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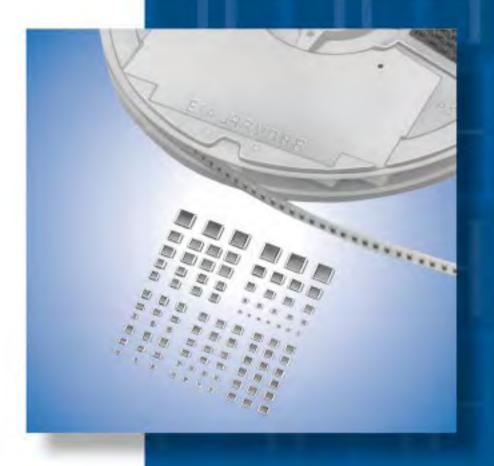
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Jameco Part Number 1858455

Chip Monolithic Ceramic Capacitors



muRata

Innovator in Electronics

Murata Manufacturing Co., Ltd.

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Part Numbering

Chip Monolithic Ceramic Capacitors

GR M 18 8 B1 1H 102 K A01 K (Part Number)

Product ID

2 Series

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

3Dimension (LXW)

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

4Dimension (T)

<u> </u>				
Code	Dimension (T)			
2	0.2mm			
2	2-elements (Array Type)			
3	0.3mm			
4	4-elements (Array Type)			
5	0.5mm			
6	0.6mm			
7	0.7mm			
8	0.8mm			
9	0.85mm			
Α	1.0mm			
В	1.25mm			
С	1.6mm			
D	2.0mm			
E	2.5mm			
F	3.2mm			
М	1.15mm			
N	1.35mm			
R	1.8mm			
s	2.8mm			
Q	1.5mm			
Х	Depends on individual standards.			
4/11/4				

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

Continued on the following page.







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5Temperature Characteristics

Temperature Characteristic Codes							
Code	Public STD	Code	Referance Temperature	Temperature Range	Capacitance Change or Temperature Coefficient	Operating Temperature Range	
1X	SL *1	JIS	20°C	20 to 85°C	+350 to -1000ppm/°C	-55 to 125°C	
2C	CH *1	JIS	20°C	20 to 125°C	0±60ppm/°C	-55 to 125°C	
2P	PH *1	JIS	20°C	20 to 85°C	-150±60ppm/°C	-25 to 85°C	
2R	RH *1	JIS	20°C	20 to 85°C	-220±60ppm/°C	-25 to 85°C	
2S	SH *1	JIS	20°C	20 to 85°C	-330±60ppm/°C	-25 to 85°C	
2T	TH *1	JIS	20°C	20 to 85°C	-470±60ppm/°C	-25 to 85°C	
3C	CJ *1	JIS	20°C	20 to 125°C	0±120ppm/°C	-55 to 125°C	
3P	PJ *1	JIS	20°C	20 to 85°C	-150±120ppm/°C	-25 to 85°C	
3R	RJ *1	JIS	20°C	20 to 85°C	-220±120ppm/°C	-25 to 85°C	
3S	SJ *1	JIS	20°C	20 to 85°C	-330±120ppm/°C	-25 to 85°C	
3T	TJ *1	JIS	20°C	20 to 85°C	-470±120ppm/°C	-25 to 85°C	
3U	UJ *1	JIS	20°C	20 to 85°C	-750±120ppm/°C	-25 to 85°C	
4C	CK *1	JIS	20°C	20 to 125°C	0±250ppm/°C	-55 to 125°C	
5C	C0G *1	EIA	25°C	25 to 125°C	0±30ppm/°C	-55 to 125°C	
5G	X8G *1	EIA	25°C	25 to 150°C	0±30ppm/°C	-55 to 150°C	
6C	C0H *1	EIA	25°C	25 to 125°C	0±60ppm/°C	-55 to 125°C	
6P	P2H *1	EIA	25°C	25 to 85°C	-150±60ppm/°C	-55 to 125°C	
6R	R2H *1	EIA	25°C	25 to 85°C	-220±60ppm/°C	-55 to 125°C	
6S	S2H *1	EIA	25°C	25 to 85°C	-330±60ppm/°C	-55 to 125°C	
6T	T2H *1	EIA	25°C	25 to 85°C	-470±60ppm/°C	-55 to 125°C	
7U	U2J *1	EIA	25°C	25 to 85°C	-750±120ppm/°C	-55 to 125°C	
B1	B *2	JIS	20°C	-25 to 85°C	±10%	-25 to 85°C	
В3	В	JIS	20°C	-25 to 85°C	±10%	-25 to 85°C	
C7	X7S	EIA	25°C	-55 to 125°C	±22%	-55 to 125°C	
C8	X6S	EIA	25°C	-55 to 105°C	±22%	-55 to 105°C	
F1	F *2	JIS	20°C	-25 to 85°C	+30, -80%	-25 to 85°C	
F5	Y5V	EIA	25°C	-30 to 85°C	+22, -82%	-30 to 85°C	
L8	X8L	EIA	25°C	-55 to 150°C	+15, -40%	-55 to 150°C	
R1	R *2	JIS	20°C	-55 to 125°C	±15%	-55 to 125°C	
R3	R	JIS	20°C	-55 to 125°C	±15%	-55 to 125°C	
R6	X5R	EIA	25°C	-55 to 85°C	±15%	-55 to 85°C	
R7	X7R	EIA	25°C	-55 to 125°C	±15%	-55 to 125°C	
R9	X8R	EIA	25°C	-55 to 150°C	±15%	-55 to 150°C	
0.5	71.54	*2	2000	-25 to 20°C	-4700+1000/-2500ppm/°C	25 +- 0500	
9E	ZLM	*3	20°C	20 to 85°C	-4700+500/-1000ppm/°C	-25 to 85°C	
14/0			25.00	FF 1- 1050C	±10% *4		
W0	-	-	25°C	-55 to 125°C	+22, -33% *5	-55 to 125°C	

^{*1} Please refer to table for Capacitance Change under reference temperature.

Continued on the following page. $\begin{tabular}{|c|c|c|c|}\hline \end{tabular}$



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^{*2} Capacitance change is specified with 50% rated voltage applied.

^{*3,*4} Murata Temperature Characteristic Code.

^{*4} Apply DC350V bias.

^{*5} No DC bias.

●Capacitance Change from each temperature

JIS Code

			Capacitance Cha	nge from 20°C (%)		
Murata Code	−55°C		−25°C		-10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
1X	-	-	-	-	-	-
2C	0.82	-0.45	0.49	-0.27	0.33	-0.18
2P	-	-	1.32	0.41	0.88	0.27
2R	-	-	1.70	0.72	1.13	0.48
2\$	-	-	2.30	1.22	1.54	0.81
2T	-	-	3.07	1.85	2.05	1.23
3C	1.37	-0.90	0.82	-0.54	0.55	-0.36
3P	-	-	1.65	0.14	1.10	0.09
3R	-	-	2.03	0.45	1.35	0.30
38	-	-	2.63	0.95	1.76	0.63
3T	-	-	3.40	1.58	2.27	1.05
3U	-	-	4.94	2.84	3.29	1.89
4C	2.56	-1.88	1.54	-1.13	1.02	-0.75

EIA Code

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

6 Rated Voltage

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

Capacitance

Ex.

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

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

Continued on the following page.



muRata

8Capacitance Tolerance

Code	Capacitance Tolerance	TC	Series	S Capacitance Step	
w	±0.05pF	СΔ	GRM/GJM	≦9.9pF	0.1pF
В	±0.1pF	СΔ	GRM/GJM	≦9.9pF	0.1pF
		СΔ	GRM/GJM	≦9.9pF	0.1pF
С	±0.25pF	except CΔ	GRM	≦5pF	* 1pF
		СΔ	ERB/GQM	≦5pF	* 1pF
		СΔ	GRM/GJM	5.1 to 9.9pF	0.1pF
D	±0.5pF	except CΔ	GRM	5.1 to 9.9pF	* 1pF
		СΔ	ERB/GQM	5.1 to 9.9pF	* 1pF
G	±2%	СΔ	GJM	≥10pF	E12 Series
G		СΔ	GQM	≥10pF	E24 Series
	±5%	CΔ-SL	GRM/GA3	≥10pF	E12 Series
J		СΔ	ERB/GQM/GJM	≥10pF	E24 Series
К	±10%	D D V7D VED 7LM	GRM/GR7/GA3	E6	Series
r.		B, R, X7R, X5R, ZLM	GR4	E12	Series
		Z5U	GRM	E3	Series
М	±20%	B, R, X7R, X7S	GRM/GMA/LLL/LLA/LLM	E6	Series
		X7R	GA2	E3	Series
Z	+80%, -20%	+80%, -20% F, Y5V GRM E3 Series			Series
R	Depends on individual standards.				

^{*} E24 series is also available.

9Individual Specification Code

Expressed by three figures.

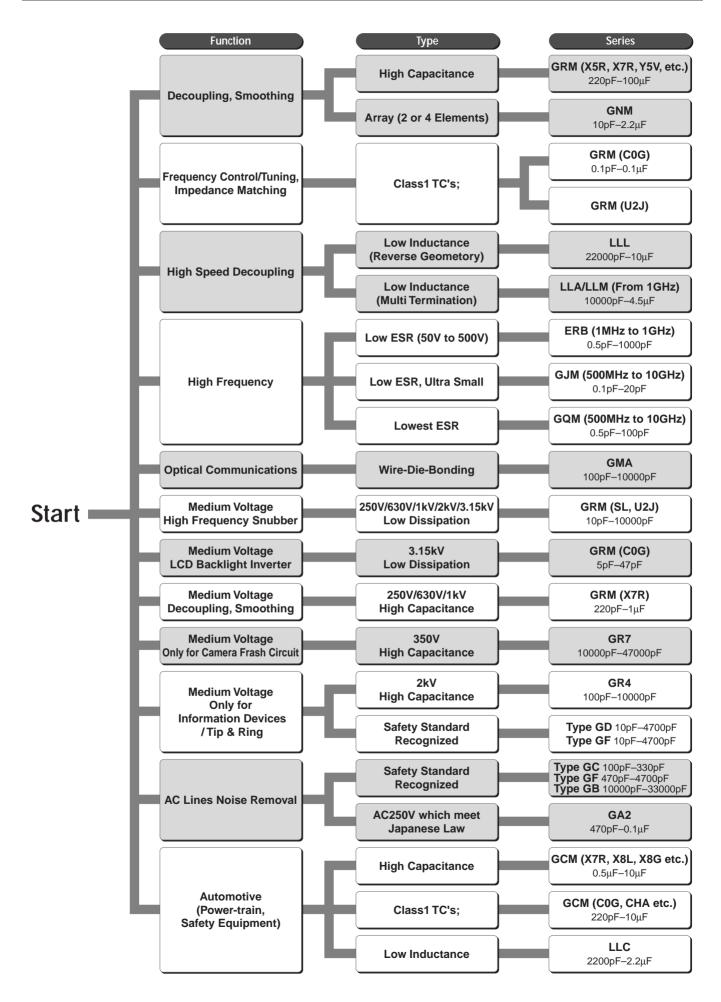
Packaging

Code	Packaging	
L	ø180mm Embossed Taping	
D	ø180mm Paper Taping	
K	ø330mm Embossed Taping	
J	ø330mm Paper Taping	
В	Bulk	
С	Bulk Case	
Т	Bulk Tray	

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



Selection Guide of Chip Monolithic Ceramic Capacitors



Chip Monolithic Ceramic Capacitors



for General Purpose GRM15/18/21/31 Series

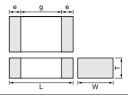
■ Features

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

■ Applications

General electronic equipment





Part Number		Din	nensions (m	nm)	
Part Number	L	W	Т	е	g min.
GRM155	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.35	0.3
GRM185	1.6 ±0.1	0.8 ±0.1	0.5 +0/-0.1	0.2 to 0.5	0.5
GRM188*	1.0 ±0.1	U.O ±U.1	0.8 ±0.1	0.2 10 0.5	0.5
GRM216			0.6 ±0.1		
GRM219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7
GRM21A	2.0 ±0.1	1.25 ±0.1	1.0 +0/-0.2	0.2 10 0.7	0.7
GRM21B			1.25 ±0.1		
GRM316			0.6 ±0.1		
GRM319	3.2 ±0.15	1.6 ±0.15	0.85 ±0.1	0.3 to 0.8	1.5
GRM31M			1.15 ±0.1	0.3 (0 0.8	1.5
GRM31C	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2		

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

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

Part Number				GR	M15			
L x W [EIA]				1.0x0.	5 [0402]			
тс	C0G (5C)	P2H (6P)	R2H (6R)	S2H (6S)		SL I X)	T2H (6T)	U2J (7U)
Rated Volt.	50 (1H)	50 (1H)	50 (1H)	50 (1H)	50 (1H)	25 (1E)	50 (1H)	50 (1H)
Capacitance (Cap	pacitance part n	umbering code)	and T (mm) Dim	ension (T Dimer	sion part numbe	ering code)		
3.0pF(3R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
4.0pF(4R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
5.0pF(5R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
6.0pF(6R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
7.0pF(7R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
8.0pF(8R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
9.0pF(9R0)	0.5 (5)	0.5(5)	0.5(5)	0.5(5)			0.5(5)	0.5(5)
10pF(100)	0.5 (5)	0.5(5)	0.5 (5)	0.5(5)			0.5 (5)	0.5(5)
12pF(120)	0.5 (5)	0.5(5)	0.5 (5)	0.5(5)	0.5 (5)	0.5 (5)	0.5 (5)	0.5(5)
15pF(150)	0.5 (5)	0.5(5)	0.5 (5)	0.5(5)	0.5 (5)	0.5 (5)	0.5 (5)	0.5(5)
18pF(180)	0.5 (5)	0.5(5)	0.5 (5)	0.5(5)	0.5(5)	0.5 (5)	0.5 (5)	0.5(5)
22pF(220)	0.5 (5)	0.5(5)	0.5 (5)	0.5(5)	0.5(5)	0.5 (5)	0.5 (5)	0.5(5)
27pF(270)	0.5 (5)	0.5(5)	0.5 (5)	0.5(5)	0.5 (5)	0.5 (5)	0.5 (5)	0.5(5)
33pF(330)	0.5 (5)		0.5 (5)	0.5(5)	0.5 (5)	0.5 (5)	0.5 (5)	0.5(5)
39pF(390)	0.5 (5)			0.5(5)	0.5(5)	0.5 (5)	0.5 (5)	0.5(5)
47pF(470)	0.5 (5)				0.5(5)	0.5(5)	0.5(5)	0.5(5)
56pF(560)	0.5 (5)				0.5(5)	0.5 (5)	0.5(5)	0.5(5)
68pF(680)	0.5 (5)				0.5(5)	0.5 (5)	0.5(5)	0.5(5)
82pF(820)	0.5 (5)				0.5(5)	0.5 (5)	0.5(5)	0.5(5)
100pF(101)	0.5 (5)				0.5(5)	0.5(5)	0.5(5)	0.5(5)
120pF(121)	0.5(5)				0.5(5)	0.5(5)		0.5(5)
150pF(151)	0.5(5)				0.5(5)	0.5(5)		0.5(5)
180pF(181)	0.5(5)				0.5(5)	0.5(5)		0.5(5)
220pF(221)	0.5(5)					0.5(5)		
270pF(271)	0.5(5)					0.5(5)		

Part Number				GR	M15			
L x W [EIA]				1.0x0.5	5 [0402]			
тс	C0G (5C)	P2H (6P)	R2H (6R)	S2H (6S)	(1	SL 1X)	T2H (6T)	U2J (7U)
Rated Volt.	50 (1H)	50 (1H)	50 (1H)	50 (1H)	50 (1H)	25 (1E)	50 (1H)	50 (1H)
Capacitance (Ca	pacitance part r	numbering code)	and T (mm) Dim	ension (T Dimen	sion part numb	ering code)	,	
330pF(331)	0.5(5)					0.5(5)		
390pF(391)	0.5(5)					0.5(5)		
470pF(471)	0.5(5)							
560pF(561)	0.5(5)							
680pF(681)	0.5(5)							
820pF(821)	0.5(5)							
1000pF(102)	0.5(5)							

The part numbering code is shown in $\ (\).$

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

Part Number							GRI	M18						
L x W [EIA]							1.6x0.8	3 [0603]						
тс)G C)		2H i P)		2H R)		2H S)		X)		2H i T)		2J ' U)
Rated Volt.	100 (2A)	50 (1H)	100 (2A)	50 (1H)	100 (2A)	50 (1H)	100 (2A)	50 (1H)						
Capacitance (Ca	pacitanc	e part nui	mbering c	ode) and	T (mm) D	imension	(T Dimen	sion part	numberin	g code)				
0.50pF(R50)	0.8(8)													
3.0pF(3R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
4.0pF(4R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
5.0pF(5R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
6.0pF(6R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
7.0pF(7R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
8.0pF(8R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
9.0pF(9R0)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)			
10pF(100)	0.8(8)		0.8(8)		0.8(8)		0.8(8)				0.8(8)		0.8(8)	
12pF(120)	0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)	
15pF(150)	0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)	
18pF(180)	0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)	
22pF(220)	0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)	
27pF(270)	0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)	
33pF(330)	0.8(8)		0.8(8)	0.8(8)	0.8(8)		0.8(8)		0.8(8)		0.8(8)		0.8(8)	
39pF(390)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)		0.8(8)		0.8(8)		0.8(8)	
47pF(470)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)				0.8(8)	
56pF(560)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)				0.8(8)	
68pF(680)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)				0.8(8)	
82pF(820)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)				0.8(8)	
100pF(101)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)				0.8(8)	
120pF(121)	0.8(8)		0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)	0.8(8)			0.8(8)	0.8(8)	
150pF(151)	0.8(8)		.,	0.8(8)	0.8(8)	0.8(8)	, , ,	0.8(8)	0.8(8)			0.8(8)	0.8(8)	
180pF(181)	0.8(8)				, ,	0.8(8)		0.8(8)	0.8(8)			0.8(8)	0.8(8)	
220pF(221)	0.8(8)					` , ,		0.8(8)	0.8(8)	0.8(8)		0.8(8)	0.8(8)	0.8(8)
270pF(271)	0.8(8)							, ,	0.8(8)	0.8(8)		0.8(8)	0.8(8)	0.8(8)
330pF(331)	0.8(8)								0.8(8)	0.8(8)		0.8(8)	0.8(8)	0.8(8)
390pF(391)	0.8(8)								0.8(8)	0.8(8)		0.8(8)	0.8(8)	0.8(8)
470pF(471)	0.8(8)								\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	0.8(8)		0.8(8)	, ,	0.8(8)
560pF(561)	0.8(8)									0.8(8)		. ,		0.8(8)
680pF(681)	0.8(8)									0.8(8)				0.8(8)
820pF(821)	0.8(8)									. (-,				1 (2)

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Dimensions are shown in mm and Rated Voltage in Vdc.

Part Number							GR	M18						
L x W [EIA]							1.6x0.8	3 [0603]						
тс)G C)		2H 6 P)		2H iR)		2H (S)		X)		2H T)	(7	2J ' U)
Rated Volt.	100 (2A)	50 (1H)												
Capacitance (Ca	pacitanc	e part nur	mbering o	code) and T (mm)		imension	(T Dimen	sion part	numberin	g code)				
1000pF(102)	0.8(8)									0.8(8)				0.8(8)
1200pF(122)		0.8(8)								0.8(8)				0.8(8)
1500pF(152)		0.8(8)								0.8(8)				0.8(8)
1800pF(182)		0.8(8)								0.8(8)				0.8(8)
2200pF(222)		0.8(8)								0.8(8)				0.8(8)
2700pF(272)		0.8(8)								0.8(8)				0.8(8)
3300pF(332)										0.8(8)				0.8(8)
3900pF(392)										0.8(8)				0.8(8)
4700pF(472)										0.8(8)				0.8(8)
5600pF(562)										0.8(8)				0.8(8)
6800pF(682)										0.8(8)				0.8(8)
8200pF(822)										0.8(8)				0.8(8)
10000pF(103)										0.8(8)				0.8(8)

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

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

Part Number							GR	M21						
L x W [EIA]							2.0x1.2	5 [0805]						
тс	C((5)G C)		2H P)		2H R)		2H (S)		X)		2H iT)	U: (7	2J U)
Rated Volt.	100 (2A)	50 (1H)												
Capacitance (Ca	pacitance	e part nui	mbering c	ode) and	T (mm) D	imension	(T Dimen	sion part	numberin	g code)	•			'
33pF(330)				0.6(6)										
39pF(390)				0.6(6)		0.6(6)								
47pF(470)				0.6(6)		0.6(6)		0.6(6)			1.25(B)			
56pF(560)				0.6(6)		0.6(6)		0.6(6)			1.25(B)			
68pF(680)				0.6(6)		0.6(6)		0.6(6)			1.25(B)			
82pF(820)				0.6(6)		0.6(6)		0.6(6)			1.25(B)			
100pF(101)				0.6(6)		0.6(6)		0.6(6)			1.25(B)			
120pF(121)				0.6(6)		0.6(6)		0.6(6)			1.25(B)	0.6(6)		
150pF(151)			0.85(9)	0.6(6)		0.6(6)	0.85(9)	0.6(6)			1.25(B)			
180pF(181)			0.85(9)	0.85(9)	0.85(9)	0.6(6)	0.85(9)	0.6(6)			1.25(B)			
220pF(221)			0.85(9)	0.85(9)	0.85(9)	0.85(9)	0.85(9)	0.6(6)		0.6(6)	1.25(B)			0.6(6)
270pF(271)			0.85(9)	0.85(9)	0.85(9)	0.85(9)	0.85(9)			0.6(6)				0.6(6)
330pF(331)			0.85(9)	0.85(9)	0.85(9)	0.85(9)	0.85(9)			0.6(6)				0.6(6)
390pF(391)			1.25(B)	1.25(B)	0.85(9)	0.85(9)	0.85(9)			0.6(6)				0.6(6)
470pF(471)			1.25(B)	1.25(B)	0.85(9)	0.85(9)	0.85(9)		0.85(9)	0.6(6)			0.85(9)	0.6(6)
560pF(561)				1.25(B)	1.25(B)	0.85(9)	1.25(B)	0.85(9)	0.85(9)	0.6(6)		1.25(B)	0.85(9)	0.6(6)
680pF(681)	0.6(6)					1.25(B)		1.25(B)	0.85(9)	0.6(6)		1.25(B)	0.85(9)	0.6(6)
820pF(821)	0.6(6)							1.25(B)	1.25(B)	0.6(6)		1.25(B)	1.25(B)	0.6(6)
1000pF(102)	0.85(9)								1.25(B)	0.6(6)		1.25(B)	1.25(B)	0.6(6)
1200pF(122)	0.85(9)	0.6(6)							1.25(B)	0.6(6)		1.25(B)	1.25(B)	0.6(6)
1500pF(152)	0.85(9)	0.6(6)							1.25(B)	0.85(9)		1.25(B)	1.25(B)	0.85(9
1800pF(182)		0.6(6)							1.25(B)	0.85(9)		1.25(B)	1.25(B)	0.85(9
2200pF(222)		0.6(6)								0.85(9)				0.85(9
2700pF(272)		0.6(6)								1.25(B)				1.25(B
3300pF(332)		0.6(6)								1.25(B)				1.25(B
3900pF(392)		0.6(6)												

Part Number							GR	M21						
L x W [EIA]							2.0x1.2	5 [0805]						
тс	C(5	0G (C)		2H i P)		2H 6R)		2H S)		SL (X)		2H i T)	(7	2J 'U)
Rated Volt.	100 (2A)	50 (1H)												
Capacitance (Ca	pacitanc	e part nur	nbering c	ode) and	T (mm) D	imension	(T Dimen	sion part	numberir	ng code)		,		•
4700pF(472)		0.6(6)												
5600pF(562)		0.85(9)												
6800pF(682)		0.85(9)												
8200pF(822)		0.85(9)												
10000pF(103)		0.85(9)								0.6(6)				0.6(6)
12000pF(123)		0.85(9)								0.6(6)				0.6(6)
15000pF(153)		0.85(9)								0.6(6)				0.6(6)
18000pF(183)		1.25(B)								0.6(6)				0.6(6)
22000pF(223)		1.25(B)								0.85(9)				0.85(9)
27000pF(273)										0.85(9)				0.85(9)
33000pF(333)										1.0(A)				1.0(A)
39000pF(393)										1.25(B)				1.25(B)
47000pF(473)										1.25(B)				1.25(B)

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

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

Part Number								GRM31							
L x W [EIA]							3.2	x1.6 [12	06]						
тс		C0G (5C)			2H i P)		2H R)		2H S)	S (1			2H T)	U2 (7 0	
Rated Volt.	100 (2A)	50 (1H)	25 (1E)	100 (2A)	50 (1H)										
Capacitance (Ca	pacitano	e part n	umbering	g code) aı	nd T (mm) Dimens	sion (T Di	mension	part nun	nbering c	ode)			'	
47pF(470)												0.85(9)			
56pF(560)												0.85(9)			
68pF(680)												0.85(9)			
82pF(820)												0.85(9)			
100pF(101)												1.15(M)			
120pF(121)												1.15(M)			
150pF(151)												1.15(M)			
180pF(181)					0.6(6)							1.15(M)			
220pF(221)					0.6(6)		0.6(6)					1.15(M)			
270pF(271)					0.6(6)		0.6(6)		0.6(6)			1.15(M)			
330pF(331)					0.6(6)		0.6(6)		0.6(6)			1.15(M)			
390pF(391)				0.85(9)			0.6(6)		0.6(6)			1.15(M)			
470pF(471)				0.85(9)					0.6(6)			1.15(M)			
560pF(561)				0.85(9)		0.85(9)		0.85(9)	0.85(9)						
680pF(681)				0.85(9)		0.85(9)	0.85(9)	0.85(9)	0.85(9)						
820pF(821)				0.85(9)		0.85(9)	0.85(9)	0.85(9)	0.85(9)	0.85(9)			1.15(M)	0.85(9)	
1000pF(102)				1.15(M)		1.15(M)	1.15(M)	0.85(9)	0.85(9)	0.85(9)			1.15(M)	0.85(9)	
1200pF(122)				1.15(M)		1.15(M)	1.15(M)	1.15(M)	1.15(M)	0.85(9)			1.15(M)	0.85(9)	
1500pF(152)					1.15(M)		1.15(M)	1.15(M)	1.15(M)	0.85(9)			1.15(M)	0.85(9)	
1800pF(182)	0.85(9)								1.15(M)	0.85(9)			1.15(M)	0.85(9)	
2200pF(222)	0.85(9)									1.15(M)			1.15(M)	1.15(M)	
2700pF(272)	0.85(9)									1.15(M)			1.15(M)	1.15(M)	
3300pF(332)	0.85(9)									1.15(M)			1.15(M)	1.15(M)	
3900pF(392)	0.85(9)									1.15(M)			1.15(M)	1.15(M)	
4700pF(472)	0.85(9)									1.15(M)				1.15(M)	
5600pF(562)	0.85(9)														



Part Number								GRM31							
L x W [EIA]							3.2	2x1.6 [12	06]						
тс		C0G (5C)			2H P)		2H R)		2H S)		X)		2H T)	U: (7	2J U)
Rated Volt.	100 (2A)	50 (1H)	25 (1E)	100 (2A)	50 (1H)										
Capacitance (Ca	pacitano	e part nu	ımbering	code) aı	nd T (mm) Dimens	sion (T Di	mension	part nun	nbering o	ode)				
18000pF(183)		0.85(9)													
22000pF(223)		0.85(9)													
27000pF(273)		0.85(9)													
33000pF(333)		0.85(9)													
39000pF(393)		1.15(M)													
47000pF(473)		1.15(M)													
56000pF(563)		1.6(C)									0.85(9)				0.85(9)
68000pF(683)		1.6(C)									1.15(M)				1.15(M)
82000pF(823)		1.6(C)									1.15(M)				1.15(M)
0.10μF(104)			1.6(C)								1.15(M)				1.15(M)

The part numbering code is shown in ().

