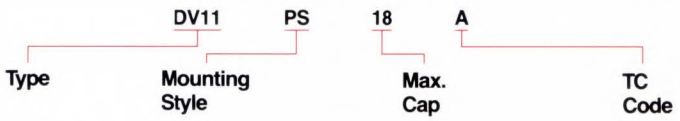
Operating Temp. Range	−55°C to +125°C
Working Voltages:	350 VDC for −55°C to +85°C 200 VDC for +85°C to +125°C Except N650 and N1500 units; 200 VDC for −55°C to +85°C 100 VDC for +85°C to +125°C
Test Voltages	500 VDC
"Q" Factor	500 min. @ 1 MHz
Insulation Resistance	10^4 megohms min.
Tuning Torque	1 to 6 in.-oz.

Part Number	Capacitance Range (pF)	Temp. Coeff. (ppm/°C)
★DV11 — 8A	2.0 to 8.0	NPO
★DV11 — 11B	2.5 to 11.0	N300
★DV11 — 15D	3.0 to 15.0	N650
★DV11 — 18A	5.5 to 18.0	NPO
★DV11 — 25B	7.0 to 25.0	N300
★DV11 — 35D	9.0 to 35.0	N650
★DV11 — 60Q	15.0 to 60.0	N1500

DIMENSIONS: in. (mm)



ORDERING INFORMATION



CAUTION: Do not wash.

★ Contact local sales office for specific standard values.

CAPACITANCE:
When measured at room temperature (25 ± 5°C) and a frequency of 0.1 to 1 MHz, the minimum capacitance shall not be greater than the specified min. and the maximum capacitance shall not be less than the specified max.

"Q" FACTOR:
When measured at room temperature using a Boonton Electronic's Type 75A bridge or equivalent at 1 MHz, the trimmer capacitor shall have a "Q" value not less than specified when the trimmer is set at 75% of rated max. capacity (Note: Air dielectric trimmers are usually measured at 100 MHz using a Boonton Radio type 190; Sapphire dielectric trimmers are read at 250 MHz also using the BR 190 or a coaxial line system)

INSULATION RESISTANCE:
Measured at room temperature through a one megohm source resistance, at approximate max. cap. setting shall equal or exceed rated value (Note: Failures measured over 50% Relative Humidity are not counted).

DIELECTRIC STRENGTH:
The capacitor, set at approximate max. capacity shall withstand rated Withstanding Volts for 5 seconds.

TORQUE:
Room temperature torque required to start and maintain rotation shall be within specified range.

TEMPERATURE COEFFICIENT:
The TC shall be measured with the capacitor set at approximately 75% rated max. capacity, then remeasured at −55, −10, +25, +85, and/or +125, and finally, at +25°C as required. The Temperature Coefficient shall remain within specified limits.

$$TC = \frac{(Cx - Co)}{Co} X \frac{(10^6)}{(Tx - To)} \quad /°C$$

CAPACITANCE DRIFT:
Drift is the greatest change between any two readings at 25°C after the normal excursions taken for TC measurements.

ACCELERATED LIFE TEST:
The capacitor shall be set for approximately 75% of rated max. capacity and tested for specified time at twice rated working volts. After return to stabilized room temperature, the capacitor shall remain within specified Q, Insulation Resistance and other limits specified.

TEMPERATURE CYCLING:
The capacitor shall be set for 75% of rated max. capacity and then be subjected to five each of the following cycles.

1. −55°C (30 minutes)
2. +25°C (15 minutes)
3. +85 (or +125) °C (30 minutes)
4. +25°C (15 minutes)

The rate of cooling or heating shall not be less than 3°C per minute. The temperature cycles shall be followed by 96 hour exposure to 95% RH at specified temperature. The capacitor shall then be removed and held at 25°C and 50% max. RH Q, Insulation Resistance, and capacity change shall remain within specified limits.

RELATIVE HUMIDITY:
Capacitors shall be set for 75% of rated max. capacity and subjected to specified time of 96% Relative Humidity (RH) at specified atmospheric temperature. (Note: standard time is 96 hours and standard temperature is +40°C) The capacitor shall then be removed from the humidity chamber and held at +25°C for the specified time with a maximum humidity of 50%. After the test sequence, the capacitor shall be tested for Q, I.R. & capacity change which are all required to remain within specified limits.

TUNING LINEARITY:
Test capacitors are rigidly mounted in the normal manner and turned through a standard number of degrees with capacity measured after each turning procedure. Plotted points shall not deviate from an average straight line by more than the allowable percentage. (i.e., theoretical line point capacity x 100)

NOTES:
Special Measurements and testing.

1) Support data and test methods are available on request. Please contact the appropriate product engineering group.
2) Special tests and test methods can be arranged by contacting your local sales office or the appropriate product manager.

GLOSSARY OF SPECIALIZED TERMS

1. DIELECTRIC:
Sometimes called "Insulator", a dielectric is a material whose internal charges are bound and can therefore only move over atomic dimensions. It separates the conductive capacitor plates and is important in determining temperature characteristics, voltage rating, capacity/volume and other characteristics of a capacitor.

2. DISSIPATION FACTOR (DF):
The dissipation factor of an insulating material is defined as the ratio of energy dissipated to energy stored in the dielectric. The DF is frequency sensitive and must be specified at a given frequency.

3. QUALITY FACTOR ("Q"):
The Q factor is the ratio of energy stored to energy dissipated and is therefore often taken as the inverse of the DF at low frequency. Sometimes called "Figure of Merit," Q factors must be specified at a given frequency.

4. WORKING (OR RATED) VOLTAGE:
Nominal continuous voltage which may be applied to a component with no derating of any kind.

5. DIELECTRIC WITHSTANDING ("BREAKDOWN") VOLTAGE:
The peak voltage which the component is designed to withstand without damage for short periods of time. This value must be specified in terms of frequency, waveform, and time.

6. INSULATION RESISTANCE (MEGOHMS):
I.R. is the terminal to terminal DC resistance of a capacitor, and must be specified in terms of voltage, temperature, and relative humidity.

