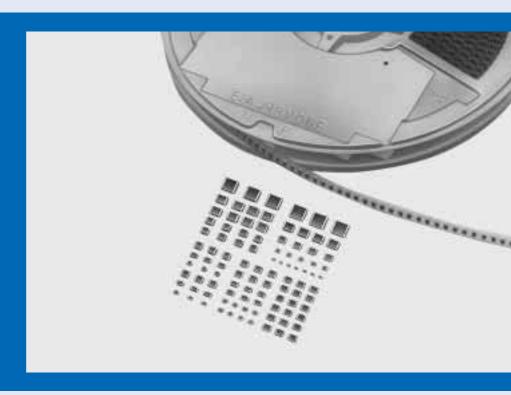


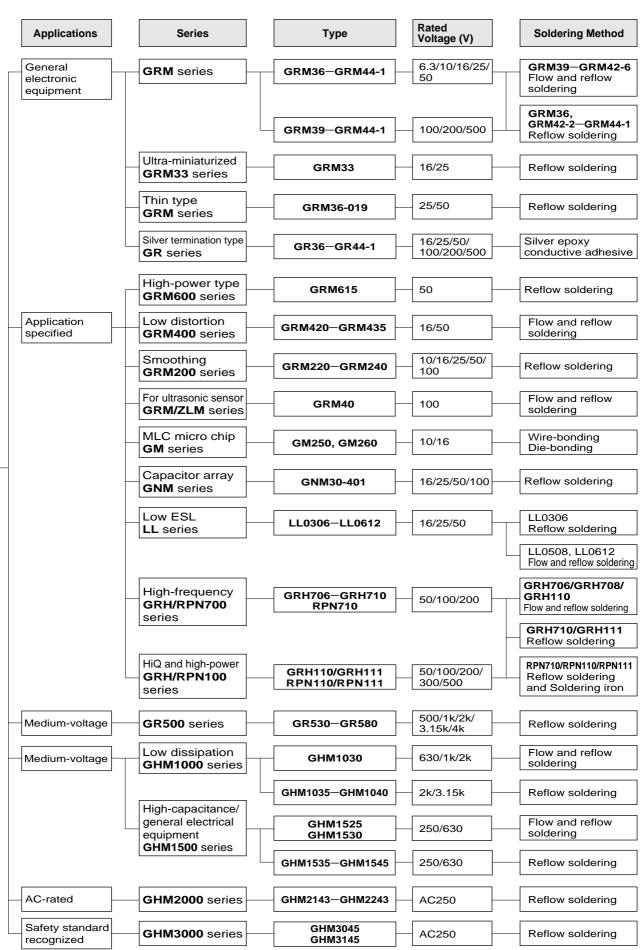
## Chip Monolithic Ceramic Capacitor

CHIP MONOLITHIC CERAMIC CAPACITOR





# Chip Monolithic Ceramic Capacitor Product Guide



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# Chip Monolithic Ceramic Capacitor CONTENTS

GRM Series for General Electronic Equipment	Ultra-miniaturized GRM33 Series
<ul> <li>Capacitance Range Table</li></ul>	<ul> <li>Capacitance Range Table</li></ul>
Characteristics (Selection of Ceramic Capacitors) · · · 14-13	GRM Series for Thin Equipment
	Capacitance Range Table
	• Specifications and Test Methods · · · · · · 21–23
Silver Termination Type GR Series for General Electronic Ed	
<ul> <li>Capacitance Range Table</li></ul>	Characteristics (Selection of Ceramic Capacitors) · · · 33–34
GRM600 Series ; High-Power	GRM200 Series ; Smoothing
<ul> <li>Capacitance Range Table</li></ul>	<ul> <li>Capacitance Range Table</li></ul>
GRM400 Series ; Low Distortion	
Capacitance Range Table	
<ul> <li>Specifications and Test Methods</li></ul>	
For Ultrasonic Sensor Temperature Compensating Type	Capacitor Array GNM Series
GRM ZLM Series	Capacitance Range Table
<ul><li>Capacitance Range Table</li></ul>	• Specifications and Test Methods · · · · · · · · · 57–59
MLC Micro Chip GM Series	Low ESL Wide Width Type LL Series     Capacitance Range Table61
Capacitance Range Table	• Specifications and Test Methods · · · · · 62–63
• Specifications and Test Methods · · · · · · · · 53–54	oppositional and root monitored 02 00
Solder Coated Type GRH/RPN700 Series ; High-frequency	Solder Coated Type GRH/RPN100 Series ; HiQ and High-
• Capacitance Range Table	power Type • Capacitance Range Table·····69
Specifications and Test Methods	Specifications and Test Methods · · · · · · · · 70–71
	Characteristics (Selection of Ceramic Capacitors) · · · 72–74
Silver Termination Type GR500 Series ; Medium voltage	
<ul> <li>Capacitance Range Table</li></ul>	
GRM□Series, GR□Series, GM Series, GNM Series, LL Serie • Standard Packaging Quantity and Taping Dimensions· · 82–83	s, GRH/RPN⊡Series
GRM□Series, GR□Series, GM Series, GNM Series, LL Serie	s, GRH/RPN⊡Series
• Notice	
GHM Series ; Medium-voltage	0 10 11 ( 0 0 0 11 0 0 0 11 0 0 0 11 0 0 0 11 0
Part Numbering	Ceramic Capacitor for 250VAC GHM2000 Series · · · 104–105
<ul><li>Capacitance Range Table</li></ul>	Safety standard Recognized GHM3000 Series · · · · 106–108 • Typical Characteristics Data · · · · · · · · · · · · · · · 109
Medium-voltage Low Dissipation GHM1000 Series · 98–99	• Packaging · · · · · · · · · · · · · · · · · · ·
Medium-capacitance for General Electrical Equipment GHM1500 Series · · · · · · · · · · · · · · · · · · ·	



## MONOLITHIC CERAMIC CAPACITOR



## **GRM** Series for General Electronic Equipment

#### **■**FEATURES

- Terminations are made of metal highly resistant to migration.
- 2. The GRM series is a complete line of chip ceramic capacitors in 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from  $C0\Delta$  to Y5V.
- 3. A wide selection of sizes is available, from the miniature GRM36 (L $\times$ W $\times$ T : 1.0 $\times$ 0.5 $\times$ 0.5mm) to the larger sized GRM44-1 (L $\times$ W $\times$ T : 5.7 $\times$ 5.0 $\times$ 2.0mm).
  - 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.
- 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

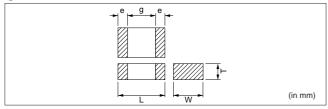
(\*Please specify the part number when ordering)



**1**Туре

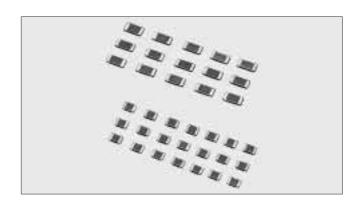
- 6 Rated Voltage
- 2Temperature Characteristics
- 6 Murata's Control No.
- 3Capacitance
- Packaging
- 4 Capacitance Tolerance

#### **1**TYPE AND DIMENSIONS



Type (EIA Code)	L	W	Т	е	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
			0.6±0.1		
GRM40 (0805)	) (0805) 2.0±0.1 1.25=		0.85±0.1	0.2 to 0.7	0.7
			1.25±0.1		
	3.2±0.15	1.6±0.15	0.85±0.1		
GRM42-6 (1206)	3.210.13	1.0±0.13	1.15±0.1	0.3 to 0.8	1.5
	3.2±0.2	1.6±0.2	1.6±0.2		
			0.85±0.1		
			1.15±0.1		
GRM42-2 (1210)	3.2±0.3	2.5±0.2	1.35±0.15	0.3 min.	1.0
			1.8±0.2		
			2.5±0.2		
GRM43-2 (1812)	4.5±0.4	3.2±0.3	2.0 max.	0.3 min.	2.0
GRM44-1 (2220)	5.7±0.4	5.0±0.4	2.0 max.	0.3 min.	2.0

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



#### **2**TEMPERATURE CHARACTERISTICS

Temperature Compensating Type

Code	COG	C0H	P2H	R2H	S2H	T2H	U2J	SL
Temp. range	-55 to	+125℃			-55 to	+85℃		
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℃	-55 to +125℃	+10 to +85℃	-30 to +85℃
Cap. change (%)	±15	±15	+22 -56	+22 -82

#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	100	10
R75	0.75	101	100
010	1	103	10,000

#### **4**CAPACITANCE TOLERANCE

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

#### **G**RATED VOLTAGE

Code	DC Rated voltage (V)
6.3	6.3
10	10
16	16
25	25
50	50
100	100
200	200
500	500

#### **7**PACKAGING CODE

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

#### **■**CAPACITANCE RANGE TABLE

## FOR FLOW AND REFLOW SOLDERING

## Temperature Compensating Type 50V/25V

Type (EIA Code)	COG	GRM36	* (04)	02) SL	1	COG	СОН	Dall		M39 (0			112.1	_		
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#### \*GRM36 is suited to only reflow soldering.

#### ■CAPACITANCE TOLERANCE

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#### ■CAPACITANCE RANGE TABLE

## FOR FLOW AND REFLOW SOLDERING

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\*5 Only for taping

\*6 Type : GRM40-034 (L : 2±0.15, W : 1.25±0.15, T : 1.25±0.15)

\*7 L: 3.2±0.2, W: 1.6±0.2, T: 1.15±0.15

\*8 Type : GRM42-631 (L : 3.2±0.2, W : 1.6±0.2, T : 1.3 <sup>+0</sup><sub>-0.2</sub> )

#### **■**CAPACITANCE TOLERANCE

X7R/X5R Characteristics K: ±10% (E12 Series) M: ±20% (E6 Series)

## High Dielectric Constant Type 50V Char. Z5U

Type (EIA Code)	GRM39 (0603)	GRM40 (0805)	GRM42-6 (1206)		
Char.	Z5U	Z5U	Z5U		
Volt.	50	50	50		
1,500					
2,200					
3,300					
4,700					
6,800					
10,000					
15,000					
22,000					
33,000					
47,000					
68,000					
100,000					
150,000					
220,000					

\* T: 0.85mm is also available.

#### ■CAPACITANCE TOLERANCE

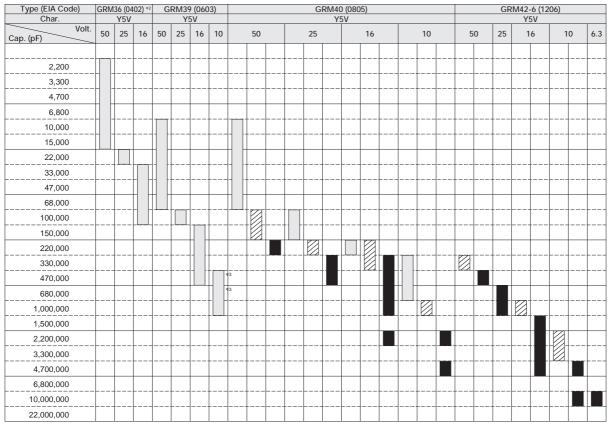
Z5U Characteristics M: ±20% (E6 Series) Z: ±20% (E6 Series)

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*	Bulk Case (pcs./case)
GRM39	: 0.8±0.1*1	1,000	4,000	15,000
	: 0.6±0.1	1,000	4,000	10,000
GRM40	: 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	_
OKW42-0	: 1.15±0.1	1,000	3,000	_

<sup>\* \$\</sup>phi330mm reel is available on request.

<sup>\*1</sup> Bulk case packaging is T=0.8±0.07

#### High Dielectric Constant Type 50V/25V/16V/10V/6.3V Char. Y5V



\*2 GRM36 series is suited to only reflow soldering. \*3 Only for taping

#### **■**CAPACITANCE TOLERANCE

Y5V Characteristics Z: ±20% (E6 Series)

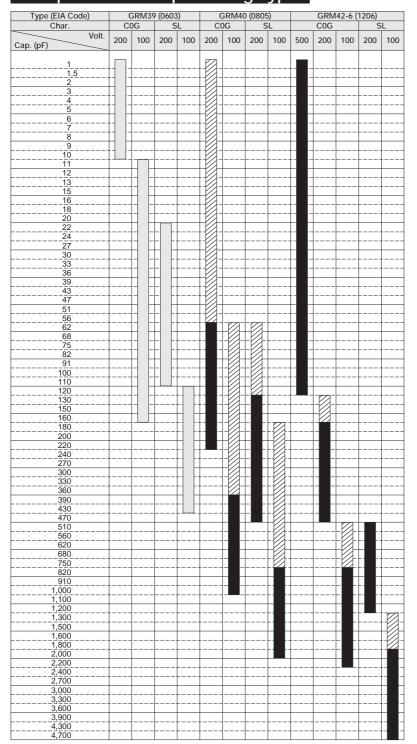
#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./\phi178mm reel)*4	Bulk Case (pcs./case)
GRM36	: 0.5±0.05	1,000	10,000	50,000
GRM39	M39 : 0.8±0.1*5 1		4,000	15,000
	: 0.6±0.1	1,000	4,000	10,000
GRM40	: 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	_
GRIVI42-0	: 1.15±0.1	1,000	3,000	_

\*4 \$330mm reel is available on request.

<sup>\*5</sup> Bulk case packaging is T=0.8 $\pm$ 0.07

## Temperature Compensating 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

#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)*
GRM39	: 0.8±0.1	1,000	4,000
GRM40	: 0.85±0.1	1,000	4,000
GRIVI40	: 1.25±0.1	1,000	3,000
GRM42-6	: 0.85±0.1	1,000	4,000
GKIVI42-0	: 1.15±0.1	1,000	3,000

\* \$\phi330mm reel is available on request.

## High Dielectric Constant Type 500V/200V/100V

Type (EIA Code)		GRM39	9 (0603					RM42-							
Char.	X.	7R	Z5U	Y5V	X	7R	Z!	5U	Y5V	X7R			Z!	5U	Y5V
Volt.	200	100	100	100	200	100	200	100	100	500	200	100	200	100	100
220	LI L	L				L			L				L	L	
270						L			L				L		
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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)

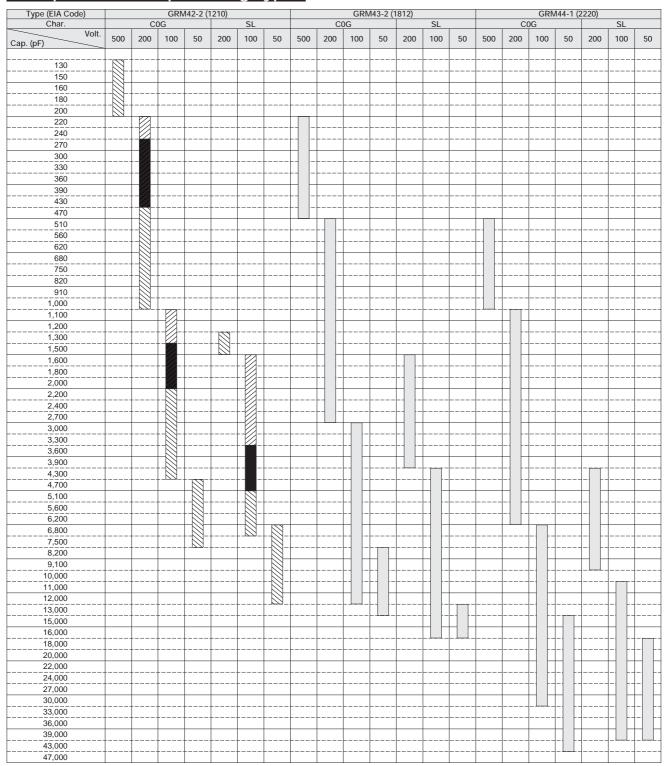
Y5V Characteristics Z: ±80% (E6 Series)

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./\phi178mm reel)*1
GRM39	: 0.8±0.1	1,000	4,000
GRM40	: 0.85±0.1	1,000	4,000
GKIVI40	: 1.25±0.1	1,000	3,000
GRM42-6	: 0.85±0.1	1,000	4,000
	: 1.15±0.1	1,000	3,000

<sup>\*1 \$330</sup>mm reel is available on request.

### FOR REFLOW SOLDERING

## Temperature Compensating Type 500V/200V/100V/50V



#### **■**CAPACITANCE TOLERANCE

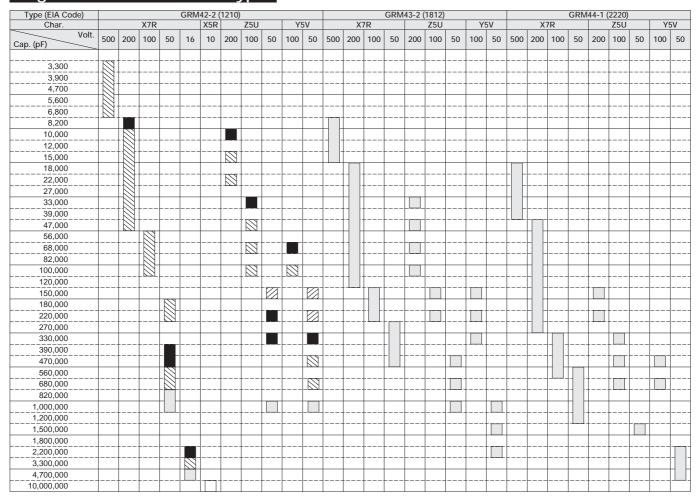
C0G/SL Characteristics J: ±5% (E24 Series)

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Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ф178mm reel)*						
	: 0.85±0.1	1,000	4,000						
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						

<sup>\* \$\</sup>phi330mm\$ reel is available on request.

## FOR REFLOW SOLDERING

## High Dielectric Constant Type 500V/200V/100V/50V/16V/10V



#### **■**CAPACITANCE TOLERANCE

X7R/X5R Characteristics  $K:\pm10\%$  (E12 Series)  $M:\pm20\%$  (E6 Series) Z5U Characteristics  $M:\pm20\%$  (E6 Series)  $Z:\pm\frac{4}{2}\%$  (E6 Series) Y5V Characteristics  $Z:\pm\frac{4}{2}\%$  (E6 Series)

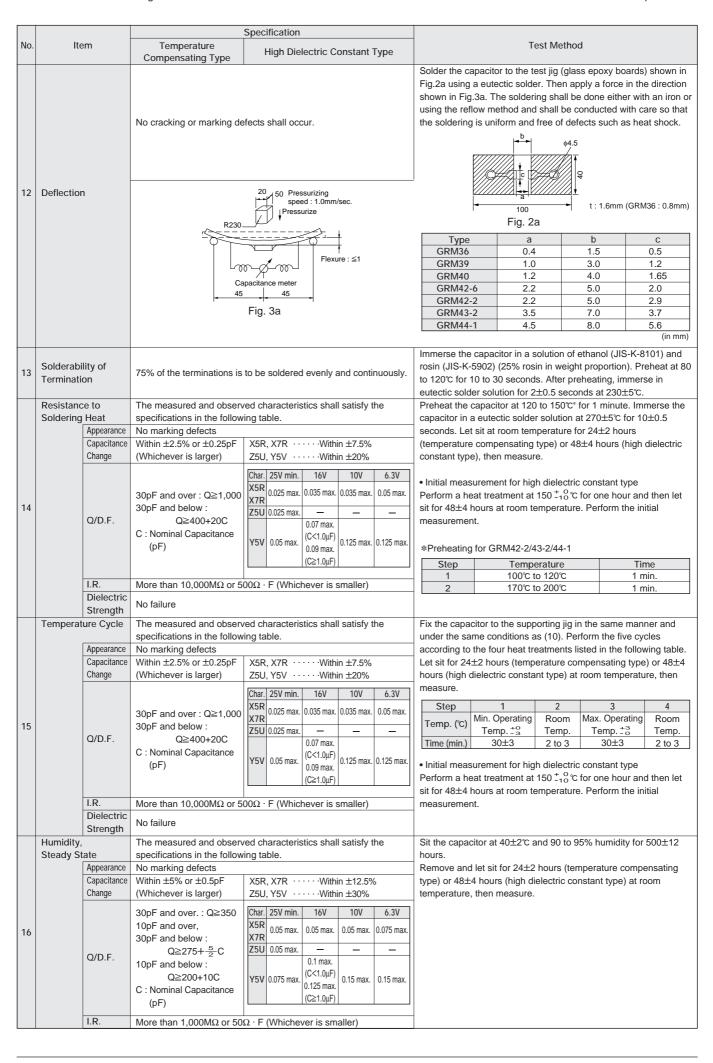
#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./∮178mm reel) *¹
	: 0.85±0.1	1,000	4,000
	: 1.15±0.1	1,000	3,000
GRM42-2	RM42-2 : 1.35±0.15		2,000
	: 1.8±0.2	1,000	1,000
	: 2.5±0.2	1,000	1,000
GRM43-2	: 2.0 max.	1,000	1,000
GRM44-1	: 2.0 max.	1,000	1,000

\*1 \$330mm reel is available on request.

#### ■SPECIFICATIONS AND TEST METHODS

		0/111011	IS AND TEST WE						
No.	Ite	em	Temperature	Specification		Test Me	ethod		
			Compensating Type	High Dielectric Constant Type					
1	Operating Temperat	J ure Range	-55 to +125℃	X5R: -55 to + 85°C X7R: -55 to +125°C Z5U: +10 to + 85°C Y5V: -30 to + 85°C					
2	Rated Vol	tage	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 <sup>p,p</sup> or V <sup>o,p</sup> , whic is larger, shall be maintained within the rated voltage range.		or V <sup>o.p</sup> , whichever		
3	Appearan		No defects or abnormalities		Visual inspection.				
4	Dimension	ns	Within the specified dimer	nsion.	Using calipers.  No failure shall be	observed when	*300% of the ra	ted voltage	
5	Dielectric	Strength	No defects or abnormalitie	es.	(C0∆ to U2J and S Z5U and Y5V) is a seconds, provided 50mA. *200% for	SL) or *250% of to applied between the charge/disc 500V	the rated voltage the terminations charge current is	e (X5R, X7R, s for 1 to 5 less than	
6	Insulation (I.R.)	Resistance	More than $10,000M\Omega$ or $5$	$00Ω \cdot F$ (Whichever is smaller)	The insulation resinot exceeding the within 2 minutes o	rated voltage at		ū	
7	Capacitar	nce	Within the specified tolera	nce.	The capacitance/0			at the	
8	Q/Dissipat (D.F.)	tion Factor	30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	Char.       25V min.       16V       10V       6.3V         X5R       0.025 max.       0.035 max.       0.035 max.       0.05 max.         Z5U       0.025 max.       —       —       —         V5V       0.05 max.       (C<1.0μF) 0.09 max. (C≥1.0μF)       0.125 max.       0.125 max.	Item (1000) Frequency 1:	to U2J, SL (mc/X5)	D∆ to U2J, SL ore than 1000pF) 5R, X7R, Y5V 1±0.1kHz	Z5U 1±0.1kHz .5±0.05Vr.m.s.	
		Capacitance Change	Within the specified tolerance. (Table A-1)	Char.         Temp. Range.         Reference Temp.         Cap. Change           X5R         -55 to + 85°C         Within±15%           X7R         -55 to +125°C         25°C         Within±15%           Y5V         -30 to + 85°C         Within±22%         Within±22%	(1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cyc				
		Temperature	Within the specified				pacitance chang		
9	Capacitance Temperature Characteristics	Capacitance Drift	within ±0.2% or ±0.05pF (Whichever is larger) *Not apply to SL/25V		between the m step 1, 3 and 5  Step 1 2 3 4 5  (2) High Dielectric The ranges of 6	aximum and mir by the cap. valu  Ter  125±3 (for C  Constant Type capacitance cha temperature ran ified ranges.	is calculated by dividing the differences in and minimum measured values in the cap. value in step 3.  Temperature (°C)  25±2  -55±3  25±2  ±3 (for C0∆)/85±3 (for other TC)  25±2  ant Type ance change compared with the 25°C return ranges shown in the table shall be		
			No removal of the termina	tions or other defects shall occur.	Fig. 1a using a eu				
				+  <sup>C</sup>  +	with the test jig for The soldering shall be method and shall be and free of defects s	10±1 sec. be done either wit conducted with o	th an iron or using care so that the so	the reflow	
10	Adhesive Strength of Termination  Adhesive Strength of Termination  Fig. 1a  Adhesive Strength of Termination  Solder resist  Baked electrode or copper foil				Type GRM36 GRM39 GRM40 GRM42-6 GRM42-2 GRM43-2 GRM44-1	a 0.4 1.0 1.2 2.2 2.2 3.5 4.5	b 1.5 3.0 4.0 5.0 5.0 7.0 8.0	c 0.5 1.2 1.65 2.0 2.9 3.7 5.6 (in mm)	
		Appearance	No defects or abnormalitie	98.	Solder the capacit	or to the test jig	(glass epoxy bo	ard) in the	
11	Capacitance			Char.   25V min.   16V   10V   6.3V   X5R   0.025 max.   0.035 max.   0.035 max.   0.035 max.   Z5U   0.025 max.	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).			10). The motion having aried uniformly he frequency be traversed in fied for a period	
				(C≧1.0μF)					



				Specification
No.	Ite	em	Temperature Compensating Type	High Dielectric Constant Type Test Method
17	Humidity	Appearance Capacitance Change  Q/D.F.	The measured and observe specifications in the follow No marking defects  Within ±7.5% or ±0.75pF (Whichever is larger)  30pF and over.: Q≥200 30pF and below: Q≥100+ 13/3 C C: Nominal Capacitance (pF)	Apply the rated voltage at $40\pm2^{\circ}\text{C}$ and 90 to 95% humidity for 500 $\pm12$ hours. Remove and let sit for $24\pm2$ hours (temperature compensating type) or $48\pm4$ hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA  Y5V
		I.R. Dielectric Strength	More than $500 M\Omega$ or $25\Omega$ No failure	· F (Whichever is smaller)
	High Tem Load	perature	The measured and observ specifications in the follow	red characteristics shall satisfy the ing table.  Apply *200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours
		Appearance Capacitance Change	No marking defects  Within ±3% or ±0.3pF (Whichever is larger)	(temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.  Z5U · · · · · · Within ±30%  Y5V · · · · ∫ Within ±30% (cap.<1.0μF)  Within ±30 % (cap.≥1.0μF)  Viiii measurement for high dielectric constant type.
18		Q/D.F.	30pF and over. : Q≥350 10pF and over, 30pF and below : Q≥275+ ½ C 10pF and below : Q≥200+10C C : Nominal Capacitance (pF)	Char. 25V min. 16V XSR X/TR         16V 0.05 max. 0.05 max. 0.075 max.         0.075 max. 0.1 max. (C≥1.0μF) 0.15 max. 0.15 max. (C≥1.0μF)         0.01 max. 0.15 ma
		I.R. Dielectric Strength	More than 1,000M $\Omega$ or 50.	Ω · F (Whichever is smaller)
19	Notice	Sirengin	When mounting capacitor	of 500V rated voltage, perform the epoxy resin coating (min. 1.0mm thickness)

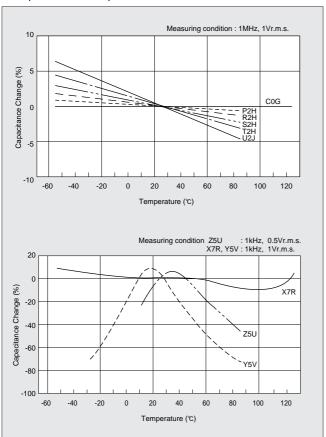
#### Table A-1

	Tomp Cooff	Capacitance Change from 25℃ (%)								
Char.	Temp. Coeff. (ppm/℃) Note 1	-5	55℃	-3	80℃	-1	−10°C			
	(ppin/ e) Note i	Max.	Min.	Max.	Min.	Max.	Min.			
COG	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	_	_	_	_	_	_			

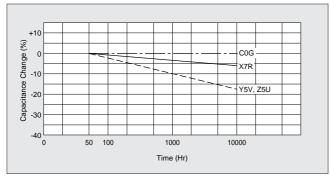
Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125℃ (for C0∆)/85℃ (for other TC).

#### ■CHARACTERISTICS (REFERENCE DATA)

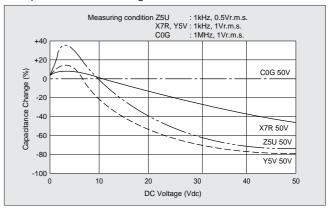
- SELECTION OF CERAMIC CAPACITORS
   When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.
- Capacitance-Temperature Characteristics



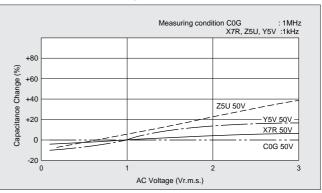
#### · Capacitance Change- Aging



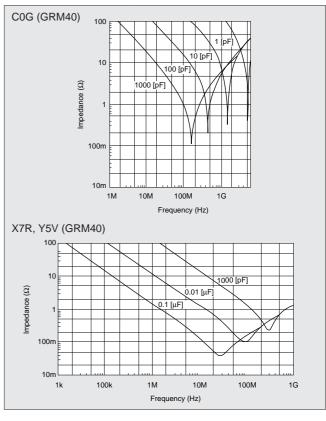
#### • Capacitance- DC Voltage Characteristics



#### • Capacitance- AC Voltage Characteristics



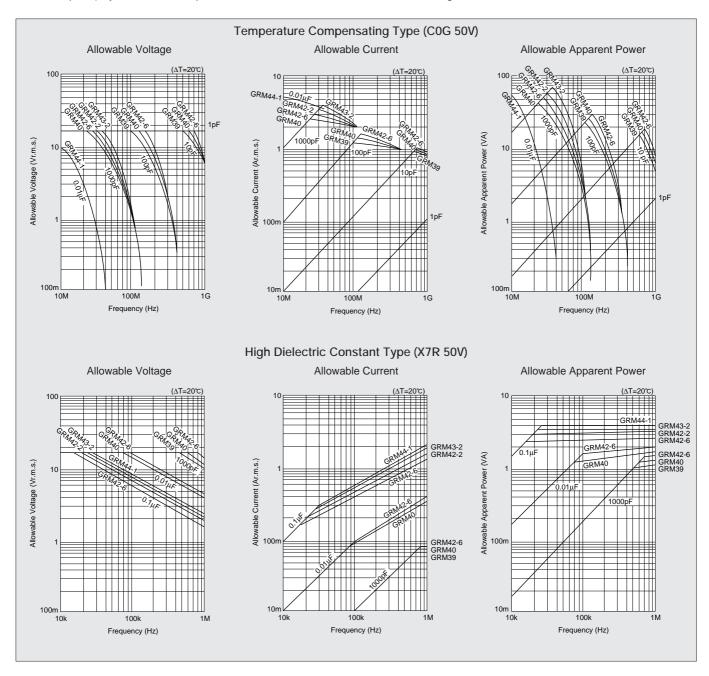
#### • Impedance- Frequency Characteristics



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 ( $\Delta T$ ) should be kept below 20°C ( $\Delta T \le$  20°C) in the actual circuit.

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





## **MONOLITHIC CERAMIC CAPACITOR**



### Ultra-miniaturized **GRM33** Series

#### **■**FEATURES

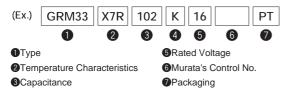
- 1. Small chip size (LXWXT: 0.6X0.3X0.3mm).
- 2. Terminations are made of metal highly resistant to migration.
- 3. GRM33 type is suited to only reflow soldering.
- 4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placements on PCBs.
- 5. GRM33 series are suited to miniature micro wave module, portable equipment and high-frequency circuit.

#### **■**APPLICATION

- Miniature micro wave module.
- Portable equipment.
- High-frequency circuit.

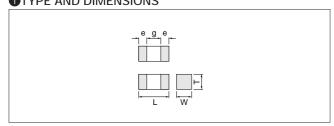
#### **■PART NUMBERING**

(\*Please specify the part number when ordering)



### **1**TYPE AND DIMENSIONS

**4**Capacitance Tolerance



Туре		Dimensions (mm)								
(EIA Code)	L	L W T e g min.								
GRM33 (0201)	0.6±0.03	0.6±0.03								

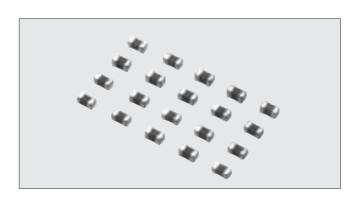
#### **2**TEMPERATURE CHARACTERISTICS

• Temperature Compensating Type

	1 3 .			
Code	Temp. Coeff. Temp. Range		Reference Temp.	
COG	0±30ppm/℃	-55 to +125℃	25℃	

#### High Dielectric Constant Type

Code	Cap. Change	Temp. Range	Reference Temp.	
X7R	±15%	-55 to +125℃	25℃	



#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
010	1	561	560
100	10	102	1,000

#### **4**CAPACITANCE TOLERANCE

Code	Tol.	Capacitance range		
С	±0.25pF	C0G, Cap.≦5pF		
D	±0.5 pF	C0G, 6pF≦Cap.≦10pF		
J	±5%	C0G, Cap.>10pF		
K	±10%	X7R (E12 Series)		
М	±20%	X7R (E6 Series)		

\*Severe tolerance for C0G is available on request.

