CHIP MONOLITHIC CERAMIC CAPACITOR



maran Innovator in Electronics

Murata Manufacturing Co., Ltd.

Cat.No.C02E-6

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• Please refer to "Specifications and Test Methods" at the end of each chapter of 5 - 16 except for GRM series.

1

2

3

4





Part Numbering

(Please specify the part number when ordering.)





• For ultrasonic

1Temperature Characteristic

• Temperature compensating type

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

• High dielectric constant

Code	X7R	X7R X5R		Y5V	В	R	
Temp. range	—55 to 125℃	—55 to 85℃	10 to 85℃	−30 to 85°C	−25 to 85°C		
Cap. change (%)	±15	±15	+22 -56	+22 -82	±10	±15	

• High-Voltage/AC250V type/Safety std. Recognition

Code	SL	R/X7R	В	code	ZI	M
Temp. range	20 to 85℃	−55 to 125℃	—25 to 85℃	Temp.range	−25 to 20°C	20 to 85℃
Cap. change	+350 to −1000ppm/°C	±15%	±10%	Temp. coeff. (ppm/℃)	4700 +1000 2500	4700 +500 1000

2Capacitance (Ex.)

Code 0R5

R75

010

100

101

103

3Capacitance Tolerance

	Capacitance (pF)		Туре	Temperature Characteristic	Code	Capac Toler	itance ance	Capacitance Step	
	0.5			C0G to U2J	С		±0.25pF	0.5, 1, 1.5, 2, 3, 4, 5 (pF)	
	0.75		Temperature compensating type	(NP0) (N750)	D	≦10 pF	±0.5pF	6, 7, 8, 9, 10 (pF)	
	1			and SL	J	>10 pF	±5%	E12 series	
	10			X7R, X5R, B, R	ĸ	±1		E6 series	
	100								
	10000		High dielectric constant	Z5U	М	±2	0%	E6 series	
	10000			Z5U, Y5V	Z	+80, -	-20%	E3 series	
				SL	D	≦10 pF	±0.5pF	10 (pF)	
			High-Voltage/AC250V type/	5L	J	>10 pF	±5%	E12 series	
			Safety Standard Recognition	X7R, B, R	к	±10%		E6 series	
				В	м	±20%		E3 series	

A Rated Voltage

Code	Rated voltage	Code	Rated voltage	Code	Rated voltage
6.3	DC6.3V	50	DC50V	3К	DC3.15kV
10	DC10V	250	DC250V	AC250	AC250V(r.m.s.)
16	DC16V	630	DC630V		
25	DC25V	2K	DC2kV		

Not apply to GHM3000 Series [Rated voltage : AC250V (r.m.s.)]

Packing Code (only for chip type)

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

GType Designation (Apply to GHM3000 Series.)

Code	Type Designation
-GB	Type GB
-GC	Type GC



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

for Flow/Reflow Soldering GRM Series

Features

- 1. Terminations are made of metal highly resistant to migration.
- 2. The GRM series is a complete line of chip ceramic capacitors in 10V,16V,25V,50V,100V,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 GRM36(LxWxT:1.0x0.5x0.5mm) to GRM42-6 (LxWxT:3.2x1.6x1.25mm).

GRM39, 40 and GRM42-6 types are suited to flow and reflow soldering.

GRM36 types is applied to only reflow soldering.

- 4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
- 5. The GRM series is available in paper or plastic embossed tape and reel packaging for automatic placement. Bulk case packaging is also available for GRM36,GRM39,GRM40(T:0.6,1.25).

Application

General electronic equipment.

Temperature Compensating Type GRM36 Series

Part Number					GRM36				
L x W(mm)					1.00x0.50				
TC Code	C0G	СОН	P2H	R2H	S2H		SL	T2H	U2J
Rated Volt.(Vdc)	50	25	50	50	50	25	50	50	50
Capacitance and	T(mm)								
0.5pF	0.50								
0.75pF	0.50								
1.0pF	0.50								
2.0pF	0.50								
3.0pF	0.50		0.50	0.50	0.50			0.50	0.50
4.0pF	0.50		0.50	0.50	0.50			0.50	0.50
5.0pF	0.50		0.50	0.50	0.50			0.50	0.50
6.0pF	0.50		0.50	0.50	0.50			0.50	0.50
7.0pF	0.50		0.50	0.50	0.50			0.50	0.50
8.0pF	0.50		0.50	0.50	0.50			0.50	0.50
9.0pF	0.50		0.50	0.50	0.50			0.50	0.50
10.0pF	0.50		0.50	0.50	0.50			0.50	0.50
12.0pF	0.50		0.50	0.50	0.50			0.50	0.50
15.0pF	0.50		0.50	0.50	0.50			0.50	0.50
18.0pF	0.50		0.50	0.50	0.50			0.50	0.50
22.0pF	0.50		0.50	0.50	0.50			0.50	0.50
27.0pF	0.50		0.50	0.50	0.50			0.50	0.50
33.0pF	0.50			0.50	0.50			0.50	0.50
39.0pF	0.50				0.50			0.50	0.50
47pF	0.50						0.50	0.50	0.50
56pF	0.50						0.50	0.50	0.50





Part Number		Din	nensions (n	וm)		
Fait Number	L	W	Т	е	g min.	
GRM36	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4	
GRM39*	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5	
			0.6 ±0.1			
GRM40	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7	
			1.25 ±0.1			
	3.2 ±0.15	1 4 +0 15	0.85 ±0.1			
GRM42-6	3.2 ±0.15	1.0 ±0.15	1.15 ±0.1	0.3 to 0.8	1.5	
	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2			

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

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Part Number					GRM36						
L x W(mm)					1.00x0.50						
TC Code	COG	C0H	P2H	R2H	S2H	SL		T2H	U2J		
Rated Volt.(Vdc)	50	25	50	50	50	25	50	50	50		
Capacitance and T(mm)											
68pF	0.50						0.50	0.50	0.50		
82pF	0.50						0.50	0.50	0.50		
100pF	0.50						0.50	0.50	0.50		
120pF	0.50						0.50		0.50		
150pF	0.50						0.50		0.50		
180pF		0.50					0.50		0.50		
220pF		0.50				0.50					
270pF		0.50				0.50					
330pF						0.50					
390pF						0.50					

Temperature Compensating Type GRM39 Series

Part Number							GRM39						
L x W(mm)							1.60x0.80)					
TC Code		C0G		COH	P2H	R2H	S2H		S	sL		T2H	U2J
Rated Volt.(Vdc)	50	100	200	25	50	50	50	25	50	100	200	50	50
Capacitance and	T(mm)							1			1		1
0.5pF	0.80												
1.0pF	0.80		0.80										
2.0pF	0.80		0.80										
3.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
4.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
5.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
6.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
7.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
8.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
9.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
10.0pF	0.80		0.80		0.80	0.80	0.80					0.80	0.80
12pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
15pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
18pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
22pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
27pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
33pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
39pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
47pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
56pF	0.80	0.80			0.80	0.80	0.80				0.80	0.80	0.80
68pF	0.80	0.80			0.80	0.80	0.80		0.80		0.80	0.80	0.80
82pF	0.80	0.80			0.80	0.80	0.80		0.80		0.80	0.80	0.80
100pF	0.80	0.80			0.80	0.80	0.80		0.80		0.80	0.80	0.80
120pF	0.80	0.80			0.80	0.80	0.80		0.80	0.80		0.80	0.80
150pF	0.80	0.80			0.80	0.80	0.80		0.80	0.80		0.80	0.80
180pF	0.80					0.80	0.80		0.80	0.80		0.80	0.80
220pF	0.80						0.80		0.80	0.80		0.80	0.80
270pF	0.80								0.80	0.80		0.80	0.80
330pF	0.80								0.80	0.80		0.80	0.80
390pF	0.80								0.80	0.80		0.80	0.80
470pF	0.80								0.80				0.80
560pF	0.80			0.80					0.80				0.80
680pF				0.80					0.80				0.80
820pF				0.80				0.80					
1000pF				0.80				0.80					

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Part Number							GRM39						
L x W(mm)							1.60x0.80)					
TC Code		COG COH P2H R2H S2H SL T2H U2J											
Rated Volt.(Vdc)	50	100 200 25 50 50 50 25 50 100 200 50 50											
Capacitance and	l T(mm)												
1200pF								0.80					
1500pF								0.80					

Temperature Compensating Type GRM40 Series

Part Number							GRM40						
L x W(mm)							2.00x1.25	5					
TC Code		C0G		COH	P2H	R2H	S2H		S	SL.		T2H	U2J
Rated Volt.(Vdc)	50	100	200	25	50	50	50	25	50	100	200	50	50
Capacitance and	T(mm)												
12pF			0.85										
15pF			0.85										
18pF			0.85										
22pF			0.85										
27pF			0.85										
33pF			0.85										
39pF			0.85										
47pF			0.85										
56pF			0.85										
68pF		0.85	1.25										
82pF		0.85	1.25										
100pF		0.85	1.25										
120pF		0.85	1.25								0.85		
150pF		0.85	1.25								1.25		
180pF		0.85	1.25		0.85						1.25		
220pF		0.85	1.25		0.85	0.85					1.25		
270pF		0.85			0.85	0.85	0.85				1.25		
330pF		0.85			0.85	0.85	0.85				1.25		
390pF		1.25			1.25	0.85	0.85				1.25		
470pF		1.25			1.25	0.85	0.85			0.85	1.25		
560pF	0.60	1.25			1.25	1.25	1.25			0.85		1.25	
680pF	0.85	1.25				1.25	1.25			0.85		1.25	
820pF	0.85	1.25					1.25		0.60	1.25		1.25	0.60
1000pF	0.85	1.25							0.60	1.25		1.25	0.60
1200pF	0.85								0.60	1.25		1.25	0.60
1500pF	0.85								0.85	1.25		1.25	0.85
1800pF	1.25								0.85	1.25		1.25	0.85
2200pF	1.25								0.85				0.85
2700pF				1.25					1.25				1.25
3300pF				1.25					1.25				1.25
3900pF				1.25				0.85					
4700pF								0.85					
5600pF								1.25					
6800pF								1.25					

1

Temperature Compensating Type GRM42-6 Series

Part Number								GRM42-6		-					
L x W(mm)			-	-			1	3.20x1.6	0						1
TC Code		C)G		C0H	P2H	R2H	S2H			SL			T2H	U2J
Rated Volt.(Vdc)	50	100	200	500	25	50	50	50	25	50	100	200	500	50	50
Capacitance and	T(mm)				r							. <u></u>			
1.0pF				1.15											
2.0pF				1.15											
3.0pF				1.15											
4.0pF				1.15											
5.0pF				1.15											
6.0pF				1.15											
7.0pF				1.15											
8.0pF				1.15											
9.0pF				1.15											
10.0pF				1.15											
12pF				1.15											
15pF				1.15											
18pF				1.15											
22pF				1.15											
27pF				1.15											
33pF				1.15											
39pF				1.15											
47pF				1.15											
56pF				1.15											
68pF				1.15											
82pF				1.15											
100pF				1.15											
120pF				1.15											
120pr 150pF				1.13									1.15		
130pF													1.15		
220pF													1.15		
			1.15										1.15		
270pF													1.15		
330pF			1.15												
390pF			1.15												
470pF			1.15												
560pF						0.05						1.15			
680pF						0.85						1.15			
820pF						0.85	0.85					1.15			
1000pF						1.15	1.15	0.85				1.15			
1200pF		1.15				1.15	1.15	1.15				1.15			
1500pF		1.15				1.15	1.15	1.15							
1800pF		1.15						1.15							
2200pF		1.15									1.15			1.15	
2700pF	0.85										1.15			1.15	
3300pF	0.85										1.15			1.15	
3900pF	1.15									0.85	1.15			1.15	0.85
4700pF	1.15									0.85	1.15				0.85
5600pF	1.15									0.85					0.85
6800pF					0.85					1.15					1.15
8200pF					1.15					1.15					1.15
10000pF					1.15				1.15						
12000pF									1.15						
15000pF									1.15						



High Dielectric Constant Type X5R GRM36/40/42-6 Series

TC Code				X5R			
Part Number	GRM36	GRM39	GR	M40		GRM42-6	
L x W(mm)	1.00x0.50	1.60x0.80	2.00	x1.25		3.20x1.60	
Rated Volt.(Vdc)	10	6.3	6.3	10	6.3	10	16
Capacitance and	T(mm)						
33000pF	0.50						
47000pF	0.50						
68000pF	0.50						
0.1µF	0.50						
0.47µF		0.80					
1.0µF		0.80		0.85			
2.20µF			1.25				1.15
3.3µF						1.30	
4.7µF			1.25		1.60	1.60	
10.0µF					1.60		

 4.7μ F for 6.3V is replaced with GRM40-034 series of L:2±0.15, W:1.25±0.15, T:1.25±0.15.

T:1.25±0.1mm is also available for GRM40 10V 1.0 μF type.

 $3.3\mu F$ for 10V rated is replaced with GRM42-631 series of L:3.2±0.2, W:1.6±0.2, T:1.3+0/-.3mm.

T:1.15mm is also available for GRM42-6 16V 1.0 μF type.

The torelance will be changed to L:3.2 \pm 0.2, W:1.6 \pm 0.2, T:1.15 \pm 0.15 for GRM42-6 16V 2.2µF type.

High Dielectric Constant Type X7R GRM36/39/40/42-6 Series

TC Code									X7R								
Part Number		GR	M36				GR	M39				GRM40			GRM	142-6	-
L x W(mm)		1.00	x0.50				1.60	x0.80			2	.00x1.2	5		3.20	x1.60	
Rated Volt.(Vdc)	10	16	25	50	10	16	25	50	100	200	16	25	50	10	16	25	50
Capacitance and	d T(mm)																
220pF				0.50				0.80		0.80							
330pF				0.50				0.80		0.80							
470pF				0.50				0.80		0.80							
680pF				0.50				0.80		0.80							
1000pF				0.50				0.80		0.80							
1500pF				0.50				0.80		0.80							
2200pF				0.50				0.80	0.80								
3300pF				0.50				0.80	0.80								
4700pF				0.50				0.80									
6800pF			0.50					0.80									
10000pF			0.50					0.80									
15000pF		0.50						0.80									
22000pF		0.50						0.80									
33000pF	0.50						0.80						0.85				
47000pF	0.50						0.80						1.25				
68000pF							0.80										
0.10µF						0.80	0.80					1.25	1.25				
0.15µF					0.80							1.25	1.25				
0.22µF					0.80							0.85	1.25				1.15
0.33µF												1.25					0.85
0.47µF											0.85	1.25					1.15
0.68µF											0.85					0.85	
1.00µF											1.25			0.85	0.85	1.15	
1.5µF															1.15		
2.2µF														1.15	1.15		

 $0.10\mu F$, 50V rated are GRM40-034 series of L:2±0.15, W:1.25±0.15, T:1.25±0.15.

T:1.25 $\pm 0.1 mm$ is also available for GRM42-6 1.0 μF for 16V.

The torelance will be changed to L:3.2 \pm 0.2, W:1.6 \pm 0.2, T:1.15 \pm 0.15 for GRM42-6 16V 2.2µF type.



High Dielectric Constant Type Y5V GRM36/39/40/42-6 Series

TC Code								Y	ōV							
Part Number		GRM36				GRM39				GR	M40			GRN	142-6	
L x W(mm)	1	.00x0.5	0		1	.60x0.8	0			2.00	x1.25			3.20	x1.60	
Rated Volt.(Vdc)	16	25	50	10	16	25	50	100	10	16	25	50	6.3	10	16	25
Capacitance and	d T(mm)															
2200pF			0.50													
4700pF			0.50					0.80								
10000pF			0.50				0.80									
22000pF		0.50					0.80									
47000pF	0.50						0.80									
0.10µF	0.50					0.80						0.85				
0.22µF					0.80						0.85	1.25				
0.47µF				0.80	0.80						1.25					
1.0µF				0.80					0.85	0.85	0.85				0.85	1.15
1.5µF										1.25	1.25					
2.2µF									1.25	1.25	1.25			0.85	1.15	
4.7µF									1.25					1.15	1.15	
10.0µF													1.15	1.15		

T:1.25 \pm 0.1mm is also available for GRM40 16V 1.0 μ F type.

High Dielectric Constant Type Z5U GRM39/40/42-6 Series

TC Code				Z	5U			
Part Number	GR	M39		GRM40			GRM42-6	
L x W(mm)	1.60	x0.80		2.00x1.25			3.20x1.60	
Rated Volt.(Vdc)	50	100	50	100	200	50	100	200
Capacitance and	T(mm)							
2200pF	0.80	0.80			1.25			
4700pF	0.80			0.85				1.15
10000pF	0.80			1.25				
22000pF			0.60				0.85	
47000pF			0.60					
0.10µF			0.85					
0.22µF						0.85		





CHIP MONOLITHIC CERAMIC CAPACITOR

for Reflow Soldering GRM Series

2

Features

- 1. Terminations are made of metal highly resistant to migration.
- 2. The GRM series is a complete line of chip ceramic capacitors in 25V,50V,100V,200V and 500V rated. These capacitors have temperature characteristics ranging from C0G to Y5V.
- This series consists of type GRM42-2(LxWxT:3.2x2.5x 0.85mm) to type GRM44-1(LxWxT:5.7x5.0x2.0mm). These are suited to only reflow soldering.
- 4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placements on PCBs.
- 5. The GRM series is available in plastic embossed tape or paper taping and reel packaging for automatic placement.

Application

General electronic equipment.

Temperature Compensating Type GRM42-2 Series

Part Number				GR	M42-2			
L x W(mm)				3.2	0x2.50			
TC Code		CC	G			S	SL	
Rated Volt.(Vdc)	50	100	200	500	50	100	200	500
Capacitance and	T(mm)							
150pF				1.35				
180pF				1.35				
330pF								1.15
390pF								1.15
470pF								1.35
560pF			1.35					
680pF			1.35					
820pF			1.35					
1000pF			1.35					
1500pF							1.35	
2700pF		1.35						
3300pF		1.35						
3900pF		1.35						
5600pF						1.35		
6800pF	1.35					1.35		
10000pF					1.35			
12000pF					1.35			





muRata

Part Number		Dir	nensions (m	ım)	
Part Number	L	W	Т	e min.	g min.
			0.85 ±0.1		
			1.15 ±0.1		
GRM42-2	3.2 ±0.3	2.5 ±0.2	1.35 ±0.15	0.3	1.0
			1.8 ±0.2		
			2.5 ±0.2		
GRM43-2	4.5 ±0.4	3.2 ±0.3	2.0 max.	0.3	2.0
GRM44-1	5.7 ±0.4	5.0 ±0.4	2.0 max.	0.3	2.0



Temperature Compensating Type GRM43-2 Series

Part Number				GRM	143-2			
L x W(mm)				4.50	x3.20			
TC Code		C)G			S	L	
Rated Volt.(Vdc)	50	100	200	500	50	100	200	500
Capacitance and T	¯(mm)							
220pF				2.00				
270pF				2.00				
330pF				2.00				
390pF				2.00				
470pF				2.00				
560pF								2.00
680pF								2.00
820pF								2.00
1000pF								2.00
1200pF			2.00					2.00
1500pF			2.00					
1800pF			2.00				2.00	
2200pF			2.00				2.00	
2700pF			2.00				2.00	
3300pF							2.00	
3900pF							2.00	
4700pF		2.00						
5600pF		2.00						
6800pF		2.00						
8200pF	2.00	2.00				2.00		
10000pF	2.00	2.00				2.00		
12000pF	2.00	2.00				2.00		
15000pF					2.00	2.00		

Temperature Compensating Type GRM44-1 Series

Part Number				GRM44-1			
L x W(mm)				5.70x5.00			
TC Code		С	:0G			SL	
Rated Volt.(Vdc)	50	100	200	500	50	100	200
Capacitance and T	(mm)		·				
560pF				2.00			
680pF				2.00			
820pF				2.00			
1000pF				2.00			
3300pF			2.00				
3900pF			2.00				
4700pF			2.00				2.00
5600pF			2.00				2.00
6800pF							2.00
8200pF							2.00
15000pF	2.00	2.00					
18000pF	2.00	2.00			2.00	2.00	
22000pF	2.00	2.00			2.00	2.00	
27000pF	2.00	2.00			2.00	2.00	
33000pF	2.00				2.00	2.00	
39000pF	2.00				2.00	2.00	





2

High Dielectric Constant Type GRM42-2 Series

Part Number					GRM	142-2				
L x W(mm)					3.20	x2.50				
TC Code	X5R			X7R			Y5V		Z5U	
Rated Volt.(Vdc)	10	16	25	50	100	200	50	50	100	200
Capacitance and	T(mm)									
10000pF										1.15
15000pF										1.35
22000pF										1.35
33000pF						1.35				
47000pF						1.35			1.35	
68000pF					1.35				1.35	
0.10µF					1.35				1.35	
0.33µF								1.15		
0.47µF				1.15						
0.68µF				1.35						
1.00µF				1.80			1.8	1.80		
2.2µF		1.15	1.80							
3.3µF		1.35								
4.7µF		1.80								
10.0µF	2.50									

High Dielectric Constant Type GRM43-2 Series

Part Number	GRM43-2						
L x W(mm)	4.50x3.20						
TC Code		X7R			Z5U		
Rated Volt.(Vdc)	50	100	200	50	100	200	
Capacitance and T(r	nm)						
33000pF						2.00	
47000pF						2.00	
68000pF			2.00			2.00	
100000pF			2.00			2.00	
0.15µF		2.00			2.00		
0.22µF		2.00			2.00		
0.33µF	2.00						
0.47µF	2.00			1.50			
0.68µF				1.50			
1.0µF				2.00			

High Dielectric Constant Type GRM44-1 Series

Part Number	GRM44-1						
L x W(mm)	5.70x5.00						
TC Code		X7R		Z5U			
Rated Volt.(Vdc)	50	100	200	50	100	200	
Capacitance and T(mm)							
0.15µF			2.00			2.00	
0.22µF			2.00			2.00	
0.33µF		2.00			2.00		
0.47µF		2.00			2.00		
0.68µF	2.00				2.00		
1.0µF	2.00						
1.5µF	2.00			2.00			



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

Ultra-small Type GRM33 Series

Features

3

- 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 are allow highly reliable, high speed autom atic 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 Number	Dimensions (mm)					
Part Number	L	W	Т	е	g min.	
GRM33	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2	

Part Number	GRM33					
L x W(mm)	0.6x0.3					
TC Code	COG	X7R	Y5V			
Rated Volt.(Vdc)	25	16	10			
Capacitance and T(mm)						
0.5pF	0.3					
1pF	0.3					
2pF	0.3					
3pF	0.3					
4pF	0.3					
5pF	0.3					
6pF	0.3					
7pF	0.3					
8pF	0.3					
9pF	0.3					
10pF	0.3					
12pF	0.3					
15pF	0.3					
18pF	0.3					
22pF	0.3					
27pF	0.3					
33pF	0.3					
39pF	0.3					
47pF	0.3					
56pF	0.3					
68pF	0.3					
82pF	0.3					
100pF	0.3	0.3				
150pF		0.3				
220pF		0.3				
330pF		0.3				
470pF		0.3				
680pF		0.3				
1000pF		0.3				
2200pF			0.3			





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Solution Continued from the preceding page.

	the preceding page.					
Part Number	GRM33					
L x W(mm)	0.6x0.3					
TC Code	C0G	X7R	Y5V			
Rated Volt.(Vdc)	25	16	10			
Capacitance and	d T(mm)					
4700pF			0.3			
10000pF			0.3			

3

CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

Thin Type for Flow/Reflow GRM Series

Features

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





Part Number	Dimensions (mm)					
	L	W	Т	е	g min.	
GRM36-019	1.0 ±0.05	0.5 ±0.05	0.25 ±0.05	0.15 to 0.3	0.4	

Application

Thin equipment such as IC cards.