High Dielectric Constant Type X5R (R6) Characteristics

тс										X5R (R6)									
Part Number			GRM15	5				GRM18	3			GR	M21				GRM31		
L x W [EIA]		1.0	x0.5 [0	402]			1.6	x0.8 [0	503]		2	2.0x1.2	5 [080]	5]		3.2	x1.6 [1:	206]	
Rated Volt.	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)
Capacitance (Ca	pacita	nce pa	rt numl	pering o	code) a	nd T (n	nm) Dir	nensior	n (T Din	nensio	n part r	number	ing coc	le)					
1000pF (102)	0.5 (5)	0.5 (5)																	
2200pF (222)	0.5 (5)	0.5 (5)																	
4700pF (472)	0.5 (5)	0.5 (5)																	
10000pF (103)						0.8 (8)													
22000pF (223)			0.5 (5)			0.8 (8)													
33000pF (333)			0.5 (5)	0.5 (5)															
47000pF (473)			0.5 (5)	0.5 (5)															
68000pF (683)			0.5 (5)	0.5 (5)															
0.10μF (104)			0.5 (5)	0.5 (5)			0.8 (8)												
0.15μF (154)				0.5* (5)	0.5* (5)														
0.22μF (224)				0.5* (5)	0.5* (5)		0.8 (8)	0.8 (8)											
0.33μF (334)				0.5* (5)	0.5* (5)														
0.47μF (474)				0.5* (5)	0.5* (5)		0.8* (8)	0.8* (8)											
0.68μF (684)				0.5* (5)	0.5* (5)														

Dimensions are shown in mm and Rated Voltage in Vdc.

тс										X5R (R6)									
Part Number			GRM15	5				GRM18	3			GRI	M21				GRM31		
L x W [EIA]		1.0	x0.5 [0	402]			1.6	x0.8 [0	503]		2	2.0x1.2	5 [080	5]		3.2	x1.6 [1	206]	
Rated Volt.	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)
Capacitance (Ca	pacita	nce pa	rt numk	pering (code) a	nd T (m	nm) Dir	nensior	T Din	nensio	n part n	umber	ing cod	le)			,		
1.0μF (105)				0.5* (5)	0.5* (5)		0.8* (8)	0.8* (8)											
2.2μF (225)								0.8* (8)	0.8* (8)	0.8* (8)	1.25* (B)					1.15 (M)			
3.3μF (335)									0.8* (8)		1.25* (B)	1.25* (B)				1.6 (C)			
4.7μF (475)										0.8* (8)	1.25* (B)	1.25* (B)	1.25* (B)		1.6 (C)	1.6 (C)	1.6 (C)		
10μF (106)													1.25* (B)	1.25* (B)	1.6* (C)	1.6 (C)			
15μF (156)																		1.6* (C)	
22μF (226)														1.25* (B)				1.6* (C)	
47μF (476)																		1.6* (C)	
100μF (107)																		1.6* (C)	1.6* (C)

The part numbering code is shown in each ().

Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type X6S (C8) Characteristics

TC						X6S (C8)					
Part Number	GR	M15	GR	M18		GR	M21			GRM31	
L x W [EIA]	1.0x0.5	5 [0402]	1.6x0.8	3 [0603]		2.0x1.2	25 [0805]		3	.2x1.6 [120	6]
Rated Volt.	6.3 (0J)	4 (0G)	6.3 (0J)	4 (0G)	25 (1E)	16 (1C)	6.3 (0J)	4 (0G)	10 (1A)	6.3 (0J)	4 (0G)
Capacitance (Ca	pacitance p	art number	ing code) ar	d T (mm) Di	mension (T	Dimension p	oart numberi	ng code)		I.	l .
0.15μF(154)	0.5*(5)										
0.22μF(224)	0.5*(5)										
0.33μF(334)	0.5*(5)										
0.47μF(474)	0.5*(5)										
0.68μF(684)		0.5*(5)	0.8(8)								
1.0μF(105)		0.5*(5)									
2.2μF(225)			0.8*(8)								
4.7μF(475)				0.8*(8)	1.25*(B)	1.25*(B)					
10μF(106)							1.25*(B)		1.15*(M)		
22μF(226)								1.25*(B)		1.6*(C)	1.6*(C)
47μF(476)											1.6*(C)

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.



 $^{3.3\}mu F$ and $4.7\mu F$, 6.3V rated are GRM21 series of L: 2 ± 0.15 , W: 1.25 ± 0.15 , T: 1.25 ± 0.15 .

T: 1.15 \pm 0.1mm is also available for GRM31 1.0 μ F for 16V.

L: 3.2 ± 0.2 , W: 1.6 ± 0.2 for GRM31 16V $1.0 \mu F$ type. Also L: 3.2 ± 0.2 , W: 1.6 ± 0.2 , T: 1.15 ± 0.15 for GRM31 16V $1.5 \mu F$ and $2.2 \mu F$ type.

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

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

High Dielectric Constant Type X7R (R7) Characteristics

тс												7R 2 7)										
Part Number		(GRM1	5				GR	M18					GR	M21			GRM31 3.2×1.6 [1206] 100				
L x W [EIA]		1.0x	0.5 [0	402]			1	.6x0.8	[060	3]			2.	0x1.2	5 [080	5]			3.2x	1.6 [1	206]	
Rated Volt.	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)			25 (1E)	16 (1C)	10 (1A)
Capacitance (Ca	pacita	·	art nu	ımberi	ng co	1	d T (m	m) Dii	mensi	on (T [Dimen	sion p	art nu	mberi	ng coo	de)	ı	1	I	I		
220pF (221)		0.5 (5)				0.8 (8)																
330pF (331)		0.5 (5)				0.8 (8)																
470pF (471)		0.5 (5)				0.8 (8)																
680pF (681)		0.5 (5)				0.8 (8)																
1000pF (102)		0.5 (5)				0.8 (8)																
1500pF (152)		0.5 (5)				0.8 (8)																
2200pF (222)		0.5 (5)				0.8																
3300pF (332)		0.5 (5)				0.8																
4700pF (472)	0.5 (5)	0.5 (5)										0.85 (9)										
6800pF (682)		0.5 (5)	0.5 (5)									0.85										
10000pF (103)		0.5 (5)	0.5 (5)									1.25 (B)										
15000pF (153)			0.5 (5)	0.5 (5)			0.8 (8)					1.25 (B)										
22000pF (223)			0.5 (5)	0.5 (5)			0.8 (8)					1.25 (B)										
33000pF (333)			0.5 (5)	0.5 (5)	0.5 (5)		0.8 (8)					1.25 (B)										
47000pF (473)			0.5 (5)	0.5 (5)	0.5 (5)		0.8 (8)					1.25 (B)										
68000pF (683)				0.5 (5)	0.5 (5)		0.8 (8)	0.8 (8)										1.15 (M)				
0.10μF (104)				0.5 (5)	0.5 (5)		0.8 (8)	0.8 (8)														
0.15μF (154)								0.8 (8)	0.8 (8)				1.25 (B)						1.15 (M)			
0.22μF (224)								0.8 (8)	0.8 (8)	0.8 (8)		1.0 (A)	1.25 (B)						0.85 (9)			
0.33μF (334)									0.8 (8)	0.8 (8)		1.0 (A)	0.85 (9)	1.25 (B)								
0.47μF (474)								0.8* (8)	0.8 (8)	0.8 (8)	0.8 (8)		1.25 (B)	0.85 (9)					1.15 (M)			
0.68μF (684)										0.8 (8)				0.85 (9)	0.85 (9)							
1.0μF (105)									0.8* (8)	0.8* (8)	0.8* (8)			1.25 (B)	1.25 (B)			1.6 (C)	1.15 (M)	1.15 (M)		
1.5μF (155)														1.25 (B)	1.25 (B)				1.6 (C)	1.15 (M)	1.15 (M)	

2 continued from	the pre	ccuing	page.																			
TC		X7R (R7)																				
Part Number		GRM15 GRM18 GRM21 GRM31																				
L x W [EIA]		1.0x0.5 [0402] 1.6x0.8 [0603]								2.0x1.25 [0805]						3.2x1.6 [1206]						
Rated Volt.	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	100 (2A)	50 (1H)	25 (1E)	16 (1C)	10 (1A)
Capacitance (Ca	pacita	ance p	art nu	ımberi	ing co	de) an	d T (m	nm) Dii	mensi	on (T I	Dimen	sion p	art nu	mberi	ng cod	de)						
2.2μF (225)										0.8* (8)				1.25* (B)	1.25* (B)				1.6 (C)		1.15 (M)	
3.3µF (335)															1.25* (B)					1.6 (C)	1.6 (C)	
4.7μF (475)															1.25* (B)	1.25* (B)				1.6 (C)	1.6 (C)	1.6 (C)
10μF (106)																1.25* (B)	1.25* (B)				1.6* (C)	

The part numbering code is shown in each ().

High Dielectric Constant Type X7S (C7) Characteristics

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

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type Y5V (F5) Characteristics

тс						Y5V (F5)					
Part Number			GRM15			GR	M18	GR	M21	GRI	W31
L x W [EIA]		1	.0x0.5 [040	2]		1.6x0.8	8 [0603]	2.0x1.2	5 [0805]	3.2x1.6	[1206]
Rated Volt.	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	50 (1H)	25 (1E)	50 (1H)	25 (1E)	50 (1H)	6.3 (0J)
Capacitance (Ca	pacitance p	oart number	ing code) an	d T (mm) Di	mension (T	Dimension p	art number	ing code)	'	1	
1000pF(102)	0.5(5)										
2200pF(222)	0.5 (5)										
4700pF(472)	0.5(5)										
10000pF(103)	0.5(5)					0.8(8)					
22000pF(223)		0.5(5)				0.8(8)					
47000pF(473)		0.5(5)	0.5(5)			0.8(8)					
0.10μF(104)		0.5(5)	0.5(5)			0.8(8)		0.85(9)	0.6(6)		
0.22μF(224)			0.5(5)			0.8(8)	0.8(8)		0.85(9)		
0.47μF(474)			0.5(5)	0.5(5)			0.8(8)	0.85(9)	0.6(6)	1.15(M)	
1.0μF(105)				0.5*(5)	0.5*(5)						
100μF(107)											1.6*(C)

The part numbering code is shown in each ().

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



The tolerance will be changed to L: 3.2 ± 0.2 , W: 1.6 ± 0.2 for GRM31 16V $1.0\mu F$ type. Also L: 3.2 ± 0.2 , W: 1.6 ± 0.2 , T: 1.15 ± 0.15 for GRM31 16V $1.5\mu F$ and $2.2\mu F$ type. Dimensions are shown in mm and Rated Voltage in Vdc.

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

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

T: 1.25 ± 0.1 mm is also available for GRM21 25V or 16V $1.0\mu F$ type.

Dimensions are shown in mm and Rated Voltage in Vdc.

Chip Monolithic Ceramic Capacitors



for General Purpose GRM32 Series

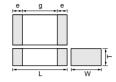
■ Features

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

Applications

General electronic equipment





Part Number		D	imensions (r	nm)	
Part Number	L	W	T	е	g min.
GRM329			0.85 ±0.1		
GRM32A			1.0 +0/-0.2		
GRM32M			1.15 ±0.1		
GRM32N	3.2 +0.3	2.5 +0.2	1.35 ±0.15	0.3 min.	1.0
GRM32C	3.2 ±0.3	2.5 ±0.2	1.6 ±0.2	0.3 111111.	1.0
GRM32R			1.8 ±0.2		
GRM32D			2.0 ±0.2		
GRM32E			2.5 ±0.2		

Temperature Compensating Type GRM32 Series

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

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

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

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

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

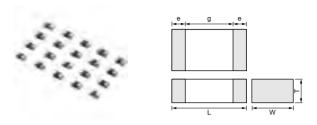
Chip Monolithic Ceramic Capacitors



Ultra-small GRM03 Series

■ Features

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



Part Number		Din	nensions (n	nm)	
Part Number	L	W	T	е	g min.
GRM033	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2

Applications

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

Part Number						GR	M03					
L x W						0.6x0.3	[0201]					
тс	C0G (5C)	R2H (6R)	S2H (6S)	T2H (6T)		2J U)		5R R6)	X6S (C8)		X7R (R7)	
Rated Volt.	25 (1E)	25 (1E)	25 (1E)	25 (1E)	50 (1H)	25 (1E)	10 (1A)	6.3 (0J)	4 (0G)	25 (1E)	16 (1C)	10 (1A)
Capacitance (Ca	pacitance	part numbe	ering code)	and T (mm) Dimensio	n (T Dimen	sion part n	umbering	code)	1		•
1.0pF(1R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)								
2.0pF(2R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)								
3.0pF(3R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
4.0pF(4R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
5.0pF(5R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
6.0pF(6R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
7.0pF(7R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
8.0pF(8R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
9.0pF(9R0)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
10pF(100)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
12pF(120)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
15pF(150)	0.3(3)	0.3(3)	0.3(3)	0.3(3)	0.3(3)							
18pF(180)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
22pF(220)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
27pF(270)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
33pF(330)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
39pF(390)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
47pF(470)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
56pF(560)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
68pF(680)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
82pF(820)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)						
100pF(101)	0.3(3)	0.3(3)	0.3(3)	0.3(3)		0.3(3)				0.3(3)		
150pF(151)										0.3(3)		
220pF(221)										0.3(3)		
330pF(331)										0.3(3)		
470pF(471)										0.3(3)		
680pF(681)										0.3(3)		

Part Number						GR	M03					
LxW						0.6x0.3	[0201]					
TC	C0G (5C)	R2H (6R)	S2H (6S)	T2H (6T)		2J U)		5R R6)	X6S (C8)		X7R (R7)	
Rated Volt.	25 (1E)	25 (1E)	25 (1E)	25 (1E)	50 (1H)	25 (1E)	10 (1A)	6.3 (0J)	4 (0G)	25 (1E)	16 (1C)	10 (1A)
Capacitance (Ca	pacitance	part numbe	ering code)	and T (mm	n) Dimensio	n (T Dimen	sion part n	umbering c	ode)			
1000pF(102)										0.3(3)		
1500pF(152)							0.3(3)			0.3(3)		0.3(3)
2200pF(222)							0.3(3)				0.3(3)	0.3(3)
3300pF(332)							0.3(3)				0.3(3)	0.3(3)
4700pF(472)							0.3(3)					0.3(3)
6800pF(682)							0.3(3)					0.3(3)
10000pF(103)							0.3(3)					0.3(3)
15000pF(153)								0.3*(3)				
22000pF(223)								0.3*(3)				
33000pF(333)								0.3*(3)				
47000pF(473)								0.3*(3)				
68000pF(683)								0.3*(3)				
0.10μF(104)								0.3*(3)	0.3(3)			

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

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

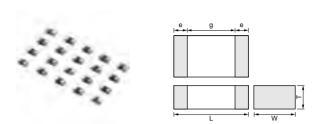
Chip Monolithic Ceramic Capacitors



Tight Tolerance GRM03/15 Series

Features

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



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

Applications

General electronic equipment

Temperature Compensating Type GRM03/15 Series

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

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

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

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

Chip Monolithic Ceramic Capacitors



Thin Type

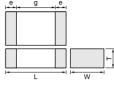
■ Features

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

Applications

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Thin equipment such as IC cards



Part Number		Dir	nensions (m	nm)	
Fait Number	L	W	Т	е	g min.
GRM15X	1.0 +0.05	0.5 +0.05	0.25 ±0.05	0.1 to 0.3	0.4
GRM153	1.0 ±0.05	0.5 ±0.05	0.3 ±0.03	0.1 10 0.3	0.4
GRM216			0.6 ±0.1		
GRM219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7
GRM21A			1.0 +0/-0.2		
GRM316	2 2 10 15	1.6 ±0.15	0.6 ±0.1	0.2 to 0.0	1.5
GRM319	3.2 ±0.15	1.6 ±0.15	0.85 ±0.1	0.3 to 0.8	1.5
GRM329	3.2 +0.3	2.5 +0.2	0.85 ±0.1	0.3 min.	1.0
GRM32A	3.2 ±0.3	2.5 ±0.2	1.0 +0/-0.2	U.S MIII.	1.0

Temperature Compensating Type

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

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High Dielectric Constant Type

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

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

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

			cations	erer to GRM Series Specifications and Test Methods (2) (P.30).		
No.	Item	Temperature Compensating Type	High Dielectric Type	Test Method		
1	Operating Temperature Range	-55 to +125℃	B1, B3, F1, R6: -25 to +85°C R1, R7: -55 to +125°C C8: -55 to +105°C E4: +10 to +85°C F5: -30 to +85°C	Reference temperature: 25° C (2Δ , 3Δ , 4Δ , B1, B3, F1, R1: 20° C)		
2	Rated Voltage	See the previous pages.		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{p,p} or V ^{o,p} , whichever is larger, should be maintained within the rated voltage range.		
3	Appearance	No defects or abnormalities		Visual inspection		
4	Dimensions	Within the specified dimensions	}	Using calipers (GRM02 size is based on Microscope)		
5	Dielectric Strength	No defects or abnormalities		No failure should be observed when 300%* of the rated voltage (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V		
6	Insulation Resistance	C≤0.047 _µ F: More than 10,000M C>0.047 _µ F: 500Ω · F	MΩ C: Nominal Capacitance	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20/25℃ and 75%RH max. and within 2 minutes of charging, provided the charge/ discharge current is less than 50mA.		
7	Capacitance	Within the specified tolerance				
8	Q/ Dissipation Factor (D.F.)	30pF and over: Q≥1000 30pF and below: Q≥400+20C C: Nominal Capacitance (pF)	[R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≥0.068μF) W.V.: 50/25V : 0.025 max. (C≤10μF) : 0.035 max. (C≥10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C≤3.3μF) : 0.1 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	The capacitance/Q/D.F. should be measured at 20/25°C at the frequency and voltage shown in the table.		





Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.

Continued from the preceding page. In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

			Specif	ications					
No.	Ite	em	Temperature Compensating Type	High Dielectric Type			Test Me	ethod	
		No bias	Within the specified tolerance (Table A-1)	B1, B3: Within ±10% (-25 to +85°C) R1, R7: Within ±15% (-55 to +125°C) R6: Within ±15% (-55 to +85°C) E4: Within +22/-56% (+10 to +85°C) F1: Within +30/-80% (-25 to +85°C) F5: Within +22/-82% (-30 to +85°C) C8: Within ±22% (-55 to +105°C)	each speci (1)Temper The tempe capacitand When cycl 5 (5C: +25 +25 to +8 the specific capacitand The capac between the	ified tempature Contracture contracture contracture contracture contracture contractured in the tempature contracture contract	o. stage. mpensating T pefficient is de red in step 3 a mperature se (C/ΔC: +20 to to +85°C) the noe for the ter e as Table A- ift is calculate tum and minin he cap. value	ype termined as a refer quentially +125°C: capacitan nperature I. d by divid num mea: in step 3.	ence. If from step 1 through other temp. coeffs.: ice should be within a coefficient and ing the differences sured values in the
				,		ер 1		emperati	• •
		50% of the Rated		B1: Within +10/–30% R1: Within +15/–40%	:	2	-55±3 (fo -30±3	or ∆C to 7	perature ±2 U/1X/R6/R7/C8) 10±3 (for E4) other TC)
		Voltage		F1: Within +30/-95%		3			perature ±2
						4	85	±3 (for o	
Ca	apacitance				ļ <u>'</u>	5	Refere	ence Tem	perature ±2
Ch	haracteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.) *Do not apply to 1X/25V	*Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement.	value over be within the In case of measured	the temphe specification of each of ea	perature range ied ranges.*	apacitance applying butter ±2 (7, R6) (6, F1) (for E4) ture ±2 (87)/ (7, R6) (10, F1) (10, F1) ture ±2 (10, F1)	red with the 20°C in the table should be change should be voltage in Applying Voltage (V) No bias 50% of the rated voltage
1()	Adhesive of Termin	Strength ation	No removal of the terminations	or other defect should occur.	Fig. 1a usi parallel wit The solder reflow met soldering i: *1N (GRM	ng an eu h the tes ing shou hod and a s uniform lo2), 2N (pe 2 3 5 5 8 1 1 2 3	tectic solder. t jig for 10±1 ld be done eit should be cor	Then app sec. her with a nducted w efects su	(in mm)





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

	Continued in			d in capacitance table, please re ications	sier to Okim deries c	pecifications	and rest met	
No.	Ite	em	Temperature Compensating Type	High Dielectric Type		Test M	ethod	
		Appearance	No defects or abnormalities					
	Capacitance		Within the specified tolerance					
11	Vibration Resistance	Q/D.F.	30pF and over: Q≥1000 30pF and below: Q≥400+20C C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≥0.068μF) W.V.: 50/25V : 0.025 max. (C≤10μF) : 0.035 max. (C≥10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C≤3.3μF) : 0.1 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	Solder the capacitor same manner and the capacitor should having a total amplication of the capacitor of the	under the san ild be subjected itude of 1.5mi the approximation om 10 to 55H proximately 1 in Il of 2 hours in	ne conditions a ed to a simple h m, the frequence ate limits of 10 z and return to minute. This me each of 3 mutu	s (10). narmonic motion by being varied and 55Hz. The 10Hz, should otion should be
12	Deflection	١	Capacitance	0 Pressurizing speed: 1.0mm/sec. Pressurize Flexure: ≦1 meter 45	Solder the capacito in Fig. 2a using an direction shown in I done by the reflow so that the solderin shock. Type GRM02 GRM03 GRM15 GRM18 GRM21	eutectic solde Fig. 3a for 5± method and s	rr. Then apply a 1 sec. The sold hould be conding free of defe	a force in the dering should be ucted with care cts such as heat
			Fig. 3a		GRM31 GRM32 GRM43 GRM55	2.2 2.2 2.2 3.5 4.5	5.0 5.0 7.0 8.0	2.0 2.9 3.7 5.6 (in mm)
13	Solderabi Terminati		75% of the terminations are to be soldered evenly and continuously.		Immerse the capaci rosin (JIS-K-5902) Preheat at 80 to 12 After preheating, in 2±0.5 seconds at 2 for 2±0.5 seconds	(25% rosin in 20℃ for 10 to 3 nmerse in an 6 230±5℃ or Sn	weight proport 30 seconds. eutectic solder	solution for





Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.