#### **G**RATED VOLTAGE

Code	DC Rated voltage (V)
16	16
25	25

#### PACKAGING CODE

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

#### ■CAPACITANCE RANGE TABLE

(in pF)

Tyroo	DC Rated Voltage (V)	Temp. Char.		
Туре	DC Rated Voltage (V)	C0G	X7R	
GRM33	25	1 to 15	_	
GRIVI33	16	-	100 to 1,000	

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./\phi178mm reel)	
GRM33	0.3±0.03	1,000	15,000	

#### ■ SPECIFICATIONS AND TEST METHODS

				Specification			
No.			Temperature Compensating Type	High Dielectric Constant Type	Test Method		
1	Operating Temperatur	re Range	C0G : -55 to +125℃	X7R : -55 to +125℃			
2	Rated Volta		e 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	е	No defects or abnormalitie	S.	Visual inspection.		
4	Dimensions	s	Within the specified dimen	sion.	Using calipers.		
5	Dielectric Strength		No defects or abnormalitie	S.	No failure shall be observed when 300% of the rated voltage (COG) or 250% of the rated voltage (X7R) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.		
6	Insulation Resistance (I.R.)		More than 10,000M $\Omega$		The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging.		
7	Capacitance		Within the specified toleral	nce.	The capacitance/Q/D.F. shall be measured at 25℃ at the frequency and voltage shown in the table.		
8	Q/Dissipatio	on Factor	Q≥400+20C C : Nominal Capacitance	0.035 max.	Char.   C0G   X7R		
			(pF)		Frequency         1±0.1MHz         1±0.1kHz           Voltage         0.5 to 5Vr.m.s.         1±0.2Vr.m.s.		
9	C   C   C   C   C   C   C   C   C   C	Capacitance Change  Temperature Coefficient Capacitance Drift	Within the specified tolerance. (Table A-2)  Within the specified tolerance. (Table A-2)  Within ±0.2% or ±0.05pF (Whichever is larger)	Char. Temp. Reference Cap. Temp. Change X7R -55 to +125°C 25°C Within±15%	The capacitance change shall be measured after 5 min. at each specified temperature stage.  (1) Temperature Compensating Type  The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, 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.  Step Temperature (℃)  1 25±2 2 -55±3 3 25±2 4 125±3 5 25±2  (2) High Dielectric Constant Type  The ranges of capacitance change compared with the 25℃ value over the temperature ranges shown in the table shall be within the specified ranges.		
10	No removal of the terminations or other defects shall occur.  Adhesive Strength of Termination  Solder resist  Baked electrode or copper foil		Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1b using a eutectic solder. Then apply 2N force in parallel with the 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 that the soldering is uniform and free of defects such as heat shock.  Type a b c GRM33 0.3 0.9 0.3 (in mm)				
	A	Appearance	No defects or abnormalitie	S.	Solder the capacitor to the test jig (glass epoxy board) in the		
11	Vibration Resistance Q/D.F.		Within the specified tolerand Q≥400+20C C: Nominal Capacitance (pF)		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).		

				Specification		
No.	Ite	em	Temperature	High Dielectric Constant Type	Test Method	
	No cracking or marking  Deflection		Compensating Type  No cracking or marking de		Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2b using a eutectic solder. Then apply a force in the direction shown in Fig.3b. 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.	
12			R230.	20 50 Pressurizing speed : 1.0mm/sec. Pressurize  Flexure : ≤1  Fig. 3b	Type a b c GRM33 0.3 0.9 0.3 (in mm)	
13	Solderability of Termination 75% of the terminations is to be soldered evenly and continuously.		to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃.		
	Resistance to Soldering Heat		The measured and observed characteristics shall satisfy the specifications in the following table.		Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours	
		Appearance Capacitance Change	No marking defects Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±7.5%	(temperature compensating type) or 48±4 hours (high dielectric constant type), then measure.	
14		Q/D.F.	Q≧400+20C C : Nominal Capacitance (pF)	0.035 max.	• Initial measurement for high dielectric constant type Perform a heat treatment at 150 <sup>+ 0</sup> / <sub>-10</sub> <sup>∞</sup> for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.	
		I.R.	More than $10,000M\Omega$			
	Dielectric Strength		No failure			
	Temperature Cycle		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.	
		Appearance	No marking defects		Let sit for 24±2 hours (temperature compensating type) or 48±4	
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±7.5%	hours (high dielectric constant type) at room temperature, then measure.	
15		Q/D.F.	Q≥400+20C C : Nominal Capacitance (pF)	0.035 max.	Step 1 2 3 4  Temp. (°C) Min. Operating Room Temp3 Temp. Temp3 Temp.	
		I.R.	More than 10,000M $\Omega$		Time (min.) 30±3 2 to 3 30±3 2 to 3	
	Dielectric Strength No failure			• 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.		
	Humidity, Steady St		The measured and observ specifications in the follow No marking defects	red characteristics shall satisfy the ing table.	Sit the capacitor at 40±2℃ and 90 to 95% humidity for 500±12 hours.  Remove and let sit for 24±2 hours (temperature compensating	
		Capacitance Change	,	Within ±12.5%	type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.	
16		Q/D.F.	10pF and over, 30pF and below: Q≥275+ ½ C 10pF and below: Q≥200+10C C: Nominal Capacitance (pF)	0.05 max.		
		I.R.	More than 1,000MΩ			

					Specification		
Ν	lo.			Temperature High Dielectric Constant Type		Test Method	
		Humidity Load		The measured and observed characteristics shall satisfy the		Apply the rated voltage at 40±2℃ and 90 to 95% humidity for	
				specifications in the follow	ring table.	500±12 hours. Remove and let sit for 24±2 hours (temperature	
			Appearance	No marking defects		compensating type) or 48±4 hours (high dielectric constant type)	
			Capacitance	Within $\pm 7.5\%$ or $\pm 0.75$ pF	Within ±12.5%	at room temperature, then measure. The charge/discharge	
			Change	(Whichever is larger)	VVIIII1 ± 12.070	current is less than 50mA.	
1	7			Q≥100+ <del>10</del> / <sub>3</sub> C			
			Q/D.F.	C : Nominal Capacitance	0.05 max.		
				(pF)			
			I.R.	More than 500MΩ		-	
			Dielectric	More than 500M2		-	
			Strength	No failure			
	$\dashv$			The measured and observ	ved characteristics shall satisfy the	Apply 200% of the rated voltage for 1,000±12 hours at the	
		Load	poruturo	specifications in the following table.		maximum operating temperature ±3°C. Let sit for 24±2 hours	
		2000	Appearance	No marking defects		(temperature compensating type) or 48±4 hours (high dielectric	
			Capacitance	Within ±3% or ±0.3pF	145.1.1.2.50	constant type) at room temperature, then measure.	
			Change	(Whichever is larger)	Within ±12.5%	The charge/discharge current is less than 50mA.	
				10pF and over,			
				30pF and below:		•Initial measurement for high dielectric constant type.	
1	8			Q≧275+ <u>5</u> C		Apply 200% of the rated DC voltage for one hour at the maximum	
			Q/D.F.	10pF and below :	0.05 max.	operating temperature ±3℃. Remove and let sit for 48±4 hours at	
				Q≥200+10C		room temperature. Perform initial measurement.	
				C : Nominal Capacitance			
				(pF)			
			I.R.	More than 1,000MΩ			
			Dielectric	No failure			
			Strength				

#### Table A-2

	Town Cooff	Capacitance Change from 25℃ (%)					
Char.	Temp. Coeff. (ppm/℃) Note 1	-5	5℃	-30℃		<b>−10</b> ℃	
	(551111 5) 11010 1	Max.	Min.	Max.	Min.	Max.	Min.
COG	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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



## MONOLITHIC CERAMIC CAPACITOR



## **GRM** Series for Thin Equipment

#### **■**FEATURES

- This series is suited to 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

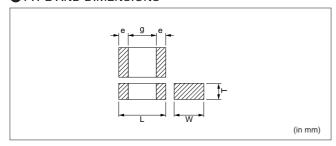
Thin equipment such as IC cards.

#### ■PART NUMBERING

(\*Please specify the part number when ordering)



#### **1**TYPE AND DIMENSIONS



Туре	L	W	Т	e min.	g min.
GRM36-019	1.0±0.05	0.5±0.05	0.25±0.05	0.15	0.4

#### **2**TEMPERATURE CHARACTERISTICS

#### • Temperature Compensating Type

·	
Code	COG
Temp. range	-55 to +125℃
Temp. coeff. (ppm/℃)	0±30

#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)
0R5	0.5
030	3
101	100

#### **4**CAPACITANCE TOLERANCE

Code	Tol.	Capacitance range
С	±0.25pF	10pF and halow
D	±0.5 pF	10pF and below
J	± 5%	More than 10pF

#### **6**RATED VOLTAGE

Code	DC Rated voltage (V)		
25	25		
50	50		

#### **PACKAGING CODE**

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

#### **■**CAPACITANCE RANGE TABLE

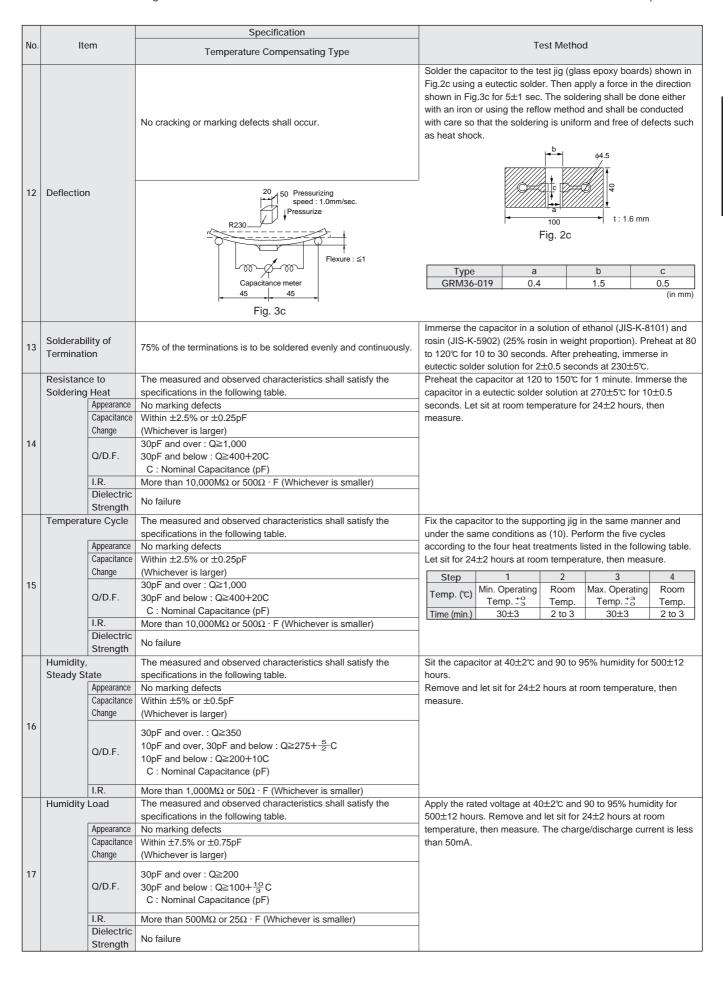
	DC Rated	Temp. Char. COG			
Туре	Voltage (V)	COG			
GRM36-019	50	0.5 to 100			
GKIVI30-019	25	COG			

#### ■PACKAGING TYPES/QUANTITY

Bulk	Taping
(pcs/bag)	(pcs/reel)
1,000	10,000

#### ■ SPECIFICATIONS AND TEST METHODS

No	No. Item		Specification	Test Method		
IVO.		Temperature Compensating Type		rescivientou		
1	Operating Temperat	ure Range	-55 to +125℃			
2	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 <sup>p,p</sup> or V <sup>o,p</sup> , whichever is larger, shall be maintained within the rated voltage range.		
3	Appearan		No defects or abnormalities.	Visual inspection.		
4	Dimension	ns	Within the specified dimension.	Using calipers.		
5	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	(I.R.)	Resistance	10,000M $\Omega$ min. or 500 $\Omega$ · 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	Capacitar	nce	Within the specified tolerance.	The capacitance/Q/D.F. shall be measured at 25°C at the		
8	Q/Dissipar (D.F.)	Q/Dissipation Factor (D.F.)  30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)		requency and voltage shown in the table  Char. C0G  Item (1,000pF and below)  Frequency 1±0.1MHz  Voltage 0.5 to 5Vr.m.s.		
		Capacitance Change	Within the specified tolerance. (Table A-3)	The capacitance change shall be measured after 5 min. at each specified temperature stage.  The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature		
	Capacitance	Temperature Coefficient	Within the specified tolerance. (Table A-3)	sequentially from step 1 through 5, (C0G: +25°C to+125°C) the capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-3.		
9	Temperature Characteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	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.  Step Temperature (°C)  1 25±2  2 -55±3  3 25±2  4 125±3  5 25±2		
10	Adhesive of Termin	-	No removal of the terminations or other defects shall occur.	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 the 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.  Type a b c GRM36-019 0.4 1.5 0.5 (in mm)		
		Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (glass epoxy board) in the		
11	Vibration Resistance	Capacitance Q/D.F.	Within the specified tolerance.  30pF min.: Q≥1,000 30pF max.: Q≥400+20C C: Nominal Capacitance (pF)	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).		



		Specification		
No.	Item		Temperature Compensating Type	Test Method
	High Temperature		The measured and observed characteristics shall satisfy the	Apply 200% of the rated voltage for 1000±12 hours at the
	Load		specifications in the following table.	maximum operating temperature ±3°C. Let sit for 24±2 hours at
		Appearance	No marking defects	room temperature, then measure.
		Capacitance	Within $\pm 3\%$ or $\pm 0.3$ pF	The charge/discharge current is less than 50mA.
		Change	(Whichever is larger)	
18		O/D.F.	30pF and over. : Q≧350	
10			10pF and over, 30pF and below :Q≥275+ 5/2 C	
		Q/D.F.	10pF and below :Q≧200+10C	
			C : Nominal Capacitance (pF)	
		I.R.	More than 1,000M $\Omega$ or $50\Omega \cdot F$ (Whichever is smaller)	
		Dielectric	No foilure	
		Strength	No failure	

#### Table A-3

	Temp. Coeff.	Capacitance Change from 25℃ Value (%)					
Char.	(ppm/℃) Note 1	-5	5℃	−30°C		<b>−10℃</b>	
	(5511) 3) 11313 1	Max.	Min.	Max.	Max. Min. Max	Max.	Min.
COG	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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



## MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

## **GR** Series for General Electronic Equipment

#### **■**FEATURES

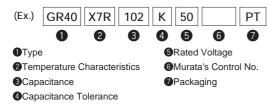
- The GR series is suited to silver epoxy conductive adhesive.
- This series is a complete line of chip monolithic ceramic capacitors in 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0G to Y5V.
- 3. A wide selection of sizes is available, 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.
- The GR series is available in both paper and plastic embossed tape and reel packaging for automatic placement.

#### **■**APPLICATION

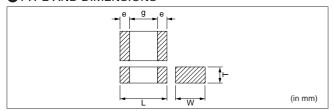
General electronic equipment.

#### **■PART NUMBERING**

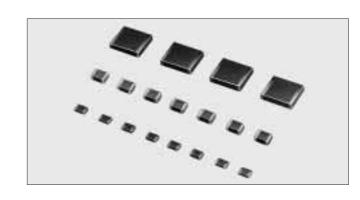
(\*Please specify the part number when ordering)



#### **1**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 <sup>+0</sup> <sub>-0.2</sub> 1.0 <sup>+0</sup> <sub>-0.2</sub> 1.25±0.15	0.2	0.7
GR42-6 (1206)	3.2±0.15	1.6±0.15	1.0 <sup>+0</sup> <sub>-0.2</sub> 1.25 <sup>+0</sup> <sub>-0.2</sub>	0.25	1.5
GR42-2 (1210)	3.2±0.3	2.5±0.2	1.25 <sup>+0</sup> <sub>-0.2</sub> 1.5 <sup>+0</sup> <sub>-0.3</sub>	0.3	1.0
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



#### **2**TEMPERATURE CHARACTERISTICS

#### • Temperature Compensating Type

Code	C0G	U2J	SL			
Temp. range	–55 to +125℃	-55 to +85℃				
Temp. coeff. (ppm/℃)	0±30	-220±60	-750±120	+350 to -1,000		

#### • High Dielectric Constant Type

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

#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
0R5	0.5	100	10
R75	0.75	101	100
010	1	103	10,000

#### **4**CAPACITANCE TOLERANCE

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

#### **3**RATED VOLTAGE

Code	DC Rated voltage (V)
16	16
25	25
50	50
100	100
200	200
500	500

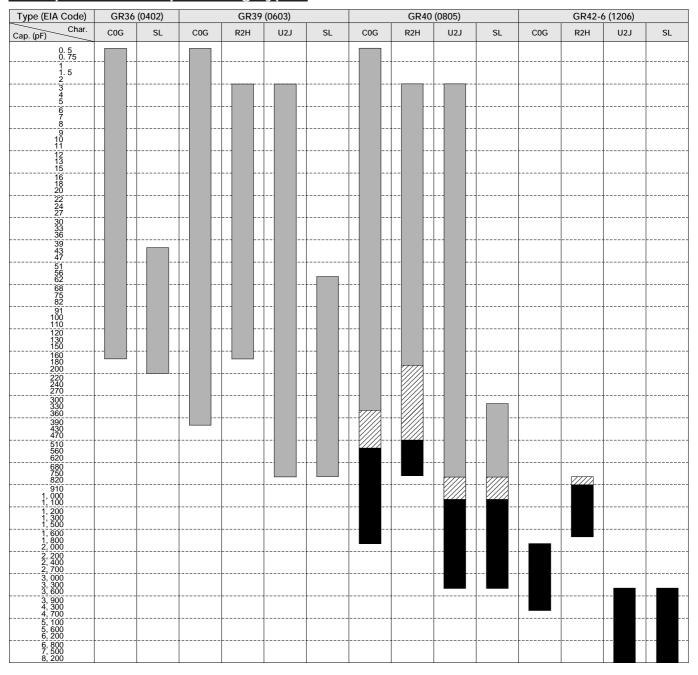
#### **PACKAGING CODE**

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

#### **■**CAPACITANCE RANGE TABLE

#### FOR SILVER EPOXY CONDUCTIVE ADHESIVE

## Temperature Compensating Type 50V



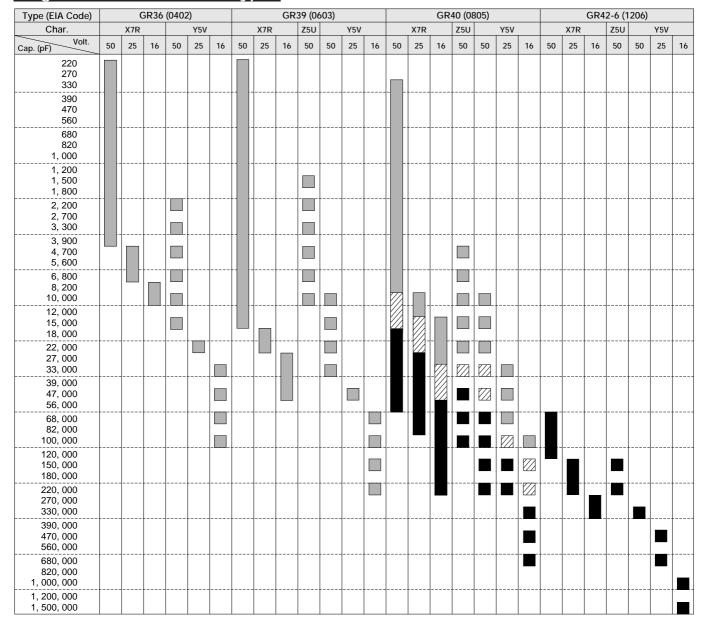
#### **■**CAPACITANCE TOLERANCE

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

Туре	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
	: 0.7 ±0.2	1,000	4,000
GR40	: 1.0 <sup>+0</sup> <sub>-0.2</sub>	1,000	4,000
	: 1.25±0.15	1,000	3,000
GR42-6	: 1.0 ±8.2	1,000	4,000
GR42-0	: 1.25 <sup>+</sup> 0.2	1,000	3,000

<sup>\*</sup>  $\phi$ 330mm reel is available on request.

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



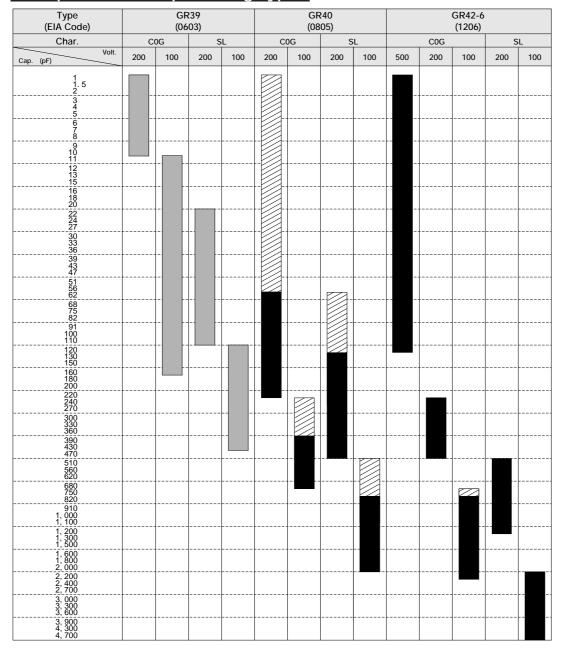
#### **■**CAPACITANCE TOLERANCE

X7R Characteristics  $K: \pm 10\%$  (E12 Series)  $M: \pm 20\%$  (E6 Series) Z5U Characteristics  $M: \pm 20\%$  (E6 Series)  $Z: \pm \frac{4}{2}\%$  (E6 Series) Y5V Characteristics  $Z: \pm \frac{4}{2}\%$  (E6 Series)

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ф178mm/reel)* <sup>1</sup>
GR36	: 0.5 ±0.05	1,000	10,000
GR39	: 0.8 ±0.1	1,000	4,000
	: 0.7 +0 -0.2	1,000	4,000
GR40	: 1.0 <sup>+0</sup> <sub>-0.2</sub>	1,000	4,000
	: 1.25±0.15	1,000	3,000
GR42-6	: 1.25 <sup>+</sup> 8. <sub>2</sub>	1,000	3,000

<sup>\*1 \$330</sup>mm reel is available on request.

### Temperature Compensating Type 500V/200V/100V



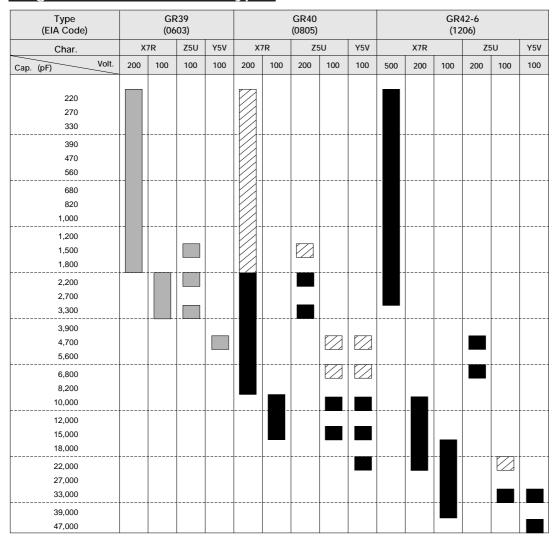
#### **■**CAPACITANCE TOLERANCE

C0G/SL Characteristics
C: ±0.25pF · · · · · 5pF and below
D: ±0.5pF · · · · · 6pF≦cap.≦10pF
J: ±5% · · · · · More than 10pF

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm/reel)*
GR39	: 0.8 ±0.1	1,000	4,000
GR40	: 1.0 +0.2	1,000	4,000
GR40	: 1.25±0.15	1,000	3,000
CD42.4	: 1.0 <sup>+0</sup> <sub>-0.2</sub>	1,000	4,000
GR42-6	: 1.25+8.2	1,000	3,000

<sup>\* \$\</sup>phi330mm reel is available on request.

## High Dielectric Constant Type 500V/200V/100V



#### **■**CAPACITANCE TOLERANCE

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

#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ф178mm/reel)* <sup>1</sup>
GR39	: 0.8 ±0.1	1,000	4,000
GR40	: 1.0 <sup>+0</sup> <sub>-0.2</sub>	1,000	4,000
GR40	: 1.25±0.15	1,000	3,000
GR42-6	: 1.0 ±8.2	1,000	4,000
GR42-0	: 1.25 <sup>+</sup> 8.2	1,000	3,000

\*1 \$330mm reel is available on request.

## Temperature Compensating Type 500V/200V/100V/50V

Type (EIA Code)	GR42-2 (1210)								GR43-2 (1812)								GR44- (2220)	1			
Char.		C	oG			SL			CC	)G			SL			C	0G			SL	
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																					
160 180 200																					
220 240 270																					
300 330 360																					
390 430 470																					
510 560 620																					
680 750 820		+-														†	İ	†			
910 1, 000 1, 100		+-															†	ļ			
1, 200 1, 300 1, 500																					
1, 600 1, 800 2, 000									-												
2, 200 2, 400 2, 700									-												
3, 000 3, 300 3, 600																					
3, 900 4, 300 4, 700																+-					
5, 100 5, 600 6, 200				1-						-						+-			-		
6, 800 7, 500 8, 200						-															
9, 100 10, 000 11, 000		†											-		<b>+</b>	t	ļ	ļ			
12, 000 13, 000 15, 000		ļ					-			-						<b>†</b>					
16, 000 18, 000													-				+	+-			
22, 000 24, 000 27, 000		†													<b>+</b>	t		+			
22, 000 24, 000 27, 000 30, 000 33, 000 36, 000		ļ															†	+-			
39, 000 43, 000		ļ															ļ			-	

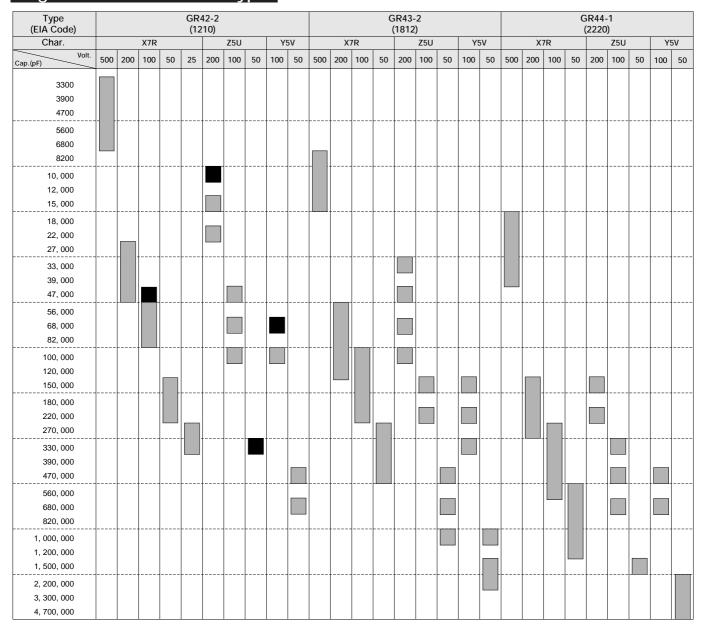
#### **■**CAPACITANCE TOLERANCE

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

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ф178mm/reel)*
GR42-2	: 1.5 <sup>+</sup> 8.3	1,000	2,000
GR43-2	2.0 max.	1,000	1,000
GR44-1	: 2.0 max.	1,000	1,000

<sup>\* \$\</sup>phi330mm reel is available on request.

## High Dielectric Constant Type 500V/200V/100V/50V/25V



#### **■**CAPACITANCE TOLERANCE

X7R Characteristics K: ±10% (E12 Series)

M: ±20% (E6 Series)

Z5U Characteristics

250 Characteristics

M: ±20% (E6 Series)

Z: ±80% (E6 Series)

Y5V Characteristics

Z: ±80% (E6 Series)

#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./ф178mm/reel)*¹
GR42-2	: 1.25 +0.2	1,000	3,000
GR42-2	: 1.5 +0.3	1,000	2,000
GR43-2	GR43-2 : 2.0 max.		1,000
GR44-1	: 2.0 max.	1,000	1,000

\*1 \$330mm reel is available on request.

#### ■ SPECIFICATIONS AND TEST METHODS

	Compensating Type High Dielectric Constant Type		Specification	Test Method					
No.			'	High Dielectric Constant Type	Test Method				
1	Operating Temperat	l ure Range	-55 to +125℃	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 <sup>p.p</sup> or V <sup>o.p</sup> , whichever is larger, shall be maintained within the rated voltage range.				
3	Appearan		No defects or abnormalitie	-	Visual inspection.				
4	Dimension	ns	Within the specified dimen	sion.	Using calipers.				
5	Dielectric	Strength	No defects or abnormalitie	s.	No failure shall be observed when *300% of the rated voltage (COG to U2J and 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 (I.R.) More than $10,000M\Omega$ or $500\Omega \cdot F$ (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	Capacitar	nce	Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 25°C at the				
8	Q/Dissipati (D.F.)	tion Factor	30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	Char.         25V min.         16V           X7R         0.025 max.         0.035 max.           Z5U         0.025 max.         —           Y5V         0.05 max.         0.07 max.	Char.   COG to U2J, SL   COG to U2J, SL   (more than 1,000pF)   X7R, Y5V				
		Capacitance Change	Within the specified tolerance. (Table A-4)	Char.         Temp. Range.         Reference Temp.         Change Change           X7R         −55 to +125°C         Within±15%           Z5U         +10 to + 85°C         25°C         Within +22° %           Y5V         −30 to + 85°C         Within +22° %	The capacitance change shall be measured after 5 min. at each specified temperature stage.  (1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, (COG:				
		Temperature	Within the specified		+25℃ to+125℃; other temp. coeffs.:+25℃ to+85℃) the				
9	Capacitance Temperature Characteristics	ure	Within ±0.2% or ±0.05pF (Whichever is larger)		capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-4. 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.  Step Temperature (°C)  1 25±2 2 -55±3 3 25±2 4 125±3 (for COG)/85±3 (for other TC)				
			No defects or abnormalitie	<u> </u>	5 25±2  (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.  Fix the capacitor to the test jig (glass epoxy boards) shown in				
	Vibration Resistance (No apply for GR36)	Capacitance	Within the specified tolerar		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).				
		O/D.F.	30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	Char.       25V min.       16V         X7R       0.025 max.       0.035 max.         Z5U       0.025 max.       —         Y5V       0.05 max.       0.07 max.					
10			Fig.	Solder resist  Baked electrode or copper foil	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           (in mm)				

				Specification					
No.	Ite	em	Temperature Compensating Type	High Dielectric Constant Type	Test Method				
	Temperature Cycle (Not apply for GR36)  Appearance  Capacitance Change		The measured and observe specifications in the followed No marking defects  Within ±2.5% or ±0.25pF (Whichever is larger)	ed characteristics shall satisfy the ing table.  X7R ·······Within ±7.5%  Z5U	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.				
11		Q/D.F.	30pF and over. : Q≥1,000 30pF and below : Q≥400+20C C : Nominal Capacitance (pF)	Char.         25V min.         16V           X7R         0.025 max.         0.035 max.           Z5U         0.025 max.         —           Y5V         0.05 max.         0.07 max.					
		I.R. Dielectric Strength	More than $10,000M\Omega$ or $50$ No failure	00Ω · F (Whichever is smaller)	Perform a heat treatment at 150 <sup>+, 0</sup> <sup>∞</sup> for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.				
12	Humidity, Steady State  Appearance Capacitance Change		The measured and observ specifications in the follow No marking defects Within ±5% or ±0.5pF (Whichever is larger)	ed characteristics shall satisfy the ing table.  X7R ······Within ±12.5%  Z5U	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) then measure.				
		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)	Char.         25V min.         16V           X7R         0.05 max.         0.05 max.           Z5U         0.05 max.         —           Y5V         0.075 max.         0.1 max.					
		I.R.		Ω · F (Whichever is smaller)					
	High Temperature The measured and observed characteristics because the specifications in the following table.			Apply *200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours					
	Load	Appearance	No marking defects	ing table.	(temperature compensating type) or 48±4 hours (high dielectric				
13		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	X7R · · · · · · Within ±12.5%  Z5U	constant type) at room temperature, then measure. The charge/discharge current is less than 50mA.				
		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)	Char.         25V min.         16V           X7R         0.04 max.         0.05 max.           Z5U         0.04 max.         —           Y5V         0.075 max.         0.1 max.	•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				
		I.R.		Ω · F (Whichever is smaller)					
	Dielectric Strength		No failure						
14	Notice		When mounting capacitor of 500V rated voltage, perform the epoxy resin coating (min. 1.0mm thickness).						

#### Table A-4

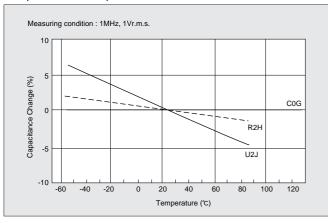
Char.	Temp. Coeff. (ppm/°C) Note 1	Capacitance Change from 25℃ Value (%)					
		<b>−</b> 55℃		-30℃		−10°C	
		Max.	Min.	Max.	Min.	Max.	Min.
COG	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
R2H	-220± 60	3.02	1.28	2.08	0.88	1.32	0.56
U2J	-750±120	8.78	5.04	6.04	3.47	3.84	2.21
SL	-350 to 1,000	_	_	_	_	_	_

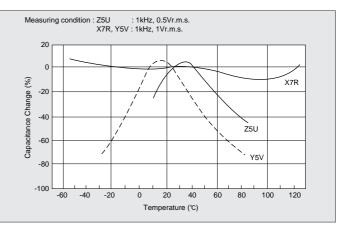
Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125℃ (for C0G)/85℃ (for other TC).