Part Number	GRM36-019			
L x W(mm)	1.00x0.50			
TC Code		COG		
Rated Volt.(Vdc)	25	50		
Capacitance and T(mm)				
1pF		0.25		
2pF		0.25		
3pF		0.25		
4pF		0.25		
5pF		0.25		
6pF		0.25		
7pF		0.25		
8pF		0.25		
9pF		0.25		
10pF		0.25		
12pF		0.25		
15pF		0.25		
18pF		0.25		
22pF		0.25		
27pF		0.25		
33pF		0.25		
39pF		0.25		
47pF		0.25		
56pF		0.25		
68pF		0.25		
82pF		0.25		
100pF		0.25		
120pF	0.25			
150pF	0.25			
180pF	0.25			
220pF	0.25			



			Specif				
No.	lte	em	Temperature Compensating Type	High Dielectric Type		Test Method	
1	Operatino Temperat		−55 to +125°C	X5R : -55 to +85℃ X7R : -55 to +125℃ Z5U : +10 to +85℃ Y5V : -30 to +85℃			
2	Rated Voltage See the previous page.		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P,P}$ or $V^{O,P}$, whichever is larger, shall be maintained within the rated voltage range.				
3	Appearar	nce	No defects or abnormalities.		Visual inspection.		
4	Dimensio	ns	Within the specified dimensions	i.	Using calipers on micro	ometer.	
5	Dielectric	electric Strength No defects or abnormalities.		No failure shall be observed when *300% of the rated voltage (C0 Δ to U2J and SL) or *250% of the rated voltage (X5R, X7R Z5U and Y5V) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V		d voltage (X5R, X7R, ninations for 1 to 5	
6	Insulation ResistanceMore than 10,000MΩ or $500Ω \bullet F$ (Whichever is smaller)		The insulation resistan not exceeding the rate within 2 minutes of cha	d voltage at 25℃ ar			
7	Capacita	nce	Within the specified tolerance.		The capacitance/Q/D.F		
				[X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V 0.05max.(C<3.3µF)	frequency and voltage		
			Item Char. C0∆ toU2J,SL (1000pF and below)		Frequency 1±0.1MHz	Voltage 0.5 to 5Vrms	
8	Q/ Dissipatio	on Factor	ctor 30pFmin. : Q≥1000 30pFmax. : Q≥400+20C C : Nominal Capacitance (pF)	0.1max.(C≧3.3µF) [Z5U] W.V. : 25Vmin. : 0.025max. [Y5V] W.V. : 25Vmin. : 0.05max.(C<10µF) : 0.09max.(C≥1.0µF) W.V. : 16V : 0.07max.(C<1.0µF)	C0∆ toU2J,SL (more than 1000pF)	1±0.1kHz	1±0.2Vrms
	(D.F.)				X5R,X7R,Y5V (10µF and below)	1±0.1kHz	1±0.2Vrms
					X5R,X7R,Y5V (more than 10µF)	120±24Hz	0.5±0.1Vrms
				: 0.09max.(C≧1.0µF) W.V. : 10Vmax. : 0.125max.	Z5U	1±0.1kHz	0.5±0.05Vrms
		Capacitance Change	Within the specified tolerance. (Table A)	X5R : Within±15% (-55 to +85°C) X7R : Within±15% (-55 to +125°C) Z5U : Within +22/-56% (+10 to +85°C) Y5V : Within +22/-82% (-30 to +85°C)	The capacitance change shall be measured a each specified temperature stage. (1) Temperature Compensating Type The temperature coefficient is determined us Capacitance measured in step 3 as a referen When cycling the temperature sequentially fm 5 ($CO\Delta : +25^{\circ}c$ to $+125^{\circ}c$: other temp. coeffs $+85^{\circ}c$) the capacitance shall be within the sp for the temperature coefficient and capacitan		I using the erence. y from step 1 through effs. : +25°C to e specified tolerance
	Capacitance	Temperature	Within the specified tolerance.		Table A. The capacitance drift is between the maximum step 1,3 and 5 by the c	and minimum mea ap value in step 3.	asured values in the
9	Temperature Characteristics	Coefficient	(Table A)		Step	Tempera 25±	
	10101010100						J2J/SL/X5R/X7R) or Y5V)
					3	25±	
					4	125±3 (for 85±3 (for c	,
		Capacitance	Within ±0.2% or ±0.05pF		5	25±	
		Drift (Whichever is larger.) *Not apply to SL/25V			(2) High Dielectric Con The ranges of capacita 25°C value over the ter shall be within the spec	nce change compa nperature ranges s	

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3		eding page.	fication	
o. Ite	em	Temperature Compensating Type	High Dielectric Type	Test Method
Adhesive Strength of Termination No removal of the terminations or other defect shall occur.		Solder the capacitor to the test jig (glass epoxy board) shown ir Fig.1 using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec. 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 gree of defects such as heat shock. *2N (GRM33) 5N (GRM36,GRM39)		
	Appearance	arance No defects or abnormalities.		Fig.1
	Capacitance	Within the specified tolerance.		
1 Vibration Resistance	Q/D.F.	30pFmin. : Q≥1000 30pFmax. : Q≥400+20C C : Nominal Capacitance (pF)	[X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V : 0.05max. (C<3.3μF) 0.1max. (C≥3.3μF) [Z5U] W.V. : 25Vmin. : 0.025max. [Y5V] W.V. : 25Vmin. : 0.05max. (C<1.0μF) : 0.09max. (C≥1.0μF) W.V. : 16V : 0.09max. (C≥1.0μF) W.V. : 10Vmax.: 0.125max.	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).
	No crack or marked defect shall		l occur.	Solder the capacitor on the test jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direc- tion 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.
2 Deflection		Deflection Type a b c GRM33 0.3 0.9 0.3 GRM36 0.4 1.5 0.5 GRM49 1.0 3.0 1.2 GRM42-6 2.2 5.0 2.0 GRM42-2 2.2 5.0 2.9 GRM42-1 4.5 8.0 5.6 (in mr Fig.2		Pressurizing speed : 1.0mm/sec. Pressurize Fig.3



Continued from the preceding page.

			Speci	fication	_			
۱o.	lte	em	Temperature Compensating Type	High Dielectric Type	Test Method			
13	Solderab Terminati		75% of the terminations is to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) rosin (JIS-K-5902) (25% rosin in weight propotion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheatir immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C.			
			The measured and observed characteristics shall satisfy the specifications in the following table.					
		Appearance	No marking defects.					
		Capacitance Change	Within $\pm 2.5\%$ or ± 0.25 pF (Whichever is larger)	X5R,X7R : Within ±7.5% Z5U,Y5V : Within ±20%	– Preheat the capacitor at 120 to 150℃ for 1 minute.			
14	Resistance to Soldering Heat	Q/D.F.	30pFmin. : Q≧1000 30pFmax. : Q≧400+20C C : Nominal Capacitance (pF)	$ \begin{array}{l} [X5R,X7R] \\ W.V.: 25Vmin.: 0.025max. \\ W.V.: 16/10V: 0.035max. \\ W.V.: 6.3V: \\ 0.05max. (C<3.3\mu F) \\ 0.1max. (C\geq3.3\mu F) \\ [Z5U] \\ W.V.: 25Vmin.: 0.025max. \\ [Y5V] \\ W.V.: 25Vmin. \\ : 0.05max. (C<1.0\mu F) \\ : 0.09max. (C\geq1.0\mu F) \\ W.V.:16V \\ : 0.07max. (C<1.0\mu F) \\ : 0.09max. (C\geq1.0\mu F) \\ \end{array} $	Immerse the capacitor in a cutectic solder solution at 270: for 10±0.5 seconds. Let sit at room temperature for 24±2 (temperature compensating type) or 48±4 hours (high die constant type), then measure. •Initial measurement for high dielectric constant type Perform a heat treatment at 150 ±₁8℃ for one hour and the let sit for 48±4 hours at room temperature. Perform the initial measurement. *Preheating for GRM42-2/43-2/44-1 Step Temperature 1 100℃ to 120℃ 2 170℃ to 200℃			
		I.R.	More than 10,000M Ω or 500 Ω • F (Whichever is smaller)		_			
		Dielectric	No failure					
		Strength	No failure					
			No failure The measured and observed cl specifications in the following ta					
			The measured and observed cl		_			
		Strength	The measured and observed cl specifications in the following ta		Fix the capacitor to the supporting jig in the same manner and			
		Strength Appearance Capacitance	The measured and observed cl specifications in the following ta No marking defects. Within ±2.5% or ±0.25pF	able. X5R,X7R : Within ±7.5% Z5U,Y5V : Within ±20% [X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V 0.05max. (C<3.3µF)	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 hour (high dielectric constant type) at room temperature, then measure.			
	Temperature	Strength Appearance Capacitance	The measured and observed cl specifications in the following ta No marking defects. Within ±2.5% or ±0.25pF (Whichever is larger)	able. X5R,X7R : Within ±7.5% Z5U,Y5V : Within ±20% [X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V 0.05max. (C<3.3µF) 0.1max. (C≥3.3µF)	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 hour (high dielectric constant type) at room temperature, then measure.Step1234			
15	Temperature Cycle	Strength Appearance Capacitance	The measured and observed cl specifications in the following ta No marking defects. Within ±2.5% or ±0.25pF (Whichever is larger) 30pFmin. : Q≥1000 30pFmax. : Q≥400+20C	able. X5R,X7R : Within ±7.5% Z5U,Y5V : Within ±20% [X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V 0.05max. (C<3.3µF) 0.1max. (C≥3.3µF) [Z5U] W.V. : 2.5Vmin. : 0.025max.	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 hour (high dielectric constant type) at room temperature, then measure.			
15		Strength Appearance Capacitance Change	The measured and observed cl specifications in the following ta No marking defects. Within ±2.5% or ±0.25pF (Whichever is larger)	able. X5R,X7R : Within ±7.5% Z5U,Y5V : Within ±20% [X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V 0.05max. (C<3.3µF) 0.1max. (C≥3.3µF) [Z5U]	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 hour (high dielectric constant type) at room temperature, then measure.Step1234Min.Room TompMax. OperatingRoom Tomp			
15		Strength Appearance Capacitance Change	The measured and observed cl specifications in the following ta No marking defects. Within ±2.5% or ±0.25pF (Whichever is larger) 30pFmin. : Q≥1000 30pFmax. : Q≥400+20C	able. X5R,X7R : Within ±7.5% Z5U,Y5V : Within ±20% [X5R,X7R] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V 0.05max. (C<3.3μF) 0.1max. (C≥3.3μF) [Z5U] W.V. : 2.5Vmin. : 0.025max. [Y5V] W.V. : 2.5Vmin. : 0.05max. (C<1.0μF) : 0.09max. (C≥1.0μF) : 0.09max. (C≥1.0μF) : 0.09max. (C≥1.0μF) W.V. : 10Vmax. : 0.125max.	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 hour (high dielectric constant type) 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 $			

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	Continuca II				
	Specification				
No.	lte	em	Temperature Compensating Type	High Dielectric Type	Test Method
			The measured and observed characteristics shall satisfy the specifications in the following table.		
		Appearance	No marking defects.		-
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	X5R,X7R : Within ±12.5% Z5U,Y5V : Within ±30%	
16	Humidity Steady State	Q/D.F.	30pF and over : Q≥350 10pF and over 30pF and below : Q≥275+5C/2 10pF and below : Q≥200+10C C : Nominal Capacitance (pF)	[X5R,X7R] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V 0.075max. (C<3.3μF) 0.125max. (C≥3.3μF) [Z5U] W.V. : 25Vmin. : 0.05max. [Y5V] W.V. : 25Vmin. : 0.075max. (C<1.0μF) : 0.0125max. (C≥1.0μF) W.V. : 16V : 0.1max. (C≥1.0μF) : 0.125max. (C≥1.0μF) W.V. : 10Vmax. : 0.15max.	Sit the capacitor at 40±2°C and 90 to 95% humiduty for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room tem- perature, then measure.
		I.R.	More than 1,000M Ω or 50 Ω • F(Whichever is smaller)		
		Dielectric Strength	No failure		
		The measured and observed characteristics shall satisfy the specifications in the following table.		-	
		Appearance	No marking defects.		
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	X5R,X7R : Within ±12.5% Z5U : Within ±30% Y5V : Within ±30% [W.V. : 10Vmax.] Y5V : Within +30/-40%	
17	Humidity Load	Q/D.F.	30pF and over : Q≥200 30pF and below : Q≥100±10C/3 C : Nominal Capacitance (pF)	[X5R,X7R] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V 0.075max. (C<3.3µF) 0.125max. (C≥3.3µF) [Z5U] W.V. : 25Vmin. : 0.05max. [Y5V] W.V. : 25Vmin. : 0.075max. (C<1.0µF) : 0.0125max. (C≥1.0µF) W.V. : 16V : 0.1max. (C<1.0µF) : 0.125max. (C≥1.0µF) W.V. : 10Vmax. : 0.15max.	Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then muasure.The charge/discharge current is less than 50mA. •Initial measurement for Y5V/10Vmax. Apply the rated DC voltage for 1 hour at 40±2°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.
		I.R.	More than 500MΩ or 25Ω • F(W	/hichever is smaller)	-
		Dielectric Strength	No failure		

Continued on the following page. \square



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	Item		Specif	ication	
No.			Temperature Compensating Type	High Dielectric Type	Test Method
			The measured and observed characteristics shall satisfy the specifications in the following table.		
		Appearance	No marking defects.		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	X5R,X7R : Within ±12.5% Z5U : Within ±30% Y5V : Within ±30% (Cap<1.0μF) Y5V : Within +30/−40%(Cap≧1.0μF)	Apply 200% of the rated voltage for 1000 ± 12 hours at the maximun operating temperature ± 3 °C. Let sit for 24 ± 2 hours
18	High Temperature Load	Q/D.F.	30pF and over : Q≥350 10pF and over 30pF and below : Q≥275±5C/2 10pF and below : Q≥200±10C C : Nominal Capacitance (pF)	[X5R,X7R] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V 0.075max. (C<3.3µF) 0.125max. (C≥3.3µF) [Z5U] W.V. : 25Vmin. : 0.05max [Y5V] W.V. : 25Vmin. : 0.075max. (C<1.0µF) : 0.0125max. (C≥1.0µF) W.V. : 16V : 0.1max. (C<1.0µF) : 0.125max. (C≥1.0µF) W.V. : 10Vmax. : 0.15max.	 (temperature compensating temperature 15°. Let stroft 24±2 floors (temperature comstant type) at room temperature, then measure. The charge/discharge current is less than 50mA. Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage for one hour at the maximun operating temperature ±3°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement. *150% for 500V and C≥10µF
		I.R.	More than 1,000MΩ or 50Ω•F(Nhichever is smaller)	
		Dielectric Strength	No failure		
19	Notice		When mounting capacitor of 50	0V rated voltage, perform the epo	oxy resin coating(min.1.0mm thickness)

Table A

		Capacitance Change from 25°C (%)						
Char.	Nominal Values (ppm/℃)*	-55		-30		-10		
		Max.	Min.	Max.	Min.	Max.	Min.	
COG	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11	
COH	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	$-330\pm$ 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 -1000	-	—	-	_	_	-	

*Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for Co∆)/85°C (for other TC).



CHIP MONOLITHIC CERAMIC CAPACITOR

High-power Type GRM600 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



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Part Number		Dimensions (mm)					
Part Number	L W	W	Т	е	g min.		
GRM615	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4		

Part Number	Rated Voltage (Vdc)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM615C0G010B50	50	C0G	1.0 –0.1pF	1.00	0.50	0.50
GRM615C0G010C50	50	C0G	1.0 –0.25pF	1.00	0.50	0.50
GRM615C0G020B50	50	C0G	2.0 –0.1pF	1.00	0.50	0.50
GRM615C0G020C50	50	C0G	2.0 –0.25pF	1.00	0.50	0.50
GRM615C0G030B50	50	C0G	3.0 –0.1pF	1.00	0.50	0.50
GRM615C0G030C50	50	C0G	3.0 –0.25pF	1.00	0.50	0.50
GRM615C0G040B50	50	C0G	4.0 –0.1pF	1.00	0.50	0.50
GRM615C0G040C50	50	C0G	4.0 –0.25pF	1.00	0.50	0.50
GRM615C0G050B50	50	C0G	5.0 –0.1pF	1.00	0.50	0.50
GRM615C0G050C50	50	C0G	5.0 –0.25pF	1.00	0.50	0.50
GRM615C0G060C50	50	C0G	6.0 –0.25pF	1.00	0.50	0.50
GRM615C0G060D50	50	C0G	6.0 –0.5pF	1.00	0.50	0.50
GRM615C0G070C50	50	C0G	7.0 –0.25pF	1.00	0.50	0.50
GRM615C0G070D50	50	C0G	7.0 –0.5pF	1.00	0.50	0.50
GRM615C0G080C50	50	C0G	8.0 –0.25pF	1.00	0.50	0.50
GRM615C0G080D50	50	C0G	8.0 –0.5pF	1.00	0.50	0.50
GRM615C0G090C50	50	C0G	9.0 –0.25pF	1.00	0.50	0.50
GRM615C0G090D50	50	C0G	9.0 –0.5pF	1.00	0.50	0.50
GRM615C0G0R5B50	50	C0G	0.5 –0.1pF	1.00	0.50	0.50
GRM615C0G0R5C50	50	C0G	0.50 –0.25pF	1.00	0.50	0.50
GRM615C0G100C50	50	C0G	10 –0.25pF	1.00	0.50	0.50
GRM615C0G100D50	50	C0G	10.0 –0.5pF	1.00	0.50	0.50
GRM615C0G110G50	50	C0G	11 –2%	1.00	0.50	0.50
GRM615C0G120G50	50	C0G	12 –2%	1.00	0.50	0.50
GRM615C0G120J50	50	C0G	12 –5%	1.00	0.50	0.50
GRM615C0G130G50	50	C0G	13 –2%	1.00	0.50	0.50
GRM615C0G150G50	50	C0G	15 –2%	1.00	0.50	0.50
GRM615C0G150J50	50	C0G	15 –5%	1.00	0.50	0.50
GRM615C0G160G50	50	C0G	16 –2%	1.00	0.50	0.50
GRM615C0G180G50	50	C0G	18 –2%	1.00	0.50	0.50
GRM615C0G180J50	50	C0G	18 –5%	1.00	0.50	0.50
GRM615C0G1R1B50	50	C0G	1.1 –0.1pF	1.00	0.50	0.50
GRM615C0G1R2B50	50	C0G	1.2 –0.1pF	1.00	0.50	0.50
GRM615C0G1R3B50	50	C0G	1.3 –0.1pF	1.00	0.50	0.50
GRM615C0G1R5B50	50	COG	1.5 –0.1pF	1.00	0.50	0.50
GRM615C0G1R5C50	50	COG	1.5 –0.25pF	1.00	0.50	0.50
GRM615C0G1R6B50	50	COG	1.6 –0.1pF	1.00	0.50	0.50
GRM615C0G1R8B50	50	C0G	1.8 –0.1pF	1.00	0.50	0.50



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Part Number	Rated Voltage (Vdc)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM615C0G200G50	50	C0G	20 –2%	1.00	0.50	0.50
GRM615C0G2R2B50	50	C0G	2.2 –0.1pF	1.00	0.50	0.50
GRM615C0G2R4B50	50	C0G	2.4 –0.1pF	1.00	0.50	0.50
GRM615C0G2R7B50	50	C0G	2.7 –0.1pF	1.00	0.50	0.50
GRM615C0G3R3B50	50	C0G	3.3 –0.1pF	1.00	0.50	0.50
GRM615C0G3R6B50	50	C0G	3.6 –0.1pF	1.00	0.50	0.50
GRM615C0G3R9B50	50	C0G	3.9 –0.1pF	1.00	0.50	0.50
GRM615C0G4R3B50	50	C0G	4.3 –0.1pF	1.00	0.50	0.50
GRM615C0G4R7B50	50	C0G	4.7 –0.1pF	1.00	0.50	0.50
GRM615C0G5R1C50	50	C0G	5.1 –0.25pF	1.00	0.50	0.50
GRM615C0G5R6C50	50	C0G	5.6 –0.25pF	1.00	0.50	0.50
GRM615C0G6R2C50	50	C0G	6.2 –0.25pF	1.00	0.50	0.50
GRM615C0G6R8C50	50	C0G	6.8 –0.25pF	1.00	0.50	0.50
GRM615C0G7R5C50	50	C0G	7.5 –0.25pF	1.00	0.50	0.50
GRM615C0G8R2C50	50	C0G	8.2 –0.25pF	1.00	0.50	0.50
GRM615C0G9R1C50	50	C0G	9.1 –0.25pF	1.00	0.50	0.50



Specifications and Test Methods

			Specification		
No.	lte	em	Temperature Compensating Type		Test Method
1	Operating Temperatu	ire Range	-55 to +125℃		
2	Rated Vo	ltage	See the previous pages.	may be applied contin When AC voltage is su	efined as the maximum voltage which uously to the capacitor. uperimposed on DC voltage, V ^{P,P} or V ^{O,P} , nall be maintained within the rated voltage
3	Appearar	nce	No defects or abnormalities.	Visual inspection.	
4	Dimensio	ns	Within the specified dimensions.	Using calipers.	
5	Dielectric	Strength	No defects or abnormalities.	applied between the te	served when 300% of the rated voltage is erminations for 1 to 5 seconds, provided current is less than 50mA.
6	Insulation (I.R.)	Resistance	10,000M Ω min. or 500 Ω • F min. (Whichever is smaller)		nce shall be measured with a DC voltage ed voltage at 25℃ and 75%RH max. and arging.
7	Capacita	nce	Within the specified tolerance.		all be measured at 25°C at the frequency
			30pF min. : Q≧1,000	and voltage shown in Item Char.	
8	Q		30pF max. : Q≧400+20C	Frequency	1±0.1MHz
			C : Nominal Capacitance (pF)	Voltage	0.5 to 5Vr.m.s.
		Capacitance Change	Within the specified tolerance. (Table A-1)	each specified temper	
		Temperature Coefficent	Within the specified tolerance. (Table A-1)		sating Type ficient is determined using the d in step 3 as a reference.
9	Capacitance Temperature Characteristics Capacitance Drift		Within $\pm 0.2\%$ or $\pm 0.05 \text{pF}$ (Whichever is larger.)	5, (C0G : +25℃ to+12 the capacitance shall temperature coefficien The capacitance drift i	perature sequentially from step 1 through 25°C : other temp. coeffs. : +25°C to 85°C) be within the specified tolerance for the tt and capacitance change as Table A. is calculated by dividing the differences in and minimum measured values in the cap value in step 3. Temperature(°C) 25±2 -55±3
				3	
				4	125±3
				5	25±2
10	Adhesive of Termin		No removal of the terminations or other defect shall occur.	Fig.1 using a eutectic s with the test jig for 10± The soldering shall be method and shall be co	done either with an iron or using the reflow onducted with care so that the soldering is ects such as heat shock. + c

Continued on the following page.



5

Specifications and Test Methods

Continued from the preceding page.

	Continued fr	om the prec						
lo.	lte	em	Specification Temperature Compensating Type	Test Method				
1	Vibration Resistance	Appearance Capacitance	No defects or abnormalities. Within the specified tolerance. 30pF min. : Q≥1,000	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				
		Q	30pF max. : Q≧400+20C C : Nominal Capacitance (pF)	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). Solder the capacitor to the test jig (glass epoxy boards) shown				
			No cracking or marking defects shall occur.	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.				
2	Deflection	n	•••• •••• <td< td=""><td>20 50 Pressurizing speed : 1.0mm/sec. Pressurize Flexure : ≤1</td></td<>	20 50 Pressurizing speed : 1.0mm/sec. Pressurize Flexure : ≤1				
			GRM615 0.4 1.5 0.5 (in mm) Fig.2	Capacitance meter 45 45 (in mm) Fig.3				
3	Solderab Terminati	•	75% of the terminations is to be soldered evenly and continuously.	Fig.3 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°				
			The measured and observed characteristics shall satisfy the specifications in the following table.					
		Appearance	No marking defects.					
	Resistance	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C				
4	to Soldering Heat	Q	30pF and over : Q≧1,000 30pF and below : Q≧400+20C C : Nominal Capacitance (pF)					
		I.R.	More than 10,000M Ω or 500 Ω • F (Whichever is smaller)	_				
		Dielectric Strength	No failure					
			The measured and observed characteristics shall satisfy the specifications in the following table.					
		Appearance Capacitance	No marking defects. Within $\pm 2.5\%$ or $\pm 0.25pF$	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				
5	Temperature Cycle	Change Q	(Whichever is larger) 30pF and over : Q≧1,000 30pF and below : Q≧400+20C	Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Tame (20) Min. Operating Room Max. Operating Room				
			C : Nominal Capacitance (pF)	$\frac{\text{Temp.}(C)}{\text{Temp.}^{-3}} \text{Temp.} \text{Temp.}^{+3} \text{Temp.}$				
		I.R. Dielectric	More than 10,000M Ω or 500 Ω • F (Whichever is smaller) No failure	Time(min.) 30±3 2 to 3 30±3 2 to 3				
		Strength	The measured and observed characteristics shall satisfy the specifications in the following table.					
		Appearance	No marking defects.	-				
4	Humidity,	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours.				
6	Steady State	Q	30pF and over. : Q≥350 10pF and over, 30pF and below : Q≥275+ -5 C 10pF and below : Q≥200+10C C : Nominal Capacitance (pF)	Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.				
		I.R.	More than 10,000M Ω or 500 Ω • F (Whichever is smaller)					
_			·					



Specifications and Test Methods

Continued from the preceding page.

