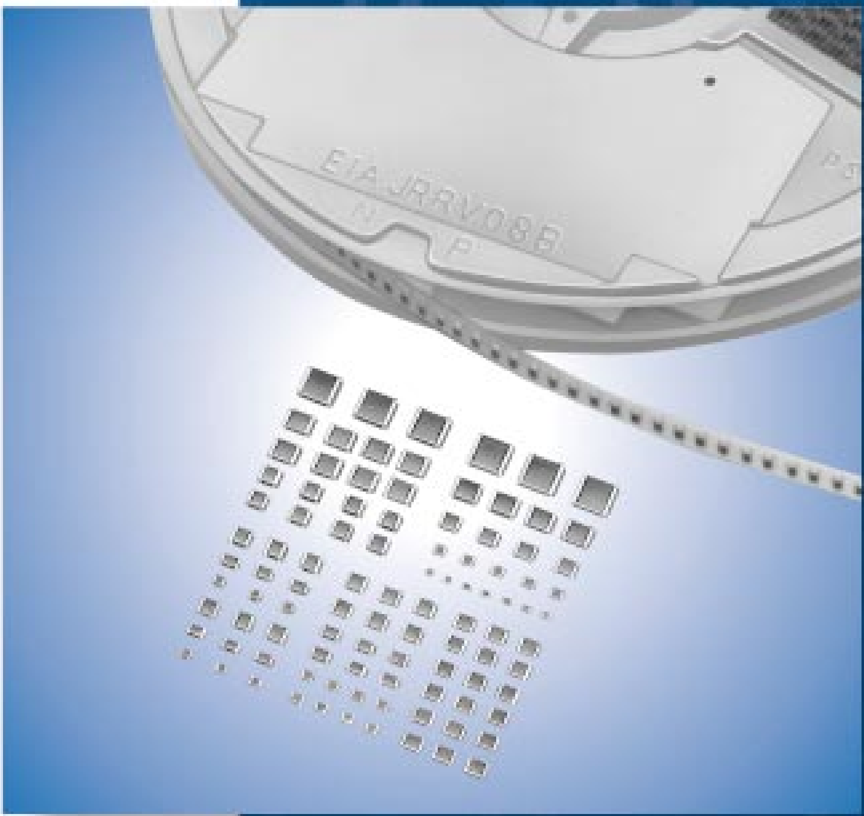
Chip Monolithic Ceramic Capacitors



Innovator in Electronics

Murata Manufacturing Co., Ltd.

Cat.No.C02E-11

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- Please refer to "Specifications and Test Methods" at the end of each chapter of 6 – 18 .

● 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
ER	F	High Frequency and high Power Type
	H	High Frequency and High Power Type (Ribbon Terminal)
	A	High Frequency Type
	D	High Frequency Type (Ribbon Terminal)
GQ	M	High Frequency for Flow/Reflow Soldering
GM	A	Monolithic Microchip
GN	M	Capacitor Array
LL	L	Low ESL Wide Width Type
	C	Automotive Low ESL Wide Width Type
GJ	M	High Frequency Low Loss Type Tin Plated Type
	6	High Frequency Low Loss Type
GA	2	for AC250V (r.m.s.)
	3	Safety Standard Recognized Type
GC	P	Automotive Soldering Electrode
	M	Automotive Tin Plated Layer

❸Dimension (L×W)

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

❹Dimension (T)

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

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

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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
6C	C0H *3	EIA	25°C	25 to 125°C	0±60ppm/°C	-55 to 125°C
6C	CH *1,*3	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 *3	EIA	25°C	25 to 85°C	-220±60ppm/°C	-55 to 125°C
6S	S2H *3	EIA	25°C	25 to 85°C	-330±60ppm/°C	-55 to 125°C
6T	T2H *3	EIA	25°C	25 to 85°C	-470±60ppm/°C	-55 to 125°C
7C	CJ *1*3	EIA	25°C	25 to 125°C	0±120ppm/°C	-55 to 125°C
7U	U2J *3	EIA	25°C	25 to 85°C	-750±120ppm/°C	-55 to 125°C
8C	CK *1,*3	EIA	25°C	25 to 125°C	0±250ppm/°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
E4	Z5U	EIA	25°C	10 to 85°C	+22, -56%	10 to 85°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
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
C8	X6S	EIA	25°C	-55 to 105°C	±22%	-55 to 105°C
9E	ZLM	*4	20°C	-25 to 20°C	-4700+100/-2500ppm/°C	-25 to 85°C
				20 to 85°C	-4700+500/-1000ppm/°C	

*1 Please refer to table for Capacitance Change under reference temperature. *2 Capacitance change is specified with 50% rated voltage applied.
*3 ER series only. *3,*4 Murata Temperature Characteristic Code.

●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

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Murata Code	Capacitance Change from 20°C (%)					
	–55°C		–25°C		–10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
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	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

ER☐ Series

Murata Code	Capacitance Change from 25°C (%)					
	–55°C		–30°C		–10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
5C	0.43	–0.22	0.28	–0.16	0.17	–0.11
6C	0.73	–0.44	0.48	–0.32	0.29	–0.20
7C	1.33	–0.93	0.88	–0.64	0.54	–0.42
8C	2.61	–0.97	1.73	–1.36	1.07	–0.86

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
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)

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❼Capacitance

Expressed by three figures. 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

❽Capacitance Tolerance

Code	Capacitance Tolerance	TC	Series	Capacitance Step	
B	±0.1pF	CΔ	**GJM**	≦5pF	E24 Series,1pF
C	±0.25pF	CΔ–SL	**GRM/ERF/ERH/ERA/ERD/GQM**	≦5pF	* 1pF
		CΔ	**GJM**	<10pF	E24 Series,1pF
D	±0.5pF	CΔ–SL	**GRM**	6.0 to 9.0pF	* 1pF
		CΔ	**ERF/ERH/ERA/ERD/GQM/GJM**	5.1 to 9.1pF	E24 Series
F	±1%	CΔ	**GRM03/15/GJM03/15**	5.0 to 9.9pF	0.1pF
G	±2%	CΔ	**GJM**	≧10pF	E12 Series
		CΔ	**GQM**	≧10pF	E24 Series
		CΔ	**GRM03/15/GJM03/15**	2.0 to 9.9pF	0.1pF
J	±5%	CΔ–SL	**GRM/GA3**	≧10pF	E12 Series
		CΔ	**ERF/ERH/ERA/ERD/GQM/GJM**	≧10pF	E24 Series
		CΔ	**GRM03/15/GJM03/15**	1.0 to 4.9pF	0.1pF
K	±10%	B, R, X7R, X5R, ZLM	**GRM/GA3**	E6 Series	
			GR4	E12 Series	
		CΔ	**GRM03/15/GJM03/15**	0.2 to 1.9pF	0.1pF
M	±20%	Z5U	**GRM**	E3 Series	
		B, R, X7R	**GRM/GMA/LLL/LLC**	E6 Series	
		X7R	**GA2**	E3 Series	
		CΔ	**GRM03/15/GJM03/15**	0.1 to 0.9pF	0.1pF
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	ø178mm Plastic Taping
D	ø178mm Paper Taping
K	ø330mm Plastic Taping
J	ø330mm Paper Taping
E	ø178mm Special Packaging
F	ø330mm Special Packaging
B	Bulk
C	Bulk Case
T	Bulk Tray

Selection Guide of Chip Monolithic Ceramic Capacitors

Start

Application

General Electronics

Function and Circuit

Filtering / Synchronize Circuit / Oscillation Circuit

- Soldering Electrode C0G Char. — **GRM_5C Series** — 0.5pF–0.1µF
- Capacitor Arrays C0G Char. — **GNM_5C Series** — 10pF–360pF

Temperature Compensation

- Soldering Electrode for Temperature Compensation — **GRM_ Series** — 0.5pF–0.1µF
- Capacitor Arrays for Temperature Compensation — **GNM_5C Series** — 10pF–360pF

Bypassing / De-coupling

- Soldering Electrodes Y5V Char. — **GRM_F5 Series** — 2200pF–10µF
- Microchip Y5V Char. — **GMA_F5 Series** — 4700pF–0.1µF
- Capacitor Arrays Y5V Char. — **GNM_F5 Series** — 22000pF–0.15µF
- Low-ESL Y5V Char. — **LLL_F5 Series** — 22000pF–0.68µF

Coupling / Time Constant Circuits

- Soldering Electrode X5R/X7R Char. — **GRM_R6, R7 Series** — 220pF–10µF
- Soldering Electrode C0G/C0H Char. — **GRM_6C Series** — 0.5pF–47000pF
- Thin Layer Large Capacitance Type X5R Char. — **GRM_R6 Series** — 47000pF–100µF
- Microchip — **GMA_R7 Series** — 470pF–10000pF
- Capacitor Arrays — **GNM Series** — 390pF–1.0µF
- Low ESL — **LLL Series** — 2200pF–1.0µF

Specific Applications

High Frequency

- High Frequency/ High Power Type Soldering Electrode — **ERF Series** — 0.75pF–1000pF
- High Frequency/ High Power Ribbon Terminal Type — **ERH Series** — 0.75pF–1000pF
- High Frequency Type — **ERA Series** — 0.75pF–1000pF
- High Frequency Ribbon Terminal Type — **ERD Series** — 0.75pF–1000pF
- High Frequency for Flow/Reflow Soldering — **GQM Series** — 0.5pF–100pF

Ultra Thin Circuit

- Thin Type Soldering Electrode — **GRM15X Series** — 0.5pF–4700pF

Low Dissipation

- **GJM Series** — 0.5pF–18pF

Ultrasonic Sensors

- ZLM Char. — **GRM2199E Series** — 1000pF/1500pF

Medium Voltage

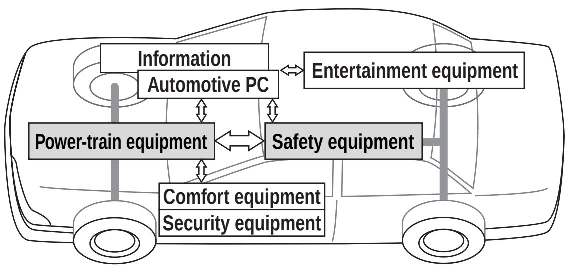
- 630V/1kV/2kV/3.15kV Low Dissipation — **GRM Series** — 5pF–2200pF
- 250V/630V/1kV High Capacitance — **GRM Series** — 220pF–1µF
- 2kV Only for Telecommunication Devices — **GR4 Series** — 100pF–4700pF

Safety Standard Recognized

- AC250V which meet Japanese Law — **GA2 Series** — 470pF–0.1µF
- UL/IEC Safety Standard Recognized — **GA3 Series** — 10pF–33000pF

Automotive (Power-train, Safety equipment)

- **GCM Series*/LLC Series** — 0.5pF–10µF



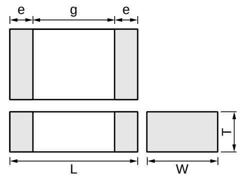
*For other automotive equipment such as comfort, security, information, entertainment, GRM series (for general electronics) are available.

Chip Monolithic Ceramic Capacitors

for Flow/Reflow Soldering GRM15/18/21/31 Series

■ Features

1. Terminations are made of metal highly resistant to migration.
2. The GRM series is a complete line of chip ceramic capacitors in 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0G to Y5V.
3. A wide selection of sizes is available, from the miniature LxWxT: 1.0x0.5x0.5mm to LxWxT: 3.2x1.6x1.6mm.
   GRM18, 21 and GRM31 types are suited to flow and reflow soldering.
   GRM15 type is applied to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. The GRM series is available in paper or plastic embossed tape and reel packaging for automatic placement. Bulk case packaging is also available for GRM15, GRM18 and GRM21.



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
GRM188*	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
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)

■ Applications

General electronic equipment

Temperature Compensating Type GRM15 Series (1.0x0.5mm) 50/25V

Part Number	**GRM15**							
L x W [EIA]	1.00x0.50 [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)								
0.50pF(**R50**)	0.50(**5**)							
0.75pF(**R75**)	0.50(**5**)							
1.0pF(**1R0**)	0.50(**5**)							
2.0pF(**2R0**)	0.50(**5**)							
3.0pF(**3R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
4.0pF(**4R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
5.0pF(**5R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
6.0pF(**6R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
7.0pF(**7R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
8.0pF(**8R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
9.0pF(**9R0**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
10pF(**100**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
12pF(**120**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
15pF(**150**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
18pF(**180**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
22pF(**220**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
27pF(**270**)	0.50(**5**)	0.50(**5**)	0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)
33pF(**330**)	0.50(**5**)		0.50(**5**)	0.50(**5**)			0.50(**5**)	0.50(**5**)

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Part Number	GRM15							
L x W [EIA]	1.00x0.50 [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)								
39pF(**390**)	0.50(**5**)			0.50(**5**)			0.50(**5**)	0.50(**5**)
47pF(**470**)	0.50(**5**)				0.50(**5**)		0.50(**5**)	0.50(**5**)
56pF(**560**)	0.50(**5**)				0.50(**5**)		0.50(**5**)	0.50(**5**)
68pF(**680**)	0.50(**5**)				0.50(**5**)		0.50(**5**)	0.50(**5**)
82pF(**820**)	0.50(**5**)				0.50(**5**)		0.50(**5**)	0.50(**5**)
100pF(**101**)	0.50(**5**)				0.50(**5**)		0.50(**5**)	0.50(**5**)
120pF(**121**)	0.50(**5**)				0.50(**5**)			0.50(**5**)
150pF(**151**)	0.50(**5**)				0.50(**5**)			0.50(**5**)
180pF(**181**)	0.50(**5**)				0.50(**5**)			0.50(**5**)
220pF(**221**)	0.50(**5**)					0.50(**5**)		
270pF(**271**)	0.50(**5**)					0.50(**5**)		
330pF(**331**)	0.50(**5**)					0.50(**5**)		
390pF(**391**)	0.50(**5**)					0.50(**5**)		
470pF(**471**)	0.50(**5**)							
560pF(**561**)	0.50(**5**)							
680pF(**681**)	0.50(**5**)							
820pF(**821**)	0.50(**5**)							
1000pF(**102**)	0.50(**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) 200/100/50/25V

Part Number	GRM18											
L x W [EIA]	1.60x0.80 [0603]											
TC	C0G (**5C**)			P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)				T2H (**6T**)	U2J (**7U**)
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
0.50pF(**R50**)	0.80(**8**)	0.80(**8**)	0.80(**8**)									
0.75pF(**R75**)	0.80(**8**)	0.80(**8**)	0.80(**8**)									
1.0pF(**1R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)									
2.0pF(**2R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)									
3.0pF(**3R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
4.0pF(**4R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
5.0pF(**5R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
6.0pF(**6R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
7.0pF(**7R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
8.0pF(**8R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
9.0pF(**9R0**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
10pF(**100**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)
12pF(**120**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
15pF(**150**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
18pF(**180**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
22pF(**220**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
27pF(**270**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
33pF(**330**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
39pF(**390**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
47pF(**470**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)
56pF(**560**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)				0.80(**8**)	0.80(**8**)

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Part Number	**GRM18**											
L x W [EIA]	1.60x0.80 [0603]											
TC	C0G (**5C**)			P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)				T2H (**6T**)	U2J (**7U**)
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
68pF(**680**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)		0.80(**8**)		0.80(**8**)	0.80(**8**)
82pF(**820**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)		0.80(**8**)		0.80(**8**)	0.80(**8**)
100pF(**101**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)		0.80(**8**)		0.80(**8**)	0.80(**8**)
120pF(**121**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
150pF(**151**)		0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
180pF(**181**)		0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
220pF(**221**)		0.80(**8**)	0.80(**8**)			0.80(**8**)		0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
270pF(**271**)		0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
330pF(**331**)		0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
390pF(**391**)		0.80(**8**)	0.80(**8**)					0.80(**8**)	0.80(**8**)		0.80(**8**)	0.80(**8**)
470pF(**471**)		0.80(**8**)	0.80(**8**)						0.80(**8**)		0.80(**8**)	0.80(**8**)
560pF(**561**)		0.80(**8**)	0.80(**8**)						0.80(**8**)			0.80(**8**)
680pF(**681**)		0.80(**8**)	0.80(**8**)						0.80(**8**)			0.80(**8**)
820pF(**821**)		0.80(**8**)	0.80(**8**)							0.80(**8**)		
1000pF(**102**)		0.80(**8**)	0.80(**8**)						0.80(**8**)	0.80(**8**)		0.80(**8**)
1200pF(**122**)			0.80(**8**)						0.80(**8**)	0.80(**8**)		0.80(**8**)
1500pF(**152**)			0.80(**8**)						0.80(**8**)	0.80(**8**)		0.80(**8**)
1800pF(**182**)			0.80(**8**)						0.80(**8**)			0.80(**8**)
2200pF(**222**)			0.80(**8**)						0.80(**8**)			0.80(**8**)
2700pF(**272**)			0.80(**8**)						0.80(**8**)			0.80(**8**)
3300pF(**332**)									0.80(**8**)			0.80(**8**)
3900pF(**392**)									0.80(**8**)			0.80(**8**)
4700pF(**472**)									0.80(**8**)			0.80(**8**)
5600pF(**562**)									0.80(**8**)			0.80(**8**)
6800pF(**682**)									0.80(**8**)			0.80(**8**)
8200pF(**822**)									0.80(**8**)			0.80(**8**)
10000pF(**103**)									0.80(**8**)			0.80(**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) 200/100/50/25V

Part Number	**GRM21**											
L x W [EIA]	2.00x1.25 [0805]											
TC	C0G (**5C**)			P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)				T2H (**6T**)	U2J (**7U**)
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
12pF(**120**)	0.85(**9**)	0.85(**9**)										
15pF(**150**)	0.85(**9**)	0.85(**9**)										
18pF(**180**)	0.85(**9**)	0.85(**9**)										
22pF(**220**)	0.85(**9**)	0.85(**9**)										
27pF(**270**)	0.85(**9**)	0.85(**9**)										
33pF(**330**)	0.85(**9**)	0.85(**9**)										
39pF(**390**)	0.85(**9**)	0.85(**9**)										
47pF(**470**)	0.85(**9**)	0.85(**9**)										
56pF(**560**)	0.85(**9**)	0.85(**9**)										
68pF(**680**)	1.25(**B**)											
82pF(**820**)	1.25(**B**)											
100pF(**101**)	1.25(**B**)											

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Part Number	**GRM21**											
L x W [EIA]	2.00x1.25 [0805]											
TC	C0G (**5C**)			P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)				T2H (**6T**)	U2J (**7U**)
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)												
120pF(**121**)	1.25(**B**)						0.85(**9**)					
150pF(**151**)	1.25(**B**)						1.25(**B**)					
180pF(**181**)	1.25(**B**)			0.85(**9**)			1.25(**B**)					
220pF(**221**)	1.25(**B**)			0.85(**9**)	0.85(**9**)		1.25(**B**)					
270pF(**271**)				0.85(**9**)	0.85(**9**)	0.85(**9**)	1.25(**B**)					
330pF(**331**)				0.85(**9**)	0.85(**9**)	0.85(**9**)	1.25(**B**)					
390pF(**391**)				1.25(**B**)	0.85(**9**)	0.85(**9**)	1.25(**B**)					
470pF(**471**)				1.25(**B**)	0.85(**9**)	0.85(**9**)	1.25(**B**)	0.85(**9**)				
560pF(**561**)				1.25(**B**)	1.25(**B**)	1.25(**B**)		0.85(**9**)			1.25(**B**)	
680pF(**681**)		0.85(**9**)			1.25(**B**)	1.25(**B**)		0.85(**9**)			1.25(**B**)	
820pF(**821**)		0.85(**9**)				1.25(**B**)		1.25(**B**)	0.60(**6**)		1.25(**B**)	0.60(**6**)
1000pF(**102**)		0.85(**9**)						1.25(**B**)	0.60(**6**)		1.25(**B**)	0.60(**6**)
1200pF(**122**)			0.60(**6**)					1.25(**B**)	0.60(**6**)		1.25(**B**)	0.60(**6**)
1500pF(**152**)		0.85(**9**)	0.60(**6**)					1.25(**B**)	0.85(**9**)		1.25(**B**)	0.85(**9**)
1800pF(**182**)			0.60(**6**)					1.25(**B**)	0.85(**9**)		1.25(**B**)	0.85(**9**)
2200pF(**222**)			0.60(**6**)						0.85(**9**)			0.85(**9**)
2700pF(**272**)			0.60(**6**)						1.25(**B**)			1.25(**B**)
3300pF(**332**)			0.60(**6**)						1.25(**B**)			1.25(**B**)
3900pF(**392**)			0.60(**6**)							0.85(**9**)		
4700pF(**472**)			0.60(**6**)							0.85(**9**)		
5600pF(**562**)			0.85(**9**)							1.25(**B**)		
6800pF(**682**)			0.85(**9**)							1.25(**B**)		
8200pF(**822**)			0.85(**9**)									
10000pF(**103**)			0.85(**9**)						0.60(**6**)			0.60(**6**)
12000pF(**123**)			0.85(**9**)						0.60(**6**)			0.60(**6**)
15000pF(**153**)			0.85(**9**)						0.60(**6**)			0.60(**6**)
18000pF(**183**)			1.25(**B**)						0.60(**6**)			0.60(**6**)
22000pF(**223**)			1.25(**B**)						0.85(**9**)			0.85(**9**)
27000pF(**273**)									0.85(**9**)			0.85(**9**)
33000pF(**333**)									1.00(**A**)			1.00(**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) 500/200/100/50/25V

Part Number	**GRM31**														
L x W [EIA]	3.20x1.60 [1206]														
TC	C0G (**5C**)					C0H (**6C**)	P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)				T2H (**6T**)	U2J (**7U**)
Rated Volt.	500 (**2H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	25 (**1E**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)															
1.0pF(**1R0**)	1.15(**M**)														
2.0pF(**2R0**)	1.15(**M**)														
3.0pF(**3R0**)	1.15(**M**)														
4.0pF(**4R0**)	1.15(**M**)														
5.0pF(**5R0**)	1.15(**M**)														
6.0pF(**6R0**)	1.15(**M**)														
7.0pF(**7R0**)	1.15(**M**)														

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Part Number	**GRM31**														
L x W [EIA]	3.20x1.60 [1206]														
TC	C0G (**5C**)					C0H (**6C**)	P2H (**6P**)	R2H (**6R**)	S2H (**6S**)	SL (**1X**)				T2H (**6T**)	U2J (**7U**)
Rated Volt.	500 (**2H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	25 (**1E**)	50 (**1H**)	50 (**1H**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)															
8.0pF(**8R0**)	1.15(**M**)														
9.0pF(**9R0**)	1.15(**M**)														
10pF(**100**)	1.15(**M**)														
12pF(**120**)	1.15(**M**)														
15pF(**150**)	1.15(**M**)														
18pF(**180**)	1.15(**M**)														
22pF(**220**)	1.15(**M**)														
27pF(**270**)	1.15(**M**)														
33pF(**330**)	1.15(**M**)														
39pF(**390**)	1.15(**M**)														
47pF(**470**)	1.15(**M**)														
56pF(**560**)	1.15(**M**)														
68pF(**680**)	1.15(**M**)														
82pF(**820**)	1.15(**M**)														
270pF(**271**)		1.15(**M**)													
330pF(**331**)		1.15(**M**)													
390pF(**391**)		1.15(**M**)													
470pF(**471**)		1.15(**M**)									0.85(**9**)				
560pF(**561**)										1.15(**M**)	0.85(**9**)				
680pF(**681**)							0.85(**9**)			1.15(**M**)	0.85(**9**)				
820pF(**821**)							0.85(**9**)	0.85(**9**)		1.15(**M**)	0.85(**9**)				
1000pF(**102**)							1.15(**M**)	1.15(**M**)	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**)				
1500pF(**152**)			1.15(**M**)				1.15(**M**)	1.15(**M**)	1.15(**M**)		0.85(**9**)				
1800pF(**182**)			1.15(**M**)						1.15(**M**)		0.85(**9**)				
2200pF(**222**)			1.15(**M**)								1.15(**M**)			1.15(**M**)	
2700pF(**272**)											1.15(**M**)			1.15(**M**)	
3300pF(**332**)				0.85(**9**)							1.15(**M**)			1.15(**M**)	
3900pF(**392**)				0.85(**9**)							1.15(**M**)	0.85(**9**)		1.15(**M**)	0.85(**9**)
4700pF(**472**)				0.85(**9**)							1.15(**M**)	0.85(**9**)			0.85(**9**)
5600pF(**562**)			0.85(**9**)	0.85(**9**)								0.85(**9**)			0.85(**9**)
6800pF(**682**)				0.85(**9**)	0.85(**9**)	0.85(**9**)						1.15(**M**)			1.15(**M**)
8200pF(**822**)				0.85(**9**)	1.15(**M**)	1.15(**M**)						1.15(**M**)			1.15(**M**)
10000pF(**103**)				0.85(**9**)	0.85(**9**)								1.15(**M**)		
12000pF(**123**)				0.85(**9**)									1.15(**M**)		
15000pF(**153**)				0.85(**9**)									1.15(**M**)		
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**)				1.60(**C**)								0.85(**9**)			0.85(**9**)
68000pF(**683**)				1.60(**C**)								1.15(**M**)			1.15(**M**)
82000pF(**823**)				1.60(**C**)								1.15(**M**)			1.15(**M**)
0.10µF(**104**)					1.60(**C**)							1.15(**M**)			1.15(**M**)

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

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High Dielectric Constant Type X5R (R6) Characteristics

TC	X5R (**R6**)									
Part Number	**GRM15**		**GRM18**			**GRM21**		**GRM31**		
L x W [EIA]	1.00x0.50 [0402]		1.60x0.80 [0603]			2.00x1.25 [0805]		3.20x1.60 [1206]		
Rated Volt.	16 (**1C**)	10 (**1A**)	25 (**1E**)	10 (**1A**)	6.3 (**0J**)	10 (**1A**)	6.3 (**0J**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)										
68000pF(**683**)		0.50(**5**)								
0.10µF(**104**)	0.50(**5**)	0.50(**5**)								
0.22µF(**224**)			0.80(**8**)							
0.33µF(**334**)				0.80(**8**)		0.60(**6**)				
0.47µF(**474**)				0.80(**8**)						
0.68µF(**684**)				0.80(**8**)						
1µF(**105**)				0.80(**8**)	0.80(**8**)	0.85(**9**)			0.85(**9**)	
1.5µF(**155**)							0.85(**9**)			
2.2µF(**225**)						1.25(**B**)	1.25(**B**)		0.85(**9**)	
3.3µF(**335**)							1.25(**B**)		1.30(**X**)	
4.7µF(**475**)							1.25(**B**)	1.60(**C**)	1.60(**C**)	1.15(**M**)
10µF(**106**)									1.60(**C**)	1.60(**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.

High Dielectric Constant Type X7R (R7) Characteristics

TC	X7R (**R7**)																			
Part Number	**GRM15**				**GRM18**					**GRM21**						**GRM31**				
L x W [EIA]	1.00x0.50 [0402]				1.60x0.80 [0603]					2.00x1.25 [0805]						3.20x1.60 [1206]				
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	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**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																				
220pF (**221**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
330pF (**331**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
470pF (**471**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
680pF (**681**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
1000pF (**102**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
1500pF (**152**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
2200pF (**222**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
3300pF (**332**)	0.50 (**5**)				0.80 (**8**)	0.80 (**8**)														
4700pF (**472**)	0.50 (**5**)					0.80 (**8**)				0.85 (**9**)										
6800pF (**682**)		0.50 (**5**)				0.80 (**8**)				0.85 (**9**)										
10000pF (**103**)		0.50 (**5**)				0.80 (**8**)				1.25 (**B**)										

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TC	X7R (**R7**)																		
Part Number	**GRM15**				**GRM18**					**GRM21**						**GRM31**			
L x W [EIA]	1.00x0.50 [0402]				1.60x0.80 [0603]					2.00x1.25 [0805]						3.20x1.60 [1206]			
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	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**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																				
15000pF (**153**)		0.50 (**5**)	0.50 (**5**)			0.80 (**8**)				1.25 (**B**)										
22000pF (**223**)		0.50 (**5**)	0.50 (**5**)			0.80 (**8**)				1.25 (**B**)										
33000pF (**333**)		0.50 (**5**)	0.50 (**5**)	0.50 (**5**)		0.80 (**8**)	0.80 (**8**)			1.25 (**B**)	0.85 (**9**)					1.15 (**M**)				
47000pF (**473**)		0.50 (**5**)		0.50 (**5**)		0.80 (**8**)	0.80 (**8**)			1.25 (**B**)	1.25 (**B**)					1.15 (**M**)				
68000pF (**683**)			0.50 (**5**)			0.80 (**8**)	0.80 (**8**)				1.25 (**B**)					1.15 (**M**)				
0.10µF (**104**)			0.50 (**5**)	0.50 (**5**)		0.80 (**8**)	0.80 (**8**)	0.80 (**8**)			1.25 (**B**)	1.25 (**B**)								
0.15µF (**154**)							0.80 (**8**)	0.80 (**8**)	0.80 (**8**)		1.25 (**B**)	1.25 (**B**)								
0.22µF (**224**)							0.80 (**8**)	0.80 (**8**)	0.80 (**8**)		1.25 (**B**)	0.85 (**9**)								
0.33µF (**334**)											0.85 (**9**)	1.25 (**B**)		0.60 (**6**)			0.85 (**9**)			
0.47µF (**474**)											1.25 (**B**)	1.25 (**B**)	0.85 (**9**)				1.15 (**M**)		0.85 (**9**)	
0.68µF (**684**)													0.85 (**9**)					0.85 (**9**)		
1.0µF (**105**)												1.25 (**B**)	1.25 (**B**)				1.15 (**M**)	1.15 (**M**)	0.85 (**9**)	0.85 (**9**)
1.5µF (**155**)												1.25 (**B**)					1.60 (**C**)		1.15 (**M**)	
2.2µF (**225**)														1.25 (**B**)	1.25 (**B**)		1.60 (**C**)	1.15 (**M**)	1.15 (**M**)	1.15 (**M**)
3.3µF (**335**)																		1.60 (**C**)	1.60 (**C**)	
4.7µF (**475**)																		1.60 (**C**)	1.60 (**C**)	1.60 (**C**)
10µF (**106**)																				1.60 (**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.

High Dielectric Constant Type Y5V (F5) Characteristics

TC	Y5V (**F5**)																
Part Number	**GRM15**			**GRM18**					**GRM21**				**GRM31**				
L x W [EIA]	1.00x0.50 [0402]			1.60x0.80 [0603]					2.00x1.25 [0805]				3.20x1.60 [1206]				
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)	6.3 (**0J**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)																	
2200pF (**222**)	0.50 (**5**)																
4700pF (**472**)	0.50 (**5**)			0.80 (**8**)													
10000pF (**103**)	0.50 (**5**)				0.80 (**8**)												
22000pF (**223**)		0.50 (**5**)			0.80 (**8**)												
47000pF (**473**)		0.50 (**5**)	0.50 (**5**)		0.80 (**8**)												
0.10µF (**104**)		0.50 (**5**)	0.50 (**5**)		0.80 (**8**)	0.80 (**8**)			0.85 (**9**)								
0.22µF (**224**)					0.80 (**8**)		0.80 (**8**)		1.25 (**B**)	0.85 (**9**)							
0.47µF (**474**)						0.80 (**8**)	0.80 (**8**)	0.80 (**8**)	0.85 (**9**)	1.25 (**B**)			1.15 (**M**)				
1.0µF (**105**)							0.80 (**8**)	0.80 (**8**)	0.85 (**9**)	0.85 (**9**)	0.85 (**9**)	0.85 (**9**)		1.15 (**M**)	0.85 (**9**)		
2.2µF (**225**)										1.25 (**B**)	1.25 (**B**)	1.25 (**B**)			1.15 (**M**)	0.85 (**9**)	
4.7µF (**475**)												1.25 (**B**)	1.60 (**C**)	1.15 (**M**)	1.15 (**M**)	1.15 (**M**)	
10µF (**106**)														1.60 (**C**)		1.15 (**M**)	1.15 (**M**)

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.

High Dielectric Constant Type Z5U (E4) Characteristics

TC	Z5U (**E4**)		
Part Number	**GRM18**	**GRM21**	**GRM31**
L x W [EIA]	1.60x0.80 [0603]	2.00x1.25 [0805]	3.20x1.60 [1206]
Rated Volt.	50 (**1H**)	50 (**1H**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)			
10000pF(**103**)	0.80(**8**)		
22000pF(**223**)	0.80(**8**)		
47000pF(**473**)		0.60(**6**)	
0.10µF(**104**)		0.85(**9**)	
0.22µF(**224**)			0.85(**9**)

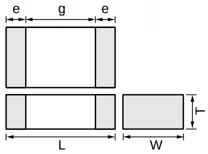
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Chip Monolithic Ceramic Capacitors

for Reflow Soldering GRM32/43/55 Series

■ Features
1. Terminations are made of metal highly resistant to migration.
2. The GRM series is a complete line of chip ceramic capacitors in 10V, 16V, 25V, 50V, 100V and 200V ratings. These capacitors have temperature characteristics ranging from C0G to Y5V.
3. This series consists of type LxWxT: 3.2x2.5x0.85mm to LxWxT: 5.7x5.0x2.5mm.These are suited to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. The GRM series is available in paper or plastic embossed tape and reel packaging for automatic placement.

Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GRM329	3.2 ±0.3	2.5 ±0.2	0.85 ±0.1	0.3	1.0
GRM32M			1.15 ±0.1		
GRM32N			1.35 ±0.15		
GRM32R			1.8 ±0.2		
GRM32E			2.5 ±0.2		
GRM43M	4.5 ±0.4	3.2 ±0.3	1.15 ±0.1	0.3	2.0
GRM43N			1.35 ±0.15		
GRM43R			1.8 ±0.2		
GRM43D			2.0 ±0.2		
GRM43E			2.5 ±0.2		
GRM55M	5.7 ±0.4	5.0 ±0.4	1.15 ±0.1	0.3	2.0
GRM55N			1.35 ±0.15		
GRM55C			1.6 ±0.2		
GRM55R			1.8 ±0.2		
GRM55D			2.0 ±0.2		
GRM55E			2.5 ±0.2		



■ Applications
General electronic equipment

Temperature Compensating Type GRM32/43/55 Series

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM32N5C2D561JV01	C0G (EIA)	200	560 ±5%	3.20	2.50	1.35
GRM32N5C2D681JY21	C0G (EIA)	200	680 ±5%	3.20	2.50	1.35
GRM32N5C2D821JY21	C0G (EIA)	200	820 ±5%	3.20	2.50	1.35
GRM32N5C2D102JY21	C0G (EIA)	200	1000 ±5%	3.20	2.50	1.35
GRM43R5C2D122JV01	C0G (EIA)	200	1200 ±5%	4.50	3.20	1.80
GRM43R5C2D152JV01	C0G (EIA)	200	1500 ±5%	4.50	3.20	1.80
GRM43R5C2D182JY21	C0G (EIA)	200	1800 ±5%	4.50	3.20	1.80
GRM43R5C2D222JY21	C0G (EIA)	200	2200 ±5%	4.50	3.20	1.80
GRM43R5C2D272JY21	C0G (EIA)	200	2700 ±5%	4.50	3.20	1.80
GRM55N5C2D332JY21	C0G (EIA)	200	3300 ±5%	5.70	5.00	1.35
GRM55R5C2D392JY21	C0G (EIA)	200	3900 ±5%	5.70	5.00	1.80
GRM55R5C2D472JY21	C0G (EIA)	200	4700 ±5%	5.70	5.00	1.80
GRM55R5C2D562JY21	C0G (EIA)	200	5600 ±5%	5.70	5.00	1.80
GRM32N1X2D152JV01	SL (JIS)	200	1500 ±5%	3.20	2.50	1.35
GRM43N1X2D182JV01	SL (JIS)	200	1800 ±5%	4.50	3.20	1.35
GRM43N1X2D222JV01	SL (JIS)	200	2200 ±5%	4.50	3.20	1.35
GRM43R1X2D272JV01	SL (JIS)	200	2700 ±5%	4.50	3.20	1.80
GRM43R1X2D332JV01	SL (JIS)	200	3300 ±5%	4.50	3.20	1.80
GRM43R1X2D392JV01	SL (JIS)	200	3900 ±5%	4.50	3.20	1.80
GRM55N1X2D472JV01	SL (JIS)	200	4700 ±5%	5.70	5.00	1.35
GRM55R1X2D562JV01	SL (JIS)	200	5600 ±5%	5.70	5.00	1.80
GRM55R1X2D682JV01	SL (JIS)	200	6800 ±5%	5.70	5.00	1.80
GRM55R1X2D822JV01	SL (JIS)	200	8200 ±5%	5.70	5.00	1.80
GRM32N1X2A562JZ01	SL (JIS)	100	5600 ±5%	3.20	2.50	1.35
GRM32N1X2A682JZ01	SL (JIS)	100	6800 ±5%	3.20	2.50	1.35
GRM43N1X2A822JZ01	SL (JIS)	100	8200 ±5%	4.50	3.20	1.35
GRM43R1X2A103JZ01	SL (JIS)	100	10000 ±5%	4.50	3.20	1.80
GRM43R1X2A123JZ01	SL (JIS)	100	12000 ±5%	4.50	3.20	1.80

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Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM43R1X2A153JZ01	SL (JIS)	100	15000 ±5%	4.50	3.20	1.80
GRM55M1X2A183JZ01	SL (JIS)	100	18000 ±5%	5.70	5.00	1.15
GRM55N1X2A223JZ01	SL (JIS)	100	22000 ±5%	5.70	5.00	1.35
GRM55R1X2A273JZ01	SL (JIS)	100	27000 ±5%	5.70	5.00	1.80
GRM55R1X2A333JZ01	SL (JIS)	100	33000 ±5%	5.70	5.00	1.80
GRM55R1X2A393JZ01	SL (JIS)	100	39000 ±5%	5.70	5.00	1.80
GRM32N1X1H103JZ01	SL (JIS)	50	10000 ±5%	3.20	2.50	1.35
GRM32N1X1H123JZ01	SL (JIS)	50	12000 ±5%	3.20	2.50	1.35
GRM43R1X1H153JZ01	SL (JIS)	50	15000 ±5%	4.50	3.20	1.80
GRM55M1X1H183JZ01	SL (JIS)	50	18000 ±5%	5.70	5.00	1.15
GRM55N1X1H223JZ01	SL (JIS)	50	22000 ±5%	5.70	5.00	1.35
GRM55R1X1H273JZ01	SL (JIS)	50	27000 ±5%	5.70	5.00	1.80
GRM55R1X1H333JZ01	SL (JIS)	50	33000 ±5%	5.70	5.00	1.80
GRM55R1X1H393JZ01	SL (JIS)	50	39000 ±5%	5.70	5.00	1.80

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

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM32ER61A106KC01	X5R (EIA)	10	10µF ±10%	3.20	2.50	2.50
GRM32NR72A683KA01	X7R (EIA)	100	68000pF ±10%	3.20	2.50	1.35
GRM32NR72A104KA01	X7R (EIA)	100	0.10µF ±10%	3.20	2.50	1.35
GRM32ER72A105KA01	X7R (EIA)	100	1.0µF ±10%	3.20	2.50	2.50
GRM32MR71H474KA01	X7R (EIA)	50	0.47µF ±10%	3.20	2.50	1.15
GRM32NR71H684KA01	X7R (EIA)	50	0.68µF ±10%	3.20	2.50	1.35
GRM32DR71H335KA88	X7R (EIA)	50	3.3µF ±10%	3.20	2.50	2.00
GRM32ER71H475KA88	X7R (EIA)	50	4.7µF ±10%	3.20	2.50	2.50
GRM32RR71E225KC01	X7R (EIA)	25	2.2µF ±10%	3.20	2.50	1.80
GRM32MR71C225KC01	X7R (EIA)	16	2.2µF ±10%	3.20	2.50	1.15
GRM32NR71C335KC01	X7R (EIA)	16	3.3µF ±10%	3.20	2.50	1.35
GRM32RR71C475KC01	X7R (EIA)	16	4.7µF ±10%	3.20	2.50	1.80
GRM32DR71C106KA01	X7R (EIA)	16	10µF ±10%	3.20	2.50	2.00
GRM32NF52A104ZA01	Y5V (EIA)	100	0.10µF +80/-20%	3.20	2.50	1.35
GRM32RF51H105ZA01	Y5V (EIA)	50	1.0µF +80/-20%	3.20	2.50	1.8
GRM32DF51H106ZA01	Y5V (EIA)	50	10µF +80/-20%	3.20	2.50	2.00
GRM329F51E475ZA01	Y5V (EIA)	25	4.7µF +80/-20%	3.20	2.50	0.85
GRM32NF51E106ZA01	Y5V (EIA)	25	10µF +80/-20%	3.20	2.50	1.35
GRM32NF51C106ZA01	Y5V (EIA)	16	10µF +80/-20%	3.20	2.50	1.35

High Dielectric Constant Type Type GRM43 Series (4.50x3.20mm)

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (µF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM43RR72A154KA01	X7R (EIA)	100	0.15 ±10%	4.50	3.20	1.80
GRM43RR72A224KA01	X7R (EIA)	100	0.22 ±10%	4.50	3.20	1.80
GRM43DR72A474KA01	X7R (EIA)	100	0.47 ±10%	4.50	3.20	2.00
GRM43ER72A225KA01	X7R (EIA)	100	2.2 ±10%	4.50	3.20	2.50
GRM43ER71H225KA01	X7R (EIA)	50	2.2 ±10%	4.50	3.20	2.50
GRM43ER71E475KA01	X7R (EIA)	25	4.7 ±10%	4.50	3.20	2.50

High Dielectric Constant Type Type GRM55 Series (5.70x5.00mm)

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (µF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM55DR61H106KA88	X5R (EIA)	50	10.0 ±10%	5.70	5.00	2.00
GRM55DR72A105KA01	X7R (EIA)	100	1.0 ±10%	5.70	5.00	2.00
GRM55ER72A475KA01	X7R (EIA)	100	4.7 ±10%	5.70	5.00	2.50
GRM55RR71H105KA01	X7R (EIA)	50	1.0 ±10%	5.70	5.00	1.80
GRM55RR71H155KA01	X7R (EIA)	50	1.5 ±10%	5.70	5.00	1.80
GRM55ER11H475KA01	X7R (EIA)	50	4.7 ±10%	5.70	5.00	2.50
GRM55ER71H475KA01	X7R (EIA)	50	4.7 ±10%	5.70	5.00	2.50
GRM55RF52A474ZA01	Y5V (EIA)	100	0.47 +80/-20%	5.70	5.00	1.80

Chip Monolithic Ceramic Capacitors

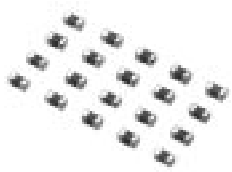
muRata

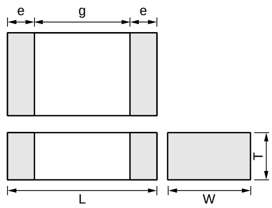
Ultra-small GRM03 Series

3

■ Features

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

Part Number	**GRM03**									
L x W [EIA]	0.6x0.3 [0201]									
TC	C0G (**5C**)	R2H (**6R**)	S2H (**6S**)	T2H (**6T**)	U2J (**7U**)		X5R (**R6**)	X7R (**R7**)		Y5V (**F5**)
Rated Volt.	25 (**1E**)	25 (**1E**)	25 (**1E**)	25 (**1E**)	50 (**1H**)	25 (**1E**)	10 (**1A**)	16 (**1C**)	6.3 (**0J**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)										
0.50pF(**R50**)	0.3(**3**)									
0.75pF(**R75**)	0.3(**3**)									
1.0pF(**1R0**)	0.3(**3**)									
2.0pF(**2R0**)	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**)		

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Part Number	**GRM03**									
L x W [EIA]	0.6x0.3 [0201]									
TC	C0G (**5C**)	R2H (**6R**)	S2H (**6S**)	T2H (**6T**)	U2J (**7U**)		X5R (**R6**)	X7R (**R7**)		Y5V (**F5**)
Rated Volt.	25 (**1E**)	25 (**1E**)	25 (**1E**)	25 (**1E**)	50 (**1H**)	25 (**1E**)	10 (**1A**)	16 (**1C**)	6.3 (**0J**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)										
680pF(**681**)								0.3(**3**)		
1000pF(**102**)								0.3(**3**)		
1500pF(**152**)							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**)	
4700pF(**472**)							0.3(**3**)		0.3(**3**)	0.3(**3**)
6800pF(**682**)							0.3(**3**)		0.3(**3**)	
10000pF(**103**)							0.3(**3**)		0.3(**3**)	0.3(**3**)

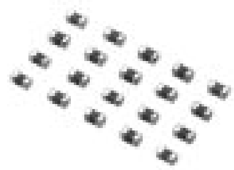
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

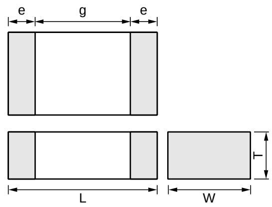
Chip Monolithic Ceramic Capacitors

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. The GRM03 type is a complete line of chip ceramic capacitors in 25V ratings, The 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. The 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 0.3	0.4

■ Applications

General electronic equipment

Temperature Compensating Type GRM03/15 Series

Part Number		**GRM03**	**GRM15**
L x W [EIA]		0.6x0.3 [0201]	1.00x0.50 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
0.10pF(**R10**)	**M, N**	0.3(**3**)	0.50(**5**)
0.20pF(**R20**)	**K, M**	0.3(**3**)	0.50(**5**)
0.30pF(**R30**)	**K, M**	0.3(**3**)	0.50(**5**)
0.40pF(**R40**)	**K, M**	0.3(**3**)	0.50(**5**)
0.50pF(**R50**)	**K, M**	0.3(**3**)	0.50(**5**)
0.60pF(**R60**)	**K, M**	0.3(**3**)	0.50(**5**)
0.70pF(**R70**)	**K, M**	0.3(**3**)	0.50(**5**)
0.80pF(**R80**)	**K, M**	0.3(**3**)	0.50(**5**)
0.90pF(**R90**)	**K, M**	0.3(**3**)	0.50(**5**)
1.0pF(**1R0**)	**J, K**	0.3(**3**)	0.50(**5**)
1.1pF(**1R1**)	**J, K**	0.3(**3**)	0.50(**5**)
1.2pF(**1R2**)	**J, K**	0.3(**3**)	0.50(**5**)
1.3pF(**1R3**)	**J, K**	0.3(**3**)	0.50(**5**)
1.4pF(**1R4**)	**J, K**	0.3(**3**)	0.50(**5**)
1.5pF(**1R5**)	**J, K**	0.3(**3**)	0.50(**5**)
1.6pF(**1R6**)	**J, K**	0.3(**3**)	0.50(**5**)
1.7pF(**1R7**)	**J, K**	0.3(**3**)	0.50(**5**)
1.8pF(**1R8**)	**J, K**	0.3(**3**)	0.50(**5**)
1.9pF(**1R9**)	**J, K**	0.3(**3**)	0.50(**5**)

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

Continued on the following page.

Continued from the preceding page.

Part Number		GRM03	GRM15
L x W [EIA]		0.6x0.3 [0201]	1.00x0.50 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
2.0pF(**2R0**)	**G, J**	0.3(**3**)	0.50(**5**)
2.1pF(**2R1**)	**G, J**	0.3(**3**)	0.50(**5**)
2.2pF(**2R2**)	**G, J**	0.3(**3**)	0.50(**5**)
2.3pF(**2R3**)	**G, J**	0.3(**3**)	0.50(**5**)
2.4pF(**2R4**)	**G, J**	0.3(**3**)	0.50(**5**)
2.5pF(**2R5**)	**G, J**	0.3(**3**)	0.50(**5**)
2.6pF(**2R6**)	**G, J**	0.3(**3**)	0.50(**5**)
2.7pF(**2R7**)	**G, J**	0.3(**3**)	0.50(**5**)
2.8pF(**2R8**)	**G, J**	0.3(**3**)	0.50(**5**)
2.9pF(**2R9**)	**G, J**	0.3(**3**)	0.50(**5**)
3.0pF(**3R0**)	**G, J**	0.3(**3**)	0.50(**5**)
3.1pF(**3R1**)	**G, J**	0.3(**3**)	0.50(**5**)
3.2pF(**3R2**)	**G, J**	0.3(**3**)	0.50(**5**)
3.3pF(**3R3**)	**G, J**	0.3(**3**)	0.50(**5**)
3.4pF(**3R4**)	**G, J**	0.3(**3**)	0.50(**5**)
3.5pF(**3R5**)	**G, J**	0.3(**3**)	0.50(**5**)
3.6pF(**3R6**)	**G, J**	0.3(**3**)	0.50(**5**)
3.7pF(**3R7**)	**G, J**	0.3(**3**)	0.50(**5**)
3.8pF(**3R8**)	**G, J**	0.3(**3**)	0.50(**5**)
3.9pF(**3R9**)	**G, J**	0.3(**3**)	0.50(**5**)
4.0pF(**4R0**)	**G, J**	0.3(**3**)	0.50(**5**)
4.1pF(**4R1**)	**G, J**	0.3(**3**)	0.50(**5**)
4.2pF(**4R2**)	**G, J**	0.3(**3**)	0.50(**5**)
4.3pF(**4R3**)	**G, J**	0.3(**3**)	0.50(**5**)
4.4pF(**4R4**)	**G, J**	0.3(**3**)	0.50(**5**)
4.5pF(**4R5**)	**G, J**	0.3(**3**)	0.50(**5**)
4.6pF(**4R6**)	**G, J**	0.3(**3**)	0.50(**5**)
4.7pF(**4R7**)	**G, J**	0.3(**3**)	0.50(**5**)
4.8pF(**4R8**)	**G, J**	0.3(**3**)	0.50(**5**)
4.9pF(**4R9**)	**G, J**	0.3(**3**)	0.50(**5**)
5.0pF(**5R0**)	**F, G**	0.3(**3**)	0.50(**5**)
5.1pF(**5R1**)	**F, G**	0.3(**3**)	0.50(**5**)
5.2pF(**5R2**)	**F, G**	0.3(**3**)	0.50(**5**)
5.3pF(**5R3**)	**F, G**	0.3(**3**)	0.50(**5**)
5.4pF(**5R4**)	**F, G**	0.3(**3**)	0.50(**5**)
5.5pF(**5R5**)	**F, G**	0.3(**3**)	0.50(**5**)
5.6pF(**5R6**)	**F, G**	0.3(**3**)	0.50(**5**)
5.7pF(**5R7**)	**F, G**	0.3(**3**)	0.50(**5**)
5.8pF(**5R8**)	**F, G**	0.3(**3**)	0.50(**5**)
5.9pF(**5R9**)	**F, G**	0.3(**3**)	0.50(**5**)
6.0pF(**6R0**)	**F, G**	0.3(**3**)	0.50(**5**)
6.1pF(**6R1**)	**F, G**	0.3(**3**)	0.50(**5**)
6.2pF(**6R2**)	**F, G**	0.3(**3**)	0.50(**5**)
6.3pF(**6R3**)	**F, G**	0.3(**3**)	0.50(**5**)
6.4pF(**6R4**)	**F, G**	0.3(**3**)	0.50(**5**)
6.5pF(**6R5**)	**F, G**	0.3(**3**)	0.50(**5**)
6.6pF(**6R6**)	**F, G**	0.3(**3**)	0.50(**5**)
6.7pF(**6R7**)	**F, G**	0.3(**3**)	0.50(**5**)
6.8pF(**6R8**)	**F, G**	0.3(**3**)	0.50(**5**)
6.9pF(**6R9**)	**F, G**	0.3(**3**)	0.50(**5**)

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

Continued on the following page.

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Part Number		GRM03	GRM15
L x W [EIA]		0.6x0.3 [0201]	1.00x0.50 [0402]
TC		C0G (**5C**)	C0G (**5C**)
Rated Volt.		25 (**1E**)	50 (**1H**)
Capacitance, Capacitance Tolerance and T Dimension			
7.0pF(**7R0**)	**F, G**	0.3(**3**)	0.50(**5**)
7.1pF(**7R1**)	**F, G**	0.3(**3**)	0.50(**5**)
7.2pF(**7R2**)	**F, G**	0.3(**3**)	0.50(**5**)
7.3pF(**7R3**)	**F, G**	0.3(**3**)	0.50(**5**)
7.4pF(**7R4**)	**F, G**	0.3(**3**)	0.50(**5**)
7.5pF(**7R5**)	**F, G**	0.3(**3**)	0.50(**5**)
7.6pF(**7R6**)	**F, G**	0.3(**3**)	0.50(**5**)
7.7pF(**7R7**)	**F, G**	0.3(**3**)	0.50(**5**)
7.8pF(**7R8**)	**F, G**	0.3(**3**)	0.50(**5**)
7.9pF(**7R9**)	**F, G**	0.3(**3**)	0.50(**5**)
8.0pF(**8R0**)	**F, G**	0.3(**3**)	0.50(**5**)
8.1pF(**8R1**)	**F, G**	0.3(**3**)	0.50(**5**)
8.2pF(**8R2**)	**F, G**	0.3(**3**)	0.50(**5**)
8.3pF(**8R3**)	**F, G**	0.3(**3**)	0.50(**5**)
8.4pF(**8R4**)	**F, G**	0.3(**3**)	0.50(**5**)
8.5pF(**8R5**)	**F, G**	0.3(**3**)	0.50(**5**)
8.6pF(**8R6**)	**F, G**	0.3(**3**)	0.50(**5**)
8.7pF(**8R7**)	**F, G**	0.3(**3**)	0.50(**5**)
8.8pF(**8R8**)	**F, G**	0.3(**3**)	0.50(**5**)
8.9pF(**8R9**)	**F, G**	0.3(**3**)	0.50(**5**)
9.0pF(**9R0**)	**F, G**	0.3(**3**)	0.50(**5**)
9.1pF(**9R1**)	**F, G**	0.3(**3**)	0.50(**5**)
9.2pF(**9R2**)	**F, G**	0.3(**3**)	0.50(**5**)
9.3pF(**9R3**)	**F, G**	0.3(**3**)	0.50(**5**)
9.4pF(**9R4**)	**F, G**	0.3(**3**)	0.50(**5**)
9.5pF(**9R5**)	**F, G**	0.3(**3**)	0.50(**5**)
9.6pF(**9R6**)	**F, G**	0.3(**3**)	0.50(**5**)
9.7pF(**9R7**)	**F, G**	0.3(**3**)	0.50(**5**)
9.8pF(**9R8**)	**F, G**	0.3(**3**)	0.50(**5**)
9.9pF(**9R9**)	**F, G**	0.3(**3**)	0.50(**5**)

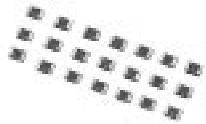
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

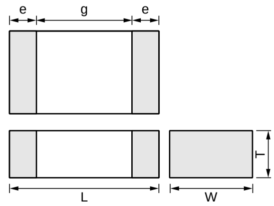
Chip Monolithic Ceramic Capacitors

Thin Type (Flow/Reflow)

■ 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. 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

■ 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
GRM15X5C1H1R0CDB4	C0G (EIA)	50	1.0 ±0.25pF	1.00	0.50	0.25	0402
GRM15X5C1H2R0CDB4	C0G (EIA)	50	2.0 ±0.25pF	1.00	0.50	0.25	0402
GRM15X5C1H3R0CDB4	C0G (EIA)	50	3.0 ±0.25pF	1.00	0.50	0.25	0402
GRM15X5C1H4R0CDB4	C0G (EIA)	50	4.0 ±0.25pF	1.00	0.50	0.25	0402
GRM15X5C1H5R0CDB4	C0G (EIA)	50	5.0 ±0.25pF	1.00	0.50	0.25	0402
GRM15X5C1H6R0DDB4	C0G (EIA)	50	6.0 ±0.5pF	1.00	0.50	0.25	0402
GRM15X5C1H7R0DDB4	C0G (EIA)	50	7.0 ±0.5pF	1.00	0.50	0.25	0402
GRM15X5C1H8R0DDB4	C0G (EIA)	50	8.0 ±0.5pF	1.00	0.50	0.25	0402
GRM15X5C1H9R0DDB4	C0G (EIA)	50	9.0 ±0.5pF	1.00	0.50	0.25	0402
GRM15X5C1H100JDB4	C0G (EIA)	50	10 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H120JDB4	C0G (EIA)	50	12 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H150JDB4	C0G (EIA)	50	15 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H180JDB4	C0G (EIA)	50	18 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H220JDB4	C0G (EIA)	50	22 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H270JDB4	C0G (EIA)	50	27 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H330JDB4	C0G (EIA)	50	33 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H390JDB4	C0G (EIA)	50	39 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H470JDB4	C0G (EIA)	50	47 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H560JDB4	C0G (EIA)	50	56 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H680JDB4	C0G (EIA)	50	68 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H820JDB4	C0G (EIA)	50	82 ±5%	1.00	0.50	0.25	0402
GRM15X5C1H101JDB4	C0G (EIA)	50	100 ±5%	1.00	0.50	0.25	0402
GRM15X5C1E121JDB4	C0G (EIA)	25	120 ±5%	1.00	0.50	0.25	0402
GRM15X5C1E151JDB4	C0G (EIA)	25	150 ±5%	1.00	0.50	0.25	0402
GRM15X5C1E181JDB4	C0G (EIA)	25	180 ±5%	1.00	0.50	0.25	0402
GRM15X5C1E221JDB4	C0G (EIA)	25	220 ±5%	1.00	0.50	0.25	0402

High Dielectric Constant Type

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	EIA
GRM15XR71H221KA86	X7R (EIA)	50	220 ±10%	1.00	0.50	0.25	0402
GRM15XR71H331KA86	X7R (EIA)	50	330 ±10%	1.00	0.50	0.25	0402
GRM15XR71H471KA86	X7R (EIA)	50	470 ±10%	1.00	0.50	0.25	0402

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Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	EIA
GRM15XR71H681KA86	X7R (EIA)	50	680 ±10%	1.00	0.50	0.25	0402
GRM15XR71H102KA86	X7R (EIA)	50	1000 ±10%	1.00	0.50	0.25	0402
GRM15XR71H152KA86	X7R (EIA)	50	1500 ±10%	1.00	0.50	0.25	0402
GRM15XR71E182KA86	X7R (EIA)	25	1800 ±10%	1.00	0.50	0.25	0402
GRM15XR71E222KA86	X7R (EIA)	25	2200 ±10%	1.00	0.50	0.25	0402
GRM15XR71C332KA86	X7R (EIA)	16	3300 ±10%	1.00	0.50	0.25	0402
GRM15XR71C472KA86	X7R (EIA)	16	4700 ±10%	1.00	0.50	0.25	0402
GRM15XR71C682KA86	X7R (EIA)	16	6800 ±10%	1.00	0.50	0.25	0402

GRM Series Specifications and Test Methods

<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 : −25 to +85℃
R1, R7 : −55 to +125℃
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</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 ΔU, 1X (1000pF and below)</th><th>ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1</th><th>E4</th></tr><tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</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±0.05Vrms</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>[B1, B3, R1, R6, R7, E4]
W.V. : 25V min. : 0.025 max.
W.V. : 16/10V : 0.035 max.
W.V. : 6.3/4V
: 0.05 max. (C<3.3μF)
: 0.1 max. (C≧3.3μF)
[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>

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GRM Series Specifications and Test Methods

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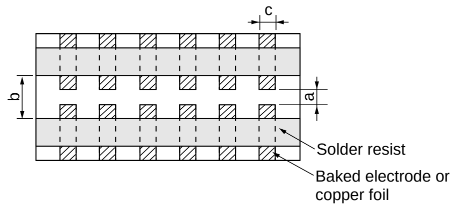
<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Characteristics</td><td>No bias</td><td>Within the specified tolerance (Table A-1)</td><td>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℃)</td><td rowspan="3">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.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>Reference Temperature ±2</td></tr>
<tr><td>2</td><td>−55±3 (for ΔC)/−25±3 (for other TC)</td></tr>
<tr><td>3</td><td>Reference Temperature ±2</td></tr>
<tr><td>4</td><td>125±3 (for ΔC)/85±3 (for other TC)</td></tr>
<tr><td>5</td><td>Reference Temperature ±2</td></tr>
</table>
(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.
<table>
<tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr>
<tr><td>1</td><td>Reference Tempereture ±2</td><td rowspan="4">No bias</td></tr>
<tr><td>2</td><td>–55±3 (for R1, R7, R6)
–25±3 (for B1, B3, F1)
–30±3 (for F5)/10±3 (for E4)</td></tr>
<tr><td>3</td><td>Reference Tempereture ±2</td></tr>
<tr><td>4</td><td>125±3 (for R1, R7)/
85±3 (for B1, B3, R6
F1, F5, E4)</td></tr>
<tr><td>5</td><td>Reference Tempereture ±2</td><td rowspan="4">50% of the rated voltage</td></tr>
<tr><td>6</td><td>–55±3 (for R1)/
–25±3 (for B1, F1)</td></tr>
<tr><td>7</td><td>Reference Tempereture ±2</td></tr>
<tr><td>8</td><td>125±3 (for R1)/
85±3 (for B1, F1)</td></tr>
</table></td></tr>
<tr><td>50% of the Rated Voltage</td><td></td><td>B1 : Within +10/–30%
R1 : Within +15/–40%
F1 : Within +30/–95%</td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05pF (Whichever is larger.)
✻Not apply to 1X/25V</td><td>✻Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/–10°C for one hour and then set for 48±4 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td colspan="2">No removal of the terminations or other defect should occur


Fig. 1a</td><td>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.
✻2N (GR□03), 5N (GR□15, GRM18)
(in mm)
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>**GR□03**</td><td>0.3</td><td>0.9</td><td>0.3</td></tr>
<tr><td>**GR□15**</td><td>0.4</td><td>1.5</td><td>0.5</td></tr>
<tr><td>**GRM18**</td><td>1.0</td><td>3.0</td><td>1.2</td></tr>
<tr><td>**GRM21**</td><td>1.2</td><td>4.0</td><td>1.65</td></tr>
<tr><td>**GRM31**</td><td>2.2</td><td>5.0</td><td>2.0</td></tr>
<tr><td>**GRM32**</td><td>2.2</td><td>5.0</td><td>2.9</td></tr>
<tr><td>**GRM43**</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>**GRM55**</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table></td></tr>
</table>

Continued on the following page.

GRM Series Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
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 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, R1, R6, R7, E4] W.V. : 25V min. : 0.025 max. W.V. : 16/10V : 0.035 max. W.V. : 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≧3.3μF) [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 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.

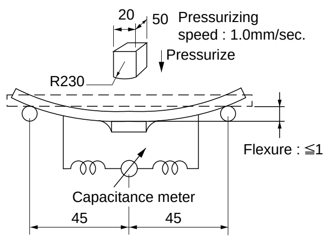


Fig. 3a

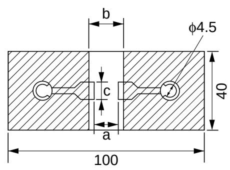


Fig. 2a

t : 1.6mm (GR□03/15 : t : 0.8mm)

Type	a	b	c
GR□03	0.3	0.9	0.3
GR□15	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)

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric 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 an eutectic solder solution for 2±0.5 seconds at 230±5℃.
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 solution at 270±5℃ for 10±0.5 seconds. Set at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), 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 48±4 hours. Perform the initial measurement. •Preheating for GRM32/43/55
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7 : 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, R1, R6, R7, E4] W.V. : 25V min. : 0.025 max. W.V. : 16/10V : 0.035 max. W.V. : 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≧3.3μF) [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		

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

Continued on the following page.

GRM Series Specifications and Test Methods

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 rowspan="6">Temperature Cycle</td><td></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 shown in the following table.
Set 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. (℃)</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 48±4 hours.
Perform the initial measurement.</td></tr>
<tr><td>Appearance</td><td colspan="2">No defects or abnormalities</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</td><td>B1, B3, R1, R6, R7
: Within ±7.5%
F1, F5, E4 : Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over : Q≧1000
30pF and below :
Q≧400+20C

C : Nominal Capacitance (pF)</td><td>[B1, B3, R1, R6, R7, E4]
W.V. : 25V min. : 0.025 max.
W.V. : 16/10V : 0.035 max.
W.V. : 6.3/4V
: 0.05 max. (C<3.3μF)
: 0.1 max. (C≧3.3μF)
[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>
<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 defects</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Humidity (Steady State)</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table</td><td rowspan="5">Set the capacitor at 40±2℃ and in 90 to 95% humidity for 500±12 hours.
Remove and set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.</td></tr>
<tr><td>Appearance</td><td colspan="2">No defects or abnormalities</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF
(Whichever is larger)</td><td>B1, B3, R1, R6, R7, C8
: Within ±12.5%
F1, F5 : Within ±30%</td></tr>
<tr><td>Q/D.F.</td><td>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)</td><td>[B1, B3, R1, R6, R7, E4]
W.V. : 25V min. : 0.05 max.
W.V. : 16/10V : 0.05 max.
W.V. : 6.3/4V
: 0.075 max. (C<3.3μF)
: 0.125 max. (C≧3.3μF)
[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.</td></tr>
<tr><td>I.R.</td><td colspan="2">More than 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
</table>

Continued on the following page.

GRM Series Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric 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 set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) 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 48±4 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 : 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, R1, R6, R7, E4] W.V. : 25V min. : 0.05 max. W.V. : 16/10V : 0.05 max. W.V. : 6.3V : 0.075 max. (C<3.3μF) : 0.125 max. (C≧3.3μF) [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)		
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 (temperature compensating type) or 48±4 hours (high dielectric constant type) 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 48±4 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 : 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, R1, R6, R7, E4] W.V. : 25V min. : 0.04 max. W.V. : 16/10V : 0.05 max. W.V. : 6.3V : 0.075 max.(C<3.3μF) : 0.125 max.(C≧3.3μF) [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)		

Continued on the following page.

GRM Series Specifications and Test Methods

Continued from the preceding page.

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).