#### ■CHARACTERISTICS (REFERENCE DATA)

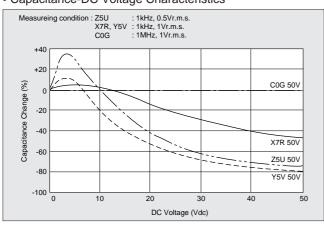
SELECTION OF CERAMIC CAPACITORS
 When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

#### • Capacitance-Temperature Characteristics

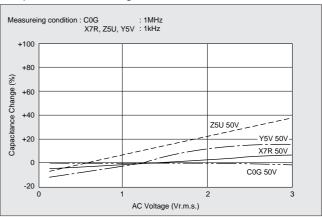




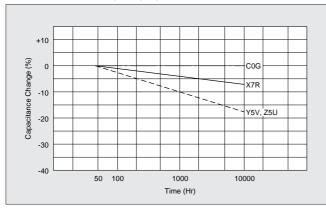
#### • Capacitance-DC Voltage Characteristics



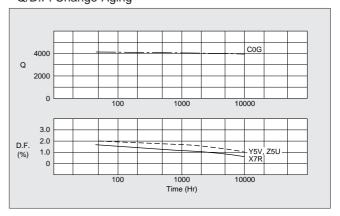
#### • Capacitance-AC Voltage Characteristics



#### • Capacitance Change-Aging



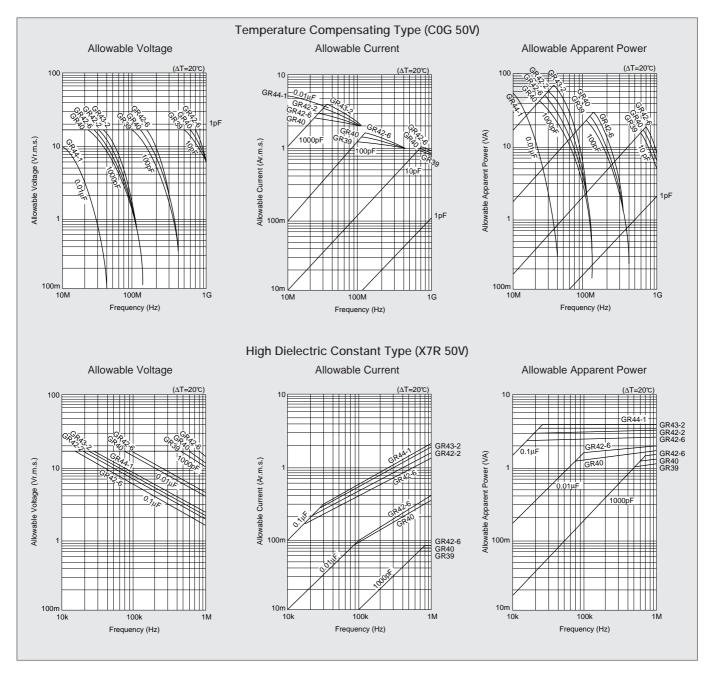
#### • Q/D.F. Change-Aging



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 ( $\Delta T$ ) should be kept below 20°C ( $\Delta T \le$  20°C) in the actual circuit.

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







High-power Type

# Temperature Compensating Type **GRM 600** Series

#### **■**FEATURES

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

# **■**APPLICATION

• VCO, PA, Mobile Telecommunication

### **■PART NUMBERING**

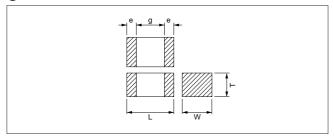
(\*Please specify the part number when ordering)



**1**Туре

- 6 Rated Voltage
- 2Temperature Characteristics
- 6Murata's Control No.
- 3Capacitance
- Packaging
- **4** Capacitance Tolerance

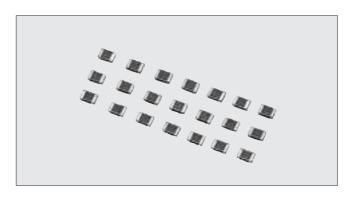
#### **1**TYPE AND DIMENSIONS



Туре	Dimensions (mm)						
(EIA Code)	L	W	Т	е	g		
GRM615 (0402)	1.0±0.05	0.5±0.05	0.5±0.05	0.15 to 0.3	0.4 min.		

#### **2**TEMPERATURE CHARACTERISTICS

Code	Temp. Coeff.	Temp. Range	Reference Temp.
COG	0±30ppm/℃	-55℃ to +125℃	25℃



#### **3**CAPACITANCE (Ex.)

Code Capacitance (pF)		Code	Capacitance (pF)
0R5	0.5	100	10

#### **4**CAPACITANCE TOLERANCE

Code	Tol.	Capacitance range
С	±0.25pF	Cap.≦5pF
D	±0.5pF	6pF≦Cap.≦10pF
J	±5pF	Cap.>10pF

#### **6**RATED VOLTAGE

Code	DC Rated voltage
50	50V

## **PACKAGING CODE**

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

## ■CAPACITANCE RANGE TABLE

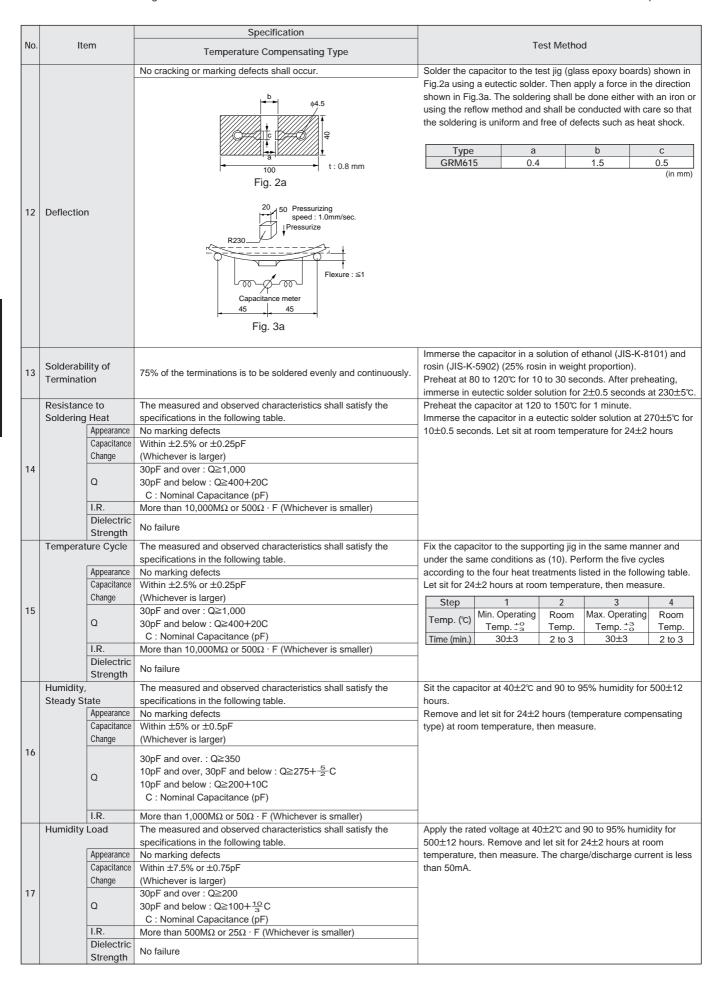
(in pF)

Туре	DC Rated Voltage (V)	Temp. Char.		
Type	DC Rated Voltage (V)	COG		
GRM615	50	0.5 to 20		

#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Bulk (pcs./bag)	Taping (pcs./\phi178mm reel)	Bulk Case (pcs./case)	
GRM615	1,000	10,000	50,000	

			Specification				
No.	Ite	m	Temperature Compensating Type		Test Method	d	
1	Operating Temperat	ure Range	-55 to +125℃				
2	Rated Voltage		See the previous pages.	applied continuou When AC voltage	e is defined as the maximusly to the capacitor.  e is superimposed on DC veral maintained within the rate	voltage, V <sup>p.p</sup> o	r V <sup>o.p</sup> , whichever
3	Appearan	ce	No defects or abnormalities.	Visual inspection.			
4	Dimension	าร	Within the specified dimension.	Using calipers.			
5	Dielectric Strength		No defects or abnormalities.	applied between charge/discharge	be observed when 300 n the terminations for 1 ge current is less than 5	to 5 second 50mA.	s, provided the
6	Insulation Resistance (I.R.)		10,000M $\Omega$ min. or 500 $\Omega$ · F min. (Whichever is smaller)	The insulation resistance shall be measured with a DC voltag not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.			
7	Capacitar	ice	Within the specified tolerance.	The capacitanc	e/Q shall be measured	at 25℃ at th	e frequency
8			30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)		COG (1,000pF and below) 1±0.1MHz 0.5 to 5Vr.m.s.		
	Change  Temperature Coefficient  Capacitance Temperature Characteristics	Capacitance Change	Within the specified tolerance. (Table A-1)	The capacitance change shall be measured after 5 min. a specified temperature stage.  Temperature Compensating Type  The temperature coefficient is determined using the capa			
		Temperature Coefficient	Within the specified tolerance. (Table A-1)	measured in ste	ep 3 as a reference. ne temperature sequent p+125℃ : other temp. c	tially from ste	ep 1 through 5,
9		Capacitance	nperature practeristics  Capacitance Within ±0.2% or ±0.05pF		temperature con The capacitance between the ma	25 -55 25 125	ce change as dividing the c
			No removal of the terminations or other defects shall occur.	Solder the capa	acitor to the test jig (glas	ss epoxy boa	ard) shown in
10	Adhesive Strength of Termination		dhesive Strength		eutectic solder. Then a for 10±1 sec. shall be done either with all be conducted with ca e of defects such as he	pply a 5N fo an an iron or u are so that the at shock.	rce in parallel sing the reflowne soldering is
			Solder resist  Baked electrode or copper foil	GRM615	0.4	1.5	0.5 (in mm)
		Appearance	No defects or abnormalities.	Solder the capa	acitor to the test jig (glas	ss epoxy boa	ard) in the
11	Vibration Resistance	Capacitance Q	Within the specified tolerance.  30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	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 direction			



			Specification	
No.	Ite	em	Temperature Compensating Type	Test Method
	High Temperature Load		The measured and observed characteristics shall satisfy the	Apply 200% of the rated voltage for 1000±12 hours at the
			specifications in the following table.	maximum operating temperature ±3℃. Let sit for 24±2 hours
		Appearance	No marking defects	(temperature compensating type) at room temperature, then
		Capacitance	Within ±3% or ±0.3pF	measure.
		Change	(Whichever is larger)	The charge/discharge current is less than 50mA.
18			30pF and over. : Q≧350	
10		Q	10pF and over, 30pF and below :Q≧275+ 5/2 C	
		Q	10pF and below :Q≥200+10C	
			C : Nominal Capacitance (pF)	
		I.R.	More than 1,000M $\Omega$ or 50 $\Omega$ · F (Whichever is smaller)	
		Dielectric	NI- f-11	
	Strength		No failure	
			0.5pF ≦C≦1pF : 350Ω · pF below	The ESR shall be measured at room Temp. and frequency
			1pF <c≦5pf 300ω="" :="" below<="" td=""><td>1±0.2GHz with the equivalent of BOONTON Model 34A.</td></c≦5pf>	1±0.2GHz with the equivalent of BOONTON Model 34A.
19	ESR		5pF <c≦10pf 250ω="" :="" below<="" td=""><td></td></c≦10pf>	
			10pF <c≦20pf: 400ω="" below<="" td=""><td>The ESR shall be measured at room Temp. and frequency 500±50MHz with the equivalent of HP8753B.</td></c≦20pf:>	The ESR shall be measured at room Temp. and frequency 500±50MHz with the equivalent of HP8753B.

# Table A-1

		Temp. Coeff.	Capacitance Change from 25℃ Value (%)						
	Char.	(ppm/℃) Note 1	<b>−</b> 55℃		-30℃		−10°C		
		(pp.111) <b>3</b> ) 11313 1	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 to 125°C.(for C0 $\Delta$ )





# **GRM400** Series; Low Distorition

#### **■**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

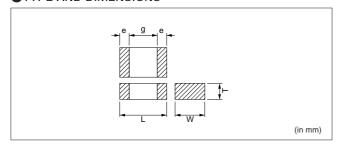
Low distortion in general electronic equipment

#### ■PART NUMBERING

(\*Please specify the part number when ordering)



#### **1**TYPE AND DIMENSIONS

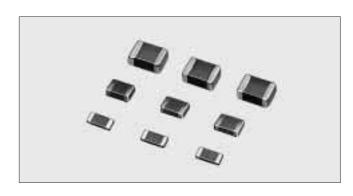


Type (EIA Code)	L	W	T*	е	g
GRM420 (0603)	1.6±0.1	0.8 ±0.1	Varies	0.2 to 0.5	0.5 min.
GRM425 (0805)	2.0±0.1	1.25±0.1	depending on	0.2 to 0.7	0.7 min.
GRM430 (1206)	3.2±0.15	1.6 ±0.15	capacitance	0.3 to 0.8	1.5 min.
GRM435 (1210)	3.2±0.3	2.5 ±0.2	value	0.3 min.	1.0 min.

\* T : Please refer to the capacitance range table.

## **2**TEMPERATURE CHARACTERISTICS

Code	Capacitance Change	Temp. Range	Reference Temp.
В	Within±10%	-25 to +85℃	20℃
R	Within±15%	-25 to +65 C	200



#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	
102	1,000	
103	10,000	
104	100,000	

#### **4** CAPACITANCE TOLERANCE

Code	Cap. Tolerance (%)	
K	±10	
M	±20	

#### **G**RATED VOLTAGE

Code	DC Rated Voltage (V)
16	16
50	50
100	100

#### **PACKAGING CODE**

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

### **■**CAPACITANCE RANGE TABLE

Type (EIA Code)	GRM42	0 (0603)	GRM42	5 (0805)		GRM430 (1206)		GRM435 (1210)
Char.	В	R	В	R	В		₹	R
Cap. (pF)	50	16	50	16	50	50	16	100
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								

# **■**CAPACITANCE TOLERANCE

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

# ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	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
GRIVI425		1,000	4,000
	: 0.7 +0.2	1,000	4,000
GRM430	: 1.0 <sup>+</sup> 8. <sub>2</sub>	1,000	4,000
	: 1.25 <sup>+0</sup> <sub>-0.2</sub>	1,000	3,000
GRM435	: 2.0 <sup>+0</sup> <sub>-0.2</sub>	1,000	2,000

\*  $\phi 330$ mm reel is available on request.

No.	Item	Specification	Test Method		
1	Operating Temperature Range	B, R : −25℃ to +85℃			
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 <sup>p,p</sup> or V <sup>o,p</sup> , 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 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≦0.047μF : 10,000MΩ min. C>0.047μF : 500Ω · 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℃ at a frequency of 1±0.1kHz and a voltage of 1±0.2Vr.m.s		
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		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.  The capacitance change shall be measured after 5 min. at each specified temperature stage.  In case of applying voltage, the capacitance change shall be measured after 1 more min.with applying voltage in equilibration of each temp. stage.		
10	Distortion	B : -90dB max. R : -80dB max.	The distortion shall be measured using the third harmonic distortion, 10±1kHz in frequency and 1±0.2Vr.m.s. in voltage.		
11	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.  C  Solder resist  Baked electrode or copper foil	Solder the capacitor to the test jig shown in Fig.1e 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)  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 GRM435 2.2 5.0 2.9  (in mm)		
12	Vibration Resistance	The measured and observed characteristics shall satisfy the specifications in the following table.    Item	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).		
13	Deflection	No cracks or marking defects shall occur.  20 50 Pressurizing speed: 1.0mm/sec. Pressurize  Flexure: ≤1  Capacitance meter  45  Fig. 3e	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 2e using a eutectic solder. Then apply force in the direction shown in Fig.3e 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.		

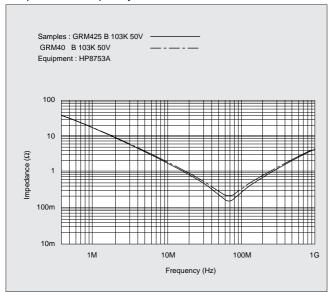
No.	Item		Specification	Test Method
140.	item		Specification	*** ***
14	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).  Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C.
		The measured and obs	erved characteristics shall satisfy the	Perform a heat treatment at 150 $^{+}_{-10}^{0}$ °C for one hour and then let
15	Resistance to Soldering Heat	specifications in the follow litem  Appearance  Capacitance Change  I. R.  D.F.		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. Let sit for 48±4 hours at room temperature, then measure values of items in table.  *Preheating for GRM435
		Dielectric Strength	No failure	Step Temperature Time
				1 100°C to 120°C 1 min. 2 170°C to 200°C 1 min.
16	Temperature Cycle	specifications in the following table.  Item Specification  Appearance No marked defect Capacitance Change Within ±7.5%  I. R. More than 10,000MΩ or 500Ω · F (Whichever is smaller)  D.F. 0.01 max.  sit for 48±4 hours at room te items in table. Fix capacitor t manner and under the same Perform the five cycles accorshown in the following table. temperature, then measure fixed the same performs the five cycles accorshown in the following table.		Perform a heat treatment at 150 $^{+}$ °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.
		Dielectric Strength	No failure	
17	Humidity Steady State	The measured and observed characteristics shall satisfy the specifications in the following table.		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.
18	Humidity Load		erved characteristics shall satisfy the wing table.  Specification  No marked defect  Within ±12.5%  More than 500MΩ or 25Ω · F  (Whichever is smaller)  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.
19	High Temperature Load	The measured and obs specifications in the follow Item Appearance Capacitance Change I. R. D.F.	erved characteristics shall satisfy the ving table. Specification No marked defect Within $\pm 12.5\%$ More than $1,000\text{M}\Omega$ or $50\Omega \cdot \text{F}$ (Whichever is smaller) 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 1,000±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.

#### **■**CHARACTERISTICS

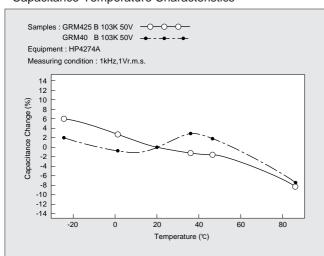
#### • SELECTION OF CERAMIC CAPACITORS

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

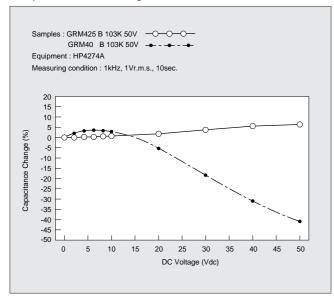
#### • Impedance-Frequency Characteristics



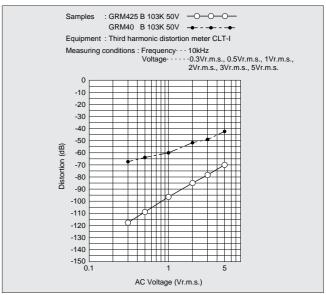
#### • Capacitance-Temperature Characteristics



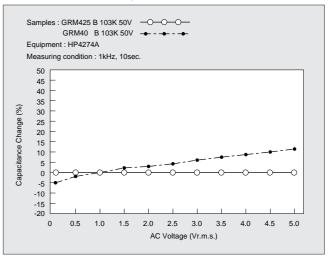
#### • Capacitance-DC Voltage Characteristics



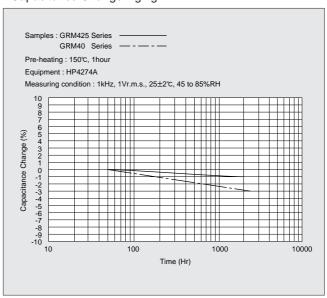
#### • Third Harmonic Distortion



#### • Capacitance-AC Voltage Characteristics



#### • Capacitance Change-Aging







Reflow Soldering Nickel Barriered Termination Type **GRM200** Series; Smoothing

#### **■**FEATURES

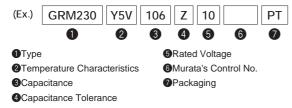
- Heat generation is low at high frequency because of low dielectric loss.
- Compared with aluminum electrolytic capacitors, capacitance can be lower to obtain the same smoothing performance.
- Ceramic capacitor has no polarity and ensures long life time

#### **■**APPLICATION

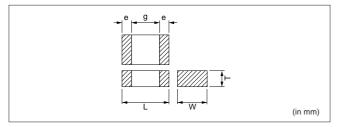
- DC-DC converter
- Noise elimination LCD bias circuit (Use for only alumina, paper or glass epoxy board)

#### **■PART NUMBERING**

(\*Please specify the part number when ordering)



#### **1**TYPE AND DIMENSIONS



Type (EIA Code)	Dimensions (mm)				
Type (EIA Code)	L	W	T	е	g
GRM220 (0603)	1.6±0.1	0.8 ±0.1		0.2-0.5	0.5 min.
GRM225 (0805)	2.0±0.1	1.25±0.1	Please refer	0.2-0.7	0.7 min.
GRM230 (1206)	3.2±0.15	1.6 ±0.15	to the capacitance	0.3-0.8	1.5 min.
GRM235 (1210)	3.2±0.3	2.5 ±0.2	range table.	0.3 min.	1.0 min.
GRM240-02 (1812)	4.5±0.4	3.2 ±0.3	ŭ	0.3 min.	2.0 min.

#### **2**TEMPERATURE CHARACTERISTICS

Code	Capacitance Change Rate	Temp. Range	Reference Temp.
Y5V	Within-82 %	-30 to +85℃	25℃



#### **3**CAPACITANCE (Ex.)

Code	Capacitance (μF)	
105	1	
226	22	

#### **4**CAPACITANCE TOLERANCE

 $Z:^{+80}_{-20}\%$ 

## **5**RATED VOLTAGE

Code	DC Rated voltage (V)	
6.3	6.3	
10	10	
16	16	
25	25	
50	50	
100	100	

#### **PACKAGING CODE**

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

## **■**CAPACITANCE RANGE TABLE

(in µF)

Type (EIA Code)	Thickness					е	
Type (LIA Code)	T (mm)	100V	50V	25V	16V	10V	6.3V
GRM220 (0603)	0.8 ±0.1	-	-	-	-	1	-
GRM225 (0805)	1.25±0.1	-	-	_	-	-	10
GRM230 (1206)	1.15±0.1	-	_	-	4.7	10	-
GRM235 (1210)	1.35±0.15	-	-	6.8	6.8, 10	22	-
GRIVI235 (1210)	1.8 ±0.2	1	4.7	10	-	-	-
GRM240-02 (1812)	2.5 max.	-	10	_	-	-	-
Capacitance Tol	erance			Z: ±	80 %		

## ■THICKNESS AND PACKAGING TYPES/QUANTITY

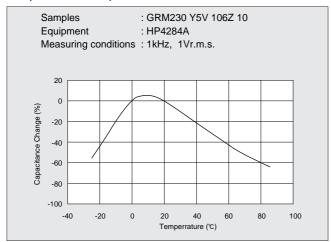
Type (EIA Code)	Thickness T (mm)	Bulk (pcs./bag)	Taping (pcs./\phi178 mm reel)
GRM220 (0603)	0.8 ±0.1	1,000	4,000
GRM225 (0805)	1.25±0.1	_	3,000
GRM230 (1206)	1.15±0.1	-	3,000
GRM235 (1210)	1.35±0.15	_	2,000
GRIVI233 (1210)	1.8 ±0.2	_	1,000
GRM240-02 (1812)	2.5 max.	-	500

Adhesive Strength of Termination  Adhesive Strength of Termination  Adhesive Strength of Termination  Fig. 11  Solder resist  Solder resist  Solder resist  Solder resist  Solder feels uniform and free of defect such as heat shock.  SSN (GRM220 on 1.0	No.	Ite	·m	Specification			Test Me	ethod	
Residu Voltage  Residu Voltage  Residuation	1			Y5V : −30°C to +85°C					
Milhin the specified dimension.   Using callipres.	2			See the previous pages.  applied continuously to the capacitor.  When AC voltage is superimposed on D is larger, shall be maintained within the			DC voltage, V <sup>p.p</sup> or V <sup>o.p</sup> , whichever		
Solicitic Strength   No deflects or abnormalities.   No failure shall be observed when 25% of the rised voltage is applied between the terminations for 15% of the rised voltage is applied between the terminations for 15% of the rised voltage is applied between the terminations for 15% of the rised voltage is accordance product of the decision of the conduction of the state of the programment of the state of the state of the programment of the programment of the state of the s	-								
Designation   Designation   Security   Sec	4	Dimension	ns	Within the specified dimension.				0=00/ //	
	5	Dielectric	Strength	No defects or abnormalities.		applied between t	he terminations	for 1 to 5 second	-
Separation   Separation of the properties   Separation	6			.) (Whichever is smaller)		not exceeding the	rated voltage at	normal tempera	•
Separation   Capacitance   C	7	Capacitar	nce					asured at 25℃ a	at the frequency
Separation   Capacitance   C				Y5V : 0.07 max (50/100V)		Capacitance	Frequency		Voltage
O.15 max. (6.3V)   Capacitance   Capacitance   Capacitance   Capacitance   Characteristics   Capacitance   Characteristics   Characteris	<sub>R</sub>	Dissipation	DISSIDATION FACTOR			C≦10μF			
Capacitance Temperature   Char.   Temp.   Reference Temp.   Cap. Change Rate Temperature   Characteristics   Temperature   PySV   -30 to +85°C   25°C   Within **52.00    Wi		(D.F.)		,			120±24Hz	0.5±	<u> Ł0.1Vr.m.s</u> .
Characteristics   Characteristics   Characteristics   Characteristics   Characteristics   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Characteristics   Section   Sect				0.10 max. (0.0v)					
Adhesive Strength of Termination  Appearance  Appear	9	Temperat	ure	Range Reference Temp.		temperature ranges shown in the table shall be within the specified ranges.  The capacitance change shall be measured after 5 min. at each			ithin the
Adhesive Strength of Termination  Adhesive Strength of Termination  Fig. 11 Solder resist Repaired learnoide or copper foil  Solder resist Repaired learnoide or copper foil  Solder resist Repaired learnoide or copper foil  Appearance No defects or abnormalities.  Capacitance Within the specified tolerance.  No cracks or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) in the same maner and under the same conditions as (10). The capacitor shall be subjected to simple harmonic motion. Resistance place in approximate limits of 10 and 55Hz. The requency being varied uniformly between the approximate limits of 10 and 55Hz. The requency shall be subjected to simple harmonic motion with the specified tolerance.  No cracks or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) in the same maner and under the same conditions as (10). The capacitor shall be subjected to simple harmonic motion. The capacitor shall be subjected to simple harmonic motion with a same maner and under the same conditions as (10). The capacitor shall be subjected to simple harmonic motion. Solder the capacitor to the testing jig (glass epoxy board) in the same maner and under the same conditions as (10). The capacitor shall be subjected to simple harmonic motion. The capacitor shall be subjected to simple harmonic motion to 10.9 max (6.3V). The capacitor to the testing jig (glass epoxy boards) shown in Factor (0.F.). The capacitor shall be subjected to simple harmonic motion of the capacitor to the testing jig (glass epoxy boards) shown in Factor (0.F.). The capacitor to the testing jig (glass epoxy boards) shown in Factor (0.F.). The capacitor to the testing jig (glass epoxy boards) shown in Factor (0.F.). The capacitor to the testing jig (glass epoxy boards) shown in Fig.21 the capacitor to the testing jig (glass epoxy boards) shown in Fig.21 the capacitor to the testing jig (glass epoxy boards) shown in Fig.21 the capacitor to the testing jig (glass epoxy boards)				No removal of the terminations or other defects	s shall occur			ija (alaee opov	v board) shown
Solder resist Baked electrode or copper foil    Fig. 11	10	Adhesive Strength		Adhesive Strength		in Fig. 1f by a 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)			
Page   Page		OI TEITIIII	ation						
Process   Proc				Sold Sold Sold Sold Sold Sold Sold Sold	older resist				
Appearance   No defects or abnormalities.   Solder the capacitor to the testing jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor shall be subjected to 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 direction (total of 6 hours).									
Appearance (apacitance Within the specified tolerance.    Vibration   Resistance   Dissipation				Fig. 1f co	opper foil				
Appearance (in mm (in mm vibration Resistance)  11 Vibration Resistance  12 Deflection  Appearance (Capacitance)  Appearance (Capacitance)  Appearance (Capacitance)  Within the specified tolerance.  Solder the capacitor to the testing jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor shall be subjected to 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 direction (total of 6 hours).  No cracks or marking defects shall occur.  Solder the capacitor to the testing jig (alss epoxy board) in the same manner and under the same conditions as (10). The capacitor shall be subjected to 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 direction (total of 6 hours).  Solder the capacitor to the testing jig (alss epoxy board) in the same manner and under the same manner and under the same enditions as (10). The capacitar shall be subjected to simple harmonic motion having a total amplitude of 1.5mm, 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 direction (total of 6 hours).  Solder the capacitor to the testing jig dass epoxy board) in the same manner and under the same enditions as (10). The capacitor to the testing jig dass epoxy being varied uniformly between the approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular direction (to									
Appearance Capacitance Vibration Resistance Dissipation Factor (D.F.)  No cracks or marking defects shall occur.  No cracks or marking defects shall occur						GRIVI240	3.3	7.0	
Type a b c GRM220 1.0 3.0 1.2 GRM235 1.2 4.0 1.65 GRM230 2.2 5.0 2.9 GRM240 3.5 7.0 3.7			Annogrango	NI - defente en elementalità e		0.11 //		" / 1	
The capacitor shall be subjected to 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 direction (total of 6 hours).  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 21 using a eutectic solder. Then apply a force in the direction shown in Fig. 31. 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. 21 sing a subjected to simple harmonic motion having a total amplitude of 1.5mm, the frequency page aried uniformly between the approximatel 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).  Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 21 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.  Type a b c  GRM220 1.0 3.0 1.2  GRM225 1.2 4.0 1.65  GRM230 2.2 5.0 2.0  GRM230 2.2 5.0 2.9  GRM240 3.5 7.0 3.7						1	_		
The Resistance Pissistance Pi			Capacitance	Within the specified tolerance.				,	,
11   Nicration   Pesistance							-		
Resistance Dissipation Factor (D.F.)  Resistance Dissipation Factor (D.F.)  Dissipation Factor (D.F.)  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2f using a eutectic solder. Then apply a force in the direction shown in Fig.3f. The soldering shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Type a b c GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.85 GRM230 2.2 5.0 2.9 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7		Vibration				having a total amp	olitude of 1.5mm	, the frequency	being varied
Pactor (D.F.)   0.09 max. (10/16/25V)   0.15 max. (6.3V)   1.0	11		Dissination	Y5V: 0.07 max. (50/100V)					
Deflection  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  No cracks or marking defects shall occur.  Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2f using a eutectic solder. Then apply a force in the direction shown in Fig.3f. The soldering shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 3f  Fig. 3f  Type  a  b  capacitance meter  45  Fig. 2f  Type  a  b  capacitance meter  GRM220  1.0  3.0  1.2  GRM225  1.2  4.0  1.65  GRM230  2.2  5.0  2.9  GRM230  2.2  5.0  2.9  GRM240  3.5  7.0  3.7				0.09 max. (10/16/25V)		frequency range,	from 10 to 55Hz	and return to 10	OHz, shall be
12   Deflection   No cracks or marking defects shall occur.   Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2f using a eutectic solder. Then apply a force in the direction shown in Fig.3f. 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.			. uotor (D.1 .)	0.15 max. (6.3V)		traversed in appro	ximately 1 minu	te. This motion	shall be applied
No cracks or marking defects shall occur.  Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2f using a eutectic solder. Then apply a force in the direction shown in Fig.3f. 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. 3f  Type a b c GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7						for a period of 2 h	ours in each 3 m	nutually perpend	licular directions
Fig. 2f using a eutectic solder. Then apply a force in the direction shown in Fig.3f. 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. 3f  Fig. 2f  Type  a b c  GRM220 1.0 3.0 1.2  GRM220 1.0 3.0 1.2  GRM225 1.2 4.0 1.65  GRM230 2.2 5.0 2.0  GRM235 2.2 5.0 2.9  GRM235 2.2 5.0 2.9  GRM240 3.5 7.0 3.7									
Shown in Fig.3f. The soldering shall be done either with an iron of using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.    Pressurize				No cracks or marking defects shall occur.					ards) shown in
12 Deflection   Deflection						Fig.2f using a euto	ectic solder. The	n apply a force i	in the direction
Type a b c GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7						shown in Fig.3f. T	he soldering sha	all be done eithe	r with an iron or
Deflection   Pressurize   Type   a   b   c   GRM220   1.0   3.0   1.2   GRM225   1.2   4.0   1.65   GRM230   2.2   5.0   2.0   GRM235   2.2   5.0   2.9   GRM240   3.5   7.0   3.7						using the reflow n	ethod and shall	be conducted w	vith care so that
Pig. 3f    Type   a   b   c   c   c   c   c   c   c   c   c				1/1/2	nm/sec.	the soldering is ur	niform and free o	f defects such a	as heat shock.
Deflection  Fig. 3f  Type  a b c  GRM220 1.0 3.0 1.2  GRM25 1.2 4.0 1.65  GRM25 1.2 4.0 1.65  GRM230 2.2 5.0 2.0  GRM235 2.2 5.0 2.9  GRM240 3.5 7.0 3.7				/  / 🕇		· ·	h		
Fig. 3f  Type a b c GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7	12	12 Deflection		Capacitance meter	exure : ≦1			9	:1.6mm
Type a b c GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7									
GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7				Fig. 3f			Fig.	<b>∠</b> ſ	
GRM220 1.0 3.0 1.2 GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7									
GRM225 1.2 4.0 1.65 GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7									
GRM230 2.2 5.0 2.0 GRM235 2.2 5.0 2.9 GRM240 3.5 7.0 3.7									
GRM235     2.2     5.0     2.9       GRM240     3.5     7.0     3.7									
GRM240 3.5 7.0 3.7									
(in mm						GRM240	3.5	7.0	
									(in mm)

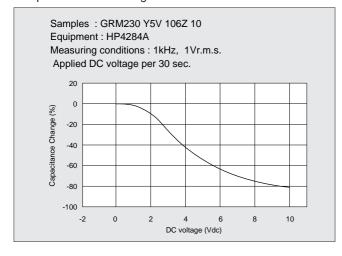
No.	Item		Specification	Test Method
13	Solderability of Termination	75% of the terminations is	s to be soldered evenly and continuously.	Immerse the capacitor first an ethanol (JIS-K-8101) solution of rosin (JIS-K-5902) (25% rosin in weight proportion), then in a eutectic solder solution for 2±0.5 seconds at 230±5°C after preheating for 10 to 30seconds at 80 to 120°C.
14	Resistance to Soldering Heat	The measured values stable.  Item Appearance Capacitance Change I. R.  D.F.  Dielectric Strength	All satisfy the values in the following  Specification No marked defect Y5V: Within ±20% More than 10,000ΜΩ or 500Ω · F (Whichever is smaller) 0.07 max.(50, 100V) 0.09 max.(10, 16, 25V) 0.15 max.(6.3V) No failure	The capacitor shall be set for 48±4 hours at room temperature after one hour heat of treatment at 150°C±1°0°C.  Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds after preheating in the flowing table. Then set it for 48±4 hours at room temperature and measure.  Chip Size Conditions  3.2×1.6 mm max. 1 minute at 120 to 150°C  Each 1 minute at 100 to 120°C and then 170 to 200°C
15	Temperature Cycle	The measured values stable.  Item Appearance Capacitance Change I. R.  D.F.  Dielectric Strength	hall satisfy the values in the following	The capacitor shall be set for $48\pm4$ hours at room temperature after one hour heat of treatment at $150^{\circ}\text{C}^{+}_{-1}^{\circ}$ °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 $48\pm4$ hours at room temperature, then measure. $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$
16	Humidity Steady State	The measured values stable.  Item Appearance Capacitance Change I. R.  D.F.  Dielectric Strength	Specification No marked defect Y5V: Within ±30% More than 1,000MΩ or 50Ω · F (Whichever is smaller) 0.1 max.(50, 100V) 0.125 max.(10, 16, 25V) 0.2 max.(6.3V) No failure	Set the capacitor for 500±12 hours at 40±2°C and 90 to 95% humidity. Take it out and set it for 48±4 hours at room temperature, then measure.
17	Humidity Load	The measured values stable.  Item Appearance Capacitance Change I. R.  D.F.	hall satisfy the values in the following  Specification No marked defect Y5V: Within ±30% More than 500MΩ or 25Ω · F (Whichever is smaller) 0.1 max.(50, 100V) 0.125 max.(10, 16, 25V) 0.2 max.(6.3V) No failure	Apply the rated voltage for 500±12 hours at 40±2°C and 90 to 95% humidity and set it for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
18	The measured values shall satisfy the values in the following table.  Item Specification Appearance No marked defect Capacitance Change Y5V: Within ±30%		hall satisfy the values in the following Specification No marked defect Y5V: Within $\pm 30\%$ More than 1,000M $\Omega$ or $50\Omega \cdot F$ (Whichever is smaller) 0.1 max.(50, 100V) 0.125 max.(10, 16, 25V) 0.2 max.(6.3V)	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 $\pm 3^{\circ}\text{C}$ 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. $*150\%$ for C>10µF

### ■CHARACTERISTICS (REFERENCE DATA)

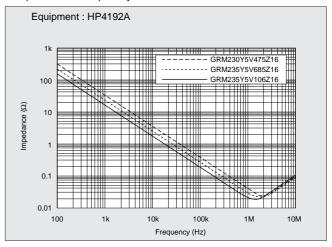
- SELECTION OF CERAMIC CAPACITORS
   When selecting capacitors, consider the DC voltage characteristics (AC & DC) and aging characteristics.
- Capacitance-Temperature Characteristics



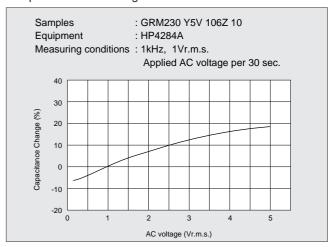
#### • Capacitance-DC Voltage Characteristics



#### • Impedance-Frequency Characteristics



#### • Capacitance-AC Voltage Characteristics



# ■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 ( $\Delta T$ ) 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 : 6.3V						
Chip Size	100kHz≦f <300kHz	300kHz≦f <500kHz	500kHz≦f ≦1MHz			
GRM225	1.4 Ar.m.s.	1.5 Ar.m.s.	1.6 Ar.m.s.			