Continued from the preceding page. In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

			Specif	ications	
No.	Ite	em	Temperature Compensating Type	High Dielectric Type	Test Method
			The measured and observed of specifications in the following to	•	
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4: Within ±20%	
14	Resistance to Soldering Heat	Q/D.F.	30pF and over: Q≧1000 30pF and below: Q≥400+20C C: Nominal Capacitance (pF)	[B1, B3, R6, R7, C8] W.V.: 100V : 0.025 max. (C<0.068μF) : 0.05 max. (C≥0.068μF) W.V.: 50/25V : 0.025 max. (C≤10μF) : 0.035 max. (C≥10μF) W.V.: 16/10V: 0.035 max. W.V.: 6.3/4V : 0.05 max. (C≤3.3μF) : 0.1 max. (C≥3.3μF) [E4] W.V.: 25Vmin: 0.025 max. [F1, F5] W.V.: 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5C solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure. •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement. •Preheating for GRM32/43/55 Step Temperature Time 1 100 to 120°C 1 min. 2 170 to 200°C 1 min.
		I.R.	More than $10,000\text{M}\Omega$ or 500Ω		
		Dielectric Strength	No defects		
			The measured and observed cl specifications in the following to	naracteristics should satisfy the able.	
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4: Within ±20%	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
				[R6, R7, C8]	shown in the following table. Set for 24±2 hours at room temperature, then measure.
				W.V.: 100V : 0.05 max. (C<0.068µF)	Step 1 2 3 4
				: 0.075 max. (C≥0.068µF) W.V.: 50/25/16/10V : 0.05 max.	Temp. (°C) Min. Operating Temp. +0/-3 Room Temp. Max. Operating Temp. +3/-0 Temp.
15	Temperature Cycle		30pF and over: Q≧1000	W.V.: 6.3/4V : 0.075 max. (C<3.3µF)	Time (min.) 30±3 2 to 3 30±3 2 to 3
	oyue .	Q/D.F.	30pF and below: Q≥400+20C C: Nominal Capacitance (pF)	: 0.075 max. (C<3.3µF) : 0.125 max. (C≥3.3µF) [E4] W.V.: 25Vmin: 0.05 max. [F1, F5] W.V.: 25V min.	•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.
				: 0.05 max. (C<0.1µF) : 0.09 max. (C≥0.1µF) W.V.: 16/10V: 0.125 max. W.V.: 6.3V: 0.15 max.	
		I.R.	More than $10,000M\Omega$ or 500Ω	F (Whichever is smaller)	
	Dielectric Strength No defects				





Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.

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





Below GRM Series Specifications and Test Methods (1) are applied to Non "*" PNs in capacitance table.

Continued from the preceding page. In case "*" is added in capacitance table, please refer to GRM Series Specifications and Test Methods (2) (P.30).

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

Table A-1

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

^{*1:} Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for ΔC)/85°C (for other TC).

(2)

		Capacitance Change from 20°C (%)						
Char.	Nominal Values (ppm/°C)*2	_	 55		-2 5		-10	
		Max.	Min.	Max.	Min.	Max.	Min.	
2C	0± 60	0.82	-0.45	0.49	-0.27	0.33	-0.18	
3C	0±120	1.37	-0.90	0.82	-0.54	0.55	-0.36	
4C	0±250	2.56	-1.88	1.54	-1.13	1.02	-0.75	
2P	-150± 60	_	_	1.32	0.41	0.88	0.27	
3P	-150±120	_	_	1.65	0.14	1.10	0.09	
4P	-150±250	_	_	2.36	-0.45	1.57	-0.30	
2R	-220± 60	_	_	1.70	0.72	1.13	0.48	
3R	-220±120	_	_	2.03	0.45	1.35	0.30	
4R	-220±250	_	_	2.74	-0.14	1.83	-0.09	
2S	-330± 60	_	_	2.30	1.22	1.54	0.81	
3S	-330±120	_	_	2.63	0.95	1.76	0.63	
4S	-330±250	_	_	3.35	0.36	2.23	0.24	
2T	-470± 60	_	_	3.07	1.85	2.05	1.23	
3T	-470±120	_	_	3.40	1.58	2.27	1.05	
4T	-470±250	_	_	4.12	0.99	2.74	0.66	
3U	-750±120	_	_	4.94	2.84	3.29	1.89	
4U	-750±250	_	_	5.65	2.25	3.77	1.50	

^{*2:} Nominal values denote the temperature coefficient within a range of 20°C to 125°C (for ΔC)/85°C (for other TC).

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

No.	Ite	em	Specifications		Test Method				
1	Operating Temperat Range	•	B1, B3, F1: -25 to +85°C R6: -55 to +85°C R7, C7: -55 to +125°C F5: -30 to +85°C C8: -55 to +105°C,	Reference (B1, B3, F1	temperature: 25°C I: 20°C)				
2	Rated Vo	ltage	See the previous pages.	The rated voltage is defined as the maximum voltage whice may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{p,p} or whichever is larger, should be maintained within the rated voltage range.					
3	Appearance		No defects or abnormalities	Visual insp	ection				
4	Dimensio	ns	Within the specified dimensions	Using calip	ers				
5	Dielectric	: Strength	No defects or abnormalities	No failure should be observed when 250% of the rated vol is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.					
6	Insulation Resistant		More than $50\Omega \cdot F$	not exceed	ared with a DC voltage be temperature and ging, provided the A.				
7	Capacita	nce	Within the specified tolerance		itance/D.F. should be measure				
8	Dissipation (D.F.)	on Factor	B1, B3, R6* ² , R7, C7, C8: 0.1 max. F1, F5: 0.2 max.	temperature at the frequency and voltage s Capacitance Frequency C≤10µF (10V min.)*¹ 1±0.1kHz C≤10µF (6.3V max.) 1±0.1kHz C>10µF 120±24Hz *1 However the voltage is 0.5±0.1Vrn items on the left side.		Voltage 1.0±0.2Vrms 0.5±0.1Vrms 0.5±0.1Vrms			
		No bias	B1, B3: Within ±10% (−25 to +85°C) F1 : Within +30/−80% (−25 to +85°C) R6 : Within ±15% (−55 to +85°C) R7 : Within ±15% (−55 to +125°C) F5 : Within +22/−82% (−30 to +85°C) C7 : Within ±22% (−55 to +125°C) C8 : Within ±22% (−55 to +105°C)	The capacitance change should be measured each specified temp. stage. The ranges of capacitance change compared reference temperature value over the tempera shown in the table should be within the specifi In case of applying voltage, the capacitance of measured after 1 more min. with applying voltage equilibration of each temp. stage.		ared with the perature ranges pecified ranges.* ce change should be			
						*GRM43 B1/R6 0J/1A 336/476 only: 1.0±0.2Vrms			
				Step	Temperature (°C)	Applying Voltage (V)			
				1	Reference temperature ±2	rippiying voltage (V)			
9	Capacitance Temperature			2	-55±3 (for R6, C7, C8)/ -25±3 (for B1, B3, F1) -30±3 (for F5)				
	Characteristics			3	Reference temperature ±2	No bias			
		50% of the Rated Voltage	B1: Within +10/-30% F1: Within +30/-95%	4	85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8)				
				5	20±2				
				6	−25±3 (for B1, F1)	50% of the rated			
				7	20±2	voltage			
				8	85±3 (for B1, F1)				
				Perform a then set for	asurement for high dielectric co heat treatment at 150 +0/–10° r 24±2 hours at room temperat e initial measurement.	C for one hour and			

*2: GRM31CR60J107: 0.15 max.

Continued on the following page. $\begin{tabular}{|c|c|c|c|}\hline \end{tabular}$





Below GRM Series Specifications and Test Methods (2) are applied to "*" PNs in capacitance table.

Continued from the preceding page. In case "*" is not added in capacitance table, please refer to GRM Series Specifications and Test Methods (1) (P.24).

Continued from the preceding page. In case "*" is not added in capacitance table, please refer to GRM Series Specifications and Test							thods (1) (P.24).	
No.	Ite	em	Specifications		Test Me	ethod		
			No removal of the terminations or other defects should occur.		Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *5N: GRM15/GRM18, 2N: GRM03			
				Туре	а	b	С	
10	Adhesive	_		GRM02	0.2	0.56	0.23	
10	of Termin	ation		GRM03	0.3	0.9	0.3	
				GRM15	0.4	1.5	0.5	
			Solder resist	GRM18	1.0	3.0	1.2	
			Baked electrode or	GRM21	1.2	4.0	1.65	
			copper foil	GRM31	2.2	5.0	2.0	
			Fig. 1a	GRM32	2.2	5.0	2.9	
				GRM43	3.5	7.0	3.7	
				GRM55	4.5	8.0	5.6	
		Appearance	No defects or abnormalities	Coldor the conseit	or on the test "	a (aloos ons:::	hoard) in the	
				Solder the capacitor same manner and	-		•	
		Capacitance	Within the specified tolerance	The capacitor shou			` '	
				having a total amplitude of 1.5mm, the frequency b				
11	Vibration			uniformly between the approximate limits of 10 and 55Hz. The				
		D.F.	B1, B3, R6*2, R7, C7, C8: 0.1 max.	-				
		D.F.	F1, F5: 0.2 max.	frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually				
				perpendicular directions (total of 6 hours).				
			No cracking or marking defects should occur	Solder the capacitor on the test jig (glass epoxy board		hoard) shown		
	No cracking or marking defects should occur. 20 50 Pressurizing speed: 1.0mm/sec. Pressurize R230 Flexure: ≤1 Capacitance meter 45 45		speed : 1.0mm/sec. Pressurize		in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as hea shock.			
				100	-			
12				Fig. 2a	а	t: 1.6mm		
			+ +0 + + +0 + 			(GRM	103/15: t: 0.8mm)	
				Туре	a	b	С	
			Fig.3a	GRM02	0.2	0.56	0.23	
				GRM03	0.3	0.9	0.3	
				GRM15	0.4	1.5	0.5	
				GRM18	1.0	3.0	1.2	
				GRM21	1.2	4.0	1.65	
				GRM31	2.2	5.0	2.0	
				GRM32	2.2	5.0	2.9	
				GRM43	3.5	7.0	3.7	
				GRM55	4.5	8.0	5.6	
				1			(in mm)	
13	Solderability of Termination		75% of the terminations is to be soldered evenly and continuously.	Immerse the capac rosin (JIS-K-5902) Preheat at 80 to 12 After preheating, ir 2±0.5 seconds at for 2±0.5 seconds	(25% rosin in 20℃ for 10 to 3 nmerse in an e 230±5℃ or Sn	weight proport 0 seconds. eutectic solder	ion) . solution for	

*2: GRM31CR60J107: 0.15 max.



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

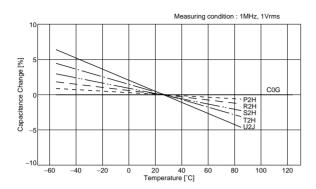
No.	tem	Specifications		Tes	st Method	d			
	Appearance Capacitance Change	No defects or abnormalities B1, B3, R6, R7, C7, C8: Within ±7.5% F1, F5: Within ±20%	Immerse the o	Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5C solder solution at 270±5℃ for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure. *Do not apply to GRM02.					
	D.F.	B1, B3, R6* ² , R7, C7, C8: 0.1 max. F1, F5: 0.2 max.							
Resistano	e I.R.	More than 50Ω · F				c constant type			
4 Soldering Heat	Dielectric	Dielectric No defects	then set at roo Perform the ir	Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement. *Preheating for GRM32/43/55					
	Strength	1.0 0010010	Step	Step Temperature			ime		
			1	100 to	o 120℃	1 :	min.		
			2	170 to	o 200℃	1 1	min.		
	Appearance	No defects or abnormalities	Fix the capac	Fix the capacitor to the supporting jig in the same man					
	Capacitance Change	B1, B3, R6, R7, C7, C8: Within ±7.5% F1, F5: Within ±20%	Perform the fi	under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table.					
	D.F.	B1, B3, R6* ² , R7, C7, C8: 0.1 max. F1, F5: 0.2 max.	Set for 24±2	hours at room	temperature, then measure.				
Temperatur	I.R.	More than $50\Omega \cdot F$	Step	Min.	2	3 Max.	4		
Sudden Change		No detects	Temp. (℃)	Operating Temp. +0/-3	Room Temp.	Operating Temp. +3/-0	Room Temp.		
			•Initial measu Perform a hea then set at roo	Time (min.) 30±3 2 to 3 30±3 2 to 3 •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.					
	Appearance	No defects or abnormalities		Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50m •Initial measurement					
High	Capacitance Change	B1, B3, R6, R7, C7, C8: Within ±12.5% F1, F5: Within ±30%							
Temperature 16 High Humidity	D.F.	B1, B3, R6, R7, C7, C8: 0.2 max. F1, F5: 0.4 max.	Perform a heathen let sit for	Perform a heat treatment at 150+0/-10°C for one if then let sit for 24±2 hours at room temperature. Per initial measurement. •Measurement after test Perform a heat treatment at 150+0/-10°C for one if then let sit for 24±2 hours at room temperature, the					
(Steady)	I.R.	More than 12.5 Ω · F	Perform a hea						
	Appearance	No defects or abnormalities	Apply 150% o	f the rated volt	age for 1	000±12 hours	at the		
	Capacitance Change	B1, B3, R6, R7, C7, C8: Within ±12.5% F1, F5: Within ±30%	room tempera	maximum operating temperature ±3°C. Let sit for 2 room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement Perform a heat treatment at 150+0/-10°C for one I then let sit for 24±2 hours at room temperature. Perinitial measurement. •Measurement after test Perform a heat treatment at 150+0/-10°C for one I then let sit for 24±2 hours at room temperature, the			l±2 hours at		
	D.F.	B1, B3, R6, R7, C7, C8: 0.2 max. F1, F5: 0.4 max.				a.an oom t			
17 Durability	I.R.	More than $25\Omega \cdot F$	then let sit for initial measure •Measuremer Perform a hea			mperature. Perf	form the		

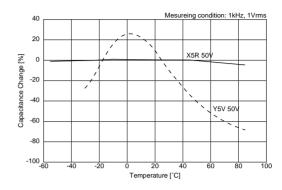
*2: GRM31CR60J107: 0.15 max.



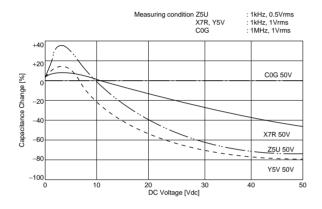
GRM Series Data

Capacitance - Temperature Characteristics

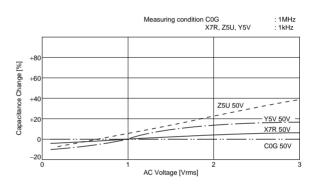




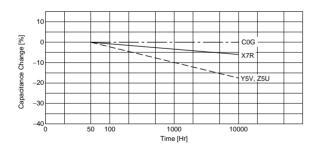
■ Capacitance - DC Voltage Characteristics



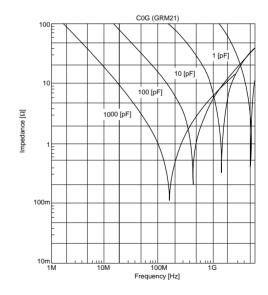
■ Capacitance - AC Voltage Characteristics



■ Capacitance Change - Aging



Impedance - Frequency Characteristics



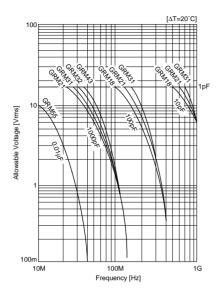




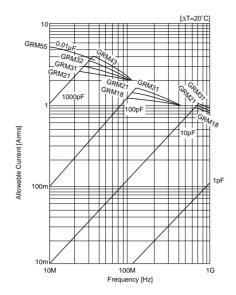
GRM Series Data

Continued from the preceding page.

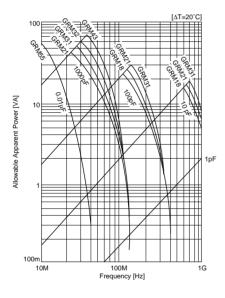
Allowable Voltage - Frequency



■ Allowable Current - Frequency



Allowable Apparent Power - Frequency





Chip Monolithic Ceramic Capacitors



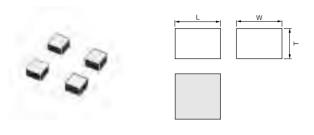
Microchips GMA Series

■ Features

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

Applications

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



	Part Number		Unitinations (Unitin)	
	Part Number	L	W	Т
	GMA05X	0.5 ±0.05	0.5 ±0.05	0.35 ±0.05
	GMA085	0.8 ±0.05	0.8 ±0.05	0.5 ±0.1
pacitance		Length L (mm)	Width W (mm)	Thickness T (mm)
Ͻp	F ±20%	0.5	0.5	0.35

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

Specifications and Test Methods

Rated Voltage See the previous pages. No before is superinged on Dic Voltage, Whither AC voltage is superingeded on Dic Voltage, Vision in Section 1997. Dielectric Strength No defects or abnormalities Visual inspection No failure should be observed when a voltage of 256 rated voltage is applied between the both termination seconds, provided the charge/discharge current is 6 stored. The insulation resistance should be measured with voltage not exceeding the rated voltage at normal and humidity and without 2 minutes of the ranging. The capacitance OF. I should be measured at refere temperature and the requestion of the ranging of the requestion of the regular provided the charge discharge shown in the specified to the ranging of the requestion of the requestion of the respective of the requestion	No.	Ite	em	Specifications	Test Method									
Rated Voltage See the previous pages. When AC voltage is supering-sed on DC voltage, whichever is larger, should be maintained within the range. Appearance Disnosions Within the specified dimensions Visual inspection No failure should be observed when a voltage of 256 rated voltage is applied between the both termination scondars, provided the chargodischarge current is to Soma. The insulation resistance should be measured with voltage not exceeding the rated voltage at normal at emperature. The capacitance and humidary and without 2 minutes of the ranging. To Capacitance Vithin the specified tolerance The capacitance Should be measured at reference temperature at the reference and humidary and without 2 minutes of the ranging. The capacitance CF. should be measured at reference temperature at the request year of the respective of the respective and the requestive at the requestive and the	1	Temperat	•	R7: -55 to +125℃	Reference Temperature: 25°C									
Directric Strength No defects or abnormalities Visual inspection	2	Rated Vo	ltage	See the previous pages.	When AC voltage is superimposed on DC voltage, VP-P or VO-P, whichever is larger, should be maintained within the rated voltage									
Dielectric Strength No defects or abnormalities South	3	Appearar	nce	No defects or abnormalities	Using calipers									
Dielectric Strength No defects or abnormalities Tareted voltage is applied between the both the mination seconds, provided the charge/discharge current is le soma.	4	Dimensio	ns	Within the specified dimersions	Visual inspection									
Insulation Resistance 10,000M2 min. voltage not exceeding the rated voltage at normal te and humidity and within 2 minutes of charging.	5	Dielectric	Strength	No defects or abnormalities	No failure should be observed when a voltage of 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.									
Bond Strength Perform a heat treatment at 150 +00-10°C for one then let sit for 24±2 hours at room temperature.	6	Insulation	Resistance	10,000MΩ min.	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes of charging.									
Bossipation Factor (D.F.) R7: 0.035 max. Frequency 1±0.1kHz Voltage 1±0.2Vms	7	Capacita	nce	Within the specified tolerance	The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table.									
Post of the content of the conten	8	•	n Factor	R7: 0.035 max.										
Capacitance Temperature Characteristics No bias R7: Within +/-15% (-55 to +125°C) Temperature R7: Within +/-15% (-55 to +125°C) R7: Within +/-15% (-55 to +12		Temperature						 The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage. 						
Temperature Characteristics No bias R7: Within +/-15% (-55 to +125°C) 2					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1									
Strength Bond Strength Pull force: 0.03N min. MilSTD-883 Method 2011 Condition D Mount the capacitor terminal using an ultrasonic ball bond. Then Strength Die Shear force: 2N min. MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the ca	9			No bias	No bias	No bias	No bias	No bias	No bias	No bias	No bias	No bias	No bias	R7: Within +/–15% (–55 to +125°C)
Mechanical Strength Bond Strength Pull force: 0.03N min. MilSTD-883 Method 2011 Condition D Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold w capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2011 Condition D Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold w capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold w capacitor terminal using an ultrasonic ball bond. Then MilSTD-883 Method 2019 Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20). Apply the force parallel to the sub with Au-Sn (80/20). Apply the force parallel to the sub visit and														
Perform a heat treatment at 150 +0/-10°C for one in the let sit for 24±2 hours at room temperature. Perform the initial measurement. Pull force: 0.03N min. MIL-STD-883 Method 2011 Condition D Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold w capacitor terminal using an ultrasonic ball bond. Then MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20). Apply the force parallel to the su with Au-Sn (80/20). Apply the force parallel to the su with Au-Sn (80/20). Apply the force parallel to the su with Au-Sn (80/20). Apply the force parallel to the su with Au-Sn (80/20). Apply the force parallel to the su manufacture apply this motion for a period of 2 hours in each of 3 perpendicular directions (total 6 hours).														
Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold w capacitor terminal using an ultrasonic ball bond. Then MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold w capacitor terminal using an ultrasonic ball bond. Then MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina sub Au-Sn (80/20). Apply the force parallel to the sub with Au-Sn (80/20). Apply the force parallel to the sub w					·									
Die Shear Strength Die Shear Strength Die Shear Strength Die Shear force: 2N min. Appearance Appearance Die Shear force: 2N min. Appearance No defects or abnormalities Capacitance D.F. R7: 0.035 max. Appearance Appearance D.F. R7: Within ±7.5% Temperature Cycle Dielectric Dielectric Dielectric Die Shear force: 2N min. MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina su with Au-Sn (80/20). Apply the force parallel to the su with Au-Sn (80/20). Apply the fo	10			Pull force: 0.03N min.	MIL-STD-883 Method 2011 Condition D Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 25μm (0.0008 inch) gold wire to the capacitor terminal using an ultrasonic ball bond. Then, pull wire.									
1 minute. Amplitude: 1.5 mm (0.06 inch) max. total of Apply this motion for a period of 2 hours in each of 3 perpendicular directions (total 6 hours). Appearance R7: 0.035 max.		Strength		Die Shear force: 2N min.	MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.									
Resistance Capacitance Capacitance Capacitance D.F.		\#I !!	Appearance	No defects or abnormalities	Ramp frequency from 10 to 55Hz then return to 10Hz all within									
D.F. R7: 0.035 max. Appearance No defects or abnormalities The capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the capacitor should be set for 24±2 hours at room temperature after one hour heat of the supporting jig in the same manner and under the conditions as (11) and conduct the five cycles according to the supporting jig in the same manner and under the conditions as (11) and conduct the five cycles according to the supporting jig in the same manner and under the conditions as (11) and conduct the f	11		Capacitance	Within the specified tolerance	1 minute. Amplitude: 1.5 mm (0.06 inch) max. total excursion. Apply this motion for a period of 2 hours in each of 3 mutually									
temperature after one hour heat of treatment at 150 then measure for the initial measurement. Fix the cather supporting jig in the same manner and under the conditions as (11) and conduct the five cycles accorditions as (11) and conduct the five cycles accorditemperatures and time shown in the following table. 12		22.2.400	D.F.	R7: 0.035 max.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1									
then measure for the initial measurement. Fix the cather supporting jig in the same manner and under the conditions as (11) and conduct the five cycles accorditions as (11) and conduct the five cycles accorditemperatures and time shown in the following table. 12 Temperature Cycle I.R. 10,000 MΩ min.			Appearance	No defects or abnormalities	The capacitor should be set for 24±2 hours at room									
D.F. R7: 0.035 max. I.R. 10,000MΩ min. I.R. 10,000MΩ min. Dielectric No defects Temperature Cycle Dielectric No defects D.F. R7: 0.035 max. conditions as (11) and conduct the five cycles according temperatures and time shown in the following table. 48±4 hours at room temperature, then measure. Step 1 2 3 Temp (%) Min. Operating Room Max. Operating				R7: Within ±7.5%	then measure for the initial measurement. Fix the capacitor to									
Cycle Cycle 1.R. 10,000M32 min. 48±4 hours at room temperature, then measure. Step 1 2 3 Temp (%) Min. Operating Room Max. Operating			D.F.	R7: 0.035 max.	conditions as (11) and conduct the five cycles according to the									
Dielectric No defects Step 1 2 3 Temp (%) Min. Operating Room Max. Operating			I.R.	10,000M Ω min.	temperatures and time shown in the following table. Set it for									
Dielectric No defects Temp (°C) Min. Operating Room Max. Operating		- Juli												
Strength Strength 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1 - 1 - 3 1							Dielectric Strength	No defects						
Time (min.) 30±3 2 to 3 30±3					Time (min.) 30±3 2 to 3 30±3 2 to 3									

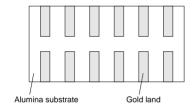


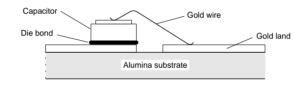
Specifications and Test Methods

Continued from the preceding page.