Chip Monolithic Ceramic Capacitors

muRata

Thin Layer Large Capacitance Type

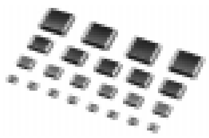
■ Features

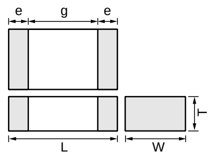
1. Smaller size and higher capacitance value
2. High reliability and no polarity
3. Excellent pulse responsibility and noise reduction due to the low impedance at high frequency

■ Applications

General electronic equipment

Part Number	Dimensions (mm)				
	L	W	T	e min.	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
GRM185	1.6 ±0.1	0.8 ±0.1	0.5 +0/-0.1	0.2 to 0.5	0.5
GRM188	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
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		
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		
GRM32C	3.2 ±0.3	2.5 ±0.2	1.6 ±0.2	0.3	1.0
GRM32D			2.0 ±0.2		
GRM32E			2.5 ±0.2		
GRM43D	4.5 ±0.4	3.2 ±0.3	2.0 ±0.2	0.3	2.0
GRM43E			2.5 ±0.2		
GRM43S			2.8 ±0.2		
GRM55F	5.7 ±0.4	5.0 ±0.4	3.2 ±0.2	0.3	2.0





6

Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM188R61E474KA12	X5R (EIA)	25	0.47µF ±10%	1.60	0.80	0.80
GRM188R61E105KA12	X5R (EIA)	25	1.0µF ±10%	1.60	0.80	0.80
GRM21BR61E105KA99	X5R (EIA)	25	1.0µF ±10%	2.00	1.25	1.25
GRM219R61E225KA12	X5R (EIA)	25	2.2µF ±10%	2.00	1.25	0.85
GRM21BR61E225KA12	X5R (EIA)	25	2.2µF ±10%	2.00	1.25	1.25
GRM21BR61E475KA12	X5R (EIA)	25	4.7µF ±10%	2.00	1.25	1.25
GRM319R61E475KA12	X5R (EIA)	25	4.7µF ±10%	3.20	1.60	0.85
GRM31CR61E106KA12	X5R (EIA)	25	10µF ±10%	3.20	1.60	1.60
GRM188R61C474KA93	X5R (EIA)	16	0.47µF ±10%	1.60	0.80	0.80
GRM188R61C105KA93	X5R (EIA)	16	1.0µF ±10%	1.60	0.80	0.80
GRM216R61C105KA88	X5R (EIA)	16	1.0µF ±10%	2.00	1.25	0.60
GRM219R61C225KA88	X5R (EIA)	16	2.2µF ±10%	2.00	1.25	0.85
GRM21BR61C225KA88	X5R (EIA)	16	2.2µF ±10%	2.00	1.25	1.25
GRM316R61C225KA88	X5R (EIA)	16	2.2µF ±10%	3.20	1.60	0.60
GRM21BR61C335KA88	X5R (EIA)	16	3.3µF ±10%	2.00	1.25	1.25
GRM21BR61C475KA88	X5R (EIA)	16	4.7µF ±10%	2.00	1.25	1.25
GRM319R61C475KA88	X5R (EIA)	16	4.7µF ±10%	3.20	1.60	0.85
GRM32ER61C226KE20	X5R (EIA)	16	22µF ±10%	3.20	2.50	2.50
GRM43ER61C226KE01	X5R (EIA)	16	22µF ±10%	4.50	3.20	2.50
GRM155R61A154KE19	X5R (EIA)	10	0.15µF ±10%	1.00	0.50	0.50
GRM155R61A224KE19	X5R (EIA)	10	0.22µF ±10%	1.00	0.50	0.50
GRM185R61A105KE36	X5R (EIA)	10	1.0µF ±10%	1.60	0.80	0.50
GRM188R61A225KE34	X5R (EIA)	10	2.2µF ±10%	1.60	0.80	0.80
GRM188R61A225ME34	X5R (EIA)	10	2.2µF ±10%	1.60	0.80	0.80
GRM216R61A225KE24	X5R (EIA)	10	2.2µF ±10%	2.00	1.25	0.60
GRM219R61A225KA01	X5R (EIA)	10	2.2µF ±10%	2.00	1.25	0.85
GRM316R61A225KA01	X5R (EIA)	10	2.2µF ±10%	3.20	1.60	0.60
GRM219R61A335KE19	X5R (EIA)	10	3.3µF ±10%	2.00	1.25	0.85
GRM316R61A335KE19	X5R (EIA)	10	3.3µF ±10%	3.20	1.60	0.60
GRM219R61A475KE34	X5R (EIA)	10	4.7µF ±10%	2.00	1.25	0.85
GRM316R61A475KE19	X5R (EIA)	10	4.7µF ±10%	3.20	1.60	0.60
GRM319R61A475KA01	X5R (EIA)	10	4.7µF ±10%	3.20	1.60	0.85
GRM21BR61A106KE19	X5R (EIA)	10	10µF ±10%	2.00	1.25	1.25
GRM21BR61A106ME19	X5R (EIA)	10	10µF ±20%	2.00	1.25	1.25
GRM319R61A106KA19	X5R (EIA)	10	10µF ±10%	3.20	1.60	0.85
GRM31MR61A106KE19	X5R (EIA)	10	10µF ±10%	3.20	1.60	1.15
GRM32ER61A226KE20	X5R (EIA)	10	22µF ±10%	3.20	2.50	2.50
GRM43ER61A476KE19	X5R (EIA)	10	47µF ±10%	4.50	3.20	2.50
GRM033R60J153KE01	X5R (EIA)	6.3	15000pF ±10%	0.6	0.3	0.3

Continued on the following page.

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Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM033R60J223KE01	X5R (EIA)	6.3	22000pF ±10%	0.6	0.3	0.3
GRM033R60J333KE01	X5R (EIA)	6.3	33000pF ±10%	0.6	0.3	0.3
GRM033R60J393KE19	X5R (EIA)	6.3	39000pF ±10%	0.6	0.3	0.3
GRM033R60J473KE19	X5R (EIA)	6.3	47000pF ±10%	0.6	0.3	0.3
GRM033R60J104KE19	X5R (EIA)	6.3	0.10μF ±10%	0.6	0.3	0.3
GRM155R60J154KE01	X5R (EIA)	6.3	0.15μF ±10%	1.00	0.50	0.50
GRM155R60J224KE01	X5R (EIA)	6.3	0.22μF ±10%	1.00	0.50	0.50
GRM155R60J334KE01	X5R (EIA)	6.3	0.33μF ±10%	1.00	0.50	0.50
GRM155R60J474KE19	X5R (EIA)	6.3	0.47μF ±10%	1.00	0.50	0.50
GRM155R60J105KE19	X5R (EIA)	6.3	1.0μF ±10%	1.00	0.50	0.50
GRM185R60J105KE21	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.50
GRM185R60J105KE26	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.50
GRM185R60J225KE26	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.50
GRM188R60J225KE01	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.80
GRM188R60J225KE19	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.80
GRM188R60J475KE19	X5R (EIA)	6.3	4.7μF ±10%	1.60	0.80	0.80
GRM219R60J475KE01	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
GRM219R60J475KE19	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
GRM219R60J475KE32	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
GRM219R60J106KE19	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	0.85
GRM219R60J106ME19	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	0.85
GRM21BR60J106KE01	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	1.25
GRM21BR60J106KE19	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	1.25
GRM21BR60J106ME01	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	1.25
GRM21BR60J106ME19	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	1.25
GRM319R60J106KE01	X5R (EIA)	6.3	10μF ±10%	3.20	0.85	1.60
GRM319R60J106KE19	X5R (EIA)	6.3	10μF ±10%	3.20	1.60	0.85
GRM31MR60J106KE19	X5R (EIA)	6.3	10μF ±10%	3.20	1.60	1.15
GRM31CR60J156KE19	X5R (EIA)	6.3	15μF ±10%	3.20	1.60	1.60
GRM21BR60J226ME39	X5R (EIA)	6.3	22μF ±20%	2.00	1.25	1.25
GRM31CR60J226KE19	X5R (EIA)	6.3	22μF ±10%	3.20	1.60	1.60
GRM31CR60J226ME19	X5R (EIA)	6.3	22μF ±20%	3.20	1.60	1.60
GRM32DR60J226KA01	X5R (EIA)	6.3	22μF ±10%	3.20	2.50	2.00
GRM32DR60J336ME19	X5R (EIA)	6.3	33μF ±10%	3.20	2.50	2.00
GRM43DR60J336KE01	X5R (EIA)	6.3	33μF ±10%	4.50	3.20	2.00
GRM31CR60J476ME19	X5R (EIA)	6.3	47μF ±20%	3.20	1.60	1.60
GRM32ER60J476ME20	X5R (EIA)	6.3	47μF ±20%	3.20	2.50	2.50
GRM43ER60J476KE01	X5R (EIA)	6.3	47μF ±10%	4.50	3.20	2.50
GRM32ER60J107ME20	X5R (EIA)	6.3	100μF ±20%	3.20	2.50	2.50
GRM43SR60J107ME20	X5R (EIA)	6.3	100μF ±20%	4.50	3.20	2.80
GRM188R60G106ME47	X5R (EIA)	4	10μF ±20%	1.60	0.80	0.80
GRM55ER71E156KA01	X7R (EIA)	25	15μF ±10%	5.70	5.00	2.50
GRM31CR71C106KAC7	X7R (EIA)	16	10μF ±10%	3.20	1.60	1.60
GRM32ER71A226KE20	X7R (EIA)	10	22μF ±10%	3.20	2.50	2.50
GRM32ER71A226ME20	X7R (EIA)	10	22μF ±20%	3.20	2.50	2.50
GRM43ER71A226KE01	X7R (EIA)	10	22μF ±10%	4.50	3.20	2.50
GRM155F51A474ZE01	Y5V (EIA)	10	0.47μF +80/-20%	1.00	0.50	0.50
GRM188F51A225ZE01	Y5V (EIA)	10	2.2μF +80/-20%	1.60	0.80	0.80
GRM188F51A475ZE20	Y5V (EIA)	10	4.7μF +80/-20%	1.60	0.80	0.80
GRM31CF51A226ZE01	Y5V (EIA)	10	22μF +80/-20%	3.20	1.60	1.60
GRM32CF51A226ZA01	Y5V (EIA)	10	22μF +80/-20%	3.20	2.50	1.60
GRM155F50J105ZE01	Y5V (EIA)	6.3	1.0μF +80/-20%	1.00	0.50	0.50
GRM188F50J225ZE01	Y5V (EIA)	6.3	2.2μF +80/-20%	1.60	0.80	0.80
GRM188F50J475ZE20	Y5V (EIA)	6.3	4.7μF +80/-20%	1.60	0.80	0.80
GRM21BF50J106ZE01	Y5V (EIA)	6.3	10μF +80/-20%	2.00	1.25	1.25
GRM31CF50J226ZE01	Y5V (EIA)	6.3	22μF +80/-20%	3.20	1.60	1.60
GRM32EF50J107ZE20	Y5V (EIA)	6.3	100μF +80/-20%	3.20	2.50	2.50

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>B1, B3, F1 : −25 to +85℃
R6 : −55 to +85℃
F5 : −30 to +85℃
C8 : −55 to +105℃, C7 : -55 to +125℃</td><td>Reference temperature : 25℃
(B1, B3, F1 : 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 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 50Ω • F</td><td>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.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance

*Table 1
<table><tr><td>GRM155 B3/R6 1A 124 to 224</td></tr><tr><td>GRM185 B3/R6 1A 105</td></tr><tr><td>GRM188 B3/R6 1C/1A 225</td></tr><tr><td>GRM219 B3/R6 1A 475</td></tr><tr><td>GRM21B B3/R6 1C/1A 106</td></tr></table></td><td>The capacitance should be measured at reference temperature 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.)*1</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>*1 However the voltage is 0.5±0.1Vrms about Table 1 items on the left side.</td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>B1, B3, R6, C7, C8 : 0.1 max.
F1, F5 : 0.2 max.

*Table 1
<table><tr><td>GRM155 B3/R6 1A 124 to 224</td></tr><tr><td>GRM185 B3/R6 1A 105</td></tr><tr><td>GRM188 B3/R6 1C/1A 225</td></tr><tr><td>GRM219 B3/R6 1A 475</td></tr><tr><td>GRM21B B3/R6 1C/1A 106</td></tr></table></td><td>The D.F. should be measured at reference temperature 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.)*1</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>*1 However the voltage is 0.5±0.1Vrms about Table 1 items on the left side.</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Capacitance Temperature Characteristics</td><td>No bias</td><td>B1, B3 : Within ±10% (−25 to +85℃)
F1 : Within +30/−80% (−25 to +85℃)
R6 : Within ±15% (−55 to +85℃)
F5 : Within +22/−82% (−30 to +85℃)
C7 : Within ±22% (−55 to +125℃)
C8 : Within ±22% (−55 to +105℃)</td><td rowspan="2">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<table><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr><tr><td>1</td><td>Reference tempereture ±2</td><td rowspan="4">No bias</td></tr><tr><td>2</td><td>–55±3 (for R6, C7, C8)/
–25±3 (for B1, B3, F1)
–30±3 (for F5)</td></tr><tr><td>3</td><td>Reference tempereture ±2</td></tr><tr><td>4</td><td>85±3 (for B1, B3, F1, R6, F5)
125±3 (for C7)/
105±3 (for C8)</td></tr><tr><td>5</td><td>20±2</td><td rowspan="4">50% of the rated voltage</td></tr><tr><td>6</td><td>–25±3 (for B1, F1)</td></tr><tr><td>7</td><td>20±2</td></tr><tr><td>8</td><td>85±3 (for B1, F1)</td></tr></table>•Initial measurement for high dielectric constant type
Perform a heat treatment at 150 +0/−10°C for one hour and then set for 48±4 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>50% of the Rated Voltage</td><td>B1: Within +10/−30%
F1: Within +30/−95%</td></tr>
</table>

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Specifications and Test Methods

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<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td>No removal of the terminations or other defects should occur
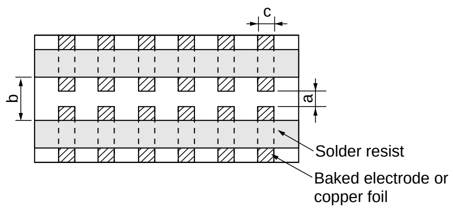
Fig. 1a</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec.
The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
*5N : GR□15/GRM18, 2N : GR□33
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>**GR□03**</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>**GR□15**</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>**GRM18**</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>**GRM21**</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>**GRM31**</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>**GRM32**</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>**GRM43**</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>**GRM55**</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table></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 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 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>B1, B3, R6, C7, C8 : 0.1 max.
F1, F5 : 0.2 max.</td></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur
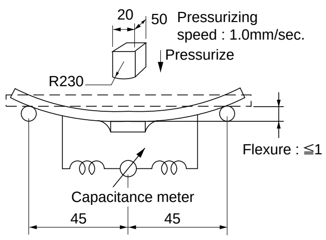
Fig.3a</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
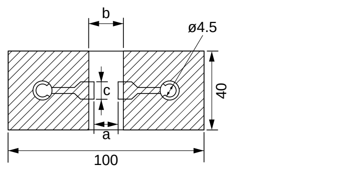
Fig. 2a
(GR□03, GR□15 : t : 0.8mm)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>**GR□03**</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>**GR□15**</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>**GRM18**</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>**GRM21**</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>**GRM31**</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>**GRM32**</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>**GRM43**</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>**GRM55**</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table>(in mm)</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations is 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℃ for 10 to 30 seconds.
After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5℃.</td></tr>
</table>

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Specifications and Test Methods

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<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 solution at 270±5℃ for 10±0.5 seconds. Set at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), 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 48±4 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, C7, C8 : Within ±7.5%
F1, F5 : Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>B1, B3, R6, 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 (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. (℃)</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 48±4 hours.
Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, C7, C8 : Within ±7.5%
F1, F5 : Within ±20%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6, 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 48±4 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 48±4 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, C7, C8 : Within ±12.5%
F1, F5 : Within ±30%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6, 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 48±4 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 48±4 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 48±4 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>B1, B3, R6, C7, C8 : Within ±12.5%
F1, F5 : Within ±30%</td></tr>
<tr><td>D.F.</td><td>B1, B3, R6, C7, C8 : 0.1 max.
F1, F5 : 0.4 max.</td></tr>
<tr><td>I.R.</td><td>More than 25Ω • F</td></tr>
</table>

Chip Monolithic Ceramic Capacitors

muRata

Low Dissipation Type

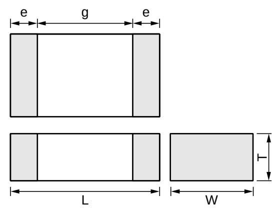
7

■ Features

1. Mobile Telecommunication and RF module, mainly
2. Quality improvement of telephone call, Low power Consumption, yield ratio improvement

■ Applications

VCO, PA, Mobile Telecommunication



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	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GJM0335C1ER50CB01	C0G (EIA)	25	0.50 ±0.25pF	0.60	0.30	0.30
GJM0335C1ER75CB01	C0G (EIA)	25	0.75 ±0.25pF	0.60	0.30	0.30
GJM0335C1E1R0CB01	C0G (EIA)	25	1.0 ±0.25pF	0.60	0.30	0.30
GJM0335C1E2R0CB01	C0G (EIA)	25	2.0 ±0.25pF	0.60	0.30	0.30
GJM0335C1E3R0CB01	C0G (EIA)	25	3.0 ±0.25pF	0.60	0.30	0.30
GJM0335C1E4R0CB01	C0G (EIA)	25	4.0 ±0.25pF	0.60	0.30	0.30
GJM0335C1E5R0CB01	C0G (EIA)	25	5.0 ±0.25pF	0.60	0.30	0.30
GJM0335C1E6R0DB01	C0G (EIA)	25	6.0 ±0.5pF	0.60	0.30	0.30
GJM1555C1HR50CB01	C0G (EIA)	50	0.50 ±0.25pF	1.00	0.50	0.50
GJM1555C1HR75CB01	C0G (EIA)	50	0.75 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R0CB01	C0G (EIA)	50	1.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R1CB01	C0G (EIA)	50	1.1 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R2CB01	C0G (EIA)	50	1.2 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R3CB01	C0G (EIA)	50	1.3 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R5CB01	C0G (EIA)	50	1.5 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R6CB01	C0G (EIA)	50	1.6 ±0.25pF	1.00	0.50	0.50
GJM1555C1H1R8CB01	C0G (EIA)	50	1.8 ±0.25pF	1.00	0.50	0.50
GJM1555C1H2R0CB01	C0G (EIA)	50	2.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H2R2CB01	C0G (EIA)	50	2.2 ±0.25pF	1.00	0.50	0.50
GJM1555C1H2R4CB01	C0G (EIA)	50	2.4 ±0.25pF	1.00	0.50	0.50
GJM1555C1H2R7CB01	C0G (EIA)	50	2.7 ±0.25pF	1.00	0.50	0.50
GJM1555C1H3R0CB01	C0G (EIA)	50	3.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H3R3CB01	C0G (EIA)	50	3.3 ±0.25pF	1.00	0.50	0.50
GJM1555C1H3R6CB01	C0G (EIA)	50	3.6 ±0.25pF	1.00	0.50	0.50
GJM1555C1H3R9CB01	C0G (EIA)	50	3.9 ±0.25pF	1.00	0.50	0.50
GJM1555C1H4R0CB01	C0G (EIA)	50	4.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H4R3CB01	C0G (EIA)	50	4.3 ±0.25pF	1.00	0.50	0.50
GJM1555C1H4R7CB01	C0G (EIA)	50	4.7 ±0.25pF	1.00	0.50	0.50
GJM1555C1H5R0CB01	C0G (EIA)	50	5.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H5R1CB01	C0G (EIA)	50	5.1 ±0.25pF	1.00	0.50	0.50
GJM1555C1H5R6CB01	C0G (EIA)	50	5.6 ±0.25pF	1.00	0.50	0.50
GJM1555C1H6R0CB01	C0G (EIA)	50	6.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H6R0DB01	C0G (EIA)	50	6.0 ±0.5pF	1.00	0.50	0.50
GJM1555C1H6R2CB01	C0G (EIA)	50	6.2 ±0.25pF	1.00	0.50	0.50
GJM1555C1H6R8CB01	C0G (EIA)	50	6.8 ±0.25pF	1.00	0.50	0.50
GJM1555C1H7R0CB01	C0G (EIA)	50	7.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H7R0DB01	C0G (EIA)	50	7.0 ±0.5pF	1.00	0.50	0.50
GJM1555C1H7R5CB01	C0G (EIA)	50	7.5 ±0.25pF	1.00	0.50	0.50

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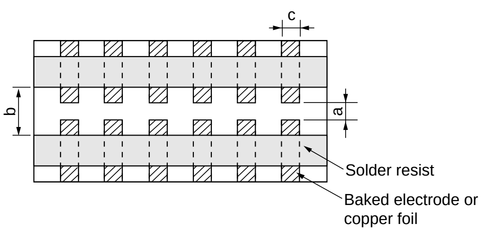
Part Number	TC Code (Standard)	Rated Voltage (Vdc)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GJM1555C1H8R0CB01	C0G (EIA)	50	8.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H8R0DB01	C0G (EIA)	50	8.0 ±0.5pF	1.00	0.50	0.50
GJM1555C1H8R2CB01	C0G (EIA)	50	8.2 ±0.25pF	1.00	0.50	0.50
GJM1555C1H9R0CB01	C0G (EIA)	50	9.0 ±0.25pF	1.00	0.50	0.50
GJM1555C1H9R0DB01	C0G (EIA)	50	9.0 ±0.5pF	1.00	0.50	0.50
GJM1555C1H9R1CB01	C0G (EIA)	50	9.1 ±0.25pF	1.00	0.50	0.50
GJM1555C1H100JB01	C0G (EIA)	50	10 ±5%	1.00	0.50	0.50
GJM1555C1H100RB01	C0G (EIA)	50	10 ±2.5%	1.00	0.50	0.50
GJM1555C1H120JB01	C0G (EIA)	50	12 ±5%	1.00	0.50	0.50
GJM1555C1H150JB01	C0G (EIA)	50	15 ±5%	1.00	0.50	0.50
GJM1555C1H180JB01	C0G (EIA)	50	18 ±5%	1.00	0.50	0.50

Specifications and Test Methods

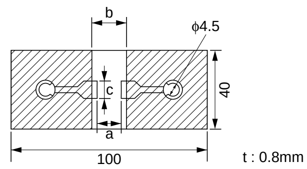
<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th>Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>Reference Temperature : 25℃
(2C, 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	30pF max. : 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 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
GJM03	0.3	0.9	0.3
GJM15	0.4	1.5	0.5

(in mm)

Fig. 2

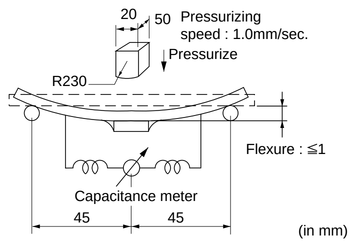


Fig. 3

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℃.
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 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	30pF and below : 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	30pF and below : 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≧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)	

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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 : $Q \geqq 100+\frac{10}{3}C$ 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 : $Q \geqq 275+\frac{5}{2}C$ 10pF and below : $Q \geqq 200+10C$ 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 • pF 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℃.

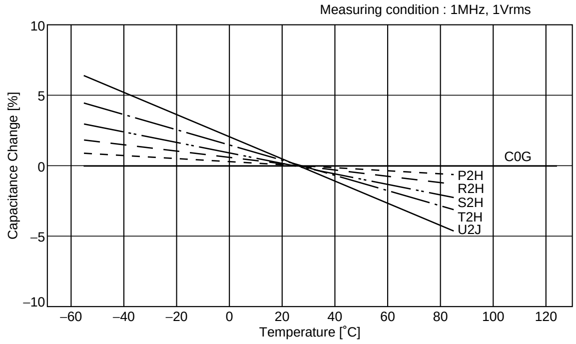
(2)

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

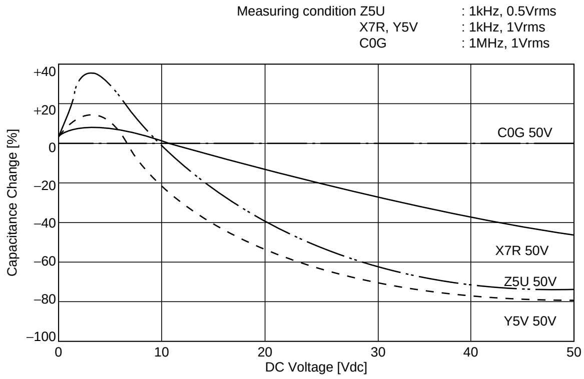
✻2 : Nominal values denote the temperature coefficient within a range of 20 to 125℃.

GRM Series Data

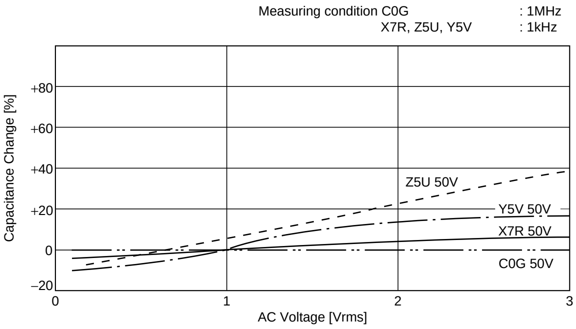
■ Capacitance-Temperature Characteristics



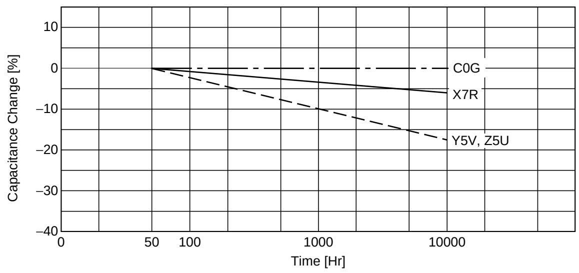
■ Capacitance-DC Voltage Characteristics



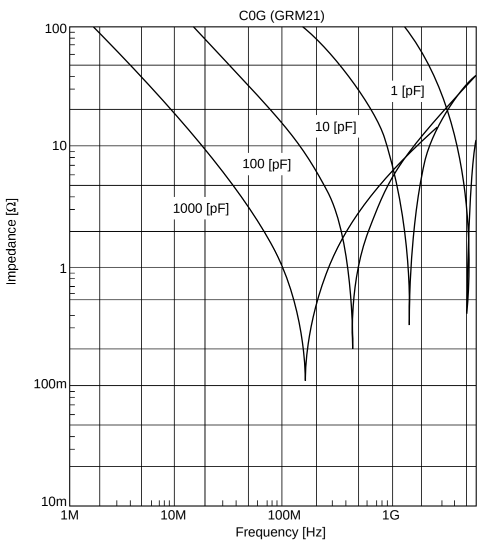
■ Capacitance-AC Voltage Characteristics



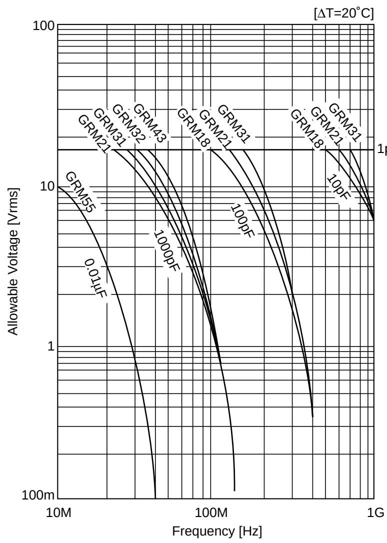
■ Capacitance Change-Aging



■ Impedance-Frequency Characteristics



■ Allowable Voltage-Frequency



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GRM Series Data

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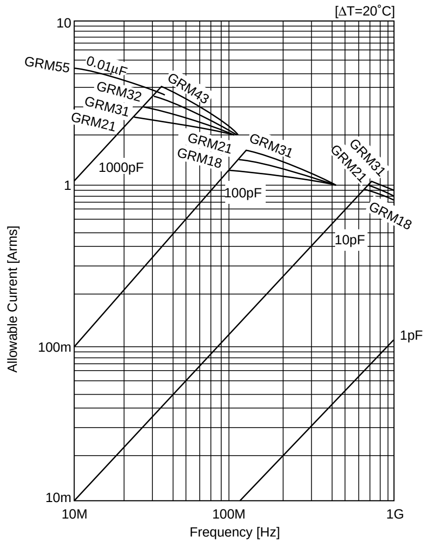
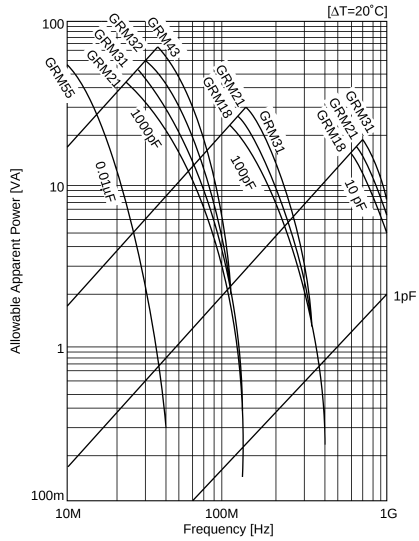
■ Allowable Current-Frequency

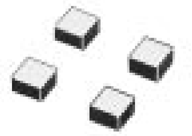


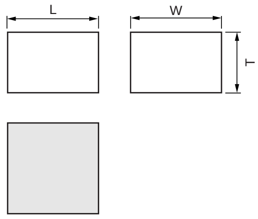
■ Allowable Apparent Power



Chip Monolithic Ceramic Capacitors

Microchips





■ Features
1. Better micro wave 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 Cod (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
GMA05XF52A102ZD01	Y5V (EIA)	100	1000pF +80/-20%	0.5	0.5	0.35
GMA085F52A103ZD01	Y5V (EIA)	100	10000pF +80/-20%	0.8	0.8	0.5
GMA05XR71H161MD01	X7R (EIA)	50	160pF ±20%	0.5	0.5	0.35
GMA05XR71H221MD01	X7R (EIA)	50	220pF ±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
GMA05XF51C472ZD01	Y5V (EIA)	16	4700pF +80/-20%	0.5	0.5	0.35
GMA05XF51C682ZD01	Y5V (EIA)	16	6800pF +80/-20%	0.5	0.5	0.35
GMA085F51C473ZD01	Y5V (EIA)	16	47000pF +80/-20%	0.8	0.8	0.5
GMA05XF51A153ZD01	Y5V (EIA)	10	15000pF +80/-20%	0.5	0.5	0.35
GMA085F51A104ZD01	Y5V (EIA)	10	0.10μF +80/-20%	0.8	0.8	0.5

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>R1, R7 : −55 to +125℃
B1, F1 : −25 to +85℃
F5 : −30 to +85℃</td><td>Reference Temperature:25℃
(B1, R1, F1 : 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 abnormality</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>See the previous pages.</td><td>Visual inspection</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormality</td><td>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.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance</td><td>10,000MΩ min.</td><td>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.</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 Reference Temperature at the frequency And voltage shown in the table.<table><tr><td>Frequency</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>1±0.2Vrms</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>B1, R1, R7 : 0.035 max.
F1, F5 : 0.09 max. (for 16V)
: 0.125 max. (for 10V)</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Capacitance Temperature Characteristics</td><td>No bias</td><td>B1 : Within +/–10% (–25 to +85°C)
F1 : Within +30/–80% (–25 to +85°C)
F5 : Within +22/–82% (–30 to +85°C)
R1, R7 : Within +/–15% (–55 to +125°C)</td><td rowspan="2">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.<table><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr><tr><td>1</td><td>Reference Tempereture±2</td><td rowspan="4">No bias</td></tr><tr><td>2</td><td>–55±3 (for R7)
–25±3 (for B1, F1)
–30±3 (for F5)</td></tr><tr><td>3</td><td>Reference Tempereture±2</td></tr><tr><td>4</td><td>85±3 (for B1, F1, F5)
125±3 (for R7)</td></tr><tr><td>5</td><td>20±2</td><td rowspan="4">50% of the rated voltage</td></tr><tr><td>6</td><td>–25±3 (for B1, R1, F1)</td></tr><tr><td>7</td><td>20±2</td></tr><tr><td>8</td><td>85±3 (for B1, R1, F1)</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 48±4 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>50% of the Rated Voltage</td><td>B1 : Within +10/–30%
R1 : Within +15/–40%
F1 : Within +30/–95%</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">Mechanical Strength</td><td>Bond Strength</td><td>Pull force : 3.0g min.</td><td>MIL-STD-883 Method 2011 Condition D
Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 20µm (0.0008 inch) gold wire to the capacitor terminal using an ultrasonic wedge bond. Then, pull wire.</td></tr>
<tr><td>Die Shear Strength</td><td>Die Shear force : 200g min.</td><td>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.</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormality</td><td rowspan="3">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).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>B1, R1, R7 : 0.035 max.
F1, F5 : 0.09 max. (for 16V)
: 0.125 max. (for 10V)</td></tr>
</table>

Continued on the following page.

Specifications and Test Methods

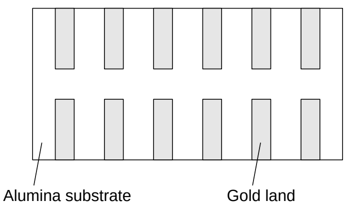
Continued from the preceding page.