			Specification	
Vo.	lte	em	Temperature Compensating Type	Apply the rated voltage at 40±2°C and 90 to 95% humic 500±12 hours. Remove and let sit for 24±2 hours at room temperature measure. The charge/discharge current is less than 50m "the Apply 200% of the rated voltage for 1000±12 hours at to maximum operating temperature ±3°C. Let sit for 24±2 (temperature compensating type) at room temperature, measure. The charge/discharge current is less than 50mA. The charge/discharge current is less than 50mA. The ESR shall be measured at room Temp. and frequend 1±0.2GHz with the equivalent of BOONTON Model 34A.
			The measured and observed characteristics shall satisfy the specifications in the following table.	
		Appearance	No marking defects.	
	the sector the sector	Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	Apply the rated voltage at 40±2°C and 90 to 95% humidity for
17	Humidity Load	Q	Image (Whichever is larger) 30pF and over : Q≥200 30pF and below : Q≥100+ $\frac{10}{3}$ C C : Nominal Capacitance (pF) More than 500MΩ or 25Ω • F (Whichever is smaller) Iectric ength No failure The measured and observed characteristics shall satisfy the specifications in the following table.	 SUU±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		I.R.	More than 500M Ω or 25 Ω • F (Whichever is smaller)	
		Dielectric Strength	No failure	
		The measured and observed characteristics shall satisfy the		
		Appearance	No marking defects.	
	llink	Appearance No marking defects. Capacitance Within ±3% or ±0.3pF (Whichever is larger) ligh 30pF and over. : Q≥350 10pF and over. : Q≥350		Apply 200% of the rated voltage for 1000 ± 12 hours at the
18	High Temperature Load			(temperature compensating type) at room temperature, then measure.
		YChange(Whichever is larger)Q $30pF$ and over : Q≥200 $30pF$ and below : Q≥100+ $\frac{19}{2}$ C C : Nominal Capacitance (pF)I.R.More than $500M\Omega$ or $25\Omega \cdot F$ (Whichever is smaller)Dielectric StrengthNo failureThe measured and observed characteristics shall satisfy the specifications in the following table.Appearance ChangeNo marking defects.Capacitance ChangeWithin $\pm 3\%$ or $\pm 0.3pF$ (Whichever is larger)a $30pF$ and over. : Q≥350 $10pF$ and over. $30pF$ and below : Q≥275+ $\frac{5}{2}$ C $10pF$ and below : Q≥20+10C C : Nominal Capacitance (pF)I.R.More than $1,000M\Omega$ or $50\Omega \cdot F$ (Whichever is smaller)Dielectric StrengthNo failure0.5pF≤C≤1pF : $350M\Omega \cdot pF$ below $1pF300M\Omega$ below		
			No failure	
19	ESR			The ESR shall be measured at room Temp. and frequency 1±0.2GHz with the equivalent of BOONTON Model 34A.
			10pF <c≦20pf 400mω="" :="" 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

	<i>"</i>	Capacitance Change from 25°C Value (%)						
Char.	Temp. Coeff. (ppm/℃) Note 1	−55°C		-30°C		−10°C		
	(ppm/c) Note i	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 C0Δ)



GRM Series Data

■ Capacitance-Temperature Characterstics



■ Capcitance-AC Voltage Characteristics



■ Impedance-Frequency Characteristics ■ Allowable V





Continued on the following page.

■ Capcitance-DC Voltage Characteristics



■ Capacitance Change-Aging



■ Allowable Voltage-Frequency



GRM Series Data

Continued from the preceding page.

■ Allowable Current-Frequency



■ Allowable Appearant Power





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W

CHIP MONOLITHIC CERAMIC CAPACITOR

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 Number	Dimensions (mm)						
	L	W	Т				
LL0306	0.8 ±0.1	1.6 ±0.1	0.6 max.				
	1.25 +0.1	2.0 +0.1	0.6 ±0.1				
LL0508	1.25 ±0.1	2.0 ±0.1	0.85 ±0.1				
110040	1 (10 15	3.2 +0.15	0.7 ±0.1				
LL0612	1.6 ±0.15	3.2 ±0.15	1.15 ±0.1				

LL0306 Series

Part Number				LL	0306			
L x W(mm)				0.8	x1.6		Z5L 25	
TC Code		X	7R		Y	5V	Z5U	
Rated Volt.(Vdc)	10	16	25	50	16	50	25	50
Capacitance and T	(mm)							
2200pF				0.6				
2700pF				0.6				
3300pF				0.6				
3900pF				0.6				
4700pF				0.6				
5600pF				0.6				
6800pF			0.6					
8200pF			0.6					
10000pF			0.6					0.6
12000pF			0.6					
15000pF			0.6			0.6	0.6	
18000pF			0.6					
22000pF			0.6			0.6	0.6	
27000pF		0.6						
33000pF		0.6			0.6			
39000pF		0.6						
47000pF		0.6			0.6			
56000pF		0.6						
68000pF		0.6			0.6			
82000pF	0.6							
0.1µF	0.6							

LL0508 Series

Part Number		LL0508								
L x W(mm)		1.25x2.0								
TC Code	X7R Y5V Z5U						5U			
Rated Volt.(Vdc)	10	16	25	50	16	25	50	25	50	
Capacitance and	T(mm)									
0.15pF								0.85		
0.22pF	0.6									
4700pF				0.6						

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Continued from the preceding page.

Part Number	LL0508								
L x W(mm)					1.25x2.0				
TC Code		X	7R			Y5V		Z5U	
Rated Volt.(Vdc)	10	16	25	50	16	25	50	25	50
Capacitance and	T(mm)								
5600pF				0.6					
6800pF				0.6					
8200pF				0.6					
10000pF				0.6					
12000pF				0.6					
15000pF				0.6					
18000pF				0.6					
22000pF				0.6					
27000pF			0.6	0.85					
33000pF		0.6	0.6	0.85					0.6
39000pF		0.6	0.6	0.85					
47000pF		0.6	0.6					0.6	0.85
56000pF		0.6	0.6						
68000pF		0.6	0.6				0.6	0.6	0.85
82000pF		0.6	0.6						
0.1µF		0.6	0.6			0.6	0.85	0.85	
0.12µF		0.6							
0.15µF		0.6	0.85		0.6	0.85		0.85	
0.18µF		0.6							
0.22µF		0.85			0.6				
0.27µF	0.6								
0.33µF	0.6				0.85				
0.39µF	0.85								
0.47µF	0.85								
0.56µF	0.85								

LL0612 Series

Part Number	LL0612 1.6x3.2										
L x W(mm)											
TC Code		X	7R			Y5V		Z	5U		
Rated Volt.(Vdc)	10	16	25	50	16	25	50	25	50		
Capacitance and	T(mm)										
10000pF				0.7							
12000pF				0.7							
15000pF				0.7							
18000pF				0.7							
22000pF				0.7							
27000pF				0.7							
33000pF				0.7							
39000pF				0.7							
47000pF				0.7							
56000pF				0.7							
68000pF				0.7							
82000pF			0.7	1.15							
0.1µF		0.7	0.7	1.15					0.7		
0.12µF		0.7	0.7	1.15							
0.15µF		0.7	0.7					0.7	1.15		
0.18µF		0.7	0.7								
0.22µF		0.7	1.15				0.7	0.7	1.15		
0.27µF		0.7	1.15								
0.33µF		0.7	1.15				1.15	1.15			
0.39µF		0.7									

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Part Number	LL0612										
L x W(mm)	1.6x3.2										
TC Code		X	7R			Y5V		Z5U			
Rated Volt.(Vdc)	10	16	25	50	16	25	50	25	50		
Capacitance and	T(mm)				•						
0.47µF		0.7	1.15		0.7	1.15		1.15			
0.56µF	0.7	1.15									
0.68µF	0.7	1.15			0.7						
0.82µF	0.7	1.15									
1000000pF	0.7	1.15			1.15						
1.2µF	1.15										
1.5µF	1.15										
1.8µF	1.15										
2.2µF	1.15										





Specifications and Test Methods

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 ^{P,P} or V ^{O,P} , whichever is larger, shall be maintained within the rated voltage range.			
3	Appearance	No defects or abnormalities.	Visual inspection.			
4	Dimensions	Within the specified dimension.	Using calipers.			
5	Dielectric Strength	No defects or abnormalities.	No failure shall be observed when 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 Ω or 500 Ω • 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.				
		Char. 25V min. 16V	The capacitance/D.F. shall be measured at 25℃ at the frequency and voltage shown in the table.			
	Dissipation Factor	X7R 0.025 max. 0.035 max.	X7R · Y5V Z5U			
8	(D.F.)	Z5U 0.025 max. —	Frequency 1±0.1kHz 1±0.1kHz			
	()	Y5V 0.05 max. 0.09 max. (C<1.0μF) 0.09 max. (C≥1.0μF)	Voltage 1±0.2Vr.m.s. 0.5±0.05Vr.m.s.			
9	Capacitance Temperature Characteristics	X7R -55 to +125 Within±15% Z5U +10 to +85 25°C Within+22%/-56% Y5V -30 to +85 Within+22%/-82%	within the specified ranges.The capacitance change shall be measured after 5 min. at each specified temperature stage.Solder the capacitor to the test jig (glass epoxy board) shown in			
			Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 10N* force in the direction of the arrow. *5N:LL0306 The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the			
10	Adhesive Strength of Termination No removal of the terminations or other defect shall occur.		soldering is uniform and free of defects such as heat shock.			
			Fig.1			
	Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).			
11	Vibration Resistance 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)	 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). 			

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Specifications and Test Methods

Continued from the preceding page.

No.	Ite	em	Specification	Test Method				
			No crack or marked defect shall occur.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3. The soldering 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	2 Deflection	n	Type a b c	20 50 Pressurizing speed : 1.0mm/sec. Pressurize Flexure : ≤1				
			LL0306 0.3 1.2 2.0 LL0508 0.6 1.6 2.4	45 45				
			LL0612 1.0 3.0 3.7	(in mm)				
			(in mm) Fig.2	Fig.3				
13	Solderabi Terminati		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 \pm 0.5 seconds at 230 \pm 5°C.				
		Appearance	No defects or abnormalities.	_				
		Capacitance Change	X7R : Within±7.5% Z5U · Y5V : Within±20%	Preheat the capacitor at 120 to 150° C for 1 minute. Immerse the capacitor in a eutectic solder solution at $270\pm5^{\circ}$ for $10\pm0.5^{\circ}$				
14	Resistance to Soldering Heat	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)	 seconds. Let sit at room temperature for 48±4 hours , then measure. Initial measurement. 				
				Perform a heat treatment at 150^{+0}_{-0} °C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial				
		I.R. Dielectric Strength	More than 10,000MΩ or 500Ω • F (Whichever is smaller) No failure	_ measurement.				
		Appearance	No defects or abnormalities.	Fix the capacitor to the supporting jig in the same manner and				
		Capacitance Change	X7R : Within±7.5% Z5U · Y5V : Within±20%	under the same conditions as (10). Perform the five cycles according to the four heat treatments				
			Char. 25V min. 16V	 listed in the following table. Let sit for 48±4 hours at room tem- perature, then measure. 				
			X7R 0.025 max. 0.035 max.	Step 1 2 3 4				
15	Temperature Cycle	D.F.	Z5U 0.025 max. — Y5V 0.05 max. 0.07 max. (C<1.0μF)	Temp.(°C)Min. Operating Temp. $\stackrel{+\circ}{-\circ}$ Room Temp. $\stackrel{Max. Operating}{Temp\circ}$ Room Temp.Temp.(°C)Temp. $\stackrel{+\circ}{-\circ}$ Temp.Temp. $\stackrel{+\circ}{-\circ}$ Temp.				
			0.09 max. (C≥1.0μF)	Time(min.) 30±3 2 to 3 30±3 2 to 3				
		I.R. Dielectric Strength	More than 10,000MΩ or 500Ω • F (Whichever is smaller) No failure	 Initial measurement. Perform a heat treatment at 150⁺⁰/₋₁₀ °C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement. 				
		Appearance	No defects or abnormalities.					
		Capacitance Change	X7R : Within±12.5% Z5U · Y5V : Within±30%					
	Humidity,		Char. 25V min. 16V	Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours.				
16	Steady State	D.F.	X7R 0.05 max. 0.05 max. Z5U 0.05 max. —	Remove and let sit for 48±4 hours at room temperature, then measure.				
			Y5V 0.075 max. 0.1 max. (C<1.0µF) 0.125 max. (C≥1.0µF) 0.125 max. (C≥1.0µF)					
		I.R.	More than 1,000M Ω or 50 Ω • F (Whichever is smaller)					

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Specifications and Test Methods

Continued from the preceding page.

No.	Ite	em		Spe	cification	Test Method		
17	Humidity Load	Appearance Capacitance Change D.F. I.R. Dielectric	No defects or a X7R : Within±1 Z5U · Y5V : Within Char. X7R Z5U Y5V More than 500N No failure	2.5% thin±30% 25V min. 0.05 max. 0.05 max. 0.075 max.	16V 0.05 max. — 0.1 max. (C<1.0μF) 0.125 max. (C≧1.0μF) (Whichever is smaller)	Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.		
		Strength No defects or abnormalities. Appearance No defects or abnormalities. Capacitance Change X7R : Within±12.5% Z5U : Within±30% Y5V : Within±30% (C<1.0µF) Within±38% (C≥1.0µF)				Apply 200% of the rated voltage for 1,000±12 hours at maxi- mum operating temperature ±3°C. Let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.		
18	High Temperature Load	D.F.	Char. X7R Z5U Y5V	25V min. 0.05 max. 0.05 max. 0.075 max.	16V 0.05 max. 	• Initial measurement. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature $\pm 3^{\circ}$ C. Remove and let sit for 48±4 hours at room temperature.		
		I.R. Dielectric Strength	More than 1,00 No failure	0MΩ or 50Ω •	F (Whichever is smaller)	Perform initial measurement.		



CHIP MONOLITHIC CERAMIC CAPACITOR

Monolithic Microchip GM Series

Features

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

Application

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





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Part Number		Dimensions (mm)	
Part Number	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 ±0.1

Part Number	Rated Voltage (Vdc)	TC Code	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)
GM250X7R102M16	16	X7R	1000pF	0.5	0.5	0.35
GM250X7R152M16	16	X7R	1500pF	0.5	0.5	0.35
GM250X7R222M16	16	X7R	2200pF	0.5	0.5	0.35
GM250X7R471M50	50	X7R	470pF	0.5	0.5	0.35
GM250Y5V153Z10	10	Y5V	15000pF	0.5	0.5	0.35
GM250Y5V472Z16	16	Y5V	4700pF	0.5	0.5	0.35
GM250Y5V682Z16	16	Y5V	6800pF	0.5	0.5	0.35
GM260X7R103M16	16	X7R	10000pF	0.8	0.8	0.5
GM260Y5V104Z10	10	Y5V	0.1µF	0.8	0.8	0.5
GM260Y5V473Z16	16	Y5V	47000pF	0.8	0.8	0.5





Specifications and Test Methods

No.	Ite	m	S	pecification		Tes	st Metho	d	
1	Operating Temperat		X7R : −55℃ to +125℃ Y5V : −30℃ to +85℃						
2	Rated Vo	Itage	See the previous pages.		The rated voltage is defined as the maximum volta may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, whichever is larger, shall be maintained within the range.				P-P or VO-P,
3	Appearar	ice	No defects or abnormalitie	S.	Visual inspect	ion.			
4	Dimensio	ns	See the previous pages.		Visual inspect	ion.			
5	Dielectric	Strength	No defects or abnormalitie	S.	voltage is app	lied between th	ne both te	oltage of 250% rminations for 1 current is less th	to 5 sec-
6	Insulation (I.R.)	Resistance	10,000MΩ min.		not exceeding		age at no	asured with a D rmal temperatu ging.	0
7	Capacita	nce	Within the specified toleral	nce.		ice shall be me I 1±0.2Vr.m.s.		t 25℃ with 1±0 e.	.1kHz in
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 r capacitance.	measured unde	er the sar	ne conditions a	t the
9	Capacitar Temperat Character	ure	Char. Temp. Range X7R -55 to +125°C Y5V -30 to +85°C		The range of capacitance change in reference to 25°C with the temperature range shown in the table shall be within th specified ranges. The capacitance change shall be measured after 5 min. at each specified temperature stage.			thin the	
10	Mechanical Strength	Bond Strength	Pull force : 3.0g min.	MIL-STD-883 Method 2011 Condition D Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 20μ m (0.0008 inch) gold wire to the capacitor terminal using an ultrasonic wedge bond. Then, pull wire.					
		Die Shear Strength	Die Shear force : 200g mir	ì.	MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.				
		Appearance	No defects or abnormalitie	S.					
	Vibration	Capacitance	Within the specified toleral	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	Resistance	D.F.	X7R : 0.035 max. Y5V : 0.09 max. (for 16V) : 0.125 max. (for 10V)	Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).					
			The measured values sha table.	all satisfy the values in the following	The capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat of treatment at 150^{-4} ° °C, then measure for the initial measurement. Fix the capacitor to the supporting				
			Item Appearance	Specification No marked defect	jig in the same	e manner and u	under the	same condition	ns as (11)
			Capacitance Change	X7R Within±7.5%		,	0	to the tempera	
12	Temperat	ure Cycle	I.R.	Y5V ······ Within±20% More than 10,000MΩ	temperature, t	0	ରମାକ: ୨୫୮	it for 48±4 hou	is at 100111
			- 1.1%.	X7R 0.035 max.	Step	1	2	3	4
			D.F.	Y5V 0.09 max.(for 16V) 0.125 max.(for 10V)	Temp.(℃)	Min. Operating Temp. ⁺ S	Room Temp.	Max. Operating Temp. +3	Room Temp.
			Dielectric Strength	No failure	Time(min.)	30±3	2 to 3	30±3	2 to 3
			table.	all satisfy the values in the following					
			Item Appearance	Specification No marked defect					
13	Humidity		Capacitance Change	X7R Within±12.5% Y5V Within±30%	humidity.			t 40±20℃, in 90	
13	(Steady S	itate)	I.R.	More than 1,000M Ω		d set it for 48±	4 hours a	at room tempera	ature, then
			D.F.	X7R 0.05 max. Y5V 0.125 max.(for 16V)	measure.				
			Dielectric Strength	0.15 max.(for 10V) No failure					

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Specifications and Test Methods

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No.	Item	S	pecification	Test Method
14	Humidity Load	The measured values sha table. Appearance Capacitance Change I.R. D.F. Dielectric Strength	all satisfy the values in the following Specification No marked defect X7R ······ Within±12.5% Y5V ······ Within±38% More than 500MΩ X7R ······ 0.05 max. Y5V ······ 0.125 max.(for 16V) 0.15 max.(for 10V) No failure	Apply the rated voltage for 500±12 hours at 40±20℃, in 90 to 95% humidity and set it for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA. • Initial measurement for Y5V Perform a heat treatment at 150 [±] ?o [°] ℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.
15	High Temperature Load	The measured values sha table. Item Appearance Capacitance Change I.R. D.F. Dielectric Strength	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) No failure	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.

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.



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CHIP MONOLITHIC CERAMIC CAPACITOR

Capacitor Arrays GNM Series

Features

- 1. High density mounting due to mounting space saving.
- 2. Mounting cost saving.
- Application General electronic equipment





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Part Number	Dimensions (mm)						
Part Number	L	W	Т	Р	е		
GNM30-401	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1	0.8 ±0.1	0.4 ±0.15		

Temperature Compensating Type

Part Number	GNM30-401				
L x W(mm)		3.2x1.6			
TC Code		COG			
Rated Volt.(Vdc)	50	100			
Capacitance and	T(mm)				
10pF	0.8	0.8			
11pF	0.8	0.8			
12pF	0.8	0.8			
13pF	0.8	0.8			
15pF	0.8	0.8			
16pF	0.8	0.8			
18pF	0.8	0.8			
20pF	0.8	0.8			
22pF	0.8	0.8			
24pF	0.8	0.8			
27pF	0.8	0.8			
30pF	0.8	0.8			
33pF	0.8	0.8			
36pF	0.8	0.8			
39pF	0.8	0.8			
43pF	0.8	0.8			
47pF	0.8	0.8			
51pF	0.8	0.8			
56pF	0.8	0.8			
62pF	0.8	0.8			
68pF	0.8	0.8			
75pF	0.8	0.8			
82pF	0.8	0.8			
91pF	0.8	0.8			
100pF	0.8	0.8			
110pF	0.8	0.8			
120pF	0.8	0.8			
130pF	0.8	0.8			
150pF	0.8	0.8			
160pF	0.8				
180pF	0.8				
200pF	0.8				
220pF	0.8				





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Part Number	GNM30-401					
L x W(mm)	3.2)	3.2x1.6				
TC Code	CC)G				
Rated Volt.(Vdc)	50	100				
Capacitance and	I T(mm)					
240pF	0.8					
270pF	0.8					
300pF	0.8					
330pF 0.8						
360pF	0.8					

High Dielectric Constant Type

Part Number	GNM30-401										
L x W(mm)	3.2x1.6										
TC Code		Х	7R		Y5V						
Rated Volt.(Vdc)	16	25	50	100	16	50	100				
Capacitance and T((mm)										
220pF				0.8							
240pF				0.8							
270pF				0.8							
300pF				0.8							
330pF				0.8							
360pF				0.8							
390pF			0.8	0.8							
470pF			0.8	0.8							
560pF			0.8	0.8							
680pF			0.8	0.8							
820pF			0.8	0.8							
1000pF			0.8	0.8							
1200pF			0.8	0.8							
1500pF			0.8	0.8							
1800pF			0.8	0.8							
2200pF			0.8	0.8			0.8				
2700pF			0.8	0.8							
3300pF			0.8	0.8			0.8				
3900pF			0.8	0.8							
4700pF			0.8	0.8			0.8				
5600pF			0.8								
6800pF			0.8								
8200pF			0.8								
10000pF			0.8								
12000pF			0.8								
15000pF			0.8								
18000pF		0.8									
22000pF	0.8					0.8					
27000pF	0.8										
33000pF	0.8					0.8					
39000pF	0.8										
47000pF						0.8					
68000pF					0.8						
100000pF					0.8						
150000pF					0.8						