7. TEMPERATURE COEFFICIENT ("TC"):
"TC" is the decimal change in capacity per degree change in environmental temperature. Some dielectrics are very lossy and generate internal heat and for that reason this test is conventionally conducted under "no load" conditions. The standard definition for "TC" in parts per million per degree centigrade is...

$$TC = \frac{(Cx - Co)}{Co} X \frac{(10^6)}{(Tx - To)} \ /°C$$

Where "Tx" is the test temperature, "To" is the reference temperature - usually 25°C. "Co" is the capacity measured at the reference temperature and "Cx" is the capacity measured at the test temperature.

8. DRIFT:
The extent in pF or % to which capacitor changes value as a result of temperature exposure. Sometimes called "Retrace", this measurement is usually made under nominal (i.e. room) conditions and is accomplished both before and after the conclusion of temperature excursion. (Note: "Drift" may occasionally be used in the test context of the simple passage of time).

9. TERMINATION:
This term refers to the material and/or geometry of the terminals of the capacitor.

10. RF POWER:
Typically measured in KVA (apparent power) for signals with frequencies greater than 1 MHz. RF Power is limited by the maximum rated voltage or the maximum power the capacitor is able to dissipate.

11. TRIMMER CAPACITOR:
This variable type of capacitor is designed to permit precision adjustment of capacitance value. These trimming capacitors are intended for factory or maintenance adjustments only.

12. RANGE:
Trimmer capacitor range is specified in terms of "Min." and "Max." This specification indicates the guaranteed capacitance values between which the device is intended to be adjustable.

13. TUNING TORQUE:
Specified in terms of inch-ounces or gram-centimeters. Torque is intentionally introduced to trimmer capacitor design to prevent unintended tuning due to shock, vibration or other environmental factors. This requirement is specified in terms of "Min." and "Max."

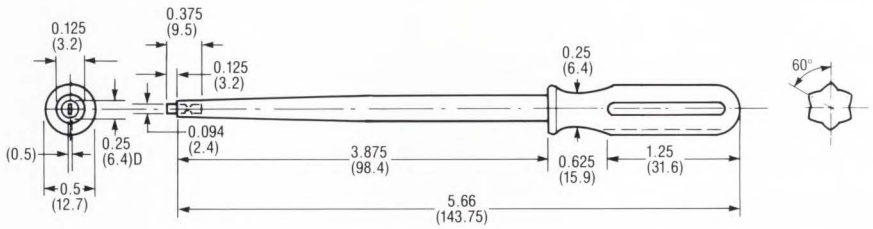
14. RESOLUTION:
Specified in terms of "pF per turn". This specification indicates the accuracy with which the trimmer can be set to a particular value.

15. LINEARITY:
This term defines the specification for change in capacity per turns or degrees of rotation.

16. REVERSALS:
This term refers to a change of "sign" of the capacity vs. turns characteristic slope.

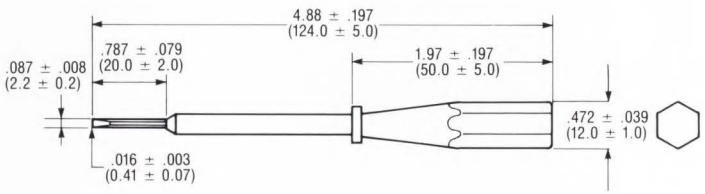
Part Number
***ME501**

A general purpose tuning tool for all Murata Erie trimming capacitors. Tuning element is metal.



Part Number
***ME502**

A high accuracy tuning tool featuring a completely passive, long life *ceramic* tuning element that has *no* incidental effect on the device under adjustment.



*Available as standard through Authorized Murata Electronics Distributors.

DESIGN ENGINEERING KITS

CAPACITORS— CHIP, MONOLITHIC

- Miniature size
- Wide capacitance, TC, voltage and tolerance range
- Industry standard sizes
- 8mm and 12mm tape and reel for auto-placements
- Barrier layer termination systems for wave, reflow or vapor phase solder
- Largest production volume and capacity in the industry

★ KIT-GRM36

Part No.	Cap.	Tol.
COG 50V, 100 each value		
GRM36COG0R5C50AB	0.5pF	± .25pF
GRM36COG010C50AB	1	± .25
GRM36COG020C50AB	2	± .25
GRM36COG030C50AB	3	± .25
GRM36COG040C50AB	4	± .25
GRM36COG050C50AB	5	± .25
GRM36COG060D50AB	6	± .5
GRM36COG070D50AB	7	± .5
GRM36COG080D50AB	8	± .5
GRM36COG090D50AB	9	± .5
GRM36COG100D50AB	10	± .5
GRM36COG120J50AB	12	±5 %
GRM36COG150J50AB	15	±5
GRM36COG180J50AB	18	±5
GRM36COG220J50AB	22	±5
GRM36COG270J50AB	27	±5
GRM36COG330J50AB	33	±5
GRM36COG390J50AB	39	±5
GRM36COG470J50AB	47	±5
GRM36COG560J50AB	56	±5
GRM36COG680J50AB	68	±5
GRM36COG820J50AB	82	±5
GRM36COG101J50AB	100	±5
GRM36COG121J50AB	120	±5
GRM36COG151J50AB	150	±5
X7R 50V, 200 each value		
GRM36X7R221K50AB	220 pF	±10%
GRM36X7R271K50AB	270	±10
GRM36X7R331K50AB	330	±10
GRM36X7R391K50AB	390	±10
GRM36X7R471K50AB	470	±10
GRM36X7R561K50AB	560	±10
GRM36X7R681K50AB	680	±10
GRM36X7R821K50AB	820	±10
GRM36X7R102K50AB	1000	±10
GRM36X7R122K50AB	1200	±10
GRM36X7R152K50AB	1500	±10
GRM36X7R182K50AB	1800	±10
GRM36X7R222K50AB	2200	±10
GRM36X7R272K50AB	2700	±10
GRM36X7R332K50AB	3300	±10
GRM36X7R392K50AB	3900	±10
GRM36X7R472K25AB	4700	±10
GRM36X7R562K25AB	5600	±10
GRM36X7R682K25AB	6800	±10
GRM36X7R822K16AB	8200	±10
GRM36X7R103K16AB	.01μF	±10
Y5V 50V, 200 each value		
GRM36Y5V102Z50AB	1000 pF	+80, −20%
GRM36Y5V222Z50AB	2200	+80, −20
GRM36Y5V332Z50AB	3300	+80, −20
GRM36Y5V472Z50AB	4700	+80, −20
GRM36Y5V103Z50AB	.01 μF	+80, −20
GRM36Y5V153Z25AB	.015	+80, −20
GRM36Y5V223Z25AB	.022	+80, −20
GRM36Y5V333Z16AB	.033	+80, −20

