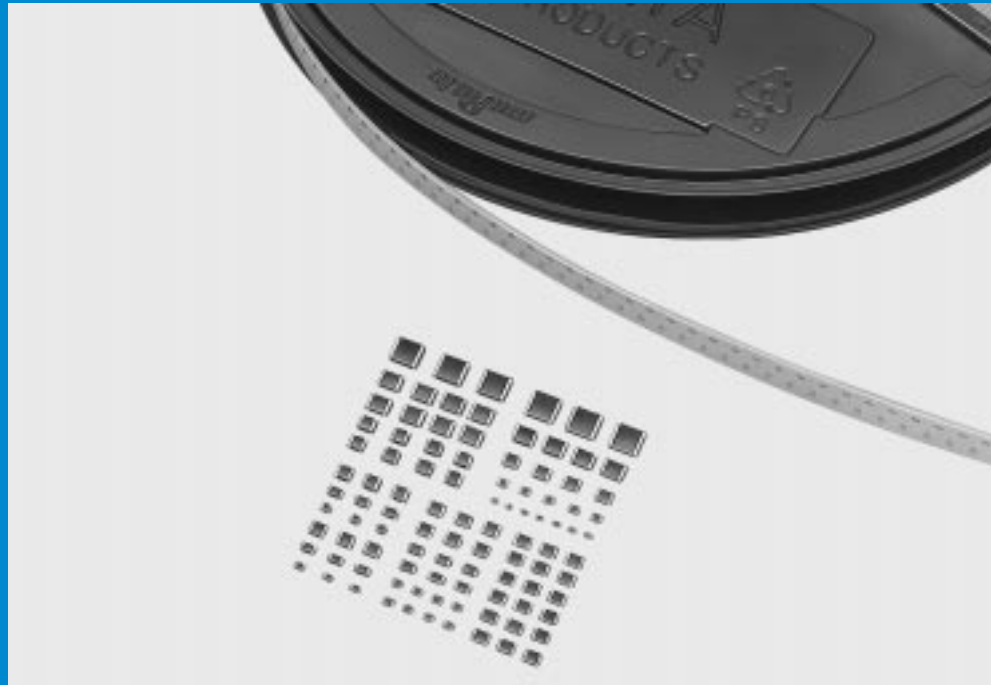




Chip Monolithic Ceramic Capacitor

CHIP MONOLITHIC CERAMIC CAPACITOR



*Innovator
in Electronics*

Murata
Manufacturing Co., Ltd.

Cat.No.C02E-3

Chip Monolithic Ceramic Capacitor

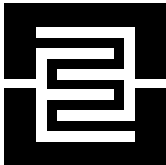
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Chip Monolithic Ceramic Capacitor Product Guide

Chip Monolithic Ceramic Capacitor

Applications	Series	Type	Rated Voltage (VDC)	Soldering Method	
General electronic equipment	Nickel barriered termination type GRM series	GRM36—GRM44-1	10/16/25/50	GRM39—GRM42-6 Flow and reflow soldering	
		GRM39—GRM44-1	100/200/500	GRM36, GRM42-2— GRM44-1 Reflow soldering	
	Low distortion GRM400 series	GRM420—GRM430	16/50	Flow and reflow soldering	
	Thin type GRM series	GRM40-024 GRM42-625	16/25/50	Flow and reflow soldering	
Smoothing circuit	Silver termination type GR series	GR36—GR44-1	16/25/50/ 100/200/500	Silver epoxy conductive adhesive	
	Smoothing GRM200 series	GRM220—GRM235	10/16/25	Reflow soldering	
	High-frequency and high-power circuits	High-frequency GRH/RPN700 series	GRH706—GRH710 RPN710	50/100/200	GRH706/GRH708/ GRH110 Flow and reflow soldering
		HiQ and high-power GRH/RPN100 series	GRH110/GRH111 RPN110/RPN111	50/100/200/ 300/500	GRH710/GRH111 Reflow soldering
High voltage	GR500 series	GR530—GR580	500/1k/2k/ 3.15k/4k	RPN710/RPN110/ RPN111 Reflow soldering and Soldering iron	
High voltage	Low dissipation GHM1000 series	GHM1030	630	Reflow soldering	
		GHM1038 GHM1040	2k/3.15k	Reflow soldering	
	High-capacitance/ general electrical equipment GHM1500 series	GHM1525 GHM1530	250/630	Flow and reflow soldering	
AC-rated	GHM2000 series	GHM1535—GHM1545	250/630	Reflow soldering	
		GHM2143—GHM2243	250VAC	Reflow soldering	



MONOLITHIC CERAMIC CAPACITOR



Nickel Barriered Termination Type

GRM Series for General Electronic Equipment

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, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0Δ to Y5V.
3. A wide selection of sizes is available, from the miniature GRM36 (LXWXT : 1.0X0.5X0.5mm) to the larger sized GRM44-1 (LXWXT : 5.7X5.0X2.0mm). GRM39, GRM40 and GRM42-6 types are suited to flow and reflow soldering. GRM36, GRM42-2 and larger types are suited to reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placements on PCBs.
5. The GRM series is available in both paper and plastic embossed tape and reel packaging for automatic placement. Bulk case packaging is also available. (GRM 36, GRM39, GRM40 (T : 0.6, 1.25))

APPLICATION

General electronic equipment.

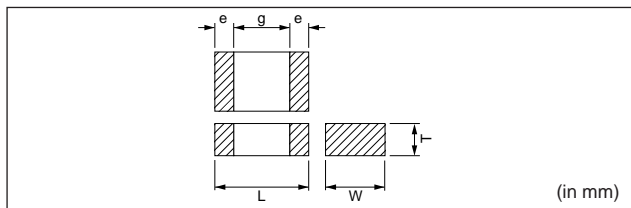
PART NUMBERING

(*Please specify the part number when ordering)



- ① Type
- ② Temperature Characteristics
- ③ Capacitance
- ④ Capacitance Tolerance
- ⑤ Rated Voltage
- ⑥ Murata's Control No.
- ⑦ Packaging

TYPE AND DIMENSIONS



Type (EIA Code)	L	W	T	e	g min.
GRM36 (0402)	1.0±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4
GRM39* (0603)	1.6±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
GRM40 (0805)	2.0±0.1	1.25±0.1	0.6 ±0.1	0.2 to 0.7	0.7
			0.85±0.1		
			1.25±0.1		
GRM42-6 (1206)	3.2±0.15	1.6 ±0.15	0.85±0.1	0.3 to 0.8	1.5
			1.15±0.1		
			1.6 ±0.2		
GRM42-2 (1210)	3.2±0.3	2.5 ±0.2	1.15±0.1	0.3min.	1.0
			1.35±0.15		
GRM43-2 (1812)	4.5±0.4	3.2 ±0.3	2.0 max.	0.3min.	2.0
GRM44-1 (2220)	5.7±0.4	5.0 ±0.4	2.0 max.	0.3min.	2.0

*Bulk case packaging is L=1.6±0.07, W,T=0.8±0.07



TEMPERATURE CHARACTERISTICS

- Temperature Compensating Type

Code	C0G	C0H	P2H	R2H	S2H	T2H	U2J	SL
Temp. range	-55 to 125°C			-55 to 85°C				
Temp. coeff. (ppm/°C)	0±30	0±60	-150±60	-220±60	-330±60	-470±60	-750±120	+350 to -1000

- High Dielectric Constant Type

Code	X5R	X7R	Z5U	Y5V
Temp. range	-55 to 85°C	-55 to 125°C	+10 to 85°C	-30 to 85°C
Cap. change (%)	±15	±15	+22 -56	+22 -82

CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	100	10
R75	0.75	101	100
010	1	103	10000

CAPACITANCE TOLERANCE

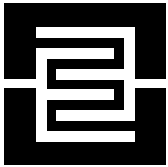
Code	Tol.	Capacitance range
C	±0.25pF	10pF and below
D	±0.5 pF	
J	±5 %	More than 10pF
K	±10%	
M	±20%	
Z	+80%	
	-20%	

RATED VOLTAGE

Code	Rated voltage (VDC)
10	10
16	16
25	25
50	50
100	100
200	200
500	500

PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging
PC	Bulk case packaging



MONOLITHIC CERAMIC CAPACITOR

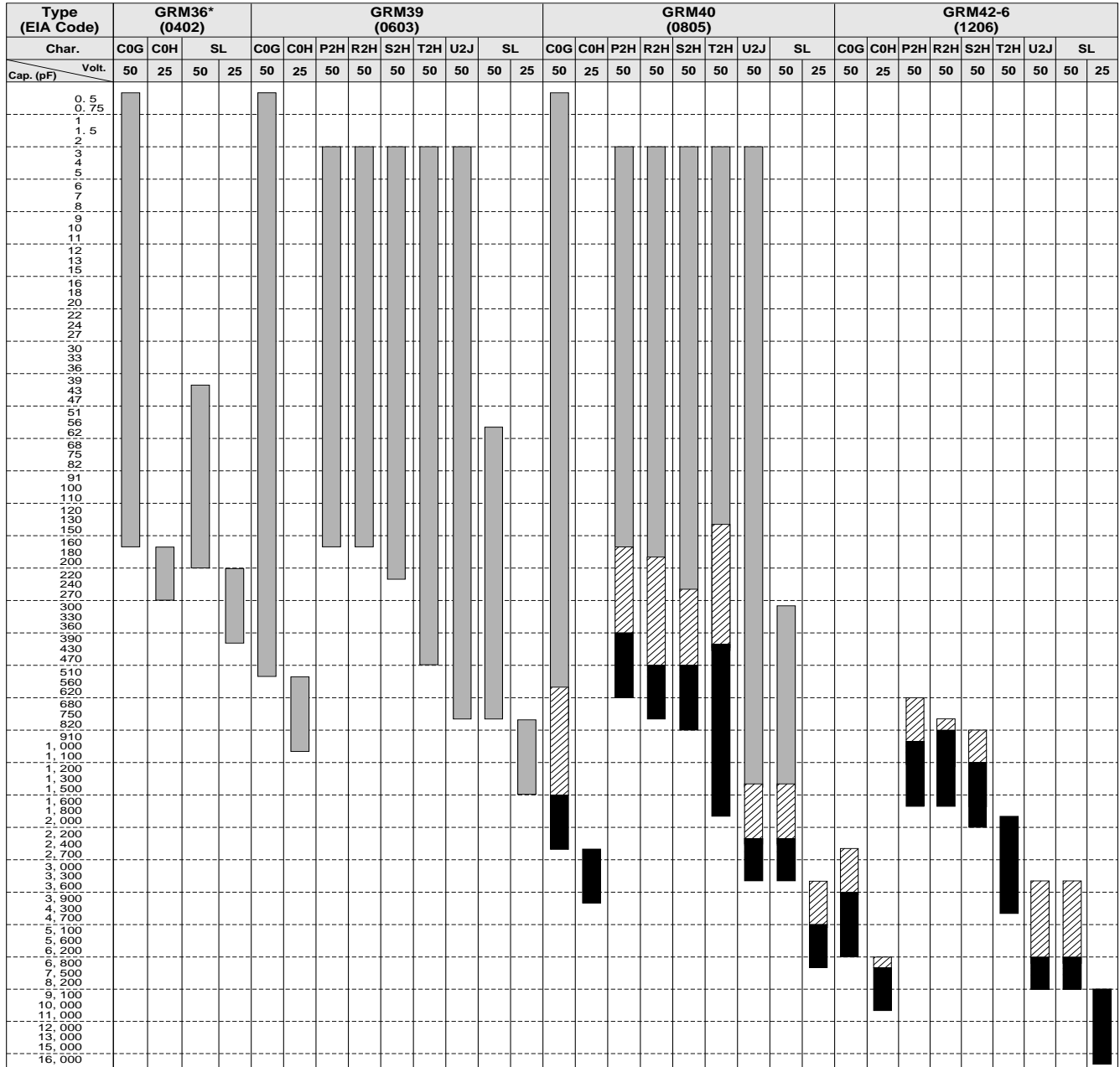


Nickel Barrired Termination Type

GRM Series for General Electronic Equipment

CAPACITANCE RANGE TABLE FOR FLOW AND REFLOW SOLDERING

Temperature Compensating Type 50V/25V



*GRM36 is suited to only reflow soldering.

CAPACITANCE TOLERANCE

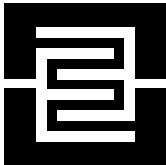
5pF and below	C : ±0.25pF
6pF and over, 10pF and below	D : ±0.5pF
More than 10pF	J : ±5%

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*1	Bulk Case (pcs./case)
GRM36	0.5 ±0.05	1,000	10,000	50,000
GRM39	0.8 ±0.1*2	1,000	4,000	15,000
GRM40	0.6 ±0.1	1,000	4,000	10,000
	0.85±0.1	1,000	4,000	—
	1.25±0.1	1,000	3,000	5,000
GRM42-6	0.85±0.1	1,000	4,000	—
	1.15±0.1	1,000	3,000	—

*1 φ330mm reel is available on request.

*2 Bulk case packaging is T=0.8±0.07



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

GRM Series for General Electronic Equipment

FOR FLOW AND REFLOW SOLDERING

High Dielectric Constant Type

50V/25V/16V/10V

Type (EIA Code)	GRM36* (0402)						GRM39 (0603)						GRM40 (0805)						GRM42-6 (1206)											
	Char.		X7R		X5R		Y5V		X7R		Z5U		Y5V		X7R		Z5U		Y5V		X7R		X5R		Z5U		Y5V			
Cap. (pF)	50	25	16	16	50	25	16	50	25	16	10	50	50	25	16	10	50	25	16	10	50	25	16	10	10	50	50	25	16	
220	■							■									■													
270	■							■									■													
330	■							■									■													
390	■							■									■													
470	■							■									■													
560	■							■									■													
680	■							■									■													
820	■							■									■													
1,000	■							■									■													
1,200	■							■									■													
1,500	■							■									■													
1,800	■							■									■													
2,200	■							■									■													
2,700	■							■									■													
3,300	■							■									■													
3,900	■							■									■													
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1,500,000	■							■									■													
2,200,000	■							■									■													
3,300,000	■							■									■													
4,700,000	■							■									■													

* GRM36 series is suited to only reflow soldering.
 *1 Base metal inner electrode type (T : 0.85±0.1mm) is also available.
 *2 Base metal inner electrode
 *3 Only for taping

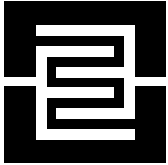
■ CAPACITANCE TOLERANCE

X7R X5R Characteristics
K : ±10% (E12 Series)
M : ±20% (E6 Series)
Z5U Characteristics
M : ±20% (E6 Series)
Z : +80% -20% (E6 Series)
Y5V Characteristics
Z : +80% -20% (E6 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)**	Bulk Case (pcs./case)
GRM36	■ : 0.5 ±0.05	1,000	10,000	50,000
GRM39	■ : 0.8 ±0.1*5	1,000	4,000	15,000
GRM40	■ : 0.6 ±0.1	1,000	4,000	10,000
	▨ : 0.85±0.1	1,000	4,000	—
	■ : 1.25±0.1	1,000	3,000	5,000
GRM42-6	▨ : 0.85±0.1	1,000	4,000	—
	■ : 1.15±0.1	1,000	3,000	—
	▨ : 1.6 ±0.2	1,000	2,000	—

**4 φ330mm reel is available on request.
 *5 Bulk case packaging is T=0.8±0.07



MONOLITHIC CERAMIC CAPACITOR



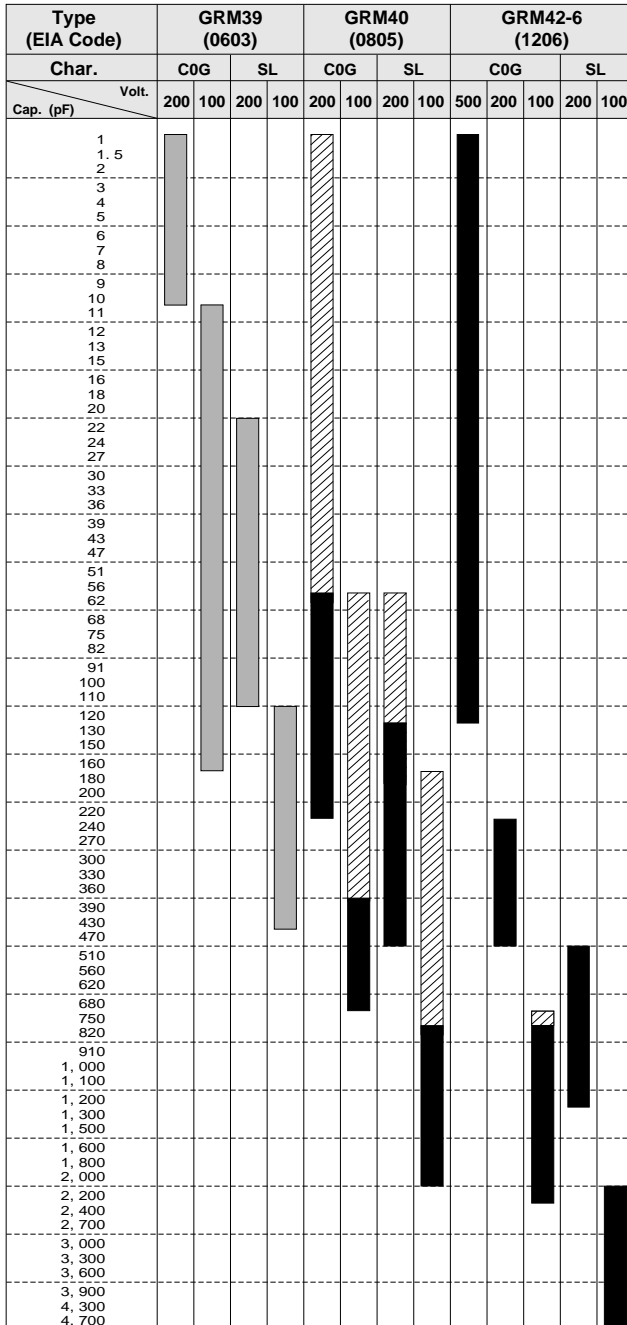
Nickel Barrired Termination Type

GRM Series for General Electronic Equipment

FOR FLOW AND REFLOW SOLDERING

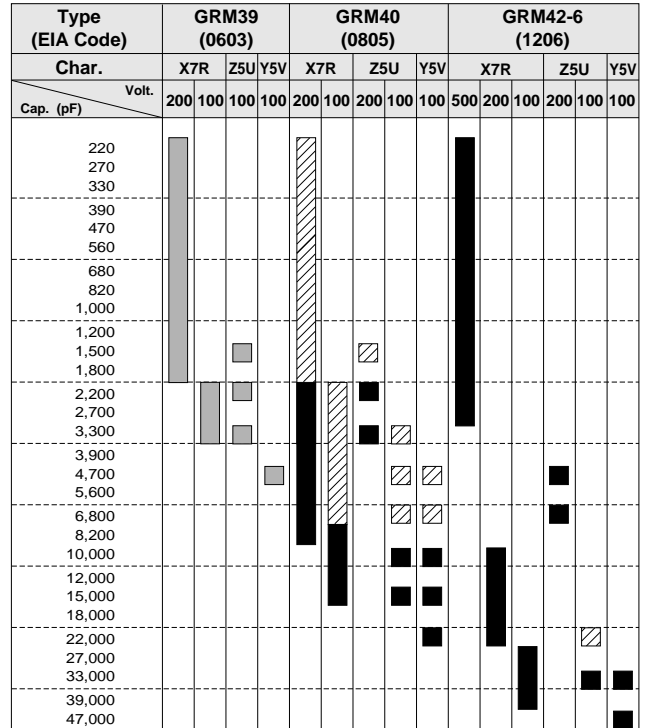
Temperature Compensating Type

500V/200V/100V



High Dielectric Constant Type

500V/200V/100V



CAPACITANCE TOLERANCE

C0G/SL Characteristics

C : ±0.25pF 5pF and below

D : ±0.5pF 6pF=<cap.<=10pF

J : ±5% More than 10pF

X7R Characteristics

K : ±10% (E12 Series)

M : ±20% (E6 Series)

Z5U Characteristics

M : ±20% (E6 Series)

Z : +80% (E6 Series)
-20%

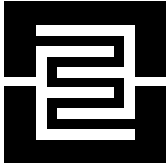
Y5V Characteristics

Z : +80% (E6 Series)
-20%

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GRM39	[Bar]: 0.8 ±0.1	1,000	4,000
	[Hatched]: 0.85±0.1	1,000	4,000
GRM40	[Bar]: 1.25±0.1	1,000	3,000
	[Hatched]: 0.85±0.1	1,000	4,000
GRM42-6	[Bar]: 1.15±0.1	1,000	3,000
	[Hatched]: 0.85±0.1	1,000	4,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

GRM Series for General Electronic Equipment

FOR REFLOW SOLDERING

Temperature Compensating Type

500V/200V/100V/50V

Type (EIA Code)	GRM42-2 (1210)						GRM43-2 (1812)						GRM44-1 (2220)											
	C0G			SL			C0G			SL			C0G			SL								
Char.	Volt.																							
Cap. (pF)	500	200	100	50	200	100	50	500	200	100	50	200	100	50	500	200	100	50	200	100	50			
130	█																							
150	█																							
160																								
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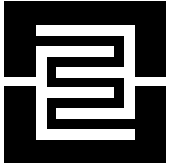
■ CAPACITANCE TOLERANCE

C0G, SL Characteristics
J : ±5% (E24 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GRM42-2	█ : 1.35±0.15	1,000	2,000
GRM43-2	█ : 2.0 max.	1,000	1,000
GRM44-1	█ : 2.0 max.	1,000	1,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

GRM Series for General Electronic Equipment

FOR REFLOW SOLDERING

High Dielectric Constant Type

500V/200V/100V/50V/25V

Type (EIA Code)	GRM42-2 (1210)										GRM43-2 (1812)										GRM44-1 (2220)																																																											
	X7R					Z5U					Y5V					X7R					Z5U					Y5V																																																						
Char.																																																																																
Cap. (pF)	500					200					100					50					25					200					100					50																																												
3,300	█																																																																															
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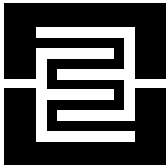
■ CAPACITANCE TOLERANCE

X7R Characteristics	
K	: ±10% (E12 Series)
M	: ±20% (E6 Series)
Z5U Characteristics	
M	: ±20% (E6 Series)
Z	: +80% (E6 Series)
	-20%
Y5V Characteristics	
Z	: +80% (E6 Series)
	-20%

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GRM42-2	█ : 1.15±0.1	1,000	3,000
	▒ : 1.35±0.15	1,000	2,000
GRM43-2	▒ : 2.0 max.	1,000	1,000
GRM44-1	▒ : 2.0 max.	1,000	1,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

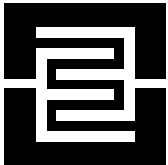
GRM Series for General Electronic Equipment

SPECIFICATIONS AND TEST METHODS

No	Item	Specification				Test Method													
		Temperature Compensating Type	High Dielectric Constant Type																
1	Operating Temperature Range	-55 to +125°C	X5R : -55 to + 85°C X7R : -55 to +125°C Z5U : +10 to + 85°C Y5V : -30 to + 85°C																
2	Rated Voltage	See the previous pages.				The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, shall 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 shall be observed when *300% of the rated voltage (C0Δ to U2J and SL) or *250% of the rated voltage (X5R, X7R, Z5U and Y5V) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V													
6	Insulation Resistance	More than 10,000MΩ or 500Ω · F. (Whichever is smaller)				The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.													
7	Capacitance	Within the specified tolerance.				The capacitance/Q/D.F. shall be measured at 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)	Char.	25V min.	16V	10V max.	<table border="1"> <thead> <tr> <th>Char. Item</th> <th>C0Δ to U2J, SL (1000pF and below)</th> <th>C0Δ to U2J, SL (more than 1000pF) X5R, X7R, Y5V</th> <th>Z5U</th> </tr> </thead> <tbody> <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> </tbody> </table>	Char. Item	C0Δ to U2J, SL (1000pF and below)	C0Δ to U2J, SL (more than 1000pF) X5R, X7R, Y5V	Z5U	Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz	Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.05Vrms
			Char. Item	C0Δ to U2J, SL (1000pF and below)	C0Δ to U2J, SL (more than 1000pF) X5R, X7R, Y5V	Z5U													
Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz																
Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.05Vrms																
X5R	0.025 max.	0.035 max.	0.035 max.																
X7R	0.025 max.	—	—																
Z5U	0.025 max.	—	—																
Y5V	0.05 max.	0.07 max. (C<1.0μF) 0.09 max. (C>=1.0μF)	0.125 max.																
9	Capacitance Temperature Characteristics	Within the specified tolerance. (Table A-1)	Char.	Temp. Range	Reference Temp.	Cap. Change													
			X5R	-55 to + 85°C	25°C	Within±15%													
			X7R	-55 to +125°C		Within ^{+25%} _{-55%}													
			Z5U	+10 to + 85°C		Within ^{+25%} _{-55%}													
Y5V	-30 to + 85°C	Within ^{+25%} _{-55%}																	
	Capacitance Change	Within the specified tolerance. (Table A-1)																	
	Temperature Coefficient	Within the specified tolerance. (Table A-1)																	
	Capacitance Drift	Within ±0.2% or ±0.05pF. (Whichever is larger.) *Not apply to SL/Z5V																	
10	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.				(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, (C0Δ: +25°C to +125°C ; other temp. coeffs.: +25°C to +85°C) the capacitance shall 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 border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3 (for C0Δ)/85±3 (for other TC)</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table>	Step	Temperature (°C)	1	25±2	2	-55±3	3	25±2	4	125±3 (for C0Δ)/85±3 (for other TC)	5	25±2	
		Step	Temperature (°C)																
1	25±2																		
2	-55±3																		
3	25±2																		
4	125±3 (for C0Δ)/85±3 (for other TC)																		
5	25±2																		
<p>Fig. 1a</p>					(2) High Dielectric Constant Type The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table shall be within the specified ranges.														
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 shall 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, shall be traversed in approximately 1 minute. This motion shall 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 min. : Q>=1000 30pF max. : Q>=400+20C C : Nominal Capacitance (pF)	Char.	25V min.	16V	10V max.													
			X5R	0.025 max.	0.035 max.	0.035 max.													
			X7R	0.025 max.	—	—													
			Z5U	0.025 max.	—	—													
			Y5V	0.05 max.	0.07 max. (C<1.0μF) 0.09 max. (C>=1.0μF)	0.125 max.													

Type	a	b	c
GRM36	0.4	1.5	0.5
GRM39	1.0	3.0	1.2
GRM40	1.2	4.0	1.65
GRM42-6	2.2	5.0	2.0
GRM42-2	2.2	5.0	2.9
GRM43-2	3.5	7.0	3.7
GRM44-1	4.5	8.0	5.6

(in mm)

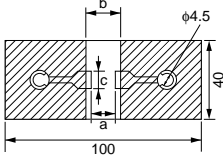
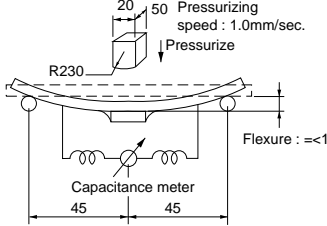


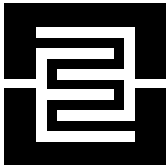
MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

GRM Series for General Electronic Equipment

No	Item	Specification		Test Method																																
		Temperature Compensating Type	High Dielectric Constant Type																																	
12	Deflection	No cracking or marking defects shall occur		<p>Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2a using a eutectic solder. Then apply a force in the direction shown in Fig.3a. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p>Fig. 2a</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM36</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM39</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM40</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM42-6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM42-2</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43-2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM44-1</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM36	0.4	1.5	0.5	GRM39	1.0	3.0	1.2	GRM40	1.2	4.0	1.65	GRM42-6	2.2	5.0	2.0	GRM42-2	2.2	5.0	2.9	GRM43-2	3.5	7.0	3.7	GRM44-1	4.5	8.0	5.6
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GRM44-1	4.5	8.0	5.6																																	
		 <p>Fig. 3a</p>																																		
13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.		<p>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.</p>																																
14	Resistance to Soldering Heat	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>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.</p> <p>• Initial measurement for high dielectric constant type Perform a heat treatment at 150⁺₀°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p> <p>*Preheating for GRM42-2/43-2/44-1</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100°C to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170°C to 200°C</td> <td>1 min.</td> </tr> </tbody> </table>	Step	Temperature	Time	1	100°C to 120°C	1 min.	2	170°C to 200°C	1 min.																							
	Step	Temperature	Time																																	
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Q/D.F.	30pF and over : Q>=1,000		<table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V max.</th> </tr> </thead> <tbody> <tr> <td>X5R</td> <td rowspan="2">0.025 max.</td> <td rowspan="2">0.035 max.</td> <td rowspan="2">0.035 max.</td> </tr> <tr> <td>X7R</td> </tr> <tr> <td>Z5U</td> <td>0.025 max.</td> <td>—</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max. (C<1.0μF)</td> <td>0.125 max. (C>=1.0μF)</td> </tr> </tbody> </table>	Char.	25V min.	16V	10V max.	X5R	0.025 max.	0.035 max.	0.035 max.	X7R	Z5U	0.025 max.	—	—	Y5V	0.05 max.	0.07 max. (C<1.0μF)	0.125 max. (C>=1.0μF)																
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Dielectric Strength	No failure																																			
15	Temperature Cycle	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>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.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. ⁺³₋₃</td> <td>Room Temp.</td> <td>Max. Operating Temp. ⁺³₋₃</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> </tbody> </table> <p>• Initial measurement for high dielectric constant type Perform a heat treatment at 150⁺₀°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. ⁺³ ₋₃	Room Temp.	Max. Operating Temp. ⁺³ ₋₃	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3																	
	Step	1	2		3	4																														
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Dielectric Strength	No failure																																			



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

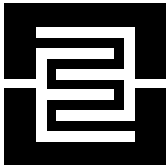
GRM Series for General Electronic Equipment

No	Item	Specification		Test Method			
		Temperature Compensating Type	High Dielectric Constant Type				
16	Humidity, Steady State	The measured and observed characteristics shall satisfy the specifications in the following table.		Sit the capacitor 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)	X5R, X7R Within ±12.5% Z5U, Y5V Within ±30%				
	Q/D.F.	30pF and over : Q>=350 10pF and over, 30pF and below : $Q \geq 275 + \frac{5}{2} \cdot C$ 10pF and below : $Q \geq 200 + 10C$ C : Nominal Capacitance (F)	Char.		25V min.	16V	10V max.
			X5R X7R Z5U		0.05 max. 0.05 max.	0.05 max. —	0.05 max. —
I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)		Y5V	0.075 max.	0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)	0.15 max.	
17	Humidity Load	The measured and observed characteristics shall 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. • Initial measurement for Y5V/10V Apply the rated DC voltage for 1 hour at 40±2°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.			
	Appearance	No marking defects					
	Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	X5R, X7R Within ±12.5% Z5U Within ±30% Y5V Within ±30% (10V) Within ±30% (others)				
	Q/D.F.	30pF and over : Q>=200 30pF and below : $Q \geq 100 + \frac{10}{3} \cdot C$ C : Nominal Capacitance (pF)	Char.		25V min.	16V	10V max.
			X5R X7R Z5U		0.05 max. 0.05 max.	0.05 max. —	0.05 max. —
I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)		Y5V	0.075 max.	0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)	0.15 max.	
18	High Temperature Load	The measured and observed characteristics shall 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. *150% for 500V			
	Appearance	No marking defects					
	Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	X5R, X7R Within ±12.5% Z5U Within ±30% Y5V Within ±30% (Cap.<1.0μF) Within ±30% (Cap.≥1.0μF)				
	Q/D.F.	30pF and over : Q>=350 10pF and over, 30pF and below : $Q \geq 275 + \frac{5}{2} \cdot C$ 10pF and below : $Q \geq 200 + 10C$ C : Nominal Capacitance (pF)	Char.		25V min.	16V	10V max.
			X5R X7R Z5U		0.04 max. 0.04 max.	0.05 max. —	0.05 max. —
I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)		Y5V	0.075 max.	0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)	0.15 max.	
19	Notice	When mounting capacitor of 500V rated voltage, perform the epoxy resin coating (min. 1.0mm thickness).					

Table A-1

Char.	Nominal Values (ppm/°C) Note 1	Capacitance Change from 25°C (%)					
		-55		-30		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
C0H	0± 60	0.87	-0.48	0.59	-0.33	0.38	-0.21
P2H	-150± 60	2.33	0.72	1.61	0.50	1.02	0.32
R2H	-220± 60	3.02	1.28	2.08	0.88	1.32	0.56
S2H	-330± 60	4.09	2.16	2.81	1.49	1.79	0.95
T2H	-470± 60	5.46	3.28	3.75	2.26	2.39	1.44
U2J	-750± 120	8.78	5.04	6.04	3.47	3.84	2.21
SL	+350 to -1,000	—	—	—	—	—	—

Note 1 : Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for C0Δ) /85°C (for other TC).



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

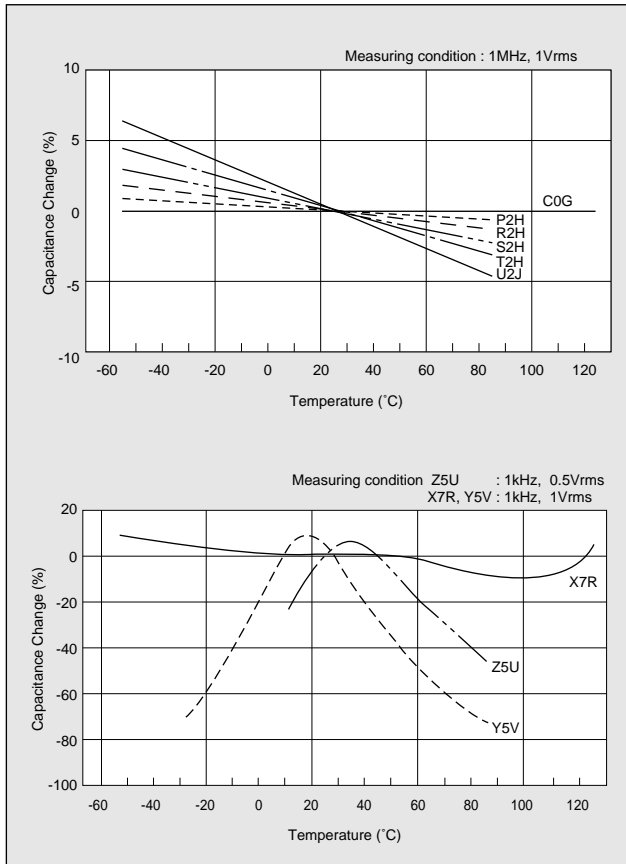
GRM Series for General Electronic Equipment

CHARACTERISTICS (REFERENCE DATA)

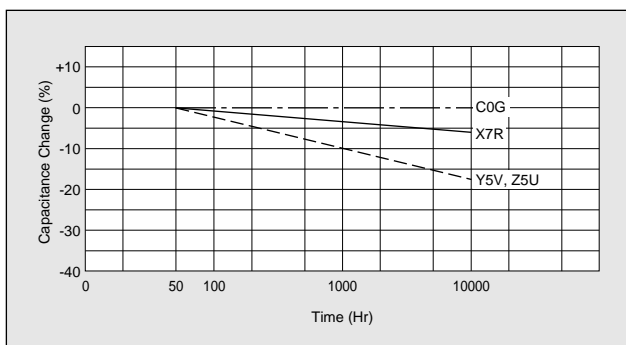
SELECTION OF CERAMIC CAPACITORS

When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

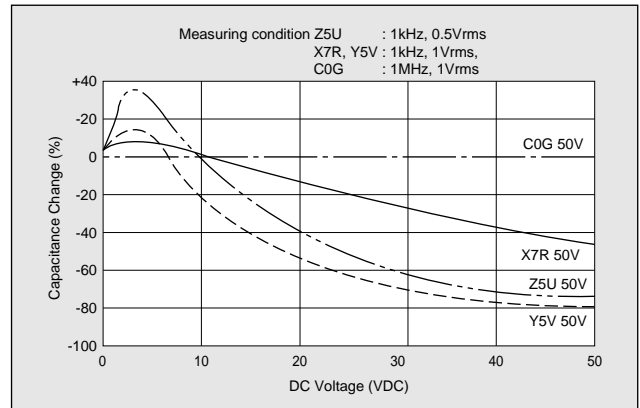
Capacitance-Temperature Characteristics



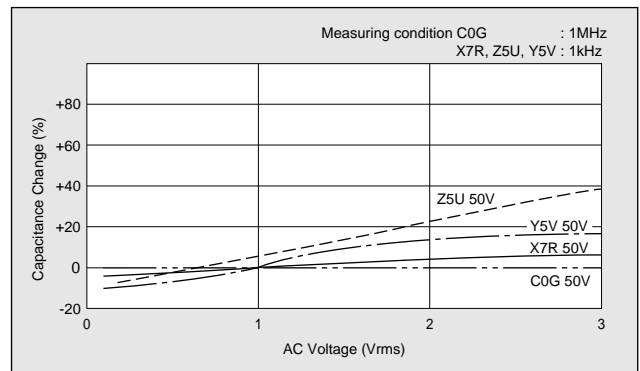
Capacitance Change- Aging



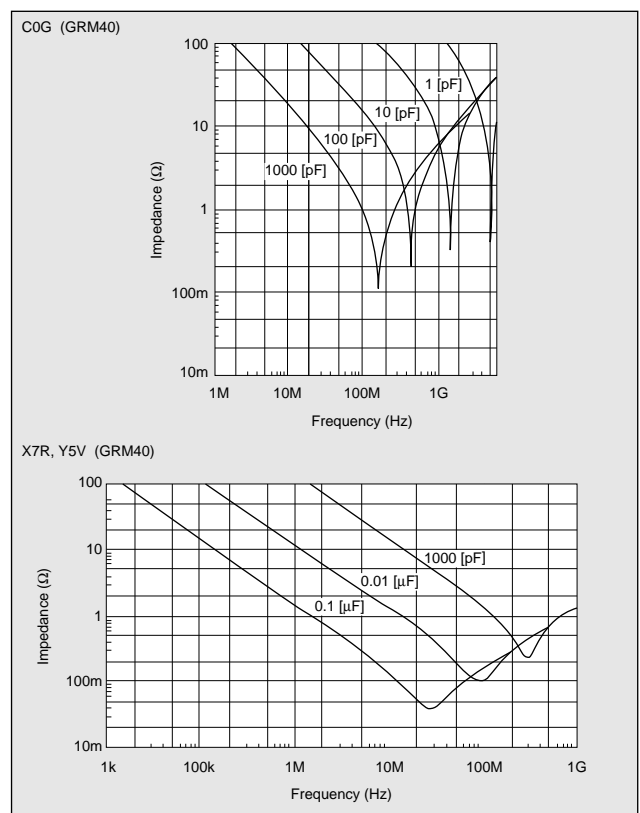
Capacitance- DC Voltage Characteristics

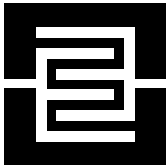


Capacitance- AC Voltage Characteristics



Impedance- Frequency Characteristics





MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type
GRM400 Series ; Low Distortion

FEATURES

1. This series features a low dissipation factor and low distortion.
2. Low shock noise* is realized without piezoelectric effects.
3. This series is suited to both flow and reflow soldering techniques without the need for silver.
4. This series is suitable for most automatic placement equipment.