8 (D.F.) 30pF max: Q2400+20C C: Nominal Capacitance X7R 0.025 max. 0.035 max. V5V 0.05 max 0.07 max					Specification			
1 Temperature U00 1 - 00 10 + 12 ℃ YEV 1 - 30 0 + 485℃ 2 Rated Voltage See the previous page. The stated voltage is defined as the maximum voltame in the maximum voltame is proper consoling to the responsition. When A ₂ ⊂ totage is sperperiod control DC voltage whenever is larger, shall be maintained within the range. 3 Appearance No defects or abnormalities. Visual inspection. 4 Dimensions Within the specified dimension. Using calipers. 5 Dielectric Strength No defects or abnormalities. No failure shall be observed when 300% of the rate voltage at 25℃ and 75%. 6 Insulation Resistance Within the specified tolerance. The capacitance/0.07. Shall be observed when 300% of the rate voltage at 25℃ and 75%. 7 Capacitance Within the specified tolerance. The capacitance/0.07. Shall be measured at 25℃ query of tole 100.07. Shall be observed when 300% of the rate voltage at 25℃ and 75%. 8 OD(Nsipplation Factor 200 Finance (Calible A-5) OD(Nsipplation Residence) OD(Nsipplation Residence) 8 OD(Nsipplation Residence) OD(Nsipplation Residence) OD(Nsipplation Residence) OD(Nsipplation Residence) 9 Capacitance Within the specified tolerance. OD(Nsipplation Residence) OD(Nsipplation Residence) 9 Capacitance OD(Nsipplation Residence) OD(Nsipplation Residence) OD(Nsipplation Res	No.	lte	em	•	High Dielectric Constant Type		Test Method	
2 Rated Voltage See the provious page. may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, whichever is larger, shall be maintained within the range. 3 Appearance No defects or abnormatilies. Visual inspection. 4 Dimensions Within the specified dimension. Using calipers. 5 Dielectric Strength No defects or abnormatilies. No failure shall be observed when 300% of the rat (CGG) or 250% of the rate voltage (XPR and YS) between the terminations for 1 to 5 seconds, provincing and voltage (XPR and YS) between the terminations of row to seconds, provincing and voltage (XPR and YS) between the terminations of row to seconds, provincing and voltage (XPR and YS) between the terminations or other defects shall occur. 7 Capacitance Within the specified tolerance. The resultation dispect of the rate voltage (XPR and YS) within 2 minutes of charging. 8 ODISipatoto Factor 300 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, Q2:20 C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, Q2:20 C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, 20:20 C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, 20:20 C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, 20:20 C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, 20:20 C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal Capacitone (GP C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal C, Qautance (MP C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal C, Qautance (MP C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal C, Qautance (MP C, Norma, 20:20 Fmin: Q2:100 ACC C, Normal C, Qautance (MP C, Norma, 20:20 Fmin: Q2:100 AC	1		-	C0G : −55 to +125℃				
Image: source of the specified dimension. Using calpers. 5 Dielectric Strength No defects or abnormalities. No defects or abnormalities. 6 Insulation Resistance (IR) More than 10,000M2 or 500(2 + F (Whichever is smaller) The insulation resistance shall be measured with a for exceeding the rated voltage at 25°c and 75°cR 7 Capacitance Within the specified tolerance. The insulation resistance shall be measured with a for exceeding the rated voltage at 25°c and 75°cR 8 O/Dissipation Factor 30°F min. 02:1000 (0F) Soft min. 02:1000 (0F) The capacitance/U/OF shall be measured at 25°c write at	2	Rated Vo	ltage	See the previous page.		may be applied contin When AC voltage is so whichever is larger, sh	uously to the capacit uperimposed on DC	tor. voltage, V ^{p.p} or V ^{o.p} ,
5 Dielectric Strongth No defects or abnormalities. No failure shall be observed when 300% of the rat (COG) or 220% of the rated voltage (XR and YS) between the terminations for 1 to 5 seconds, provide harge/discharge currents less than 50m.A. 6 Insulation Resistance (R,R) More than 10,000MΩ or 500Ω + F (Whichever is smaller) The insulation resistance shall be measured with a 20minutes of charging. 7 Capacitance Within the specified tolerance. The capacitance/QD,F shall be measured with 2 minutes of charging. 8 QUDissignation factor (D,F,) That insulation resistance shall be with 2 minutes of charging. The capacitance charge shown in the table. 8 QUDissignation factor (D,F,) The insulation resistance shall be measured at 250 container The capacitance charge shown in the table. 8 QUDissignation factor (D,F,) Char	3	Appearar	nce	No defects or abnormaliti	ies.	Visual inspection.		
5 Dielectric Strength (COG) or 250% of the rated voltage (XPR and YS) between the terminations for 1 to 5 seconds, provi charge/discharge at 25C and 75%R within 2 minutes of charging. 6 Insulation Resistance (R) More than 10.000M2 or 5002 • F (Whichever is smaller) The insulation resistance shall be measured with in resusceding the rated voltage 425C and 75%R within 2 minutes of charging. 7 Capacitance Within the specified tolerance. The insulation resistance shall be measured at 25C query and voltage shown in the table. 8 Q/Dissipation Factor (DF) 30pF min. 102:400+20C C: Nomial Capacitance (pF) Char Tamp. Tetrance Cap. Trequency 1 ±0.1MHz 1 ±0. 9 Q/Dissipation Factor (D) Util this the specified tolerance. (Table A-5) Char Tamp. Tetrance Cap. Trequency 1 ±0.1MHz 1 ±0. 9 Capacitance (D) Within the specified tolerance. (Table A-5) Char Tamp. Tetrance Cap. Trequency 1 ±0.1MHz 1 ±0. 9 Capacitance (D) Within ±0.2% or ±0.05pF (Whichever is larger) Char Tamp. Tetrance Cap. Trepace Capacitance Charge shall be measured fact tolerance for the temperature coefficient and ci- charge as Table A. Tre capacitance thang shall be measured at 25C 2 (High Dielectric Constant Type Terequency 1 ±0.1MHz 1 ±0. 9 Capacitance Distribution Within ±0.2% or ±0.05pF (Whichever is larger) Char Tamp. Tetrance Cap. Tree capacitance for the temperature coefficient and ci- charge as Table A. Tree capacitance thange shall be measured fact tolerance charge compared to value over the term perature coefficient and ci- charge as Table A. Tree capacitance than	4	Dimensio	ons	Within the specified dime	ension.	Using calipers.		
6 Insulation Resistance (UR.) More than 10,000M2 or 50002 • F (Whichever is smaller) not exceeding the rated voltage at 25°c and 75°R within 2 minutes of charging. 7 Capacitance Within the specified tolerance. The capacitance/(D.F. shall be measured at 25°C quercy and voltage shown in the table. 8 O/Dissignation Factor (D.F.) 30,F min.: 02:1,000 30,F max.: 02:400+200 (C,F) Chartic 25V min.: 10/V 77R 100,05 max. 100 8 O/Dissignation Factor (D.F.) Capacitance (GF) Chartic 25V min.: 10/V 77R 100,05 max. 100 9 Capacitance (Darge Within the specified tolerance. (Table A-5) Chartic Temp. Temp. Temp. Charge 77R Charge 77R 100,05 max. 100 9 Capacitance Dati Within the specified tolerance. (Table A-5) Chartic Temp. Temp. Charge 75V 100,07 max. The capacitance and the stem 1, 3 and 5 by the cap. value (1) 9 Capacitance Dati Within the 25% or ±0.05pF Capacitance Within ±0.2% or ±0.05pF Capacitance drift is calculated by dividing the step 1, 3 and 5 by the cap. value (1) 10 Achesive Strength of Termination No removal of the terminations or other defects shall occur. Solder the capacitance change compared with an can or reformed and shall be conducted with care as dering is uniform and free of defects such as heat Solder resist	5	Dielectric	: Strength	No defects or abnormaliti	ies.	(C0G) or 250% of the between the termination	rated voltage (X7R on s for 1 to 5 second	and Y5V) is applied Is, provided the
8 O/Dissipation Factor (D.F.) 30pF min. : Q2400+20C C: Nominal Capacitance (pF) Char. 25V min. 140/ XIR_0.025 max. Q05 max. Q05 max. Q05 max. Q05 max. Q05 max. Q06 max. Q07 max. Q06 max. Q06 max. Q07 max. Q06 max.	6		Resistance	More than 10,000M Ω or the second s	500 Ω • F (Whichever is smaller)	not exceeding the rate	ed voltage at 25℃ an	
8 O/Dissipation Factor (D.F.) 30pF min.: 224:00-20C C: Nominal Capacitance (pF) Char.: 23V min.: 16V XR: 0.025 max.: 0.035 max. Imm: Char.: Cost SVr.ms.: 1±0. Voltage 0.05 max.: 0.025 max.: 0.027 max. 0.035 max.: 0.077 max. Voltage 0.5 to SVr.ms.: 1±0. Voltage Capacitance (pF) Within the specified tolerance. (Table A-5) Char.: Temp. Reference XR: 550 +125C Capacitance Charge shall be measured after teach specified temperature coefficient is determined using capacitance measured in step 3 as a reference When cycling the temperature coefficient is determined using capacitance measured in step 3 as a reference When cycling the temperature coefficient add estimation and minimuv values in the step 1, 3 and 5 by the cap. value is ultrance for the toperature coefficient add estimated add charge as Table A. 9 Capacitance Dratifies Within ±0.2% or ±0.05pF (Whichever is larger) Within ±0.2% or ±0.05pF (Whichever is larger) Temperature coefficient add estimated add by dividing the differences between the measured area change compared to value over the temperature canges shown in the be within the specified ranges. 10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur. Solder the capacitance change score than and minimuv values in the step if O121 sec. 10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur. Solder the capacitance than apply 5N force with the test ig fo121 sec.	7	Capacita	nce	Within the specified tolera	ance.	The capacitance/Q/D.	F. shall be measured	d at 25℃ at the fre-
8 OUDscipation Factor (D.F.) 30p Fmax. 0.24-00-22C C: Nominal Capacitance (pF) Outstink is the set (pF) Outsthe set (pF) Outstink is the set				30pF min · O≥1 000				
(D,F.) C: Nominal Capacitance (pF) YSV 0.05 max 0.07 max. YSV 0.05 max 0.07 max. Voltage 0.5 to 5Vr.m.s. 1±0. Voltage Capacitance (pF) Capacitance		Q/Dissipa	tion Factor					X7R, Y5V
9 Capacitance Charge Within the specified tolerance. (Table A-5) Char. Temperature (Table A-5) Temperature (Table A-5) Cap. Temperature (Table A-5) Temperature (Table A-5) Temperature (Table A-5) Temperature (Table A-5) Temperature (Table A-5) 9 Capacitance Charge Temperature (Table A-5) Within the specified tolerance. (Table A-5) Temperature (Table A-5) Temperature (Table A-5) Temperature (Table A-5) 10 Capacitance Data Within the specified tolerance for the temperature coefficient tolerance for the temperature coefficien	8	(D.F.)		-				1±0.1MHz
9 Capacitance Change Within the specified tolerance. (Table A-5) Change XTR Empty 25° Within="128" Within="128" each specified temperature stage. (1) Temperature Compensating Type The temperature coefficient is determined using capacitance measured in step 3 as a reference when cycling the temperature coefficient and ca change as Table A. 7 Capacitance Detected is Within ±0.2% or ±0.05pF Image: Temperature Coefficient Within ±0.2% or ±0.05pF 10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur. Solder the capacitance diff is calculated with an ion or training is uniform and free of defects such as heat				(pF)		voitage	0.5 to 5Vr.m.s.	1±0.2Vr.m.s.
9 Capacitance Temperature Capacitance Coefficient Int tolerance. (Table A-5) 9 Capacitance Temperature Caracteristics Capacitance Capacitance Within ±0.2% or ±0.05pF (Whichever is larger) No removal of the terminations or other defects shall occur. Step Temperature Capacitance drift is calculated by dividing the differences between the maximum and minimum values in the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 3 and 5 by the cap. value if the step 1, 1 and 1 an			Change	tolerance. (Table A-5)	Char. Range. Temp. Change X7R -55to +125°C 25°C Within±15%	each specified temper (1) Temperature Comp The temperature co capacitance measu	ature stage. bensating Type befficient is determin ured in step 3 as a re	ed using the ference.
9 Capacitance Temperature Characteristics Capacitance Drift Within ±0.2% or ±0.05pF (Whichever is larger) Step Temperature(C) 1 10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur. Step Temperature(C) 1 10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur. Step Temperature(C) 1						through 5, the capa tolerance for the te change as Table A	acitance shall be with mperature coefficien	hin the specified t and capacitance
Capacitance Drift Within ±0.2% or ±0.05pF (Whichever is larger) Within ±0.2% or ±0.05pF (Whichever is larger) 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 w value over the temperature ranges shown in the be within the specified ranges. Solder the capacitor to the test jig (glass epoxy bo Fig.1 using a eutectic solder. Then apply 5N force with the test jig to 10±1 sec. The soldering shall be conducted with care sc dering is uniform and free of defects such as heat 10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur.	9				differences betwee	n the maximum and	minimum measured	
10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur. Image: Capacitance of the terminations or other defects shall occur.		Characteristics				· · · · · · · · · · · · · · · · · · ·		. ,
Drift (Whichever is larger)			Canacitanco	Within ±0.2% or ±0.05pE				
10 Adhesive Strength of Termination 10 Adhesive Strength of Termination			· ·					
10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur.				(
10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur.								
10 Adhesive Strength of Termination 10 Adhesive Strength of Termination						The ranges of capa value over the temp	nstant Type acitance change com perature ranges show	pared with the 25℃
10 Adhesive Strength of Termination No removal of the terminations or other defects shall occur.						Fig.1 using a eutectic with the test jig for 10- The soldering shall be reflow method and sha	solder. Then apply 5 ±1 sec. done either with an all be conducted with	N force in parallel iron or using the care so that the sol-
	10		-	No removal of the termin	ations or other defects shall occur.			sist
Type a b c GNM30-401 0.8 2.5 0.4								
Fig.1							Fig.1	. ,



8

Specifications and Test Methods

Continued from the preceding page.

7	Continued fr	om the prec	eding page.		
				Specification	
۷o.	lte	em	Temperature Compensating Type	High Dielectric Constant Type	Test Method
		Appearance	No defects or abnormalit	ies.	Solder the capacitor to the test jig (glass epoxy board) in the
		Capacitance	Within the specified toler	ance.	same manner and under the same conditions as (10). The capacitor shall be subjected to a simple harmonic motion
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.	 The capacitor shall be subjected to a simple naminal month 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 cracking or marking c	lefects shall occur.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2 using a eutectic solder. Then apply a force in the direc- tion shown in Fig.3. The soldering shall be done either with an
care so that the soldering is uniform and heat shock.		20 50 Pressurizing speed : 1.0mm/sec. Pressurize R230 Capacitance meter 45 + 45 (in mm)			
13	Solderab Terminati	-			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 \pm 0.5 seconds at 230 \pm 5°C.
			The measured and obserspecifications in the follow	rved characteristics shall satisfy the wing table.	
		Appearance	No marking defects.		Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	X7R ······· Within±7.5% Y5V ······ Within±20%	capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (tempera- ture compensating type) or 48±4 hours (high dielectric constant
14	Resistance to Soldering Heat	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. Y5V 0.05 max. 0.07 max.	 type), then measure. Initial measurement for high dielectric constant type Perform a heat treatment at 150⁺⁰/₁₀ ℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.
		I.R.	More than 10,000M2 or	500Ω • F (Whichever is smaller)	
		Dielectric Strength	No failure		
			The measured and obse specifications in the follo	rved characteristics shall satisfy the wing table.	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles
		Appearance	No marking defects.	·	according to the four heat treatments listed in the following
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	X7R Within±7.5% Y5V Within±20%	table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room tempera- ture, then measure.
15	Temperature Cycle	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. Y5V 0.05 max. 0.07 max.	Step 1 2 3 4 Temp.(°C) Min. Operating Temp. $\stackrel{+o}{-3}$ Room Temp. $\stackrel{+o}{-3}$ Temp. $\stackrel{+o}{-3}$ Temp. Time(min.) 30±3 2 to 3 30±3 2 to 3 • Initial measurement for high dielectric constant type
		I.R.	More than 10,000M Ω or	500Ω • F (Whichever is smaller)	Perform a heat treatment at 150 ± 0.0 ° for one hour and then
		Dielectric Strength	No failure		let sit for 48±4 hours at room temperature. Perform the initial measurement.

Continued on the following page.



Continued from the preceding page.

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	Item Temperature						
No.	lte	em	Temperature Compensating Type	High Dielectric Constant Type	Test Method		
		The measured and observed characteristics shall satisfy the specifications in the following table.					
		Appearance	No marking defects.				
		Capacitance Change	Within $\pm 5\%$ or ± 0.5 pF (Whichever is larger)	X7R ······· Within±12.5% Y5V ······ Within±30%	Sit the capacitor at $40\pm2^{\circ}$ and 90 to 95% humidity for 500±12		
16	Humidity, Steady State	Q/D.F.	30pF and over : Q≥350 10pF and over, 30pF and below :	Char. 25V min. 16V X7R 0.05 max. 0.05 max. Y5V 0.075 max. 0.1 max.	hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room tem- perature, then measure.		
		I.R.	More than 1,000M Ω or 5	0Ω • F (Whichever is smaller)			
			The measured and obse specifications in the follo	rved characteristics shall satisfy the wing table.			
		Appearance	No marking defects.				
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	X7R Within±12.5% Y5V Within±30%	_ Apply the rated voltage at 40±2℃ and 90 to 95% humidity for		
17	Humidity Load	Q/D.F.	30pF and over : Q≧200 30pF and below : Q≧100+ ¹ / ₃ C C : Nominal Capacitance (pF)	Char. 25V min. 16V X7R 0.05 max. 0.05 max. Y5V 0.075 max. 0.1 max.	500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA.		
		I.R.	More than 500M Ω or 259	2 • F (Whichever is smaller)			
		Dielectric Strength	No failure				
			The measured and obse specifications in the follo	rved characteristics shall satisfy the wing table.			
		Appearance	No marking defects.				
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	X7R ······· Within±12.5% Y5V ······ Within±30%	Apply 200% of the rated voltage for 1,000 \pm 12 hours at the maximum operating temperature \pm 3°C. Let sit for 24 \pm 2 hours		
18	High Temperature Load	Q/D.F.	$\begin{array}{l} 30 \text{pF and over : } Q \geqq 350 \\ 10 \text{pF and over,} \\ 30 \text{pF and below :} \\ Q \geqq 275 + \frac{5}{2} \text{ C} \\ 10 \text{pF and below :} \\ Q \geqq 200 + 10 \text{C} \\ \text{C : Nominal Capacitance} \\ (\text{pF)} \end{array}$	Char. 25V min. 16V X7R 0.04 max. 0.05 max. Y5V 0.075 max. 0.1 max.	 (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement. 		
		I.R.	More than 1,000M Ω or 5	0Ω • F (Whichever is smaller)			
		Dielectric Strength	No failure				

Table A

	T 0 <i>T</i>		Capacitance Change from 25°C (%)							
Char.	Temp. Coeff. (ppm/℃) Note 1	—55℃		-30°C		−10°C				
		Max.	Min.	Max.	Min.	Max.	Min.			
C0G	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11			

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



CHIP MONOLITHIC CERAMIC CAPACITOR

for Ultrasonic Sensors ZLM Type

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.)





muRata

Part Number		Dimensions (mm)						
Part Number	L	W	Т	е	g min.			
GRM40	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7			

Part Number	Rated Voltage (Vdc)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM40ZLM102K100	100	ZLM	1000 ±10%	2.0 ±0.1mm	1.25 ±0.1mm	0.85 ±0.1mm
GRM40ZLM152K100	100	ZLM	1500 ±10%	2.0 ±0.1mm	1.25 ±0.1mm	0.85 ±0.1mm



No.	Ite	m	Specification		Test Method	
1	Operating Temperat		−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 ^{p.p} or V whichever is larger, shall be maintained within the rated vol range.		
3	Appearan	ce	No defects or abnormalities.	Visual inspection.		
4	Dimensio	ns	Within the specified dimensions.	Using calipers.		
5	Dielectric	Strength	No defects or abnormalities.	applied between th	observed when 300% of the rated voltage is ne terminations for 1 to 5 seconds, provided ge current is less than 50mA.	
6	Insulation I (I.R.)	Resistance	More than 10,000M Ω or 500 Ω • F. (Whichever is smaller)		stance shall be measured with a DC voltage rated voltage at 20°C and 75%RH max. and i charging.	
7	Capacitar	nce	Within the specified tolerance.	The especitores/D	\mathbf{E} shall be massived at 20% with 1±0.1/4z	
8	Dissipation (D.F.)	n Factor	0.01 max.		.F. shall be measured at 20℃ with 1±0.1kHz ±0.2Vr.m.s. in voltage.	
9	Capacitanc		Within −4,700 ⁺¹ :200 ppm/°C (at −25 to +20°C)	capacitance measu When cycling the to 5, the capacitance temperature coeffic	hange shall be measured after 5 min. at perature stage.	
9		mperature naracteristics	Within −4,700 ⁺⁵⁰⁰ _{−1,000} ppm/°C (at +20 to +85°C)	Step	Temperature(℃)	
				1	20±2	
				2 3	 	
				4	20±2 85±3	
				5 20±2		
10	Adhesive Strength of Termination		No removal of the terminations or other defect shall occur.	Fig.1 using a euted direction of the arro The soldering shall reflow method and dering is uniform a	l be done either with an iron or using the shall be conducted with care so that the sol- nd free of defects such as heat shock.	
		Appendix	No defecto er obnormalitica	Colder the second "	Fig.1	
	-	Appearance	No defects or abnormalities.		or to the test jig (glass epoxy board) in the under the same conditions as (10).	
11	Vibration Resistance	D.F.	Within the specified tolerance. 0.01 max.	 The capacitor shall having a total ampl uniformly between frequency range, fr traversed in approx 	I be subjected to a simple harmonic motion litude of 1.5mm, the frequency being varied the approximate limits of 10 and 55Hz. The rom 10 to 55Hz and return to 10Hz, shall be kimately 1 minute. This motion shall be d of 2 hours in each 3 mutually perpendicular	

Continued on the following page. \square



Continued from the preceding page.

No.	Ite	em	Specification	Test Method				
			No cracking or marking defects shall occur.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the				
12	2 Deflection		Type a b c GRM40 1.2 4.0 1.65 (in mm) Fig.2	reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock. $\begin{array}{c} 20 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\$				
13	Solderabi Terminati	-	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.				
		Appearance	No defects or abnormalities.					
	Resistance	Capacitance Change	Within ±7.5%	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the				
14	to Soldering Heat	D.F.	0.01 max.	capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours , then				
		I.R.	More than 10,000M Ω or 500 Ω • F (Whichever is smaller)	measure.				
		Dielectric Strength	No failure					
		Appearance	No defects or abnormalities.	Fix the capacitor to the supporting jig in the same manner and				
	Temperature	Capacitance Change	Within ±7.5%	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 tem-				
15	Cycle	D.F.	0.01 max.	perature, then measure. Step 1 2 3 4				
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)	$\frac{3100}{100000000000000000000000000000000$				
		Dielectric Strength	No failure	Time(min.) 30±3 2 to 3 30±3 2 to 3				
		Appearance	No defects or abnormalities.	_				
	Humidity,	Capacitance Change	Within ±12.5%	Sit the capacitor at 40±2℃ and 90 to 95% humidity for 500±12 hours.				
16	Steady State	D.F.	0.02 max.	Remove and let sit for 24 ± 2 hours at room temperature, then				
	oluto	I.R. Dielectric	More than 1,000MΩ or 50Ω • F (Whichever is smaller)	measure.				
		Strength						
		Appearance	No defects or abnormalities.	Apply the rated voltage at 40±2°C and 90 to 95% humidity for				
17	Humidity Load	Capacitance Change	Within ±12.5%	500±12 hours. Remove and let sit for 24±2 hours at room tem- perature, then measure. The charge/discharge current is less				
		D.F.	0.02 max.	than 50mA.				
_		I.R.	More than 500M Ω or 25 Ω • F (Whichever is smaller)					
		Appearance	No defects or abnormalities.	-				
18		Capacitance Change	Within ±12.5%	Apply 200% of the rated voltage for $1,000\pm12$ hours at 85 ± 3 °C. Let sit for 24 ± 2 hours at room temperature, then measure.				
	Load	D.F.	0.02 max.	The charge/discharge current is less than 50mA.				
		I.R.	More than 1,000M Ω or 50 Ω • F (Whichever is smaller)					



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

High-frequency for Flow/Reflow Soldering GRQ Series

Features

1.HiQ and low ESR at VHF, UHF, Microwave.

2.Feature improvement, low power consumption for mobile telecommunication (Base station, terminal, etc.)

Application

High-frequency circuit (Mobile telecommunication, etc.)





art Number	L W	nensions (r	nsions (mm)				
art Number	L	W	Т	е	g min.		
GRQ706	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5		
GRQ708	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7		
					-		

Part Number	GRQ70)6	GRO	2708
L x W(mm)	1.60x0.	80	2.00	x1.25
TC Code	COG		C	0G
Rated Volt.(Vdc)	50	100	50	100
Capacitance and T(mm)			
0.5pF		0.80		0.85
0.75pF		0.80		0.85
1.0pF		0.80		0.85
1.1pF		0.80		0.85
1.2pF		0.80		0.85
1.3pF		0.80		0.85
1.5pF		0.80		0.85
1.6pF		0.80		0.85
1.8pF		0.80		0.85
2.0pF		0.80		0.85
2.2pF		0.80		0.85
2.4pF		0.80		0.85
2.7pF		0.80		0.85
3.0pF		0.80		0.85
3.3pF		0.80		0.85
3.6pF		0.80		0.85
3.9pF		0.80		0.85
4.0pF		0.80		0.85
4.3pF		0.80		0.85
4.7pF		0.80		0.85
5.0pF		0.80		0.85
5.1pF		0.80		0.85
5.6pF		0.80		0.85
6.0pF		0.80		0.85
6.2pF		0.80		0.85
6.8pF		0.80		0.85
7.0pF	0.80			0.85
7.5pF	0.80			0.85
8.0pF	0.80			0.85
8.2pF	0.80			0.85
9.0pF	0.80			0.85
9.1pF	0.80			0.85
10.0pF	0.80			0.85
11pF	0.80			0.85
12pF	0.80			0.85



Continued from the preceding page.