★ STANDARD DISTRIBUTOR ITEMS

★ KIT-GRM39

Part No.	Cap.	Tol.
COG 100V, 50 each value		
GRM39COG010B100AB	1 pF	± .1 pF
GRM39COG1R5B100AB	1.5	± .1
GRM39COG2R2B100AB	2.2	± .1
GRM39COG3R3B100AB	3.3	± .1
GRM39COG4R7B100AB	4.7	± .1
GRM39COG6R8C100AB	6.8	± .25
GRM39COG100D100AB	10	± .5
GRM39COG150J100AB	15	±5 %
GRM39COG220J100AB	22	±5
GRM39COG330J100AB	33	±5
GRM39COG470J100AB	47	±5
GRM39COG680J100AB	68	±5
GRM39COG101J100AB	100	±5
COG 50V, 50 each value		
GRM39COG010B050AB	1 pF	± .1 pF
GRM39COG1R5B050AB	1.5	± .1
GRM39COG2R2B050AB	2.2	± .1
GRM39COG3R3B050AB	3.3	± .1
GRM39COG4R7B050AB	4.7	± .1
GRM39COG6R8C050AB	6.8	± .25
GRM39COG100D050AB	10	± .5
GRM39COG150J050AB	15	±5 %
GRM39COG220J050AB	22	±5
GRM39COG330J050AB	33	±5
GRM39COG470J050AB	47	±5
GRM39COG680J050AB	68	±5
GRM39COG101J050AB	100	±5
GRM39COG151J050AB	150	±5
GRM39COG221J050AB	220	±5
X7R 50V, 50 each value		
GRM39X7R221K050AB	220pF	±10%
GRM39X7R331K050AB	330	±10
GRM39X7R471K050AB	470	±10
GRM39X7R681K050AB	680	±10
GRM39X7R102K050AB	1000	±10
GRM39X7R152K050AB	1500	±10
GRM39X7R222K050AB	2200	±10
GRM39X7R332K050AB	3300	±10
GRM39X7R472K050AB	4700	±10
GRM39X7R682K050AB	6800	±10
GRM39X7R103K050AB	.01μF	±10
X7R 25V, 50 each value		
GRM39X7R472K025AB	4700pF	±10%
GRM39X7R682K025AB	6200	±10
GRM39X7R103K025AB	.01μF	±10
X7R 16V, 50 each value		
GRM39X7R153K016AB	.015μF	±10%
GRM39X7R223K016AB	.022	±10
GRM39X7R333K016AB	.033	±10
Y5V 50V, 50 each value		
GRM39Y5V152Z050AB	1500pF	+80, −20%
GRM39Y5V222Z050AB	2200	+80, −20
GRM39Y5V332Z050AB	3300	+80, −20
GRM39Y5V472Z050AB	4700	+80, −20
GRM39Y5V682Z050AB	6800	+80, −20
GRM39Y5V103Z050AB	.01 μF	+80, −20%
GRM39Y5V153Z050AB	.015	+80, −20
GRM39Y5V223Z050AB	.022	+80, −20
Y5V 25V, 50 each value		
GRM39Y5V152Z025AB	1500pF	+80, −20%
GRM39Y5V222Z025AB	2200	+80, −20
GRM39Y5V332Z025AB	3300	+80, −20
GRM39Y5V472Z025AB	4700	+80, −20
GRM39Y5V682Z025AB	6800	+80, −20
GRM39Y5V103Z025AB	.01 μF	+80, −20
GRM39Y5V153Z025AB	.015	+80, −20
GRM39Y5V223Z025AB	.022	+80, −20
GRM39Y5V333Z025AB	.033	+80, −20
GRM39Y5V473Z025AB	.047	+80, −20
Y5V 16V, 50 each value		
GRM39Y5V333Z016AB	.033μF	+80, −20%
GRM39Y5V473Z016AB	.047	+80, −20
GRM39Y5V683Z016AB	.068	+80, −20
GRM39Y5V104Z016AB	.1	+80, −20

CAPACITORS— CHIP, MONOLITHIC (continued)