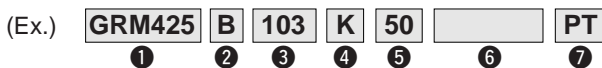
* Noise resulting from mechanical stress.

APPLICATION

Low distortion in general electronic equipment

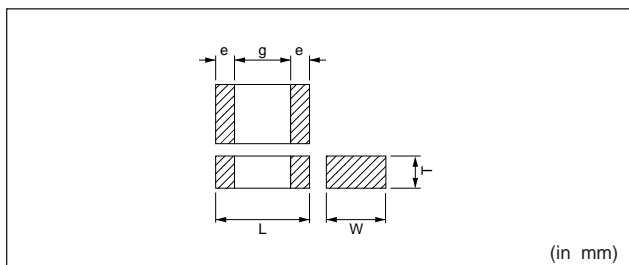
PART NUMBERING

(*Please specify the part number when ordering.)



- ① Type
- ② Temperature Characteristics
- ③ Capacitance
- ④ Capacitance Tolerance
- ⑤ Rated Voltage
- ⑥ Murata's Control No.
- ⑦ Packaging

TYPE AND DIMENSIONS

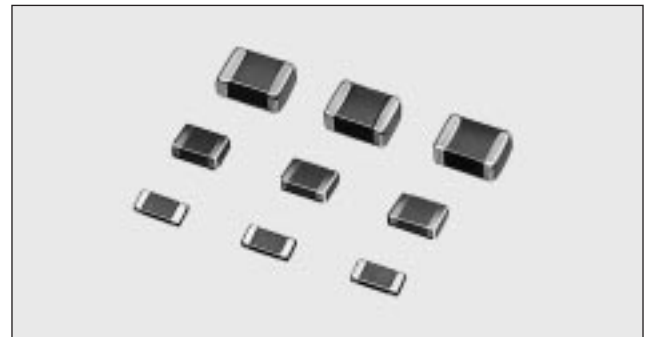


Type (EIA Code)	GRM420 (0603)	GRM425 (0805)	GRM430 (1206)
L	1.6±0.1	2.0 ±0.1	3.2±0.15
W	0.8±0.1	1.25±0.1	1.6±0.15
T*	Varies depending on capacitance value		
e	0.2 to 0.5	0.2 to 0.7	0.3 to 0.8
g	0.5 min.	0.7 min.	1.5 min.

*T : Please refer to the capacitance range table

TEMPERATURE CHARACTERISTICS

Code	Capacitance Change	Temp. Range	Reference Temp.
B	Within ±10%	-25 to 85°C	20°C
R	Within ±15%		



CAPACITANCE (Ex.)

Code	Capacitance (pF)
102	1000
103	10000
104	100000

CAPACITANCE TOLERANCE

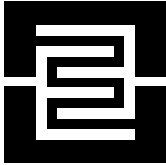
Code	Cap. Tolerance (%)
K	±10
M	±20

RATED VOLTAGE

Code	Rated Voltage (VDC)
16	16
50	50

PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging



MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type

GRM400 Series ; Low Distortion

■ CAPACITANCE RANGE TABLE

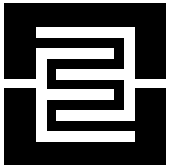
Type (EIA Code)	GRM420 (0603)		GRM425 (0805)		GRM430 (1206)	
Char.	B	R	B	R	B	R
Volt.	50	16	50	16	50	16
Cap. (pF)						
1,000	█		█			
1,200						
1,500						
1,800						
2,200						
2,700						
3,300						
3,900		█				
4,700						
5,600						
6,800						
8,200						
10,000						
12,000			▨	█		
15,000						
18,000				▨	█	
22,000						
27,000						
33,000				▨	█	
39,000						
47,000						▨
56,000						
68,000						█
82,000						
100,000						█

■ CAPACITANCE TOLERANCE

K : ±10% (E12 Series)
M : ±20% (E 6 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)
GRM420	█ : 0.8 ±0.1	1,000	4,000
GRM425	█ : 0.7 ⁺⁰ / _{-0.2}	1,000	4,000
	▨ : 1.0 ⁺⁰ / _{-0.2}	1,000	4,000
GRM430	█ : 0.7 ⁺⁰ / _{-0.2}	1,000	4,000
	▨ : 1.0 ⁺⁰ / _{-0.2}	1,000	4,000
	█ : 1.25 ⁺⁰ / _{-0.2}	1,000	3,000



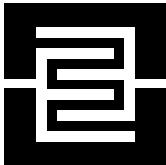
MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type
GRM400 Series ; Low Distortion

OTHER SPECIFICATIONS AND TEST METHODS

No.	Item	Specification	Test Method																
1	Operating Temperature Range	B, R : -25°C to +85°C																	
2	Rated Voltage	See the previous page.	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, shall be maintained within the rated voltage range.																
3	Appearance	No defects or abnormalities.	Visual inspection.																
4	Dimension	Within the specified dimension.	Using calipers.																
5	Dielectric Strength	No defects or abnormalities.	No failure shall 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.)	$C \leq 0.047 \mu F$: 10,000M Ω min. $C > 0.047 \mu F$: 500 $\Omega \cdot F$ min. C : Nominal Capacitance (μF)	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage, at normal temperature and humidity, and within 2 minutes of charging.																
7	Capacitance	Within the specified tolerance.	The capacitance shall be measured at 20°C, at a frequency of 1±0.1kHz and a voltage of 1±0.2Vrms.																
8	Dissipation Factor (D.F.)	B, R : 0.01 max.	D.F. shall be measured under the same conditions as the capacitance.																
9	Capacitance Temperature Characteristics	<table border="1"> <thead> <tr> <th rowspan="2">Char.</th> <th rowspan="2">Temp. Range</th> <th colspan="2">Capacitance Change</th> </tr> <tr> <th>Without Voltage</th> <th>With 50% Rated Voltage</th> </tr> </thead> <tbody> <tr> <td>B</td> <td rowspan="2">-25°C to +85°C</td> <td>Within ±10%</td> <td>Within $\pm \frac{10}{20}$%</td> </tr> <tr> <td>R</td> <td>Within ±15%</td> <td>Within $\pm \frac{15}{20}$%</td> </tr> </tbody> </table>	Char.	Temp. Range	Capacitance Change		Without Voltage	With 50% Rated Voltage	B	-25°C to +85°C	Within ±10%	Within $\pm \frac{10}{20}$ %	R	Within ±15%	Within $\pm \frac{15}{20}$ %	The ranges of capacitance change compared with the 20°C value over the temperature ranges shown in the table shall be within the specified ranges.			
Char.	Temp. Range	Capacitance Change																	
		Without Voltage	With 50% Rated Voltage																
B	-25°C to +85°C	Within ±10%	Within $\pm \frac{10}{20}$ %																
R		Within ±15%	Within $\pm \frac{15}{20}$ %																
10	Distortion	50V : -90dB max. 16V : -80dB max.	The distortion shall be measured using the third harmonic distortion, 10±1kHz in frequency and 1±0.2Vrms in voltage.																
11	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.	Solder the capacitor to the test jig shown in Fig.1b using a eutectic solder. Then apply 10N* force in the direction of the arrow. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defect such as heat shock. *5N (GRM420)																
		<p>Fig. 1b</p>	<table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM420</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM425</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM430</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM420	1.0	3.0	1.2	GRM425	1.2	4.0	1.65	GRM430	2.2	5.0	2.0
Type	a	b	c																
GRM420	1.0	3.0	1.2																
GRM425	1.2	4.0	1.65																
GRM430	2.2	5.0	2.0																
12	Vibration Resistance	The measured and observed characteristics shall satisfy the specifications in the following table.	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (11). The capacitor shall 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, shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).																
		<table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects.</td> </tr> <tr> <td>Capacitance</td> <td>Within the specified tolerance.</td> </tr> <tr> <td>DF</td> <td>0.01 max.</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defects.	Capacitance	Within the specified tolerance.	DF	0.01 max.									
Item	Specification																		
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13	Deflection	No cracks or marking defects shall occur.	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 2b using a eutectic solder. Then apply force in the direction shown in Fig.3b for 5±1 sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.																
		<p>Fig. 3b</p>	<p>Fig. 2b</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM420</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM425</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM430</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM420	1.0	3.0	1.2	GRM425	1.2	4.0	1.65	GRM430	2.2	5.0	2.0
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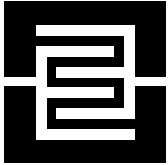


MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Type
GRM400 Series ; Low Distortion

No	Item	Specification	Test Method																											
14	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C.																											
15	Resistance to Soldering Heat	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects.</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±7.5%</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>0.01 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defects.	Capacitance Change	Within ±7.5%	I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)	D.F.	0.01 max.	Dielectric Strength	No failure	Perform a heat treatment at 150±10°C for one hour and then let sit for 48±4 hours at room temperature. Measure initial values. Preheat the capacitor for 1 minute at 120 to 150°C. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds (flow soldering bath). Let sit for 48±4 hours at room temperature, then measure values of items in table.															
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Capacitance Change	Within ±7.5%																													
I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)																													
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16	Temperature Cycle	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects.</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±7.5%</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>0.01 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defects.	Capacitance Change	Within ±7.5%	I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)	D.F.	0.01 max.	Dielectric Strength	No failure	Perform a heat treatment at 150±10°C for one hour and then let sit for 48±4 hours at room temperature. Measure initial values of items in table. Fix capacitor to the supporting jig in the same manner and under the same conditions as in (11). Perform the five cycles according to the four heat treatments shown in the following table. Let sit for 48±4 hours at room temperature, then measure final values of items in table. <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <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> </tbody> </table>	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
Item	Specification																													
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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																										
17	Humidity (Steady State)	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects.</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±12.5%</td> </tr> <tr> <td>I.R.</td> <td>More than 1,000MΩ or 50Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>0.015 max.</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defects.	Capacitance Change	Within ±12.5%	I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)	D.F.	0.015 max.	Set the capacitor 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 values of items in table.																	
Item	Specification																													
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18	Humidity Load	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects.</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±12.5%</td> </tr> <tr> <td>I.R.</td> <td>More than 500MΩ or 25Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>0.015 max.</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defects.	Capacitance Change	Within ±12.5%	I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)	D.F.	0.015 max.	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 values of items in table. The charge/discharge current is less than 50mA.																	
Item	Specification																													
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D.F.	0.015 max.																													
19	High Temperature Load	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects.</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±12.5%</td> </tr> <tr> <td>I.R.</td> <td>More than 1,000MΩ or 50Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>0.015 max.</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defects.	Capacitance Change	Within ±12.5%	I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)	D.F.	0.015 max.	Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Let sit for 48±4 hours at room temperature, then measure initial values of items in table. Apply 200% of the rated DC voltage for 1000±12 hours at maximum operating temperature ±3°C. Remove and let sit for 48±4 hours at room temperature, then measure final values of items in table. The charge/discharge current is less than 50mA.																	
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MONOLITHIC CERAMIC CAPACITOR



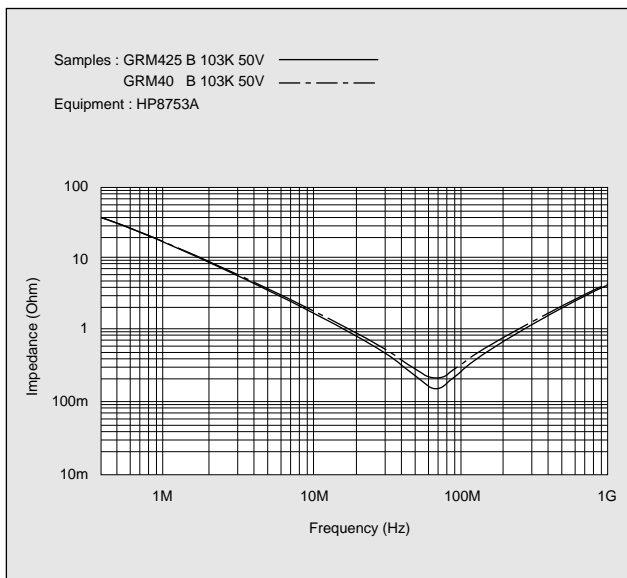
Nickel Barrired Termination Type
GRM400 Series ; Low Distortion

CHARACTERISTICS

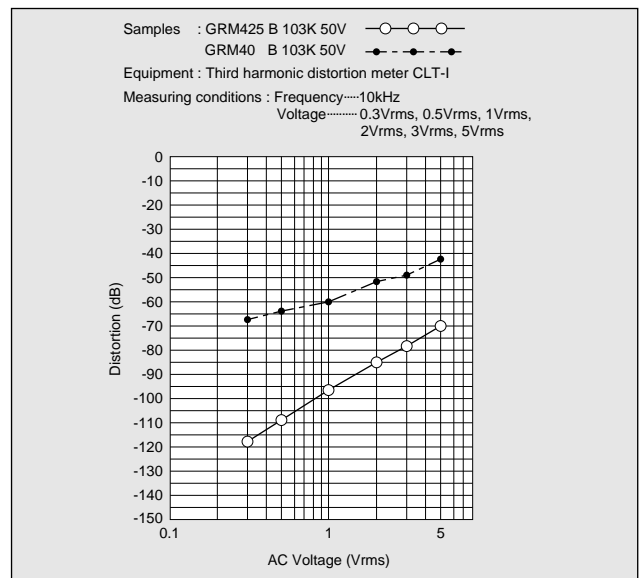
- SELECTION OF CERAMIC CAPACITORS

When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

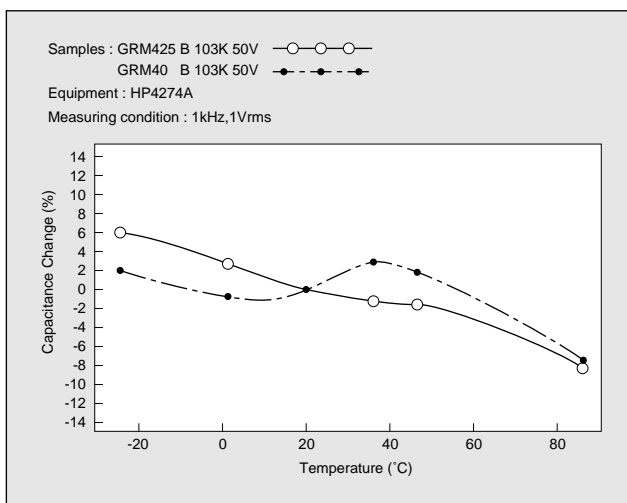
- Impedance-Frequency Characteristics



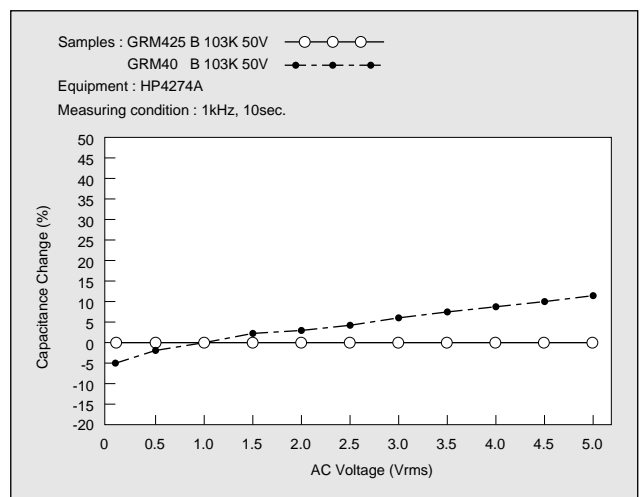
- Third Harmonic Distortion

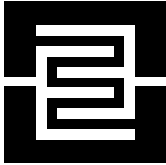


- Capacitance-Temperature Characteristics



- Capacitance-AC Voltage Characteristics





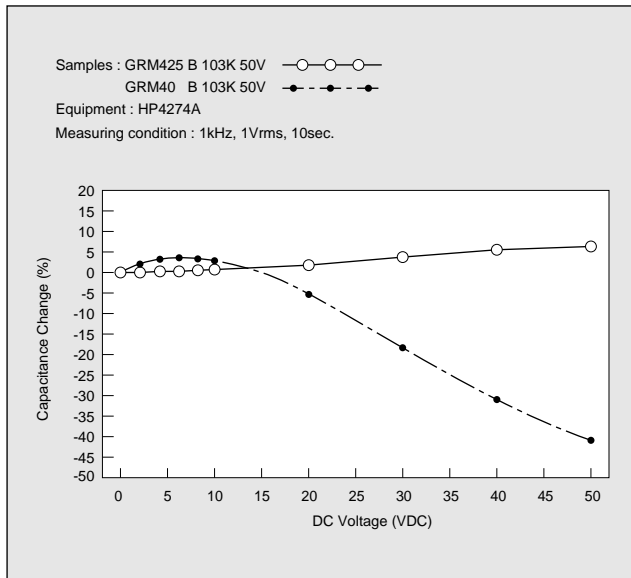
MONOLITHIC CERAMIC CAPACITOR



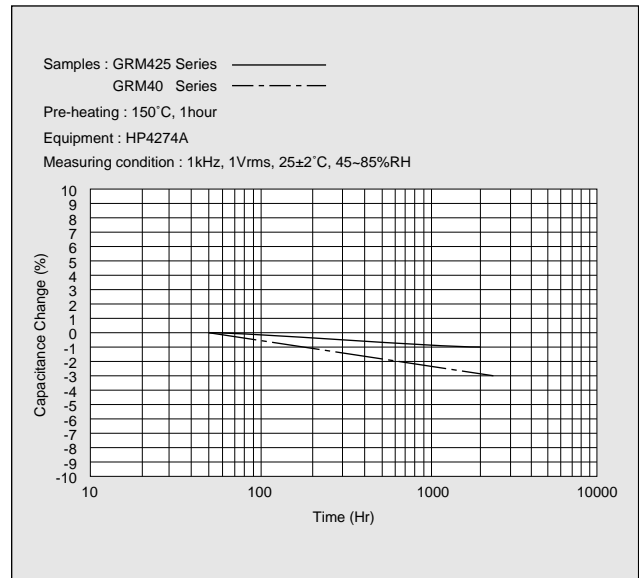
Nickel Barrired Termination Type

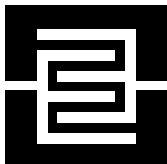
GRM400 Series ; Low Distortion

• Capacitance-DC Voltage Characteristics



• Capacitance Change-Aging





MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Thin Type
GRM Series for Thin Equipment

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.

APPLICATION

Thin equipment such as IC cards.

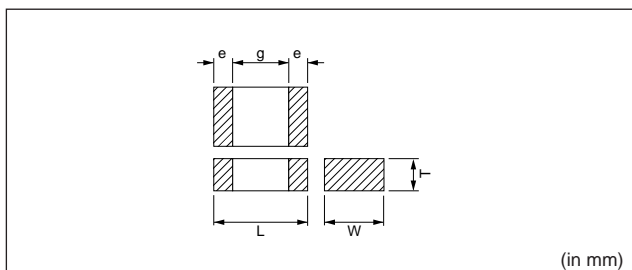
PART NUMBERING

(*Please specify the part number when ordering.)



- | | |
|-------------------------------|------------------------|
| ① Type | ⑤ Rated Voltage |
| ② Temperature Characteristics | ⑥ Murata's Control No. |
| ③ Nominal Capacitance | ⑦ Packaging |
| ④ Capacitance Tolerance | |

TYPE AND DIMENSIONS



Type	L	W	T	e min.	g min.
GRM40-024	2.0±0.1	1.25±0.1	0.5 max.	0.2	0.7
GRM42-625	3.2±0.15	1.6 ±0.15	0.6 max.	0.3	1.5

CAPACITANCE RANGE TABLE

Type	Temp. Char. Rated Voltage	C0G	SL	X7R	Y5V
GRM40-024	50VDC	0.5~360	220~470	220~ 6,800	10,000
	25VDC	—	—	8,200~10,000	15,000~ 33,000
	16VDC	—	—	12,000~27,000	47,000~100,000
GRM42-625	25VDC	—	—	—	150,000~220,000

TEMPERATURE CHARACTERISTICS

- Temperature Compensating Type

Code	C0G	SL
Temp. range	-55 to 125°C	-55 to 85°C
Temp. coeff. (ppm/°C)	0±30	+350 to -1000

- High Dielectric Constant Type

Code	X7R	Y5V
Temp. range	-55 to 125°C	-30 to 85°C
Cap. change (%)	±15	+22 -82

CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	102	1000
030	3	103	10000
101	100	224	220000

CAPACITANCE TOLERANCE

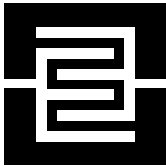
Code	Tol.	Capacitance range
C	±0.25pF	10pF and below
D	±0.5 pF	
J	± 5%	More than 10pF
K	±10%	
M	±20%	
Z	+80 -20 %	

RATED VOLTAGE

Code	Rated voltage (VDC)
16	16
25	25
50	50

PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging



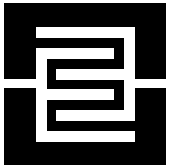
MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Thin Type
GRM Series for Thin Equipment

SPECIFICATIONS AND TEST METHODS

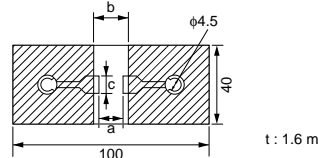
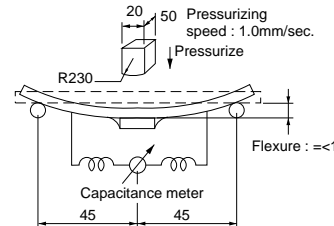
No.	Item	Specification		Test Method																		
		Temperature Compensating Type	High Dielectric Constant Type																			
1	Operating Temperature Range	-55 to +125°C	X7R : -55 to +125°C Y5V : -30 to + 85°C																			
2	Rated Voltage	See the previous pages.		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{P-P} or V ^{O-P} , whichever is larger, shall be maintained within the rated voltage range.																		
3	Appearance	No defects or abnormalities.		Visual inspection.																		
4	Dimension	Within the specified dimension		Using calipers.																		
5	Dielectric Strength	No defects or abnormalities.		No failure shall be observed when 300% of the rated voltage (C0G and SL) or 250% of the rated voltage (X7R, and Y5V) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																		
6	Insulation Resistance	10,000MΩmin. or 500Ω · F min. (Whichever is smaller)		The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75% RH max. and within 2 minutes of charging.																		
7	Capacitance	Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 25°C at the frequency and voltage shown in the table.																		
8	Q/Dissipation Factor (D.F.)	30pF min. : Q>=1,000 30pF max. : Q>=400+20C C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>50V · 25V</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.025 max.</td> <td>0.035 max.</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max.</td> </tr> </tbody> </table>	Char.	50V · 25V	16V	X7R	0.025 max.	0.035 max.	Y5V	0.05 max.	0.07 max.	<table border="1"> <thead> <tr> <th>Char. Item</th> <th>C0G, SL (1000pF and below)</th> <th>X7R, Y5V</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td>1±0.1MHz</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> <td>1±0.2Vrms</td> </tr> </tbody> </table>	Char. Item	C0G, SL (1000pF and below)	X7R, Y5V	Frequency	1±0.1MHz	1±0.1kHz	Voltage	0.5 to 5Vrms	1±0.2Vrms
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9	Capacitance Temperature Characteristics	Capacitance Change	Within the specified tolerance. (Table A-2)	<table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55 to +125°C</td> <td>25°C</td> <td>Within±15%</td> </tr> <tr> <td>Y5V</td> <td>-30 to + 85°C</td> <td></td> <td>Within+22 % -82 %</td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change	X7R	-55 to +125°C	25°C	Within±15%	Y5V	-30 to + 85°C		Within+22 % -82 %						
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		X7R	-55 to +125°C		25°C	Within±15%																
Y5V	-30 to + 85°C		Within+22 % -82 %																			
Temperature Coefficient	Within the specified tolerance. (Table A-2)																					
Capacitance Drift	Within ±0.2% or ±0.05pF. (Whichever is larger.)																					
10	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.		<p>(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 (C0G : +25°C to +125°C ; SL : +25°C to +85°C) the capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-2. 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.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3 (for C0G)/85±3 (for SL)</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>(2) High Dielectric Constant Type The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table shall be within the specified ranges.</p>	Step	Temperature (°C)	1	25±2	2	-55±3	3	25±2	4	125±3 (for C0G)/85±3 (for SL)	5	25±2						
		Step	Temperature (°C)																			
1	25±2																					
2	-55±3																					
3	25±2																					
4	125±3 (for C0G)/85±3 (for SL)																					
5	25±2																					
11	Vibration Resistance	Appearance	No defects or abnormalities.	<p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1c using a eutectic solder. Then apply a 10N force in parallel with test jig for 10±1 sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so the soldering is uniform and free of defects such as heat shock. *5N (GRM40-024)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM40</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM42-6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> </tbody> </table> <p>(in mm)</p> <p>Fig. 1c</p>	Type	a	b	c	GRM40	1.2	4.0	1.65	GRM42-6	2.2	5.0	2.0						
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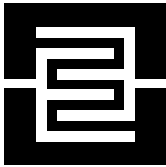


MONOLITHIC CERAMIC CAPACITOR



Nickel Barrired Termination Thin Type
GRM Series for Thin Equipment

No.	Item	Specification		Test Method															
		Temperature Compensating Type	High Dielectric Constant Type																
12	Deflection	No cracks or marking defects shall occur.		<p>Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2c using a eutectic solder. Then apply a force in the direction shown in Fig.3c for 5±1 sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p style="text-align: center;">Fig. 2c</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM40</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM42-6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm)</p>	Type	a	b	c	GRM40	1.2	4.0	1.65	GRM42-6	2.2	5.0	2.0			
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GRM42-6	2.2	5.0	2.0																
		 <p style="text-align: center;">Fig. 3c</p>																	
13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C.															
14	Resistance to Soldering Heat	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>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.</p> <ul style="list-style-type: none"> Initial measurement for high dielectric constant type <p>Perform a heat treatment at 150 ±₁₀ °C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p>															
		Appearance	No marking defects.																
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)		X7R Within ±7.5% Y5V Within ±20%														
		Q	30pF and over : Q>=1,000 30pF and below : Q>=400+20C C : Nominal Capacitance (pF)		<table border="1"> <thead> <tr> <th>Char.</th> <th>50V · 25V</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.025 max.</td> <td>0.035 max.</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max.</td> </tr> </tbody> </table>	Char.	50V · 25V	16V	X7R	0.025 max.	0.035 max.	Y5V	0.05 max.	0.07 max.					
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I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)																		
Dielectric Strength	No failure																		
15	Temperature Cycle	The measured and observed characteristics shall satisfy the specifications in the following table.		<p>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. Sit it for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. ₋₃₀</td> <td>Room Temp.</td> <td>Max. Operating Temp. ₊₃₀</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> </tbody> </table> <ul style="list-style-type: none"> Initial measurement for high dielectric constant type <p>Perform a heat treatment at 150 ±₁₀ °C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. ₋₃₀	Room Temp.	Max. Operating Temp. ₊₃₀	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
		Step	1		2	3	4												
		Temp. (°C)	Min. Operating Temp. ₋₃₀		Room Temp.	Max. Operating Temp. ₊₃₀	Room Temp.												
		Time (min.)	30±3		2 to 3	30±3	2 to 3												
		Appearance	No marking defects																
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)		X7R Within ±7.5% Y5V Within ±20%														
Q	30pF and over : Q>=1,000 30pF and below : Q>=400+20C C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>50V · 25V</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.025 max.</td> <td>0.035 max.</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max.</td> </tr> </tbody> </table>	Char.	50V · 25V	16V	X7R	0.025 max.	0.035 max.	Y5V	0.05 max.	0.07 max.								
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Y5V	0.05 max.	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 shall satisfy the specifications in the following table.		<p>Sit the capacitor 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.</p>															
		Appearance	No marking defects																
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)		X7R Within ±12.5% Y5V Within ±30%														
		Q	30pF and over : Q>=350 10pF and over, 30pF and below : Q>=275+ $\frac{C}{2}$ 10pF and below : Q>=200+10C C : Nominal Capacitance (pF)		<table border="1"> <thead> <tr> <th>Char.</th> <th>50V · 25V</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.05 max.</td> <td>0.05 max.</td> </tr> <tr> <td>Y5V</td> <td>0.075 max.</td> <td>0.1 max.</td> </tr> </tbody> </table>	Char.	50V · 25V	16V	X7R	0.05 max.	0.05 max.	Y5V	0.075 max.	0.1 max.					
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MONOLITHIC CERAMIC CAPACITOR



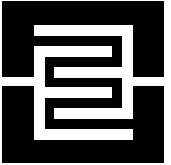
Nickel Barrired Termination Thin Type
GRM Series for Thin Equipment

No.	Item	Specification		Test Method									
		Temperature Compensating Type	High Dielectric Constant Type										
17	Humidity Load	The measured and observed characteristics shall satisfy the specifications in the following table.		Apply the rated voltage at 40±2°C and in 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)	X7R Within ±12.5% Y5V Within ±30%										
	Q	30pF and over : Q>=200 30pF and below : Q>=100+ $\frac{10}{3}$ C C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>50V · 25V</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.05 max.</td> <td>0.05 max.</td> </tr> <tr> <td>Y5V</td> <td>0.075 max.</td> <td>0.1 max.</td> </tr> </tbody> </table>		Char.	50V · 25V	16V	X7R	0.05 max.	0.05 max.	Y5V	0.075 max.	0.1 max.
	Char.	50V · 25V	16V										
X7R	0.05 max.	0.05 max.											
Y5V	0.075 max.	0.1 max.											
I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)												
	Dielectric Strength	No failure											
18	High Temperature Load	The measured and observed characteristics shall 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)	X7RWithin ±12.5% Y5VWithin ±30%										
	Q	30pF and over : Q>=350 10pF and over, 30pF and below : Q>=275+ $\frac{5}{2}$ C 10pF and below : Q>=200+10C C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>50V · 25V</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.04 max.</td> <td>0.05 max.</td> </tr> <tr> <td>Y5V</td> <td>0.075 max.</td> <td>0.1 max.</td> </tr> </tbody> </table>		Char.	50V · 25V	16V	X7R	0.04 max.	0.05 max.	Y5V	0.075 max.	0.1 max.
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Y5V	0.075 max.	0.1 max.											
I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)												
	Dielectric Strength	No failure											

Table A-2

Char.	Nominal Values (ppm/°C) Note 1	Capacitance Change from 25°C Value (%)					
		-55°C		-25°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
SL	+350 to-1,000	—	—	—	—	—	—

Note 1 : Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for C0G) /85°C (for SL).



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR Series for General Electronic Equipment

FEATURES

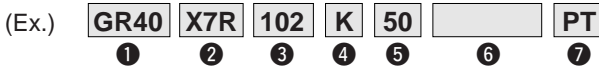
1. The GR series is suited to silver epoxy conductive adhesive.
2. This series is a complete line of chip monolithic ceramic capacitors in 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0G to Y5V.
3. A wide selection of sizes is available, from the miniature GR36 (LXWXT : 1.0X0.5X0.5mm) to the larger sized GR44-1 (LXWXT : 5.7X5.0X2.0mm).
4. Stringent dimensional tolerances allow highly reliable, high-speed automatic chip placement on PCBs.
5. The GR series is available in both paper and plastic embossed tape and reel packaging for automatic placement.

APPLICATION

General electronic equipment.

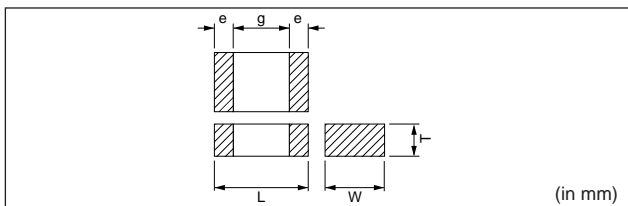
PART NUMBERING

(*Please specify the part number and adhesive method when ordering.)