Part Number	GRQ706	;	G	RQ708
L x W(mm)	1.60x0.8	0	2.	00x1.25
TC Code	COG			COG
Rated Volt.(Vdc)	50	100	50	100
Capacitance and T(m	ım)			
13pF	0.80			0.85
15pF	0.80			0.85
16pF	0.80			0.85
18pF	0.80			0.85
20pF	0.80		0.85	
22pF	0.80		0.85	
24pF	0.80		0.85	
27pF			0.85	
30pF			0.85	
33pF			0.85	
36pF			0.85	
39pF			0.85	
43pF			0.85	
47pF			0.85	

■ Q-Frequency Characteristics



■ Resonant Frequency-Capacitance



Resonant Frequency • Capacitance



No.	lte	em	Specification		Test Method				
1	Operating Temperatu		C0G : −55℃ to 125℃						
2	Rated Vo	ltage	See the previous pages.	may be applied conti When AC voltage is	defined as the maximum voltage which inuously to the capacitor. superimposed on DC voltage, V ^{p.p} or V ^{0.p} , shall be maintained within the rated voltage				
3	Appearar	nce	No defects or abnormalities.	Visual inspection.					
4	Dimensio	ons	Within the specified dimensions.	Using calipers.					
5	Dielectric	c Strength	No defects or abnormalities.	applied between the	bserved when 300% of the rated voltage is terminations for 1 to 5 seconds, provided e current is less than 50mA.				
6	Insulation (I.R.)	Resistance	More than 10,000M Ω or 500 Ω • F. (Whichever is smaller)		ance shall be measured with a DC voltage ted voltage at 25℃ and 75%RH max. and harging.				
7	Capacita	nce	Within the specified tolerance.		shall be measured at 25°C at the frequency				
				and voltage shown ir					
8	Q		Q≥1000	Item Cha Frequency	ar. C0G(1000pF and below) 1±0.1MHz				
-				Voltage	0.5 to 5Vrms				
		0							
		Capacitance Change	Within the specified tolerance. (Table A-1)		efficient is determined using the capaci- tep 3 as a reference.				
		Temperature Coefficent	Within the specified tolerance. (Table A-1)	tance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 throug 5, the capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A.					
9	Capacitance Temperature Characteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.)	The capacitance drift is caluculated 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.StepTemperature(°C)1 25 ± 2 2 -55 ± 3 3 25 ± 2 4 125 ± 3 5 25 ± 2					
10	Adhesive of Termir	Strength	No removal of the terminations or other defect shall occur.	Fig.1 using a eutectic with the test jig for 10. The soldering shall be method and shall be uniform and free of de	to the test jig (glass epoxy board) shown in solder. Then apply 10N* force in parallel ±1sec. e done either with an iron or using the reflow conducted with care so that the soldering is efects such as heat shock. *5N (GRQ706) +C+ +C+ Solder resist Baked electrode or copper foil a b c 1.0 3.0 1.2 1.2 4.0 1.65 (in mm) Fig.1				
		Appearance	No defects or abnormalities.		to the test jig (glass epoxy board) in the				
		Capacitance	Within the specified tolerance.		nder the same conditions as (10).				
11	Vibration Resistance	Q	Q≥1000	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).					

Continued on the following page. \square



Continued from the preceding page.

	Ite	em	Specification	Test Method					
			No cracking or marking defects shall occur.	Solder the capacitor to the test jig (glass epoxy board) shown Fig.2 using a eutectic solder. Then apply a force in the directic shown in Fig.3. The soldering shall be done either with an iror					
12	2 Deflection		¢4.5 ¢ ¢ t t 100 • • • • • • • • • • • • •	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 GRQ706 1.0 3.0 1.2 GRQ708 1.2 4.0 1.65 (in mm) Fig.2	Flexure : ≤1 Capacitance meter 45 45 (in mm)					
				Fig.3					
13	Solderabi Terminati	2	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) ar rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat a 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 observed characteristics shall satisfy the specifications in the following table.						
		Appearance	No marking defects.	-					
4	Resistance to Soldering	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	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					
	Heat	Q	Q≧1000	seconds. Let sit at room temperature for 24±2 hours.					
	-	I.R.	More than 10,000M Ω or 500 Ω • F (Whichever is smaller)	-					
		Dielectric Strength	No failure						
	S		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).					
		Appearance	No marking defects.	Perform the five cycles according to the four heat treatments					
	Tomporatura	Capacitance	Within ±2.5% or ±0.25pF	listed in the following table.					
5	Temperature Cycle	Change	Within ±2.5% or ±0.25pF (Whichever is larger)						
5		Change Q	Within ±2.5% or ±0.25pF (Whichever is larger) Q≧1000	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp (%) Min. Operating Room Max. Operating Room					
5		Change Q I.R.	Within ±2.5% or ±0.25pF (Whichever is larger)	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$					
5		Change Q	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller) No failure	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp (%) Min. Operating Room Max. Operating Room					
5		Change Q I.R. Dielectric	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$					
5		Change Q I.R. Dielectric	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger)Q ≥ 1000 More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. <u>Step 1 2 3 4</u> Temp.(°C) Min. Operating Room Max. Operating Room Temp.+0/-3 Temp. Temp.+3/-0 Temp. Time(min.) 30±3 2 to 3 30±3 2 to 3					
	Cycle Humidity,	Change Q I.R. Dielectric Strength Appearance Capacitance	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$					
	Cycle Humidity, Steady	Change Q I.R. Dielectric Strength Appearance Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger)	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°c) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°c and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation)					
	Cycle Humidity,	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger) $Q \ge 350$	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°c) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°c and 90 to 95% humidity for 500±1 hours.					
15	Cycle Humidity, Steady	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R. Dielectric	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger)	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°c) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°c and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation)					
	Cycle Humidity, Steady	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R.	Within $\pm 2.5\%$ or ± 0.25 pF (Whichever is larger)Q ≥ 1000 More than $10,000$ MΩ or 500 Ω • F (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or ± 0.5 pF (Whichever is larger)Q ≥ 350 More than $1,000$ MΩ or 50 Ω • F (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°c) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°c and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation)					
	Cycle Humidity, Steady	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R. Dielectric Strength	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger) $Q \ge 350$ More than $1,000M\Omega$ or $50\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°c) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°c and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation)					
16	Cycle Humidity, Steady State	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R. Dielectric Strength Appearance Capacitance	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger) $Q \ge 350$ More than $1,000M\Omega$ or $50\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No failureNo failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 7.5\%$ or $\pm 0.75pF$	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°c) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°c and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation)					
6	Cycle Humidity, Steady	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R. Dielectric Strength Appearance Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger) $Q \ge 350$ More than $1,000M\Omega$ or $50\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No failureNo failureNo marking defects.Within $\pm 7.5\%$ or $\pm 0.75pF$ (Whichever is larger)	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°C) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation type) at room temperature, then measure. Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.					
	Cycle Humidity, Steady State Humidity	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R. Dielectric Strength Appearance Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger) $Q \ge 350$ More than $1,000M\Omega$ or $50\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 7.5\%$ or $\pm 0.75pF$ (Whichever is larger)Q ≥ 200	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°C) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation type) at room temperature, then measure. Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature.					
6	Cycle Humidity, Steady State Humidity	Change Q I.R. Dielectric Strength Appearance Capacitance Change Q I.R. Dielectric Strength Appearance Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) $Q \ge 1000$ More than $10,000M\Omega$ or $500\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No marking defects.Within $\pm 5\%$ or $\pm 0.5pF$ (Whichever is larger) $Q \ge 350$ More than $1,000M\Omega$ or $50\Omega \bullet F$ (Whichever is smaller)No failureThe measured and observed characteristics shall satisfy the specifications in the following table.No failureNo failureNo marking defects.Within $\pm 7.5\%$ or $\pm 0.75pF$ (Whichever is larger)	listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4 Temp.(°C) Min. Operating Temp.+0/-3 Room Temp. Max. Operating Temp.+3/-0 Room Temp.+3/-0 Time(min.) 30±3 2 to 3 30±3 2 to 3 Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±1 hours. Remove and let sit for 24±2 hours (temperature compensation type) at room temperature, then measure. Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.					

Continued on the following page. \square



Continued from the preceding page.

No.	lte	em	Specification	Test Method
			The measured and observed characteristics shall satisfy the specifications in the following table.	
		Appearance	No marking defects.	Apply 200% of the roted voltage for 1 000±12 hours at the
18	High Temperature	Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	 Apply 200% of the rated voltage for 1,000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) at
	Load	Q Q≧350		room temperature, then measure.
		I.R.	More than 1,000M Ω or 50 Ω • F (Whichever is smaller)	The charge/discharge current is less than 50mA.
		Dielectric Strength	No failure	-

Table A

	No. 1 No. 1	Capacitance Change from 25°C (%)								
Char.	Nominal Values (ppm/°C) Note 1	—55℃		-3	0℃	−10°C				
		Max.	Min.	Max.	Min.	Max.	Min.			
C0G	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11			
 COG		-		0.40						

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



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

High-Q & High-power GRH/RPN100 Series

■ Features(GRH100 Series)

- 1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high-frequency applications (VHS-microwave band).
- 2. The series is ultraminiature, yet has a high-power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
- 3. GRH110 type is designed for both flow and reflow soldering and GRH111 type is designed for reflow soldering.
- 4. GRH type capacitors exhibit better solderability and lower solder leaching because of its nickel barriered terminations.

Application

High-frequency and high-power circuits.

■ Features(RPN100 Series)

- 1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high-frequency applications (VHS-microwave band).
- 2. The series is ultraminiature, yet has a high-power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
- 3. RPN type capacitors withstand high temperatures because ribbon leads are attached with silver paste.
- 4. 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.

	6
6	4
~	999



Part Number		Dimens	sions (mm)		
Part Number	L	W	Т	е	
GRH110	1.4 ^{+0.6} -0.4	1.4 ^{+0.6} -0.4	0.8 to 1.65	0.25 ^{+0.25} -0.15	
GRH111	2.8 ^{+0.6} - 0.4	2.8 ^{+0.6} - 0.4	2.0 to 2.8	0.4+0.4	



*** : Capacitance Code

Part Number		Din	nensions (ı	nm)	
Part Number	L	W	T max.	l	w
RPN110	1.6 ±0.4	1.4 ±0.4	1.6	5.0 min.	1.3 ±0.4
RPN111	3.2 ±0.4	2.8 ±0.4	3.0	9.0 ±2.0	2.35 ±0.15

Part Number	GRH110			GRH111			RPN110	RPN111				
L x W(mm)	1.40x1.40			2.80x2.80			1.60x1.40			3.20x2.80		
TC Code	C0G			C0G			C0G		C0G			
Rated Volt.(Vdc)	50	50	100	200	300	500	50	50	100	200	300	500
Capacitance and	d T(mm)											
0.5pF	1.20					2.40	1.60					3.00
0.6pF	1.20					2.40	1.60					3.00
0.7pF	1.20					2.40	1.60					3.00
0.8pF	1.20					2.40	1.60					3.00
0.9pF	1.20					2.40	1.60					3.00
1.0pF	1.20					2.40	1.60					3.00
1.1pF	1.20					2.40	1.60					3.00
1.2pF	1.20					2.40	1.60					3.00
1.3pF	1.20					2.40	1.60					3.00
1.4pF	1.20					2.40	1.60					3.00
1.5pF	1.20					2.40	1.60					3.00
										Continued of	on the followi	ng page. 🖊



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Part Number	GRH110			GRH111			RPN110					
	1.40x1.40			2.80x2.80			1.60x1.40	3.20x2.80				
TC Code	COG		1	C0G	1	1	COG		1	C0G		
Rated Volt.(Vdc)	50	50	100	200	300	500	50	50	100	200	300	500
Capacitance and	1		1		1							1
1.6pF	1.20					2.40	1.60					3.00
1.7pF	1.20					2.40	1.60					3.00
1.8pF	1.20					2.40	1.60					3.00
1.9pF	1.20					2.40	1.60					3.00
2.0pF	1.20					2.40	1.60					3.00
2.1pF	1.20					2.40	1.60					3.00
2.2pF	1.20					2.40	1.60					3.00
2.4pF	1.20					2.40	1.60					3.00
2.7pF	1.20					2.40	1.60					3.00
3.0pF	1.20					2.40	1.60					3.00
3.3pF	1.20					2.40	1.60					3.00
3.6pF	1.20					2.40	1.60					3.00
3.9pF	1.20					2.40	1.60					3.00
4.3pF	1.20					2.40	1.60					3.00
4.7pF	1.20					2.40	1.60					3.00
5.1pF	1.20					2.40	1.60					3.00
5.6pF	1.20					2.40	1.60					3.00
6.2pF	1.20					2.40	1.60					3.00
6.8pF	1.20					2.40	1.60					3.00
7.5pF	1.20					2.40	1.60					3.00
8.2pF	1.20					2.40	1.60					3.00
9.1pF	1.20					2.40	1.60					3.00
10.0pF	1.20					2.40	1.60					3.00
11pF	1.20					2.40	1.60					3.00
12pF	1.20					2.40	1.60					3.00
13pF	1.20					2.40	1.60					3.00
15pF	1.20					2.40	1.60					3.00
16pF	1.20					2.40	1.60					3.00
18pF	1.20					2.40	1.60					3.00
20pF	1.20					2.40	1.60					3.00
22pF	1.20					2.40	1.60					3.00
24pF	1.20					2.40	1.60					3.00
27pF	1.20					2.40	1.60					3.00
30pF	1.20					2.40	1.60					3.00
33pF	1.20					2.40	1.60					3.00
36pF 39pF	1.20					2.40	1.60 1.60					3.00 3.00
	1.20					2.40	+					
43pF	1.20					2.40	1.60					3.00
47pF	1.20					2.40	1.60					3.00
51pF	1.20					2.40	1.60					3.00
56pF 62pF	1.20 1.20					2.40	1.60					3.00 3.00
						2.40	1.60					3.00
68pF	1.20					2.40	1.60					
75pF	1.20					2.40	1.60					3.00
82pF 91pF	1.20					2.40	1.60					3.00 3.00
	1.20					2.40	1.60					
100pF	1.20				2.40	2.40	1.60				2.00	3.00
110pF					2.40						3.00	
120pF					2.40						3.00	
130pF					2.40						3.00	
150pF					2.40						3.00	
160pF					2.40						3.00	
180pF					2.40						3.00	

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Part Number	GRH110			GRH111			RPN110			RPN111			
L x W(mm)	1.40x1.40		2.80x2.80 1.60x1.40						3.20x2.80				
TC Code	C0G			C0G			COG			C0G			
Rated Volt.(Vdc)	50	50	100	200	300	500	50	50	100	200	300	500	
Capacitance and	d T(mm)												
220pF				2.40						3.00			
240pF				2.40						3.00			
270pF				2.40						3.00			
300pF				2.40						3.00			
330pF				2.40						3.00			
360pF				2.40						3.00			
390pF				2.40						3.00			
430pF				2.40						3.00			
470pF				2.40						3.00			
510pF			2.40						3.00				
560pF			2.40						3.00				
620pF			2.40						3.00				
680pF			2.40						3.00				
750pF		2.40						3.00					
820pF		2.40						3.00					
910pF		2.40						3.00					
1000pF		2.40						3.00					



No.	lte	em	Specification		Test Method				
1	Operating Temperatu		-55℃ to +125℃						
2	Rated Vo	I voltage See th arance No de nsior Within ctric Strength No de 125°C 470pF 125°C 470pF 125°C 470pF 125°C 470pF Ciaction Within 220pF 470pF Ciaction Within Rate Within Coefficient Within Coefficient Within Capacitance Within Rate Within Coefficient Within Ciapacitance Within See fee Capacitance Within Strength Drift Within Strength of Termination No readiment for nicro- strip type) No readiment for nicro- strip type)	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 ^{0.p} , whichever is larger, shall be maintained within the rated voltage range.					
3	Appearar	nce	No defects or abnormalities.	Visual inspection.					
4	Dimensio	ns	Within the specified dimension.	Using calipers.					
5	Dielectric	: Strength	No defects or abnormalities.	applied between the ter	erved when 250% of the rated voltage is minations for 1 to 5 seconds, provided urrent is less than 50mA.				
6	Insulation Resistance	25℃	C≦ 470pF :1,000,000MΩ min. 470pF <c≦1,000pf 100,000mω="" :="" min.<="" td=""><td></td><td>ce shall be measured with a DC voltage I voltage at 25℃ and 125℃ standard</td></c≦1,000pf>		ce shall be measured with a DC voltage I voltage at 25℃ and 125℃ standard				
0	(I.R.)	125℃	C≦ 470pF : 100,000MΩ min. 470pF <c≦1,000pf 10,000mω="" :="" min.<="" td=""><td>humidity and within 2 m</td><td>-</td></c≦1,000pf>	humidity and within 2 m	-				
7	Capacita	nce	Within the specified tolerance.		Il be measured at 25°C at the frequency				
8	Q		$\begin{array}{lll} C \leq & 220 \text{pF}: \text{Q} \geq 10,000 \\ 220 \text{pF} < C \leq & 470 \text{pF}: \text{Q} \geq & 5,000 \\ 470 \text{pF} < C \leq 1,000 \text{pF}: \text{Q} \geq & 3,000 \\ \text{C}: \text{Nominal Capacitance (pF)} \end{array}$	and voltage shown in th Item Char Frequency Voltage					
		Variation	Within the specified tolerance. (Table A-7)	tance measured in step temperature sequential	cient is determined using the capaci- 3 as a reference. When cycling the ly from step 1 through 5, the capaci-				
			Within the specified tolerance. (Table A-7)	coefficient and capacita	e specified tolerance for the temperature ince change as Table A. calculated by dividing the differences				
9	Capacitance Temperature Characteristics		Within ±0.2% or ±0.05pF (Whichever is larger)	step 1, 3 and 5 by the c	e shall be measured after 5 min. at				
10	Terminal	Strength of Termination	No removal of the terminations or other defects shall occur.	Fig.1 using solder conta done either with an iron care so the soldering is shock. Then apply a 10	the test jig (alumina substrate) shown in ining 2.5% silver. The soldering shall be or in furnace and be conducted with uniform and free of defects such as heat N force in the direction of the arrow.				
10	Strength	Strength (for micro-	Capacitor shall not be broken or damaged.		xed and a load is applied gradually in is value reaches 10N (5N for RPN110).				
		Bending Strength of lead wire terminal (for micro- strip type)	Lead wire shall not be cut or broken.	nal is perpendicular, an Bend the main body by	of the capacitor so the lead wire termi- d load 2.5N to the lead wire terminal. 90 degrees, bend back to original posi- n the reverse direction, and then bend I.				

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No.	Item		5	Specification	Test Method
	Арре	earance	No defects or abnormalitie	es.	Solder the capacitor to the test jig (alumina substrate) shown in
11	Vibration Resistance Q	citance	Within the specified tolera C≦ 220pF : Q≧1 220pF <c≦ 470pf="" :="" q≧<br="">470pF<c≦1,000pf :="" q≧<br="">C : Nominal Capacitance</c≦1,000pf></c≦>	0,000 5,000 3,000	Fig.2 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).
12	Solderability o Termination	of	95% of the terminations is t	o 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 \pm 0.5 seconds at 230 \pm 5°C. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.
13	Resistance to Soldering H	eat	The measured and obse specifications in the follow <u>Item</u> Appearance Capacitance Change Q I.R. Dielectric Strength	rved characteristics shall satisfy the ing table. Specification No marked defect Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) C≦ 220pF : Q≥10,000 220pF <c≤ 470pf="" 5,000<br="" :="" q≥="">470pF<c≤1,000pf 3,000<br="" :="" q≥="">More than 30% of the initial spec- ification value at 25°C. No failure C : Nominal Capacitance (pF)</c≤1,000pf></c≤>	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.
14	Temperature Cycle		The measured and obse specifications in the follow Item Appearance Capacitance Change Q I.R. Dielectric Strength	rved characteristics shall satisfy the ing table. No marked defect Within $\pm 1\%$ or ± 0.25 pF (Whichever is larger) $C \le 220$ pF : $Q \ge 10,000$ 220 pF < $C \le 470$ pF : $Q \ge 5,000$ 470 pF < $C \le 1,000$ pF : $Q \ge 3,000$ More than 30% of the initial spec- ification value at 25°c. No failure C : Nominal Capacitance (pF)	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11). Perform the five cycles according to the four heat treatments listed in the following table. Then, repeat twice the successive cycles of immersion, each cycle consisting of immersion in a fresh water at $65 \pm ^{\circ}{_{5}}^{\circ}$ C for 15 minutes and immersion in a saturated uqueous solution of salt at 0 $\pm ^{\circ}{_{5}}^{\circ}$ for 15 minutes. The cpapcitor is promptly washed with running water, dried with a dry cloth, and allowed to sit at room temperature for 24 ± 2 hours. $\frac{\text{Step} 1 2 3 4}{\text{Temp.(°C)} -55 \pm ^{\circ}{_{5}}^{\circ} \text{RoomTemp.} 125 \pm ^{\circ}{_{6}} \text{RoomTemp.} \\ \hline \text{Time(min.)} 30 \pm 3 2 \text{ to } 3 30 \pm 3 2 \text{ to } 3 \end{cases}$
15	Humidity		The measured and obse specifications in the follow <u>Item</u> <u>Appearance</u> Capacitance Change Q I.R.	rved characteristics shall satisfy the ring table. Specification No marked defect Within $\pm 5\%$ or $\pm 0.5 pF$ (Whichever is larger) C $\leq 220 pF : Q \geq 10,000$ $220 pF < C \leq 470 pF : Q \geq 5,000$ $470 pF < C \leq 1,000 pF : Q \geq 3,000$ More than 30% of the initial spec- ification value at 25°C. 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. United to the set of the set

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No.	Item	5	Specification	Test Method
		the specifications in the fo	0	
		Item	Specification No marked defect	
		Appearance Capacitance	Within $\pm 2.5\%$ or ± 0.25 pF	Apply 150% of the rated voltage for 2,000±12 hours at 125±3℃.
	High Temperature	Change	(Whichever is larger)	Remove and set for 24 ± 2 hours at room temperature, then
16	Load		C≦ 220pF : Q≧10,000	measure.
		Q	220pF <c≦ 470pf="" 5,000<="" :="" q≧="" td=""><td>The charge/discharge current is less than 50mA.</td></c≦>	The charge/discharge current is less than 50mA.
			470pF <c≦1,000pf 3,000<="" :="" q≧="" td=""><td></td></c≦1,000pf>	
		I.R.	More than 30% of the initial spec-	
		I.R.	ification value at 25°C.	
	C : Nominal Capacitance (pF)		C : Nominal Capacitance (pF)	

Table A

	T 0 11		Capacitance Change from 25℃ Value (%)								
Char.	Temp. Coeff. (ppm/℃) Note 1	—5	5°C	-3	O°C	−10℃					
	(ppm/c) Note i	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.



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

High-frequency GRH/RPN700 Series

■ Features(GRH700 Series)

- 1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
- 2. Nickel barriered terminations of GRH type improve solderability and decrease solder leaching.
- 3. GRH706/GRH708 type is designed for both flow and reflow soldering and GRH710 type is designed for reflow soldering.

Application

High-frequency and high-power circuits.

■ Features(RPN700 Series)

- 1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
- 2. RPN type capacitors withstand at high temperatures because ribbon leads are attached with silver paste.
- 3. 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.





			L	vv						
Part Number	Dimensions (mm)									
Fait Number	L	W	T max.	е	g min.					
GRH706	1.25 ^{+0.5} - 0.3	1.0 ^{+0.5} -0.3	1.2	0.15 min.	0.3					
GRH708	2.0 ^{+0.5} -0.3	1.25 ^{+0.5} -0.3	1.45	0.2 max.	0.5					
GRH710	3.2 +0.6	2.5 ^{+0.5} -0.3	1.9	0.3 max.	0.5					



*** : Capacitance Code

Part Number	Dimensions (mm)							
Part Number	L max.	W max.	T max.					
RPN710	4.0	3.0	2.3					

Part Number		GRH706			GRH708			GRH710			RPN710	
L x W(mm)		1.25x1.00			2.00x1.25			3.20x2.50			4.00x3.00	
TC Code		C0G			C0G			C0G			C0G	
Rated Volt.(Vdc)	50	100	200	50	100	200	50	100	200	50	100	200
Capacitance and	l T(mm)											
0.5pF			1.20			1.45			1.90			2.30
0.6pF			1.20			1.45			1.90			2.30
0.7pF			1.20			1.45			1.90			2.30
0.8pF			1.20			1.45			1.90			2.30
0.9pF			1.20			1.45			1.90			2.30
1.0pF			1.20			1.45			1.90			2.30
1.1pF			1.20			1.45			1.90			2.30
1.2pF			1.20			1.45			1.90			2.30
1.3pF			1.20			1.45			1.90			2.30
1.4pF			1.20			1.45			1.90			2.30
1.5pF			1.20			1.45			1.90			2.30
1.6pF			1.20			1.45			1.90			2.30
1.7pF			1.20			1.45			1.90			2.30
1.8pF			1.20			1.45			1.90			2.30
1.9pF			1.20			1.45			1.90			2.30
2.0pF			1.20			1.45			1.90			2.30
2.1pF			1.20			1.45			1.90			2.30
2.2pF			1.20			1.45			1.90			2.30
2.4pF			1.20			1.45			1.90			2.30
2.7pF			1.20			1.45			1.90			2.30

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Part Number		GRH706			GRH708			GRH710		RPN710		
L x W(mm)		1.25x1.00			2.00x1.25			3.20x2.50		4.00x3.00		
TC Code		C0G			C0G			C0G			C0G	
Rated Volt.(Vdc)	50	100	200	50	100	200	50	100	200	50	100	200
Capacitance and	T(mm)	1			1			1				1
3.0pF			1.20			1.45			1.90			2.30
3.3pF			1.20			1.45			1.90			2.30
3.6pF			1.20			1.45			1.90			2.30
3.9pF			1.20			1.45			1.90			2.30
4.3pF			1.20			1.45			1.90			2.30
4.7pF			1.20			1.45			1.90			2.30
5.1pF			1.20			1.45			1.90			2.30
5.6pF			1.20			1.45			1.90			2.30
6.2pF			1.20			1.45			1.90			2.30
6.8pF			1.20			1.45			1.90			2.30
7.5pF			1.20			1.45			1.90			2.30
8.2pF			1.20			1.45			1.90			2.30
9.1pF			1.20			1.45			1.90			2.30
10pF			1.20			1.45			1.90			2.30
11pF			1.20			1.45			1.90			2.30
12pF			1.20			1.45			1.90			2.30
13pF			1.20			1.45			1.90			2.30
15pF		1.20				1.45			1.90			2.30
16pF		1.20				1.45			1.90			2.30
18pF		1.20				1.45			1.90			2.30
20pF		1.20				1.45			1.90			2.30
22pF		1.20				1.45			1.90			2.30
24pF	1.20					1.45			1.90			2.30
27pF	1.20					1.45			1.90			2.30
30pF	1.20					1.45			1.90			2.30
33pF	1.20					1.45			1.90			2.30
36pF	1.20					1.45			1.90			2.30
39pF	1.20					1.45			1.90			2.30
43pF	1.20					1.45			1.90			2.30
47pF	1.20					1.45			1.90			2.30
51pF	1.20					1.45			1.90			2.30
56pF					1.45				1.90			2.30
62pF					1.45				1.90			2.30
68pF					1.45				1.90			2.30
75pF					1.45				1.90			2.30
82pF					1.45				1.90			2.30
91pF					1.45				1.90			2.30
100pF				1.45					1.90			2.30
110pF				1.45					1.90			2.30
120pF				1.45					1.90			2.30
130pF				1.45					1.90			2.30
150pF				1.45					1.90			2.30
160pF				1.45				1.00	1.90		2.20	2.30
180pF								1.90			2.30	
200pF								1.90			2.30	
220pF								1.90			2.30	
240pF								1.90			2.30	
270pF								1.90			2.30	
300pF								1.90			2.30	
330pF								1.90			2.30	
360pF								1.90			2.30	
390pF								1.90			2.30	
430pF		1			1	1		1.90			2.30	1

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Solution Continued from the preceding page.