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

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





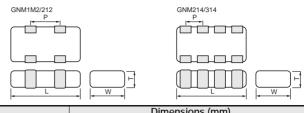
Capacitor Arrays GNM Series

■ Features

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

Applications

General electronic equipment



Part Number		Dimensi	ons (mm)	
Part Number	L	W	T	Р
GNM1M2	1.37 ±0.15	1.0 ±0.15	0.6 ±0.1	0 64 ±0 05
GNIVITIVIZ	1.37 ±0.15	1.0 ±0.15	0.8 +0/-0.15	P 0.64 ±0.05 1.0 ±0.1 0.5 ±0.05 0.8 ±0.1
GNM212	2.0 ±0.15	1.25 ±0.15	0.85 ±0.1	1.0 ±0.1
GNM214	2.0 ±0.15	1.25 ±0.15	0.6 ±0.1	0.5 ±0.05
GNM314	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1	0.0.40.1
GINIVIS 14	3.2 ±0.15	1.0 ±0.15	1.0 ±0.1	U.0 <u>F</u> U.1

Temperature Compensating Type

Part Number		GNM1M	GNM21	GN	M31
LxW		1.37x1.0	2.0x1.25	3.22	x1.6
тс		C0G (5C)	C0G (5C)		0G C)
Rated Volt.		50 (1H)	50 (1H)	100 (2A)	50 (1H)
Capacitance, Cap	pacitano	ce Tolerance and T Dimension			
10pF(100)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
15pF(150)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
22pF(220)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
27pF(270)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
33pF(330)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
39pF(390)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
47pF(470)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
68pF(680)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
100pF(101)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
150pF(151)	K	0.6(2)	0.6(4)	0.8(4)	0.8(4)
220pF(221)	K	0.6(2)	0.6(4)		0.8(4)
270pF(271)	K				0.8(4)
330pF(331)	K				0.8(4)

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

High Dielectric Constant Type GNM1M Series

Part Number					GNM1M				
LxW			1.37x1.0						
TC Rated Volt.			X5R (R6)				7R ?7)		
		16 (1C)	10 (1A)	6.3 (0J)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	
Capacitance, Ca	pacitanc	e Tolerance and	T Dimension				1	'	
1000pF(102)	М				0.6(2)				
2200pF(222)	K, M					0.6(2)			
4700pF(472)	K, M					0.6(2)			
10000pF(103)	М					0.6(2)			
22000pF(223)	K, M	0.6(2)	0.6(2)				0.6(2)	0.6(2)	

Part Number					GNM1M			
LxW					1.37x1.0			
тс			X5R (R6)			X7 (R		
Rated Volt.		16 (1C)	10 (1A)	6.3 (0J)	50 (1H)	25 (1E)	16 (1C)	10 (1A)
Capacitance, Ca	pacitano	e Tolerance and	T Dimension		1			<u>'</u>
47000pF(473)	K, M	0.6(2)	0.6(2)				0.6(2)	0.6(2)
0.10μF(104)	М		0.6(2)					
1.0μF(105)	М	0.8(2)	0.8(2)	0.8(2)				

The part numbering code is shown in each (). The (2) code in T (mm) means number of elements (two).

High Dielectric Constant Type GNM21 Series

Part Number		GNM21					
LxW		2.0x1.25					
тс			5R (6)		X7R (R7)		
Rated Volt.		16 (1C)	10 (1A)	50 (1H)	25 (1E)	16 (1C)	
Capacitance, Ca	pacitano	e Tolerance and T Dime	nsion				
1000pF(102)	М			0.6(4)			
2200pF(222)	K, M				0.6(4)		
4700pF(472)	K, M				0.6(4)		
10000pF(103)	М				0.6(4)		
22000pF(223)	K, M					0.85(4)	
47000pF(473)	K, M					0.85(4)	
0.10μF(104)	М					0.85(4)	
0.47μF(474)	М	0.85(2)					
1.0μF(105)	М	0.85(2)	0.85(4)				
2.2μF(225)	K, M		0.85(2)				

The part numbering code is shown in each (). The (2) code in T (mm) means number of elements (two).

High Dielectric Constant Type GNM31 Series

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

Dimensions are shown in mm and Rated Voltage in Vdc.

Please refer to Specifications and Test Methods (2) about $1.0\mu F$ products.

Dimensions are shown in mm and Rated Voltage in Vdc.

Please refer to Specifications and Test Methods (2) about X5R, 10V products.

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Part Number	·		G	NM31			
LxW			3.2x1.6				
тс			X7R (R7)		X5R (R6)		
Rated Volt.		100 (2A)	50 (1H)	16 (1C)	10 (1A)		
Capacitance, Ca	pacitanc	e Tolerance and T Dimension					
15000pF(153)	K, M		0.8(4)				
22000pF(223)	K, M			0.8(4)			
33000pF(333)	K, M			0.8(4)			
47000pF(473)	K, M			1.0(4)			
68000pF(683)	K, M			1.0(4)			
0.10μF(104)	K, M			1.0(4)			
1.0μF(105)	М				0.85(4)		

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



				Specifications				
No.	Ite	em	Temperature Compensating Type	High Dielectric Type	Test Method			
1	Operating Temperating Range		5C: -55 to +125°C	R7: -55 to +125°C R6: -30 to +85°C				
2	Rated Vo	ltage	See the previous page	ges.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{P-P} or V ^{O-P} , whichever is larger, should be maintained within the rated voltage range.			
3	Appearar	nce	No defects or abnorr	malities	Visual inspection			
4	Dimensio	ons	Within the specified	dimensions	Using calipers			
5	Dielectric	Strength	No defects or abnorr	nalities	No failure should be observed when 300 (5C) or 250% of the rated voltage (R7) is terminations for 1 to 5 seconds, provided current is less than 50mA.	applied between the		
6	Insulation Resistant	-	More than 10,000Ms (Whichever is smalle		The insulation resistance should be measulated voltage not exceeding the rated voltage amax. and within 2 minutes of charging.			
7	Capacita	nce	Within the specified	tolerance	The capacitance/Q/D.F. should be measi	ured at 25°C at the		
			30pF min.: Q≧1000 30pF max.:		frequency and voltage shown in the table) .		
8	Q/ Dissipation Factor		Q≧400+20C	Char. 25V min. 16V 10V 6.3V R7, R6 0.025 0.035 0.035 0.05	Item 5C	R7		
J	(D.F.)	C: Nominal	max. max. max. max.	Frequency 1±0.1MHz Voltage 0.5 to 5Vrms	1±0.1kHz 1.0±0.2Vrms			
			Capacitance (pF)					
	Capacitan Change	Capacitance Change	Within the specified tolerance (Table A) Within the	Char. Temp. Range Reference Temp. Cap. Change R7 -55°C to +125°C Within ±15% R6 -55°C to +85°C 25°C	The capacitance change should be meas each specified temperature stage. (1) Temperature Compensating Type The temperature coefficient is determined tance measured in step 3 as a reference, temperature sequentially from step 1 throughout be within the specified tolerance for coefficient and capacitance change as Tathe capacitance drift is calculated by divibetween the maximum and minimum me	d using the capaci When cycling the ugh 5, the capacitance for the temperature able A. iding the differences		
9	Capacitance Temperature	Coefficent	specified tolerance (Table A)		steps 1, 3 and 5 by the cap. value in step			
	Characteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.)		Step Temperature 1 25±2 255±3 (for 5C/R7), -3 3 25±2 4 125±3 (for 5C/R7), 8 5 20±2 (2) High Dielectric Constant Type The ranges of capacitance change comp 25°C value over the temperature ranges	30±3 (for F5) 5±3 (for F5) ared with the above		
			No serve and of the te		should be within the specified ranges.			
10	Adhesive of Termin	Strength nation	GNM	GNM 2 GNM 2 Solder resist Copper foil	Solder the capacitor to the test jig (glass epig.1 using a eutectic solder. Then apply 5 the test jig for 10±1 sec. The soldering should be done either with a reflow method and should be conducted w soldering is uniform and free of defects such that is a soldering is uniform and free of defects such that is a soldering is uniform and free of defects such that is a soldering is uniform and free of defects such that is a soldering is uniform and free of defects such that is a soldering is uniform and free of defects such that is a soldering in the soldering in the soldering is a soldering in the soldering in the soldering is a soldering in the soldering in the soldering is a soldering in the soldering in the soldering is a soldering in the soldering in the soldering is a soldering in the soldering in the soldering is a soldering in the soldering in the soldering is a soldering in the solderin	N force in parallel with an iron or using the with care so that the		
					Fig. 1			





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	Significant the preceding page.										
				Specifications	T						
No.	Ite	em	Temperature Compensating Type	High Dielectric Type	Test Method						
		Appearance	No defects or abnorr	nalities	Solder the capacitor to the test jig (glass epoxy board) in the						
		Capacitance	Within the specified	colerance	same manner and under the same conditions as (10). The capacitor should 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 10V 6.3V R7, R6 0.025 max. 0.035 max. 0.035 max. 0.05 max.	having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).						
			No cracking or marki	ng defects should occur.	Solder the capacitor on the test jig (glass epoxy board) shown						
			•GNM□□4	•GNM□□2	in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3 for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.						
12	Deflection		5.0 100 a 100 b 1.0	5.0	20 50 Pressurizing speed: 1.0mm/sec. Pressurize						
			GNM212 2 GNM214 2	t=0.8mm a b c d 2.0±0.05 0.5±0.05 0.32±0.05 0.32±0.05 2.0±0.05 0.6±0.05 0.5±0.05 0.5±0.05 2.0±0.05 0.7±0.05 0.3±0.05 0.2±0.05 2.5±0.05 0.8±0.05 0.4±0.05 0.4±0.05 (in mm)	Capacitance meter 45 Fig. 3						
				Fig. 2							
13	Solderabi Terminati	•	75% of the termination continuously.	ons are to be soldered evenly and	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.						
	Resistanc Soldering		The measured and conspecifications in the	bserved characteristics should satisfy the following table.							
		Appearance	No marking defects								
	Capacitar Change		Within ±2.5% or ±0.25pF (Whichever is larger)	R7, R6: Within ±7.5%	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.						
14		Q/D.F.	30pF min.: Q≥1000 30pF max.: Q≥400+20C C: Nominal Capacitance (pF)	Char. 25V min. 16V 10V 6.3V R7, R6 0.025 max. 0.035 max. 0.035 max. 0.05 max.	• Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.						
		I.R.	More than 10,000Mg	2 or 500Ω · F (Whichever is smaller)							
		Dielectric Strength	No failure								

Continued on the following page.



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				Specifications						
No.	Ite	em	Temperature Compensating Type	High Dielectric Type	Test Method					
	Temperat Cycle	ure	The measured and o	bserved characteristics should satisfy the following table.	Fix the capacitor to the supporting jig in the same manner and					
		Appearance	No marking defects	· · · · · · · · · · · · · · · · · · ·	under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following					
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	R7, R6: Within ±7.5%	table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.					
15		Q/D.F.	30pF min.: Q≥1000 30pF max.: Q≥400+20C	Char. 25V min. 16V 10V 6.3V R7, R6 0.025 max. 0.035 max. 0.035 max. 0.05 max.	Step 1 2 3 4 Temp. (°C) Min. Operating Temp. +0/-3 Room Temp. Temp. Max. Operating Temp. +3/-0 Room Temp. Time (min.) 30±3 2 to 3 30±3 2 to 3					
		I.R.	Capacitance (pF)	or 500Ω · F (Whichever is smaller)	Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and the object of the control of the					
		Dielectric Strength	No failure	t of occit i (willows) to situation	then let sit for 24±2 hours at room temperature. Perform the initial measurement.					
	Humidity State		The measured and o	bserved characteristics should satisfy the following table.						
		Appearance	No marking defects	<u> </u>						
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	R7, R6: Within ±12.5%						
16		Q/D.F.	30pF and over: Q≥350 10pF and over, 30pF and below: Q≥275+5C/2 10pF and below: Q≥200+10C C: Nominal Capacitance (pF)	Char. 25V min. 16V 10V/6.3V R7, R6 0.05 max. 0.05 max. max.	Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.					
		I.R.	More than 1,000MΩ	or 50Ω · F (Whichever is smaller)						
		Dielectric Strength	No failure							
	Humidity	Load	The measured and o	bserved characteristics should satisfy the following table.						
		Appearance	No marking defects							
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	R7, R6: Within ±12.5%	Apply the rated voltage at 40±2°C and 90 to 95% humidity for					
17		Q/D.F.	30pF and over: Q≥200 30pF and below: Q≥100+10C/3 C: Nominal Capacitance (pF)	Char. 25V min. 16V 10V/6.3V R7, R6 0.05 max. 0.05 max. max.	 500±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.		$25\Omega \cdot F$ (Whichever is smaller)	-					
		Dielectric Strength	No failure	· (vinoleve is smaller)						



Continued from the preceding page.

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

Table A

	Name in all Malana	Capacitance Change from 25℃ (%)								
Char.	Nominal Values (ppm/°C) Note 1	-5	5℃	-3	0℃	-10℃				
	(ppin/c) Note i	Max.	Min.	Max.	Min.	Max.	Min.			
5C	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11			

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

No.	Ite	em		Spe	cifications			Tes	t Method				
1	Operating Temperatu	ure Range	R6: -55°C	to +85°C									
2	Rated Vo	Itage	See the pr	evious pages.			The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, VP-P or VO-P, whichever is larger, should be maintained within the rated voltage range.						
3	Appearar	nce	No defects	or abnormalities			Visual inspection						
4	Dimensio	ns	Within the	specified dimension	on		Using calipers						
5	Dielectric	Strength	No defects	or abnormalities			No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.						
6	Insulation	Resistance	50Ω · F mi	n.			The insulation resis voltage not exceed max. and within 1 r	ing the rat	ed voltage				
7	Capacita	nce	Within the	specified toleranc	Э		The capacitance/D frequency and volta				at the		
8	Dissipation (D.F.)	on Factor	0.1 max.				Capacitance R6		equency =0.1kHz		Itage 0.1Vrms		
							The capacitance change should be measured affter 5 min each specified temperature stage.						
							Step 1		•	ature (℃) ±2			
							2			5±3			
							3			±2			
9	Capacitar Temperat	pacitance mperature Char. Temp. Range Reference Temp. Cap. Char.				Cap. Change	<u>4</u> 5			±3 ±2			
	Character	ristics	R6	-55 to +85°C	25°C	The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should b within the specified ranges. • Initial measurement for high dielectric constant type. Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement.							
			No remova	I of the terminatio	ns or other defe	ects should occur.	Solder the capacitor	to the test	t jig (glass e	poxy board	d) shown in		
10	Adhesive of Termin	9		b			Fig. 1 using a eutec Then apply 5N force soldering should be method and should is uniform and free	tic solder. e in paralle done eithe be conduc	I with the tea er with an iro	st jig for 10 on or using e so that th	±1 sec. The the reflow		
					Solder resist		Type	a 0.5	b	C	d		
					-Copper foil		<u>GNM1M2</u> GNM212	0.5 0.6	1.6 1.8	0.32	0.32		
					Fig. 1						(in mm)		
		Appearance	No defects	or abnormalities			Solder the capacito	or to the te	st jig (glass	epoxy boa	ard) in		
		Capacitance	Within the	specified toleranc	9		the same manner a	and under	the same c	onditions a	as (10).		
11	Vibration			The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).				eing varied I 55Hz. o 10Hz, s motion					





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GNM Series Specifications and Test Methods (2)

Continued from the preceding page Specifications No Item Test Method No cracking or marking defects should occur. Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. Pressurizing speed : 1.0mm/sec (35) Pressurize R230 Thickness: 0.8mm 100 5.0 Deflection Flexure : ≤1 l.b. Type Fig. 3 GNM1M2 2.0±0.5 0.5±0.05 0.32±0.05 0.32±0.05 2.0±0.05 0.6±0.05 0.5±0.05 0.5±0.05 GNM212 (in mm) Fig. 2 Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at Solderability of 75% of the terminations are to be soldered evenly 80 to 120°C for 10 to 30 seconds. After preheating, immerse in Termination and continuously. eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. Appearance No marking defects Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder Canacitance R6: Within ±7.5% solution at 270±5°C for 10±0.5 seconds. Change Resistance Let sit at room temperature for 24±2 hours, then measure. to Soldering D.F. 0.1 max Initial measurement Heat I.R. $50\Omega \cdot F min.$ Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform Dielectric No failure the initial measurement. Strenath Fix the capacitor to the supporting jig in the same manner and Appearance No marking defects under the same conditions as (10). Capacitance Perform the five cycles according to the four heat treatments R6: Within ±12.5% Change listed in the following table. D.F. Let sit for 24±2 hours at room temperature, then measure. 0.1 max Step $50\Omega \cdot F min.$ I.R Temperature Min. Operating Room Max. Operating Room 15 Temp. (℃) Cycle Temp. Temp. Temp. Temp. Time (min.) 30 ± 3 2 to 3 30 ± 3 2 to 3 Dielectric No failure Initial measurement Strength Perform a heat treatment at 150 +0/-10 °C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Appearance No marking defects Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA. Capacitance R6: Within ±12.5% High Initial measurement Change Temperature Perform a heat treatment at 150 +0/-10°C for one hour High D.F 0.2 max. and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Humidity I.R. $12.5\Omega \cdot F min.$ (Steady) Measurement after test Perform a heat treatment at 150 +0/-10°C for one hour Dielectric No failure and then let sit for 24±2 hours at room temperature, then Strength measure Apply 125% of the rated voltage for 1000±12 hours at the Appearance No marking defects maximum operating temperature ±3°C. Let sit for 24±2 hours Capacitance R6: Within ±12.5% at room temperature, then measure. Change The charge/discharge current is less than 50mA. D.F. 0.2 max. Initial measurement Perform a heat treatment at 150 +0/-10°C for one hour Durability I.R $25\Omega \cdot F min.$ 17 and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Dielectric No failure Perform a heat treatment at 150 +0/-10°C for one hour Strenath and then let sit for 24±2 hours at room temperature, then measure

Chip Monolithic Ceramic Capacitors



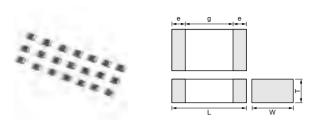
for Ultrasonic Sensors GRM Series

■ Features

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

Applications

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



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

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

Specifications and Test Methods

No.	Ite	em	Specifications		Test Me	thod			
1	Operating Temperat	,	−25 to +85°C	Reference Tempera	ature: 20°C				
2	Rated Vo	ltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{P-P} or V ^{O-P} , whichever is larger, should be maintained within the rated voltage range.					
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	No failure should be is applied between ed the charge/disch	the termination	ns for 1 to 5 se	econds, provid-		
6	Insulation (I.R.)	Resistance	More than 10,000MΩ	The insulation resis age not exceeding the and within 2 minute	the rated volta				
7	Capacita	nce	Within the specified tolerance	The capacitance/D.	E should be a	neasured at 2	 ∩°C with		
8	Dissipatio (D.F.)	n Factor	0.01 max.	1±0.1kHz in freque					
9	Capacitar Temperat Character	ure	Within −4,700 $^{+1.000}_{-2.500}$ ppm/°C (at −25 to +20°C) Within −4,700 $^{+500}_{-1.000}$ ppm/°C (at +20 to +85°C)	The temperature coefficient is determined using the capacitance measured in step 1 as a reference. When cycling the temperature sequentially from step 1 throu 5, the capacitance should be within the specified tolerance for the temperature coefficient. The capacitance change should be measured after 5 min. at each specified temperature stage. Step Temperature (°C) 1 20±2 2 -25±3 3 20±2 4 85±3 5 20±2					
10	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.	Solder the capacito Fig.1 using a eutect direction of the arro The soldering shoul reflow method and soldering is uniform Type GRM21	tic solder. The ow. Id be done eith should be cond	n apply 10N f appl	orce in the n or using the are so that the		
		Appearance	No defects or abnormalities	Solder the capacito	r to the test jig	(glass epoxy	board) in the		
		Capacitance	Within the specified tolerance	same manner and u	under the same	e conditions a	s (10).		
11	Vibration Resistance	D.F.	0.01 max.	The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).					



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Specifications and Test Methods

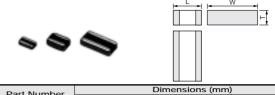
Continued from the preceding page Specifications No Item Test Method Solder the capacitor to the test jig (glass epoxy boards) shown No cracking or marking defects should occur. in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 50 Pressurizing speed: 1.0mm/sec. _Pressurize Deflection 12 R230 t: 1.6mm 100 Type а h C Capacitance meter GRM21 1.2 4.0 1.65 45 (in mm) (in mm) Fig. 2 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 Solderability of 75% of the terminations are to be soldered evenly and 80 to 120°C for 10 to 30 seconds. After preheating, immerse in 13 Termination continuously. eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. Appearance No defects or abnormalities Capacitance Within ±7.5% Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the Change Resistance capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution 14 to Soldering D.F 0.01 max at 270±5°C for 10±0.5 seconds. Let sit at room temperature for Heat More than $10,000M\Omega$ I.R. 24±2 hours, then measure. Dielectric No failure Strength Appearance No defects or abnormalities Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11). Capacitance Within ±7.5% Perform the five cycles according to the four heat treatments Change listed in the following table. Let sit for 24±2 hours at room tem-Temperature perature, then measure. D.F. 0.01 max 15 Cycle Step I.R. More than $10,000M\Omega$ 2 3 4 85⁺³_o -25±3 Room Temp. Room Temp. Temp. (℃) Dielectric No failure 30±3 2 to 3 30±3 Time (min.) 2 to 3 Strength Appearance No defects or abnormalities Capacitance Within ±12.5% Sit the capacitor at 40±2℃ and 90 to 95% humidity for 500±12 Change Humidity, Steady D.F. 0.02 max Remove and let sit for 24±2 hours at room temperature, then State I.R. More than 1,000M Ω measure Dielectric No failure Strength Appearance No defects or abnormalities Apply the rated voltage at 40±2℃ and 90 to 95% humidity for Capacitance Within ±12.5% Humidity 500±12 hours. Remove and let sit for 24±2 hours at room tem-Change 17 Load perature, then measure. The charge/discharge current is less D.F. 0.02 max. than 50mA. I.R. More than $500M\Omega$ No defects or abnormalities Appearance Capacitance Apply 200% of the rated voltage for 1,000±12 hours at 85±3℃. Within ±12.5% Change Let sit for 24±2 hours at room temperature, then measure. 18 Temperature The charge/discharge current is less than 50mA. Load D.F. 0.02 max

I.R.

More than $1,000M\Omega$

Low ESL LLL/LLA/LLM Series

- Features (Reversed Geometry Low ESL Type)
- 1. Low ESL, good for noise reduction for high frequency
- 2. Small, high cap
- Applications
- 1. High speed microprocessor
- 2. High frequency digital equipment



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

Reversed Geometry Low ESL Type

Part Number	LLL15		LLL18					LLL21				LLL31							
LxW	0.5x1.0			0.8	x1.6					1.25	x2.0					1.6	x3.2		
тс	X6S (C8)			X7R (R7)			X7S (C7)			X7R (R7)			X7S (C7)			X7R (R7)			X7S (C7)
Rated Volt.	6.3 (0J)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)
Capacitance (Ca	apacita	nce pa	rt numl	pering (code) a	nd T (n	nm) Dir	nensior	T Din	nensior	n part r	umber	ing cod	le)					
2200pF (222)		0.5 (5)																	
4700pF (472)		0.5 (5)						0.6 (6)											
10000pF (103)			0.5 (5)					0.6 (6)						0.7 (7)					
22000pF (223)			0.5 (5)					0.6 (6)						0.7 (7)					
47000pF (473)				0.5 (5)					0.6 (6)					0.7 (7)					
0.10μF (104)	0.3 (3)				0.5 (5)				0.6 (6)					1.15 (M)	0.7 (7)				
0.22μF (224)						0.5 (5)				0.85 (9)	0.6 (6)				1.15 (M)	0.7 (7)			
0.47μF (474)							0.5 (5)				0.85 (9)				1.15 (M)	0.7 (7)			
1.0μF (105)							0.5 (5)					0.85 (9)				1.15 (M)	0.7 (7)		
2.2μF (225)							0.5 (5)						0.85 (9)				1.15 (M)	0.7 (7)	
4.7μF (475)																		1.15 (M)	
10μF (106)																			1.25 (B)

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

Please refer to Specifications and Test Method (2) about LLL15 Series and LLL18 Series $1.0\mu F/2.2\mu F$ type.

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Reversed Geometry Low ESL Type Low Profile

Part Number		LLI	L18				LL	L21				LL	L31			
LxW		0.83	x1.6				1.25	x2.0			1.6x3.2					
TC		X7R (R7)		X7S (C7)			X7R (R7)			X7S (C7)	X7R (R7)					
Rated Volt.	25 (1E)	16 (1C)	10 (1A)	4 (0G)	50 (1H)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)	50 (1H)	25 (1E)	16 (1C)	10 (1A)		
Capacitance (Ca	pacitanc	e part nur	mbering c	ode) and	T (mm) D	imension	(T Dimen	sion part	numberin	g code)						
1000pF(102)					0.5(5)											
2200pF(222)					0.5(5)											
4700pF(472)					0.5(5)											
10000pF(103)	0.5(5)				0.5(5)						0.5(5)					
22000pF(223)		0.5(5)				0.5(5)					0.5(5)					
47000pF(473)		0.5(5)					0.5(5)					0.5(5)				
0.10μF(104)			0.5(5)				0.5(5)					0.5(5)				
0.22μF(224)				0.5(5)				0.5(5)					0.5(5)			
0.47μF(474)									0.5(5)					0.5(5)		
1.0μF(105)										0.5(5)						

The part numbering code is shown in ().

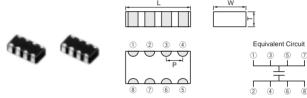
Dimensions are shown in mm and Rated Voltage in Vdc.