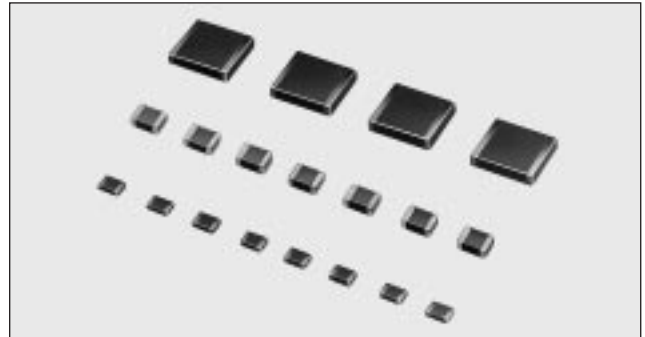


- ① Type
- ② Temperature Characteristics
- ③ Capacitance
- ④ Capacitance Tolerance
- ⑤ Rated Voltage
- ⑥ Murata's Control No.
- ⑦ Packaging Code

TYPE AND DIMENSIONS



Type (EIA Code)	L	W	T	e min.	g min.
GR36 (0402)	1.0±0.05	0.5 ±0.05	0.5 ±0.05	0.15	0.4
GR39 (0603)	1.6±0.1	0.8 ±0.1	0.8 ±0.1	0.15	0.5
GR40 (0805)	2.0±0.15	1.25±0.15	0.7 ⁺⁰ / _{-0.2}	0.2	0.7
			1.0 ⁺⁰ / _{-0.2}		
			1.25 ±0.15		
GR42-6 (1206)	3.2±0.15	1.6 ±0.15	1.0 ⁺⁰ / _{-0.2}	0.25	1.5
			1.25 ⁺⁰ / _{-0.2}		
GR42-2 (1210)	3.2±0.3	2.5 ±0.2	1.25 ⁺⁰ / _{-0.2}	0.3	1.0
			1.5 ⁺⁰		
GR43-2 (1812)	4.5±0.4	3.2 ±0.3	2.0 max.	0.3	2.0
GR44-1 (2220)	5.7±0.4	5.0 ±0.4	2.0 max.	0.3	2.0



TEMPERATURE CHARACTERISTICS

- Temperature Compensating Type

Code	C0G	R2H	U2J	SL
Temp. range	-55 to 125°C		-55 to 85°C	
Temp. coeff. (ppm/°C)	0±30	-220±60	-750±120	+350 to -1000

- High Dielectric Constant Type

Code	X7R	Z5U	Y5V
Temp. range	-55 to 125°C	+10 to 85°C	-30 to 85°C
Cap. change (%)	±15	+22 -56	+22 -82

CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	100	10
R75	0.75	101	100
010	1	103	10000

CAPACITANCE TOLERANCE

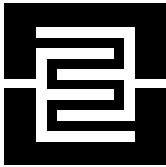
Code	Tol.	Capacitance range
C	±0.25pF	10pF and below
D	±0.5 pF	
J	± 5%	
K	±10%	More than 10pF
M	±20%	
Z	+80%	
	-20%	

RATED VOLTAGE

Code	Rated voltage (VDC)
16	16
25	25
50	50
100	100
200	200
500	500

PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR Series for General Electronic Equipment

CAPACITANCE RANGE TABLE

FOR SILVER EPOXY CONDUCTIVE ADHESIVE

Temperature Compensating Type 50V

Type (EIA Code)	GR36 (0402)		GR39 (0603)			GR40 (0805)				GR42-6 (1206)				
Char. Cap. (pF)	C0G	SL	C0G	R2H	U2J	SL	C0G	R2H	U2J	SL	C0G	R2H	U2J	SL
0.5														
0.75														
1														
1.5														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
15														
16														
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20														
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36														
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56														
62														
68														
75														
82														
91														
100														
110														
120														
130														
150														
160														
180														
200														
220														
240														
270														
300														
330														
360														
390														
430														
470														
510														
560														
620														
680														
750														
820														
910														
1,000														
1,100														
1,200														
1,300														
1,500														
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2,700														
3,000														
3,300														
3,600														
3,900														
4,300														
4,700														
5,100														
5,600														
6,200														
6,800														
7,500														
8,200														

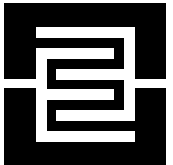
CAPACITANCE TOLERANCE

5pF and below	C : ±0.25pF
6pF and over, 10pF and below	D : ±0.5pF
More than 10pF	J : ± 5% (E24 Series)

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GR36	0.5 ±0.05	1,000	10,000
GR39	0.8 ±0.1	1,000	4,000
GR40	0.7 ⁺⁰ / _{-0.2}	1,000	4,000
	1.0 ⁺⁰ / _{-0.2}	1,000	4,000
	1.25±0.15	1,000	3,000
GR42-6	1.0 ⁺⁰ / _{-0.2}	1,000	4,000
	1.25 ⁺⁰ / _{-0.2}	1,000	3,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR Series for General Electronic Equipment

FOR SILVER EPOXY CONDUCTIVE ADHESIVE

High Dielectric Constant Type 50V/25V/16V

Type (EIA Code)	GR36 (0402)						GR39 (0603)						GR40 (0805)						GR42-6 (1206)								
Char.	X7R			Y5V			X7R			Z5U			Y5V			X7R			Z5U			Y5V					
Cap. (pF)	50	25	16	50	25	16	50	25	16	50	50	25	16	50	25	16	50	50	25	16	50	25	16	50	50	25	16
220	█						█																				
270	█						█																				
330	█						█																				
390	█						█																				
470	█						█																				
560	█						█																				
680	█						█																				
820	█						█																				
1,000	█						█																				
1,200	█						█																				
1,500	█						█																				
1,800	█						█																				
2,200	█						█																				
2,700	█						█																				
3,300	█						█																				
3,900	█						█																				
4,700	█						█																				
5,600	█						█																				
6,800	█						█																				
8,200	█						█																				
10,000	█						█																				
12,000	█						█																				
15,000	█						█																				
18,000	█						█																				
22,000	█						█																				
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560,000	█						█																				
680,000	█						█																				
820,000	█						█																				
1,000,000	█						█																				
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1,500,000	█						█																				

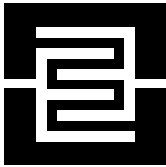
■ CAPACITANCE TOLERANCE

X7R Characteristics	
K	: ±10% (E12 Series)
M	: ±20% (E 6 Series)
Z5U Characteristics	
M	: ±20% (E 6 Series)
Z	: +80% (E 6 Series)
	: -20%
Y5V Characteristics	
Z	: +80% (E 6 Series)
	: -20%

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GR36	█ : 0.5 ±0.05	1,000	10,000
GR39	█ : 0.8 ±0.1	1,000	4,000
GR40	█ : 0.7 ⁺⁰ / _{-0.2}	1,000	4,000
	▨ : 1.0 ⁺⁰ / _{-0.2}	1,000	4,000
	█ : 1.25±0.15	1,000	3,000
GR42-6	█ : 1.25 ⁺⁰ / _{-0.2}	1,000	3,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR Series for General Electronic Equipment

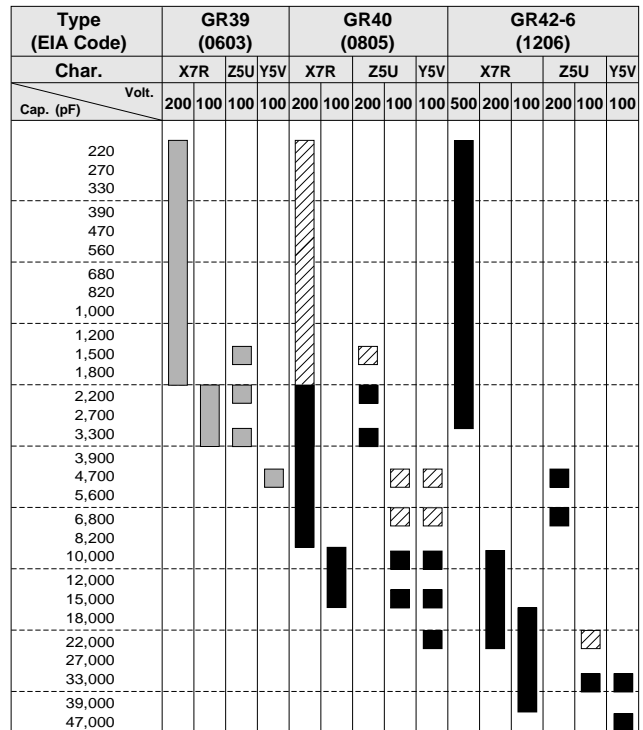
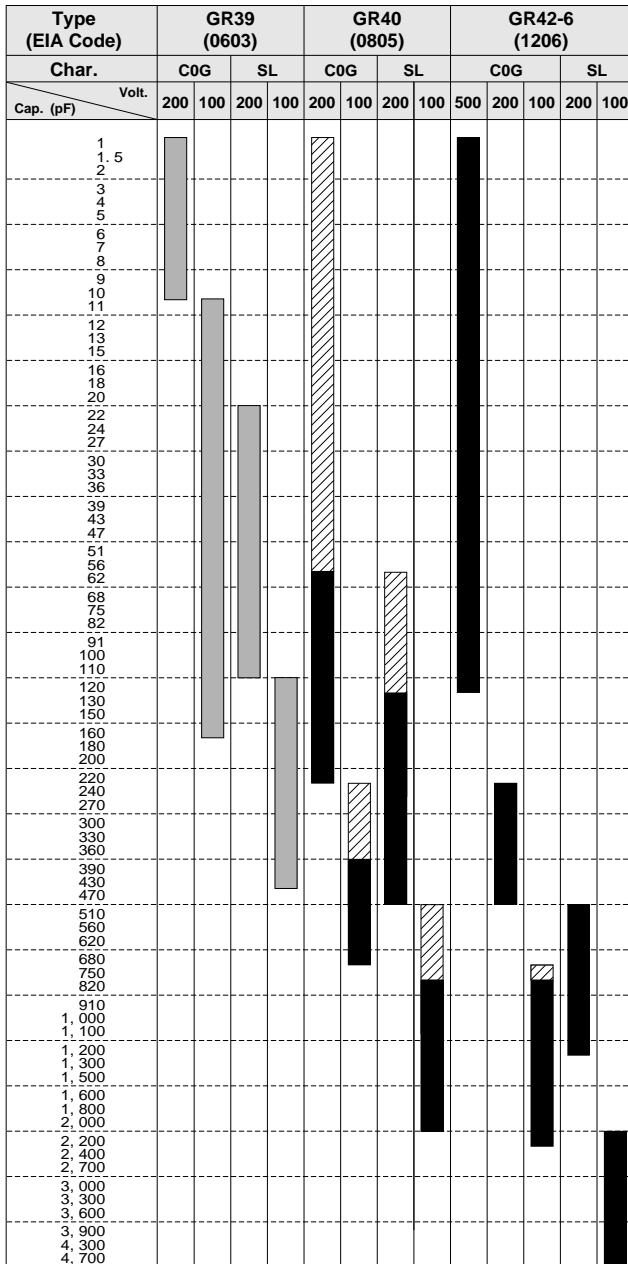
FOR SILVER EPOXY CONDUCTIVE ADHESIVE

Temperature Compensating Type

500V/200V/100V

High Dielectric Constant Type

500V/200V/100V



■ CAPACITANCE TOLERANCE

C0G/SL Characteristics

- C : ±0.25pF 5pF and below
- D : ±0.5pF 6pF=<cap.=<10pF
- J : ±5% More than 10pF

X7R Characteristics

- K : ±10% (E12 Series)
- M : ±20% (E6 Series)

Z5U Characteristics

- M : ±20% (E6 Series)
- Z : +80% (E6 Series)
- 20%

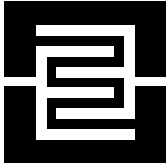
Y5V Characteristics

- Z : +80% (E6 Series)
- 20%

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GR39	■ : 0.8 ±0.1	1,000	4,000
	▨ : 1.0 ±0.2	1,000	4,000
GR40	■ : 1.25±0.15	1,000	3,000
	▨ : 1.0 ±0.2	1,000	4,000
GR42-6	■ : 1.25 ±0.2	1,000	3,000
	▨ : 1.0 ±0.2	1,000	4,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR Series for General Electronic Equipment

FOR SILVER EPOXY CONDUCTIVE ADHESIVE

Temperature Compensating Type

500V/200V/100V/50V

Type (EIA Code)	GR42-2 (1210)								GR43-2 (1812)						GR44-1 (2220)						
	COG				SL				COG				SL		COG				SL		
	500	200	100	50	200	100	50	500	200	100	50	200	100	50	500	200	100	50	200	100	50
130																					
150																					
160																					
180																					
200																					
220																					
240																					
270																					
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33,000																					
36,000																					
39,000																					
43,000																					

■ CAPACITANCE TOLERANCE

COG, SL Characteristics
J : ±5% (E24 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GR42-2	1.5 ^{+0.3}	1,000	2,000
GR43-2	2.0 max.	1,000	1,000
GR44-1	2.0 max.	1,000	1,000

*φ330mm reel is available on request.



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR Series for General Electronic Equipment

FOR SILVER EPOXY CONDUCTIVE ADHESIVE

High Dielectric Constant Type

500V/200V/100V/50V/25V

Type (EIA Code)	GR42-2 (1210)										GR43-2 (1812)										GR44-1 (2220)														
	X7R					Z5U					Y5V					X7R					Z5U					Y5V									
Char.	500					200					100					50					25					100					50				
Cap. (pF)	500					200					100					50					200					100					50				
3300	█																																		
3900	█																																		
4700	█																																		
5600	█																																		
6800	█																																		
8200	█																																		
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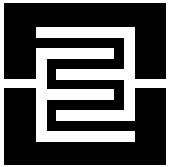
■ CAPACITANCE TOLERANCE

X7R Characteristics
K : ±10% (E12 Series)
M : ±20% (E6 Series)
Z5U Characteristics
M : ±20% (E6 Series)
Z : +80% -20% (E6 Series)
Y5V Characteristics
Z : +80% -20% (E6 Series)

■ THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GR42-2	█ : 1.25 ^{+0.2}	1,000	3,000
	█ : 1.5 ^{+0.3}	1,000	2,000
GR43-2	█ : 2.0 max.	1,000	1,000
GR44-1	█ : 2.0 max.	1,000	1,000

*φ330mm reel is available on request.



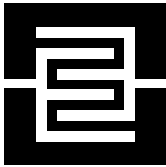
MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type
GR Series for General Electronic Equipment

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification		Test Method																															
		Temperature Compensating Type	High Dielectric Constant Type																																
1	Operating Temperature Range	-55 to +125°C	X7R : -55 to +125°C Z5U : +10 to + 85°C Y5V : -30 to + 85°C																																
2	Rated Voltage	See the previous pages.		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, shall be maintained within the rated voltage range.																															
3	Appearance	No defects or abnormalities.		Visual inspection.																															
4	Dimension	Within the specified dimension.		Using calipers.																															
5	Dielectric Strength	No defects or abnormalities.		No failure shall be observed when *300% of the rated voltage (C0G to U2J, SL) or *250% of the rated voltage (X7R, Z5U, Y5V) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V																															
6	Insulation Resistance	More than 10,000MΩ or 500Ω·F (Whichever is smaller)		The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.																															
7	Capacitance	Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 25°C at the frequency and voltage shown in the table.																															
8	Q/Dissipation Factor (D.F.)	30pF min. : Q>=1,000 30pF max. : Q>=400+20C C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.025 max.</td> <td>0.035 max.</td> </tr> <tr> <td>Z5U</td> <td>0.025 max.</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max.</td> </tr> </tbody> </table>	Char.	25V min.	16V	X7R	0.025 max.	0.035 max.	Z5U	0.025 max.	—	Y5V	0.05 max.	0.07 max.	<table border="1"> <thead> <tr> <th>Char.</th> <th>C0G to U2J, SL (1000pF and below)</th> <th>C0G to U2J, SL (more than 1000pF) X7R, Y5V</th> <th>Z5U</th> </tr> </thead> <tbody> <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> </tbody> </table>	Char.	C0G to U2J, SL (1000pF and below)	C0G to U2J, SL (more than 1000pF) X7R, Y5V	Z5U	Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz	Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.05Vrms							
			Char.	25V min.	16V																														
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Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz																																
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9	Capacitance Temperature Characteristics	Capacitance Change	Within the specified tolerance. (Table A-3)	<table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55 to +125°C</td> <td rowspan="3">25°C</td> <td>Within±15%</td> </tr> <tr> <td>Z5U</td> <td>+10 to + 85°C</td> <td>Within⁺²²₋₅₆ %</td> </tr> <tr> <td>Y5V</td> <td>-30 to + 85°C</td> <td>Within⁺²²₋₈₂ %</td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change	X7R	-55 to +125°C	25°C	Within±15%	Z5U	+10 to + 85°C	Within ⁺²² ₋₅₆ %	Y5V	-30 to + 85°C	Within ⁺²² ₋₈₂ %																	
		Char.	Temp. Range		Reference Temp.	Cap. Change																													
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Y5V	-30 to + 85°C	Within ⁺²² ₋₈₂ %																																	
Temperature Coefficient	Within the specified tolerance. (Table A-3)																																		
Capacitance Drift	Within ±0.2% or ±0.05pF. (Whichever is larger.)																																		
10	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.		<p>(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 (C0G:+25°C to +125°C; other temp. coeffs. :+25°C to +85°C) the capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-3. 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.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3 (for C0G)/85±3 (for other TC)</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>(2) High Dielectric Constant Type The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table shall be within the specified ranges.</p>	Step	Temperature (°C)	1	25±2	2	-55±3	3	25±2	4	125±3 (for C0G)/85±3 (for other TC)	5	25±2																			
		Step	Temperature (°C)																																
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2	-55±3																																		
3	25±2																																		
4	125±3 (for C0G)/85±3 (for other TC)																																		
5	25±2																																		
		<p>Fig. 1d</p>	<table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GR36</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GR39</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GR40</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GR42-6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GR42-2</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GR43-2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GR44-1</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table>	Type	a	b	c	GR36	0.4	1.5	0.5	GR39	1.0	3.0	1.2	GR40	1.2	4.0	1.65	GR42-6	2.2	5.0	2.0	GR42-2	2.2	5.0	2.9	GR43-2	3.5	7.0	3.7	GR44-1	4.5	8.0	5.6
Type	a	b	c																																
GR36	0.4	1.5	0.5																																
GR39	1.0	3.0	1.2																																
GR40	1.2	4.0	1.65																																
GR42-6	2.2	5.0	2.0																																
GR42-2	2.2	5.0	2.9																																
GR43-2	3.5	7.0	3.7																																
GR44-1	4.5	8.0	5.6																																
11	Vibration Resistance (Not apply for GR36)	Appearance	No defects or abnormalities.	Fix the capacitor to the test jig (glass epoxy boards) shown in Fig.1d using silver epoxy conductive adhesive. The capacitor shall 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, shall be traversed in approximately 1 minute. This motion shall 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 min. : Q>=1,000 30pF max. : Q>=400+20C C : Nominal Capacitance (pF)		<table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.025 max.</td> <td>0.035 max.</td> </tr> <tr> <td>Z5U</td> <td>0.025 max.</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max.</td> </tr> </tbody> </table>	Char.	25V min.	16V	X7R	0.025 max.	0.035 max.	Z5U	0.025 max.	—	Y5V	0.05 max.	0.07 max.																		
Char.	25V min.	16V																																	
X7R	0.025 max.	0.035 max.																																	
Z5U	0.025 max.	—																																	
Y5V	0.05 max.	0.07 max.																																	



MONOLITHIC CERAMIC CAPACITOR



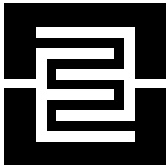
Silver Termination Type
GR Series for General Electronic Equipment

No.	Item	Specification		Test Method															
		Temperature Compensating Type	High Dielectric Constant Type																
12	Temperature Cycle (Not apply for GR36)	The measured and observed characteristics shall 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. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <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> </tbody> </table> <ul style="list-style-type: none"> • 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. 	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
	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													
	Appearance	No marking defects																	
Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	X7R Within ±7.5% Z5U Within ±20% Y5V																	
Q / D.F.	30pF and over : Q>=1,000 30pF and below : Q>=400+20C C : Nominal Capacitance (pF)	<table border="1" style="font-size: small;"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.025 max.</td> <td>0.035 max.</td> </tr> <tr> <td>Z5U</td> <td>0.025 max.</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.05 max.</td> <td>0.07 max.</td> </tr> </tbody> </table>	Char.	25V min.	16V	X7R	0.025 max.	0.035 max.	Z5U	0.025 max.	—	Y5V	0.05 max.	0.07 max.					
Char.	25V min.	16V																	
X7R	0.025 max.	0.035 max.																	
Z5U	0.025 max.	—																	
Y5V	0.05 max.	0.07 max.																	
I.R.	More than 10,000MΩ or 500Ω·F (Whichever is smaller)																		
Dielectric Strength	No failure																		
13	Humidity, Steady State	The measured and observed characteristics shall satisfy the specifications in the following table.		Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) and 48±4 hours (high dielectric constant type), then measure.															
	Appearance	No marking detects																	
	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	X7R Within ±12.5% Z5U Within ±30% Y5V																
	Q / D.F.	30pF and over : Q>=350 10pF and over, 30pF and below : Q>=275+ $\frac{5}{2}$ C 10pF and below : Q>=200+10C C : Nominal Capacitance (pF)	<table border="1" style="font-size: small;"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.05 max.</td> <td>0.05 max.</td> </tr> <tr> <td>Z5U</td> <td>0.05 max.</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.075 max.</td> <td>0.1 max.</td> </tr> </tbody> </table>		Char.	25V min.	16V	X7R	0.05 max.	0.05 max.	Z5U	0.05 max.	—	Y5V	0.075 max.	0.1 max.			
	Char.	25V min.	16V																
X7R	0.05 max.	0.05 max.																	
Z5U	0.05 max.	—																	
Y5V	0.075 max.	0.1 max.																	
I.R.	More than 1,000MΩ or 50Ω·F (Whichever is smaller)																		
14	High Temperature Load	The measured and observed characteristics shall 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. <ul style="list-style-type: none"> • 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. *150% for 500V															
	Appearance	No marking detects																	
	Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	X7R Within ±12.5% Z5U Within ±30% Y5V																
	Q / D.F.	30pF and over : Q>=350 10pF and over, 30pF and below : Q>=275+ $\frac{5}{2}$ C 10pF and below : Q>=200+10C C : Nominal Capacitance (pF)	<table border="1" style="font-size: small;"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.04 max.</td> <td>0.05 max.</td> </tr> <tr> <td>Z5U</td> <td>0.04 max.</td> <td>—</td> </tr> <tr> <td>Y5V</td> <td>0.075 max.</td> <td>0.1 max.</td> </tr> </tbody> </table>		Char.	25V min.	16V	X7R	0.04 max.	0.05 max.	Z5U	0.04 max.	—	Y5V	0.075 max.	0.1 max.			
	Char.	25V min.	16V																
X7R	0.04 max.	0.05 max.																	
Z5U	0.04 max.	—																	
Y5V	0.075 max.	0.1 max.																	
I.R.	More than 1,000MΩ or 50Ω·F (Whichever is smaller)																		
Dielectric Strength	No failure																		
15	Notice	When mounting capacitor of 500V rated voltage, perform the epoxy resin coating (min. 1.0mm thickness).																	

Table A-3

Char.	Nominal Values (ppm/°C) Note 1	Capacitance Change from 25°C Value (%)					
		-55°C		-30°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
R2H	-220± 60	3.02	1.28	2.08	0.88	1.32	0.56
U2J	-750± 120	8.78	5.04	6.04	3.47	3.84	2.21
SL	+350 to -1,000	—	—	—	—	—	—

Note 1 : Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for C0G) /85°C (for other TC).



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

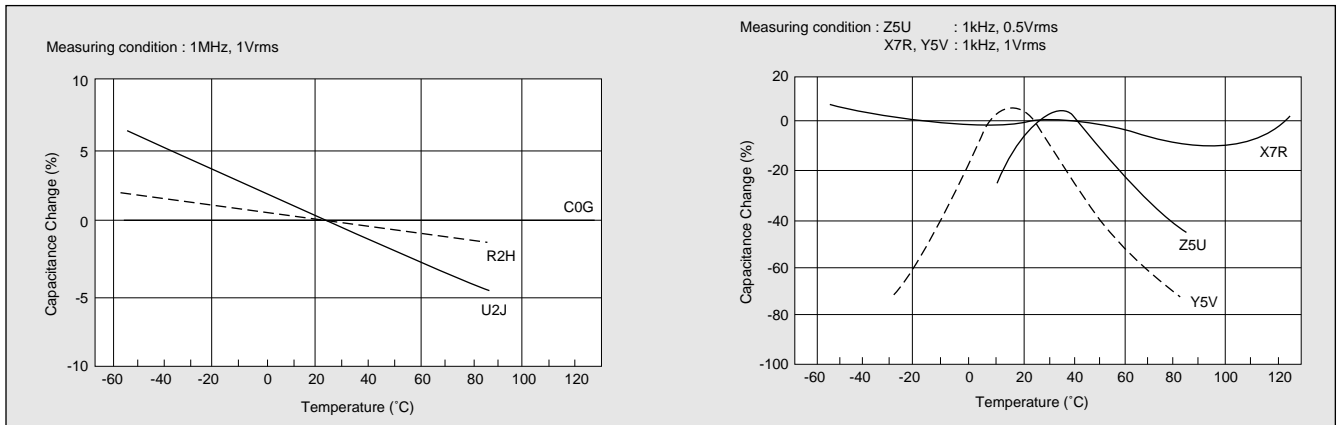
GR Series for General Electronic Equipment

CHARACTERISTICS (REFERENCE DATA)

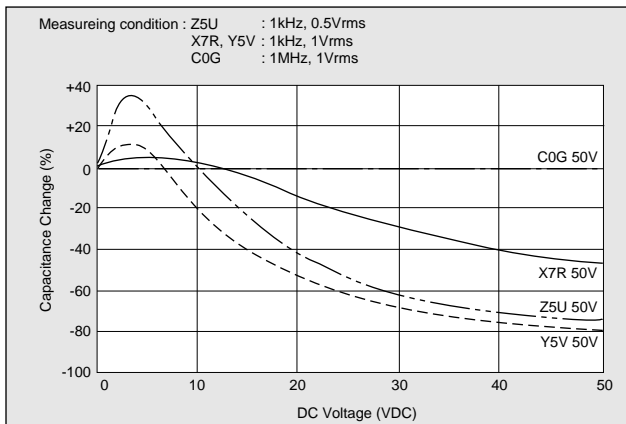
- SELECTION OF CERAMIC CAPACITORS

When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

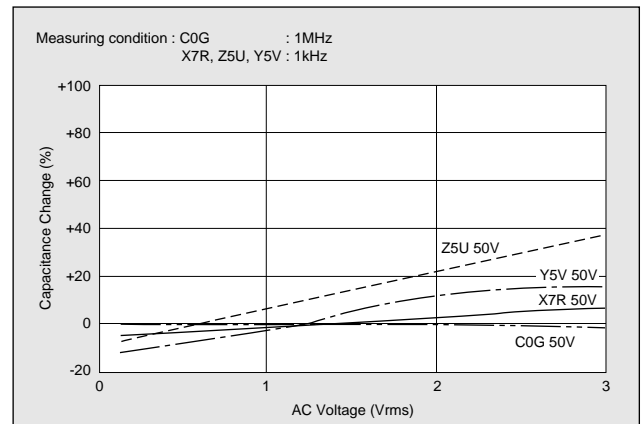
- Capacitance-Temperature Characteristics



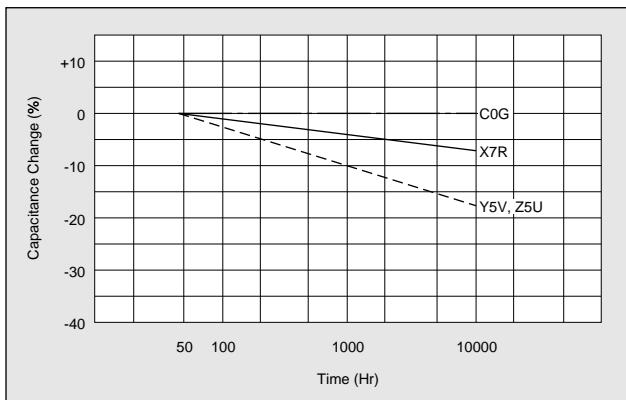
- Capacitance-DC Voltage Characteristics



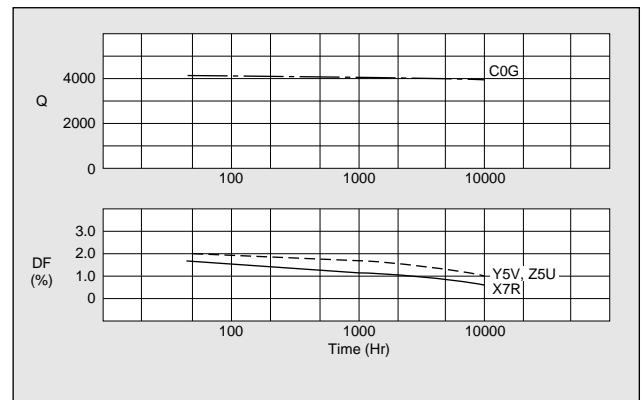
- Capacitance-AC Voltage Characteristics

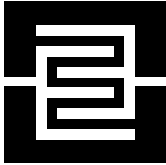


- Capacitance Change-Aging



- Q/DF Change-Aging





MONOLITHIC CERAMIC CAPACITOR

Silver Termination Type

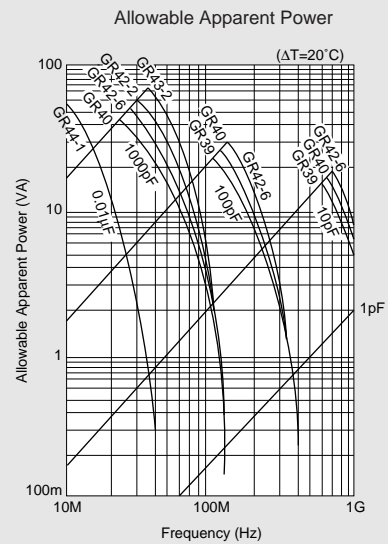
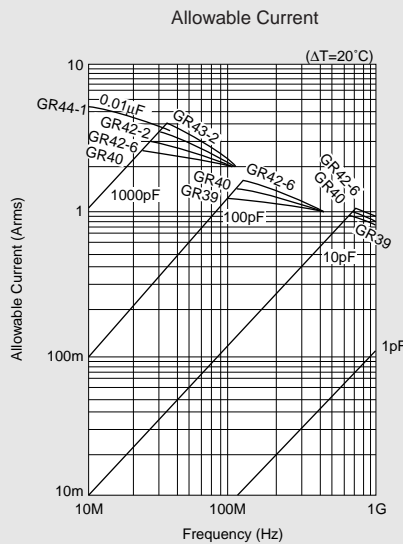
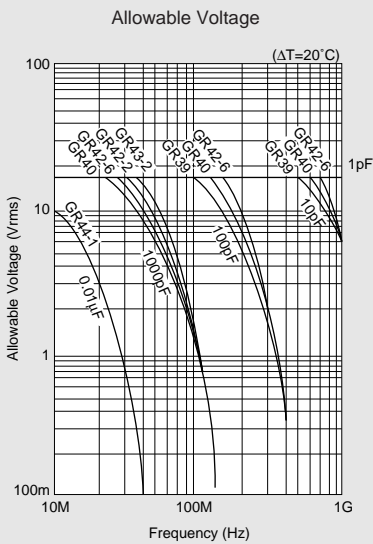
GR Series for General Electronic Equipment



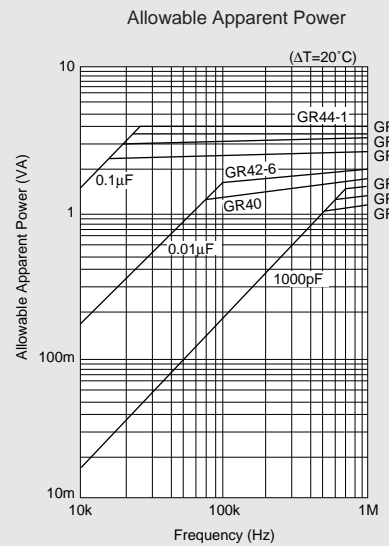
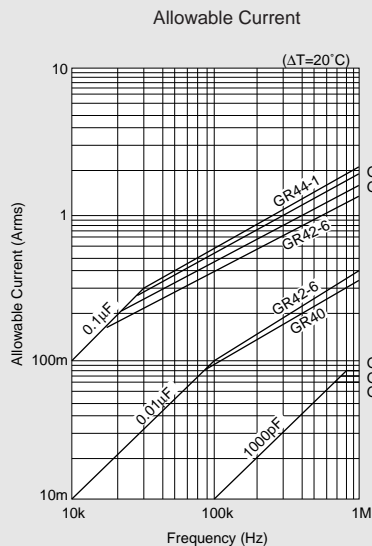
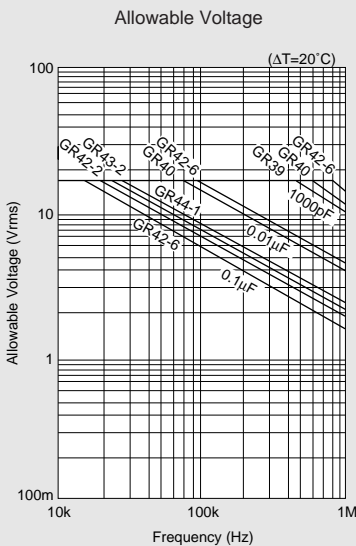
- High Frequency-Power Capacity
The monolithic ceramic capacitor has a small dielectric loss. When high frequency current is applied to the capacitor, the capacitor generates heat (power consumption) by its E.S.R. Temperature rise of the capaci-

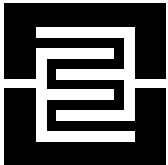
tor (ΔT) should be kept below 20°C ($\Delta T \leq 20^{\circ}\text{C}$) in the actual circuit. Therefore, when selecting capacitors, the applicable voltage, power and current should be considered with in the following limits.

Temperature Compensating Type (C0G 50V)



High Dielectric Constant Type (X7R 50V)





MONOLITHIC CERAMIC CAPACITOR



Reflow Soldering Nickel Barrired Termination Type
GRM200 Series ; Smoothing

FEATURES

1. Large capacitance at low cost because of the use of base-metal materials.
2. Heat generation is low at high frequency because of low dielectric loss.
3. Compared with aluminum electrolytic capacitors, capacitance can be lower to obtain the same smoothing performance.
4. Ceramic capacitor has no polarity and ensures long life time.

APPLICATION

- DC-DC converter
- Noize elimination LCD bias circuit
(Use for only alumina, paper or glass epoxy board)

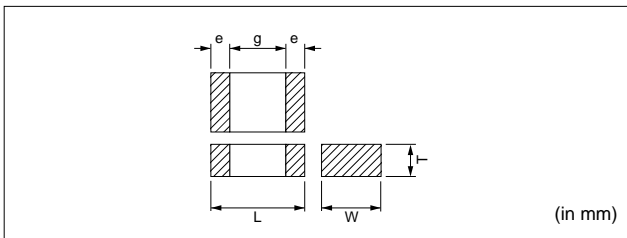
PART NUMBERING

(* Please specify the part number when ordering)



- ① Type
- ② Temperature Characteristics
(Please refer to the table)
- ③ Capacitance
- ④ Capacitance Tolerance
- ⑤ Rated Voltage
- ⑥ Murata's Control No.
- ⑦ Packaging

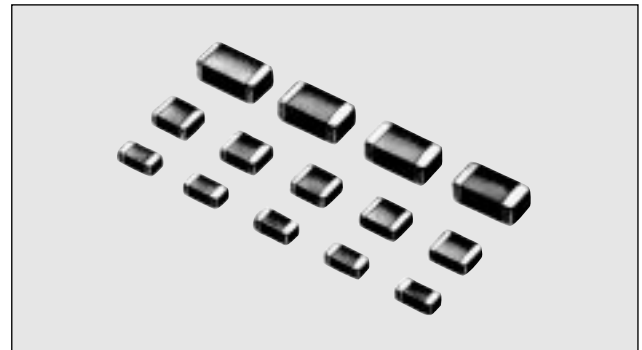
TYPE AND DIMENSIONS



Type (EIA Code)	Dimensions (mm)				
	L	W	T	e	g
GRM220 (0603)	1.6±0.1	0.8±0.1	Please refer to the capacitance range table.	0.2-0.5	0.5min.
GRM230 (1206)	3.2±0.15	1.6±0.15		0.3-0.8	0.5min.
GRM235 (1210)	3.2±0.3	2.5±0.2		0.3min.	1.0min.

TEMPERATURE CHARACTERISTICS

Code	Capacitance Change Rate	Temp. Range	Reference Temp.
Y5V	Within ± 22 %	-30 to 85 °C	25 °C



CAPACITANCE (Ex.)