#### Rated Voltage: 10V

Chip Size	100kHz≦f <300kHz	300kHz≦f <500kHz	500kHz≦f ≦1MHz
GRM220	1.4 Ar.m.s.	1.5 Ar.m.s.	1.6 Ar.m.s.
GRM230	1.5 Ar.m.s.	1.6 Ar.m.s.	1.6 Ar.m.s.
GRM235	GRM235 1.7 Ar.m.s.		2.0 Ar.m.s.

#### Rated Voltage: 16V

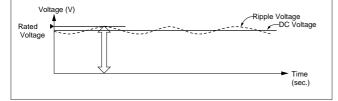
Chip Size	100kHz≦f <300kHz	300kHz≦f <500kHz	500kHz≦f ≦1MHz
GRM230	1.5 Ar.m.s.	1.6 Ar.m.s.	1.6 Ar.m.s.
GRM235	GRM235 1.7 Ar.m.s.		2.0 Ar.m.s.

### Rated Voltage: 25V/50V

Chip Size	100kHz≦f <300kHz	300kHz≦f <500kHz	500kHz≦f ≦1MHz
GRM235	2.0 Ar.m.s.	2.2 Ar.m.s.	2.2 Ar.m.s.
GRM240	2.0 Ar.m.s.	2.2 Ar.m.s.	2.2 Ar.m.s.

#### Rated Voltage: 100V

Chip Size	100kHz≦f	300kHz≦f	500kHz≦f
Chip Size	<300kHz	<500kHz	≦1MHz
GRM235	1.6 Ar.m.s.	1.7 Ar.m.s.	1.8 Ar.m.s.







For Ultrasonic Sensor

# Temperature Compensating Type **GRM ZLM** Series

#### **■**FEATURES

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

#### **■**APPLICATION

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

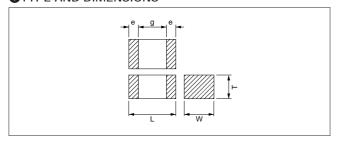
#### **■PART NUMBERING**

(\*Please specify the part number when ordering)



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

#### **1**TYPE AND DIMENSIONS

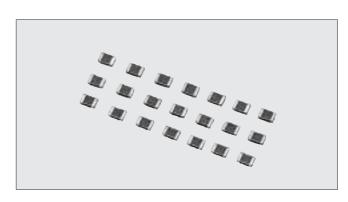


Туре		Dimensions (mm)					
(EIA Code)	L	W	Т	е	g		
GRM40 (0805)	2.0±0.1	1.25±0.1	0.85±0.1	0.2 to 0.7	0.7 min.		

#### **2**TEMPERATURE CHARACTERISTICS

Code	Temp. Coeff.*	Temp. Range	Reference Temp.
ZLM	–4700ppm/℃	-25℃ to +85℃	20℃

\*Please refer to the specifications on next page.



#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
102	1,000	152	1,500

#### **4**CAPACITANCE TOLERANCE

Code	Cap. tolerance
K	±10%

#### **5**RATED VOLTAGE

Code	DC Rated voltage	
100	100V	

### **7**PACKAGING CODE

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

#### **■**CAPACITANCE RANGE TABLE

(in pF)

Type	DC Dated Voltage (\( \Lambda \)	Temp. Char.
Type DC Rated Voltage (V)		ZLM
GRM40	100	1,000, 1,500

#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./φ178mm reel)
GRM40	0.85±0.1	1,000	4,000

No.	Item	Specification	Test Method	
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 <sup>p,p</sup> or V <sup>o,p</sup> , whichever is larger, shall be maintained within the rated voltage range.	
3	Appearance	No defects or abnormalities.	Visual inspection.	
5	Dimensions  Dielectric Strength	Within the specified dimension.  No defects or abnormalities.	Using calipers.  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 (I.R.)	More than 10,000M $\Omega$ or 500 $\Omega$ · F. (Whichever is smaller)	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 20°C and 75%RH max. and within 2 minutes of charging.	
7	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 20℃ with 1±0.1kHz in	
8	Dissipation Factor (D.F.)	0.01 max.	frequency and 1±0.2Vr.m.s. in voltage.	
9	Capacitance Temperature Characteristics	Within −4,700 <sup>+1,000</sup> / <sub>-2,500</sub> ppm/°C (at −25 to +20°C) Within −4,700 <sup>+5,00</sup> / <sub>-1,000</sub> ppm/°C (at +20 to +85°C)	The temperature coefficient is determined using the capacitance measured in step 1 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance shall be within the specified tolerance for the temperature coefficient. The capacitance change shall be measured after 5 min. at each specified temperature stage.	
10	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1g 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.  Solder resist  Baked electrode or copper foil  Type a b c  GRM40 1.2 4.0 1.65  (in mm)	
	Appearance Capacitance	No defects or abnormalities.  Within the specified tolerance.	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	
11	Vibration Resistance D.F.	0.01 max.	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).	
12	Deflection	No cracking or marking defects shall occur.  20 50 Pressurizing speed:1.0mm/sec. Pressurize  Flexure:≤1  Capacitance meter 45 45  Fig. 3g	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2g using a eutectic solder. Then apply a force in the direction shown in Fig.3g. 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.	

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





# For Wire-bonding/Die-bonding, **MLC** Micro Chip **GM250** Series

#### **■**FEATURES

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

#### **■**APPLICATION

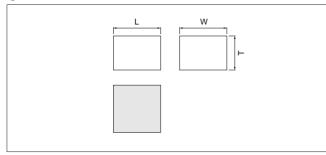
- Optical device for telecommunication
- IC, IC package built-in
- Measuring equipment

#### **■PART NUMBERING**

(\*Please specify the part number when ordering)



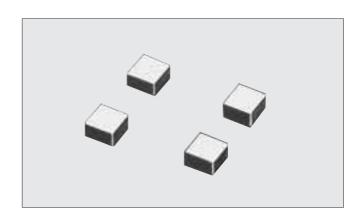
#### **1**TYPE AND DIMENSIONS



Typo	Dimensions (mm)		
Туре	L	W	Т
GM250	0.5±0.05	0.5±0.05	0.35±0.05
GM260	0.8±0.05	0.8±0.05	0.5±0.05

#### **2**TEMPERATURE CHARACTERISTICS

Code	Cap. Change	Temp. Range	Reference Temp.
X7R	±15%	-55 to +125℃	25℃
Y5V	±82%	-30 to + 85℃	25℃



### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (pF)
102	1,000	103	10,000
152	1,500	104	100,000

#### **4**CAPACITANCE TOLERANCE

Code	Tol.
M	±20%
Z	±80%

### **6**RATED VOLTAGE

Code	DC Rated voltage (V)
50	50
16	16
10	10

## **PACKAGING CODE**

Code	Packaging
PM	Bulk packaging in a tray (400 pcs./tray)

# ■CAPACITANCE RANGE TABLE

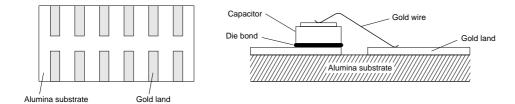
(in pF)

				(III pi )
Temp. Char.	X7R		Y!	5V
Type DC Rated Voltage (V)	16	50	10	16
GM250	1,000, 1,500, 2,200	470	15,000	4,700, 6,800 10,000
GM260	10,000		100,000	47,000

No.	Ite	em		Specification	Test Method	
1	Operating	g ture Range	X7R : −55°C to +125°C Y5V : −30°C to +85°C			
2	Rated Vol		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 <sup>p.p</sup> or V <sup>o.p</sup> , whichever is larger, shall be maintained within the rated voltage range.	
3	Appearan	nce	No defects or abnormality.		Visual inspection.	
4	Dimensio	ns	See the previous pages.		Visual inspection.	
5	Dielectric	Strength	No defects or abnormality.		No failure shall be observed when a voltage of 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.	
6	Insulation (I.R.)	Resistance	10,000M $\Omega$ min.		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	Capacitar	nce	Within the specified tolera	ance.	The capacitance shall be measured at 25°C with 1±0.1kHz in frequency and 1±0.2Vr.m.s. in voltage.	
8	Dissipatio (D.F.)	n Factor	X7R: 0.035 max. Y5V: 0.09 max. (for 16V) : 0.125 max. (for 10V		D.F. shall be measured under the same conditions at the capacitance.	
9	Capacitar Temperat Character	ture	Char. Temp. Rang X7R -55 to +125 Y5V -30 to + 85	°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.  The capacitance change shall be measured after 5 min. at each specified temperature stage.	
10	Mechanical Strength				MIL-STD-883 Method 2011 Condition D  Mount the capacitor on a gold metallized alumina substrate with Au- Sn (80/20) and bond a 20μm (0.0008 inch) gold wire to the capacitor terminal using an ultrasonic wedge bond. Then, pull wire.  MIL-STD-883 Method 2019	
		Die Shear Strength	ar   Die Shear force : 200g min.   Mount the capacitor on a gold metallized alum		Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.	
		Appearance	e No defect nor abnormality.		Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude: 1.5 mm (0.06 inch) max. total excursion.	
11	X7R : 0.035 max.   D.F.   Y5V : 0.09 max. (for 16V)   : 0.125 max. (for 10V)		ance.	Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).		
			Y5V: 0.09 max. (for 16V) : 0.125 max. (for 10V)	·/)		
		The measured values s table.		hall satisfy the values in the following  Specification	The capacitor shall be set for 48±4 hours at room temperature after one hour heat of treatment at 150 +0 the initial measurement. Fix the capacitor to the supporting jig i	
			Appearance	No marked defect	the same manner and under the same conditions as (11) and	
			Canacitance Change	X7R ······ Within±7.5%	conduct the five cycles according to the temperatures and time	
12	Temperat	tura Cycla	Capacitance Change	Y5V ······ Within±20%	shown in the following table. Set it for 48±4 hours at room	
12	Гепрегас	ture Cycle	I.R.	More than 10,000MΩ	temperature, then measure.	
			2.5	X7R 0.035 max.	Step 1 2 3 4	
			D.F.	Y5V 0.09 max.(for 16V)	Min Operating Room May Operating Room	
			Dielectric Strength	0.125 max.(for 10V)  No failure	Temp. (°C) Temp. + Temp. Temp. + Temp. Temp. Temp.	
			Diologic Gueriga:	TVO TAINATO	Time (min.) 30±3 2 to 3 30±3 2 to 3	
			table.	hall satisfy the values in the following	Set the capacitor for 500±12 hours at 40±20°C, in 90 to 95% humidity.  Take it out and set it for 48±4 hours at room temperature, then	
			Appearance	Specification No marked defect	measure.	
			Appearance	X7R ······ Within±12.5%		
40	Humidity		Capacitance Change	Y5V Within±30%		
13	(Steady S	state)	I.R.	More than 1,000MΩ		
			D.F.	X7R ······ 0.05 max. Y5V ····· 0.125 max.(for 16V) 0.15 max.(for 10V)		
			Dielectric Strength	No failure		
				hall satisfy the values in the following	Apply the rated voltage for 500±12 hours at 40±20℃, in 90 to	
			table.		95% humidity and set it for 48±4 hours at room temperature, then	
			Item	Specification	measure. The charge/discharge current is less than 50mA.	
			Appearance	No marked defect	• Initial measurement for Y5V  Perform a heat treatment at 150 <sup>+ 0</sup> <sub>-10</sub> ℃ for one hour and then let	
			Capacitance Change	X7R ······ Within±12.5% Y5V ····· Within±38%	sit for 48±4 hours at room temperature. Perform the initial	
14	Humidity	Load	I.R.	More than 500MΩ	measurement.	
				X7R ······ 0.05 max.		
			D.F.	Y5V ······ 0.125 max.(for 16V) 0.15 max.(for 10V)		
			Dielectric Strength	No failure		

No.	Item	Specification		Test Method
15	High Temperature Load	Item Appearance Capacitance Change I.R. D.F.	Specification  No marked defect  X7R ······ Within±12.5%  Y5V ····· Within±38%  More than 1,000MΩ  X7R ····· 0.05 max.  Y5V ···· 0.125 max.(for 16V)  0.15 max.(for 10V)	A 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 initial 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.
		Dielectric Strength	No failure	

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







# Capacitor Array **GNM** Series

#### **■**FEATURES

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

### **■**APPLICATION

• General electronic equipment

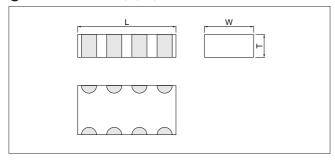
#### **■PART NUMBERING**

(\*Please specify the part number when ordering)



- Type
- 6 Rated Voltage
- Temperature Characteristics
- 6 Murata's Control No.
- **3**Capacitance
- Packaging

#### **O**TYPE AND DIMENSIONS



Type (EIA Code)		Dimensions (mm)	
(EIA Code)	L	W	T
GNM30-401 (1206)	3.2±0.15	1.6±0.15	0.8±0.1

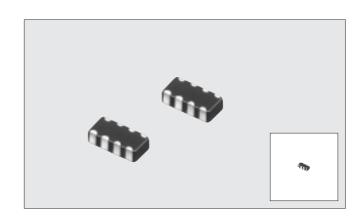
#### **2**TEMPERATURE CHARACTERISTICS

#### •Temperature Compensating Type

-		
Code	COG	SL
Temp. range	-55 to +125℃	-55 to +85℃
Temp. coeff. (ppm/℃)	0±30	+350 to -1,000

#### •Temperature Compensating Type

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



#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (µF)
100	10	103	0.01
472	4,700	154	0.15

#### **4**CAPACITANCE TOLERANCE

Code	Tol.	Capacitance range
D	±0.5pF	C0G, 10pF
J	± 5%	C0G, Over 10pF
K	±10%	C0G/X7R, Over 10pF
M	±20%	X7R
Z	±20%	Y5V

#### **5**RATED VOLTAGE

Code	DC Rated voltage (V)
16	16
25	25
50	50
100	100

#### **PACKAGING CODE**

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

#### ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : T (mm)	Bulk (pcs./bag)	Taping (pcs./\phi178mm reel)
GNM30-401	0.8±0.1	1,000	4,000

# **■**CAPACITANCE RANGE TABLE

Tom	ype n Char	COG				GNM30-401 X7R				Y5V												
DC	p. Char. Rated Voltage (V)			U(			_		10	_			X /		T	1/	_	00				,
Cap. (pF)	7.77		50			100	)		100	)		50		25	1	16	1	00	5	U	10	6
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	10	H		-			-	-					+		+							
	11	H		-			-						+		+							
	12	Н					H						+		+							
	15	H		-			-						+		+							
	16	H		-			-						+		+							
	18	H					r						$\dagger$		t							
	20	H		-			-						+		1							
	22	M		_			r	r					1		T							
	24																					
	27			_									I		I							
	30	Ц					L															
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	43	H		-			-						+		+							
<u> </u>	47 51	H		-			-	ŀ-					+		+							
	56	Н		_			H	H					+		+							
	62	H		-	-		-	-					+		+							
	 68	H		-			-	-					+		+							
	75	Н											†		t							
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	160	Н											+		+							
	180	H		-				-					+		+							
	200 220	H		-				-		T-			+		+							
	240	Н		-	_	_	-	H		H			+		$^{+}$							_
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	300	H		-						-			+		+							
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	560	ļ.,						Ļ.		-	H	-	4		_							
	680									L	Н	-	4		+							
<u> </u>	820			-	L.			Ļ.		-	H	-	+		+							
	1,000			-				-		-	H	-	+		+		LL					
	1,200 1,500	$\vdash$		_				$\vdash$		$\vdash$	Н	-	+		+				$\vdash$			
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		07111011	IS AND TEST WE	Specification				
No.	Ite	em	Temperature Compensating Type	High Dielectric Constant Type	Test Method			
1	Operating Temperat	J ure Range	C0G : −55 to +125°C	X7R : -55 to +125℃ Y5V : -30 to + 85℃				
2	Rated Vol	ltage	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 <sup>p-p</sup> or V <sup>c-p</sup> , whichever is larger, shall be maintained within the rated voltage range.			
3	Appearan	ice	No defects or abnormalities	es.	Visual inspection.			
4	Dimensions Within the specified dimension.		sion.	Using calipers.				
5	Dielectric	Strength	No defects or abnormalitie	es.	No failure shall be observed when 300% of the rated voltage (COG) 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 (I.R.)	Resistance	More than 10,000M $\Omega$ or 5	00Ω · 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	Capacitar	nce	Within the specified tolera	nce.	The capacitance/Q/D.F. shall be measured at 25℃ at the			
8	Q/Dissipat	tion Factor	30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance	Char.         25V min.         16V           X7R         0.025 max.         0.035 max.           Y5V         0.05 max.         0.07 max.	frequency and voltage shown in the table.  Char. COG X7R, Y5V			
	(2,		(pF)		Frequency         1±0.1MHz         1±0.1kHz           Voltage         0.5 to 5Vr.m.s.         1±0.2Vr.m.s.			
9	Capacitance Temperature Characteristics	Capacitance Change  Temperature Coefficient  Capacitance Drift	Within the specified tolerance. (Table A-5)  Within the specified tolerance. (Table A-5)  Within ±0.2% or ±0.05pF (Whichever is larger)	Char.         Temp. Range.         Reference Temp.         Change Change           X7R         -55t0 +125°C         25°C         Within±15% Within±82%	The capacitance change shall be measured after 5 min. at each specified temperature stage.  (1) Temperature Compensating Type  The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from 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.  Step Temperature (°C)  1 25±2 2 -55±3 3 25±2 4 125±3 5 25±2  (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.			
10	Adhesive Strength of Termination  Adhesive Strength of Termination  No removal of the terminations or other defects shall occur.		Solder resist Copper foil	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1h using a eutectic solder. Then apply 5N force in parallel with the 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 that the soldering is uniform and free of defects such as heat shock.  Type a b c d GNM30-401 0.8 2.5 0.4 0.8  (in mm)				
		Appearance	No defects or abnormalitie	es.	Solder the capacitor to the test jig (glass epoxy board) in the			
		Capacitance	Within the specified tolera		same manner and under the same conditions as (10). The			
11	Vibration Resistance	Q/D.F.	30pF min. : Q≥1000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	Char.         25V min.         16V           X7R         0.025 max.         0.035 max.           Y5V         0.05 max.         0.07 max.	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).			

				Specification				
No.	Ite	m	Temperature	·	 Test Method			
			Compensating Type	High Dielectric Constant Type				
			No cracking or marking de	offects shall occur.  20 150 Pressurizing speed: 1.0mm/sec.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2h using a eutectic solder. Then apply a force in the direction shown in Fig.3h. 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.			
12	Deflection		R230. Ca 45	Flexure : ≤1 pacitance meter 45 Fig. 3h	100    Copper foil   Solder resist t = 1.6mm			
					Immerse the capacitor in a solution of ethanol (JIS-K-8101) and			
13	Solderabil Termination	-	75% of the terminations is	to be soldered evenly and continuously.	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.			
	Resistance to Soldering Heat  The measured and observed characteristics shall satisfy the specifications in the following table.				Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours			
	-	Appearance Capacitance	No marking defects Within ±2.5% or ±0.25pF	X7R ······ Within±7.5%	(temperature compensating type) or 48±4 hours (high dielectric constant type), then measure.			
		Change	(Whichever is larger)	Y5V Within±20%	constant typo), then measure.			
14	-	•	30pF and over : Q≥1,000	Char. 25V min. 16V	Initial measurement for high dielectric constant type			
		Q/D.F.	30pF and below : Q≥400+20C C : Nominal Capacitance (pF)	X7R 0.025 max. 0.035 max. Y5V 0.05 max. 0.07 max.	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.			
		I.R.	u /	00Ω · F (Whichever is smaller)	-			
		Dielectric	No failure					
	Temperati	Strength ure Cycle	The measured and observ specifications in the follow	red characteristics shall satisfy the ing 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.			
		Appearance	No marking defects		Let sit for 24±2 hours (temperature compensating type) or 48±4			
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger) 30pF and over : Q≥1,000	X7R ······· Within±7.5% Y5V ······ Within±20%	hours (high dielectric constant type) at room temperature, then measure.			
15			30pF and below :	Char.         25V min.         16V           X7R         0.025 max.         0.035 max.	Step 1 2 3 4  The step 1 Room Max. Operating Room Room Max. Operating Room			
		Q/D.F.	Q≧400+20C C : Nominal Capacitance	Y5V 0.05 max. 0.07 max.	Temp. (C) Temp. $^{+0}_{-3}$ Temp. Temp. $^{+3}_{-0}$ Temp.			
		I.D.	(pF)	000 5 (M/h:-h ' ' '				
		I.R. Dielectric Strength	More than $10,000M\Omega$ or $5$	00Ω · F (Whichever is smaller)	Initial measurement for high dielectric constant type Perform a heat treatment at 150 <sup>+ 0</sup> <sub>-10</sub> <sup>c</sup> for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.			
	Humidity,		The measured and observ	red characteristics shall satisfy the	Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12			
	Steady Sta		specifications in the follow	ing table.	hours.			
	-	Appearance	No marking defects	X7R ······· Within±12.5%	Remove and let sit for 24±2 hours (temperature compensating			
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	Y5V ······ Within±12.5%	type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.			
		-9-	30pF and over : Q≧350		1			
16			10pF and over,	Char.         25V min.         16V           X7R         0.05 max.         0.05 max.				
			30pF and below : Q≧275+ 5/2 C	Y5V 0.075 max. 0.1 max.				
		Q/D.F.	10pF and below:  Q≧200+10C C: Nominal Capacitance (pF)					
		I.R.	4 /	Ω · F (Whichever is smaller)	<u> </u>			

				Specification		
No.	Ite	em	Temperature Compensating Type	High Dielectric Constant Type	Test Method	
	Humidity	Load	The measured and observ specifications in the follow	ved characteristics shall satisfy the ring 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	
		Appearance	No marking defects		compensating type) or 48±4 hours (high dielectric constant type	
		Capacitance	Within $\pm 7.5\%$ or $\pm 0.75$ pF	X7R ······· Within±12.5%	at room temperature, then measure. The charge/discharge	
		Change	(Whichever is larger)	Y5V ······ Within±30%	current is less than 50mA.	
17		Q/D.F.	30pF and over : Q≥200 30pF and below : Q≥100+ 10/3 C C : Nominal Capacitance (pF)	Char.         25V min.         16V           X7R         0.05 max.         0.05 max.           Y5V         0.075 max.         0.1 max.		
		I.R.	More than $500 \mathrm{M}\Omega$ or $25\Omega$	· F (Whichever is smaller)		
		Dielectric Strength	No failure			
	High Tem	perature	The measured and observ	ved characteristics shall satisfy the	Apply 200% of the rated voltage for 1,000±12 hours at the	
	Load		specifications in the follow	ring table.	maximum operating temperature ±3°C. Let sit for 24±2 hours	
		Appearance	No marking defects		(temperature compensating type) or 48±4 hours (high dielectric	
		Capacitance	Within ±3% or ±0.3pF	X7R ······ Within±12.5%	constant type) at room temperature, then measure.	
		Change	(Whichever is larger)	Y5V ······ Within±30%	The charge/discharge current is less than 50mA.	
18		Q/D.F.	30pF and over: Q≥350 10pF and over, 30pF and below: Q≥275+ 5/2 C 10pF and below: Q≥200+10C C: Nominal Capacitance (pF)	Char.         25V min.         16V           X7R         0.04 max.         0.05 max.           Y5V         0.075 max.         0.1 max.	•Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3℃. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.	
		I.R.	More than 1,000MΩ or 50	Ω · F (Whichever is smaller)	1	
		Dielectric	N. 6.71	,	1	
		Strength	No failure			

# Table A-5

	Temp. Coeff.		C	apacitance Cha	nge from 25 <b>℃</b> (9	%)	
Char.	(ppm/℃) Note 1	<b>−55℃</b>		-3	0℃	<b>−10</b> °C	
	(pp.11) 3) 11313 1	Max.	Min.	Max.	Min.	Max.	Min.
COG	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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





# Low ESL Wide Width Type LL Series

#### **■**FEATURES

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

### **■**APPLICATION

- High speed micro processor
- High frequency digital equipment

### ■PART NUMBERING

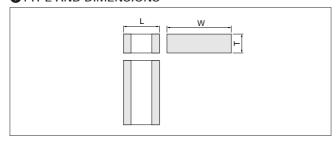
(\*Please specify the part number when ordering)



**1**Туре

- **6**Rated Voltage
- 2Temperature Characteristics
- 6 Murata's Control No.
- 3Capacitance
- Packaging

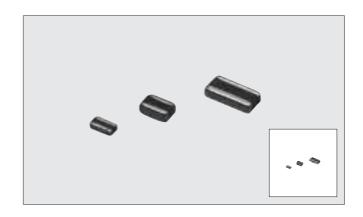
#### **1**TYPE AND DIMENSIONS



Type	Dimensions (mm)						
Туре	L	W	T				
LL0306	0.8 ±0.1	1.6±0.1	0.6 max.				
LL0508	1.25±0.1	2.0±0.1	1.0 max.				
LL0612	1.6 ±0.15	3.2±0.15	0.7 ±0.1				
LLU012	1.6 ±0.15	3.2±0.15	1.15±0.1				

#### **2**TEMPERATURE CHARACTERISTICS

•			
Code	Cap. Change	Temp. Range	Reference Temp.
X7R	±15%	-55 to +125℃	
Z5U	±22 %	+10 to + 85℃	25℃
Y5V	±22%	-30 to + 85℃	



#### **3**CAPACITANCE (Ex.)

Code	Capacitance (pF)	Code	Capacitance (µF)
472	4,700	224	0.22
103	10,000	105	1

#### **4**CAPACITANCE TOLERANCE

Code	Tol.	Applied Temp. char.
K	±10%	X7R
M	±20%	X7R, Z5U
Z	±20%	Z5U, Y5V

#### **G**RATED VOLTAGE

Code	DC Rated voltage (V)
16	16
25	25
50	50

#### **PACKAGING CODE**

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

# ■CAPACITANCE RANGE TABLE

Туре				- 1	LL030	6								LL050	8								LL061	2			
Temp. Char.		X	7R		Z!	5U		Y5V			X	7R		Z!	5U		Y5V			X	7R		Z	5U		Y5V	
DC Rated Voltage (V)	50	25	16	10	50	25	50	25	16	50	25	16	10	50	25	50	25	16	50	25	16	10	50	25	50	25	16
Cap. (pF)																											
2,200											<del> </del> -												+				
2,700							<del> </del>				<del> </del> -												+	<del> </del> -			
3,300							t				t											·	+	<del> </del> -			†
3,900																											
4,700							1				ļ						1					T	1				
5,600							Ī				ļ											ļ					
6,800																											
8,200							L				L			L	L	l	L		L					<u> </u>			<u> </u>
10,000																											
12,000		L					ļ				ļ			L		ļ	L		L. L.			L		ļ			ļ
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# ■THICKNESS AND PACKAGING TYPES/QUANTITY

Туре	Thickness : (mm) Bulk (pcs./bag)		Taping (pcs./φ178mm reel)
LL0306	T: 0.6 max.	1,000	4,000
LL0508	T: 1.0 max.	1,000	4,000
110/12	T: 0.7±0.1	1,000	4,000
LL0612	T: 1.15±0.1	1,000	3,000

No.	Item	Specification	Test Method			
1	Operating Temperature Range	X7R: -55°C to +125°C Z5U: +10°C to + 85°C Y5V: -30°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 <sup>P,P</sup> or V <sup>O,P</sup> , whichever is larger, shall be maintained within the rated voltage range.			
3	Appearance Dimensions	No defects or abnormalities.  Within the specified dimension.	Visual inspection. 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.)	More than 10,000M $\Omega$ or 500 $\Omega$ · 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/D.F. shall be measured at 25℃ at the frequency			
8	Dissipation Factor (D.F.)	Char.       25V min.       16V         X7R       0.025 max.       0.035 max.         Z5U       0.025 max.       —         Y5V       0.05 max.       0.07 max. (C<1.0μF)	X7R · Y5V   Z5U			
9	Capacitance Char. Temp. Range (°C) Reference Temp. Cap. Change.    X7R		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.  The capacitance change shall be measured after 5 min. at each specified temperature stage.			
10	Adhesive Strength of Termination  No removal of the terminations or other defects shall a shal		Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1i using a eutectic solder. Then apply 10N⁵ force in the direction of the arrow. *5N:LL0306  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.  Type a b c LL0306 0.3 1.2 2.0 LL0508 0.6 1.6 2.4 LL0612 1.0 3.0 3.7			
11	Vibration Resistance D.F.	No defects or abnormalities.         Within the specified tolerance.         Char. 25V min. 16V         X7R 0.025 max. 0.035 max.         Z5U 0.025 max 0.07 max. (C<1.0μF)         Y5V 0.05 max. 0.09 max. (C≥1.0μF)	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).			
12	Deflection	No crack or marked defect shall occur.  20 50 Pressurizing speed: 1.0mm/sec. Pressurize  Capacitance meter 45 45  Fig. 3i	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2i using a eutectic solder. Then apply a force in the direction shown in Fig.3i. 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.			
13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃.			