★KIT-GRM40

Part No.	Cap.	Tol.
COG 50V, 50 each value		
GRM40COG010C050AB	1pF	± .25pF
GRM40COG020C050AB	2	± .25
GRM40COG030C050AB	3	± .25
GRM40COG040C050AB	4	± .25
GRM40COG050D050AB	5	± .5
GRM40COG060D050AB	6	± .5
GRM40COG070D050AB	7	± .5
GRM40COG080D050AB	8	± .5
GRM40COG090D050AB	9	± .5
GRM40COG100D050AB	10	± .5
GRM40COG120J050AB	12	±5 %
GRM40COG150J050AB	15	±5
GRM40COG180J050AB	18	±5
GRM40COG220J050AB	22	±5
GRM40COG330J050AB	33	±5
GRM40COG390J050AB	39	±5
GRM40COG470J050AB	47	±5
GRM40COG560J050AB	56	±5
GRM40COG680J050AB	68	±5
GRM40COG820J050AB	82	±5
GRM40COG101J050AB	100	±5
GRM40COG121J050AB	120	±5
GRM40COG151J050AB	150	±5
GRM40COG181J050AB	180	±5
GRM40COG221J050AB	220	±5
GRM40COG271J050AB	270	±5
GRM40COG331J050AB	330	±5
GRM40COG391J050AB	390	±5
GRM40COG471J050AB	470	±5
X7R 50V, 100 each value		
GRM40X7R391K050AB	390pF	±10%
GRM40X7R471K050AB	470	±10
GRM40X7R561K050AB	560	±10
GRM40X7R681K050AB	680	±10
GRM40X7R821K050AB	820	±10
GRM40X7R102K050AB	1000	±10
GRM40X7R122K050AB	1200	±10
GRM40X7R152K050AB	1500	±10
GRM40X7R182K050AB	1800	±10
GRM40X7R222K050AB	2200	±10
GRM40X7R272K050AB	2700	±10
GRM40X7R332K050AB	3300	±10
GRM40X7R392K050AB	3900	±10
GRM40X7R472K050AB	4700	±10
GRM40X7R562K050AB	5600	±10
GRM40X7R682K050AB	6800	±10
GRM40X7R822K050AB	8200	±10
GRM40X7R103K050AB	.01 μF	±10
GRM40X7R123K050AB	.012	±10
GRM40X7R153K050AB	.015	±10
GRM40X7R183K050AB	.018	±10
GRM40X7R223K050AB	.022	±10
Z5U 50V, 100 each value		
GRM40Z5U103M050AB	.01 μF	±20%
GRM40Z5U123M050AB	.012	±20
GRM40Z5U183M050AB	.018	±20
GRM40Z5U223M050AB	.022	±20
GRM40Z5U333M050AB	.033	±20
GRM40Z5U473M050AB	.047	±20
Y5V, 25V, 100 each value		
GRM40Y5V104Z25V	.1 μF	+80, −20%

★ STANDARD DISTRIBUTOR ITEMS

★KIT-GRM42-6

Part No.	Cap.	Tol.
COG 50V, 50 each value		
GRM42-6COG100D050AB	10pF	± .5pF
GRM42-6COG120J050AB	12	±5 %
GRM42-6COG150J050AB	15	±5
GRM42-6COG180J050AB	18	±5
GRM42-6COG220J050AB	22	±5
GRM42-6COG330J050AB	33	±5
GRM42-6COG390J050AB	39	±5
GRM42-6COG470J050AB	47	±5
GRM42-6COG560J050AB	56	±5
GRM42-6COG680J050AB	68	±5
GRM42-6COG820J050AB	82	±5
GRM42-6COG101J050AB	100	±5
GRM42-6COG121J050AB	120	±5
GRM42-6COG151J050AB	150	±5
GRM42-6COG181J050AB	180	±5
GRM42-6COG221J050AB	220	±5
GRM42-6COG271J050AB	270	±5
GRM42-6COG331J050AB	330	±5
GRM42-6COG391J050AB	390	±5
GRM42-6COG471J050AB	470	±5
GRM42-6COG561J050AB	560	±5
GRM42-6COG681J050AB	680	±5
GRM42-6COG821J050AB	820	±5
GRM42-6COG102J050AB	1000	±5
X7R 50V, 100 each value		
GRM42-6X7R331K050AB	330pF	±10%
GRM42-6X7R391K050AB	390	±10
GRM42-6X7R471K050AB	470	±10
GRM42-6X7R561K050AB	560	±10
GRM42-6X7R681K050AB	680	±10
GRM42-6X7R821K050AB	820	±10
GRM42-6X7R102K050AB	1000	±10
GRM42-6X7R122K050AB	1200	±10
GRM42-6X7R152K050AB	1500	±10
GRM42-6X7R182K050AB	1800	±10
GRM42-6X7R222K050AB	2200	±10
GRM42-6X7R272K050AB	2700	±10
GRM42-6X7R332K050AB	3300	±10
GRM42-6X7R392K050AB	3900	±10
GRM42-6X7R472K050AB	4700	±10
GRM42-6X7R562K050AB	5600	±10
GRM42-6X7R682K050AB	6800	±10
GRM42-6X7R822K050AB	8200	±10
GRM42-6X7R103K050AB	.01 μF	±10
GRM42-6X7R123K050AB	.012	±10
GRM42-6X7R153K050AB	.015	±10
GRM42-6X7R183K050AB	.018	±10
GRM42-6X7R223K050AB	.022	±10
GRM42-6X7R273K050AB	.027	±10
GRM42-6X7R333K050AB	.033	±10
GRM42-6X7R393K050AB	.039	±10
GRM42-6X7R473K050AB	.047	±10
GRM42-6X7R563K050AB	.056	±10
GRM42-6X7R683K050AB	.068	±10
GRM42-6X7R823K050AB	.082	±10
GRM42-6X7R104K050AB	.1	±10
Z5U 50V, 100 each value		
GRM42-6Z5U473M050AB	.047μF	±20%
GRM42-6Z5U563M050AB	.056	±20
GRM42-6Z5U683M050AB	.068	±20
GRM42-6Z5U823M050AB	.082	±20
GRM42-6Z5U104M050AB	.1	±20

DESIGN ENGINEERING KITS

CAPACITORS— CHIP, MONOLITHIC (continued)

★ **KIT-GRM40-TC**
Temperature compensating
Values below in each of these T.C.'s: P2H, R2H, S2H, T2H, U2J

Part No.	Cap.	Tol.
50V, 50 each value		
GRM40□□□010B050AB	1 pF	± .1 pF
GRM40□□□1R5B050AB	1.5	± .1
GRM40□□□2R2B050AB	2.2	± .1
GRM40□□□3R3B050AB	3.3	± .1
GRM40□□□4R7B050AB	4.7	± .1
GRM40□□□6R8C050AB	6.8	± .25
GRM40□□□100D050AB	10	± .5
GRM40□□□150J050AB	15	±5 %
GRM40□□□220J050AB	22	±5
GRM40□□□330J050AB	33	±5
GRM40□□□470J050AB	47	±5
GRM40□□□680J050AB	68	±5
GRM40□□□101J050AB	100	±5
GRM40□□□151J050AB	150	±5
GRM40□□□221J050AB	220	±5
GRM40□□□331J050AB	330	±5
GRM40□□□471J050AB	470	±5
GRM40□□□681J050AB	680	±5
GRM40□□□102J050AB	1000*	±5
GRM40□□□152J050AB	1500*	±5

