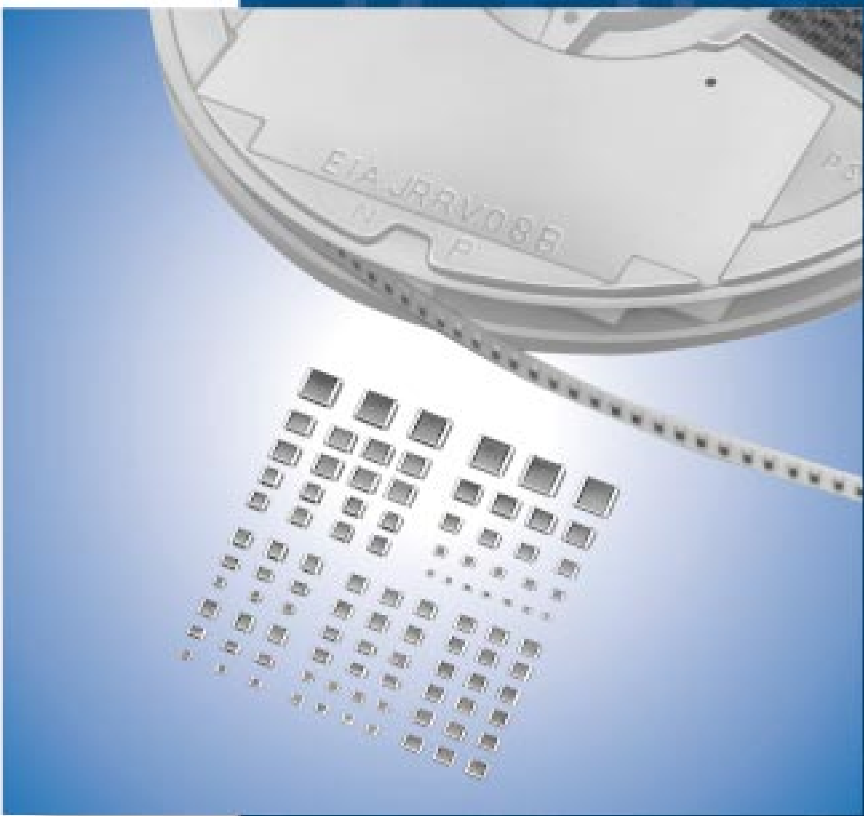
Chip Monolithic Ceramic Capacitors



Innovator in Electronics

Murata Manufacturing Co., Ltd.

Cat.No.C02E-13

CONTENTS

● Please refer to "Specifications and Test Methods" at the end of each chapter of 14 – 19 .

● Part Numbering

Chip Monolithic Ceramic Capacitors

(Part Number) GR M 18 8 B1 1H 102 K A01 K
❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾ ❿

❶Product ID

❷Series

Product ID	Code	Series
GR	M	Tin Plated Layer
	4	Only for Information Devices / Tip & Ring
	7	Only for Camera Flash Circuit
ER	B	High Frequency Type
GQ	M	High Frequency for Flow/Reflow Soldering
GM	A	Monolithic Microchip
GN	M	Capacitor Array
LL	L	Low ESL Wide Width Type
	A	Eight-termination Low ESL Type
	M	Ten-termination Low ESL Type
GJ	M	High Frequency Low Loss Type Tin Plated Type
GA	2	for AC250V (r.m.s.)
	3	Safety Standard Recognized Type

❸Dimension (L×W)

Code	Dimension (L×W)	EIA
02	0.4×0.2mm	01005
03	0.6×0.3mm	0201
05	0.5×0.5mm	0202
08	0.8×0.8mm	0303
11	1.25×1.0mm	0504
15	1.0×0.5mm	0402
18	1.6×0.8mm	0603
1D	1.4×1.4mm	
1X	Depends on individual standards.	
21	2.0×1.25mm	0805
22	2.8×2.8mm	1111
31	3.2×1.6mm	1206
32	3.2×2.5mm	1210
3X	Depends on individual standards.	
42	4.5×2.0mm	1808
43	4.5×3.2mm	1812
52	5.7×2.8mm	2211
55	5.7×5.0mm	2220

❹Dimension (T)

Code	Dimension (T)
2	0.2mm
2	2-elements (Array Type)
3	0.3mm
4	4-elements (Array Type)
5	0.5mm
6	0.6mm
7	0.7mm
8	0.8mm
9	0.85mm
A	1.0mm
B	1.25mm
C	1.6mm
D	2.0mm
E	2.5mm
F	3.2mm
M	1.15mm
N	1.35mm
R	1.8mm
S	2.8mm
Q	1.5mm
X	Depends on individual standards.

With the array type GNM series, "Dimension(T)" indicates the number of elements.

Continued on the following page. ↗

Continued from the preceding page.

❺Temperature Characteristics

Temperature Characteristic Codes			Temperature Characteristics			Operating Temperature Range
Code	Public STD Code		Referance Temperature	Temperature Range	Capacitance Change or Temperature Coefficient	
1X	SL *1	JIS	20°C	20 to 85°C	+350 to -1000ppm/°C	-55 to 125°C
2C	CH *1	JIS	20°C	20 to 125°C	0±60ppm/°C	-55 to 125°C
2P	PH *1	JIS	20°C	20 to 85°C	-150±60ppm/°C	-25 to 85°C
2R	RH *1	JIS	20°C	20 to 85°C	-220±60ppm/°C	-25 to 85°C
2S	SH *1	JIS	20°C	20 to 85°C	-330±60ppm/°C	-25 to 85°C
2T	TH *1	JIS	20°C	20 to 85°C	-470±60ppm/°C	-25 to 85°C
3C	CJ *1	JIS	20°C	20 to 125°C	0±120ppm/°C	-55 to 125°C
3P	PJ *1	JIS	20°C	20 to 85°C	-150±120ppm/°C	-25 to 85°C
3R	RJ *1	JIS	20°C	20 to 85°C	-220±120ppm/°C	-25 to 85°C
3S	SJ *1	JIS	20°C	20 to 85°C	-330±120ppm/°C	-25 to 85°C
3T	TJ *1	JIS	20°C	20 to 85°C	-470±120ppm/°C	-25 to 85°C
3U	UJ *1	JIS	20°C	20 to 85°C	-750±120ppm/°C	-25 to 85°C
4C	CK *1	JIS	20°C	20 to 125°C	0±250ppm/°C	-55 to 125°C
5C	C0G *1	EIA	25°C	25 to 125°C	0±30ppm/°C	-55 to 125°C
5G	X8G *1	EIA	25°C	25 to 150°C	0±30ppm/°C	-55 to 150°C
6C	C0H *1	EIA	25°C	25 to 125°C	0±60ppm/°C	-55 to 125°C
6P	P2H *1	EIA	25°C	25 to 85°C	-150±60ppm/°C	-55 to 125°C
6R	R2H *1	EIA	25°C	25 to 85°C	-220±60ppm/°C	-55 to 125°C
6S	S2H *1	EIA	25°C	25 to 85°C	-330±60ppm/°C	-55 to 125°C
6T	T2H *1	EIA	25°C	25 to 85°C	-470±60ppm/°C	-55 to 125°C
7U	U2J *1	EIA	25°C	25 to 85°C	-750±120ppm/°C	-55 to 125°C
B1	B *2	JIS	20°C	-25 to 85°C	±10%	-25 to 85°C
B3	B	JIS	20°C	-25 to 85°C	±10%	-25 to 85°C
C7	X7S	EIA	25°C	-55 to 125°C	±22%	-55 to 125°C
C8	X6S	EIA	25°C	-55 to 105°C	±22%	-55 to 105°C
F1	F *2	JIS	20°C	-25 to 85°C	+30, -80%	-25 to 85°C
F5	Y5V	EIA	25°C	-30 to 85°C	+22, -82%	-30 to 85°C
L8	X8L	EIA	25°C	-55 to 150°C	+15, -40%	-55 to 150°C
R1	R *2	JIS	20°C	-55 to 125°C	±15%	-55 to 125°C
R3	R	JIS	20°C	-55 to 125°C	±15%	-55 to 125°C
R6	X5R	EIA	25°C	-55 to 85°C	±15%	-55 to 85°C
R7	X7R	EIA	25°C	-55 to 125°C	±15%	-55 to 125°C
R9	X8R	EIA	25°C	-55 to 150°C	±15%	-55 to 150°C
9E	ZLM	*3	20°C	-25 to 20°C	-4700+1000/-2500ppm/°C	-25 to 85°C
				20 to 85°C	-4700+500/-1000ppm/°C	
W0	-	-	25°C	-55 to 125°C	±10% *4	-55 to 125°C
					+22, -33% *5	

*1 Please refer to table for Capacitance Change under reference temperature.
*2 Capacitance change is specified with 50% rated voltage applied.
*3,*4 Murata Temperature Characteristic Code.
*4 Apply DC350V bias.
*5 No DC bias.

Continued on the following page.

Continued from the preceding page.

●Capacitance Change from each temperature

JIS Code

Murata Code	Capacitance Change from 20°C (%)					
	–55°C		–25°C		–10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
1X	–	–	–	–	–	–
2C	0.82	–0.45	0.49	–0.27	0.33	–0.18
2P	–	–	1.32	0.41	0.88	0.27
2R	–	–	1.70	0.72	1.13	0.48
2S	–	–	2.30	1.22	1.54	0.81
2T	–	–	3.07	1.85	2.05	1.23
3C	1.37	–0.90	0.82	–0.54	0.55	–0.36
3P	–	–	1.65	0.14	1.10	0.09
3R	–	–	2.03	0.45	1.35	0.30
3S	–	–	2.63	0.95	1.76	0.63
3T	–	–	3.40	1.58	2.27	1.05
3U	–	–	4.94	2.84	3.29	1.89
4C	2.56	–1.88	1.54	–1.13	1.02	–0.75

EIA Code

Murata Code	Capacitance Change from 25°C (%)					
	–55°C		–30°C		–10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
5C/5G	0.58	–0.24	0.40	–0.17	0.25	–0.11
6C	0.87	–0.48	0.59	–0.33	0.38	–0.21
6P	2.33	0.72	1.61	0.50	1.02	0.32
6R	3.02	1.28	2.08	0.88	1.32	0.56
6S	4.09	2.16	2.81	1.49	1.79	0.95
6T	5.46	3.28	3.75	2.26	2.39	1.44
7U	8.78	5.04	6.04	3.47	3.84	2.21

❻Rated Voltage

Code	Rated Voltage
0G	DC4V
0J	DC6.3V
1A	DC10V
1C	DC16V
1E	DC25V
1H	DC50V
2A	DC100V
2D	DC200V
2E	DC250V
YD	DC300V
2H	DC500V
2J	DC630V
3A	DC1kV
3D	DC2kV
3F	DC3.15kV
BB	DC350V (for Camera Flash Circuit)
E2	AC250V
GB	X2; AC250V (Safety Standard Recognized Type GB)
GC	X1/Y2; AC250V (Safety Standard Recognized Type GC)
GD	Y3; AC250V (Safety Standard Recognized Type GD)
GF	Y2, X1/Y2; AC250V (Safety Standard Recognized Type GF)

❼Capacitance

Expressed by three-digit alphanumerics. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two numbers.If there is a decimal point, it is expressed by the capital letter "**R**". In this case, all figures are significant digits.

Ex.)

Code	Capacitance
R50	0.5pF
1R0	1.0pF
100	10pF
103	10000pF

Continued on the following page.

Continued from the preceding page.

❽Capacitance Tolerance

Code	Capacitance Tolerance	TC	Series	Capacitance Step	
W	±0.05pF	CΔ	**GRM/GJM**	≦9.9pF	0.1pF
B	±0.1pF	CΔ	**GRM/GJM**	≦9.9pF	0.1pF
C	±0.25pF	CΔ	**GRM/GJM**	≦9.9pF	0.1pF
		except CΔ	**GRM**	≦5pF	* 1pF
		CΔ	**ERB/GQM**	≦5pF	* 1pF
D	±0.5pF	CΔ	**GRM/GJM**	5.1 to 9.9pF	0.1pF
		except CΔ	**GRM**	5.1 to 9.9pF	* 1pF
		CΔ	**ERB/GQM**	5.1 to 9.9pF	* 1pF
G	±2%	CΔ	**GJM**	≧10pF	E12 Series
		CΔ	**GQM**	≧10pF	E24 Series
J	±5%	CΔ–SL	**GRM/GA3**	≧10pF	E12 Series
		CΔ	**ERB/GQM/GJM**	≧10pF	E24 Series
K	±10%	B, R, X7R, X5R, ZLM	**GRM/GR7/GA3**	E6 Series	
			GR4	E12 Series	
M	±20%	Z5U	**GRM**	E3 Series	
		B, R, X7R, X7S	**GRM/GMA/LLL/LLA/LLM**	E6 Series	
		X7R	**GA2**	E3 Series	
Z	+80%, -20%	F, Y5V	**GRM**	E3 Series	
R	Depends on individual standards.				

***** E24 series is also available.

❾Individual Specification Code

Expressed by three figures.

❿Packaging

Code	Packaging
L	ø180mm Embossed Taping
D	ø180mm Paper Taping
K	ø330mm Embossed Taping
J	ø330mm Paper Taping
B	Bulk
C	Bulk Case
T	Bulk Tray

Please check MURATA home page (http://www.murata.com/index.html) in case you can not find the part number on the catalog.

Selection Guide of Chip Monolithic Ceramic Capacitors

Start

Function	Type	Series
Decoupling, Smoothing	High Capacitance	GRM (X5R, X7R, Y5V, etc.) 220pF–100µF
	Array (2 or 4 Elements)	GNM 10pF–2.2µF
Frequency Control/Tuning, Impedance Matching	Class1 TC's;	GRM (C0G) 0.1pF–0.1µF
		GRM (U2J)
High Speed Decoupling	Low Inductance (Reverse Geometory)	LLL 22000pF–10µF
	Low Inductance (Multi Termination)	LLA/LLM (From 1GHz) 10000pF–4.5µF
High Frequency	Low ESR (50V to 500V)	ERB (1MHz to 1GHz) 0.5pF–1000pF
	Low ESR, Ultra Small	GJM (500MHz to 10GHz) 0.1pF–20pF
	Lowest ESR	GQM (500MHz to 10GHz) 0.5pF–100pF
Optical Communications	Wire-Die-Bonding	GMA 100pF–10000pF
Medium Voltage High Frequency Snubber	250V/630V/1kV/2kV/3.15kV Low Dissipation	GRM (SL, U2J) 10pF–10000pF
Medium Voltage LCD Backlight Inverter	3.15kV Low Dissipation	GRM (C0G) 5pF–47pF
Medium Voltage Decoupling, Smoothing	250V/630V/1kV High Capacitance	GRM (X7R) 220pF–1µF
Medium Voltage Only for Camera Frash Circuit	350V High Capacitance	GR7 10000pF–47000pF
Medium Voltage Only for Information Devices / Tip & Ring	2kV High Capacitance	GR4 100pF–10000pF
	Safety Standard Recognized	**Type GD** 10pF–4700pF **Type GF** 10pF–4700pF
AC Lines Noise Removal	Safety Standard Recognized	**Type GC** 100pF–330pF **Type GF** 470pF–4700pF **Type GB** 10000pF–33000pF
	AC250V which meet Japanese Law	GA2 470pF–0.1µF
Automotive (Power-train, Safety Equipment)	High Capacitance	GCM (X7R, X8L, X8G etc.) 0.5µF–10µF
	Class1 TC's;	GCM (C0G, CHA etc.) 220pF–10µF
	Low Inductance	LLC 2200pF–2.2µF

muRata

Chip Monolithic Ceramic Capacitors

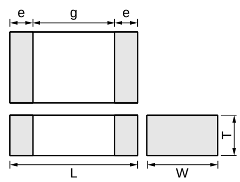
for General Purpose GRM15/18/21/31 Series

■ Features

1. Terminations are made of metal highly resistant to migration.
2. A wide selection of sizes is available, from the miniature LxW: 1.0x0.5mm to LxW: 3.2x1.6mm.
   GRM18, 21 and GRM31 types are suited to flow and reflow soldering.
   GRM15 type is applied to only reflow soldering.
3. Smaller size and higher capacitance value
4. High reliability and no polarity
5. Excellent pulse responsibility and noise reduction due to the low impedance at high frequency.
6. Ta replacement

■ Applications

General electronic equipment



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM155	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.35	0.3
GRM185	1.6 ±0.1	0.8 ±0.1	0.5 +0/-0.1	0.2 to 0.5	0.5
GRM188*			0.8 ±0.1		
GRM216	2.0 ±0.1	1.25 ±0.1	0.6 ±0.1	0.2 to 0.7	0.7
GRM219			0.85 ±0.1		
GRM21A			1.0 +0/-0.2		
GRM21B			1.25 ±0.1		
GRM316	3.2 ±0.15	1.6 ±0.15	0.6 ±0.1	0.3 to 0.8	1.5
GRM319			0.85 ±0.1		
GRM31M			1.15 ±0.1		
GRM31C	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2		

* Bulk Case : 1.6 ±0.07(L)×0.8 ±0.07(W)×0.8 ±0.07(T)

Temperature Compensating Type GRM15 Series (1.00x0.50mm) 50/25V

Part Number	**GRM15**							
L x W [EIA]	1.0x0.5 [0402]							
TC	C0G (**5C**)	P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)		T2H (**6T**)	U2J (**7U**)
Rated Volt.	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)								
3.0pF(**3R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
4.0pF(**4R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
5.0pF(**5R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
6.0pF(**6R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
7.0pF(**7R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
8.0pF(**8R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
9.0pF(**9R0**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
10pF(**100**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)			0.5(**5**)	0.5(**5**)
12pF(**120**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
15pF(**150**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
18pF(**180**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
22pF(**220**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
27pF(**270**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
33pF(**330**)	0.5(**5**)		0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
39pF(**390**)	0.5(**5**)			0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
47pF(**470**)	0.5(**5**)				0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
56pF(**560**)	0.5(**5**)				0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
68pF(**680**)	0.5(**5**)				0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
82pF(**820**)	0.5(**5**)				0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
100pF(**101**)	0.5(**5**)				0.5(**5**)	0.5(**5**)	0.5(**5**)	0.5(**5**)
120pF(**121**)	0.5(**5**)				0.5(**5**)	0.5(**5**)		0.5(**5**)
150pF(**151**)	0.5(**5**)				0.5(**5**)	0.5(**5**)		0.5(**5**)
180pF(**181**)	0.5(**5**)				0.5(**5**)	0.5(**5**)		0.5(**5**)
220pF(**221**)	0.5(**5**)					0.5(**5**)		
270pF(**271**)	0.5(**5**)					0.5(**5**)		

Continued on the following page.

Continued from the preceding page.

Part Number	GRM15							
L x W [EIA]	1.0x0.5 [0402]							
TC	C0G (**5C**)	P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)		T2H (**6T**)	U2J (**7U**)
Rated Volt.	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)								
330pF(**331**)	0.5(**5**)					0.5(**5**)		
390pF(**391**)	0.5(**5**)					0.5(**5**)		
470pF(**471**)	0.5(**5**)							
560pF(**561**)	0.5(**5**)							
680pF(**681**)	0.5(**5**)							
820pF(**821**)	0.5(**5**)							
1000pF(**102**)	0.5(**5**)							

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Temperature Compensating Type GRM18 Series (1.60x0.80mm) 100/50V

Part Number	GRM18													
L x W [EIA]	1.6x0.8 [0603]													
TC	C0G (**5C**)		P2H (**6P**)		R2H (**6R**)		S2H (**6S**)		SL (**1X**)		T2H (**6T**)		U2J (**7U**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)														
0.50pF(**R50**)	0.8(**8**)													
3.0pF(**3R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
4.0pF(**4R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
5.0pF(**5R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
6.0pF(**6R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
7.0pF(**7R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
8.0pF(**8R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
9.0pF(**9R0**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)			
10pF(**100**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)				0.8(**8**)		0.8(**8**)	
12pF(**120**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
15pF(**150**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
18pF(**180**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
22pF(**220**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
27pF(**270**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
33pF(**330**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
39pF(**390**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)		0.8(**8**)		0.8(**8**)		0.8(**8**)	
47pF(**470**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)				0.8(**8**)	
56pF(**560**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)				0.8(**8**)	
68pF(**680**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)				0.8(**8**)	
82pF(**820**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)				0.8(**8**)	
100pF(**101**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)				0.8(**8**)	
120pF(**121**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)	0.8(**8**)			0.8(**8**)	0.8(**8**)	
150pF(**151**)	0.8(**8**)			0.8(**8**)	0.8(**8**)	0.8(**8**)		0.8(**8**)	0.8(**8**)			0.8(**8**)	0.8(**8**)	
180pF(**181**)	0.8(**8**)					0.8(**8**)		0.8(**8**)	0.8(**8**)			0.8(**8**)	0.8(**8**)	
220pF(**221**)	0.8(**8**)							0.8(**8**)	0.8(**8**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)
270pF(**271**)	0.8(**8**)								0.8(**8**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)
330pF(**331**)	0.8(**8**)								0.8(**8**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)
390pF(**391**)	0.8(**8**)								0.8(**8**)	0.8(**8**)		0.8(**8**)	0.8(**8**)	0.8(**8**)
470pF(**471**)	0.8(**8**)									0.8(**8**)		0.8(**8**)		0.8(**8**)
560pF(**561**)	0.8(**8**)									0.8(**8**)				0.8(**8**)
680pF(**681**)	0.8(**8**)									0.8(**8**)				0.8(**8**)
820pF(**821**)	0.8(**8**)													

Continued on the following page.

Continued from the preceding page.

Part Number	GRM18													
L x W [EIA]	1.6x0.8 [0603]													
TC	C0G (**5C**)		P2H (**6P**)		R2H (**6R**)		S2H (**6S**)		SL (**1X**)		T2H (**6T**)		U2J (**7U**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)														
1000pF(**102**)	0.8(**8**)									0.8(**8**)				0.8(**8**)
1200pF(**122**)		0.8(**8**)								0.8(**8**)				0.8(**8**)
1500pF(**152**)		0.8(**8**)								0.8(**8**)				0.8(**8**)
1800pF(**182**)		0.8(**8**)								0.8(**8**)				0.8(**8**)
2200pF(**222**)		0.8(**8**)								0.8(**8**)				0.8(**8**)
2700pF(**272**)		0.8(**8**)								0.8(**8**)				0.8(**8**)
3300pF(**332**)										0.8(**8**)				0.8(**8**)
3900pF(**392**)										0.8(**8**)				0.8(**8**)
4700pF(**472**)										0.8(**8**)				0.8(**8**)
5600pF(**562**)										0.8(**8**)				0.8(**8**)
6800pF(**682**)										0.8(**8**)				0.8(**8**)
8200pF(**822**)										0.8(**8**)				0.8(**8**)
10000pF(**103**)										0.8(**8**)				0.8(**8**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Temperature Compensating Type GRM21 Series (2.00x1.25mm) 100/50V

Part Number	GRM21													
L x W [EIA]	2.0x1.25 [0805]													
TC	C0G (**5C**)		P2H (**6P**)		R2H (**6R**)		S2H (**6S**)		SL (**1X**)		T2H (**6T**)		U2J (**7U**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)														
33pF(**330**)				0.6(**6**)										
39pF(**390**)				0.6(**6**)		0.6(**6**)								
47pF(**470**)				0.6(**6**)		0.6(**6**)		0.6(**6**)			1.25(**B**)			
56pF(**560**)				0.6(**6**)		0.6(**6**)		0.6(**6**)			1.25(**B**)			
68pF(**680**)				0.6(**6**)		0.6(**6**)		0.6(**6**)			1.25(**B**)			
82pF(**820**)				0.6(**6**)		0.6(**6**)		0.6(**6**)			1.25(**B**)			
100pF(**101**)				0.6(**6**)		0.6(**6**)		0.6(**6**)			1.25(**B**)			
120pF(**121**)				0.6(**6**)		0.6(**6**)		0.6(**6**)			1.25(**B**)	0.6(**6**)		
150pF(**151**)			0.85(**9**)	0.6(**6**)		0.6(**6**)	0.85(**9**)	0.6(**6**)			1.25(**B**)			
180pF(**181**)			0.85(**9**)	0.85(**9**)	0.85(**9**)	0.6(**6**)	0.85(**9**)	0.6(**6**)			1.25(**B**)			
220pF(**221**)			0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)	0.6(**6**)		0.6(**6**)	1.25(**B**)			0.6(**6**)
270pF(**271**)			0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)			0.6(**6**)				0.6(**6**)
330pF(**331**)			0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)			0.6(**6**)				0.6(**6**)
390pF(**391**)			1.25(**B**)	1.25(**B**)	0.85(**9**)	0.85(**9**)	0.85(**9**)			0.6(**6**)				0.6(**6**)
470pF(**471**)			1.25(**B**)	1.25(**B**)	0.85(**9**)	0.85(**9**)	0.85(**9**)		0.85(**9**)	0.6(**6**)			0.85(**9**)	0.6(**6**)
560pF(**561**)				1.25(**B**)	1.25(**B**)	0.85(**9**)	1.25(**B**)	0.85(**9**)	0.85(**9**)	0.6(**6**)		1.25(**B**)	0.85(**9**)	0.6(**6**)
680pF(**681**)	0.6(**6**)					1.25(**B**)		1.25(**B**)	0.85(**9**)	0.6(**6**)		1.25(**B**)	0.85(**9**)	0.6(**6**)
820pF(**821**)	0.6(**6**)							1.25(**B**)	1.25(**B**)	0.6(**6**)		1.25(**B**)	1.25(**B**)	0.6(**6**)
1000pF(**102**)	0.85(**9**)								1.25(**B**)	0.6(**6**)		1.25(**B**)	1.25(**B**)	0.6(**6**)
1200pF(**122**)	0.85(**9**)	0.6(**6**)							1.25(**B**)	0.6(**6**)		1.25(**B**)	1.25(**B**)	0.6(**6**)
1500pF(**152**)	0.85(**9**)	0.6(**6**)							1.25(**B**)	0.85(**9**)		1.25(**B**)	1.25(**B**)	0.85(**9**)
1800pF(**182**)		0.6(**6**)							1.25(**B**)	0.85(**9**)		1.25(**B**)	1.25(**B**)	0.85(**9**)
2200pF(**222**)		0.6(**6**)								0.85(**9**)				0.85(**9**)
2700pF(**272**)		0.6(**6**)								1.25(**B**)				1.25(**B**)
3300pF(**332**)		0.6(**6**)								1.25(**B**)				1.25(**B**)
3900pF(**392**)		0.6(**6**)												

Continued on the following page.

Continued from the preceding page.

Part Number	GRM21													
L x W [EIA]	2.0x1.25 [0805]													
TC	C0G (**5C**)		P2H (**6P**)		R2H (**6R**)		S2H (**6S**)		SL (**1X**)		T2H (**6T**)		U2J (**7U**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)														
4700pF(**472**)		0.6(**6**)												
5600pF(**562**)		0.85(**9**)												
6800pF(**682**)		0.85(**9**)												
8200pF(**822**)		0.85(**9**)												
10000pF(**103**)		0.85(**9**)								0.6(**6**)				0.6(**6**)
12000pF(**123**)		0.85(**9**)								0.6(**6**)				0.6(**6**)
15000pF(**153**)		0.85(**9**)								0.6(**6**)				0.6(**6**)
18000pF(**183**)		1.25(**B**)								0.6(**6**)				0.6(**6**)
22000pF(**223**)		1.25(**B**)								0.85(**9**)				0.85(**9**)
27000pF(**273**)										0.85(**9**)				0.85(**9**)
33000pF(**333**)										1.0(**A**)				1.0(**A**)
39000pF(**393**)										1.25(**B**)				1.25(**B**)
47000pF(**473**)										1.25(**B**)				1.25(**B**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Temperature Compensating Type GRM31 Series (3.20x1.60mm) 100/50/25V

Part Number	GRM31														
L x W [EIA]	3.2x1.6 [1206]														
TC	C0G (**5C**)			P2H (**6P**)		R2H (**6R**)		S2H (**6S**)		SL (**1X**)		T2H (**6T**)		U2J (**7U**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	25 (**1E**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)															
47pF(**470**)												0.85(**9**)			
56pF(**560**)												0.85(**9**)			
68pF(**680**)												0.85(**9**)			
82pF(**820**)												0.85(**9**)			
100pF(**101**)												1.15(**M**)			
120pF(**121**)												1.15(**M**)			
150pF(**151**)												1.15(**M**)			
180pF(**181**)					0.6(**6**)							1.15(**M**)			
220pF(**221**)					0.6(**6**)		0.6(**6**)					1.15(**M**)			
270pF(**271**)					0.6(**6**)		0.6(**6**)		0.6(**6**)			1.15(**M**)			
330pF(**331**)					0.6(**6**)		0.6(**6**)		0.6(**6**)			1.15(**M**)			
390pF(**391**)				0.85(**9**)			0.6(**6**)		0.6(**6**)			1.15(**M**)			
470pF(**471**)				0.85(**9**)					0.6(**6**)			1.15(**M**)			
560pF(**561**)				0.85(**9**)		0.85(**9**)		0.85(**9**)	0.85(**9**)						
680pF(**681**)				0.85(**9**)		0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)						
820pF(**821**)				0.85(**9**)		0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)	0.85(**9**)			1.15(**M**)	0.85(**9**)	
1000pF(**102**)				1.15(**M**)		1.15(**M**)	1.15(**M**)	0.85(**9**)	0.85(**9**)	0.85(**9**)			1.15(**M**)	0.85(**9**)	
1200pF(**122**)				1.15(**M**)		1.15(**M**)	1.15(**M**)	1.15(**M**)	1.15(**M**)	0.85(**9**)			1.15(**M**)	0.85(**9**)	
1500pF(**152**)					1.15(**M**)		1.15(**M**)	1.15(**M**)	1.15(**M**)	0.85(**9**)			1.15(**M**)	0.85(**9**)	
1800pF(**182**)	0.85(**9**)								1.15(**M**)	0.85(**9**)			1.15(**M**)	0.85(**9**)	
2200pF(**222**)	0.85(**9**)									1.15(**M**)			1.15(**M**)	1.15(**M**)	
2700pF(**272**)	0.85(**9**)									1.15(**M**)			1.15(**M**)	1.15(**M**)	
3300pF(**332**)	0.85(**9**)									1.15(**M**)			1.15(**M**)	1.15(**M**)	
3900pF(**392**)	0.85(**9**)									1.15(**M**)			1.15(**M**)	1.15(**M**)	
4700pF(**472**)	0.85(**9**)									1.15(**M**)				1.15(**M**)	
5600pF(**562**)	0.85(**9**)														

Continued on the following page.

Continued from the preceding page.

Part Number	GRM31														
L x W [EIA]	3.2x1.6 [1206]														
TC	C0G (**5C**)			P2H (**6P**)		R2H (**6R**)		S2H (**6S**)		SL (**1X**)		T2H (**6T**)		U2J (**7U**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	25 (**1E**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)															
18000pF(**183**)		0.85(**9**)													
22000pF(**223**)		0.85(**9**)													
27000pF(**273**)		0.85(**9**)													
33000pF(**333**)		0.85(**9**)													
39000pF(**393**)		1.15(**M**)													
47000pF(**473**)		1.15(**M**)													
56000pF(**563**)		1.6(**C**)									0.85(**9**)				0.85(**9**)
68000pF(**683**)		1.6(**C**)									1.15(**M**)				1.15(**M**)
82000pF(**823**)		1.6(**C**)									1.15(**M**)				1.15(**M**)
0.10µF(**104**)			1.6(**C**)								1.15(**M**)				1.15(**M**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type X5R (R6) Characteristics

TC	X5R (**R6**)																		
Part Number	GRM15					GRM18					GRM21				GRM31				
L x W [EIA]	1.0x0.5 [0402]					1.6x0.8 [0603]					2.0x1.25 [0805]				3.2x1.6 [1206]				
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																			
1000pF (**102**)	0.5 (**5**)	0.5 (**5**)																	
2200pF (**222**)	0.5 (**5**)	0.5 (**5**)																	
4700pF (**472**)	0.5 (**5**)	0.5 (**5**)																	
10000pF (**103**)						0.8 (**8**)													
22000pF (**223**)			0.5 (**5**)			0.8 (**8**)													
33000pF (**333**)			0.5 (**5**)	0.5 (**5**)															
47000pF (**473**)			0.5 (**5**)	0.5 (**5**)															
68000pF (**683**)			0.5 (**5**)	0.5 (**5**)															
0.10µF (**104**)			0.5 (**5**)	0.5 (**5**)			0.8 (**8**)												
0.15µF (**154**)				0.5* (**5**)	0.5* (**5**)														
0.22µF (**224**)				0.5* (**5**)	0.5* (**5**)		0.8 (**8**)	0.8 (**8**)											
0.33µF (**334**)				0.5* (**5**)	0.5* (**5**)														
0.47µF (**474**)				0.5* (**5**)	0.5* (**5**)		0.8* (**8**)	0.8* (**8**)											
0.68µF (**684**)				0.5* (**5**)	0.5* (**5**)														

Continued on the following page.

Continued from the preceding page.

TC	X5R (**R6**)																		
Part Number	**GRM15**					**GRM18**					**GRM21**				**GRM31**				
L x W [EIA]	1.0x0.5 [0402]					1.6x0.8 [0603]					2.0x1.25 [0805]				3.2x1.6 [1206]				
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																			
1.0µF (**105**)				0.5* (**5**)	0.5* (**5**)		0.8* (**8**)	0.8* (**8**)											
2.2µF (**225**)								0.8* (**8**)	0.8* (**8**)	0.8* (**8**)	1.25* (**B**)					1.15 (**M**)			
3.3µF (**335**)									0.8* (**8**)		1.25* (**B**)	1.25* (**B**)				1.6 (**C**)			
4.7µF (**475**)										0.8* (**8**)	1.25* (**B**)	1.25* (**B**)	1.25* (**B**)		1.6 (**C**)	1.6 (**C**)	1.6 (**C**)		
10µF (**106**)													1.25* (**B**)	1.25* (**B**)	1.6* (**C**)	1.6 (**C**)			
15µF (**156**)																		1.6* (**C**)	
22µF (**226**)														1.25* (**B**)				1.6* (**C**)	
47µF (**476**)																		1.6* (**C**)	
100µF (**107**)																		1.6* (**C**)	1.6* (**C**)

The part numbering code is shown in each ( ).
3.3µF and 4.7µF, 6.3V rated are GRM21 series of L: 2±0.15, W: 1.25±0.15, T: 1.25±0.15.
T: 1.15±0.1mm is also available for GRM31 1.0µF for 16V.
L: 3.2±0.2, W: 1.6±0.2 for GRM31 16V 1.0µF type. Also L: 3.2±0.2, W: 1.6±0.2, T: 1.15±0.15 for GRM31 16V 1.5µF and 2.2µF type.
Dimensions are shown in mm and Rated Voltage in Vdc.
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

High Dielectric Constant Type X6S (C8) Characteristics

TC	X6S (**C8**)										
Part Number	**GRM15**		**GRM18**		**GRM21**				**GRM31**		
L x W [EIA]	1.0x0.5 [0402]		1.6x0.8 [0603]		2.0x1.25 [0805]				3.2x1.6 [1206]		
Rated Volt.	6.3 (**0J**)	4 (**0G**)	6.3 (**0J**)	4 (**0G**)	25 (**1E**)	16 (**1C**)	6.3 (**0J**)	4 (**0G**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)											
0.15µF(**154**)	0.5*(**5**)										
0.22µF(**224**)	0.5*(**5**)										
0.33µF(**334**)	0.5*(**5**)										
0.47µF(**474**)	0.5*(**5**)										
0.68µF(**684**)		0.5*(**5**)	0.8(**8**)								
1.0µF(**105**)		0.5*(**5**)									
2.2µF(**225**)			0.8*(**8**)								
4.7µF(**475**)				0.8*(**8**)	1.25*(**B**)	1.25*(**B**)					
10µF(**106**)							1.25*(**B**)		1.15*(**M**)		
22µF(**226**)								1.25*(**B**)		1.6*(**C**)	1.6*(**C**)
47µF(**476**)											1.6*(**C**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

murata

High Dielectric Constant Type X7R (R7) Characteristics

TC	X7R (R7)																					
Part Number	GRM15					GRM18						GRM21						GRM31				
L x W [EIA]	1.0x0.5 [0402]					1.6x0.8 [0603]						2.0x1.25 [0805]						3.2x1.6 [1206]				
Rated Volt.	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																						
220pF (221)		0.5 (5)				0.8 (8)																
330pF (331)		0.5 (5)				0.8 (8)																
470pF (471)		0.5 (5)				0.8 (8)																
680pF (681)		0.5 (5)				0.8 (8)																
1000pF (102)		0.5 (5)				0.8 (8)																
1500pF (152)		0.5 (5)				0.8 (8)																
2200pF (222)		0.5 (5)				0.8 (8)																
3300pF (332)		0.5 (5)				0.8 (8)																
4700pF (472)	0.5 (5)	0.5 (5)										0.85 (9)										
6800pF (682)		0.5 (5)	0.5 (5)									0.85 (9)										
10000pF (103)		0.5 (5)	0.5 (5)									1.25 (B)										
15000pF (153)			0.5 (5)	0.5 (5)			0.8 (8)					1.25 (B)										
22000pF (223)			0.5 (5)	0.5 (5)			0.8 (8)					1.25 (B)										
33000pF (333)			0.5 (5)	0.5 (5)	0.5 (5)		0.8 (8)					1.25 (B)										
47000pF (473)			0.5 (5)	0.5 (5)	0.5 (5)		0.8 (8)					1.25 (B)										
68000pF (683)				0.5 (5)	0.5 (5)		0.8 (8)	0.8 (8)										1.15 (M)				
0.10μF (104)				0.5 (5)	0.5 (5)		0.8 (8)	0.8 (8)														
0.15μF (154)								0.8 (8)	0.8 (8)				1.25 (B)						1.15 (M)			
0.22μF (224)								0.8 (8)	0.8 (8)	0.8 (8)		1.0 (A)	1.25 (B)						0.85 (9)			
0.33μF (334)									0.8 (8)	0.8 (8)		1.0 (A)	0.85 (9)	1.25 (B)								
0.47μF (474)								0.8* (8)	0.8 (8)	0.8 (8)	0.8 (8)		1.25 (B)	0.85 (9)					1.15 (M)			
0.68μF (684)										0.8 (8)				0.85 (9)	0.85 (9)							
1.0μF (105)									0.8* (8)	0.8* (8)	0.8* (8)			1.25 (B)	1.25 (B)			1.6 (C)	1.15 (M)	1.15 (M)		
1.5μF (155)														1.25 (B)	1.25 (B)				1.6 (C)	1.15 (M)	1.15 (M)	

Continued on the following page.

Continued from the preceding page.

TC	X7R (**R7**)																					
Part Number	GRM15					GRM18						GRM21						GRM31				
L x W [EIA]	1.0x0.5 [0402]					1.6x0.8 [0603]						2.0x1.25 [0805]						3.2x1.6 [1206]				
Rated Volt.	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																						
2.2µF (**225**)										0.8* (**8**)				1.25* (**B**)	1.25* (**B**)				1.6 (**C**)		1.15 (**M**)	
3.3µF (**335**)															1.25* (**B**)					1.6 (**C**)	1.6 (**C**)	
4.7µF (**475**)															1.25* (**B**)	1.25* (**B**)				1.6 (**C**)	1.6 (**C**)	1.6 (**C**)
10µF (**106**)																1.25* (**B**)	1.25* (**B**)				1.6* (**C**)	

The part numbering code is shown in each ( ).
The tolerance will be changed to L: 3.2±0.2, W: 1.6±0.2 for GRM31 16V 1.0µF type. Also L: 3.2±0.2, W: 1.6±0.2, T: 1.15±0.15 for GRM31 16V 1.5µF and 2.2µF type.
Dimensions are shown in mm and Rated Voltage in Vdc.
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

High Dielectric Constant Type X7S (C7) Characteristics

TC	X7S (**C7**)		
Part Number	GRM18	GRM21	GRM31
L x W [EIA]	1.6x0.8 [0603]	2.0x1.25 [0805]	3.2x1.6 [1206]
Rated Volt.	6.3 (**0J**)	10 (**1A**)	4 (**0G**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)			
2.2µF(**225**)	0.8*(**8**)		
3.3µF(**335**)		1.25*(**B**)	
22µF(**226**)			1.6*(**C**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

High Dielectric Constant Type Y5V (F5) Characteristics

TC	Y5V (**F5**)										
Part Number	GRM15					GRM18		GRM21		GRM31	
L x W [EIA]	1.0x0.5 [0402]					1.6x0.8 [0603]		2.0x1.25 [0805]		3.2x1.6 [1206]	
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	6.3 (**0J**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)											
1000pF(**102**)	0.5(**5**)										
2200pF(**222**)	0.5(**5**)										
4700pF(**472**)	0.5(**5**)										
10000pF(**103**)	0.5(**5**)					0.8(**8**)					
22000pF(**223**)		0.5(**5**)				0.8(**8**)					
47000pF(**473**)		0.5(**5**)	0.5(**5**)			0.8(**8**)					
0.10µF(**104**)		0.5(**5**)	0.5(**5**)			0.8(**8**)		0.85(**9**)	0.6(**6**)		
0.22µF(**224**)			0.5(**5**)			0.8(**8**)	0.8(**8**)		0.85(**9**)		
0.47µF(**474**)			0.5(**5**)	0.5(**5**)			0.8(**8**)	0.85(**9**)	0.6(**6**)	1.15(**M**)	
1.0µF(**105**)				0.5*(**5**)	0.5*(**5**)						
100µF(**107**)											1.6*(**C**)

The part numbering code is shown in each ( ).
T: 1.25±0.1mm is also available for GRM21 25V or 16V 1.0µF type.
Dimensions are shown in mm and Rated Voltage in Vdc.
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

Chip Monolithic Ceramic Capacitors

muRata

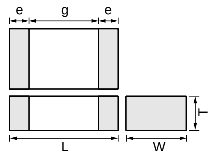
for General Purpose GRM32 Series

■ Features

1. Terminations are made of metal highly resistant to migration.
2. Smaller size and higher capacitance value
3. High reliability and no polarity
4. Excellent pulse responsibility and noise reduction due to the low impedance at high frequency.
5. Ta replacement

■ Applications

General electronic equipment



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM329	3.2 ±0.3	2.5 ±0.2	0.85 ±0.1	0.3 min.	1.0
GRM32A			1.0 +0/-0.2		
GRM32M			1.15 ±0.1		
GRM32N			1.35 ±0.15		
GRM32C			1.6 ±0.2		
GRM32R			1.8 ±0.2		
GRM32D			2.0 ±0.2		
GRM32E			2.5 ±0.2		

Temperature Compensating Type GRM32 Series

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM3291X2A222JZ01	SL (JIS)	100	2200 ±5%	3.2	2.5	0.85
GRM3291X2A272JZ01	SL (JIS)	100	2700 ±5%	3.2	2.5	0.85
GRM3291X2A332JZ01	SL (JIS)	100	3300 ±5%	3.2	2.5	0.85
GRM32N1X2A562JZ01	SL (JIS)	100	5600 ±5%	3.2	2.5	1.35
GRM32N1X2A682JZ01	SL (JIS)	100	6800 ±5%	3.2	2.5	1.35

High Dielectric Constant Type GRM32 Series (3.20x2.50mm)

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (µF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM32ER61E226ME15	X5R (EIA)	25	22 ±20%*	3.2	2.5	2.5
GRM32ER61C226ME20	X5R (EIA)	16	22 ±20%*	3.2	2.5	2.5
GRM32ER61C476ME15	X5R (EIA)	16	47 ±20%*	3.2	2.5	2.5
GRM32ER61A226ME20	X5R (EIA)	10	22 ±20%*	3.2	2.5	2.5
GRM32ER61A476ME20	X5R (EIA)	10	47 ±20%*	3.2	2.5	2.5
GRM32DR60J226KA01	X5R (EIA)	6.3	22 ±10%*	3.2	2.5	2.0
GRM32DR60J336ME19	X5R (EIA)	6.3	33 ±20%*	3.2	2.5	2.0
GRM32ER60J476ME20	X5R (EIA)	6.3	47 ±20%*	3.2	2.5	2.5
GRM32ER60J107ME20	X5R (EIA)	6.3	100 ±20%*	3.2	2.5	2.5
GRM32DC81E106KA12	X6S(EIA)	25	10 ±10%	3.2	2.5	2.0
GRM32EC80J476ME64	X6S(EIA)	6.3	47 ±20%*	3.2	2.5	2.5
GRM32EC80G107ME20	X6S(EIA)	4	100 ±20%*	3.2	2.5	2.5
GRM32CR72A684KA01	X7R (EIA)	100	0.68 ±10%	3.2	2.5	1.6
GRM32CR72A105KA35	X7R (EIA)	100	1.0 ±10%	3.2	2.5	1.6
GRM32DR72A155KA35	X7R (EIA)	100	1.5 ±10%	3.2	2.5	2.0
GRM32ER72A225KA35	X7R (EIA)	100	2.2 ±10%*	3.2	2.5	2.5
GRM32ER71H105KA01	X7R (EIA)	50	1.0 ±10%	3.2	2.5	2.5
GRM32DR71H335KA88	X7R (EIA)	50	3.3 ±10%	3.2	2.5	2.0
GRM32ER71H475KA88	X7R (EIA)	50	4.7 ±10%	3.2	2.5	2.5
GRM32DR71E335KA01	X7R (EIA)	25	3.3 ±10%	3.2	2.5	2.0
GRM32DR71E475KA61	X7R (EIA)	25	4.7 ±10%	3.2	2.5	2.0
GRM32DR71E106KA12	X7R (EIA)	25	10 ±10%	3.2	2.5	2.0

Continued on the following page.