No.	Ite	em	Specification	Test Method				
IVO.	TIE.		'					
		Appearance Capacitance	No defects or abnormalities.  X7R : Within±7.5%	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the				
		Change	Z5U · Y5V : Within±20%	capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 48±4 hours , then				
		Onlange		measure.				
			Char. 25V min. 16V	modelio.				
١	Resistance	D.F.	X7R         0.025 max.         0.035 max.           Z5U         0.025 max.         —	Initial measurement.				
14	to Soldering	D.F.	Z5U 0.025 max. — 0.07 max. (C<1.0μF)	Perform a heat treatment at 150 <sup>+</sup> <sub>-10</sub> <sup>o</sup> c for one hour and then let				
	Heat		Y5V 0.05 max. 0.09 max. (C≥1.0μF)	sit for 48±4 hours at room temperature. Perform the initial				
			0.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	measurement.				
		I.R.	More than $10,000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller)					
		Dielectric	No failure					
		Strength	NI- defeate an elementalist	Firstly and the state of the st				
		Appearance Capacitance	No defects or abnormalities.  X7R : Within±7.5%	Fix the capacitor to the supporting jig in the same manner and				
		Change	Z5U · Y5V : Within±20%	under the same conditions as (10).  Perform the five cycles according to the four heat treatments				
		onango		listed in the following table. Let sit for 48±4 hours at room				
			Char. 25V min. 16V	temperature, then measure.				
		D.F.	X7R         0.025 max.         0.035 max.           Z5U         0.025 max.         —					
15	Temperature	D.F.	0.07 may (C<1.0uE)	Step 1 2 3 4				
15	Cycle		Y5V 0.05 max. 0.09 max. (C≥1.0μF)	Temp. (°C) Temp Temp. Temp. Temp. Temp. Temp.				
				Time (min.) 30±3 2 to 3 30±3 2 to 3				
		I.R.	More than $10,000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller)					
				•Initial measurement.				
		Dielectric	No failure	Perform a heat treatment at 150 <sup>+ O</sup> <sub>-10</sub> °C for one hour and then let				
		Strength		sit for 48±4 hours at room temperature. Perform the initial				
		Appearance	No defects or abnormalities	measurement.  Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12				
		Appearance No defects or abnormalities.  Capacitance X7R : Within±12.5%		hours.				
		Change	Z5U . Y5V : Within±30%	Remove and let sit for 48±4 hours at room temperature, then				
		J		measure.				
	Humidity,		Char. 25V min. 16V					
16	Steady	D.F.	X7R   0.05 max.   0.05 max.					
	State	D.F.	0.1 may (C<1.0uE)					
			Y5V 0.075 max. 0.125 max. (C≥1.0μF)					
		1.0						
		I.R. Appearance	More than 1,000M $\Omega$ or 50 $\Omega$ . F (Whichever is smaller)	Ah, the rested with reserve 40 10°0 and 00 to 050/ hoursidit. for				
		Capacitance	No defects or abnormalities.  X7R : Within±12.5%	Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room				
		Change	Z5U . Y5V : Within±30%	temperature, then measure. The charge/discharge current is less				
				than 50mA.				
			Char.         25V min.         16V           X7R         0.05 max.         0.05 max.					
17	Humidity	D.F.	X7R   0.05 max.   0.05 max.					
17	Load	D.I .	0.1 max. (C<1.0uF)					
			75V 0.075 max. 0.125 max. (C≥1.0μF)					
		1.0						
		I.R. Dielectric	More than $500M\Omega$ or $25\Omega \cdot F$ (Whichever is smaller)					
		Strength	No failure					
		Appearance	No defects or abnormalities.	Apply 200% of the rated voltage for 1,000±12 hours at maximum				
		7.6600.01.00	X7R: Within±12.5%	operating temperature ±3°C. Let sit for 48±4 hours at room				
		Capacitance	Z5U: Within±30%	temperature, then measure.				
		Change	Y5V : Within±30% (C<1.0μF)	The charge/discharge current is less than 50mA.				
			Within $^{+30}_{-40}$ % (C≥1.0μF)					
	High		Char. 25V min. 16V	•Initial measurement.				
18	Temperature		X7R 0.05 max. 0.05 max.	Apply 200% of the rated DC voltage for one hours at the				
	Load	D.F.	Z5U 0.05 max. —	maximum operating temperature ±3℃.				
			V5V 0.075 max 0.1 max. (C<1.0μF)	Remove and let sit for 48±4 hours at room temperature. Perform				
			0.073 Hax. 0.125 max. (C≧1.0μF)	initial measurement.				
		I.R.	More than 1,000M $\Omega$ or 50 $\Omega$ · F (Whichever is smaller)	-				
		Dielectric						
		Strength	No failure					
				•				





Solder Coated Type

GRH/RPN700 Series; High-frequency Type

#### **■**FEATURES

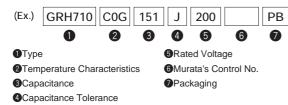
- Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
- 2. Nickel barriered terminations of GRH type improve solderability and decrease solder leaching.
- GRH706/GRH708 type is designed for both flow and reflow soldering and GRH710 type is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

#### **■**APPLICATION

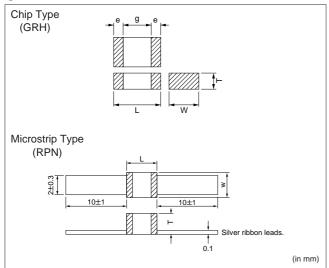
High-frequency and high-power circuits

#### **■PART NUMBERING**

(\*Please specify the part number when ordering)



#### **1**TYPE AND DIMENSIONS



Туре		Dim			
Туре	L	W	Т	е	g
GRH706	1.25 +0.5		1.2 max.	0.15 min.	0.3 min.
GRH708	2.0 +0.5	1.25 +0.5	1.45 max.	0.2 min.	0.5 min.
GRH710	3.2 +0.6	2.5 +0.5	1.9 max.	0.3 min.	0.5 min.
RPN710	4.0 max.	3.0 max.	2.3 max.	_	_

## **2**TEMPERATURE CHARACTERISTICS

Code	Temp. Coeff.	Temp. Range	Reference Temp.
COG	0±30ppm/℃	-55℃ to +125℃	25℃

## **3**CAPACITANCE (Ex.)

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

#### **4**CAPACITANCE TOLERANCE

Code	С	D	J
Cap. tolerance	±0.25pF	±0.5pF	±5%
Cap. range	C≦5pF	5pF <c≦10pf< td=""><td>10pF<c< td=""></c<></td></c≦10pf<>	10pF <c< td=""></c<>

### **5**RATED VOLTAGE

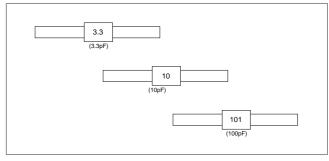
Code	DC Rated voltage (V)
50	50
100	100
200	200

#### **PACKAGING CODE**

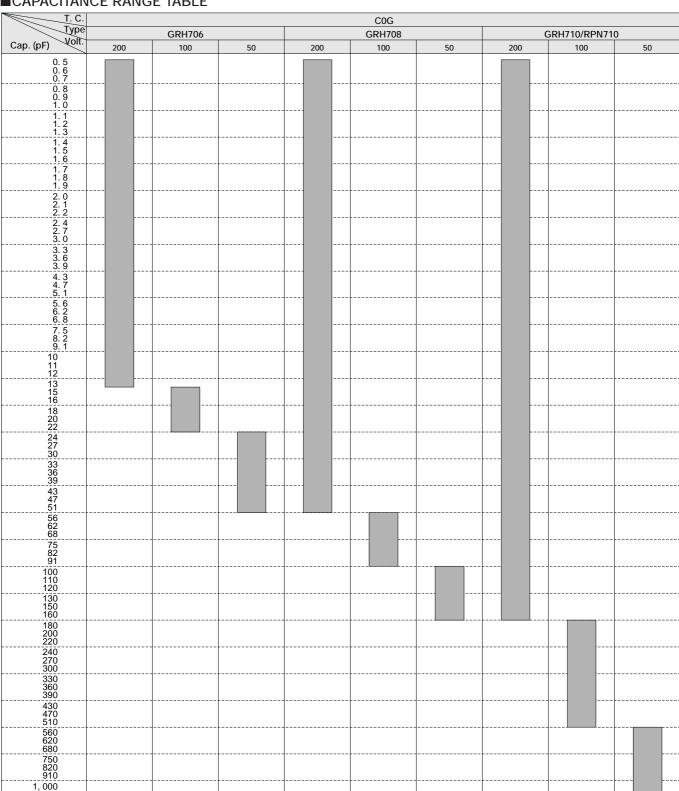
Code	Packaging			
PB	Bulk packaging in a bag			
PT	Tape carrier packaging (for only GRH type)			

#### **■**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.



# **■**CAPACITANCE RANGE TABLE



# **■**CAPACITANCE TOLERANCE

5pF and below  $\cdots$  C:  $\pm 0.25$ pF Over 5pF, 10pF and below  $\cdots$  D:  $\pm 0.5$ pF More than 10pF  $\cdots$  J:  $\pm 5\%$ 

### ■PACKAGING TYPES/QUANTITY

17.010.10110111111111111111111111111111						
Туре	Bulk (pcs./bag)	Taping (pcs./φ178mm/reel)				
GRH706	1,000	_				
GRH708	1,000	3,000				
GRH710	1,000	2,000				
RPN710	100	_				

# Temperature Compensating Type

No.			Specification	Test Method	
1	Operating	I ure Range	−55°C to +125°C		
2	Rated Vol		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, VP-P or VO-P, whichever is larger, shall be maintained within the rated voltage range.	
3	- ' '		No defects or abnormalities.  Within the specified dimension.	Visual inspection. Using calipers.	
5			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 (I.R.)	Resistance	10,000M $\Omega$ 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	Capacitar	nce	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="" 5,000<br="" :="" q≥="">470pF<c≦1,000pf 3,000<br="" :="" q≥="">C : Nominal Capacitance (pF)</c≦1,000pf></c≦>	Char. C0G (1,000pF and below)  Frequency 1±0.1MHz  Voltage 0.5 to 5Vr.m.s.	
		Capacitance Variation Rate	Within the specified tolerance. (Table A-6)	The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance shall be	
		Temperature Coefficient	Within the specified tolerance. (Table A-6)	within the specified tolerance for the temperature coefficient and capacitance change as Table A-6.	
9	Capacitance Temperature Characteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	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.  The capacitance change shall be measured after 5 min. at each specified temperature stage.  Step Temperature (°C)  1 25±2 2 -55±3 3 25±2 4 125±3 5 25±2	
	Terminal	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. 1j using solder containing 2.5% silver. The soldering shall be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N* force in the direction of the arrow.  Fig. 1j *5N (GRH 706)	
10	Strength			The capacitor body is fixed and a load is applied gradually in the axial direction until its value reaches 5N.	
		Bending Strength of lead wire terminal (for micro- strip type)	Lead wire 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.	
		Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (alumina substrate) shown in	
11	Vibration Resistance	Q Q	Within the specified tolerance.  Satisfies the initial value.  C≤ 220pF: Q≥10,000  220pF <c≤ (pf)<="" 3,000="" 470pf:="" 470pf<c≤1,000pf:="" 5,000="" c:="" capacitance="" nominal="" q≥="" td=""><td>Fig.2j 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).</td></c≤>	Fig.2j 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).	

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℃ for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5℃. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.	
13	Resistance to Soldering Heat	The measured and obs specifications in the follow litem Appearance Capacitance Change  Q Dielectric Strength	served characteristics shall satisfy the wing table.  Specification  No marked defect  Within ±2.5% or ±0.25pF  (Whichever is larger)  C≤ 220pF : Q≥10,000  220pF <c≤ (pf)<="" 3,000="" 470pf="" 470pf<c≤1,000pf="" 5,000="" :="" c="" capacitance="" failure="" no="" nominal="" q≥="" td=""><td colspan="2">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.  Chip Size Preheat Condition  2.0×1.25mm max. 1minute at 120 to 150°C  3.2×2.5mm Each 1 minute at 100 to 120°C and then 170 to 200°C</td></c≤>	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.  Chip Size Preheat Condition  2.0×1.25mm max. 1minute at 120 to 150°C  3.2×2.5mm Each 1 minute at 100 to 120°C and then 170 to 200°C	
14	Temperature Cycle	The measured and obsepecifications in the following litem  Appearance Capacitance Change  Q  I.R. Dielectric Strength	served characteristics shall satisfy the	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.    Step	
15	Humidity	The measured and obsepecifications in the followage in th	served characteristics shall satisfy the wing table.  Specification  No marked defect  Within ±5% or ±0.5pF (Whichever is larger)  C≧30pF : Q≧350  10pF≦C<30pF : Q≥275+ ½ C C<10pF : Q≥200+10C  1,000MΩ min.  C : Nominal Capacitance (pF)	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.  C Humidity Humidity 80-98% Humidity 80-98% 90-98% 90-98% Humidity 80-98% Humidity 80-98% 145 145 145 1516 1718 19 2021 222324 — Hours	
16	The measured and observed characteristics shall satisfy the specifications in the following table.    Item		wing table.  Specification  No marked defect  Within ±3% or ±0.3pF (Whichever is larger)  C≥30pF : Q≥350  10pF≤C<30pF : Q≥275+ ½C  C<10pF : Q≥200+10C  1,000MΩ min.	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.	

	Tomporature Coefficient	Capacitance Change from 25℃ Value (%)					
Char.	Temperature Coefficient (ppm/℃) Note 1	<b>−</b> 55°C		-30℃		<b>−10</b> °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 to 125°C.





Solder Coated Type

# GRH/RPN100 Series; HiQ and High-power Type

#### **■**FEATURES

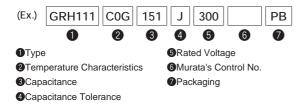
- The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high-frequency applications (VHF-microwave band).
- The series is ultraminiature, yet has a high-power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
- GRH110 type is designed for both flow and reflow soldering and GRH111 type is designed for reflow soldering.
- 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.
- RPN type capacitors are easily soldered and especially well suited in applications where only a soldering iron can be used.

#### **■**APPLICATION

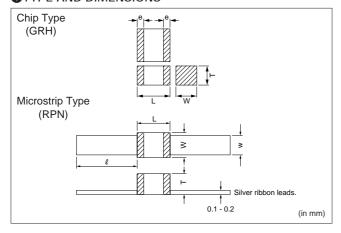
High-frequency and high-power circuits

#### ■PART NUMBERING

(\*Please specify the part number when ordering)



## **1**TYPE AND DIMENSIONS



Type	Dimensions (mm)				
Турс	L	W	T	е	
GRH110	1.4 +0.6	1.4 +0.6	0.8 to 1.65	0.25 +0.25	
GRH111	2.8 +0.6	2.8 +0.6	2.0 to 2.8	0.4 +0.4	

Type	Dimensions (mm)					
Туре	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	

#### **2**TEMPERATURE CHARACTERISTICS

Code	Temp. Coeff.	Temp. Range	Reference Temp.
COG	0±30ppm/℃	-55℃ to +125℃	25℃

#### **3**CAPACITANCE (Ex.)

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

#### **ACAPACITANCE TO FRANCE**

Code	С	D	J
Cap. tolerance	±0.25pF	±0.5pF	±5%
Applied	C≦5pF	5pF <c≦10pf< td=""><td>10pF<c< td=""></c<></td></c≦10pf<>	10pF <c< td=""></c<>

#### **G**RATED VOLTAGE

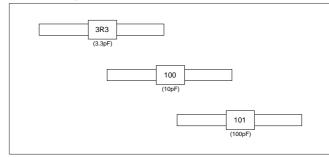
Code	DC Rated voltage (V)
50	50
100	100
200	200
300	300
500	500

#### **PACKAGING CODE**

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

#### ■MARKING

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



#### ■CAPACITANCE RANGE TABLE

T. C. Type			С	0G		
\ \ \	GRH110/RPN110	F00	222	GRH111/RPN111	100	
oup. (p. )	50	500	300	200	100	50
0. 5 0. 6 0. 7						
0. 7		-l				
0. 8 0. 9 1. 0						
1.0						
1. 1 1. 2 1. 3						
1. 4				<del> </del>	<del> </del>	
1. 5 1. 6						
1.7						
1. 8 1. 9						
2. 0 2. 1 2. 2						
2. 1						
2. 4 2. 7 3. 0						
3. 0		-l				
3. 3 3. 6 3. 9						
3. 9						
4. 3 4. 7						
5. 1 5. 6						
5. 6 6. 2 6. 8						
7. 5						
7. 5 8. 2 9. 1						
10						
12						
11 12 13 15 16						
16						
18 20						
22						
27						
33				<del></del>		
36 39						
18 20 22 24 27 30 33 36 39 43 47 51 56 62 68 75 82 91						
47 51						
56 62						
68		<u> </u>				
75 82						
9 <u>1</u> 100				<del> </del>		
110 110 120						
120						
130 150 160						
180				<del> </del>	<del> </del>	
200 220						
240				1		
300						
180 200 220 240 270 300 330 360 390 430 470 510 560 620 680 750 820 910						
390				ļ		
430 470					<u></u>	
510			ļ	<del></del>		
620						
750						
820						
4 000			<b></b>	<del></del>	+	

# ■CAPACITANCE TOLERANCE

5pF and below  $\cdots$  C :  $\pm 0.25$ pF Over 5pF, 10pF and below  $\cdots$  D :  $\pm 0.5$ pF More than 10pF  $\cdots$  J :  $\pm 5\%$ 

### ■PACKAGING TYPES/QUANTITY

Туре	Bulk (pcs./bag)	Taping (pcs./ф178mm/reel)
GRH110	1,000	2,000
GRH111	1,000	1,000
RPN110	100	-
RPN111	50	-

### ■ SPECIFICATIONS AND TEST METHODS

### Temperature Compensating Type

No.	Ite	em	Specification	Test Method		
1	Operating		_55℃ to +125℃			
2	Rated Vol	ure Range tage	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 <sup>p-p</sup> or V <sup>o-p</sup> , whichever is larger, shall be maintained within the rated voltage range.		
3	- ' '		No defects or abnormalities.	Visual inspection.		
5	Dimension Dielectric		Within the specified dimension.  No defects or abnormalities.	Using calipers.  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.) Capacitan	25℃ 125℃ nce	C≦ 470pF :1,000,000MΩ min. 470pF <c≦1,000pf 100,000mω="" :="" min.<br="">C≦ 470pF : 100,000MΩ min. 470pF<c≦1,000pf 10,000mω="" :="" min.<br="">Within the specified tolerance.</c≦1,000pf></c≦1,000pf>	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.  The capacitance/Q shall be measured at 25°C at the frequency		
8	Q		C≦ 220pF: Q≧10,000 220pF <c≦ 470pf:="" 5,000<br="" q≧="">470pF<c≦1,000pf: 3,000<br="" q≧="">C: Nominal Capacitance (pF)</c≦1,000pf:></c≦>	and voltage shown in the table.  Char. COG (1,000pF and below)  Frequency 1±0.1MHz  Voltage 0.5 to 5Vr.m.s.		
		Capacitance Variation Rate	Within the specified tolerance. (Table A-7)	The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance shall be		
9	Capacitance Temperature Characteristics	iture	Within the specified tolerance. (Table A-7)	within the specified tolerance for the temperature coefficient and capacitance change as Table A-7.  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.  The capacitance change shall be measured after 5 min. at each specified temperature stage.  Step  Temperature (°C)		
			(Whichever is larger)	1 25±2 2 -55±3 3 25±2 4 125±3 5 25±2 Solder the capacitor to the test jig (alumina substrate) shown in		
	Torminal	Adhesive Strength of Termination (for chip type)	No removal of the terminations or other defects shall occur.	Fig. 1k using solder containing 2.5% silver. The soldering shall be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N force in the direction of the arrow.    10N		
10	Strength	rength Tensile Strength (for microstrip 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 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.		
		Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (alumina substrate) shown in		
11	Vibration Resistance	Capacitance	Within the specified tolerance.   Satisfies the initial value. $C \le 220 pF : Q \ge 10,000$ $220 pF < C \le 470 pF : Q \ge 5,000$ $470 pF < C \le 1,000 pF : Q \ge 3,000$ $C : Nominal Capacitance (pF)$	Fig. 2k 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. 2k  Solder resist Alumina substrate		

No.	Item		Specification	Test Method	
IVO.	пеш		Specification		
12	Solderability of Termination	95% of the terminations i	s 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	The measured and obsectifications in the follows the follows are specifications in the follows are specifications in the follows are specifications in the follows are specifications. The measured and observed and observed are specifications are specifications are specifications.	Specification	Preheat the capacitor at 80 to 100°C for 2 minutes and then at 150 to 200°C for 5 minutes.  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.	
		I.R.	More than 30% of the initial specification value at 25℃.		
		Dielectric Strength	No failure		
			C : Nominal Capacitance (pF)		
		The measured and obs	served characteristics shall satisfy the	Fix the capacitor to the supporting jig in the same manner and	
		specifications in the follo		under the same conditions as (11). Perform the five cycles	
		Item	Specification	according to the four heat treatments listed in the following table.	
		Appearance	No marked defect	Then, repeat twice the successive cycles of immersion, each	
		Capacitance	Within ±1% or ±0.25pF	cycle consisting of immersion in a fresh water at 65 $^{+5}_{-0}$ °C for 15	
		Change	·	minutes and immersion in a saturated uqueous solution of salt at	
14	Temperature Cycle	Change	(Whichever is larger) C≦ 220pF : Q≥10,000	0±3°C for 15 minutes.	
14	remperature Cycle	Q	C≦ 220pr : Q≤10,000 220pF <c≤ 470pf="" 5,000<="" :="" q≥="" td=""><td>The cpapcitor is promptly washed with running water, dried with a</td></c≤>	The cpapcitor is promptly washed with running water, dried with a	
		Q	470pF <c≦1,000pf 3,000<="" :="" q≥="" td=""><td>dry cloth, and allowed to sit at room temperature for 24±2 hours.</td></c≦1,000pf>	dry cloth, and allowed to sit at room temperature for 24±2 hours.	
		I.R.	More than 30% of the initial specification value at 25°C.	Step 1 2 3 4	
		Dielectric Strength	No failure	Temp. (℃) −55 <sup>+0</sup> <sub>-3</sub> Room Temp. +125 <sup>+3</sup> <sub>-0</sub> Room Temp.	
			C : Nominal Capacitance (pF)	Time (min.) 30±3 2 to 3 30±3 2 to 3	
		The measured and obs	served characteristics shall satisfy the	Apply the 24-hour heat (-10 to +65°C) and humidity (80 to 98%)	
		specifications in the follo		treatment shown below, 10 consecutive times. Remove, set for	
		-		·	
		Item	Specification	24±2 hours at room temperature, and measure.	
		Appearance	No marked defect	Humidity Humidity  C Humidity 80−98% Humidity 80−98%	
		Capacitance	Within ±5% or ±0.5pF	70 90-98%	
		Change	(Whichever is larger)	65 / / / / / / / / / / / / / / / / / / /	
		Q	C≦ 220pF: Q≥10,000 220pF <c≤ 470pf:="" 5,000<="" q≥="" td=""><td>60 / / / / / / / / / / / / / / / / / / /</td></c≤>	60 / / / / / / / / / / / / / / / / / / /	
			470pF <c≦1,000pf 3,000<="" :="" q≥="" td=""><td>50 45 2 40</td></c≦1,000pf>	50 45 2 40	
15	Humidity	I.R.	More than 30% of the initial specification	문 35	
			value at 25℃.	ğ 30 E 25	
			C : Nominal Capacitance (pF)	±0 20 +10 c	
				15	
				10 Initial measurement 5	
				0 Applied voltage 50Vdc	
				-5	
				One cycle 24 hours	
				0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 2021 22 23 24	
				U 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 16 19 2021 22 23 24  → Hours	
			served characteristics shall satisfy the	Apply 150% of the rated voltage for 2,000±12 hours at 125±3℃.	
		specifications in the follo	wing table.	Remove and set for 24±2 hours at room temperature, then	
		Item	Specification	measure.	
		Appearance	No marked defect	The charge/discharge current is less than 50mA.	
		Capacitance	Within ±2.5% or ±0.25pF		
	High Temperature	Change	(Whichever is larger)		
16	Load	J-	C≦ 220pF : Q≧10,000		
		Q	220pF <c≤ 470pf="" 5,000<="" :="" q≥="" td=""><td></td></c≤>		
			470pF <c≦1,000pf 3,000<="" :="" q≧="" td=""><td></td></c≦1,000pf>		
			More than 30% of the initial specification		
		I.R.	value at 25°C.		
			C : Nominal Capacitance (pF)		

#### Table A-7

	Town Cooff	Capacitance Change from 25℃ Value (%)					
Char.	Temp. Coeff. (ppm/℃) Note 1	<b>−55℃</b>		−30°C		−10°C	
	(pp.11.) <b>3</b> ) 11313 1	Max.	Min.	Max.	Min.	Max.	Min.
COG	0+30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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



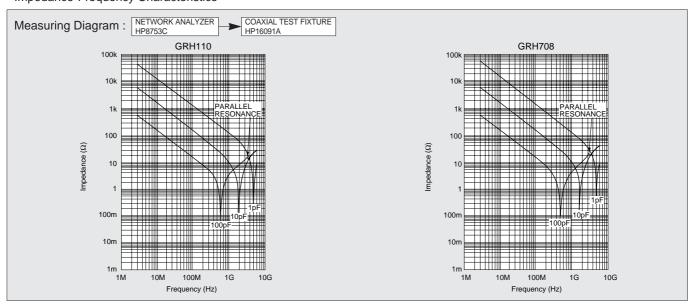
# MONOLITHIC CERAMIC CAPACITOR



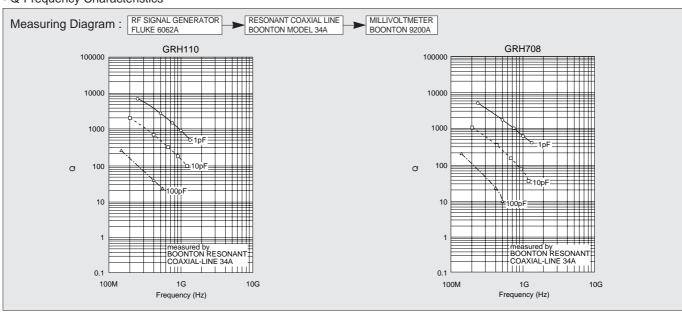
Solder Coated Type
GRH/RPN700 Series and GRH/RPN100 Series

#### **■**CHARACTERISTICS

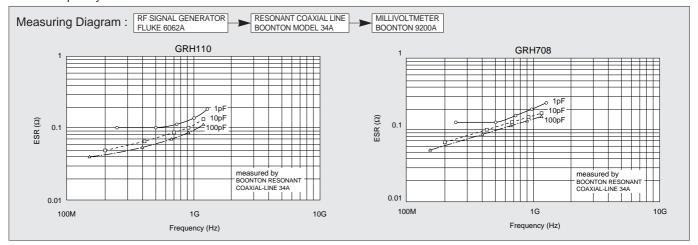
• Impedance-Frequency Characteristics



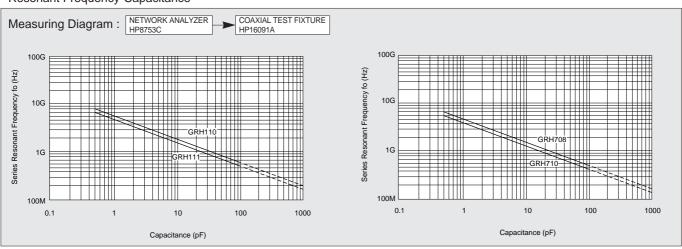
#### • Q-Frequency Characteristics



#### • 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 capacitor) by its F.C.P. Torrespond to a fitting of the capacitor.

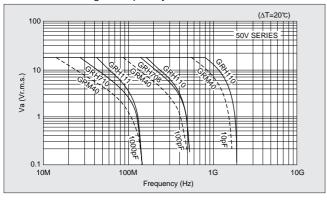
capacitor, the capacitor generates heat (power consumption) by its E.S.R. Temperature rise of the capacitor ( $\Delta T$ ) should be kept below 20°C ( $\Delta T \leq 20$ °C) in the actual circuit.

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

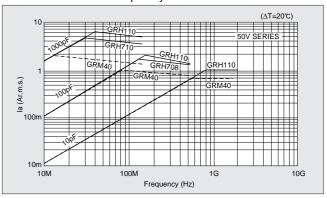
#### Effective power at ∆T=20°C is as follows

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

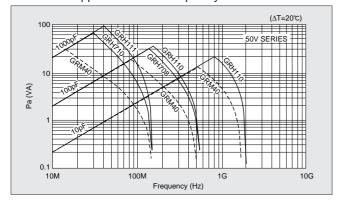
#### Allowable Voltage-Frequency



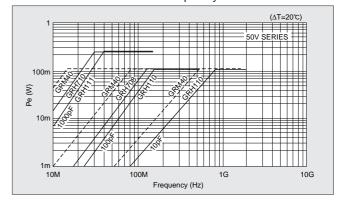
#### • Allowable Current-Frequency



#### Allowable Apparent Power-Frequency



#### Allowable Effective Power-Frequency







### MONOLITHIC CERAMIC CAPACITOR



Silver Termination Type

**GR500** Series ; Medium voltage

#### **■**FEATURES

- 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

- 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.	
COG	Capacitance Temp. Coefficient : 0±30ppm/℃	

Temperature Range : -55<sup>℃</sup> to +125<sup>℃</sup>

Standard Temperature : 25℃

#### 3 Nominal Capacitance (Ex.)

Code	Capacitance (pF)		
100	10		
101	100		
222	2,200		
683	68,000		
334	330,000 (=0.33μF)		
	· · · · · · · · · · · · · · · · · · ·		

#### **4** Capacitance Tolerance

Cod	e S	tandards	Condition
F		± 1pF	10pF and below
K		±10%	More than 10pF

#### **5**Rated Voltage

	3
Code	DC Rated Voltage (V)
500	500
1K	1k
2K	2k
3K	3.15k
4K	4k

#### 6Murata's Control No.

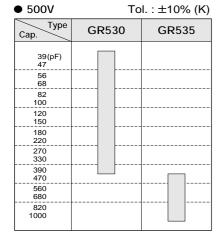
Packaging Code Bulk Packaging : PM

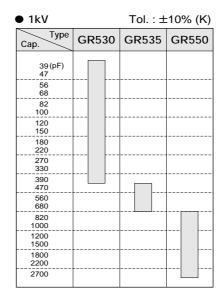
#### **■**DIMENSIONS

Туре	Annogranco	Dimensions (mm)				
Туре	Appearance	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	

#### **■**CAPACITANCE RANGE TABLE

### Temperature Characteristic: C0G





● 2kV		Tol.: ±	:10% (K)
Type Cap.	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			

● 3.15kV

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

● 3.15KV		±1pF (F) for capacitance 10pF.			
Type Cap.	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					

Tol. :  $\pm 10\%$  (K)  $\pm 1$ pF (F) for capacitance 10pF. 4kV 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

<sup>\*</sup>The standard tolerance for C0G is K%, but the tolerance J% is also available.

#### **■**CAPACITANCE RANGE TABLE

### Temperature Characteristic : X7R

● 500V Tol. : ±10% (K)

			1011 = 1070 (11)
Type Cap.	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			

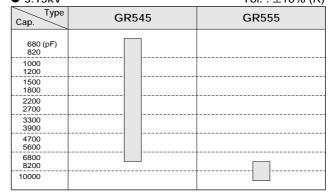
• 1kV		Tol. : ±10% (K)

Type Cap.	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			

● 2kV Tol.: ±10% (K)

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

● 3.15kV Tol. : ±10% (K)



### ■ SPECIFICATIONS AND TEST METHODS

### Temperature Compensating Type

No.	Ite	em	Specification	Test Method				
1	Operating Temperat	l ure Range	−25°C to +85°C					
2	Rated Vol	tage	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 <sup>p,p</sup> or V <sup>o,p</sup> , whichev is larger, shall be maintained within the rated voltage range.				
3	Appearan	ce	No defects or abnormalities.	Visual inspection.				
4	Dimension	ns	Within the specified dimension.	Using calipers.  No failure shall be observed when a voltage of 150% of the rated				
5	Dielectric	Strength	No defects nor abnormality.	voltage are applied between electrodes in a circuit as shown in Fig.1l 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				
6	Resistance		10,000M $\Omega$ min. or 100 $\Omega$ · 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.  DC Rated voltage DC Voltage applied  WV : 500V 500V  WV≥1kV 1kV				
7	Capacitar	nce	Within the specified tolerance.	The capacitance/Q shall be measured at 25℃ with the frequency				
8	Q		30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	and voltage shown in the table.  Char. C0G, C0G, Item (1,000pF and below) (more than 1,000pF)  Frequency 1±0.2MHz 1±0.2kHz  Voltage 5Vr.m.s. max. 5Vr.m.s. max.				
		Capacitance Variation Rate	Within the specified tolerance. (Table A-8)	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				
		Temperature Coefficient	Within the specified tolerance. (Table A-8)	+125°C shall be within the specified tolerance for the temperature coefficient. −55 to +25°C shall be within the tolerance for				
9	Capacitance Temperature Characteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	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).  The capacitance change shall be measured after 5 min.at each specified temperature stage.  Step Temperature (°C)  1 25±2 2 -55±3 3 25±2 4 125±3 5 25±2				
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.  Capacitor  Alumina with purity of more than 95% (Min. thickness: 0.6mm)  95% (Min. thickness: 0.6mm)  Holding Time: 10±1sec.				