*T2H and U2J only

★ **KIT-GRM42-6-TC**
Temperature compensating
Values below in each of these T.C.'s: P2H, R2H, S2H, T2H, U2J

Part No.	Cap.	Tol.
50V, 50 each value		
GRM42-6□□□010B050AB	1 pF	± .1 pF
GRM42-6□□□1R5B050AB	1.5	± .1
GRM42-6□□□2R2B050AB	2.2	± .1
GRM42-6□□□3R3B050AB	3.3	± .1
GRM42-6□□□4R7B050AB	4.7	± .1
GRM42-6□□□6R8C050AB	6.8	± .25
GRM42-6□□□100D050AB	10	± .5
GRM42-6□□□150J050AB	15	±5 %
GRM42-6□□□220J050AB	22	±5
GRM42-6□□□330J050AB	33	±5
GRM42-6□□□470J050AB	47	±5
GRM42-6□□□680J050AB	68	±5
GRM42-6□□□101J050AB	100	±5
GRM42-6□□□151J050AB	150	±5
GRM42-6□□□221J050AB	220	±5
GRM42-6□□□331J050AB	330	±5
GRM42-6□□□471J050AB	470	±5
GRM42-6□□□681J050AB	680	±5
GRM42-6□□□102J050AB	1000*	±5
GRM42-6□□□152J050AB	1500*	±5

*T2H and U2J only

★ STANDARD DISTRIBUTOR ITEMS

CAPACITORS— CHIP, MONOLITHIC, ELECTROLYTICS REPLACEMENTS

★ **KIT-GRM-TA**
Tantalum Alternative

Part No.	Cap.	Tol.
X7R 16V, 25 each value, *10 each value		
GRM39X7R153K016AB	.015μF	±10%
GRM39X7R223K016AB	.022	±10
GRM39X7R333K016AB	.033	±10
GRM40X7R153K016AB	.015	±10
GRM40X7R223K016AB	.022	±10
GRM40X7R333K016AB	.033	±10
GRM40X7R473K016AB	.047	±10
GRM40X7R683K016AB	.068	±10
GRM40X7R104K016AB	.1	±10
GRM40X7R154K016AB	.15	±10
GRM42-6X7R104K016AB	.1	±10
GRM42-6X7R154K016AB	.15	±10
GRM42-6X7R224K016AB	.22	±10
GRM42-6X7R334K016AB	.33	±10
*GRM42-2X7R154K016AB	.15	±10
*GRM42-2X7R224K016AB	.22	±10
*GRM42-2X7R334K016AB	.33	±10
*GRM42-2X7R474K016AB	.47	±10
*GRM43-2X7R474K016AB	.47	±10
Y5V 16V, 25 each value, *10 each value		
GRM39Y5V333Z016AB	.033μF	+80, −20%
GRM39Y5V473Z016AB	.047	+80, −20
GRM39Y5V683Z016AB	.068	+80, −20
GRM39Y5V104Z016AB	.1	+80, −20
GRM40Y5V333Z016AB	.033	+80, −20
GRM40Y5V473Z016AB	.047	+80, −20
GRM40Y5V683Z016AB	.068	+80, −20
GRM40Y5V104Z016AB	.1	+80, −20
GRM40Y5V154Z016AB	.15	+80, −20
GRM40Y5V224Z016AB	.22	+80, −20
GRM40Y5V334Z016AB	.33	+80, −20
GRM40Y5V474Z016AB	.47	+80, −20
GRM42-6Y5V154Z016AB	.15	+80, −20
GRM42-6Y5V224Z016AB	.22	+80, −20
GRM42-6Y5V334Z016AB	.33	+80, −20
GRM42-6Y5V474Z016AB	.47	+80, −20
GRM42-6Y5V684Z016AB	.68	+80, −20
GRM42-6Y5V105Z016AB	1.0	+80, −20
GRM42-6Y5V155Z016AB	1.5	+80, −20
*GRM42-2Y5V684Z016AB	.68	+80, −20
*GRM42-2Y5V105Z016AB	1.0	+80, −20
*GRM42-2Y5V155Z016AB	1.5	+80, −20
*GRM42-2Y5V225Z016AB	2.2	+80, −20
*GRM43-2Y5V225Z016AB	2.2	+80, −20

CAPACITORS— RADIAL LEADED, MONOLITHIC

- Wide capacitance, T.C., voltage and tolerance range
- Industry standard sizes
- Tape and Reel available for auto insertion
- Various lead spacing available
- Marking standard or to customer specification

★KIT-RPE

Part No.	Cap.	Tol.
COG 100V, 50 each value		
RPE110COG1R0C100V	1pF	± .25pF
RPE110COG2R2C100V	2.2	± .25
RPE110COG4R7C100V	4.7	± .25
RPE110COG8R2D100V	8.2	± .25
RPE110COG100D100V	10	±5%
RPE110COG180J100V	18	±5
RPE110COG220J100V	22	±5
RPE110COG330J100V	33	±5
RPE110COG470J100V	47	±5
RPE110COG680J100V	68	±5
RPE110COG820J100V	82	±5
RPE122COG101J100V	100	±5
RPE122COG221J100V	220	±5
RPE122COG331J100V	330	±5
RPE122COG471J100V	470	±5
RPE122COG821J100V	820	±5
X7R 100V, 50 each value		
RPE122X7R102K100V	1,000pF	±10%
RPE122X7R222K100V	2,200	±10
RPE122X7R472K100V	4,700	±10
RPE122X7R103K100V	10,000	±10
RPE122X7R223K100V	22,000	±10
RPE122X7R333K100V	33,000	±10
RPE122X7R473K100V	47,000	±10
RPE122X7R104K100V	100,000	±10
Z5U 50V, 50 each value		
RPE122Z5U224M050V	220,000pF	±20%
RPE122Z5U334M050V	330,000	±20
RPE123Z5U474M050V	470,000	±20
RPE123Z5U105M050V	1,000,000	±20