Code	Capacitance (μF)
105	1
226	22

CAPACITANCE TOLERANCE

Z : +80 / -20 %

RATED VOLTAGE

Code	Rated Voltage (VDC)
10	10
16	16
25	25

RATED VOLTAGE

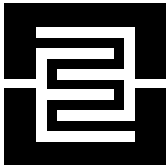
Code	Packaging
PB	Bulk packaging in a bag (only for GRM220)
PT	Tape carrier packaging

CAPACITANCE RANGE

(in μF)

Type (EIA Code)	Tickness T (mm)	Rated Voltage		
		25VDC	16VDC	10VDC
GRM220 (0603)	0.8±0.1	—	—	1
GRM230 (1206)	1.15±0.1	—	4.7	10
GRM235 (1210)	1.5 ± ⁰ / _{0.3}	6.8	6.8, 10	22
	2.0 ± ⁰ / _{0.4}	10	—	—
Capacitance Tolerance		Z : ± 80 / 20 %		

Type (EIA Code)	Tickness T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)
GRM220 (0603)	0.8±0.1	1,000	4,000
GRM230 (1206)	1.15±0.1	—	3,000
GRM235 (1210)	1.5 ± ⁰ / _{0.3}	—	2,000
	2.0 ± ⁰ / _{0.4}	—	1,000



MONOLITHIC CERAMIC CAPACITOR



Reflow Soldering Nickel Barrired Termination Type
GRM200 Series ; Smoothing

SPECIFICATIONS AND TEST METHODS

No	Item	Specification	Test Method																
1	Operating Temperature Range	Y5V : -30°C to +85°C																	
2	Rated Voltage	See the previous page.	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, shall be maintained within the rated voltage range.																
3	Appearance	No defects or abnormalities.	Visual inspection.																
4	Dimension	Within the specified dimension.	Using calipers.																
5	Dielectric Strength	No defects or abnormalities.	No failure shall be observed when a voltage 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																
6	Insulation Resistance	10000MΩ min. or 500Ω · F min. (whichever is smaller)	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes of charging.																
7	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 20°C at the frequency and voltage shown in the table.																
8	Dissipation Factor (D. F.)	Y5V : 0.09 max.	<table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>C < 10μF</td> <td>1±0.1kHz</td> <td>1±0.2Vrms</td> </tr> <tr> <td>C > 10μF</td> <td>120kHz±20%</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table>	Capacitance	Frequency	Voltage	C < 10μF	1±0.1kHz	1±0.2Vrms	C > 10μF	120kHz±20%	0.5±0.1Vrms							
Capacitance	Frequency	Voltage																	
C < 10μF	1±0.1kHz	1±0.2Vrms																	
C > 10μF	120kHz±20%	0.5±0.1Vrms																	
9	Capacitance Temperature Characteristics	<table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change Rate</th> </tr> </thead> <tbody> <tr> <td>Y5V</td> <td>-30 to 85°C</td> <td>25°C</td> <td>Within ±$\frac{22}{82}\%$</td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change Rate	Y5V	-30 to 85°C	25°C	Within ± $\frac{22}{82}\%$	The ranges of capacitance change reference to 25°C within the temperature ranges shown in the table shall be within the specified ranges.								
Char.	Temp. Range	Reference Temp.	Cap. Change Rate																
Y5V	-30 to 85°C	25°C	Within ± $\frac{22}{82}\%$																
10	Adhesive strength of Termination	No removal of the terminations or other defect shall occur.	<p>Solder the capacitor on the testing jig (glass epoxy board) shown in Fig. 1e by an eutectic solder. Then apply 10N of force in parallel with the test jig for 10±1 sec. The soldering shall be done either by iron or reflow and be conducted with care so that the soldering is uniform and free of defect such as heat shock. *5N (GRM220 only)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM220</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM230</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM235</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM220	1.0	3.0	1.2	GRM230	2.2	5.0	2.0	GRM235	2.2	5.0	2.9
Type	a	b	c																
GRM220	1.0	3.0	1.2																
GRM230	2.2	5.0	2.0																
GRM235	2.2	5.0	2.9																
11	Vibration Resistance	<p>Appearance: No defects or abnormalities.</p> <p>Capacitance: Within the specified tolerance.</p> <p>Dissipation Factor(D.F.): Y5V : 0.09 max.</p>	Solder the capacitor to the testing jig (glass epoxy boards) in the same manner and under the same conditions as (10). The range of vibration frequency (10 to 55Hz), total amplitude (1.5mm), and the ratio of changes in the number of vibrations shall satisfy the specified values after applying vibration which takes about 1 minute to be transmitted from 10Hz to 55Hz and back to 10Hz for a total of six hours (two hours each in three mutually perpendicular directions).																
12	Deflection	No cracks or marked defect shall occur.	<p>Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2e using a eutectic solder. Then apply a force in the direction shown in Fig.3e. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>																

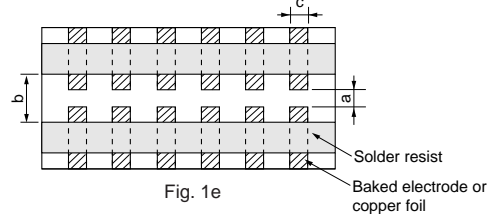


Fig. 1e

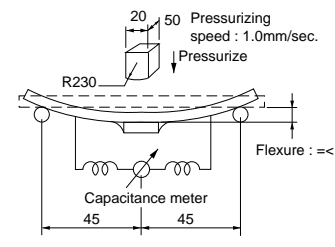


Fig. 3e

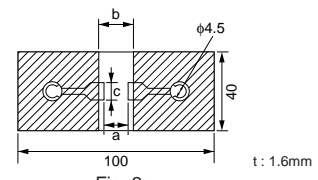
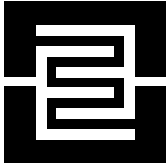


Fig. 2e

Type	a	b	c
GRM220	1.0	3.0	1.2
GRM230	2.2	5.0	2.0
GRM235	2.2	5.0	2.9

(in mm)

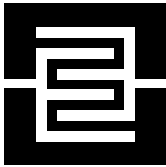


MONOLITHIC CERAMIC CAPACITOR



Reflow Soldering Nickel Barrired Termination Type
GRM200 Series ; Smoothing

No	Item	Specification	Test Method																											
13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor first a ethanol (JIS-K-8101) solution of rosin (JIS-K-5902) (25% rosin in weight proportion), then in an eutectic solder solution for 2±0.5 seconds at 230±5°C after preheating for 10 to 30 seconds at 80 to 120°C.																											
14	Resistance to Soldering Heat	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defect.</td> </tr> <tr> <td>Capacitance Change</td> <td>Y5V : Within ±20%</td> </tr> <tr> <td>I.R.</td> <td>More than 10000MΩ or 500Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>Y5V : 0.09 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defect.	Capacitance Change	Y5V : Within ±20%	I.R.	More than 10000MΩ or 500Ω · F (Whichever is smaller)	D.F.	Y5V : 0.09 max.	Dielectric Strength	No failure	<p>The capacitor shall be set for 48±4 hours at room temperature after one hour heat of treatment at 150°C±⁰/₁₀°C. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds (flowsoldering bath) after preheating in the flowing table. Then set it for 48±4 hours at room temperature and measure.</p> <table border="1"> <thead> <tr> <th>Chip Size</th> <th>Conditions</th> </tr> </thead> <tbody> <tr> <td>3.2X1.6mm max.</td> <td>1 minute at 120 to 150°C</td> </tr> <tr> <td>3.2X2.5mm min.</td> <td>Each 1 minute at 100 to 120°C and then 170 to 200°C</td> </tr> </tbody> </table>	Chip Size	Conditions	3.2X1.6mm max.	1 minute at 120 to 150°C	3.2X2.5mm min.	Each 1 minute at 100 to 120°C and then 170 to 200°C									
Item	Specification																													
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D.F.	Y5V : 0.09 max.																													
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3.2X1.6mm max.	1 minute at 120 to 150°C																													
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15	Temperature Cycle	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defect.</td> </tr> <tr> <td>Capacitance Change</td> <td>Y5V : Within ±20%</td> </tr> <tr> <td>I.R.</td> <td>More than 10000MΩ or 500Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>Y5V : 0.09 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defect.	Capacitance Change	Y5V : Within ±20%	I.R.	More than 10000MΩ or 500Ω · F (Whichever is smaller)	D.F.	Y5V : 0.09 max.	Dielectric Strength	No failure	<p>The capacitor shall be set for 48±4 hours at room temperature after one hour heat of treatment at 150°C±⁰/₁₀°C, then measure for the initial measurement. Fix capacitor to the supporting jig in the same manner and under the same conditions as in (10) and conduct the five cycles according to the temperature and time shown in the following table. Set it for 48±4 hours at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. +⁰/₃</td> <td>Room Temp.</td> <td>Max. Operating Temp. +⁰/₃</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> </tbody> </table>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. + ⁰ / ₃	Room Temp.	Max. Operating Temp. + ⁰ / ₃	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
Item	Specification																													
Appearance	No marking defect.																													
Capacitance Change	Y5V : Within ±20%																													
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Step	1	2	3	4																										
Temp. (°C)	Min. Operating Temp. + ⁰ / ₃	Room Temp.	Max. Operating Temp. + ⁰ / ₃	Room Temp.																										
Time (min.)	30±3	2 to 3	30±3	2 to 3																										
16	Humidity (Steady State)	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defect.</td> </tr> <tr> <td>Capacitance Change</td> <td>Y5V : Within ±30%</td> </tr> <tr> <td>I.R.</td> <td>More than 1000MΩ or 50Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>Y5V : 0.125 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defect.	Capacitance Change	Y5V : Within ±30%	I.R.	More than 1000MΩ or 50Ω · F (Whichever is smaller)	D.F.	Y5V : 0.125 max.	Dielectric Strength	No failure	Set the capacitor at 500±12 hours at 40±2°C. in 90 to 95% humidity. Take it out and set it for 48±4 hours at room temperature, then measure.															
Item	Specification																													
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Item	Specification																													
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18	High Temperature Load	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defect.</td> </tr> <tr> <td>Capacitance Change</td> <td>Y5V : Within ±30%</td> </tr> <tr> <td>I.R.</td> <td>More than 1000MΩ or 50Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>Y5V : 0.125 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marking defect.	Capacitance Change	Y5V : Within ±30%	I.R.	More than 1000MΩ or 50Ω · F (Whichever is smaller)	D.F.	Y5V : 0.125 max.	Dielectric Strength	No failure	The voltage treatment shall 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°C then it shall be set for 48±4 hours at room temperature and the measurement shall 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.															
Item	Specification																													
Appearance	No marking defect.																													
Capacitance Change	Y5V : Within ±30%																													
I.R.	More than 1000MΩ or 50Ω · F (Whichever is smaller)																													
D.F.	Y5V : 0.125 max.																													
Dielectric Strength	No failure																													



MONOLITHIC CERAMIC CAPACITOR

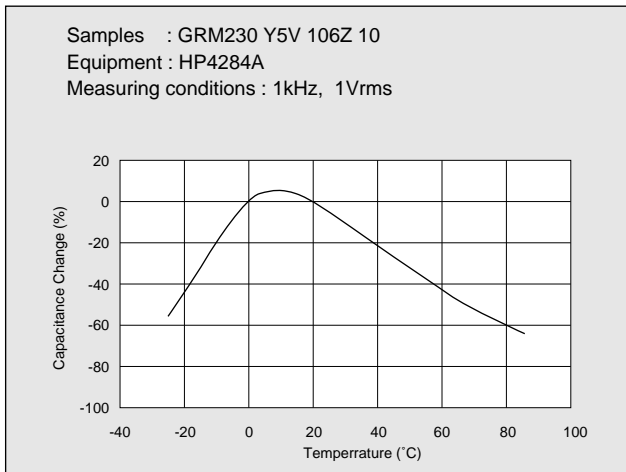


Reflow Soldering Nickel Barrired Termination Type
GRM200 Series ; Smoothing

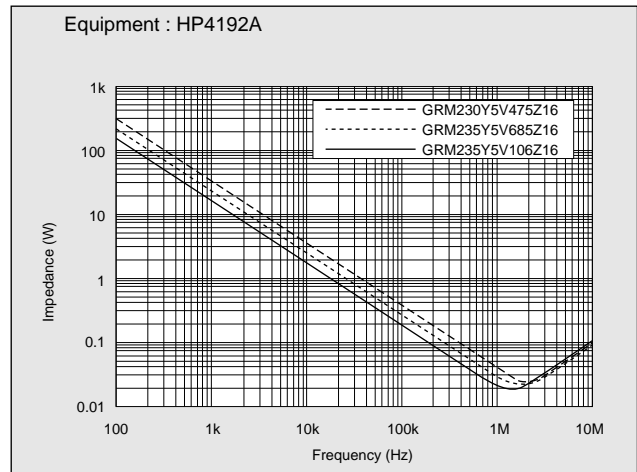
CHARACTERISTICS (REFERENCE DATA)

- SELECTION OF CERAMIC CAPACITORS
 When selecting capacitors, consider the DC voltage characteristics (AC & DC) and aging characteristics.

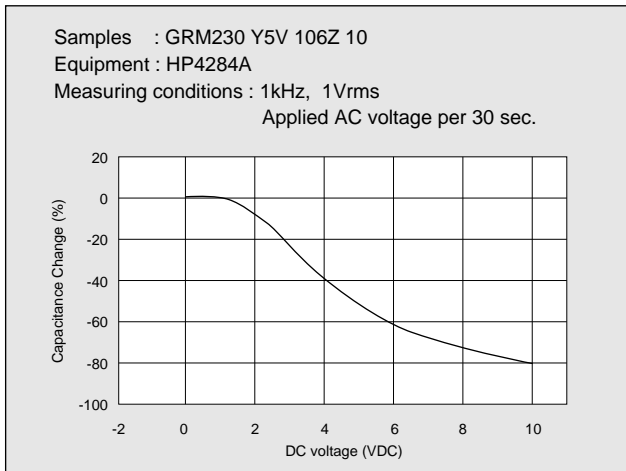
Capacitance-Temperature Characteristics



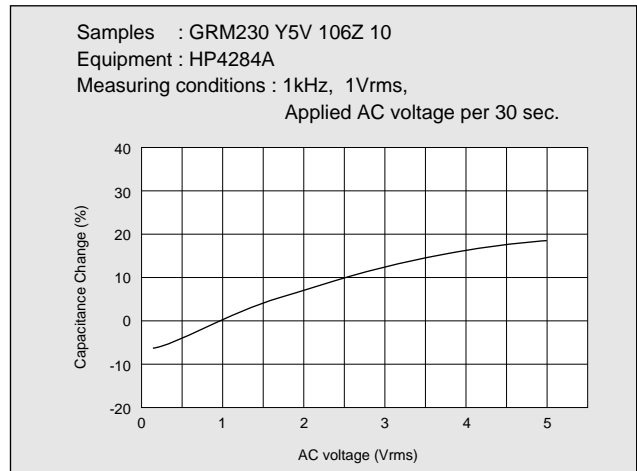
Impedance-Frequency Characteristics

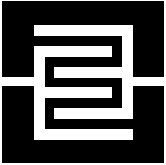


Capacitance-DC Voltage Characteristics



Capacitance-AC Voltage Characteristics





MONOLITHIC CERAMIC CAPACITOR



Reflow Soldering Nickel Barrired Termination Type
GRM200 Series ; Smoothing

■ ALLOWABLE RIPPLE CURRENT (GRM200 SERIES)

Ripple current should be less than "Allowable Ripple Current Value" shown in the following table .
 And temperature rise of the chip surface (ΔT) should be below 20°C.
 When AC and DC voltage are superimposed, keep the peak value of the voltage within the rated voltage.

- Allowable Ripple Current Value

Rated Voltage : 10V

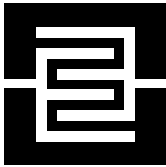
Chip Size	100kHz= \leq f <300kHz	300kHz= \leq f <500kHz	500kHz= \leq f = \leq 1MHz
GRM220	1.4Arms	1.5Arms	1.6Arms
GRM230	1.5Arms	1.6Arms	1.6Arms
GRM235	1.7Arms	1.8Arms	2.0Arms

Rated Voltage : 16V

Chip Size	100kHz= \leq f <300kHz	300kHz= \leq f <500kHz	500kHz= \leq f = \leq 1MHz
GRM230	1.5Arms	1.6Arms	1.6Arms
GRM235	1.7Arms	1.8Arms	2.0Arms

Rated Voltage : 25V

Chip Size	100kHz= \leq f <300kHz	300kHz= \leq f <500kHz	500kHz= \leq f = \leq 1MHz
GRM230	2.0Arms	2.2Arms	2.2Arms



MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

GRH/RPN700 Series ; High-frequency Type

FEATURES

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. Nickel barriered terminations of GRH type improve solderability and decrease solder leaching.
3. GRH706/GRH708 type is designed for both flow and reflow soldering and GRH710 type is designed for reflow soldering.
4. RPN type capacitors withstand at high temperatures because ribbon leads are attached with silver paste.
5. RPN type capacitors are easily soldered and are especially well suited in applications where only a soldering iron can be used.

APPLICATION

High-frequency and high-power circuits

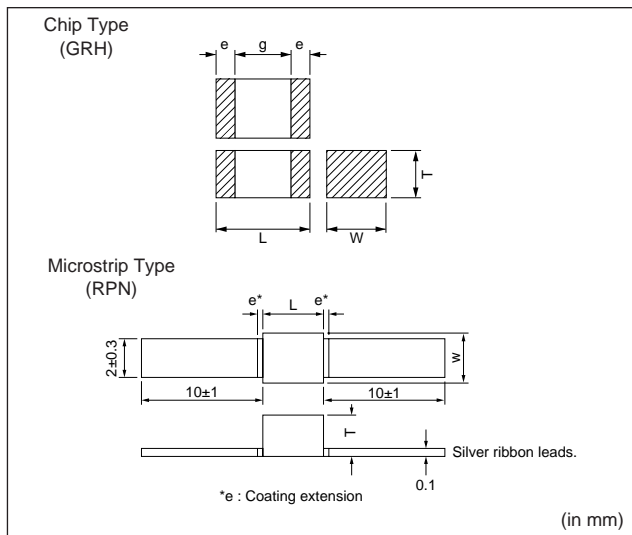
PART NUMBERING

(*Please specify the part number when ordering)



- ① Type
- ② Temperature Characteristic
- ③ Capacitance
- ④ Capacitance Tolerance
- ⑤ Rated Voltage
- ⑥ Murata's Control No.
- ⑦ Packaging Code

TYPE AND DIMENSIONS



Type	Dimensions (mm)				
	L	W	T	e	g
GRH706	1.25 ^{+0.5} _{-0.3}	1.0 ^{+0.5} _{-0.3}	1.2 max.	0.15min.	0.3min.
GRH708	2.0 ^{+0.5} _{-0.3}	1.25 ^{+0.5} _{-0.3}	1.45max.	0.2 min.	0.5min.
GRH710	3.2 ^{+0.6} _{-0.4}	2.5 ^{+0.5} _{-0.3}	1.9 max.	0.3 min.	0.5min.
RPN710	4.0 max.	3.0 max.	2.3 max.	1.5 max.	—

TEMPERATURE CHARACTERISTIC

Code	Temp. coeff.	Temp. range	Reference temp.
C0G	0±30ppm/°C	-55°C to 125°C	25°C

CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
010	1	220	22
1R5	1.5	471	470

CAPACITANCE TOLERANCE

Code	C	D	J
Cap. tolerance	±0.25pF	±0.5pF	±5%
Cap. range	C=<5pF	5pF<C=<10pF	10pF<C

RATED VOLTAGE

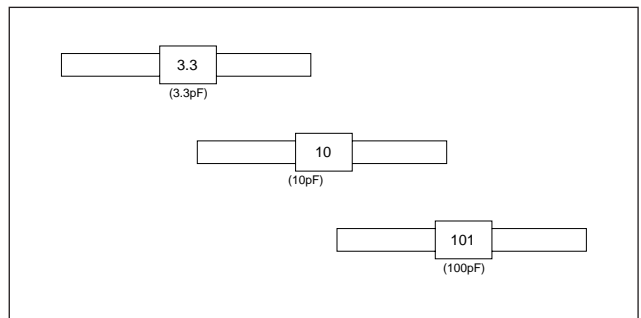
Code	Rated voltage
50	50VDC
100	100VDC
200	200VDC

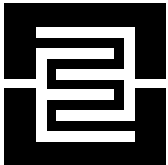
PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging (for only GRH type)

MARKING

Marking is omitted from GRH706, GRH708 and GRH710. For the RPN710, the actual number is marked if less than 100pF and the three digit code is marked if 100pF or over.





MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

GRH/RPN700 Series ; High-frequency Type

■ CAPACITANCE RANGE TABLE

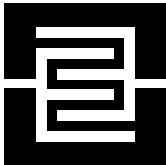
Cap. (pF)	T. C. Type Volt.	C0G								
		GRH706			GRH708			GRH710/RPN710		
		200	100	50	200	100	50	200	100	50
0.5										
0.6										
0.7										
0.8										
0.9										
1.0										
1.1										
1.2										
1.3										
1.4										
1.5										
1.6										
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220										
240										
270										
300										
330										
360										
390										
430										
470										
510										
560										
620										
680										
750										
820										
910										
1,000										

■ CAPACITANCE TOLERANCE

5pF and below	C : ±0.25pF
Over 5pF, 10pF and below	D : ±0.5pF
More than 10pF	J : ± 5%

■ PACKAGING TYPES/QUANTITY

Type	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)
GRH706	1,000	—
GRH708	1,000	3,000
GRH710	1,000	2,000
RPN710	100	—



MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

GRH/RPN700 Series ; High-frequency Type

SPECIFICATIONS AND TEST METHODS

Temperature Compensating Type

No	Item	Specification	Test Method								
1	Operating Temperature Range	-55 to +125°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^{C-P} , whichever is larger, shall be maintained within the rated voltage range.								
3	Appearance	No defects or abnormalities.	Visual inspection.								
4	Dimension	Within the specified dimension.	Using calipers.								
5	Dielectric Strength	No defects or abnormalities	No failure shall 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	10,000MΩ min.	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and standard humidity and within 2 minutes of charging.								
7	Capacitance	Within the specified tolerance.	The capacitance/Q shall be measured at 25°C at the frequency and voltage shown in the table.								
8	Q	$C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Char.</th> <th>COG (1,000pF and below)</th> </tr> </thead> <tbody> <tr> <td>Item</td> <td></td> </tr> <tr> <td>Frequency</td> <td>1±0.1MHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> </tr> </tbody> </table>	Char.	COG (1,000pF and below)	Item		Frequency	1±0.1MHz	Voltage	0.5 to 5Vrms
Char.	COG (1,000pF and below)										
Item											
Frequency	1±0.1MHz										
Voltage	0.5 to 5Vrms										
9	Capacitance Temperature Characteristics	Capacitance Variation Rate	Within the specified tolerance. (Table A-4)								
		Temperature Coefficient	Within the specified tolerance. (Table A-4)								
		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 shall occur.								
		Tensile Strength (for micro-strip type)	Capacitor shall not be broken or damaged.								
		Bending Strength of lead wire terminal (for micro-strip type)	Lead wire shall not be cut or broken.								
11	Vibration Resistance	Appearance	No defects or abnormalities.								
		Capacitance	Within the specified tolerance.								
		Q	Satisfies the initial value. $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ C : Nominal Capacitance (pF)								

Char.	COG (1,000pF and below)
Item	
Frequency	1±0.1MHz
Voltage	0.5 to 5Vrms

Step	Temperature (°C)
1	25±2
2	-55±3
3	25±2
4	125±3
5	25±2

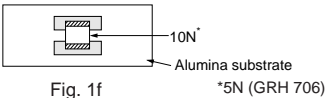


Fig. 1f *5N (GRH 706)

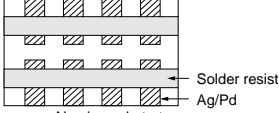
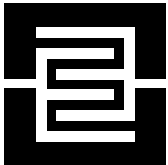


Fig. 2f



MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

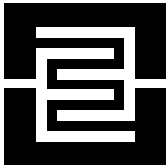
GRH/RPN700 Series ; High-frequency Type

No	Item	Specification	Test Method																											
12	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5°C. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.																											
13	Resistance to Soldering Heat	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</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> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Q	C < 220pF : Q ≥ 10,000 220pF < C < 470pF : Q ≥ 5,000 470pF < C < 1,000pF : Q ≥ 3,000	Dielectric Strength	No failure	<p>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°C. 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.</p> <table border="1"> <thead> <tr> <th>Chip Size</th> <th>Preheat Condition</th> </tr> </thead> <tbody> <tr> <td>2.0X1.25 mm max.</td> <td>1 minute at 120 to 150°C</td> </tr> <tr> <td>3.2X2.5mm</td> <td>Each 1 minute at 100 to 120°C and then 170 to 200°C</td> </tr> </tbody> </table>	Chip Size	Preheat Condition	2.0X1.25 mm max.	1 minute at 120 to 150°C	3.2X2.5mm	Each 1 minute at 100 to 120°C and then 170 to 200°C											
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Appearance	No marking defects																													
Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)																													
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14	Temperature Cycle	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</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> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	Q	C ≥ 30pF : Q ≥ 350 10pF < C < 30pF : Q ≥ 275 + $\frac{5}{2}$ C C < 10pF : Q ≥ 200+10C	I.R.	1,000MΩ min.	Dielectric Strength	No failure	<p>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.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table>	Step	1	2	3	4	Temp. (°C)	-55 ⁺⁰ ₋₃	Room temp.	+125 ⁺³ ₋₀	Room temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
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Time (min.)	30±3	2 to 3	30±3	2 to 3																										
15	Humidity	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</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> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	Capacitance Change	Within ±5% or ±0.5pF (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.	<p>Apply the 24-hour heat (-10 to +65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, set for 24±2 hours at room temperature, and measure.</p>																	
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I.R.	1,000MΩ min.																													
16	High Temperature Load	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±3% or ±0.3pF (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> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	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.	<p>Apply 200% of the rated voltage for 1,000±12 hours at 125±3°C. Remove and set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p>																	
Item	Specification																													
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I.R.	1,000MΩ min.																													

Table A-4

Char.	Temperature Coefficient (ppm/°C) Note1	Capacitance Change from 25°C Value (%)					
		-55°C		-30°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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



MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

GRH/RPN100 Series ; HiQ and High-power Type

FEATURES

1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high-frequency applications (VHF-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. GRH110 type is designed for both flow and reflow soldering and GRH111 type is designed for reflow soldering.
4. GRH type capacitors exhibit better solderability and lower solder leaching because of its nickel barriered terminations.
5. RPN type capacitors withstand high temperatures because ribbon leads are attached with silver paste.
6. RPN type capacitors are easily soldered and especially well suited in applications where only a soldering iron can be used.

APPLICATION

High-frequency and high-power circuits

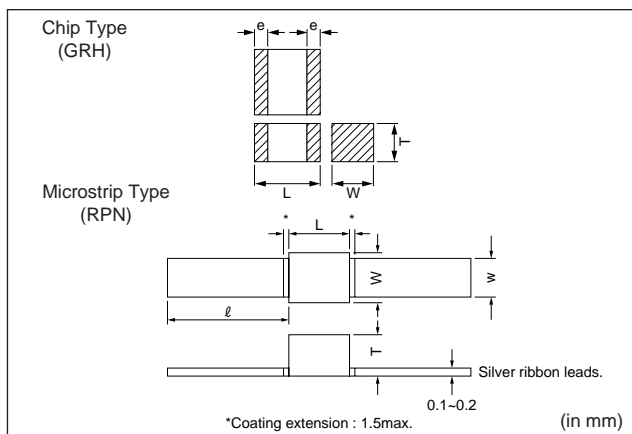
PART NUMBERING

(*Please specify the part number when ordering)



- | | |
|------------------------------|------------------------|
| ① Type | ⑤ Rated Voltage |
| ② Temperature Characteristic | ⑥ Murata's Control No. |
| ③ Capacitance | ⑦ Packaging Code |
| ④ Capacitance Tolerance | |

TYPE AND DIMENSIONS



Type	Dimensions (mm)			
	L	W	T	e
GRH110	1.4 ^{+0.6} _{-0.4}	1.4 ^{+0.6} _{-0.4}	0.8 to 1.65	0.25 ^{+0.25} _{-0.15}
GRH111	2.8 ^{+0.6} _{-0.4}	2.8 ^{+0.6} _{-0.4}	2.0 to 2.8	0.4 ^{+0.4} _{-0.3}

Type	Dimensions (mm)				
	L	W	T	ℓ	w
RPN110	1.6±0.4	1.4±0.4	1.6 max.	5.0 min.	1.3±0.4
RPN111	3.2±0.4	2.8±0.4	3.0 max.	9.0±2.0	2.35±0.15

TEMPERATURE CHARACTERISTIC

Code	Temp. coeff.	Temp. range	Reference temp.
C0G	0±30ppm/°C	-55°C to 125°C	25°C

CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
010	1	220	22
1R5	1.5	471	470

CAPACITANCE TOLERANCE

Code	C	D	J
Cap. tolerance	±0.25pF	±0.5pF	±5%
Applied	C=<5pF	5pF<C=<10pF	10pF<C

RATED VOLTAGE

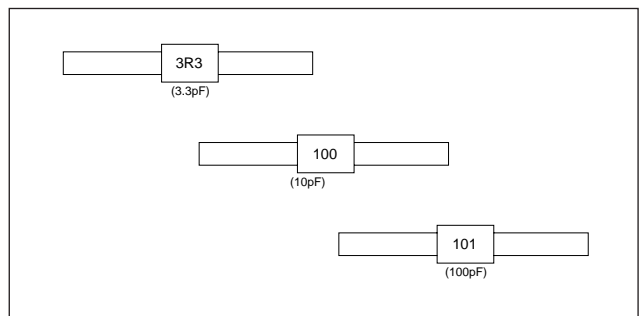
Code	Rated voltage	Code	Rated Voltage
50	50VDC	300	300VDC
100	100VDC	500	500VDC
200	200VDC		

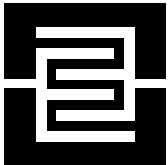
PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging (only for GRH type)

MARKING

Marking is omitted from the GRH110, GRH111 and RPN110. The three digit code is marked on the RPN111 series.





MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

GRH/RPN100 Series ; HiQ and High-power Type

■ CAPACITANCE RANGE TABLE

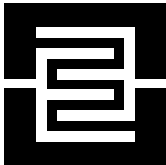
Cap. (pF)	T. C. Type Volt.	C0G					
		GRH110/RPN110	500	300	200	100	50
0.5							
0.6							
0.7							
0.8							
1.0							
1.1							
1.2							
1.3							
1.4							
1.5							
1.6							
1.7							
1.8							
1.9							
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160							
180							
200							
220							
240							
270							
300							
330							
360							
390							
430							
470							
510							
560							
620							
680							
750							
820							
910							
1,000							

■ CAPACITANCE TOLERANCE

5pF and below	C : ±0.25pF
Over 5pF, 10pF and below	D : ±0.5pF
More than 10pF	J : ±5%

■ PACKAGING TYPES/QUANTITY

Type	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)
GRH110	1,000	2,000
GRH111	1,000	1,000
RPN110	100	---
RPN111	50	---



MONOLITHIC CERAMIC CAPACITOR

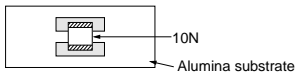
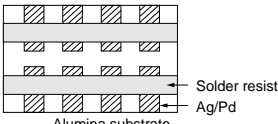


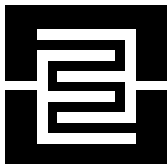
Solder Coated Type

GRH/RPN100 Series ; HiQ and High-power Type

SPECIFICATIONS AND TEST METHODS

Temperature Compensating Type

No	Item	Specification	Test Method									
1	Operating Temperature Range	-55 to +125°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, shall be maintained within the rated voltage range.									
3	Appearance	No defects or abnormalities.	Visual inspection.									
4	Dimension	Within the specified dimension.	Using calipers.									
5	Dielectric Strength	No defects or abnormalities.	No failure shall 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	25°C 470pF < C ≤ 470pF : 1,000,000MΩmin. C ≤ 1,000pF : 100,000MΩmin.	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 125°C, standard humidity and within 2 minutes of charging.									
		125°C 470pF < C ≤ 470pF : 100,000MΩmin. C ≤ 1,000pF : 10,000MΩmin.										
7	Capacitance	Within the specified tolerance.	The capacitance/Q shall be measured at 25°C at the frequency and voltage shown in the table.									
8	Q	C ≤ 220pF : Q ≥ 10,000 220pF < C ≤ 470pF : Q ≥ 5,000 470pF < C ≤ 1,000pF : Q ≥ 3,000 C : Nominal Capacitance (pF)	<table border="1"> <thead> <tr> <th>Item</th> <th>Char.</th> <th>COG (1,000pF and below)</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td></td> <td>1±0.1MHz</td> </tr> <tr> <td>Voltage</td> <td></td> <td>0.5 to 5Vrms</td> </tr> </tbody> </table>	Item	Char.	COG (1,000pF and below)	Frequency		1±0.1MHz	Voltage		0.5 to 5Vrms
		Item	Char.	COG (1,000pF and below)								
Frequency		1±0.1MHz										
Voltage		0.5 to 5Vrms										
9	Capacitance Temperature Characteristics	Capacitance Variation Rate Within the specified tolerance. (Table A-5)	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 shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-5. 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.									
		Temperature Coefficient Within the specified tolerance. (Table A-5)										
		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 shall occur.	Solder the capacitor to the test jig (alumina substrate) shown in Fig.1g using solder containing 2.5% silver. The soldering shall be done either with an iron or in a 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.  Fig. 1g									
		Tensile Strength (for micro-strip type) Capacitor shall 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 RPN110).									
		Bending Strength of lead wire terminal (for micro-strip type) Lead wire shall 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.									
11	Vibration Resistance	Appearance No defects or abnormalities.	Solder the capacitor to the test jig (alumina substrate) shown in Fig.2g using solder containing 2.5% silver. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so the soldering is uniform and free of defects such as heat shock. The capacitor shall 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, shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).  Fig. 2g									
		Capacitance Within the specified tolerance.										
11	Vibration Resistance	Q Satisfies the initial value. C ≤ 220pF : Q ≥ 10,000 220pF < C ≤ 470pF : Q ≥ 5,000 470pF < C ≤ 1,000pF : Q ≥ 3,000 C : Nominal Capacitance (pF)										



MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

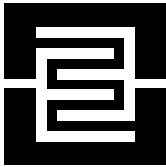
GRH/RPN100 Series ; HiQ and High-power Type

No	Item	Specification	Test Method																											
12	Solderability of Termination	95% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion), Preheat at 80 to 120°C for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5°C. The dipping depth for microstrip type capacitors is up to 1mm from the root of the terminal.																											
13	Resistance to Soldering Heat	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</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°C.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	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.	Dielectric Strength	No failure	<p>Preheat the capacitor at 80 to 100°C for 2 minutes and then at 150 to 200°C for 5 minutes.</p> <p>Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5°C. 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.</p>															
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Dielectric Strength	No failure																													
14	Temperature and Immersion Cycle	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</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°C.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	Capacitance Change	Within ±1% 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.	Dielectric Strength	No failure	<p>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 °C for 15 minutes and immersion in a saturated aqueous solution of salt at 0±3°C 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.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table>	Step	1	2	3	4	Temp. (°C)	-55 ⁺⁰ ₋₃	Room temp.	+125 ⁺³ ₋₀	Room temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
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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.																													
16	High Temperature Load	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marking defects</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°C.</td> </tr> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marking defects	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.	<p>Apply 150% of the rated voltage for 2000±12 hours at 125±3°C. Remove and set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p>																	
Item	Specification																													
Appearance	No marking defects																													
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.																													