■ Features (Eight Terminals Low ESL Type)

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

Applications

- 1. High speed microprocessor
- 2. High frequency digital equipment



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

Eight Terminals Low ESL Type

Part Number	LLA18			LLA21				LLA31	
LxW	1.6x0.8		2.0x1.25				3.2x1.6		
тс	X7S (C7)			7R R7)		X7S (C7)		X7R (R7)	
Rated Volt.	(0G)	25 (1E)	16 (1C)	10 (1A)	6.3 (0J)	4 (0G)	16 (1C)	10 (1A)	(0G)
Capacitance (Ca	pacitance par	t numbering co	de) and T (mr	n) Dimension (1	Dimension pa	rt numbering o	ode)	'	<u>'</u>
10000pF(103)		0.85(9)							
22000pF(223)		0.85(9)							
47000pF(473)		0.85(9)							
0.10μF(104)	0.5 (5)		0.85(9)				0.85(9)		
0.22μF(224)	0.5(5)		0.85(9)				0.85(9)		
0.47μF(474)	0.5 (5)			0.85(9)			0.85(9)		
1.0μF(105)	0.5 (5)				0.85(9)			0.85(9)	
2.2μF(225)	0.5 (5)					0.85(9)		1.15(M)	0.85(9)
4.7μF(475)						0.85(9)			

The part numbering code is shown in ().

Please refer to Specifications and Test Method (2) about LLA18 Series 1.0µF/2.2µF type and LLA21 Series 4.7µF type.

Dimensions are shown in mm and Rated Voltage in Vdc.

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Eight Terminals Low ESL Type Low Profile

Part Number			LLA21				LLA31	
LxW		2.0x1.25				3.2x1.6		
TC			7R 1 7)		X7S (C7)		X7R (R7)	
Rated Volt.	25 16 (1E) (1C)		10 (1A)	6.3 (0J)	4 (0G)	16 (1C)	10 (1A)	6.3 (0J)
Capacitance (Ca	pacitance part n	numbering code)	and T (mm) Dim	nension (T Dimen	sion part numbe	ring code)		
10000pF(103)	0.5(5)							
22000pF(223)	0.5(5)							
47000pF(473)		0.5 (5)						
0.10μF(104)		0.5 (5)				0.5 (5)		
0.22μF(224)			0.5(5)	0.5(5)		0.5 (5)		
0.47μF(474)				0.5(5)			0.5(5)	
1.0μF(105)					0.5(5)			0.5(5)
2.2μF(225)					0.5(5)			0.5(5)
4.7μF(475)					0.5(5)			

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

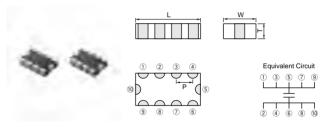
Please refer to Specifications and Test Method (2) about LLA21 Series (Low Profile) $2.2\mu F/4.7\mu F$ type.

■ Features (Ten Terminals Low ESL Type)

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

Applications

- 1. High speed microprocessor
- 2. High frequency digital equipment



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

Ten Terminals Low ESL Type Low Profile

Part Number		LL	M21			LLM31	
LxW	2.0x1.		k1.25			3.2x1.6	
тс		X7R (R7)		X7S (C7)		X7R (R7)	
Rated Volt. 25 (1E)		16 (1C)	6.3 (0J)	4 (0G)	16 (1C)	10 (1A)	6.3 (0J)
Capacitance (Ca	pacitance part nu	mbering code) and	T (mm) Dimension	(T Dimension part	numbering code)		'
10000pF(103)	0.5 (5)						
22000pF(223)	0.5 (5)						
47000pF(473)		0.5(5)					
0.10μF(104)		0.5(5)			0.5(5)		
0.22μF(224)			0.5(5)		0.5(5)		
0.47μF(474)			0.5(5)			0.5(5)	
1.0μF(105)				0.5(5)			
2.2μF(225)				0.5(5)			0.5(5)

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

Please refer to Specifications and Test Method (2) about LLM21 Series (Low Profile) 2.2µF type.

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

No.	Ite	em		Spe	ecifications			Т	est Method	
1	Operating Temperat Range		R7, C7: -55	5 to +125°C						
2	Rated Vo	Itage	See the prev	vious pages.			may be ap When AC	oplied continuous voltage is super r is larger, should	ed as the maximu sly to the capacito imposed on DC v d be maintained w	or. oltage, VP-P or VO-P,
3	Appearar	nce	No defects of	No defects or abnormalities				pection		
4	Dimensio	ns	Within the s	pecified dimensi	on		Using cali	pers		
5	Dielectric	Strength	No defects of	or abnormalities			is applied	between the terr	ved when 250% on the contractions for 1 to arge current is less	
6	Insulation Resistance		More than 1 (Whichever	$0,000 \mathrm{M}\Omega$ or 500 is smaller)	Ω·F		not excee		oltage at 25°C and	ed with a DC voltage d 75%RH max. and
7	Capacita	nce	Within the s	pecified tolerand	е			citance/D.F. shou and voltage sho	uld be measured when in the table.	at 25°C at the
	Dissipatio	n Factor	W.V.: 25V m	nin.; 0.025 max.				apacitance OµF (10V min.)	Frequency 1±0.1kHz	Voltage 1.0±0.2Vrms
8	(D.F.)			nax.; 0.035 max.	*1			μF (6.3V max.)	1±0.1kHz	0.5±0.1Vrms
								C>10µF	120±24Hz	0.5±0.1Vrms
								citance change s cified temperature	hould be measure stage. Temperature (°0	
				Town Dange	Deference		1		25±2	5,
_	Capacitar		Char.	Temp. Range (°C)	Reference Temp.	Cap.Change	2		-55±3	
9	Temperat Character		R7	-55 to +125	25°C	Within ±15%	3 4		25±2 125±3	
			C7	-55 to +125	25°C	Within ±22%	5		25±2	
							value ove	•	•	ed with the 25°C n the table should
10	Adhesive of Termin	•	No removal	of the termination	ns or other defe	ct should occur.	eutectic s jig for 10± iron or usi care so th	older. Then apply 1 sec. The soldering the reflow me at the soldering in	y 10N* force in pa ering should be do ethod and should is uniform and fre	oxy board) using a arallel with the test one either with an be conducted with e of defects such as LLA/LLM Series: 5N
		Appearance	No defects of	or abnormalities			Solder the	capacitor to the	test jig (glass ep	oxy board) in
		Capacitance	Within the s	pecified tolerand	e					litions as (10). The
11	Vibration Resistance	D.F.	W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1			having a t uniformly frequency be travers applied fo	otal amplitude of between the app range, from 10 ted in approxima	proximate limits of to 55Hz and retur tely 1 minute. Thi purs in each of 3 i	uency being varied 10 and 55Hz. The n to 10Hz, should s motion should be	
12	Solderability of Termination 75% of the terminations are to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.			portion). Preheat at neating, immerse in at 230±5°C, or				
		Appearance	No marking	defects			Preheat th	ne capacitor at 1°	20 to 150°C for 1	minute. Immerse
	Docistor	Capacitance Change	Within ±7.5%		the capac solution a	itor in a eutectic t 270±5°C for 10	solder or Sn-3.0A ±0.5 seconds. Le	ng-0.5Cu solder et sit at room		
13	Resistance to Soldering Heat	D.F.		nin.; 0.025 max. nax.; 0.035 max.	*1			ire for 24±2 houi easurement.	rs, then measure.	
		I.R.	More than 1	0,000MΩ or 500	Ω · F (Whicheve	er is smaller)				one hour and then
		Dielectric Strength	No failure				let sit for measure		continued on	. Perform the initial

Continued on the following page. $\begin{tabular}{|c|c|c|c|} \hline \end{tabular}$



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

No.	Ite	em	Specifications		Tes	st Metho	d			
		Appearance Capacitance Change	No marking defects Within ±7.5% *1	under the sam	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure. Step 1 2 3 4					
		D.F.	W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1	temperature, t						
14	Temperature Cycle	I.R.	More than $10{,}000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller)	Temp. (°C)	Min. Operating Temp. = 3	Room Temp.	Max. Operating Temp. ±3	Room Temp.		
				Time (min.)	30±3	2 to 3	30±3	2 to 3		
		Dielectric Strength	No failure		eat treatment a 2 hours at roo		°C for one hou rature. Perform			
		Appearance	No marking defects							
15	Humidity (Steady	Capacitance Change	Within ±12.5% *1	•	Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.					
	State)	D.F.	0.05 max. *1	then measure						
		I.R.	More than 1,000M Ω or $50\Omega \cdot F$ (Whichever is smaller)							
		Appearance	No marking defects							
		Capacitance Change	Within ±12.5% *1	Apply the rate	d voltage at 40)±2°C an	d 90 to 95% hu	ımiditv for		
16	Humidity	D.F.	0.05 max. *1	500±12 hours	Apply the rated voltage at 40±2°C and 90 to 95% humidity 500±12 hours. Remove and let sit for 24±2 hours at room					
	Load	I.R.	More than $500M\Omega$ or $25\Omega \cdot F$ *1 (Whichever is smaller)	•	temperature, then measure. The charge/discharge culess than 50mA.		urrent is			
		Dielectric Strength	No failure							
		Appearance	No marking defects	Apply 200% o	f the rated volt	age for 1	000±12 hours	at the		
	High D.F.	Capacitance Change	Within ±12.5% *1	maximum ope at room tempe	Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement.					
17		D.F.	W.V.: 25V min.; 0.04 max. W.V.: 16V max.; 0.05 max. *1							
		I.R.	More than 1,000M Ω or 50 Ω · F *1 (Whichever is smaller)	Apply 200% maximum op	of the rated DO erating temper	ature ±3	for one hour a			
					at room tempe					

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

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

No.	Ite	em	Specifications	Test Method		
1	Operating Temperat Range		R7, C7: -55 to +125°C C8: -55 to +105°C			
2	Rated Voltage See the previous pages.		See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V ^{p,p} or V ^{o,p} , whichever is larger, should be maintained within the rated voltage range.		
3	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 should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.		
6	Insulation Resistant		$50\Omega \cdot$ F min.	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 1 minute of charging.		
7	Capacita	apacitance Within the specified tolerance		The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.		
8	Dissipatio (D.F.)	n Factor	R7, C7, C8: 0.120 max.	Capacitance Frequency Voltage C≤10μF (10V min.) 1±0.1kHz 1.0±0.2Vrms C≤10μF (6.3V max.) 1±0.1kHz 0.5±0.1Vrms C>10μF 120±24Hz 0.5±0.1Vrms		
9			R7 -55 to +125 Within ±15% C7 -55 to +125 25°C Within ±22%	The capacitance change should be measured after 5 min. at each specified temperature stage. The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.		
10	Adhesive of Termin	•	No removal of the terminations or other defect should occur.	Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *5N (LLL15, LLL18, LLA,LLM Series)		
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board) in		
		Capacitance	Within the specified tolerance	the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion		
11			R7, C7, C8: 0.120 max.	having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).		
12	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.		
	Appearance No marking defects Capacitance Change R7, C7, C8: Within ±7.5%		No marking defects	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse		
			R7, C7, C8: Within ±7.5%	the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.		
13	to Soldering	D.F.	R7, C7, C8: 0.120 max.	a Initial manaurament		
	Heat	I.R.	$50\Omega \cdot F$ min.	• Initial measurement. Perform a heat treatment at 150 ± °C for one hour and then		
		Dielectric Strength	No failure	let sit for 24±2 hours at room temperature. Perform the initial measurement.		





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

Continued from the preceding page.

Vo.	Ite	em	Specifications	Test Method
		Appearance Capacitance Change D.F.	No marking defects R7, C7, C8: Within ±12.5% R7, C7, C8: 0.120 max.	Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.
	Tanananahana	I.R.	50Ω · F min.	Step 1 2 3 4
14	Temperature Sudden Change	I.K.	5052 · F min.	Temp. (°C) Min. Operating Temp. ± g Temp. Room Temp. ± g Temp. Max. Operating Temp. ± g Temp. Room Temp. ± g Temp. Time (min.) 30±3 2 to 3 30±3 2 to 3
		Dielectric Strength	No failure	• Initial measurement Perform a heat treatment at 150±9° °C for one hour and the let sit for 24±2 hours at room temperature. Perform the initial measurement.
		Appearance	No marking defects	Apply the rated voltage at 40±2°C and 90 to 95% humidity fo 500±12 hours.
	High	Capacitance Change	R7, C7, C8: Within ±12.5%	The charge/discharge current is less than 50mA.
	Temperatue	D.F.	R7, C7, C8: 0.2 max.	•Initial measurement
15	High Humidity (Steady State)	I.R.	12.5Ω · F min.	Perform a heat treatment at 150±9°°C for one hour and the let sit for 24±2 hours at room temperature. Perform the initial measurement. •Measurement after test Perform a heat treatment at 150±9°°C for one hour and the let sit for 24±2 hours at room temperature, then measure.
		Appearance	No marking defects	Apply 150% of the rated voltage for 1000±12 hours at the
		Capacitance Change	R7, C7, C8: Within ±12.5%	maximum operating temperature ±3°C. The charge/discharge current is less than 50mA.
		D.F.	R7, C7, C8: 0.2 max.	•Initial measurement
16	Durability	I.R.	$25\Omega \cdot F$ min.	Perform a heat treatment at 150±\(^0\)0°C for one hour and the let sit for 24±2 hours at room temperature. Perform the initial measurement. •Measurement after test Perform a heat treatment at 150±\(^0\)0°C for one hour and the let sit for 24±2 hours at room temperature, then measure.

Chip Monolithic Ceramic Capacitors



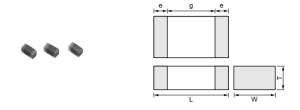
High-Q GJM Series

■ Features

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

Applications

VCO, PA, Mobile telecommunications



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

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

Continued from the preceding page.

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

Continued from the preceding page

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

The part numbering code is shown in $\ (\).$

Dimensions are shown in mm and Rated Voltage in Vdc.

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Chip Monolithic Ceramic Capacitors



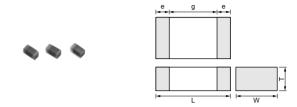
Tight Tolerance High-Q GJM Series

■ Features

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

Applications

VCO, PA, Mobile telecommunications



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

Part Number		GJM03	GJM15
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
тс		C0G (5C)	C0G (5C)
Rated Volt.		25 (1E)	50 (1H)
Capacitance, Ca	pacitano	ce Tolerance and T Dimension	
0.10pF(R10)	W, B		0.5(5)
0.20pF(R20)	W, B	0.3(3)	0.5(5)
0.30pF(R30)	W, B	0.3(3)	0.5(5)
0.40pF(R40)	W, B	0.3(3)	0.5(5)
0.50pF(R50)	W, B	0.3(3)	0.5(5)
0.60pF(R60)	W, B	0.3(3)	0.5(5)
0.70pF(R70)	W, B	0.3(3)	0.5(5)
0.80pF(R80)	W, B	0.3(3)	0.5(5)
0.90pF(R90)	W, B	0.3(3)	0.5(5)
1.0pF(1R0)	W, B	0.3(3)	0.5(5)
1.1pF(1R1)	W, B	0.3(3)	0.5(5)
1.2pF(1R2)	W, B	0.3(3)	0.5(5)
1.3pF(1R3)	W, B	0.3(3)	0.5(5)
1.4pF(1R4)	W, B	0.3(3)	0.5(5)
1.5pF(1R5)	W, B	0.3(3)	0.5(5)
1.6pF(1R6)	W, B	0.3(3)	0.5(5)
1.7pF(1R7)	W, B	0.3(3)	0.5(5)
1.8pF(1R8)	W, B	0.3(3)	0.5(5)
1.9pF(1R9)	W, B	0.3(3)	0.5(5)
2.0pF(2R0)	W, B	0.3(3)	0.5(5)
2.1pF(2R1)	W, B	0.3(3)	0.5(5)
2.2pF(2R2)	W, B	0.3(3)	0.5(5)
2.3pF(2R3)	W, B	0.3(3)	0.5(5)
2.4pF(2R4)	W, B	0.3(3)	0.5(5)
2.5pF(2R5)	W, B	0.3(3)	0.5(5)
2.6pF(2R6)	W, B	0.3(3)	0.5(5)
2.7pF(2R7)	W, B	0.3(3)	0.5(5)
2.8pF(2R8)	W, B	0.3(3)	0.5(5)
2.9pF(2R9)	W, B	0.3(3)	0.5(5)
3.0pF(3R0)	W, B	0.3(3)	0.5(5)
3.1pF(3R1)	W, B	0.3(3)	0.5(5)
3.2pF(3R2)	W, B	0.3(3)	0.5(5)
3.3pF(3R3)	W, B	0.3(3)	0.5(5)
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Part Number		GJM03	GJM15
L x W [EIA]		0.6x0.3 [0201]	1.0x0.5 [0402]
тс		C0G (5C)	C0G (5C)
Rated Volt.		25 (1E)	50 (1H)
Capacitance, Ca	apacitano	e Tolerance and T Dimension	
3.4pF(3R4)	W, B	0.3(3)	0.5(5)
3.5pF(3R5)	W, B	0.3(3)	0.5(5)
3.6pF(3R6)	W, B	0.3(3)	0.5(5)
3.7pF(3R7)	W, B	0.3(3)	0.5 (5)
3.8pF(3R8)	W, B	0.3(3)	0.5 (5)
3.9pF(3R9)	W, B	0.3(3)	0.5 (5)
4.0pF(4R0)	W, B	0.3(3)	0.5 (5)
4.1pF(4R1)	W, B	0.3(3)	0.5 (5)
4.2pF(4R2)	W, B	0.3(3)	0.5 (5)
4.3pF(4R3)	W, B	0.3(3)	0.5 (5)
4.4pF(4R4)	W, B	0.3(3)	0.5(5)
4.5pF(4R5)	W, B	0.3(3)	0.5(5)
4.6pF(4R6)	W, B	0.3(3)	0.5(5)
4.7pF(4R7)	W, B	0.3(3)	0.5 (5)
4.8pF(4R8)	W, B	0.3(3)	0.5 (5)
4.9pF(4R9)	W, B	0.3(3)	0.5 (5)
5.0pF(5R0)	W, B	0.3(3)	0.5 (5)
5.1pF(5R1)	W, B, C	0.3(3)	0.5 (5)
5.2pF(5R2)	W, B, C	0.3(3)	0.5 (5)
5.3pF(5R3)	W, B, C	0.3(3)	0.5 (5)
5.4pF(5R4)	W, B, C	0.3(3)	0.5(5)
5.5pF(5R5)	W, B, C	0.3(3)	0.5 (5)
5.6pF(5R6)	W, B, C	0.3(3)	0.5 (5)
5.7pF(5R7)	W, B, C	0.3(3)	0.5 (5)
5.8pF(5R8)	W, B, C	0.3(3)	0.5 (5)
5.9pF(5R9)	W, B, C	0.3(3)	0.5 (5)
6.0pF(6R0)	W, B, C	0.3(3)	0.5(5)
6.1pF(6R1)	W, B, C	0.3(3)	0.5 (5)
6.2pF(6R2)	W, B, C	0.3(3)	0.5 (5)
6.3pF(6R3)	W, B, C	0.3(3)	0.5 (5)
6.4pF(6R4)	W, B, C	0.3(3)	0.5 (5)
6.5pF(6R5)	W, B, C	0.3(3)	0.5(5)
6.6pF(6R6)	W, B, C	0.3(3)	0.5(5)
6.7pF(6R7)	W, B, C	0.3(3)	0.5(5)
6.8pF(6R8)	W, B, C	0.3 (3)	0.5(5)
6.9pF(6R9)	W, B, C		0.5(5)
7.0pF(7R0)	W, B, C		0.5(5)
7.1pF(7R1)	W, B, C		0.5(5)
7.2pF(7R2)	W, B, C		0.5(5)
7.3pF(7R3)	W, B, C		0.5(5)
7.4pF(7R4)	W, B, C		0.5(5)
7.5pF(7R5)	W, B, C		0.5(5)
7.6pF(7R6)	W, B, C		0.5(5)
7.7pF(7R7)	W, B, C		0.5(5)
7.8pF(7R8)	W, B, C		0.5(5)
7.9pF(7R9)	W, B, C		0.5(5)
8.0pF(8R0)	W, B, C		0.5(5)
8.1pF(8R1)	W, B, C		0.5 (5)
8.2pF(8R2)	W, B, C		0.5(5)
8.3pF(8R3)	W, B, C		0.5(5)
8.4pF(8R4)			0.5(5)
8.5pF(8R5)			0.5(5)
			· · · · · · · · · · · · · · · · · · ·

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

The part numbering code is shown in $\ (\).$

Dimensions are shown in mm and Rated Voltage in Vdc.

Specifications and Test Methods

NI -	No. Item		Specifications		TestMolley	
No.	Ite	em	Temperature Compensating Type	Test Method		
1	Operating Temperati		-55 to +125℃	Reference Temperature: 25°C (2C, 3C, 4C: 20°C)		
2	2 Rated Voltage		Oltage See the previous pages.		defined as the maximum voltage which nuously to the capacitor. superimposed on DC voltage, VP-P or VO-P, should be maintained within the rated	
3	Appearar	nce	No defects or abnormalities	Visual inspection		
4	Dimensio	ons	Within the specified dimensions	Using calipers		
5	Dielectric	Strength	No defects or abnormalities	is applied between th	observed when 300% of the rated voltage terminations for 1 to 5 seconds, discharge current is less than 50mA.	
6	Insulation (I.R.)	Resistance	10,000M Ω min. or 500 Ω · F min. (Whichever is smaller)		ance should be measured with a DC g the rated voltage at 25℃ and 75%RH nutes of charging.	
7	Capacita	nce	Within the specified tolerance	•	hould be measured at 25°C at the	
			20pF may : 0>400 200	frequency and voltag		
8	Q	30pF max.: Q≥400+20C C: Nominal Capacitance (pF)		Frequency	1±0.1MHz 0.5 to 5Vrms	
			. " ,	Voltage	0.5 to 541115	
		Capacitance Change	Within the specified tolerance (Table A)	each specified tempe	•	
		Temperature Coefficient	Within the specified tolerance (Table A)	Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, (5C: +25 to 125℃: other temp. coeffs.: +20 to 125℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3. Step Temperature (℃) Reference Temp. ±2		
9	Capacitance Temperature Characteristics	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.)			
					2	-55±3
				3 4	Reference Temp. ±2 125±3	
				5	Reference Temp. ±2	
10	Adhesive Strength of Termination				Fig. 1 using a eutectic with the test jig for 10-with an iron or using the with care so that the sas heat shock.	o the test jig (glass epoxy board) shown in a solder. Then apply a 5N* force in parallel ±1 sec. The soldering should be done either the reflow method and should be conducted soldering is uniform and free of defects such *2N (GJM03) **Description* **Solder resist* **Baked electrode or copper foil **Description* **Description*
					(in mm)	
					Fig. 1	



S	pecific Continued fr		s and Test Methods			
		·	Specifications			
No.	Ite	em	Temperature Compensating Type	Test Method		
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board) in the		
		Capacitance	Within the specified tolerance	same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion		
Vibration Resistanc		Q	Q≥400+20C C: Nominal Capacitance (pF)	having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).		
			No cracking or marking defects should occur.	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3.		
12	12 Deflection				\$\frac{b}{c}\$\$ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing speed: 1.0mm/sec. Pressurize
			100 t: 0.8mm			

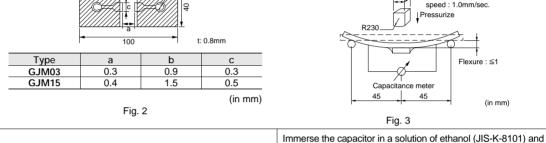


			Fig. 2	Fig. 3				
13	3 Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.				
			The measured and observed characteristics should satisfy the specifications in the following table.					
		Appearance	No marking defects					
14	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 or Sn-3.0Ag-0.5Cu				
14	Heat	Q	Q≥400+20C C: Nominal Capacitance (pF)	solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours.				
		I.R.	More than $10,000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller)					
		Dielectric Strength	No failure					
			The measured and observed characteristics should satisfy the specifications in the following table.	Fix the conscitor to the currenting iie in the come manner and				
		Appearance No marking defects		Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles				
4-	Temperature	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.				
15	Cycle	Q	Q≥400+20C C: Nominal Capacitance (pF)	Step 1 2 3 4 Temp. (°C) Min. Operating Temp. ±3 Temp. Room Temp. ±3 Temp. Max. Operating Temp. ±3 Temp. Room Temp. ±3 Temp.				
		I.R.	More than 10,000M Ω or 500 Ω · F (Whichever is smaller)	Time (min.) 30±3 2 to 3 30±3 2 to 3				
		Dielectric Strength	No failure					
			The measured and observed characteristics should satisfy the specifications in the following table.					
		Appearance	No marking defects					

Step	1	2	3	4
Temp. (℃)	Min. Operating Temp. [±] 3	Room Temp.	Max. Operating Temp. ^{±3}	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

Let the capacitor sit at $40\pm2^{\circ}$ C and 90 to 95% humidity for 500±12 hours.

Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.

Continued on the following page.





16

Humidity,

Steady

State

Capacitance

Change

Q

I.R.