★KIT-RPE-TR*

Part No.	Cap.	Tol.
COG 100V, 50 each value		
RPE122COG1R0C100V	1pF	± .25pF
RPE122COG2R2C100V	2.2	± .25
RPE122COG4R7C100V	4.7	± .25
RPE122COG8R2D100V	8.2	± .25
RPE122COG100D100V	10	±5%
RPE122COG180J100V	18	±5
RPE122COG220J100V	22	±5
RPE122COG330J100V	33	±5
RPE122COG470J100V	47	±5
RPE122COG680J100V	68	±5
RPE122COG820J100V	82	±5
RPE122COG101J100V	100	±5
RPE122COG221J100V	220	±5
RPE122COG331J100V	330	±5
RPE122COG471J100V	470	±5
RPE122COG821J100V	820	±5
X7R 100V, 50 each value		
RPE122X7R102K100V	1,000pF	±10%
RPE122X7R222K100V	2,200	±10
RPE122X7R472K100V	4,700	±10
RPE122X7R103K100V	10,000	±10
RPE122X7R223K100V	22,000	±10
RPE122X7R333K100V	33,000	±10
RPE122X7R473K100V	47,000	±10
RPE122X7R104K100V	100,000	±10

★KIT-RPE-TR* *(continued)*

Part No.	Cap.	Tol.
Z5U 100V, 50 each value		
RPE122Z5U103M100V	10,000pF	±20%
RPE122Z5U104M100V	100,000	±20
Z5U 50V, 50 each value		
RPE122Z5U224M050V	220,000pF	±20%
RPE122Z5U334M050V	330,000	±20
RPE123Z5U474M050V	470,000	±20
RPE123Z5U105M050V	1,000,000	±20

*Supplied with typical Tape & Reel lead forms.

CAPACITORS— DISC, SAFETY

★KIT-SAFETY-CAPACITOR

- Meet UL, CSA, SEV, VDE, etc. standards

Part No.	Cap.	Tol.
400, 250, 125VAC 25 each value		
DE7090B101KVA1-KC	100pF	± 10%
DE7090B151KVA1-KC	150	± 10
DE7090B221KVA1-KC	220	± 10
DE7090B331KVA1-KC	330	± 10
DE7090B471KVA1-KC	470	± 10
DE7090B102KVA1-KC	1,000	± 10
DE7100F222MVA1-KC	2,200	± 20
DE7120F332MVA1-KC	3,300	± 20
DE7150F472MVA1-KC	4,700	± 20
DE7100FZ472PVA1-KC	4,700	+100, −0
DE7150F103MVA1-KC	10,000	± 20
DE7150FZ103PVA1-KC	10,000	+100, −0
DE2110F682MAC125-MX	6,800	± 20
DE1910E472MACT4K-KD	4,700	± 20
DE1410E222MACT4K-KD	2,200	± 20

★STANDARD DISTRIBUTOR ITEMS

DESIGN ENGINEERING KITS

CAPACITORS— CHIP MONOLITHIC, MICROWAVE

- Miniature sizes
- Very high Q at high frequencies
- High RF power capabilities
- Impervious to adverse environmental conditions
- Low dissipation factors
- Perfect retrace capability
- High temperature stability
- Low noise

★KIT-MA18-001
(Evaluation Kit)

Part No.	Cap.	Tol.
P90 150V, 5 each value		
MA181R0B	1.0pF	± .1 pF
MA181R8C	1.8	± .25
MA182R7D	2.7	± .5
MA183R3D	3.3	± .5
MA184R7D	4.7	± .5
MA185R7D	5.6	± .5
MA188R2K	8.2	±10 %
MA18100K	10	±10
MA18120K	12	±10
MA18150K	15	±10
MA18220K	22	±10
MA18360K	36	±10
MA18470K	47	±10
MA18560K	56	±10
MA18820K	82	±10

★KIT-MA18-002
(Tune Kit)

Part No.	Cap.	Tol.
P90 150V, 5 each value		
MA180R3B	0.3pF	± .1 pF
MA180R4B	0.4	± .1
MA180R5B	0.5	± .1
MA180R6B	0.6	± .1
MA180R7B	0.7	± .1
MA180R8B	0.8	± .1
MA180R9B	0.9	± .1
MA181R0B	1.0	± .1
MA181R2B	1.2	± .1
MA181R4B	1.4	± .1
MA181R5B	1.5	± .1
MA181R6B	1.6	± .1
MA181R8B	1.8	± .1
MA181R9B	1.9	± .1
MA182R0B	2.0	± .1
MA182R1B	2.1	± .1
MA182R2B	2.2	± .1
MA182R4B	2.4	± .1
MA182R7B	2.7	± .1
MA183R0B	3.0	± .1
MA183R6C	3.6	± .25
MA183R9C	3.9	± .25
MA184R7C	4.7	± .25
MA185R1C	5.1	± .25
MA185R6C	5.6	± .25
MA186R2C	6.2	± .25
MA186R8J	6.8	±5 %
MA188R2J	8.2	±5
MA189R1J	9.1	±5
MA18100J	10	±5

★ STANDARD DISTRIBUTOR ITEMS

★KIT-MA18-003
(Designer Kit)

Part No.	Cap.	Tol.
P90 150V, 5 each value		
MA181R0B	1.0pF	± .1 pF
MA181R3B	1.3	± .1
MA181R6B	1.6	± .1
MA181R9B	1.9	± .1
MA182R1B	2.1	± .1
MA182R7C	2.7	± .25
MA183R3C	3.3	± .25
MA183R9C	3.9	± .25
MA184R7C	4.7	± .25
MA185R6C	5.6	± .25
MA186R8J	6.8	± 5 %
MA187R5J	7.5	± 5
MA188R5J	8.2	± 5
MA189R1J	9.1	± 5
MA18100J	10	± 5
MA18120J	12	± 5
MA18150J	15	± 5
MA18180J	18	± 5
MA18220J	22	± 5
MA18240J	24	± 5
MA18270J	27	± 5
MA18330J	33	± 5
MA18360J	36	± 5
MA18390J	39	± 5
MA18470J	47	± 5
MA18560J	56	± 5
MA18680K	68	±10
MA18750K	75	±10
MA18820K	82	±10
MA18910K	91	±10