No.	Item	n		Specification	Test Method	
			No defects as above 19	<u> </u>		
	_	Appearance Capacitance	No defects or abnormality.  Within the specified tolerance.		Solder the capacitor on the testing jig (alumina substrate) shown in Fig. 3I by solder containing 2.5% silver. The soldering shall be done	
11	Vibration Resistance		Satisfies the initial value.  30pF min.: Q≥1,000  30pF max.: Q≥400+20C  C: Nominal Capacitance (pF)		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 t specified values after applying vibration which takes about 1 minut to be transmitted from 10Hz to 55Hz and back to 10Hz for a total six hours (two hours each in three mutually perpendicular directions).  Solder resist Ag/Pd  Alumina substrate  Fig. 3I	
12	Solderability of Termination			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℃ after preheating for 5 minutes at 80 to 100℃ and then 1 to 2 minutes at 160 to 170℃.	
			The measured values sh	all satisfy the values in the following table.	Immerse the capacitor in solder containing 2.5% silver of 260±5℃	
			Item	Specification	for 5±0.5 seconds after preheating for 5 minutes at 80 to 100°C	
			Appearance	No marked defect	and then for 1 to 2 minutes at 160 to 170°C. Set it for 24±2 hours	
	Resistance to Soldering Heat		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	at room temperature, then measure.	
13				30pF and over : Q≥1,000		
			Q	30pF and below : Q≥400+20C		
			I.D.	More than $10,000M\Omega$ or $100\Omega \cdot F$		
			I.R.	(Whichever is smaller)		
			Dielectric Strength	No failure		
				C : Nominal Capacitance (pF)		
			The measured values sh	all satisfy the values in the following table.	Fix the capacitor to the supporting jig in the same manner and	
			Item	Specification	under the same conditions as (11) and conduct the five cycles	
			Appearance	No marked defect	according to the temperatures and time shown in the following	
			Capacitance	Within ±2.5% or ±0.25pF	table. Set it for 24±2 hours at room temperature, then measure.	
1.1	T	0	Change	(Whichever is larger)	Step         1         2         3         4	
14	Temperatur	re Cycle	Q	30pF and over : Q≥1,000 30pF and below : Q≥400+20C	Temp. (°C) $-25^{+O}_{-3}$ Room Temp. $+85^{+3}_{-O}$ Room Temp.	
				More than $10,000M\Omega$ or $100\Omega \cdot F$	Time (min.) 30±3 2 to 3 30±3 2 to 3	
			I.R.	(Whichever is smaller)		
			Dielectric Strength	No failure		
				C : Nominal Capacitance (pF)		
			The measured values sh	all satisfy the values in the following table.	Set the capacitor for 500 <sup>+24</sup> <sub>-0</sub> hours at 40±2°C, in 90 to 95%	
			Item	Specification	humidity. Take it out and set it for 24±2 hours at room temperature,	
			Appearance	No marked defect	then measure.	
			Capacitance	Within ±5% or ±0.5pF		
	Humidity		Change	(Whichever is larger)		
15	(Steady Sta	ate)		30pF and over : Q≧350		
			Q	10pF and over, 30pF and below : $Q \ge 275 + \frac{5}{2}C$ 30pF and below : $Q \ge 200 + 10C$		
				More than 1,000M $\Omega$ or 10 $\Omega$ · F		
			I.R.	(Whichever is smaller)		
				C : Nominal Capacitance (pF)		
			The measured values sh	all satisfy the values in the following table.	Apply a voltage of 125 % of the rated voltage for 1000 ±48 hours at	
			Item	Specification	85±3℃ and set it for 24±2 hours at room temperature, then	
			Appearance	No marked defect	measure. The charge/discharge current is less than 50mA.	
			Capacitance	Within ±3% or ±0.3pF		
			Change	(Whichever is larger)		
16	High Tempe	erature		30pF and over : Q≧350		
.0	Load		Q	10pF and over, 30pF and below : Q≥275+5/2C		
				10pF and below : Q≥200+10C		
			I.R.	More than $2,000M\Omega$ or $20\Omega \cdot F$		
			Dielectric Strength	(Whichever is smaller)  No failure		
			Dielectric Strength			
17	Notice		When mounting conseits	C : Nominal Capacitance (pF)	1 mm thicknoss)	
17	Notice		vvnen mounting capacito	or, perform the epoxy resin coating (min. 0.	mim unickness).	

#### Table A-8

	Temp. Coeff.	Capacitance Change from 25℃ Value (%)						
Char.	(ppm/℃) Note1	<b>−55℃</b>		-30℃		<b>−10</b> ℃		
		Max.	Min.	Max.	Min.	Max.	Min.	
COG	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11	

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

### ■SPECIFICATIONS AND TEST METHODS

### High Dielectric Constant Type

No.	Ite	em	Specification	Test Method	
1	Operating Temperati	I ure Range	−25°C to +85°C		
2	Rated Vol	tage	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 <sup>p,p</sup> or V <sup>o,p</sup> , whicheve is larger, shall be maintained within the rated voltage range.	
3	Appearan		No defects or abnormalities.	Visual inspection.	
4	Dimension	ns	Within the specified dimension.	Using calipers.	
5	Dielectric	Strength	No defects 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.1m 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	
6	Insulation 6 Resistance (I.R.)		10,000M $\Omega$ min. or 100 $\Omega$ · 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.  DC Rated voltage DC Voltage applied  WV : 500V 500V  WV≥1kV 1kV	
7	Capacitar	anacitance Within the specified tolerance		The capacitance shall be measured at 25°C with 1±0.2kHz in frequency and 1±0.2Vr.m.s. in voltage.	
8	Dissipation Factor 0.025 max.		0.025 max.	D.F. shall be measured under the same conditions as the capacitance.	
9	Capacitance 7 Temperature Characteristics		$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	The range of capacitance change in reference to 25°C within the temperature range shown in the table shall be within the specified ranges.	
10	Adhasive Strength		No removal of the terminations or other defect shall occur.	Solder a capacitor to test jig (alumina substrate) shown in Fig. 2r 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 5 "force" is imposed to the capacitor in the direction of the arrow.  Capacitor  Alumina with purity of more than 95% (Min. thickness: 0.6mm)  Fig. 2m  Fig. 2m	
		Appearance	No defects or abnormality.	Solder the capacitor on the testing jig (alumina substrate) shown in	
11	Capacitance		Within the specified tolerance.  0.025 max.	Figs. 3m 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).  Solder resist  Ag/Pd  Alumina substrate  Fig. 3m	
12	Solderabil Terminatio	-	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.	

No.	Item		Specification	Test Method
		The measured values shall satisfy the values in the following table.		The capacitor shall be set for 24±2 hours at room temperature after one hour heat of treatment at 150 <sup>+</sup> <sub>.10</sub> °C. Immerse the
		Item	Specification	capacitor in solder containing 2.5% silver of 260±5℃ for 5±0.5
	Posistanco	Appearance	No marked defect	seconds after preheating for 5 minutes at 80 to 100°C and then for
13	Resistance	Capacitance Change	Within ±7.5%	1 to 2 minutes at 160 to 170°C. Then set it for 48±4 hours at room
13	to Soldering Heat	I.D.	More than $10,000M\Omega$ or $100\Omega \cdot F$	temperature and measure.
		I.R.	(Whichever is smaller)	
		D.F.	0.025 max.	
		Dielectric Strength	No failure	
		The measured values shatable.	all satisfy the values in the following	The capacitor shall be set for 24±2 hours at room temperature after one hour heat of treatment at 150 <sup>+</sup> <sub>-10</sub> °C then measure for
		Item	Specification	the initial measurement. Fix the capacitor to the supporting jig in
		Appearance	No marked defect	the same manner and under the same conditions as (11) and
		Capacitance Change	Within ±7.5%	conduct the five cycles according to the temperatures and time
14	Temperature Cycle	I.R.	More than $10,000M\Omega$ or $100\Omega \cdot F$	shown in the following table. Set it for 24±2 hours at room
			(Whichever is smaller)	temperature, then measure.
		D.F.	0.025 max.	Step 1 2 3 4
		Dielectric Strength	No failure	Temp. (°C) $-25^{+\circ}_{-3}$ Room Temp. $+85^{+\circ}_{-0}$ Room Temp.
				Time (min.) 30±3 2 to 3 30±3 2 to 3
		The measured values shatable.	all satisfy the values in the following	The capacitor shall be set for 24 $\pm$ 2 hours at room temperature after one hour heat of treatment at150 $^{+}_{10}$ °C, then measure for the initial
		Item	Specification	measurement. Set the capacitor for 500 <sup>+24</sup> / <sub>0</sub> ℃ hours at 40±2℃, in
		Appearance	No marked defect	90 to 95% humidity. Take it out and set it for 24±2 hours at room
15	Humidity	Capacitance Change	Within ±10%	temperature, then measure.
15	(Steady State)	I.R.	More than 1,000M $\Omega$ or 10 $\Omega$ · F	
			(Whichever is smaller)	
		D.F.	0.05 max.	
		Dielectric Strength	No failure	_
		The measured values sha table.	all satisfy the values in the following	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±3°C
		Item	Specification	then it shall be set for 24±2 hours at room temperature and the
		Appearance	No marked defect	initial measurement shall be conducted. Then apply the above
16	High Temperature	Capacitance Change	Within ±12.5%	mentioned voltage continuously for 1000 <sup>+48</sup> / <sub>0</sub> hours at the same
	Load	I.R.	More than $2,000M\Omega$ or $20\Omega \cdot F$	temperature, remove it from the bath, and set it for 24±2 hours at
			(Whichever is smaller)	room temperature, then measure. The charge/discharge current is
		D.F.	0.05 max.	less than 50mA.
		Dielectric Strength	No failure	<b>」</b>
47	N. P.	14/1		
17	Notice	When mounting capacito	r, perform the epoxy resin coating (min.	. U.1mm 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 GM250/GR500 Series) Minimum Quantity\*

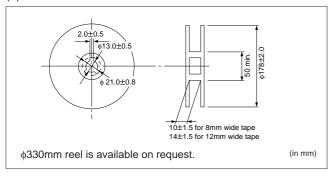
Туре	Minimum Quantity (pcs./bag or tray)
GRM33, GR(M)36, GR(M)39, GR(M)40, GR(M)42-6, GR(M)42-2, GR(M)43-2, GR(M)44-1, GRM420, GRM425, GRM430, GRM435, GRM220, GRM615, GNM30-401, LL0306, LL0508, LL0612 GRH110, GRH111, GRH706, GRH708, GRH710	1,000
RPN710	100
RPN110, RPN111, GR530, GR535	50
GR540, GR545, GR550	20
GR555, GR580	40
GM250, GM260	400

<sup>\* &</sup>quot;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

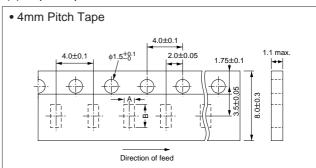
Packaging code: PT

#### (1) Dimensions of Reel



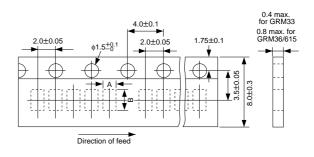
#### (2) Dimensions of Tape

#### (a) Paper Tape



	GR(M)39 GRM420 GRM220 LL0306	GR(M)40 GRM425 LL0508 (T≦1.0mm)	GR(M)42-6 GRM430 GNM30-401 LL0612 (T≦1.0mm)	GRM42-2 (T=8.5mm)
Α	1.05±0.1	1.55±0.15	2.0±0.2	2.8±0.2
В	1.85±0.1	2.3 ±0.15	3.6±0.2	3.6±0.2

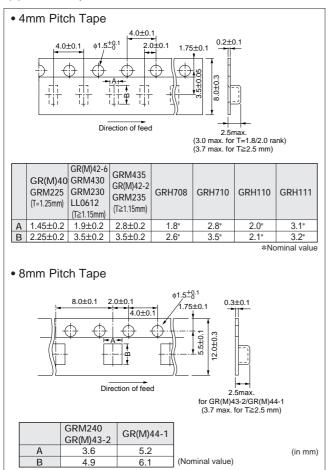
#### • 2mm Pitch Tape



	GRM33	GRM615 GR(M)36		
Α	0.37	0.65		
В	0.67	1.15	(Nominal value)	
			-	(in mm)

#### **PACKAGE**

#### (b) Plastic Tape



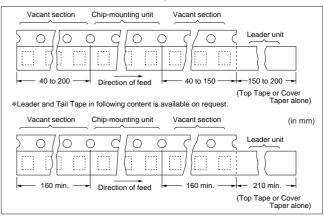
#### (3) Minimum Quantity\*

Tuno	Chip	Minimum Quar	ntity* (pcs./reel)
Туре	Thickness	φ178 mm reel	\$330 mm reel
GRM33	All	15,000	_
GR(M)36, GRM615	All	10,000	50,000
GR(M)39, GR(M)40, GR(M)42-6,			
GR(M)42-2, GRM420, GRM425,	1.0mm max.	4,000	10,000
GRM430, GRM220			
GR(M)40, GR(M)42-6, GR(M)42-2			
GRM430, GRM225, GRM230	1.15/1.25mm	3,000	10,000
LL0612			
GRH708	All	3,000	_
GR(M)42-2, GRM235	1.35mm	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	1.000	4,000
GR(IVI)43-2, GR(IVI)44-1	2.0mm	1.000	4,000
GRM42-2, GRM235	1.8mm	1,000	_
GRM42-6, GRM235	1.6mm	2,000	6,000
GRM42-2, GRM435	2.5mm	1,000	_
GRM240	2.5mm	500	1,000

#### (4) Others

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

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



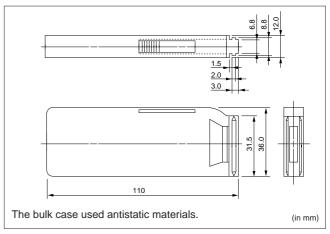
- ③ The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- 4 Missing capacitors number within 0.1% of the number per reel or 1 pc., whichever is greater, and are not continuous.
- ⑤ The top tape and bottom tape shall not protrude beyond the edges of the tape 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	GRM36/615	GRM39	GRM40
0.5 mm	50,000	_	_
0.8 mm	_	15,000	_
0.6 mm	_	_	10,000
1.25 mm	_	_	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

Process Cautions	Control Points				
Storage of     Chip monolithic ceramic capacitors     S	orage environment must be at an ambient temperature of 5-40℃ and an	Data 1			
Chips (chips) can experience degradation a	nbient humidity of 20-70% RH.	Solderability			
of termination solderability when	se chips within 6 months. If 6 months or more have elapsed, check				
subjected to high temperature or s	Iderability before use.				
humidity, or if exposed to sulfur or • F	or GR series and GR500 series, do not unpack the minimum package until				
chlorine gases.	mediately before use. After unpacking, re-seal promptly or store with a				
d	siccant.				
• A	roid mechanical shock (ex. falling) to the capacitor to prevent mechanical				
	acking inside of the ceramic dielectric due to its own weight.				
Circuit     • These capacitors on this catalog are					
Design not safety recognized products.					
	hen designing substrates, take land patterns and dimensions into consideration				
	eliminate the possibility of excess solder fillet height.	Board bending			
flexing stresses since they are		strength for			
-	attern Forms]	solder fillet height			
They are also more sensitive to	Incorrect Correct	Data 3			
mechanical and thermal stresses than leaded components.	Lead wire	Temperature			
Excess solder fillet height can	Solder resist	cycling for solder			
multiply these stresses and cause	Lead wire Solder resist our group of the state of the sta	fillet height			
chip cracking.		Imot noight			
Simp diagrams.		Data 4			
	Chassis	Board bending			
	Solder (Ground) Solder resist Solder resist Solder resist Felectrode pattern	strength for			
	DO .si resist re	board material			
	or or or or or or or or or or or or or o				
	Electrode pattern				
	7 5 0				
	Components affect chip connection of feaded chip connection of the				
	Lead wire Solder resist				
	Pro 6 6				
	o o m i o i o i o i o i o i o i o i o i				
	Solder resist				
	d Dimensions]				

#### [Land Dimensions]

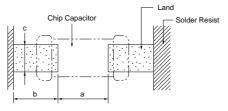


Table 1 Flow soldering method

(in mm)

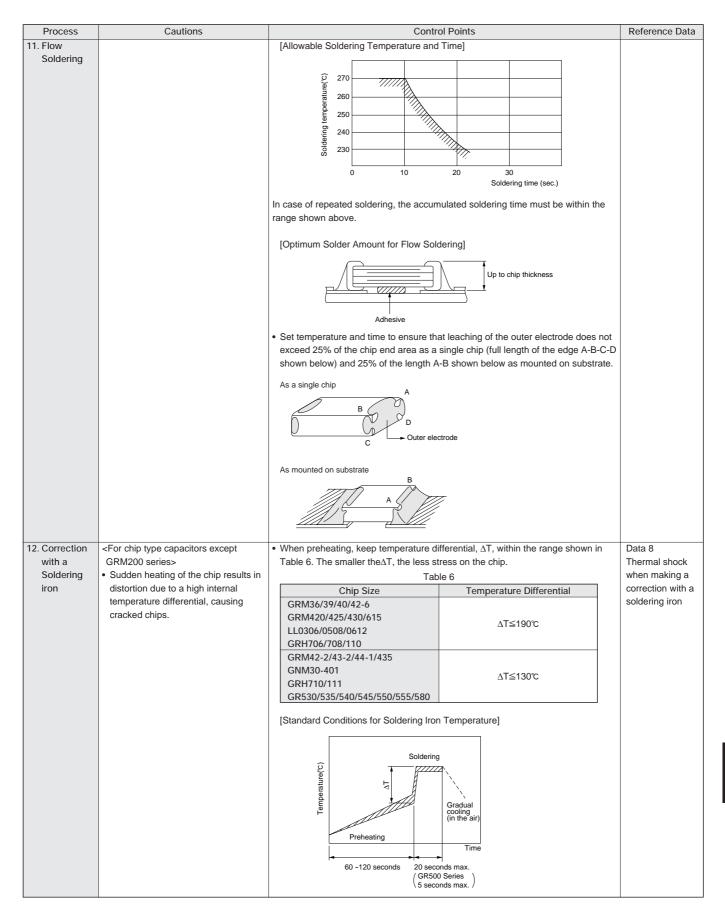
		•							, ,
		GRM39 GRM420	GRM40 GRM425	GRM42-6 GRM430	LL0508	LL0612	GRH706	GRH708	GRH110
Dimen-	L	1.6	2.0	3.2	1.25	1.6	1.25	2.0	1.4
sions	W	0.8	1.25	1.6	2.0	3.2	1.0	1.25	1.4
а		0.6-1.0	1.0-1.2	2.2-2.6	0.4-0.7	0.6-1.0	0.4-0.6	1.0-1.2	0.5-0.8
b		0.8-0.9	0.9-1.0	1.0-1.1	0.5-0.7	0.8-0.9	0.6-0.8	0.9-1.0	0.8-0.9
С		0.6-0.8	0.8-1.1	1.0-1.4	1.4-1.8	2.6-2.8	0.8-1.0	0.8-1.0	1.0-1.2

Process	Cautio	ns					Cor	ntrol Poir	nts				Refe	rence Data
3. PCB	Table 2 R	eflow sol	dering meth	od									(in mm	)
Design			M33 GRM3	GRM39	GRM40 GRM425 GRM225		GRM42-2 GRM235 GRM435		GRM44-1	LL0306	LL0508	LL0612	GRH706	, 
	Dimen-		6 1.0	1.6	2.0	3.2	3.2	4.5	5.7	0.8	1.25	1.6	1.25	
	sions		3 0.5	0.8	1.25	1.6	2.5	3.2	5.0	1.6	2.0	3.2	1.0	
	a b	0.2	0.3   0.3 -0.5 0.35   0.35-0.5		1.0-1.2 0.6-0.7	2.2-2.4 0.8-0.9	2.0-2.4 1.0-1.2	3.0-3.5 1.2-1.4	4.0-4.6 1.4-1.6	0.2-0.4	0.4-0.6 0.3-0.5	0.6-0.8	0.4-0.6 0.6-0.8	
	C	0.2		_	0.8-1.1	1.0-1.4	1.8-2.3	2.3-3.0	3.5-4.8	1.0-1.4	1.4-1.8	2.6-2.8	0.8-1.0	
		0.2	0.1   0.1 0.	0.0 0.0	0.0 1.1	1.0 1.1	1.0 2.0	2.0 0.0	0.0 1.0	1.0 1.1	1.1 1.0	2.0 2.0	0.0 1.0	
		GR	1708 GRH71	0 GRH110	GRH111	GR530	GR535	GR540	GR545	GR550	GR555	GR580		
	Dimen-	L 2		1.4	2.8	4.5	5.6	10.6	10.6	11.8	16.0	28.1		
	sions		25 2.5	1.4	2.8	3.8	5.0	5.0	10.0	10.6	5.0	13.2		
	a		1.2 2.2-2.		1.8-2.1	3.2-3.4	4.2-4.5	8.5-9.0	8.5- 9.0			25.0-25.5		
	b c		0.8 0.8-1. 1.0 1.9-2.		0.7-0.9 2.2-2.6	0.9-1.2 3.0-3.8	0.9-1.2 4.0-5.0	1.3-1.5 4.0-5.0	1.3- 1.5 8.0-10.0	1.8-2.0 8.0-10.0		2.2- 2.4 10.0-13.0		
	C	0.0	1.0   1.3-2.	1.0-1.2	2.2-2.0	3.0-3.0	4.0-3.0	4.0-3.0	0.0-10.0	0.0-10.0	4.0- 3.0	10.0-13.0	l	
	Table 3 G	NM Seri	s for reflow	soldering	method									
				_				Dimen	sions (mi	m)				
	CH	nip Capacito	r a	Ту	pe	L	W	а	b	С	:	d		
	لها.		<del>       </del>	GNM3	80-401	3.2	1.6	0.8-1.0	0.7-0	.9 0.3-	0.4 0.4	l-0.5		
			b											
	c d		Land											
			•	Choose a flexing or		• •		nimizes t	he stress	imposed	d on the c	chip durin	g	
				[Compon	ent Direc	tion]			4			1		
									A to	the direc		tai		
				[Chip Mo	unting CI	ose to Bo	oard Sepa	aration po	oint]					
						ation B	00000			nip arranç orst A-C-	gement ·(B≃D) B	est		
4. Solder Paste Printing	<ul> <li>Overly thick applicate paste results in excessolder.</li> </ul>			Make sur 0.2mm m		der has b	een appl	ied smoo	othly to th	e end su	rface to a	a height o	of	
Timung	This makes the chip susceptible to mech thermal stress on the cause cracked chips.  Too little solder pas lack of adhesive structure electrode, whi	anical ar e board as. te results ength on ch may r	in a the esult in	[Optimum	n Solder /	Amount f	or Reflow	Solderin		0.2mm min.				
	chips breaking loose	e from the	PCB.											

8

Process	Cautions	Control Points	Reference Data
5. Chip Placing	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> <li>Adjust the suction nozzle's bottom dead point by correcting warps in the board.</li> <li>Correct         <ul> <li>Support pin</li> <li>Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board.</li> <li>Nozzle pressure for chip mounting must be a 1 to 3N static load.</li> <li>The suction nozzle and the locating claw must be maintained, checked and replaced periodically.</li> </ul> </li> </ul>	Data 5 Break Strength
6. Reflow Soldering	Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips.	When preheating, keep temperature differential, ΔT, within the range shown in Table 4. The smaller the ΔT, the less stress on the chip.      Table 4      Chip Size Temperature Differential     GRM33/36/39/40/42-6     GRM420/425/430/615     GRM220/225/230     LL0306/0508/0612	
		GRH706/708/110 GRM42-2/43-2/44-1/240/435 GRH710/111 GRM235/GNM30-401 GR530/535/540/545/550/555/580  • 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.  [Standard Conditions for Reflow Soldering]  • Infrared reflow  Soldering  Gradual cooling (in the air)  Preheating  Preheating  Preheating  O seconds min.  120 seconds max.  GRS00 Series 20 seconds max.	
		[Allowable Soldering Temperature and Time]    Soldering Temperature and Time]   GRM   VLL   /GNM   Series   GRH	
Inverting the PCB		Make sure not to impose an abnormal mechanical shock on the PCB.	

Process	Cautions	Control Points	Reference Data
7. Adhesive Application	<ul> <li>Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered.</li> <li>Low viscosity adhesive causes chips to slip after mounting.</li> </ul>	<ul> <li>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.     </li> <li>Adhesive must have a viscosity of 500ps (at 25°C) min.</li> </ul> Chip capacitor <ul> <li>a : 20 to 70 μm</li> <li>b : 30 to 35 μm</li> <li>c : 50 to 105 μm</li> <li>d : 40 to 70 μm</li> <li>d : 30 to 35 μm</li> <li>c : 70 to 105 μm</li> </ul>	
8. Adhesive Curing	Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption.	Control curing temperature and time in order to prevent insufficient hardening.	
Inverting the board		Make sure not to impose an abnormal mechanical shock on the PCB	
9. Leaded Component Insertion	If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.	Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping.	
10. Flux Application	<ul> <li>An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability.</li> <li>Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned.</li> </ul>	<ul> <li>Apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).</li> <li>Use flux with a halide content of 0.2wt% max. But do not use strongly acidix flux.</li> <li>Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned.</li> </ul>	
11. Flow Soldering	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> <li>When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 5. The smaller the ΔT, the less stress on the chip.</li> <li>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 5.</li> <li>Do not apply flow soldering to chips not listed in Table 5.         Table 5         Chip Size             Temperature Differential             GRM39/40/42-6             GRM420/425/430             LL0508/0612             GRH706/708/110         </li> </ul> <li>[Standard Conditions for Flow Soldering]</li>	Data 6 Thermal shock Data 7 Solder heat resistance



Process	Cautions		Control Points		Reference Data
12. Correction		[Allowable Time and ]	Temperature for Making Cor	rections with a Soldering Iron]	Data 8
with a Soldering iron		The accumulated solder be within the range sho	-	ing reflow/flow soldering must	Thermal shock when making a correction with a
		When correcting chips	ount when Corrections Are N	90 Soldering time (sec.)  Made Using a Soldering Iron]  Up to chip thickness  The heating is required if the chip able 7) are met.	soldering iron
			performed on chips not liste Table 7		
		Item	Cond	itions	
		item	GRM36/39/40	GRM42-6	
		Chin Cina	GRM420/425/615	GRM430	
		Chip Size	LL0306/0508	LL0612	
			GRH706/708/110	GNM30-401	
		Temperature of iron tip	300℃ max.	270℃ max.	
		Soldering iron wattage			
		Diameter of iron tip Restriction	φ 3mm Do not allow the iron tip to dire		
	<for grm200="" series=""></for>	When solder GRM200	) series chip capacitor, keep	the following conditions.	
		<soldering iron="" metho<="" td=""><td>od&gt;</td><td></td><td></td></soldering>	od>		
		Item	Cond		
		Chip type	GRM220	GRM225/230/235/240	
		Pre-heating	no pre-heating is possible	Δ≦130℃	
		Temperature of iron tip	300℃		
		Soldering iron wattage	20W		
		Diameter of iron tip  Soldering time	φ 3mn 5 sec.	n max.	
		Solder amount	≤Chip thickness	≤1/2 of chip thickness	
		Restriction	'	ctly touch the ceramic element.	
	<for microstrip="" types=""></for>	does not directly conta	m the ribbon terminal base, act the capacitor. Preheating ithin 3 seconds with a solde	•	
13. Washing	Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder.	Take note not to vibra	te PCBs.		
14. Inspection	Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints.	Provide support pins of	on the back side of the PCB	to prevent warping or flexing.	
15. Resin Coating		When selecting resin	materials, select those with	low contraction.	
16. Board Separation (or Depane- lization)	Board flexing at the time of separation causes cracked chips or broken solder.	of : Pushback <slitter<< td=""><td></td><td>ne of board break is in the order</td><td></td></slitter<<>		ne of board break is in the order	

# 8

### ■DIE BONDING/WIRE BONDING (GM Series)

#### (1) Die Bonding of capacitors

 Use the following materials Braze alloy:

Au-Si (98/2) 400 to 420°C in  $N_2$  atmosphere Au-Sn (80/20) 300 to 320°C in  $N_2$  atmosphere Au-Ge (88/12) 380 to 400°C in  $N_2$  atmosphere

- Mounting
  - Control the temperature of the substrate so that it matches the temperature of the braze alloy.
  - ② Place braze alloy on substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation in 1 minute.

#### (2) Wire Bonding

• Wire

Gold wire :  $20\mu m$  (0.0008 inch),  $25\mu m$  (0.001 inch) diameter

- Bonding
  - Thermocompression, ultrasonic wedge or ball bonding. Required stage temperature: 150 to 250℃.
  - 2 Required wedge or capillary weight: 0.2N to 0.5N.
  - 3 Bond the capacitor and base substrate or other devices with gold wire.

#### **■**REMARKS

- The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions. Select optimum conditions for operation as they determine the reliability of the product after assembly.
- The data here in are given in typical values, not guaranteed ratings.

#### ■REFERENCE DATA

#### 1. Solderability

#### (1) Test method

Subject the chip capacitor to the following conditions. Then apply flux (a ethanol solution of 25% rosin) to the chip and dip it in 230°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

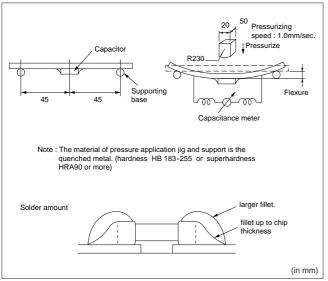
Table 1

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

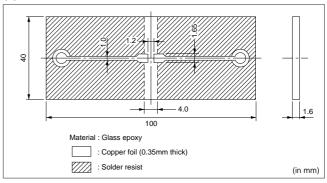
#### 2. Board Bending Strength for Solder Fillet Height

#### (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

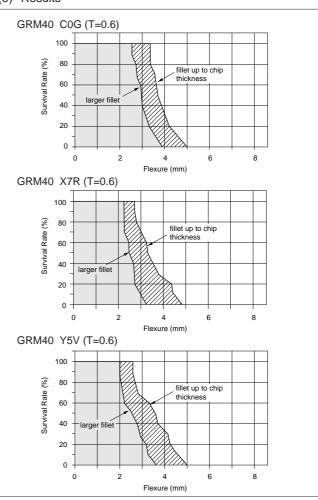
#### (4) Acceptance criteria

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

Table 2

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

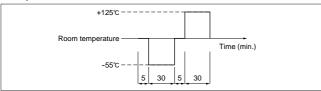
#### (5) Results



#### 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:

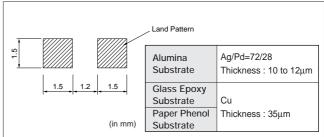
Substrate		Alumina*1	Glass Epoxy*2 or Paper Phenol		
ount	1	T5:0			
Solder Amount	2	0.77	1.3T		
Solc	3		1.6T		
Solder to be used		6X4 Eute	ctic solder		

- \*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)

(4) Results

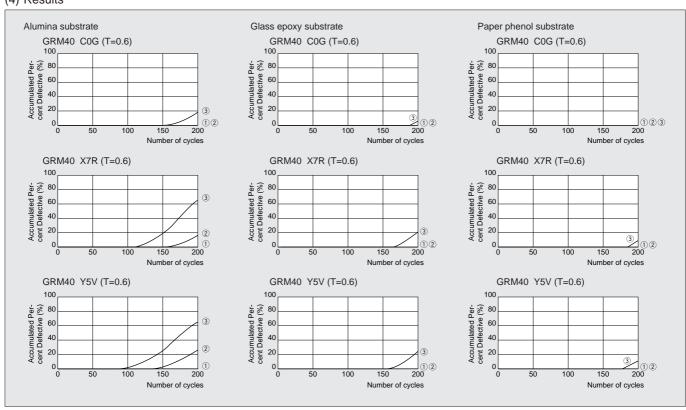
#### Land Dimension:



- (2) Test samples GRM40 C0G/X7R/Y5V Characteristics T=0.6mm
- (3) Acceptance criteria Products shall be determined to be defective if the change in capacitance has exceeded the values specified in Table 3.

Table 3

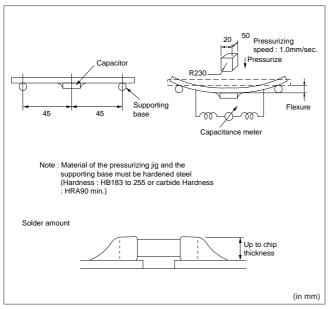
Characteristics	Change in Capacitance
COG	Within ±2.5% or ±0.25pF, whichever is greater
X7R	Within ±7.5%
Y5V	Within +20%



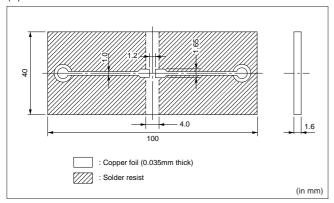
#### 4. Board Bending Strength for Board Material

#### (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

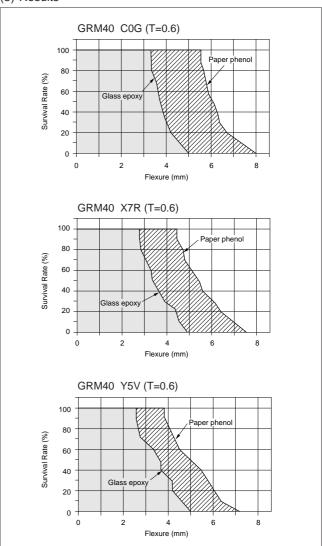
#### (4) Acceptance criteria

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

Table 4

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

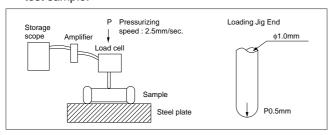
#### (5) Results



#### 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.

(in mm)

The formula is:

$$P = \frac{2 \Upsilon W T^2}{3 L} (N)$$

W: Width of ceramic element (mm)

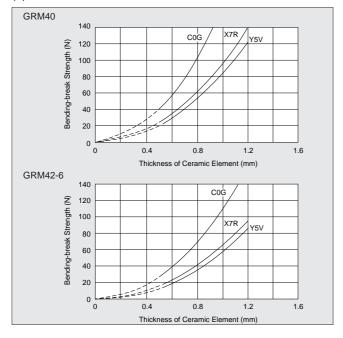
: Thickness of element (mm)

L : Distance between fulcrums (mm)

γ : Bending stress  $(N/mm^2)$ 

, , , ,		, ,	,	
		Chip size	GRM40	GRM42-6
U ↓ w		Ĺ	1.5	2.7
		W	1.2	1.5
<b>↑</b> ₹ τ		C0G Characteristics	300	
l <del>-</del> L →	γ	X7R Characteristics	180	
		Y5V Characteristics	16	60

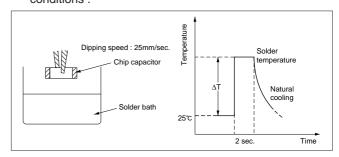
#### (5) Results



#### 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:



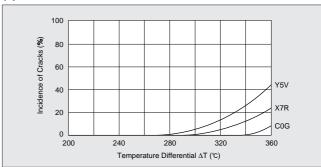
#### (2) Test samples

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



# 8

#### 7. Solder Heat Resistance

- (1) Test method
- ① Reflow soldering :

Apply about 300  $\mu m$  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:

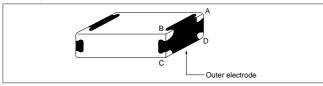
After dipping the test sample with a pair of tweezers in static solder (eutectic solder), check for leaching that may have occurred on the outer electrode.