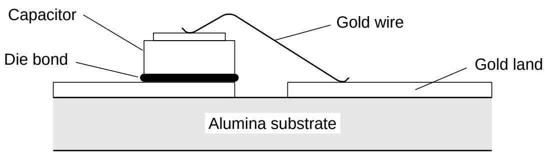
No.	Item		Specifications	Test Method
12	Temperature Cycle	Appearance	No marked defect	The capacitor should be set for 48±4 hours at room temperature after one hour heat of treatment at 150+0/−10℃, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and 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	B1, R1, R7 : Within ±7.5% F1, F5 : Within ±20%	
		D.F.	B1, R1, R7 : 0.035 max. F1, F5 : 0.09 max. (for 16V) 0.125 max. (for 10V)	
		I.R.	More than 10,000Ω • F	
		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
13	Humidity (Steady State)	Appearance	No marked defect	Set the capacitor for 500±12 hours at 40±20℃, in 90 to 95% humidity. Take it out and set it for 48±4 hours at room temperature, then measure.
		Capacitance Change	B1, R1, R7 : Within ±12.5% F1, F5 : Within ±30%	
		D.F.	B1, R1, R7 : 0.05 max. F1, F5 : 0.125 max. (for 16V) 0.15 max. (for 10V)	
		I.R.	More than 1,000Ω • F	
		Dielectric Strength	No failure	
14	Humidity Load	Appearance	No marked defect	Apply the rated voltage for 500±12 hours at 40±2℃, in 90 to 95% humidity and set it for 48±4 hours at room temperature,then measure. The charge/discharge current is less than 50mA. • Initial measurement for F1/F5 Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.
		Capacitance Change	B1, R1, R7 : Within ±12.5% F1, F5 : Within +30/−40%	
		D.F.	B1, R1, R7 : 0.05 max. F1, F5 : 0.125 max. (for 16V) 0.15 max. (for 10V)	
		I.R.	More than 500Ω • F	
		Dielectric Strength	No failure	
15	High Temperature Load	Appearance	No marked defect	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 48±4 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 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	B1, R1, R7 : Within ±12.5% F1, F5 : Within +30/−40%	
		D.F.	B1, R1, R7 : 0.05 max. F1, F5 : 0.125 max. (for 16V) 0.15 max. (for 10V)	
		I.R.	More than 1,000Ω • F	
		Dielectric Strength	No failure	

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.





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Chip Monolithic Ceramic Capacitors

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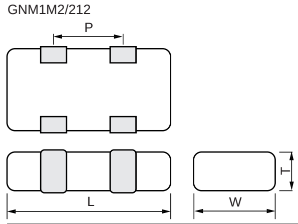
Capacitor Arrays

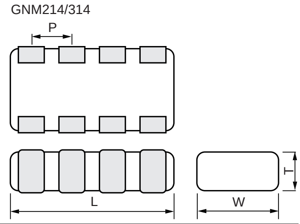
■ Features

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

■ Applications

General electronic equipment





Part Number	Dimensions (mm)			
	L	W	T	P
GNM1M2	1.37 ±0.15	1.0 ±0.15	0.6 ±0.1	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

Temperature Compensating Type

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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 part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
10pF(**100**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
11pF(**110**)			0.8(**4**)	0.8(**4**)
12pF(**120**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
13pF(**130**)			0.8(**4**)	0.8(**4**)
15pF(**150**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
16pF(**160**)			0.8(**4**)	0.8(**4**)
18pF(**180**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
20pF(**200**)			0.8(**4**)	0.8(**4**)
22pF(**220**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
24pF(**240**)			0.8(**4**)	0.8(**4**)
27pF(**270**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
30pF(**300**)			0.8(**4**)	0.8(**4**)
33pF(**330**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
36pF(**360**)			0.8(**4**)	0.8(**4**)
39pF(**390**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
43pF(**430**)			0.8(**4**)	0.8(**4**)
47pF(**470**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
51pF(**510**)			0.8(**4**)	0.8(**4**)
56pF(**560**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
62pF(**620**)			0.8(**4**)	0.8(**4**)
68pF(**680**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
75pF(**750**)			0.8(**4**)	0.8(**4**)
82pF(**820**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
91pF(**910**)			0.8(**4**)	0.8(**4**)
100pF(**101**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
110pF(**111**)			0.8(**4**)	0.8(**4**)
120pF(**121**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
130pF(**131**)			0.8(**4**)	0.8(**4**)
150pF(**151**)	0.85(**2**)	0.6(**4**)	0.8(**4**)	0.8(**4**)
160pF(**161**)				0.8(**4**)
180pF(**181**)	0.85(**2**)	0.6(**4**)		0.8(**4**)

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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 part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
200pF(**201**)				0.8(**4**)
220pF(**221**)	0.85(**2**)	0.6(**4**)		0.8(**4**)
240pF(**241**)				0.8(**4**)
270pF(**271**)	0.85(**2**)	0.6(**4**)		0.8(**4**)
300pF(**301**)				0.8(**4**)
330pF(**331**)				0.8(**4**)
360pF(**361**)				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	1.37x1.00				
TC	X5R (**R6**)		X7R (**R7**)		
Rated Volt.	10 (**1A**)	6.3 (**0J**)	50 (**1H**)	25 (**1E**)	16 (**1C**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)					
1000pF(**102**)			0.6(**2**)		
10000pF(**103**)				0.6(**2**)	
22000pF(**223**)					0.6(**2**)
47000pF(**473**)					0.6(**2**)
0.10µF(**104**)	0.8(**2**)				
1.0µF(**105**)	0.6(**2**)	0.6(**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.

High Dielectric Constant Type GNM21 Series

Part Number	**GNM21**					
L x W	2.0x1.25	1.37x1.00	2.0x1.25			
TC	X5R (**R6**)	X5R (**R6**)	X5R (**R6**)	X7R (**R7**)		
Rated Volt.	16 (**1C**)	10 (**1A**)	10 (**1A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
1000pF(**102**)				0.6(**4**)		
10000pF(**103**)					0.6(**4**)	
0.10µF(**104**)						0.8(**4**)
1.0µF(**105**)	0.6(**2**)	0.6(**2**)				
2.2µF(**225**)			0.6(**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.

High Dielectric Constant Type GNM31 Series

Part Number	**GNM31**							
L x W	3.2x1.6							
TC	X5R (**R6**)	X7R (**R7**)				Y5V (**F5**)		
Rated Volt.	10 (**1A**)	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	100 (**2A**)	50 (**1H**)	16 (**1C**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)								
220pF(**221**)		0.8(**4**)						
270pF(**271**)		0.8(**4**)						
330pF(**331**)		0.8(**4**)						
390pF(**391**)		0.8(**4**)	0.8(**4**)					
470pF(**471**)		0.8(**4**)	0.8(**4**)					
560pF(**561**)		0.8(**4**)	0.8(**4**)					
680pF(**681**)		0.8(**4**)	0.8(**4**)					
820pF(**821**)		0.8(**4**)	0.8(**4**)					
1000pF(**102**)		0.8(**4**)	0.8(**4**)					
1200pF(**122**)		0.8(**4**)	0.8(**4**)					
1500pF(**152**)		0.8(**4**)	0.8(**4**)					
1800pF(**182**)		0.8(**4**)	0.8(**4**)					
2200pF(**222**)		0.8(**4**)	0.8(**4**)			0.8(**4**)		
2700pF(**272**)		0.8(**4**)	0.8(**4**)					
3300pF(**332**)		0.8(**4**)	0.8(**4**)			0.8(**4**)		
3900pF(**392**)		0.8(**4**)	0.8(**4**)					
4700pF(**472**)		0.8(**4**)	0.8(**4**)			0.8(**4**)		
5600pF(**562**)			0.8(**4**)					
6800pF(**682**)			0.8(**4**)					
8200pF(**822**)			0.8(**4**)					
10000pF(**103**)			0.8(**4**)					
12000pF(**123**)			0.8(**4**)					
15000pF(**153**)			0.8(**4**)					
18000pF(**183**)				0.8(**4**)				
22000pF(**223**)					0.8(**4**)		0.8(**4**)	
27000pF(**273**)					0.8(**4**)			
33000pF(**333**)					0.8(**4**)		0.8(**4**)	
39000pF(**393**)					0.8(**4**)			
47000pF(**473**)					1.0(**4**)		0.8(**4**)	
68000pF(**683**)					1.0(**4**)			0.8(**4**)
0.10µF(**104**)					1.0(**4**)			0.8(**4**)
0.15µF(**154**)								0.8(**4**)
1.0µF(**105**)	1.0(**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.

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Specifications and Test Methods

No.	Item	Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
1	Operating Temperature Range	–55 to +125°C	B1, F1 : –25 to +85°C R1, R7 : –55 to +125°C F5 : –30 to +85°C	Reference Temperature : 25°C (2C, B1, R1, F1 : 20°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	Dimension	Within the specified dimensions		Using calipers
5	Dielectric Strength	No defects or abnormalities		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.
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 20/25°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 20/25°C at the frequency and voltage shown in the table.
8	Q/ Dissipation Factor (D.F.)	30pF min. : Q≧1000 30pF max. : Q≧400+20C C : Nominal Capacitance (pF)	[B1, R1, R7] W.V. : 25V min. : 0.025 max. W.V. : 16V : 0.035 max. [F1, F5] W.V. : 25V min. : 0.05 max. W.V. : 16V : 0.07 max.	(see table below)

Item \ Char.	2C	B1, R1, R7, F1, F5
Frequency	1±0.1MHz	1±0.1kHz
Voltage	0.5 to 5Vrms	1.0±0.2Vrms

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 : Within±10% (–25 to +85°C) R1, R7 : Withn±15% (–55 to +125°C) F1 : Within +30/–80% (–25 to +85°C) F5 : Within +22/–82% (–30 to +85°C)	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. (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.
		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.)		

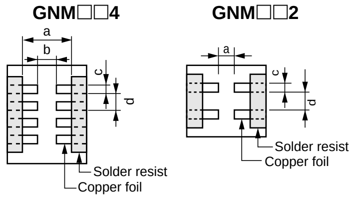
Step	Temperature (°C)	Applying Voltage (V)
1	Reference Temperature±2	No bias
2	–55±3 (for R1, R7)/ –25±3 (for B1, F1)/ –30±3 (for F5)	
3	Reference Temperature±2	
4	125±3 (for R1, R7)/ 85±3 (for B1, F1, F5)	
5	20±2	50% of the Rated Voltage
6	–55±3 (for R1)/ –25±3 (for B1, F1)	
7	20±2	
8	125±3 (for R1)/ 85±3 (for B1, F1)	

• Initial measurement for high dielectric constant type
Perform a heat treatment at 150 +0/–10°C for one hour and then set for 48±4 hours at room temperature.
Perform the initial measurement.

Continued on the following page. ↗

Specifications and Test Methods

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>10</td><td colspan="2">Adhesive Strength of Termination</td><td colspan="2">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 5N 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

<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>GNM1M</td><td>0.5</td><td>–</td><td>0.32</td><td>0.32</td></tr>
<tr><td>GNM21</td><td>0.4</td><td>1.6</td><td>0.25</td><td>0.5</td></tr>
<tr><td>GNM31</td><td>0.8</td><td>2.5</td><td>0.4</td><td>0.8</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 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>[B1, R1, R7]
W.V. : 25V min. : 0.025 max.
W.V. : 16V : 0.035 max.
[F1, F5]
W.V. : 25V min. : 0.05 max.
W.V. : 16V : 0.07 max.</td></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td colspan="2">No cracking or marking defects should occur

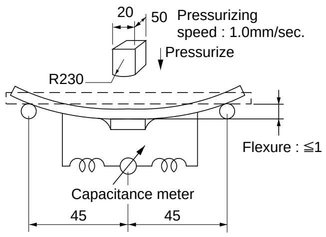
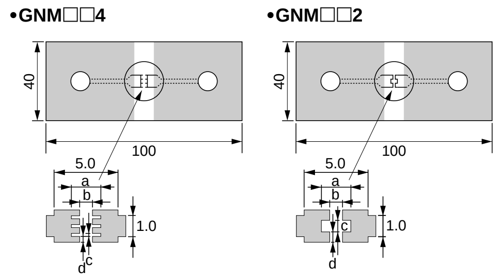



Fig. 3</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3 for 5±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.

t=0.8mm
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>GNM1M</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>GNM21</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>GNM31</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.</td></tr>
</table>

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

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°C for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), 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 48±4 hours at room temperature. Perform the initial measurement.
		Appearance	No marking defects		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, R1, R7 : Within ±7.5% F1, F5 : Within ±20%	
		Q/D.F.	30pF min. : Q≧1000 30pF max. : Q≧400+20C C : Nominal Capacitance (pF)	[B1, R1, R7] W.V. : 25V min. : 0.025 max. W.V. : 16V : 0.035 max. [F1, F5] W.V. : 25V min. : 0.05 max. W.V. : 16V : 0.07 max.	
		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 (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. Step: 1 / 2 / 3 / 4 Temp. (°C): 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 • Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/–10°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.
		Appearance	No marking defects		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, R1, R7 : Within ±7.5% F1, F5 : Within ±20%	
		Q/D.F.	30pF min. : Q≧1000 30pF max. : Q≧400+20C C:Nominal Capacitance (pF)	[B1, R1, R7] W.V. : 25V min. : 0.025 max. W.V. : 16V : 0.035 max. [F1, F5] W.V. : 25V min. : 0.05 max. W.V. : 16V : 0.07 max.	
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		
16	Humidity Steady State		The measured and observed characteristics should satisfy the specifications in the following table.		Let the capacitor sit at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.
		Appearance	No marking defects		
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	B1, R1, R7 : Within ±12.5% F1, F5 : Within ±30%	
		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)	[B1, R1, R7] W.V. : 25V min. : 0.05 max. W.V. : 16V : 0.05 max. [F1, F5] W.V. : 25V min. : 0.075 max. W.V. : 16V : 0.1 max.	
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		
17	Humidity Load		The measured and observed characteristics should satisfy the specifications in the following table.		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 (temperature compensating type) or 48±4 hours (high dielectric constant type) 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)	B1, R1, R7 : Within ±12.5% F1, F5 : Within ±30%	
		Q/D.F.	30pF and over : Q≧200 30pF and below : Q≧100+10C/3 C : Nominal Capacitance (pF)	[B1, R1, R7] W.V. : 25V min. : 0.05 max. W.V. : 16V : 0.05 max. [F1, F5] W.V. : 25V min. : 0.075 max. W.V. : 16V : 0.1 max.	
		I.R.	More than 500MΩ or 25Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		

Continued on the following page.

Specifications and Test Methods

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 (temperature compensating type) or 48±4 hours (high dielectric constant type) 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 48±4 hours at room temperature. Perform initial measurement.
		Appearance	No marking defects		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	B1, R1, R7 : Within ±12.5% F1, F5 : Within ±30%	
		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)	[B1, R1, R7] W.V. : 25V min. : 0.04 max. W.V. : 16V : 0.05 max. [F1, F5] W.V. : 25V min. : 0.075 max. W.V. : 16V : 0.1 max.	
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)		

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℃.

(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

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

Chip Monolithic Ceramic Capacitors

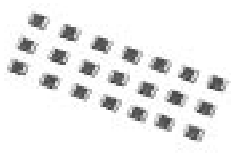
for Ultrasonic Sensors

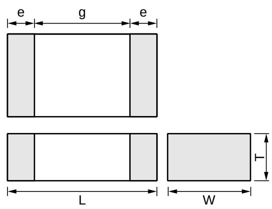
■ Features

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

■ Applications

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

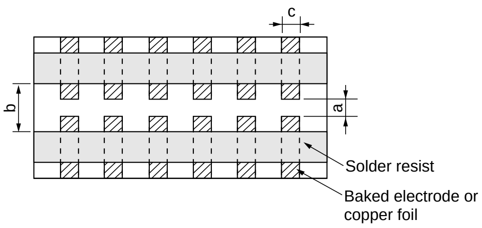




Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7

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.


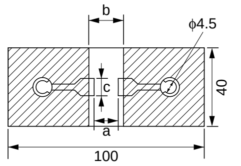
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr></table>(in mm)
Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the 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.

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 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
GRM21	1.2	4.0	1.65

(in mm)

Fig. 2

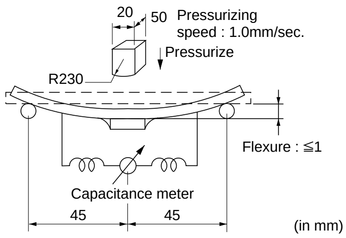


Fig.3

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℃.
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 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	

Temperature cycle (No. 15) heat treatments:

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

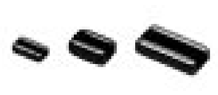
10

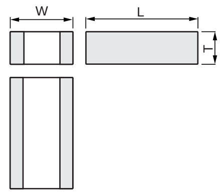
Chip Monolithic Ceramic Capacitors

Low ESL

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

■ Applications
1. High speed micro processor
2. High frequency digital equipment





Part Number	Dimensions (mm)		
	L	W	T
LLL185	1.6 ±0.1	0.8 ±0.1	0.6 max.
LLL216	2.0 ±0.1	1.25 ±0.1	0.6 ±0.1
LLL219			0.85 ±0.1
LLL317	3.2 ±0.15	1.6 ±0.15	0.7 ±0.1
LLL31M			1.15 ±0.1

LLL18 Series

Part Number	**LLL18**			
L x W	1.6x0.8			
TC	X7R (**R7**)			
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
2200pF(**222**)	0.5(**5**)			
3300pF(**332**)	0.5(**5**)			
4700pF(**472**)	0.5(**5**)			
6800pF(**682**)		0.5(**5**)		
10000pF(**103**)		0.5(**5**)		
15000pF(**153**)		0.5(**5**)		
22000pF(**223**)		0.5(**5**)		
33000pF(**333**)			0.5(**5**)	
47000pF(**473**)			0.5(**5**)	
68000pF(**683**)			0.5(**5**)	
0.10μF(**104**)				0.5(**5**)

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

LLL21 Series

Part Number	**LLL21**			
L x W	2.0x1.25			
TC	X7R (**R7**)			
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
4700pF(**472**)	0.6(**6**)			
6800pF(**682**)	0.6(**6**)			
10000pF(**103**)	0.6(**6**)			
15000pF(**153**)	0.6(**6**)			
22000pF(**223**)	0.6(**6**)	0.6(**6**)		
33000pF(**333**)	0.85(**9**)	0.6(**6**)	0.6(**6**)	
47000pF(**473**)		0.6(**6**)	0.6(**6**)	

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Part Number	LLL21			
L x W	2.0x1.25			
TC	X7R (**R7**)			
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
68000pF(**683**)		0.6(**6**)	0.6(**6**)	
0.10µF(**104**)		0.6(**6**)	0.6(**6**)	
0.15µF(**154**)		0.85(**9**)	0.6(**6**)	
0.22µF(**224**)			0.85(**9**)	0.6(**6**)
0.33µF(**334**)				0.6(**6**)
0.47µF(**474**)				0.85(**9**)

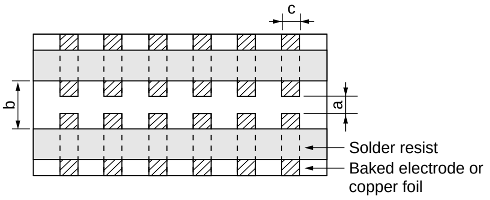
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

LLL31 Series

Part Number	LLL31			
L x W	3.2x1.6			
TC	X7R (**R7**)			
Rated Volt.	50 (**1H**)	25 (**1E**)	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
10000pF(**103**)	0.7(**7**)			
15000pF(**153**)	0.7(**7**)			
22000pF(**223**)	0.7(**7**)			
33000pF(**333**)	0.7(**7**)			
47000pF(**473**)	0.7(**7**)			
68000pF(**683**)	0.7(**7**)			
0.10µF(**104**)	1.15(**M**)	0.7(**7**)	0.7(**7**)	
0.15µF(**154**)	1.15(**M**)	0.7(**7**)	0.7(**7**)	
0.22µF(**224**)		1.15(**M**)	0.7(**7**)	
0.33µF(**334**)		1.15(**M**)	0.7(**7**)	
0.47µF(**474**)		1.15(**M**)	0.7(**7**)	
0.68µF(**684**)			1.15(**M**)	0.7(**7**)
1.0µF(**105**)			1.15(**M**)	0.7(**7**)
1.5µF(**155**)				1.15(**M**)
2.2µF(**225**)				1.15(**M**)

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

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>B1 : –25 to +85°C
R7, R1 : –55 to +125°C
F1 : –25 to +85°C
F5 : –30 to +85°C</td><td>Reference Temperature : 25°C
(B1, R1, F1 : 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 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 (I.R.)</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 standard temperature 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 standard temperature at the frequency and voltage shown in the table.<table><tr><td>Frequency</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>1±0.2Vrms</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.025 max.</td><td>0.035 max.</td></tr><tr><td>F1, F5</td><td>0.05 max.</td><td>–</td></tr></table></td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Capacitance Temperature Characteristics</td><td>No bias</td><td>R7 : Within ±15% (–55 to +125°C)
F5 : Within +22/–82% (–30 to +85°C)
B1 : Within ±10% (–25 to +85°C)
R1 : Within ±15% (–55 to +125°C)
F1 : Within +30/–80% (–25° to +85°C)</td><td rowspan="2">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.<table><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr><tr><td>1</td><td>Reference Tempereture ±2</td><td rowspan="4">No bias</td></tr><tr><td>2</td><td>–55±3 (for R1, R7)/
–25±3 (for B1, F1)
–30±3 (for F5)</td></tr><tr><td>3</td><td>Reference Tempereture ±2</td></tr><tr><td>4</td><td>125±3 (for R1, R7)/
85±3 (for B1, F1, F5)</td></tr><tr><td>5</td><td>20±2</td><td rowspan="4">50% of the rated voltage</td></tr><tr><td>6</td><td>–55±3 (for R1)/
–25±3 (for B1, F1)</td></tr><tr><td>7</td><td>20±2</td></tr><tr><td>8</td><td>125±3 (for R1)/
85±3 (for B1, F1)</td></tr></table>✻Initial measurement for high dielectric constant type Perform a heat treatment at 150 +0/–10°C for one hour and then set for 48±4 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>50% of the Rated Voltage</td><td>B1 : Within +10/–30%
R1 : Within +15/–40%
F1 : Within +30/–95%</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. ✻5N: LLL18
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>**LLL18**</td><td>0.3</td><td>1.2</td><td>2.0</td></tr><tr><td>**LLL21**</td><td>0.6</td><td>1.6</td><td>2.4</td></tr><tr><td>**LLL31**</td><td>1.0</td><td>3.0</td><td>3.7</td></tr></table>(in mm)
Fig. 1</td></tr>
</table>

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="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><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.025 max.</td><td>0.035 max.</td></tr><tr><td>F1, F5</td><td>0.05 max.</td><td>–</td></tr></table></td></tr>
<tr><td rowspan="2">12</td><td colspan="2" rowspan="2">Deflection</td><td>No crack or marked defect should occur</td><td rowspan="2">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 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.

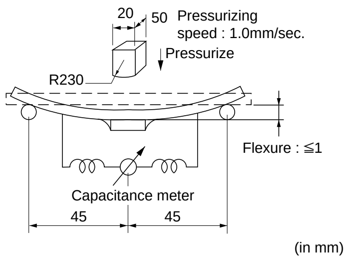
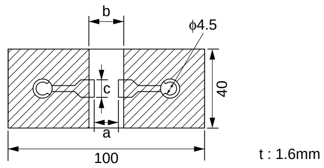



Fig. 3</td></tr>
<tr><td><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>LLL18</td><td>0.3</td><td>1.2</td><td>2.0</td></tr><tr><td>LLL21</td><td>0.6</td><td>1.6</td><td>2.4</td></tr><tr><td>LLL31</td><td>1.0</td><td>3.0</td><td>3.7</td></tr></table>(in mm)
Fig. 2</td></tr>
<tr><td>13</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.</td></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°C for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 48±4 hours, then measure.

• Initial measurement.
Perform a heat treatment at 150^{+0}_{-10}°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>B1, R1, R7 : Within ±7.5%
F1, F5 : Within ±20%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.025 max.</td><td>0.035 max.</td></tr><tr><td>F1, F5</td><td>0.05 max.</td><td>–</td></tr></table></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="5">15</td><td rowspan="5">Temperature Cycle</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 listed in the following table. Let sit for 48±4 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 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>B1, R1, R7 : Within ±7.5%
F1, F5 : Within ±20%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.025 max.</td><td>0.035 max.</td></tr><tr><td>F1, F5</td><td>0.05 max.</td><td>–</td></tr></table></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">16</td><td rowspan="4">Humidity, Steady State</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">Let the capacitor sit at 40±2°C and 90 to 95% humidity for 500±12 hours.
Remove and let sit for 48±4 hours at room temperature, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>B1, R1, R7 : Within ±12.5%
F1, F5 : Within ±30%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.05 max.</td><td>0.05 max.</td></tr><tr><td>F1, F5</td><td>0.075 max.</td><td>–</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
</table>

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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 Load</td><td>Appearance</td><td>No defects or abnormalities</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 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</td></tr>
<tr><td>Capacitance Change</td><td>B1, R1, R7 : Within ±12.5%
F1, F5 : Within ±30%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.05 max.</td><td>0.05 max.</td></tr><tr><td>F1, F5</td><td>0.075 max.</td><td>–</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 500MΩ or 25Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
<tr><td rowspan="5">18</td><td rowspan="5">High Temperature Load</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="5">Apply 200% of the rated voltage for 1,000±12 hours at maximum operating temperature ±3°C. Let sit for 48±4 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.

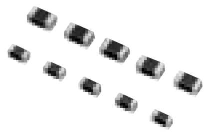
•Initial measurement.
Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C.
Remove and let sit for 48±4 hours at room temperature.
Perform initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>B1, R1, R7 : Within ±12.5%
F1, F5 : Within ±30%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>B1, R1, R7</td><td>0.05 max.</td><td>0.05 max.</td></tr><tr><td>F1, F5</td><td>0.075 max.</td><td>–</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>

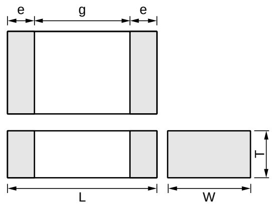
Chip Monolithic Ceramic Capacitors

High Frequency for Flow/Reflow Soldering

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

■ Applicatons
High frequency circuit (Mobile telecommunication, 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	1.60x0.80		2.00x1.25	
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**)	0.80(**8**)		0.85(**9**)	
0.75pF(**R75**)	0.80(**8**)		0.85(**9**)	
1.0pF(**1R0**)	0.80(**8**)		0.85(**9**)	
1.1pF(**1R1**)	0.80(**8**)		0.85(**9**)	
1.2pF(**1R2**)	0.80(**8**)		0.85(**9**)	
1.3pF(**1R3**)	0.80(**8**)		0.85(**9**)	
1.5pF(**1R5**)	0.80(**8**)		0.85(**9**)	
1.6pF(**1R6**)	0.80(**8**)		0.85(**9**)	
1.8pF(**1R8**)	0.80(**8**)		0.85(**9**)	
2.0pF(**2R0**)	0.80(**8**)		0.85(**9**)	
2.2pF(**2R2**)	0.80(**8**)		0.85(**9**)	
2.4pF(**2R4**)	0.80(**8**)		0.85(**9**)	
2.7pF(**2R7**)	0.80(**8**)		0.85(**9**)	
3.0pF(**3R0**)	0.80(**8**)		0.85(**9**)	
3.3pF(**3R3**)	0.80(**8**)		0.85(**9**)	
3.6pF(**3R6**)	0.80(**8**)		0.85(**9**)	
3.9pF(**3R9**)	0.80(**8**)		0.85(**9**)	
4.0pF(**4R0**)	0.80(**8**)		0.85(**9**)	
4.3pF(**4R3**)	0.80(**8**)		0.85(**9**)	
4.7pF(**4R7**)	0.80(**8**)		0.85(**9**)	
5.0pF(**5R0**)	0.80(**8**)		0.85(**9**)	
5.1pF(**5R1**)	0.80(**8**)		0.85(**9**)	
5.6pF(**5R6**)	0.80(**8**)		0.85(**9**)	
6.0pF(**6R0**)	0.80(**8**)		0.85(**9**)	
6.2pF(**6R2**)	0.80(**8**)		0.85(**9**)	
6.8pF(**6R8**)	0.80(**8**)		0.85(**9**)	
7.0pF(**7R0**)		0.80(**8**)	0.85(**9**)	
7.5pF(**7R5**)		0.80(**8**)	0.85(**9**)	
8.0pF(**8R0**)		0.80(**8**)	0.85(**9**)	
8.2pF(**8R2**)		0.80(**8**)	0.85(**9**)	
9.0pF(**9R0**)		0.80(**8**)	0.85(**9**)	
9.1pF(**9R1**)		0.80(**8**)	0.85(**9**)	
10pF(**100**)		0.80(**8**)	0.85(**9**)	

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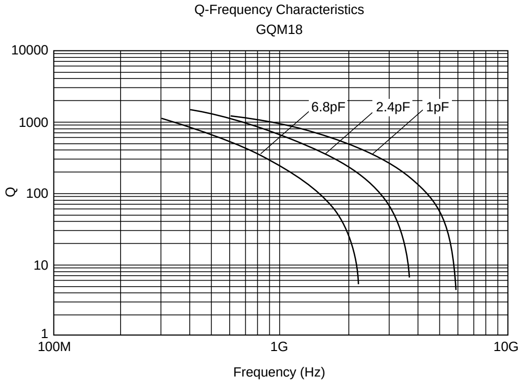
Part Number	GQM18		GQM21	
L x W	1.60x0.80		2.00x1.25	
TC	C0G (**5C**)		C0G (**5C**)	
Rated Volt.	100 (**2A**)	50 (**1H**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)				
11pF(**110**)		0.80(**8**)	0.85(**9**)	
12pF(**120**)		0.80(**8**)	0.85(**9**)	
13pF(**130**)		0.80(**8**)	0.85(**9**)	
15pF(**150**)		0.80(**8**)	0.85(**9**)	
16pF(**160**)		0.80(**8**)	0.85(**9**)	
18pF(**180**)		0.80(**8**)	0.85(**9**)	
20pF(**200**)		0.80(**8**)		0.85(**9**)
22pF(**220**)		0.80(**8**)		0.85(**9**)
24pF(**240**)		0.80(**8**)		0.85(**9**)
27pF(**270**)		0.80(**8**)		0.85(**9**)
30pF(**300**)		0.80(**8**)		0.85(**9**)
33pF(**330**)		0.80(**8**)		0.85(**9**)
36pF(**360**)		0.80(**8**)		0.85(**9**)
39pF(**390**)		0.80(**8**)		0.85(**9**)
43pF(**430**)		0.80(**8**)		0.85(**9**)
47pF(**470**)		0.80(**8**)		0.85(**9**)
51pF(**510**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
56pF(**560**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
62pF(**620**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
68pF(**680**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
75pF(**750**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
82pF(**820**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
91pF(**910**)		0.80(**8**)	0.85(**9**)	0.85(**9**)
100pF(**101**)		0.80(**8**)		0.85(**9**)

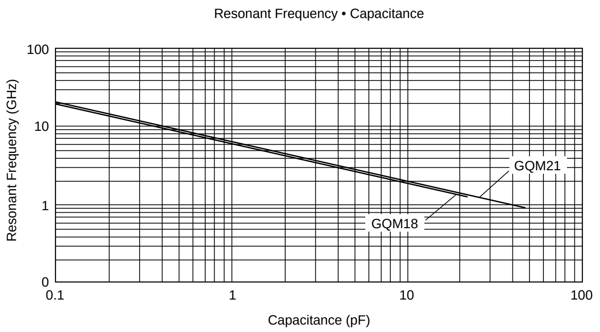
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

12

■ Q-Frequency Characteristics

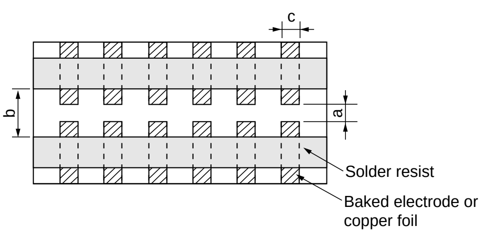


■ Resonant Frequency-Capacitance



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

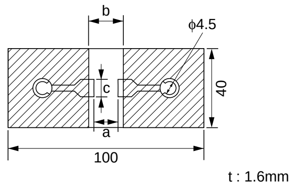
C : Nominal Capacitance (pF)</td></tr>
</table>

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 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. (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

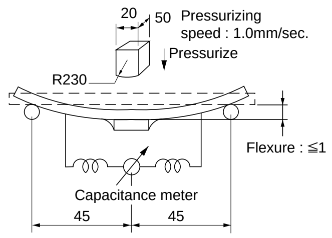


Fig. 3

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℃.
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 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	
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	

Test Method table for 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.

12

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℃.

(2)

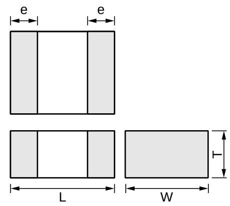
Char.	Nominal Values (ppm/℃) ∗2	Capacitance Change from 20℃ (%)					
		−55℃		−25℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
2C	0±60	0.82	−0.45	0.49	−0.27	0.33	−0.18
3C	0±120	0.37	−0.90	0.82	−0.54	0.55	−0.36
4C	0±250	0.56	−0.88	1.54	−1.13	1.02	−0.75

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

Chip Monolithic Ceramic Capacitors

High-Q & High Power Type

SMD Type



Part Number	Dimensions (mm)			
	L	W	T	e
ERF1DM	$1.4^{+0.6}_{-0.4}$	$1.4^{+0.6}_{-0.4}$	$1.15^{+0.50}_{-0.35}$	$0.25^{+0.25}_{-0.15}$
ERF22X	$2.8^{+0.6}_{-0.4}$	$2.8^{+0.6}_{-0.4}$	$2.3^{+0.5}_{-0.3}$	$0.4^{+0.4}_{-0.3}$

■ Features (ERF Series)

1. The dielectric is composed of low dielectric loss ceramic. This series is perfectly suited to high frequency applications. (VHS-microwave band)
2. The series is ultraminiature, yet has a high power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
3. ERF1D type is designed for both flow and reflow soldering and ERF22 type is designed for reflow soldering.