★KIT-MA28-001 (1)
★KIT-MA22-001-MS (2)
(Evaluation Kit)

Part No.	Cap.	Tol.
P90 500V, 5 each value		
MA281R0C	1.0pF	± .25pF
MA282R2D	2.2	± .5
MA283R6D	3.6	± .5
MA285R6D	5.6	± .5
MA287R5D	7.5	± .5
MA28110J	11	± 5 %
MA28160J	16	± 5
MA28240J	24	± 5
MA28360J	36	± 5
MA28510J	51	± 5
MA28750J	75	± 5
MA28101J	100	± 5
MA28201J	200*	± 5
MA28471M	470*	±20
MA28621M	620**	±20

*300VDC **200VDC

★KIT-MA28-002 (1)
KIT-MA22-002-MS (2)
(Tune Kit)

Part No.	Cap.	Tol.
P90 500V, 5 each value		
MA280R3B	0.3pF	± .1pF
MA280R4B	0.4	± .1
MA280R5B	0.5	± .1
MA280R6B	0.6	± .1
MA280R7B	0.7	± .1
MA280R8B	0.8	± .1
MA280R9B	0.9	± .1
MA281R0B	1.0	± .1
MA281R2B	1.2	± .1
MA281R4B	1.4	± .1

CAPACITORS— CHIP MONOLITHIC, MICROWAVE *(continued)*

★**KIT-MA28-002 (1)** *(continued)*
(Tune Kit)

Part No.	Cap.	Tol.
P90 500V, 5 each value *(continued)*		
MA281R5B	1.5pF	± .1pF
MA281R6B	1.6	± .1
MA281R8B	1.8	± .1
MA281R9B	1.9	± .1
MA282R0B	2.0	± .1
MA282R1B	2.1	± .1
MA282R2B	2.2	± .1
MA282R4B	2.4	± .1
MA282R7B	2.7	± .1
MA283R0B	3.0	± .1
MA283R6C	3.6	± .25
MA283R9C	3.9	± .25
MA284R7C	4.7	± .25
MA285R1C	5.1	± .25
MA285R6C	5.6	± .25
MA286R2C	6.2	± .25
MA286R8J	6.8	± 5%
MA288R2J	8.2	± 5
MA289R1J	9.1	± 5
MA28100J	10	± 5

★**KIT-MA28-003 (1)**
(Designer Kit)

Part No.	Cap.	Tol.
P90 500V, 5 each value		
MA280R3B	0.3pF	± .1pF
MA280R4B	0.4	± .1
MA280R5B	0.5	± .1
MA280R6B	0.6	± .1
MA280R7B	0.7	± .1
MA280R8B	0.8	± .1
MA280R9B	0.9	± .1
MA281R2B	1.2	± .1
MA281R5C	1.5	± .25
MA281R8C	1.8	± .25
MA282R2C	2.2	± .25
MA282R7C	2.7	± .25
MA283R0C	3.0	± .25
MA283R3C	3.3	± .25
MA283R6C	3.6	± .25
MA284R3C	4.3	± .25
MA285R6C	5.6	± .25
MA286R2C	6.2	± .25
MA286R8J	6.8	± 5%
MA287R5J	7.5	± 5
MA288R2J	8.2	± 5
MA289R1J	9.1	± 5
MA28100J	10	± 5
MA28110J	11	± 5
MA28130J	13	± 5
MA28160J	16	± 5
MA28180J	18	± 5
MA28240J	24	± 5
MA28270J	27	± 5
MA28300J	30	± 5
MA28330J	33	± 5
MA28360J	36	± 5
MA28430J	43	± 5
MA28470J	47	± 5
MA28560K	56	± 10
MA28620K	62	± 10
MA28680K	68	± 10
MA28910K	91	± 10
MA28131K	130*	± 10
MA28161K	160*	± 10

★STANDARD DISTRIBUTOR ITEMS

★**KIT-MA28-003 (1)**
★**KIT-MA22-003MS (2)**
(Designer Kit)

Part No.	Cap.	Tol.
P90 150V, 5 each value		
MA28181K	180*pF	± 10%
MA28201K	200**	± 10
MA28221K	220**	± 10
MA28241K	240**	± 10
MA28301K	300**	± 10
MA28361M	360**	± 20
MA28431M	430**	± 20
MA28471M	470**	± 20
MA28511M	510**	± 20
MA28561M	560**	± 20
MA28621M	620**	± 20

*300VDC **200VDC
(1) Termination-Palladium silver, nickel interface, solder (SN62)
(2) Termination-Microstrip leads

KIT-MA58-001
(Evaluation Kit)

Part No.	Cap.	Tol.
Part No. COG, 5 each value		
MA581R0B		
MA581R8C		
MA582R7D		
MA583R3D		
MA584R7D		
MA585R6D		
MA586R8K		
MA58100K		
MA58120K		
MA58150K		
MA58220K		
MA58330K		
MA58470K		
MA58560K		
MA58101K		

KIT-MA68-001
(Evaluation Kit)

Part No.	Cap.	Tol.
Part No. COG, 5 each value		
MA681R0C		
MA682R2D		
MA683R6D		
MA685R6D		
MA686R8D		
MA68100J		
MA68150J		
MA68270J		
MA68330J		
MA68470J		
MA68680J		
MA68101J		
MA68471M		
MA68681M		
MA68102M		

GRH708 and 710 DESIGN ENGINEERING KITS

GRH708 and 710 Design Engineering Kits are offered as well. Both kits contain 10 pieces each of 15 different part numbers covering the full range of values in each respective size.