- 5 Flux to be used: An ethanol solution of 25 % rosin.
- (2) Test samples

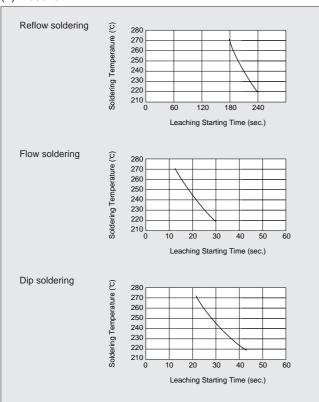
GRM40 : For flow/reflow soldering T=0.6mm

(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:



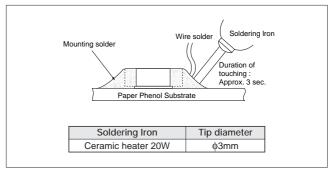
#### (4) Results



# 8. Thermal Shock when Making Corrections with a Soldering Iron

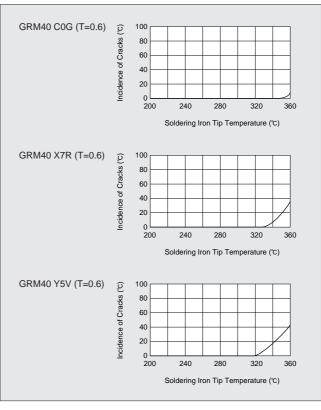
(1) Test method

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 60power optical microscope. Those units displaying any
  breaks cracks shall be determined to be defective.
- (4) Results



#### ■PART NUMBERING

(\*Please specify the part number when ordering)



#### ●Type GHMXX

GHM plus two digits denote the series.

Code	Series	Feature
GHM10	GHM1000	Low dissipation
GHM15	GHM1500	High-capacitance
GITIVITS	GI IIVI 1300	General electrical equipment
GHM21	GHM2000	AC-rated capacitor
GHM22	GHM2000	AC-rated capacitor
GHM30	GHM3000	Safety standard recognized
GHIVISU	GI IIVISOOO	Y capacitor
GHM31	GHM3000	Safety standard recognized
GHIVIST	GI IIVISOOO	X capacitor

#### **2**Dimension

Code	Dimension (mm)	Code	Dimension (mm)		
(EIA Code)	Difficusion (min)	(EIA Code)	Difficusion (min)		
25 (0805)	2.0×1.25	40 (1812)	4.5×3.2		
30 (1206)	3.2×1.6	43 (2211)	5.7×2.8		
35 (1210)	3.2×2.5	45 (2220)	5.7×5.0		
38 (1808)	4.5×2.0				

#### **3**Temperature Characteristics

Code	Temp. Coeff./Cap. Change	Temp. Range (℃)	Remarks	
SL	+350 to −1000ppm/°C	+20 to + 85		
В	±10%	-25  to + 85	Equivalent to X7R*	
R	±15%	-55 to +125	Equivalent to X7R*	
X7R	±15%	-55 to +125		

<sup>\*</sup> Except GHM2000 series

#### **4** Nominal Capacitance

The first two digits represent significant figures; the last digit represents the multiplier of 10 in pF.

•	•	•	•
Code (Ex.)	Value (pF)	Code (Ex.)	Value (pF)
100	10	223	22,000
121	120	104	100,000
472	4,700	_	_

#### **6**Capacitance Tolerance

Code	Tolerance
D	±0.5pF
J	± 5%
K	± 10%
M	± 20%

#### **6**Rated Voltage

Code	Voltage
250	DC250V
630	DC630V
1K	DC1kV
2K	DC2kV
3K	DC3.15kV
AC250	AC250V (r.m.s.)

<sup>\*</sup> Not apply to GHM3000 series [Rated Voltage : AC250V (r.m.s.)]

#### Type Designation

Code	Type Designation	
-GC	Type GC	
-GB	Type GB	* Apply to

\* Apply to GHM3000 series.

#### **■**CAPACITANCE RANGE TABLE

Tuna	Temp.	Rated	Nominal Capacitance Range (pF)
Туре	Char.	Voltage	10 50 100 500 1,000 5,000 10,000 50,000 100,000 500,000
GHM1030	R	DC630V	100—1,000
GHWH030 K		DC1kV	47–470
GHM1030	SL	DC2kV	10-22
GHM1035	SL	DC2kV	27–82
GHM1040	SL	DC2kV	120-220
GHM1038	SL	DC3.15kV	10-82
GHM1040	SL	DC3.15kV	100
GHM1525	В	DC250V	1,000—10,000
0111141500	-	DC250V	15,000-47,000
GHM1530	В	DC630V	1,000—10,000
0.114505		DC250V	68,000 • 100,000
GHM1535	В	DC630V	15,000 • 22,000
GHM1540	Б	DC250V	150,000 • 220,000
GHIVI 1540	В	DC630V	33,000-100,000
CUBATEAE	Б	DC250V	330,000 • 470,000
GHM1545	В	DC630V	150,000 • 220,000
GHM2143	В	AC250V (r.m.s.)	10,000-47,000
GHM2145	В	AC250V (r.m.s.)	100,000
GHM2243	В	AC250V (r.m.s.)	470-4,700
GHM3045	X7R	AC250V (r.m.s.)	100-4,700
GHM3145	X7R	AC250V (r.m.s.)	10,000—33,000



## MONOLITHIC CERAMIC CAPACITOR



### Medium voltage Low Dissipation GHM1000 Series

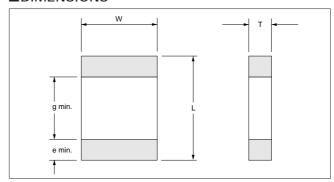
#### **■**FEATURES

- 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)		Dime	nsions (mm)		
(EIA Code)	L	W	T	g	е
GHM1030 (1206)	3.2±0.2	1.6±0.2	See	1.5*	0.3
GHM1035 (1210)	3.2±0.2	2.5±0.2	"STANDARD	1.8	
GHM1038 (1808)	4.5±0.3	2.0±0.2	LIST"	2.9	
GHM1040 (1812)	4.5±0.3	3.2±0.6	LIST	2.9	

\* 1.8mm for SL 2kV

#### **■**STANDARD LIST

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

Part Number		Dimensions (mm)		Nom.Cap.	Cap.	DC Rated Volt.	Packaging Qty.
Part Number	L	W	T	(pF) ·	Tol.	(V)	(pcs./reel)
GHM1030 SL 100 D 2K				10	±0.5pF		
GHM1030 SL 120 J 2K			1.25 <sup>+0</sup>	12	·	-	
GHM1030 SL 150 J 2K		1.6±0.2		15			3,000
GHM1030 SL 180 J 2K				18			
GHM1030 SL 220 J 2K				22			
GHM1035 SL 270 J 2K	3.2±0.2			27		2k	
GHM1035 SL 330 J 2K	3.210.2			33	±5%	ZK	
GHM1035 SL 390 J 2K				39			
GHM1035 SL 470 J 2K		2.5±0.2	1.5 +0	47			2,000
GHM1035 SL 560 J 2K				56			
GHM1035 SL 680 J 2K				68			
GHM1035 SL 820 J 2K				82			
GHM1040 SL 121 J 2K				120	±5%	2k	1,000
GHM1040 SL 151 J 2K	4.5±0.3	3 3.2±0.3	2.0 +0 -0.3	150			
GHM1040 SL 181 J 2K	4.5±0.5			180			
GHM1040 SL 221 J 2K				220			
GHM1038 SL 100 D 3K				10	±0.5pF		
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	4.5±0.3	2.0±0.2	2.0 ±0.3	27			2,000
GHM1038 SL 330 J 3K	4.0±0.0	2.010.2	2.0 ±0.5	33	±5%	3.15k	2,000
GHM1038 SL 390 J 3K				39	±370		
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±0.3	100			500

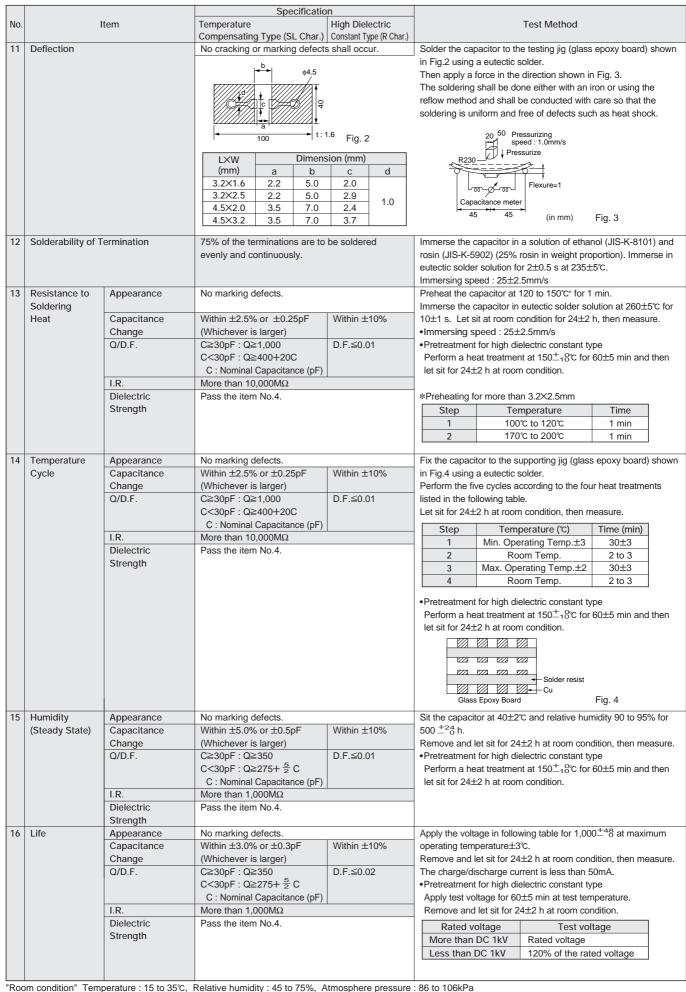
#### High Dielectric Constant Type R Characteristic (±15%)

Part Number		Dimensions (mm)		Nom.Cap.	Cap.	DC Rated Volt.	Packaging Qty. (pcs./reel)
Tart Warnber	L	W	T	(pF)	Tol.	(V)	(pcs./reel)
GHM1030 R 101 K 630				100			
GHM1030 R 151 K 630			1.0+0	150			4,000
GHM1030 R 221 K 630			1.0_0.3	220			4,000
GHM1030 R 331 K 630	3.2±0.2	1.6±0.2		330	±10%	630	
GHM1030 R 471 K 630			1.25+0	470			3,000
GHM1030 R 681 K 630				680			
GHM1030 R 102 K 630				1,000			
GHM1030 R 470 K 1K				47			
GHM1030 R 680 K 1K				68	±10%	1k	4,000
GHM1030 R 101 K 1K			1.0.+0	100			
GHM1030 R 151 K 1K	3.2±0.2	1.6±0.2	1.0 <del>+</del> <sub>0.3</sub>	150			4,000
GHM1030 R 221 K 1K				220			
GHM1030 R 331 K 1K				330			
GHM1030 R 471 K 1K			1 25 + 8 2	470			3 000

#### ■SPECIFICATIONS AND TEST METHODS

No.	I	tem	Specification Temperature Compensating Type (SL Char.)	High Dielectric	Test Method
1	Operating Temperature Rar	nge	-55 to +125℃	31 ( /	_
2	Appearance	<u> </u>	No defects or abnormalities.		Visual inspection.
3	Dimensions		Within the specified dimension		Using Calipers.
4	Dielectric		No defects or abnormalities.	•	No failure shall be observed when voltage in Table is applied
•	Strength		140 delecte et abrieffiantee.		between the terminations for 1 to 5 s, provided the charge/
	Strength				
					discharge current is less than 50mA.
					Rated voltage Test voltage
					More than DC 1kV 120% of the rated voltage
					Less than DC 1kV 150% of the rated voltage
5	Insulation		More than 10,000MΩ		The insulation resistance shall be measured with 500±50V and
	Resistance (I. R.)				within 60±5 s of charging.
6	Capacitance		Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 20°C at the
7	Q/		C≥30pF : Q≥1,000	D.F.≦0.01	frequency and voltage shown as follows.
	Dissipation		C<30pF : Q≥400+20C		(1) Temperature Compensating Type
	Factor (D.F.)		C : Nominal Capacitance (pF)		Frequency: 1±0.2MHz
	Tactor (D.I.)		C. Nominal Capacitance (pr.)		
					Voltage : 0.5 to 5V (r.m.s.)
					(2) High Dielectric Constant Type
					Frequency: 1±0.2kHz
					Voltage : 1±0.2V (r.m.s.)
8	Capacitance		Temp. Coefficient	Cap. Change	(1) Temperature Compensating Type
	Temperature		+350 to −1,000 ppm/°C	Within ±15%	The temperature coefficient is determined using the
	Characteristics		(Temp. Range : +20 to +85℃)		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.
					Specified tolerance for the temperature coefficient.
					Step Temperature (℃)
					1 20±2
					2 Min. Operating Temp.±3
					3 20±2
					4 Max. Operating Temp.±2
					5 20±2
					5 2012
					(2) High Dielectric Constant Type
					The range of capacitance change compared to the 20℃ value
					within −55 to +125°C shall be within the specified range.
					Pretreatment
					Perform a heat treatment at 150 $^{+}_{-10}$ °C for 60±5 min and
	A II		N 1 60 1 1 1		then let sit for 24±2 h at room condition.
9	Adhesive Strengt	in	No removal of the terminations	or otner	Solder the capacitor to the testing jig (glass epoxy board) shown
	of Termination		defects shall occur.		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.
					10N 10+10
					10N, 10±1s Speed : 1.0mm/s
					Glass Epoxy Board
					Fig. 1
			N 16 6 1 100		Coldenda and described to the total in the coldendary of the colde
10	N''L L'		No defects or abnormalities.		Solder the capacitor to the test jig (glass epoxy board).
10	Vibration	Appearance	14001 1 11 10 100		Libraranasitas aballiba aubiantad ta a aimala bassasaia matian
10	Vibration Resistance	Capacitance	Within the specified tolerance.		The capacitor shall be subjected to a simple harmonic motion
10		- ' '	Within the specified tolerance. C≥30pF: Q≥1,000	D.F.≦0.01	having a total amplitude of 1.5mm, the frequency being varied
10		Capacitance	<u>'</u>	D.F.≦0.01	
10		Capacitance	C≧30pF : Q≧1,000	D.F.≦0.01	having a total amplitude of 1.5mm, the frequency being varied
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).
10		Capacitance	C≥30pF : Q≥1,000 C<30pF : Q≥400+20C	D.F.≦0.01	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).

<sup>&</sup>quot;Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa



<sup>&</sup>quot;Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa



# MONOLITHIC CERAMIC CAPACITOR



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

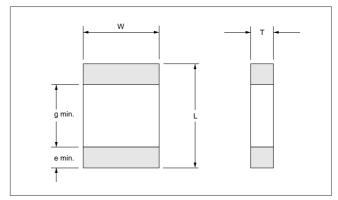
#### **■**FEATURES

- 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.
- 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	Dimensions (mm)					
Type (EIA Code)	L	W	Т	g	е	
GHM1525 (0805)	2.0±0.2	1.25±0.2		0.7		
GHM1530 (1206)	3.2±0.2	1.6±0.2	See	1.5		
GHM1535 (1210)	3.2±0.3	2.5±0.2	"STANDARD	1.0	0.3	
GHM1540 (1812)	4.5±0.4	3.2±0.3	LIST	2.5		
GHM1545 (2220)	5.7±0.4	5.0±0.4		3.5		

#### **■**STANDARD LIST

High Dielectric Constant Type B Characteristic (±10%)

Part Number	Dimensions (mm)			Nom.Cap.	Cap.	DC Rated Volt.	Packaging Qty.
Part Number	L	W	Т	(pF)	Tol.	(V)	(pcs./reel)
GHM1525 B 102 K 250				1,000			
GHM1525 B 152 K 250	2.0±0.2			1,500			
GHM1525 B 222 K 250			1.0 + 0	2,200			4,000
GHM1525 B 332 K 250		1.25±0.2	1.0 -0.3	3,300			4,000
GHM1525 B 472 K 250				4,700			
GHM1525 B 682 K 250	:			6,800			
GHM1525 B 103 K 250			1.25±0.2	10,000			3,000
GHM1530 B 153 K 250			1.0 + 0	15,000			4.000
GHM1530 B 223 K 250	3.2±0.2	1.6±0.2		22,000		250	4,000
GHM1530 B 333 K 250	3.210.2	1.0±0.2	1.25+0	33,000			3,000
GHM1530 B 473 K 250			1.6 ±0.2	47,000			2,000
GHM1535 B 683 K 250	3.2±0.3	2.5±0.2	1.5 + 0	68,000			2,000
GHM1535 B 104 K 250	3.210.3	2.5±0.2	2.0 + 0	100,000			1,000
GHM1540 B 154 K 250	4.5±0.4	3.2±0.3		150,000	±10%		1,000
GHM1540 B 224 K 250			2.5 + 0	220,000			500
GHM1545 B 334 K 250	5.7±0.4	5.0±0.4	2.0 + 0	330,000			1,000
GHM1545 B 474 K 250	3.7 ±0.4			470,000			1,000
GHM1530 B 102 K 630				1,000			
GHM1530 B 152 K 630				1,500			
GHM1530 B 222 K 630				2,200			
GHM1530 B 332 K 630	3.2±0.2	1.6±0.2	1.25 <sup>+</sup> 0	3,300			3,000
GHM1530 B 472 K 630				4,700			
GHM1530 B 682 K 630				6,800	]		
GHM1530 B 103 K 630				10,000			
GHM1535 B 153 K 630	3.2±0.3	2.5±0.2		15,000		630	2,000
GHM1535 B 223 K 630	J.Z.T.U.J	2.0.0.2	1.5 + 0	22,000			2,000
GHM1540 B 333 K 630			1.0 -0.3	33,000			
GHM1540 B 473 K 630	4.5±0.4	3.2±0.3		47,000			1,000
GHM1540 B 683 K 630	4.010.4	3.210.3	2.0 + 0	68,000			
GHM1540 B 104 K 630			2.6 + 0	100,000			500
GHM1545 B 154 K 630	5.7±0.4	5.0±0.4	2.0 + 0	150,000			1,000
GHM1545 B 224 K 630	3.7 ±0.4	3.0±0.4	2.7 + 0	220,000			500

#### ■SPECIFICATIONS AND TEST METHODS

No.		Item	Specification	Test Method
1	Operating		-55 to +125℃	
	Temperature Rai	nge		_
2	Appearance		No defects or abnormalities.	Visual inspection.
_	Dimensions			•
3			Within the specified dimension.	Using Calipers.
4	Dielectric		No defects or abnormalities.	No failure shall be observed when 150% of the rated voltage
	Strength			(200% of the rated voltage in case of rated voltage: DC 250V) is
				applied between the terminations for 1 to 5 s, provided the
				charge/discharge current is less than 50mA.
5	Insulation		C≧0.01μF : More than 100MΩ · μF	The insulation resistance shall be measured with 500±50V
٦			· ·	
	Resistance (I.R.)		C<0.01μF : More than 10,000MΩ	(250±50V in case of rated voltage: DC 250V) and within 60±5 s
				of charging.
6	Capacitance		Within the specified tolerance.	The capacitance/D.F. shall be measured at 20°C at a frequency
7	Dissipation		0.025 max.	of 1±0.2kHz and a voltage of 1±0.2V (r.m.s.)
	Factor (D.F.)			
8	Capacitance		Cap. Change	The range of capacitance change compared with the 20℃ value
٥				
	Temperature		Within ±10%	within −25 to +85°C shall be within the specified range.
	Characteristics		(Temp. Range : −25 to +85°C)	Pretreatment
				Perform a heat treatment at 150 <sup>+</sup> <sub>1</sub> % <sup>c</sup> for 60±5 min and then
				let sit for 24±2 h at room condition.
9	Adhesive Streng	ıth	No removal of the terminations or other defects	Solder the capacitor to the testing jig (glass epoxy board) shown
	of Termination	,	shall occur.	in Fig.1 using a eutectic solder.
			Silali Occui.	
				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.
				77770
				10N, 10±1s Speed : 1.0mm/s
				1 1
				Fig. 1
				Tig. 1
10	Vibration	Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (glass epoxy board).
	Resistance	Capacitance	Within the specified tolerance.	The capacitor shall be subjected to a simple harmonic motion
	resistance	D.F.	0.025 max.	<b>-</b>
		D.F.	0.025 Max.	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 min. This motion shall be applied for
				a period of 2 h in each 3 mutually perpendicular directions (total
				of 6 h).
				<u> </u>
				→ Solder resist
				Solder resist
				→ Solder resist
11	Doffaction		No oracking as morbing the factor at all a con-	Solder resist  Glass Epoxy Board
11	Deflection		No cracking or marking defects shall occur.	Solder resist  Glass Epoxy Board  Solder the capacitor to the testing jig (glass epoxy board) shown
11	Deflection			Solder resist  Glass Epoxy Board  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder.
11	Deflection		, b ,	Solder resist  Glass Epoxy Board  Solder the capacitor to the testing jig (glass epoxy board) shown
11	Deflection			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.
11	Deflection		, b ,	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
11	Deflection		, b ,	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
11	Deflection		, b ,	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
11	Deflection		, b ,	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.
11	Deflection		04.5 04.5 04.5	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.
11	Deflection		04.5 04.5 04.5 100 t: 1.6 Fig. 2	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder.  Then apply a force in the direction shown in Fig. 3.  The soldering 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.
11	Deflection		04.5 04.5 04.5	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.
11	Deflection		04.5 04.5 100 t: 1.6 Fig. 2	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder.  Then apply a force in the direction shown in Fig. 3.  The soldering 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.
11	Deflection		04.5 04.5 100 t: 1.6 Fig. 2  LXW Dimension (mm) (mm) a b c d	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.
11	Deflection		04.5 04.5 100 t: 1.6 Fig. 2 LXW Dimension (mm) (mm) a b c d 2.0X1.25 1.2 4.0 1.65	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.
11	Deflection		04.5   04.5	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.
11	Deflection		Dimension (mm)	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.
11	Deflection		Dimension (mm) (mm)   a   b   c   d   d   d   d   d   d   d   d   d	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.
11	Deflection		Dimension (mm)	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.
			Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   Dimen	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.
11	Deflection  Solderability of T	Termination	Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   Dimen	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.
		Termination	Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   Dimen	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.
		Termination	Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   Dimen	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.
		Termination	Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   C   Dimension (mm)   Dimen	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.  20 50 Pressurizing speed: 1.0mm/s Pressurize  Pressurize  (in mm) Fig. 3  Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).

<sup>&</sup>quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

13

Resistance to

Soldering

Item

Appearance

Capacitance

Test Method

Immerse the capacitor in eutectic solder solution at 260±5°C for

Preheat the capacitor at 120 to 150℃\* for 1 min.

Specification

No marking defects.

Within ±10%



# MONOLITHIC CERAMIC CAPACITOR



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

### Ceramic Capacitor for AC250V **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. Only for Reflow soldering.

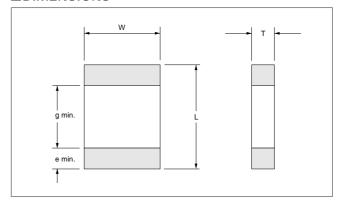
#### **■**APPLICATIONS

Noise filter 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.

#### **■**DIMENSIONS



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

#### **■**STANDARD LIST

B Characteristic (±10%)

[ GHM21xx (Line to line capacitor) ]

Part Number	Dimensions (mm)			Nom.Cap.		AC Rated Volt.	Packaging Qty.
Part Number	L	W	Т	(pF)	Tol.	[ V (r.m.s.)]	(pcs./reel)
GHM2143 B 103 M AC250				10,000			
GHM2143 B 223 M AC250	F 7±0.4	2.8±0.3	2.0±0.3	22,000	±20%	250	1,000
GHM2143 B 473 M AC250	5.7±0.4			47,000			
GHM2145 B 104 M AC250		5.0±0.4		100,000			

#### [ GHM22xx (Line to earth capacitor) ]

	Part Number		Dimensions (mm)	Nom.Cap.	Cap.	AC Rated Volt.	Packaging Qty.	
	Part Number	L	W	Т	(pF)	Tol.	[ V (r.m.s.)]	(pcs./reel)
(	GHM2243 B 471 M AC250				470			
(	GHM2243 B 102 M AC250	5.7±0.4	2.8±0.3	2.0±0.3	1,000	±20%	250	1,000
(	GHM2243 B 222 M AC250	5.7±0.4	2.010.3	2.010.3	2,200	120%	250	1,000
(	GHM2243 B 472 M AC250				4,700			