Part Number		GRH706			GRH708			GRH710			RPN710	
L x W(mm)		1.25x1.00		2.00x1.25		3.20x2.50			4.00x3.00			
TC Code		C0G		COG		COG			COG			
Rated Volt.(Vdc)	50	100	200	50	100	200	50	100	200	50	100	200
Capacitance and	T(mm)											
510pF								1.90			2.30	
560pF							1.90			2.30		
620pF							1.90			2.30		
680pF							1.90			2.30		
750pF							1.90			2.30		
820pF							1.90			2.30		
910pF							1.90			2.30		
1000pF							1.90			2.30		



No.	lte	em	Specification		Test Method									
1	Operating Temperatu	ure Range	-55℃ to +125℃											
2	Rated Vo	ing rature Range -55°C to +125°C Voltage See the previous pages. rance No defects or abnormalities. sions Within the specified dimension tric Strength No defects or abnormalities. on Resistance 10,000MΩ min. itarce Within the specified tolerance C220pF Q≥10,00 220pF Q≥10,00 200 C<: Nominal Capacitance (PF	See the previous pages.	The rated voltage is defined as the maximum voltage we may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{p,p} whichever is larger, shall be maintained within the rate range.										
3	Appearar	nce	No defects or abnormalities.	Visual inspection.										
4	Dimensio	ns	Within the specified dimension.	Using calipers.										
5	Dielectric	: Strength	No defects or abnormalities.	No failure shall be observed when 300% of the rated vo applied between the terminations for 1 to 5 seconds, pro- the charge/discharge current is less than 50mA.										
6	Insulation (I.R.)	Resistance	10,000MΩ min.		e shall be measured with a DC voltage voltage at 25℃ and standard humidity charging.									
7	Capacita	nce	Within the specified tolerance.		be measured at 25℃ at the frequency									
8	Q		$C \le 220pF : Q \ge 10,000$ $220pF < C \le 470pF : Q \ge 5,000$ $470pF < C \le 1,000pF : Q \ge 3,000$ C : Nominal Capacitance (pF)	and voltage shown in the Item Char. Frequency Voltage	e table. COG (1,000pF and below) 1±0.1MHz 0.5 to 5Vr.m.s.									
		Variation	Within the specified tolerance. (Table A-6)	tance measured in step temperature sequentially	ent is determined using the capaci- 3 as a reference. When cycling the 7 from step 1 through 5, the capaci-									
			Within the specified tolerance. (Table A-6)	 tance shall be within the specified tolerance for the temperator coefficient and capacitance change as Table A. The capacitance drift is calculated by dividing the difference 										
9	Capacitance Temperature Characteristics	rature teristics	Capacitance	Capacitance	Capacitance	Capacitance	Capacitance	Capacitance	Capacitance	Capacitance	Capacitance	Within ±0.2% or ±0.05pF	step 1, 3 and 5 by the ca The capacitance change each specified temperate Step	shall be measured after 5 min. at ure stage. Temperature(℃)
			•	1	25±2									
				2 3	55±3 25±2									
				4	125±3									
				5	25±2									
10	Terminal	Strength of Termination	No removal of the terminations or other defects shall occur.	Fig.1 using solder contai done either with an iron o care so the soldering is u	he test jig (alumina substrate) shown in ning 2.5% silver. The soldering shall be or in furnace and be conducted with uniform and free of defects such as heat I* force in the direction of the arrow. *5N (GRH 706)									
.0	Strength		Capacitor shall not be broken or damaged.	The capacitor body is fix the axial direction until it	ed and a load is applied gradually in s value reaches 5N.									
		Bending Strength of lead wire terminal (for micro- strip type)	Lead wire shall not be cut or broken.	nal is perpendicular, and Bend the main body by 9	of the capacitor so the lead wire termi- l load 2.5N to the lead wire terminal. 20 degrees, bend back to original posi- the reverse direction, and then bend									

Continued on the following page. \square



Continued from the preceding page.

No.	Item		5	Specification			Test Method	k		
	Арр	pearance	No defects or abnormalitie	es.	Solder the capa					
	Cap	pacitance	Within the specified tolera	ince.	Fig.2 using sold		-		-	
11	Vibration Resistance Q		Satisfies the initial value. C≦ 220pF : Q≥1 220pF <c≤ 470pf="" :="" q≥<br="">470pF<c≤1,000pf :="" q≥<br="">C : Nominal Capacitance</c≤1,000pf></c≤>	5,000 3,000	done either with an iron or using the reflow method and shall conducted with care so the soldering is uniform and free defects such as heat shock. The capacitor shall be subjected to simple harmonic motion having a total amplitude of 1.5mm, t frequency being varied uniformly between the approximate lim of 10 and 55Hz. The frequency range, from 10 to 55Hz a return to 10Hz, shall be traversed in approximately 1 minute. Th motion shall be applied for a period of 2 hours in each 3 mutua perpendicular directions (total of 6 hours).					
12	Solderability Termination	of	75% of the terminations is t	to be soldered evenly and continuously.	Immerse the ca rosin (JIS-K-59 80 to 120°C for solder containir The dipping dep	02) (25% 10 to 30 ng 2.5% s	5 rosin in weigl seconds. Afte silver for 5±0.	ht proportio r preheatin 5 seconds	n). Preheat at g immerse in at 230±5℃.	
					from the root of	•				
13	Resistance to Soldering Heat		The measured and obse specifications in the follow Item Appearance Capacitance Change Q	rved characteristics shall satisfy the ring table. Specification No marked defect Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) C $\leq 220pF : Q \geq 10,000$ $220pF < C \leq 470pF : Q \geq 5,000$	Preheat accord Immerse in sold 270±5°C. Set a sure. The dippin 2mm from the r Chip Siz	der conta t room te ng depth root of the ze	aining 2.5% silvemperature for for microstrip e terminal. Prehe	ver for 3±0 24±2 hour type capac	5 seconds at s, then mea- itors is up to	
			Q	470pF <c≦ 3,000<br="" 470pf="" :="" q≧="">470pF<c≦1,000pf 3,000<="" :="" q≧="" td=""><td>2.0×1.25mm</td><td>n max.</td><td>1minute</td><td>at 120 to 1</td><td>50℃</td></c≦1,000pf></c≦>	2.0×1.25mm	n max.	1minute	at 120 to 1	50℃	
			Dielectric Strength	No failure	3.2×2.5mm	Ea	ach 1 minute at 100	to 120°C and t	nen 170 to 200℃	
			0	C : Nominal Capacitance (pF)						
14	Temperature Cycle	2	The measured and obse specifications in the follow Item Appearance Capacitance Change Q I.R. Dielectric Strength	rved characteristics shall satisfy the ing table. No marked defect Within ±5% or ±0.5pF (Whichever is larger) C≥30pF : Q≥350 10pF≦C<30pF : Q≥275+ $\frac{5}{2}$ C C<10pF : Q≥200+10C 1,000MΩ min. No failure C : Nominal Capacitance (pF)	Fix the capacito under the same according to the Let sit for 24±2 Step Temp.(°C) Time(min.)	e condition e four hea hours at 1 -55 ⁺ 3 30±3	ns as (11). Per at treatments li room tempera 2 RoomTemp. 2 to 3	form the fivested in the fivested in the fiture, then n 3 $125 \stackrel{+3}{-0}$ 30 ± 3	e cycles following table. neasure. 4 RoomTemp. 2 to 3	
15	Humidity		The measured and obse specifications in the follow Item Appearance Capacitance Change Q I.R.	rved characteristics shall satisfy the ring table. Specification No marked defect Within $\pm 5\%$ or $\pm 0.5 pF$ (Whichever is larger) C $\geq 30 pF$: Q ≥ 350 $10 pF \leq C < 30 pF$: Q $\geq 275 \pm \frac{5}{2}$ C C $< 10 pF$: Q $\geq 200 \pm 10C$ 1,000M Ω min. C : Nominal Capacitance (pF)	65 60 55 50 40 55 50 40 55 50 50 50 50 50 50 50 50 5	n below, oom temp Hur 20-98%	10 consecutive perature, and r -98% Humidity 90-98% +	e times. Rer measure. tumidity 80-98% 	idity90-98%	

Continued on the following page. \square



Continued from the preceding page.

No.	Item	5	Specification	Test Method
16	High Temperature Load	The measured and observations in the follow specifications in the follow Item Appearance Capacitance Change Q	rved characteristics shall satisfy the ving table. Specification No marked defect Within ±3% or ±0.3pF (Whichever is larger) C≥30pF : Q≥350 10pF≦C<30pF : Q≥275+ $\frac{5}{2}$ C C<10pF : Q≥200+10C	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.
		I.R.	1,000MΩ min.	
			C : Nominal Capacitance (pF)	

Table A

Townshing Occution		Cap	bacitance Change	e from 25℃ Value	(%)	
	—5	5℃	-30°C		−10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11
	Temperature Coefficient (ppm/°C) Note 1 0±30	, (ppm/℃) Note 1	Temperature Coefficient (ppm/°C) Note 1 —55°C Max. Min.	Temperature Coefficient (ppm/°C) Note 1 -55°C -3 Max. Min. Max.	Temperature Coefficient (ppm/°C) Note 1 -55°C -30°C Max. Min. Max. Min.	(ppm/℃) Note 1 Max. Min. Max. Min. Max. Min. Max.

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



GRH/RPN Series Data

Q-Frequency Characteristics



Impedance-Frequency Characteristics





GRH100 Series





GRH700 Series





Continued on the following page.



1000

GRH/RPN Series Data

Continued from the preceding page.



GRH100 Series



■ Allowable Voltage-Frequency



■ Allowable Appearent Power-Frequency



■ Allowable Current-Frequency

100G

10G

1G

100M

0.1

Series Resonant Frequency fo [Hz]



GRH700 Series

GRH70

100

GRH710

10

Capacitance [pF]







Packaging Code

Dackaging Type	Tana Carrier Deckaging	Bulk Coco Dookoging	Bulk Packaging		
Packaging Type	Tape Carrier Packaging	Bulk Case Packaging	Bulk Packaging in a bag	Bulk Packaging in a tray	
Packaging Code	PT	PC	PB	РМ	

Minimum Quantity Guide

Part Number		D.					Quantit	ty (pcs.)	(pcs.)		
		Dimensions (mm)		¢180mm reel		¢330mm reel		D # 0			
		L	w	Т	Paper Tape	Plastic Tape	Paper Tape	Plastic Tape	Bulk Case	Bulk Bag	
Ultra-miniaturized	GRM33	0.6	0.3	0.3	15,000	-	-	-	-	1,000	
	GRM36	1.0	0.5	0.5	10,000	-	50,000	-	50,000	1,000	
	GRM39	1.6	0.8	0.8	4,000	-	10,000	-	15,000 ¹⁾	1,000 1)	
				0.6	4,000	-	10,000	-	10,000	1,000	
For Flow/Deflow	GRM40	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000	
For Flow/Reflow				1.25	-	3,000	-	10,000	5,000	1,000	
				0.85	4,000	-	10,000	-	-	1,000	
	GRM42-6	3.2	1.6	1.15	-	3,000	-	10,000	-	1,000	
				1.6	-	2,000	-	6,000	-	1,000	
				1.15	-	3,000	-	10,000	-	1,000	
	GRM42-2	2.2	2.5	1.35	-	2,000	-	8,000	-	1,000	
For Reflow	GRIVI42-2	3.2	2.5	1.8	-	1,000	-	4,000	-	1,000	
1 of Kenow				2.5	-	1,000	-	4,000	-	1,000	
	GRM43-2	4.5	3.2	2.0	-	1,000	-	4,000 2)	-	1,000	
	GRM44-1	5.7	5.0	2.0	-	1,000	-	4,000 2)	-	1,000	
High-power Type	GRM615	1.0	0.5	0.5	10,000	-	50,000	-	50,000	1,000	
	GRM420	1.6	0.8	0.8	4,000	-	10,000	-	-	1,000	
	GRM425	2.0	1.25	0.7	4,000	-	10,000	-	-	1,000	
Low distortion	GRIVI425		1.25	1.0	4,000	-	10,000	-	-	1,000	
Low-distortion Series		3.2	1.6	0.7	4,000	-	10,000	-	-	1,000	
				1.0	4,000	-	10,000	-	-	1,000	
				1.25	-	3,000	-	10,000	-	1,000	
	GRM435	4.5	2.5	2.0	-	1,000	-	4,000	-	1,000	
	GRQ706	1.6	0.8	0.8	4,000	-	10,000	-	-	1,000	
	GRQ708	2.0	1.25	1.0	4,000	-	10,000	-	-	1,000	
	GRH706	1.25	1.0	1.2	-	-	-	-	-	1,000	
High-frequency	GRH708	2.0	1.25	1.45	-	3,000	-	~	-	1,000	
	GRH710	3.2	2.5	1.9	-	2,000	-	-	-	1,000	
	GRH110	1.4	1.4	1.65	-	2,000	-	-	-	1,000	
	GRH111	2.8	2.8	2.8	-	1,000	-	-	-	1,000	
For Ultrasonic	GRM40	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000	
Micro Chip	GM250	0.5	0.5	0.35	-	-	-	-	-	400 3)	
	GM260	0.8	0.8	0.5	-	-	-	-	-	400 3)	
Array	GNM30-401	3.2	1.6	0.8	4,000	-	10,000	-	-	1,000	
	LL0306	0.8	1.6	0.6	4,000	-	10,000	-	-	1,000	
Low ESL	LL0508	1.25	2.0	1.0	-	4,000 4)	-	10,000	-	1,000	
	LL0612	1.6	3.2	0.7	-	4,000	-	10,000	-	1,000	
			0.2	1.25	-	3,000	-	10,000	-	1,000	

1) 0.15 µF and 0.22 µF of X7R, 10V rated are available by taping packages only. (Applied to neither bulk case nor bag package.) 560pF of C0G, 50V rated and 0.47µF or 1.0µF of X5R, 6.3V rated are not available by bulk case. (Applied to taping or bag packages only.)

2) Depending on capacitance, some products are supplied on the 5,000pcs./reel basis.

3) Tray

4) Depending on capacitance, some products are supplied on the 3,000 pcs./reel basis.

Continued on the following page.



Continued from the preceding page.

Tape Carrier Packaging

(1) Dimensions of Reel



(2) Dimensions of Paper Tape



8mm width 2mm pitch Tape 0.5 max. (GRM33) 0.8 max. (GRM36/GRM615) 4.0±0.1 2.0±0.05 1.75±0.1 2.0±0.05 φ1.5^{+0.1} \bigoplus 3.5±0.05 8.0±0.3 Direction of Feed Part Number A* B* GRM33 0.37 0.67 GRM615 GR(M)36 0.65 1.15 *Nominal Value (in mm)

Continued on the following page. \checkmark



(in mm)

Continued from the preceding page.

(3) Dimensions of Plastic Tape





(4) Taping Method

- 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 atteached 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 sprocked holes.
- (6) Cumulative tolerance of sprocket holes, 10 pitches : ± 0.3 mm.
- Peeling off force : 0.1 to 0.6N* in the direction shown below. *GRM33:0.05 to 0.5N





Continued on the following page. \square



Package

Continued from the preceding page.

Dimensions of Bulk Case Packaging The bulk case used antistatic materials. Please contact Murata for details.





Notice

Storage and Operating Conditions

Chip monolithic ceramic capacitors (chips) can experience degradation of termination solderability when subjected to high temperature or humidity, or if exposed to sulfur or chlorine gases. (Reference Data 1. Solderability)

Rating

- Die Bonding/Wire Bonding (GM Series)
- (1) Die Bonding of Capacitors
 - Use the following materials Braze alloy : Au-Si (98/2) 400 to 420D in N2 atmosphere

Au-Sn (80/20) 300 to 320D in N2 atmosphere Au-Ge (88/12) 380 to 400D in N2 atmosphere

- Mounting
- 1. Control the temperature of the substrate so that it matches the temperature of the braze alloy.
- 2. Place braze alloy on substrate and place the capacitor on the alloy. Hold the capacitor and

Handling

1. Inspection

Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints. Provide support pins on the back side of the PCB to prevent warping or flexing.

- 2. Board Separation (or Depane-lization)
- Board flexing at the time of separation causes cracked chips or broken solder.
- Severity of stresses imposed on the chip at the time of board break is in the order of : PushbackFSlitterFV SlotFPerforator.
- Board separation must be performed using special jigs, not with hands.

Others

1. Resin Coating When selecting resin materials, select those with

- low contraction. 2. Circuit Design These capacitors on this catalog are not safety recognized products
- 3. Remarks

gently apply the load. Be sure to complete the operation in 1 minute.

- (2) Wire Bonding
- Wire

Gold wire : 20mm (0.0008 inch), 25mm (0.001 inch) diameter

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

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.



Soldering and Mounting

1. PCB Design

(1) Notice for Pattern Forms

Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate.

They are also more sensitive to mechanical and thermal stresses than leaded components.

Excess solder fillet height can multiply these stresses and cause chip cracking. When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.

Pattern Forms



Continued on the following page.



Notice

Continued from the preceding page.

(2) Land Dimensions



Table 1 Flow Soldering Method

Dimensions Part Number	Dimensions (L×W)	а	b	с
GRM39 GRM420 GRQ706	1.6×0.8	0.6—1.0	0.8-0.9	0.6-0.8
GRM40 GRM425 GRQ708	2.0×1.25	1.0-1.2	0.9—1.0	0.8-1.1
GRM42-6 GRM430	3.2×1.6	2.2-2.6	1.0-1.1	1.0-1.4
LL0508	1.25×2.0	0.4-0.7	0.5-0.7	1.4—1.8
LL0612	1.6×3.2	0.6-1.0	0.8-0.9	2.6-2.8
GRH706	1.25×1.0	0.4-0.6	0.6-0.8	0.8—1.0
GRH708	2.0×1.25	1.0-1.2	0.9-1.0	0.8-1.0
GRH110	1.4×1.4	0.5-0.8	0.8-0.9	1.0-1.2

(in mm)

Table 2 Reflow Soldering Method

Dimensions Part Number	Dimensions (L \times W)	а	b	с
GRM33	0.6×0.3	0.2-0.3	0.2-0.35	0.2-0.4
GRM36 GRM615	1.0×0.5	0.3-0.5	0.35-0.45	0.4-0.6
GRM39 GRM420 GRQ706	1.6×0.8	0.6-0.8	0.6-0.7	0.6-0.8
GRM40 GRM425 GRQ708	2.0×1.25	1.0-1.2	0.6-0.7	0.8—1.1
GRM42-6 GRM430	3.2×1.6	2.2-2.4	0.8-0.9	1.0—1.4
GRM42-2 GRM435	3.2×2.5	2.0-2.4	1.0-1.2	1.8–2.3
GRM43-2	4.5×3.2	3.0-3.5	1.2-1.4	2.3-3.0
GRM44-1	5.7×5.0	4.0-4.6	1.4-1.6	3.5-4.8
LL0306	0.8×1.6	0.2-0.4	0.3-0.4	1.0-1.4
LL0508	1.25×2.0	0.4-0.6	0.3-0.5	1.4—1.8
LL0612	1.6×3.2	0.6-0.8	0.6-0.7	2.6-2.8
GRH706	1.25×1.0	0.4-0.6	0.6-0.8	0.8-1.0
GRH708	2.0×1.25	1.0-1.2	0.6-0.8	0.8-1.0
GRH710	3.2×2.5	2.2-2.5	0.8-1.0	1.9-2.3
GRH110	1.4×1.4	0.4-0.8	0.6-0.8	1.0-1.2
GRH111	2.8×2.8	1.8-2.1	0.7-0.9	2.2-2.6
GR530	4.5×3.8	3.2-3.4	0.9-1.2	3.0-3.8
GR535	5.6×5.0	4.2-4.5	0.9-1.2	4.0-5.0
GR540	10.6×5.0	8.5-9.0	1.3-1.5	4.0-5.0
GR545	10.6×10.0	8.5-9.0	1.3-1.5	8.0-10.0
GR550	11.8×10.6	9.0-9.5	1.8-2.0	8.0-10.0
GR555	16.0×5.0	13.0-13.5	1.8-2.0	4.0-5.0
GR580	28.1×13.2	25.0-25.5	2.2-2.4	10.0-13.0

(in mm) Continued on the following page. \fbox



Notice

Continued from the preceding page.

• GNM Series for reflow soldering method



Table 3

Part Number	Dimensions (mm)						
Fait Number	L	W	а	b	с	d	
GNM30-401	3.2	1.6	0.8—1.0	0.7—0.9	0.3-0.4	0.4-0.5	

(3) Mounting Position

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

[Component Direction]

Locate chip horizontal to the direction in which stress acts





Chip arrangement Worst A-C-(B₂D) Best

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

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



Continued on the following page.



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3. Chip Placing

- An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. So adjust the suction nozzle's bottom dead point by correcting warp in the board. Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board. Nozzle pressure for chip mounting must be a 1 to 3N static load.
- Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes great force on the chip during mounting, causing cracked chips. And the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically. (Reference Data 5. Break strength)
- 4. Reflow Soldering
- Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips. So when preheating, keep temperature differential, ΔT, within the range shown in Table 4. The smaller the ΔT, the less stress on the chip.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and solvent within the range shown in the above table.

l able 4

Part Number	Temperature Differential
GRM33/36/39/40/42-6	
GRM420/425/430/615	
LL0306/0508/0612	∆T≦190℃
GRH706/708/110	
GRQ706/708	
GRM42-2/43-2/44-1/435	
GNM30-401	∆T≤130℃
GRH710/111	∆1≥130 C
GR530/535/540/545/550/555/580	





Inverting the PCB

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

Continued on the following page.

Soldering time (sec.)

90



0

30

60

soldering time must be within the range shown above.

In case of repeated soldering, the accumulated
Notice

Continued from the preceding page.

- 5. Adhesive Application
- Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. The amount of adhesive must be more than dimension C shown in the drawing below to obtain enough bonding strength. The chip's electrode thickness and land thickness must be taken into consideration.
- Low viscosity adhesive causes chips to slip after mounting. Adhesive must have a viscosity of 5000pa-s (500ps)min. (at 25°C)
- 6. Adhesive Curing

Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption.

Control curing temperature and time in order to prevent insufficient hardening.

Inverting the PCB

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

7. 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.

8. Flux Application

 An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability. So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).

 Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned.Use flux with a halide content of 0.2wt% max. But do not use strongly acidix flux.

Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned.



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9. Flow Soldering

- Sudden heating of the chip results in thermal distortion causing cracked chips. And an excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 5. The smaller the ΔT, the less stress on the chip.
 When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 5.

Do not apply flow soldering to chips not listed in Table 5.

Та	ble	e 5

Part Number	Temperature Differential
GRM39/40/42-6	
GRM420/425/430	
LL0508/0612	∆T≦150℃
GRH706/708/110	
GRQ706/708	

Optimum Solder Amount for Flow Soldering





[Standard Conditions for Flow Soldering]

Preheating

[Allowable Soldering Temperature and Time]

10

Adhesive

Temperature(°C)

Soldering Temperature(°C)

270 -260 -250 -240 -230 - Soldering

60 -120 seconds 5 seconds max.