Within ±5% or ±0.5pF

(Whichever is larger)

10pF and below: Q≥200+10C C: Nominal Capacitance (pF)

10pF and over, 30pF and below: Q≥275+ 5/2 C

More than $10,000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller)

Specifications and Test Methods

Continued from the preceding page.

	Continued fr	om me preci	euing page.	T	
No.	o. Item		Specifications	Test Method	
140.			Temperature Compensating Type	rest method	
			The measured and observed characteristics should satisfy the specifications in the following table.		
		Appearance	No marking defects		
17	Humidity	Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours.	
17	Load	Q	30pF and below: Q≧100+ 10 C C: Nominal Capacitance (pF)	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 $500 \text{M}\Omega$ or $25 \Omega \cdot \text{F}$ (Whichever is smaller)		
		Dielectric Strength No failure			
		The measured and observed characteristics should satisfy the specifications in the following table.			
		Appearance	No marking defects		
	High	Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours	
18	Temperature Load	Q	10pF and over, 30pF and below: Q≥275+ ½ C 10pF and below: Q≥200+10C C: Nominal Capacitance (pF)	(temperature compensating type) at room temperature, then measure. The charge/discharge current is less than 50mA.	
		I.R.	More than 1,000M Ω or 50 Ω · F (Whichever is smaller)		
		Dielectric Strength	No failure		
19	ESR		0.5pF≦C≦1pF: 350mΩ below 1pF <c≦5pf: 300mω="" below<br="">5pF<c≦10pf: 250mω="" below<="" td=""><td>The ESR should be measured at room temperature, and frequency 1±0.2GHz with the equivalent of BOONTON Model 34A.</td></c≦10pf:></c≦5pf:>	The ESR should be measured at room temperature, and frequency 1±0.2GHz with the equivalent of BOONTON Model 34A.	
			10pF <c≦20pf: 400mω="" below<="" td=""><td>The ESR should be measured at room temperature, and frequency 500±50MHz with the equivalent of HP8753B.</td></c≦20pf:>	The ESR should be measured at room temperature, and frequency 500±50MHz with the equivalent of HP8753B.	

Table A

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

^{*1:} Nominal values denote the temperature coefficient within a range of 25 to 125°C.

(2)

(-)	Nominal Values (ppm/℃) *2	Capacitance Change from 20°C Value (%)						
Char.		_55°C		−25 ℃		-10°C		
		Max.	Min.	Max.	Min.	Max.	Min.	
2C	0±60	0.82	-0.45	0.49	-0.27	0.33	-0.18	
3C	0±120	0.37	-0.90	0.82	-0.54	0.55	-0.36	
4C	0±250	0.56	-0.88	1.54	-1.13	1.02	-0.75	

^{*2:} Nominal values denote the temperature coefficient within a range of 20 to 125°C.

Chip Monolithic Ceramic Capacitors



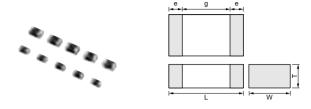
High Frequency GQM Series

■ Features

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

Applications

High frequency circuit (Mobile telecommunications, etc.)



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

Part Number	GQN	118	GQM2	21
LxW	1.6xl	0.8	2.0x1	25
тс	C0((5 0	G ;)	C0G (5C)	i
Rated Volt.	100 (2A)	50 (1H)	100 (2A)	50 (1H)
Capacitance (Capaci	tance part numbering code) a	and T (mm) Dimension (T Dimen	sion part numbering code)	
0.50pF(R50)	0.8(8)		0.85(9)	
0.75pF(R75)	0.8(8)		0.85(9)	
1.0pF(1R0)	0.8(8)		0.85(9)	
1.1pF(1R1)	0.8(8)		0.85(9)	
1.2pF(1R2)	0.8(8)		0.85(9)	
1.3pF(1R3)	0.8(8)		0.85(9)	
1.5pF(1R5)	0.8(8)		0.85(9)	
1.6pF(1R6)	0.8(8)		0.85(9)	
1.8pF(1R8)	0.8(8)		0.85(9)	
2.0pF(2R0)	0.8(8)		0.85(9)	
2.2pF(2R2)	0.8(8)		0.85(9)	
2.4pF(2R4)	0.8(8)		0.85(9)	
2.7pF(2R7)	0.8(8)		0.85(9)	
3.0pF(3R0)	0.8(8)		0.85(9)	
3.3pF(3R3)	0.8(8)		0.85(9)	
3.6pF(3R6)	0.8(8)		0.85(9)	
3.9pF(3R9)	0.8(8)		0.85(9)	
4.0pF(4R0)	0.8(8)		0.85(9)	
4.3pF(4R3)	0.8(8)		0.85(9)	
4.7pF(4R7)	0.8(8)		0.85(9)	
5.0pF(5R0)	0.8(8)		0.85(9)	
5.1pF(5R1)	0.8(8)		0.85(9)	
5.6pF(5R6)	0.8(8)		0.85(9)	
6.0pF(6R0)	0.8(8)		0.85(9)	
6.2pF(6R2)	0.8(8)		0.85(9)	
6.8pF(6R8)	0.8(8)		0.85(9)	
7.0pF(7R0)		0.8(8)	0.85(9)	
7.5pF(7R5)		0.8(8)	0.85(9)	
8.0pF(8R0)		0.8(8)	0.85(9)	
8.2pF(8R2)		0.8(8)	0.85(9)	
9.0pF(9R0)		0.8(8)	0.85(9)	
9.1pF(9R1)		0.8(8)	0.85(9)	
10pF(100)		0.8(8)	0.85(9)	

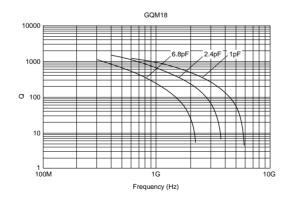
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Part Number	GQM18		GQ	M21
LxW	1.6x0.8		2.0)	(1.25
тс	C0G (5C)		C (5	0G 6C)
Rated Volt.	100 (2A)	50 (1H)	100 (2A)	50 (1H)
Capacitance (Capacita	ance part numbering code) and	T (mm) Dimension (T Dimer	sion part numbering code)	
11pF(110)		0.8(8)	0.85(9)	
12pF(120)		0.8(8)	0.85(9)	
13pF(130)		0.8(8)	0.85(9)	
15pF(150)		0.8(8)	0.85(9)	
16pF(160)		0.8(8)	0.85(9)	
18pF(180)		0.8(8)	0.85(9)	
20pF(200)		0.8(8)		0.85(9)
22pF(220)		0.8(8)		0.85 (9)
24pF(240)		0.8(8)		0.85(9)
27pF(270)		0.8(8)		0.85 (9)
30pF(300)		0.8(8)		0.85 (9)
33pF(330)		0.8(8)		0.85 (9)
36pF(360)		0.8(8)		0.85(9)
39pF(390)		0.8(8)		0.85(9)
43pF(430)		0.8(8)		0.85 (9)
47pF(470)		0.8(8)		0.85(9)
51pF(510)		0.8(8)		0.85(9)
56pF(560)		0.8(8)		0.85(9)
62pF(620)		0.8(8)		0.85 (9)
68pF(680)		0.8(8)		0.85(9)
75pF(750)		0.8(8)		0.85(9)
82pF(820)		0.8(8)		0.85(9)
91pF(910)		0.8(8)		0.85(9)
100pF(101)		0.8(8)		0.85(9)

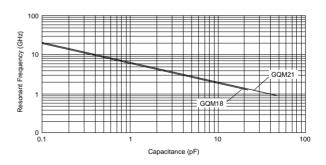
The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

■ Q - Frequency Characteristics



Resonant Frequency - Capacitance



Specifications and Test Methods

No.	Ite	Item Specifications		Test Method			
1	Operating Temperati		-55 to 125℃	Reference Temperature: 25℃ (2C, 3C, 4C: 20℃)			
2	·		See the previous page.	The rated voltage is may be applied conti When AC voltage is whichever is larger, s voltage range.	inuously to th superimpose	ie capacitor. d on DC volta	ge, V ^{p.p} or V ^{o.p} ,
3	Appearar	nce	No defects or abnormalities	Visual inspection			
4	Dimensio	n	Within the specified dimensions	Using calipers			
5	Dielectric	: Strength	No defects or abnormalities	No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.			
6	6 Insulation Resistance		More than $10,000M\Omega$ (Whichever is smaller)	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%R max. and within 2 minutes of charging.			
7	Capacita	nce	Within the specified tolerance	The capacitance/Q s			at the
			30pF min.: Q≧1400	frequency and voltag	ge shown in th	he table.	
8	Q		30pF max.: Q≥800+20C	Frequency		1±0.1MHz	-
U	Q		C. Naminal Canacitanas (a E)	Voltage		0.5 to 5Vrm	S
			C: Nominal Capacitance (pF)				
	Capacitance		Within the specified tolerance (Table A)	The temperature coe		-	the capacitance
		Change		measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5			
	Temperature Coefficient		Within the specified tolerance (Table A)	the capacitance should be within the specified tolerance for the			
9		re	ature eristics	temperature coefficient and capacitance change as in Table A. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the steps 1, 3 and 5 by the capacitance value in step 3. Step Temperature (°C)			
			acitance Within ±0.2% or ±0.05pF (Whichever is larger)	1	Ref	erence Temp.	<u>±2</u>
		Dillit	(Willonever is larger)	3		-55±3	
				4	Ret	erence Temp. 125±3	±2
				5	Pof	erence Temp.	+2
					IXEI	erence remp.	
	Adhesive Strength		No removal of the terminations or other defect should occur.	Solder the capacitor t Fig. 1 using a eutectic with the test jig for 10. The soldering should reflow method and sh soldering is uniform a	c solder. Then ±1 sec. be done eithe hould be cond	n apply 10N* fo er with an iron of lucted with care	or using the e so that the
10	of Termin		+				
				Type	a	b	C
				GQM18 GQM21	1.0	3.0 4.0	1.2 1.65
			Solder resist Baked electrode or	<u> </u>			(in mm)
			copper foil		Fig.	1	
		Appearance No defects or abnormalities		Solder the capacitor to the test jig (glass epoxy board) in th		board) in the	
	Capacitance		Within the specified tolerance	same manner and ur			` '
11	Vibration Resistance	Q	30pF min.: Q≥1400 30pF max.: Q≥800+20C	The capacitor should having a total amplituuniformly between the frequency range, from be traversed in approximation.	ude of 1.5mm le approxima m 10 to 55Hz	n, the frequence te limits of 10 a and return to	y being varied and 55Hz. The
			C: Nominal Capacitance (pF)	This motion should be 3 mutually perpendic		-	



sales representatives or product engineers before ordering.

• This PDF catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

Specifications and Test Methods

Continued from the preceding page Specifications No Item Test Method Solder the capacitor on the test jig (glass epoxy board) shown No crack or marked defect should occur. in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 50 Pressurizing speed: 1.0mm/sec. Pressurize Deflection 100 t: 1.6mm Flexure : ≤1 Type а h С GQM18 1.0 3.0 1.2 GQM21 4.0 1.65 45 (in mm) Fig. 2 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 Solderability of 75% of the terminations are to be soldered evenly 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in Termination and continuously. eutectic solder solution for 2±0.5 seconds at 230±5℃ or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. The measured and observed characteristics should satisfy the specifications in the following table. No marking defects Appearance Capacitance Within $\pm 2.5\%$ or ± 0.25 pF (Whichever is larger) Change Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the Resistance capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution 30pF min.: Q≥1400 to Soldering 14 at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 30pF max.: Q≥800+20C Heat Q 24±2 hours. C: Nominal Capacitance (pF) I.R. More than $10,000M\Omega$ Dielectric No failure Strength

			specifications in the following table.
		Appearance	No marking defects
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)
15	Temperature Cycle	Q	30pF min.: Q≥1400 30pF max.: Q≥800+20C
			C: Nominal Capacitance (pF)
		I.R.	More than 10,000M Ω
		Dielectric Strength	No failure
			The measured and observed characteristics should satisfy the

Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments

listed in the following table. Let sit for 24±2 hours at room temperature, then measure.

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

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



Continued from the preceding page.

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

Table A

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

 $[\]pm 1$: Nominal values denote the temperature coefficient within a range of 25 to 125°C.

Chip Monolithic Ceramic Capacitors

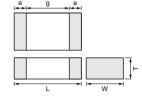


High Frequency Type ERB Series

■ Features (ERB Series)

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





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

Applications

High frequency and high-power circuits

Part Number	ER	B18		ERI	B21				ER	B32		
LxW	1.62	x0.8		2.0x	1.25			3.2x2.5				
тс		DG C)		C((5)						0G (C)		
Rated Volt.	250 (2E)	200 (2D)	250 (2E)	200 (2D)	100 (2A)	50 (1H)	500 (2H)	300 (YD)	250 (2E)	200 (2D)	100 (2A)	50 (1H)
Capacitance (Ca	pacitance	part numb	ering code)	and T (mm) Dimensio	n (T Dimen	sion part nu	umbering c	ode)			
0.50pF(R50)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
0.75pF(R75)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.0pF(1R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.1pF(1R1)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.2pF(1R2)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.3pF(1R3)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.5pF(1R5)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.6pF(1R6)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
1.8pF(1R8)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
2.0pF(2R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
2.2pF(2R2)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
2.4pF(2R4)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
2.7pF(2R7)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
3.0pF(3R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
3.3pF(3R3)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
3.6pF(3R6)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
3.9pF(3R9)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
4.0pF(4R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
4.3pF(4R3)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
4.7pF(4R7)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
5.0pF(5R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
5.1pF(5R1)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
5.6pF(5R6)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
6.0pF(6R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
6.2pF(6R2)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
6.8pF(6R8)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
7.0pF(7R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
7.5pF(7R5)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
8.0pF(8R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
8.2pF(8R2)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
9.0pF(9R0)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
9.1pF(9R1)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					

Note • This PDF catalog is downloaded from the website of Murata Manufacturing co., ltd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering.

• This PDF catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

\overline{A}	Continu	ed from	the pre	eceding	page.

	· · · · · · · · · · · · · · · · · · ·											
Part Number	ER	B18		ER	B21				ER	B32		
LxW	1.6	x0.8		2.0x	1.25		3.2x2.5					
тс	C((5	0G C)		C(5)G C)		C0G (5C)					
Rated Volt.	250 (2E)	200 (2D)	250 (2E)	200 (2D)	100 (2A)	50 (1H)	500 (2H)	300 (YD)	250 (2E)	200 (2D)	100 (2A)	50 (1H)
Capacitance (Ca	pacitance	part numb	ering code)	and T (mm) Dimensio	n (T Dimen	sion part n	umbering o	ode)			
10pF(100)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
11pF(110)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
12pF(120)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
13pF(130)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
15pF(150)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
16pF(160)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
18pF(180)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
20pF(200)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
22pF(220)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
24pF(240)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
27pF(270)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
30pF(300)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
33pF(330)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
36pF(360)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
39pF(390)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
43pF(430)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
47pF(470)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
51pF(510)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
56pF(560)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
62pF(620)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
68pF(680)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
75pF(750)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
82pF(820)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
91pF(910)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
100pF(101)	0.9(8)	0.9(8)	1.35(B)	1.35(B)			1.7(Q)					
110pF(111)	0.7(0)	0.7(0)	1.55(D)	1.55(b)	1.35(B)		1.7(Q)					
120pF(121)					1.35(B)		1.7(Q)					
							1.7(04)	1.7(0)				
130pF(131)					1.35(B)	1.35(B)		1.7(Q) 1.7(Q)				
150pF(151) 160pF(161)						1.35(B)		1.7(Q)	1.7(Q)	1.7(Q)		
180pF(181)						1.33(D)			1.7(Q)			
										1.7(Q)		
200pF(201) 220pF(221)									1.7(Q) 1.7(Q)	1.7(Q) 1.7(Q)		
240pF(241)									1.7(0)	1.7(02)	1.7(Q)	
270pF(271)											1.7(Q)	
300pF(301)											1.7(Q)	
330pF(331)											1.7(Q)	
360pF(361)											1.7(Q)	
390pF(391)											1.7(Q)	
430pF(431)											1.7(Q)	
470pF(471)											1.7(Q)	4 7/6
510pF(511)												1.7(Q)
560pF(561)												1.7(Q)
620pF(621)												1.7(Q)
680pF(681)												1.7(Q)
750pF(751)												1.7(Q)
820pF(821)												1.7(Q)
910pF(911)												1.7(Q)
1000pF(102)												1.7(Q)

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

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



Continued from the preceding page.

No.	Ite	em	Specifications	Test Method				
	Appearance Capacitance		No defects or abnormalities Within the specified tolerance	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion				
11	Vibration Resistance	Q	Satisfies the initial value. $C \leq 220 pF : Q \geq 10,000$ $220 pF < C \leq 470 pF : Q \geq 5,000$ $470 pF < C \leq 1,000 pF : Q \geq 3,000$ C: Nominal Capacitance (pF)	having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).				
12	12 Deflection		No crack or marked defect should occur. 20 50 Pressurizing speed: 1.0mm/sec. Pressurize 04.5	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.				
			Capacitance meter 45 45 Fig. 3a Flexure : ≤1 Flexure : ≤1	Type a b c ERB18 1.0 3.0 1.2 ERB21 1.2 4.0 1.65 ERB32 2.2 5.0 2.9 (in mm)				
	Tigota			Immerse the capacitor in a solution of isopropyl alcohol an				

Solderability of 95% of the terminations are to be soldered evenly and Termination continuously.

specifications in the following table.

rosin (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution for 5±0.5 seconds at 245±5℃.

Resistance to Soldering Heat

> Temperature Cycle

Humidity

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

The measured and observed characteristics should satisfy the

Preheat according to the conditions listed in the table below. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours.

0	p Size	Preheat Condition		
2.0×1.2	5mm max.	1minute at 120 to 150°C		
3.2×2.5	mm	Each 1 minute at 100 to 120℃ and then 170 to 200℃		

The measured and observed characteristics should satisfy the specifications in the following table.

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

Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.

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

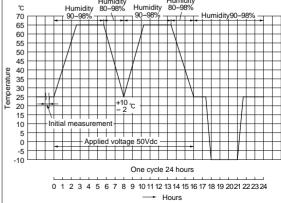
C: Nominal Capacitance (pF)

C: Nominal Capacitance (pF)

The measured and observed characteristics should satisfy the

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

Apply the 24-hour heat (-10 to +65°C) and humidity (80 to 100%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure



Continued from the preceding page.

	-			
No.	Item	Specifications		Test Method
		The measured and observed characteristics should satisfy the specifications in the following table.		
17	High Temperature Load	Appearance Capacitance Change	Specifications No marked defect Within ±3% or ±0.3pF (Whichever is larger) C≥30pF : Q≥350 10pF≤C<30pF : Q≥275+ ½ C	Apply 200% (500V only 150%) of the rated voltage for 1,000±12 hours at 125±3°C. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		I.R. Dielectric Strength	C<10pF : Q≥200+10C 1,000MΩ min. No failure C: Nominal Capacitance (pF)	

Table A-6

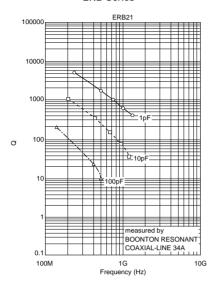
Char.	Nominal Values (ppm/°C) Note 1	Capacitance Change from 25℃ (%)					
		- 55		-30		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	-0.24	0.40	-0.17	0.25	-0.11

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

ERB Series Data

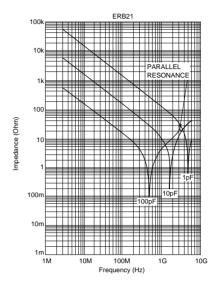
Q - Frequency Characteristics

ERB Series



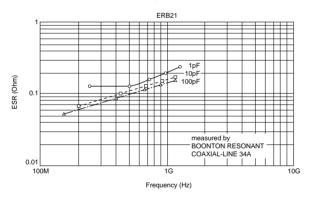
Impedance - Frequency Characteristics

ERB Series



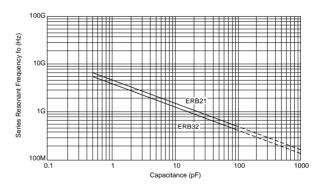
■ ESR - Frequency Characteristics

ERB Series

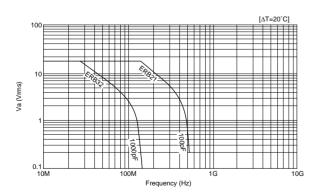


Resonant Frequency - Capacitance

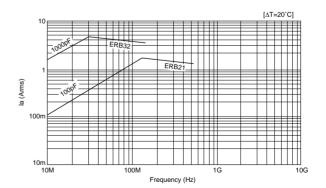
ERB Series



Allowable Voltage - Frequency



Allowable Current - Frequency







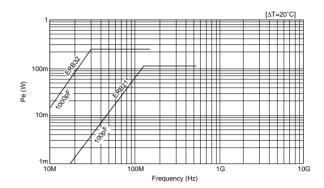
ERB Series Data

Continued from the preceding page.

Allowable Apparent Power - Frequency

[ΔT=20°C Pa (VA) 1G Frequency (Hz)

■ Allowable Effective Power - Frequency





Package

■ Minimum Quantity Guide

Part Number		Dimensions (mm)		a120n	nm Reel		ty (pcs.) nm Reel			
Packaging Code		L W T		Paper Tape Embossed Tape		Paper Tape	Embossed Tape	Bulk Case	Bulk Bag	
					D	L	J	К	С	Bulk : B Tray : T
	GRM02	0.4	0.2	0.2	20,000	-	-	-	_	1,000
	GRM03	0.6	0.3	0.3	15,000	_	50,000	-	-	1,000
				0.25	10,000	-	50,000	-	-	1,000
	GRM15	1.0	0.5	0.5	10,000	-	50,000	-	50,000	1,000
	GRM18	1.6	0.8	8.0	4,000	-	10,000	-	15,000 ¹⁾	1,000
				0.6	4,000	-	10,000	-	10,000	1,000
	GRM21	2.0	1.25	0.85/1.0	4,000	-	10,000	-	-	1,000
				1.25	-	3,000	-	10,000	5,000 2)	1,000
				0.6/0.85	4,000	-	10,000	-	-	1,000
	GRM31	3.2	1.6	1.15	-	3,000	-	10,000	-	1,000
				1.6	-	2,000	-	6,000	-	1,000
For General				0.85	-	4,000	-	10,000	-	1,000
Purpose	ODMOO	0.0	0.5	1.15	-	3,000	-	10,000	-	1,000
	GRM32	3.2	2.5	1.35	-	2,000	-	8,000	-	1,000
				1.6 1.8/2.0 2.5	-	2,000	<u> </u>	6,000	-	1,000 1,000
				1.15		1,000 1,000	-	4,000 5,000	-	1,000
				1.15 1.35/1.6 1.8/2.0	<u> </u>	1,000	<u> </u>	4,000	-	1,000
	GRM43	4.5	3.2	2.5		500	<u> </u>	2,000	-	1,000
				2.8	-	500	-	1,500	-	500
	GRM55 5.7			1.15		1,000	-	5,000		1,000
				1.35/1.6 1.8/2.0	_	1,000	_	4,000	-	1,000
		5.7	5.0	2.5	-	500	-	2,000	-	500
				3.2	_	300	-	1,500	-	500
	GJM03	0.6	0.3	0.3	15,000	-	50,000	-	-	1,000
ligh Power Type	GJM15	1.0	0.5	0.5	10,000	_	50,000	-	50,000	1,000
	GQM18	1.6	0.8	0.8	4,000	-	10,000	-	-	1,000
	GQM21	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000
ligh Frequency	ERB18	1.6	0.8	0.9 max.	4,000	-	10,000	-	-	1,000
	ERB21	2.0	1.25	1.35 max.	-	3,000	-	10,000	-	1,000
	ERB32	3.2	2.5	1.7 max.	-	2,000	-	8,000	-	1,000
For Ultrasonic	GRM21	2.0	1.25	0.85	4,000	-	10,000	-	-	1,000
Microchip	GMA05	0.5	0.5	0.35	-	-	-	-	-	400 3)
Microcrip	GMA08	0.8	0.8	0.5	-	-	-	-	-	400 3)
	GNM1M	1.37	1.0	0.6	4,000	-	10,000	-	-	1,000
Array	GNM21	2.0	1.25	0.6/0.85	4,000	-	10,000	-	-	1,000
	GNM31	3.2	1.6	0.8	4,000	-	10,000	-	-	1,000
				1.0	-	3,000	-	10,000	-	1,000
	LLL15	0.5	1.0	0.3	10,000	-	50,000	-	-	1,000
	LLL18	0.8	1.6	0.5	-	4,000	-	10,000	-	1,000
	LLL21	1.25	2.0	0.5/0.6	-	4,000	-	10,000	-	1,000
				0.85	-	3,000	-	10,000	-	1,000
	LLL31	1.6	3.2	1.15		4,000 3,000	<u> </u>	10,000	-	1,000
	LLA18	1.6	0.8	0.5		4,000	<u> </u>	10,000	-	1,000
				0.5	<u> </u>	4,000	<u> </u>	10,000	-	1,000
Low ESL	LLA21	2.0	1.25	0.85	-	3,000		10,000	-	1,000
				0.55	-	4,000	-	10,000	-	1,000
	LLA31	3.2	1.6	0.85	-	3,000	-	10,000	-	1,000
		0.2		1.15		3,000		10,000		1,000
				0.5		4,000	-	10,000	-	1,000
	LLM21	2.0	1.25	0.85	-	3,000	-	10,000	-	1,000
				0.5	-	4,000	-	10,000	-	1,000
	LLM31	3.2	1.6	1.15	-	3,000	-	10,000	-	1,000

¹⁾ $68{,}000pF/0.1\mu F$ of 50V R7 rated are not available by bulk case.