Continued from the preceding page.

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (μF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM32ER71C226ME18	X7R (EIA)	16	22 ±20%*	3.2	2.5	2.5
GRM32ER71A226ME20	X7R (EIA)	10	22 ±20%*	3.2	2.5	2.5
GRM32EF50J107ZE20	Y5V (EIA)	6.3	100 +80/-20%*	3.2	2.5	2.5

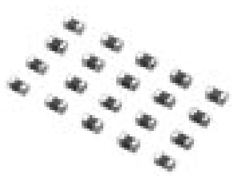
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

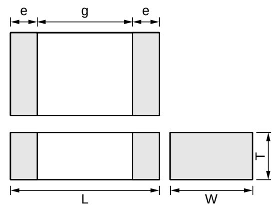
Chip Monolithic Ceramic Capacitors

Ultra-small GRM03 Series

■ Features

1. Small chip size (LxWxT: 0.6x0.3x0.3mm)
2. Terminations are made of metal highly resistant to migration.
3. GRM03 series is suited to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. GRM03 series is suited to miniature microwave module, portable equipment and high frequency circuits.





Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM033	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2

■ Applications

1. Miniature microwave module
2. Portable equipment
3. High frequency circuit

Part Number	**GRM03**											
L x W	0.6x0.3 [0201]											
TC	C0G (**5C**)	R2H (**6R**)	S2H (**6S**)	T2H (**6T**)	U2J (**7U**)		X5R (**R6**)		X6S (**C8**)	X7R (**R7**)		
Rated Volt.	25 (**1E**)	25 (**1E**)	25 (**1E**)	25 (**1E**)	50 (**1H**)	25 (**1E**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
1.0pF(**1R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)								
2.0pF(**2R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)								
3.0pF(**3R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
4.0pF(**4R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
5.0pF(**5R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
6.0pF(**6R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
7.0pF(**7R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
8.0pF(**8R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
9.0pF(**9R0**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
10pF(**100**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
12pF(**120**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
15pF(**150**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)							
18pF(**180**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
22pF(**220**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
27pF(**270**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
33pF(**330**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
39pF(**390**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
47pF(**470**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
56pF(**560**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
68pF(**680**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
82pF(**820**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)						
100pF(**101**)	0.3(**3**)	0.3(**3**)	0.3(**3**)	0.3(**3**)		0.3(**3**)				0.3(**3**)		
150pF(**151**)										0.3(**3**)		
220pF(**221**)										0.3(**3**)		
330pF(**331**)										0.3(**3**)		
470pF(**471**)										0.3(**3**)		
680pF(**681**)										0.3(**3**)		

Continued on the following page.

Continued from the preceding page.

Part Number	**GRM03**											
L x W	0.6x0.3 [0201]											
TC	C0G (**5C**)	R2H (**6R**)	S2H (**6S**)	T2H (**6T**)	U2J (**7U**)		X5R (**R6**)		X6S (**C8**)	X7R (**R7**)		
Rated Volt.	25 (**1E**)	25 (**1E**)	25 (**1E**)	25 (**1E**)	50 (**1H**)	25 (**1E**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
1000pF(**102**)										0.3(**3**)		
1500pF(**152**)							0.3(**3**)			0.3(**3**)		0.3(**3**)
2200pF(**222**)							0.3(**3**)				0.3(**3**)	0.3(**3**)
3300pF(**332**)							0.3(**3**)				0.3(**3**)	0.3(**3**)
4700pF(**472**)							0.3(**3**)					0.3(**3**)
6800pF(**682**)							0.3(**3**)					0.3(**3**)
10000pF(**103**)							0.3(**3**)					0.3(**3**)
15000pF(**153**)								0.3*(**3**)				
22000pF(**223**)								0.3*(**3**)				
33000pF(**333**)								0.3*(**3**)				
47000pF(**473**)								0.3*(**3**)				
68000pF(**683**)								0.3*(**3**)				
0.10μF(**104**)								0.3*(**3**)	0.3(**3**)			

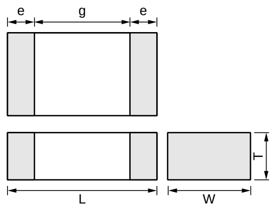
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

Chip Monolithic Ceramic Capacitors

Tight Tolerance GRM03/15 Series

■ Features

1. Terminations are made of metal highly resistant to migration.
2. A wide selection of sizes is available, from the miniature LxWxT: 0.6x0.3x0.3mm or LxWxT: 1.0x0.5x0.5mm.
3. GRM03 type is a complete line of chip ceramic capacitors in 25V ratings, GRM15 type is a complete line of chip ceramic capacitors in 50V ratings.
4. These capacitors have temperature characteristics ranging C0G.
5. GRM03 and GRM15 type are applied to only reflow soldering.
6. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
7. GRM series is available in paper tape and reel packaging for automatic placement.



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM033	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2
GRM155	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.35	0.3

■ Applications

General electronic equipment

Temperature Compensating Type GRM03/15 Series

Part Number		**GRM03**	**GRM15**
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
0.30pF(**R30**)	**W, B**	0.3(**3**)	0.5(**5**)
0.40pF(**R40**)	**W, B**	0.3(**3**)	0.5(**5**)
0.50pF(**R50**)	**W, B**	0.3(**3**)	0.5(**5**)
0.60pF(**R60**)	**W, B**	0.3(**3**)	0.5(**5**)
0.70pF(**R70**)	**W, B**	0.3(**3**)	0.5(**5**)
0.80pF(**R80**)	**W, B**	0.3(**3**)	0.5(**5**)
0.90pF(**R90**)	**W, B**	0.3(**3**)	0.5(**5**)
1.0pF(**1R0**)	**W, B**	0.3(**3**)	0.5(**5**)
1.1pF(**1R1**)	**W, B**	0.3(**3**)	0.5(**5**)
1.2pF(**1R2**)	**W, B**	0.3(**3**)	0.5(**5**)
1.3pF(**1R3**)	**W, B**	0.3(**3**)	0.5(**5**)
1.4pF(**1R4**)	**W, B**	0.3(**3**)	0.5(**5**)
1.5pF(**1R5**)	**W, B**	0.3(**3**)	0.5(**5**)
1.6pF(**1R6**)	**W, B**	0.3(**3**)	0.5(**5**)
1.7pF(**1R7**)	**W, B**	0.3(**3**)	0.5(**5**)
1.8pF(**1R8**)	**W, B**	0.3(**3**)	0.5(**5**)
1.9pF(**1R9**)	**W, B**	0.3(**3**)	0.5(**5**)
2.0pF(**2R0**)	**W, B**	0.3(**3**)	0.5(**5**)
2.1pF(**2R1**)	**W, B**	0.3(**3**)	0.5(**5**)
2.2pF(**2R2**)	**W, B**	0.3(**3**)	0.5(**5**)
2.3pF(**2R3**)	**W, B**	0.3(**3**)	0.5(**5**)

Continued on the following page. ↗

Continued from the preceding page.

Part Number		GRM03	GRM15
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
2.4pF(**2R4**)	**W, B**	0.3(**3**)	0.5(**5**)
2.5pF(**2R5**)	**W, B**	0.3(**3**)	0.5(**5**)
2.6pF(**2R6**)	**W, B**	0.3(**3**)	0.5(**5**)
2.7pF(**2R7**)	**W, B**	0.3(**3**)	0.5(**5**)
2.8pF(**2R8**)	**W, B**	0.3(**3**)	0.5(**5**)
2.9pF(**2R9**)	**W, B**	0.3(**3**)	0.5(**5**)
3.0pF(**3R0**)	**W, B**	0.3(**3**)	0.5(**5**)
3.1pF(**3R1**)	**W, B**	0.3(**3**)	0.5(**5**)
3.2pF(**3R2**)	**W, B**	0.3(**3**)	0.5(**5**)
3.3pF(**3R3**)	**W, B**	0.3(**3**)	0.5(**5**)
3.4pF(**3R4**)	**W, B**	0.3(**3**)	0.5(**5**)
3.5pF(**3R5**)	**W, B**	0.3(**3**)	0.5(**5**)
3.6pF(**3R6**)	**W, B**	0.3(**3**)	0.5(**5**)
3.7pF(**3R7**)	**W, B**	0.3(**3**)	0.5(**5**)
3.8pF(**3R8**)	**W, B**	0.3(**3**)	0.5(**5**)
3.9pF(**3R9**)	**W, B**	0.3(**3**)	0.5(**5**)
4.0pF(**4R0**)	**W, B**	0.3(**3**)	0.5(**5**)
4.1pF(**4R1**)	**W, B**	0.3(**3**)	0.5(**5**)
4.2pF(**4R2**)	**W, B**	0.3(**3**)	0.5(**5**)
4.3pF(**4R3**)	**W, B**	0.3(**3**)	0.5(**5**)
4.4pF(**4R4**)	**W, B**	0.3(**3**)	0.5(**5**)
4.5pF(**4R5**)	**W, B**	0.3(**3**)	0.5(**5**)
4.6pF(**4R6**)	**W, B**	0.3(**3**)	0.5(**5**)
4.7pF(**4R7**)	**W, B**	0.3(**3**)	0.5(**5**)
4.8pF(**4R8**)	**W, B**	0.3(**3**)	0.5(**5**)
4.9pF(**4R9**)	**W, B**	0.3(**3**)	0.5(**5**)
5.0pF(**5R0**)	**W, B**	0.3(**3**)	0.5(**5**)
5.1pF(**5R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.2pF(**5R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.3pF(**5R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.4pF(**5R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.5pF(**5R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.6pF(**5R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.7pF(**5R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.8pF(**5R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.9pF(**5R9**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.0pF(**6R0**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.1pF(**6R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.2pF(**6R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.3pF(**6R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.4pF(**6R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.5pF(**6R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.6pF(**6R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.7pF(**6R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.8pF(**6R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.9pF(**6R9**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.0pF(**7R0**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.1pF(**7R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.2pF(**7R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.3pF(**7R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.4pF(**7R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.5pF(**7R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)

Continued on the following page.

Continued from the preceding page.

Part Number		**GRM03**	**GRM15**
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
7.6pF(**7R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.7pF(**7R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.8pF(**7R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
7.9pF(**7R9**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.0pF(**8R0**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.1pF(**8R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.2pF(**8R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.3pF(**8R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.4pF(**8R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.5pF(**8R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.6pF(**8R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.7pF(**8R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.8pF(**8R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
8.9pF(**8R9**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.0pF(**9R0**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.1pF(**9R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.2pF(**9R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.3pF(**9R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.4pF(**9R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.5pF(**9R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.6pF(**9R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.7pF(**9R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.8pF(**9R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
9.9pF(**9R9**)	**W, B, C**	0.3(**3**)	0.5(**5**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

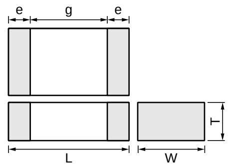
Chip Monolithic Ceramic Capacitors

muRata

Thin Type

■ Features

1. This series is suited to flow and reflow soldering. Capacitor terminations are made of metal highly resistant to migration.
2. Large capacitance values enable excellent bypass effects to be realized.
3. GRM18, 21 and GRM31 types are suited to flow and reflow soldering.
   GRM15 and GRM32 types are applied to only reflow soldering.
4. Its thin package makes this series ideally suited for the production of small electronic products and for mounting underneath ICs.



Part Number	Dimensions (mm) L	W	T	e	g min.
GRM15X	1.0 ±0.05	0.5 ±0.05	0.25 ±0.05	0.1 to 0.3	0.4
GRM153			0.3 ±0.03		
GRM216	2.0 ±0.1	1.25 ±0.1	0.6 ±0.1	0.2 to 0.7	0.7
GRM219			0.85 ±0.1		
GRM21A			1.0 +0/-0.2		
GRM316	3.2 ±0.15	1.6 ±0.15	0.6 ±0.1	0.3 to 0.8	1.5
GRM319			0.85 ±0.1		
GRM329	3.2 ±0.3	2.5 ±0.2	0.85 ±0.1	0.3 min.	1.0
GRM32A			1.0 +0/-0.2		

■ Applications

Thin equipment such as IC cards

Temperature Compensating Type

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	EIA
GRM1535C1H1R0CDD5	C0G (EIA)	50	1.0 ±0.25pF	1.0	0.5	0.3	0402
GRM1535C1H2R0CDD5	C0G (EIA)	50	2.0 ±0.25pF	1.0	0.5	0.3	0402
GRM1535C1H3R0CDD5	C0G (EIA)	50	3.0 ±0.25pF	1.0	0.5	0.3	0402
GRM1535C1H4R0CDD5	C0G (EIA)	50	4.0 ±0.25pF	1.0	0.5	0.3	0402
GRM1535C1H5R0CDD5	C0G (EIA)	50	5.0 ±0.25pF	1.0	0.5	0.3	0402
GRM1535C1H6R0DDD5	C0G (EIA)	50	6.0 ±0.5pF	1.0	0.5	0.3	0402
GRM1535C1H7R0DDD5	C0G (EIA)	50	7.0 ±0.5pF	1.0	0.5	0.3	0402
GRM1535C1H8R0DDD5	C0G (EIA)	50	8.0 ±0.5pF	1.0	0.5	0.3	0402
GRM1535C1H9R0DDD5	C0G (EIA)	50	9.0 ±0.5pF	1.0	0.5	0.3	0402
GRM1535C1H100JDD5	C0G (EIA)	50	10 ±5%	1.0	0.5	0.3	0402
GRM1535C1H120JDD5	C0G (EIA)	50	12 ±5%	1.0	0.5	0.3	0402
GRM1535C1H150JDD5	C0G (EIA)	50	15 ±5%	1.0	0.5	0.3	0402
GRM1535C1H180JDD5	C0G (EIA)	50	18 ±5%	1.0	0.5	0.3	0402
GRM1535C1H220JDD5	C0G (EIA)	50	22 ±5%	1.0	0.5	0.3	0402
GRM1535C1H270JDD5	C0G (EIA)	50	27 ±5%	1.0	0.5	0.3	0402
GRM1535C1H330JDD5	C0G (EIA)	50	33 ±5%	1.0	0.5	0.3	0402
GRM1535C1H390JDD5	C0G (EIA)	50	39 ±5%	1.0	0.5	0.3	0402
GRM1535C1H470JDD5	C0G (EIA)	50	47 ±5%	1.0	0.5	0.3	0402
GRM1535C1H560JDD5	C0G (EIA)	50	56 ±5%	1.0	0.5	0.3	0402
GRM1535C1H680JDD5	C0G (EIA)	50	68 ±5%	1.0	0.5	0.3	0402
GRM1535C1H820JDD5	C0G (EIA)	50	82 ±5%	1.0	0.5	0.3	0402
GRM1535C1H101JDD5	C0G (EIA)	50	100 ±5%	1.0	0.5	0.3	0402

High Dielectric Constant Type

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	EIA
GRM15XR71H221KA86	X7R (EIA)	50	220pF ±10%	1.0	0.5	0.25	0402
GRM15XR71H331KA86	X7R (EIA)	50	330pF ±10%	1.0	0.5	0.25	0402
GRM15XR71H471KA86	X7R (EIA)	50	470pF ±10%	1.0	0.5	0.25	0402
GRM15XR71H681KA86	X7R (EIA)	50	680pF ±10%	1.0	0.5	0.25	0402
GRM15XR71H102KA86	X7R (EIA)	50	1000pF ±10%	1.0	0.5	0.25	0402
GRM15XR71H152KA86	X7R (EIA)	50	1500pF ±10%	1.0	0.5	0.25	0402
GRM15XR71E222KA86	X7R (EIA)	25	2200pF ±10%	1.0	0.5	0.25	0402
GRM219R71E105KA88	X7R (EIA)	25	1.0µF ±10%	2.0	1.25	0.85	0805
GRM15XR71C332KA86	X7R (EIA)	16	3300pF ±10%	1.0	0.5	0.25	0402
GRM15XR71C472KA86	X7R (EIA)	16	4700pF ±10%	1.0	0.5	0.25	0402
GRM15XR71C682KA86	X7R (EIA)	16	6800pF ±10%	1.0	0.5	0.25	0402
GRM15XR71C103KA86	X7R (EIA)	16	10000pF ±10%	1.0	0.5	0.25	0402
GRM216C81C105KA12	X6S(EIA)	16	1.0µF ±10%	2.0	1.25	0.6*	0805
GRM316C81C225KA12	X6S(EIA)	16	2.2µF ±10%	3.2	1.6	0.6*	1206
GRM219C81C225KA12	X6S(EIA)	16	2.2µF ±10%	2.0	1.25	0.85*	0805
GRM319C81C475KA12	X6S(EIA)	16	4.7µF ±10%	3.2	1.6	0.85*	1206
GRM219C81A475KE34	X6S(EIA)	10	4.7µF ±10%	2.0	1.25	0.85*	0805
GRM219C80J475KE19	X6S(EIA)	6.3	4.7µF ±10%	2.0	1.25	0.85*	0805
GRM319C80J106KE19	X6S(EIA)	6.3	10µF ±10%	3.2	1.6	0.85*	1206
GRM219C80G106KE19	X6S(EIA)	4	10µF ±10%	2.0	1.25	0.85*	0805
GRM216R61E105KA12	X5R (EIA)	25	1.0µF ±10%	2.0	1.25	0.6*	0805
GRM316R61E225KA12	X5R (EIA)	25	2.2µF ±10%	3.2	1.6	0.6*	1206
GRM219R61E225KA12	X5R (EIA)	25	2.2µF ±10%	2.0	1.25	0.85*	0805
GRM319R61E475KA12	X5R (EIA)	25	4.7µF ±10%	3.2	1.6	0.85*	1206
GRM216R61C105KA88	X5R (EIA)	16	1.0µF ±10%	2.0	1.25	0.6*	0805
GRM316R61C225KA88	X5R (EIA)	16	2.2µF ±10%	3.2	1.6	0.6*	1206
GRM219R61C225KA88	X5R (EIA)	16	2.2µF ±10%	2.0	1.25	0.85*	0805
GRM219R61C475KE15	X5R (EIA)	16	4.7µF ±10%	2.0	1.25	0.85*	0805
GRM319R61C475KA88	X5R (EIA)	16	4.7µF ±10%	3.2	1.6	0.85*	1206
GRM319R61C106KE15	X5R (EIA)	16	10µF ±10%	3.2	1.6	0.85*	1206
GRM216R61A225KE24	X5R (EIA)	10	2.2µF ±10%	2.0	1.25	0.6*	0805
GRM219R61A225KA01	X5R (EIA)	10	2.2µF ±10%	2.0	1.25	0.85*	0805
GRM316R61A335KE19	X5R (EIA)	10	3.3µF ±10%	3.2	1.6	0.6*	1206
GRM219R61A335KE19	X5R (EIA)	10	3.3µF ±10%	2.0	1.25	0.85*	0805
GRM316R61A475KE19	X5R (EIA)	10	4.7µF ±10%	3.2	1.6	0.6*	1206
GRM219R61A475KE34	X5R (EIA)	10	4.7µF ±10%	2.0	1.25	0.85*	0805
GRM319R61A106KE19	X5R (EIA)	10	10µF ±10%	3.2	1.6	0.85*	1206
GRM219R60J475KE19	X5R (EIA)	6.3	4.7µF ±10%	2.0	1.25	0.85*	0805
GRM319R60J106KE19	X5R (EIA)	6.3	10µF ±10%	3.2	1.6	0.85*	1206

*: Please refer to GRM Series Specifications and Test Methods (2) (P.30).

GRM Series Specifications and Test Methods (1)

Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.
In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td>1</td><td>Operating Temperature Range</td><td>−55 to +125℃</td><td>B1, B3, F1, R6: −25 to +85℃
R1, R7: −55 to +125℃
C8: −55 to +105℃
E4: +10 to +85℃
F5: −30 to +85℃</td><td>Reference temperature: 25℃
(2Δ, 3Δ, 4Δ, B1, B3, F1, R1: 20℃)</td></tr>
<tr><td>2</td><td>Rated Voltage</td><td colspan="2">See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td>Appearance</td><td colspan="2">No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td>Dimensions</td><td colspan="2">Within the specified dimensions</td><td>Using calipers (GRM02 size is based on Microscope)</td></tr>
<tr><td>5</td><td>Dielectric Strength</td><td colspan="2">No defects or abnormalities</td><td>No failure should be observed when 300%* of the rated voltage (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V</td></tr>
<tr><td>6</td><td>Insulation Resistance</td><td colspan="2">C≦0.047μF: More than 10,000MΩ
C>0.047μF: 500Ω · F
C: Nominal Capacitance</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20/25℃ and 75%RH max. and within 2 minutes of charging, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>7</td><td>Capacitance</td><td colspan="2">Within the specified tolerance</td><td rowspan="2">The capacitance/Q/D.F. should be measured at 20/25℃ at the frequency and voltage shown in the table.
<table><tr><th>Char. / Item</th><th>ΔC to 7U, 1X (1000pF and below)</th><th>ΔC to 7U, 1X (more than 1000pF) R6, R7, C8, F5, B1, B3, F1</th><th>R6, R7, F5 (C>10μF)</th><th>E4</th></tr><tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</td><td>120±24kHz</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>0.5 to 5Vrms</td><td>1±0.2Vrms</td><td>0.5±0.1Vrms</td><td>0.5±0.05Vrms</td></tr></table></td></tr>
<tr><td>8</td><td>Q/
Dissipation Factor (D.F.)</td><td>30pF and over: Q≧1000
30pF and below:
Q≧400+20C

C: Nominal Capacitance (pF)</td><td>[R6, R7, C8]
W.V.: 100V
: 0.025 max. (C<0.068μF)
: 0.05 max. (C≧0.068μF)
W.V.: 50/25V
: 0.025 max. (C<10μF)
: 0.035 max. (C≧10μF)
W.V.: 16/10V: 0.035 max.
W.V.: 6.3/4V
: 0.05 max. (C<3.3μF)
: 0.1 max. (C≧3.3μF)
[E4]
W.V.: 25Vmin: 0.025 max.
[F1, F5]
W.V.: 25V min.
: 0.05 max. (C<0.1μF)
: 0.09 max. (C≧0.1μF)
W.V.: 16/10V: 0.125 max.
W.V.: 6.3V: 0.15 max.</td></tr>
</table>

Continued on the following page. ↗

GRM Series Specifications and Test Methods (1)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.
In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
9	Capacitance Temperature Characteristics	No bias	Within the specified tolerance (Table A-1)	B1, B3: Within ±10% (−25 to +85℃) R1, R7: Within ±15% (−55 to +125℃) R6: Within ±15% (−55 to +85℃) E4: Within +22/−56% (+10 to +85℃) F1: Within +30/−80% (−25 to +85℃) F5: Within +22/−82% (−30 to +85℃) C8: Within ±22% (−55 to +105℃)	The capacitance change should be measured after 5 min. at each specified temp. stage. (1)Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5 (5C: +25 to +125℃/ΔC: +20 to +125℃: other temp. coeffs.: +25 to +85℃/+20 to +85℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.
		50% of the Rated Voltage		B1: Within +10/–30% R1: Within +15/–40% F1: Within +30/–95%	
		Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.) *Do not apply to 1X/25V	*Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/–10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement.	(2) High Dielectric Constant Type The ranges of capacitance change compared with the 20℃ value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.
10	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.		Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *1N (GRM02), 2N (GRM03), 5N (GRM15, GRM18)

Step	Temperature (℃)
1	Reference Temperature ±2
2	−55±3 (for ΔC to 7U/1X/R6/R7/C8) −30±3 (for F5), 10±3 (for E4) −25±3 (for other TC)
3	Reference Temperature ±2
4	125±3 (for ΔC/R7), 105±3 (for C8) 85±3 (for other TC)
5	Reference Temperature ±2

Step	Temperature (°C)	Applying Voltage (V)
1	Reference Temperature ±2	No bias
2	–55±3 (for R1, R7, R6) –25±3 (for B1, B3, F1) –30±3 (for F5)/10±3 (for E4)	
3	Reference Temperature ±2	
4	125±3 (for R1, R7)/ 85±3 (for B1, B3, R6 F1, F5, E4)	
5	Reference Temperature ±2	50% of the rated voltage
6	–55±3 (for R1)/ –25±3 (for B1, F1)	
7	Reference Temperature ±2	
8	125±3 (for R1)/ 85±3 (for B1, F1)	

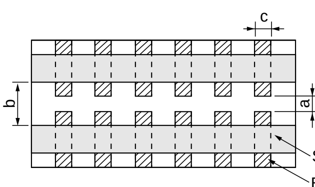


Fig. 1a

(in mm)

Type	a	b	c
GRM02	0.2	0.56	0.23
GRM03	0.3	0.9	0.3
GRM15	0.4	1.5	0.5
GRM18	1.0	3.0	1.2
GRM21	1.2	4.0	1.65
GRM31	2.2	5.0	2.0
GRM32	2.2	5.0	2.9
GRM43	3.5	7.0	3.7
GRM55	4.5	8.0	5.6

Continued on the following page.

GRM Series Specifications and Test Methods (1)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.
In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

No.	Item		Specifications		Test Method
			Temperature Compensating Type	High Dielectric Type	
11	Vibration Resistance	Appearance	No defects or abnormalities		Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).
		Capacitance	Within the specified tolerance		
		Q/D.F.	30pF and over: Q≧1000 30pF and below: Q≧400+20C C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≧0.068μF) W.V.: 50/25V : 0.025 max. (C<10μF) : 0.035 max. (C≧10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≧3.3μF) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≧0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	
12	Deflection		No crack or marked defect should occur.		Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
13	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion) . Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.

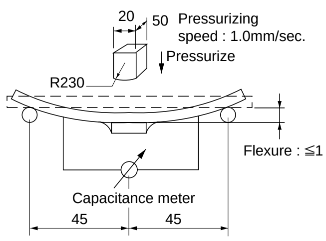


Fig. 3a

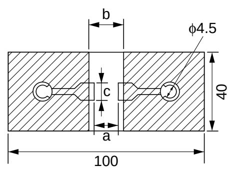


Fig. 2a

t: 1.6mm (GRM02/03/15: t: 0.8mm)

Type	a	b	c
GRM02	0.2	0.56	0.23
GRM03	0.3	0.9	0.3
GRM15	0.4	1.5	0.5
GRM18	1.0	3.0	1.2
GRM21	1.2	4.0	1.65
GRM31	2.2	5.0	2.0
GRM32	2.2	5.0	2.9
GRM43	3.5	7.0	3.7
GRM55	4.5	8.0	5.6

(in mm)

Continued on the following page.

GRM Series Specifications and Test Methods (1)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.
In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
14	Resistance to Soldering Heat		The measured and observed characteristics should satisfy the specifications in the following table.		Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure. •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement. •Preheating for GRM32/43/55 (see table below)
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4: Within ±20%	
		Q/D.F.	30pF and over: Q≧1000 30pF and below: Q≧400+20C C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≧0.068μF) W.V.: 50/25V : 0.025 max. (C<10μF) : 0.035 max. (C≧10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≧3.3μF) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≧0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	
		I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)		
		Dielectric Strength	No defects		
15	Temperature Cycle		The measured and observed characteristics should satisfy the specifications in the following table.		Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table. Set for 24±2 hours at room temperature, then measure. (see table below) •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4: Within ±20%	
		Q/D.F.	30pF and over: Q≧1000 30pF and below: Q≧400+20C C: Nominal Capacitance (pF)	[R6, R7, C8] W.V.: 100V : 0.05 max. (C<0.068μF) : 0.075 max. (C≧0.068μF) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. (C<3.3μF) : 0.125 max. (C≧3.3μF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≧0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	
		I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)		
		Dielectric Strength	No defects		

Preheating for GRM32/43/55 (No. 14):

Step	Temperature	Time
1	100 to 120℃	1 min.
2	170 to 200℃	1 min.

Temperature cycle (No. 15):

Step	1	2	3	4
Temp. (℃)	Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

Continued on the following page.

GRM Series Specifications and Test Methods (1)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.
In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

No.	Item		Specifications		Test Method
			Temperature Compensating Type	High Dielectric Type	
16	Humidity (Steady State)		The measured and observed characteristics should satisfy the specifications in the following table.		Set the capacitor at 40±2℃ and in 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4: Within ±30%	
		Q/D.F.	30pF and over: Q≧350 10pF and over 30pF and below: Q≧275+2.5C 10pF and below: Q≧200+10C C: Nominal Capacitance (pF)	[R6, R7, C8] W.V.: 100V : 0.05 max. (C<0.068µF) : 0.075 max. (C≧0.068µF) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. (C<3.3µF) : 0.125 max. (C≧3.3µF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.075 max. (C<0.1µF) : 0.125 max. (C≧0.1µF) W.V.: 16/10V: 0.15 max. W.V.: 6.3V: 0.2 max.	
		I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)		
17	Humidity Load		The measured and observed characteristics should satisfy the specifications in the following table.		Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for F1, F5/10V max. Apply the rated DC voltage for 1 hour at 40±2℃. Remove and set for 24±2 hours at room temperature. Perform initial measurement.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4: Within ±30% [W.V.: 10V max.] F1, F5: Within +30/−40%	
		Q/D.F.	30pF and over: Q≧200 30pF and below: Q≧100+10C/3 C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.05 max. (C<0.068µF) : 0.075 max. (C≧0.068µF) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. (C<3.3µF) : 0.125 max. (C≧3.3µF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.075 max. (C<0.1µF) : 0.125 max. (C≧0.1µF) W.V.: 16/10V: 0.15 max. W.V.: 6.3V: 0.2 max.	
		I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)		

Continued on the following page.

GRM Series Specifications and Test Methods (1)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.
In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

No.	Item		Specifications		Test Method
			Temperature Compensating Type	High Dielectric Type	
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table.		Apply 200%* of the rated voltage at the maximum operating temperature ±3℃ for 1000±12 hours. Set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage at the maximum operating temperature ±3℃ for one hour. Remove and set for 24±2 hours at room temperature. Perform initial measurement. *150% for 500V
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4: Within ±30% [Except 10V max. and. C≧1.0μF] F1, F5: Within +30/−40% [10V max. and C≧1.0μF]	
		Q/D.F.	30pF and over: Q≧350 10pF and over 30pF and below: Q≧275+2.5C 10pF and below: Q≧200+10C C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.05 max. (C<0.068μF) : 0.075 max. (C≧0.068μF) W.V.: 50/25/16/10V : 0.05 max. W.V.: 6.3/4V : 0.075 max. (C<3.3μF) : 0.125 max. (C≧3.3μF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min. : 0.075 max.(C<0.1μF) : 0.125 max.(C≧0.1μF) W.V.: 16/10V: 0.15 max. W.V.: 6.3V: 0.2 max.	
		I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)		

Table A-1

(1)

Char.	Nominal Values (ppm/℃)*1	Capacitance Change from 25℃ (%)					
		−55		−30		−10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0± 30	0.58	−0.24	0.40	−0.17	0.25	−0.11
6C	0± 60	0.87	−0.48	0.59	−0.33	0.38	−0.21
6P	−150± 60	2.33	0.72	1.61	0.50	1.02	0.32
6R	−220± 60	3.02	1.28	2.08	0.88	1.32	0.56
6S	−330± 60	4.09	2.16	2.81	1.49	1.79	0.95
6T	−470± 60	5.46	3.28	3.75	2.26	2.39	1.44
7U	−750±120	8.78	5.04	6.04	3.47	3.84	2.21
1X	+350 to −1000	–	–	–	–	–	–

∗1: Nominal values denote the temperature coefficient within a range of 25℃ to 125℃ (for ΔC)/85℃ (for other TC).

(2)

Char.	Nominal Values (ppm/℃)*2	Capacitance Change from 20℃ (%)					
		−55		−25		−10	
		Max.	Min.	Max.	Min.	Max.	Min.
2C	0± 60	0.82	−0.45	0.49	−0.27	0.33	−0.18
3C	0±120	1.37	−0.90	0.82	−0.54	0.55	−0.36
4C	0±250	2.56	−1.88	1.54	−1.13	1.02	−0.75
2P	−150± 60	–	–	1.32	0.41	0.88	0.27
3P	−150±120	–	–	1.65	0.14	1.10	0.09
4P	−150±250	–	–	2.36	−0.45	1.57	−0.30
2R	−220± 60	–	–	1.70	0.72	1.13	0.48
3R	−220±120	–	–	2.03	0.45	1.35	0.30
4R	−220±250	–	–	2.74	−0.14	1.83	−0.09
2S	−330± 60	–	–	2.30	1.22	1.54	0.81
3S	−330±120	–	–	2.63	0.95	1.76	0.63
4S	−330±250	–	–	3.35	0.36	2.23	0.24
2T	−470± 60	–	–	3.07	1.85	2.05	1.23
3T	−470±120	–	–	3.40	1.58	2.27	1.05
4T	−470±250	–	–	4.12	0.99	2.74	0.66
3U	−750±120	–	–	4.94	2.84	3.29	1.89
4U	−750±250	–	–	5.65	2.25	3.77	1.50

∗2: Nominal values denote the temperature coefficient within a range of 20℃ to 125℃ (for ΔC)/85℃ (for other TC).

GRM Series Specifications and Test Methods (2)

Below GRM Series Specifications and Test Methods (2) are applied to "*" PNs in capacitance table.
In case "*" is not added in capacitance table, please refer to GRM Series Specifications and Test Methods (1) (P.24).

No.	Item		Specifications	Test Method
1	Operating Temperature Range		B1, B3, F1: −25 to +85℃ R6: −55 to +85℃ R7, C7: -55 to +125℃ F5: −30 to +85℃ C8: −55 to +105℃,	Reference temperature: 25℃ (B1, B3, F1: 20℃)
2	Rated Voltage		See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.
3	Appearance		No defects or abnormalities	Visual inspection
4	Dimensions		Within the specified dimensions	Using calipers
5	Dielectric Strength		No defects or abnormalities	No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.
6	Insulation Resistance		More than 50Ω · F	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at reference temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA.
7	Capacitance		Within the specified tolerance	The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table. (see table below)
8	Dissipation Factor (D.F.)		B1, B3, R6*2, R7, C7, C8: 0.1 max. F1, F5: 0.2 max.	
9	Capacitance Temperature Characteristics	No bias	B1, B3: Within ±10% (−25 to +85℃) F1 : Within +30/−80% (−25 to +85℃) R6 : Within ±15% (−55 to +85℃) R7 : Within ±15% (−55 to +125℃) F5 : Within +22/−82% (−30 to +85℃) C7 : Within ±22% (−55 to +125℃) C8 : Within ±22% (−55 to +105℃)	The capacitance change should be measured after 5 min. at each specified temp. stage. The ranges of capacitance change compared with the reference temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage. *GRM43 B1/R6 0J/1A 336/476 only: 1.0±0.2Vrms (see table below) •Initial measurement for high dielectric constant type Perform a heat treatment at 150 +0/−10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement.
		50% of the Rated Voltage	B1: Within +10/−30% F1: Within +30/−95%	

Table for items 7 and 8:

Capacitance	Frequency	Voltage
C≦10μF (10V min.)*1	1±0.1kHz	1.0±0.2Vrms
C≦10μF (6.3V max.)	1±0.1kHz	0.5±0.1Vrms
C>10μF	120±24Hz	0.5±0.1Vrms

*1 However the voltage is 0.5±0.1Vrms about Table 1 items on the left side.

Table for item 9:

Step	Temperature (°C)	Applying Voltage (V)
1	Reference temperature ±2	No bias
2	–55±3 (for R6, C7, C8)/ –25±3 (for B1, B3, F1) –30±3 (for F5)	
3	Reference temperature ±2	
4	85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8)	
5	20±2	50% of the rated voltage
6	–25±3 (for B1, F1)	
7	20±2	
8	85±3 (for B1, F1)	

*2: GRM31CR60J107: 0.15 max.

Continued on the following page.

GRM Series Specifications and Test Methods (2)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (2) are applied to "*" PNs in capacitance table.
In case "*" is not added in capacitance table, please refer to GRM Series Specifications and Test Methods (1) (P.24).

No.	Item		Specifications	Test Method
10	Adhesive Strength of Termination		No removal of the terminations or other defects should occur. (Fig. 1a)	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *5N: GRM15/GRM18, 2N: GRM03
11	Vibration	Appearance	No defects or abnormalities	Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).
		Capacitance	Within the specified tolerance	
		D.F.	B1, B3, R6*2, R7, C7, C8: 0.1 max. F1, F5: 0.2 max.	
12	Deflection		No cracking or marking defects should occur. (Fig.3a)	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
13	Solderability of Termination		75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion) . Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.

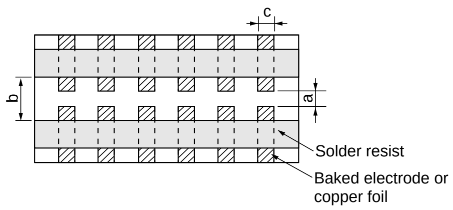


Fig. 1a

Type	a	b	c
GRM02	0.2	0.56	0.23
GRM03	0.3	0.9	0.3
GRM15	0.4	1.5	0.5
GRM18	1.0	3.0	1.2
GRM21	1.2	4.0	1.65
GRM31	2.2	5.0	2.0
GRM32	2.2	5.0	2.9
GRM43	3.5	7.0	3.7
GRM55	4.5	8.0	5.6

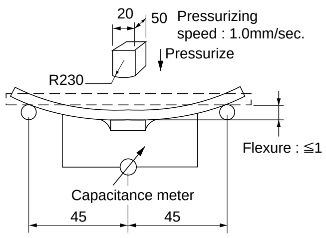


Fig.3a

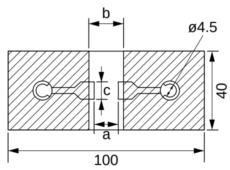


Fig. 2a

(GRM03/15: t: 0.8mm)

Type	a	b	c
GRM02	0.2	0.56	0.23
GRM03	0.3	0.9	0.3
GRM15	0.4	1.5	0.5
GRM18	1.0	3.0	1.2
GRM21	1.2	4.0	1.65
GRM31	2.2	5.0	2.0
GRM32	2.2	5.0	2.9
GRM43	3.5	7.0	3.7
GRM55	4.5	8.0	5.6

(in mm)

*2: GRM31CR60J107: 0.15 max.

Continued on the following page.

GRM Series Specifications and Test Methods (2)

Continued from the preceding page.

Below GRM Series Specifications and Test Methods (2) are applied to "*" PNs in capacitance table.
In case "*" is not added in capacitance table, please refer to GRM Series Specifications and Test Methods (1) (P.24).

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="5">Preheat the capacitor at 120 to 150℃ for 1 minute.
Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure.
*Do not apply to GRM02.

•Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 24±2 hours.
Perform the initial measurement.

*Preheating for GRM32/43/55<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120℃</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200℃</td><td>1 min.</td></tr></table></td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, R7, C7, C8: Within ±7.5%
F1, F5: Within ±20%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6*2, R7, C7, C8: 0.1 max.
F1, F5: 0.2 max.</td></tr>
<tr><td>I.R.</td><td>More than 50Ω · F</td></tr>
<tr><td>Dielectric Strength</td><td>No defects</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Temperature Sudden Change</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="5">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).
Perform the five cycles according to the four heat treatments shown in the following table.
Set for 24±2 hours at room temperature, then measure.<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (℃)</td><td>Min. Operating Temp. +0/−3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/−0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>•Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 24±2 hours.
Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, R7, C7, C8: Within ±7.5%
F1, F5: Within ±20%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6*2, R7, C7, C8: 0.1 max.
F1, F5: 0.2 max.</td></tr>
<tr><td>I.R.</td><td>More than 50Ω · F</td></tr>
<tr><td>Dielectric Strength</td><td>No defects</td></tr>
<tr><td rowspan="4">16</td><td rowspan="4">High Temperature High Humidity (Steady)</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA.

•Initial measurement
Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.

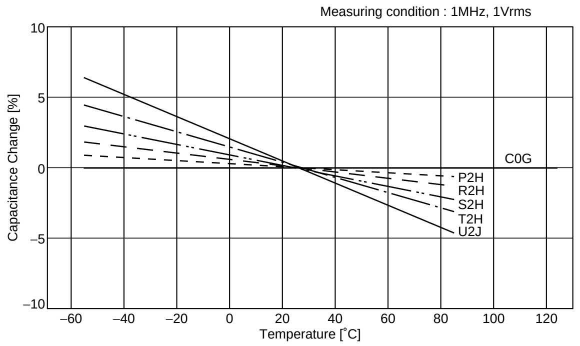
•Measurement after test
Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, R7, C7, C8: Within ±12.5%
F1, F5: Within ±30%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6, R7, C7, C8: 0.2 max.
F1, F5: 0.4 max.</td></tr>
<tr><td>I.R.</td><td>More than 12.5Ω · F</td></tr>
<tr><td rowspan="4">17</td><td rowspan="4">Durability</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.