Table A-5

Char.	Temperature Coefficient (ppm/°C) Note 1	Capacitance Change from 25°C Value (%)					
		-55°C		-30°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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



MONOLITHIC CERAMIC CAPACITOR

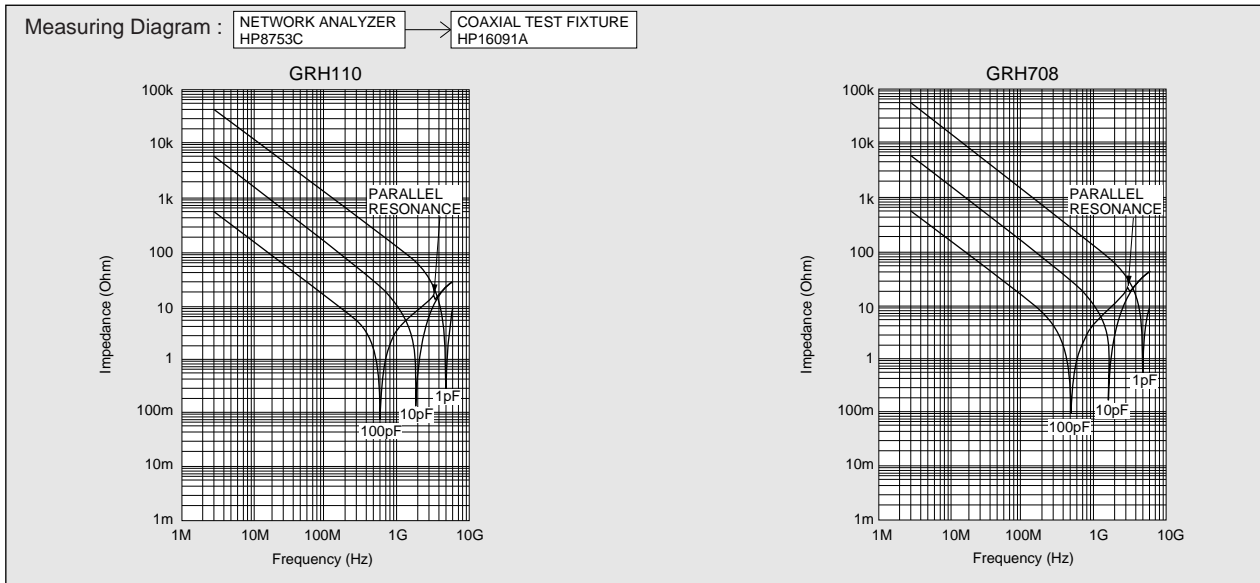


Solder Coated Type

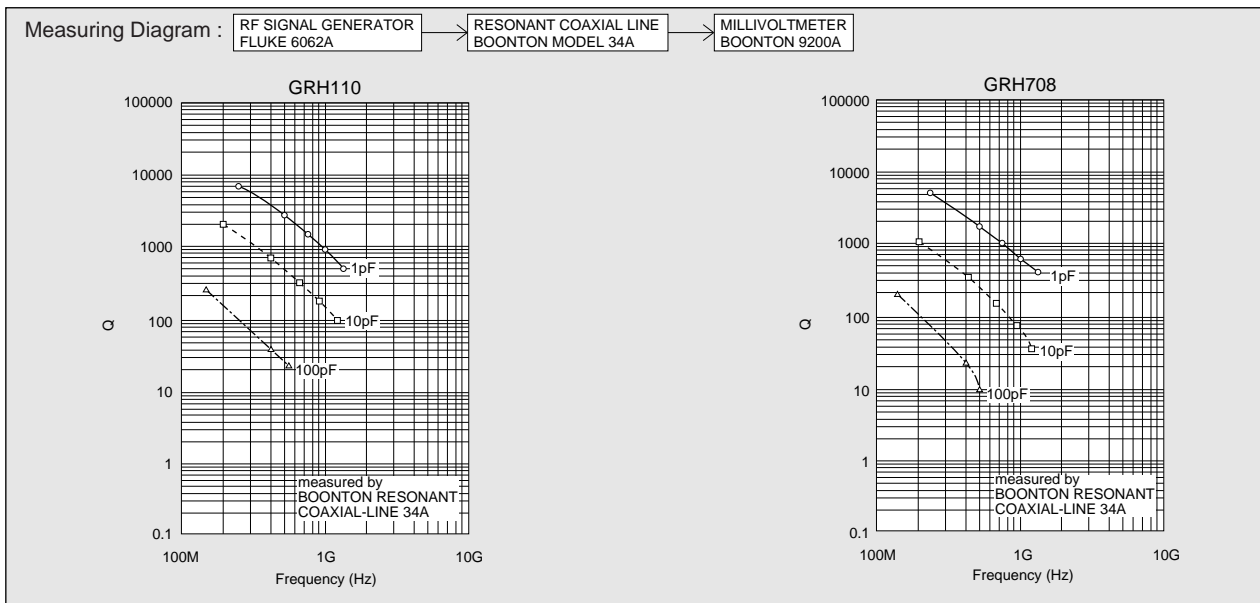
GRH/RPN700 Series and GRH/RPN100 Series

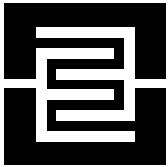
CHARACTERISTICS

- Impedance-Frequency Characteristics



- Q-Frequency Characteristics





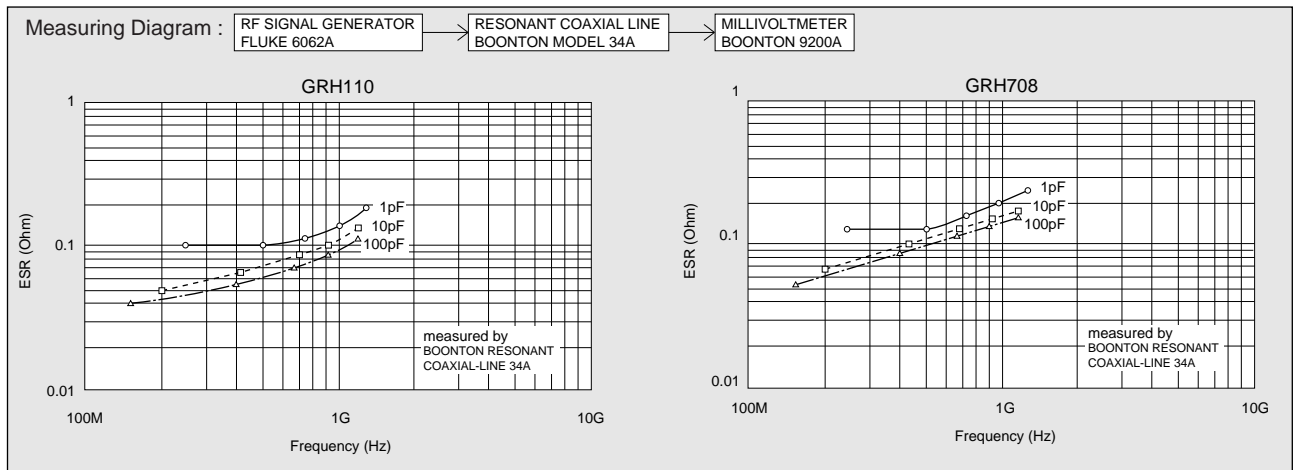
MONOLITHIC CERAMIC CAPACITOR



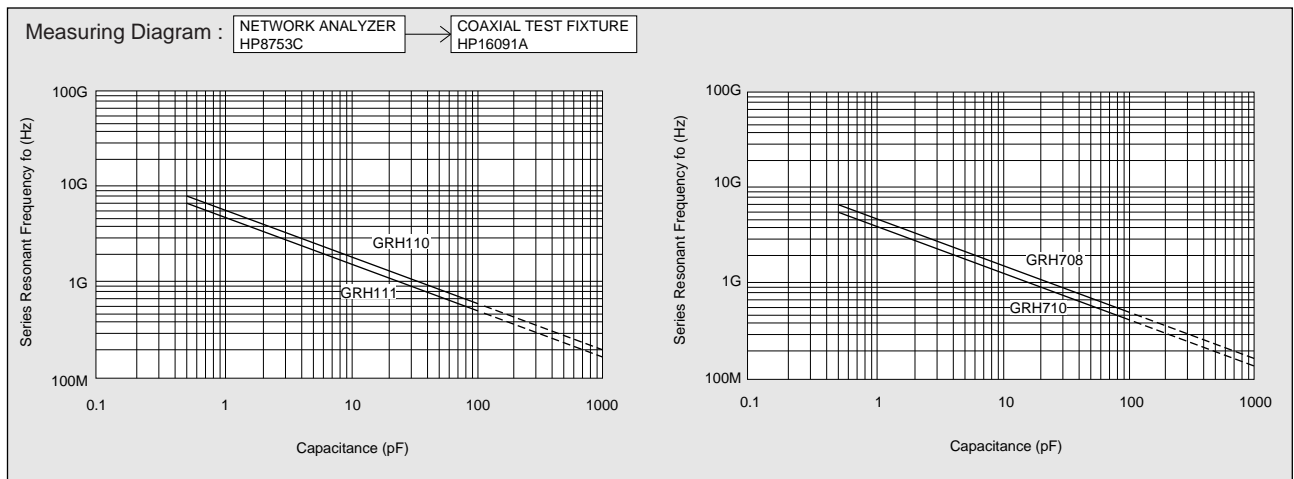
Solder Coated Type

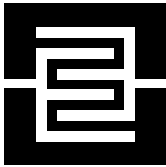
GRH/RPN700 Series and GRH/RPN100 Series

• ESR-Frequency



• Resonant Frequency-Capacitance





MONOLITHIC CERAMIC CAPACITOR



Solder Coated Type

GRH/RPN100 Series ; HiQ and High-power Type

• High Frequency-Power Capacity

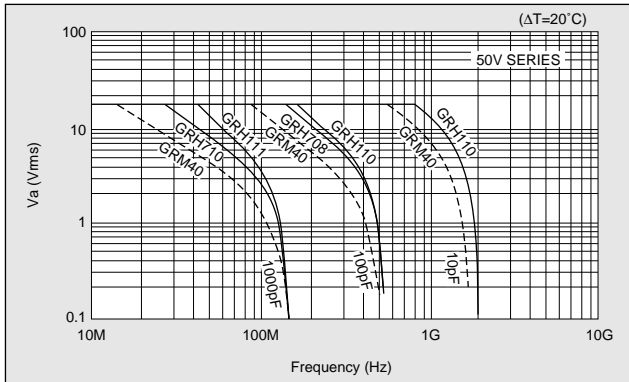
The monolithic ceramic capacitor has a small dielectric loss. When high frequency current is applied to the capacitor, the capacitor generates heat (power consumption) by its E.S.R. Temperature rise of the capacitor (ΔT) should be kept below 20°C ($\Delta T \leq 20^\circ\text{C}$) in the actual circuit.

Therefore, when selecting capacitors, the applicable voltage, power and current should be considered with in the following limits.

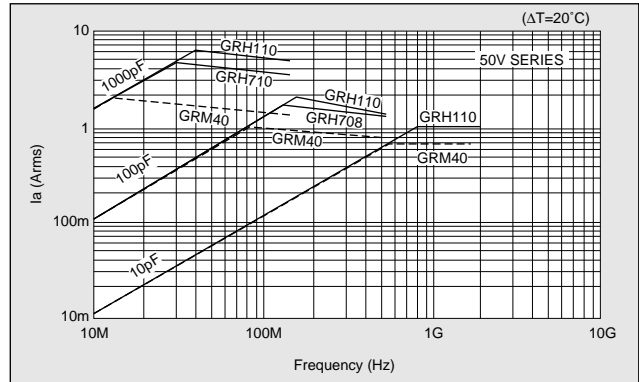
Effective power at $\Delta T = 20^\circ\text{C}$ is as follows

Size	Effective power P. [mW]
GRH110	120
GRH111	245
GRH708	125
GRH710	225

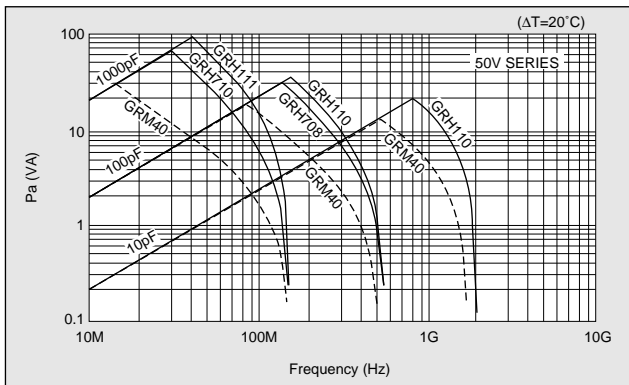
• Allowable Voltage-Frequency



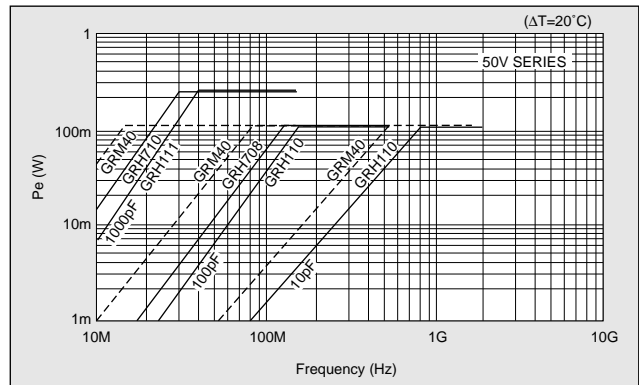
• Allowable Current-Frequency

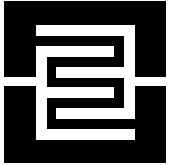


• Allowable Apparent Power-Frequency



• Allowable Effective Power-Frequency





MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type
GR500 Series ; High-voltage

FEATURES

1. Large capacitance but of compact size due to monolithic construction.
2. Ceramic covered internal electrodes offer excellent humidity resistance.
3. Elimination of lead wires reduces inductance for high frequency application.
4. Can be soldered on to substrates with resin coating.

APPLICATION

1. For by-pass and coupling of high voltage generation circuits of measuring instruments, medical instruments, automated office equipment, and many other types of equipment.
2. For pick-up tube related high voltage generating circuits.

PART NUMBERING

(*Please specify the part number when ordering)



① Type

See the Dimensions.

② Temperature Characteristics

Code	Characteristic
X7R	Capacitance Change Rate : ±15% max.
C0G	Capacitance Temp. Coefficient : 0±30ppm/°C

Temperature Range : -55°C to +125 °C
 Standard Temperature : 25 °C

③ Nominal Capacitance (Ex.)

Code	Capacitance (pF)
100	10
101	100
222	2200
683	68000
334	330000 (=0.33μF)

④ Capacitance Tolerance

Code	Standards	Condition
F	± 1pF	10pF and below
K	±10%	More than 10pF

⑤ Rated Voltage

Code	Standards
500	500VDC
1K	1kVDC
2K	2kVDC
3K	3.15kVDC
4K	4kVDC

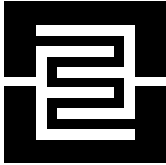
⑥ Murata's Control No.

⑦ Packaging Code

Bulk Packaging : PM

DIMENSIONS

Type	Appearance	Dimensions (mm)			
		L	W	T max.	e min.
GR530		4.5±0.3	3.8±0.3	3.6	0.3
GR535		5.6±0.3	5.0±0.3	4.3	0.3
GR540		10.6±0.5	5.0±0.3	4.3	0.3
GR545		10.6±0.5	10.0±0.6	4.3	0.3
GR550		11.8±1.0	10.6±0.9	4.5	0.3
GR555		16.0±0.7	5.0±0.3	4.3	0.3
GR580		28.0±1.4	13.2±1.3	5.1	0.3



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type
GR500 Series ; High-voltage

CAPACITANCE RANGE

Temperature Characteristic : C0G

● 500VDC

Tol. : ±10% (K)

Cap.	Type	GR530	GR535
39 (pF)			
47			
56			
68			
82			
100			
120			
150			
180			
220			
270			
330			
390			
470			
560			
680			
820			
1000			

● 1kVDC

Tol. : ±10% (K)

Cap.	Type	GR530	GR535	GR550
39 (pF)				
47				
56				
68				
82				
100				
120				
150				
180				
220				
270				
330				
390				
470				
560				
680				
820				
1000				
1200				
1500				
1800				
2200				
2700				

● 2kVDC

Tol. : ±10% (K)

Cap.	Type	GR530	GR535	GR550
15 (pF)				
18				
22				
27				
33				
39				
47				
56				
68				
82				
100				
120				
150				
180				
220				
270				
330				
390				
470				
560				
680				
820				
1000				
1200				
1500				
1800				

● 3.15kVDC

Tol. : ±10% (K)
 ±1pF (F) for capacitance 10pF.

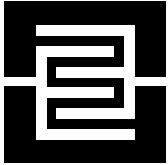
Cap.	Type	GR530	GR535	GR550	GR580
10 (pF)					
12					
15					
18					
22					
27					
33					
39					
47					
56					
68					
82					
100					
120					
150					
180					
220					
270					
330					
390					
470					
560					
680					
820					
1000					
1200					
1500					

● 4kVDC

Tol. : ±10% (K)
 ±1pF (F) for capacitance 10pF.

Cap.	Type	GR535	GR540	GR550	GR580
10 (pF)					
12					
15					
18					
22					
27					
33					
39					
47					
56					
68					
82					
100					
120					
150					
180					
220					
270					
330					
390					
470					
560					
680					
820					
1000					
1200					

*The standard tolerance for C0G is K%, but the tolerance J% is also available.



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type
GR500 Series ; High-voltage

CAPACITANCE RANGE

Temperature Characteristic : X7R

● 500VDC

Tol. : ±10% (K)

Cap. \ Type	GR530	GR535	GR550
1200 (pF)	█		
1500			
1800			
2200			
2700			
3300			
3900			
4700			
5600			
6800			
8200			
10000			
12000			
15000			
18000			
22000			
27000			
33000			
39000			
47000			
56000			
68000			
82000			
0.1 (μF)		█	
0.12			
0.15			
0.18			
0.22			
0.27			
0.33			█

● 1kVDC

Tol. : ±10% (K)

Cap. \ Type	GR530	GR535	GR550
820 (pF)	█		
1000			
1200			
1500			
1800			
2200			
2700			
3300			
3900			
4700			
5600			
6800			
8200			
10000			
12000			
15000			
18000			
22000			
27000			
33000			
39000			
47000			
56000			
68000			
82000			
0.1 (μF)			█
0.12			
0.15			

● 2kVDC

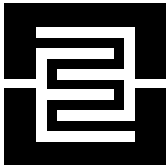
Tol. : ±10% (K)

Cap. \ Type	GR540	GR545	GR580
470 (pF)	█		
560			
680			
820			
1000			
1200			
1500			
1800			
2200			
2700			
3300			
3900			
4700			
5600			
6800			
8200			
10000			
12000			
15000			
18000			
22000			
27000			
33000			
39000			
47000			
56000			
68000			
82000			
0.1 (μF)			█
0.12			

● 3.15kVDC

Tol. : ±10% (K)

Cap. \ Type	GR545	GR555
680 (pF)	█	
820		
1000		
1200		
1500		
1800		
2200		
2700		
3300		
3900		
4700		
5600		
6800		
8200		
10000		



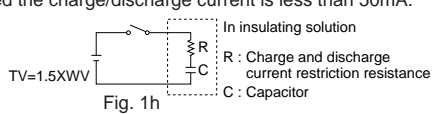
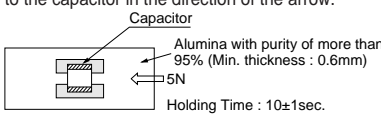
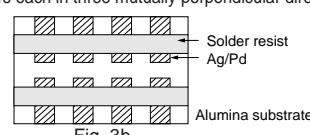
MONOLITHIC CERAMIC CAPACITOR

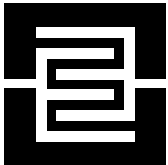


Silver Termination Type
GR500 Series ; High-voltage

SPECIFICATIONS AND TEST METHODS

Temperature Compensating Type

No	Items	Specifications	Test Methods												
1	Operating Temperature Range	-25°C to +85°C													
2	Rated Voltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, shall be maintained within the rated voltage range.												
3	Appearance	No defects or abnormality.	Visual inspection.												
4	Dimension	Within the specified dimension.	Using calipers.												
5	Dielectric Strength	No defect nor abnormality.	No failure shall be observed when a voltage of 150% of the rated voltage are applied between electrodes in a circuit as shown in Fig.1h for 1 to 5 seconds, in insulating solution, provided the charge/discharge current is less than 50mA.  In insulating solution R : Charge and discharge current restriction resistance C : Capacitor Fig. 1h												
6	Insulation Resistance	10,000MΩ min. or 100Ω·F min. (Whichever is smaller).	The Insulation Resistance shall be measured with the following voltage at normal temperature and humidity and within 1 minute of charging. <table border="1" data-bbox="925 929 1428 1019"> <thead> <tr> <th>Rated voltage</th> <th>Voltage applied</th> </tr> </thead> <tbody> <tr> <td>WV : 500VDC</td> <td>500VDC</td> </tr> <tr> <td>WV ≥ 1kVDC</td> <td>1kVDC</td> </tr> </tbody> </table>	Rated voltage	Voltage applied	WV : 500VDC	500VDC	WV ≥ 1kVDC	1kVDC						
Rated voltage	Voltage applied														
WV : 500VDC	500VDC														
WV ≥ 1kVDC	1kVDC														
7	Capacitance	Within the specified tolerance.	The capacitance/Q shall be measured at 25°C with the frequency and voltage shown in the table. <table border="1" data-bbox="925 1086 1428 1187"> <thead> <tr> <th rowspan="2">Item</th> <th>Char</th> <th>C0G, (1000pF and below)</th> <th>C0G, (more than 1000pF)</th> </tr> </thead> <tbody> <tr> <th>Frequency</th> <td>1±0.2MHz</td> <td>1±0.2kHz</td> </tr> <tr> <th>Voltage</th> <td>5Vrms max.</td> <td>5Vrms max.</td> </tr> </tbody> </table>	Item	Char	C0G, (1000pF and below)	C0G, (more than 1000pF)	Frequency	1±0.2MHz	1±0.2kHz	Voltage	5Vrms max.	5Vrms max.		
Item	Char	C0G, (1000pF and below)	C0G, (more than 1000pF)												
	Frequency	1±0.2MHz	1±0.2kHz												
Voltage	5Vrms max.	5Vrms max.													
9	Capacitance Variation Rate	Within the specified tolerance. (Table A-6)	When the temperature coefficient is measured with the capacitance of step 3 as a reference which changing the capacitor temperature from step 1 to 5 in sequence, +25 to +125°C shall be within the specified tolerance for the temperature coefficient. -55 to +25°C shall be within the tolerance for capacitance change specified. The values of drift are obtained by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the intermediate measured value (or the maximum tolerance). <table border="1" data-bbox="925 1366 1428 1534"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table>	Step	Temperature (°C)	1	25±2	2	-55±3	3	25±2	4	125±3	5	25±2
	Step	Temperature (°C)													
	1	25±2													
2	-55±3														
3	25±2														
4	125±3														
5	25±2														
Capacitance Temperature Coefficient	Within the specified tolerance. (Table A-6)														
Capacitance Drift	Within ±0.2% or ±0.05pF. (Whichever is larger.)														
10	Adhesive Strength of Termination	No removal of the terminations or other defect shall occur.	Solder a capacitor to test jig (alumina substrate) shown in Fig. 2h with solder containing 2.5% silver. Soldering should be done either by hand iron or in furnace so carefully as to make a uniform finish and to avoid anything irregular such as thermal shock. No peeling or other troubles of external electrode when 5N "force" is imposed to the capacitor in the direction of the arrow.  Fig. 2h												
11	Appearance	No defect nor abnormality.	Solder the capacitor on the testing jig (alumina substrate) shown in Fig. 3h by solder containing 2.5% silver. The soldering shall be done either by iron or reflow and be conducted with care so that the soldering is uniform and free of defect such as heat shock. The range of vibration frequency (10 to 55Hz), total amplitude (1.5 mm), and the ratio of changes in the number of vibrations shall satisfy the specified values after applying vibration which takes about 1 minute to be transmitted from 10Hz to 55Hz and back to 10Hz for a total of six hours (two hours each in three mutually perpendicular directions).  Fig. 3h												
	Capacitance	Within the specified tolerance.													
	Q	Satisfies the initial value. 30pF min. : Q ≥ 1,000 30pF max. : Q ≥ 400+20C C : Nominal Capacitance (pF)													



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type
GR500 Series ; High-voltage

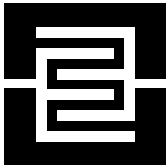
Temperature Compensating Type

No	Items	Specifications	Test Methods																											
12	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor first in a ethanol (JIS-K-8101) solution of rosin (JIS-K-5902) (25% rosin in weight proportion), then in solder containing 2.5% silver for 2±0.5 seconds at 235±5°C after preheating for 5 minutes at 80 to 100°C and then 1 to 2 minutes at 160 to 170°C.																											
13	Resistance to Soldering Heat	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <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>30pF and over : Q ≥1,000 30pF and below : Q ≥400+20C</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ or 100Ω·F (Whichever is smaller)</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> <p>C : Nominal Capacitance</p>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ± 2.5% or ±0.25pF (Whichever is larger)	Q	30pF and over : Q ≥1,000 30pF and below : Q ≥400+20C	I.R.	More than 10,000MΩ or 100Ω·F (Whichever is smaller)	Dielectric Strength	No failure	Immerse the capacitor in solder containing 2.5% silver of 260±5°C for 5±0.5 seconds after preheating for 5 minutes at 80 to 100°C and then for 1 to 2 minutes at 160 to 170°C. Set it for 24±2 hours at room temperature, then measure.															
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within ± 2.5% or ±0.25pF (Whichever is larger)																													
Q	30pF and over : Q ≥1,000 30pF and below : Q ≥400+20C																													
I.R.	More than 10,000MΩ or 100Ω·F (Whichever is smaller)																													
Dielectric Strength	No failure																													
14	Temperature Cycle	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <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>30pF and over : Q ≥1,000 30pF and below : Q ≥400+20C</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ or 100Ω·F (Whichever is smaller)</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> <p>C : Nominal Capacitance</p>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ± 2.5% or ±0.25pF (Whichever is larger)	Q	30pF and over : Q ≥1,000 30pF and below : Q ≥400+20C	I.R.	More than 10,000MΩ or 100Ω·F (Whichever is smaller)	Dielectric Strength	No failure	<p>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 24±2 hours at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>-25±$\frac{3}{2}$</td> <td>Room temp.</td> <td>+85±$\frac{3}{2}$</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> </tbody> </table>	Step	1	2	3	4	Temp. (°C)	-25± $\frac{3}{2}$	Room temp.	+85± $\frac{3}{2}$	Room temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within ± 2.5% or ±0.25pF (Whichever is larger)																													
Q	30pF and over : Q ≥1,000 30pF and below : Q ≥400+20C																													
I.R.	More than 10,000MΩ or 100Ω·F (Whichever is smaller)																													
Dielectric Strength	No failure																													
Step	1	2	3	4																										
Temp. (°C)	-25± $\frac{3}{2}$	Room temp.	+85± $\frac{3}{2}$	Room temp.																										
Time (min.)	30±3	2 to 3	30±3	2 to 3																										
15	Humidity (Steady State)	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <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>30pF and over : Q ≥350 10pF and over, 30pF and below : Q ≥275+$\frac{5}{2}$C 10pF and below : Q ≥200+10C</td> </tr> <tr> <td>I.R.</td> <td>More than 1,000MΩ or 10Ω·F (Whichever is smaller)</td> </tr> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	Q	30pF and over : Q ≥350 10pF and over, 30pF and below : Q ≥275+ $\frac{5}{2}$ C 10pF and below : Q ≥200+10C	I.R.	More than 1,000MΩ or 10Ω·F (Whichever is smaller)	Set the capacitor for 500± $\frac{2}{3}$ hours at 40±2°C, in 90 to 95% humidity. Take it out and set it for 24±2 hours at room temperature, then measure.																	
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)																													
Q	30pF and over : Q ≥350 10pF and over, 30pF and below : Q ≥275+ $\frac{5}{2}$ C 10pF and below : Q ≥200+10C																													
I.R.	More than 1,000MΩ or 10Ω·F (Whichever is smaller)																													
16	High Temperature Load	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±3% or ±0.3pF (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>30pF and over : Q ≥350 10pF and over, 30pF and below : Q ≥275+$\frac{5}{2}$C 10pF and below : Q ≥200+10C</td> </tr> <tr> <td>I.R.</td> <td>More than 2,000MΩ or 20Ω·F (Whichever is smaller)</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> <p>C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	Q	30pF and over : Q ≥350 10pF and over, 30pF and below : Q ≥275+ $\frac{5}{2}$ C 10pF and below : Q ≥200+10C	I.R.	More than 2,000MΩ or 20Ω·F (Whichever is smaller)	Dielectric Strength	No failure	Apply a voltage of 125 % of the rated voltage for 1000± $\frac{48}{0}$ hours at 85±3°C and set it for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.															
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)																													
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I.R.	More than 2,000MΩ or 20Ω·F (Whichever is smaller)																													
Dielectric Strength	No failure																													
17	Notice	When mounting capacitor, perform the epoxy resin coating (min. 0.1mm thickness).																												

Table A-6

Char.	Temperature Coefficient (ppm/°C)	Capacitance Change from 25°C (%)					
		-55°C		-30°C		-10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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



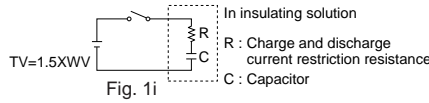
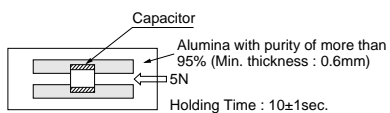
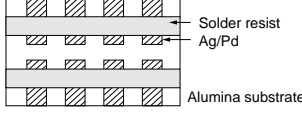
MONOLITHIC CERAMIC CAPACITOR

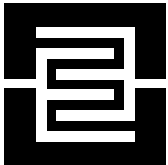


Silver Termination Type
GR500 Series ; High-voltage

SPECIFICATIONS AND TEST METHODS

High Dielectric Constant Type

No	Items	Specifications	Test Methods								
1	Operating Temperature Range	-25°C to +85°C									
2	Rated Voltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, shall be maintained within the rated voltage range.								
3	Appearance	No defects or abnormality.	Visual inspection.								
4	Dimensions	Within the specified dimension.	Using calipers.								
5	Dielectric Strength	No defect nor abnormality.	No failure shall be observed when a voltage of 150% of the rated voltage are applied between electrodes in a circuit as shown in Fig.1i for 1 to 5 seconds, in insulating solution, provided the charge/discharge current is less than 50mA.  <p>Fig. 1i</p>								
6	Insulation Resistance	10,000MΩ min. or 100Ω·F min. (Whichever is smaller).	The Insulation resistance shall be measured with the following voltage at normal temperature and humidity and within 1 minute of charging. <table border="1" data-bbox="922 952 1433 1034"> <thead> <tr> <th>Rated voltage</th> <th>Voltage applied</th> </tr> </thead> <tbody> <tr> <td>WV : 500VDC</td> <td>500VDC</td> </tr> <tr> <td>WV >= 1kVDC</td> <td>1kVDC</td> </tr> </tbody> </table>	Rated voltage	Voltage applied	WV : 500VDC	500VDC	WV >= 1kVDC	1kVDC		
Rated voltage	Voltage applied										
WV : 500VDC	500VDC										
WV >= 1kVDC	1kVDC										
7	Capacitance	Within the specified tolerance.	The capacitance shall be measured at 25°C with 1±0.2kHz in frequency and 1±0.2Vrms in voltage.								
8	Dissipation Factor (D.F.)	0.025max.	DF shall be measured under the same conditions as the capacitance.								
9	Capacitance Temperature Characteristics	<table border="1" data-bbox="363 1153 885 1209"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change Rate</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55~+125°C</td> <td>25°C</td> <td>Within ±15%</td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change Rate	X7R	-55~+125°C	25°C	Within ±15%	The range of capacitance change in reference to 25°C within the temperature range shown in the table shall be within the specified ranges.
Char.	Temp. Range	Reference Temp.	Cap. Change Rate								
X7R	-55~+125°C	25°C	Within ±15%								
10	Adhesive Strength of Termination	No removal of the terminations or other defect shall occur.	Solder a capacitor to test jig (alumina substrate) shown in Fig. 2i with solder containing 2.5% silver. Soldering should be done either by hand iron or in furnace so carefully as to make a uniformed finish and to avoid anything irregular such as thermal shock. No peeling or other troubles of external electrode when 5N "force" is imposed to the capacitor in the direction of the arrow.  <p>Fig. 2i</p>								
11	Vibration Resistance	<table border="1" data-bbox="247 1512 885 1624"> <thead> <tr> <th>Appearance</th> <th>Specifications</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No defect nor abnormality</td> </tr> <tr> <td>Capacitance</td> <td>Within the specified tolerance.</td> </tr> <tr> <td>Dissipation Factor (DF)</td> <td>0.025 max.</td> </tr> </tbody> </table>	Appearance	Specifications	Appearance	No defect nor abnormality	Capacitance	Within the specified tolerance.	Dissipation Factor (DF)	0.025 max.	Solder the capacitor on the testing jig (alumina substrate) shown in Figs. 3i by solder containing 2.5% silver. The soldering shall be done either by iron or reflow and be conducted with care so that the soldering is uniform and free of defect such as heat shock. The range of vibration frequency (10 to 55Hz), total amplitude (1.5mm), and the ratio of changes in the number of vibrations shall satisfy the specified values after applying vibration which takes about 1 minute to be transmitted from 10Hz to 55Hz and back to 10Hz for a total of six hours (two hours each in three mutually perpendicular directions).  <p>Fig. 3i</p>
Appearance	Specifications										
Appearance	No defect nor abnormality										
Capacitance	Within the specified tolerance.										
Dissipation Factor (DF)	0.025 max.										
12	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor first in a ethanol (JIS-K-8101) solution of rosin (JIS-K-5902) (25% rosin in weight proportion), then in solder containing 2.5% silver for 2±0.5 seconds at 235±5°C after preheating for 5 minutes at 80 to 100°C and then 1 to 2 minutes at 160 to 170°C.								



MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

GR500 Series ; High-voltage

High Dielectric Constant Type

No	Items	Specifications	Test Methods																											
13	Resistance to Soldering Heat	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within $\pm 7.5\%$</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ or 100Ω·F (Whichever is smaller)</td> </tr> <tr> <td>DF</td> <td>0.025 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within $\pm 7.5\%$	I.R.	More than 10,000M Ω or 100 Ω ·F (Whichever is smaller)	DF	0.025 max.	Dielectric Strength	No failure	<p>The capacitor shall be set for 24\pm2 hours at room temperature after one hour heat of treatment at 150$^{+0}_{-10}$°C. Immerse the capacitor in solder containing 2.5% silver of 260\pm5 °C for 5\pm0.5 seconds after preheating for 5 minutes at 80 to 100°C and then for 1 to 2 minutes at 160 to 170°C. Then set it for 48 \pm4 hours at room temperature and measure.</p>															
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within $\pm 7.5\%$																													
I.R.	More than 10,000M Ω or 100 Ω ·F (Whichever is smaller)																													
DF	0.025 max.																													
Dielectric Strength	No failure																													
14	Temperature Cycle	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within $\pm 7.5\%$</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ or 100Ω·F (Whichever is smaller)</td> </tr> <tr> <td>DF</td> <td>0.025 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within $\pm 7.5\%$	I.R.	More than 10,000M Ω or 100 Ω ·F (Whichever is smaller)	DF	0.025 max.	Dielectric Strength	No failure	<p>The capacitor shall be set for 24\pm2 hours at room temperature after one hour heat of treatment at 150$^{+0}_{-10}$°C 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 24 \pm2 hours at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>-25$^{+0}_{-3}$</td> <td>Room temp.</td> <td>+85$^{+3}_{-0}$</td> <td>Room temp.</td> </tr> <tr> <td>Time (min.)</td> <td>30\pm3</td> <td>2 to 3</td> <td>30\pm3</td> <td>2 to 3</td> </tr> </tbody> </table>	Step	1	2	3	4	Temp. (°C)	-25 $^{+0}_{-3}$	Room temp.	+85 $^{+3}_{-0}$	Room temp.	Time (min.)	30 \pm 3	2 to 3	30 \pm 3	2 to 3
Item	Specification																													
Appearance	No marked defect																													
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Time (min.)	30 \pm 3	2 to 3	30 \pm 3	2 to 3																										
15	Humidity (Steady State)	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within $\pm 10\%$</td> </tr> <tr> <td>I.R.</td> <td>More than 1,000MΩ or 10Ω·F (Whichever is smaller)</td> </tr> <tr> <td>DF</td> <td>0.05 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within $\pm 10\%$	I.R.	More than 1,000M Ω or 10 Ω ·F (Whichever is smaller)	DF	0.05 max.	Dielectric Strength	No failure	<p>The capacitor shall be set for 24\pm2 hours at room temperature after one hour heat of treatment at 150$^{+0}_{-10}$°C, then measure for the initial measurement. Set the capacitor for 500$^{+24}_{-0}$°C hours at 40\pm2°C, in 90 to 95% humidity. Take it out and set it for 24\pm2 hours at room temperature, then measure.</p>															
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16	High Temperature Load	<p>The measured values shall satisfy the values in the following table.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within $\pm 12.5\%$</td> </tr> <tr> <td>I.R.</td> <td>More than 2,000MΩ or 20Ω·F (Whichever is smaller)</td> </tr> <tr> <td>DF</td> <td>0.05 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within $\pm 12.5\%$	I.R.	More than 2,000M Ω or 20 Ω ·F (Whichever is smaller)	DF	0.05 max.	Dielectric Strength	No failure	<p>A voltage treatment shall be given to the capacitor, in which a DC voltage of 125% the rated voltage is applied for one hour at 85\pm3°C then it shall be set for 24\pm2 hours at room temperature and the initial measurement shall be conducted. Then apply the above mentioned voltage continuously for 1000 $^{+48}_{-0}$ hours at the same temperature, remove it from the bath, and set it for 24\pm2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p>															
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within $\pm 12.5\%$																													
I.R.	More than 2,000M Ω or 20 Ω ·F (Whichever is smaller)																													
DF	0.05 max.																													
Dielectric Strength	No failure																													
17	Notice	When mounting capacitor, perform the epoxy resin coating (min. 1.0mm thickness).																												

PACKAGE

PACKAGING

There are three types of packaging for chip monolithic ceramic capacitors. Please specify the packaging code when ordering.

1. BULK PACKAGING

Packaging code : PB (PM for GR500 Series)
Minimum Quantity*

Type	Minimum Quantity (pcs./bag or tray)
GR(M)36, GR(M)39, GR(M)40, GR(M)42-6, GR(M)42-2, GR(M)43-2, GR(M)44-1, GRM420, GRM425, GRM430, GRM220, GRH110, GRH111, GRH706, GRH708, GRH710	1,000
RPN710	100
RPN110, RPN111, GR530, GR535	50
GR540, GR545, GR550	20
GR555, GR580	40

* "Minimum Quantity" means the numbers of units of each delivery or order. The quantity should be an integral multiple of the "minimum quantity" (Please note that the actual delivery quantity in a package may change sometimes.)