20

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

Gradual Cooling (in the air)

Time

30 Soldering Time (sec.)

Up to Chip Thickness

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

Continued on the following page. \square



Notice

- Continued from the preceding page.
- 10. Correction with a Soldering Iron
- (1) For Chip Type Capacitors
- Sudden heating of the chip results in distortion due to a high internal temperature differential, causing cracked chips. When preheating, keep temperature differential, ΔT, within the range shown in Table 6. The smaller theΔT, the less stress on the chip.

Та	ble	6
		-

Part Number	Temperature Differential
GRM36/39/40/42-6	
GRM420/425/430/615	
LL0306/0508/0612	∆T≦190℃
GRQ706/708	
GRH706/708/110	
GRM42-2/43-2/44-1/435	
GNM30-401	AT<120°C
GRH710/111	∆T≦130℃
GR530/535/540/545/550/555/580	





flow soldering must be within the range shown above.



 When correcting chips with a soldering iron, no preheating is required if the chip is listed in Table 7 and the following conditions (Table 7) are met.
 Preheating should be performed on chips not listed in Table 7.

(Reference Data 8. Thermal shock when making a correction with a soldering iron)

Table 7	Correction with a Soldering Iron
	een een en mar a eenaering nen

Part Number	Temperature of Iron Tip	Soldering Iron Wattage	Diameter of Iron Tip	Restriction
GRM36/39/40				
GRM420/425/615				
LL0306/0508	300℃ max.			
GRQ706/708		20W max.	φ 3mm max.	Do not allow the iron tip to directly touch the ceramic
GRH706/708/110				
GRM42-6				element.
GRM430	070%			
LL0612	270°C max.			
GNM30-401				





- Continued from the preceding page.
- (2) For Microstrip Types
- Solder 1mm away from the ribbon terminal base, being careful that the solder tip does not directly contact the capacitor. Preheating is unnecessary.
- Complete soldering within 3 seconds with a soldering tip less than 270D in temperature.

11. Washing

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



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)

Table 1

90%RH to 95%RH at 40℃)				
ble 1				
Sample	Initial State	Prepared at Room Temperature	Prepared at High Temperature for	Prepared at High Humidity for 100 Hours at 90 to

Sample	Initial State	Prepared at Room Temperature		Temperature for 100 Hours at 85°C	for 100 Hours at 90 to 95% RH and 40°C
	6 months	12 months			
GRM40 for flow/reflow soldering	95 to 100%	95 to 100%	95%	90 to 95%	95%

(2) Test Samples

(4) Results

(3) Acceptance Criteria

Refer to Table 1.

GRM40 : Products for flow/reflow soldering.

With a 60-power optical microscope, measure the surface

area of the outer electrode that is covered with solder.

2. Board Bending Strength for Solder Fillet Height

(1) Test Method

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



(2) Test Samples

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 2.

Table 2

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



 \fbox Continued from the preceding page.

(4) 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.





Alumina substrates are typically designed for reflow soldering.

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

2 Material

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

3 Land Dimension







Reference Data

Continued from the preceding page.

(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 $\pm 2.5\%$ or ± 0.25 pF, whichever is greater	
X7R	Within ±7.5%	
Y5V	Within ±20%	

(4) Results



Continued on the following page.



Continued from the preceding page.

4. Board Bending Strength for Board Material

(1) Test Method

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



(2) Test Samples

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

(3) 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 $\pm 12.5\%$
Y5V	Within ±20%

(4) Results







Reference Data

Continued from the preceding page.

- 5. Break Strength
- (1) Test Method

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

(2) Test Samples

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.

 (N/mm^2)

X7R

Y5V

1.2

1.6

C0Ġ

0.8

Thickness of Ceramic Element (mm)

The formula is :

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

W: Width of ceramic element (mm)

- T : Thickness of element (mm)
- L : Distance between fulcrums (mm)

GRM40

γ : Bending stress

140

120

100

80

60

40

20

0 6

Bending-break Strength (N)

(5) Results









6. Thermal Shock(1) Test method

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

0.4

(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.



- Continued from the preceding page.
- (4) Results



7. Solder Heat Resistance

(1) Test Method

① Reflow soldering :

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

2 Flow soldering :

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

(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





Outer Electrode



③ Dip soldering :

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

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

Reference Data

Continued from the preceding page.

8. Thermal Shock when Making Corrections with a Soldering Iron

(1) Test Method

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

(2) Test Samples

GRM40 C0G/X7R/Y5V Characteristics T=0.6mm

(3) Acceptance Criteria for Defects

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









CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

for High-voltage Low Dissipation Type GHM1000 Series

Features

- 1. Murata's original internal electrode structure realizes high Flash-over Voltage.
- 2. A new monolithic structure for small, surface-mountable devices capable of operating at high-voltage levels.
- 3. Sn-plated external electrodes allow mounting without silver compound solder.
- 4. The GHM1030 type for flow and reflow soldering, and other types for reflow soldering.
- 5. Low-loss and suitable for high-frequency circuits.
- 6. The temperature characteristics R is high dielectric constant type, and SL is temperature compensating type.

Application

- 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)





Part Number		Dim	ensions (mm)	-					
Fait Number	L	W	Т	e min.	g min.					
GHM1030	3.2 ±0.2	1.6 ±0.2	1.0 ⁺⁰ -0.3		1.5*					
GHIWITUSU	3.2 <u>±</u> 0.2		1.25 ⁺⁰ -0.3		1.5					
GHM1035	3.2 ±0.2	2.5 ±0.2	1.5 ⁺⁰ -0.3	0.3	1.8					
GHM1038	4.5 ±0.3	2.0 ±0.2	2.0 ±0.3							
GHM1040	4.5 +0.3	3.2 ±0.3	2.0 ⁺⁰ -0.3		2.9					
GIIWII040	4.5 ±0.5	J.∠ <u>1</u> 0.3	2.5 ⁺⁰ -0.3							

* SL 2kV : 1.8mm min.

Part Number	Rated Voltage (V)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM1030R101K630	DC630	R	100 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R151K630	DC630	R	150 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R221K630	DC630	R	220 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R331K630	DC630	R	330 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R471K630	DC630	R	470 +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1030R681K630	DC630	R	680 +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1030R102K630	DC630	R	1000 +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1030R470K1K	DC1000	R	47 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R680K1K	DC1000	R	68 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R101K1K	DC1000	R	100 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R151K1K	DC1000	R	150 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R221K1K	DC1000	R	220 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R331K1K	DC1000	R	330 +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1030R471K1K	DC1000	R	470 +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1030SL100D2K	DC2000	SL	10 +0.5,-0.5pF	3.2	1.6	1.25	1.8 min.	0.3 min.
GHM1030SL120J2K	DC2000	SL	12 +5,-5%	3.2	1.6	1.25	1.8 min.	0.3 min.
GHM1030SL150J2K	DC2000	SL	15 +5,-5%	3.2	1.6	1.25	1.8 min.	0.3 min.
GHM1030SL180J2K	DC2000	SL	18 +5,-5%	3.2	1.6	1.25	1.8 min.	0.3 min.
GHM1030SL220J2K	DC2000	SL	22 +5,-5%	3.2	1.6	1.25	1.8 min.	0.3 min.
GHM1035SL270J2K	DC2000	SL	27 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1035SL330J2K	DC2000	SL	33 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1035SL390J2K	DC2000	SL	39 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1035SL470J2K	DC2000	SL	47 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1035SL560J2K	DC2000	SL	56 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1035SL680J2K	DC2000	SL	68 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1035SL820J2K	DC2000	SL	82 +5,-5%	3.2	2.5	1.5	1.8 min.	0.3 min.
GHM1040SL121J2K	DC2000	SL	120 +5,-5%	4.5	3.2	2.0	2.9 min.	0.3 min.



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Part Number	Rated Voltage (V)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM1040SL151J2K	DC2000	SL	150 +5,-5%	4.5	3.2	2.0	2.9 min.	0.3 min.
GHM1040SL181J2K	DC2000	SL	180 +5,-5%	4.5	3.2	2.0	2.9 min.	0.3 min.
GHM1040SL221J2K	DC2000	SL	220 +5,-5%	4.5	3.2	2.0	2.9 min.	0.3 min.
GHM1038SL100D3K	DC3150	SL	10 +0.5,-0.5pF	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL120J3K	DC3150	SL	12 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL150J3K	DC3150	SL	15 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL180J3K	DC3150	SL	18 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL220J3K	DC3150	SL	22 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL270J3K	DC3150	SL	27 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL330J3K	DC3150	SL	33 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL390J3K	DC3150	SL	39 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL470J3K	DC3150	SL	47 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL560J3K	DC3150	SL	56 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL680J3K	DC3150	SL	68 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1038SL820J3K	DC3150	SL	82 +5,-5%	4.5	2.0	2.0	2.9 min.	0.3 min.
GHM1040SL101J3K	DC3150	SL	100 +5,-5%	4.5	3.2	2.5	2.9 min.	0.3 min.



			Specif	ication				
No.	Ite	em	Temperature Compensating Type (SL Char.)	High Dielectric Constant Type (R Char.)	-	Test Method		
1	Operating Temperatu		−55 to +125℃					
2	Appearar	nce	No defects or abnormalities.		Visual inspection.			
3	Dimensio	ns	Within the specified dimension.		Using calipers.			
4	Dielectric	Strength	No defects or abnormalities.		No failure shall be observed when voltage in Table is applet between the terminations for 1 to 5 s, provided the charge 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 Resistance (I.R.)		More than 10,000MΩ		The insulation resistan within 60±5 s of charg	ce shall be measured with $500\pm50V$ and ing.		
6	Capacita	nce	Within the specified tolerance.			F. shall be measured at 20°C at the		
7	Q/ Dissipatio Factor (D		C≧30pF : Q≧1,000 C<30pF : Q≧400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	frequency and voltage (1) Temperature Comp Frequency : 1±0.2N Voltage : 0.5 to 5V (2) High Dielectric Com Frequency : 1±0.2V Voltage : 1±0.2V (r	pensating Type vHz (r.m.s.) istant Type kHz		
					capacitance measu When cycling the te through 5 (+20 to + specified tolerance Step	befficient is determined using the red in step 3 as a reference. Imperature sequentially from step 1 -85 °C) the capacitance shall be within the for the temperature coefficient. Temperature(°C)		
	Capacitar		Temp. Coefficient		1	20±2		
8	Temperat		+350 to -1,000 ppm/°C	Cap. Change	2	Min. Operating Temp.±3		
	Character	ristics	(Temp. Range : +20 to +85℃)	Within ±15%	3 4	<u>20±2</u>		
					5	Max. Operating Temp.±2 20±2		
					 (2) High Dielectric Constant Type The range of capacitance change compared to the 20°C value within −55 to +125°C shall be within the specified range. •Pretreatment Perform a heat treatment at 150⁺⁰/₋₁₀°C for 60±5 min and then let sit for 24±2 h at room condition.			
9	9 Adhesive Strength of Termination				in Fig.1 using a eutecti Then apply 10N force i The soldering shall be method and shall be co	the testing jig (glass epoxy board) shown c solder. in the direction of the arrow. done either with an iron or using the reflow onducted with care so that the soldering is fects such as heat shock.		
		Appearance	No defects or abnormalities.		Solder the capacitor to	the test jig (glass epoxy board).		
		Capacitance	Within the specified tolerance.		The capacitor shall be	subjected to a simple harmonic motion		
10	Vibration Resistance	Q/D.F.	30pF min. : Q≥1,000 30pF max. : Q≥400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	uniformly between the frequency range, from traversed in approxima	e of 1.5mm, the frequency being varied approximate limits of 10 and 55Hz. The 10 to 55Hz and return to 10Hz, shall be ttely 1 min. This motion shall be applied for 3 mutually perpendicular directions (total		
			(Pr.)		E21 F72 Glas	Solder resist		

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



Continued from the preceding page.

		· · ·	ication			
o. I	tem	Temperature Compensating Type (SL Char.)	High Dielectric Constant Type (R Char.)	Test Method		
		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		
1 Deflection	bility of	(mm) a 3.2×1.6 2.2 4 3.2×2.5 2.2 4 4.5×2.0 3.5 7 4.5×3.2 3.5 7 75% of the terminations are to be 75%	•4.5 •4.5 ••1.5 ••1.5 ••1.1.6 ••1.1.0 •1.0 •1.0 •1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 •1.1.0 <td colspan="3">uniform and free of defects such as heat shock.</td>	uniform and free of defects such as heat shock.		
² Termina	tion	and continuously.		eutectic solder solution for 2±0.5 s at 235±5℃. Immersing speed : 25±2.5mm/s		
	Appearance Capacitance Change	No marking defects. Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10%	 Preheat the capacitor at 120 to 150°C* for 1 min. Immerse the capacitor in eutectic solder solution at 260±5°C for 10±1 s. Let sit at room condition for 24±2 h, then measure. Immersing speed : 25±2.5mm/s 		
Resistance 3 to Soldering	Q/D.F.	C≧30pF : Q≧1,000 C<30pF : Q≧400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	 Pretreatment for high dielectric constant type Perform a heat treatment at 150 ^{±0}₁₀ ℃ for 60±5 min and then let sit for 24±2 h at room condition. 		
Heat	I.R.	More than 10,000MΩ		*Preheating for more than 3.2×2.5mm		
	Dielectric Strength	Pass the item No.4.		Step Temperature Time 1 100°C to 120°C 1 min. 2 170°C to 200°C 1 min.		
	Appearance	No marking defects.		Fix the capacitor to the supporting jig (glass epoxy board) shown		
	Capacitance Change	Within $\pm 2.5\%$ or ± 0.25 pF (Whichever is larger)	Within ±10%	 in Fig.4 using a eutectic solder. Perform the five cycles according to the four heat treatments listed in the following table. 		
	Q/D.F.	C \geq 30pF : Q \geq 1,000 C $<$ 30pF : Q \geq 400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	Let sit for 24±2 h at room condition, then measure. Step Temperature (°C)		
	I.R.	More than 10,000M Ω		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		
4 Temperature Cycle	Dielectric			•Pretreatment for high dielectric constant type Perform a heat treatment at $150 \pm 9_{0}^{\circ}$ °C for 60 ± 5 min and then let sit for 24±2 h at room condition.		
	Dielectric Strength Pass the item No.4.			Glass Epoxy Board		
	Appearance	No marking defects.		Fig.4		
	Capacitance	Within ±5.0% or ±0.5pF	Within ±100/	-		
Humidity 5 (Steady	Change Q/D.F.	(Whichever is larger) C≧30pF : Q≧350 C<30pF : Q≧275+ 5/2 C	Within ±10% D.F.≦0.01	Sit the capacitor at 40±2°C and relative humidity 90 to 95% for 500±2° h. Remove and let sit for 24±2 h at room condition, then measure.		
State)		C : Nominal Capacitance (pF)		Perform a heat treatment at 150 [±] ₁ 8 ℃ for 60±5 min and then		
	I.R.	More than 1,000MΩ		let sit for 24 ± 2 h at room condition.		
	Dielectric Strength	Pass the item No.4.				

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



Continued from the preceding page.

			Specif	ication				
No.	o. Item		Temperature Compensating Type (SL Char.)	High Dielectric Constant Type (R Char.)	Test Method			
		Appearance	No marking defects.		Apply the voltage in following	ng table for 1,000 ⁺⁴⁸ at maximum		
		Capacitance Change	Within $\pm 3.0\%$ or ± 0.3 pF (Whichever is larger)	Within ±10%	operating temperature±3°C. Remove and let sit for 24±2 h at room condition, then measure The charge/discharge current is less than 50mA.			
16	Life	Q/D.F.	C≧30pF : Q≧350 C<30pF : Q≧275+ 5⁄2 C C : Nominal Capacitance (pF)	D.F.≦0.02	Pretreatment for high diele	lectric constant type L5 min at test temperature.		
		I.R.	More than 1,000M Ω		Rated voltage	Test voltage		
		Dielectric Strength	Pass the item No.4.		More than DC 1kV Less than DC 1kV	Rated voltage 120% of the rated voltage		

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



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

for High-voltage High-capacitance Type 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 and GHM1530 type for flow and reflow soldering, and other types for reflow soldering.

Application

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





~		↓				
Part Number		Din	nensions (mm)			
Part Number	L	W	Т	g min.		
GHM1525	2.0 ±0.2	1.25 ±0.2	1.0 +0,-0.3	0.7		
GHM1525	2.0 ±0.2	1.25 ±0.2	1.25 ±0.2	1 0.7		
			1.0 +0,-0.3			
GHM1530		1.6 ±0.2	1.25 +0,-0.3	1.5		
			1.6 ±0.2			
GHM1535			1.5 +0,-0.3	_		
GHM1535	3.2 <u>1</u> 0.3	2.5 ±0.2	2.0 +0,-0.3			
			1.5 +0,-0.3			
GHM1540	4.5 ±0.4	3.2 ±0.3	2.0 +0,-0.3	2.5		
GHW1540	4.5 ±0.4	3.2 <u>⊥</u> 0.3	2.5 +0,-0.3	2.5		
			2.6 +0,-0.3			
GHM1545	5.7 ±0.4	5.0 ±0.4	2.0 +0,-0.3	3.5		
GENN 1545	J.7 <u>1</u> 0.4	J.0 <u>1</u> 0.4	2.7 +0,-0.3	5.5		

Part Number	Rated Voltage (V)	TC Code	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM1525B102K250	DC250	В	1000pF +10,-10%	2.0	1.25	1.0	0.7 min.	0.3 min.
GHM1525B152K250	DC250	В	1500pF +10,-10%	2.0	1.25	1.0	0.7 min.	0.3 min.
GHM1525B222K250	DC250	В	2200pF +10,-10%	2.0	1.25	1.0	0.7 min.	0.3 min.
GHM1525B332K250	DC250	В	3300pF +10,-10%	2.0	1.25	1.0	0.7 min.	0.3 min.
GHM1525B472K250	DC250	В	4700pF +10,-10%	2.0	1.25	1.0	0.7 min.	0.3 min.
GHM1525B682K250	DC250	В	6800pF +10,-10%	2.0	1.25	1.0	0.7 min.	0.3 min.
GHM1525B103K250	DC250	В	10000pF +10,-10%	2.0	1.25	1.25	0.7 min.	0.3 min.
GHM1530B153K250	DC250	В	15000pF +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1530B223K250	DC250	В	22000pF +10,-10%	3.2	1.6	1.0	1.5 min.	0.3 min.
GHM1530B333K250	DC250	В	33000pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B473K250	DC250	В	47000pF +10,-10%	3.2	1.6	1.6	1.5 min.	0.3 min.
GHM1535B683K250	DC250	В	68000pF +10,-10%	3.2	2.5	1.5	1.5 min.	0.3 min.
GHM1535B104K250	DC250	В	0.1µF +10,-10%	3.2	2.5	2.0	1.5 min.	0.3 min.
GHM1540B154K250	DC250	В	0.15µF +10,-10%	4.5	3.2	2.0	2.9 min.	0.3 min.
GHM1540B224K250	DC250	В	0.22µF +10,-10%	4.5	3.2	2.5	2.9 min.	0.3 min.
GHM1545B334K250	DC250	В	0.33µF +10,-10%	5.7	5.0	2.0	3.5 min.	0.3 min.
GHM1545B474K250	DC250	В	0.47µF +10,-10%	5.7	5.0	2.0	3.5 min.	0.3 min.
GHM1530B102K630	DC630	В	1000pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B152K630	DC630	В	1500pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B222K630	DC630	В	2200pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B332K630	DC630	В	3300pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B472K630	DC630	В	4700pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B682K630	DC630	В	6800pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1530B103K630	DC630	В	10000pF +10,-10%	3.2	1.6	1.25	1.5 min.	0.3 min.
GHM1535B153K630	DC630	В	15000pF +10,-10%	3.2	2.5	1.5	1.5 min.	0.3 min.
GHM1535B223K630	DC630	В	22000pF +10,-10%	3.2	2.5	1.5	1.5 min.	0.3 min.
GHM1540B333K630	DC630	В	33000pF +10,-10%	4.5	3.2	1.5	2.5 min.	0.3 min.
GHM1540B473K630	DC630	В	47000pF +10,-10%	4.5	3.2	1.5	2.5 min.	0.3 min.
GHM1540B683K630	DC630	В	68000pF +10,-10%	4.5	3.2	2.0	2.5 min.	0.3 min.
GHM1540B104K630	DC630	В	0.1µF +10,-10%	4.5	3.2	2.6	2.5 min.	0.3 min.
GHM1545B154K630	DC630	В	0.15µF +10,-10%	5.7	5.0	2.0	3.5 min.	0.3 min.
GHM1545B224K630	DC630	В	0.22µF +10,-10%	5.7	5.0	2.7	3.5 min.	0.3 min.



Ite	m	Specification	Test Method
)perating Temperatu	re Range	-55 to +125℃	_
ppearan	се	No defects or abnormalities.	Visual inspection.
Dimensio	ns	Within the specified dimensions.	Using calipers.
Dielectric Strength		No defects or abnormalities.	No failure shall be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage: DC 250V) is applied between the terminations for 1 to 5 s, provided the charge/discharge current is less than 50mA.
Insulation Resistance (I.R.)		C≧0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ	The insulation resistance shall be measured with 500±50V (250±50V in case of rated voltage: DC 250V) and within 60±5 s of charging.
Capacitar	nce	Within the specified tolerance.	The appeality $P_{\rm E}$ shall be measured at 20° at a frequency of
•		0.025 max.	 The capacitance/D.F. shall be measured at 20°C at a frequency o 1±0.2kHz and a voltage of 1±0.2V (r.m.s.)
Factor (D.F.) Capacitance Temperature Characteristics		Cap. Change Within ±10% (Temp. Range : −25 to +85℃)	 The range of capacitance change compared with the 20℃ value within -25 to +85℃ shall be within the specified range. Pretreatment Perform a heat treatment at 150⁺⁰/₋₁₀ ℃ for 60±5 min and then let sit for 24±2 h at room condition.
	0	No removal of the terminations or other defect shall occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock. $\underbrace{10N, 10\pm1s}_{Glass Epoxy Board}$ Fig.1
	Appearance	No defects or abnormalities.	Solder the capacitor to the test jig (glass epoxy board).
		Within the specified tolerance.	The capacitor shall be subjected to a simple harmonic motion
bration esistance	ration		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.	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 unifer and face of defend on when a boat short.
		$\begin{array}{c c c c c c c c c c c c c c c c c c c $	uniform and free of defects such as heat shock.
	perating mperating pearan imensio ielectric sulation R apacitan mperatinaracter dhesive Termin	emperature Range ppearance inensions ielectric Strength apacitance apacitance apacitance apacitance apacitance apacitance apacitance apacitance apacitance apacitance apacitance apacitance apacitance basis dhesive Strength Termination Appearance Capacitance pration sistance D.F.	and the specified of the specified dimensions. and the specified dimensions. intervalue No defects or abnormalities. intervalue No defects or abnormalities. iselectric Strength No defects or abnormalities. sulation Resistance C20.01µF : More than 100MΩ + µF c<0.01µF : More than 10,000MΩ

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

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lo.	lte	em	Specification	Test Method				
12	Solderab Terminati	-	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). Immerse in eutectic solder solution for 2±0.5 s at 235±5°C. Immersing speed : 25±2.5mm/s				
		Appearance	No marking defects.	Preheat the capacitor at 120 to 150°C* for 1 min.				
		Capacitance Change	Within ±10%	 Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 s. Let sit at room condition for 24±2 h, then measure. Immersing speed : 25±2.5mm/s 				
		D.F.	0.025 max.	•Pretreatment				
3	Resistance to Soldering Heat	I.R. $\begin{array}{c} C \geqq 0.01 \mu F : \text{More than } 100 M\Omega \bullet \mu F \\ C < 0.01 \mu F : \text{More than } 10,000 M\Omega \end{array}$		Perform a heat treatment at 150 [±] ₁ 8 [°] ℃ for 60±5 min and then let sit for 24±2 h at room condition.				
				*Preheating for more than 3.2×2.5mm				
		Dielectric	Pass the item No.4.	Step Temperature Time				
		Strength		1 100°C to 120°C 1 min. 2 170°C to 200°C 1 min.				
		Appearance	No marking defects.	Fix the capacitor to the supporting jig (glass epoxy board) show				
		Capacitance	Within ±7.5%	in Fig.4 using a eutectic solder. Perform the five cycles according to the four heat treatments				
		Change D.F.	0.025 max.	 listed in the following table. Let sit for 24±2 h at room condition, then measure. 				
			C≥0.01μF : More than 100MΩ • μF	Step Temperature (°C) Time (min)				
		I.R.	$C \le 0.01 \mu F$: More than 10,000 MΩ	1 Min. Operating Temp.±3 30±3				
				2 Room Temp. 2 to 3				
				3 Max. Operating Temp.±2 30±3				
	Temperature			4 Room Temp. 2 to 3				
4	Cycle	Dielectric Strength	Pass the item No.4.	•Pretreatment Perform a heat treatment at 150±18°C for 60±5 min and then let sit for 24±2 h at room condition.				
_		Appearance	No marking defects.	Fig.4				
		Capacitance Change	Within ±15%	Sit the capacitor at 40 \pm 2°C and relative humidity 90 to 95% for $500 \pm {}^{26}_{0}$ h.				
_	Humidity	D.F.	0.05 max.	Remove and let sit for 24 ± 2 h at room condition, then measure				
5	(Steady State)	I.R.	C≧0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ	 Pretreatment Perform a heat treatment at 150⁺₋₁⁰ ℃ for 60±5 min and then let sit for 24±2 h at room condition. 				
		Dielectric Strength	Pass the item No.4.					
		Appearance	No marking defects.					
		Capacitance Change	Within ±15%	Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage: DC250V) for $1,000^{\pm 48}$ h at maximum operating temperature $\pm 3^{\circ}$ C. Remove and let sit for 24 ± 2 h at				
16	Life	D.F.	0.05 max.	room condition, then measure.				
U	LIIE	I.R.	C≧0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ	The charge/discharge current is less than 50mA. Pretreatment Apply for the structure for 50+5 min at text temperature				
		Dielectric Strength Pass the item No.4.		 Apply test voltage for 60±5 min at test temperature. Remove and let sit for 24±2 h at room condition. 				
		Appearance	No marking defects.					
		Capacitance Change	Within ±15%	Apply the rated voltage at $40\pm2^{\circ}$ and relative humidity 90 to 95% for $500\pm2^{\circ}$ h.				
	Humidity	D.F.	0.05 max.	95% for 500 ± 20 h. Remove and let sit for 24±2 h at room condition, then measure				
17	, Humidity Loading	oading C≧0.01µF : More than 10MΩ • µF		•Pretreatment Apply test voltage for 60±5 min at test temperature.				
		1.K.	C<0.01μF : More than 1,000MΩ	Remove and let sit for 24 ± 2 h at room condition.				