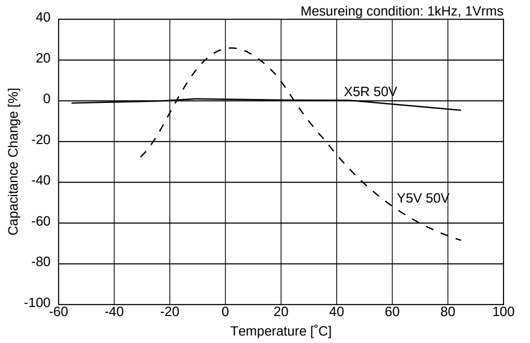
•Initial measurement
Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.

•Measurement after test
Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, R7, C7, C8: Within ±12.5%
F1, F5: Within ±30%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6, R7, C7, C8: 0.2 max.
F1, F5: 0.4 max.</td></tr>
<tr><td>I.R.</td><td>More than 25Ω · F</td></tr>
</table>

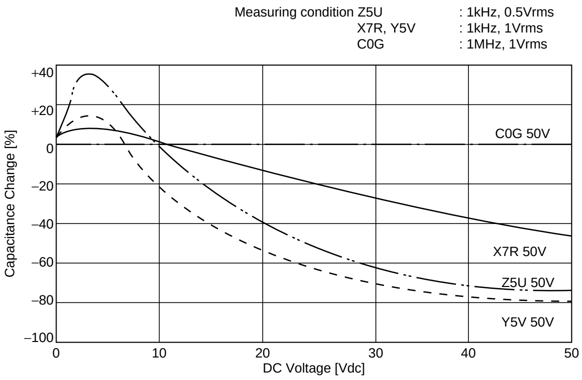
*2: GRM31CR60J107: 0.15 max.

■ Capacitance - Temperature Characteristics

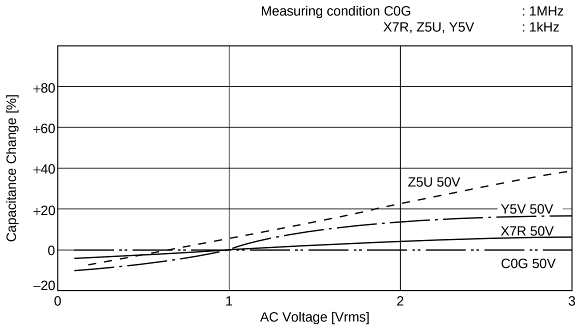




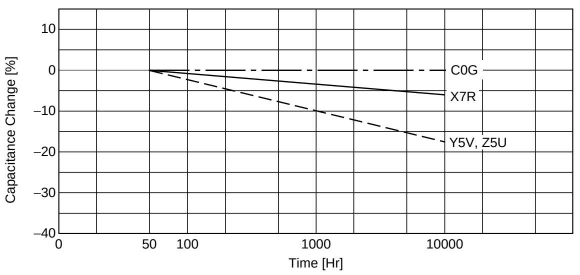
■ Capacitance - DC Voltage Characteristics



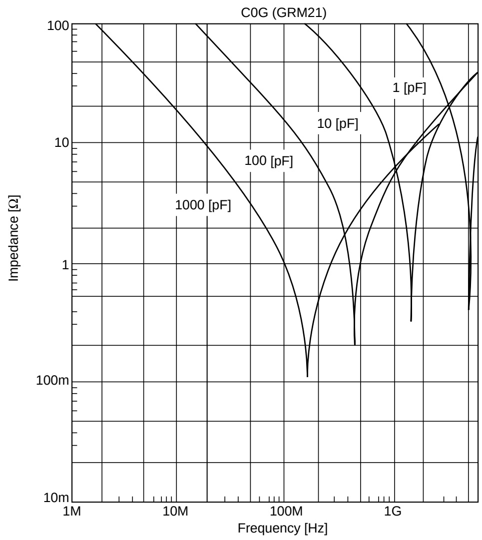
■ Capacitance - AC Voltage Characteristics



■ Capacitance Change - Aging



■ Impedance - Frequency Characteristics

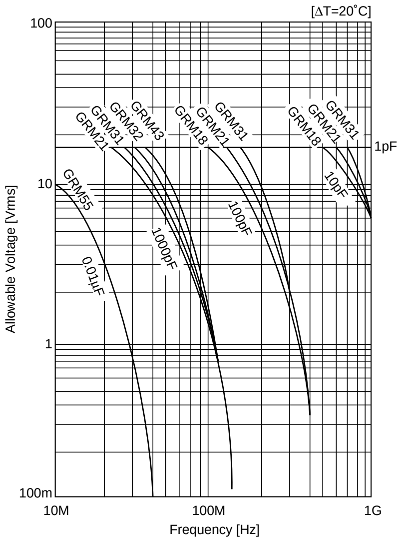


Continued on the following page.

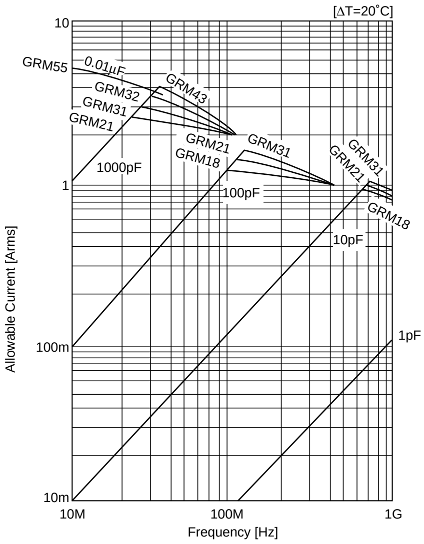
GRM Series Data

Continued from the preceding page.

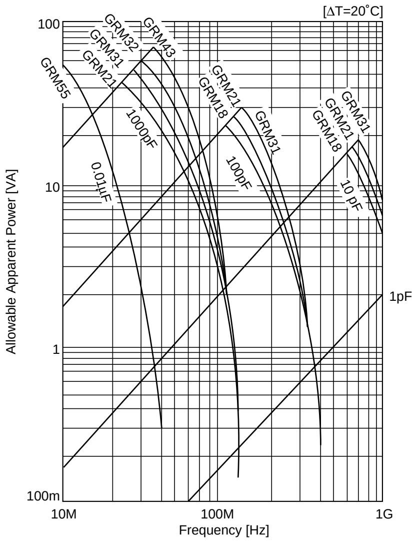
■ Allowable Voltage - Frequency



■ Allowable Current - Frequency



■ Allowable Apparent Power - Frequency



Chip Monolithic Ceramic Capacitors

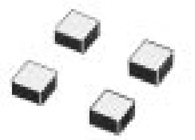
Microchips GMA Series

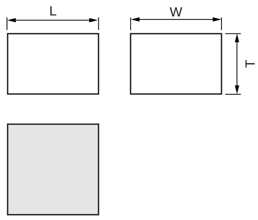
■ Features

1. Better microwave characteristics
2. Suitable for by-passing
3. High density mounting

■ Applications

1. Optical device for telecommunication
2. IC, IC packaging built-in
3. Measuring equipment





Part Number	Dimensions (mm)		
	L	W	T
GMA05X	0.5 ±0.05	0.5 ±0.05	0.35 ±0.05
GMA085	0.8 ±0.05	0.8 ±0.05	0.5 ±0.1

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)
GMA05XR72A101MD01	X7R (EIA)	100	100pF ±20%	0.5	0.5	0.35
GMA05XR72A151MD01	X7R (EIA)	100	150pF ±20%	0.5	0.5	0.35
GMA05XR72A221MD01	X7R (EIA)	100	220pF ±20%	0.5	0.5	0.35
GMA05XR72A331MD01	X7R (EIA)	100	330pF ±20%	0.5	0.5	0.35
GMA085R72A331MD01	X7R (EIA)	100	330pF ±20%	0.8	0.8	0.5
GMA085R72A471MD01	X7R (EIA)	100	470pF ±20%	0.8	0.8	0.5
GMA085R72A681MD01	X7R (EIA)	100	680pF ±20%	0.8	0.8	0.5
GMA085R72A102MD01	X7R (EIA)	100	1000pF ±20%	0.8	0.8	0.5
GMA05XR71H161MD01	X7R (EIA)	50	160pF ±20%	0.5	0.5	0.35
GMA05XR71H331MD01	X7R (EIA)	50	330pF ±20%	0.5	0.5	0.35
GMA05XR71H471MD01	X7R (EIA)	50	470pF ±20%	0.5	0.5	0.35
GMA05XR71C431MD01	X7R (EIA)	16	430pF ±20%	0.5	0.5	0.35
GMA05XR71C471MD01	X7R (EIA)	16	470pF ±20%	0.5	0.5	0.35
GMA05XR71C681MD01	X7R (EIA)	16	680pF ±20%	0.5	0.5	0.35
GMA05XR71C102MD01	X7R (EIA)	16	1000pF ±20%	0.5	0.5	0.35
GMA085R71C102MD01	X7R (EIA)	16	1000pF ±20%	0.8	0.8	0.5
GMA05XR71C152MD01	X7R (EIA)	16	1500pF ±20%	0.5	0.5	0.35
GMA085R71C152MD01	X7R (EIA)	16	1500pF ±20%	0.8	0.8	0.5
GMA05XR71C222MD01	X7R (EIA)	16	2200pF ±20%	0.5	0.5	0.35
GMA085R71C222MD01	X7R (EIA)	16	2200pF ±20%	0.8	0.8	0.5
GMA085R71C332MD01	X7R (EIA)	16	3300pF ±20%	0.8	0.8	0.5
GMA085R71C472MD01	X7R (EIA)	16	4700pF ±20%	0.8	0.8	0.5
GMA085R71C682MD01	X7R (EIA)	16	6800pF ±20%	0.8	0.8	0.5
GMA085R71C103MD01	X7R (EIA)	16	10000pF ±20%	0.8	0.8	0.5

Specifications and Test Methods

No.	Item		Specifications	Test Method
1	Operating Temperature Range		R7: −55 to +125℃	Reference Temperature: 25℃
2	Rated Voltage		See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.
3	Appearance		No defects or abnormalities	Using calipers
4	Dimensions		Within the specified dimersions	Visual inspection
5	Dielectric Strength		No defects or abnormalities	No failure should be observed when a voltage of 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.
6	Insulation Resistance		10,000MΩ min.	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes of charging.
7	Capacitance		Within the specified tolerance	The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table.
8	Dissipation Factor (D.F.)		R7: 0.035 max.	

Frequency	1±0.1kHz
Voltage	1±0.2Vrms

No.	Item		Specifications	Test Method
9	Capacitance Temperature Characteristics	No bias	R7: Within +/–15% (–55 to +125°C)	The capacitance change should be measured after 5min. at each specified temp. stage. •The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.

Step	Temperature (°C)	Applying Voltage (V)
1	Reference Temperature±2	No bias
2	–55±3 (for R7) –30±3 (for F5)	
3	Reference Temperature±2	
4	125±3 (for R7) 85±3 (for F5)	

*Initial measurement for high dielectric constant type
Perform a heat treatment at 150 +0/−10°C for one hour and then let sit for 24±2 hours at room temperature.
Perform the initial measurement.

No.	Item		Specifications	Test Method
10	Mechanical Strength	Bond Strength	Pull force: 0.03N min.	MIL-STD-883 Method 2011 Condition D Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.
		Die Shear Strength	Die Shear force: 2N min.	MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.
11	Vibration Resistance	Appearance	No defects or abnormalities	Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude: 1.5 mm (0.06 inch) max. total excursion. Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).
		Capacitance	Within the specified tolerance	
		D.F.	R7: 0.035 max.	
12	Temperature Cycle	Appearance	No defects or abnormalities	The capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150+0/−10℃, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11) and conduct the five cycles according to the temperatures and time shown in the following table. Set it for 48±4 hours at room temperature, then measure.
		Capacitance Change	R7: Within ±7.5%	
		D.F.	R7: 0.035 max.	
		I.R.	10,000MΩ min.	
		Dielectric Strength	No defects	

Step	1	2	3	4
Temp. (℃)	Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

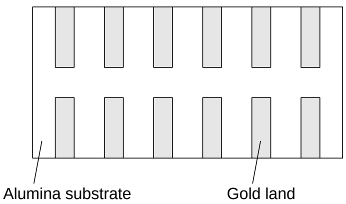
Continued on the following page.

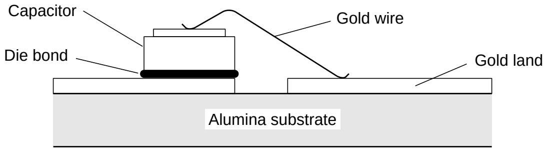
Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
13	Humidity (Steady State)	Appearance	No defects or abnormalities	Set the capacitor for 500±12 hours at 40±20℃, in 90 to 95% humidity. Take it out and set it for 24±2 hours at room temperature, then measure.
		Capacitance Change	R7: Within ±12.5%	
		D.F.	R7: 0.05 max.	
		I.R.	1,000MΩ min.	
14	Humidity Load	Appearance	No defects or abnormalities	Apply the rated voltage for 500±12 hours at 40±2℃, in 90 to 95% humidity and set it for 24±2 hours at room temperature,then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	R7: Within ±12.5%	
		D.F.	R7: 0.05 max.	
		I.R.	500MΩ min.	
15	High Temperature Load	Appearance	No defects or abnormalities	A voltage treatment should be given to the capacitor, in which a DC voltage of 200% the rated voltage is applied for one hour at the maximum operating temperature ±3℃ then it should be set for 24±2 hours at room temperature and the initial measurement should be conducted. Then apply the above mentioned voltage continuously for 1000±12 hours at the same temperature, remove it from the bath, and set it for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	R7: Within ±12.5%	
		D.F.	R7: 0.05 max.	
		I.R.	1,000MΩ min.	

Mounting for testing: The capacitors should be mounted on the substrate as shown below using die bonding and wire bonding when tests No.11 to 15 are performed.

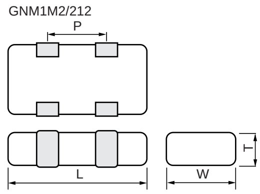


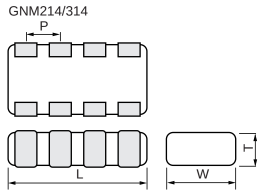


Chip Monolithic Ceramic Capacitors

muRata

Capacitor Arrays GNM Series





Part Number	Dimensions (mm) L	W	T	P
GNM1M2	1.37 ±0.15	1.0 ±0.15	0.6 ±0.1 0.8 +0/-0.15	0.64 ±0.05
GNM212	2.0 ±0.15	1.25 ±0.15	0.85 ±0.1	1.0 ±0.1
GNM214			0.6 ±0.1	0.5 ±0.05
GNM314	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1 1.0 ±0.1	0.8 ±0.1

■ Features

1. High density mounting due to mounting space saving
2. Mounting cost saving

■ Applications

General electronic equipment

Temperature Compensating Type

Part Number		**GNM1M**	**GNM21**	**GNM31**	
L x W		1.37x1.0	2.0x1.25	3.2x1.6	
TC		C0G (**5C**)	C0G (**5C**)	C0G (**5C**)	
Rated Volt.		50 (**1H**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension					
10pF(**100**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
15pF(**150**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
22pF(**220**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
27pF(**270**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
33pF(**330**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
39pF(**390**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
47pF(**470**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
68pF(**680**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
100pF(**101**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
150pF(**151**)	**K**	0.6(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
220pF(**221**)	**K**	0.6(**2**)	0.6(**4**)		0.8(**4**)
270pF(**271**)	**K**				0.8(**4**)
330pF(**331**)	**K**				0.8(**4**)

The part numbering code is shown in each ( ). The (4) code in T (mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type GNM1M Series

Part Number		**GNM1M**						
L x W		1.37x1.0						
TC		X5R (**R6**)			X7R (**R7**)			
Rated Volt.		16 (**1C**)	10 (**1A**)	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance, Capacitance Tolerance and T Dimension								
1000pF(**102**)	**M**				0.6(**2**)			
2200pF(**222**)	**K, M**					0.6(**2**)		
4700pF(**472**)	**K, M**					0.6(**2**)		
10000pF(**103**)	**M**					0.6(**2**)		
22000pF(**223**)	**K, M**	0.6(**2**)	0.6(**2**)				0.6(**2**)	0.6(**2**)

Continued on the following page.

muRata

Continued from the preceding page.

Part Number		**GNM1M**						
L x W		1.37x1.0						
TC		X5R (**R6**)			X7R (**R7**)			
Rated Volt.		16 (**1C**)	10 (**1A**)	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance, Capacitance Tolerance and T Dimension								
47000pF(**473**)	**K, M**	0.6(**2**)	0.6(**2**)				0.6(**2**)	0.6(**2**)
0.10µF(**104**)	**M**		0.6(**2**)					
1.0µF(**105**)	**M**	0.8(**2**)	0.8(**2**)	0.8(**2**)				

The part numbering code is shown in each ( ). The (2) code in T (mm) means number of elements (two).
Dimensions are shown in mm and Rated Voltage in Vdc.
Please refer to Specifications and Test Methods (2) about 1.0µF products.

High Dielectric Constant Type GNM21 Series

Part Number		**GNM21**				
L x W		2.0x1.25				
TC		X5R (**R6**)		X7R (**R7**)		
Rated Volt.		16 (**1C**)	10 (**1A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)
Capacitance, Capacitance Tolerance and T Dimension						
1000pF(**102**)	**M**			0.6(**4**)		
2200pF(**222**)	**K, M**				0.6(**4**)	
4700pF(**472**)	**K, M**				0.6(**4**)	
10000pF(**103**)	**M**				0.6(**4**)	
22000pF(**223**)	**K, M**					0.85(**4**)
47000pF(**473**)	**K, M**					0.85(**4**)
0.10µF(**104**)	**M**					0.85(**4**)
0.47µF(**474**)	**M**	0.85(**2**)				
1.0µF(**105**)	**M**	0.85(**2**)	0.85(**4**)			
2.2µF(**225**)	**K, M**		0.85(**2**)			

The part numbering code is shown in each ( ). The (2) code in T (mm) means number of elements (two).
Dimensions are shown in mm and Rated Voltage in Vdc.
Please refer to Specifications and Test Methods (2) about X5R, 10V products.

High Dielectric Constant Type GNM31 Series

Part Number		**GNM31**			
L x W		3.2x1.6			
TC		X7R (**R7**)			X5R (**R6**)
Rated Volt.		100 (**2A**)	50 (**1H**)	16 (**1C**)	10 (**1A**)
Capacitance, Capacitance Tolerance and T Dimension					
220pF(**221**)	**K, M**	0.8(**4**)			
330pF(**331**)	**K, M**	0.8(**4**)			
470pF(**471**)	**K, M**	0.8(**4**)	0.8(**4**)		
680pF(**681**)	**K, M**	0.8(**4**)	0.8(**4**)		
1000pF(**102**)	**K, M**	0.8(**4**)	0.8(**4**)		
1500pF(**152**)	**K, M**	0.8(**4**)	0.8(**4**)		
2200pF(**222**)	**K, M**	0.8(**4**)	0.8(**4**)		
3300pF(**332**)	**K, M**	0.8(**4**)	0.8(**4**)		
4700pF(**472**)	**K, M**	0.8(**4**)	0.8(**4**)		
6800pF(**682**)	**K, M**		0.8(**4**)		
10000pF(**103**)	**K, M**		0.8(**4**)		

Continued on the following page.

Continued from the preceding page.

Part Number		GNM31			
L x W		3.2x1.6			
TC		X7R (**R7**)			X5R (**R6**)
Rated Volt.		100 (**2A**)	50 (**1H**)	16 (**1C**)	10 (**1A**)
Capacitance, Capacitance Tolerance and T Dimension					
15000pF(**153**)	**K, M**		0.8(**4**)		
22000pF(**223**)	**K, M**			0.8(**4**)	
33000pF(**333**)	**K, M**			0.8(**4**)	
47000pF(**473**)	**K, M**			1.0(**4**)	
68000pF(**683**)	**K, M**			1.0(**4**)	
0.10µF(**104**)	**K, M**			1.0(**4**)	
1.0µF(**105**)	**M**				0.85(**4**)

The part numbering code is shown in each ( ). The (4) code in T (mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

muRata

GNM Series Specifications and Test Methods (1)

No.	Item	Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
1	Operating Temperature Range	5C: –55 to +125°C	R7: –55 to +125°C R6: –30 to +85°C	
2	Rated Voltage	See the previous pages.		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.
3	Appearance	No defects or abnormalities		Visual inspection
4	Dimensions	Within the specified dimensions		Using calipers
5	Dielectric Strength	No defects or abnormalities		No failure should be observed when 300% of the rated voltage (5C) or 250% of the rated voltage (R7) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.
6	Insulation Resistance	More than 10,000MΩ or 500Ω · F (Whichever is smaller)		The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.
7	Capacitance	Within the specified tolerance		The capacitance/Q/D.F. should be measured at 25°C at the frequency and voltage shown in the table. (Table below)
8	Q/ Dissipation Factor (D.F.)	30pF min.: Q≧1000 30pF max.: Q≧400+20C C: Nominal Capacitance (pF)	(Table below)	
9	Capacitance Temperature Characteristics — Capacitance Change	Within the specified tolerance (Table A)	(Table below)	The capacitance change should be measured after 5 min. at each specified temperature stage. (1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the steps 1, 3 and 5 by the cap. value in step 3. (Step table below) (2) High Dielectric Constant Type The ranges of capacitance change compared with the above 25°C value over the temperature ranges shown in the table should be within the specified ranges.
	Capacitance Temperature Characteristics — Temperature Coefficent	Within the specified tolerance (Table A)		
	Capacitance Temperature Characteristics — Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.)		
10	Adhesive Strength of Termination	No removal of the terminations or other defect should occur. (Figure below)		Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 5N force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. (Table below)

Test method, items 7 and 8:

Char. / Item	5C	R7
Frequency	1±0.1MHz	1±0.1kHz
Voltage	0.5 to 5Vrms	1.0±0.2Vrms

Item 8, High Dielectric Type:

Char.	25V min.	16V	10V	6.3V
R7, R6	0.025 max.	0.035 max.	0.035 max.	0.05 max.

Item 9, High Dielectric Type:

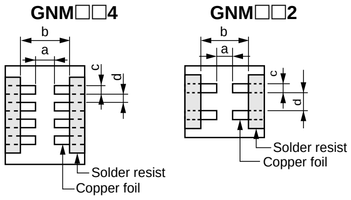
Char.	Temp. Range	Reference Temp.	Cap. Change
R7	–55°C to +125°C	25°C	Within ±15%
R6	–55°C to +85°C		

Item 9, Test Method:

Step	Temperature (°C)
1	25±2
2	–55±3 (for 5C/R7), –30±3 (for F5)
3	25±2
4	125±3 (for 5C/R7), 85±3 (for F5)
5	20±2

Item 10:

GNM□□4 **GNM□□2**



Type	a	b	c	d
GNM1M2	0.5	1.6	0.32	0.32
GNM212	0.6	1.8	0.5	0.5
GNM214	0.6	2.0	0.25	0.25
GNM314	0.8	2.5	0.4	0.4

(in mm)

Fig. 1

Continued on the following page.

GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td colspan="2">No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td colspan="2">Within the specified tolerance</td></tr>
<tr><td>Q/D.F.</td><td>30pF min.: Q≧1000
30pF max.: Q≧400+20C

C: Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>R7, R6</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td><td>0.05 max.</td></tr></table></td></tr>
<tr><td rowspan="2">12</td><td rowspan="2" colspan="2">Deflection</td><td colspan="2">No cracking or marking defects should occur.</td><td rowspan="2">Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder.
Then apply a force in the direction shown in Fig. 3 for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.

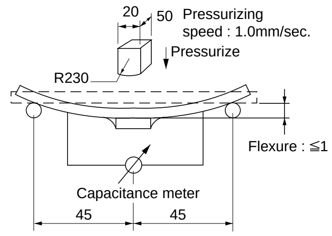
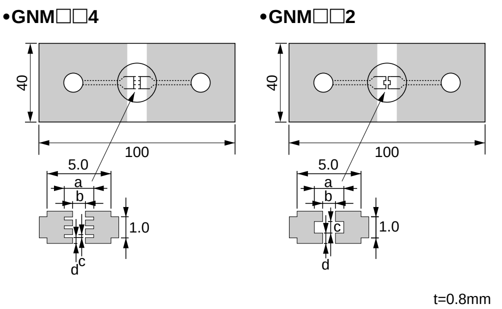



Fig. 3</td></tr>
<tr><td colspan="2"><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M2</td><td>2.0±0.05</td><td>0.5±0.05</td><td>0.32±0.05</td><td>0.32±0.05</td></tr><tr><td>GNM212</td><td>2.0±0.05</td><td>0.6±0.05</td><td>0.5±0.05</td><td>0.5±0.05</td></tr><tr><td>GNM214</td><td>2.0±0.05</td><td>0.7±0.05</td><td>0.3±0.05</td><td>0.2±0.05</td></tr><tr><td>GNM314</td><td>2.5±0.05</td><td>0.8±0.05</td><td>0.4±0.05</td><td>0.4±0.05</td></tr></table>(in mm)
Fig. 2</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td colspan="2">75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.</td></tr>
<tr><td rowspan="6">14</td><td colspan="2">Resistance to Soldering Heat</td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="6">Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.

• Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td rowspan="5"></td><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R7, R6: Within ±7.5%</td></tr>
<tr><td>Q/D.F.</td><td>30pF min.: Q≧1000
30pF max.: Q≧400+20C

C: Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>R7, R6</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td><td>0.05 max.</td></tr></table></td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

Continued on the following page.

GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td rowspan="6">15</td><td colspan="2">Temperature Cycle</td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="6">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.
<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. +0/–3</td><td>Room Temp.</td><td>Max. Operating Temp. +3/–0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>• Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R7, R6: Within ±7.5%</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pF min.: Q≧1000
30pF max.: Q≧400+20C
C:Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>R7, R6</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td><td>0.05 max.</td></tr></table></td></tr>
<tr><td></td><td>I.R.</td><td colspan="2">More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td rowspan="6">16</td><td colspan="2">Humidity Steady State</td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="6">Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours.
Remove and let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±5% or ±0.5pF (Whichever is larger)</td><td>R7, R6: Within ±12.5%</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pF and over: Q≧350
10pF and over, 30pF and below: Q≧275+5C/2
10pF and below: Q≧200+10C
C: Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V/6.3V</th></tr><tr><td>R7, R6</td><td>0.05 max.</td><td>0.05 max.</td><td>0.05 max.</td></tr></table></td></tr>
<tr><td></td><td>I.R.</td><td colspan="2">More than 1,000MΩ or 50Ω · F (Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td rowspan="6">17</td><td colspan="2">Humidity Load</td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="6">Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours.
Remove and let sit for 24±2 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±7.5% or ±0.75pF (Whichever is larger)</td><td>R7, R6: Within ±12.5%</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pF and over: Q≧200
30pF and below: Q≧100+10C/3
C: Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V/6.3V</th></tr><tr><td>R7, R6</td><td>0.05 max.</td><td>0.05 max.</td><td>0.05 max.</td></tr></table></td></tr>
<tr><td></td><td>I.R.</td><td colspan="2">More than 500MΩ or 25Ω · F (Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

Continued on the following page.

GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table.		Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. • Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 24±2 hours at room temperature. Perform initial measurement.
		Appearance	No marking defects		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	R7, R6: Within ±12.5%	
		Q/D.F.	30pF and over: Q≧350 10pF and over, 30pF and below: Q≧275+5C/2 10pF and below: Q≧200+10C C: Nominal Capacitance (pF)	Char. / 25V min. / 16V / 10V/6.3V R7, R6 / 0.04 max. / 0.05 max. / 0.05 max.	
		I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)		

7

Table A

Char.	Nominal Values (ppm/℃) Note 1	Capacitance Change from 25℃ (%)					
		−55℃		−30℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	−0.24	0.40	−0.17	0.25	−0.11

Note 1: Nominal values denote the temperature coefficient within a range of 25 to 125℃.

GNM Series Specifications and Test Methods (2)

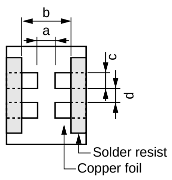
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>R6: −55°C to +85°C</td><td></td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance</td><td>50Ω · F min.</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 1 minute of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.
<table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>R6</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>0.1 max.</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change</th></tr><tr><td>R6</td><td>−55 to +85°C</td><td>25°C</td><td>Within ±15%</td></tr></table></td><td>The capacitance change should be measured affter 5 min.at each specified temperature stage.
<table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>85±3</td></tr><tr><td>5</td><td>25±2</td></tr></table>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.
• Initial measurement for high dielectric constant type.
Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defects should occur.


Fig. 1</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder.
Then apply 5N force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M2</td><td>0.5</td><td>1.6</td><td>0.32</td><td>0.32</td></tr><tr><td>GNM212</td><td>0.6</td><td>1.8</td><td>0.5</td><td>0.5</td></tr></table>(in mm)</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz.
The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>0.1 max.</td></tr>
</table>

Continued on the following page.

GNM Series Specifications and Test Methods (2)

Continued from the preceding page.

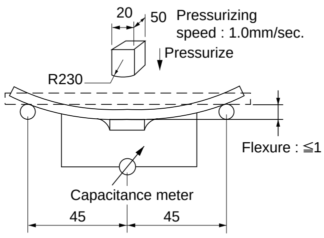
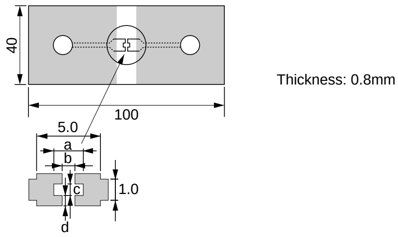
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur.


Fig. 3</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M2</td><td>2.0±0.5</td><td>0.5±0.05</td><td>0.32±0.05</td><td>0.32±0.05</td></tr><tr><td>GNM212</td><td>2.0±0.05</td><td>0.6±0.05</td><td>0.5±0.05</td><td>0.5±0.05</td></tr></table>(in mm)
Fig. 2</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds.
Let sit at room temperature for 24±2 hours, then measure.
• Initial measurement
Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>R6: Within ±7.5%</td></tr>
<tr><td>D.F.</td><td>0.1 max.</td></tr>
<tr><td>I.R.</td><td>50Ω · F min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).
Perform the five cycles according to the four heat treatments listed in the following table.
Let sit for 24±2 hours at room temperature, then measure.
<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (℃)</td><td>Min. Operating Temp.</td><td>Room Temp.</td><td>Max. Operating Temp.</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>• Initial measurement
Perform a heat treatment at 150 +0/-10 °C for one hour and then let sit for 24±2 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>R6: Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.1 max.</td></tr>
<tr><td>I.R.</td><td>50Ω · F min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">High Temperature High Humidity (Steady)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA.
• Initial measurement
Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature.
Perform the initial measurement.
• Measurement after test
Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>R6: Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.2 max.</td></tr>
<tr><td>I.R.</td><td>12.5Ω · F min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="5">17</td><td rowspan="5">Durability</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply 125% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.
• Initial measurement
Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature.
Perform the initial measurement.
• Measurement after test
Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>R6: Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.2 max.</td></tr>
<tr><td>I.R.</td><td>25Ω · F min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>

Chip Monolithic Ceramic Capacitors

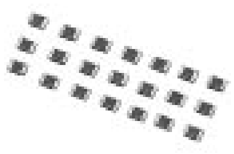
for Ultrasonic Sensors GRM Series

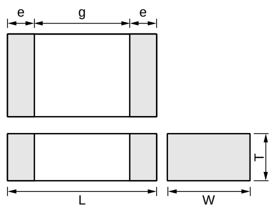
■ Features

1. Proper to compensate for ultrasonic sensor
2. Small chip size and high cap. value

■ Applications

Ultrasonic sensor
(Back sonar, Corner sonar, etc.)

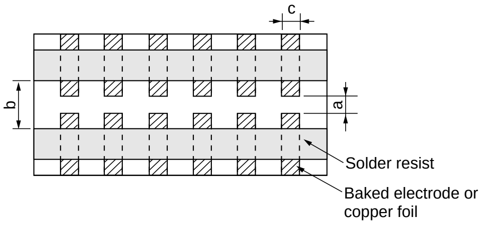




Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM2199E2A102KD42	ZLM (Murata)	100	1000 ±10%	2.0	1.25	0.85
GRM2199E2A152KD42	ZLM (Murata)	100	1500 ±10%	2.0	1.25	0.85

Specifications and Test Methods

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature</td><td>−25 to +85℃</td><td>Reference Temperature: 20°C</td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 10,000MΩ</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20℃ and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at 20℃ with 1±0.1kHz in frequency and 1±0.2Vrms in voltage.</td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>0.01 max.</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Within $-4{,}700^{+1{,}000}_{-2{,}500}$ ppm/℃ (at −25 to +20℃)
Within $-4{,}700^{+500}_{-1{,}000}$ ppm/℃ (at +20 to +85℃)</td><td>The temperature coefficient is determined using the capacitance measured in step 1 as a reference.
When cycling the temperature sequentially from step 1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient.
The capacitance change should be measured after 5 min. at each specified temperature stage.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>20±2</td></tr>
<tr><td>2</td><td>−25±3</td></tr>
<tr><td>3</td><td>20±2</td></tr>
<tr><td>4</td><td>85±3</td></tr>
<tr><td>5</td><td>20±2</td></tr>
</table></td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 10N force in the direction of the arrow.
The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>**GRM21**</td><td>1.2</td><td>4.0</td><td>1.65</td></tr>
</table>
(in mm)
Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>0.01 max.</td></tr>
</table>

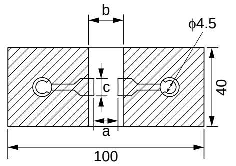
Continued on the following page.

muRata

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
12	Deflection		No cracking or marking defects should occur.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.



t : 1.6mm

Type	a	b	c
GRM21	1.2	4.0	1.65

(in mm)

Fig. 2

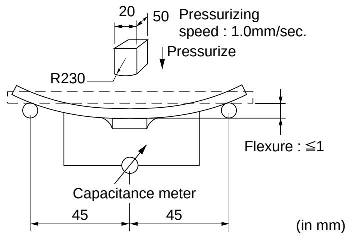


Fig.3

No.	Item		Specifications	Test Method
13	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.
14	Resistance to Soldering Heat	Appearance	No defects or abnormalities	Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.
		Capacitance Change	Within ±7.5%	
		D.F.	0.01 max.	
		I.R.	More than 10,000MΩ	
		Dielectric Strength	No failure	
15	Temperature Cycle	Appearance	No defects or abnormalities	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.
		Capacitance Change	Within ±7.5%	
		D.F.	0.01 max.	
		I.R.	More than 10,000MΩ	
		Dielectric Strength	No failure	
16	Humidity, Steady State	Appearance	No defects or abnormalities	Sit the capacitor at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.
		Capacitance Change	Within ±12.5%	
		D.F.	0.02 max.	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	No failure	
17	Humidity Load	Appearance	No defects or abnormalities	Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	Within ±12.5%	
		D.F.	0.02 max.	
		I.R.	More than 500MΩ	
18	High Temperature Load	Appearance	No defects or abnormalities	Apply 200% of the rated voltage for 1,000±12 hours at 85±3℃. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	Within ±12.5%	
		D.F.	0.02 max.	
		I.R.	More than 1,000MΩ	

Table for No. 15 (Temperature Cycle):

Step	1	2	3	4
Temp. (℃)	-25^{+0}_{-3}	Room Temp.	85^{+3}_{-0}	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

Chip Monolithic Ceramic Capacitors

muRata

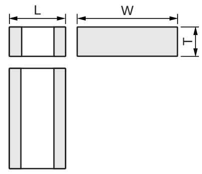
Low ESL LLL/LLA/LLM Series

■ Features (Reversed Geometry Low ESL Type)

1. Low ESL, good for noise reduction for high frequency
2. Small, high cap

■ Applications

1. High speed microprocessor
2. High frequency digital equipment



Part Number	Dimensions (mm)		
	L	W	T
LLL153	0.5 ±0.05	1.0 ±0.05	0.3 ±0.05
LLL185	0.8 ±0.1	1.6 ±0.1	0.6 max.
LLL215	1.25 ±0.1	2.0 ±0.1	0.5 +0/-0.15
LLL216			0.6 ±0.1
LLL219			0.85 ±0.1
LLL315	1.6 ±0.15	3.2 ±0.15	0.5 +0/-0.15
LLL317			0.7 ±0.1
LLL31M			1.15 ±0.1
LLL31B			1.25 +0.15/-0.05

Reversed Geometry Low ESL Type

Part Number	**LLL15**	**LLL18**						**LLL21**						**LLL31**					
L x W	0.5x1.0	0.8x1.6						1.25x2.0						1.6x3.2					
TC	X6S (**C8**)	X7R (**R7**)					X7S (**C7**)	X7R (**R7**)					X7S (**C7**)	X7R (**R7**)					X7S (**C7**)
Rated Volt.	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																			
2200pF (**222**)		0.5 (**5**)																	
4700pF (**472**)		0.5 (**5**)						0.6 (**6**)											
10000pF (**103**)			0.5 (**5**)					0.6 (**6**)						0.7 (**7**)					
22000pF (**223**)			0.5 (**5**)					0.6 (**6**)						0.7 (**7**)					
47000pF (**473**)				0.5 (**5**)					0.6 (**6**)					0.7 (**7**)					
0.10µF (**104**)	0.3 (**3**)				0.5 (**5**)				0.6 (**6**)					1.15 (**M**)	0.7 (**7**)				
0.22µF (**224**)						0.5 (**5**)				0.85 (**9**)	0.6 (**6**)				1.15 (**M**)	0.7 (**7**)			
0.47µF (**474**)							0.5 (**5**)				0.85 (**9**)				1.15 (**M**)	0.7 (**7**)			
1.0µF (**105**)							0.5 (**5**)					0.85 (**9**)				1.15 (**M**)	0.7 (**7**)		
2.2µF (**225**)							0.5 (**5**)						0.85 (**9**)				1.15 (**M**)	0.7 (**7**)	
4.7µF (**475**)																		1.15 (**M**)	
10µF (**106**)																			1.25 (**B**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
Please refer to Specifications and Test Method (2) about LLL15 Series and LLL18 Series 1.0µF/2.2µF type.

muRata

Reversed Geometry Low ESL Type Low Profile

Part Number	**LLL18**				**LLL21**						**LLL31**			
L x W	0.8x1.6				1.25x2.0						1.6x3.2			
TC	X7R (**R7**)			X7S (**C7**)	X7R (**R7**)					X7S (**C7**)	X7R (**R7**)			
Rated Volt.	25 (**1E**)	16 (**1C**)	10 (**1A**)	4 (**0G**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)														
1000pF(**102**)					0.5(**5**)									
2200pF(**222**)					0.5(**5**)									
4700pF(**472**)					0.5(**5**)									
10000pF(**103**)	0.5(**5**)				0.5(**5**)						0.5(**5**)			
22000pF(**223**)		0.5(**5**)				0.5(**5**)					0.5(**5**)			
47000pF(**473**)		0.5(**5**)					0.5(**5**)					0.5(**5**)		
0.10µF(**104**)			0.5(**5**)				0.5(**5**)					0.5(**5**)		
0.22µF(**224**)				0.5(**5**)				0.5(**5**)					0.5(**5**)	
0.47µF(**474**)									0.5(**5**)					0.5(**5**)
1.0µF(**105**)										0.5(**5**)				

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

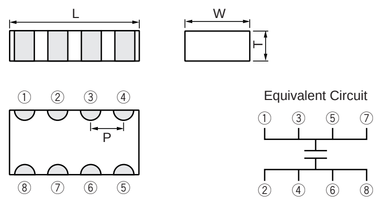
9

■ Features (Eight Terminals Low ESL Type)

1. Low ESL(100pH), suitable to decoupling capacitor for 1GHz clock speed IC.
2. Small, large cap

■ Applications

1. High speed microprocessor
2. High frequency digital equipment



Part Number	Dimensions (mm)			
	L	W	T	P
LLA185	1.6 ±0.1	0.8 ±0.1	0.5 +0.05/-0.1	0.4 ±0.1
LLA215	2.0 ±0.1	1.25 ±0.1	0.5 +0.05/-0.1	0.5 ±0.05
LLA219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.5 ±0.05
LLA315	3.2 ±0.15	1.6 ±0.15	0.5 +0.05/-0.1	0.8 ±0.1
LLA319	3.2 ±0.15	1.6 ±0.15	0.85 ±0.1	0.8 ±0.1
LLA31M	3.2 ±0.15	1.6 ±0.15	1.15±0.1	0.8 ±0.1

Eight Terminals Low ESL Type

Part Number	**LLA18**	**LLA21**					**LLA31**		
L x W	1.6x0.8	2.0x1.25					3.2x1.6		
TC	X7S (**C7**)	X7R (**R7**)				X7S (**C7**)	X7R (**R7**)		
Rated Volt.	4 (**0G**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	16 (**1C**)	10 (**1A**)	4 (**0G**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)									
10000pF(**103**)		0.85(**9**)							
22000pF(**223**)		0.85(**9**)							
47000pF(**473**)		0.85(**9**)							
0.10µF(**104**)	0.5(**5**)		0.85(**9**)				0.85(**9**)		
0.22µF(**224**)	0.5(**5**)		0.85(**9**)				0.85(**9**)		
0.47µF(**474**)	0.5(**5**)			0.85(**9**)			0.85(**9**)		
1.0µF(**105**)	0.5(**5**)				0.85(**9**)			0.85(**9**)	
2.2µF(**225**)	0.5(**5**)					0.85(**9**)		1.15(**M**)	0.85(**9**)
4.7µF(**475**)						0.85(**9**)			

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
Please refer to Specifications and Test Method (2) about LLA18 Series 1.0µF/2.2µF type and LLA21 Series 4.7µF type.

Eight Terminals Low ESL Type Low Profile

Part Number	LLA21					LLA31		
L x W	2.0x1.25					3.2x1.6		
TC	X7R (**R7**)				X7S (**C7**)	X7R (**R7**)		
Rated Volt.	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)	4 (**0G**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)								
10000pF(**103**)	0.5(**5**)							
22000pF(**223**)	0.5(**5**)							
47000pF(**473**)		0.5(**5**)						
0.10µF(**104**)		0.5(**5**)				0.5(**5**)		
0.22µF(**224**)			0.5(**5**)	0.5(**5**)		0.5(**5**)		
0.47µF(**474**)				0.5(**5**)			0.5(**5**)	
1.0µF(**105**)					0.5(**5**)			0.5(**5**)
2.2µF(**225**)					0.5(**5**)			0.5(**5**)
4.7µF(**475**)					0.5(**5**)			

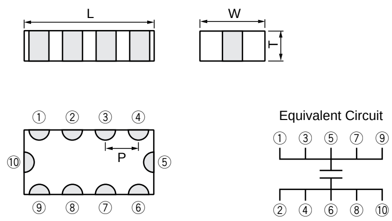
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
Please refer to Specifications and Test Method (2) about LLA21 Series (Low Profile) 2.2µF/4.7µF type.