Continued on the following page. $\begin{tabular}{|c|c|c|c|} \hline \end{tabular}$







²⁾ Dimension tolerance $\pm 0.15 \text{mm}$ rated are not available by bulk case.

³⁾ Tray

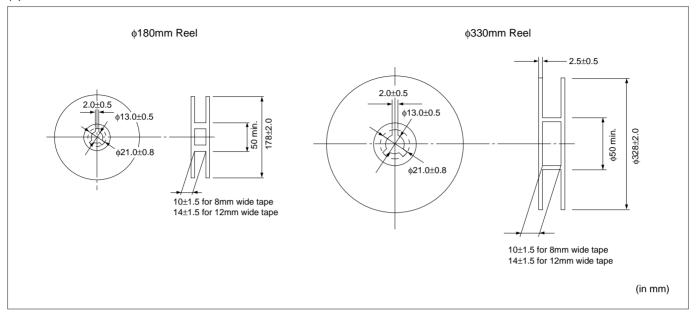
Package



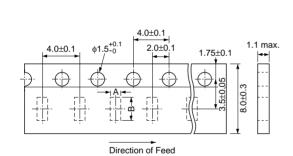
Continued from the preceding page.

■ Tape Carrier Packaging

(1) Dimensions of Reel

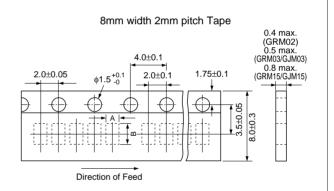


(2) Dimensions of Paper Tape



8mm width 4mm pitch Tape

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



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

*Nominal Value

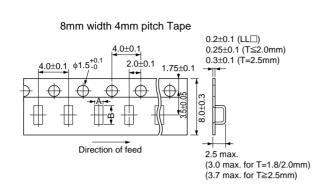
(in mm)



Package

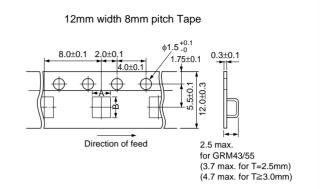
Continued from the preceding page.

(3) Dimensions of Embossed Tape



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

*Nominal Value



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

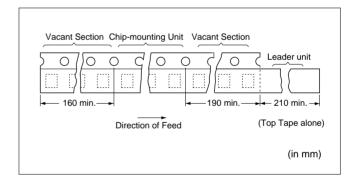
*Nominal Value

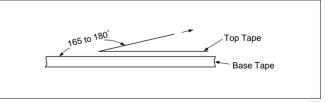
(in mm)

(4) Taping Method

- ① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
- 2 Part of the leader and part of the empty tape should be attached to the end of the tape as follows.
- 3 The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- 4 Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
- 5 The top tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.
- 6 Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.
- 7 Peeling off force: 0.1 to 0.6N* in the direction shown below.

GRM03 : 0.05 to 0.5N







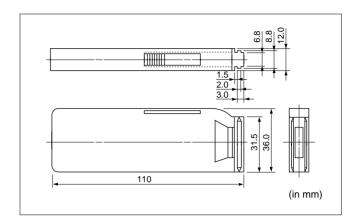


Package



Continued from the preceding page.

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





⚠Caution

Storage and Operating Conditions

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

Storage environment must be at an ambient temperature of 5-40 degree C and an ambient humidity of 20-70%RH. Use chip within 6 months. If 6 months or more have elapsed, check solderability before use.

based solder in advance.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY

Please contact Murata factory for the use of Sn-Zn

Use of Sn-Zn based solder will deteriorate

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

■ Handling

1. Inspection

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

- 2. Board Separation (or depanalization)
 - (1) Board flexing at the time of separation causes cracked chips or broken solder.
- (2) Severity of stresses imposed on the chip at the time of board break is in the order of: Pushback<Slitter<V Slot<Perforator.</p>
- (3) Board separation must be performed using special jigs, not with hands.

3. Reel and bulk case

reliability of MLCC.

In the handling of reel and case, please be careful and do not drop it.

Do not use chips from a case which has been dropped.

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



⚠Caution

■ ①Caution (Soldering and Mounting)

1. Mounting Position

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

[Component Direction]

Locate chip horizontal to the direction in which stress acts

[Chip Mounting Close to Board Separation Point]

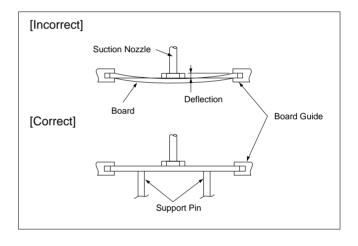
Chip arrangement Worst A-C-(B-D) Best

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

2. Chip Placing

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

(Reference Data 5. Break strength)





⚠Caution

Continued from the preceding page.

3. Reflow Soldering

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

Table 1

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

Recommended Conditions

	Pb-Sn S	Lead Free Solder		
	Infrared Reflow	Vapor Reflow	Lead Free Solder	
Peak Temperature	230-250°C	230-240°C	240-260°C	
Atmosphere	Air	Air	Air or N2	

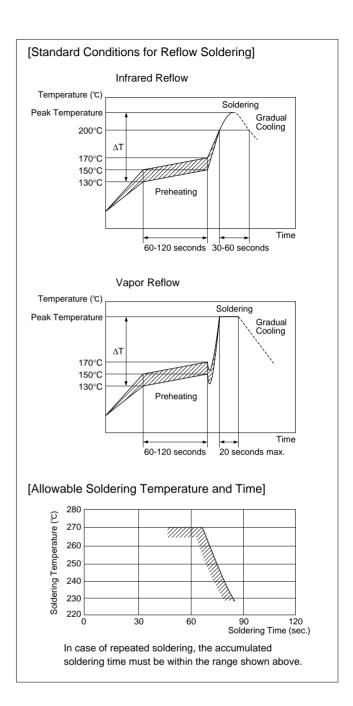
Pb-Sn Solder: Sn-37Pb Lead Free Solder: Sn-3.0Ag-0.5Cu

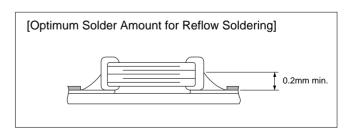
Optimum Solder Amount for Reflow Soldering

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

Inverting the PCB

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





Continued from the preceding page

4. Leaded Component Insertion

If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.

Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping.

5. Flow Soldering

- When sudden heat is applied to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity inside components. And an excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- In order to prevent mechanical damage in the components, preheating shoud be required for the both components and the PCB board. Preheating conditions are shown in table 2. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.

When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.

Do not apply flow soldering to chips not listed in Table 2.

Table 2

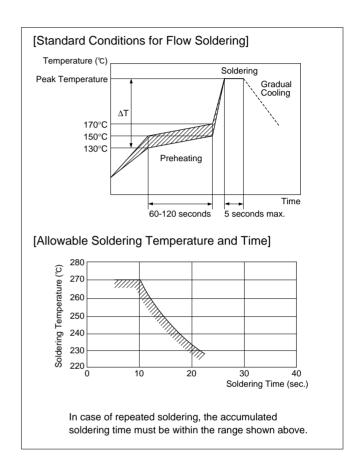
Part Number	Temperature Differential
GRM18/21/31	
LLL21/31	ΛT≤150°C
ERB18/21	Δ1≦150 C
GQM18/21	

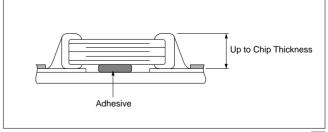
Recommended Conditions

	Pb-Sn Solder	Lead Free Solder
Peak Temperature	240-250°C	250-260°C
Atmosphere	Air	N2

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

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







⚠Caution

Continued from the preceding page.

6. Correction with a Soldering Iron

(1) For Chip Type Capacitors

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

 Optimum Solder Amount when Corrections Are Made Using a Soldering Iron

The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions. Soldering iron ø3mm or smaller should be required. And it is necessary to keep a distance between the soldering iron and the components without direct touch. Thread solder with Ø0.5mm or smaller is required for soldering.

7. Washing

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

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

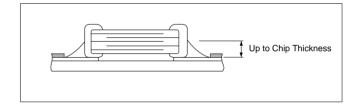
Table 3

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

*Applicable for both Pb-Sn and Lead Free Solder.

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu



Rating

Die Bonding/Wire Bonding (GMA Series)

- 1. Die Bonding of Capacitors
- •Use the following materials Brazing alloy: Au-Sn (80/20) 300 to 320 degree C in N2 atmosphere
- (1) Control the temperature of the substrate so that it matches the temperature of the brazing
- (2) Place brazing alloy on substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation in 1 minute.

- 2. Wire Bonding
- •Wire

Gold wire:

20 micro m (0.0008 inch), 25 micro m (0.001 inch) diameter

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



■ Notice (Soldering and Mounting)

1. PCB Design

(1) Notice for Pattern Forms

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

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

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

Pattern Forms

	Placing Close to Chassis	Placing of Chip Components and Leaded Components	Placing of Leaded Components after Chip Component	Lateral Mounting
Prohibited	Chassis Solder (ground) Electrode Pattern	Lead Wire	Soldering Iron Lead Wire	
Correct	Solder Resist	Solder Resist	Solder Resist	Solder Resist





Continued from the preceding page.

(2) Land Dimensions

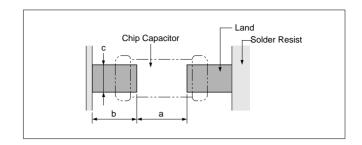


Table 1 Flow Soldering Method

Dimensions Part Number	Dimensions (LXW)	a	b	С	
GRM18 GQM18	1.6×0.8	0.6-1.0	0.8-0.9	0.6-0.8 0.8-1.1	
GRM21 GQM21	2.0×1.25	1.0-1.2	0.9-1.0		
GRM31	3.2×1.6	2.2-2.6	1.0-1.1	1.0-1.4	
LLL21	1.25×2.0	0.4-0.7	0.5-0.7	1.4-1.8	
LLL31	1.6×3.2	0.6-1.0	0.8-0.9	2.6-2.8	
ERB18	1.6×0.8	0.6-1.0	0.8-0.9	0.6-0.8	
ERB21	2.0×1.25	1.0-1.2	0.9-1.0	0.8-1.1	

(in mm)

Table 2 Reflow Soldering Method

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

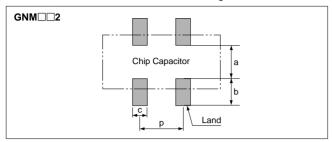
(in mm)





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GNM, LLA Series for Reflow Soldering Method



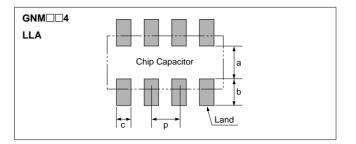


Table 3 GNM, LLA Series for Reflow Soldering Land Dimensions

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

LLM Series for Reflow Soldering Method

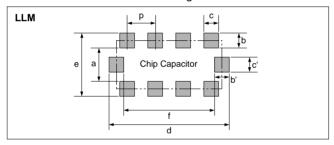


Table 4 LLM Series for Reflow Soldering Land Dimensions

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

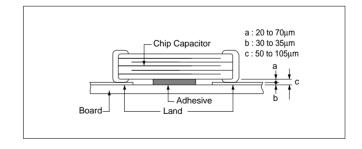
b=(c-e)/2, b'=(d-f)/2

2. Adhesive Application

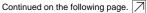
- Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. The amount of adhesive must be more than dimension c shown in the drawing at right to obtain enough bonding strength. The chip's electrode thickness and land thickness must be taken into consideration.
-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

Adhesive Coverage³

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



*Nominal Value





Notice

Continued from the preceding page.

3. Adhesive Curing

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

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

Inverting the PCB

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

4. Flux Application

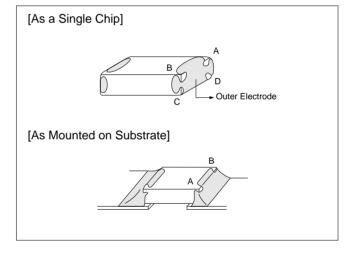
- An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability. So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
- Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently

cleaned. Use flux with a halide content of 0.2wt% max. But do not use strong acidic flux.

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

5. Flow Soldering

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



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

Others

1. Resin Coating

When selecting resin materials, select those with low contraction.

2. Circuit Design

These capacitors in this catalog are not safety recognized products

3. Remarks

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



Reference Data

1. Solderability

(1) Test Method

Subject the chip capacitor to the following conditions. Then apply flux (an ethanol solution of 25% rosin) to the chip and dip it in 230℃ eutectic solder for 2 seconds. Conditions:

Expose prepared at room temperature (for 6 months and 12 months, respectively)

Prepared at high temperature (for 100 hours at 85°C) Prepared left at high humidity (for 100 hours under 90%RH to 95%RH at 40°C) (2) Test Samples

GRM21: Products for flow/reflow soldering.

(3) Acceptance Criteria

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

(4) Results

Refer to Table 1.

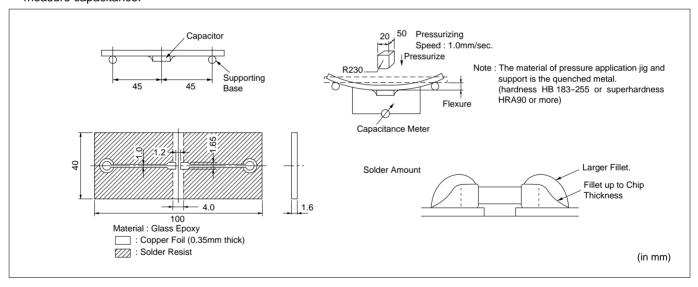
Table 1

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

2. Board Bending Strength for Solder Fillet Height

(1) Test Method

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



(2) Test Samples

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

(3) Acceptance Criteria

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

Table 2

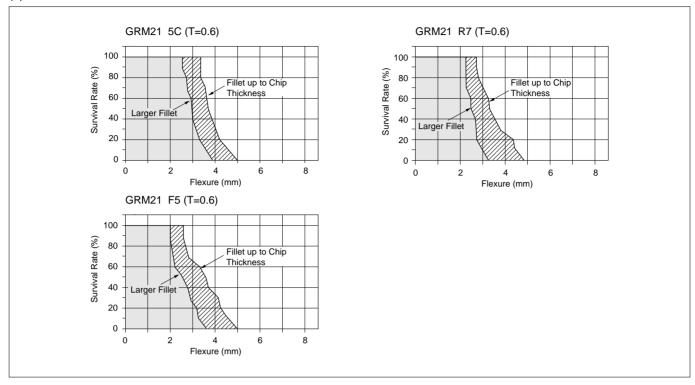
Characteristics	Change in Capacitance
5C	Within ±5% or ±0.5pF, whichever is greater
R7	Within ±12.5%
F5	Within ±20%



Reference Data

Continued from the preceding page.

(4) Results



3. Temperature Cycling for Solder Fillet Height

(1) Test Method

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

(1) Solder Amount

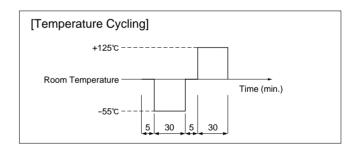
Alumina substrates are typically designed for reflow soldering.

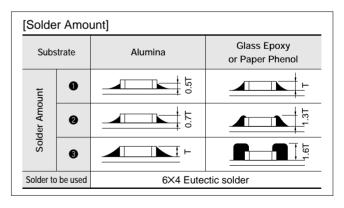
Glass epoxy or paper phenol substrates are typically used for flow soldering.

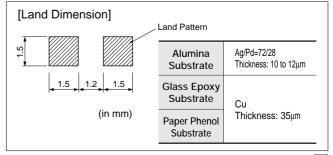
② Material

Alumina (Thickness: 0.64mm) Glass epoxy (Thickness: 1.64mm) Paper phenol (Thickness: 1.64mm)

(3) Land Dimension







Reference Data

Continued from the preceding page.

(2) Test Samples

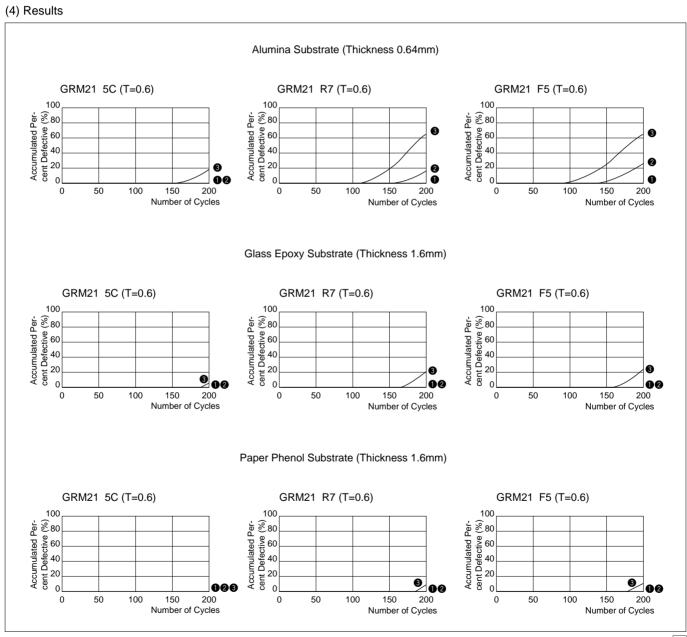
GRM21 5C/R7/F5 Characteristics T=0.6mm

(3) Acceptance Criteria

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

Table 3

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





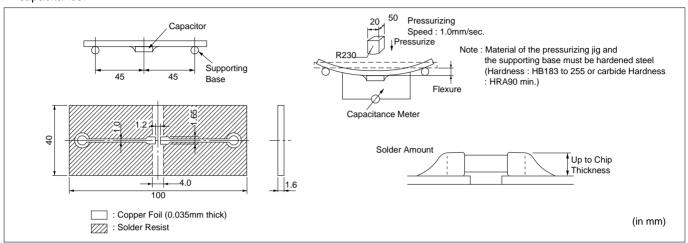
Reference Data

Continued from the preceding page.

4. Board Bending Strength for Board Material

(1) Test Method

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



(2) Test Samples

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

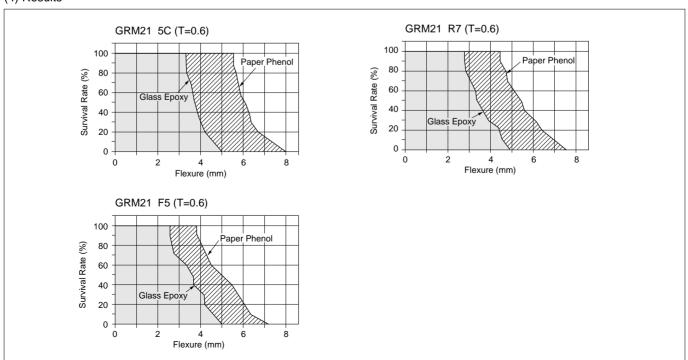
(3) Acceptance Criteria

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

Table 4

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

(4) Results



Reference Data

Continued from the preceding page.

5. Break Strength

(1) Test Method

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

(2) Test Samples

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

(3) Acceptance Criteria

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

(4) Explanation

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

The formula is:

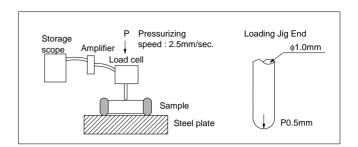
$$P = \frac{2\gamma WT^2}{3L} \quad (N)$$

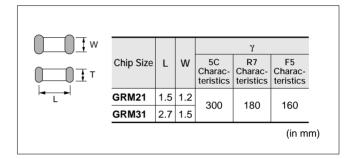
W: Width of ceramic element (mm)

T: Thickness of element (mm)

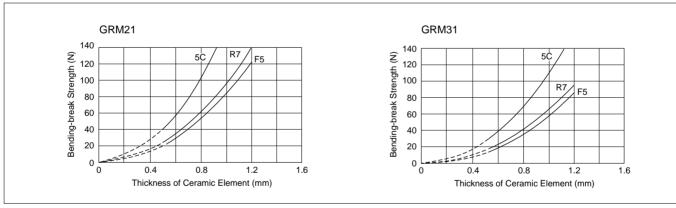
L: Distance between fulcrums (mm)

γ: Bending stress (N/mm²)





(5) Results



6. Thermal Shock

(1) Test method

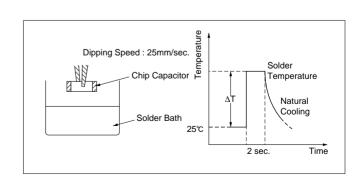
After applying flux (an ethanol solution of 25% rosin), dip the chip in a solder bath (6×4 eutectic solder) in accordance with the following conditions:

(2) Test samples

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

(3) Acceptance criteria

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



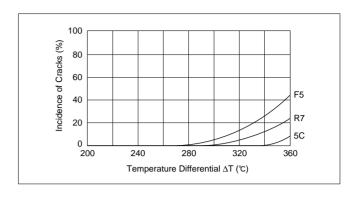




Reference Data

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

GRM21: For flow/reflow soldering T=0.6mm

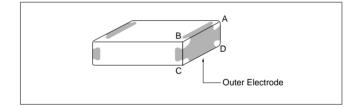
(3) Acceptance criteria

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

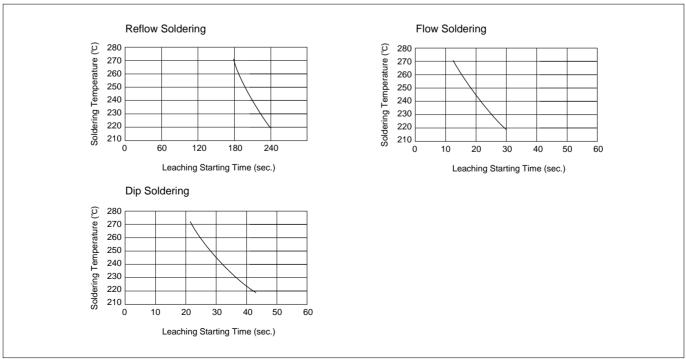
3 Dip soldering:

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.



(4) Results



Reference Data

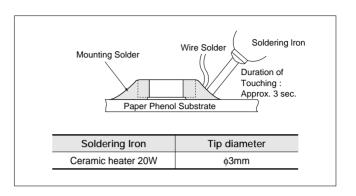
Continued from the preceding page.

8. Thermal Shock when Making Corrections with a Soldering Iron

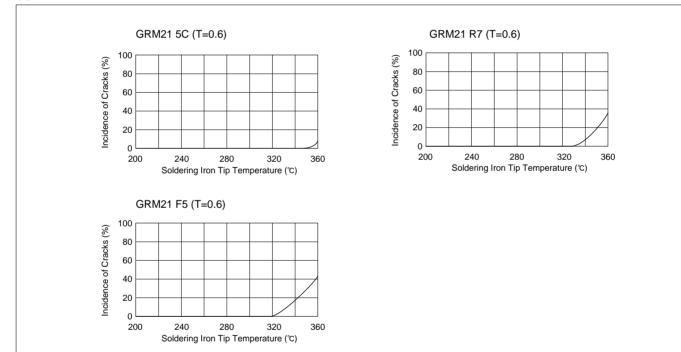
(1) Test Method

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

- (2) Test Samples GRM21 5C/R7/F5 Characteristics T=0.6mm
- (3) Acceptance Criteria for Defects Observe the appearance of the test sample with a 60-power optical microscope. Those units displaying any breaks or cracks are determined to be defective.



(4) Results



Chip Monolithic Ceramic Capacitors

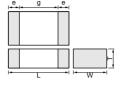


Medium Voltage Low Dissipation Factor

■ Features

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





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

* GRM31A7U3D, GRM32A7U3D, GRM32B7U3D : 1.8mm min.

Applications

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

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

Continued from the preceding page.