■ Applications

High frequency and high power circuits

Part Number	**ERF1D**	**ERF22**				
L x W	1.40x1.40	2.80x2.80				
TC	C0G (**5C**)	C0G (**5C**)				
Rated Volt.	50 (**1H**)	500 (**2H**)	300 (**YD**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
0.50pF(**R50**)	1.15(**M**)	2.30(**X**)				
0.6pF(**R60**)	1.15(**M**)	2.30(**X**)				
0.7pF(**R70**)	1.15(**M**)	2.30(**X**)				
0.75pF(**R75**)	1.15(**M**)	2.30(**X**)				
0.8pF(**R80**)	1.15(**M**)	2.30(**X**)				
0.9pF(**R90**)	1.15(**M**)	2.30(**X**)				
1.0pF(**1R0**)	1.15(**M**)	2.30(**X**)				
1.1pF(**1R1**)	1.15(**M**)	2.30(**X**)				
1.2pF(**1R2**)	1.15(**M**)	2.30(**X**)				
1.3pF(**1R3**)	1.15(**M**)	2.30(**X**)				
1.4pF(**1R4**)	1.15(**M**)	2.30(**X**)				
1.5pF(**1R5**)	1.15(**M**)	2.30(**X**)				
1.6pF(**1R6**)	1.15(**M**)	2.30(**X**)				
1.7pF(**1R7**)	1.15(**M**)	2.30(**X**)				
1.8pF(**1R8**)	1.15(**M**)	2.30(**X**)				
1.9pF(**1R9**)	1.15(**M**)	2.30(**X**)				
2.0pF(**2R0**)	1.15(**M**)	2.30(**X**)				
2.1pF(**2R1**)	1.15(**M**)	2.30(**X**)				
2.2pF(**2R2**)	1.15(**M**)	2.30(**X**)				
2.4pF(**2R4**)	1.15(**M**)	2.30(**X**)				
2.7pF(**2R7**)	1.15(**M**)	2.30(**X**)				
3.0pF(**3R0**)	1.15(**M**)	2.30(**X**)				
3.3pF(**3R3**)	1.15(**M**)	2.30(**X**)				
3.6pF(**3R6**)	1.15(**M**)	2.30(**X**)				
3.9pF(**3R9**)	1.15(**M**)	2.30(**X**)				
4.0pF(**4R0**)	1.15(**M**)	2.30(**X**)				
4.3pF(**4R3**)	1.15(**M**)	2.30(**X**)				
4.7pF(**4R7**)	1.15(**M**)	2.30(**X**)				

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Part Number	ERF1D	ERF22				
L x W	1.40x1.40	2.80x2.80				
TC	C0G (**5C**)	C0G (**5C**)				
Rated Volt.	50 (**1H**)	500 (**2H**)	300 (**YD**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
5.0pF(**5R0**)	1.15(**M**)	2.30(**X**)				
5.1pF(**5R1**)	1.15(**M**)	2.30(**X**)				
5.6pF(**5R6**)	1.15(**M**)	2.30(**X**)				
6.0pF(**6R0**)	1.15(**M**)	2.30(**X**)				
6.2pF(**6R2**)	1.15(**M**)	2.30(**X**)				
6.8pF(**6R8**)	1.15(**M**)	2.30(**X**)				
7.0pF(**7R0**)	1.15(**M**)	2.30(**X**)				
7.5pF(**7R5**)	1.15(**M**)	2.30(**X**)				
8.0pF(**8R0**)	1.15(**M**)	2.30(**X**)				
8.2pF(**8R2**)	1.15(**M**)	2.30(**X**)				
9.0pF(**9R0**)	1.15(**M**)	2.30(**X**)				
9.1pF(**9R1**)	1.15(**M**)	2.30(**X**)				
10pF(**100**)	1.15(**M**)	2.30(**X**)				
11pF(**110**)	1.15(**M**)	2.30(**X**)				
12pF(**120**)	1.15(**M**)	2.30(**X**)				
13pF(**130**)	1.15(**M**)	2.30(**X**)				
15pF(**150**)	1.15(**M**)	2.30(**X**)				
16pF(**160**)	1.15(**M**)	2.30(**X**)				
18pF(**180**)	1.15(**M**)	2.30(**X**)				
20pF(**200**)	1.15(**M**)	2.30(**X**)				
22pF(**220**)	1.15(**M**)	2.30(**X**)				
24pF(**240**)	1.15(**M**)	2.30(**X**)				
27pF(**270**)	1.15(**M**)	2.30(**X**)				
30pF(**300**)	1.15(**M**)	2.30(**X**)				
33pF(**330**)	1.15(**M**)	2.30(**X**)				
36pF(**360**)	1.15(**M**)	2.30(**X**)				
39pF(**390**)	1.15(**M**)	2.30(**X**)				
43pF(**430**)	1.15(**M**)	2.30(**X**)				
47pF(**470**)	1.15(**M**)	2.30(**X**)				
51pF(**510**)	1.15(**M**)	2.30(**X**)				
56pF(**560**)	1.15(**M**)	2.30(**X**)				
62pF(**620**)	1.15(**M**)	2.30(**X**)				
68pF(**680**)	1.15(**M**)	2.30(**X**)				
75pF(**750**)	1.15(**M**)	2.30(**X**)				
82pF(**820**)	1.15(**M**)	2.30(**X**)				
91pF(**910**)	1.15(**M**)	2.30(**X**)				
100pF(**101**)	1.15(**M**)	2.30(**X**)				
110pF(**111**)			2.30(**X**)			
120pF(**121**)			2.30(**X**)			
130pF(**131**)			2.30(**X**)			
150pF(**151**)			2.30(**X**)			
160pF(**161**)			2.30(**X**)			
180pF(**181**)			2.30(**X**)			
200pF(**201**)			2.30(**X**)			
220pF(**221**)				2.30(**X**)		
240pF(**241**)				2.30(**X**)		
270pF(**271**)				2.30(**X**)		
300pF(**301**)				2.30(**X**)		
330pF(**331**)				2.30(**X**)		
360pF(**361**)				2.30(**X**)		
390pF(**391**)				2.30(**X**)		
430pF(**431**)				2.30(**X**)		

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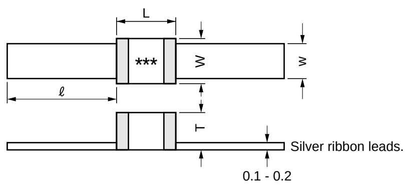
Part Number	ERF1D	ERF22				
L x W	1.40x1.40	2.80x2.80				
TC	C0G (**5C**)	C0G (**5C**)				
Rated Volt.	50 (**1H**)	500 (**2H**)	300 (**YD**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
470pF(**471**)				2.30(**X**)		
510pF(**511**)					2.30(**X**)	
560pF(**561**)					2.30(**X**)	
620pF(**621**)					2.30(**X**)	
680pF(**681**)					2.30(**X**)	
750pF(**751**)						2.30(**X**)
820pF(**821**)						2.30(**X**)
910pF(**911**)						2.30(**X**)
1000pF(**102**)						2.30(**X**)

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

Ribbon Terminal

■ Features (ERH Series)

1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high frequency applications (VHS-microwave band).
2. The series is ultraminiature, yet has a high power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
3. ERH1X/3X Series capacitors withstand high temperatures because ribbon leads are attached with silver paste.
4. ERH1X/3X Series capacitors are easily soldered and especially well suited in applications where only a soldering iron can be used.



*** : Capacitance Code

Part Number	Dimensions (mm)				
	L	W	T max.	ℓ	w
ERH1XC	1.6 ±0.4	1.4 ±0.4	1.6	5.0 min.	1.3 ±0.4
ERH3XX	3.2 ±0.4	2.8 ±0.4	3.0	9.0 ±2.0	2.35 ±0.15

13

■ Applications

High frequency and high power circuits

Part Number	ERH1X	ERH3X				
L x W	1.60x1.40	3.20x2.80				
TC	C0G (**5C**)	C0G (**5C**)				
Rated Volt.	50 (**1H**)	500 (**2H**)	300 (**YD**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
0.50pF(**R50**)	1.60(**C**)	3.00(**X**)				
0.6pF(**R60**)	1.60(**C**)	3.00(**X**)				
0.7pF(**R70**)	1.60(**C**)	3.00(**X**)				
0.75pF(**R75**)	1.60(**C**)	3.00(**X**)				
0.8pF(**R80**)	1.60(**C**)	3.00(**X**)				
0.9pF(**R90**)	1.60(**C**)	3.00(**X**)				
1.0pF(**1R0**)	1.60(**C**)	3.00(**X**)				
1.1pF(**1R1**)	1.60(**C**)	3.00(**X**)				
1.2pF(**1R2**)	1.60(**C**)	3.00(**X**)				
1.3pF(**1R3**)	1.60(**C**)	3.00(**X**)				
1.4pF(**1R4**)	1.60(**C**)	3.00(**X**)				
1.5pF(**1R5**)	1.60(**C**)	3.00(**X**)				

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Part Number	**ERH1X**	**ERH3X**				
L x W	1.60x1.40	3.20x2.80				
TC	C0G (**5C**)	C0G (**5C**)				
Rated Volt.	50 (**1H**)	500 (**2H**)	300 (**YD**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
1.6pF(**1R6**)	1.60(**C**)	3.00(**X**)				
1.7pF(**1R7**)	1.60(**C**)	3.00(**X**)				
1.8pF(**1R8**)	1.60(**C**)	3.00(**X**)				
1.9pF(**1R9**)	1.60(**C**)	3.00(**X**)				
2.0pF(**2R0**)	1.60(**C**)	3.00(**X**)				
2.1pF(**2R1**)	1.60(**C**)	3.00(**X**)				
2.2pF(**2R2**)	1.60(**C**)	3.00(**X**)				
2.4pF(**2R4**)	1.60(**C**)	3.00(**X**)				
2.7pF(**2R7**)	1.60(**C**)	3.00(**X**)				
3.0pF(**3R0**)	1.60(**C**)	3.00(**X**)				
3.3pF(**3R3**)	1.60(**C**)	3.00(**X**)				
3.6pF(**3R6**)	1.60(**C**)	3.00(**X**)				
3.9pF(**3R9**)	1.60(**C**)	3.00(**X**)				
4.0pF(**4R0**)	1.60(**C**)	3.00(**X**)				
4.3pF(**4R3**)	1.60(**C**)	3.00(**X**)				
4.7pF(**4R7**)	1.60(**C**)	3.00(**X**)				
5.0pF(**5R0**)	1.60(**C**)	3.00(**X**)				
5.1pF(**5R1**)	1.60(**C**)	3.00(**X**)				
5.6pF(**5R6**)	1.60(**C**)	3.00(**X**)				
6.0pF(**6R0**)	1.60(**C**)	3.00(**X**)				
6.2pF(**6R2**)	1.60(**C**)	3.00(**X**)				
6.8pF(**6R8**)	1.60(**C**)	3.00(**X**)				
7.0pF(**7R0**)	1.60(**C**)	3.00(**X**)				
7.5pF(**7R5**)	1.60(**C**)	3.00(**X**)				
8.0pF(**8R0**)	1.60(**C**)	3.00(**X**)				
8.2pF(**8R2**)	1.60(**C**)	3.00(**X**)				
9.0pF(**9R0**)	1.60(**C**)	3.00(**X**)				
9.1pF(**9R1**)	1.60(**C**)	3.00(**X**)				
10pF(**100**)	1.60(**C**)	3.00(**X**)				
11pF(**110**)	1.60(**C**)	3.00(**X**)				
12pF(**120**)	1.60(**C**)	3.00(**X**)				
13pF(**130**)	1.60(**C**)	3.00(**X**)				
15pF(**150**)	1.60(**C**)	3.00(**X**)				
16pF(**160**)	1.60(**C**)	3.00(**X**)				
18pF(**180**)	1.60(**C**)	3.00(**X**)				
20pF(**200**)	1.60(**C**)	3.00(**X**)				
22pF(**220**)	1.60(**C**)	3.00(**X**)				
24pF(**240**)	1.60(**C**)	3.00(**X**)				
27pF(**270**)	1.60(**C**)	3.00(**X**)				
30pF(**300**)	1.60(**C**)	3.00(**X**)				
33pF(**330**)	1.60(**C**)	3.00(**X**)				
36pF(**360**)	1.60(**C**)	3.00(**X**)				
39pF(**390**)	1.60(**C**)	3.00(**X**)				
43pF(**430**)	1.60(**C**)	3.00(**X**)				
47pF(**470**)	1.60(**C**)	3.00(**X**)				
51pF(**510**)	1.60(**C**)	3.00(**X**)				
56pF(**560**)	1.60(**C**)	3.00(**X**)				
62pF(**620**)	1.60(**C**)	3.00(**X**)				
68pF(**680**)	1.60(**C**)	3.00(**X**)				
75pF(**750**)	1.60(**C**)	3.00(**X**)				
82pF(**820**)	1.60(**C**)	3.00(**X**)				
91pF(**910**)	1.60(**C**)	3.00(**X**)				

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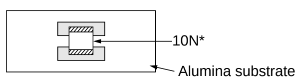
Part Number	**ERH1X**	**ERH3X**				
L x W	1.60x1.40	3.20x2.80				
TC	C0G (**5C**)	C0G (**5C**)				
Rated Volt.	50 (**1H**)	500 (**2H**)	300 (**YD**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)						
100pF(**101**)	1.60(**C**)	3.00(**X**)				
110pF(**111**)			3.00(**X**)			
120pF(**121**)			3.00(**X**)			
130pF(**131**)			3.00(**X**)			
150pF(**151**)			3.00(**X**)			
160pF(**161**)			3.00(**X**)			
180pF(**181**)			3.00(**X**)			
200pF(**201**)			3.00(**X**)			
220pF(**221**)				3.00(**X**)		
240pF(**241**)				3.00(**X**)		
270pF(**271**)				3.00(**X**)		
300pF(**301**)				3.00(**X**)		
330pF(**331**)				3.00(**X**)		
360pF(**361**)				3.00(**X**)		
390pF(**391**)				3.00(**X**)		
430pF(**431**)				3.00(**X**)		
470pF(**471**)				3.00(**X**)		
510pF(**511**)					3.00(**X**)	
560pF(**561**)					3.00(**X**)	
620pF(**621**)					3.00(**X**)	
680pF(**681**)					3.00(**X**)	
750pF(**751**)						3.00(**X**)
820pF(**821**)						3.00(**X**)
910pF(**911**)						3.00(**X**)
1000pF(**102**)						3.00(**X**)

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

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 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 (I.R.)	25℃	C≦ 470pF :1,000,000MΩ min. 470pF<C≦1,000pF : 100,000MΩ min.	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25 and 125℃ standard humidity and within 2 minutes of charging.
		125℃	C≦ 470pF : 100,000MΩ min. 470pF<C≦1,000pF : 10,000MΩ min.	
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: 0.5 to 5Vrms
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 Variation Rate	Within the specified tolerance (Table A-7)	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. The capacitance change should be measured after 5 min. at each specified temperature stage. Step / Temperature (℃) 1: 25±2 2: −55±3 3: 25±2 4: 125±3 5: 25±2
		Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	
10	Terminal Strength	Adhesive Strength of Termination (for chip type)	No removal of the terminations or other defects should occur.	Solder the capacitor to the test jig (alumina substrate) shown in Fig. 1 using solder containing 2.5% silver. The soldering should be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N* force in the direction of the arrow. *ERF1D : 5N  Fig. 1
		Tensile Strength (for micro-strip type)	Capacitor should not be broken or damaged.	The capacitor body is fixed and a load is applied gradually in the axial direction until its value reaches 10N (5N for ERH1X).
		Bending Strength of lead wire terminal (for micro-strip type)	Lead wire should not be cut or broken.	Position the main body of the capacitor so the lead wire terminal is perpendicular, and load 2.5N to the lead wire terminal. Bend the main body by 90 degrees, bend back to original position, bend 90 degrees in the reverse direction, and then bend back to original position.

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="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 (alumina substrate) shown in Fig. 2 using solder containing 2.5% silver. The soldering should be done either with an iron or using the reflow method and should be conducted with care so the soldering is uniform and free of defects such as heat shock. 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).

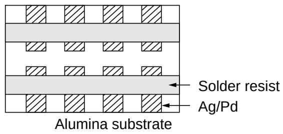
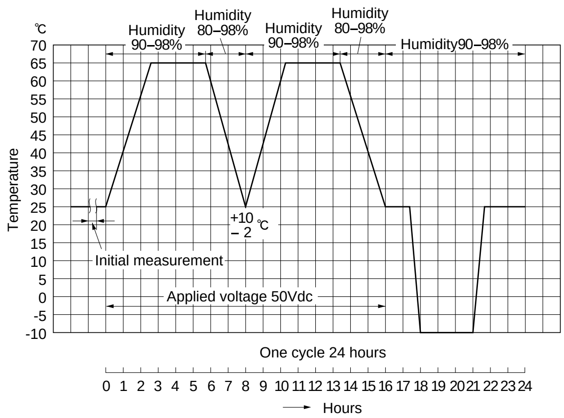



Fig. 2</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>Satisfies the initial value.
C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000
C : Nominal Capacitance (pF)</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>95% 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℃ for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5℃. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.</td></tr>
<tr><td>13</td><td colspan="2">Resistance to Soldering Heat</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr>
<tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Preheat the capacitor at 80 to 100℃ for 2 minutes and then at 150 to 200℃ for 5 minutes.
Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5℃. Set at room temperature for 24±2 hours, then measure. The dipping depth for microstrip type capacitors is up to 2mm from the root of the terminal.</td></tr>
<tr><td>14</td><td colspan="2">Temperature Cycle</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±1% or ±0.25pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr>
<tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>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. Then, repeat twice the successive cycles of immersion, each cycle consisting of immersion in a fresh water at 65^{+5}_{-0}℃ for 15 minutes and immersion in a saturated aqueous solution of salt at 0±3℃ for 15 minutes.
The capacitor is promptly washed with running water, dried with a dry cloth, and allowed to sit at room temperature for 24±2 hours.
<table>
<tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Temp. (℃)</td><td>-55^{+0}_{-3}</td><td>Room Temp.</td><td>125^{+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></td></tr>
<tr><td>15</td><td colspan="2">Humidity</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr>
<tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Apply the 24-hour heat (−10 to +65℃) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure.
</td></tr>
</table>

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13

Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications	Test Method
16	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 ±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 I.R.: More than 30% of the initial specification value at 25℃. C : Nominal Capacitance (pF)	Apply 150% of the rated voltage for 2,000±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

Char. Code	Temp. Coeff. (ppm/℃) Note 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
6C	0±60	0.73	−0.44	0.48	−0.32	0.29	−0.20

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

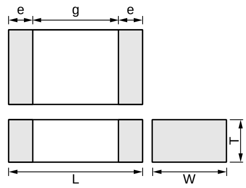
Chip Monolithic Ceramic Capacitors

High Frequency Type

SMD Type

■ Features (ERA 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 ERA series improve solderability and decrease solder leaching.
3. ERA11A/21A series are designed for both flow and reflow soldering and ERA32 series are designed for reflow soldering.



Part Number	Dimensions (mm)				
	L	W	T max.	e	g min.
ERA11A	1.25 +0.5/-0.3	1.0 +0.5/-0.3	1.0±0.2	0.15 min.	0.3
ERA21A	2.0 +0.5/-0.3	1.25 +0.5/-0.3	1.0±0.2	0.2 min.	0.5
ERA21B			1.25±0.2		
ERA32X	3.2 +0.6/-0.4	2.5 +0.5/-0.3	1.7±0.2	0.3 min.	0.5

■ Applications

High frequency and high-power circuits

Part Number	**ERA11**			**ERA21**			**ERA32**		
L x W	1.25x1.00			2.00x1.25			3.20x2.50		
TC	C0G (**5C**)			C0G (**5C**)			C0G (**5C**)		
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)									
0.50pF(**R50**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
0.6pF(**R60**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
0.7pF(**R70**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
0.75pF(**R75**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
0.8pF(**R80**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
0.9pF(**R90**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.0pF(**1R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.1pF(**1R1**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.2pF(**1R2**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.3pF(**1R3**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.4pF(**1R4**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.5pF(**1R5**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.6pF(**1R6**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.7pF(**1R7**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.8pF(**1R8**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
1.9pF(**1R9**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
2.0pF(**2R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
2.1pF(**2R1**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
2.2pF(**2R2**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
2.4pF(**2R4**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
2.7pF(**2R7**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
3.0pF(**3R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
3.3pF(**3R3**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
3.6pF(**3R6**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
3.9pF(**3R9**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
4.0pF(**4R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
4.3pF(**4R3**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
4.7pF(**4R7**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
5.0pF(**5R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
5.1pF(**5R1**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		

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Part Number	**ERA11**			**ERA21**			**ERA32**		
L x W	1.25x1.00			2.00x1.25			3.20x2.50		
TC	C0G (**5C**)			C0G (**5C**)			C0G (**5C**)		
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)									
5.6pF(**5R6**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
6.0pF(**6R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
6.2pF(**6R2**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
6.8pF(**6R8**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
7.0pF(**7R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
7.5pF(**7R5**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
8.0pF(**8R0**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
8.2pF(**8R2**)	1.00(**A**)			1.00(**A**)			1.70(**X**)		
9.0pF(**9R0**)	1.00(**A**)			1.25(**B**)			1.70(**X**)		
9.1pF(**9R1**)	1.00(**A**)			1.25(**B**)			1.70(**X**)		
10pF(**100**)	1.00(**A**)			1.25(**B**)			1.70(**X**)		
11pF(**110**)	1.00(**A**)			1.25(**B**)			1.70(**X**)		
12pF(**120**)	1.00(**A**)			1.25(**B**)			1.70(**X**)		
13pF(**130**)	1.00(**A**)			1.25(**B**)			1.70(**X**)		
15pF(**150**)		1.00(**A**)		1.25(**B**)			1.70(**X**)		
16pF(**160**)		1.00(**A**)		1.25(**B**)			1.00(**X**)		
18pF(**180**)		1.00(**A**)		1.25(**B**)			1.70(**X**)		
20pF(**200**)		1.00(**A**)		1.25(**B**)			1.70(**X**)		
22pF(**220**)		1.00(**A**)		1.25(**B**)			1.70(**X**)		
24pF(**240**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
27pF(**270**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
30pF(**300**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
33pF(**330**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
36pF(**360**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
39pF(**390**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
43pF(**430**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
47pF(**470**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
51pF(**510**)			1.00(**A**)	1.25(**B**)			1.70(**X**)		
56pF(**560**)					1.25(**B**)		1.70(**X**)		
62pF(**620**)					1.25(**B**)		1.70(**X**)		
68pF(**680**)					1.25(**B**)		1.70(**X**)		
75pF(**750**)					1.25(**B**)		1.70(**X**)		
82pF(**820**)					1.25(**B**)		1.70(**X**)		
91pF(**910**)					1.25(**B**)		1.70(**X**)		
100pF(**101**)						1.00(**A**)	1.70(**X**)		
110pF(**111**)						1.25(**B**)	1.70(**X**)		
120pF(**121**)						1.25(**B**)	1.70(**X**)		
130pF(**131**)						1.25(**B**)	1.70(**X**)		
150pF(**151**)						1.25(**B**)	1.70(**X**)		
160pF(**161**)						1.25(**B**)	1.70(**X**)		
180pF(**181**)								1.70(**X**)	
200pF(**201**)								1.70(**X**)	
220pF(**221**)								1.70(**X**)	
240pF(**241**)								1.70(**X**)	
270pF(**271**)								1.70(**X**)	
300pF(**301**)								1.70(**X**)	
330pF(**331**)								1.70(**X**)	
360pF(**361**)								1.70(**X**)	
390pF(**391**)								1.70(**X**)	
430pF(**431**)								1.70(**X**)	
470pF(**471**)								1.70(**X**)	
510pF(**511**)								1.70(**X**)	

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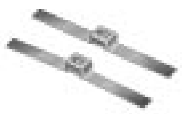
Part Number	ERA11			ERA21			ERA32		
L x W	1.25x1.00			2.00x1.25			3.20x2.50		
TC	C0G (**5C**)			C0G (**5C**)			C0G (**5C**)		
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)									
560pF(**561**)									1.70(**X**)
620pF(**621**)									1.70(**X**)
680pF(**681**)									1.70(**X**)
750pF(**751**)									1.70(**X**)
820pF(**821**)									1.70(**X**)
910pF(**911**)									1.70(**X**)
1000pF(**102**)									1.70(**X**)

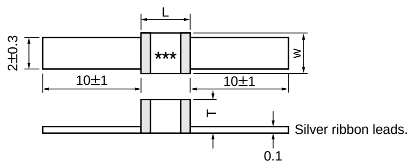
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

Ribbon Terminal

■ Features (ERD Series)

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. ERD Series capacitors withstand at high temperatures because ribbon leads are attached with silver paste.
3. ERD Series capacitors are easily soldered and are especially well suited in applications where only a soldering iron can be used.





*** : Capacitance Code

Part Number	Dimensions (mm)		
	L max.	W max.	T max.
ERD32D	4.0	3.0	2.3

■ Applications

High frequency and high power circuits

Part Number	ERD32		
L x W	4.00x3.00		
TC	C0G (**5C**)		
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)			
0.50pF(**R50**)	2.30(**D**)		
0.6pF(**R60**)	2.30(**D**)		
0.7pF(**R70**)	2.30(**D**)		
0.75pF(**R75**)	2.30(**D**)		
0.8pF(**R80**)	2.30(**D**)		
0.9pF(**R90**)	2.30(**D**)		
1.0pF(**1R0**)	2.30(**D**)		
1.1pF(**1R1**)	2.30(**D**)		
1.2pF(**1R2**)	2.30(**D**)		
1.3pF(**1R3**)	2.30(**D**)		
1.4pF(**1R4**)	2.30(**D**)		
1.5pF(**1R5**)	2.30(**D**)		
1.6pF(**1R6**)	2.30(**D**)		
1.7pF(**1R7**)	2.30(**D**)		
1.8pF(**1R8**)	2.30(**D**)		
1.9pF(**1R9**)	2.30(**D**)		
2.0pF(**2R0**)	2.30(**D**)		
2.1pF(**2R1**)	2.30(**D**)		

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Part Number	**ERD32**		
L x W	4.00x3.00		
TC	C0G (**5C**)		
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)			
2.2pF(**2R2**)	2.30(**D**)		
2.4pF(**2R4**)	2.30(**D**)		
2.7pF(**2R7**)	2.30(**D**)		
3.0pF(**3R0**)	2.30(**D**)		
3.3pF(**3R3**)	2.30(**D**)		
3.6pF(**3R6**)	2.30(**D**)		
3.9pF(**3R9**)	2.30(**D**)		
4.0pF(**4R0**)	2.30(**D**)		
4.3pF(**4R3**)	2.30(**D**)		
4.7pF(**4R7**)	2.30(**D**)		
5.0pF(**5R0**)	2.30(**D**)		
5.1pF(**5R1**)	2.30(**D**)		
5.6pF(**5R6**)	2.30(**D**)		
6.0pF(**6R0**)	2.30(**D**)		
6.2pF(**6R2**)	2.30(**D**)		
6.8pF(**6R8**)	2.30(**D**)		
7.0pF(**7R0**)	2.30(**D**)		
7.5pF(**7R5**)	2.30(**D**)		
8.0pF(**8R0**)	2.30(**D**)		
8.2pF(**8R2**)	2.30(**D**)		
9.0pF(**9R0**)	2.30(**D**)		
9.1pF(**9R1**)	2.30(**D**)		
10pF(**100**)	2.30(**D**)		
11pF(**110**)	2.30(**D**)		
12pF(**120**)	2.30(**D**)		
13pF(**130**)	2.30(**D**)		
15pF(**150**)	2.30(**D**)		
16pF(**160**)	2.30(**D**)		
18pF(**180**)	2.30(**D**)		
20pF(**200**)	2.30(**D**)		
22pF(**220**)	2.30(**D**)		
24pF(**240**)	2.30(**D**)		
27pF(**270**)	2.30(**D**)		
30pF(**300**)	2.30(**D**)		
33pF(**330**)	2.30(**D**)		
36pF(**360**)	2.30(**D**)		
39pF(**390**)	2.30(**D**)		
43pF(**430**)	2.30(**D**)		
47pF(**470**)	2.30(**D**)		
51pF(**510**)	2.30(**D**)		
56pF(**560**)	2.30(**D**)		
62pF(**620**)	2.30(**D**)		
68pF(**680**)	2.30(**D**)		
75pF(**750**)	2.30(**D**)		
82pF(**820**)	2.30(**D**)		
91pF(**910**)	2.30(**D**)		
100pF(**101**)	2.30(**D**)		
110pF(**111**)	2.30(**D**)		
120pF(**121**)	2.30(**D**)		
130pF(**131**)	2.30(**D**)		
150pF(**151**)	2.30(**D**)		
160pF(**161**)	2.30(**D**)		

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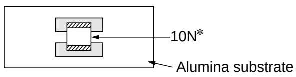
Part Number	**ERD32**		
L x W	4.00x3.00		
TC	C0G (**5C**)		
Rated Volt.	200 (**2D**)	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)			
180pF(**181**)		2.30(**D**)	
200pF(**201**)		2.30(**D**)	
220pF(**221**)		2.30(**D**)	
240pF(**241**)		2.30(**D**)	
270pF(**271**)		2.30(**D**)	
300pF(**301**)		2.30(**D**)	
330pF(**331**)		2.30(**D**)	
360pF(**361**)		2.30(**D**)	
390pF(**391**)		2.30(**D**)	
430pF(**431**)		2.30(**D**)	
470pF(**471**)		2.30(**D**)	
510pF(**511**)		2.30(**D**)	
560pF(**561**)			2.30(**D**)
620pF(**621**)			2.30(**D**)
680pF(**681**)			2.30(**D**)
750pF(**751**)			2.30(**D**)
820pF(**821**)			2.30(**D**)
910pF(**911**)			2.30(**D**)
1000pF(**102**)			2.30(**D**)

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

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.
6	Insulation Resistance (I.R.)		10,000MΩ min.	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: 0.5 to 5Vrms
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 Variation Rate	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. The capacitance change should be measured after 5 min. at each specified temperature stage. Step / Temperature (℃) 1 / 25±2 2 / −55±3 3 / 25±2 4 / 125±3 5 / 25±2
		Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	
10	Terminal Strength	Adhesive Strength of Termination (for chip type)	No removal of the terminations or other defects should occur	Solder the capacitor to the test jig (alumina substrate) shown in Fig.1 using solder containing 2.5% silver. The soldering should be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N* force in the direction of the arrow. *5N (ERA11)  Fig.1
		Tensile Strength (for micro-strip type)	Capacitor should not be broken or damaged	The capacitor body is fixed and a load is applied gradually in the axial direction until its value reaches 5N.
		Bending Strength of lead wire terminal (for micro-strip type)	Lead wire should not be cut or broken	Position the main body of the capacitor so the lead wire terminal is perpendicular, and load 2.5N to the lead wire terminal. Bend the main body by 90 degrees, bend back to original position, bend 90 degrees in the reverse direction, and then bend back to original position.

Continued on the following page.

14

Specifications and Test Methods

Continued from the preceding page.

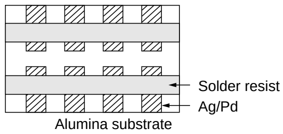
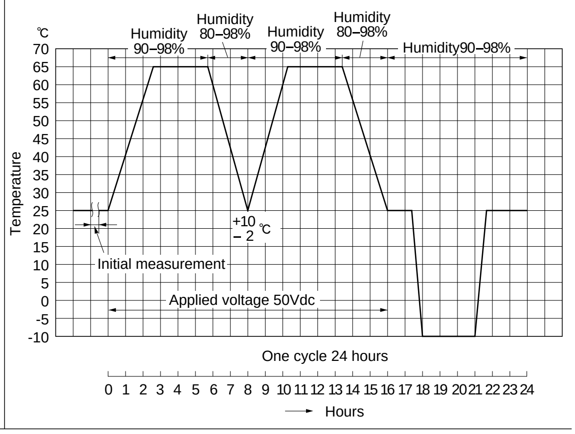
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (alumina substrate) shown in Fig. 2 using solder containing 2.5% silver. The soldering should be done either with an iron or using the reflow method and should be conducted with care so the soldering is uniform and free of defects such as heat shock. 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).


Fig. 2</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>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)</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℃ for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5℃. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.</td></tr>
<tr><td>13</td><td colspan="2">Resistance to Soldering Heat</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Preheat according to the conditions listed in the table below. Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5℃. Set at room temperature for 24±2 hours, then measure. The dipping depth for microstrip type capacitors is up to 2mm from the root of the terminal.
<table>
<tr><th>Chip Size</th><th>Preheat Condition</th></tr>
<tr><td>2.0×1.25mm max.</td><td>1minute at 120 to 150℃</td></tr>
<tr><td>3.2×2.5mm</td><td>Each 1 minute at 100 to 120℃ and then 170 to 200℃</td></tr>
</table></td></tr>
<tr><td>14</td><td colspan="2">Temperature Cycle</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF (Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≧30pF : Q≧350
10pF≦C<30pF : Q≧275+ $\frac{5}{2}$ C
C<10pF : Q≧200+10C</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>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.
<table>
<tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Temp.(℃)</td><td>-55^{+0}_{-3}</td><td>Room Temp.</td><td>125^{+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></td></tr>
<tr><td>15</td><td colspan="2">Humidity</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF (Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≧30pF : Q≧350
10pF≦C<30pF : Q≧275+ $\frac{5}{2}$ C
C<10pF : Q≧200+10C</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Apply the 24-hour heat (−10 to +65℃) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure.