■ Features (Ten Terminals Low ESL Type)

1. Low ESL(45pH), suitable to decoupling capacitor for 2GHz clock speed IC.
2. Small, large cap

■ Applications

1. High speed microprocessor
2. High frequency digital equipment



Part Number	Dimensions (mm)			
	L	W	T	P
LLM215	2.0 ±0.1	1.25 ±0.1	0.5 +0.05/-0.1	0.5 ±0.05
LLM315	3.2 ±0.15	1.6 ±0.15	0.5 +0.05/-0.1	0.8 ±0.1

Ten Terminals Low ESL Type Low Profile

Part Number	LLM21				LLM31		
L x W	2.0x1.25				3.2x1.6		
TC	X7R (**R7**)			X7S (**C7**)	X7R (**R7**)		
Rated Volt.	25 (**1E**)	16 (**1C**)	6.3 (**0J**)	4 (**0G**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)							
10000pF(**103**)	0.5(**5**)						
22000pF(**223**)	0.5(**5**)						
47000pF(**473**)		0.5(**5**)					
0.10µF(**104**)		0.5(**5**)			0.5(**5**)		
0.22µF(**224**)			0.5(**5**)		0.5(**5**)		
0.47µF(**474**)			0.5(**5**)			0.5(**5**)	
1.0µF(**105**)				0.5(**5**)			
2.2µF(**225**)				0.5(**5**)			0.5(**5**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.
Please refer to Specifications and Test Method (2) about LLM21 Series (Low Profile) 2.2µF type.

LLL/LLA/LLM Series Specifications and Test Methods (1)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>R7, C7: −55 to +125°C</td><td></td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance</td><td>More than 10,000MΩ or 500Ω · F
(Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.
<table>
<tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr>
<tr><td>C≦10μF (10V min.)</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr>
<tr><td>C≦10μF (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr>
<tr><td>C>10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr>
</table></td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>W.V.: 25V min.; 0.025 max.
W.V.: 16V max.; 0.035 max. *1</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td>
<table>
<tr><th>Char.</th><th>Temp. Range (°C)</th><th>Reference Temp.</th><th>Cap.Change</th></tr>
<tr><td>R7</td><td>−55 to +125</td><td>25°C</td><td>Within ±15%</td></tr>
<tr><td>C7</td><td>−55 to +125</td><td>25°C</td><td>Within ±22%</td></tr>
</table></td><td>The capacitance change should be measured after 5 min. at each specified temperature stage.
<table>
<tr><th>Step</th><th>Temperature (°C)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>−55±3</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>125±3</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table>
The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 10N✻ force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. ✻LLL18 and LLA/LLM Series: 5N</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>W.V.: 25V min.; 0.025 max.
W.V.: 16V max.; 0.035 max. *1</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.

• Initial measurement.
Perform a heat treatment at 150^{+0}_{-10}°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5%</td></tr>
<tr><td>D.F.</td><td>W.V.: 25V min.; 0.025 max.
W.V.: 16V max.; 0.035 max. *1</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>

Continued on the following page.

muRata

LLL/LLA/LLM Series Specifications and Test Methods (1)

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).
Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.
<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. $^{+0}_{-3}$</td><td>Room Temp.</td><td>Max. Operating Temp. $^{+3}_{-0}$</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>• Initial measurement.
Perform a heat treatment at 150$^{+0}_{-10}$°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5% *1</td></tr>
<tr><td>D.F.</td><td>W.V.: 25V min.; 0.025 max.
W.V.: 16V max.; 0.035 max. *1</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="4">15</td><td rowspan="4">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5% *1</td></tr>
<tr><td>D.F.</td><td>0.05 max. *1</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 50Ω · F (Whichever is smaller)</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Humidity Load</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5% *1</td></tr>
<tr><td>D.F.</td><td>0.05 max. *1</td></tr>
<tr><td>I.R.</td><td>More than 500MΩ or 25Ω · F *1
(Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="5">17</td><td rowspan="5">High Temperature Load</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.

•Initial measurement.
Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 24±2 hours at room temperature.
Perform initial measurement. (*1)</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5% *1</td></tr>
<tr><td>D.F.</td><td>W.V.: 25V min.; 0.04 max.
W.V.: 16V max.; 0.05 max. *1</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 50Ω · F *1
(Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>

*1: The figure indicates typical inspection.Please refer to individual specifications.

LLL/LLA/LLM Series Specifications and Test Methods (2)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>R7, C7: −55 to +125°C
C8: −55 to +105°C</td><td></td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance</td><td>50Ω · F min.</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 1 minute of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.
<table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>C≦10μF (10V min.)</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>C≦10μF (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>C>10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>R7, C7, C8: 0.120 max.</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Temp. Range (°C)</th><th>Reference Temp.</th><th>Cap.Change</th></tr><tr><td>R7</td><td>−55 to +125</td><td rowspan="3">25°C</td><td>Within ±15%</td></tr><tr><td>C7</td><td>−55 to +125</td><td>Within ±22%</td></tr><tr><td>C8</td><td>−55 to +105</td><td>Within ±22%</td></tr></table></td><td>The capacitance change should be measured after 5 min. at each specified temperature stage.
The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *5N (LLL15, LLL18, LLA,LLM Series)</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>R7, C7, C8: 0.120 max.</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds.
Let sit at room temperature for 24±2 hours, then measure.

• Initial measurement.
Perform a heat treatment at 150^{+0}_{-10}°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>R7, C7, C8: Within ±7.5%</td></tr>
<tr><td>D.F.</td><td>R7, C7, C8: 0.120 max.</td></tr>
<tr><td>I.R.</td><td>50Ω · F min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>

Continued on the following page. ↗

LLL/LLA/LLM Series Specifications and Test Methods (2)

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Temperature Sudden Change</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.
<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. $^{+0}_{-3}$</td><td>Room Temp.</td><td>Max. Operating Temp. $^{+3}_{-0}$</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>• Initial measurement
Perform a heat treatment at 150$^{+0}_{-10}$°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>R7, C7, C8: Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>R7, C7, C8: 0.120 max.</td></tr>
<tr><td>I.R.</td><td>50Ω · F min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="4">15</td><td rowspan="4">High Temperatue High Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours.
The charge/discharge current is less than 50mA.

•Initial measurement
Perform a heat treatment at 150$^{+0}_{-10}$°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.

•Measurement after test
Perform a heat treatment at 150$^{+0}_{-10}$°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>R7, C7, C8: Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>R7, C7, C8: 0.2 max.</td></tr>
<tr><td>I.R.</td><td>12.5Ω · F min.</td></tr>
<tr><td rowspan="4">16</td><td rowspan="4">Durability</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C.
The charge/discharge current is less than 50mA.

•Initial measurement
Perform a heat treatment at 150$^{+0}_{-10}$°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.

•Measurement after test
Perform a heat treatment at 150$^{+0}_{-10}$°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>R7, C7, C8: Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>R7, C7, C8: 0.2 max.</td></tr>
<tr><td>I.R.</td><td>25Ω · F min.</td></tr>
</table>

Chip Monolithic Ceramic Capacitors

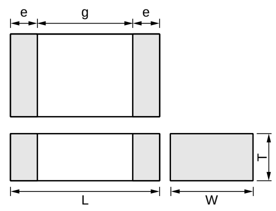
High-Q GJM Series

■ Features

1. Mobile telecommunications and RF module, mainly
2. Quality improvement of telephone call, low power consumption, yield ratio improvement

■ Applications

VCO, PA, Mobile telecommunications



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GJM03	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2
GJM15	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4

Part Number	**GJM03**	**GJM15**
L x W [EIA]	0.6x0.3 [0201]	1.0x0.5 [0402]
TC	C0G (**5C**)	C0G (**5C**)
Rated Volt.	25 (**1E**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)		
0.20pF(**R20**)	0.3(**3**)	
0.30pF(**R30**)	0.3(**3**)	0.5(**5**)
0.40pF(**R40**)	0.3(**3**)	0.5(**5**)
0.50pF(**R50**)	0.3(**3**)	0.5(**5**)
0.60pF(**R60**)	0.3(**3**)	0.5(**5**)
0.70pF(**R70**)	0.3(**3**)	0.5(**5**)
0.75pF(**R75**)	0.3(**3**)	0.5(**5**)
0.80pF(**R80**)	0.3(**3**)	0.5(**5**)
0.90pF(**R90**)	0.3(**3**)	0.5(**5**)
1.0pF(**1R0**)	0.3(**3**)	0.5(**5**)
1.1pF(**1R1**)	0.3(**3**)	0.5(**5**)
1.2pF(**1R2**)	0.3(**3**)	0.5(**5**)
1.3pF(**1R3**)	0.3(**3**)	0.5(**5**)
1.4pF(**1R4**)	0.3(**3**)	0.5(**5**)
1.5pF(**1R5**)	0.3(**3**)	0.5(**5**)
1.6pF(**1R6**)	0.3(**3**)	0.5(**5**)
1.7pF(**1R7**)	0.3(**3**)	0.5(**5**)
1.8pF(**1R8**)	0.3(**3**)	0.5(**5**)
1.9pF(**1R9**)	0.3(**3**)	0.5(**5**)
2.0pF(**2R0**)	0.3(**3**)	0.5(**5**)
2.1pF(**2R1**)	0.3(**3**)	0.5(**5**)
2.2pF(**2R2**)	0.3(**3**)	0.5(**5**)
2.3pF(**2R3**)	0.3(**3**)	0.5(**5**)
2.4pF(**2R4**)	0.3(**3**)	0.5(**5**)
2.5pF(**2R5**)	0.3(**3**)	0.5(**5**)
2.6pF(**2R6**)	0.3(**3**)	0.5(**5**)
2.7pF(**2R7**)	0.3(**3**)	0.5(**5**)
2.8pF(**2R8**)	0.3(**3**)	0.5(**5**)
2.9pF(**2R9**)	0.3(**3**)	0.5(**5**)
3.0pF(**3R0**)	0.3(**3**)	0.5(**5**)
3.1pF(**3R1**)	0.3(**3**)	0.5(**5**)
3.2pF(**3R2**)	0.3(**3**)	0.5(**5**)
3.3pF(**3R3**)	0.3(**3**)	0.5(**5**)

Continued on the following page.

Continued from the preceding page.

Part Number	**GJM03**	**GJM15**
L x W [EIA]	0.6x0.3 [0201]	1.0x0.5 [0402]
TC	C0G (**5C**)	C0G (**5C**)
Rated Volt.	25 (**1E**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)		
3.4pF(**3R4**)	0.3(**3**)	0.5(**5**)
3.5pF(**3R5**)	0.3(**3**)	0.5(**5**)
3.6pF(**3R6**)	0.3(**3**)	0.5(**5**)
3.7pF(**3R7**)	0.3(**3**)	0.5(**5**)
3.8pF(**3R8**)	0.3(**3**)	0.5(**5**)
3.9pF(**3R9**)	0.3(**3**)	0.5(**5**)
4.0pF(**4R0**)	0.3(**3**)	0.5(**5**)
4.1pF(**4R1**)	0.3(**3**)	0.5(**5**)
4.2pF(**4R2**)	0.3(**3**)	0.5(**5**)
4.3pF(**4R3**)	0.3(**3**)	0.5(**5**)
4.4pF(**4R4**)	0.3(**3**)	0.5(**5**)
4.5pF(**4R5**)	0.3(**3**)	0.5(**5**)
4.6pF(**4R6**)	0.3(**3**)	0.5(**5**)
4.7pF(**4R7**)	0.3(**3**)	0.5(**5**)
4.8pF(**4R8**)	0.3(**3**)	0.5(**5**)
4.9pF(**4R9**)	0.3(**3**)	0.5(**5**)
5.0pF(**5R0**)	0.3(**3**)	0.5(**5**)
5.1pF(**5R1**)	0.3(**3**)	0.5(**5**)
5.2pF(**5R2**)	0.3(**3**)	0.5(**5**)
5.3pF(**5R3**)	0.3(**3**)	0.5(**5**)
5.4pF(**5R4**)	0.3(**3**)	0.5(**5**)
5.5pF(**5R5**)	0.3(**3**)	0.5(**5**)
5.6pF(**5R6**)	0.3(**3**)	0.5(**5**)
5.7pF(**5R7**)	0.3(**3**)	0.5(**5**)
5.8pF(**5R8**)	0.3(**3**)	0.5(**5**)
5.9pF(**5R9**)	0.3(**3**)	0.5(**5**)
6.0pF(**6R0**)	0.3(**3**)	0.5(**5**)
6.1pF(**6R1**)	0.3(**3**)	0.5(**5**)
6.2pF(**6R2**)	0.3(**3**)	0.5(**5**)
6.3pF(**6R3**)	0.3(**3**)	0.5(**5**)
6.4pF(**6R4**)	0.3(**3**)	0.5(**5**)
6.5pF(**6R5**)	0.3(**3**)	0.5(**5**)
6.6pF(**6R6**)	0.3(**3**)	0.5(**5**)
6.7pF(**6R7**)	0.3(**3**)	0.5(**5**)
6.8pF(**6R8**)	0.3(**3**)	0.5(**5**)
6.9pF(**6R9**)		0.5(**5**)
7.0pF(**7R0**)		0.5(**5**)
7.1pF(**7R1**)		0.5(**5**)
7.2pF(**7R2**)		0.5(**5**)
7.3pF(**7R3**)		0.5(**5**)
7.4pF(**7R4**)		0.5(**5**)
7.5pF(**7R5**)		0.5(**5**)
7.6pF(**7R6**)		0.5(**5**)
7.7pF(**7R7**)		0.5(**5**)
7.8pF(**7R8**)		0.5(**5**)
7.9pF(**7R9**)		0.5(**5**)
8.0pF(**8R0**)		0.5(**5**)
8.1pF(**8R1**)		0.5(**5**)
8.2pF(**8R2**)		0.5(**5**)
8.3pF(**8R3**)		0.5(**5**)
8.4pF(**8R4**)		0.5(**5**)
8.5pF(**8R5**)		0.5(**5**)

Continued on the following page.

Continued from the preceding page.

Part Number	**GJM03**	**GJM15**
L x W [EIA]	0.6x0.3 [0201]	1.0x0.5 [0402]
TC	C0G (**5C**)	C0G (**5C**)
Rated Volt.	25 (**1E**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)		
8.6pF(**8R6**)		0.5(**5**)
8.7pF(**8R7**)		0.5(**5**)
8.8pF(**8R8**)		0.5(**5**)
8.9pF(**8R9**)		0.5(**5**)
9.0pF(**9R0**)		0.5(**5**)
9.1pF(**9R1**)		0.5(**5**)
9.2pF(**9R2**)		0.5(**5**)
9.3pF(**9R3**)		0.5(**5**)
9.4pF(**9R4**)		0.5(**5**)
9.5pF(**9R5**)		0.5(**5**)
9.6pF(**9R6**)		0.5(**5**)
9.7pF(**9R7**)		0.5(**5**)
9.8pF(**9R8**)		0.5(**5**)
9.9pF(**9R9**)		0.5(**5**)
10pF(**100**)		0.5(**5**)
12pF(**120**)		0.5(**5**)
15pF(**150**)		0.5(**5**)
18pF(**180**)		0.5(**5**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Chip Monolithic Ceramic Capacitors

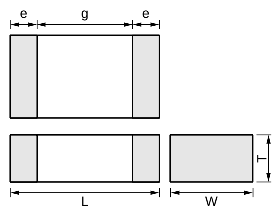
Tight Tolerance High-Q GJM Series

■ Features

1. Mobile telecommunications and RF module, mainly
2. Quality improvement of telephone call, low power consumption, yield ratio improvement

■ Applications

VCO, PA, Mobile telecommunications



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GJM03	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2
GJM15	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4

Part Number		**GJM03**	**GJM15**
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
0.10pF(**R10**)	**W, B**		0.5(**5**)
0.20pF(**R20**)	**W, B**	0.3(**3**)	0.5(**5**)
0.30pF(**R30**)	**W, B**	0.3(**3**)	0.5(**5**)
0.40pF(**R40**)	**W, B**	0.3(**3**)	0.5(**5**)
0.50pF(**R50**)	**W, B**	0.3(**3**)	0.5(**5**)
0.60pF(**R60**)	**W, B**	0.3(**3**)	0.5(**5**)
0.70pF(**R70**)	**W, B**	0.3(**3**)	0.5(**5**)
0.80pF(**R80**)	**W, B**	0.3(**3**)	0.5(**5**)
0.90pF(**R90**)	**W, B**	0.3(**3**)	0.5(**5**)
1.0pF(**1R0**)	**W, B**	0.3(**3**)	0.5(**5**)
1.1pF(**1R1**)	**W, B**	0.3(**3**)	0.5(**5**)
1.2pF(**1R2**)	**W, B**	0.3(**3**)	0.5(**5**)
1.3pF(**1R3**)	**W, B**	0.3(**3**)	0.5(**5**)
1.4pF(**1R4**)	**W, B**	0.3(**3**)	0.5(**5**)
1.5pF(**1R5**)	**W, B**	0.3(**3**)	0.5(**5**)
1.6pF(**1R6**)	**W, B**	0.3(**3**)	0.5(**5**)
1.7pF(**1R7**)	**W, B**	0.3(**3**)	0.5(**5**)
1.8pF(**1R8**)	**W, B**	0.3(**3**)	0.5(**5**)
1.9pF(**1R9**)	**W, B**	0.3(**3**)	0.5(**5**)
2.0pF(**2R0**)	**W, B**	0.3(**3**)	0.5(**5**)
2.1pF(**2R1**)	**W, B**	0.3(**3**)	0.5(**5**)
2.2pF(**2R2**)	**W, B**	0.3(**3**)	0.5(**5**)
2.3pF(**2R3**)	**W, B**	0.3(**3**)	0.5(**5**)
2.4pF(**2R4**)	**W, B**	0.3(**3**)	0.5(**5**)
2.5pF(**2R5**)	**W, B**	0.3(**3**)	0.5(**5**)
2.6pF(**2R6**)	**W, B**	0.3(**3**)	0.5(**5**)
2.7pF(**2R7**)	**W, B**	0.3(**3**)	0.5(**5**)
2.8pF(**2R8**)	**W, B**	0.3(**3**)	0.5(**5**)
2.9pF(**2R9**)	**W, B**	0.3(**3**)	0.5(**5**)
3.0pF(**3R0**)	**W, B**	0.3(**3**)	0.5(**5**)
3.1pF(**3R1**)	**W, B**	0.3(**3**)	0.5(**5**)
3.2pF(**3R2**)	**W, B**	0.3(**3**)	0.5(**5**)
3.3pF(**3R3**)	**W, B**	0.3(**3**)	0.5(**5**)

Continued on the following page. ↗

Continued from the preceding page.

Part Number		GJM03	GJM15
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
3.4pF(**3R4**)	**W, B**	0.3(**3**)	0.5(**5**)
3.5pF(**3R5**)	**W, B**	0.3(**3**)	0.5(**5**)
3.6pF(**3R6**)	**W, B**	0.3(**3**)	0.5(**5**)
3.7pF(**3R7**)	**W, B**	0.3(**3**)	0.5(**5**)
3.8pF(**3R8**)	**W, B**	0.3(**3**)	0.5(**5**)
3.9pF(**3R9**)	**W, B**	0.3(**3**)	0.5(**5**)
4.0pF(**4R0**)	**W, B**	0.3(**3**)	0.5(**5**)
4.1pF(**4R1**)	**W, B**	0.3(**3**)	0.5(**5**)
4.2pF(**4R2**)	**W, B**	0.3(**3**)	0.5(**5**)
4.3pF(**4R3**)	**W, B**	0.3(**3**)	0.5(**5**)
4.4pF(**4R4**)	**W, B**	0.3(**3**)	0.5(**5**)
4.5pF(**4R5**)	**W, B**	0.3(**3**)	0.5(**5**)
4.6pF(**4R6**)	**W, B**	0.3(**3**)	0.5(**5**)
4.7pF(**4R7**)	**W, B**	0.3(**3**)	0.5(**5**)
4.8pF(**4R8**)	**W, B**	0.3(**3**)	0.5(**5**)
4.9pF(**4R9**)	**W, B**	0.3(**3**)	0.5(**5**)
5.0pF(**5R0**)	**W, B**	0.3(**3**)	0.5(**5**)
5.1pF(**5R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.2pF(**5R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.3pF(**5R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.4pF(**5R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.5pF(**5R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.6pF(**5R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.7pF(**5R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.8pF(**5R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
5.9pF(**5R9**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.0pF(**6R0**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.1pF(**6R1**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.2pF(**6R2**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.3pF(**6R3**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.4pF(**6R4**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.5pF(**6R5**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.6pF(**6R6**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.7pF(**6R7**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.8pF(**6R8**)	**W, B, C**	0.3(**3**)	0.5(**5**)
6.9pF(**6R9**)	**W, B, C**		0.5(**5**)
7.0pF(**7R0**)	**W, B, C**		0.5(**5**)
7.1pF(**7R1**)	**W, B, C**		0.5(**5**)
7.2pF(**7R2**)	**W, B, C**		0.5(**5**)
7.3pF(**7R3**)	**W, B, C**		0.5(**5**)
7.4pF(**7R4**)	**W, B, C**		0.5(**5**)
7.5pF(**7R5**)	**W, B, C**		0.5(**5**)
7.6pF(**7R6**)	**W, B, C**		0.5(**5**)
7.7pF(**7R7**)	**W, B, C**		0.5(**5**)
7.8pF(**7R8**)	**W, B, C**		0.5(**5**)
7.9pF(**7R9**)	**W, B, C**		0.5(**5**)
8.0pF(**8R0**)	**W, B, C**		0.5(**5**)
8.1pF(**8R1**)	**W, B, C**		0.5(**5**)
8.2pF(**8R2**)	**W, B, C**		0.5(**5**)
8.3pF(**8R3**)	**W, B, C**		0.5(**5**)
8.4pF(**8R4**)	**W, B, C**		0.5(**5**)
8.5pF(**8R5**)	**W, B, C**		0.5(**5**)

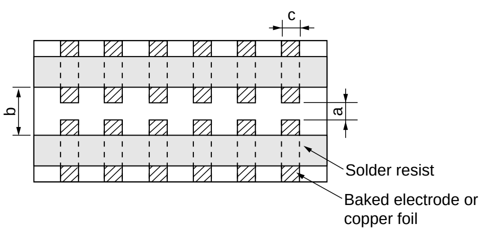
Continued on the following page.

Continued from the preceding page.

Part Number		GJM03	GJM15
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
8.6pF(**8R6**)	**W, B, C**		0.5(**5**)
8.7pF(**8R7**)	**W, B, C**		0.5(**5**)
8.8pF(**8R8**)	**W, B, C**		0.5(**5**)
8.9pF(**8R9**)	**W, B, C**		0.5(**5**)
9.0pF(**9R0**)	**W, B, C**		0.5(**5**)
9.1pF(**9R1**)	**W, B, C**		0.5(**5**)
9.2pF(**9R2**)	**W, B, C**		0.5(**5**)
9.3pF(**9R3**)	**W, B, C**		0.5(**5**)
9.4pF(**9R4**)	**W, B, C**		0.5(**5**)
9.5pF(**9R5**)	**W, B, C**		0.5(**5**)
9.6pF(**9R6**)	**W, B, C**		0.5(**5**)
9.7pF(**9R7**)	**W, B, C**		0.5(**5**)
9.8pF(**9R8**)	**W, B, C**		0.5(**5**)
9.9pF(**9R9**)	**W, B, C**		0.5(**5**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Specifications and Test Methods

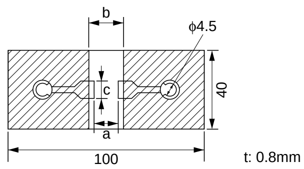
<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th>Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>Reference Temperature: 25℃
(2C, 3C, 4C: 20℃)</td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>10,000MΩ min. or 500Ω · F min. (Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table.<table><tr><td>Frequency</td><td>1±0.1MHz</td></tr><tr><td>Voltage</td><td>0.5 to 5Vrms</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Q</td><td>30pF max.: Q≧400+20C
C: Nominal Capacitance (pF)</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Characteristics</td><td>Capacitance Change</td><td>Within the specified tolerance (Table A)</td><td rowspan="3">The capacitance change should be measured after 5 min. at each specified temperature stage.
Temperature Compensating Type
The temperature coefficient is determined using the capacitance measured in step 3 as a reference.
When cycling the temperature sequentially from step 1 through 5, (5C: +25 to 125℃: other temp. coeffs.: +20 to 125℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.
The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.<table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>Reference Temp. ±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>Reference Temp. ±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>Reference Temp. ±2</td></tr></table></td></tr>
<tr><td>Temperature Coefficient</td><td>Within the specified tolerance (Table A)</td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05pF
(Whichever is larger.)</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply a 5N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *2N (GJM03)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GJM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GJM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr></table>(in mm)
Fig. 1</td></tr>
</table>

Continued on the following page. ↗

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Test Method
11	Vibration Resistance	Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).
		Capacitance	Within the specified tolerance	
		Q	Q≧400+20C C: Nominal Capacitance (pF)	
12	Deflection		No cracking or marking defects should occur.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.



Type	a	b	c
GJM03	0.3	0.9	0.3
GJM15	0.4	1.5	0.5

(in mm)

Fig. 2

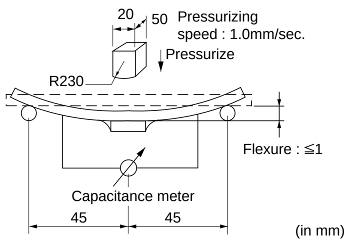


Fig. 3

No.	Item		Specifications: Temperature Compensating Type	Test Method
13	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.
14	Resistance to Soldering Heat		The measured and observed characteristics should satisfy the specifications in the following table.	Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours.
		Appearance	No marking defects	
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	
		Q	Q≧400+20C C: Nominal Capacitance (pF)	
		I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)	
		Dielectric Strength	No failure	
15	Temperature Cycle		The measured and observed characteristics should satisfy the specifications in the following table.	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.
		Appearance	No marking defects	
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	
		Q	Q≧400+20C C: Nominal Capacitance (pF)	
		I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)	
		Dielectric Strength	No failure	

Step	1	2	3	4
Temp. (℃)	Min. Operating Temp. $^{+0}_{-3}$	Room Temp.	Max. Operating Temp. $^{+3}_{-0}$	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

No.	Item		Specifications: Temperature Compensating Type	Test Method
16	Humidity, Steady State		The measured and observed characteristics should satisfy the specifications in the following table.	Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.
		Appearance	No marking defects	
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	
		Q	10pF and over, 30pF and below: $Q \geqq 275+\frac{5}{2}C$ 10pF and below: Q≧200+10C C: Nominal Capacitance (pF)	
		I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)	

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Test Method
17	Humidity Load		The measured and observed characteristics should satisfy the specifications in the following table.	Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Appearance	No marking defects	
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	
		Q	30pF and below: Q≧100+ $\frac{10}{3}$ C C: Nominal Capacitance (pF)	
		I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)	
		Dielectric Strength	No failure	
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table.	Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. The charge/discharge current is less than 50mA.
		Appearance	No marking defects	
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	
		Q	10pF and over, 30pF and below: Q≧275+ $\frac{5}{2}$ C 10pF and below: Q≧200+10C C: Nominal Capacitance (pF)	
		I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)	
		Dielectric Strength	No failure	
19	ESR		0.5pF≦C≦1pF: 350mΩ below 1pF<C≦5pF: 300mΩ below 5pF<C≦10pF: 250mΩ below	The ESR should be measured at room temperature, and frequency 1±0.2GHz with the equivalent of BOONTON Model 34A.
			10pF<C≦20pF: 400mΩ below	The ESR should be measured at room temperature, and frequency 500±50MHz with the equivalent of HP8753B.

Table A

(1)

Char. Code	Temp. Coeff. (ppm/℃) *1	Capacitance Change from 25℃ Value (%)					
		−55℃		−30℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	−0.24	0.40	−0.17	0.25	−0.11

*1: Nominal values denote the temperature coefficient within a range of 25 to 125℃.

(2)

Char.	Nominal Values (ppm/℃) *2	Capacitance Change from 20℃ Value (%)					
		−55℃		−25℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
2C	0±60	0.82	−0.45	0.49	−0.27	0.33	−0.18
3C	0±120	0.37	−0.90	0.82	−0.54	0.55	−0.36
4C	0±250	0.56	−0.88	1.54	−1.13	1.02	−0.75

*2: Nominal values denote the temperature coefficient within a range of 20 to 125℃.

Chip Monolithic Ceramic Capacitors

muRata

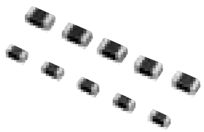
High Frequency GQM Series

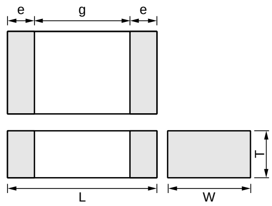
■ Features

1. HiQ and low ESR at VHF, UHF, Microwave
2. Feature improvement, low power consumption for mobile telecommunications (Base station, terminal, etc.)

■ Applicatons

High frequency circuit (Mobile telecommunications, etc.)





Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GQM188	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
GQM219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7

Part Number	**GQM18**		**GQM21**	
L x W	1.6x0.8		2.0x1.25	
TC	C0G (**5C**)		C0G (**5C**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
0.50pF(**R50**)	0.8(**8**)		0.85(**9**)	
0.75pF(**R75**)	0.8(**8**)		0.85(**9**)	
1.0pF(**1R0**)	0.8(**8**)		0.85(**9**)	
1.1pF(**1R1**)	0.8(**8**)		0.85(**9**)	
1.2pF(**1R2**)	0.8(**8**)		0.85(**9**)	
1.3pF(**1R3**)	0.8(**8**)		0.85(**9**)	
1.5pF(**1R5**)	0.8(**8**)		0.85(**9**)	
1.6pF(**1R6**)	0.8(**8**)		0.85(**9**)	
1.8pF(**1R8**)	0.8(**8**)		0.85(**9**)	
2.0pF(**2R0**)	0.8(**8**)		0.85(**9**)	
2.2pF(**2R2**)	0.8(**8**)		0.85(**9**)	
2.4pF(**2R4**)	0.8(**8**)		0.85(**9**)	
2.7pF(**2R7**)	0.8(**8**)		0.85(**9**)	
3.0pF(**3R0**)	0.8(**8**)		0.85(**9**)	
3.3pF(**3R3**)	0.8(**8**)		0.85(**9**)	
3.6pF(**3R6**)	0.8(**8**)		0.85(**9**)	
3.9pF(**3R9**)	0.8(**8**)		0.85(**9**)	
4.0pF(**4R0**)	0.8(**8**)		0.85(**9**)	
4.3pF(**4R3**)	0.8(**8**)		0.85(**9**)	
4.7pF(**4R7**)	0.8(**8**)		0.85(**9**)	
5.0pF(**5R0**)	0.8(**8**)		0.85(**9**)	
5.1pF(**5R1**)	0.8(**8**)		0.85(**9**)	
5.6pF(**5R6**)	0.8(**8**)		0.85(**9**)	
6.0pF(**6R0**)	0.8(**8**)		0.85(**9**)	
6.2pF(**6R2**)	0.8(**8**)		0.85(**9**)	
6.8pF(**6R8**)	0.8(**8**)		0.85(**9**)	
7.0pF(**7R0**)		0.8(**8**)	0.85(**9**)	
7.5pF(**7R5**)		0.8(**8**)	0.85(**9**)	
8.0pF(**8R0**)		0.8(**8**)	0.85(**9**)	
8.2pF(**8R2**)		0.8(**8**)	0.85(**9**)	
9.0pF(**9R0**)		0.8(**8**)	0.85(**9**)	
9.1pF(**9R1**)		0.8(**8**)	0.85(**9**)	
10pF(**100**)		0.8(**8**)	0.85(**9**)	

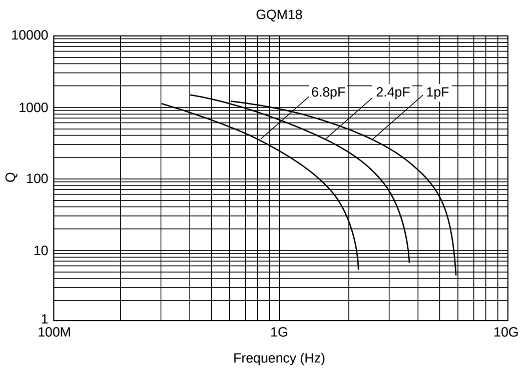
Continued on the following page.

Continued from the preceding page.

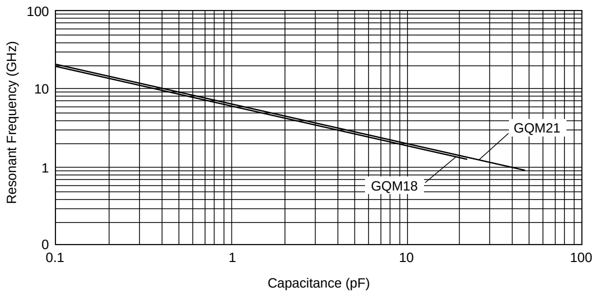
Part Number	GQM18		GQM21	
L x W	1.6x0.8		2.0x1.25	
TC	C0G (**5C**)		C0G (**5C**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
11pF(**110**)		0.8(**8**)	0.85(**9**)	
12pF(**120**)		0.8(**8**)	0.85(**9**)	
13pF(**130**)		0.8(**8**)	0.85(**9**)	
15pF(**150**)		0.8(**8**)	0.85(**9**)	
16pF(**160**)		0.8(**8**)	0.85(**9**)	
18pF(**180**)		0.8(**8**)	0.85(**9**)	
20pF(**200**)		0.8(**8**)		0.85(**9**)
22pF(**220**)		0.8(**8**)		0.85(**9**)
24pF(**240**)		0.8(**8**)		0.85(**9**)
27pF(**270**)		0.8(**8**)		0.85(**9**)
30pF(**300**)		0.8(**8**)		0.85(**9**)
33pF(**330**)		0.8(**8**)		0.85(**9**)
36pF(**360**)		0.8(**8**)		0.85(**9**)
39pF(**390**)		0.8(**8**)		0.85(**9**)
43pF(**430**)		0.8(**8**)		0.85(**9**)
47pF(**470**)		0.8(**8**)		0.85(**9**)
51pF(**510**)		0.8(**8**)		0.85(**9**)
56pF(**560**)		0.8(**8**)		0.85(**9**)
62pF(**620**)		0.8(**8**)		0.85(**9**)
68pF(**680**)		0.8(**8**)		0.85(**9**)
75pF(**750**)		0.8(**8**)		0.85(**9**)
82pF(**820**)		0.8(**8**)		0.85(**9**)
91pF(**910**)		0.8(**8**)		0.85(**9**)
100pF(**101**)		0.8(**8**)		0.85(**9**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

■ Q - Frequency Characteristics

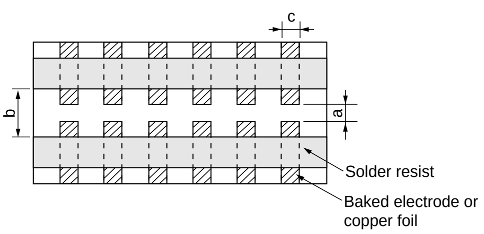


■ Resonant Frequency - Capacitance



Specifications and Test Methods

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature</td><td>−55 to 125℃</td><td>Reference Temperature: 25℃
(2C, 3C, 4C: 20℃)</td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous page.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.
When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimension</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance</td><td>More than 10,000MΩ
(Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table.<table><tr><td>Frequency</td><td>1±0.1MHz</td></tr><tr><td>Voltage</td><td>0.5 to 5Vrms</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Q</td><td>30pF min.: Q≧1400
30pF max.: Q≧800+20C

C: Nominal Capacitance (pF)</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Characteristics</td><td>Capacitance Change</td><td>Within the specified tolerance (Table A)</td><td rowspan="3">The temperature coefficient is determined using the capacitance measured in step 3 as a reference.
When cycling the temperature sequentially from step 1 through 5 the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as in Table A.
The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the steps 1, 3 and 5 by the capacitance value in step 3.<table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>Reference Temp. ±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>Reference Temp. ±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>Reference Temp. ±2</td></tr></table></td></tr>
<tr><td>Temperature Coefficient</td><td>Within the specified tolerance (Table A)</td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05pF
(Whichever is larger)</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.

</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec.
The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
*5N (GQM188)<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GQM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GQM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr></table>(in mm)
Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute.
This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>30pF min.: Q≧1400
30pF max.: Q≧800+20C

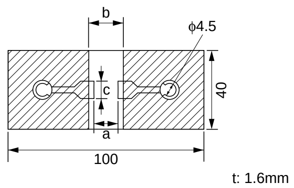
C: Nominal Capacitance (pF)</td></tr>
</table>

Continued on the following page. ↗

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
12	Deflection		No crack or marked defect should occur. (see Fig. 2 below)	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. (see Fig. 3 below)



Type	a	b	c
GQM18	1.0	3.0	1.2
GQM21	1.2	4.0	1.65

(in mm)

Fig. 2

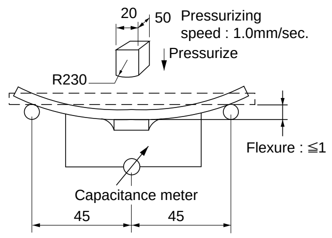


Fig. 3

No.	Item		Specifications	Test Method
13	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.
14	Resistance to Soldering Heat		The measured and observed characteristics should satisfy the specifications in the following table.	Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours.
		Appearance	No marking defects	
		Capacitance Change	Within ±2.5% or ±0.25 pF (Whichever is larger)	
		Q	30pF min.: Q≧1400 30pF max.: Q≧800+20C C: Nominal Capacitance (pF)	
		I.R.	More than 10,000MΩ	
		Dielectric Strength	No failure	
15	Temperature Cycle		The measured and observed characteristics should satisfy the specifications in the following table.	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure. (see table below)
		Appearance	No marking defects	
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	
		Q	30pF min.: Q≧1400 30pF max.: Q≧800+20C C: Nominal Capacitance (pF)	
		I.R.	More than 10,000MΩ	
		Dielectric Strength	No failure	

Step	1	2	3	4
Temp. (℃)	Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

No.	Item		Specifications	Test Method
16	Humidity Steady State		The measured and observed characteristics should satisfy the specifications in the following table.	Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.
		Appearance	No marking defects	
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	
		Q	30pF min.: Q≧350 10pF and over, 30pF and below: Q≧275+5C/2 10pF max.: Q≧200+10C C: Nominal Capacitance (pF)	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	No failure	

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
17	Humidity Load		The measured and observed characteristics should satisfy the specifications in the following table.	Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature then measure. The charge/discharge current is less than 50mA.
		Appearance	No marking defects	
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	
		Q	30pF min.: Q≧200 30pF max.: Q≧100+10C/3 C: Nominal Capacitance (pF)	
		I.R.	More than 500MΩ	
		Dielectric Strength	No failure	
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table.	Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. The charge/discharge current is less than 50mA.
		Appearance	No marking defects	
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	
		Q	30pF min.: Q≧350 10pF and over, 30pF and below: Q≧275+5C/2 10pF max.: Q≧200+10C C: Nominal Capacitance (pF)	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	No failure	

Table A

(1)

Char.	Nominal Values (ppm/℃) ∗1	Capacitance Change from 25℃ (%)					
		−55℃		−30℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	−0.24	0.40	−0.17	0.25	−0.11

∗1: Nominal values denote the temperature coefficient within a range of 25 to 125℃.

Chip Monolithic Ceramic Capacitors

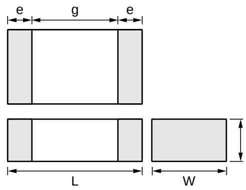
High Frequency Type ERB Series

■ Features (ERB Series)

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. Nickel barriered terminations of ERB series improve solderability and decrease solder leaching.
3. ERB18/21 series are designed for both flow and reflow soldering and ERB32 series are designed for reflow soldering.

■ Applications

High frequency and high-power circuits



Part Number	Dimensions (mm)				
	L	W	T max.	e min.	g min.
ERB188	1.6±0.1	0.8±0.1	0.9	0.2	0.5
ERB21B	2.0±0.3	1.25±0.3	1.35	0.25	0.7
ERB32Q	3.2±0.3	2.5±0.3	1.7	0.3	1.0

Part Number	**ERB18**		**ERB21**				**ERB32**					
L x W	1.6x0.8		2.0x1.25				3.2x2.5					
TC	C0G (**5C**)		C0G (**5C**)				C0G (**5C**)					
Rated Volt.	250 (**2E**)	200 (**2D**)	250 (**2E**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	500 (**2H**)	300 (**YD**)	250 (**2E**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
0.50pF(**R50**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
0.75pF(**R75**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.0pF(**1R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.1pF(**1R1**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.2pF(**1R2**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.3pF(**1R3**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.5pF(**1R5**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.6pF(**1R6**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
1.8pF(**1R8**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
2.0pF(**2R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
2.2pF(**2R2**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
2.4pF(**2R4**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
2.7pF(**2R7**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
3.0pF(**3R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
3.3pF(**3R3**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
3.6pF(**3R6**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
3.9pF(**3R9**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
4.0pF(**4R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
4.3pF(**4R3**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
4.7pF(**4R7**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
5.0pF(**5R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
5.1pF(**5R1**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
5.6pF(**5R6**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
6.0pF(**6R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
6.2pF(**6R2**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
6.8pF(**6R8**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
7.0pF(**7R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
7.5pF(**7R5**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
8.0pF(**8R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
8.2pF(**8R2**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
9.0pF(**9R0**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
9.1pF(**9R1**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					

Continued on the following page. ↗

Continued from the preceding page.