2. TAPE CARRIER PACKAGING

Packaging code : PT

(1) Appearance of taping

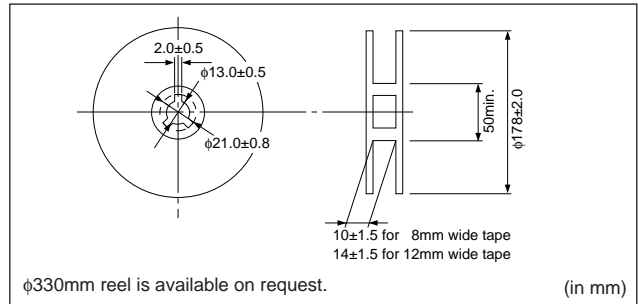
• Paper Tape

(in mm)

• Plastic Tape

(in mm)

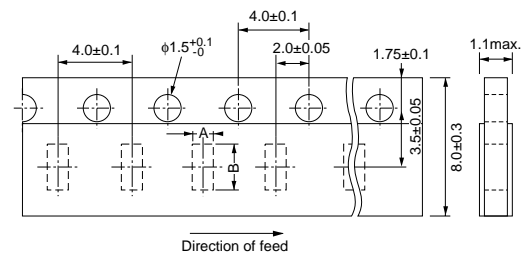
(2) Dimensions of Reel



(3) Dimensions of Tape

(a) Paper Tape

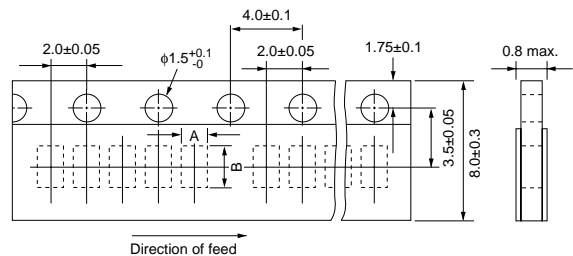
• 4mm Pitch Tape



	GR(M)39 GRM420 GRM220	GR(M)40* GRM425 (T<1.0mm)	GR(M)42-6* GRM430* (T<1.0mm)
A	1.05±0.1	1.55±0.15	2.0±0.2
B	1.85±0.1	2.3 ±0.15	3.6±0.2

* Please see plastic tape of page 54 for 1.25mm thickness type.

• 2mm Pitch Tape



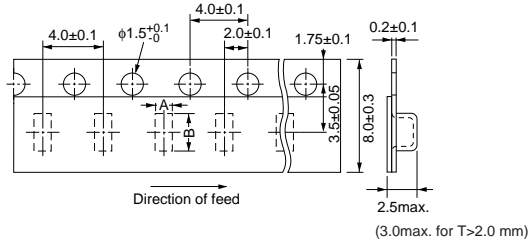
	GR(M)36	(Nominal value)
A	0.65	
B	1.15	

(in mm)

PACKAGE

(b) Plastic Tape

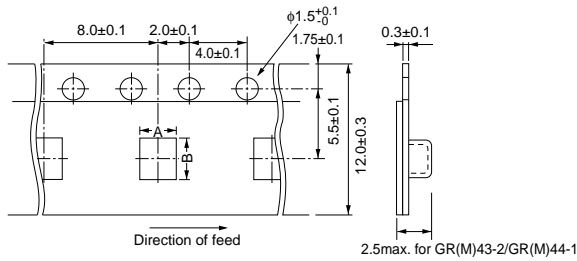
• 4mm Pitch Tape



	GR(M)40 (T=1.25mm)	GR(M)42-6 GRM430 GRM230 (T>=1.15mm)	GR(M)42-2 GRM235 (T>=1.15mm)	GRH708	GRH710	GRH110	GRH111
A	1.45±0.2	1.9±0.2	2.8±0.2	1.8'	2.8'	2.0'	3.1'
B	2.25±0.2	3.5±0.2	3.5±0.2	2.6'	3.5'	2.1'	3.2'

*Nominal value

• 8mm Pitch Tape



	GR(M)43-2	GR(M)44-1
A	3.6	5.2
B	4.9	6.1

(Nominal value)

(in mm)

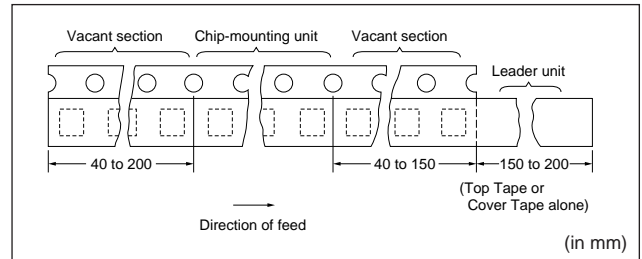
(4) Minimum Quantity*

Type	Chip Thickness	Minimum Quantity(pcs./reel)	
		φ178mm reel	φ330mm reel
GR(M)36	All	10,000	50,000
GR(M)39, GR(M)40, GR(M)42-6 GRM420, GRM425, GRM430 GRM220	1.0mm max.	4,000	10,000
GR(M)40, GR(M)42-6, GR(M)42-2, GRM430, GRM230	1.15/1.25mm	3,000	10,000
GRH708	All	3,000	—
GR(M)42-2, GRM235	1.35/1.5mm	2,000	8,000
GRH110, GRH710	All	2,000	—
GR(M)43-2, GR(M)44-1	1.25mm	1,000	5,000
GRH111	All	1,000	—
GR(M)43-2, GR(M)44-1	1.5mm 2.0mm	1,000	4,000
GRM235	2.0mm	1,000	—
GRM42-6	1.6mm	2,000	—

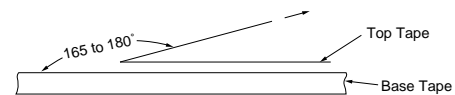
(5) Others

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

- Part of the leader and part of the empty tape shall be attached to the end of the tape as follows.



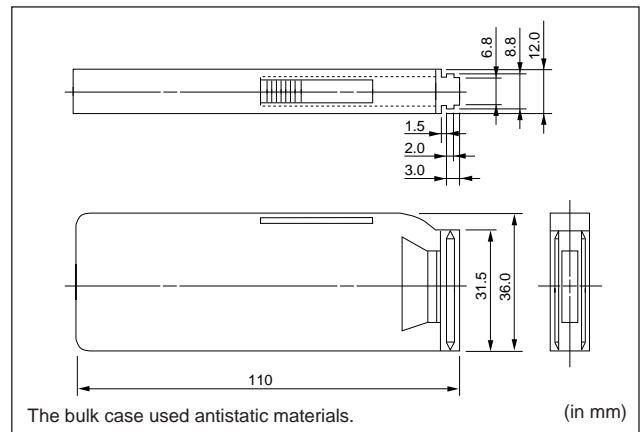
- The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- Missing capacitors number within 0.1% of the number per reel or 1 pc., whichever is greater, and are not continuous.
- The top tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover sprocket holes.
- Cumulative tolerance of sprocket holes, 10 pitches : ±0.3mm.
- Peeling off force : 0.1 to 0.6N in the direction shown below.



3. BULK CASE PACKAGING

Packaging code : PC (Please contact Murata for details)

(1) Dimensions of Bulk case



(2) Minimum Quantity*

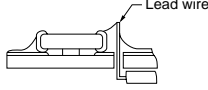
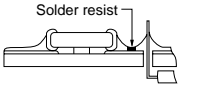
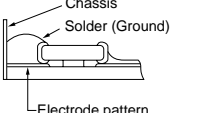
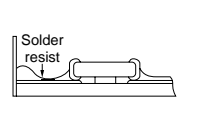
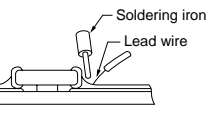
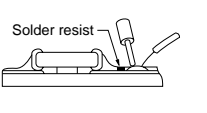

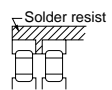
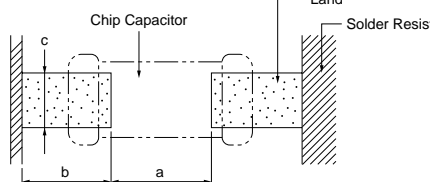
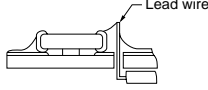
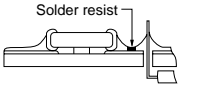
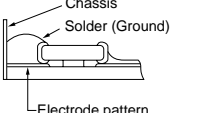
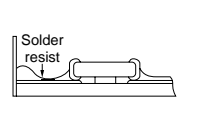
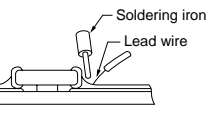
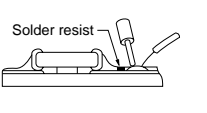

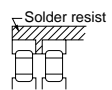
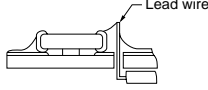
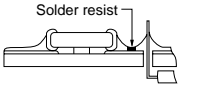
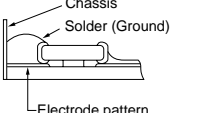
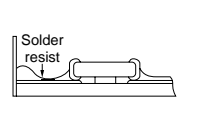
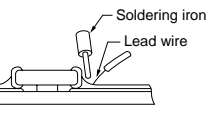
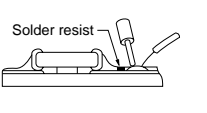

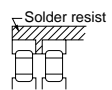
(pcs./case)

Type Thickness	GRM36	GRM39	GRM40
0.5 mm	50,000	—	—
0.8 mm	—	15,000	—
0.6 mm	—	—	10,000
1.25mm	—	—	5,000

* "Minimum Quantity" means the numbers of units of each delivery or order. The quantity should be an integral multiple of the "minimum quantity" (Please note that the actual delivery quantity in a package may change sometimes.)

NOTICE

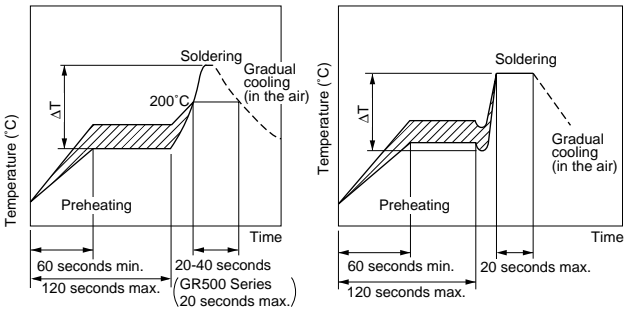
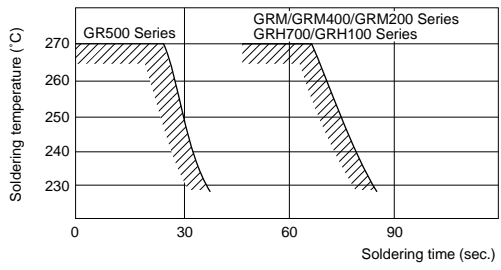
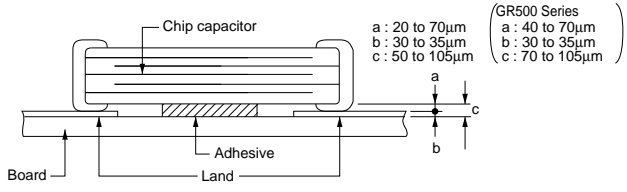
NOTICE

Process	Cautions	Control Points	Reference Data															
1. Storage of Chips	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Storage environment must be at an ambient temperature of 5-40°C and an ambient humidity of 20-70 % RH. Use chips within 6 months. If 6 months or more have elapsed, check solderability before use. For GR series and GR500 series, do not unpack the minimum package until immediately before use. After unpacking, re-seal promptly or store with a desiccant. Avoid mechanical shock (ex. falling) to the capacitor to prevent mechanical cracking inside of the ceramic dielectric due to its own weight. 	Data 1 Solderability															
2. Circuit Design	<ul style="list-style-type: none"> These capacitors on this catalog are not safety recognized products. 																	
3. PCB Design	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height. [Pattern Forms] <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Incorrect</th> <th>Correct</th> </tr> </thead> <tbody> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Placing of chip components and leaded components</td> <td></td> <td></td> </tr> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Placing close to chassis</td> <td></td> <td></td> </tr> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Placing of leaded components after chip components</td> <td></td> <td></td> </tr> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Lateral mounting</td> <td></td> <td></td> </tr> </tbody> </table> <p>[Land Dimensions]</p> 		Incorrect	Correct	Placing of chip components and leaded components			Placing close to chassis			Placing of leaded components after chip components			Lateral mounting			Data 2 Board bending strength for solder fillet height Data 3 Temperature cycling for solder fillet height Data 4 Board bending strength for board material
	Incorrect	Correct																
Placing of chip components and leaded components																		
Placing close to chassis																		
Placing of leaded components after chip components																		
Lateral mounting																		
Table 1 Flow soldering method (in mm)																		
		GRM39 GRM420	GRM40 GRM425	GRM42-6 GRM430	GRH706	GRH708	GRH110											
Dimensions	L	1.6	2.0	3.2	1.25	2.0	1.4											
	W	0.8	1.25	1.6	1.0	1.25	1.4											
a		0.6-1.0	1.0-1.2	2.2-2.6	0.4-0.6	1.0-1.2	0.5-0.8											
b		0.8-0.9	0.9-1.0	1.0-1.1	0.6-0.8	0.9-1.0	0.8-0.9											
c		0.6-0.8	0.8-1.1	1.0-1.4	0.8-1.0	0.8-1.0	1.0-1.2											

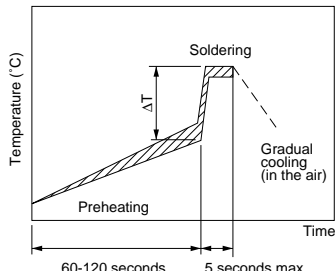
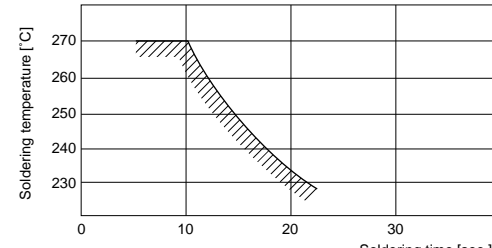
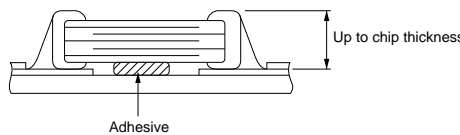
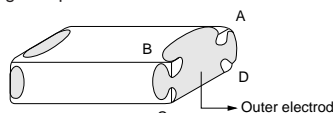
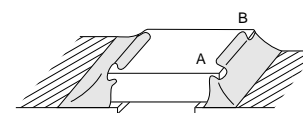
NOTICE

Process	Cautions	Control Points	Reference Data																																																																																																																																	
3. PCB Design		<p align="center">Table 2 Reflow soldering method (in mm)</p> <table border="1"> <thead> <tr> <th></th> <th>GRM36</th> <th>GRM39 GRM420 GRM220</th> <th>GRM40 GRM425</th> <th>GRM42-6 GRM430 GRM230</th> <th>GRM42-2 GRM235</th> <th>GRM43-2</th> <th>GRM44-1</th> <th>GRH706</th> <th>GRH708</th> <th>GRH710</th> <th>GRH110</th> <th>GRH111</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Dimensions</td> <td>L</td> <td>1.0</td> <td>1.6</td> <td>2.0</td> <td>3.2</td> <td>3.2</td> <td>4.5</td> <td>5.7</td> <td>1.25</td> <td>2.0</td> <td>3.2</td> <td>1.4</td> <td>2.8</td> </tr> <tr> <td>W</td> <td>0.5</td> <td>0.8</td> <td>1.25</td> <td>1.6</td> <td>2.5</td> <td>3.2</td> <td>5.0</td> <td>1.0</td> <td>1.25</td> <td>2.5</td> <td>1.4</td> <td>2.8</td> </tr> <tr> <td>a</td> <td>0.3-0.5</td> <td>0.6-0.8</td> <td>1.0-1.2</td> <td>2.2-2.4</td> <td>2.0-2.4</td> <td>3.0-3.5</td> <td>4.0-4.6</td> <td>0.4-0.6</td> <td>1.0-1.2</td> <td>2.2-2.5</td> <td>0.4-0.8</td> <td>1.8-2.1</td> </tr> <tr> <td>b</td> <td>0.35-0.45</td> <td>0.6-0.7</td> <td>0.6-0.7</td> <td>0.8-0.9</td> <td>1.0-1.2</td> <td>1.2-1.4</td> <td>1.4-1.6</td> <td>0.6-0.8</td> <td>0.6-0.8</td> <td>0.8-1.0</td> <td>0.6-0.8</td> <td>0.7-0.9</td> </tr> <tr> <td>c</td> <td>0.4-0.6</td> <td>0.6-0.8</td> <td>0.8-1.1</td> <td>1.0-1.4</td> <td>1.8-2.3</td> <td>2.3-3.0</td> <td>3.5-4.8</td> <td>0.8-1.0</td> <td>0.8-1.0</td> <td>1.9-2.3</td> <td>1.0-1.2</td> <td>2.2-2.6</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th></th> <th>GR530</th> <th>GR535</th> <th>GR540</th> <th>GR545</th> <th>GR550</th> <th>GR555</th> <th>GR580</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Dimensions</td> <td>L</td> <td>4.5</td> <td>5.6</td> <td>10.6</td> <td>10.6</td> <td>11.8</td> <td>16.0</td> <td>28.1</td> </tr> <tr> <td>W</td> <td>3.8</td> <td>5.0</td> <td>5.0</td> <td>10.0</td> <td>10.6</td> <td>5.0</td> <td>13.2</td> </tr> <tr> <td>a</td> <td>3.2-3.4</td> <td>4.2-4.5</td> <td>8.5-9.0</td> <td>8.5- 9.0</td> <td>9.0- 9.5</td> <td>13.0-13.5</td> <td>25.0-25.5</td> </tr> <tr> <td>b</td> <td>0.9-1.2</td> <td>0.9-1.2</td> <td>1.3-1.5</td> <td>1.3- 1.5</td> <td>1.8- 2.0</td> <td>1.8- 2.0</td> <td>2.2- 2.4</td> </tr> <tr> <td>c</td> <td>3.0-3.8</td> <td>4.0-5.0</td> <td>4.0-5.0</td> <td>8.0-10.0</td> <td>8.0-10.0</td> <td>4.0- 5.0</td> <td>10.0-13.0</td> </tr> </tbody> </table> <ul style="list-style-type: none"> Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board. <p>[Component Direction]</p> <p>Locate chip horizontal to the direction in which stress acts</p> <p>[Chip Mounting Close to Board Separation point]</p> <p>Chip arrangement Worst A-C-(B D)-Best</p>			GRM36	GRM39 GRM420 GRM220	GRM40 GRM425	GRM42-6 GRM430 GRM230	GRM42-2 GRM235	GRM43-2	GRM44-1	GRH706	GRH708	GRH710	GRH110	GRH111	Dimensions	L	1.0	1.6	2.0	3.2	3.2	4.5	5.7	1.25	2.0	3.2	1.4	2.8	W	0.5	0.8	1.25	1.6	2.5	3.2	5.0	1.0	1.25	2.5	1.4	2.8	a	0.3-0.5	0.6-0.8	1.0-1.2	2.2-2.4	2.0-2.4	3.0-3.5	4.0-4.6	0.4-0.6	1.0-1.2	2.2-2.5	0.4-0.8	1.8-2.1	b	0.35-0.45	0.6-0.7	0.6-0.7	0.8-0.9	1.0-1.2	1.2-1.4	1.4-1.6	0.6-0.8	0.6-0.8	0.8-1.0	0.6-0.8	0.7-0.9	c	0.4-0.6	0.6-0.8	0.8-1.1	1.0-1.4	1.8-2.3	2.3-3.0	3.5-4.8	0.8-1.0	0.8-1.0	1.9-2.3	1.0-1.2	2.2-2.6		GR530	GR535	GR540	GR545	GR550	GR555	GR580	Dimensions	L	4.5	5.6	10.6	10.6	11.8	16.0	28.1	W	3.8	5.0	5.0	10.0	10.6	5.0	13.2	a	3.2-3.4	4.2-4.5	8.5-9.0	8.5- 9.0	9.0- 9.5	13.0-13.5	25.0-25.5	b	0.9-1.2	0.9-1.2	1.3-1.5	1.3- 1.5	1.8- 2.0	1.8- 2.0	2.2- 2.4	c	3.0-3.8	4.0-5.0	4.0-5.0	8.0-10.0	8.0-10.0	4.0- 5.0	10.0-13.0	
			GRM36	GRM39 GRM420 GRM220	GRM40 GRM425	GRM42-6 GRM430 GRM230	GRM42-2 GRM235	GRM43-2	GRM44-1	GRH706	GRH708	GRH710	GRH110	GRH111																																																																																																																						
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4. Solder Paste Printing	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min. <p>[Optimum Solder Amount for Reflow Soldering]</p>																																																																																																																																		
5. Chip Placing	<ul style="list-style-type: none"> An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. 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. The locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. 	<ul style="list-style-type: none"> Adjust the suction nozzle's bottom dead point by correcting warps in the board. <ul style="list-style-type: none"> 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. The suction nozzle and the locating claw must be maintained, checked and replaced periodically. 	Data 5 Break Strength																																																																																																																																	
6. Reflow Soldering	<ul style="list-style-type: none"> Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips. 	<ul style="list-style-type: none"> When preheating, keep temperature differential, ΔT, within the range shown in Table 3. The smaller the ΔT, the less stress on the chip. <p align="center">Table 3</p> <table border="1"> <thead> <tr> <th>Chip Size</th> <th>Temperature Differential</th> </tr> </thead> <tbody> <tr> <td>GRM36/39/40/42-6 GRM420/425/430 GRM220/230 GRH706/708/110</td> <td>$\Delta T = < 190^\circ\text{C}$</td> </tr> <tr> <td>GRM42-2/43-2/44-1 GRH710/111 GRM235 GR530/535/540/545/550/555/580</td> <td>$\Delta T = < 130^\circ\text{C}$</td> </tr> </tbody> </table>	Chip Size	Temperature Differential	GRM36/39/40/42-6 GRM420/425/430 GRM220/230 GRH706/708/110	$\Delta T = < 190^\circ\text{C}$	GRM42-2/43-2/44-1 GRH710/111 GRM235 GR530/535/540/545/550/555/580	$\Delta T = < 130^\circ\text{C}$																																																																																																																												
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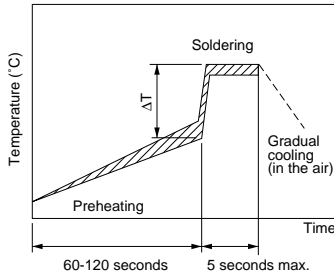
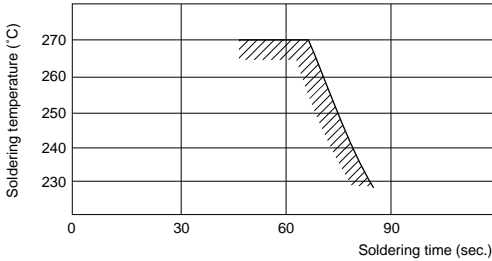
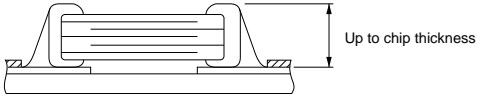
NOTICE

Process	Cautions	Control Points	Reference Data
		<p>• 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.</p> <p>[Standard Conditions for Reflow Soldering]</p> <ul style="list-style-type: none"> • Infrared reflow • Vapor reflow  <p>[Allowable Soldering Temperature and Time]</p>  <p>• In case of repeated soldering, the accumulated soldering time must be within the range shown above.</p>	
<p>Inverting the PCB</p>		<p>• Make sure not to impose an abnormal mechanical shock on the PCB.</p>	
<p>7. Adhesive Application</p>	<ul style="list-style-type: none"> • Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. • Low viscosity adhesive causes chips to slip after mounting. 	<ul style="list-style-type: none"> • 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. • Adhesive must have a viscosity of 500ps (at 25°C) min.  <p>Chip capacitor Board Land Adhesive</p> <p>a : 20 to 70μm b : 30 to 35μm c : 50 to 105μm</p> <p>(GR500 Series a : 40 to 70μm b : 30 to 35μm c : 70 to 105μm)</p>	
<p>8. Adhesive Curing</p>	<ul style="list-style-type: none"> • Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption. 	<ul style="list-style-type: none"> • Control curing temperature and time in order to prevent insufficient hardening. 	
<p>Inverting the board</p>		<ul style="list-style-type: none"> • Make sure not to impose an abnormal mechanical shock on the PCB. 	
<p>9. Leaded Component Insertion</p>	<ul style="list-style-type: none"> • If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break. 	<ul style="list-style-type: none"> • Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping. 	
<p>10. Flux Application</p>	<ul style="list-style-type: none"> • An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability. • Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned. 	<ul style="list-style-type: none"> • Apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering). • Use flux with a halide content of 0.2wt% max. But do not use strongly acid flux. • Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned. 	

NOTICE

Process	Cautions	Control Points	Reference Data				
<p>11. Flow Soldering</p>	<ul style="list-style-type: none"> • Sudden heating of the chip results in thermal distortion causing cracked chips. • 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. 	<ul style="list-style-type: none"> • When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 4. 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 4. • Do not apply flow soldering to chips not listed in Table 4. <div style="text-align: center;"> <p>Table 4</p> <table border="1" style="margin: auto;"> <thead> <tr> <th>Chip Size</th> <th>Temperature Differential</th> </tr> </thead> <tbody> <tr> <td>GRM39/40/42-6 GRM420/425/430 GRH706/708/110</td> <td>$\Delta T \leq 150^\circ\text{C}$</td> </tr> </tbody> </table> </div> <p>[Standard Conditions for Flow Soldering]</p>  <p>[Allowable Soldering Temperature and Time]</p>  <p>In case of repeated soldering, the accumulated soldering time must be within the range shown above.</p> <p>[Optimum Solder Amount for Flow Soldering]</p>  <ul style="list-style-type: none"> • 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. <div style="display: flex; flex-direction: column; align-items: center;"> <p>As a single chip</p>  <p>As mounted on substrate</p>  </div>	Chip Size	Temperature Differential	GRM39/40/42-6 GRM420/425/430 GRH706/708/110	$\Delta T \leq 150^\circ\text{C}$	<p>Data 6 Thermal shock</p> <p>Data 7 Solder heat resistance</p>
Chip Size	Temperature Differential						
GRM39/40/42-6 GRM420/425/430 GRH706/708/110	$\Delta T \leq 150^\circ\text{C}$						

NOTICE

Process	Cautions	Control Points	Reference Data																								
<p>12. Correction with a Soldering Iron</p>	<p>⟨For chip type capacitors except GRM200 series⟩</p> <ul style="list-style-type: none"> Sudden heating of the chip results in distortion due to a high internal temperature differential, causing cracked chips. 	<ul style="list-style-type: none"> When preheating, keep temperature differential, ΔT, within the range shown in Table 5. The smaller the ΔT, the less stress on the chip. <p style="text-align: center;">Table 5</p> <table border="1" data-bbox="635 456 1273 645"> <thead> <tr> <th>Chip Size</th> <th>Temperature Differential</th> </tr> </thead> <tbody> <tr> <td>GRM36/39/40/42-6 GRM420/425/430 GRH706/708/110</td> <td>$\Delta T < 190^{\circ}\text{C}$</td> </tr> <tr> <td>GRM42-2/43-2/44-1 GRH710/111 GR530/535/540/545/550/555/580</td> <td>$\Delta T < 130^{\circ}\text{C}$</td> </tr> </tbody> </table> <p>[Standard Conditions for Soldering Iron Temperature]</p>  <p>[Allowable Time and Temperature for Making Corrections with a Soldering Iron]</p> <p>The accumulated soldering time/temperature including reflow/flow soldering must be within the range shown below :</p>  <p>[Optimum Solder Amount when Corrections Are Made Using a Soldering Iron]</p>  <ul style="list-style-type: none"> When correcting chips with a soldering iron, no preheating is required if the chip is listed in Table 6 and the following conditions (Table 6) are met. Preheating should be performed on chips not listed in Table 6. <p style="text-align: center;">Table 6</p> <table border="1" data-bbox="635 1688 1273 1989"> <thead> <tr> <th>Item</th> <th colspan="2">Conditions</th> </tr> </thead> <tbody> <tr> <td>Chip size</td> <td>GRM36/39/40 GRM420/425 GRH706/708/110</td> <td>GRM42-6 GRM430</td> </tr> <tr> <td>Temperature of iron tip</td> <td>300°C max.</td> <td>270°C max.</td> </tr> <tr> <td>Soldering iron wattage</td> <td colspan="2">20W max.</td> </tr> <tr> <td>Diameter of iron tip</td> <td colspan="2">φ3mm max.</td> </tr> <tr> <td>Restriction</td> <td colspan="2">Do not allow the iron tip to directly touch the ceramic element.</td> </tr> </tbody> </table>	Chip Size	Temperature Differential	GRM36/39/40/42-6 GRM420/425/430 GRH706/708/110	$\Delta T < 190^{\circ}\text{C}$	GRM42-2/43-2/44-1 GRH710/111 GR530/535/540/545/550/555/580	$\Delta T < 130^{\circ}\text{C}$	Item	Conditions		Chip size	GRM36/39/40 GRM420/425 GRH706/708/110	GRM42-6 GRM430	Temperature of iron tip	300°C max.	270°C max.	Soldering iron wattage	20W max.		Diameter of iron tip	φ3mm max.		Restriction	Do not allow the iron tip to directly touch the ceramic element.		<p>Data 8 Thermal shock when making a correction with a soldering iron</p>
Chip Size	Temperature Differential																										
GRM36/39/40/42-6 GRM420/425/430 GRH706/708/110	$\Delta T < 190^{\circ}\text{C}$																										
GRM42-2/43-2/44-1 GRH710/111 GR530/535/540/545/550/555/580	$\Delta T < 130^{\circ}\text{C}$																										
Item	Conditions																										
Chip size	GRM36/39/40 GRM420/425 GRH706/708/110	GRM42-6 GRM430																									
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Restriction	Do not allow the iron tip to directly touch the ceramic element.																										

NOTICE

Process	Cautions	Control Points	Reference Data																											
	<p>〈For GRM200 series〉</p>	<ul style="list-style-type: none"> When solder GRM200 series chip capacitor, keep the following conditions. 〈Soldering iron method〉 <table border="1"> <thead> <tr> <th>Item</th> <th colspan="2">Condition</th> </tr> </thead> <tbody> <tr> <td>Chip type</td> <td>GRM220</td> <td>GRM230/235</td> </tr> <tr> <td>Pre-heating</td> <td>no pre-heating is possible</td> <td>$\Delta T = < 130^{\circ}\text{C}$</td> </tr> <tr> <td>Temperature of iron tip</td> <td colspan="2">300°C max.</td> </tr> <tr> <td>Soldering iron wattage</td> <td colspan="2">20W max.</td> </tr> <tr> <td>Diameter of iron tip</td> <td colspan="2">φ3mm max.</td> </tr> <tr> <td>Soldering time</td> <td colspan="2">5 sec.max.</td> </tr> <tr> <td>Solder amount</td> <td>= < Chip thickness</td> <td>= < 1/2 of chip thickness</td> </tr> <tr> <td>Restriction</td> <td colspan="2">Don't allow the iron tip to directly touch the ceramic element</td> </tr> </tbody> </table>	Item	Condition		Chip type	GRM220	GRM230/235	Pre-heating	no pre-heating is possible	$\Delta T = < 130^{\circ}\text{C}$	Temperature of iron tip	300°C max.		Soldering iron wattage	20W max.		Diameter of iron tip	φ3mm max.		Soldering time	5 sec.max.		Solder amount	= < Chip thickness	= < 1/2 of chip thickness	Restriction	Don't allow the iron tip to directly touch the ceramic element		
Item	Condition																													
Chip type	GRM220	GRM230/235																												
Pre-heating	no pre-heating is possible	$\Delta T = < 130^{\circ}\text{C}$																												
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Solder amount	= < Chip thickness	= < 1/2 of chip thickness																												
Restriction	Don't allow the iron tip to directly touch the ceramic element																													
	<p>〈For Microstrip types〉</p>	<ul style="list-style-type: none"> 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. 																												
13. Washing	<ul style="list-style-type: none"> Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder. 	<ul style="list-style-type: none"> Take note not to vibrate PCBs. 																												
14. Inspection	<ul style="list-style-type: none"> Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints. 	<ul style="list-style-type: none"> Provide support pins on the back side of the PCB to prevent warping or flexing. 																												
15. Resin Coating		<ul style="list-style-type: none"> When selecting resin materials, select those with low contraction. 																												
16. Board Separation (or Depanelization)	<ul style="list-style-type: none"> Board flexing at the time of separation causes cracked chips or broken solder. 	<ul style="list-style-type: none"> Severity of stresses imposed on the chip at the time of board break is in the order of : Pushback < Slitter < V Slot < Perforator. Board separation must be performed using special jigs, not with hands. 																												

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.

GRM SERIES REFERENCE DATA

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°C 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°C)

Prepared left at high humidity (for 100 hours under 90%RH to 95%RH at 40°C)

(2) Test samples

GRM40 : 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

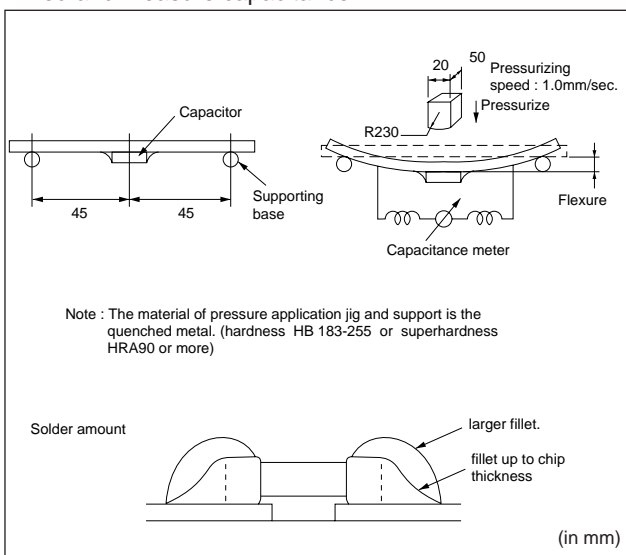
Table 7

Sample	Initial state	Prepared at room temperature		Prepared at high temperature for 100 hours at 85°C	Prepared at high humidity for 100 hours at 90 to 95%RH and 40°C
		6 months	12 months		
GRM40 for flow/reflow soldering	95 to 100%	95 to 100%	95%	90 to 95%	95%

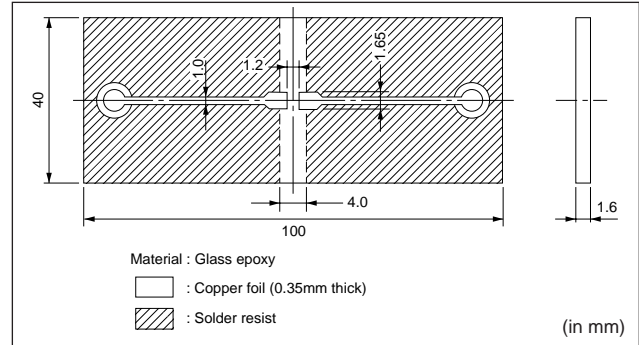
2. Board Bending Strength for Solder Fillet Height

(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 board



(3) Test samples

GRM40 C0G/X7R/Y5V Characteristics T=0.6mm

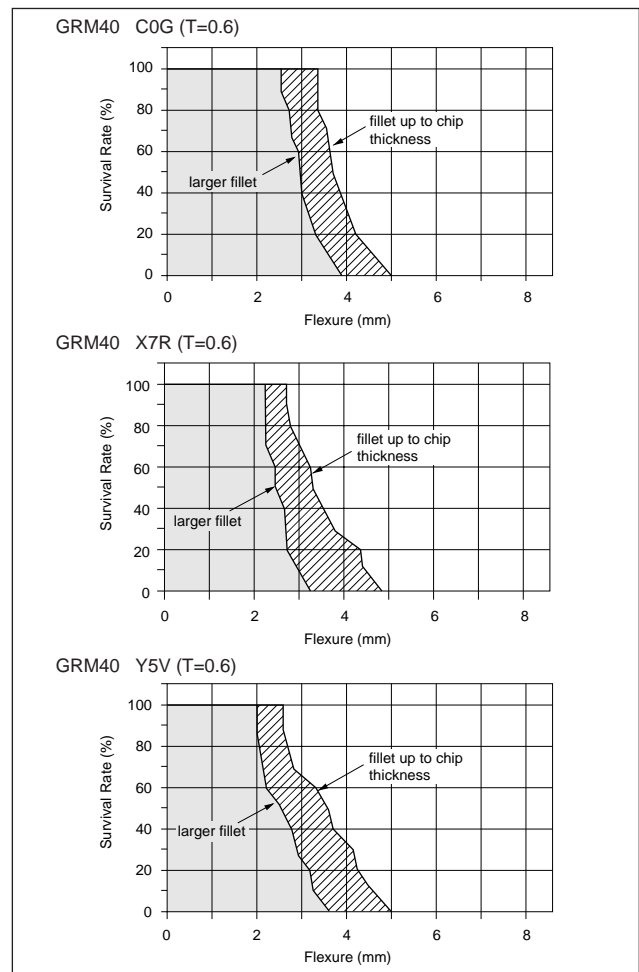
(4) Acceptance criteria

Products shall be determined to be defective if the change in capacitance has exceeded the values specified in Table 8.