</td></tr>
</table>

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Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications	Test Method
16	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. C : Nominal Capacitance (pF)	Apply 200% of the rated voltage for 1,000±12 hours at 125+4/−0℃. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.

Table A

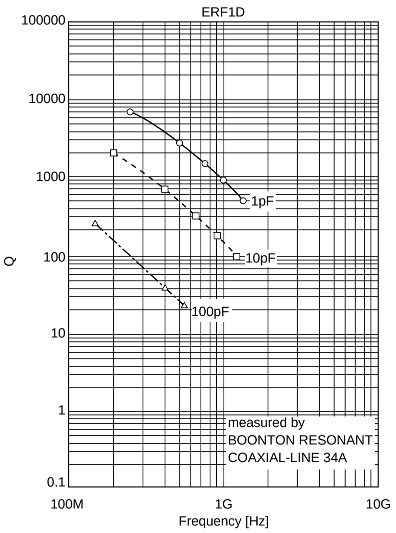
Char. Code	Temp. Coeff. (ppm/℃) Note 1	Capacitance Change from 25℃ Value (%)					
		−55℃		−30℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	−0.24	0.40	−0.17	0.25	−0.11
6C	0±60	0.73	−0.44	0.48	−0.32	0.29	−0.20

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

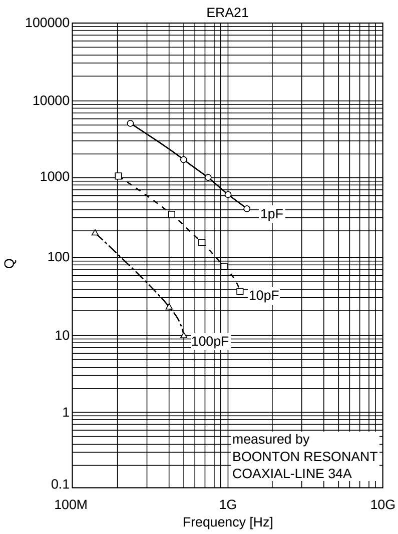
ERA/ERD/ERF/ERH Series Data

■ Q-Frequency Characteristics

ERF Series

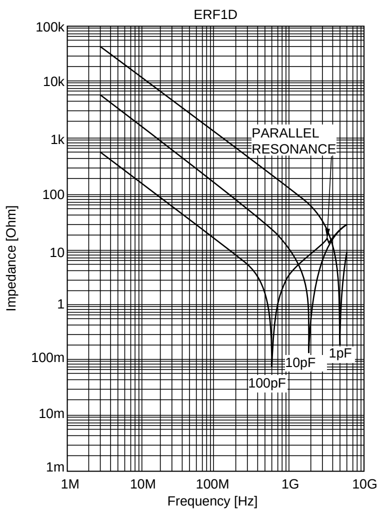


ERA Series

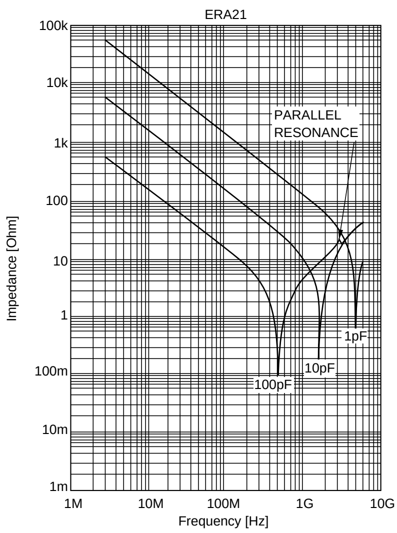


■ Impedance-Frequency Characteristics

ERF Series

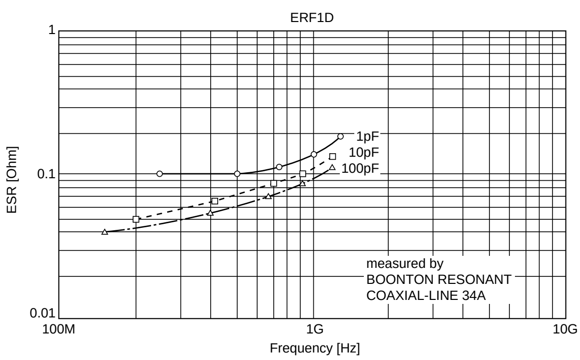


ERA Series

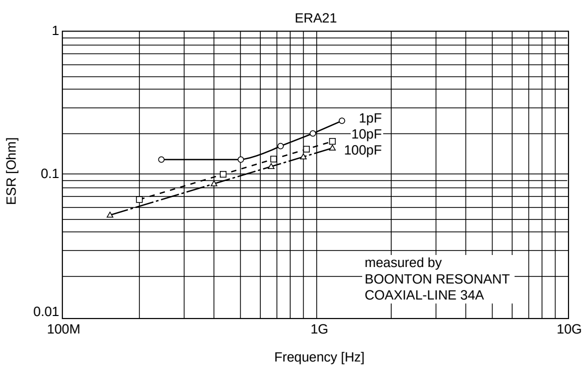


■ ESR-Frequency Characteristics

ERF Series



ERA Series



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ERA/ERD/ERF/ERH Series Data

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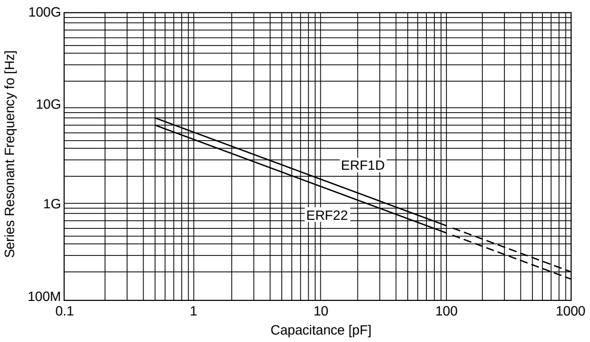
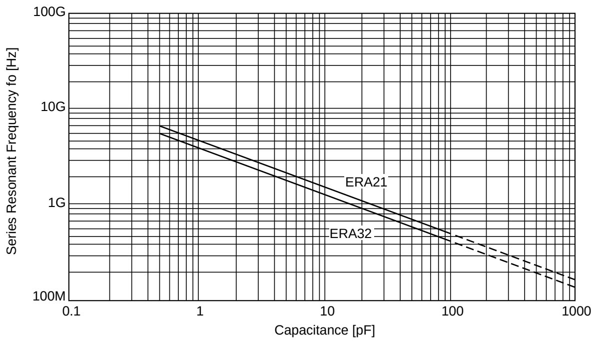
■ Resonant Frequency-Capacitance

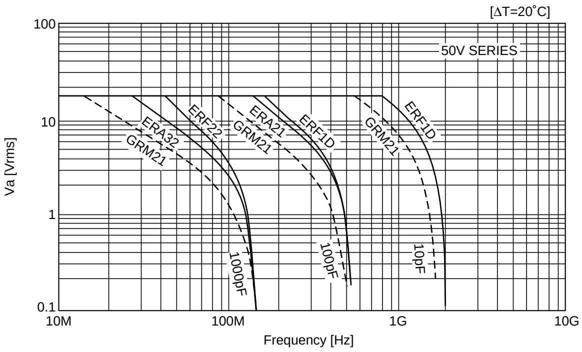
ERF Series



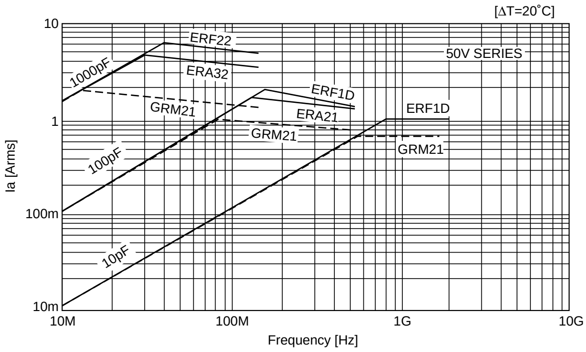
ERA Series



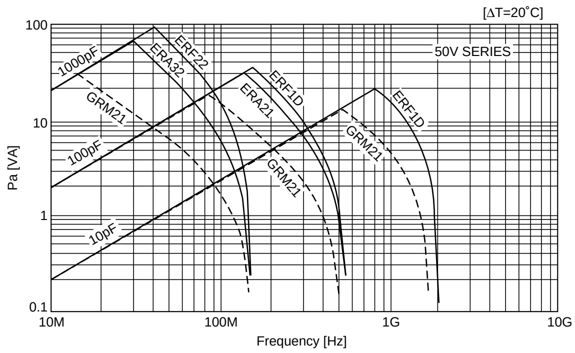
■ Allowable Voltage-Frequency



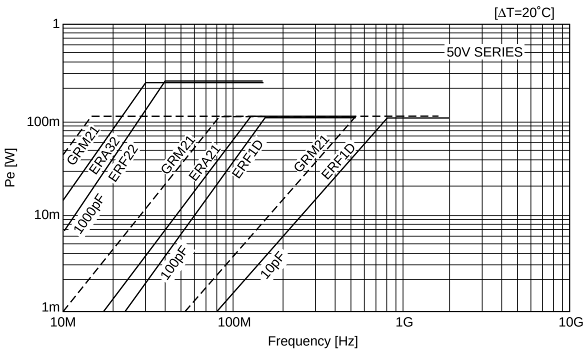
■ Allowable Current-Frequency



■ Allowable Apparent Power-Frequency



■ Allowable Effective Power-Frequency



Package

■ Packaging Code

Packaging Type	Tape Carrier Packaging	Bulk Case Packaging	Bulk Packaging	
			Bulk Packaging in a Bag	Bulk Packaging in a Tray
Packaging Code	**D, L, K, J, E, F**	**C**	**B**	**T**

■ Minimum Quantity Guide

Part Number		Dimensions (mm)			Quantity (pcs.)					
					ø180mm reel		ø330mm reel		Bulk Case	Bulk Bag
		L	W	T	Paper Tape	Plastic Tape	Paper Tape	Plastic Tape		
Ultra Miniaturized	**GRM03**	0.6	0.3	0.3	15,000	-	50,000	-	-	1,000
For Flow/Reflow	**GRM18**	1.6	0.8	0.8	4,000	-	10,000	-	15,000	1,000
	GRM21	2.0	1.25	0.6	4,000	-	10,000	-	10,000	1,000
				0.85	4,000	-	10,000	-	-	1,000
				1.0	-	3,000	-	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
For Reflow	**GRM155**	1.0	0.5	0.5	10,000	-	50,000	-	50,000	1,000
	GRM15X	1.0	0.5	0.25	10,000	-	50,000	-	-	1,000
	GRM32	3.2	2.5	1.15	-	3,000	-	10,000	-	1,000
				1.35	-	2,000	-	8,000	-	1,000
				1.8/1.6	-	1,000	-	4,000	-	1,000
				2.0	-	1,000	-	4,000	-	1,000
				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	-	1,000
	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
	ERA11	1.25	1.0	1.0	-	-	-	-	-	1,000
	ERA21	2.0	1.25	1.0/1.25	-	3,000	-	-	-	1,000
	ERA32	3.2	2.5	1.7	-	2,000	-	-	-	1,000
	ERF1D	1.4	1.4	1.15	-	2,000	-	-	-	1,000
	ERF22	2.8	2.8	2.3	-	1,000	-	-	-	1,000
For Ultrasonic	**GRM21**	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000
Micro Chip	**GMA05**	0.5	0.5	0.35	-	-	-	-	-	400 [1]
	GMA08	0.8	0.8	0.5	-	-	-	-	-	400 [1]
Array	**GNM1M**	1.37	1.0	0.6	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
	GNM21	2.0	1.25	0.6/0.85	4,000	-	10,000	-	-	1,000
Low ESL	**LLL18**	0.8	1.6	0.6	-	4,000	-	10,000	-	1,000
	LLL21	1.25	2.0	0.6	-	4,000	-	10,000	-	1,000
				0.85	-	3,000	-	10,000	-	1,000
	LLL31	1.6	3.2	0.7	-	4,000	-	10,000	-	1,000
				1.15	-	3,000	-	10,000	-	1,000

1) Tray 2) 10µF, 1.0µF, 3.3/4.7µF of 6.3V R6 rated are not available by bulk case.

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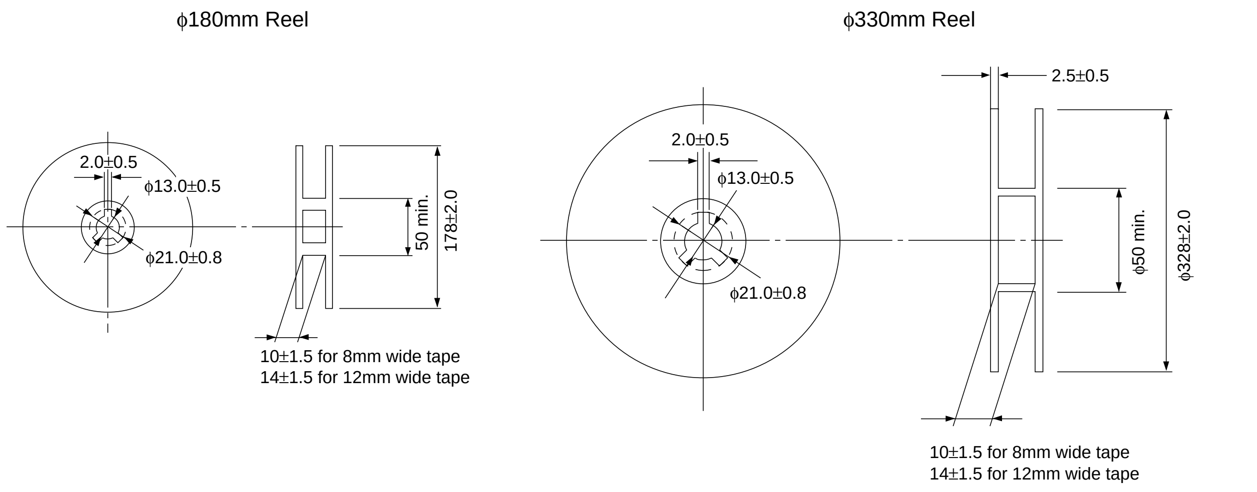
Package

Continued from the preceding page.

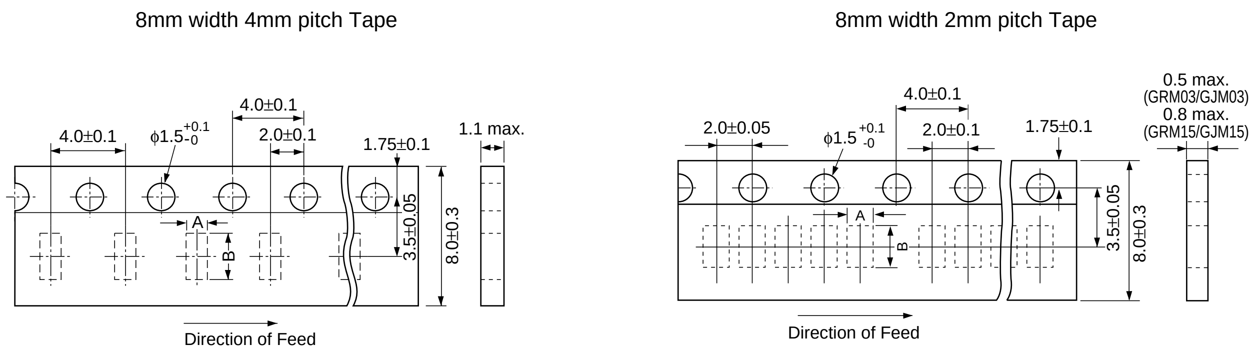
■ Tape Carrier Packaging

(1) Dimensions of Reel



(in mm)

(2) Dimensions of Paper Tape



Part Number	A	B
GRM18 **GQM18**	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*
GJM03 **GRM03**	0.37	0.67
GJM15 **GRM15**	0.65	1.15

*Nominal Value

(in mm)

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Package

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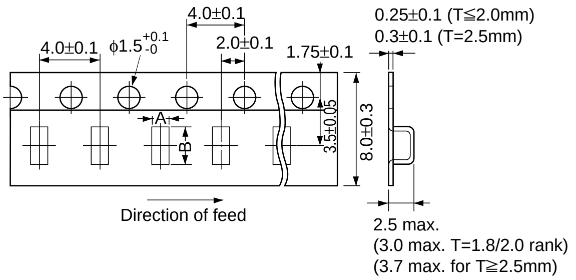
(3) Dimensions of Plastic Tape

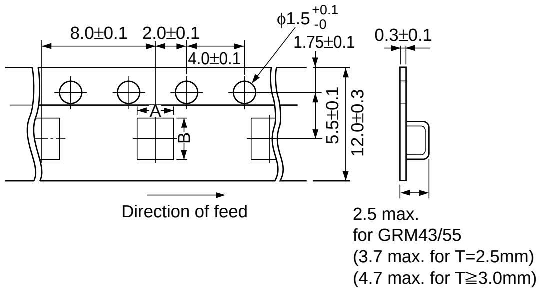
8mm width 4mm pitch Tape



Part Number	A	B
LLL18	1.05±0.1	1.85±0.1
GRM21 (T≧1.0mm) **LLL21**	1.45±0.2	2.25±0.2
GRM31 (T≧1.15mm) **LLL31** **GNM31** (T≧1.0mm)	1.9±0.2	3.5±0.2
GRM32 (T≧1.15mm)	2.8±0.2	3.5±0.2
ERA21	1.8*	2.6*
ERA32	2.8*	3.5*
ERF1D	2.0*	2.1*
ERF22	3.1*	3.2*

*Nominal Value

12mm width 4mm pitch Tape



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.

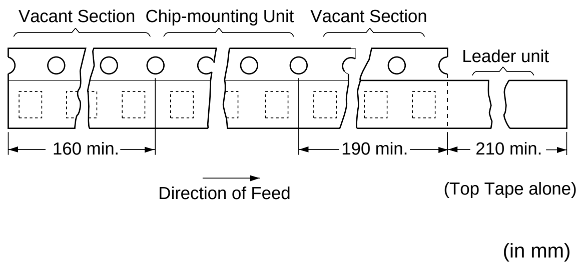
③ The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

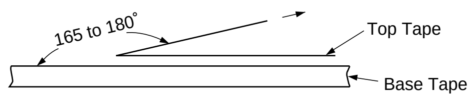
④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

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. *GRM03, GJM03 : 0.05 to 0.5N





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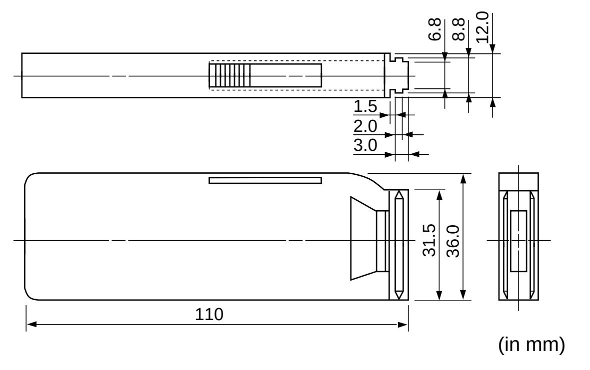
■ Dimensions of Bulk Case Packaging

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.
(Reference Data 1. Solderability)

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 PRODUCTS IS USED.

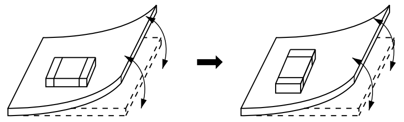
⚠Caution

■ Soldering and Mounting

1. Mounting Position

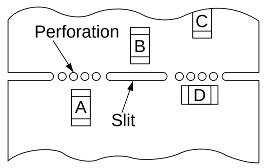
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



Locate chip horizontal to the direction in which stress acts

[Chip Mounting Close to Board Separation Point]



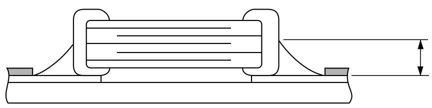
Chip arrangement
Worst A-C-(B~D) Best

(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. Solder Paste Printing

- 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]

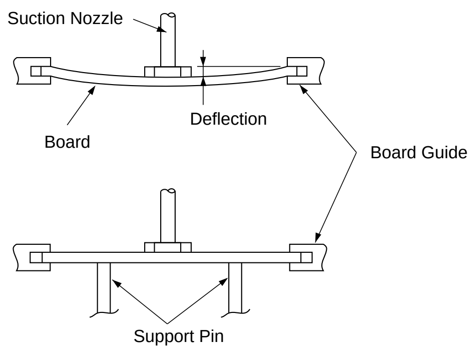


3. Chip Placing

- 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]



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⚠Caution

Continued from the preceding page.

4. Reflow Soldering

- Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips. So when preheating, keep temperature differential, ΔT, within the range shown in Table 1. The smaller the ΔT, the less stress on the chip.
- 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 above table.

Table 1

Part Number	Temperature Differential
GRM02/03/15/18/21/31 **GJM03/15** **LLL18/21/31** **ERB11/21, ERF1D** **GQM18/21**	ΔT≦190℃
GRM32/43/55 **LLA18/21/31** **LLM21/31** **GNM** **ERB32, ERF22**	ΔT≦130℃

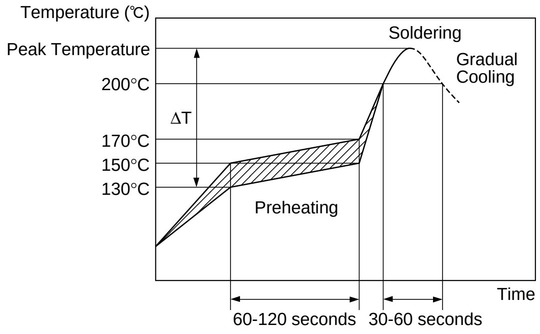
Recommended Conditions

	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

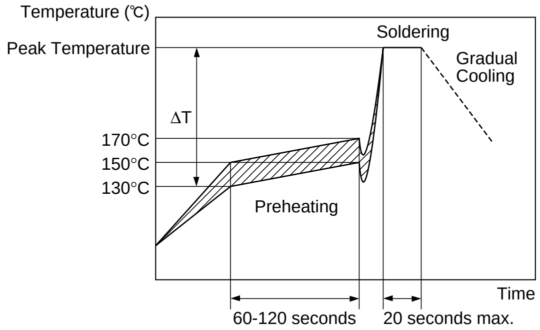
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Reflow Soldering]

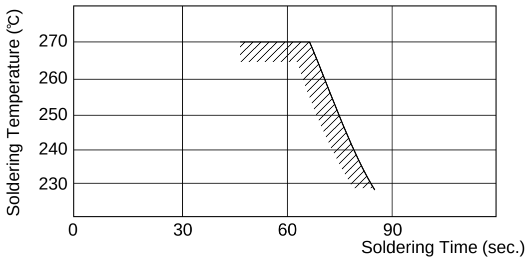
Infrared Reflow



Vapor Reflow



[Allowable Soldering Temperature and Time]



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

Inverting the PCB

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

5. 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.

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⚠Caution

Continued from the preceding page.

6. Flow Soldering

- Sudden heating of the chip results in thermal distortion causing cracked chips. 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.
- When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 2. The smaller the ΔT, the less stress on the chip.
  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

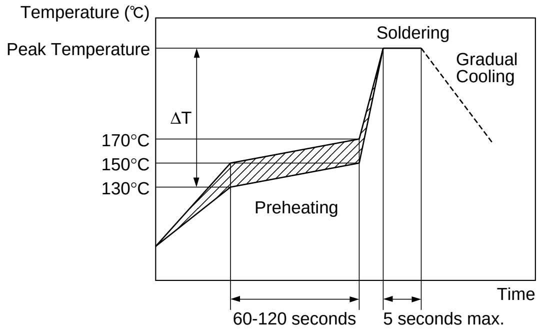
Part Number	Temperature Differential
GRM18/21/31 **LLL21/31** **ERB11/21, ERF1D** **GQM18/21**	ΔT≦150℃

Recommended Conditions

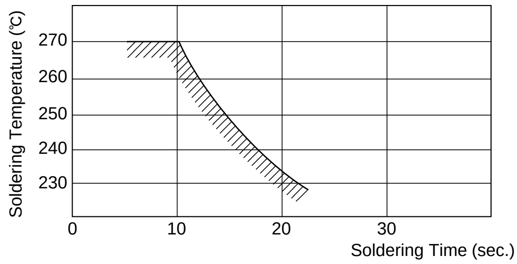
	Pb-Sn Solder	Lead Free Solder
Peak Temperature	240-250°C	250-260°C
Atmosphere	Air	N_2

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

[Standard Conditions for Flow Soldering]

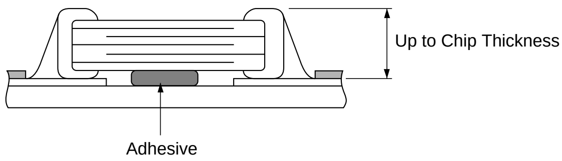


[Allowable Soldering Temperature and Time]



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

- Optimum Solder Amount for Flow Soldering



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⚠Caution

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7. Correction with a Soldering Iron

(1) For Chip Type Capacitors

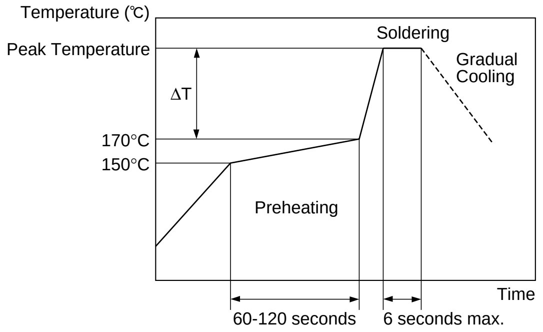
- Sudden heating of the chip results in distortion due to a high internal temperature differential, causing cracked chips. When preheating, keep temperature differential, ΔT, within the range shown in Table 3. The smaller the ΔT, the less stress on the chip.

Table 3

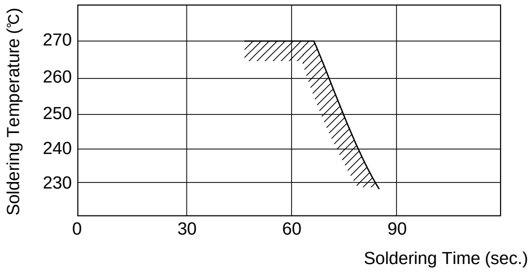
Part Number	Temperature Differential	Peak Temperature	Atmosphere
GRM15/18/21/31 **GJM15** **LLL18/21/31** **GQM18/21** **ERB11/21, ERF1D**	ΔT≦190℃	300°C max. 3 seconds max. / termination	Air
GRM32/43/55 **GNM** **LLA18/21/31** **LLM21/31** **ERB32, ERF22**	ΔT≦130℃	270°C max. 3 seconds max. / termination	Air

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

[Standard Conditions for Soldering Iron Temperature]

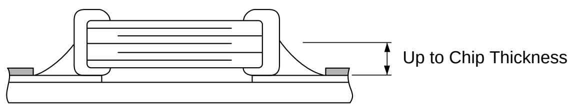


[Allowable Time and Temperature for Making Corrections with a Soldering Iron]



The accumulated soldering Time / temperature including reflow / flow soldering must be within the range shown above.

- Optimum Solder Amount when Corrections Are Made Using a Soldering Iron



(2) For Microstrip Types

- Solder 1mm away from the ribbon terminal base, being careful that the solder tip does not directly contact the capacitor. Preheating is unnecessary.
- Complete soldering within 3 seconds with a soldering tip less than 270°C in temperature.

8. 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

■ Rating

Die Bonding/Wire Bonding (GMA Series)

1. Die Bonding of Capacitors

•Use the following materials Braze alloy :
Au-Si (98/2) 400 to 420 degree C in N2 atmosphere
Au-Sn (80/20) 300 to 320 degree C in N2 atmosphere
Au-Ge (88/12) 380 to 400 degree C in N2 atmosphere

•Mounting
(1) Control the temperature of the substrate so that it matches the temperature of the braze alloy.
(2) Place braze 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

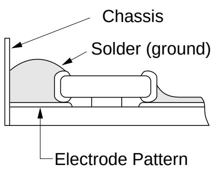
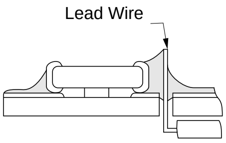
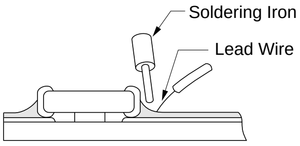
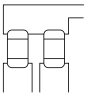
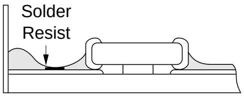
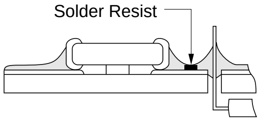
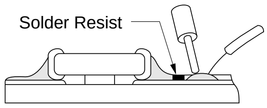
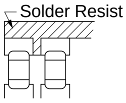
■ Soldering and Mounting

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
Incorrect				
Correct				

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Notice

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(2) Land Dimensions

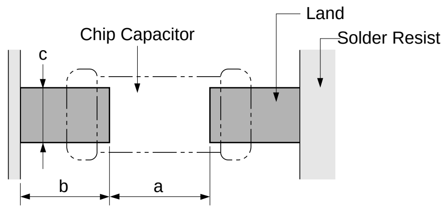


Table 1 Flow Soldering Method

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
ERA11	1.25×1.0	0.4–0.6	0.6–0.8	0.8–1.0
ERA21	2.0×1.25	1.0–1.2	0.9–1.0	0.8–1.0
ERF1D	1.4×1.4	0.5–0.8	0.8–0.9	1.0–1.2

(in mm)

Table 2 Reflow Soldering Method

Part Number \ Dimensions	Dimensions (L×W)	a	b	c
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
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
ERA11	1.25×1.0	0.4–0.6	0.6–0.8	0.8–1.0
ERA21	2.0×1.25	1.0–1.2	0.6–0.8	0.8–1.0
ERA32	3.2×2.5	2.2–2.5	0.8–1.0	1.9–2.3
ERF1D	1.4×1.4	0.4–0.8	0.6–0.8	1.0–1.2
ERF22	2.8×2.8	1.8–2.1	0.7–0.9	2.2–2.6

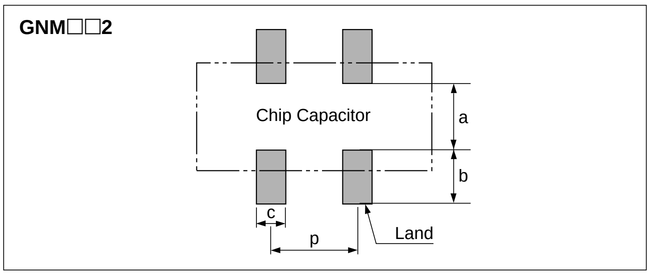
(in mm)

Continued on the following page.

Notice

Continued from the preceding page.

● GNM Series for reflow soldering method



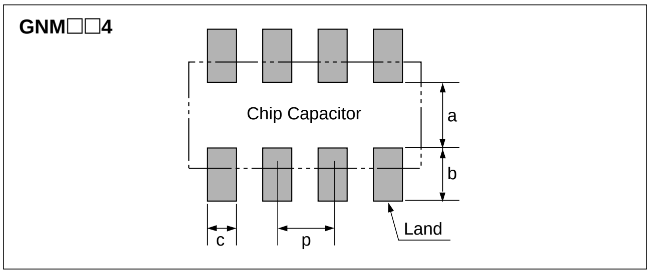


Table 3 GNM Series for Reflow Soldering Land Dimensions

Part Number	Dimensions (mm)					
	L	W	a	b	c	p
GNM1M2	1.37	1.0	0.45 to 0.5	0.5 to 0.55	0.3 to 0.35	0.64±0.1
GNM212	2.0	1.25	0.6 to 0.7	0.5 to 0.7	0.4 to 0.5	1.0±0.1
GNM214	2.0	1.25	0.6 to 0.7	0.5 to 0.7	0.25 to 0.35	0.5±0.05
GNM314	3.2	1.6	0.8 to 1.0	0.7 to 0.9	0.3 to 0.4	0.8±0.05

2. Adhesive Application

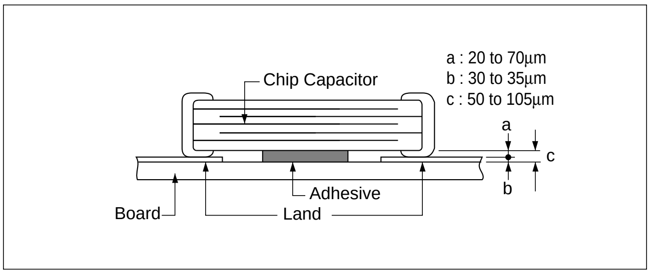
● Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. The amount of adhesive must be more than dimension C shown in the drawing below to obtain enough bonding strength.
The chip's electrode thickness and land thickness must be taken into consideration.