Part Number	**ERB18**		**ERB21**				**ERB32**					
L x W	1.6x0.8		2.0x1.25				3.2x2.5					
TC	C0G (**5C**)		C0G (**5C**)				C0G (**5C**)					
Rated Volt.	250 (**2E**)	200 (**2D**)	250 (**2E**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	500 (**2H**)	300 (**YD**)	250 (**2E**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
10pF(**100**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
11pF(**110**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
12pF(**120**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
13pF(**130**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
15pF(**150**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
16pF(**160**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
18pF(**180**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
20pF(**200**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
22pF(**220**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
24pF(**240**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
27pF(**270**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
30pF(**300**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
33pF(**330**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
36pF(**360**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
39pF(**390**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
43pF(**430**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
47pF(**470**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
51pF(**510**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
56pF(**560**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
62pF(**620**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
68pF(**680**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
75pF(**750**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
82pF(**820**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
91pF(**910**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
100pF(**101**)	0.9(**8**)	0.9(**8**)	1.35(**B**)	1.35(**B**)			1.7(**Q**)					
110pF(**111**)					1.35(**B**)		1.7(**Q**)					
120pF(**121**)					1.35(**B**)		1.7(**Q**)					
130pF(**131**)					1.35(**B**)			1.7(**Q**)				
150pF(**151**)						1.35(**B**)		1.7(**Q**)				
160pF(**161**)						1.35(**B**)			1.7(**Q**)	1.7(**Q**)		
180pF(**181**)									1.7(**Q**)	1.7(**Q**)		
200pF(**201**)									1.7(**Q**)	1.7(**Q**)		
220pF(**221**)									1.7(**Q**)	1.7(**Q**)		
240pF(**241**)											1.7(**Q**)	
270pF(**271**)											1.7(**Q**)	
300pF(**301**)											1.7(**Q**)	
330pF(**331**)											1.7(**Q**)	
360pF(**361**)											1.7(**Q**)	
390pF(**391**)											1.7(**Q**)	
430pF(**431**)											1.7(**Q**)	
470pF(**471**)											1.7(**Q**)	
510pF(**511**)												1.7(**Q**)
560pF(**561**)												1.7(**Q**)
620pF(**621**)												1.7(**Q**)
680pF(**681**)												1.7(**Q**)
750pF(**751**)												1.7(**Q**)
820pF(**821**)												1.7(**Q**)
910pF(**911**)												1.7(**Q**)
1000pF(**102**)												1.7(**Q**)

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

muRata

Specifications and Test Methods

No.	Item		Specifications	Test Method
1	Operating Temperature Range		−55 to +125℃	Reference Temperature: 25°C
2	Rated Voltage		See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, should be maintained within the rated voltage range.
3	Appearance		No defects or abnormalities	Visual inspection
4	Dimensions		Within the specified dimension	Using calipers
5	Dielectric Strength		No defects or abnormalities	No failure should be observed when 300%(*) of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. (*) 300V: 250%, 500V: 200%
6	Insulation Resistance (I.R.)		1,000,000MΩ min. (C≦470pF) 100,000MΩ min. (C>470pF)	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and standard humidity and within 2 minutes of charging.
7	Capacitance		Within the specified tolerance	The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table. Frequency: 1±0.1MHz Voltage: 1±0.2Vrms
8	Q		C≦ 220pF : Q≧10,000 220pF<C≦ 470pF : Q≧ 5,000 470pF<C≦1,000pF : Q≧ 3,000 C: Nominal Capacitance (pF)	
9	Capacitance Temperature Characteristics	Capacitance Change	Within the specified tolerance (Table A-6)	The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3. Step / Temperature (℃): 1: 25±2 2: −55±3 3: 25±2 4: 125±3 5: 25±2
		Temperature Coefficent	Within the specified tolerance (Table A-6)	
		Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	
10	Adhesive Strength of Termination		No removal of the terminations or other defects should occur.	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1 using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. (Type / a / b / c) ERB18: 1.0 / 3.0 / 1.2 ERB21: 1.2 / 4.0 / 1.65 ERB32: 2.2 / 5.0 / 2.9 (in mm) *5N (ERB188)

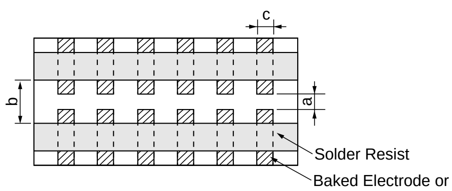


Fig.1

Frequency	1±0.1MHz
Voltage	1±0.2Vrms

Step	Temperature (℃)
1	25±2
2	−55±3
3	25±2
4	125±3
5	25±2

Type	a	b	c
ERB18	1.0	3.0	1.2
ERB21	1.2	4.0	1.65
ERB32	2.2	5.0	2.9

(in mm)
*5N (ERB188)

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
11	Vibration Resistance	Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).
		Capacitance	Within the specified tolerance	
		Q	Satisfies the initial value. C≦ 220pF : Q≧10,000 220pF<C≦ 470pF : Q≧ 5,000 470pF<C≦1,000pF : Q≧ 3,000 C: Nominal Capacitance (pF)	
12	Deflection		No crack or marked defect should occur. (see Fig.3a and Fig. 2a below)	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
13	Solderability of Termination		95% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of isopropyl alcohol and rosin (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution for 5±0.5 seconds at 245±5℃.
14	Resistance to Soldering Heat		The measured and observed characteristics should satisfy the specifications in the following table. (see table 14-A)	Preheat according to the conditions listed in the table below. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours. (see table 14-B)
15	Temperature Cycle		The measured and observed characteristics should satisfy the specifications in the following table. (see table 15-A)	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure. (see table 15-B)
16	Humidity		The measured and observed characteristics should satisfy the specifications in the following table. (see table 16-A)	Apply the 24-hour heat (−10 to +65℃) and humidity (80 to 100%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure.

12 Deflection

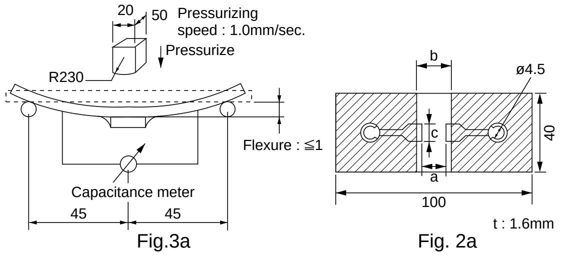


Fig.3a Fig. 2a

Type	a	b	c
ERB18	1.0	3.0	1.2
ERB21	1.2	4.0	1.65
ERB32	2.2	5.0	2.9

(in mm)

14 Resistance to Soldering Heat

Item	Specifications
Appearance	No marked defect
Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)
Q	C≦ 220pF : Q≧10,000 220pF<C≦ 470pF : Q≧ 5,000 470pF<C≦1,000pF : Q≧ 3,000
Dielectric Strength	No failure

C: Nominal Capacitance (pF)

Chip Size	Preheat Condition
2.0×1.25mm max.	1minute at 120 to 150℃
3.2×2.5mm	Each 1 minute at 100 to 120℃ and then 170 to 200℃

15 Temperature Cycle

Item	Specifications
Appearance	No marked defect
Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)
Q	C≧30pF : Q≧350 10pF≦C<30pF : Q≧275+ 5/2 C C<10pF : Q≧200+10C
I.R.	1,000MΩ min.
Dielectric Strength	No failure

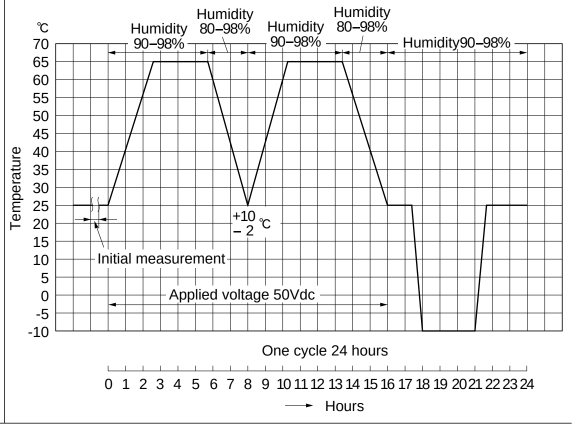
C: Nominal Capacitance (pF)

Step	1	2	3	4
Temp. (℃)	Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0	Room Temp.
Time (min.)	30±3	5 max.	30±3	5 max.

16 Humidity

Item	Specifications
Appearance	No marked defect
Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)
Q	C≧30pF : Q≧350 10pF≦C<30pF : Q≧275+ 5/2 C C<10pF : Q≧200+10C
I.R.	1,000MΩ min.

C: Nominal Capacitance (pF)



Continued on the following page.

13

muRata

Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications	Test Method
17	High Temperature Load	The measured and observed characteristics should satisfy the specifications in the following table. Item: Specifications Appearance: No marked defect Capacitance Change: Within ±3% or ±0.3pF (Whichever is larger) Q: C≧30pF : Q≧350; 10pF≦C<30pF : Q≧275+ $\frac{5}{2}$ C; C<10pF : Q≧200+10C I.R.: 1,000MΩ min. Dielectric Strength: No failure C: Nominal Capacitance (pF)	Apply 200% (500V only 150%) of the rated voltage for 1,000±12 hours at 125±3℃. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.

Table A-6

Char.	Nominal Values (ppm/℃) Note 1	Capacitance Change from 25℃ (%)					
		−55		−30		−10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	−0.24	0.40	−0.17	0.25	−0.11

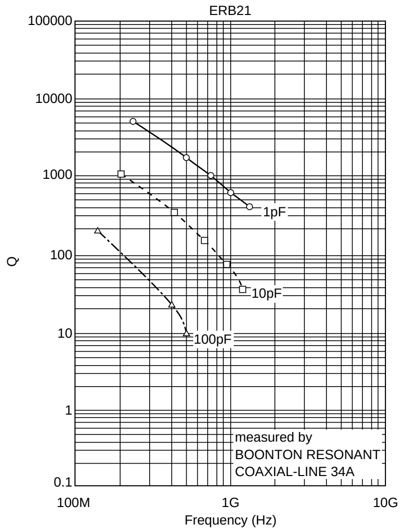
Note 1: Nominal values denote the temperature coefficient within a range of 25 to 125℃ (for 5C)

13

ERB Series Data

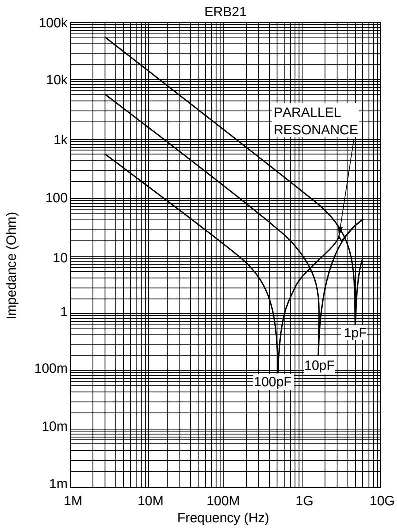
■ Q - Frequency Characteristics

ERB Series



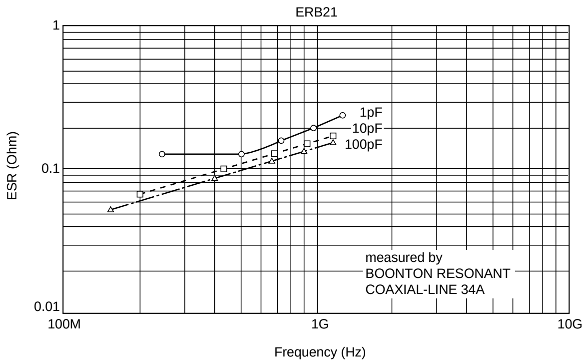
■ Impedance - Frequency Characteristics

ERB Series



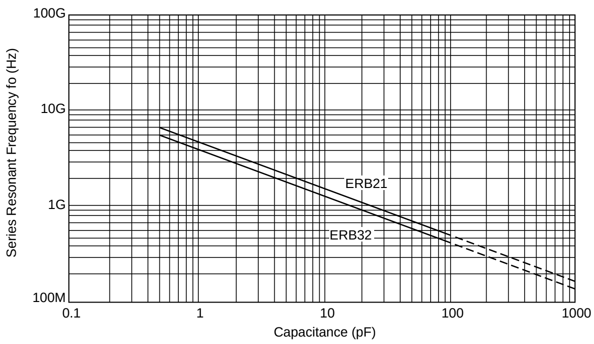
■ ESR - Frequency Characteristics

ERB Series

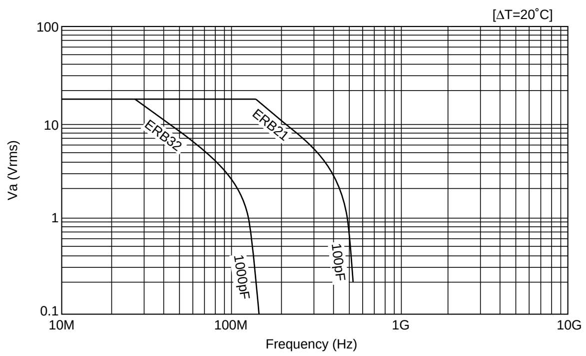


■ Resonant Frequency - Capacitance

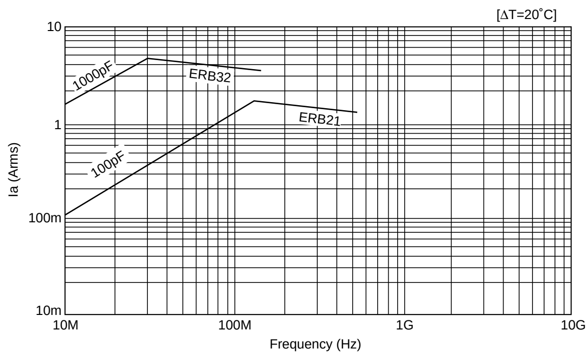
ERB Series



■ Allowable Voltage - Frequency



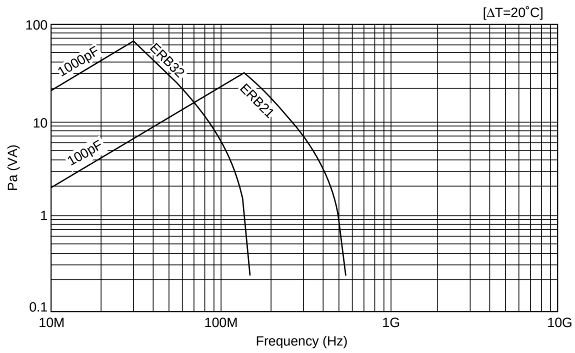
■ Allowable Current - Frequency



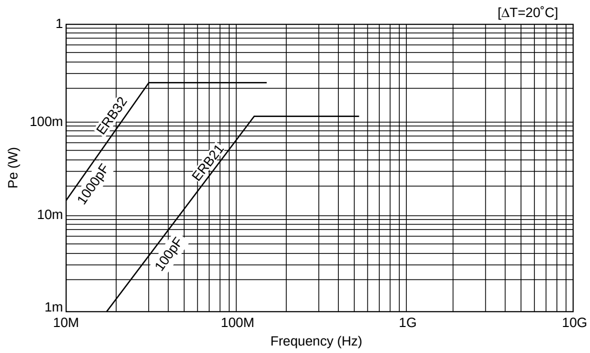
Continued on the following page.

Continued from the preceding page.

■ Allowable Apparent Power - Frequency



■ Allowable Effective Power - Frequency



Package

■ Minimum Quantity Guide

Part Number		Dimensions (mm)			Quantity (pcs.)					
					ø180mm Reel		ø330mm Reel		Bulk Case	Bulk Bag
		L	W	T	Paper Tape	Embossed Tape	Paper Tape	Embossed Tape		
Packaging Code					D	L	J	K	C	Bulk : B Tray : T
For General Purpose	GRM02	0.4	0.2	0.2	20,000	-	-	-	-	1,000
	GRM03	0.6	0.3	0.3	15,000	-	50,000	-	-	1,000
	GRM15	1.0	0.5	0.25	10,000	-	50,000	-	-	1,000
				0.5	10,000	-	50,000	-	50,000	1,000
	GRM18	1.6	0.8	0.8	4,000	-	10,000	-	15,000 [1]	1,000
	GRM21	2.0	1.25	0.6	4,000	-	10,000	-	10,000	1,000
				0.85/1.0	4,000	-	10,000	-	-	1,000
				1.25	-	3,000	-	10,000	5,000 [2]	1,000
	GRM31	3.2	1.6	0.6/0.85	4,000	-	10,000	-	-	1,000
				1.15	-	3,000	-	10,000	-	1,000
				1.6	-	2,000	-	6,000	-	1,000
	GRM32	3.2	2.5	0.85	-	4,000	-	10,000	-	1,000
				1.15	-	3,000	-	10,000	-	1,000
				1.35	-	2,000	-	8,000	-	1,000
				1.6	-	2,000	-	6,000	-	1,000
				1.8/2.0 2.5	-	1,000	-	4,000	-	1,000
	GRM43	4.5	3.2	1.15	-	1,000	-	5,000	-	1,000
				1.35/1.6 1.8/2.0	-	1,000	-	4,000	-	1,000
				2.5	-	500	-	2,000	-	1,000
				2.8	-	500	-	1,500	-	500
	GRM55	5.7	5.0	1.15	-	1,000	-	5,000	-	1,000
				1.35/1.6 1.8/2.0	-	1,000	-	4,000	-	1,000
				2.5	-	500	-	2,000	-	500
				3.2	-	300	-	1,500	-	500
High Power Type	GJM03	0.6	0.3	0.3	15,000	-	50,000	-	-	1,000
	GJM15	1.0	0.5	0.5	10,000	-	50,000	-	50,000	1,000
High Frequency	GQM18	1.6	0.8	0.8	4,000	-	10,000	-	-	1,000
	GQM21	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000
	ERB18	1.6	0.8	0.9 max.	4,000	-	10,000	-	-	1,000
	ERB21	2.0	1.25	1.35 max.	-	3,000	-	10,000	-	1,000
	ERB32	3.2	2.5	1.7 max.	-	2,000	-	8,000	-	1,000
For Ultrasonic	GRM21	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000
Microchip	GMA05	0.5	0.5	0.35	-	-	-	-	-	400 [3]
	GMA08	0.8	0.8	0.5	-	-	-	-	-	400 [3]
Array	GNM1M	1.37	1.0	0.6	4,000	-	10,000	-	-	1,000
	GNM21	2.0	1.25	0.6/0.85	4,000	-	10,000	-	-	1,000
	GNM31	3.2	1.6	0.8	4,000	-	10,000	-	-	1,000
				1.0	-	3,000	-	10,000	-	1,000
Low ESL	LLL15	0.5	1.0	0.3	10,000	-	50,000	-	-	1,000
	LLL18	0.8	1.6	0.5	-	4,000	-	10,000	-	1,000
	LLL21	1.25	2.0	0.5/0.6	-	4,000	-	10,000	-	1,000
				0.85	-	3,000	-	10,000	-	1,000
	LLL31	1.6	3.2	0.5/0.7	-	4,000	-	10,000	-	1,000
				1.15	-	3,000	-	10,000	-	1,000
	LLA18	1.6	0.8	0.5	-	4,000	-	10,000	-	1,000
	LLA21	2.0	1.25	0.5	-	4,000	-	10,000	-	1,000
				0.85	-	3,000	-	10,000	-	1,000
	LLA31	3.2	1.6	0.5	-	4,000	-	10,000	-	1,000
				0.85	-	3,000	-	10,000	-	1,000
				1.15	-	3,000	-	10,000	-	1,000
	LLM21	2.0	1.25	0.5	-	4,000	-	10,000	-	1,000
				0.85	-	3,000	-	10,000	-	1,000
	LLM31	3.2	1.6	0.5	-	4,000	-	10,000	-	1,000
				1.15	-	3,000	-	10,000	-	1,000

1) 68,000pF/0.1μF of 50V R7 rated are not available by bulk case.
2) Dimension tolerance ±0.15mm rated are not available by bulk case.
3) Tray

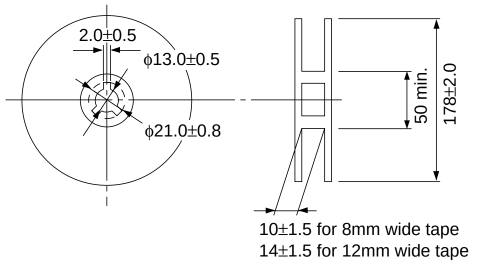
Continued on the following page. ↗

Continued from the preceding page.

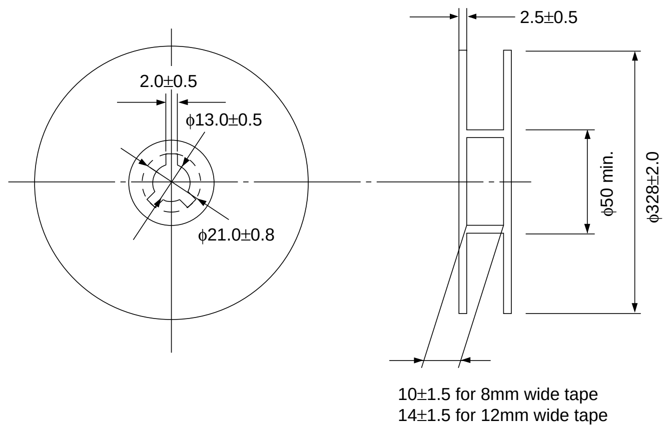
■ Tape Carrier Packaging

(1) Dimensions of Reel

ϕ180mm Reel



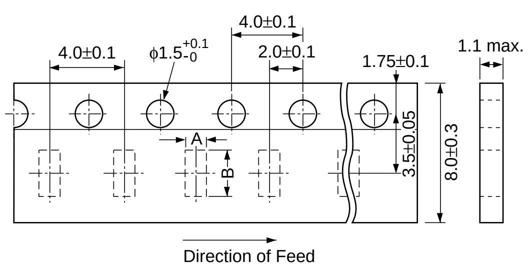
ϕ330mm Reel



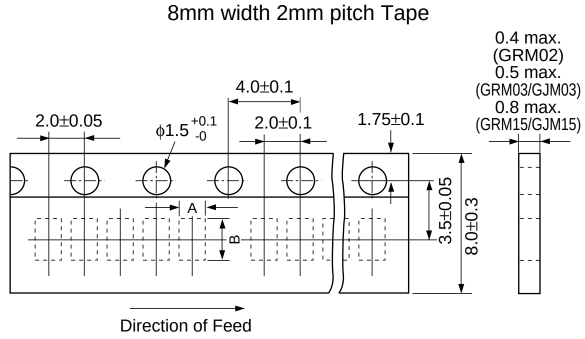
(in mm)

(2) Dimensions of Paper Tape

8mm width 4mm pitch Tape



8mm width 2mm pitch Tape



Part Number	A	B
LLL15	0.65	1.15
GRM18 **GQM18** **ERB18**	1.05±0.1	1.85±0.1
GNM1M	1.17±0.05	1.55±0.05
GRM21 (T≦0.85mm) **GQM21** **GNM21**	1.55±0.15	2.3±0.15
GRM31 (T≦0.85mm) **GNM31** (T≦0.8mm)	2.0±0.2	3.6±0.2
GRM32 (T≦0.85mm)	2.8±0.2	3.6±0.2

Part Number	A*	B*
GRM02	0.25	0.45
GJM03 **GRM03**	0.37	0.67
GJM15 **GRM15**	0.65	1.15

*Nominal Value

(in mm)

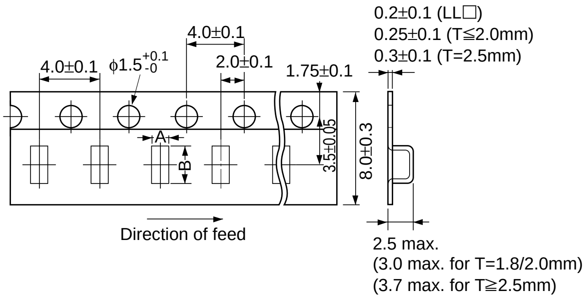
Continued on the following page.

Package

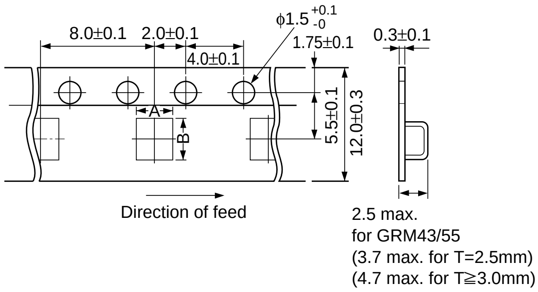
Continued from the preceding page.

(3) Dimensions of Embossed Tape

8mm width 4mm pitch Tape



12mm width 8mm pitch Tape



Part Number	A	B
LLL18, LLA18	1.05±0.1	1.85±0.1
GRM21, ERB21 (T≧1.0mm) **LLL21** **LLA21, LLM21**	1.45±0.2	2.25±0.2
GRM31 (T≧1.15mm) **LLL31** **LLA31, LLM31** **GNM31** (T≧1.0mm)	1.9±0.2	3.5±0.2
GRM32, ERB32 (T≧1.0mm)	2.8±0.2	3.5±0.2

*Nominal Value

Part Number	A*	B*
GRM43	3.6	4.9
GRM55	5.2	6.1

*Nominal Value

(in mm)

(4) Taping Method

① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.

② Part of the leader and part of the empty tape should be attached to the end of the tape as follows.

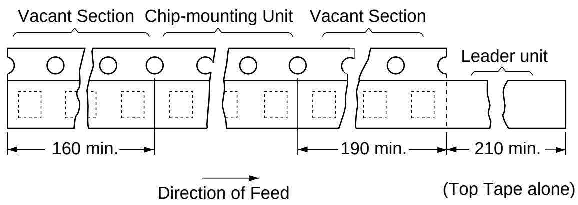
③ The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

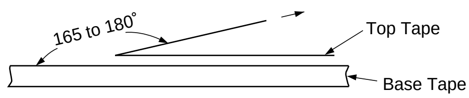
⑤ The top tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.

⑥ Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.

⑦ Peeling off force: 0.1 to 0.6N* in the direction shown below.
*GRM02, GRM03, GJM03 : 0.05 to 0.5N



(in mm)

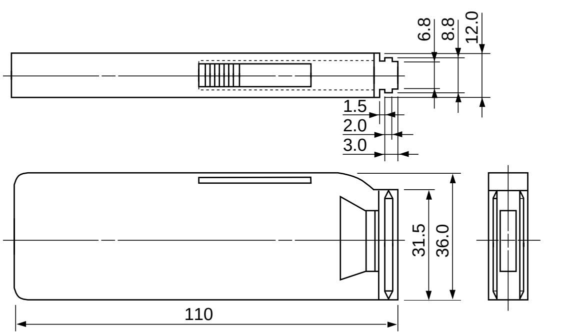


Continued on the following page.

Continued from the preceding page.

■ Dimensions of Bulk Case Packaging

The bulk case uses antistatic materials. Please contact Murata for details.



⚠Caution

■ Storage and Operating Conditions

Chip monolithic ceramic capacitors (chips) can experience degradation of termination solderability when subjected to high temperature or humidity, or if exposed to sulfur or chlorine gases.
Storage environment must be at an ambient temperature of 5-40 degree C and an ambient humidity of 20-70%RH.
Use chip within 6 months. If 6 months or more have elapsed, check solderability before use.

Use of Sn-Zn based solder will deteriorate reliability of MLCC.
Please contact Murata factory for the use of Sn-Zn based solder in advance.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

■ Handling

1. Inspection
   Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints.
   Provide support pins on the back side of the PCB to prevent warping or flexing.
2. Board Separation (or depanalization)
   (1) Board flexing at the time of separation causes cracked chips or broken solder.
   (2) Severity of stresses imposed on the chip at the time of board break is in the order of:
   Pushback<Slitter<V Slot<Perforator.
   (3) Board separation must be performed using special jigs, not with hands.
3. Reel and bulk case
   In the handling of reel and case, please be careful and do not drop it.
   Do not use chips from a case which has been dropped.

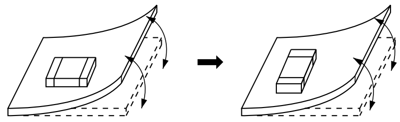
FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCT IS USED.

■ ⚠Caution (Soldering and Mounting)

1. Mounting Position

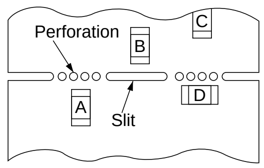
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



Locate chip horizontal to the direction in which stress acts

[Chip Mounting Close to Board Separation Point]



Chip arrangement
Worst A-C-(B~D) Best

(Reference Data 2. Board bending strength for solder fillet height)
(Reference Data 3. Temperature cycling for solder fillet height)
(Reference Data 4. Board bending strength for board material)

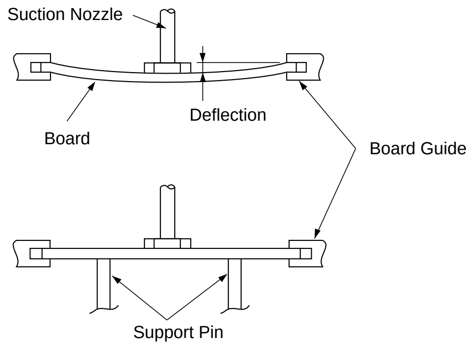
2. Chip Placing

- An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. So adjust the suction nozzle's bottom dead point by correcting warp in the board. Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board. Nozzle pressure for chip mounting must be a 1 to 3N static load.
- Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes great force on the chip during mounting, causing cracked chips. And the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically.

(Reference Data 5. Break strength)

[Incorrect]

[Correct]



Continued on the following page. ↗

⚠Caution

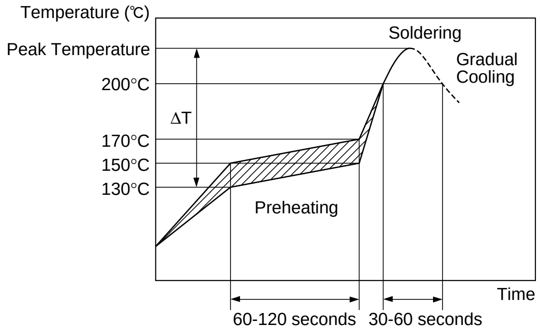
Continued from the preceding page.

3. Reflow Soldering

- When sudden heat is applied to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity inside components. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in table 1. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- Solderability of Tin plating termination chip might be deteriorated when low temperature soldering profile where peak solder temperature is below the Tin melting point is used. Please confirm the solderability of Tin plating termination chip before use.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and solvent within the range shown in the table 1.

[Standard Conditions for Reflow Soldering]

Infrared Reflow



Vapor Reflow

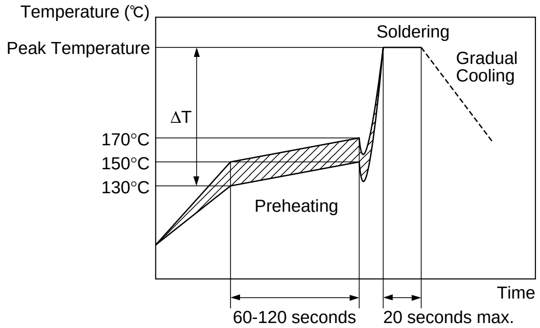


Table 1

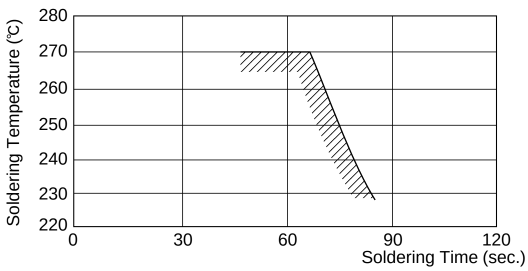
Part Number	Temperature Differential
GRM02/03/15/18/21/31 GJM03/15 LLL15/18/21/31 ERB18/21 GQM18/21	ΔT≦190℃
GRM32/43/55 LLA18/21/31 LLM21/31 GNM ERB32	ΔT≦130℃

Recommended Conditions

	Pb-Sn Solder		Lead Free Solder
	Infrared Reflow	Vapor Reflow	
Peak Temperature	230-250°C	230-240°C	240-260°C
Atmosphere	Air	Air	Air or N_2

Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

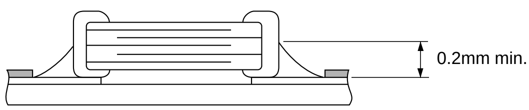
[Allowable Soldering Temperature and Time]



In case of repeated soldering, the accumulated soldering time must be within the range shown above.

- Optimum Solder Amount for Reflow Soldering
  - Overly thick application of solder paste results in excessive fillet height solder.
    This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.
  - Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
  - Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.

[Optimum Solder Amount for Reflow Soldering]



Inverting the PCB

Make sure not to impose an abnormal mechanical shock on the PCB.

Continued on the following page.

Continued from the preceding page.

4. Leaded Component Insertion

If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.
Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping.

5. Flow Soldering

- When sudden heat is applied to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity inside components. And an excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- In order to prevent mechanical damage in the components, preheating shoud be required for the both components and the PCB board. Preheating conditions are shown in table 2. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
  When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.
  Do not apply flow soldering to chips not listed in Table 2.

Table 2

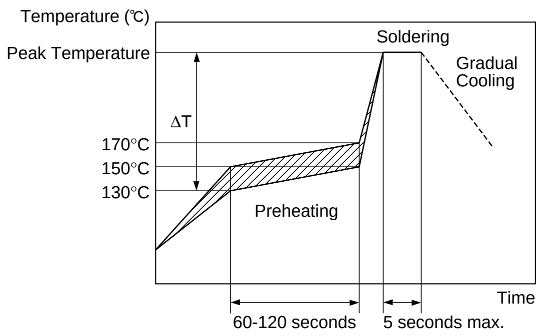
Part Number	Temperature Differential
GRM18/21/31 **LLL21/31** **ERB18/21** **GQM18/21**	ΔT≦150℃

Recommended Conditions

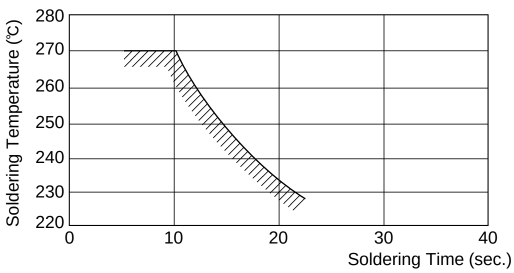
	Pb-Sn Solder	Lead Free Solder
Peak Temperature	240-250°C	250-260°C
Atmosphere	Air	N_2

Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Flow Soldering]

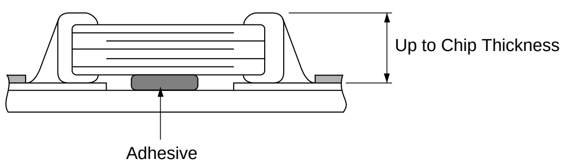


[Allowable Soldering Temperature and Time]



In case of repeated soldering, the accumulated soldering time must be within the range shown above.

- Optimum Solder Amount for Flow Soldering
  The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions.



Continued on the following page.

⚠Caution

Continued from the preceding page.

6. Correction with a Soldering Iron

(1) For Chip Type Capacitors

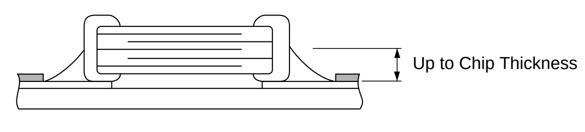
● When sudden heat is applied to the components by soldering iron, the mechanical strength of the components should go down because remarkable temperature change causes deformity inside components. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in table 3. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible. After soldering, it is not allowed to cool it down rapidly.

Table 3

Part Number	Temperature Differential	Peak Temperature	Atmosphere
GRM15/18/21/31 **GJM15** **LLL15/18/21/31** **GQM18/21** **ERB18/21**	ΔT≦190℃	300°C max. 3 seconds max. / termination	Air
GRM32/43/55 **GNM** **LLA18/21/31** **LLM21/31** **ERB32**	ΔT≦130℃	270°C max. 3 seconds max. / termination	Air

*Applicable for both Pb-Sn and Lead Free Solder.
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

● Optimum Solder Amount when Corrections Are Made Using a Soldering Iron
The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions. Soldering iron ø3mm or smaller should be required. And it is necessary to keep a distance between the soldering iron and the components without direct touch. Thread solder with ø0.5mm or smaller is required for soldering.



7. Washing

Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder. Take note not to vibrate PCBs.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCT IS USED.

■ Rating

Die Bonding/Wire Bonding (GMA Series)

1. Die Bonding of Capacitors

- Use the following materials Brazing alloy:
  Au-Sn (80/20) 300 to 320 degree C in N_2 atmosphere
- Mounting
  (1) Control the temperature of the substrate so that it matches the temperature of the brazing alloy.
  (2) Place brazing alloy on substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation in 1 minute.

2. Wire Bonding

- Wire
  Gold wire:
  20 micro m (0.0008 inch), 25 micro m (0.001 inch) diameter
- Bonding
  (1) Thermocompression, ultrasonic ball bonding.
  (2) Required stage temperature : 200 to 250 degree C
  (3) Required wedge or capillary weight : 0.5N to 2N.
  (4) Bond the capacitor and base substrate or other devices with gold wire.

Notice

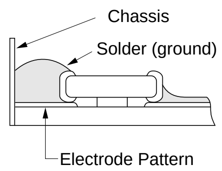
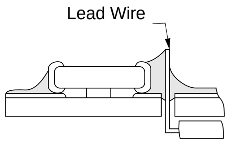
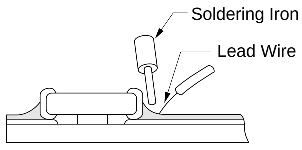
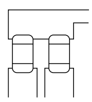
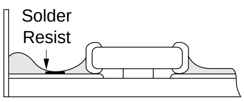
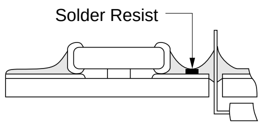
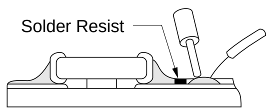
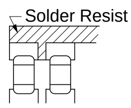
■ Notice (Soldering and Mounting)

1. PCB Design

(1) Notice for Pattern Forms

Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate.
They are also more sensitive to mechanical and thermal stresses than leaded components.
Excess solder fillet height can multiply these stresses and cause chip cracking. When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.

Pattern Forms

	Placing Close to Chassis	Placing of Chip Components and Leaded Components	Placing of Leaded Components after Chip Component	Lateral Mounting
Prohibited				
Correct				

Continued on the following page. ↗

Continued from the preceding page.

(2) Land Dimensions

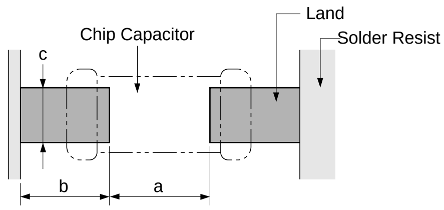


Table 1 Flow Soldering Method

Part Number \ Dimensions	Dimensions (L×W)	a	b	c
GRM18 **GQM18**	1.6×0.8	0.6–1.0	0.8–0.9	0.6–0.8
GRM21 **GQM21**	2.0×1.25	1.0–1.2	0.9–1.0	0.8–1.1
GRM31	3.2×1.6	2.2–2.6	1.0–1.1	1.0–1.4
LLL21	1.25×2.0	0.4–0.7	0.5–0.7	1.4–1.8
LLL31	1.6×3.2	0.6–1.0	0.8–0.9	2.6–2.8
ERB18	1.6×0.8	0.6–1.0	0.8–0.9	0.6–0.8
ERB21	2.0×1.25	1.0–1.2	0.9–1.0	0.8–1.1

(in mm)

Table 2 Reflow Soldering Method

Part Number \ Dimensions	Dimensions (L×W)	a	b	c
GRM02	0.4×0.2	0.16–0.2	0.12–0.18	0.2–0.23
GRM03 **GJM03**	0.6×0.3	0.2–0.3	0.2–0.35	0.2–0.4
GRM15 **GJM15**	1.0×0.5	0.3–0.5	0.35–0.45	0.4–0.6
GRM18 **GQM18**	1.6×0.8	0.6–0.8	0.6–0.7	0.6–0.8
GRM21 **GQM21**	2.0×1.25	1.0–1.2	0.6–0.7	0.8–1.1
GRM31	3.2×1.6	2.2–2.4	0.8–0.9	1.0–1.4
GRM32	3.2×2.5	2.0–2.4	1.0–1.2	1.8–2.3
GRM43	4.5×3.2	3.0–3.5	1.2–1.4	2.3–3.0
GRM55	5.7×5.0	4.0–4.6	1.4–1.6	3.5–4.8
LLL15	0.5×1.0	0.15–0.2	0.2–0.3	0.7–1.0
LLL18	0.8×1.6	0.2–0.4	0.3–0.4	1.0–1.4
LLL21	1.25×2.0	0.4–0.6	0.3–0.5	1.4–1.8
LLL31	1.6×3.2	0.6–0.8	0.6–0.7	2.6–2.8
ERB18	1.6×0.8	0.6–0.8	0.6–0.7	0.6–0.8
ERB21	2.0×1.25	1.0–1.2	0.6–0.7	0.8–1.1
ERB32	3.2×2.5	2.0–2.4	1.0–1.2	1.8–2.3

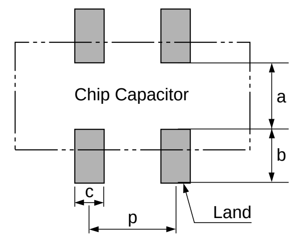
(in mm)

Continued on the following page.

Notice

Continued from the preceding page.

● GNM, LLA Series for Reflow Soldering Method



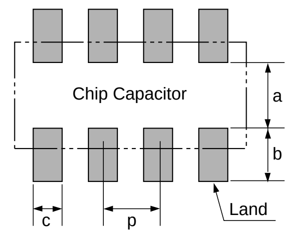


Table 3 GNM, LLA Series for Reflow Soldering Land Dimensions

Part Number	Dimensions (mm)					
	L	W	a	b	c	p
GNM1M2	1.37	1.0	0.4 to 0.5	0.35 to 0.45	0.3 to 0.35	0.64
GNM212	2.0	1.25	0.6 to 0.7	0.5 to 0.7	0.4 to 0.5	1.0
GNM214	2.0	1.25	0.6 to 0.7	0.5 to 0.7	0.25 to 0.35	0.5
GNM314	3.2	1.6	0.8 to 1.0	0.7 to 0.9	0.3 to 0.4	0.8
LLA18	1.6	0.8	0.3 to 0.4	0.25 to 0.4	0.2 to 0.28	0.4
LLA21	2.0	1.25	0.7 to 0.8	0.4 to 0.6	0.2 to 0.3	0.5
LLA31	3.2	1.6	0.8 to 1.0	0.7 to 0.9	0.3 to 0.4	0.8

● LLM Series for Reflow Soldering Method

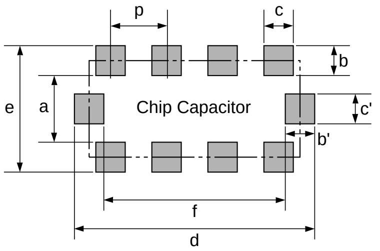


Table 4 LLM Series for Reflow Soldering Land Dimensions

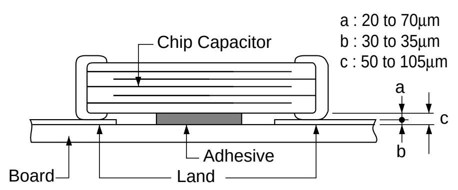
Part Number	Dimensions (mm)					
	a	b, b'	c, c'	d	e	f	p
LLM21	0.6 to 0.8	(0.3 to 0.5)	0.3	2.0 to 2.6	1.3 to 1.8	1.4 to 1.6	0.5
LLM31	1.0	(0.3 to 0.5)	0.4	3.2 to 3.6	1.6 to 2.0	2.6	0.8

b=(c-e)/2, b'=(d-f)/2

2. Adhesive Application

● Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. The amount of adhesive must be more than dimension c shown in the drawing at right to obtain enough bonding strength.
The chip's electrode thickness and land thickness must be taken into consideration.

● Low viscosity adhesive causes chips to slip after mounting. Adhesive must have a viscosity of 5000Pa • s (500ps) min. (at 25℃)



● Adhesive Coverage*

Part Number	Adhesive Coverage*
GRM18, GQM18	0.05mg min.
GRM21, LLL21, GQM21	0.1mg min.
GRM31, LLL31	0.15mg min.

*Nominal Value

Continued on the following page.

Notice

Continued from the preceding page.

3. Adhesive Curing

Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption.
Control curing temperature and time in order to prevent insufficient hardening.

Inverting the PCB

Make sure not to impose an abnormal mechanical shock on the PCB.

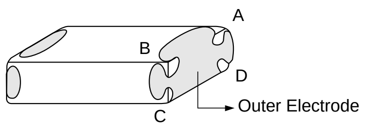
4. Flux Application

- An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability. So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
- Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned. Use flux with a halide content of 0.2wt% max. But do not use strong acidic flux.
  Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned.

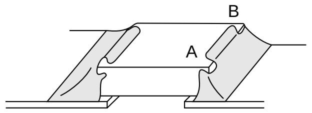
5. Flow Soldering

- Set temperature and time to ensure that leaching of the outer electrode does not exceed 25% of the chip end area as a single chip (full length of the edge A-B-C-D shown below) and 25% of the length A-B shown below as mounted on substrate.