Table 8

Characteristics	Change in Capacitance
C0G	Within ±5% or ±0.5pF, whichever is greater
X7R	Within ±12.5%
Y5V	Within ±20%

(5) Results

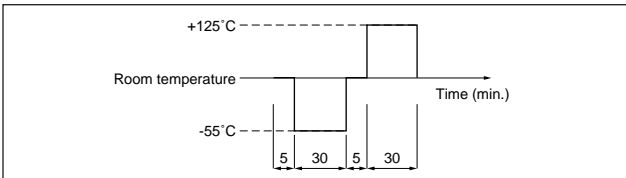


GRM SERIES REFERENCE DATA

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.



Solder Amount :

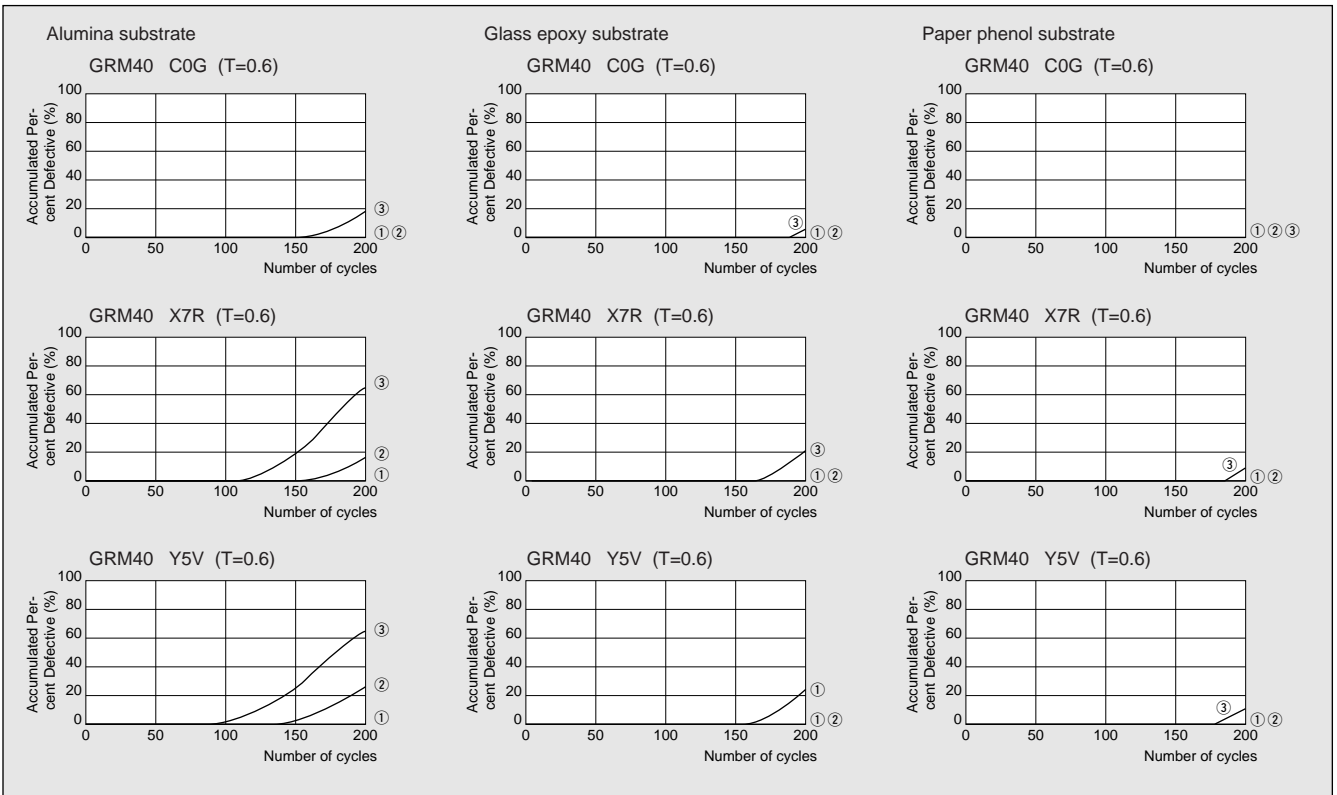
Substrate		Alumina ^{*1}	Glass Epoxy ^{*2} or Paper Phenol
Solder Amount	①		
	②		
	③		
Solder to be Used		6X4 Eutectic solder	

*1 : Alumina substrates are typically designed for reflow soldering.

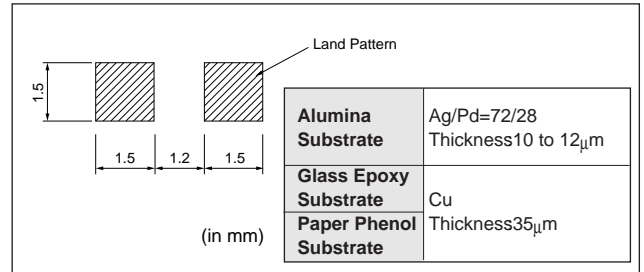
*2 : Glass epoxy or paper phenol substrates are typically used for flow soldering.

Material : Alumina (Thickness ; 0.64mm)
 Glass epoxy (Thickness ; 1.6 mm)
 Paper phenol (Thickness ; 1.6 mm)

(5) Results



Land Dimension :



(3) Test samples

GRM40 C0G/X7R/Y5V Characteristics T=0.6mm

(4) Acceptance criteria

Products shall be determined to be defective if the change in capacitance has exceeded the values specified in Table 9.

Table 9

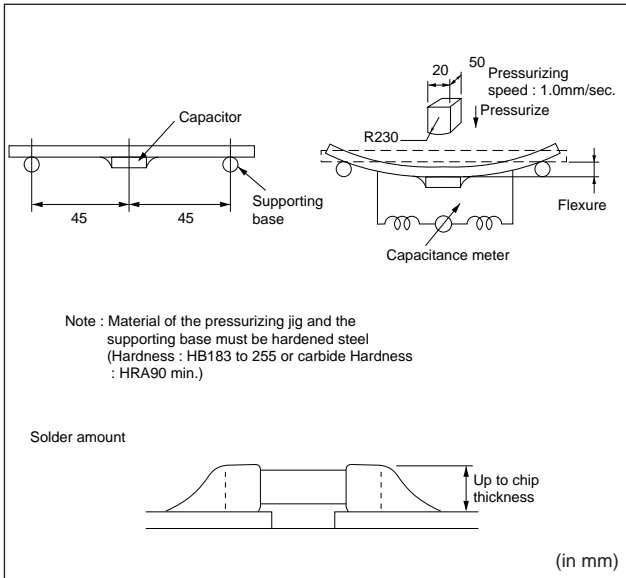
Characteristics	Change in Capacitance
C0G	Within ±2.5% or ±0.25pF, whichever is greater
X7R	Within ±7.5%
Y5V	Within ±20%

GRM SERIES REFERENCE DATA

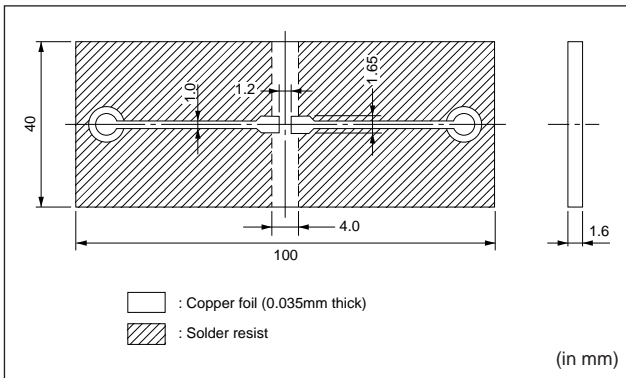
4. Board Bending Strength for Board Material

(1) Test method

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



(2) Test board



(3) Test samples

GRM40 C0G/X7R/Y5V Characteristics T=0.6mm typical

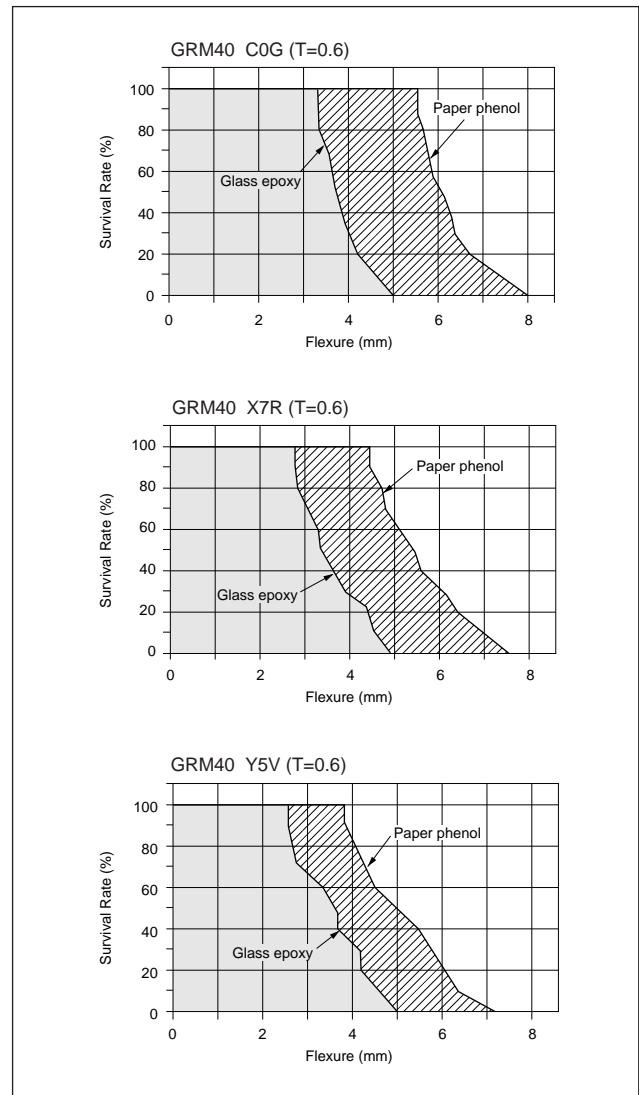
(4) Acceptance criteria

Products shall be determined to be defective if the change in capacitance has exceeded the values specified in Table 10.

Table 10

Characteristics	Change in Capacitance
C0G	Within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever is greater
X7R	Within $\pm 12.5\%$
Y5V	Within $\pm 20\%$

(5) Results

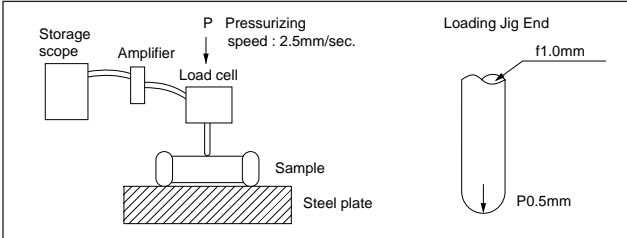


GRM SERIES REFERENCE DATA

5. Break Strength

(1) Test method

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



(2) Test samples

GRM40 C0G/X7R/Y5V Characteristics
GRM42-6 C0G/X7R/Y5V Characteristics

(3) Acceptance criteria

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

(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 :

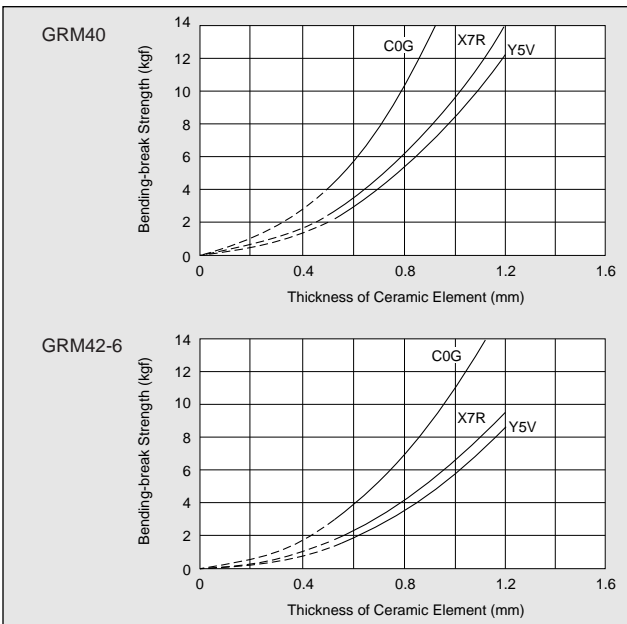
$$P = \frac{2 \gamma W T^2}{3L} \text{ (kgf)}$$

- W : Width of ceramic element (mm)
- T : Thickness of element (mm)
- L : Distance between fulcrums (mm)
- γ : Bending stress (N/mm²)

	Chip size	
	GRM40	GRM42-6
L	1.5	2.7
W	1.2	1.5
γ	C0G Characteristics	300
	X7R Characteristics	180
	Y5V Characteristics	160

(in mm)

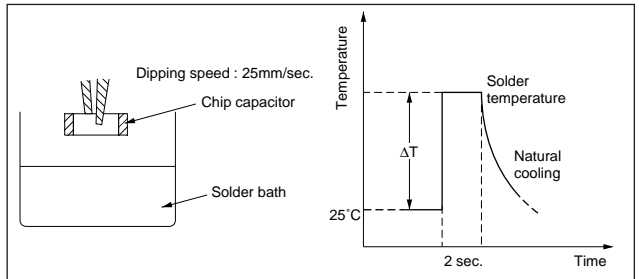
(5) Results



6. Thermal Shock

(1) Test method

After applying flux (an ethanol solution of 25% rosin), dip the chip in a solder bath (6X4 eutectic solder) in accordance with the following conditions :



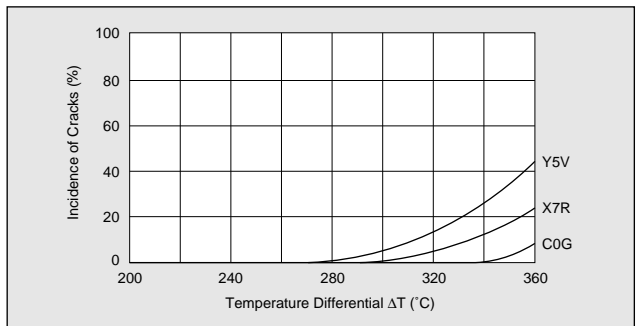
(2) Test samples

GRM40 C0G/X7R/Y5V 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.

(4) Results



GRM SERIES REFERENCE DATA

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

④ 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.

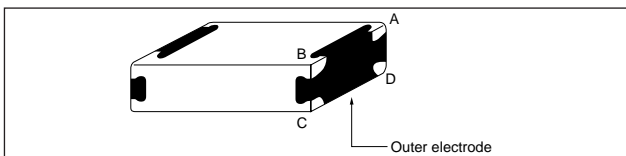
⑤ Flux to be used : An ethanol solution of 25 % rosin

(2) Test samples

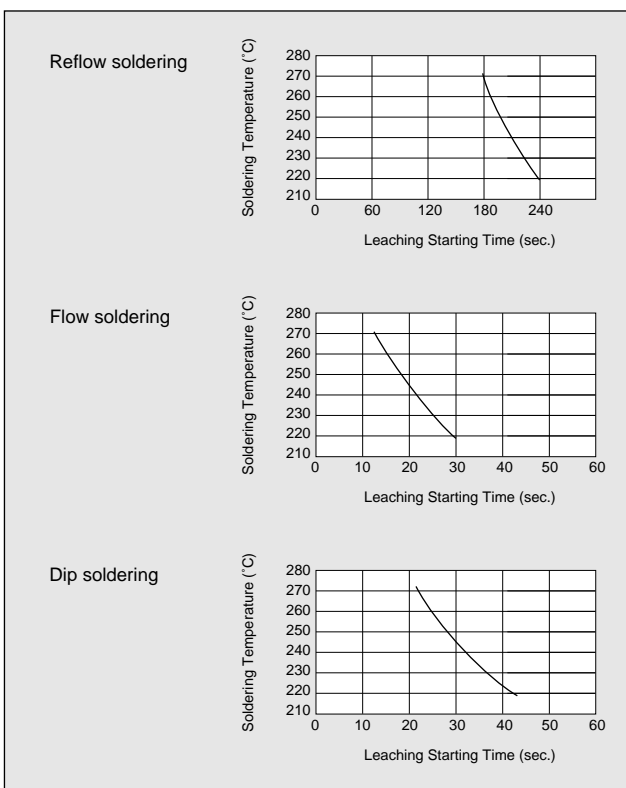
GRM40 : For flow/reflow soldering T=0.6mm

(3) Acceptance criteria

The starting time of leaching shall be defined as the time when the outer electrode has lost 25 % of the total edge length of A-B-C-D as illustrated :



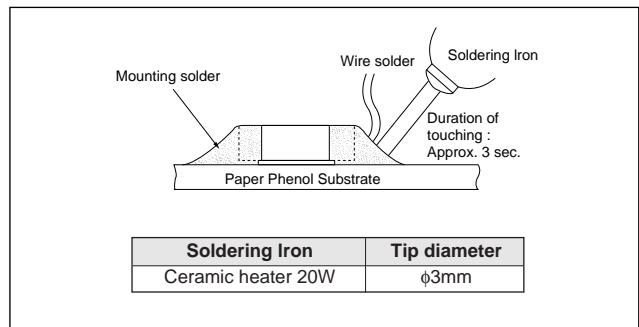
(4) Results



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 shall not directly touch the ceramic element of the chip.)



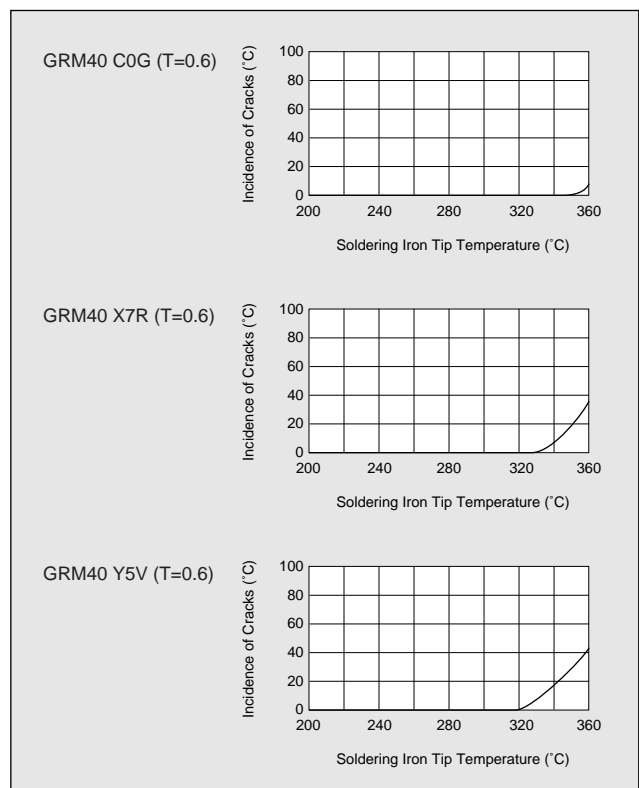
(2) Test samples

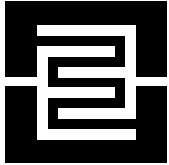
GRM40 C0G/X7R/Y5V Characteristics T=0.6mm

(3) Acceptance criteria for defects

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

(4) Results





MONOLITHIC CERAMIC CAPACITOR



High-voltage Low Dissipation **GHM1000** Series

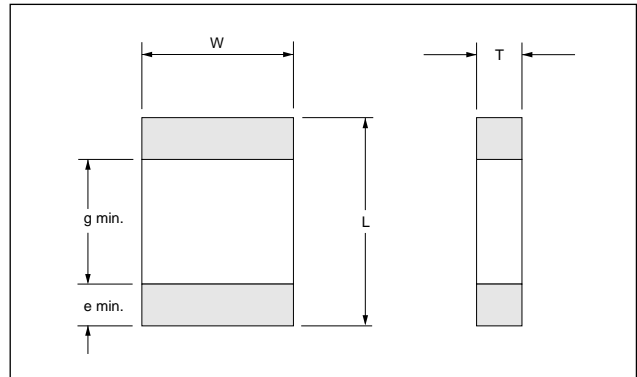
FEATURES

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 allow mounting without silver compound solder.
4. The GHM1030 type for flow and reflow soldering, and other types for reflow soldering.
5. Low-loss and suitable for high-frequency circuits.

APPLICATIONS

1. Ideal use on high-frequency pulse circuit such as snubber circuit for switching power supply, DC-DC converter, ballast (inverter fluorescent lamp), and so on. (R Characteristics)
2. Ideal for use as the ballast in liquid crystal back-lighting inverters. (SL Characteristics)

DIMENSIONS



Type (EIA Code)	Dimensions (mm)				
	L	W	T	g	e
GHM1030 (1206)	3.2±0.2	1.6±0.2	See "STANDARD LIST"	1.5	0.3
GHM1038 (1808)	4.5±0.3	2.0±0.2		2.9	
GHM1040 (1812)	4.5±0.3	3.2±0.3			

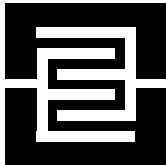
STANDARD LIST

Temperature Compensating Type SL Characteristic (+350 to -1000ppm/°C)

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	Rated Volt. (VDC)	Packaging Qty. (pcs./reel)				
	L	W	T								
GHM1040 SL 121 J 2K	4.5±0.3	3.2±0.3	2.0 ⁺⁰ _{-0.3}	120	±5%	2k	1,000				
GHM1040 SL 151 J 2K				150							
GHM1040 SL 181 J 2K				180							
GHM1040 SL 221 J 2K				220							
GHM1038 SL 100 D 3K				4.5±0.3				2.0±0.2	2.0±0.3	10	±5%
GHM1038 SL 120 J 3K	12										
GHM1038 SL 150 J 3K	15										
GHM1038 SL 180 J 3K	18										
GHM1038 SL 220 J 3K	22										
GHM1038 SL 270 J 3K	27										
GHM1038 SL 330 J 3K	33										
GHM1038 SL 390 J 3K	39										
GHM1038 SL 470 J 3K	47										
GHM1038 SL 560 J 3K	56										
GHM1038 SL 680 J 3K	68										
GHM1038 SL 820 J 3K	82										
GHM1040 SL 101 J 3K	4.5±0.3	3.2±0.3	2.5 ⁺⁰ _{-0.3}		100		500				

High Dielectric Constant Type R Characteristic (±15%)

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	Rated Volt. (VDC)	Packaging Qty. (pcs./reel)
	L	W	T				
GHM1030 R 101 K 630	3.2±0.2	1.6±0.2	1.0 ⁺⁰ _{-0.3}	100	±10%	630	4,000
GHM1030 R 151 K 630				150			
GHM1030 R 221 K 630				220			
GHM1030 R 331 K 630				330			
GHM1030 R 471 K 630			1.25 ⁺⁰ _{-0.3}	470			3,000
GHM1030 R 681 K 630				680			
GHM1030 R 102 K 630				1000			


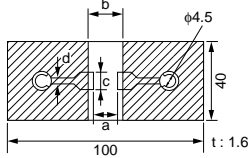
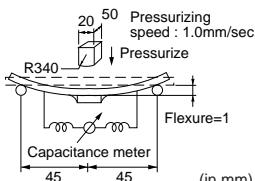


MONOLITHIC CERAMIC CAPACITOR

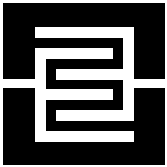


High-voltage Low Dissipation **GHM1000** Series

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification		Test Method																							
		Temperature Compensating Type	High Dielectric Constant Type																								
1	Operating Temperature Range	-55 to +125°C		-																							
2	Appearance	No defects or abnormalities.		Visual inspection.																							
3	Dimensions	Within the specified dimension.		Using Calipers.																							
4	Dielectric Strength	No defects or abnormalities.		No failure shall be observed when voltage in Table is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td>More than 1kVDC</td> <td>120% of the rated voltage</td> </tr> <tr> <td>Less than 1kVDC</td> <td>150% of the rated voltage</td> </tr> </tbody> </table>	Rated voltage	Test voltage	More than 1kVDC	120% of the rated voltage	Less than 1kVDC	150% of the rated voltage																	
Rated voltage	Test voltage																										
More than 1kVDC	120% of the rated voltage																										
Less than 1kVDC	150% of the rated voltage																										
5	Insulation Resistance (I.R.)	More than 10000MΩ		The insulation resistance shall be measured with 500±50V and within 60±5 seconds of charging.																							
6	Capacitance	Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 20°C at the frequency and voltage shown as follows.																							
7	Q/ Dissipation Factor (D.F.)	C>=30pF : Q>=1000 C<30pF : Q>=400+20C C : Nominal Capacitance (pF)	D.F.=<0.01	(1) Temperature Compensating Type Frequency : 1±0.2MHz Voltage : 0.5 to 5Vrms (2) High Dielectric Constant Type Frequency : 1±0.2kHz Voltage : 1±0.2Vrms																							
8	Capacitance Temperature Characteristics	Temp. Coefficient +350 to -1000 ppm/°C (Temp. Range : +20 to +85°C)	Cap. Change Within ±15%	(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 (+20 to +85 °C) the capacitance shall be within the specified tolerance for the temperature coefficient. <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20±2</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp.±3</td> </tr> <tr> <td>3</td> <td>20±2</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp.±2</td> </tr> <tr> <td>5</td> <td>20±2</td> </tr> </tbody> </table> (2) High Dielectric Constant Type The range of capacitance change compared to the 20°C value within -55 to 125°C shall be within the specified range. • Pretreatment Perform a heat treatment at 150 ⁺⁰ ₋₁₀ °C for 60±5 minutes and then let sit for 24±2 hours at room condition.	Step	Temperature (°C)	1	20±2	2	Min. Operating Temp.±3	3	20±2	4	Max. Operating Temp.±2	5	20±2											
Step	Temperature (°C)																										
1	20±2																										
2	Min. Operating Temp.±3																										
3	20±2																										
4	Max. Operating Temp.±2																										
5	20±2																										
9	Adhesive Strength of Termination	No removal of the terminations or other defects shall 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 shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 1																							
10	Deflection	No cracking or marking defects shall occur.  Fig. 2 <table border="1"> <thead> <tr> <th rowspan="2">LXW (mm)</th> <th colspan="4">Dimension (mm)</th> <th rowspan="2">t</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>3.2X1.6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> <td rowspan="3">1.0</td> </tr> <tr> <td>4.5X2.0</td> <td>3.5</td> <td>7.0</td> <td>2.4</td> </tr> <tr> <td>4.5X3.2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> </tbody> </table>		LXW (mm)	Dimension (mm)				t	a	b	c	d	3.2X1.6	2.2	5.0	2.0	1.0	4.5X2.0	3.5	7.0	2.4	4.5X3.2	3.5	7.0	3.7	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 shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 3
LXW (mm)	Dimension (mm)				t																						
	a	b	c	d																							
3.2X1.6	2.2	5.0	2.0	1.0																							
4.5X2.0	3.5	7.0	2.4																								
4.5X3.2	3.5	7.0	3.7																								

"room condition" Temperature : 15 to 35°C, Humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa



MONOLITHIC CERAMIC CAPACITOR



High-voltage Low Dissipation **GHM1000** Series

No.	Item	Specification		Test Method	
		Temperature Compensating Type	High Dielectric Constant Type		
11	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 seconds at 235±5°C. Immersing speed : 25±2.5mm/sec.	
12	Resistance to Soldering Heat	Appearance	No marking defects		Preheat the capacitor at 120 to 150°C* for 1 minute. Immerse the capacitor in eutectic solder solution at 260±5°C for 10±1 seconds. Let sit at room condition for 24±2 hours, then measure. <ul style="list-style-type: none"> • Immersing speed : 25±2.5mm/sec. • Pretreatment for high dielectric constant type Perform a heat treatment at 150⁺₋₁₀°C for 60±5 minutes and then let sit for 24±2 hours at room condition. *Preheating for more than 3.2X2.5mm
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C>=30pF : Q>=1000 C<30pF : Q>=400+20C C : Nominal Capacitance (pF)	D.F.=<0.01	
		I.R.	More than 10000MΩ		
		Dielectric Strength	Pass the item No.4.		
13	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 five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room condition, then measure.
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C>=30pF : Q>=1000 C<30pF : Q>=400+20C C : Nominal Capacitance (pF)	D.F.=<0.01	
		I.R.	More than 10000MΩ		
		Dielectric Strength	Pass the item No.4.		
14	Humidity (Steady State)	Appearance	No marking defects		Sit the capacitor at 40±2°C and 90 to 95% humidity for 500 ⁺²⁴ ₀ hours. Remove and let sit for 24±2 hours at room condition, then measure. <ul style="list-style-type: none"> • Pretreatment for high dielectric constant type Perform a heat treatment at 150⁺₋₁₀°C for 60±5 minutes and then let sit for 24±2 hours at room condition.
		Capacitance Change	Within ±5.0% or ±0.5pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C>=30pF : Q>=350 C<30pF : Q>=275+ ⁵ / ₂ C C : Nominal Capacitance (pF)	D.F.=<0.01	
		I.R.	More than 1000MΩ		
		Dielectric Strength	Pass the item No.4.		
15	Life	Appearance	No marking defects		Apply the voltage in following table for 1000 ⁺⁴⁸ ₋₁ hours at maximum operating temperature±3°C. Remove and let sit for 24±2 hours at room condition, then measure. The charge/discharge current is less than 50mA. <ul style="list-style-type: none"> • Pretreatment for high dielectric constant type Apply test voltage for 60±5 minutes at test temperature. Remove and let sit for 24±2 hours at room condition.
		Capacitance Change	Within ±3.0% or ±0.3pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C>=30pF : Q>=350 C<30pF : Q>=275+ ⁵ / ₂ C C : Nominal Capacitance (pF)	D.F.=<0.02	
		I.R.	More than 1000MΩ		
		Dielectric Strength	Pass the item No.4.		

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

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

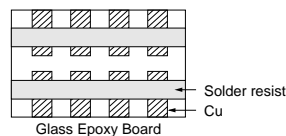
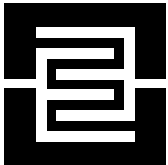


Fig. 4

Rated voltage	Test voltage
More than 1kVDC	Rated voltage
Less than 1kVDC	120% of the rated voltage

"room condition" Temperature : 15 to 35°C, Humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa



MONOLITHIC CERAMIC CAPACITOR



High-capacitance for General Electrical Equipment **GHM1500** Series

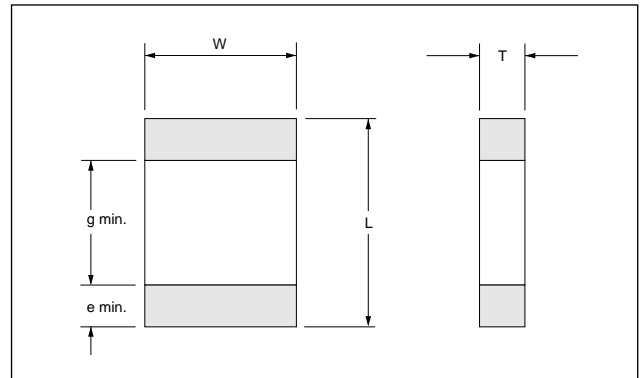
FEATURES

1. A new monolithic structure for small, high-capacitance capable of operating at high-voltage levels.
2. Sn-plated external electrodes allow mounting without silver compound solder.
3. The GHM1525/1530 type for flow and reflow soldering, and other types for reflow soldering.

APPLICATIONS

1. Ideal use as hot-cold coupling for DC-DC converter.
2. Ideal use on line filter and ringer detector for telephone, facsimile and modem.
3. Ideal use on diode-snubber circuit for switching power supply.

DIMENSIONS

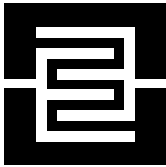


Type (EIA Code)	Dimension (mm)				
	L	W	T	g	e
GHM1525 (0805)	2.0±0.2	1.25±0.2	See "STANDARD LIST"	0.7	0.3
GHM1530 (1206)	3.2±0.2	1.6 ±0.2		1.5	
GHM1535 (1210)	3.2±0.3	2.5 ±0.2		2.5	
GHM1540 (1812)	4.5±0.4	3.2 ±0.3		3.5	
GHM1545 (2220)	5.7±0.4	5.0 ±0.4			

STANDARD LIST

High Dielectric Constant Type B Characteristic (±10%)

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	Rated Volt. (VDC)	Packaging Qty. (pcs./reel)						
	L	W	T										
GHM1525 B 102 K 250	2.0±0.2	1.25±0.2	1.0 ⁺⁰ / _{-0.3}	1000	±10%	250	4,000						
GHM1525 B 152 K 250				1500									
GHM1525 B 222 K 250				2200									
GHM1525 B 332 K 250				3300									
GHM1525 B 472 K 250				4700									
GHM1525 B 682 K 250				6800									
GHM1525 B 103 K 250	3.2±0.2	1.6 ±0.2	1.25±0.2	10000				±10%	250	3,000			
GHM1530 B 153 K 250			15000										
GHM1530 B 223 K 250			22000										
GHM1530 B 333 K 250			33000										
GHM1530 B 473 K 250			47000										
GHM1530 B 683 K 250			68000										
GHM1535 B 683 K 250	3.2±0.3	2.5 ±0.2	1.5 ⁺⁰ / _{-0.3}	68000		±10%	630			2,000			
GHM1535 B 104 K 250			100000										
GHM1540 B 154 K 250			2.0 ⁺⁰ / _{-0.3}	150000						1,000			
GHM1540 B 224 K 250			220000										
GHM1545 B 334 K 250			2.5 ⁺⁰ / _{-0.3}	220000						500			
GHM1545 B 474 K 250			470000										
GHM1545 B 334 K 250	5.7±0.4	5.0 ±0.4	2.0 ⁺⁰ / _{-0.3}	330000	±10%			630	1,000				
GHM1545 B 474 K 250			470000										
GHM1530 B 102 K 630			3.2±0.2	1.6 ±0.2					1.25 ⁰ / _{-0.3}	1000	±10%	630	3,000
GHM1530 B 152 K 630										1500			
GHM1530 B 222 K 630										2200			
GHM1530 B 332 K 630										3300			
GHM1530 B 472 K 630	4700												
GHM1530 B 682 K 630	6800												
GHM1530 B 103 K 630	3.2±0.3	2.5 ±0.2	1.5 ⁺⁰ / _{-0.3}	10000			±10%		630	2,000			
GHM1535 B 153 K 630				15000									
GHM1535 B 223 K 630				22000									
GHM1540 B 333 K 630				33000									
GHM1540 B 473 K 630				47000									
GHM1540 B 683 K 630				68000									
GHM1540 B 154 K 630	4.5±0.4	3.2 ±0.3	2.0 ⁺⁰ / _{-0.3}	100000		±10%		630			1,000		
GHM1540 B 104 K 630				2.6 ⁺⁰ / _{-0.3}								100000	500
GHM1545 B 154 K 630				2.0 ⁺⁰ / _{-0.3}								150000	1,000
GHM1545 B 224 K 630				2.7 ⁺⁰ / _{-0.3}								220000	500

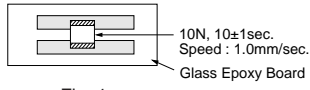
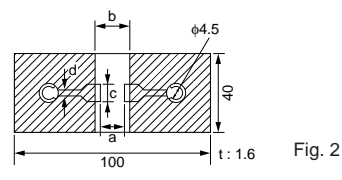
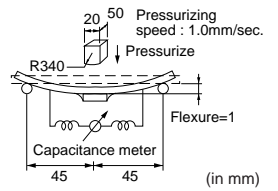


MONOLITHIC CERAMIC CAPACITOR

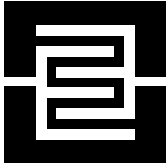


High-capacitance for General Electrical Equipment **GHM1500** Series

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification	Test Method																														
1	Operating Temperature Range	-55 to +125°C	—																														
2	Appearance	No defects or abnormalities.	Visual inspection.																														
3	Dimensions	Within the specified dimension.	Using Calipers.																														
4	Dielectric Strength	No defects or abnormalities.	No failure shall be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage: 250V) is applied between the terminations for 1 to 5 seconds, 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 10000MΩ	The insulation resistance shall be measured with 500±50V (250±50V in case of rated voltage: 250V) and within 60±5 seconds of charging.																														
6	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 20°C at a frequency of 1±0.2kHz and a voltage of 1±0.2Vrms.																														
7	Dissipation Factor (D.F.)	0.025 max.																															
8	Capacitance Temperature Characteristics	Cap. Change Within ±10% (Temp. Range -25 to 85°C)	The range of capacitance change compared with the 20°C value within -25 to 85°C shall be within the specified range. • Pretreatment Perform a heat treatment at 150± ₁₀ °C for 60±5 minutes and then let sit for 24±2 hours at room condition.																														
9	Adhesive Strength of Termination	No removal of the terminations or other defects shall 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 shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 1																														
10	Deflection	No cracking or marking defects shall occur.  Fig. 2 <table border="1" data-bbox="462 1366 877 1545"> <thead> <tr> <th rowspan="2">LXW (mm)</th> <th colspan="4">Dimension (mm)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>2.0X1.25</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> <td rowspan="5">1.0</td> </tr> <tr> <td>3.2X1.6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>3.2X2.5</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>4.5X3.2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>5.7X5.0</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table>	LXW (mm)	Dimension (mm)				a	b	c	d	2.0X1.25	1.2	4.0	1.65	1.0	3.2X1.6	2.2	5.0	2.0	3.2X2.5	2.2	5.0	2.9	4.5X3.2	3.5	7.0	3.7	5.7X5.0	4.5	8.0	5.6	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply force in the direction shown in Fig.3. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 3
LXW (mm)	Dimension (mm)																																
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4.5X3.2	3.5	7.0	3.7																														
5.7X5.0	4.5	8.0	5.6																														
11	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 seconds at 235±5°C. Immersing speed : 25±2.5mm/sec.																														
12	Resistance to Soldering Heat	Appearance	Preheat the capacitor at 120 to 150°C* for 1 minute. Immerse the capacitor in eutectic solder solution at 260±5°C for 10±1 seconds. Let sit at room condition for 24±2 hours, then measure. • Immersing speed : 25±2.5mm/sec. • Pretreatment Perform a heat treatment at 150± ₁₀ °C for 60±5 minutes and then let sit for 24±2 hours at room condition. *Preheating for more than 3.2X2.5mm <table border="1" data-bbox="933 1881 1396 1960"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100°C to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170°C to 200°C</td> <td>1 min.</td> </tr> </tbody> </table>	Step	Temperature	Time	1	100°C to 120°C	1 min.	2	170°C to 200°C	1 min.																					
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2		170°C to 200°C		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 10000MΩ																																
Dielectric Strength	Pass the item No.4.																																