● 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 **GQM21**	0.1mg min.
GRM31	0.15mg min.

*Nominal Value



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.

Continued on the following page.

Notice

Continued from the preceding page.

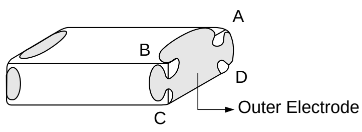
4. Flux Application

- 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.

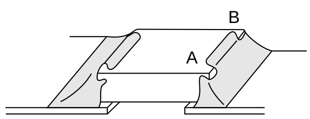
5. Flow Soldering

- 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 on 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 here in 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 (a 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.

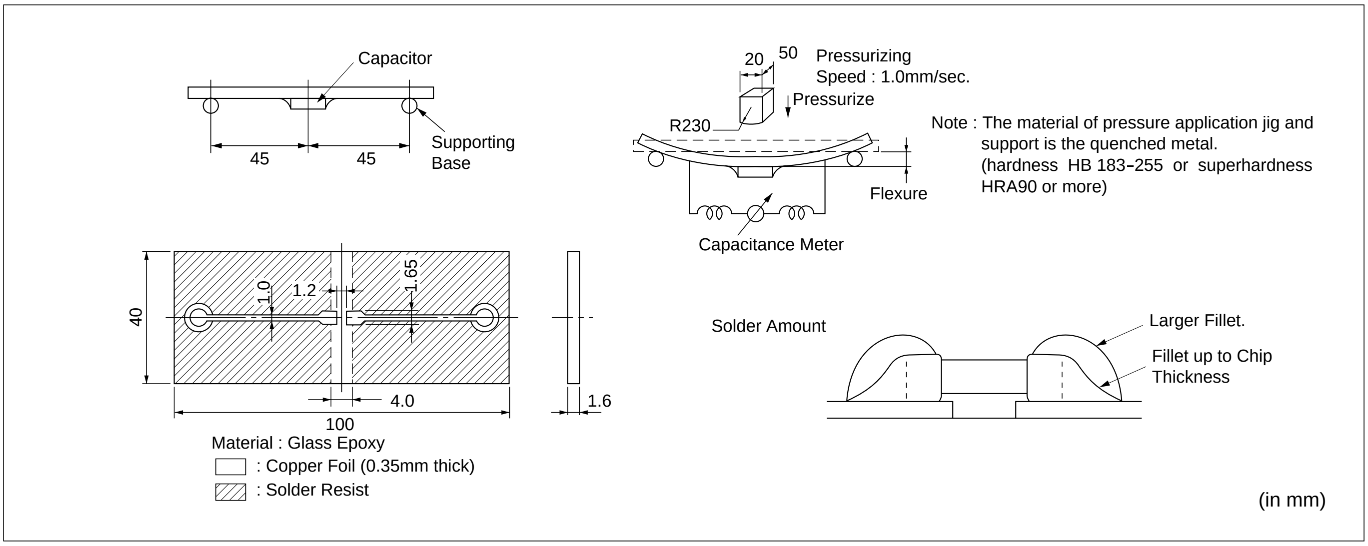
Table 1

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

Table 2

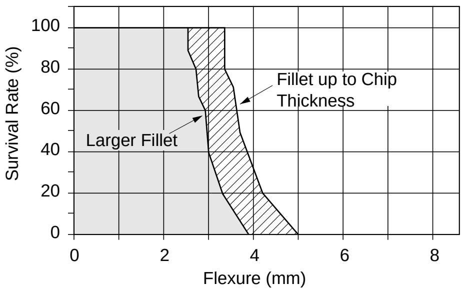
Characteristics	Change in Capacitance
5C	Within ±5% or ±0.5pF, whichever is greater
R7	Within ±12.5%
F5	Within ±20%

Continued on the following page.

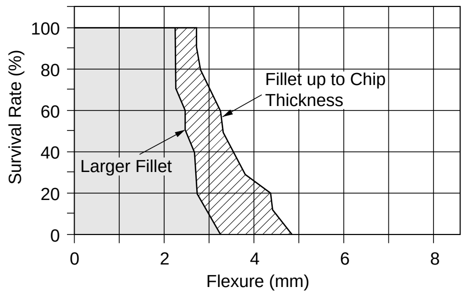
Continued from the preceding page.

(4) Results

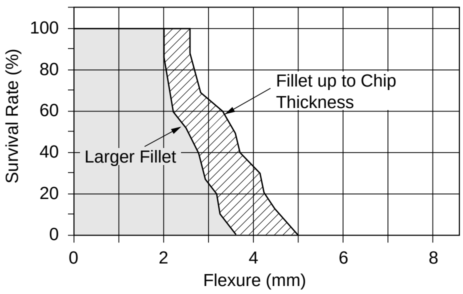
GRM21 5C (T=0.6)



GRM21 R7 (T=0.6)



GRM21 F5 (T=0.6)

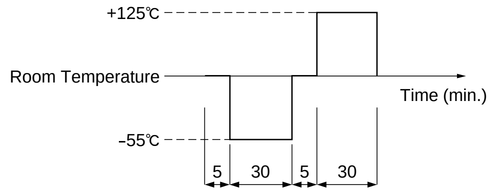


3. Temperature Cycling for Solder Fillet Height

(1) Test Method

Solder the chips to the substrate 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.

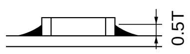
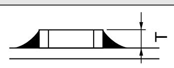
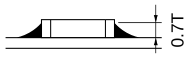
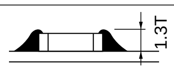
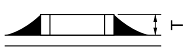
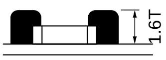
② Material

Alumina (Thickness : 0.64mm)

Glass epoxy (Thickness : 1.64mm)

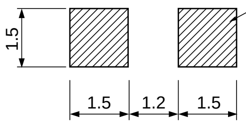
Paper phenol (Thickness : 1.64mm)

[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)

Substrate	Land
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.

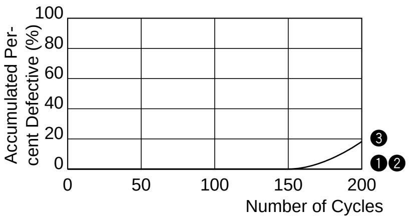
Table 3

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

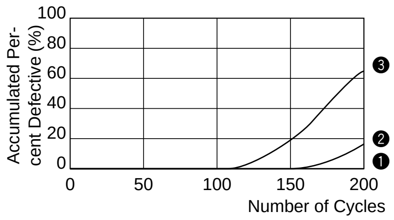
(4) Results

Alumina Substrate (Thickness 0.64mm)

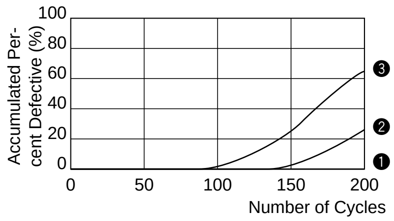
GRM21 5C (T=0.6)



GRM21 R7 (T=0.6)

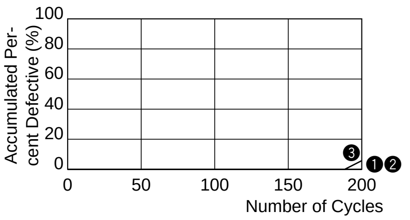


GRM21 F5 (T=0.6)

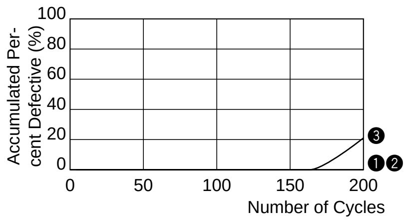


Glass Epoxy Substrate (Thickness 1.6mm)

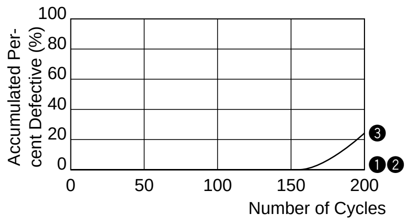
GRM21 5C (T=0.6)



GRM21 R7 (T=0.6)

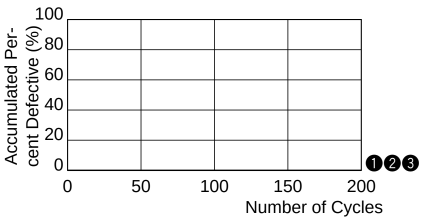


GRM21 F5 (T=0.6)

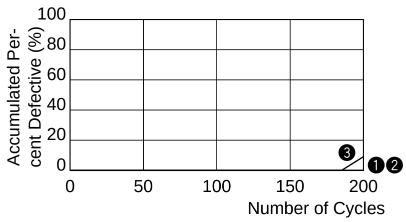


Paper Phenol Substrate (Thickness 1.6mm)

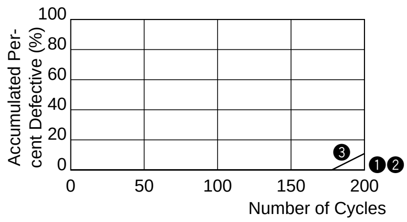
GRM21 5C (T=0.6)



GRM21 R7 (T=0.6)



GRM21 F5 (T=0.6)



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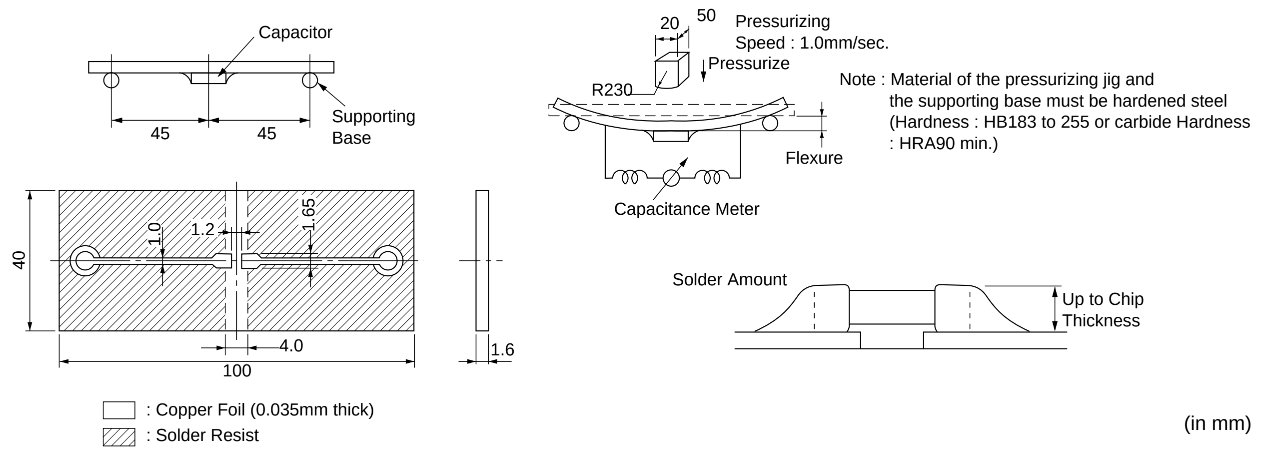
4. Board Bending Strength for Board Material

(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

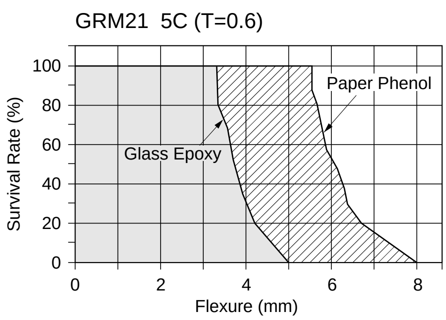
(3) Acceptance Criteria

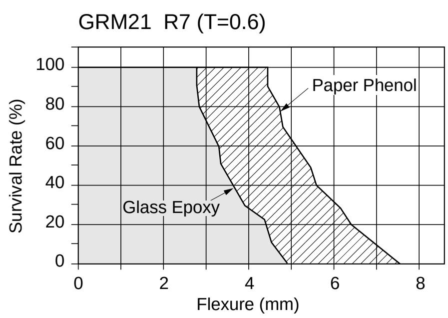
Products should be determined to be defective if the change in capacitance has exceeded the values specified in Table 4.

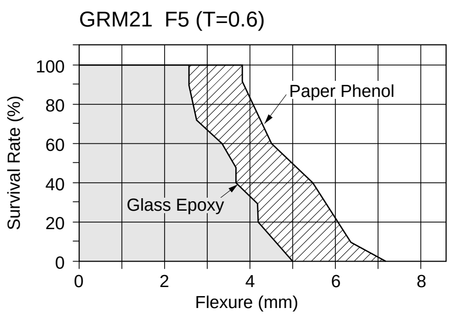
Table 4

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

(4) Results







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Reference Data

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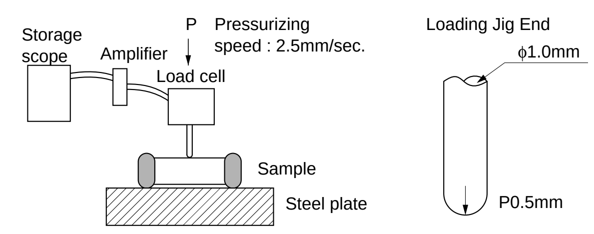
5. Break Strength

(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.

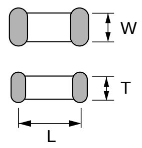


(2) Test Samples

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

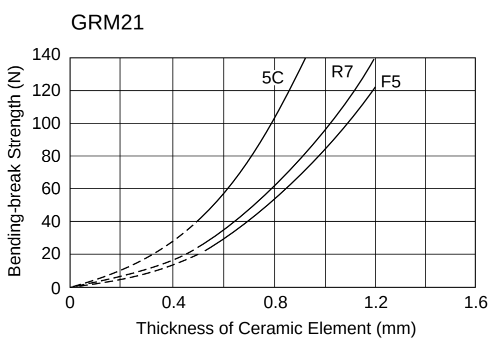
Break strength, P, is proportionate to the square of the thickness of the ceramic element and is expressed as a curve of secondary degree.

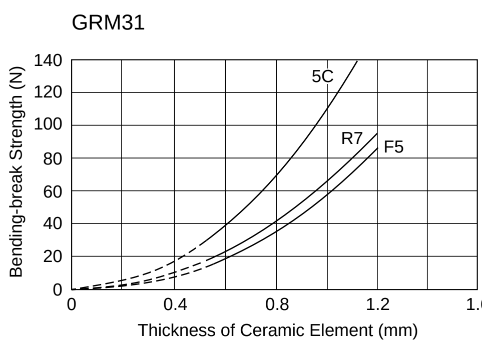
The formula is :

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

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

(5) Results

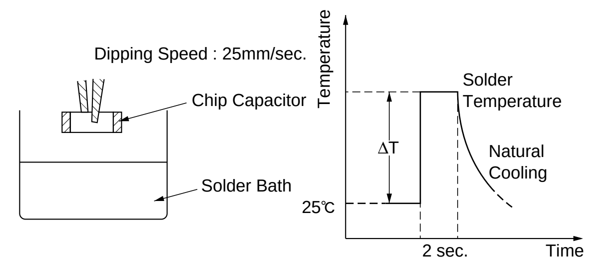




6. Thermal Shock

(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 shall be determined to be defective.

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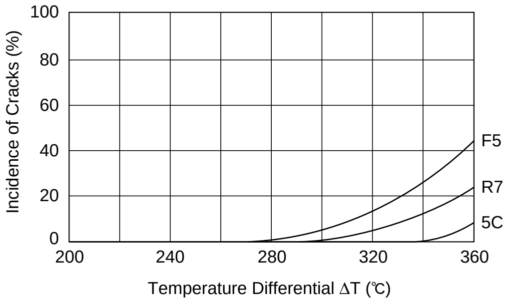
(4) Results



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.

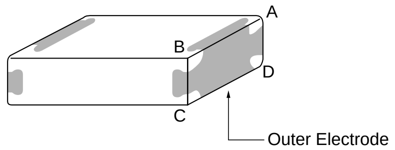
② Flow soldering :
After dipping the test sample with a pair of tweezers in wave solder (eutectic solder), check for leaching that may have occurred on the outer electrode.

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.

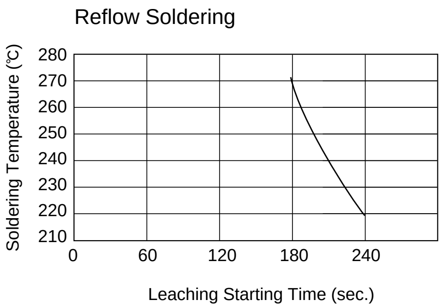
④ Flux to be used : An ethanol solution of 25% rosin.

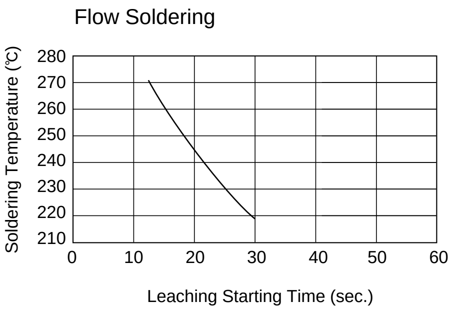
(2) Test samples
GRM21 : For flow/reflow soldering T=0.6mm

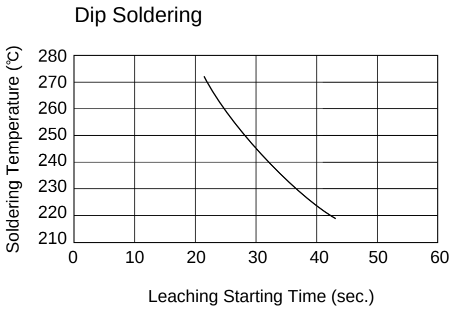
(3) Acceptance criteria
The starting time of leaching should be defined as the time when the outer electrode has lost 25% of the total edge length of A-B-C-D as illustrated :



(4) Results







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Reference Data

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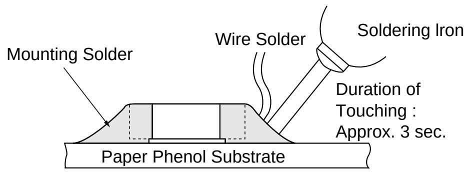
8. Thermal Shock when Making Corrections with a Soldering Iron

(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

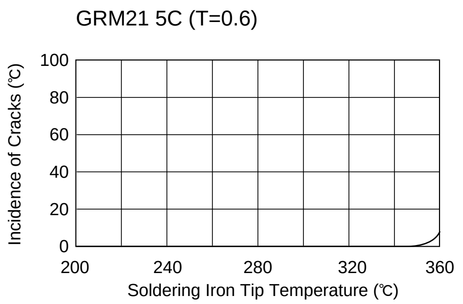
(2) Test Samples

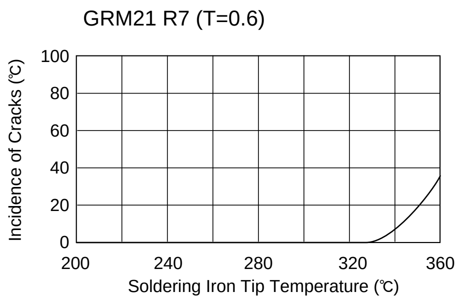
GRM21 5C/R7/F5 Characteristics T=0.6mm

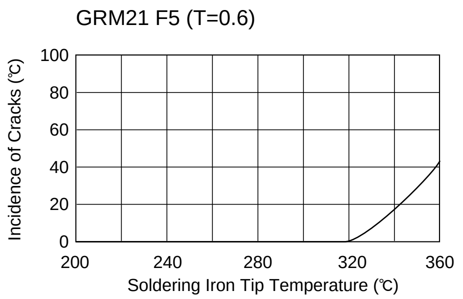
(3) Acceptance Criteria for Defects

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





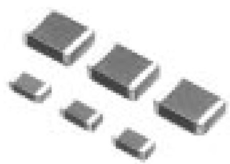


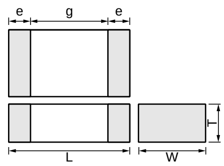
Chip Monolithic Ceramic Capacitors

Medium Voltage Low Dissipation Factor

■ Features

1. Murata's original internal electrode structure realizes high flash-over voltage.
2. A new monolithic structure for small, surface-mountable devices capable of operating at high voltage levels.
3. Sn-plated external electrodes realize good solderability.
4. Use the GRM31 type with flow or reflow soldering, and other types with reflow soldering only.
5. Low-loss and suitable for high frequency circuits.





Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GRM31A	3.2 ±0.2	1.6 ±0.2	1.0 +0,-0.3	0.3	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
GRM42D			2.0 ±0.3		

* GRM31A7U3D, GRM32A7U3D, GRM32B7U3D : 1.8mm min.

■ Applications

1. Ideal for use on high frequency pulse circuits such as snubber circuits for switching power supplies, DC-DC converters, ballasts (inverter fluorescent lamps), etc.
2. Ideal for use as the ballast in liquid crystal back lighting inverters.
3. Please contact our sales representatives or engineers before using our products for other applications not specified above.

SL/U2J Characteristics

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)
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.
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.

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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)
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.
GRM42D1X3F100JY02L	DC3150	SL (JIS)	10 ±5%	4.5	2.0	2.0	2.9	0.3 min.
GRM42D1X3F120JY02L	DC3150	SL (JIS)	12 ±5%	4.5	2.0	2.0	2.9	0.3 min.
GRM42D1X3F150JY02L	DC3150	SL (JIS)	15 ±5%	4.5	2.0	2.0	2.9	0.3 min.
GRM42D1X3F180JY02L	DC3150	SL (JIS)	18 ±5%	4.5	2.0	2.0	2.9	0.3 min.
GRM42D1X3F220JY02L	DC3150	SL (JIS)	22 ±5%	4.5	2.0	2.0	2.9	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.

Application Specific Products, C0G Characteristics

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.

Please contact us in case that the C0G char. DC3150V items are considered to use for the application which is not LCD back lighting inverters circuit.

Specifications and Test Methods

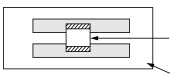
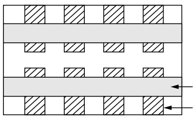
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td></td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></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>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 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 20℃ 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>C0G/U2J char. : 1,000 min.
SL char. : 400+20C*¹ min.</td></tr>
<tr><td>8</td><td colspan="2">Capacitance Temperature Characteristics</td><td>Temp. Coefficient
C0G char. :
0±30ppm/°C (Temp. Range : +25 to +125°C)
0+30, −72ppm/°C (Temp. Range : −55 to +25°C)
U2J char. :
−750±120 ppm/℃ (Temp. Range : +25 to +125℃)
−750+120, −347 ppm/℃ (Temp. Range : −55 to +25℃)
SL char. :
+350 to −1000 ppm/℃ (Temp. Range : +20 to +85℃)</td><td>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 (SL char. : +20 to +85°C) the capacitance should be within the specified tolerance for the temperature coefficient.
<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></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 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.


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 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>C0G/U2J char. : 1,000 min.
SL char. : 400+20C*¹ min.</td></tr>
</table>

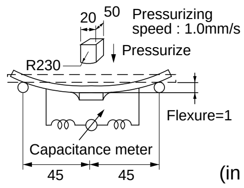
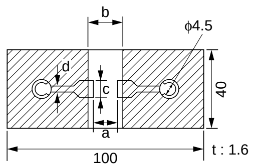
*¹ "C" expresses nominal capacitance value (pF).

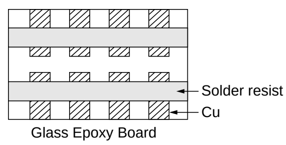
Continued on the following page. ↗

15

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 using a eutectic solder.
Then apply a force in the direction shown in Fig. 3.
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.

(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 rowspan="3">1.0</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></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 eutectic solder solution for 2±0.5 sec. at 235±5℃.
Immersing speed : 25±2.5mm/s</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 eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *1room condition for 24±2 hrs., then measure.
•Immersing speed : 25±2.5mm/s

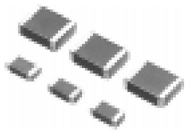
*Preheating for more than 3.2×2.5mm<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100℃ to 120℃</td><td>1 min.</td></tr><tr><td>2</td><td>170℃ to 200℃</td><td>1 min.</td></tr></table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5%</td></tr>
<tr><td>Q</td><td>C0G/U2J char. : 1,000 min.
SL char. : 400+20C*2 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 using a eutectic solder.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at *1room 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>C0G char. : 1,000 min.
U2J char. : 500 min.
SL char. : 400+20C*2 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 *1room condition, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5.0%</td></tr>
<tr><td>Q</td><td>C0G/U2J char. : 350 min.
SL char. : 275+5/2C*2 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 *1room 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>C0G/U2J char. : 350 min.
SL char. : 275+5/2C*2 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>

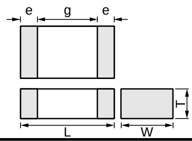
*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Chip Monolithic Ceramic Capacitors

muRata

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*

* GRM55DR73A : 2.5mm min.

■ 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 as a hot-cold coupling for DC-DC converter.
2. Ideal for use on line filters and ringer detectors for telephones, facsimiles and modems.
3. Ideal for use on diode-snubber circuits for switching power supplies.

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.

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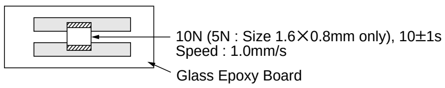
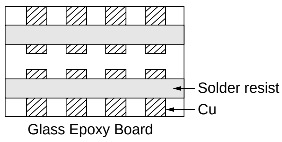
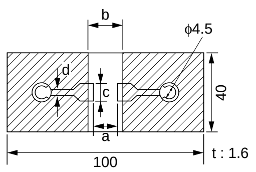
Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM31BR72J222KW01L	DC630	X7R (EIA)	2200pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J332KW01L	DC630	X7R (EIA)	3300pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J472KW01L	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.
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	2.5	0.3 min.

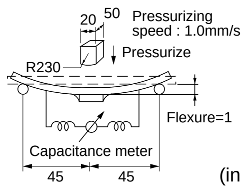
Specifications and Test Methods

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 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.
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 DC500±50V (DC250±50V in case of rated voltage : DC250V) and within 60±5 sec. of charging.
6	Capacitance	Within the specified tolerance	The capacitance/D.F. should be measured at 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.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.
7	Dissipation Factor (D.F.)	0.025 max.	
8	Capacitance Temperature Characteristics	Cap. Change Within ±15% (Temp. Range : −55 to +125℃)	The range of capacitance change compared with the 25℃ value within −55 to +125℃ should be within the specified range. •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 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.  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 3 mutually perpendicular directions (total of 6 hrs.). 
	Vibration Resistance — Capacitance	Within the specified tolerance	
	Vibration Resistance — D.F.	0.025 max.	
11	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 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. 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. (See Fig. 3)



L×W (mm)	Dimension (mm) a	b	c	d
1.6×0.8	1.0	3.0	1.2	1.0
2.0×1.25	1.2	4.0	1.65	
3.2×1.6	2.2	5.0	2.0	
3.2×2.5	2.2	5.0	2.9	
4.5×3.2	3.5	7.0	3.7	
5.7×5.0	4.5	8.0	5.6	

Fig. 2



(in mm)

Fig. 3

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

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Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method
12	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 eutectic solder solution for 2±0.5 sec. at 235±5℃. Immersing speed : 25±2.5mm/s
13	Resistance to Soldering Heat	Appearance	No marking defects	Preheat the capacitor at 120 to 150℃* for 1 min. Immerse the capacitor in eutectic 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 Step / Temperature / Time 1 / 100℃ to 120℃ / 1 min. 2 / 170℃ to 200℃ / 1 min.
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	C≧0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ	
		Dielectric Strength	In accordance with item No.4	
14	Temperature Cycle	Appearance	No marking defects	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. 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. 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 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 ±7.5%	
		D.F.	0.025 max.	
		I.R.	C≧0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ	
		Dielectric Strength	In accordance with item No.4	
15	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.	C≧0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	
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	

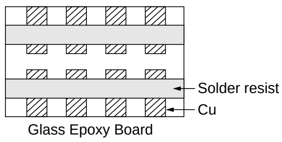

Fig. 4

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

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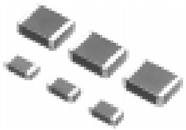
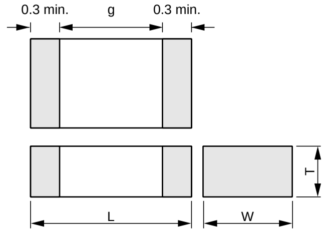
Chip Monolithic Ceramic Capacitors

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	

■ Features

1. These items are designed specifically for telecommunication devices (IEEE802.3) in Ethernet LAN.
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

Ideal for use on telecommunication devices in Ethernet LAN.

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.

Specifications and Test Methods

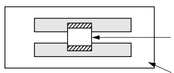
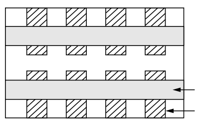
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>−55 to +125℃</td><td>−</td></tr>
<tr><td>2</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></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 break downs 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 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.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>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 range of capacitance change compared with the 25℃ value within the specified range.
•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 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.


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 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>

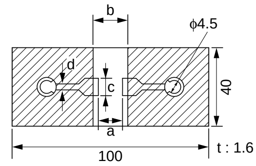
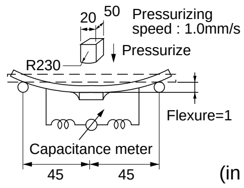
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

Continued on the following page.

17

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">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>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="2">1.0</td></tr>
<tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
</table>
Fig. 2</td><td>Solder the capacitor to the testing 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 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.

(in mm)
Fig. 3</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 eutectic solder solution for 2±0.5 sec. at 235±5℃.
Immersing speed : 25±2.5mm/s</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 as table.
Immerse the capacitor in eutectic 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 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">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 using a eutectic solder.
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.

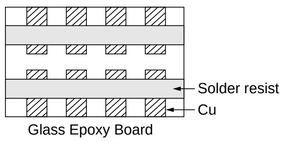



Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Humidity (Steady State)</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>
</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
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	

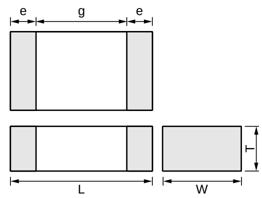
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

Chip Monolithic Ceramic Capacitors

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

■ 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 0.1 uF for connecting lines and 470 to 4700 pF for connecting lines to earth.



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		

■ 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	2.5	0.3 min.

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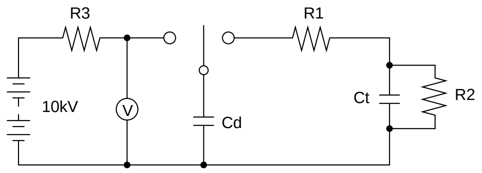
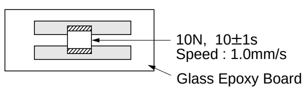
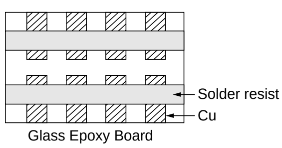
Specifications and Test Methods

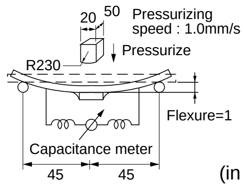
No.	Item		Specifications	Test Method
1	Operating Temperature Range		−55 to +125℃	—
2	Appearance		No defects or abnormalities	Visual inspection
3	Dimensions		Within the specified dimensions	Using calipers
4	Dielectric Strength		No defects or abnormalities	No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. Nominal Capacitance / Test voltage C≧10,000pF / AC575V (r.m.s.) C<10,000pF / AC1500V (r.m.s.)
5	Insulation Resistance (I.R.)		More than 2,000MΩ	The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.
6	Capacitance		Within the specified tolerance	The capacitance/D.F. should be measured at 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.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.
7	Dissipation Factor (D.F.)		0.025 max.	
8	Capacitance Temperature Characteristics		Cap. Change Within ±15% (Temp. Range : −55 to +125℃)	The range of capacitance change compared with the 25℃ value within −55 to +125℃ should be within the specified range. •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	Discharge Test (Application: Nominal Capacitance C<10,000pF)	Appearance	No defects or abnormalities	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
10	Adhesive Strength of Termination		No removal of the terminations or other defects should occur.	Solder the capacitor to the testing 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.  Fig. 1
11	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 3 mutually perpendicular directions (total of 6 hrs.). 
		Capacitance	Within the specified tolerance	
		D.F.	0.025 max.	

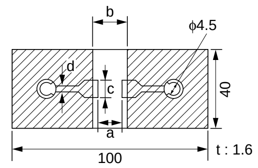
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

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">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 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. 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.


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

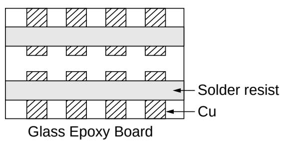
<table>
<tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="3">1.0</td></tr>
<tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>5.7×5.0</td><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 eutectic solder solution for 2±0.5 sec. at 235±5℃.
Immersing speed : 25±2.5mm/s</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 eutectic 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 using a eutectic solder.
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

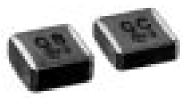
Safety Standard Recognized Type GC (UL, IEC60384-14 Class X1/Y2)

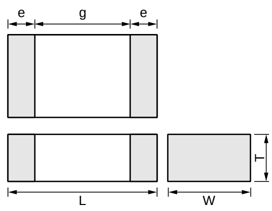
■ Features

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





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

■ 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.