[As a Single Chip]



[As Mounted on Substrate]



(Reference Data 6. Thermal shock)
(Reference Data 7. Solder heat resistance)

■ Others

1. Resin Coating
   When selecting resin materials, select those with low contraction.
2. Circuit Design
   These capacitors in this catalog are not safety recognized products
3. Remarks
   The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions. Select optimum conditions for operation as they determine the reliability of the product after assembly.
   The data herein are given in typical values, not guaranteed ratings.

Reference Data

1. Solderability

(1) Test Method

Subject the chip capacitor to the following conditions.
Then apply flux (an ethanol solution of 25% rosin) to the chip and dip it in 230℃ eutectic solder for 2 seconds.
Conditions:
Expose prepared at room temperature (for 6 months and 12 months, respectively)
Prepared at high temperature (for 100 hours at 85℃)
Prepared left at high humidity (for 100 hours under 90%RH to 95%RH at 40℃)

(2) Test Samples

GRM21 : Products for flow/reflow soldering.

(3) Acceptance Criteria

With a 60-power optical microscope, measure the surface area of the outer electrode that is covered with solder.

(4) Results

Refer to Table 1.

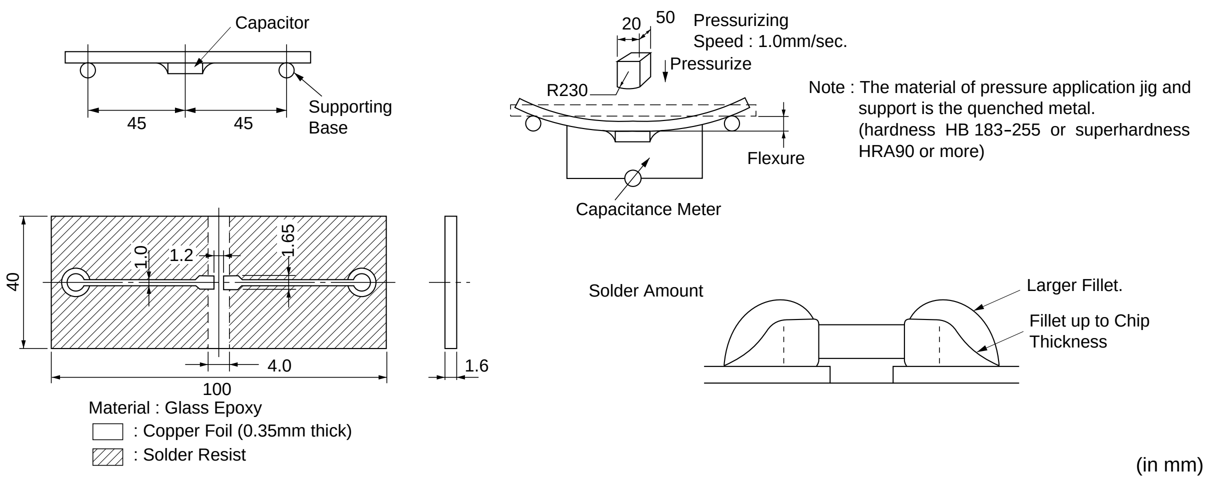
Table 1

Sample	Initial State	Prepared at Room Temperature		Prepared at High Temperature for 100 Hours at 85℃	Prepared at High Humidity for 100 Hours at 90 to 95% RH and 40℃
		6 months	12 months		
GRM21 for flow/reflow soldering	95 to 100%	95 to 100%	95%	90 to 95%	95%

2. Board Bending Strength for Solder Fillet Height

(1) Test Method

Solder the chip capacitor to the test PCB with the amount of solder paste necessary to achieve the fillet heights.
Then bend the PCB using the method illustrated and measure capacitance.



(2) Test Samples

GRM21: 5C/R7/F5 Characteristics T=0.6mm

(3) Acceptance Criteria

Products should be determined to be defective if the change in capacitance has exceeded the values specified in Table 2.

Table 2

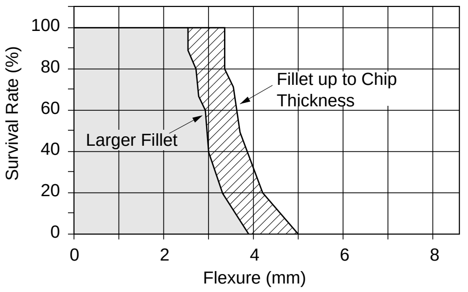
Characteristics	Change in Capacitance
5C	Within ±5% or ±0.5pF, whichever is greater
R7	Within ±12.5%
F5	Within ±20%

Continued on the following page.

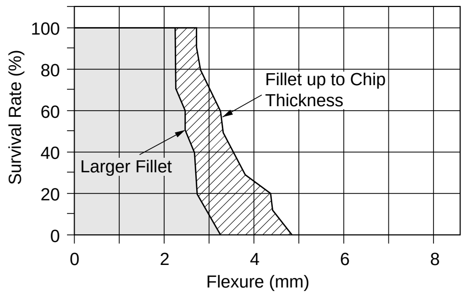
Continued from the preceding page.

(4) Results

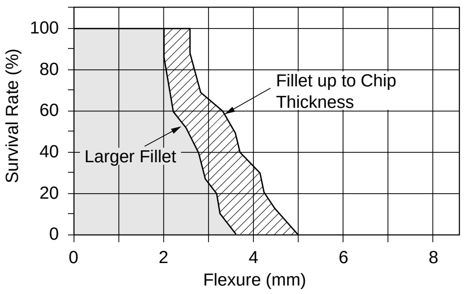
GRM21 5C (T=0.6)



GRM21 R7 (T=0.6)



GRM21 F5 (T=0.6)

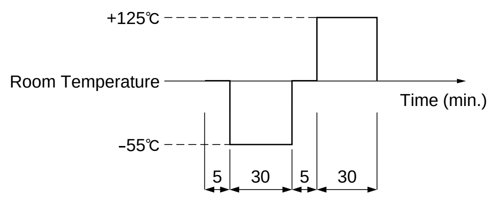


3. Temperature Cycling for Solder Fillet Height

(1) Test Method

Solder the chips to the substrate of various test fixtures using sufficient amounts of solder to achieve the required fillet height. Then subject the fixtures to the cycle illustrated below 200 times.

[Temperature Cycling]



① Solder Amount

Alumina substrates are typically designed for reflow soldering.

Glass epoxy or paper phenol substrates are typically used for flow soldering.

② Material

Alumina (Thickness: 0.64mm)

Glass epoxy (Thickness: 1.64mm)

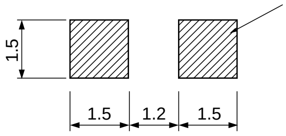
Paper phenol (Thickness: 1.64mm)

[Solder Amount]

Substrate		Alumina	Glass Epoxy or Paper Phenol
Solder Amount	❶	0.5T	T
	❷	0.7T	1.3T
	❸	T	1.6T
Solder to be used		6×4 Eutectic solder	

③ Land Dimension

[Land Dimension]



(in mm)

Alumina Substrate	Ag/Pd=72/28 Thickness: 10 to 12μm
Glass Epoxy Substrate	Cu Thickness: 35μm
Paper Phenol Substrate	

Continued on the following page.

Reference Data

Continued from the preceding page.

(2) Test Samples

GRM21 5C/R7/F5 Characteristics T=0.6mm

(3) Acceptance Criteria

Products are determined to be defective if the change in capacitance has exceeded the values specified in Table 3.

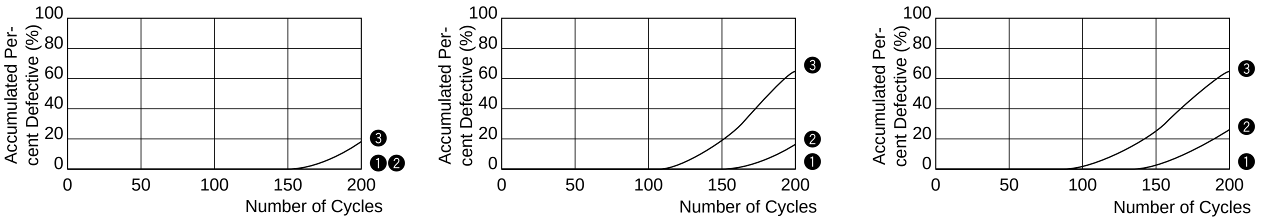
Table 3

Characteristics	Change in Capacitance
5C	Within ±2.5% or ±0.25pF, whichever is greater
R7	Within ±7.5%
F5	Within ±20%

(4) Results

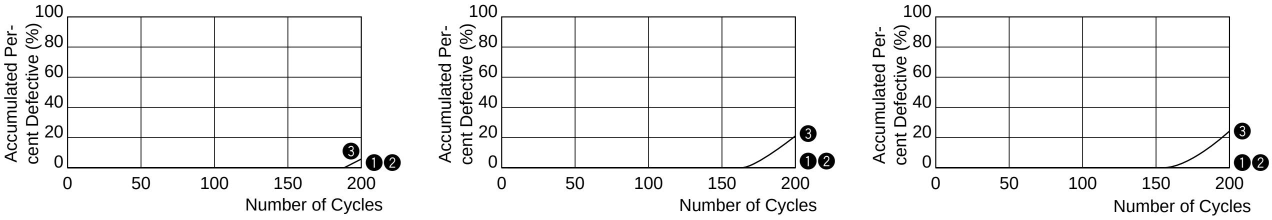
Alumina Substrate (Thickness 0.64mm)

GRM21 5C (T=0.6) GRM21 R7 (T=0.6) GRM21 F5 (T=0.6)



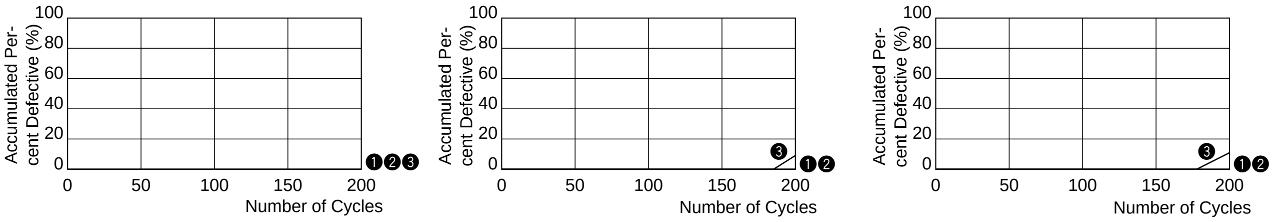
Glass Epoxy Substrate (Thickness 1.6mm)

GRM21 5C (T=0.6) GRM21 R7 (T=0.6) GRM21 F5 (T=0.6)



Paper Phenol Substrate (Thickness 1.6mm)

GRM21 5C (T=0.6) GRM21 R7 (T=0.6) GRM21 F5 (T=0.6)



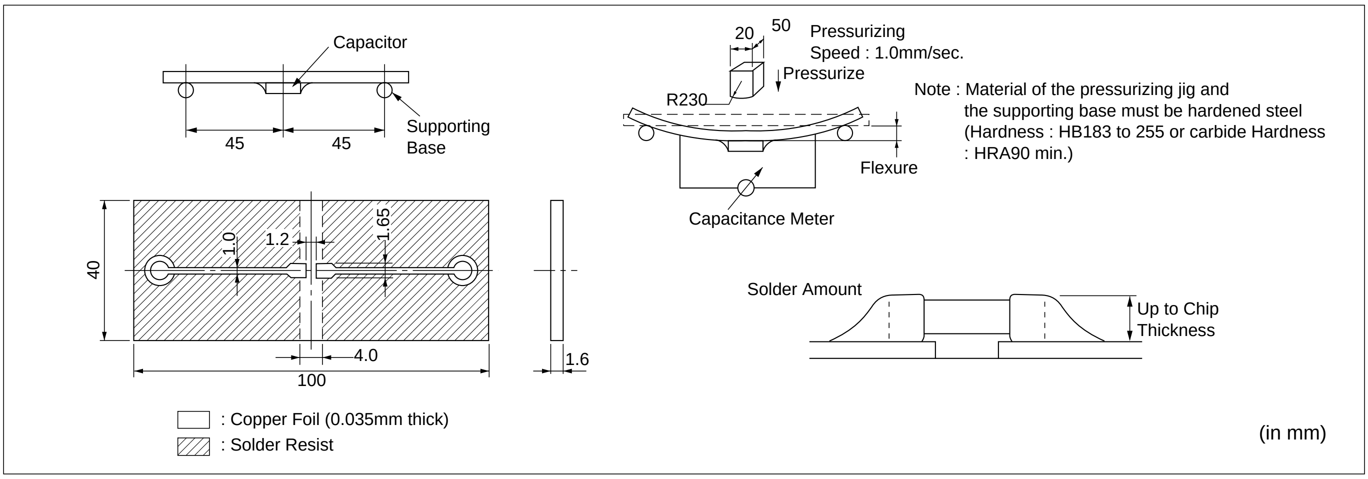
Continued on the following page.

Continued from the preceding page.

4. Board Bending Strength for Board Material

(1) Test Method

Solder the chip to the test board. Then bend the board using the method illustrated below, to measure capacitance.



(2) Test Samples

GRM21 5C/R7/F5 Characteristics T=0.6mm typical

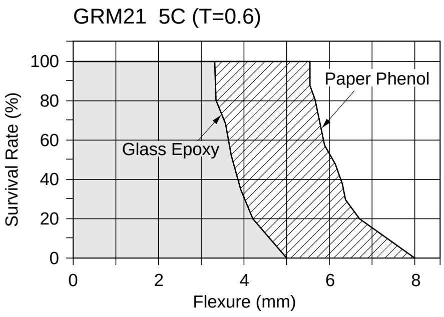
(3) Acceptance Criteria

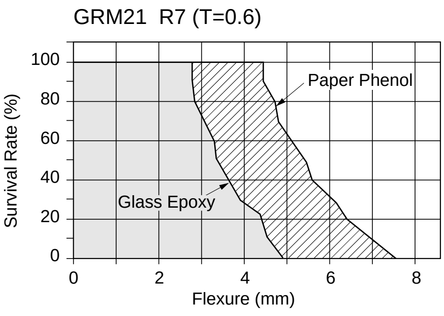
Products should be determined to be defective if the change in capacitance has exceeded the values specified in Table 4.

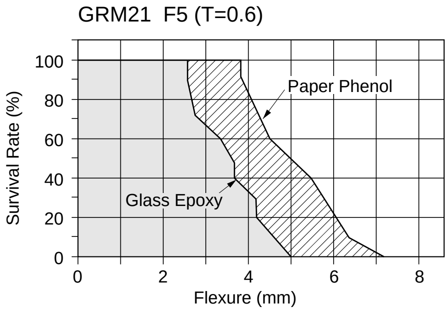
Table 4

Characteristics	Change in Capacitance
5C	Within ±5% or ±0.5pF, whichever is greater
R7	Within ±12.5%
F5	Within ±20%

(4) Results







Continued on the following page.

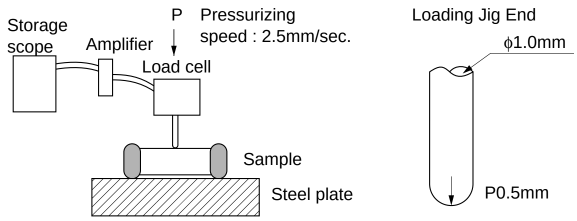
Reference Data

Continued from the preceding page.

5. Break Strength

(1) Test Method

Place the chip on a steel plate as illustrated on the right. Increase load applied to a point near the center of the test sample.

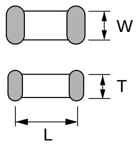


(2) Test Samples

GRM21 5C/R7/F5 Characteristics
GRM31 5C/R7/F5 Characteristics

(3) Acceptance Criteria

Define the load that has caused the chip to break or crack, as the bending force.



Chip Size	L	W	γ 5C Charac-teristics	γ R7 Charac-teristics	γ F5 Charac-teristics
GRM21	1.5	1.2	300	180	160
GRM31	2.7	1.5			

(in mm)

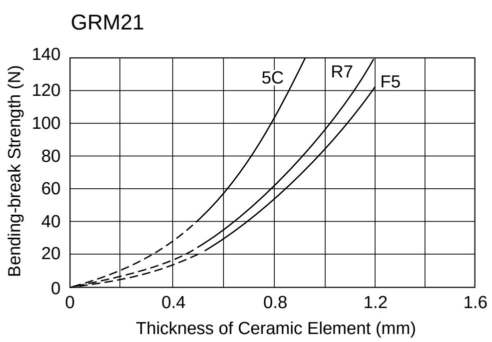
(4) Explanation

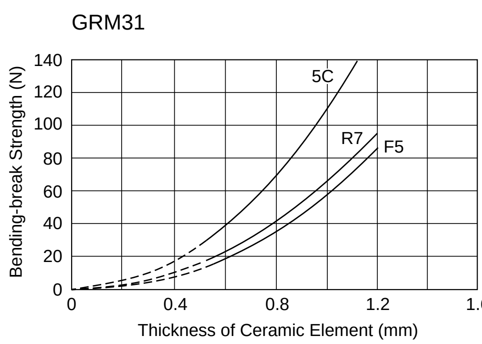
Break strength, P, is proportionate to the square of the thickness of the ceramic element and is expressed as a curve of secondary degree.
The formula is:

$$P=\frac{2\gamma WT^2}{3L} \quad \text{(N)}$$

W: Width of ceramic element (mm)
T: Thickness of element (mm)
L: Distance between fulcrums (mm)
γ: Bending stress (N/mm^2)

(5) Results

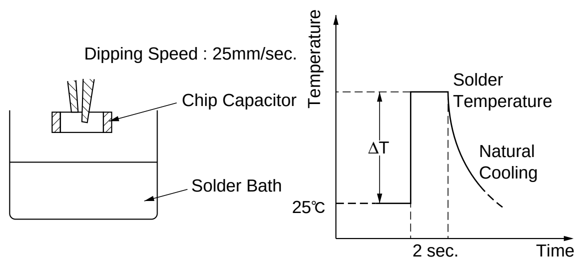




6. Thermal Shock

(1) Test method

After applying flux (an ethanol solution of 25% rosin), dip the chip in a solder bath (6✕4 eutectic solder) in accordance with the following conditions:



(2) Test samples

GRM21 5C/R7/F5 Characteristics T=0.6mm typical

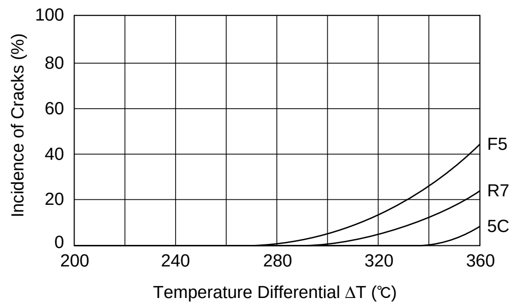
(3) Acceptance criteria

Visually inspect the test sample with a 60-power optical microscope. Chips exhibiting breaks or cracks should be determined to be defective.

Continued on the following page.

Continued from the preceding page.

(4) Results



7. Solder Heat Resistance

(1) Test Method

① Reflow soldering:
Apply about 300 μm of solder paste over the alumina substrate. After reflow soldering, remove the chip and check for leaching that may have occurred on the outer electrode.

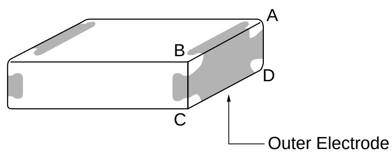
② Flow soldering:
After dipping the test sample with a pair of tweezers in wave solder (eutectic solder), check for leaching that may have occurred on the outer electrode.

③ Dip soldering:
After dipping the test sample with a pair of tweezers in static solder (eutectic solder), check for leaching that may have occurred on the outer electrode.

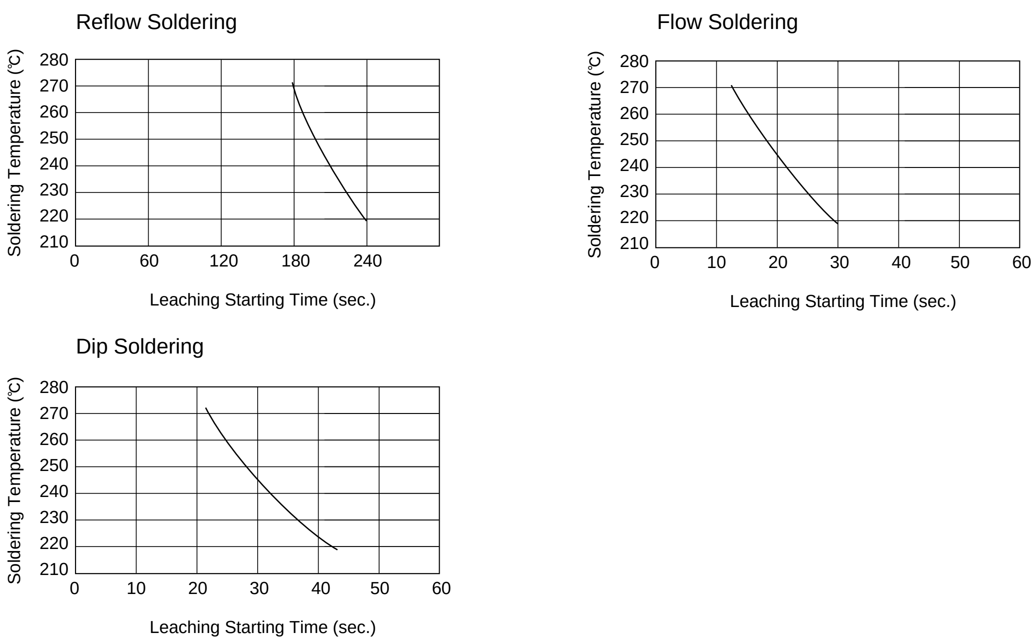
④ Flux to be used: An ethanol solution of 25% rosin.

(2) Test samples
GRM21: For flow/reflow soldering T=0.6mm

(3) Acceptance criteria
The starting time of leaching should be defined as the time when the outer electrode has lost 25% of the total edge length of A-B-C-D as illustrated:



(4) Results



Continued on the following page.

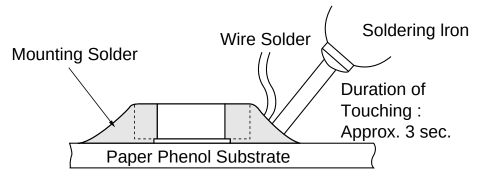
Reference Data

Continued from the preceding page.

8. Thermal Shock when Making Corrections with a Soldering Iron

(1) Test Method

Apply a soldering iron meeting the conditions below to the soldered joint of a chip that has been soldered to a paper phenol board, while supplying wire solder. (Note: the soldering iron tip should not directly touch the ceramic element of the chip.)



Soldering Iron	Tip diameter
Ceramic heater 20W	ϕ3mm

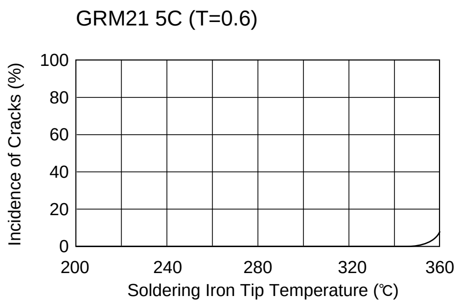
(2) Test Samples

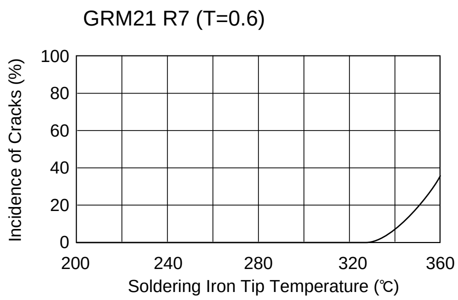
GRM21 5C/R7/F5 Characteristics T=0.6mm

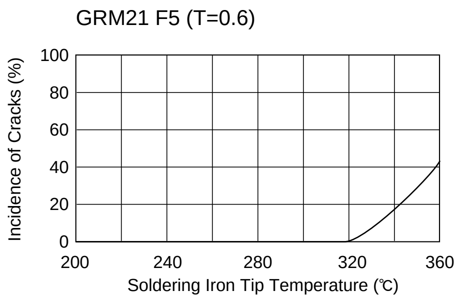
(3) Acceptance Criteria for Defects

Observe the appearance of the test sample with a 60-power optical microscope. Those units displaying any breaks or cracks are determined to be defective.

(4) Results

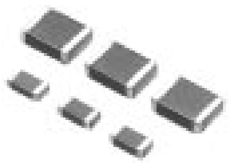


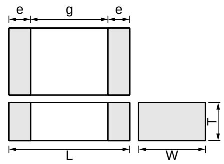




Chip Monolithic Ceramic Capacitors

Medium Voltage Low Dissipation Factor





■ Features

1. Low-loss and suitable for high frequency circuits
2. Murata's original internal electrode structure realizes high flash-over voltage.
3. A new monolithic structure for small, surface-mountable devices capable of operating at high voltage levels
4. Sn-plated external electrodes realize good solderability.
5. Use the GRM21/31 type with flow or reflow soldering, and other types with reflow soldering only.

Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GRM21A	2.0 ±0.2	1.25 ±0.2	1.0 +0,-0.3	0.3	0.7
GRM31A	3.2 ±0.2	1.6 ±0.2			1.5*
GRM31B			1.25 +0,-0.3		
GRM32A	3.2 ±0.2	2.5 ±0.2	1.0 +0,-0.3		
GRM32B			1.25 +0,-0.3		
GRM42A	4.5 ±0.3	2.0 ±0.2	1.0 +0,-0.3		2.9

* GRM31A7U3D, GRM32A7U3D, GRM32B7U3D : 1.8mm min.

■ Applications

Ideal for use on high frequency pulse circuits such as snubber circuits for switching power supplies, DC-DC converters, ballasts (inverter fluorescent lamps), etc.

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM21A7U2E101JW31D	DC250	U2J (EIA)	100 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E151JW31D	DC250	U2J (EIA)	150 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E221JW31D	DC250	U2J (EIA)	220 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E331JW31D	DC250	U2J (EIA)	330 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E471JW31D	DC250	U2J (EIA)	470 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E681JW31D	DC250	U2J (EIA)	680 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E102JW31D	DC250	U2J (EIA)	1000 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E152JW31D	DC250	U2J (EIA)	1500 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM21A7U2E222JW31D	DC250	U2J (EIA)	2200 ±5%	2.0	1.25	1.0	0.7	0.3 min.
GRM31A7U2E332JW31D	DC250	U2J (EIA)	3300 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2E472JW31D	DC250	U2J (EIA)	4700 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31B7U2E682JW31L	DC250	U2J (EIA)	6800 ±5%	3.2	1.6	1.25	1.5	0.3 min.
GRM31B7U2E103JW31L	DC250	U2J (EIA)	10000 ±5%	3.2	1.6	1.25	1.5	0.3 min.
GRM31A7U2J100JW31D	DC630	U2J (EIA)	10 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J150JW31D	DC630	U2J (EIA)	15 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J220JW31D	DC630	U2J (EIA)	22 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J330JW31D	DC630	U2J (EIA)	33 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J470JW31D	DC630	U2J (EIA)	47 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J680JW31D	DC630	U2J (EIA)	68 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J101JW31D	DC630	U2J (EIA)	100 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J151JW31D	DC630	U2J (EIA)	150 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J221JW31D	DC630	U2J (EIA)	220 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J331JW31D	DC630	U2J (EIA)	330 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J471JW31D	DC630	U2J (EIA)	470 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J681JW31D	DC630	U2J (EIA)	680 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U2J102JW31D	DC630	U2J (EIA)	1000 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM32A7U2J152JW31D	DC630	U2J (EIA)	1500 ±5%	3.2	2.5	1.0	1.5	0.3 min.
GRM32A7U2J222JW31D	DC630	U2J (EIA)	2200 ±5%	3.2	2.5	1.0	1.5	0.3 min.
GRM31A7U3A100JW31D	DC1000	U2J (EIA)	10 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A150JW31D	DC1000	U2J (EIA)	15 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A220JW31D	DC1000	U2J (EIA)	22 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A330JW31D	DC1000	U2J (EIA)	33 ±5%	3.2	1.6	1.0	1.5	0.3 min.

Continued on the following page. ↗

Continued from the preceding page.

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM31A7U3A470JW31D	DC1000	U2J (EIA)	47 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A680JW31D	DC1000	U2J (EIA)	68 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A101JW31D	DC1000	U2J (EIA)	100 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A151JW31D	DC1000	U2J (EIA)	150 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A221JW31D	DC1000	U2J (EIA)	220 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31A7U3A331JW31D	DC1000	U2J (EIA)	330 ±5%	3.2	1.6	1.0	1.5	0.3 min.
GRM31B7U3A471JW31L	DC1000	U2J (EIA)	470 ±5%	3.2	1.6	1.25	1.5	0.3 min.
GRM31A7U3D100JW31D	DC2000	U2J (EIA)	10 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D120JW31D	DC2000	U2J (EIA)	12 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D150JW31D	DC2000	U2J (EIA)	15 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D180JW31D	DC2000	U2J (EIA)	18 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D220JW31D	DC2000	U2J (EIA)	22 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D270JW31D	DC2000	U2J (EIA)	27 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D330JW31D	DC2000	U2J (EIA)	33 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D390JW31D	DC2000	U2J (EIA)	39 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D470JW31D	DC2000	U2J (EIA)	47 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D560JW31D	DC2000	U2J (EIA)	56 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM31A7U3D680JW31D	DC2000	U2J (EIA)	68 ±5%	3.2	1.6	1.0	1.8	0.3 min.
GRM32A7U3D820JW31D	DC2000	U2J (EIA)	82 ±5%	3.2	2.5	1.0	1.8	0.3 min.
GRM32A7U3D101JW31D	DC2000	U2J (EIA)	100 ±5%	3.2	2.5	1.0	1.8	0.3 min.
GRM32A7U3D121JW31D	DC2000	U2J (EIA)	120 ±5%	3.2	2.5	1.0	1.8	0.3 min.
GRM32A7U3D151JW31D	DC2000	U2J (EIA)	150 ±5%	3.2	2.5	1.0	1.8	0.3 min.
GRM32B7U3D181JW31L	DC2000	U2J (EIA)	180 ±5%	3.2	2.5	1.25	1.8	0.3 min.
GRM32B7U3D221JW31L	DC2000	U2J (EIA)	220 ±5%	3.2	2.5	1.25	1.8	0.3 min.
GRM42A7U3F270JW31L	DC3150	U2J (EIA)	27 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F330JW31L	DC3150	U2J (EIA)	33 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F390JW31L	DC3150	U2J (EIA)	39 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F470JW31L	DC3150	U2J (EIA)	47 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F560JW31L	DC3150	U2J (EIA)	56 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F680JW31L	DC3150	U2J (EIA)	68 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F820JW31L	DC3150	U2J (EIA)	82 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A7U3F101JW31L	DC3150	U2J (EIA)	100 ±5%	4.5	2.0	1.0	2.9	0.3 min.

Specifications and Test Methods

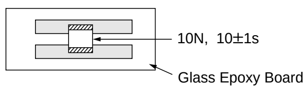
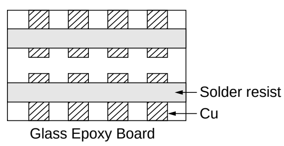
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>–</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td colspan="2">Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>4</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when voltage in Table is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.
<table>
<tr><th>Rated voltage</th><th>Test voltage</th></tr>
<tr><td>DC250V</td><td>200% of the rated voltage</td></tr>
<tr><td>DC630V</td><td>150% of the rated voltage</td></tr>
<tr><td>DC1kV, DC2kV</td><td>120% of the rated voltage</td></tr>
<tr><td>DC3.15kV</td><td>DC4095V</td></tr>
</table></td></tr>
<tr><td>5</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 10,000MΩ</td><td>The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage: DC250V) and within 60±5 sec. of charging.</td></tr>
<tr><td>6</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q should be measured at the frequency and voltage shown as follows.
<table>
<tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr>
<tr><td>C<1,000pF</td><td>1±0.2MHz</td><td>AC0.5 to 5V(r.m.s.)</td></tr>
<tr><td>C≧1,000pF</td><td>1±0.2kHz</td><td>AC1±0.2V(r.m.s.)</td></tr>
</table></td></tr>
<tr><td>7</td><td colspan="2">Q</td><td>1,000 min.</td></tr>
<tr><td>8</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Temp. Coefficient
−750±120 ppm/℃ (Temp. Range: +25 to +125℃)
−750+120, −347 ppm/℃ (Temp. Range: −55 to +25℃)</td><td>The capacitance measurement should be made at each step specified in Table.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>Min. Operating Temp.±3</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>Max. Operating Temp.±2</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table></td></tr>
<tr><td>9</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.
Then apply 10N force in the direction of the arrow.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


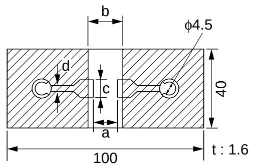
Fig. 1</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).

</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>1,000 min.</td></tr>
</table>

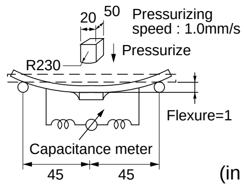
Continued on the following page. ↗

14

Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>11</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur.


<table>
<tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>2.0×1.25</td><td>1.2</td><td>4.0</td><td>1.65</td><td rowspan="4">1.0</td></tr>
<tr><td>3.2×1.6</td><td>2.2</td><td>5.0</td><td>2.0</td></tr>
<tr><td>3.2×2.5</td><td>2.2</td><td>5.0</td><td>2.9</td></tr>
<tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td></tr>
</table>
Fig. 2</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.
Then apply a force in the direction shown in Fig. 3.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


(in mm)
Fig. 3</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec.
Immersing speed: 25±2.5mm/s
Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor at 120 to 150℃* for 1 min.
Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec.
Let sit at room condition* for 24±2 hrs., then measure.
•Immersing speed: 25±2.5mm/s

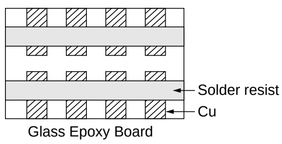
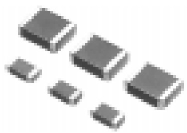
*Preheating for more than 3.2×2.5mm
<table>
<tr><th>Step</th><th>Temperature</th><th>Time</th></tr>
<tr><td>1</td><td>100 to 120℃</td><td>1 min.</td></tr>
<tr><td>2</td><td>170 to 200℃</td><td>1 min.</td></tr>
</table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5%</td></tr>
<tr><td>Q</td><td>1,000 min.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition*, then measure.
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr>
<tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr>
</table>


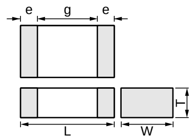
Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5%</td></tr>
<tr><td>Q</td><td>500 min.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500^{+24}_{-0} hrs.
Remove and let sit for 24±2 hrs. at room condition*, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5.0%</td></tr>
<tr><td>Q</td><td>350 min.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Life</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply 120% of the rated voltage for $1,000^{+48}_{-0}$ hrs. at maximum operating temperature ±3℃.
Remove and let sit for 24±2 hrs. at room condition*, then measure.
The charge/discharge current is less than 50mA.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±3.0%</td></tr>
<tr><td>Q</td><td>350 min.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors

Medium Voltage High Capacitance for General Use





Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM188	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.4
GRM21A	2.0 ±0.2	1.25 ±0.2	1.0 +0,-0.3	0.3 min.	0.7
GRM21B			1.25 ±0.2		
GRM31B	3.2 ±0.2	1.6 ±0.2	1.25 +0,-0.3		1.2
GRM31C			1.6 ±0.2		
GRM32Q	3.2 ±0.3	2.5 ±0.2	1.5 +0,-0.3		
GRM32D			2.0 +0,-0.3		
GRM43Q	4.5 ±0.4	3.2 ±0.3	1.5 +0,-0.3		2.2
GRM43D			2.0 +0,-0.3		
GRM55D	5.7 ±0.4	5.0 ±0.4	2.0 +0,-0.3		3.2

■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
2. Sn-plated external electrodes realizes good solderability.
3. Use the GRM18/21/31 types with flow or reflow soldering, and other types with reflow soldering only.

■ Applications

1. Ideal for use on diode-snubber circuits for switching power supplies
2. Ideal for use as primary-secondary coupling for DC-DC converter
3. Ideal for use on line filters and ringer detectors for telephones, facsimiles and modems

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM188R72E221KW07D	DC250	X7R (EIA)	220pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E331KW07D	DC250	X7R (EIA)	330pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E471KW07D	DC250	X7R (EIA)	470pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E681KW07D	DC250	X7R (EIA)	680pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E102KW07D	DC250	X7R (EIA)	1000pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM21AR72E102KW01D	DC250	X7R (EIA)	1000pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM188R72E152KW07D	DC250	X7R (EIA)	1500pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM21AR72E152KW01D	DC250	X7R (EIA)	1500pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM188R72E222KW07D	DC250	X7R (EIA)	2200pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM21AR72E222KW01D	DC250	X7R (EIA)	2200pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21AR72E332KW01D	DC250	X7R (EIA)	3300pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21AR72E472KW01D	DC250	X7R (EIA)	4700pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21AR72E682KW01D	DC250	X7R (EIA)	6800pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21BR72E103KW03L	DC250	X7R (EIA)	10000pF ±10%	2.0	1.25	1.25	0.7	0.3 min.
GRM31BR72E153KW01L	DC250	X7R (EIA)	15000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72E223KW01L	DC250	X7R (EIA)	22000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31CR72E333KW03L	DC250	X7R (EIA)	33000pF ±10%	3.2	1.6	1.6	1.2	0.3 min.
GRM31CR72E473KW03L	DC250	X7R (EIA)	47000pF ±10%	3.2	1.6	1.6	1.2	0.3 min.
GRM31BR72E683KW01L	DC250	X7R (EIA)	68000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM32QR72E683KW01L	DC250	X7R (EIA)	68000pF ±10%	3.2	2.5	1.5	1.2	0.3 min.
GRM31CR72E104KW03L	DC250	X7R (EIA)	0.10μF ±10%	3.2	1.6	1.6	1.2	0.3 min.
GRM32DR72E104KW01L	DC250	X7R (EIA)	0.10μF ±10%	3.2	2.5	2.0	1.2	0.3 min.
GRM43QR72E154KW01L	DC250	X7R (EIA)	0.15μF ±10%	4.5	3.2	1.5	2.2	0.3 min.
GRM32DR72E224KW01L	DC250	X7R (EIA)	0.22μF ±10%	3.2	2.5	2.0	1.2	0.3 min.
GRM43DR72E224KW01L	DC250	X7R (EIA)	0.22μF ±10%	4.5	3.2	2.0	2.2	0.3 min.
GRM43DR72E334KW01L	DC250	X7R (EIA)	0.33μF ±10%	4.5	3.2	2.0	2.2	0.3 min.
GRM55DR72E334KW01L	DC250	X7R (EIA)	0.33μF ±10%	5.7	5.0	2.0	3.2	0.3 min.
GRM43DR72E474KW01L	DC250	X7R (EIA)	0.47μF ±10%	4.5	3.2	2.0	2.2	0.3 min.
GRM55DR72E474KW01L	DC250	X7R (EIA)	0.47μF ±10%	5.7	5.0	2.0	3.2	0.3 min.
GRM55DR72E105KW01L	DC250	X7R (EIA)	1.0μF ±10%	5.7	5.0	2.0	3.2	0.3 min.
GRM31BR72J102KW01L	DC630	X7R (EIA)	1000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J152KW01L	DC630	X7R (EIA)	1500pF ±10%	3.2	1.6	1.25	1.2	0.3 min.

Continued on the following page. ↗

Continued from the preceding page.

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM31BR72J222KW01L	DC630	X7R (EIA)	2200pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J332KW01L	DC630	X7R (EIA)	3300pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J472KW01L	DC630	X7R (EIA)	4700pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J682KW01L	DC630	X7R (EIA)	6800pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J103KW01L	DC630	X7R (EIA)	10000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31CR72J153KW03L	DC630	X7R (EIA)	15000pF ±10%	3.2	1.6	1.6	1.2	0.3 min.
GRM32QR72J223KW01L	DC630	X7R (EIA)	22000pF ±10%	3.2	2.5	1.5	1.2	0.3 min.
GRM32DR72J333KW01L	DC630	X7R (EIA)	33000pF ±10%	3.2	2.5	2.0	1.2	0.3 min.
GRM32DR72J473KW01L	DC630	X7R (EIA)	47000pF ±10%	3.2	2.5	2.0	1.2	0.3 min.
GRM43QR72J683KW01L	DC630	X7R (EIA)	68000pF ±10%	4.5	3.2	1.5	2.2	0.3 min.
GRM43DR72J104KW01L	DC630	X7R (EIA)	0.10µF ±10%	4.5	3.2	2.0	2.2	0.3 min.
GRM55DR72J154KW01L	DC630	X7R (EIA)	0.15µF ±10%	5.7	5.0	2.0	3.2	0.3 min.
GRM55DR72J224KW01L	DC630	X7R (EIA)	0.22µF ±10%	5.7	5.0	2.0	3.2	0.3 min.
GRM31BR73A471KW01L	DC1000	X7R (EIA)	470pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR73A102KW01L	DC1000	X7R (EIA)	1000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR73A152KW01L	DC1000	X7R (EIA)	1500pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR73A222KW01L	DC1000	X7R (EIA)	2200pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR73A332KW01L	DC1000	X7R (EIA)	3300pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR73A472KW01L	DC1000	X7R (EIA)	4700pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM32QR73A682KW01L	DC1000	X7R (EIA)	6800pF ±10%	3.2	2.5	1.5	1.2	0.3 min.
GRM32QR73A103KW01L	DC1000	X7R (EIA)	10000pF ±10%	3.2	2.5	1.5	1.2	0.3 min.
GRM32DR73A153KW01L	DC1000	X7R (EIA)	15000pF ±10%	3.2	2.5	2.0	1.2	0.3 min.
GRM32DR73A223KW01L	DC1000	X7R (EIA)	22000pF ±10%	3.2	2.5	2.0	1.2	0.3 min.
GRM43DR73A333KW01L	DC1000	X7R (EIA)	33000pF ±10%	4.5	3.2	2.0	2.2	0.3 min.
GRM43DR73A473KW01L	DC1000	X7R (EIA)	47000pF ±10%	4.5	3.2	2.0	2.2	0.3 min.
GRM55DR73A104KW01L	DC1000	X7R (EIA)	0.10µF ±10%	5.7	5.0	2.0	3.2	0.3 min.

Specifications and Test Methods

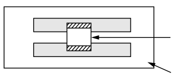
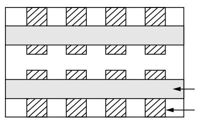
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>–</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td colspan="2">Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>4</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage: DC250V, 120% of the rated voltage in case of rated voltage: DC1kV) is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>5</td><td colspan="2">Insulation Resistance (I.R.)</td><td>C≧0.01μF: More than 100MΩ • μF
C<0.01μF: More than 10,000MΩ</td><td>The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage: DC250V) and within 60±5 sec. of charging.</td></tr>
<tr><td>6</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)</td></tr>
<tr><td>7</td><td colspan="2">Dissipation Factor (D.F.)</td><td>0.025 max.</td></tr>
<tr><td>8</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Cap. Change
Within ±15%
(Temp. Range: −55 to +125℃)</td><td>The capacitance measurement should be made at each step specified in Table.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>Min. Operating Temp.±3</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>Max. Operating Temp.±2</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table>
•Pretreatment
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>9</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.
Then apply 10N force in the direction of the arrow.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


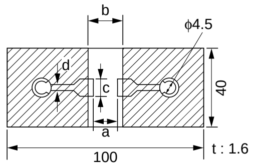
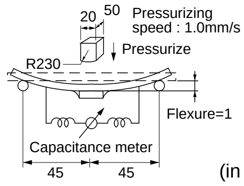
Fig. 1</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).