Please consult your local Murata Electronics Sales Office for further information on these kits.

DESIGN ENGINEERING KITS

CAPACITORS— CHIP TRIMMING

- Miniature Size
- Designed for auto-placement
- Can be immersed in flux and solder bath

★KIT-TZSBOX-1

Part No.	Min. Cap.	Max. Cap.	T.C.
TZ03, 8 each value			
TZ03Z2R3FR169	1.25pF	2.3pF	NPO
TZ03Z050FR169	1.8	5.0	NPO
TZ03Z070FR169	2.0	7.0	NPO
TZ03Z100FR169	2.7	10.0	NPO
TZ03N100FR169	2.1	10.0	N220
TZ03T110FR169	3.0	11.0	N450
TZ03T200FR169	4.2	20.0	N450
TZ03R200FR169	4.2	20	N750
TZ03R300FR169	5.2	30	N750
TZ03P450FR169	6.8	45	N1200
TZ03P600FR169	9.8	60	N1200
TZ03Z500FR169	6	50	NPO
TZ03R900FR169	9	90	N750
TZBX4, 10 each value			
TZBX4Z030BC110	1.4pF	3.0pF	NPO
TZBX4Z060BC110	2.0	6.0	NPO
TZBX4Z100BC110	3.0	10.0	NPO
TZBX4R200BC110	4.5	20.0	N750
TZBX4P300BC110	6.5	30.0	N1200
TZBX4P400BC110	9.0	40.0	N1200
TZBX4Z250BC110	4.0	25.0	NPO
TZBX4R500BC110	7.0	50.0	N750

★KIT-TZSBOX-2

Part No.	Min. Cap.	Max. Cap.	T.C.
TZBX4, 10 each value			
TZBX4Z030BA110	1.4pF	3.0pF	NPO
TZBX4Z060BA110	2.0	6.0	NPO
TZBX4Z100BA110	3.0	10.0	NPO
TZBX4R200BA110	4.5	20.0	N750
TZBX4P300BA110	6.5	30.0	N1200
TZBX4P400BA110	9.0	40.0	N1200
TZBX4Z250BA110	4.0	25.0	NPO
TZBX4R500BA110	7.0	50.0	N750
TZBX4Z060BB110	2.0	6.0	NPO
TZBX4Z100BB110	3.0	10.0	NPO
TZBX4R200BB110	4.5pF	20.0pF	N750
TZBX4P300BB110	6.5	30.0	N1200
TZBX4Z060BE110	2.0	6.0	NPO
TZBX4Z100BE110	3.0	10.0	NPO
TZBX4R200BE110	4.5	20.0	N750
TZBX4P400BE110	9.0	40.0	N1200
TZC03, 10 each value			
TZC03Z030A110	1.4	3.0	NPO
TZC03Z060A110	2.0pF	6.0pF	NPO
TZC03R100A110	3.0	10.0	N750
TZC03P200A110	5.0	20.0	N1200
TZC03P300A110	6.5	30.0	N1200

★Available as standard through authorized Murata Electronics Distributors.

★KIT-TZSBOX-3

Part No.	Min. Cap.	Max. Cap.	T.C.
TZBX4, 10 each value			
TZBX4Z030BA110	1.4pF	3.0pF	NPO
TZBX4Z060BA110	2.0	6.0	NPO
TZBX4Z100BA110	3.0	10.0	NPO
TZBX4R200BA110	4.5	20.0	N750
TZBX4P300BA110	6.5	30.0	N1200
TZBX4P400BA110	9.0	40.0	N1200
TZBX4Z250BA110	4.0	25.0	NPO
TZBX4R500BA110	7.0	50.0	N750
TZBX4R200BB110	4.5	20.0	N750
TZBX4P300BB110	6.5	30.0	N1200
TZBX4Z060BB110	2.0	6.0	NPO
TZBX4Z100BB110	3.0	10.0	NPO
TZBX4R200BC110	4.5	20.0	N750
TZBX4Z060BD110	2.0	6.0	NPO
TZBX4Z100BD110	3.0	10.0	NPO
TZBX4R200BD110	4.5	20.0	N750
TZBX4Z060BE110	2.0	6.0	NPO
TZBX4Z100BE110	3.0	10.0	NPO
TZBX4R200BE110	4.5	20.0	N750
TZBX4Z060BB110	2.0	6.0	NPO
TZBX4Z100BB110	3.0	10.0	NPO

★KIT-TZSBOX-4

Part No.	Min. Cap.	Max. Cap.	T.C.
TZ03, 8 each value			
TZ03Z070FR169	2.0pF	7.0pF	NPO
TZ03Z100FR169	2.7	10.0	NPO
TZ03T110FR169	3.0	11.0	N450
TZ03T200FR169	4.2	20.0	N450
TZ03R200FR169	4.2	20.0	N750
TZ03R300FR169	5.2	30.0	N750
TZ03P450FR169	6.8	45.0	N1200
TZ03Z500FR169	6.0	50.0	NPO
TZBX4, 10 each value			
TZBX4Z030BA110	1.4pF	3.0pF	NPO
TZBX4Z060BA110	2.0	6.0	NPO
TZBX4Z100BA110	3.0	10.0	NPO
TZBX4R200BA110	4.5	20.0	N750
TZBX4P300BA110	6.5	30.0	N1200
TZBX4P400BA110	9.0	40.0	N1200
TZBX4Z250BA110	4.0	25.0	NPO
TZBX4R500BA110	7.0	50	N750
TZC03, 10 each value			
TZC03Z030A110	1.4	3.0	NPO
TZC03Z060A110	2.0pF	6.0pF	NPO
TZC03P100A110	3.0	10.0	N750
TZC03P200A110	5.0	20.0	N1200
TZC03P300A110	6.5	30.0	N1200

For Technical Information, call—
Regional Sales Offices

Midwest:
(810) 348-9975

Northwest:
(503) 646-4973

Southwest:
(310) 436-8700

Northeast:
(617) 356-4155

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