#### ■SPECIFICATIONS AND TEST METHODS

Department   Partment	No.			Specification	Tost Mothod		
No celectes or abnormalities.   Visual respection.   Using Cigines.					Test Method		
Discharge Termination   Within the specified dimension.   Using Collisions.   No failure strength   No defects or alternormalities.   No failure strength   No failure strengt					Visual inspection.		
Desilocinic Strength		- ' '			•		
between the terminations for 60:21.5, provided the charge/decharge current to lise share from A. ACSTAY (m.n.4.)    Fig. 1	-		th	•			
Chapteristic   Commonwealth   Comm	4	Dielectric Streng	ш	No defects of abhoritialities.	9		
Sinsulation Resistance (I.R.)   More than 2,000MD   The installation Resistance (I.R.)   More than 2,000MD   The installation resistance and be measured with 500-550V and 616MD22xx   AC150VV (rm.s.)					The state of the s		
GRMD21x   ACTSOV (m.s.)							
Substantion Resistance (LR2)   More than 2,000M2   The insulation Resistance (LR2)   More than 2,000M2   Within the specified obterance.							
Installation Resistance (I,R)   More than 2,000M2   The insulation resistance shall be measured with 500=50V and within 610=5 of disripling.					\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		
Capacitance   Within the specified tolerance.   The capacitance					GHM22xx AC1500V (r.m.s.)		
Capacitance   Within the specified tolerance.   The capacitance	Е	Inculation Design	anas /LD.)	More than 2 000MO	The inscription registance shall be managined with 500±50V and		
Disciplation Factor (D.F.)   O.025 max	5	IIISUIALIOII RESISTA	ance (i.k.)	INIOTE ITIAIT 2,000IVIS2			
7 Discharge Test Control of Termination   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   7 Discharge Test Opplication. OHM 22x0   8 Discharge Test Opplication. OHM 22x0   8 Discharge Test Opplication. OHM 22x0   8 Discharge Test Opplication. OHM 22x0   9 Discharge Test Opplication. OHM 22	6	Canacitanco		Within the specified telerance	0 0		
The range of capacitance change compared with the 201 value within =25 to 450 shall be within the specified range.	-	•	or (D.E.)	·	1 .		
Characteristics  Within ±10%  within -25 to 148C shall be within the specified range.  **Performance Perform a heat treatment at 150±, 3° to for 60±5 min and then let sit for 24±2 h at room condition.  As in Fig. discharge is made \$60 times at \$5 intervals from the capacitor (of sharped and CV obliged of specified.  **R1 ±1,000 A 2 ±1,000 M 2 mage relations of the termination or other detects shall occur.  **The speciment of Termination Performance Performan		•	• •				
Performan haut trautment at 150.1.8 to 160±5 min and then let sit for 24±2 hit come condition.  A in Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor/Cd; changed at DC voltage of specified.  As hit Fig., discharge is made 50 times at 5 s intervals from the capacitor of the setting light (glass epoxy board) shown fig., the capacitor is the soldering suit between the approximate limits of 13 and 55 hit. The requery range, from 10 to 56 fize, and the forequery range, from 10 to 56 fize, and the forequery range, from 10 to 56 fize, and the forequery range, from 10 to 56 fize, and any single of 15 min. This motion shall be supplied for ship and proportionally from 10 times fig. and the soldering shall be conceived with an oral capacitor to the testing light (signs epoxy board) shown fig. and the capacitor to the testing light (signs epoxy board) shown fig. and the capacitor to the testing light (signs epoxy board) shown fig. and the capacitor is the capacitor to t		•	iperature				
Perform a heat realment at 150% (% to 602.5 min and then let sit for 242.5 at 250 at 250 min and then let sit for 242.5 at 250 min and then let sit for 242.5 at 250 min and then let sit for 242.5 at 250 min and then let sit for 242.5 at 250 min and then let sit for 242.5 at 250 min and then let sit for 242.5 at 250 min and then let sit for 242.5 sit in a real sit form the sit sit for 242.5 sit in a real sit form the sit sit for 242.5 sit in and then let sit for 242.5 sit in a real sit sit for 242.5 sit in a real sit sit sit sit sit sit sit sit sit sit		Ondracteristics		VVIIII1 = 1070			
Best 8 for 24±2 h at room condition.							
Appearance   Appearance   Appearance   Appearance   Appleach							
the capacitor (Cq) charged at DC voltage of specified.  Resistance  Appearance DF.  No defects or abnormalities.  Resistance  Appearance DF.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solider the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a sustacts solder. Then apply 10N force in the direction of the arrow. The soldering shall be done dether with an iron or using the reflow method and shall be concluded with care so that the soldering is uniform and free of defects such as heat shock.  Solider the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a sustact solder. Then apply 10N force in the soldering shall be done defer with an iron or using the reflow method and shall be concluded with care so that the soldering is uniform. The capacitor is the lest jig (glass epoxy board) shown in Fig. 2 using a stock solder free and approximately in misc of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be uniformly between the approximately in misc of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be uniformly between the approximately in misc of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be uniformly between the approximately in misc of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be uniformly between the approximately in misc of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be uniformly between the approximately in misc of 10 and 55Hz. The frequency ange, from 10 to 55Hz and return to 10Hz, shall be uniformly between the approximately in misc of 10 and 55Hz. The frequency page, from 10 to 55Hz and return to 10Hz, shall be conducted with a period of 2 h in each 3 mitually perpendicular defects such as heat shock.  12 Deflection  No cracking or marking defects shall occur.  Solder the capa	0	Discharge Test	Annearance	No defects or abnormalities			
Cit Capacitor under test Cd : 0.001µF	,	-	Appearance	TWO defects of abilitimatiles.			
10   Adhesive Strength of Termination   No removal of the terminations or other detects shall occur.   Solder the capacitor to the testing  ig (glass spoxy board) shown in fig.1 using a audictic solder. Then apply 10N force in the direction of the arrow. The soldering hall be done either with an incorrusing the reflow method and shall be conducted with care so that the soldering is uniform and red of defects such as heat shock.   Solder the capacitor to the testing  ig (glass spoxy board) shown in fig.1 using a audictic solder. Then apply 10N force in the direction of the arrow. The soldering is uniform and red of defects such as heat shock.   Solder the capacitor to the testing  ig (glass spoxy board) shown in fig.2 using a contact specified to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximately in misor of valid to a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).   Solder the capacitor to the testing  ig (glass spoxy board) shown in fig.2 using a subclass (spoxy							
To Adhesive Strength of Termination  No removal of the terminations or other detects shall occur.  No removal of the terminations or other detects shall occur.  No removal of the terminations or other detects shall occur.  No defects or abnormalities.  Capacitance  O.F.  No defects or abnormalities.  Capacitance  O.F.  O.025 max.  No defects or abnormalities.  Capacitance  O.025 max.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The soldering is uniform and of the order of the defects such as heat shock.  Solder the capacitor to the testing by the defect of the sold of 8 h).  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The soldering is uniform and order of the defects such as heat shock.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a extended solder. Then apply a force in the direction shown in Fig. 3. The soldering is uniform and in the order of the soldering is uniform and in the order of defects such as heat shock.  The capacitor of the testing jig (glass epoxy board) shown in Fig. 3. The soldering is uniform and in the order of defects such as heat shock.  The capacitor is the testing jig (glass epoxy board) shown in Fig. 3. The soldering is uniform and order of defects such as heat shock.  The capacitor is the capacitor in the stalling jig (glass epoxy board) shown in Fig. 3. The soldering is uniform and order of defects such as he		OI IIVIZZXX)			The state of the s		
To Adhesive Strength of Termination  No removal of the terminations or other detects shall occur.  No defects or abnormalities.  Resistance  No defects or abnormalities.  Capacitance  Within the specified tolerance.  D.F.  O.025 max.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board). The capacitor to the testing jig (glass epoxy board) and the papeled for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The capacitor shall be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency pengy varied uniformly between the apprehiate limits of 10 and 65Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with care so that the soldering shall be done either with an iron or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and sha							
To Adhesive Strength of Termination  No removal of the terminations or other detects shall occur.  No defects or abnormalities.  Resistance  No defects or abnormalities.  Capacitance  Within the specified tolerance.  D.F.  O.025 max.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board). The capacitor to the testing jig (glass epoxy board) and the papeled for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The capacitor shall be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency pengy varied uniformly between the apprehiate limits of 10 and 65Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be traversed in approximately into 10Hz, shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with care so that the soldering shall be done either with an iron or using the reflow method and shall be conducted with a long or using the reflow method and shall be conducted with a long or using the reflow method and sha							
The continuence of the state					1 10KV (V)		
R1: 1,000\(\text{Q}\) R2: 100\(\text{Q}\) R3: Surge resistance  R1: 1,000\(\text{Q}\) R3: Surge resistance  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.    Vibration   Appearance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board). The capacitor shall be subjected to a simple harmonic motion have been subjected to a simple harmonic motion have been subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subject of the simple subjected to a simple harmonic motion of the subject of the simple sub					<b>= T C C C C C C C C C C</b>		
R1: 1,000\(\text{Q}\) R2: 100\(\text{Q}\) R3: Surge resistance  R1: 1,000\(\text{Q}\) R3: Surge resistance  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.    Vibration   Appearance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board). The capacitor shall be subjected to a simple harmonic motion have been subjected to a simple harmonic motion have been subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subject of the simple subjected to a simple harmonic motion of the subject of the simple sub							
R1: 1,000\(\text{Q}\) R2: 100\(\text{Q}\) R3: Surge resistance  R1: 1,000\(\text{Q}\) R3: Surge resistance  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.    Vibration   Appearance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board). The capacitor shall be subjected to a simple harmonic motion have been subjected to a simple harmonic motion have been subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion have been subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subjected to a simple harmonic motion of the subject of the simple subjected to a simple harmonic motion of the subject of the simple sub					Ct : Capacitor under test Cd : 0.001µF		
shall occur.    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.    10N 10±1s   Speed: 1.0mm's   Fig. 1					· ·		
shall occur.    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.    10N 10±1s   Speed: 1.0mm's   Fig. 1							
shall occur.    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.    10N 10±1s   Speed: 1.0mm's   Fig. 1	10	Adhesive Strengt	h of Termination	No removal of the terminations or other detects	Solder the capacitor to the testing jig (glass epoxy board) shown		
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.    11   Vibration   Appearance   No defects or abnormalities.   Solder the capacitor to the testing (glass epoxy board). 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 it min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a period of 2 h approximately at min. This motion shall be applied to a simple period by a period of 2 h approximately at min. This motion shall be		Ü		shall occur.			
so that the soldering is uniform and free of defects such as heat shock.    Till   Vibration   Resistance   Appearance   No defects or abnormalities.   Capacitance   Within the specified tolerance.					direction of the arrow. The soldering shall be done either with an		
so that the soldering is uniform and free of defects such as heat shock.    Till   Vibration   Resistance   Appearance   No defects or abnormalities.   Capacitance   Within the specified tolerance.							
Solder the capacitor to the test jig (glass epoxy board). 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 min. This motion shall be applied for a period of 2 hin each 3 mutually perpendicular directions (total of 6 h).    Deflection							
Vibration   Resistance   Appearance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board).   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 min. This motion shall be applied fo a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).   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 an iron or using the reflow method and shall be conducted with an iron or using the reflow method and shall be conducted 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.   Solder the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).   Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).   Immersing speed: 25±2.5mm/s							
Vibration   Resistance   Appearance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board).   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 min. This motion shall be applied fo a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).   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 an iron or using the reflow method and shall be conducted with an iron or using the reflow method and shall be conducted 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.   Solder the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).   Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).   Immersing speed: 25±2.5mm/s							
Vibration   Resistance   Appearance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board).   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 min. This motion shall be applied fo a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).   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 an iron or using the reflow method and shall be conducted with an iron or using the reflow method and shall be conducted 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.   Solder the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).   Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).   Immersing speed: 25±2.5mm/s					10N, 10±1s		
Vibration   Resistance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board).   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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).					Speed: 1.0mm/s		
Vibration   Resistance   No defects or abnormalities.   Solder the capacitor to the test jig (glass epoxy board).					Fig. 1		
Resistance  D.F.  O.025 max.  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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).  Deflection  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering 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.  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-902) (25% rosin in weight proportion). Immerse in eutectic solders solution for 2±0.5 s at 235±5°C. Immersing speed: 25±2.5mm/s					j		
D.F.  0.025 max.    Day	11	Vibration	Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (glass epoxy board).		
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 min. This motion shall be applied fo a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).    Deflection		Resistance	Capacitance	Within the specified tolerance.	The capacitor shall be subjected to a simple harmonic motion		
frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 min. This motion shall be applied fo a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering 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.  Dimension (mm)  Solder ablity of Termination  Town 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 s at 235±5°C. Immersing speed : 25±2.5mm/s			D.F.	0.025 max.	having a total amplitude of 1.5mm, the frequency being varied		
traversed in approximately 1 min. This motion shall be applied fo a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).    No cracking or marking defects shall occur.					uniformly between the approximate limits of 10 and 55Hz. The		
a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).    Deflection					frequency range, from 10 to 55Hz and return to 10Hz, shall be		
of 6 h).  No cracking or marking defects shall occur.  No cracking or marking defects shall occur.  Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3 the soldering 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.    Solderability of Termination   T5% 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 s at 235±5°C.   Immersing speed: 25±2.5mm/s					traversed in approximately 1 min. This motion shall be applied for		
No cracking or marking defects shall occur.    Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3. The soldering 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.    W							
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No cracking or marking defects shall occur.    Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 2 using a eutectic solder 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.    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 conducted with care so that the soldering is uniform and free of defects such as heat shock.    Solder the capacitor to the testing jig (glass epoxy board) 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.    Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The soldering shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.    Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The soldering shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.    Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The soldering shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.    Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 3. The soldering shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.    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. 2.   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 s at 235±5°C. I							
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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.    LXW   Dimension (mm)					Glass Epoxy Board		
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.    LXW   Dimension (mm)	10	Dofloction		No graphing or morbing defeats = h=11 = ====	Colder the conseiter to the testing iir (glass seems bessel)		
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.    Value	12	Deflection		INO CRACKING OF MARKING DETECTS Shall occur.			
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.    LXW							
care so that the soldering is uniform and free of defects such as heat shock.    Capacitance meter   Capacitance meter   Laplace   Lapla							
heat shock.    Capacitance meter   Lyman   Lym					_		
LXW Dimension (mm)  (mm) a b c d  5.7X2.8 4.5 8.0 3.2 1.0  Solderability of Termination  75% of the terminations are to be soldered evenly and continuously.  The solder of the termination of the terminat							
LXW Dimension (mm)  (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 1.0  Solderability of Termination  75% of the terminations are to be soldered evenly and continuously.  The speed: 1.0mm/s Pressurize  Pressurize  (in mm) Fig. 3  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 s at 235±5°C. Immersing speed: 25±2.5mm/s				\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\			
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Capacitance meter   Flexure   Flexure				100 1 Fig. 2			
5.7×2.8 4.5 8.0 3.2 1.0 Capacitance meter    Solderability of Termination   To solderability of Termination				(mams)			
13 Solderability of Termination  75% of the terminations are to be soldered evenly and continuously.  The solution of the termination of the termination are to be soldered evenly and continuously.  The solution of the termination of the term					Flexure=1		
Solderability of Termination   Termination					000000		
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evenly and continuously.  rosin (JIS-K-5902) (25% rosin in weight proportion).  Immerse in eutectic solder solution for 2±0.5 s at 235±5°C.  Immersing speed: 25±2.5mm/s					45 45 (in mm) Fig. 3		
evenly and continuously.  rosin (JIS-K-5902) (25% rosin in weight proportion).  Immerse in eutectic solder solution for 2±0.5 s at 235±5°C.  Immersing speed: 25±2.5mm/s	12	Solderability of T	ermination	75% of the terminations are to be coldered	Immerse the canacitor in a solution of otheral (IIS V 9404) and		
Immerse in eutectic solder solution for 2±0.5 s at 235±5°C. Immersing speed : 25±2.5mm/s	13	Soluerability of T	CITIIIIduUII				
Immersing speed : 25±2.5mm/s				everily and continuously.			
"Room condition" Temperature: 15 to 35°C. Relative humidity: 45 to 75%. Atmosphere pressure: 86 to 106kPa				D. I. I. I. I. I. I. I. I. I. I. I. I. I.			

<sup>&</sup>quot;Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

No.		Item	Specification	Test Method
14	Humidity	Appearance	No marking defects.	The capacitor shall be subjected to 40±2°C, relative humidity of
14			-	
	Insulation	Capacitance	Within ±15%	90 to 98% for 8 h, and then removed in room condition for 16 h
		Change		until 5 cycles.
		D.F.	0.05 max.	
		I.R.	More than 1,000MΩ	
		Dielectric	Pass the item No.4.	
		Strength		
15	Resistance to	Appearance	No marking defects.	Preheat the capacitor as table.
	Soldering	Capacitance	Within ±10%	Immerse the capacitor in eutectic solder solution at 260±5°C for
			VVIIIIII ± 10 %	·
	Heat	Change		10±1 s. Let sit at room condition for 24±2 h, then measure.
		D.F.	0.025 max.	•Immersing speed : 25±2.5mm/s
		I.R.	More than 2,000MΩ	Pretreatment
		Dielectric	Pass the item No.4.	Perform a heat treatment at 150 <sup>+</sup> <sub>−10</sub> °C for 60±5 min and then
		Strength		let sit for 24±2 h at room condition.
				*Preheating
				Step Temperature Time
				1 100°C to 120°C 1 min
				2 170°C to 200°C 1 min
16	Temperature	Appearance	No marking defects.	Fix the capacitor to the supporting jig (glass epoxy board) shown
	Cycle	Capacitance	Within ±7.5%	in Fig.4 using a eutectic solder.
		Change		Perform the five cycles according to the four heat treatments
		D.F.	0.025 max.	listed in the following table.
		I.R.		
			More than 2,000MΩ	Let sit for 24±2 h at room condition, then measure.
		Dielectric	Pass the item No.4.	Step Temperature (℃) Time (min)
		Strength		1 Min. Operating Temp.±3 30±3
				2 Room Temp. 2 to 3
				3 Max. Operating Temp.±2 30±3
				4 Room Temp. 2 to 3
				Pretreatment
				Perform a heat treatment at 150 <sup>±</sup> <sub>10</sub> °C for 60±5 min and then
				let sit for 24±2 h at room condition.
				<u> </u>
				Cu Cu
				Glass Epoxy Board Fig. 4
47	11		N	
17	Humidity	Appearance	No marking defects.	Sit the capacitor at 40±2℃ and relative humidity 90 to 95% for
	(Steady State)	Capacitance	Within ±15%	500 <sup>+2</sup> <sup>4</sup> h.
		Change		Remove and let sit for 24±2 h at room condition, then measure.
		D.F.	0.05 max.	Pretreatment
		I.R.	More than 1,000MΩ	Perform a heat treatment at 150 <sup>+</sup> <sub>10</sub> °C for 60±5 min and then
		Dielectric	Pass the item No.4.	let sit for 24±2 h at room condition.
		Strength		
18	Life	Appearance	No marking defects.	Apply voltage and time as Table at 85±2°C. Remove and let sit
10	LITE		<u> </u>	
		Capacitance	Within ±15%	for 24 ±2 h at room condition, then measure. The charge /
		Change		discharge current is less than 50mA.
		D.F.	0.05 max.	Test Time Test voltage
		I.R.	More than 1,000MΩ	GHM21xx 1,000 <sup>+48</sup> / <sub>o</sub> h AC300V (r.m.s.)
		Dielectric	Pass the item No.4.	GHM22xx 1,500 <sup>+48</sup> <sub>o</sub> h AC500V (r.m.s.) *
		Strength		* Except that once each hour the voltage is increased
		3		to AC1,000V (r.m.s.) for 0.1 s
				Pretreatment
				Apply test voltage for 60±5 min at test temperature.
				Remove and let sit for 24±2 h at room condition.
19	Humidity	Appearance	No marking defects.	Apply the rated voltage at 40±2℃ and relative humidity 90 to
	Loading	Capacitance	Within ±15%	95% for 500 <sup>±24</sup> <sub>0</sub> h. Remove and let sit for 24±2 h at room
		Change		condition, then measure.
		D.F.	0.05 max.	Pretreatment
		I.R.	More than 1,000MΩ	Apply test voltage for 60±5 min at test temperature.
		Dielectric	Pass the item No.4.	Remove and let sit for 24±2 h at room condition.
		Strength		

<sup>&</sup>quot;Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa



# MONOLITHIC CERAMIC CAPACITOR



# Safety Standard Recognized GHM3000 Series

#### **■**FEATURES

- 1. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC line.
- 2. A new monolithic structure for small, high-capacitance capable of operating at high-voltage levels.
- 3. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
- 4. The type GB can be used as an X2-class capacitor.
- 5. The type GC can be used as an X1-class and Y2-class capacitor, line by pass capacitor in UL1414.
- 6. +125°C guaranteed.
- 7. Only for Reflow soldering.

#### **■**APPLICATIONS

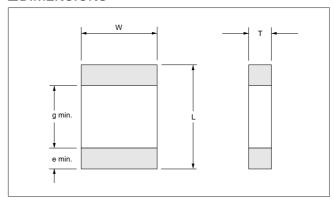
- 1. Ideal use as Y capacitor or X capacitor for various switching power supply.
- 2. Ideal use as line filter for modem.

# ■STANDARD NO.

	Standard No.	Status of R	AC Rated Voltage [ V (r.m.s.) ]	
	Standard No.	Type GB Type GC		[ V (r.m.s.) ]
UL	UL1414	_	©*	
BSI		_	0	
VDE	EN132400	0	0	250
SEV	LIV132400	0	0	250
SEMKO		0	0	
EN132400 Class		X2	X1, Y2	

<sup>\*</sup> Line By Pass only

#### **■**DIMENSIONS



Туре		Dimensions (mm)				
Type (EIA Code)	L	W	Т	g	е	
GHM3045 (2220)	57104	50104	See "STANDARD		0.0	
GHM3145 (2220) 5.7±0.4		5.0±0.4	"STANDARD LIST"	4.0	0.3	

#### ■STANDARD LIST

#### High Dielectric Constant Type X7R Characteristic (±15%)

#### Type GC

Part Number		Dimensions (mm)		Nom.Cap.	Cap.	AC Rated Volt.	Packaging Qty. (pcs./reel)
Fait Nullibei	L	W	Т	(pF)	Tol.	[ V (r.m.s.)]	(pcs./reel)
GHM3045 X7R 101K -GC				100			
GHM3045 X7R 151K -GC				150			
GHM3045 X7R 221K -GC				220			
GHM3045 X7R 331K -GC				330			
GHM3045 X7R 471K -GC				470			
GHM3045 X7R 681K -GC	5.7±0.4	5.0±0.4	2.0±0.3	680	±10%	250	1,000
GHM3045 X7R 102K -GC				1,000			
GHM3045 X7R 152K -GC				1,500			
GHM3045 X7R 222K -GC				2,200			
GHM3045 X7R 332K -GC				3,300			
GHM3045 X7R 472K -GC				4,700			

#### Type GB

Part Number	Dimensions (mm)		Nom.Cap.	Cap.	AC Rated Volt.	Packaging Qty.				
Part Number	L	W	Т	(pF)	Tol.	[ V (r.m.s.)]	(pcs./reel)			
GHM3145 X7R 103K -GB				10,000						
GHM3145 X7R 153K -GB	57104	50104	F 0+0 4	F 0+0 4	5.0±0.4	2.0±0.3	15,000	±10%	050	1,000
GHM3145 X7R 223K -GB	5.7±0.4	5.0±0.4	0.4	22,000	⊥10%	250				
GHM3145 X7R 333K -GB			2.7±0.3	33,000			500			

#### ■SPECIFICATIONS AND TEST METHODS

1	Operating Tempe	tem erature Range	Specification -55 to +125°C	Test Method  —		
2	Appearance		No defects or abnormalities.	Visual inspection.		
3	Dimensions		Within the specified dimension.	Using Calipers.  No failure shall be observed when voltage as table is applied between the terminations for 60±1 s, provided the charge/discharge current is less than 50mA.		
4	Dielectric Strength		No defects or abnormalities.			
				Test voltage		
				Type GB DC1075V		
				Type GC AC1500V (r.m.s.)		
				7101000 (1.111.0.)		
5	Insulation Resist	ance (I.R.)	More than $6{,}000M\Omega$	The insulation resistance shall be measured with 500±50V and within 60±5 s of charging.		
6	Capacitance		Within the specified tolerance.	The capacitance/D.F. shall be measured at 20°C at a frequency		
7	Dissipation Factor	• •	0.025 max.	of 1±0.2kHz and a voltage of 1±0.2V (r.m.s.)		
8	Capacitance Ten Characteristics	nperature	Cap. Change Within ±15%	The range of capacitance change compared with the 25°C value within -55 to +125°C shall be within the specified range.  •Pretreatment Perform a heat treatment at 150 <sup>+</sup> <sub>-1</sub> 8 °C for 60±5 min and then let sit for 24±2 h at room condition.		
9	Discharge Test	Appearance	No defects or abnormalities.	As in Fig., discharge is made 50 times at 5 s intervals from		
	(Application:	I.R.	More than 1,000M $\Omega$	the capacitor(Cd) charged at DC voltage of specified.		
			Pass the item No.4.	R3 R1 Ct R2		
10	Adhasiya Strong	th of Tormination	No removal of the terminations or other detects	Ct : Capacitor under test $Cd: 0.001 \mu F$ R1: 1,000 $\Omega$ R2: 100M $\Omega$ R3: Surge resistance		
	Adhesive Strength of Termination		shall occur.	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.  10N, 10±1s Speed: 1.0mm/s		
				Fig. 1		
11	Vibration	Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (glass epoxy board).		
	Resistance	Capacitance	Within the specified tolerance.	The capacitor shall be subjected to a simple harmonic motion		
		D.F.	0.025 max.	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 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h).  Solder resist  Glass Epoxy Board		
12	Deflection		No cracking or marking defects shall occur.	Solder the capacitor to the testing jig (glass epoxy board) shown		
			Dimension (mm)	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.  20 50 Pressurizing speed: 1.0mm/s Pressurize  Pressurize  (in mm) Fig. 3		
13	Solderability of T	ermination	75% of the terminations are to be soldered	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and		
	Solderability of Termination		evenly and continuously.	rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 2±0.5 s at 235±5°c.		

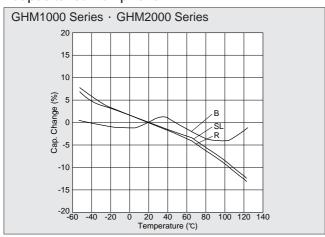
"Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

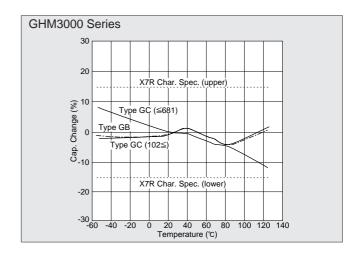
No.		Item	Specification	Test Method
14	Resistance to	Appearance	No marking defects.	Preheat the capacitor as table. Immerse the capacitor in eutectic
	Soldering	Capacitance	Within ±10%	solder solution at 260±5℃ for 10±1 s. Let sit at room condition
	Heat	Change		for 24±2 h, then measure.
		I.R.	More than 1,000MΩ	•Immersing speed : 25±2.5mm/s
		Dielectric	Pass the item No.4.	Pretreatment
		Strength		Perform a heat treatment at 150 <sup>+</sup> <sub>-10</sub> ℃ for 60±5 min and then
				let sit for 24±2 h at room condition.
				*Preheating
				Step Temperature Time
				1 100°C to 120°C 1 min
				2 170°C to 200°C 1 min
15	Temperature	Appearance	No marking defects.	Fix the capacitor to the supporting jig (glass epoxy board) shown
	Cycle	Capacitance	Within ±15%	in Fig.4 using a eutectic solder.
		Change		Perform the five cycles according to the four heat treatments
		D.F.	0.05 max.	listed in the following table.
		I.R.	More than 3,000MΩ	Let sit for 24±2 h at room condition, then measure.
		Dielectric	Pass the item No.4.	Step Temperature (°C) Time (min)
		Strength		1 Min. Operating Temp.±3 30±3
				2 Room Temp. 2 to 3
				3 Max. Operating Temp.±2 30±3
				4 Room Temp. 2 to 3
				Pretreatment
				Perform a heat treatment at 150 <sup>+</sup> <sub>-10</sub> °C for 60±5 min and then
				let sit for 24±2 h at room condition.
				<u> </u>
				Solder resist
				Cu
				Glass Epoxy Board Fig. 4
16	Humidity	Appearance	No marking defects.	Sit the capacitor at 40±2℃ and relative humidity 90 to 95% for
	(Steady State)	Capacitance	Within ±15%	500±12 h.
		Change		Remove and let sit for 24±2 h at room condition, then measure.
		D.F.	0.05 max.	
		I.R.	More than 3,000MΩ	
		Dielectric	Pass the item No.4.	
		Strength		
17	Life	Appearance	No marking defects.	Impulse Voltage
		Capacitance	Within ±20%	Each individual capacitor shall be    100 (%)   T1=1.2µs=1.67T   T2=50µs   T2=50µs   T3=1.67T   T3=50µs   T3=1.67T   T3=1.
		Change		subjected to a 2.5kV (Type GC:5kV)
		D.F.	0.05 max.	Impulses (the voltage value means 307
		I.R.	More than 3,000MΩ	zero to peak) for three times. Then
		Dielectric	Pass the item No.4.	the capacitors are applied to life test.
		Strength		
				Apply voltage as Table for 1,000 h at $125^{+2}_{-0}$ °C, relative humidity
				50% max.
				Type Applied voltage
				AC312 5V (r.m.s.), except that once each hour the
				voltage is increased to AC1,000V (r.m.s.) for 0.1s.
				AC425V (r.m.s.), except that once each hour the
				voltage is increased to AC1,000V (r.m.s.) for 0.1s.
18	Humidity	Appearance	No marking defects.	Apply the rated voltage at 40±2℃ and relative humidity 90 to
10	Loading	Capacitance	Within ±15%	95% for 500 <sup>±2</sup> 0 h. Remove and let sit for 24±2 h at room
	Loading	Change	VVId III = 1370	condition, then measure.
			0.05 may	Condition, then measure.
		D.F.	0.05 max. More than $3,000$ M $Ω$	
		I.R.	Pass the item No.4.	
		Dielectric Strength	1 033 1116 116111 140.4.	

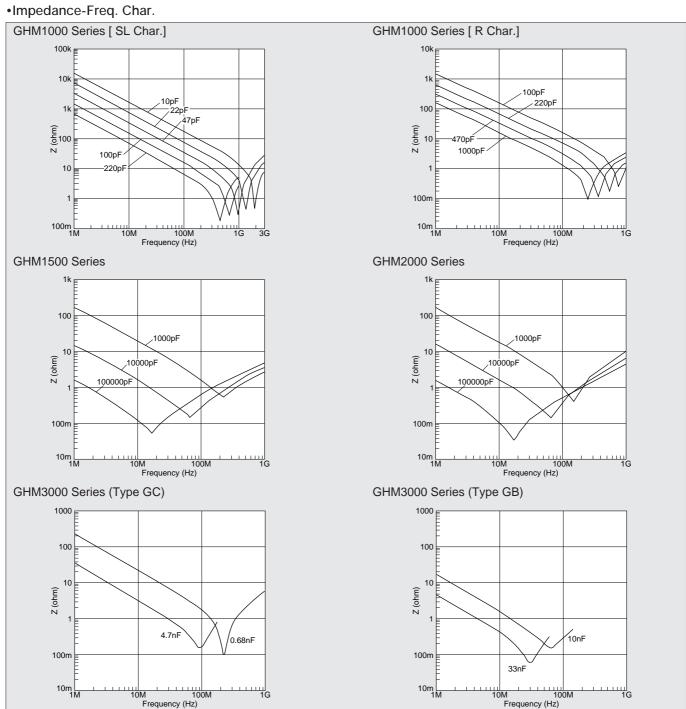
"Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

### TYPICAL CHARACTERISTICS DATA

#### •Capacitance-Temp. Char.





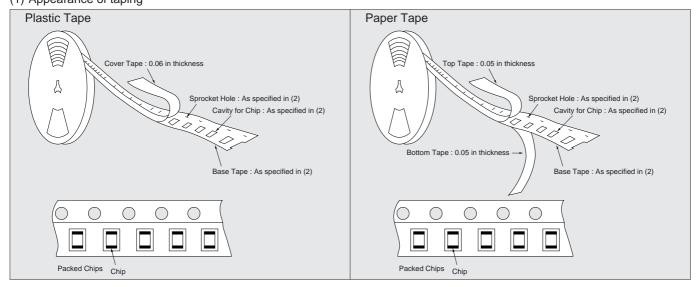


0.3±0.1

3.7 max

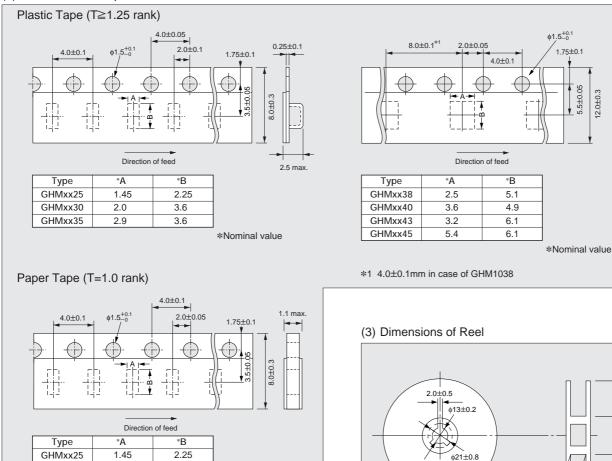
(in mm)

## (1) Appearance of taping



#### (2) Dimensions of Tape

GHMxx30



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

3.6

\*Nominal value

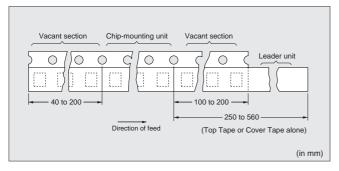
(in mm)

2.0

# 2.0±0.5 013±0.2 021±0.8 021±0.8 03.01,0 (Tape width 8mm) 13.01,0 (Tape width 12 mm)

#### 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 :  $\pm 0.3$ mm.
- (10) Peeling off force : 0.1 to 0.7N in the direction shown below.



#### **!** CAUTION

#### 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 Vp-p value of the applied voltage within the rated voltage range.

 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℃.

#### 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%. Use capacitors within 6 months.

#### 4. Vibration and impact

Do not expose a capacitor to excessive shock or vibration during use.

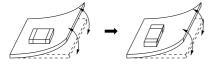
#### 5. Circuit board material

Please contact our sales representatives or engineers in case that GHM products (size 4.5×3.2mm and over) are to be mounted upon a metal-board or metal-frame. Soldering heat causes the expansion and shrinkage of a board or frame, which may result in chip-cracking.

#### 6. Land layout for cropping PC Board

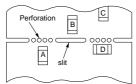
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component direction]



Locate chip horizontal to the direction in which stress acts.

[Chip Mounting Close to Board Separation Point]



Chip arrangement Worst A>C>B≂D Best

#### **!** CAUTION

Soldering (Prevention of the thermal shock)
 If a chip component is heated or cooled abruptly during soldering, it may crack due to the thermal shock. To prevent this, adequate soldering condition should be taken following our recommendation below.

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

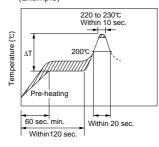
Chip Size Soldering method	3.2×1.6mm and under	3.2×2.5mm and over	
Reflow method or Soldering iron method	ΔΤ≦190℃	ΔΤ≦130℃	
Flow method or Dip Soldering method	ΔΤ≦150℃		

When components are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100  $^{\circ}\!\text{C}.$ 

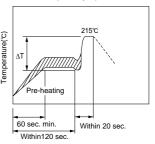
When soldering chips with a soldering iron, it should be performed in following conditions.

Item	Conditions			
Chip size	≦2.0×1.25mm	3.2×1.6mm		
Temperature of iron-tip	300℃ max. 270℃ max			
Soldering iron wattage	20W max.			
Diameter of iron-tip	φ 3.0mm max.			
Soldering time	3 sec. max.			
Caution	Do not allow the iron-tip to directly touch the ceramic element.			

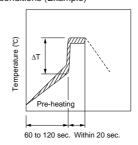
 Infrared reflow soldering conditions (Example)



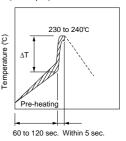
 Vapor reflow soldering (VPS) conditions (Example)



• Dip soldering/Soldering iron conditions (Example)



 Flow soldering conditions (Example)



#### 8. Soldering method

GHM products whose sizes are 3.2×1.6mm and under for flow and reflow soldering, and other sizes for reflow soldering.

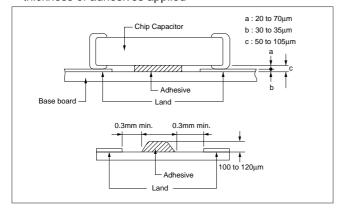
Be sure to contact our sales representatives or engineers in case that GHM products (size 3.2×2.5mm and over) are to be mounted with flow soldering. It may crack due to the thermal shock.

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.

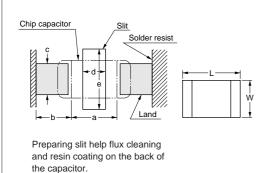
Careful checking and maintenance are necessary to prevent unexpected trouble.

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.

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

#### Construction and dimensions of pattern (example)



● Flow soldering				
	L×W	a	b	С

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

#### Reflow soldering

(in mm)

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

#### Land layout to prevent excessive solder

- Land layout t	Land layout to prevent excessive solder							
Examples of arrangements to be avoided	Mounting close to a chassis  Chassis Solder (Ground solder)  Adhesive Base board Land Pattern	Mounting with leaded components  Lead Wire Connected to a Part Provided with Lead Wires.	Mounting leaded Components later  Soldering Iron Lead Wire of Component to be Connected Later.					
Examples of improvements by the land division	d <sub>2</sub> d <sub>1</sub> <d<sub>2 Solder Resist</d<sub>	Solder Resist	Solder Resist					

#### **NOTICE**

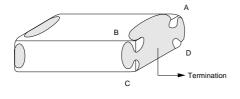
#### 3. SOLDERING

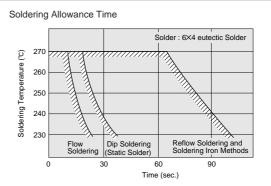
(Care for minimizing loss of the terminations)

 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.





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

#### (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)

- (i) Flow soldering and iron soldering
  Use as little solder as possible (as shown in Fig.1), and confirm that the solder is securely placed.
- (ii) Reflow soldering

When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations (as shown in 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).

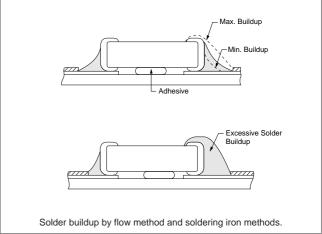


Fig.1

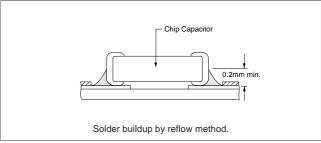


Fig.2

#### ■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	Mar. 31, '95	RCJ★ ISO9001	RCJ-85M-01C
Co.,Ltd.			
Izumo Murata Manufacturing	May. 11, '95		RCJ-93M-05A
Co.,Ltd.			
Murata Electronics	Aug. 13, '92	SISIR★★	SG MES 91M001A
Singapore (Pte.) Ltd.		ISO9002	
Murata Manufacturing	Nov. 18, '92	BSI★★★	FM 22169
(UK) Ltd.		ISO9002	
Murata Amazonia	Sep. '93	RCJ★	RCJ-(B)-93M-01
Industria Comercio Ltda.		ISO9002	
Murata Electronics North America	Jun. '94	UL★★★★	A1734
State College Plant		ISO9002	

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

★★★ BSI : British Standards Institution ★★★★ UL : Underwriters Laboratories Inc.

#### **⚠ Note:**

1. Export Control

(For customers outside Japan)

Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons (For customers in Japan)

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

- 2. Please contact our sales representatives or product engineers before using our products listed in this catalog for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property, or when intending to use one of our products for other applications than specified in this catalog.
  - 1 Aircraft equipment
  - 2 Aerospace equipment
  - 3 Undersea equipment
  - 4 Medical equipment
  - 5 Transportation equipment (vehicles, trains, ships,etc.)
  - 6 Traffic signal equipment
  - 7 Disaster prevention / crime prevention equipment
  - ® Data-processing equipment
  - Application of similar complexity and/or reliability requirements to the applications listed in the above
- 3. Product specifications in this catalog are as of July 1999. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before your ordering. If there are any questions, please contact our sales representatives or product
- 4. The parts numbers and specifications listed in this catalog are for information only. You are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.
- 5. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or third party's intellectual property rights and other related rights in consideration of your using our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under
- 6. None of ozone depleting substances (ODS) under the Montreal Protocol is used in manufacturing process of us.



http://www.murata.co.jp/products/