</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ↗

Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>11</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur.

<table>
<tr><th>L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr>
<tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>1.6×0.8</td><td>1.0</td><td>3.0</td><td>1.2</td><td rowspan="6">1.0</td></tr>
<tr><td>2.0×1.25</td><td>1.2</td><td>4.0</td><td>1.65</td></tr>
<tr><td>3.2×1.6</td><td>2.2</td><td>5.0</td><td>2.0</td></tr>
<tr><td>3.2×2.5</td><td>2.2</td><td>5.0</td><td>2.9</td></tr>
<tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table>
Fig. 2</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.
Then apply a force in the direction shown in Fig. 3.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.

(in mm)
Fig. 3</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).
Immerse in solder solution for 2±0.5 sec.
Immersing speed: 25±2.5mm/s
Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor at 120 to 150℃* for 1 min.
Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.
•Immersing speed: 25±2.5mm/s
•Pretreatment
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.

*Preheating for more than 3.2×2.5mm
<table>
<tr><th>Step</th><th>Temperature</th><th>Time</th></tr>
<tr><td>1</td><td>100 to 120℃</td><td>1 min.</td></tr>
<tr><td>2</td><td>170 to 200℃</td><td>1 min.</td></tr>
</table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>C≧0.01μF: More than 100MΩ • μF
C<0.01μF: More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition*, then measure.
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr>
<tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr>
</table>
•Pretreatment
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.

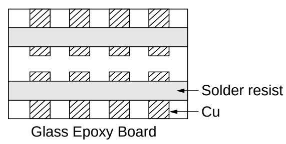



Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5%</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>C≧0.01μF: More than 100MΩ • μF
C<0.01μF: More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500$^{+24}_{-0}$ hrs.
Remove and let sit for 24±2 hrs. at room condition*, then measure.
•Pretreatment
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>C≧0.01μF: More than 10MΩ • μF
C<0.01μF: More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
16	Life	Appearance	No marking defects	Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage: DC250V, 110% of the rated voltage in case of rated voltage: DC1kV) for $1,000^{+48}_{-0}$ hrs. at maximum operating temperature ±3℃. Remove and let sit for 24 ±2 hrs. at room condition*, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±15% (rated voltage: DC250V, DC630V) Within ±20% (rated voltage: DC1kV)	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF: More than 10MΩ • μF C<0.01μF: More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	
17	Humidity Loading (Application: DC250V, DC630V item)	Appearance	No marking defects	Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500^{+24}_{-0} hrs. Remove and let sit for 24±2 hrs. at room condition*, then measure. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF: More than 10MΩ • μF C<0.01μF: More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	

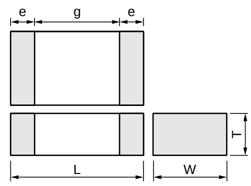
* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors

Only for LCD Backlight Inverter Circuit

■ Features

1. Low-loss and suitable for high frequency circuits
2. Murata's original internal electrode structure realizes high flash-over voltage.
3. A new monolithic structure for small, surface-mountable devices capable of operating at high voltage levels.
4. Sn-plated external electrodes realize good solderability.
5. Only for reflow soldering
6. The capacitors less than 22pF can be applied maximum 4.0kV peak to peak at 100kHz or less only for the ballast or the resonance usage in the LCD backlight inverter circuit.



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GRM42A	4.5 ±0.3	2.0 ±0.2	1.0 +0, - 0.3	0.3	2.9

■ Applications

Ideal for use as the ballast in LCD backlight inverter.

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM42A5C3F050DW01L	DC3150	C0G (EIA)	5.0 ±0.5pF	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F100JW01L	DC3150	C0G (EIA)	10 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F120JW01L	DC3150	C0G (EIA)	12 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F150JW01L	DC3150	C0G (EIA)	15 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F180JW01L	DC3150	C0G (EIA)	18 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F220JW01L	DC3150	C0G (EIA)	22 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F270JW01L	DC3150	C0G (EIA)	27 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F330JW01L	DC3150	C0G (EIA)	33 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F390JW01L	DC3150	C0G (EIA)	39 ±5%	4.5	2.0	1.0	2.9	0.3 min.
GRM42A5C3F470JW01L	DC3150	C0G (EIA)	47 ±5%	4.5	2.0	1.0	2.9	0.3 min.

Specifications and Test Methods

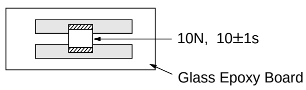
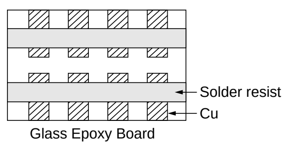
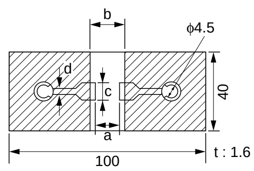
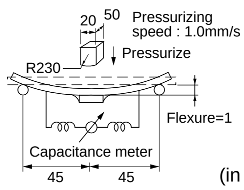
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>–</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td colspan="2">Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>4</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when DC4095V is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>5</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 10,000MΩ</td><td>The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.</td></tr>
<tr><td>6</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q should be measured at a frequency of 1±0.2MHz and a voltage of AC0.5 to 5V(r.m.s.)</td></tr>
<tr><td>7</td><td colspan="2">Q</td><td>1,000 min.</td></tr>
<tr><td>8</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Temp. Coefficient
0±30 ppm/℃ (Temp. Range: +25 to +125℃)
0+30, −72 ppm/℃ (Temp. Range: −55 to +25℃)</td><td>The capacitance measurement should be made at each step specified in Table.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>Min. Operating Temp.±3</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>Max. Operating Temp.±2</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table></td></tr>
<tr><td>9</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.
Then apply 10N force in the direction of the arrow.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


Fig. 1</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).

</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>1,000 min.</td></tr>
<tr><td>11</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur.


<table>
<tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td>1.0</td></tr>
</table>
Fig. 2</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.
Then apply a force in the direction shown in Fig. 3.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


(in mm)
Fig. 3</td></tr>
</table>

Continued on the following page.

16

muRata

Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec.
Immersing speed: 25±2.5mm/s
Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor as table.
Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec.
Let sit at room condition* for 24±2 hrs., then measure.
•Immersing speed: 25±2.5mm/s

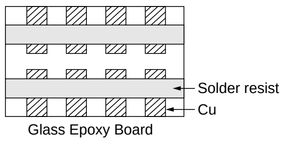
*Preheating
<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120℃</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200℃</td><td>1 min.</td></tr></table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5%</td></tr>
<tr><td>Q</td><td>1,000 min.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition*, then measure.
<table><tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table>


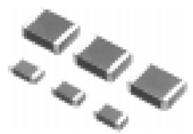
Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5%</td></tr>
<tr><td>Q</td><td>1,000 min.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500^{+24}_{-0} hrs.
Remove and let sit for 24±2 hrs. at room condition*, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5.0%</td></tr>
<tr><td>Q</td><td>350 min.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Life</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply 120% of the rated voltage for $1{,}000^{+48}_{-0}$ hrs. at maximum operating temperature ±3℃.
Remove and let sit for 24±2 hrs. at room condition*, then measure.
The charge/discharge current is less than 50mA.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±3.0%</td></tr>
<tr><td>Q</td><td>350 min.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

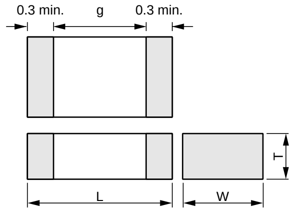
* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors

muRata

Only for Information Devices/Tip & Ring





Part Number	Dimensions (mm)			
	L	W	T	g min.
GR442Q	4.5 ±0.3	2.0 ±0.2	1.5 +0, -0.3	2.5
GR443D	4.5 ±0.4	3.2 ±0.3	2.0 +0, -0.3	
GR443Q			1.5 +0, -0.3	
GR455D	5.7 ±0.4	5.0 ±0.4	2.0 +0, -0.3	3.2

■ Features

1. These items are designed specifically for telecommunications devices (IEEE802.3) in Ethernet LAN and primary-secondary coupling for DC-DC converter.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
3. Sn-plated external electrodes realizes good solderability.
4. Only for reflow soldering
5. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.

■ Applications

1. Ideal for use on telecommunications devices in Ethernet LAN
2. Ideal for use as primary-secondary coupling for DC-DC converter

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GR442QR73D101KW01L	DC2000	X7R (EIA)	100 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D121KW01L	DC2000	X7R (EIA)	120 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D151KW01L	DC2000	X7R (EIA)	150 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D181KW01L	DC2000	X7R (EIA)	180 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D221KW01L	DC2000	X7R (EIA)	220 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D271KW01L	DC2000	X7R (EIA)	270 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D331KW01L	DC2000	X7R (EIA)	330 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D391KW01L	DC2000	X7R (EIA)	390 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D471KW01L	DC2000	X7R (EIA)	470 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D561KW01L	DC2000	X7R (EIA)	560 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D681KW01L	DC2000	X7R (EIA)	680 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D821KW01L	DC2000	X7R (EIA)	820 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D102KW01L	DC2000	X7R (EIA)	1000 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D122KW01L	DC2000	X7R (EIA)	1200 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR442QR73D152KW01L	DC2000	X7R (EIA)	1500 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GR443QR73D182KW01L	DC2000	X7R (EIA)	1800 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GR443QR73D222KW01L	DC2000	X7R (EIA)	2200 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GR443QR73D272KW01L	DC2000	X7R (EIA)	2700 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GR443QR73D332KW01L	DC2000	X7R (EIA)	3300 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GR443QR73D392KW01L	DC2000	X7R (EIA)	3900 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GR443DR73D472KW01L	DC2000	X7R (EIA)	4700 ±10%	4.5	3.2	2.0	2.5	0.3 min.
GR455DR73D103KW01L	DC2000	X7R (EIA)	10000 ±10%	5.7	5.0	2.0	3.2	0.3 min.

Specifications and Test Methods

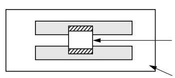
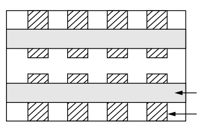
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>–</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td colspan="2">Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>4</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when voltage in table is applied between the terminations, provided the charge/discharge current is less than 50mA.
<table>
<tr><th>Rated voltage</th><th>Test Voltage</th><th>Time</th></tr>
<tr><td rowspan="2">DC2kV</td><td>120% of the rated voltage</td><td>60±1 sec.</td></tr>
<tr><td>AC1500V(r.m.s.)</td><td>60±1 sec.</td></tr>
</table></td></tr>
<tr><td>5</td><td colspan="2">Pulse Voltage</td><td>No self healing breakdowns or flash-overs have taken place in the capacitor.</td><td>10 impulse of alternating polarity is subjected.
(5 impulse for each polarity)
The interval between impulse is 60 sec.
Applied Voltage: 2.5kV zero to peak</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 6,000MΩ</td><td>The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)</td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>0.025 max.</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Cap. Change
within ±15%
(Temp. Range: −55 to +125℃)</td><td>The capacitance measurement should be made at each step specified in Table.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>Min. Operating Temp.±3</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>Max. Operating Temp.±2</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table>
•Pretreatment
Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.
Then apply 10N force in the direction of the arrow.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).

</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
</table>

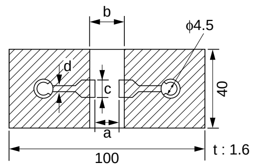
* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Specifications and Test Methods

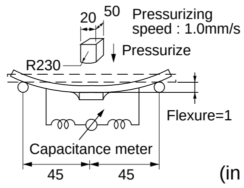
Continued from the preceding page.

No.	Item		Specifications	Test Method
12	Deflection		No cracking or marking defects should occur. (See Fig. 2)	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2. Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. (See Fig. 3)
13	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder
14	Resistance to Soldering Heat	Appearance	No marking defects	Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure. •Immersing speed: 25±2.5mm/s •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*. *Preheating (see table below)
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	
15	Temperature Cycle	Appearance	No marking defects	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4. Perform the 5 cycles according to the 4 heat treatments listed in the following table. Let sit for 24±2 hrs. at room condition*, then measure. (see table below) •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 3,000MΩ	
		Dielectric Strength	In accordance with item No.4	
16	Humidity (Steady State)	Appearance	No marking defects	Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500$^{+24}_{-0}$hrs. Remove and let sit for 24±2 hrs. at room condition*, then measure. •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	



L×W (mm)	Dimension (mm)			
	a	b	c	d
4.5×2.0	3.5	7.0	2.4	1.0
4.5×3.2	3.5	7.0	3.7	

Fig. 2



(in mm)

Fig. 3

*Preheating

Step	Temperature	Time
1	100 to 120℃	1 min.
2	170 to 200℃	1 min.

Step	Temperature (℃)	Time (min.)
1	Min. Operating Temp.±3	30±3
2	Room Temp.	2 to 3
3	Max. Operating Temp.±2	30±3
4	Room Temp.	2 to 3

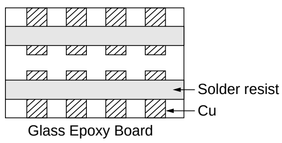


Fig. 4

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

17

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
17	Life	Appearance	No marking defects	Apply 110% of the rated voltage for $1{,}000^{+48}_{-0}$ hrs. at maximum operating temperature ±3℃. Remove and let sit for 24 ±2 hrs. at room condition*, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±20%	
		D.F.	0.05 max.	
		I.R.	More than 2,000MΩ	
		Dielectric Strength	In accordance with item No.4	

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

muRata

Chip Monolithic Ceramic Capacitors

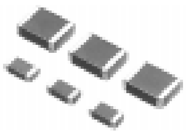
Only for Camera Flash Circuit

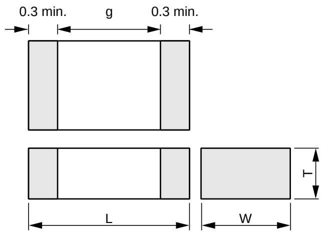
■ Features

1. Suitable for the trigger of the flash circuit, because real capacitance is stable during operating voltage
2. The thin type fit for thinner camera.
3. Sn-plated external electrodes realizes good solderability.
4. For flow and reflow soldering

■ Applications

For strobe circuit

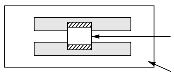
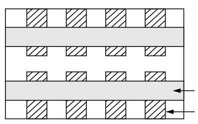




Part Number	Dimensions (mm)			
	L	W	T	g min.
GR731A	3.2 ±0.2	1.6 ±0.2	1.0 +0, -0.3	1.2
GR731B			1.25 +0, -0.3	
GR731C			1.6 ±0.2	

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GR731AW0BB103KW01D	DC350	-	10000 ±10%	3.2	1.6	1.0	1.2	0.3 min.
GR731AW0BB153KW01D	DC350	-	15000 ±10%	3.2	1.6	1.0	1.2	0.3 min.
GR731BW0BB223KW01L	DC350	-	22000 ±10%	3.2	1.6	1.25	1.2	0.3 min.
GR731BW0BB333KW01L	DC350	-	33000 ±10%	3.2	1.6	1.25	1.2	0.3 min.
GR731CW0BB473KW03L	DC350	-	47000 ±10%	3.2	1.6	1.6	1.2	0.3 min.

Specifications and Test Methods

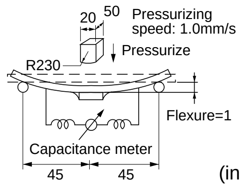
No.	Item	Specifications	Test Method
1	Operating Temperature Range	−55 to +125℃	–
2	Appearance	No defects or abnormalities	Visual inspection
3	Dimensions	Within the specified dimensions	Using calipers
4	Dielectric Strength	No defects or abnormalities	No failure should be observed when DC500V is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.
5	Insulation Resistance (I.R.)	C≧0.01μF: More than 100MΩ • μF C<0.01μF: More than 10,000MΩ	The insulation resistance should be measured with DC250±50V and within 60±5 sec. of charging.
6	Capacitance	Within the specified tolerance	The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)
7	Dissipation Factor (D.F.)	0.025 max.	
8	Capacitance Temperature Characteristics	Cap. Change Within ±10% (Apply DC350V bias) Within $^{+22}_{-33}$% (No DC bias) (Temp. Range : −55 to +125℃)	The capacitance measurement should be made at each step specified in Table. Step / Temperature (℃) 1 / 25±2 2 / Min. Operating Temp.±3 3 / 25±2 4 / Max. Operating Temp.±2 5 / 25±2 •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.
9	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1. Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 1
10	Vibration Resistance – Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). 
	Vibration Resistance – Capacitance	Within the specified tolerance	
	Vibration Resistance – D.F.	0.025 max.	

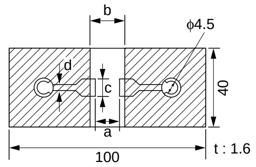
* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="2">11</td><td colspan="2" rowspan="2">Deflection</td><td>No cracking or marking defects should occur.</td><td rowspan="2">Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.
Then apply a force in the direction shown in Fig. 3.
The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


(in mm)
Fig. 3</td></tr>
<tr><td>

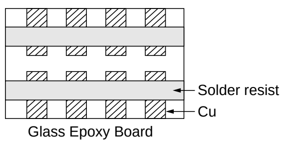
<table><tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>3.2×1.6</td><td>2.2</td><td>5.0</td><td>2.0</td><td>1.0</td></tr></table>
Fig. 2</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).
Immerse in solder solution for 2±0.5 sec.
Immersing speed: 25±2.5mm/s
Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor at 120 to 150℃* for 1 min.
Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.
•Immersing speed: 25±2.5mm/s
•Pretreatment
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>C≧0.01μF: More than 100MΩ • μF
C<0.01μF: More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition*, then measure.
<table><tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table>
•Pretreatment
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.


Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5%</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>C≧0.01μF: More than 100MΩ • μF
C<0.01μF: More than 10,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500^{+24}_{-0} hrs.
Remove and let sit for 24±2 hrs. at room condition*, then measure.
•Pretreatment
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>C≧0.01μF: More than 10MΩ • μF
C<0.01μF: More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

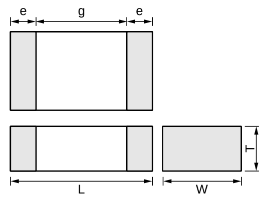
No.	Item		Specifications	Test Method
16	Life	Appearance	No marking defects	Apply DC350V for $1,000^{+48}_{-0}$ hrs. at maximum operating temperature ±3℃. Remove and let sit for 24 ±2 hrs. at room condition*, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF: More than 10MΩ • μF C<0.01μF: More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	
17	Humidity Loading	Appearance	No marking defects	Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500^{+24}_{-0} hrs. Remove and let sit for 24±2 hrs. at room condition*, then measure. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF: More than 10MΩ • μF C<0.01μF: More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors

muRata

AC250V (r.m.s.) Type (Which Meet Japanese Law)



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA242Q	4.5 ±0.3	2.0 ±0.2	1.5 +0, -0.3	0.3	2.5
GA243D	4.5 ±0.4	3.2 ±0.3	2.0 +0, -0.3		
GA243Q			1.5 +0, -0.3		
GA255D	5.7 ±0.4	5.0 ±0.4	2.0 +0, -0.3		3.2

■ Features

1. Chip monolithic ceramic capacitor for AC lines
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
3. Sn-plated external electrodes realizes good solderability.
4. Only for reflow soldering
5. Capacitance 0.01 to 0.1uF for connecting lines and 470 to 4700pF for connecting lines to earth

■ Applications

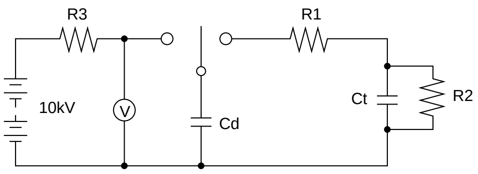
Noise suppression filters for switching power supplies, telephones, facsimiles, modems

■ Reference standard

GA2 series obtains no safety approval.
This series is based on JIS C 5102, JIS C 5150, and the standards of the electrical appliance and material safety law of Japan (separated table 4).

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GA242QR7E2471MW01L	AC250 (r.m.s.)	X7R (EIA)	470pF ±20%	4.5	2.0	1.5	2.5	0.3 min.
GA242QR7E2102MW01L	AC250 (r.m.s.)	X7R (EIA)	1000pF ±20%	4.5	2.0	1.5	2.5	0.3 min.
GA243QR7E2222MW01L	AC250 (r.m.s.)	X7R (EIA)	2200pF ±20%	4.5	3.2	1.5	2.5	0.3 min.
GA243QR7E2332MW01L	AC250 (r.m.s.)	X7R (EIA)	3300pF ±20%	4.5	3.2	1.5	2.5	0.3 min.
GA243DR7E2472MW01L	AC250 (r.m.s.)	X7R (EIA)	4700pF ±20%	4.5	3.2	2.0	2.5	0.3 min.
GA243QR7E2103MW01L	AC250 (r.m.s.)	X7R (EIA)	10000pF ±20%	4.5	3.2	1.5	2.5	0.3 min.
GA243QR7E2223MW01L	AC250 (r.m.s.)	X7R (EIA)	22000pF ±20%	4.5	3.2	1.5	2.5	0.3 min.
GA243DR7E2473MW01L	AC250 (r.m.s.)	X7R (EIA)	47000pF ±20%	4.5	3.2	2.0	2.5	0.3 min.
GA255DR7E2104MW01L	AC250 (r.m.s.)	X7R (EIA)	0.10μF ±20%	5.7	5.0	2.0	3.2	0.3 min.

Specifications and Test Methods

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>−</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td colspan="2">Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>4</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA.<table><tr><th>Nominal Capacitance</th><th>Test voltage</th></tr><tr><td>C≧10,000pF</td><td>AC575V (r.m.s.)</td></tr><tr><td>C<10,000pF</td><td>AC1500V (r.m.s.)</td></tr></table></td></tr>
<tr><td>5</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 2,000MΩ</td><td>The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.</td></tr>
<tr><td>6</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.s.)</td></tr>
<tr><td>7</td><td colspan="2">Dissipation Factor (D.F.)</td><td>0.025 max.</td></tr>
<tr><td>8</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Cap. Change
Within ±15%
(Temp. Range: −55 to +125℃)</td><td>The capacitance measurement should be made at each step specified in Table.<table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2</td></tr></table>•Pretreatment
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>9</td><td>Discharge Test (Application: Nominal Capacitance C<10,000pF)</td><td>Appearance</td><td>No defects or abnormalities</td><td>As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified.


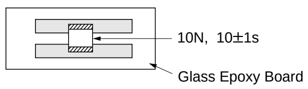
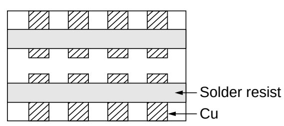
Ct: Capacitor under test Cd: 0.001μF
R1: 1,000Ω R2: 100MΩ R3: Surge resistance</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defects should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.
Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.


Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).

</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
</table>

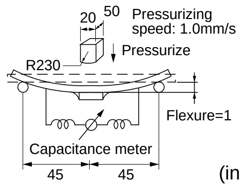
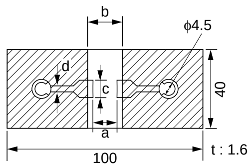
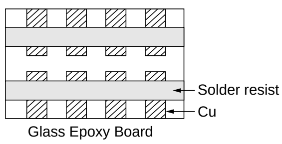
* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ↗

muRata

Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="2">12</td><td colspan="2" rowspan="2">Deflection</td><td>No cracking or marking defects should occur.</td><td rowspan="2">Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.
Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
(in mm)
Fig. 3</td></tr>
<tr><td>
<table>
<tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="3">1.0</td></tr>
<tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table>
Fig. 2</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).
Immerse in solder solution for 2±0.5 sec.
Immersing speed: 25±2.5mm/s
Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Humidity Insulation</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">The capacitor should be subjected to 40±2℃, relative humidity of 90 to 98% for 8 hrs., and then removed in room condition* for 16 hrs. until 5 cycles.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor as table.
Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure.
•Immersing speed: 25±2.5mm/s
•Pretreatment
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.
*Preheating
<table>
<tr><th>Step</th><th>Temperature</th><th>Time</th></tr>
<tr><td>1</td><td>100 to 120℃</td><td>1 min.</td></tr>
<tr><td>2</td><td>170 to 200℃</td><td>1 min.</td></tr>
</table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>More than 2,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition*, then measure.
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr>
<tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr>
</table>
•Pretreatment
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.
Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 2,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

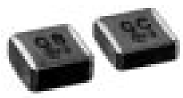
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">17</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{-0}$ hrs.
Remove and let sit for 24±2 hrs. at room condition*, then measure.
•Pretreatment
Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">18</td><td rowspan="5">Life</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply voltage and time as Table at 85±2℃. Remove and let sit for 24 ±2 hrs. at room condition*, then measure. The charge / discharge current is less than 50mA.<table><tr><th>Nominal Capacitance</th><th>Test Time</th><th>Test voltage</th></tr><tr><td>C≧10,000pF</td><td>1,000 $^{+48}_{-0}$ hrs.</td><td>AC300V (r.m.s.)</td></tr><tr><td>C<10,000pF</td><td>1,500 $^{+48}_{-0}$ hrs.</td><td>AC500V (r.m.s.) *</td></tr></table>* Except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.

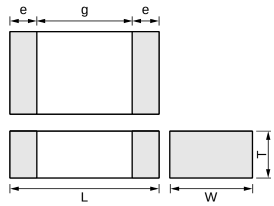
•Pretreatment
Apply test voltage for 60±5 min. at test temperature.
Remove and let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±20%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">19</td><td rowspan="5">Humidity Loading</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{-0}$ hrs.
Remove and let sit for 24±2 hrs. at room condition*, then measure.
•Pretreatment
Apply test voltage for 60±5 min. at test temperature.
Remove and let sit for 24±2 hrs. at room condition*.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

* "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors

Safety Standard Recognized Type GC (UL, IEC60384-14 Class X1/Y2)





Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA355D	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0

■ Features

1. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC lines
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
3. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
4. The type GC can be used as an X1-class and Y2-class capacitor, line-by-pass capacitor of UL1414.
5. +125 degree C guaranteed
6. Only for reflow soldering

■ Applications

1. Ideal for use as Y capacitor or X capacitor for various switching power supplies
2. Ideal for modem applications

■ Standard Recognition

	Standard No.	Status of Recognition		Rated Voltage
		Type GB	Type GC	
UL	UL1414	–	◎*	AC250V (r.m.s.)
BSI	EN132400	–	◎	
VDE		◎	◎	
SEV		◎	◎	
SEMKO		◎	◎	
EN132400 Class		X2	X1, Y2	

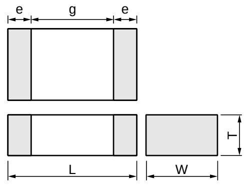
*: Line By-pass only

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GA355DR7GC101KY02L	AC250 (r.m.s.)	X7R (EIA)	100 ±10%	5.7	5.0	2.0	4.0	0.3 min.
GA355DR7GC151KY02L	AC250 (r.m.s.)	X7R (EIA)	150 ±10%	5.7	5.0	2.0	4.0	0.3 min.
GA355DR7GC221KY02L	AC250 (r.m.s.)	X7R (EIA)	220 ±10%	5.7	5.0	2.0	4.0	0.3 min.
GA355DR7GC331KY02L	AC250 (r.m.s.)	X7R (EIA)	330 ±10%	5.7	5.0	2.0	4.0	0.3 min.

Chip Monolithic Ceramic Capacitors

muRata

Safety Standard Recognized Type GD (IEC60384-14 Class Y3)



■ Features

1. Available for equipment based on IEC/EN60950 and UL1950
2. The type GD can be used as a Y3-class capacitor.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
4. +125 degree C guaranteed
5. Only for reflow soldering
6. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.

Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA342A	4.5 ±0.3	2.0 ±0.2	1.0 +0, -0.3	0.3	2.5
GA342D			2.0 ±0.3		
GA342Q			1.5 +0, -0.3		
GA343D	4.5 ±0.4	3.2 ±0.3	2.0 +0, -0.3		
GA343Q			1.5 +0, -0.3		

■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers
2. Ideal for use on line filters for information equipment

■ Standard Recognition

	Standard No.	Class	Status of Recognition Type GD	Rated Voltage
SEMKO	EN132400	Y3	◎	AC250V(r.m.s.)

Applications

Size	Switching power supplies	Communication network devices such as a modem
4.5×3.2mm and under	–	◎

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GA342D1XGD100JY02L	AC250 (r.m.s.)	SL (JIS)	10 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD120JY02L	AC250 (r.m.s.)	SL (JIS)	12 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD150JY02L	AC250 (r.m.s.)	SL (JIS)	15 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD180JY02L	AC250 (r.m.s.)	SL (JIS)	18 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD220JY02L	AC250 (r.m.s.)	SL (JIS)	22 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342A1XGD270JW31L	AC250 (r.m.s.)	SL (JIS)	27 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD330JW31L	AC250 (r.m.s.)	SL (JIS)	33 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD390JW31L	AC250 (r.m.s.)	SL (JIS)	39 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD470JW31L	AC250 (r.m.s.)	SL (JIS)	47 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD560JW31L	AC250 (r.m.s.)	SL (JIS)	56 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD680JW31L	AC250 (r.m.s.)	SL (JIS)	68 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD820JW31L	AC250 (r.m.s.)	SL (JIS)	82 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342QR7GD101KW01L	AC250 (r.m.s.)	X7R (EIA)	100 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD151KW01L	AC250 (r.m.s.)	X7R (EIA)	150 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD221KW01L	AC250 (r.m.s.)	X7R (EIA)	220 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD331KW01L	AC250 (r.m.s.)	X7R (EIA)	330 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD471KW01L	AC250 (r.m.s.)	X7R (EIA)	470 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD681KW01L	AC250 (r.m.s.)	X7R (EIA)	680 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD102KW01L	AC250 (r.m.s.)	X7R (EIA)	1000 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD152KW01L	AC250 (r.m.s.)	X7R (EIA)	1500 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA343QR7GD182KW01L	AC250 (r.m.s.)	X7R (EIA)	1800 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GA343QR7GD222KW01L	AC250 (r.m.s.)	X7R (EIA)	2200 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GA343DR7GD472KW01L	AC250 (r.m.s.)	X7R (EIA)	4700 ±10%	4.5	3.2	2.0	2.5	0.3 min.

Chip Monolithic Ceramic Capacitors

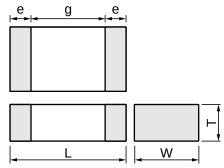
Safety Standard Recognized Type GF (IEC60384-14 Class Y2, X1/Y2)

■ Features

1. Available for equipment based on IEC/EN60950 and UL1950. Besides, the GA352/355 types are available for equipment based on IEC/EN60065, UL1492, and UL6500
2. The type GF can be used as a Y2-class capacitor.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
4. +125 degree C guaranteed
5. Only for reflow soldering
6. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.

■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers
2. Ideal for use on line filters for information equipment
3. Ideal for use as Y capacitor or X capacitor for various switching power supplies (GA352/355 types only)



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA342A	4.5 ±0.3	2.0 ±0.2	1.0 +0, -0.3	0.3	2.5
GA342D			2.0 ±0.2*		
GA342Q			1.5 +0, -0.3		
GA352Q	5.7 ±0.4	2.8 ±0.3	1.5 +0, -0.3		4.0
GA355D		5.0 ±0.4	2.0 +0, -0.3		
GA355Q			1.5 +0, -0.3		

* GA342D1X : 2.0±0.3

■ Standard Recognition

	Standard No.	Class	Status of Recognition Type GF		Rated Voltage
			Size : 4.5×2.0mm	Size : 5.7×2.8mm and over	
UL	UL1414	X1, Y2	–	◎	AC250V (r.m.s.)
SEMKO	EN132400	Y2	◎	◎	

Applications

Size	Switching power supplies	Communication network devices such as a modem
4.5×2.0mm	–	◎
5.7×2.8mm and over	◎	◎

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GA342D1XGF100JY02L	AC250 (r.m.s.)	SL (JIS)	10 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF120JY02L	AC250 (r.m.s.)	SL (JIS)	12 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF150JY02L	AC250 (r.m.s.)	SL (JIS)	15 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF180JY02L	AC250 (r.m.s.)	SL (JIS)	18 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF220JY02L	AC250 (r.m.s.)	SL (JIS)	22 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342A1XGF270JW31L	AC250 (r.m.s.)	SL (JIS)	27 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF330JW31L	AC250 (r.m.s.)	SL (JIS)	33 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF390JW31L	AC250 (r.m.s.)	SL (JIS)	39 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF470JW31L	AC250 (r.m.s.)	SL (JIS)	47 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF560JW31L	AC250 (r.m.s.)	SL (JIS)	56 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF680JW31L	AC250 (r.m.s.)	SL (JIS)	68 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF820JW31L	AC250 (r.m.s.)	SL (JIS)	82 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342QR7GF101KW01L	AC250 (r.m.s.)	X7R (EIA)	100 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GF151KW01L	AC250 (r.m.s.)	X7R (EIA)	150 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342DR7GF221KW02L	AC250 (r.m.s.)	X7R (EIA)	220 ±10%	4.5	2.0	2.0	2.5	0.3 min.
GA342DR7GF331KW02L	AC250 (r.m.s.)	X7R (EIA)	330 ±10%	4.5	2.0	2.0	2.5	0.3 min.
GA352QR7GF471KW01L	AC250 (r.m.s.)	X7R (EIA)	470 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA352QR7GF681KW01L	AC250 (r.m.s.)	X7R (EIA)	680 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA352QR7GF102KW01L	AC250 (r.m.s.)	X7R (EIA)	1000 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA352QR7GF152KW01L	AC250 (r.m.s.)	X7R (EIA)	1500 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA355QR7GF182KW01L	AC250 (r.m.s.)	X7R (EIA)	1800 ±10%	5.7	5.0	1.5	4.0	0.3 min.
GA355QR7GF222KW01L	AC250 (r.m.s.)	X7R (EIA)	2200 ±10%	5.7	5.0	1.5	4.0	0.3 min.
GA355QR7GF332KW01L	AC250 (r.m.s.)	X7R (EIA)	3300 ±10%	5.7	5.0	1.5	4.0	0.3 min.
GA355DR7GF472KW01L	AC250 (r.m.s.)	X7R (EIA)	4700 ±10%	5.7	5.0	2.0	4.0	0.3 min.

Chip Monolithic Ceramic Capacitors

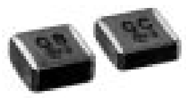
Safety Standard Recognized Type GB (IEC60384-14 Class X2)

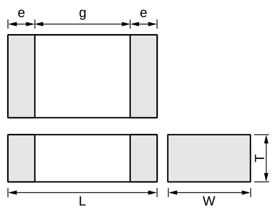
■ Features

1. The type GB can be used as an X2-class capacitor.
2. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC lines
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels
4. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
5. +125 degree C guaranteed
6. Only for reflow soldering

■ Applications

Ideal for use as X capacitor for various switching power supplies





Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA355D	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0
GA355X			2.7 ±0.3		

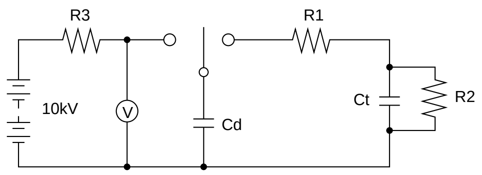
■ Standard Recognition

	Standard No.	Status of Recognition		Rated Voltage
		Type GB	Type GC	
UL	UL1414	–	◎*	AC250V (r.m.s.)
BSI	EN132400	–	◎	
VDE		◎	◎	
SEV		◎	◎	
SEMKO		◎	◎	
EN132400 Class		X2	X1, Y2	

*: Line By-pass only

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GA355DR7GB103KY02L	AC250 (r.m.s.)	X7R (EIA)	10000 ±10%	5.7	5.0	2.0	4.0	0.3 min.
GA355DR7GB153KY02L	AC250 (r.m.s.)	X7R (EIA)	15000 ±10%	5.7	5.0	2.0	4.0	0.3 min.
GA355DR7GB223KY02L	AC250 (r.m.s.)	X7R (EIA)	22000 ±10%	5.7	5.0	2.0	4.0	0.3 min.
GA355XR7GB333KY06L	AC250 (r.m.s.)	X7R (EIA)	33000 ±10%	5.7	5.0	2.7	4.0	0.3 min.

GA3 Series Specifications and Test Methods

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>–</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td colspan="2">Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>4</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA.<table><tr><th></th><th>Test Voltage</th></tr><tr><td>Type GB</td><td>DC1075V</td></tr><tr><td>Type GC/GD/GF</td><td>AC1500V (r.m.s.)</td></tr></table></td></tr>
<tr><td>5</td><td colspan="2">Pulse Voltage (Application: Type GD/GF)</td><td>No self healing breakdowns or flash-overs have taken place in the capacitor.</td><td>10 impulse of alternating polarity is subjected.
(5 impulse for each polarity)
The interval between impulse is 60 sec.
Applied Voltage: 2.5kV zero to peak</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>More than 6,000MΩ</td><td>The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q/D.F. should be measured at a frequency of 1±0.2kHz (SL char.: 1±0.2MHz) and a voltage of AC1±0.2V (r.m.s.).</td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.025</td></tr><tr><td rowspan="2">SL</td><td>Q≧400+20C*2 (C<30pF)</td></tr><tr><td>Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table>Temperature characteristic guarantee is −55 to +125℃<table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to −1000ppm/℃</td></tr></table>Temperature characteristic guarantee is +20 to +85℃</td><td>The capacitance measurement should be made at each step specified in Table.<table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2 (20±2 for SL char.)</td></tr><tr><td>2</td><td>Min. Operating Temp.±3</td></tr><tr><td>3</td><td>25±2 (20±2 for SL char.)</td></tr><tr><td>4</td><td>Max. Operating Temp.±2</td></tr><tr><td>5</td><td>25±2 (20±2 for SL char.)</td></tr></table>SL char. :
The capacitance should be measured at even 85℃ between step 3 and step 4.
•Pretreatment for X7R char.
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Discharge Test (Application: Type GC)</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified.

Ct: Capacitor under test Cd: 0.001μF
R1: 1,000Ω R2: 100MΩ R3: Surge resistance</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td>11</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1.
Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.

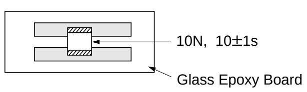



Fig. 1</td></tr>
</table>

*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

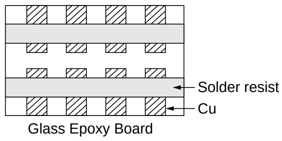
Continued on the following page.

GA3 Series Specifications and Test Methods

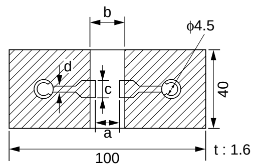
Continued from the preceding page.

No.	Item		Specifications	Test Method
12	Vibration Resistance	Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).
		Capacitance	Within the specified tolerance	
		D.F. Q	(see table below)	

Char.	Specification
X7R	D.F.≦0.025
SL	Q≧400+20C*2 (C<30pF) Q≧1000 (C≧30pF)

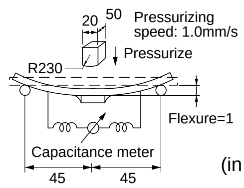


No.	Item	Specifications	Test Method
13	Deflection	No cracking or marking defects should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2. Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.



L×W (mm)	Dimension (mm)			
	a	b	c	d
4.5×2.0	3.5	7.0	2.4	1.0
4.5×3.2	3.5	7.0	3.7	
5.7×2.8	4.5	8.0	3.2	
5.7×5.0	4.5	8.0	5.6	

Fig. 2



(in mm)

Fig. 3

No.	Item	Specifications	Test Method
14	Solderability of Termination	75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder

No.	Item		Specifications	Test Method
15	Resistance to Soldering Heat	Appearance	No marking defects	Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition*1 for 24±2 hrs., then measure. •Immersing speed: 25±2.5mm/s •Pretreatment for X7R char. Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.
		Capacitance Change	(see table below)	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	

Char.	Capacitance Change
X7R	Within ±10%
SL	Within ±2.5% or ±0.25pF (Whichever is larger)

*Preheating

Step	Temperature	Time
1	100 to 120℃	1 min.
2	170 to 200℃	1 min.

*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

GA3 Series Specifications and Test Methods

Continued from the preceding page.

No. 16 Temperature Cycle

Item	Specifications
Appearance	No marking defects
Capacitance Change	Char. X7R: Within ±15% Char. SL: Within ±2.5% or ±0.25pF (Whichever is larger)
D.F. Q	Char. X7R: D.F.≦0.05 Char. SL: Q≧400+20C*2 (C<30pF); Q≧1000 (C≧30pF)
I.R.	More than 3,000MΩ
Dielectric Strength	In accordance with item No.4

Test Method

Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition*1, then measure.

Step	Temperature (℃)	Time (min.)
1	Min. Operating Temp.±3	30±3
2	Room Temp.	2 to 3
3	Max. Operating Temp.±2	30±3
4	Room Temp.	2 to 3

•Pretreatment for X7R char.
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.

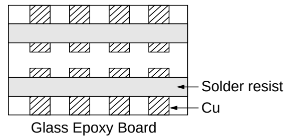


Fig. 4

No. 17 Humidity (Steady State)

Item	Specifications
Appearance	No marking defects
Capacitance Change	Char. X7R: Within ±15% Char. SL: Within ±5.0% or ±0.5pF (Whichever is larger)
D.F. Q	Char. X7R: D.F.≦0.05 Char. SL: Q≧275+5/2C*2 (C<30pF); Q≧350 (C≧30pF)
I.R.	More than 3,000MΩ
Dielectric Strength	In accordance with item No.4

Test Method

Before this test, the test shown in the following is performed.
·Item 11 Adhesive Strength of Termination (applied force is 5N)
·Item 13 Deflection

Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500^{+24}_{-0} hrs.
Remove and let sit for 24±2 hrs. at room condition*1, then measure.
•Pretreatment for X7R char.
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.

No. 18 Life

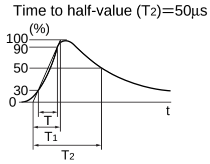
Item	Specifications
Appearance	No marking defects
Capacitance Change	Char. X7R: Within ±20% Char. SL: Within ±3.0% or ±0.3pF (Whichever is larger)
D.F. Q	Char. X7R: D.F.≦0.05 Char. SL: Q≧275+5/2C*2 (C<30pF); Q≧350 (C≧30pF)
I.R.	More than 3,000MΩ
Dielectric Strength	In accordance with item No.4

Test Method

Before this test, the test shown in the following is performed.
·Item 11 Adhesive Strength of Termination (apply force is 5N)
·Item 13 Deflection

Impulse Voltage
Each individual capacitor should be subjected to a 2.5kV (Type GC/GF: 5kV) Impulse (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.