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



CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

for High-voltage GHM2000 Series AC250V r.m.s.

Features

- 1. Chip monolitic 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.
- 5. Capacitance 0.01 to 0.1 uF for connecting lines and 470 to 4700 pF for connecting line to earth.

Application

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

Reference Standard

JIS C 5102

JIS C 5150

The standards of the electrical appliance and material control law of Japan, separated table 4.





Part Number	Dimensions (mm)							
Part Number	L	W	Т	e min.	g min.			
GHM2143		2.8 ±0.3						
GHM2145	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	3.5			
GHM2243		2.8 ±0.3						

Part Number	Rated Voltage (V)	TC Code	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM2243B471MAC250	AC250 (r.m.s.)	В	470pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2243B102MAC250	AC250 (r.m.s.)	В	1000pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2243B222MAC250	AC250 (r.m.s.)	В	2200pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2243B472MAC250	AC250 (r.m.s.)	В	4700pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2143B103MAC250	AC250 (r.m.s.)	В	10000pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2143B223MAC250	AC250 (r.m.s.)	В	22000pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2143B473MAC250	AC250 (r.m.s.)	В	47000pF +20,-20%	5.7	2.8	2.0	3.5 min.	0.3 min.
GHM2145B104MAC250	AC250 (r.m.s.)	В	0.1µF +20,-20%	5.7	5.0	2.0	3.5 min.	0.3 min.



No.	Ite	em	Specification		Test Method			
1	Operating Temperatu	ire Range	−25 to +85°C		-			
2	Appearar	nce	No defects or abnormalities.	Visual inspection.				
3	Dimensio	ns	Within the specified dimensions.	Using calipers.				
4	4 Dielectric Strength		No defects or abnormalities.	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. Image: Comparison of the termination of termination of the termination of terminatin of termination of termination of terminatin of termination of t				
GHM22xx AC15 5 Insulation Resistance (I.R.) More than 2,000MΩ The insulation resistance shall be measure within 60±5 s of charging.								
6	Capacita	200	Within the specified tolerance.	within 00±0 3 of charging	·			
7	Dissipation Factor (D	on	0.025 max.	The capacitance/D.F. sha 1±0.2kHz and a voltage of	II be measured at 20°C at a frequency of $1\pm0.2V$ (r.m.s.)			
8	Capacitar Temperat Character	ure	Cap. Change Within ±10%	The range of capacitance change compared with the 20°C value within -25 to $+85$ °C shall be within the specified range. •Pretreatment Perform a heat treatment at 150^{+}_{-1} °C for 60±5 min and then let sit for 24±2 h at room condition.				
9	Discharge Test (Application: GHM22xx) Appearance No defects or abnormalities.		the capacitor(Cd) charged	ade 50 times at 5 s intervals from d at DC voltage of specified. $\begin{array}{c} R1 \\ Ct \\ Ct \\ Ct \\ Cd \\ Ct \\ R2 \\ R2 \\ R2 \\ R3 : Surge resistance \\ \end{array}$				
10	0 Adhesive Strength No		No removal of the terminations or other defect shall occur.	Solder the capacitor to the testing jig (glass epoxy board) show in Fig.1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering shall be done either with a iron or using the reflow method and shall be conducted with ca so that the soldering is uniform and free of defects such as hea shock.				
		Appearance	No defects or abnormalities.	Solder the capacitor to the	Fig.1 e test jig (glass epoxy board).			
		Capacitance	Within the specified tolerance.	The capacitor shall be sul	ojected to a simple harmonic motion			
11	Vibration Resistance	D.F.	0.025 max.	uniformly between the ap frequency range, from 10 traversed in approximatel a period of 2 h in each 3 r of 6 h).	2 122 122 2 122 122 → Solder resist			

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

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lo.	Ite	em		S	pecification	n			Test Method		
			No cracking or	marking de	fects shall o	occur.		in Fig.2 using direction show	pacitor to the testing jig (glass a eutectic solder. Then apply a n in Fig. 3. The soldering shal g the reflow method and shall	a force in the Il be done either with	
2	Deflectio			care so that th heat shock.	care so that the soldering is uniform and free of defects such a						
2	Denection				100	↓ t:1.6			R230		
			L×W			ion (mm)			Flexure	=1	
			(mm) 5.7×2.8	4.5	8.0	с 3.2	d		Capacitance meter 45 45	(in mm)	
			5.7×5.0	4.5	8.0	5.6	1.0			()	
					Fig.2		·	1	Fig.3		
3	Solderability of Termination		75% of the term	inations is te	o be soldere	d evenly and	l continuously.	rosin (JIS-K-5 Immerse in eu	capacitor in a solution of ethan 902) (25% rosin in weight prop trectic solder solution for 2±0. eed : 25±2.5mm/s	oortion).	
		Appearance	No marking def	ects.							
	Humidity Insulation	Capacitance Change	Within ±15%						shall be subjected to $40\pm2^{\circ}$	relative humidity of	
4		D.F.	0.05 max.					The capacitor shall be subjected to $40\pm2^{\circ}$, relative humidity of 90 to 98% for 8 h, and then removed in room condition for 16 h			
	IIISUIdiiOII	I.R.	More than 1,000MΩ				until 5 cycles.	until 5 cycles.			
		Dielectric Strength	Pass the item No.4.								
		Appearance	No marking defects.						apacitor as table.		
		Capacitance Change	Within ±10%			 Immerse the capacitor in eutectic solder solution at 260±5°C for 10±1 s. Let sit at room condition for 24±2 h, then measure. Immersing speed : 25±2.5mm/s 					
	Resistance	D.F.	0.025 max.					Pretreatment Perform a heat treatment at 150 ⁺ ₋₁ ⁰ ℃ for 60±5 min and then let sit for 24±2 h at room condition.			
5	to Soldering	I.R.	More than 2,00	More than 2,000MΩ							
	Heat	Dielectric						*Preheating			
		Strength	Pass the item N	No.4.				Step 1	Temperature 100℃ to 120℃	Time 1 min.	
								2	170°C to 200°C	1 min.	
		Appearance	No marking def	ects.					tor to the supporting jig (glass	epoxy board) show	
		Capacitance Change	Within ±7.5%						a eutectic solder. ve cycles according to the four llowing table.	heat treatments	
		D.F.	0.025 max.						2 h at room condition, then me	easure.	
		I.R.	More than 2,00	0MΩ				Step 1	Temperature (℃) Min. Operating Temp.±3	Time (min) 30±3	
								2	Room Temp.	2 to 3	
								3	Max. Operating Temp.±2	30±3	
,	Temperature							4	Room Temp.	2 to 3	
6	Cycle							Pretreatmen		00 5	
									at treatment at $150\pm_18^{\circ}$ °C for 2 h at room condition.	ou±5 min and then	
		Dielectric Strength	Pass the item N	No.4.							
									- Solde	er resist	
									Glass Epoxy Board Fig.4		

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

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No.	Ite	em	Specification	Test Method				
		Appearance	No marking defects.					
	Humidity	Capacitance Change	Within ±15%	Sit the capacitor at 40 ± 2 °C and relative humidity 90 to 95% for $500\pm^{22}$ °C h.				
7	(Steady	D.F.	0.05 max.	Remove and let sit for 24±2 h at room condition, then measure. Pretreatment				
	State)	I.R.	More than 1,000M Ω	Perform a heat treatment at 150 ⁺ ¹ 0 [°] ℃ for 60±5 min and then				
		Dielectric Strength	Pass the item No.4.	let sit for 24 ± 2 h at room condition.				
		Appearance	No marking defects.	Apply voltage and time as Table at 85±2°C. Remove and let sit				
	-	Capacitance Change	Within ±15%	for 24 \pm 2 h at room condition, then measure. The charge / discharge current is less than 50mA.				
		D.F.	0.05 max.	Test Time Test voltage GHM21xx 1,000 ⁺⁴ ₀ h AC300V (r.m.s.)				
8	Life	I.R.	More than 1,000MΩ	GHM22xx 1,500 ⁻⁴ 8 h AC500V (r.m.s.)*				
0		Dielectric Strength	Pass the item No.4.	 * Except that once each hour the voltage is increased 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. 				
		Appearance	No marking defects.					
		Capacitance Change	Within ±15%	Apply the rated voltage at $40\pm2^{\circ}$ C and relative humidity 90 to 95% for 500 \pm^{24} h.				
9	Humidity Loading	D.F.	0.05 max.	Remove and let sit for 24±2 h at room condition, then measure. •Pretreatment				
	Loading	I.R.	More than 1,000MΩ	Apply test voltage for 60 ± 5 min at test temperature.				
		Dielectric Strength	Pass the item No.4.	Remove and let sit for 24±2 h at room condition.				

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



CHIP MONOLITHIC CERAMIC CAPACITOR



for High-voltage GHM3000 Series Safety Recognized

Features

- 1. Chip monolitic 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.
- 6. +125 degree C guaranteed.
- 7. Only for reflow soldering.

Application

- 1. Ideal use as Y capacitor or X capacitor for various switching power supply.
- 2. Ideal use as linefilter for MODEM.





Part Number	Dimensions (mm)						
Part Number	L	W	Т	e min.	g min.		
GHM3045			2.0 ±0.3				
GHM3145	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0		
GHM3145			2.7 ±0.3				

Standard Recognition

	Standard No.	Status of R	Recognition	Rated	
	Standard No.	Type GB	Type GC	Voltage	
UL	UL1414	_	◎*		
BSI		-	0		
VDE		0	0	AC250V	
SEV	EN132400	0	0	(r.m.s.)	
SEMKO		0	0		
EN1324	400 Class	X2	X1, Y2		

* : Line By Pass only

GC Type

Part Number	Rated Voltage (V)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM3045X7R101K-GC	AC250 (r.m.s.)	X7R	100 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R151K-GC	AC250 (r.m.s.)	X7R	150 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R221K-GC	AC250 (r.m.s.)	X7R	220 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R331K-GC	AC250 (r.m.s.)	X7R	330 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R471K-GC	AC250 (r.m.s.)	X7R	470 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R681K-GC	AC250 (r.m.s.)	X7R	680 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R102K-GC	AC250 (r.m.s.)	X7R	1000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R152K-GC	AC250 (r.m.s.)	X7R	1500 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R222K-GC	AC250 (r.m.s.)	X7R	2200 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R332K-GC	AC250 (r.m.s.)	X7R	3300 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R472K-GC	AC250 (r.m.s.)	X7R	4700 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.

GB Type

Part Number	Rated Voltage (V)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM3145X7R103K-GB	AC250 (r.m.s.)	X7R	10000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3145X7R153K-GB	AC250 (r.m.s.)	X7R	15000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3145X7R223K-GB	AC250 (r.m.s.)	X7R	22000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3145X7R333K-GB	AC250 (r.m.s.)	X7R	33000 +10,-10%	5.7	5.0	2.7	4.0 min.	0.3 min.

Dielectric Strength: DC1075V, 60+/- 1s.



No.	Ite	em	Specification		Test Method	
1	Operating Temperatu	ure Range	−55 to +125℃		-	
2	Appearar	nce	No defects or abnormalities.	Visual inspection.		
3	Dimensio	ns	Within the specified dimensions.	Using calipers.		
4	Dielectric Strength		No defects or abnormalities.	No failure shall be observed when voltage as table is applied between the terminations for 60±1 s, provided the charge/discharge current is less than 50mA. Image: Constraint of the constraint of the charge of the char		
5	Insulation I (I.R.)	Resistance	More than 6,000MΩ	The insulation resistance within 60±5 s of charging	shall be measured with $500\pm50V$ and	
6	Capacita	nce	Within the specified tolerance.			
7	Dissipatio Factor (D		0.025 max.	 The capacitance/D.F. sha 1±0.2kHz and a voltage of 	Il be measured at 20℃ at a frequency of f 1±0.2V (r.m.s.)	
8	Capacitar Temperat Character	ure	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 ⁺ ₋₁ ° °C for 60±5 min and then let sit for 24±2 h at room condition.		
		Appearance	No defects or abnormalities.		ade 50 times at 5 s intervals from	
		I.R.	More than 1,000M Ω		at DC voltage of specified.	
9	Discharge Test (Application: Type GC)	Dielectric Strength	Pass the item No.4.		r under test Cd : 0.001μ F 100M Ω R3 : Surge resistance	
10	Adhesive of Termin	0	No removal of the terminations or other defect shall occur.	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		
		Appearance	No defects or abnormalities.	Solder the capacitor to the	Fig.1	
		Capacitance	Within the specified tolerance.	The capacitor shall be sul	pjected to a simple harmonic motion	
11	Vibration Resistance	D.F.	0.025 max.	uniformly between the app frequency range, from 10 traversed in approximately a period of 2 h in each 3 r of 6 h).	3 1223 1223	
			1	1		

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

Continued on the following page.



Continued from the preceding page.

No.	lte	em	Specification	Test Method			
12	2 Deflection		No cracking or marking defects shall occur. $ \begin{array}{c c} & & & & & & & \\ \hline & & & & & & \\ \hline & & & &$	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. $ \begin{array}{c} 20 & 50 & \text{Pressurizing} \\ 9 & \text{pressurize} \\ 1.0 \text{mm/s} \\ Flexure=1 \\ 45 & (in mm) \\ Fig.3 \end{array} $			
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). Immerse in eutectic solder solution for 2±0.5 s at 235±5°C. Immersing speed : 25±2.5mm/s			
		Appearance	No marking defects.	Preheat the capacitor as table. Immerse the capacitor in			
		Capacitance Change	Within ±10%	 eutectic solder solution at 260±5°C for 10±1 s. Let sit at room condition for 24±2 h, then measure. Immersing speed : 25±2.5mm/s 			
	Resistance	I.R.	More than 1,000MΩ	•Pretreatment Perform a heat treatment at 150 ± 18 °C for 60±5 min and then			
		Dielectric Strength	Pass the item No.4.	Step Temperature Time 1 100°C to 120°C 1 min. 2 170°C to 200°C 1 min.			
		Appearance Capacitance	No marking defects.	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig.4 using a eutectic solder.			
		Change D.F.	0.05 max.	Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 h at room condition, then measure.			
				Step Temperature (°C) Time (min)			
		I.R.	More than 3,000MΩ	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			
15	5 Temperature Cycle	Dielectric Strength	Pass the item No.4.	•Pretreatment Perform a heat treatment at 150 [±] ₁ 8°C for 60±5 min and then let sit for 24±2 h at room condition.			
		Appearance	No marking defects.				
		Appearance Capacitance Change	No marking defects. Within ±15%	Sit the conceptor at 40±0% and relative humidity 00 to 05% for			
16	Humidity (Steady	Capacitance		- Sit the capacitor at 40±2℃ and relative humidity 90 to 95% for 500±12 h.			
16	Humidity (Steady State)	Capacitance Change	Within ±15%				

Continued on the following page.



Continued from the preceding page.

No.	Ite	em	Specification	Test Method				
		Appearance	No marking defects.	Impulse Voltage Τ1=1.2μs=1.67T				
		Capacitance Change	Within ±20%	Each individual capacitor shall be subjected to a 2.5kV (Type GC:5kV) Impulses (the voltage value means 30				
		D.F.	0.05 max.	zero to peak) for three times. Then				
		I.R.	More than 3,000MΩ	the capacitors are applied to life test.				
17	Life			Apply voltage as Table for 1,000 h at $125 \stackrel{+2}{=} ^{\circ}$ C, relative humidity 50% max.				
		Dielectric Strength		Type Applied voltage				
			Pass the item No.4.	GB AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1s.				
				GC AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1s.				
		Appearance	No marking defects.					
		Capacitance Change	Within ±15%	Apply the rated voltage at 40±2°C and relative humidity 90 to				
18	Humidity Loading	D.F.	0.05 max.	95% for 500 \pm^{24} h. Remove and let sit for 24 \pm 2 h at room				
	Loading	I.R.	More than $3,000M\Omega$	condition, then measure.				
		Dielectric Strength	Pass the item No.4.					

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





GHM Series Data

■ Capacitance-Temperature Characteristics



■ Impedance-Frequency Characteristics















Continued on the following page.



GHM Series Data

Continued from the preceding page.















Taping is standard packaging method.

■ Minimum Quantity Guide

		C)imensions (m	m) -	Quantit	
Part Number			-		φ 180 m	
		L	W	Т	Paper Tape	Plastic Tape
	GHM1030	3.2	1.6	1.0	4,000	-
	Chimitoso	0.2	1.0	1.25	-	3,000
	GHM1035	3.2	2.5	1.5	-	2,000
	GHM1038	4.5	2.0	2.0	-	2,000
	GHM1040	4 5	3.2	2.0	-	1,000
	GHW1040	4.5	3.2	2.5	-	500
	CUM4525	2.0	4.05	1.0	4,000	-
	GHM1525	2.0	1.25	1.25	-	3,000
	GHM1530	3.2	1.6	1.0	4,000	-
High-voltage				1.25	-	3,000
				1.6	-	2,000
	011114505		0.5	1.5	-	2,000
	GHM1535	GHM1535 3.2	2.5	2.0	-	1,000
				1.5	-	1,000
	011111540	4.5		2.0	-	1,000
	GHM1540	4.5	3.2	2.5	-	500
				2.6	-	500
	011114545		5.0	2.0	-	1,000
	GHM1545	5.7	5.0	2.7	-	500
	GHM2143	5.7	2.8	2.0	-	1,000
AC250V	GHM2145	5.7	5.0	2.0	-	1,000
	GHM2243	5.7	2.8	2.0	-	1,000
	GHM3045	5.7	5.0	2.0	-	1,000
Safty Std. Recognition	0111104.45	F 7	5.0	2.0	-	1,000
Recognition	GHM3145	5.7	5.0	2.7	-	500

■ Tape Carrier Packaging

(1) Appearance of Taping

1) Plastic Tape



2 Paper Tape



Continued on the following page.



Package

Continued from the preceding page.

(2) Dimensions of Tape

1) Plastic Tape



2 Paper Tape









Package

- (4) Taping Method
 - ① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
 - ② Part of the leader and part of the empty tape shall be attached to the end of the tape as follows.
 - ③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
 - ④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
 - (5) The top tape or cover tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover sprocket holes.
 - (6) Cumulative tolerance of sprocket holes, 10 pitches : ± 0.3 mm.
 - $\ensuremath{\overline{\mathcal{O}}}$ Peeling off force : 0.1 to 0.7N in the direction shown on the right.







1 Caution

■ Storage and Operating Conditions

Do not use or store capacitorsin 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

Handling

Vibration and impact

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

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

■ Caution (Rating)

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, <u>be sure to maintain the</u> Vp-p value of the applied voltage within the rated voltage range.

2. Operating Temperature and Self-generated Heat Keep the surface temperature of a capacitor within the rated operating temperature range.

Be sure to take into account the heat produced by the capacitor itself. When a capacitor is used in a high-frequency circuit, pulse voltage circuit or the like, it may produce heat due to dielectric loss.

Keep such self-generated temperature below $20^{\circ}C$ in B(X7R) characteristic products.

Regarding R and SL characteristic products, the applied voltage should be limited in high frequency circuit. Please contact our sales representatives or engineers for more details.

3. Test Condition for AC Withstanding Voltage

(1) Test Equipment

Test equipment for AC withstanding voltage shall be used with the performance of the wave similar to 50/60 Hz sine wave.

If the distorted sine wave or over load exceeding the

molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed 5 to 40 degrees centigrade and 20 to 70%. Use capacitors within 6 months. Failure to follow the above cautions may result, worst case,in a short circuit and fuming when the product is used.

specified voltage value is applied, the defective may be caused.

(2) Voltage Applied Method

When the withstanding voltage is applied, capacitor's lead or terminal shall be firmly connected to the out-put of the withstanding voltage test equipment, and then the voltage shall be raised from near zero to the test voltage. If the test voltage without the raise from near zero voltage would be applied directly to capacitor, test voltage should be applied with the *zero cross. At the end of the test time, the test voltage shall be reduced to near zero, and then capacitor's lead or terminal shall be taken off the out-put of the withstanding voltage test equipment.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, the surge voltage may arise, and therefore, the defective may be caused. *ZERO CROSS is the point where voltage sine wave pass 0V.



-See the right figure-

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



⚠ Caution

Caution (Soldering and Mounting)

1. Vibration and Impact

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

2. 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.

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



Continued on the following page.



Caution

Continued from the preceding page.

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

Carefully perform pre-heating so that temperature difference (ΔT) between the solder and component surface should be in the following range. When components are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100°C.

Chip Size Soldering Method	3.2×1.6mm and under	3.2×2.5mm and over
Reflow Method or Soldering Iron Method	∆T≦190°C	∆T≦130°C
Flow Method or Dip Soldering Method	∆T≦150°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°C max.	270°C max.	
Soldering Iron Wattage	20W max.		
Diameter of Iron-tip	φ 3.0mm max.		
Soldering Time	3 sec. max.		
Caution	Do not allow the iron-tip to directly touch the ceramic element.		





60 to 120 sec. Within 20 sec.

5. Soldering Method

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

Pre-heating

60 to 120 sec.

Within 5 sec

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.



1. Mounting of Chips

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

Construction and Dimensions of Pattern (Example)



Flow Solde	ring				
L×W	а	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 Solo	dering				
L×W	а	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



Continued on the following page.

(in mm)



Termination Thickness of Chip Capacitor and Desirable Thickness of Adhesives Applied



Notice

Continued from the preceding page.

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.



(2) 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 6Z4 eutectic solder, or 5Z5 solder. (Do not use solder with silver.)
- (3) Solder Buildup
 - Flow soldering and iron soldering Use as little solder as possible, and confirm that the solder is securely placed.

When soldering, confirm that the solder is placed over

0.2mm of the surface of the terminations.







(2) Reflow soldering

4. Cleaning

To perform ultrasonic cleaning, observe the following conditions on the right.

- 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).

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



■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-85M-01C	
Co.,Ltd.	Mai: 51, 55	RCJ★ ISO9001		
Izumo Murata Manufacturing	May. 11, '95		RCJ-93M-05A	
Co.,Ltd.	May. 11, 95		1(C3-3310-03A	
Murata Electronics	Aug. 13, '92	SISIR★★	SG MES 91M001A	
Singapore (Pte.) Ltd.	Aug. 13, 92	ISO9002	SG MES STMOUTA	
Murata Manufacturing	Nov. 18, '92	BSI★★★	FM 22169	
(UK) Ltd.	100.18, 92	ISO9002		
Murata Amazonia	Sep. '93	RCJ★	RCJ-(B)-93M-01	
Industria Comercio Ltda.	Sep. 95	ISO9002		
Murata Electronics North America	Jun. '94	UL★★★★	A1734	
State College Plant	Jun. 94	ISO9002	A1734	

★ 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
 - Power plant equipment
 - (5) Medical equipment
 - $\underline{\textcircled{6}}$ Transportation equipment (vehicles, trains, ships, etc.)
 - Traffic signal equipment
 - (8) Disaster prevention / crime prevention equipment
 - Data-processing equipment
 - 0 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 2000. 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 engineers.
- 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.
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