"room condition" Temperature · 15 to 35°C, Humidity · 45 to 75%, Atmosphere pressure · 86 to 106kPa



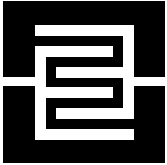
MONOLITHIC CERAMIC CAPACITOR



High-capacitance for General Electrical Equipment **GHM1500** Series

No.	Item	Specification	Test Method															
13	Temperature Cycle	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 7.5\%$.															
		D.F.	0.025 max.															
		I.R.	C \geq 0.01 μ F : More than 100M Ω - μ F C<0.01 μ F : More than 10000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig.4 using a eutectic solder. Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24 \pm 2 hours at room condition, then measure.															
			<table border="1"> <thead> <tr> <th>Step</th> <th>Temperature ($^{\circ}$C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. Operating Temp.\pm3</td> <td>30\pm3</td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> <tr> <td>3</td> <td>Max. Operating Temp.\pm2</td> <td>30\pm3</td> </tr> <tr> <td>4</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> </tbody> </table>	Step	Temperature ($^{\circ}$ C)	Time (min.)	1	Min. Operating Temp. \pm 3	30 \pm 3	2	Room Temp.	2 to 3	3	Max. Operating Temp. \pm 2	30 \pm 3	4	Room Temp.	2 to 3
Step	Temperature ($^{\circ}$ C)	Time (min.)																
1	Min. Operating Temp. \pm 3	30 \pm 3																
2	Room Temp.	2 to 3																
3	Max. Operating Temp. \pm 2	30 \pm 3																
4	Room Temp.	2 to 3																
			<ul style="list-style-type: none"> • Pretreatment Perform a heat treatment at 150$^{\pm}$₁₀$^{\circ}$C for 60\pm5 minutes and then let sit for 24\pm2 hours at room condition. 															
			<p>Fig. 4</p>															
14	Humidity (Steady State)	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 15\%$															
		D.F.	0.05 max.															
		I.R.	C \geq 0.01 μ F : More than 10M Ω - μ F C<0.01 μ F : More than 1000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Sit the capacitor at 40 \pm 2 $^{\circ}$ C and 90 to 95% humidity for 500 $^{\pm}$ ₂₄ $^{\circ}$ hours. Remove and let sit for 24 \pm 2 hours at room condition, then measure.															
			<ul style="list-style-type: none"> • Pretreatment Perform a heat treatment at 150$^{\pm}$₁₀$^{\circ}$C for 60\pm5 minutes and then let sit for 24\pm2 hours at room condition. 															
15	Life	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 15\%$															
		D.F.	0.05 max.															
		I.R.	C \geq 0.01 μ F : More than 10M Ω - μ F C<0.01 μ F : More than 1000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage: 250V) for 1000 $^{\pm}$ ₄₈ hours at maximum operating temperature \pm 3 $^{\circ}$ C. Remove and let sit for 24 \pm 2 hours at room condition, then measure. The charge/discharge current is less than 50mA.															
			<ul style="list-style-type: none"> • Pretreatment Apply test voltage for 60\pm5 minutes at test temperature. Remove and let sit for 24\pm2 hours at room condition. 															

"room condition" Temperature · 15 to 35 $^{\circ}$ C, Humidity · 45 to 75%, Atmosphere pressure · 86 to 106kPa



MONOLITHIC CERAMIC CAPACITOR



Products which are based on the Standards of the Electrical Appliance And Material Control Law of Japan

Ceramic Capacitor for 250VAC **GHM2000** Series

FEATURES

1. Chip monolithic ceramic capacitor for AC line.
2. A new monolithic structure for small, high-capacitance capable of operating at high-voltage levels.
3. Sn-plated external electrodes allow mounting without silver compound solder.
4. For Reflow soldering.

APPLICATIONS

Ideal use as Y capacitor (line by pass) or X capacitor (across the line) for switching power supply, telephone, facsimile and modem.

REFERENCE STANDARD

- JIS C 5102
- JIS C 5150
- The standards of the electrical appliance and material control law of Japan, separated table 4.

STANDARD LIST

B Characteristic ($\pm 10\%$)

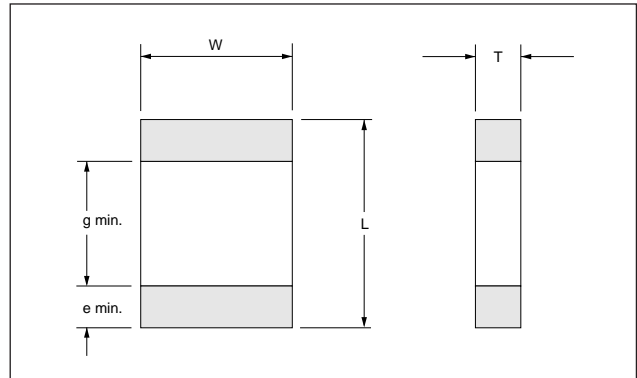
[X capacitor]

Part Number	Dimensions (mm)			Nom. Cap. (pF)	Cap. Tol.	Rated Volt. (VAC)	Packaging Qty. (pcs./reel)
	L	W	T				
GHM2143 B 103 M AC250	5.7 \pm 0.4	2.8 \pm 0.3	2.0 \pm 0.3	10000	$\pm 20\%$	250	1,000
GHM2143 B 223 M AC250				22000			
GHM2143 B 473 M AC250				47000			
GHM2145 B 104 M AC250		5.0 \pm 0.4		100000			

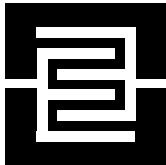
[Y capacitor]

Part Number	Dimensions (mm)			Nom. Cap. (pF)	Cap. Tol.	Rated Volt. (VAC)	Packaging Qty. (pcs./reel)
	L	W	T				
GHM2243 B 471 M AC250	5.7 \pm 0.4	2.8 \pm 0.3	2.0 \pm 0.3	470	$\pm 20\%$	250	1,000
GHM2243 B 102 M AC250				1000			
GHM2243 B 222 M AC250				2200			
GHM2243 B 472 M AC250				4700			

DIMENSIONS



Type (EIA Code)	Dimensions (mm)				
	L	W	T	g	e
GHM2143 (2211)	5.7 \pm 0.4	2.8 \pm 0.3	2.0 \pm 0.3	3.5	0.3
GHM2145 (2220)		5.0 \pm 0.4			
GHM2243 (2211)		2.8 \pm 0.3			



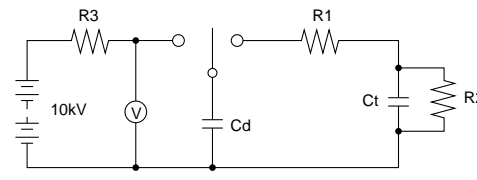
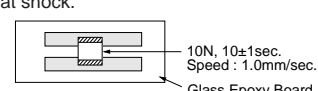
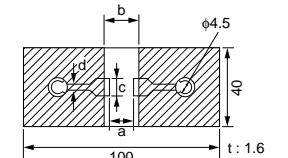
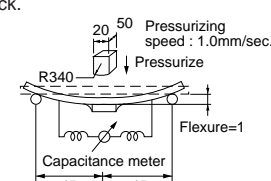
MONOLITHIC CERAMIC CAPACITOR



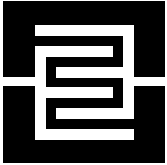
Products which are based on the Standards of the Electrical Appliance And Material Control Law of Japan

Ceramic Capacitor for 250VAC **GHM2000** Series

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification	Test Method																			
1	Operating Temperature Range	-25 to +85°C	—																			
2	Appearance	No defects or abnormalities.	Visual inspection.																			
3	Dimensions	Within the specified dimension.	Using Calipers.																			
4	Dielectric Strength	No defects or abnormalities.	No failure shall be observed when voltage as table is applied between the terminations for 60±1 seconds, provided the charge/discharge current is less than 50mA. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>X Capacitor</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td></td> <td>575VAC</td> </tr> <tr> <td>Y Capacitor</td> <td>1500VAC</td> </tr> </tbody> </table>	X Capacitor	Test voltage		575VAC	Y Capacitor	1500VAC													
X Capacitor	Test voltage																					
	575VAC																					
Y Capacitor	1500VAC																					
5	Insulation Resistance (I.R.)	More than 2000MΩ	The insulation resistance shall be measured with 500±50V and within 60±5 seconds of charging.																			
6	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 20°C at a frequency of 1±0.2kHz and a voltage of 1±0.2Vrms.																			
7	Dissipation Factor (D.F.)	0.025 max.																				
8	Capacitance Temperature Characteristics	Cap. Change Within ±10%	The range of capacitance change compared with the 20°C value within -25 to 85°C shall be within the specified range. • Pretreatment Perform a heat treatment at 150±10°C for 60±5 minutes and then let sit for 24±2 hours at room condition.																			
9	Discharge Test (Application: Y Capacitor)	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 : 1000Ω R2 : 100MΩ R3 : Surge resistance																			
10	Adhesive Strength of Termination	No removal of the terminations or other defects shall 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 shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 1 10N, 10±1sec. Speed : 1.0mm/sec. Glass Epoxy Board																			
11	Deflection	No cracking or marking defects shall occur.  Fig. 2 <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">LXW (mm)</th> <th colspan="4">Dimension (mm)</th> <th rowspan="2"></th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>5.7X2.8</td> <td>4.5</td> <td>8.0</td> <td>3.2</td> <td rowspan="2">1.0</td> </tr> <tr> <td>5.7X5.0</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table>	LXW (mm)	Dimension (mm)					a	b	c	d	5.7X2.8	4.5	8.0	3.2	1.0	5.7X5.0	4.5	8.0	5.6	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 shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 3 50 Pressurizing speed : 1.0mm/sec. Pressurize R340 Flexure=1 Capacitance meter 45 45 (in mm)
LXW (mm)	Dimension (mm)																					
	a	b	c	d																		
5.7X2.8	4.5	8.0	3.2	1.0																		
5.7X5.0	4.5	8.0	5.6																			
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 seconds at 235±5°C. Immersing speed : 25±2.5mm/sec.																			
13	Humidity Insulation	Appearance Capacitance Change D.F. I.R. Dielectric Strength	No marking defects. within ±15% 0.05 max. More than 1000MΩ Pass the item No.4.																			

"room condition" Temperature : 15 to 35°C, Humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa



MONOLITHIC CERAMIC CAPACITOR



Products which are based on the Standards of the Electrical Appliance And Material Control Law of Japan

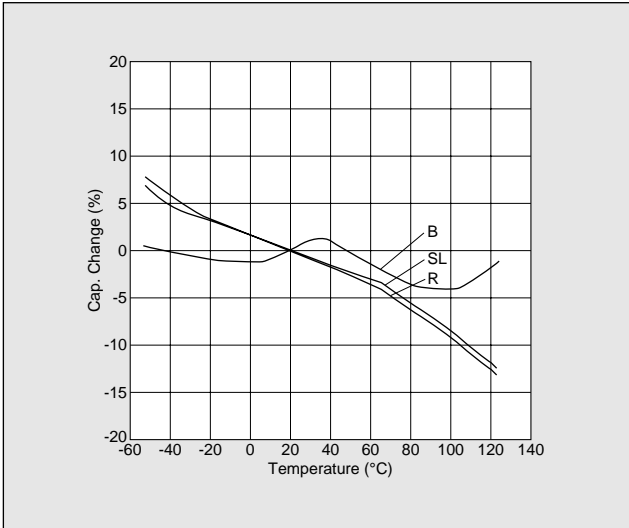
Ceramic Capacitor for 250VAC GHM2000 Series

No.	Item	Specification	Test Method															
14	Resistance to Soldering Heat	Appearance	No marking defects.															
		Capacitance Change	within $\pm 10\%$															
		D.F.	0.025 max.															
		I.R.	More than 2000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at $260\pm 5^\circ\text{C}$ for 10 ± 1 seconds. Let sit at room condition for 24 ± 2 hours, then measure. <ul style="list-style-type: none"> • Immersing speed : $25\pm 2.5\text{mm/sec}$. • Pre-treatment Perform a heat treatment at $150\pm 10^\circ\text{C}$ for 60 ± 5 minutes and then let sit for 24 ± 2 hours at room condition. <p>*Preheating</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100°C to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170°C to 200°C</td> <td>1 min.</td> </tr> </tbody> </table>	Step	Temperature	Time	1	100°C to 120°C	1 min.	2	170°C to 200°C	1 min.						
Step	Temperature	Time																
1	100°C to 120°C	1 min.																
2	170°C to 200°C	1 min.																
15	Temperature Cycle	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 7.5\%$															
		D.F.	0.025 max.															
		I.R.	More than 2000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig.4 using a eutectic solder. Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24 ± 2 hours at room condition, then measure. <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature ($^\circ\text{C}$)</th> <th>Time (mi n.)</th> </tr> </thead> <tbody> <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> </tbody> </table> <ul style="list-style-type: none"> • Pre-treatment Perform a heat treatment at $150\pm 10^\circ\text{C}$ for 60 ± 5 minutes and then let sit for 24 ± 2 hours at room condition. <p style="text-align: center;">Fig. 4</p>	Step	Temperature ($^\circ\text{C}$)	Time (mi n.)	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
Step	Temperature ($^\circ\text{C}$)	Time (mi n.)																
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																
16	Humidity (Steady State)	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 15\%$															
		D.F.	0.05 max.															
		I.R.	More than 1000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Sit the capacitor at $40\pm 2^\circ\text{C}$ and 90 to 95% humidity for $500\pm 24_0$ hours. Remove and let sit for 24 ± 2 hours at room condition, then measure. <ul style="list-style-type: none"> • Pre-treatment Perform a heat treatment at $150\pm 10^\circ\text{C}$ for 60 ± 5 minutes and then let sit for 24 ± 2 hours at room condition. 															
17	Life	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 15\%$															
		D.F.	0.05 max.															
		I.R.	More than 1000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Apply voltage and time as Table at $85\pm 2^\circ\text{C}$. Remove and let sit for 24 ± 2 hours at room condition, then measure. The charge/discharge current is less than 50mA. <table border="1"> <thead> <tr> <th></th> <th>Test Time</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td>X Capacitor</td> <td>$1000\pm 48_0$ hours</td> <td>300VAC</td> </tr> <tr> <td>Y Capacitor</td> <td>$1500\pm 48_0$ hours</td> <td>500VAC*</td> </tr> </tbody> </table> <p>*Except that once each hour the voltage is increased to 1000VAC for 0.1 sec.</p> <ul style="list-style-type: none"> • Pre-treatment Apply test voltage for 60 ± 5 minutes at test temperature. Remove and let sit for 24 ± 2 hours at room condition. 		Test Time	Test voltage	X Capacitor	$1000\pm 48_0$ hours	300VAC	Y Capacitor	$1500\pm 48_0$ hours	500VAC*						
	Test Time	Test voltage																
X Capacitor	$1000\pm 48_0$ hours	300VAC																
Y Capacitor	$1500\pm 48_0$ hours	500VAC*																
18	Humidity Loading	Appearance	No marking defects.															
		Capacitance Change	Within $\pm 15\%$															
		D.F.	0.05 max.															
		I.R.	More than 1000M Ω															
		Dielectric Strength	Pass the item No.4.															
			Apply the rated voltage at $40\pm 2^\circ\text{C}$ and 90 to 95% humidity for $500\pm 24_0$ hours. Remove and let sit 24 ± 2 hours at room condition, then measure. <ul style="list-style-type: none"> • Pre-treatment Apply test voltage for 60 ± 5 minutes at test temperature. Remove and let sit for 24 ± 2 hours at room condition. 															

"room condition" Temperature : 15 to 35 $^\circ\text{C}$, Humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

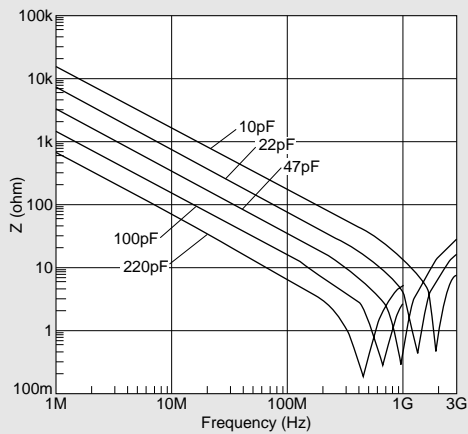
TYPICAL CHARACTERISTICS DATA

• Capacitance-Temp. Char.

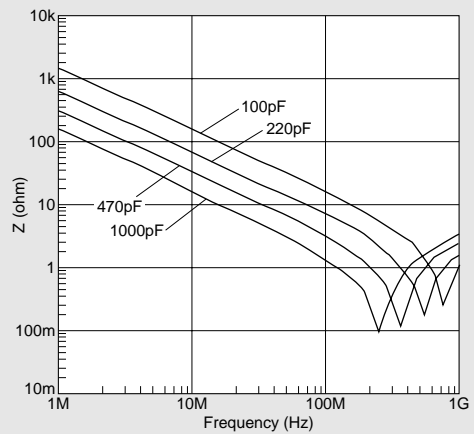


• Impedance-Freq. Char.

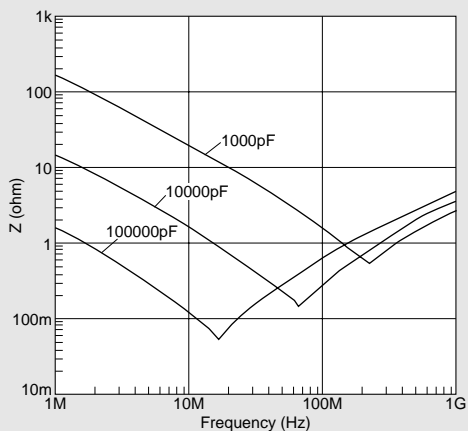
GHM1000 Series [SL Char.]



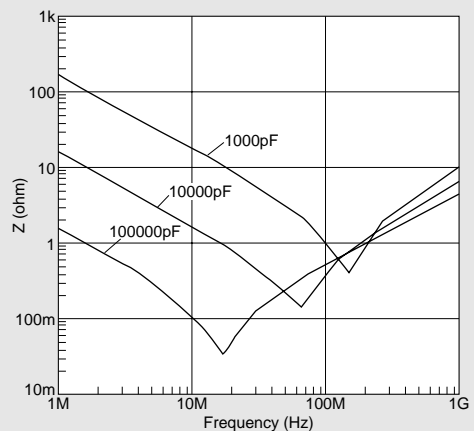
GHM1000 Series [R Char.]



GHM1500 Series

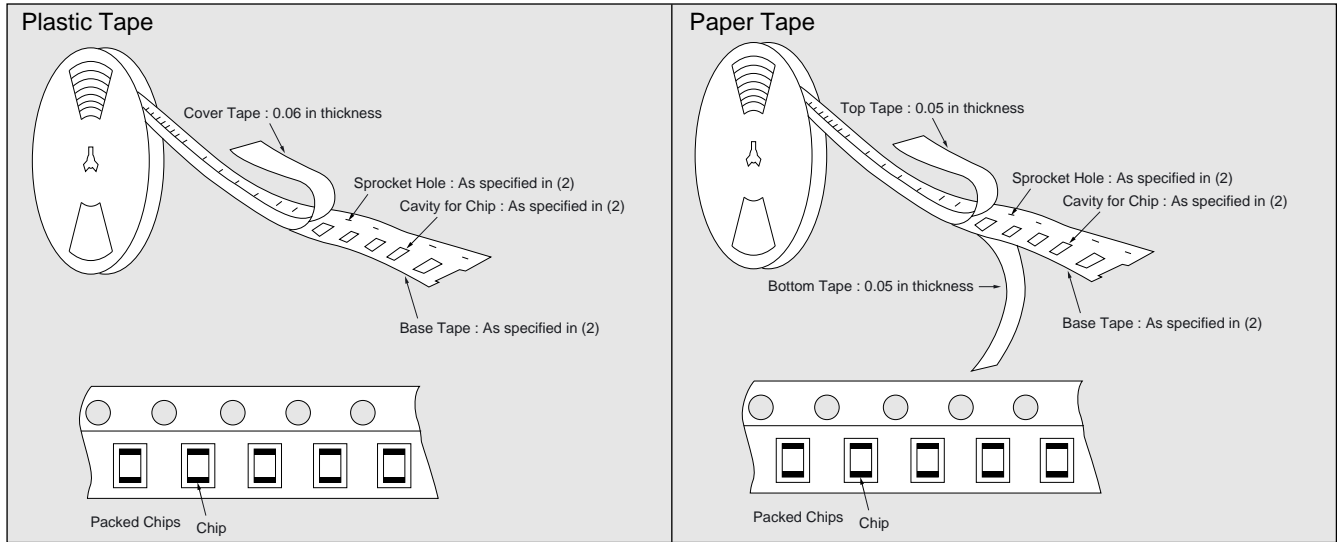


GHM2000 Series



PACKAGING (Taping is standard packaging method.)

(1) Appearance of taping



(2) Dimensions of Tape

Plastic Tape (T>=1.25 rank)

Type	*A	*B
GHM1030	2.0	3.6
GHM1525	1.45	2.25
GHM1530	2.0	3.6
GHM1535	2.9	3.6

*Nominal value

Paper Tape (T=1.0 rank)

Type	*A	*B
GHM1038	2.4	4.9
GHM1040	3.6	4.9
GHM1540	3.6	4.9
GHM2143	3.2	6.1
GHM2243	3.2	6.1
GHM1545	5.4	6.1
GHM2145	5.4	6.1

*Nominal value (in mm)

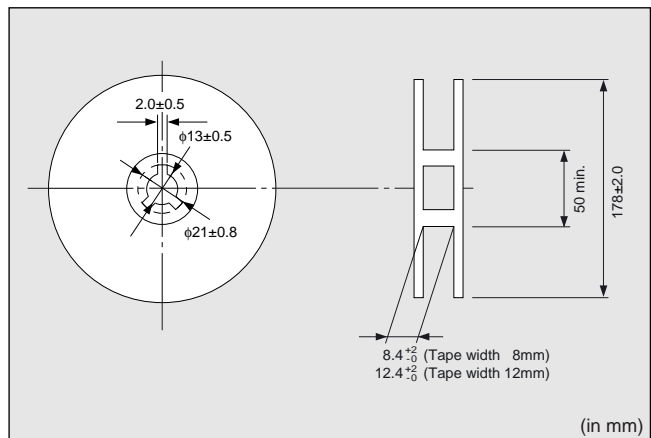
*1 4.0±0.1mm in case of GHM1038

Paper Tape (T=1.0 rank)

Type	*A	*B
GHM1030	2.0	3.6
GHM1525	1.45	2.25
GHM1530	2.0	3.6

*Nominal value (in mm)

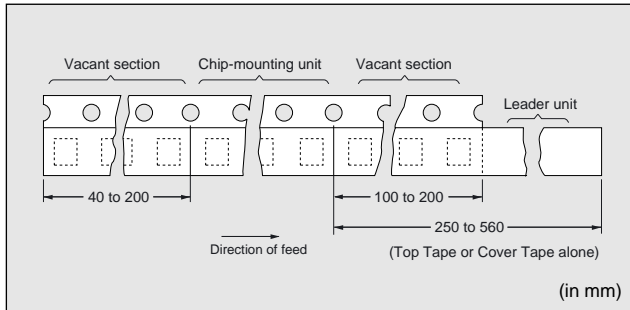
(3) Dimensions of Reel



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

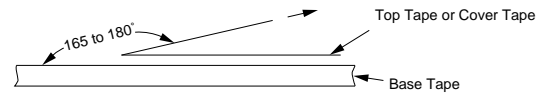
PACKAGING (Taping is standard packaging method.)

- (5) Part of the leader and part of the empty tape shall be attached to the end of the tape as follows.



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

- (7) Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
- (8) The top tape or cover tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover sprocket holes.
- (9) Cumulative tolerance of sprocket holes, 10 pitches : $\pm 0.3\text{mm}$.
- (10) Peeling off force : 0.1 to 0.6N in the direction shown below.



PRECAUTION

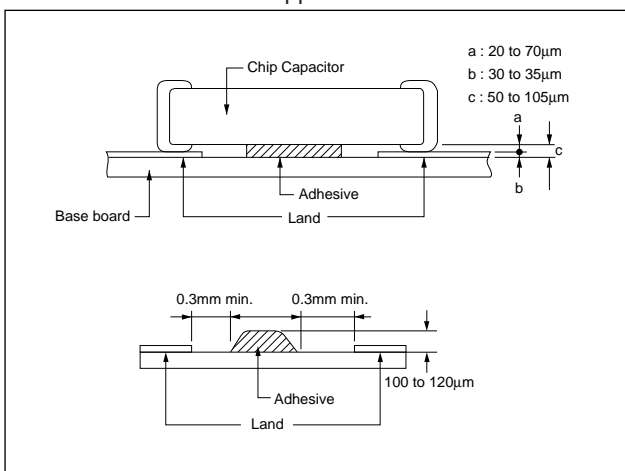
1. **Operating voltage**
Be sure to use a capacitor only within its rated operating voltage range. When DC-rated capacitors are to be used in AC or ripple voltage circuits, be sure to maintain the V_{p-p} value of the applied voltage within the rated voltage range.
2. **Operating temperature and self-generated heat**
Keep the surface temperature of a capacitor within the rated operating temperature range.
Be sure to take into account the heat produced by the capacitor itself. When a capacitor is used in a high-frequency circuit, pulse voltage circuit or the like, it may produce heat due to dielectric loss.
Keep such self-generated temperature below 20°C.
3. **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°C and 20 to 70%RH.
Use capacitors within 6 months.
4. **Vibration and impact**
Do not expose a capacitor to excessive shock or vibration during use.

Failure to follow the above cautions may result, worst case, in a short circuit and fuming when the product is used.

NOTICE

1. MOUNTING OF CHIPS

- Termination thickness of chip capacitor and desirable thickness of adhesives applied



- 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 to 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.

NOTICE

2. 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 pre-

vent this, be extremely careful in determining shape and dimension before designing the circuit board diagram.

● Construction and dimensions of pattern (example)

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

● Flow soldering (in mm)			
LXW	a	b	c
2.0X1.25	1.0-1.2	0.9-1.0	0.8-1.1
3.2X1.6	2.2-2.6	1.0-1.1	1.0-1.4

● Reflow soldering (in mm)					
LXW	a	b	c	d	e
2.0X1.25	1.0-1.2	0.9-1.0	0.8-1.1	--	--
3.2X1.6	2.2-2.4	0.8-0.9	1.0-1.4	1.0-2.0	3.2-3.7
3.2X2.5	2.0-2.4	1.0-1.2	1.8-2.3	1.0-2.0	4.1-4.6
4.5X2.0	2.8-3.4	1.2-1.4	1.4-1.8	1.0-2.8	3.6-4.1
4.5X3.2	2.8-3.4	1.2-1.4	2.3-3.0	1.0-2.8	4.8-5.3
5.7X2.8	4.0-4.6	1.4-1.6	2.1-2.6	1.0-4.0	4.4-4.9
5.7X5.0	4.0-4.6	1.4-1.6	3.5-4.8	1.0-4.0	6.6-7.1

● Land layout for cropping PC board

Design layout of components on the PC board to minimize the stress imposed on the wrap or flexure of the board.

[Component direction] Put the component lateral to the direction in which stress acts.

[Component layout close to board break] Susceptibility to stress is in the order of ; A>C>B=D

● 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			
Examples of improvements by the land division			

NOTICE

3. SOLDERING (Prevention of the thermal shock)

● **Pre-heat conditions and example.**

Carefully perform pre-heating so that temperature difference(ΔT) between the solder and component surface should be in the following range.

Chip Size	3.2X1.6mm and under	3.2X2.5mm and over
Soldering method		
Reflow method or Soldering iron method	$\Delta T \leq 190^\circ\text{C}$	$\Delta T \leq 130^\circ\text{C}$
Flow method or Dip Soldering method	$\Delta T \leq 150^\circ\text{C}$	—

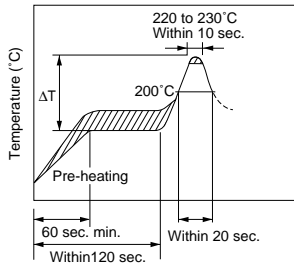
When components are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100°C .

When correcting chips with a soldering iron, no preheating is required if the following conditions are met.

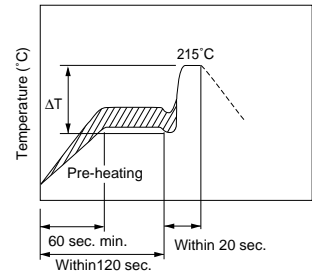
Preheating should be performed on chip not listed in following Table.

Item	Conditions
Chip size	2.0X1.25mm, 3.2X1.6mm
Temperature of iron-tip	270°C max.
Soldering iron wattage	20W max.
Diameter of iron-tip	$\phi 3.0\text{mm}$ max.
Soldering time	3 sec. max.
Caution	Do not allow the iron-tip to directly touch the ceramic element.

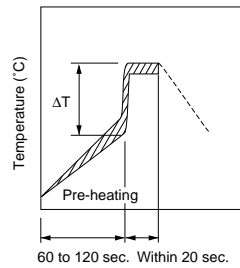
● **Infrared reflow soldering conditions (Example)**



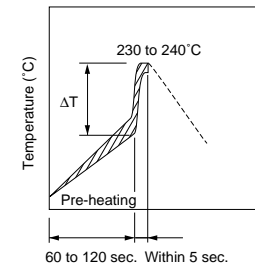
● **Vapor reflow soldering (VPS) conditions (Example)**



● **Dip soldering/Soldering iron conditions (Example)**



● **Flow soldering conditions (Example)**

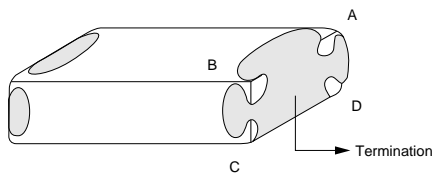


⟨ **Care for minimizing loss of the terminations** ⟩

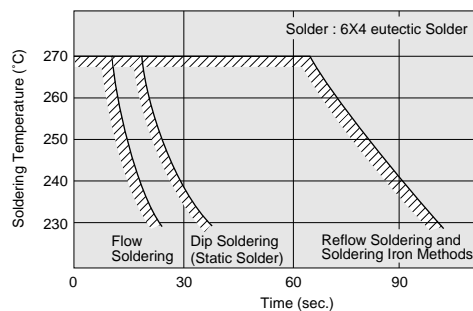
● **Limit of losing effective area of the terminations and conditions needed for soldering.**

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 minimum 25% on all edge length A-B-C-D of part with A, B, C, D, shown in the Figure below.



Soldering Allowance Time



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

NOTICE

<Flux and Solder>

- Use rosin-type flux and do not use a highly acidic flux (any containing a minimum of 0.2wt% chlorine).
- Please use 6X4 eutectic solder, or 5X5 solder. (Do not use solder with silver.)

<Solder Buildup>

- Flow soldering and iron soldering
Use as little solder as possible (as shown in Fig.1), and confirm that the solder is securely placed.
- Reflow soldering
When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations (as shown in Fig.2).

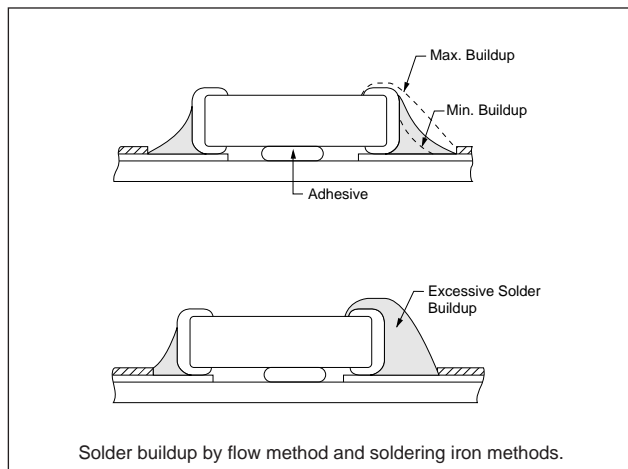


Fig.1

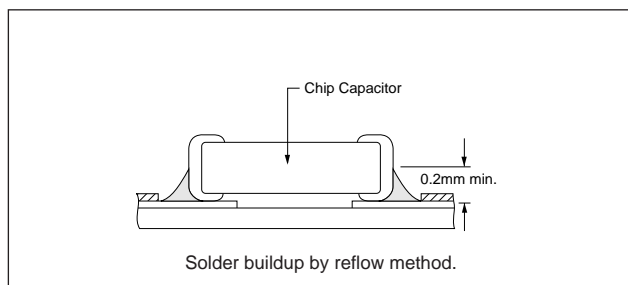


Fig.2

4. CLEANING

- To perform ultrasonic cleaning, observe the following conditions.

Rinse bath capacity : Output of 20 watts per liter or less.
Rinsing time : 5 minutes maximum.

5. RESIN COATING

- When selecting resin materials, select those with low contraction and low moisture absorption coefficient (generally epoxy resin is used).
- Buffer coat can decrease the influence of the resin shrinking (generally silicone resin).

■ ISO9000 CERTIFICATIONS

Manufacturing plants of these products in this catalog have obtained the ISO9001 or ISO9002 certificate.

Plant	Certified Date	Organization	Registration NO.
Fukui Murata Manufacturing Co.,Ltd.	Mar. 31, '95	RCJ* ISO9001	RCJ-85M-01C
Izumo Murata Manufacturing Co.,Ltd.	May. 11, '95		RCJ-93M-05A
Murata Electronics Singapore (Pte.) Ltd.	Aug. 13, '92	SISIR** ISO9002	SG MES 91M001A
Murata Manufacturing (UK) Ltd.	Nov. 18, '92	BSI*** ISO9002	FM 22169
Murata Amazonia Industria Comercio Ltda.	Sep. '93	RCJ* ISO9002	RCJ-(B)-93M-01
Murata Electronics North America State College Plant	Jun. '94	UL**** ISO9002	A1734

- ★RCJ : Reliability Center for Electronic Components of Japan
- ★★SISIR : Singapore Institute of Standards and Industrial Research
- ★★★BSI : British Standards Institution
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