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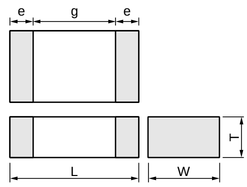
Chip Monolithic Ceramic Capacitors

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

■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. The type GD can be used as a Y3-class capacitor.
3. Available for equipment based on IEC/EN60950 and UL1950.
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.
GA342D	4.5 ±0.3	2.0 ±0.2	2.0 ±0.2*	0.3	2.5
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		

* GA342D1X : 2.0±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	Rated Voltage
			Type GD	
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.
GA342D1XGD270JY02L	AC250 (r.m.s.)	SL (JIS)	27 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD330JY02L	AC250 (r.m.s.)	SL (JIS)	33 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD390JY02L	AC250 (r.m.s.)	SL (JIS)	39 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD470JY02L	AC250 (r.m.s.)	SL (JIS)	47 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD560JY02L	AC250 (r.m.s.)	SL (JIS)	56 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD680JY02L	AC250 (r.m.s.)	SL (JIS)	68 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD820JY02L	AC250 (r.m.s.)	SL (JIS)	82 ±5%	4.5	2.0	2.0	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

muRata

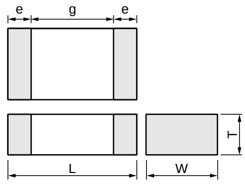
Safety Standard Recognized Type GF (IEC60384-14 Class Y2, X1/Y2)

■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. The type GF can be used as a Y2-class capacitor.
3. 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.
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.
GA342D	4.5 ±0.3	2.0 ±0.2	2.0 ±0.2*	0.3	2.5
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, Size : 4.5×2.0mm	Status of Recognition: Type GF, Size : 5.7×2.8mm and over	Rated Voltage
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	◎	◎

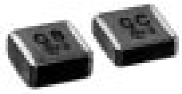
Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GA342D1XGF100JY02L	AC250 (r.m.s.)	SL (JIS)	10 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF120JY02L	AC250 (r.m.s.)	SL (JIS)	12 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF150JY02L	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.
GA342D1XGF270JY02L	AC250 (r.m.s.)	SL (JIS)	27 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF330JY02L	AC250 (r.m.s.)	SL (JIS)	33 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF390JY02L	AC250 (r.m.s.)	SL (JIS)	39 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF470JY02L	AC250 (r.m.s.)	SL (JIS)	47 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF560JY02L	AC250 (r.m.s.)	SL (JIS)	56 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF680JY02L	AC250 (r.m.s.)	SL (JIS)	68 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF820JY02L	AC250 (r.m.s.)	SL (JIS)	82 ±5%	4.5	2.0	2.0	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.

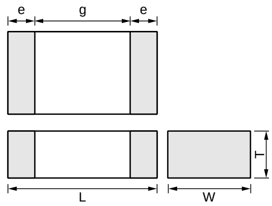
Chip Monolithic Ceramic Capacitors

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

■ Features
1. 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 GB can be used as an X2-class capacitor.
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		

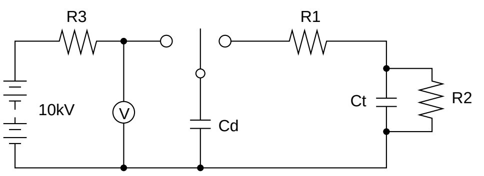
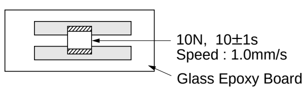
■ Standard Recognition

	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

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 voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. (Test voltage) Type GB: DC1075V; Type GC/GD/GF: AC1500V (r.m.s.)
5	Pulse Voltage (Application: Type GD/GF)	No self healing break downs or flash-overs have taken place in the capacitor.	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
6	Insulation Resistance (I.R.)	More than 6,000MΩ	The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.
7	Capacitance	Within the specified tolerance	The capacitance/Q/D.F. should be measured at 20℃ at a frequency of 1±0.2kHz (SL char. : 1±0.2MHz) and a voltage of AC1±0.2V (r.m.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 *1room condition.
8	Dissipation Factor (D.F.) Q	Char. X7R: Specification D.F.≦0.025 Char. SL: Q≧400+20C*2 (C<30pF); Q≧1000 (C≧30pF)	(see item 7)
9	Capacitance Temperature Characteristics	Char. X7R: Capacitance Change Within ±15% Temperature characteristic guarantee is −55 to +125℃ Char. SL: Temperature Coefficient +350 to -1000ppm/℃ Temperature characteristic guarantee is +20 to +85℃	The range of capacitance change compared with the 25℃ (SL char. : 20℃) value within −55 to +125℃ should be within the specified range. •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 *1room condition.
10	Discharge Test (Application: Type GC) — Appearance	No defects or abnormalities	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
	I.R.	More than 1,000MΩ	
	Dielectric Strength	In accordance with item No.4	
11	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 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.  Fig. 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.

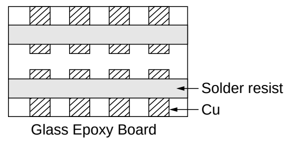
GA3 Series Specifications and Test Methods

Continued from the preceding page.

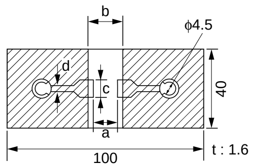
No.	Item		Specifications	Test Method
12	Vibration Resistance	Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the 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 3 mutually perpendicular directions (total of 6 hrs.).
		Capacitance	Within the specified tolerance	
		D.F. Q	(see table below)	
13	Deflection		No cracking or marking defects should occur.	Solder the capacitor to the testing 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 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.
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 eutectic solder solution for 2±0.5 sec. at 235±5℃. Immersing speed : 25±2.5mm/s
15	Resistance to Soldering Heat	Appearance	No marking defects	Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *1room condition 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 *1room condition.
		Capacitance Change	(see table below)	
		I.R.	More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	

Item 12, D.F. Q:

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

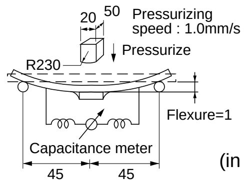


Item 13:



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

Item 15, Capacitance Change:

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.

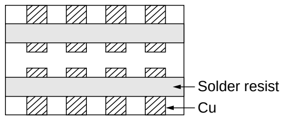
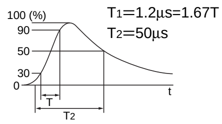
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at *1room 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 for X7R char.
Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.


Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td><table>
<tr><th>Char.</th><th>Capacitance Change</th></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>SL</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</td></tr>
</table></td></tr>
<tr><td>D.F.
Q</td><td><table>
<tr><th>Char.</th><th>Specification</th></tr>
<tr><td>X7R</td><td>D.F.≦0.05</td></tr>
<tr><td>SL</td><td>Q≧400+20C*2 (C<30pF)
Q≧1000 (C≧30pF)</td></tr>
</table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></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±12 hrs.
Remove and let sit for 24±2 hrs. at *1room condition, 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 *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table>
<tr><th>Char.</th><th>Capacitance Change</th></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>SL</td><td>Within ±5.0% or ±0.5pF
(Whichever is larger)</td></tr>
</table></td></tr>
<tr><td>D.F.
Q</td><td><table>
<tr><th>Char.</th><th>Specification</th></tr>
<tr><td>X7R</td><td>D.F.≦0.05</td></tr>
<tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)
Q≧350 (C≧30pF)</td></tr>
</table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</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">Impulse Voltage
Each individual capacitor should be subjected to a 2.5kV (Type GC/GF : 5kV) Impulses (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.


Apply voltage as Table for 1,000 hrs. at 125^{+3}_{-0}℃, relative humidity 50% max.
<table>
<tr><th>Type</th><th>Applied voltage</th></tr>
<tr><td>GB</td><td>AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr>
<tr><td>GC
GD
GF</td><td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr>
</table>
Let sit for 24±2 hrs. at *1room condition, 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 *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table>
<tr><th>Char.</th><th>Capacitance Change</th></tr>
<tr><td>X7R</td><td>Within ±20%</td></tr>
<tr><td>SL</td><td>Within ±3.0% or ±0.3pF
(Whichever is larger)</td></tr>
</table></td></tr>
<tr><td>D.F.
Q</td><td><table>
<tr><th>Char.</th><th>Specification</th></tr>
<tr><td>X7R</td><td>D.F.≦0.05</td></tr>
<tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)
Q≧350 (C≧30pF)</td></tr>
</table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</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.

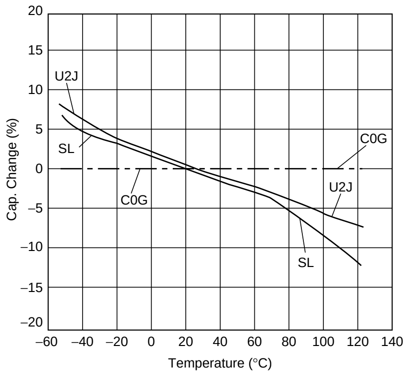
No.	Item		Specifications	Test Method
19	Humidity Loading	Appearance	No marking defects	Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{-0}$ hrs. Remove and let sit for 24±2 hrs. at *1room condition, then measure. •Pretreatment for X7R char. Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.
		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	

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

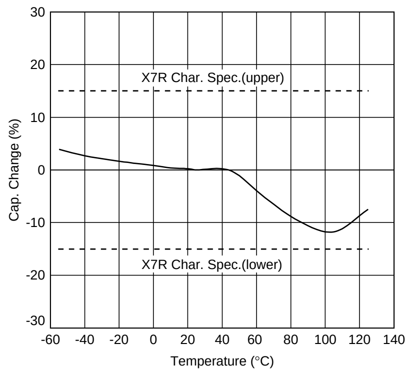
GRM/GR4/GA2/GA3 Series Data (Typical Example)

■ Capacitance-Temperature Characteristics

C0G/U2J/SL Characteristics

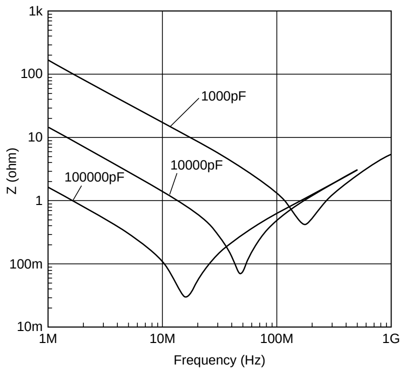


X7R Characteristics

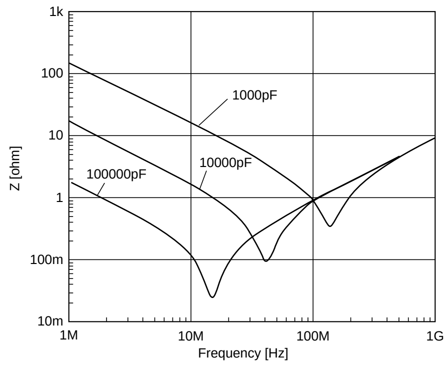


■ Impedance-Frequency Characteristics

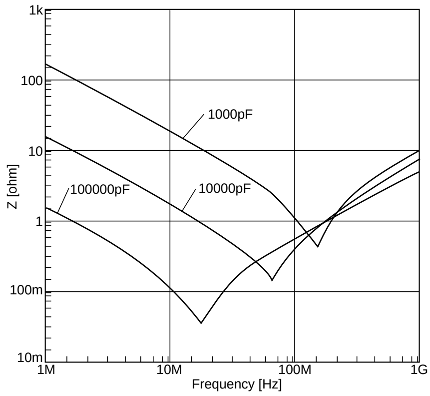
GRM Series (X7R Char. 250V)



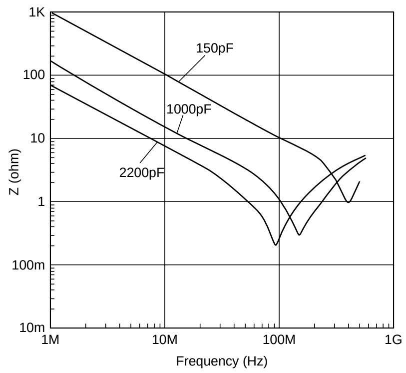
GRM Series (X7R Char. 630V)



GA2 Series



GA3 Series (Type GD)



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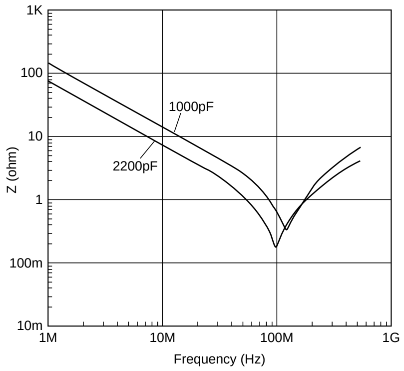
GRM/GR4/GA2/GA3 Series Data (Typical Example)

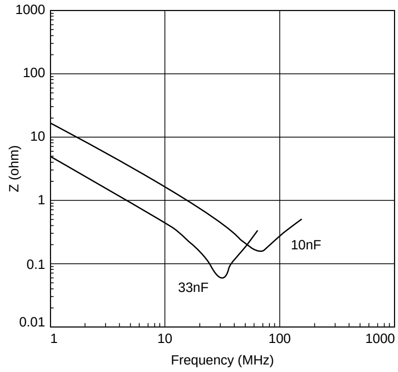
Continued from the preceding page.

■ Impedance-Frequency Characteristics

GA3 Series (Type GF)

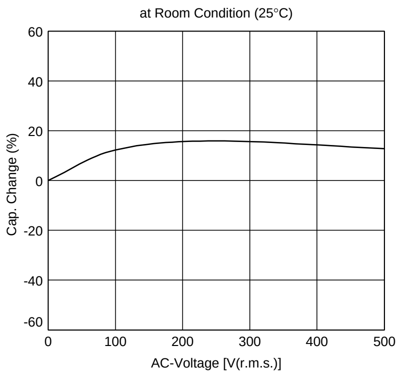


GA3 Series (Type GB)

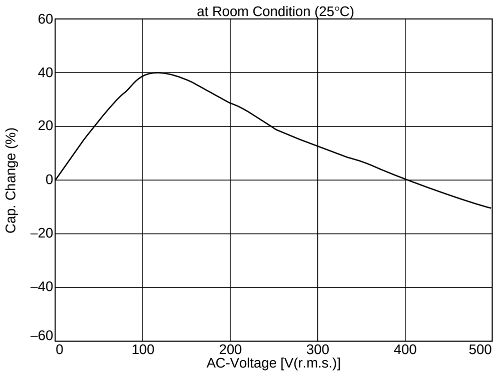


■ Capacitance-AC Voltage Characteristics

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



GA3 Series (Type GB)



Package

Taping is standard packaging method.

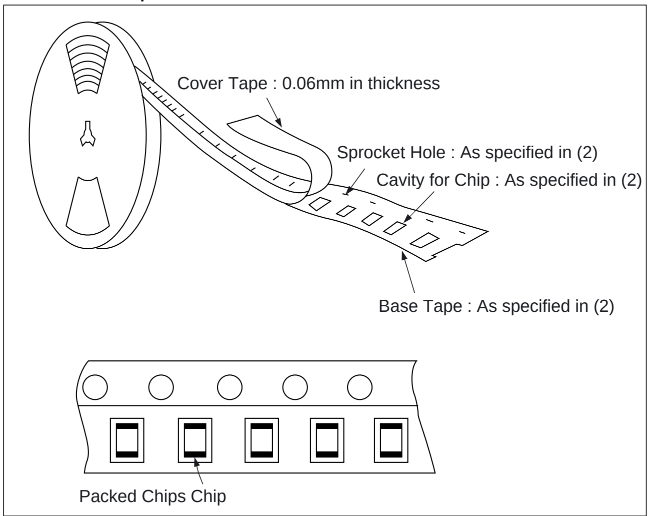
■ Minimum Quantity Guide

Part Number		Dimensions (mm) L	W	T	Quantity (pcs.) φ180mm reel Paper Tape	Plastic 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	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	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	1.5	-	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

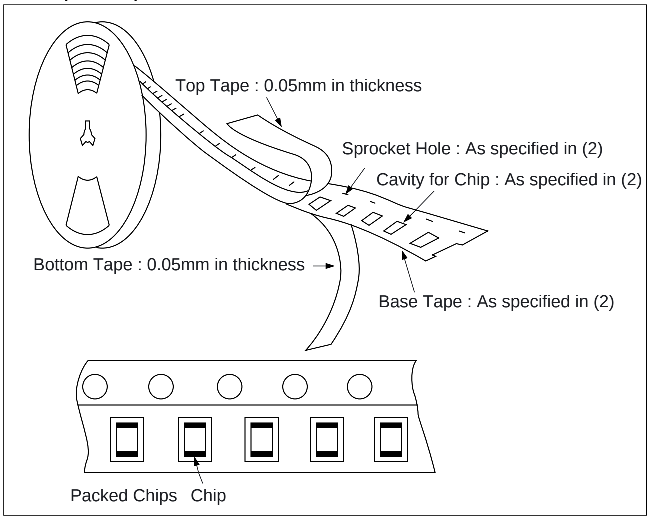
■ Tape Carrier Packaging

(1) Appearance of Taping

① Plastic Tape



② Paper Tape



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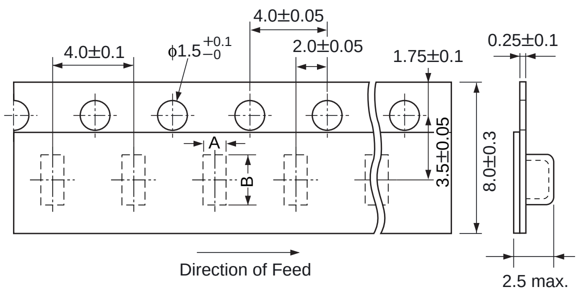
Package

Continued from the preceding page.

(2) Dimensions of Tape

① Plastic Tape

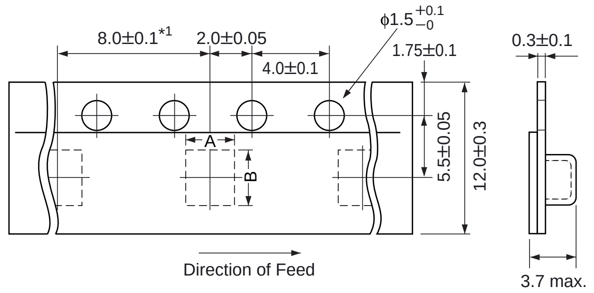
8mm width 4mm pitch Tape



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

*Nominal Value

12mm width 8mm/4mm pitch Tape



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/GA255/GA355	5.4	6.1

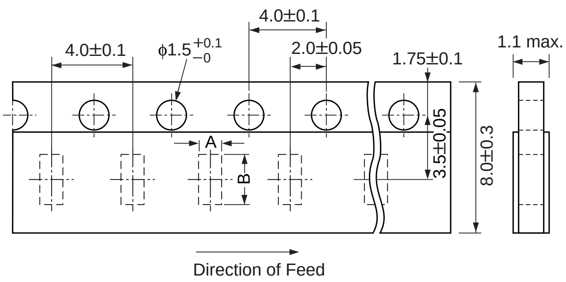
*1 4.0±0.1mm in case of GRM42/GR442/GA242/GA342

*Nominal Value

(in mm)

② Paper Tape

8mm width 4mm pitch Tape

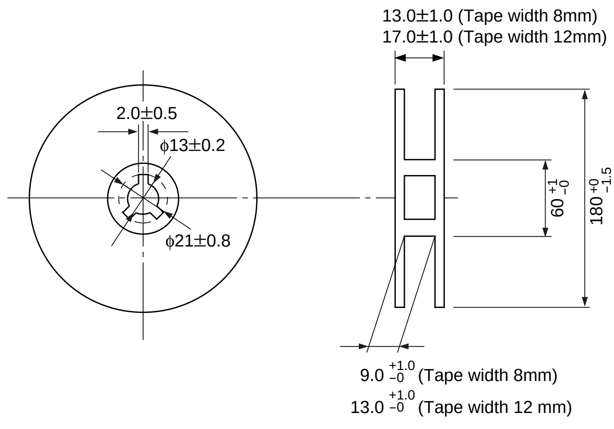


Part Number	A*	B*
GRM18	1.05	1.85
GRM21 (T=1.0mm)	1.45	2.25
GRM31 (T=1.0mm)	2.0	3.6

*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 shall be attached to the end of the tape as shown at right.

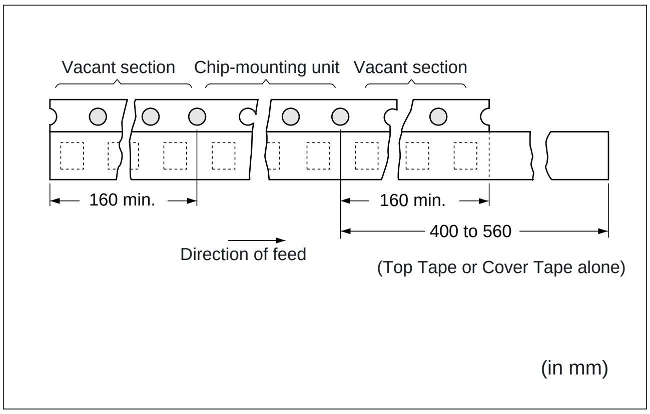
③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

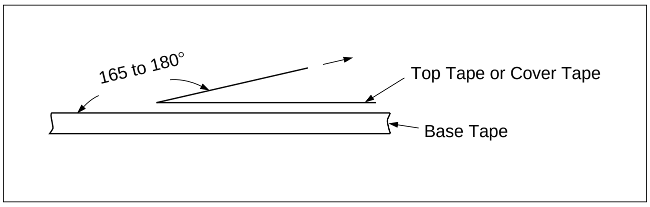
④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

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

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

⑦ Peeling off force : 0.1 to 0.7N 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. 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.

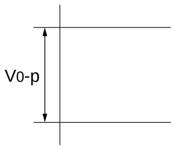
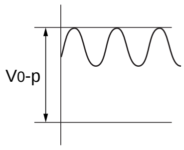
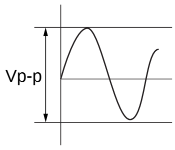
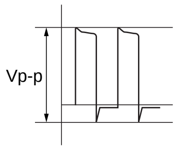
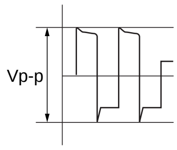
FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

⚠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					

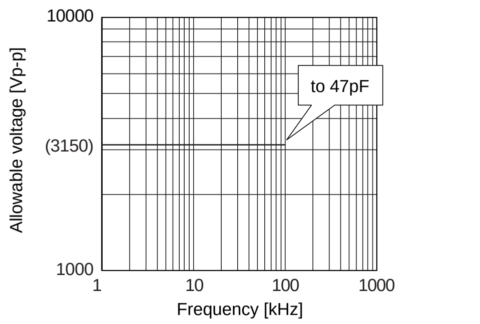
2. Operating Temperature and Self-generated Heat

(1) In case of X7R char.
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 current, pulse current or the like, it may have the self-generated heat due to dielectric-loss.
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.)

(2) In case of C0G char.
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 current, pulse current or similar current, it may self-generate heat due to dielectric loss.
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.
In case of non-sine wave which include a harmonic frequency, please contact our sales representatives or product engineers. 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.)

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

C0G char., Rated Voltage: DC3.15kV



The sine-wave frequency VS allowable voltage

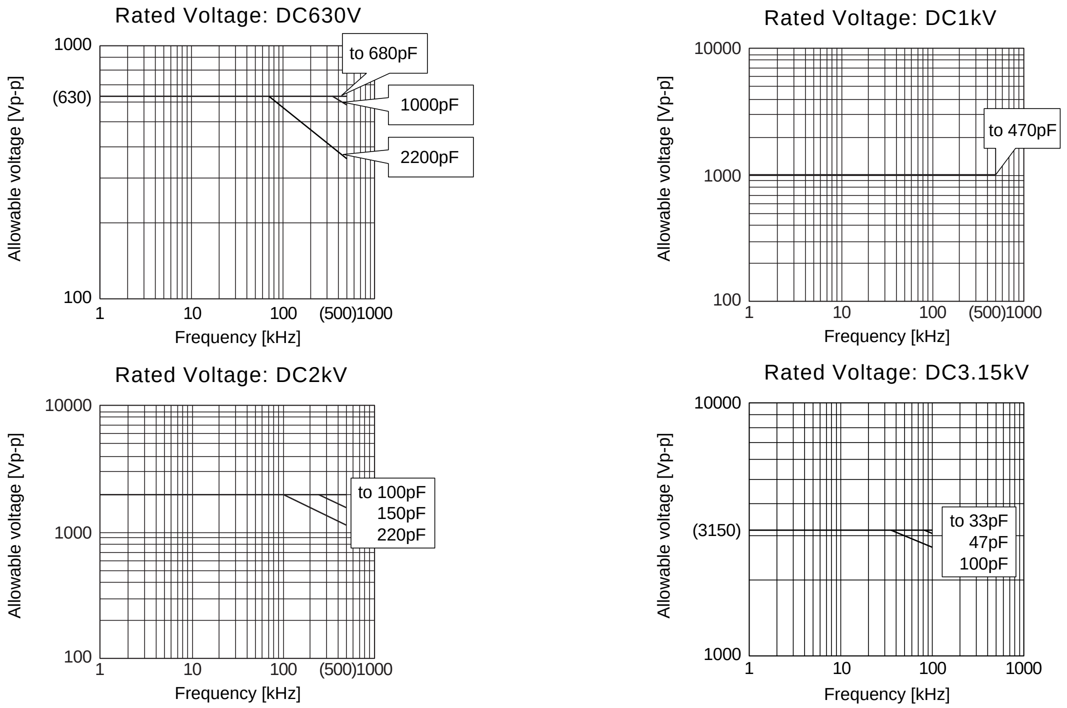
Continued on the following page.

⚠Caution

Continued from the preceding page.

(3) In case of U2J char.
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 current, pulse current or similar current, it may self-generate heat due to dielectric loss.
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.
In case of non-sine wave which include a harmonic frequency, please contact our sales representatives or product engineers. 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.)

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

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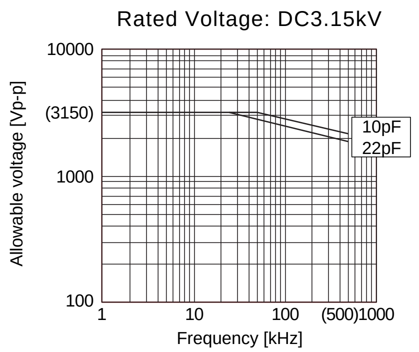
(4) In case of GRM series SL char.

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 current, pulse current or similar current, it may self-generate heat due to dielectric loss.
The frequency of the applied sine wave voltage should be less than 500kHz. The applied voltage should be less than the value shown in figure at right.
In case of non-sine wave which include a harmonic frequency, please contact our sales representatives or product engineers. 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.)

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



The sine-wave frequency VS allowable voltage

3. Test condition for AC withstanding Voltage

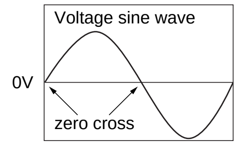
(1) Test Equipment

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 -



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⚠Caution

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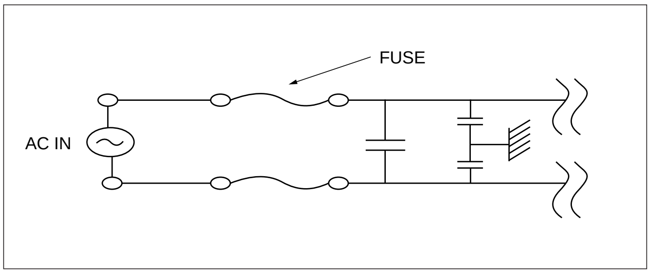
4. Fail-safe

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.



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.

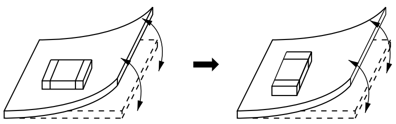
■ Caution (Soldering and Mounting)

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

2. Circuit Board Material
   In case that chip size is 4.5×3.2mm or more, a metal-board or metal-frame such as Aluminum board is not available because soldering heat causes expansion and shrinkage of a board or frame, which will cause a chip to crack.

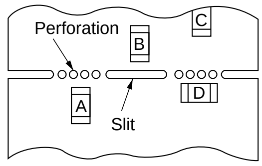
3. Land Layout for Cropping PC Board
   Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[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

4. Soldering
   If a chip component is heated or cooled abruptly during soldering, it may crack due to the thermal shock. To prevent this, follow our recommendations below for adequate soldering conditions. Carefully perform pre-heating so that temperature difference (ΔT) between the solder and component surface is in the following range. The smaller the temperatures difference (ΔT) between the solder and component surface is, the smaller the influence on the chip is. When components are immersed in solvent after mounting, please set the slow cooling process to keep the temperature difference within 100°C.

Soldering Method \ Chip Size	3.2×1.6mm and under	3.2×2.5mm and over
Reflow Method or Soldering Iron Method	ΔT≦190°C	ΔT≦130°C
Flow Method or Dip Soldering Method	ΔT≦150°C	——

5. Soldering Iron
   When soldering chips with a soldering iron, it should be performed in following conditions.
   And pre-heating shown in clause 4.

Item	Conditions	
Chip Size	≦2.0×1.25mm	≧3.2×1.6mm
Temperature of Iron tip	300°C max.	270°C max.
Soldering Iron Wattage	20W max.	
Diameter of Iron tip	ϕ 3.0mm max.	
Soldering Time	3 sec. max.	
Caution	Do not allow the iron tip to directly touch the ceramic element.	

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.

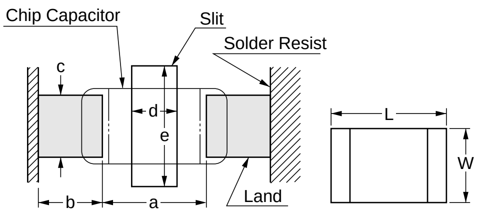
Notice

■ 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

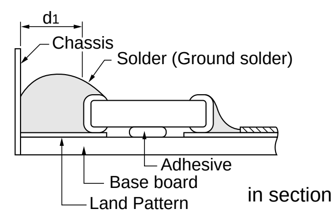
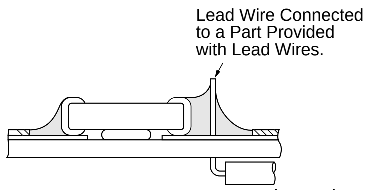
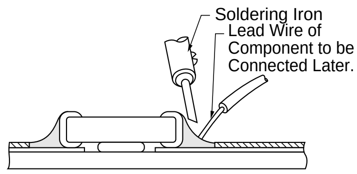
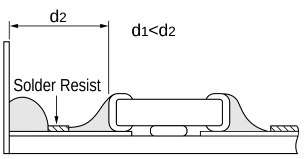
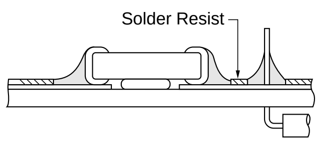
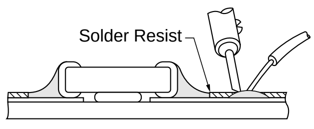
Flow soldering : 3.2×1.6 or less available.

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 Arrangements to be Avoided	 in section	 in section	 in section
Examples of Improvements by the Land Division	 in section	 in section	 in section

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2. Mounting of Chips

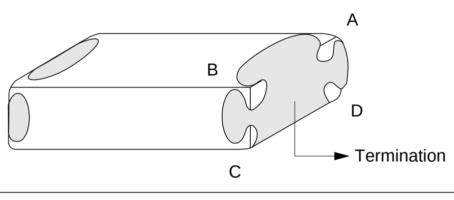
- Thickness of adhesives applied
  Keep thickness of adhesives applied (50-105µm or more) to reinforce the adhesive contact considering the thickness of the termination or capacitor (20-70µm) and the land pattern (30-35µm).

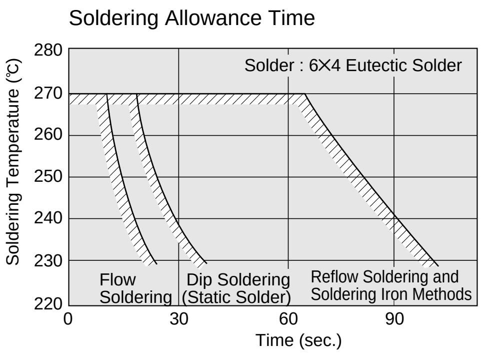
- Mechanical shock of the chip placer
  When the positioning claws and pick-up nozzle are worn, the load is applied to the chip while positioning is concentrated in one position, thus causing cracks, breakage, faulty positioning accuracy, etc.
  Careful checking and maintenance are necessary to prevent 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.
In case of repeated soldering, the accumulated soldering time must be within the range shown at right.





(2) Flux

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

(3) Solder Amount

① Flow soldering and iron soldering
Use as little solder as possible, and confirm that the solder is securely placed.

Continued on the following page.

Notice

Continued from the preceding page.

② Reflow soldering
When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations.

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

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.
The chip crack might be caused at the cool and heat cycle by bias of the amount of spreading of the resin and spreading thickness.
The resin for the coating and molding must use the thing that as the stress when stiffening is small, and the hygroscopic is as 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 a 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 characteristic.
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.

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   ① Aircraft equipment ② Aerospace equipment
   ③ Undersea equipment ④ Power plant equipment
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   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 in the above
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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.
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