Front time (T_1)=1.2µs=1.67T
Time to half-value (T_2)=50µs



Apply voltage as Table for 1,000 hrs. at 125^{+3}_{-0}℃, relative humidity 50% max.

Type	Applied Voltage
GB	AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.
GC GD GF	AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.

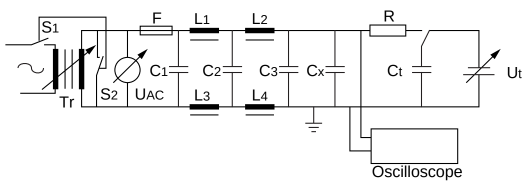
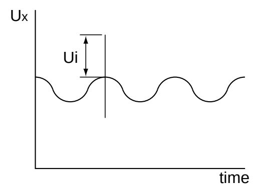
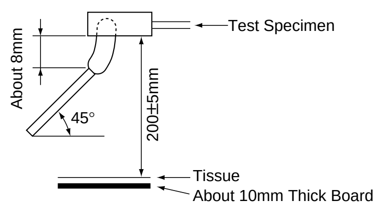
Let sit for 24±2 hrs. at room condition*1, then measure.
•Pretreatment for X7R char.
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.

*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

GA3 Series Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
19	Humidity Loading	Appearance	No marking defects	Before this test, the test shown in the following is performed. ·Item 11 Adhesive Strength of Termination (apply force is 5N) ·Item 13 Deflection Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{-0}$ hrs. Remove and let sit for 24±2 hrs. at room condition*1, then measure. •Pretreatment for X7R char. Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.
		Capacitance Change	Char. / Capacitance Change X7R: Within ±15% SL: Within ±5.0% or ±0.5pF (Whichever is larger)	
		D.F. Q	Char. / Specification X7R: D.F.≦0.05 SL: Q≧275+5/2C*2 (C<30pF) Q≧350 (C≧30pF)	
		I.R.	More than 3,000MΩ	
		Dielectric Strength	In accordance with item No.4	
20	Active Flammability		The cheesecloth should not be on fire.	The capacitor should be individually wrapped in at least one but not more than two complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The UAC should be maintained for 2 min. after the last discharge.  C1,2 : 1μF±10% C3 : 0.033μF±5% 10kV L1 to 4 : 1.5mH±20% 16A Rod core choke Ct : 3μF±5% 10kV R : 100Ω±2% Cx : Capacitor under test UAC : UR±5% F : Fuse, Rated 16A UR : Rated Voltage Ut : Voltage applied to Ct  Type / Ui GB, GD: 2.5kV GC, GF: 5kV
21	Passive Flammability		The burning time should not exceed 30 sec. The tissue paper should not ignite.	The capacitor under test should be held in the flame in the position which best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec. Length of flame : 12±1mm Gas burner : Length 35mm min. Inside Dia. 0.5±0.1mm Outside Dia. 0.9mm max. Gas : Butane gas Purity 95% min. 

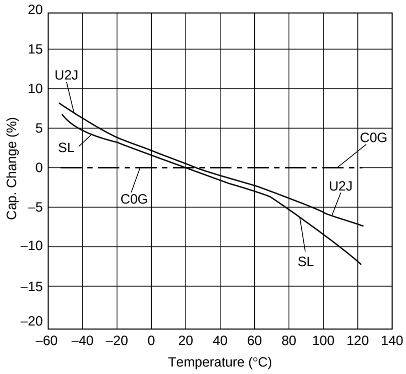
*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

murata

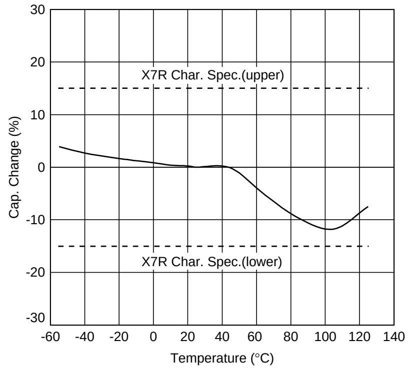
GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

■ Capacitance - Temperature Characteristics

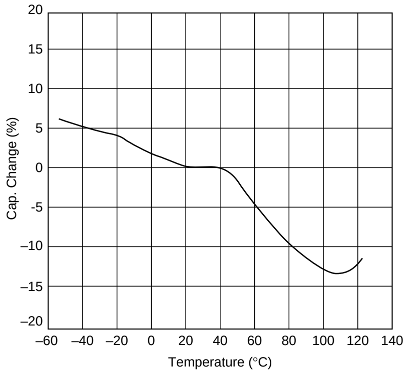
C0G/U2J/SL Characteristics



X7R Characteristics

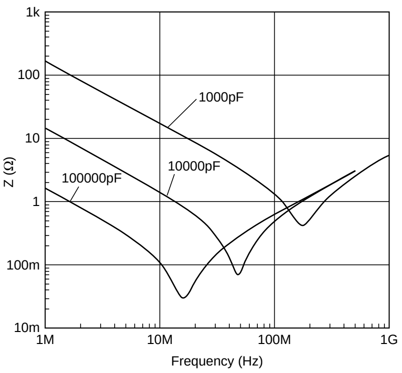


GR4 Series

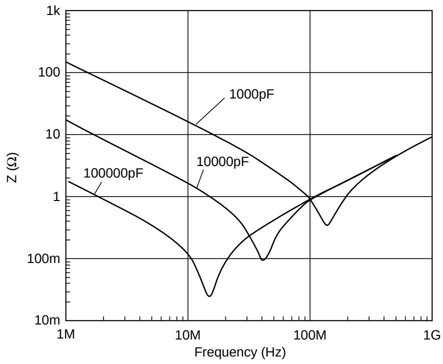


■ Impedance - Frequency Characteristics

GRM Series (X7R Char. 250V)



GRM Series (X7R Char. 630V)



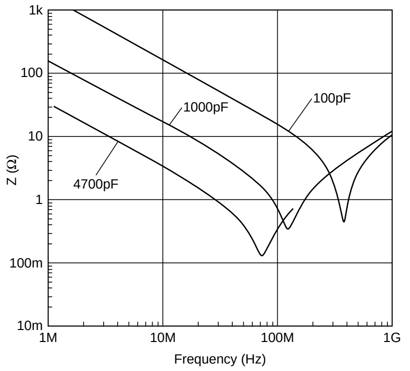
Continued on the following page. ↗

GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

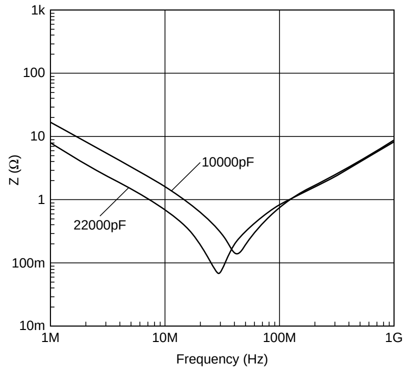
Continued from the preceding page.

■ Impedance - Frequency Characteristics

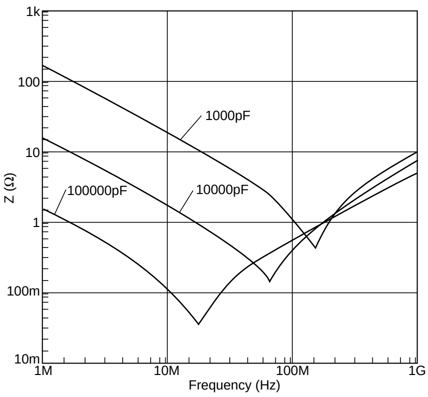
GR4 Series



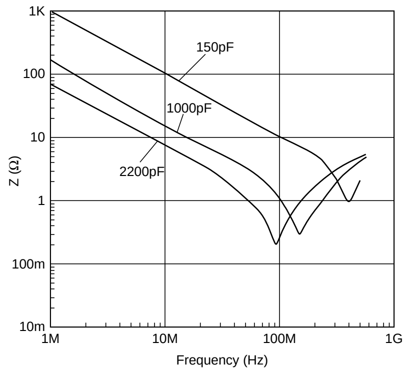
GR7 Series



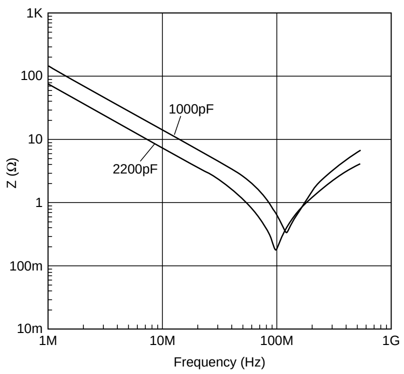
GA2 Series



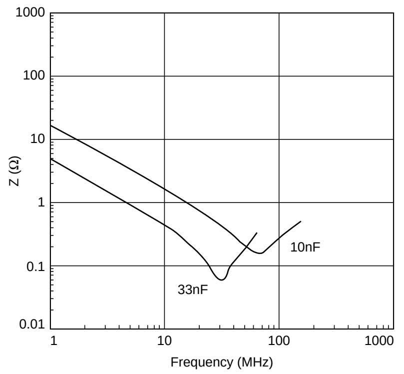
GA3 Series (Type GD)



GA3 Series (Type GF)

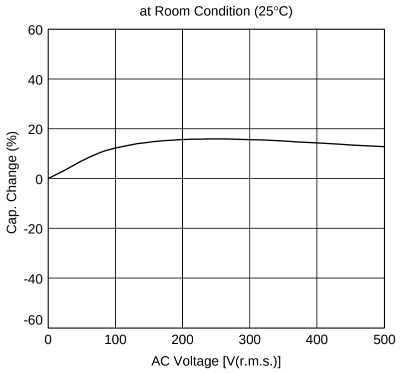


GA3 Series (Type GB)

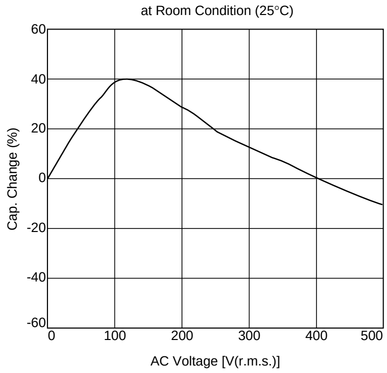


■ Capacitance - AC Voltage Characteristics

GA3 Series (Type GD/GF, X7R char.)



GA3 Series (Type GB)



Package

Taping is standard packaging method.

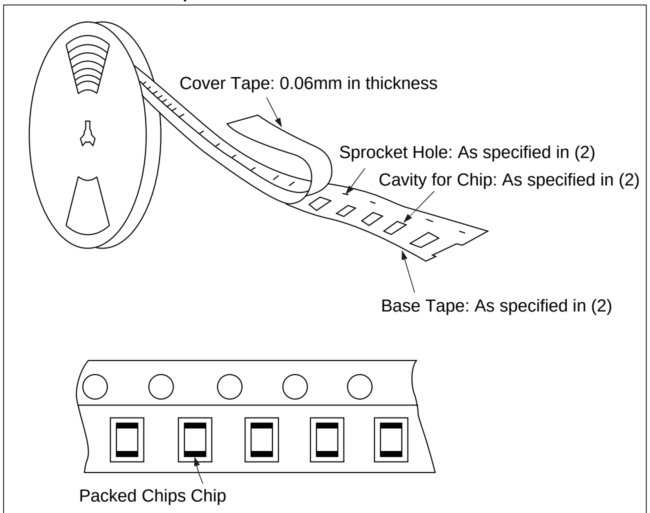
■ Minimum Quantity Guide

Part Number		Dimensions (mm)			Quantity (pcs.)	
					ø180mm Reel	
		L	W	T	Paper Tape	Embossed Tape
Medium-voltage	GRM18	1.6	0.8	0.8	4,000	-
	GRM21	2.0	1.25	1.0	4,000	-
				1.25	-	3,000
	GRM31/GR731	3.2	1.6	1.0	4,000	-
				1.25	-	3,000
				1.6	-	2,000
	GRM32	3.2	2.5	1.0	4,000	-
				1.25	-	3,000
				1.5	-	2,000
				2.0	-	1,000
	GRM42/GR442	4.5	2.0	1.0	-	3,000
				1.5	-	2,000
				2.0	-	2,000
	GRM43/GR443	4.5	3.2	1.5	-	1,000
				2.0	-	1,000
				2.5	-	500
	GRM55/GR455	5.7	5.0	2.0	-	1,000
AC250V	GA242	4.5	2.0	1.5	-	2,000
	GA243	4.5	3.2	1.5	-	1,000
				2.0	-	1,000
	GA255	5.7	5.0	2.0	-	1,000
Safety Std. Recognition	GA342	4.5	2.0	1.0	-	3,000
				1.5	-	2,000
				2.0	-	2,000
	GA343	4.5	3.2	1.5	-	1,000
				2.0	-	1,000
	GA352	5.7	2.8	1.5	-	1,000
	GA355	5.7	5.0	1.5	-	1,000
				2.0	-	1,000
				2.7	-	500

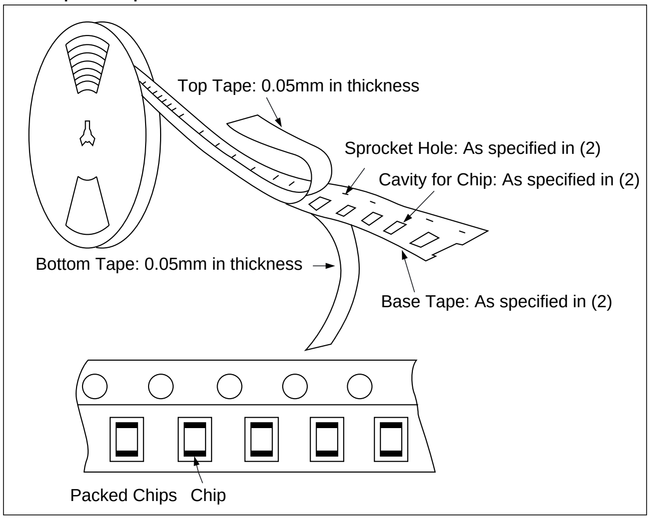
■ Tape Carrier Packaging

(1) Appearance of Taping

① Embossed Tape



② Paper Tape



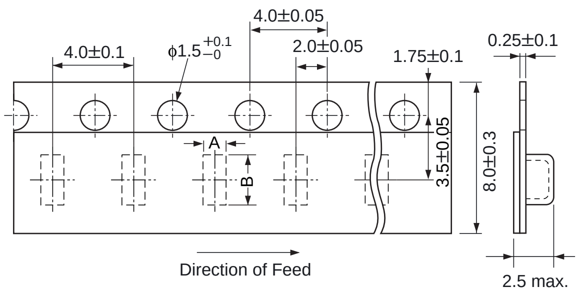
Continued on the following page. ↗

Continued from the preceding page.

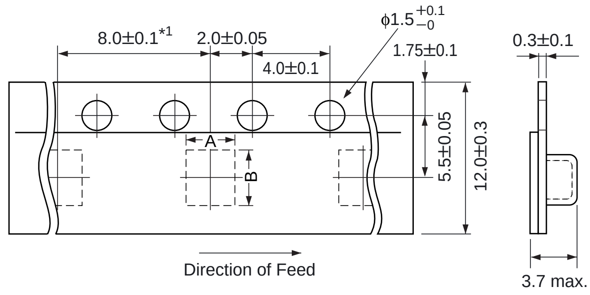
(2) Dimensions of Tape

① Embossed Tape

8mm width 4mm pitch Tape



12mm width 8mm/4mm pitch Tape



Part Number	A*	B*
GRM21 (T≧1.25mm)	1.45	2.25
GRM31/GR731 (T≧1.25mm)	2.0	3.6
GRM32 (T≧1.25mm)	2.9	3.6

*Nominal Value

Part Number	A*	B*
GRM42/GR442/GA242/GA342	2.5	5.1
GRM43/GR443/GA243/GA343	3.6	4.9
GA352	3.2	6.1
GRM55/GR455/GA255/GA355	5.4	6.1

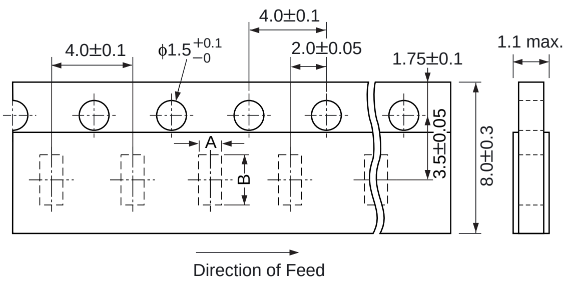
*1 4.0±0.1mm in case of GRM42/GR442/GA242/GA342

*Nominal Value

(in mm)

② Paper Tape

8mm width 4mm pitch Tape

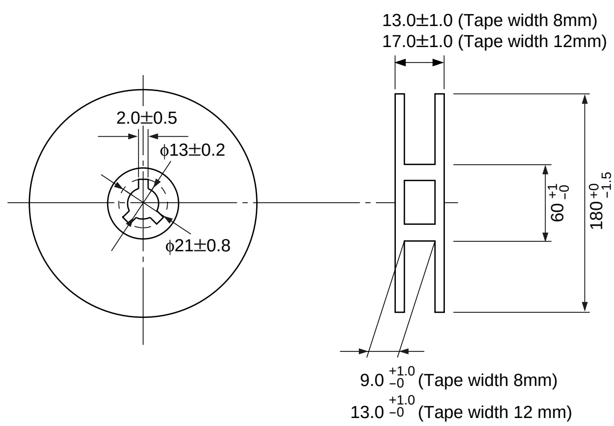


Part Number	A*	B*
GRM18	1.05	1.85
GRM21 (T=1.0mm)	1.45	2.25
GRM31/GR731 (T=1.0mm)	2.0	3.6
GRM32 (T=1.0mm)	2.9	3.6

*Nominal value

(in mm)

(3) Dimensions of Reel



(in mm)

Continued on the following page.

Package

Continued from the preceding page.

(4) Taping Method

① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.

② Part of the leader and part of the empty tape should be attached to the end of the tape as shown at right.

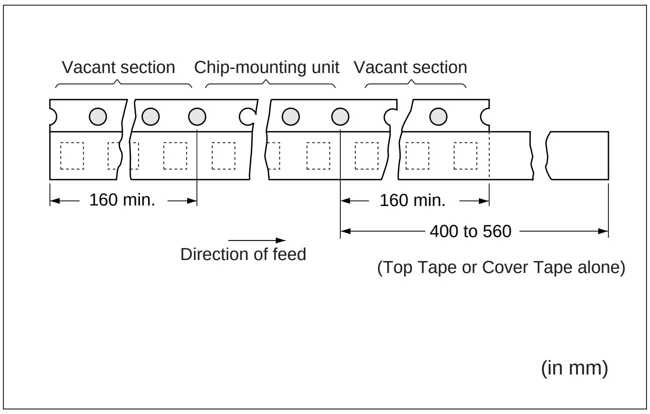
③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

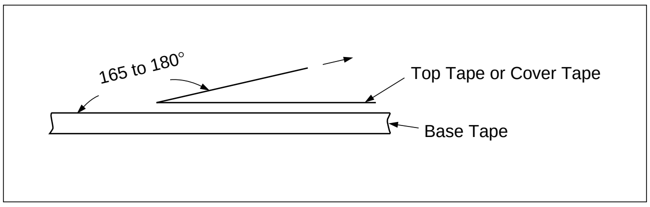
④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

⑤ The top tape or cover tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.

⑥ Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.

⑦ Peeling off force: 0.1 to 0.6N in the direction shown at right.





⚠Caution

■ Storage and Operating Conditions

Operating and storage environment
Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture. Before cleaning, bonding or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed 5 to 40 degrees centigrade and 20 to 70%. Use capacitors within 6 months after delivered. Check the solderability after 6 months or more.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

■ Handling

1. Vibration and impact
   Do not expose a capacitor to excessive shock or vibration during use.
2. Do not directly touch the chip capacitor, especially the ceramic body. Residue from hands/fingers may create a short circuit environment.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

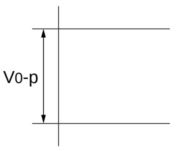
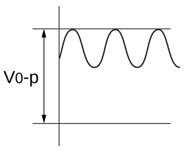
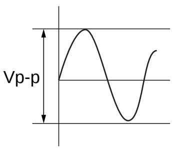
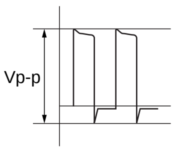
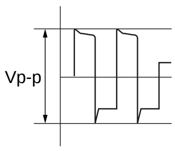
⚠Caution

■ Caution (Rating)

1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-p which contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

Voltage	DC Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage (1)	Pulse Voltage (2)
Positional Measurement					

2. Operating Temperature, Self-generated Heat, and Lead Reduction at High-frequency voltage condition

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range.

Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency voltage, pulse voltage, it may self-generate heat due to dielectric loss.

(1) In case of X7R char.

Applied voltage should be the load such as self-generated heat is within 20°C on the condition of atmosphere temperature 25°C. When measuring, use a thermocouple of small thermal capacity -K of ø0.1mm in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

Continued on the following page. ↗

⚠Caution

Continued from the preceding page.

(2) In case of C0G, U2J char.

Due to the low self-heating characteristics of low-dissipation capacitors, the allowable electric power of these capacitors is generally much higher than that of X7R characteristic capacitors.

When a high frequency voltage which cause 20°C self heating to the capacitor is applied, it will exceed capacitor's allowable electric power.

<C0G char.>

Therefore, in case of C0G char., the frequency of the applied sine wave voltage should be less than 100kHz. The applied voltage should be less than the value shown in figure at right. The capacitors less than 22pF can be applied maximum 4.0kV peak to peak at 100kHz or less only for the ballast or the resonance usage in the LCD backlight inverter circuit.

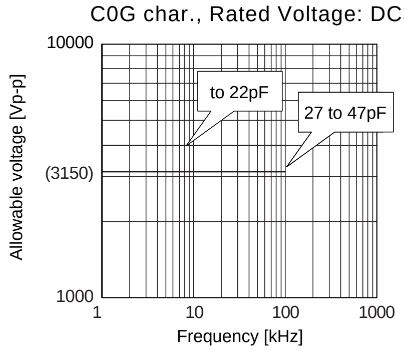
<U2J char.>

In case of U2J char., the frequency of the applied sine wave voltage should be less than 500kHz (less than 100kHz in case of rated voltage: DC3.15kV). The applied voltage should be less than the value shown in figure below.

<Capacitor selection tool>

We are also offering free software the "capacitor selection tool: Murata Medium Voltage Capacitors Selection Tool by Voltage Form (*)" which will assist you in selecting a suitable capacitor.

The temperature of the surface
of capacitor: 125˚C or less (including self-heating)

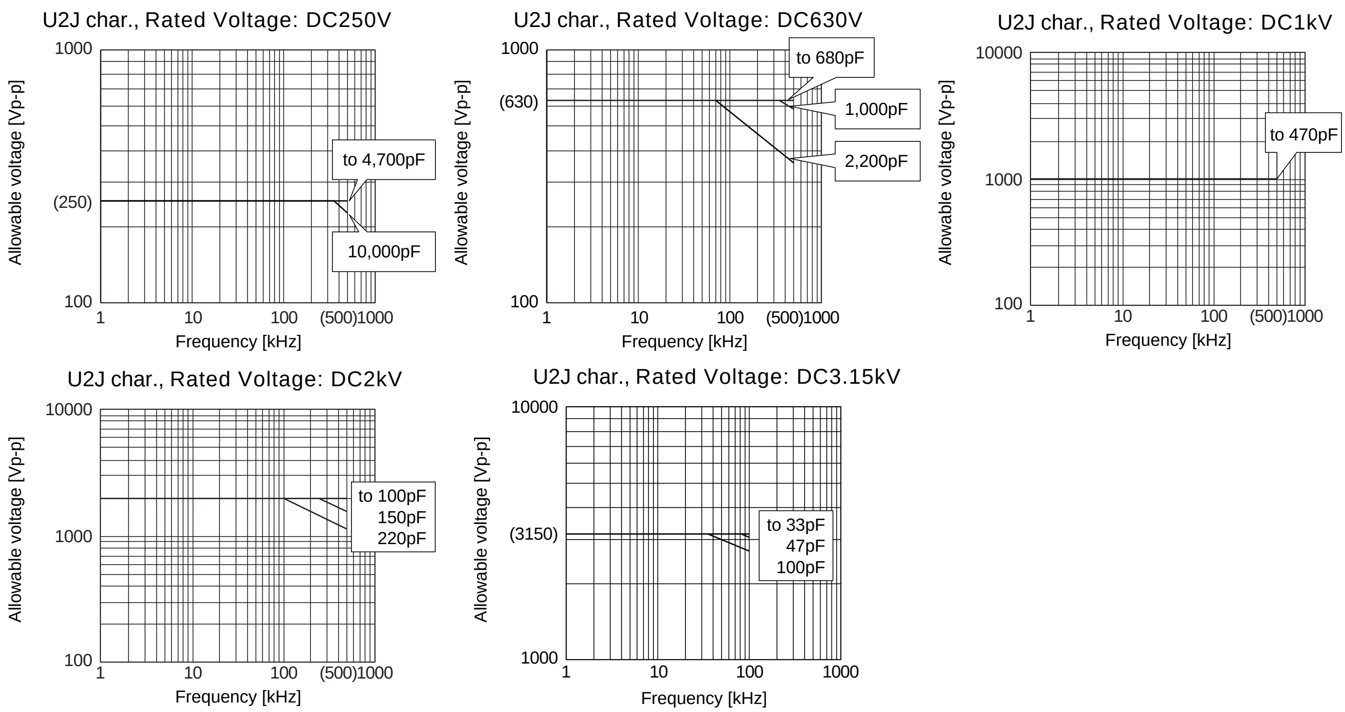


The sine-wave frequency VS allowable voltage

The software can be downloaded from Murata's Internet Website (http://www.murata.com/designlib/mmcsv_e.html). By inputting capacitance values and applied voltage waveform of the specific capacitor series, this software will calculate the capacitor's power consumption and list suitable capacitors (non-sine wave is also available).

* As of Jul. 2006, subject series are below.
· Temperature Characteristics C0G, U2J

The temperature of the surface
of capacitor: 125˚C or less (including self-heating)



The sine-wave frequency VS allowable voltage

Continued on the following page.

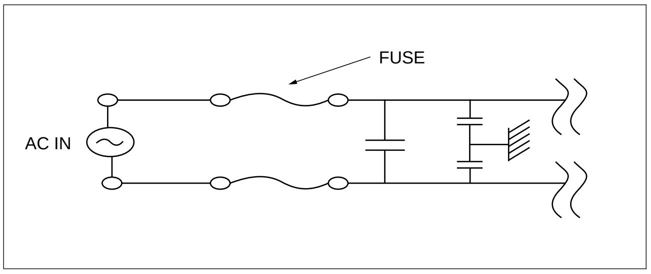
⚠Caution

Continued from the preceding page.

3. Fail-safe

Failure of a capacitor may result in a short circuit. Be sure to provide an appropriate fail-safe function such as a fuse on your product to help eliminate possible electric shock, fire, or fumes.

Please consider using fuses on each AC line if the capacitors are used between the AC input lines and earth (line bypass capacitors), to prepare for the worst case, such as a short circuit.



4. Test condition for AC withstanding Voltage

(1) Test Equipment

Tests for AC withstanding voltage should be made with equipment capable of creating a wave similar to a 50/60 Hz sine wave.

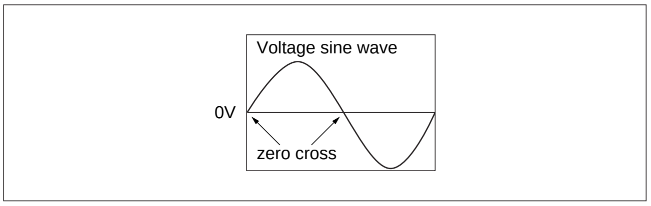
If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

(2) Voltage applied method

The capacitor's leads or terminals should be firmly connected to the output of the withstanding voltage test equipment, and then the voltage should be raised from near zero to the test voltage. If the test voltage is applied directly to the capacitor without raising it from near zero, it should be applied with the zero cross*. At the end of the test time, the test voltage should be reduced to near zero, and then the capacitor's leads or terminals should be taken off the output of the withstanding voltage test equipment. If the test voltage is applied directly to the capacitor without raising it from near zero, surge voltage may occur and cause a defect.

*ZERO CROSS is the point where voltage sine wave pass 0V.

- See the figure at right -



FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

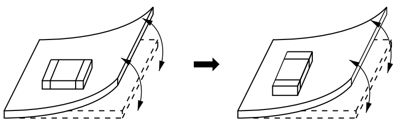
■ Caution (Soldering and Mounting)

1. Vibration and Impact
   Do not expose a capacitor to excessive shock or vibration during use.

2. Circuit Board Material
   In case that ceramic chip capacitor is soldered on the metal board, such as Aluminum board, the stress of heat expansion and contraction might cause the crack of ceramic capacitor, due to the difference of thermal expansion coefficient between metal board and ceramic chip.

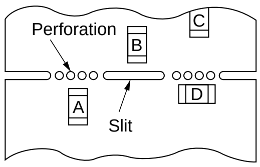
3. Land Layout for Cropping PC Board
   Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



Locate chip horizontal to the direction in which stress acts.

[Chip Mounting Close to Board Separation Point]



Chip arrangement
Worst A>C>B~D Best

Continued on the following page.

⚠Caution

Continued from the preceding page.

4. Reflow Soldering

- When sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 1. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- Solderability of Tin plating termination chip might be deteriorated when low temperature soldering profile where peak solder temperature is below the Tin melting point is used. Please confirm the solderability of Tin plating termination chip before use.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and solvent within the range shown in the Table 1.

Table 1

Part Number	Temperature Differential
G□□18/21/31	ΔT≦190℃
G□□32/42/43/52/55	ΔT≦130℃

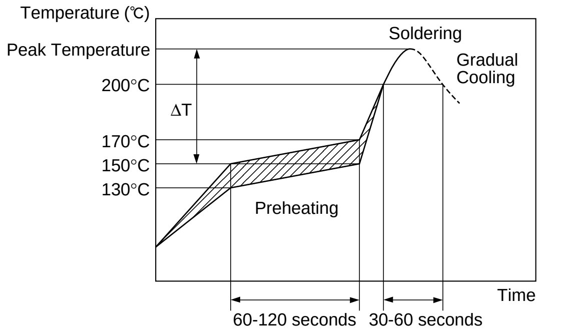
Recommended Conditions

	Pb-Sn Solder		Lead Free Solder
	Infrared Reflow	Vapor Reflow	
Peak Temperature	230-250°C	230-240°C	240-260°C
Atmosphere	Air	Air	Air or N_2

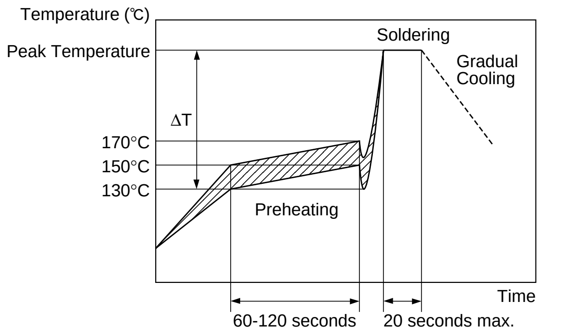
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Reflow Soldering]

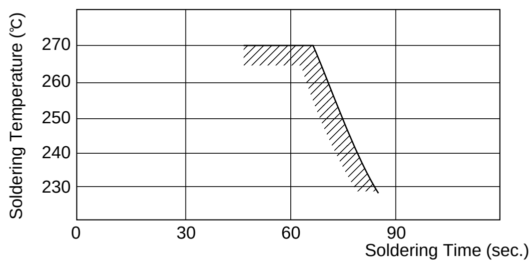
Infrared Reflow



Vapor Reflow



[Allowable Soldering Temperature and Time]

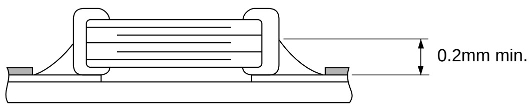


In case of repeated soldering, the accumulated soldering time must be within the range shown above.

Optimum Solder Amount for Reflow Soldering

- Overly thick application of solder paste results in excessive fillet height solder.
  This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.
- Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
- Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.

[Optimum Solder Amount for Reflow Soldering]



Inverting the PCB

Make sure not to impose an abnormal mechanical shock on the PCB.

Continued on the following page.

Continued from the preceding page.

5. Flow Soldering

- When sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. And an excessively long soldering time or high soldering temperature results in leaching by the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 2. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.
  Do not apply flow soldering to chips not listed in Table 2.

Table 2

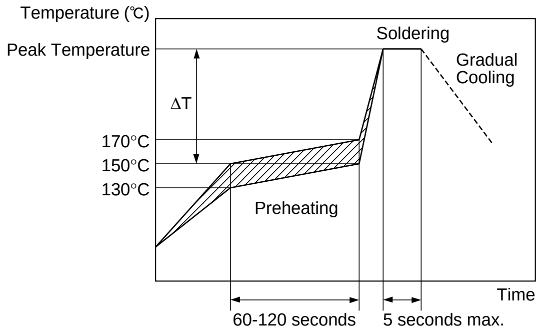
Part Number	Temperature Differential
G□□18/21/31	ΔT≦150℃

Recommended Conditions

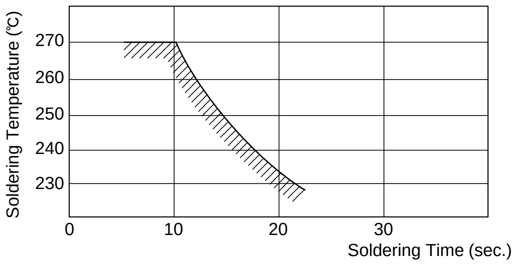
	Pb-Sn Solder	Lead Free Solder
Peak Temperature	240-250°C	250-260°C
Atmosphere	Air	N_2

Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Flow Soldering]

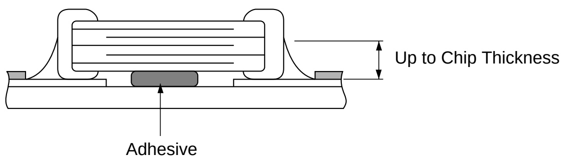


[Allowable Soldering Temperature and Time]



In case of repeated soldering, the accumulated soldering time must be within the range shown above.

- Optimum Solder Amount for Flow Soldering
  The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions.



Continued on the following page.

⚠Caution

Continued from the preceding page.

6. Correction with a Soldering Iron

(1) For Chip Type Capacitors

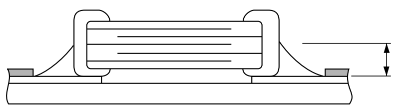
- When sudden heat is applied to the components by soldering iron, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 3. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible. After soldering, it should not be allowed to cool down rapidly.

Table 3

Part Number	Temperature Differential	Peak Temperature	Atmosphere
G□□18/21/31	ΔT≦190℃	300°C max. 3 sec. max. / termination (both sides total 6 sec. max.)	Air
G□□32/42/43/ 52/55	ΔT≦130℃	270°C max. 3 sec. max. / termination (both sides total 6 sec. max.)	Air

*Applicable for both Pb-Sn and Lead Free Solder.
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

- Optimum Solder Amount when Corrections Are Made Using a Soldering Iron
  The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions. Soldering iron ø3mm or smaller should be required. And it is necessary to keep a distance between the soldering iron and the components without direct touch. Thread solder with ø0.5mm or smaller is required for soldering.



7. Washing

Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder. Take note not to vibrate PCBs.

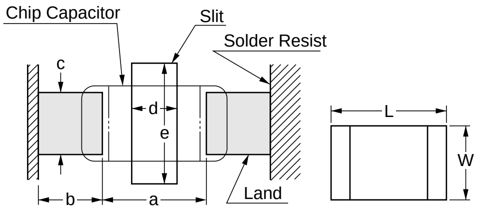
FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCT IS USED.

■ Notice (Soldering and Mounting)

1. Construction of Board Pattern

After installing chips, if solder is excessively applied to the circuit board, mechanical stress will cause destruction resistance characteristics to lower. To prevent this, be extremely careful in determining shape and dimension before designing the circuit board diagram.

Construction and Dimensions of Pattern (Example)



Preparing slit helps flux cleaning and resin coating on the back of the capacitor.

Flow Soldering

L×W	a	b	c
1.6×0.8	0.6-1.0	0.8-0.9	0.6-0.8
2.0×1.25	1.0-1.2	0.9-1.0	0.8-1.1
3.2×1.6	2.2-2.6	1.0-1.1	1.0-1.4

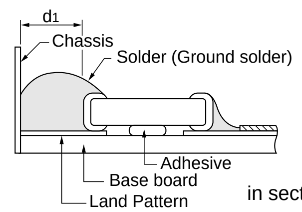
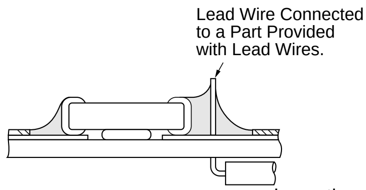
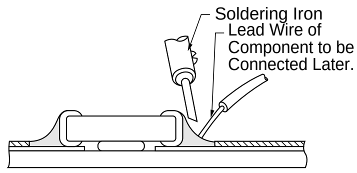
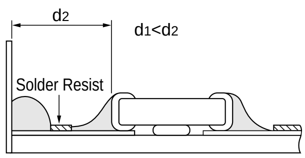
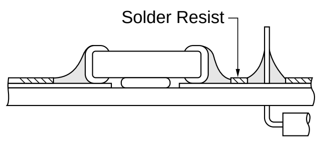
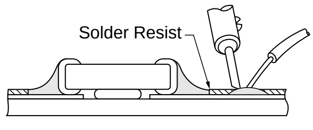
Flow soldering : 3.2×1.6 or less available.

Reflow Soldering

L×W	a	b	c	d	e
1.6×0.8	0.6-0.8	0.6-0.7	0.6-0.8	-	-
2.0×1.25	1.0-1.2	0.9-1.0	0.8-1.1	-	-
3.2×1.6	2.2-2.4	0.8-0.9	1.0-1.4	1.0-2.0	3.2-3.7
3.2×2.5	2.0-2.4	1.0-1.2	1.8-2.3	1.0-2.0	4.1-4.6
4.5×2.0	2.8-3.4	1.2-1.4	1.4-1.8	1.0-2.8	3.6-4.1
4.5×3.2	2.8-3.4	1.2-1.4	2.3-3.0	1.0-2.8	4.8-5.3
5.7×2.8	4.0-4.6	1.4-1.6	2.1-2.6	1.0-4.0	4.4-4.9
5.7×5.0	4.0-4.6	1.4-1.6	3.5-4.8	1.0-4.0	6.6-7.1

(in mm)

Land Layout to Prevent Excessive Solder

	Mounting Close to a Chassis	Mounting with Leaded Components	Mounting Leaded Components Later
Examples of Prohibition	 in section	 in section	 in section
Examples of Improvements by the Land Division	 in section	 in section	 in section

Continued on the following page. ↗

Notice

Continued from the preceding page.

2. Mounting of Chips

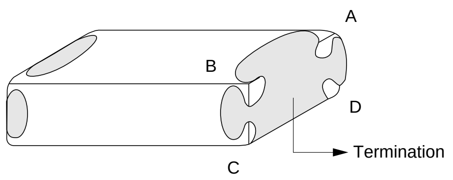
- Thickness of adhesives applied
  Keep thickness of adhesives applied (50-105μm or more) to reinforce the adhesive contact considering the thickness of the termination or capacitor (20-70μm) and the land pattern (30-35μm).

- Mechanical shock of the chip placer
  When the positioning claws and pick-up nozzle are worn, the load is applied to the chip while positioning is concentrated in one position, thus causing cracks, breakage, faulty positioning accuracy, etc.
  Careful checking and maintenance are necessary to prevent unexpected trouble.
  An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. Please set the suction nozzle's bottom dead point on the upper surface of the board.

3. Soldering

(1) Limit of losing effective area of the terminations and conditions needed for soldering.

Depending on the conditions of the soldering temperature and/or immersion (melting time), effective areas may be lost in some part of the terminations.
To prevent this, be careful in soldering so that any possible loss of the effective area on the terminations will securely remain at a maximum of 25% on all edge length A-B-C-D-A of part with A, B, C, D, shown in the Figure below.



(2) Flux

- Please use it after confirming there is no problem in the reliability of the product beforehand with the intended equipment. The residue of flux might cause a decrease in nonconductivity and the corrosion of an external electrode, etc.

Continued on the following page.

Continued from the preceding page.

4. Cleaning

Please confirm there is no problem in the reliability of the product beforehand when cleaning it with the intended equipment.
The residue after cleaning it might cause the decrease in the surface resistance of the chip and the corrosion of the electrode part, etc. As a result it might cause reliability to deteriorate. Please confirm beforehand that there is no problem with the intended equipment in ultrasonic cleansing.

5. Resin Coating

Please use it after confirming there is no influence on the product with a intended equipment beforehand when the resin coating and molding.
A cracked chip might be caused at the cooling/heating cycle by the amount of resin spreading and/or bias thickness.
The resin for coating and molding must be selected as the stress is small when stiffening and the hygroscopic is low as possible.

■ Rating

1. Capacitance change of capacitor

(1) In case of X7R char.
Capacitors have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. So, it is not likely to be suitable for use in a time constant circuit.
Please contact us if you need detailed information.

(2) In case of any char. except X7R
Capacitance might change a little depending on the surrounding temperature or an applied voltage.
Please contact us if you intend to use this product in a strict time constant circuit.

2. Performance check by equipment

Before using a capacitor, check that there is no problem in the equipment's performance and the specifications.
Generally speaking, CLASS 2 (X7R char.) ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance. So, the capacitance value may change depending on the operating condition in the equipment.
Therefore, be sure to confirm the apparatus performance of receiving influence in a capacitance value change of a capacitor, such as leakage current and noise suppression characteristics.
Moreover, check the surge-proof ability of a capacitor in the equipment, if needed, because the surge voltage may exceed specific value by the inductance of the circuit.

ISO 9001 Certifications

■ Qualified Standards

The products listed here have been produced by ISO 9001 certified factory.

Plant
Fukui Murata Mfg. Co., Ltd.
Izumo Murata Mfg. Co., Ltd.
Okayama Murata Mfg. Co., Ltd.
Murata Electronics Singapore (Pte.) Ltd.
Murata Amazonia Industria E Comercio Ltda.
Suzhou Murata Electronics Co., Ltd.
Beijing Murata Electronics Co., Ltd.

⚠Note:

1. Export Control
   〈For customers outside Japan〉
   No muRata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction (nuclear, chemical or biological weapons or missiles) or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.
   〈For customers in Japan〉
   For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.
2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.
   ① Aircraft equipment ② Aerospace equipment
   ③ Undersea equipment ④ Power plant equipment
   ⑤ Medical equipment ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment ⑩ Application of similar complexity and/or reliability requirements to the applications listed above
3. Product specifications in this catalog are as of July 2006. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.
4. Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.
7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

muRata Murata Manufacturing Co., Ltd.

http://www.murata.com/

Head Office
1-10-1, Higashi Kotari, Nagaokakyo-shi, Kyoto 617-8555, Japan
Phone: 81-75-951-9111

International Division
3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan
Phone: 81-3-5469-6123 Fax: 81-3-5469-6155 E-mail: intl@murata.co.jp