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

No.	Item Specifications		Specifications	Test Method				
1	Operating Temperature Range		-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 should be observed when voltage in Table is applied between the terminations for 1 to 5 sec., provided the charge/ discharge current is less than 50mA. Rated voltage				
5	Insulation I	Resistance	More than 10,000MΩ	The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage: DC250V) and within 60±5 sec. of charging.				
6	Capacita	nce	Within the specified tolerance	The capacitance/Q should be measured at the frequency and				
7	7 Q		1,000 min.	voltage shown as follows. Capacitance Frequency Voltage C<1,000pF				
8	Capacitance 8 Temperature Characteristics		Temp. Coefficient -750±120 ppm/℃ (Temp. Range: +25 to +125℃) -750+120, -347 ppm/℃ (Temp. Range: -55 to +25℃)	The capacitance measurement should be made at each step specified in Table. Step Temperature (℃) 1 25±2 2 Min. Operating Temp.±3 3 25±2 4 Max. Operating Temp.±2 5 25±2				
9	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1. Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. Tolder Told				
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board).				
		Capacitance	Within the specified tolerance	The capacitor should be subjected to a simple harmonic motion				
10	Vibration Resistance			having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). Solder resist Glass Epoxy Board				





Continued from the preceding page Specifications No Item Test Method No cracking or marking defects should occur. Solder the capacitor to the testing jig (glass epoxy board) shown Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing speed: 1.0mm/s Deflection Pressurize Dimension (mm) LXW (mm) а h Flexure=1 2.0X1.25 1.2 4.0 1.65 3.2×1.6 2.2 5.0 2.0 10 3.2X2.5 5.0 2.9 (in mm) 2.2 7.0 4 5×2 0 3.5 24 Fig. 3 Fig. 2 Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in Solderability of 75% of the terminations are to be soldered evenly solder solution for 2±0.5 sec. 12 Termination and continuously. Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Aq-0.5Cu) 235±5°C H60A or H63A Eutectic Solder Appearance No marking defects Preheat the capacitor at 120 to 150°C* for 1 min. Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Capacitance Within ±2.5% Let sit at room condition* for 24±2 hrs., then measure. Change •Immersing speed: 25±2.5mm/s Resistance 1.000 min Q to Soldering *Preheating for more than 3.2×2.5mm I.R. More than $10,000M\Omega$ Heat Time Step **Temperature** Dielectric 100 to 120℃ 1 min In accordance with item No.4 Strength 2 170 to 200℃ 1 min No marking defects Fix the capacitor to the supporting jig (glass epoxy board) shown Appearance Capacitance Within ±2.5% Perform the 5 cycles according to the 4 heat treatments listed in Change the following table. 500 min. Let sit for 24±2 hrs. at room condition*, then measure. Time (min.) More than 10,000M Ω Step Temperature (°C) I.R. Min. Operating Temp.±3 30 ± 3 1 2 Room Temp. 2 to 3 Temperature Max. Operating Temp.±2 3 30 ± 3 14 Cycle Room Temp 4 2 to 3 Dielectric In accordance with item No.4 Strength Solder resist Cu Glass Epoxy Board Fig. 4 Appearance No marking defects Capacitance Within ±5.0% Change Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% Humidity Q 350 min. 15 (Steady Remove and let sit for 24±2 hrs. at room condition*, then I.R. More than $1,000M\Omega$ State) measure. Dielectric In accordance with item No.4 Strength Appearance No marking defects Capacitance Within ±3.0% Apply 120% of the rated voltage for 1,000 ± 48 hrs. at maximum Change operating temperature ±3℃.

Remove and let sit for 24±2 hrs. at room condition*, then

The charge/discharge current is less than 50mA.

Q

I.R.

Dielectric

Strength

Life

16

350 min.

More than 1,000M Ω

In accordance with item No.4

^{* &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

1 E

Chip Monolithic Ceramic Capacitors



Medium Voltage High Capacitance for General Use

Features

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

Applications

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



Part Number	Dimensions (mm)								
Fait Number	L	L W T		е	g min.				
GRM188	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.4				
GRM21A	2.0 ±0.2	1.25 ±0.2	1.0 +0,-0.3		0.7				
GRM21B	2.0 ±0.2	1.25 ±0.2	1.25 ±0.2		0.7				
GRM31B	3.2 ±0.2	1.6 ±0.2	1.4 ± 0.2 1.25 ± 0.03						
GRM31C	3.2 ±0.2	1.0 ±0.2		12					
GRM32Q	3.2 ±0.3	2.5 ±0.2	1.5 +0,-0.3	0.3 min.	1.2				
GRM32D	3.2 ±0.3	2.5 ±0.2	2.0 +0,-0.3						
GRM43Q	4.5 ±0.4	3.2 ±0.3	1.5 +0,-0.3	22					
GRM43D		3.2 ±0.3	2.0 + 0, -0.3		2.2				
GRM55D	5.7 ±0.4	5.0 ±0.4	2.0 +0,-0.3		3.2				

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

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

No.	Ite	Item Specifications		Test Method				
1	Operating Temperature Range -55 to +125℃			-				
2	Appearan	ce	No defects or abnormalities	Visual inspection				
3	Dimension	าร	Within the specified dimensions	Using calipers				
4	Dielectric	Strength	No defects or abnormalities	No failure should be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage: DC250V, 120% of the rated voltage in case of rated voltage: DC1kV) is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.				
5	Insulation R (I.R.)	esistance	C≥0.01μF: More than 100M Ω • μF C<0.01μF: More than 10,000M Ω	The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage: DC250V) and within 60±5 sec. of charging.				
6	Capacitan	ice	Within the specified tolerance	The capacitance/D.F. should be measured at a frequency of				
7	Dissipatio Factor (D.		0.025 max.	1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)				
9	Characteristics Adhesive Strength		Cap. Change Within ±15% (Temp. Range: −55 to +125°C) No removal of the terminations or other defect should occur.	The capacitance measurement should be made at each step specified in Table. Step Temperature (°C) 1 25±2 2 Min. Operating Temp.±3 3 25±2 4 Max. Operating Temp.±2 5 25±2 • Pretreatment Perform a heat treatment at 150±90 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*. Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1. Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.				
				Glass Epoxy Board Fig. 1				
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion				
		Capacitance	Within the specified tolerance	having a total amplitude of 1.5mm, the frequency being varied				
10	Vibration Resistance	D.F. 0.025 max.		uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). Solder resist Glass Epoxy Board				

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa





Deflection

Dielectric

Strength

I.R.

Dielectric

Strength

Temperature Cycle

Continued from the preceding page Specifications No Item **Test Method** No cracking or marking defects should occur.

	"	100	,	
L×W		Dimensi	on (mm)	
(mm)	a	b	С	d
1.6×0.8	1.0	3.0	1.2	
2.0×1.25	1.2	4.0	1.65	
3.2×1.6	2.2	5.0	2.0	1.0
3.2×2.5	2.2	5.0	2.9	1.0
4.5×3.2	3.5	7.0	3.7	
5.7×5.0	4.5	8.0	5.6	

Fig. 2

Solder the capacitor to the testing jig (glass epoxy board) shown Then apply a force in the direction shown in Fig. 3.

The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.

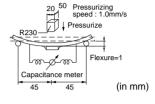


Fig. 3

12	Solderability of Termination	75% of the terminations are to be soldered evenly and continuously.

Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).

Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s

Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder

Appearance No marking defects Capacitance Within ±10% Change D.F. 0.025 max. Resistance C≧0.01μF: More than 100MΩ • μF to Soldering 13 I.R. C<0.01 μ F: More than 10,000M Ω Heat

In accordance with item No.4

C≥0.01 μ F: More than 100M Ω • μ F

C<0.01 μ F: More than 10,000M Ω

In accordance with item No.4

Preheat the capacitor at 120 to 150°C* for 1 min. Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure. •Immersing speed: 25±2.5mm/s

- Pretreatment

Perform a heat treatment at 150⁺₋₁₀ °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.

*Preheating for more than 3.2×2.5mm

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

Appearance No marking defects in Fig. 4. Capacitance Within ±7.5% Change the following table. 0.025 max. D.F.

Fix the capacitor to the supporting jig (glass epoxy board) shown Perform the 5 cycles according to the 4 heat treatments listed in

Let sit for 24±2 hrs. at room condition*, then measure.

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

Pretreatment

Perform a heat treatment at 150[±]₁0 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.

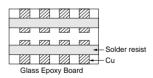


Fig. 4

15	Humidity (Steady State)	Appearance	No marking defects
		Capacitance Change	Within ±15%
		D.F.	0.05 max.
		I.R.	C≥0.01μF: More than 10M Ω • μF C<0.01μF: More than 1,000M Ω
		Dielectric Strength	In accordance with item No.4

Let the capacitor sit at $40\pm2^{\circ}$ C and relative humidity of 90 to 95% for 500 ±24 hrs. Remove and let sit for 24±2 hrs. at room condition*, then

measure Pretreatment

Perform a heat treatment at 150[±]₁₀ °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.



^{* &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued from the preceding page.

No.	Ite	em	Specifications	Test Method			
		Appearance	No marking defects	Apply 120% of the rated voltage (150% of the rated voltage in			
		Capacitance Change	Within ±15% (rated voltage: DC250V, DC630V) Within ±20% (rated voltage: DC1kV)	case of rated voltage: DC250V, 110% of the rated voltage in case of rated voltage: DC1kV) for 1,000 \pm^{-48} hrs. at maximum			
16	Life	D.F.	0.05 max.	operating temperature ±3°C. Remove and let sit for 24 ±2 hrs. at room condition*, then measure.			
10	Liio	I.R.	C≥0.01μF: More than 10M Ω • μF C<0.01μF: More than 1,000M Ω	The charge/discharge current is less than 50mA. •Pretreatment			
		Dielectric Strength	In accordance with item No.4	Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.			
		Appearance	No marking defects				
	Humidity Loading	Capacitance Change	Within ±15%	Apply the rated voltage at $40\pm2^{\circ}\text{C}$ and relative humidity of 90 to 95% for $500\pm^{24}\text{hrs}$.			
17	(Application:	D.F.	0.05 max.	Remove and let sit for 24±2 hrs. at room condition*, then measure.			
17	DC250V, DC630V	I.R.	C≥0.01μF: More than 10M Ω • μF C<0.01μF: More than 1,000M Ω	Pretreatment Apply test voltage for 60±5 min. at test temperature.			
	item) -	Dielectric Strength	In accordance with item No.4	Remove and let sit for 24±2 hrs. at room condition*.			

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

g min.

2.9

Chip Monolithic Ceramic Capacitors



Only for LCD Backlight Inverter Circuit

■ Features

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



2.0 ±0.2 1.0 +0, -0.3

4.5 ±0.3

Applications

Ideal for use as the ballast in LCD backlight inverter.

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

GRM42A

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No.	Ite	em	Specifications	Test Method	
1	Operating Temperatu	ıre Range	-55 to +125℃	-	
2	2 Appearance No defects or abnormalities		No defects or abnormalities	Visual inspection	
3	Dimensio	ns	Within the specified dimension	Using calipers	
4	Dielectric	Strength	No defects or abnormalities	No failure should be observed when DC4095V is applied between the terminations for 1 to 5 sec., provided the charge/ discharge current is less than 50mA.	
5	Insulation I (I.R.)	Resistance	More than 10,000M Ω	The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.	
6	Capacita	nce	Within the specified tolerance	The capacitance/Q should be measured at a frequency of	
7	Q		1,000 min.	1±0.2MHz and a voltage of AC0.5 to 5V(r.m.s.)	
8	Capacitar Temperat Character	ure	Temp. Coefficient 0±30 ppm/°C (Temp. Range: +25 to +125°C) 0+30, −72 ppm/°C (Temp. Range: −55 to +25°C)	The capacitance measurement should be made at each step specified in Table. Step Temperature (°C) 1 25±2 2 Min. Operating Temp.±3 3 25±2 4 Max. Operating Temp.±2 5 25±2	
9	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1. Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 10N, 10±1s Glass Epoxy Board Glass Epoxy Board	
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board).	
10	Vibration Resistance	Capacitance	Within the specified tolerance 1,000 min.	The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). Solder resist Cu Glass Epoxy Board	
			No cracking or marking defects should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown	
11	11 Deflection		Dimension (mm)	in Fig. 2. Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing speed: 1.0mm/s Pressurize Capacitance meter 45 (in mm) Fig. 3	



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Specifications and Test Methods

Continued from the preceding page.

No	Item Specifications Test Method								
No.	Ite	2111	эреспісаціоня	Test Method					
12	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder					
		Appearance	No marking defects	Preheat the capacitor as table.					
		Capacitance Change	Within ±2.5%	Immerse the capacitor in solder solution at 260±5°C for 10± Let sit at room condition* for 24±2 hrs., then measure. •Immersing speed: 25±2.5mm/s					
13	Resistance to Soldering	Q	1,000 min.						
13	Heat	I.R.	More than $10,000M\Omega$	*Preheating					
		6		Step Temperature Time					
		Dielectric Strength	In accordance with item No.4	1 100 to 120℃ 1 min.					
		Suengui		2 170 to 200°C 1 min.					
		Appearance	No marking defects	Fix the capacitor to the supporting jig (glass epoxy board) shown					
		Capacitance Change	Within ±2.5%	in Fig. 4. Perform the 5 cycles according to the 4 heat treatments listed in the following table.					
		Q	1,000 min.	Let sit for 24±2 hrs. at room condition*, then measure.					
		I.R.	More than $10,000 M\Omega$	Step Temperature (°C) Time (min.)					
14	Temperature Cycle	Dielectric Strength	In accordance with item No.4	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 Room Temp. 2 to 3 Solder resist Cu Glass Epoxy Board Fig. 4					
		Appearance	No marking defects						
	Humidity	Capacitance Change	Within ±5.0%	Let the capacitor sit at 40±2°C and relative humidity of 90 to 95%					
15	(Steady	Q	350 min.	for 500 ±2 d hrs. Remove and let sit for 24±2 hrs. at room condition*, then					
	State)	I.R.	More than 1,000M Ω	measure.					
		Dielectric Strength	In accordance with item No.4						
		Appearance	No marking defects						
		Capacitance Change	Within ±3.0%	Apply 120% of the rated voltage for 1,000 ± 48 hrs. at maximum operating temperature ±3°C.					
16	Life	Q	350 min.	Remove and let sit for 24±2 hrs. at room condition*, then					
		I.R.	More than 1,000M Ω	measure.					
		Dielectric Strength	In accordance with item No.4	The charge/discharge current is less than 50mA.					

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors



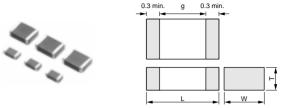
Only for Information Devices/Tip & Ring

■ Features

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

Applications

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



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

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

No.	Ite	em	Specifications	Test Method			
1	Operating Temperatu	ure Range	−55 to +125°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 should be observed when voltage in table is applied between the terminations, provided the charge/discharge current is less than 50mA. Rated voltage Test Voltage Time DC2kV 120% of the rated voltage 60±1 sec. AC1500V(r.m.s.) 60±1 sec.			
5	Pulse Vol	tage	No self healing breakdowns or flash-overs have taken place in the capacitor.	10 impulse of alternating polarity is subjected. (5 impulse for each polarity) The interval between impulse is 60 sec. Applied Voltage: 2.5kV zero to peak			
6	Insulation I (I.R.)	Resistance	More than $6{,}000M\Omega$	The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.			
7	Capacita	nce	Within the specified tolerance	The capacitance/D.F. should be measured at a frequency of			
8	Dissipation Factor (D		0.025 max.	1±0.2kHz and a voltage of AC1±0.2V(r.m.s.)			
9	Capacitance 9 Temperature Characteristics		Cap. Change within ±15% (Temp. Range: −55 to +125°C)	The capacitance measurement should be made at each step specified in Table. Step			
10	Adhesive Strength of Termination		in Fig. 1. Then apply 10N for The soldering shot should be conducted and free of defect. Adhesive Strength No removal of the terminations or other defect should occur.		No removal of the terminations or other defect should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1. Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. INN, 10±1s Glass Epoxy Board Fig. 1	
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board).			
		Capacitance	Within the specified tolerance	The capacitor should be subjected to a simple harmonic motion			
11	Vibration Resistance	D.F.	0.025 max.	having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). Solder resist Glass Epoxy Board			

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa



Continued from the preceding page Specifications No Item Test Method No cracking or marking defects should occur. Solder the capacitor to the testing jig (glass epoxy board) shown Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing speed: 1.0mm/s Deflection 12 Pressurize Dimension (mm) L×W (mm) а b С d 4.5X2.0 3.5 7 0 24 Flexure=1 1.0 4.5X3.2 3.5 7.0 3.7 Capacitance mete Fig. 2 (in mm) Fig. 3 Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Solderability of Immerse in solder solution for 2±0.5 sec. 75% of the terminations are to be soldered evenly and continuously. Termination Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder No marking defects Appearance Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5℃ for 10±1 Capacitance Within ±10% sec. Let sit at room condition* for 24±2 hrs., then measure. Change •Immersing speed: 25±2.5mm/s 0.025 max. D.F Pretreatment Perform a heat treatment at 150 ± 100 °C for 60±5 min. and then Resistance I.R More than $1,000M\Omega$ to Soldering let sit for 24±2 hrs. at room condition*. Heat *Preheating Dielectric In accordance with item No.4 Step Temperature Time Strength 100 to 120℃ 1 min 170 to 200℃ 2 1 min Appearance No marking defects Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4. Capacitance Perform the 5 cycles according to the 4 heat treatments listed in Within ±15% Change the following table D.F. 0.05 max. Let sit for 24±2 hrs. at room condition*, then measure. Temperature (°C) Time (min.) Step I.R. More than $3,000M\Omega$ 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 Temperature 15 Pretreatment Cycle Perform a heat treatment at 150±10 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*. Dielectric In accordance with item No.4 Strength *m* m m Cu Glass Epoxy Board Fig. 4 Appearance No marking defects Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% Capacitance for 500 ±24 hrs. Within +15% Change Humidity Remove and let sit for 24±2 hrs. at room condition*, then (Steady D.F. 0.05 max measure 16 Pretreatment State) I.R. More than $1,000M\Omega$ Perform a heat treatment at 150⁺₁₀ °C for 60±5 min. and then Dielectric let sit for 24±2 hrs. at room condition*.

In accordance with item No.4

Strength



^{* &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued from the preceding page.

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

^{* &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

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Chip Monolithic Ceramic Capacitors



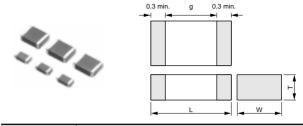
Only for Camera Flash Circuit

■ Features

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

Applications

For strobe circuit



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

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

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

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa



Continued from the preceding page.

	Continued from the preceding page.							
No.	Ite	em	Specifications	Test Method				
11	11 Deflection		No cracking or marking defects should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2. Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing speed: 1.0mm/s Pressurize R230 Flexure=1 Capacitance meter 45 (in mm) Fig. 3				
12	Solderab Terminati		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder				
		Appearance	No marking defects					
		Capacitance Change	Within ±10%	Preheat the capacitor at 120 to 150°C* for 1 min. Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition* for 24±2 hrs., then measure. •Immersing speed: 25±2.5mm/s •Pretreatment Perform a heat treatment at 150±18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*.				
13	Resistance to Soldering Heat	D.F.	0.025 max.					
		I.R.	C≥0.01μF: More than $100MΩ • μFC<0.01μF$: More than $10,000MΩ$					
		Dielectric Strength	In accordance with item No.4					
		Appearance	No marking defects	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.				
		Capacitance Change	Within ±7.5%	Perform the 5 cycles according to the 4 heat treatments listed in the following table.				
		D.F.	0.025 max.	Let sit for 24±2 hrs. at room condition*, then measure.				
		I.R.	C≥0.01μF: More than 100MΩ • μF C<0.01μF: More than 10,000MΩ	Step Temperature (℃) Time (min.) 1 Min. Operating Temp.±3 30±3				
			C<0.01μι . INIOTE ITIATI 10,000INIS2	2 Room Temp. 2 to 3				
				3 Max. Operating Temp.±2 30±3				
14	Temperature Cycle	Dielectric Strength	In accordance with item No.4	•Pretreatment Perform a heat treatment at 150 ± 18° C for 60±5 min. and then let sit for 24±2 hrs. at room condition*. Solder resist Glass Epoxy Board Fig. 4				
		Appearance	No marking defects					
		Capacitance Change	Within ±15%	Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500±26 hrs.				
15	Humidity (Steady	D.F.	0.05 max.	Remove and let sit for 24±2 hrs. at room condition*, then measure.				
13	State)	I.R.	C≥0.01μF: More than $10M\Omega$ • μF C<0.01μF: More than $1,000M\Omega$	•Pretreatment Perform a heat treatment at 150 $^{\pm}_{1}$ %°C for 60 \pm 5 min. and then				
		Dielectric Strength	In accordance with item No.4	let sit for 24±2 hrs. at room condition*.				

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa



Continued from the preceding page.

No.	Ite	em	Specifications	Test Method		
		Appearance	No marking defects			
		Capacitance Change	Within ±15%	Apply DC350V for 1,000 \pm 48 hrs. at maximum operating temperature \pm 3°C. Remove and let sit for 24 \pm 2 hrs. at room		
16	Life	D.F.	0.05 max.	condition*, then measure. The charge/discharge current is less than 50mA.		
10	Liic	I.R.	C≥0.01μF: More than 10M Ω • μF C<0.01μF: More than 1,000M Ω	Pretreatment Apply test voltage for 60±5 min. at test temperature.		
		Dielectric Strength	In accordance with item No.4	Remove and let sit for 24±2 hrs. at room condition*.		
		Appearance	No marking defects			
		Capacitance Change	Within ±15%	Apply the rated voltage at $40\pm2^{\circ}$ C and relative humidity of 90 to 95% for $500\pm^{23}$ hrs.		
17	Humidity	D.F.	0.05 max.	Remove and let sit for 24±2 hrs. at room condition*, then measure.		
.,	Loading	I.R.	C≥0.01μF: More than 10M Ω • μF C<0.01μF: More than 1,000M Ω	Pretreatment Apply test voltage for 60±5 min. at test temperature.		
		Dielectric Strength	In accordance with item No.4	Remove and let sit for 24±2 hrs. at room condition*.		

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors



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

■ Features

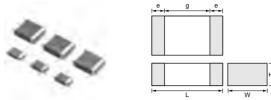
- 1. Chip monolithic ceramic capacitor for AC lines
- A new monolithic structure for small, high capacitance capable of operating at high voltage levels
- 3. Sn-plated external electrodes realizes good solderability.
- 4. Only for reflow soldering
- 5. Capacitance 0.01 to 0.1uF for connecting lines and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

■ Applications

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

■ Reference standard

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



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

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

No.	Ite	em	Specifications	Specifications Test Method		
1	Operating Temperatu	ıre Range	−55 to +125°C	-		
2	Appearar	nce	No defects or abnormalities	Visual inspection		
3	Dimensio	ns	Within the specified dimensions	Using calipers		
				No failure should be observed when vectore the terminations for 60±1 sectorarge/discharge current is less than 5	c., provided the	
4	Dielectric	Strength	No defects or abnormalities	Nominal Capacitance C≥10,000pF C<10,000pF	Test voltage AC575V (r.m.s.) AC1500V (r.m.s.)	
5	Insulation F	Resistance	More than $2,000M\Omega$	The insulation resistance should be m and within 60±5 sec. of charging.	easured with DC500±50V	
6	Capacita	nce	Within the specified tolerance	The constitution of D.E. also I.I.I.		
7	Dissipation Factor (D		0.025 max.	The capacitance/D.F. should be meas 1±0.2kHz and a voltage of AC1±0.2V		
				The capacitance measurement should specified in Table.	be made at each step	
					perature (°C)	
	Capacitar	nce	Cap. Change	1 Min. Ope	25±2 erating Temp.±3	
8	Temperat	erature Within	Within ±15%	3	25±2	
	Character	ristics	(Temp. Range: −55 to +125°C)	4 Max. Ope	erating Temp.±2 25±2	
				•Pretreatment Perform a heat treatment at 150±₁% ℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition*.		
9	Discharge Test (Application: Nominal Capacitance C<10,000pF)	Appearance	No defects or abnormalities	As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified. R3 R1 Ct: Capacitor under test Cd: 0.001μF R1: 1,000Ω R2: 100ΜΩ R3: Surge resistance		
10	Adhesive Strength of Termination		No removal of the terminations or other defects should occur.	Tanas L	of the arrow. The soldering od and should be	
		Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glas	ss epoxy board).	
		Capacitance	Within the specified tolerance	The capacitor should be subjected to a having a total amplitude of 1.5mm, the	•	
11	Vibration Resistance	D.F.	0.025 max.	uniformly between the approximate lim frequency range, from 10 to 55Hz and traversed in approximately 1 min. This for a period of 2 hrs. in each of 3 mutu directions (total of 6 hrs.).	nits of 10 and 55Hz. The return to 10Hz, should be motion should be applied	
		D.F. 0.025 max.			— Solder resist — Cu	

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa



Continued from the preceding page Specifications No Item Test Method Solder the capacitor to the testing jig (glass epoxy board) shown No cracking or marking defects should occur. Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing ↓ Pressurize Deflection t · 16 100 Flexure=1 Dimension (mm) LXW (mm) d Capacitance meter а С 4.5×2.0 3.5 7.0 (in mm) 4.5X3.2 3.5 7.0 3.7 1.0 Fig. 3 5.7×5.0 4.5 8.0 5.6 Fig. 2 Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Solderability of Immerse in solder solution for 2±0.5 sec. 75% of the terminations are to be soldered evenly and continuously. Immersing speed: 25±2.5mm/s Termination Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder No marking defects Appearance Capacitance Within ±15% Change The capacitor should be subjected to 40±2℃, relative humidity of Humidity D.F. 0.05 max. 90 to 98% for 8 hrs., and then removed in room condition* for 16 Insulation hrs. until 5 cycles. More than $1,000M\Omega$ I.R. Dielectric In accordance with item No.4 Strength Appearance No marking defects Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5℃ for 10±1 Capacitance Within ±10% sec. Let sit at room condition* for 24±2 hrs., then measure. Change •Immersing speed: 25±2.5mm/s 0.025 max. D.F Pretreatment Resistance I.R. More than $2,000M\Omega$ Perform a heat treatment at 150 ± 10 °C for 60±5 min. and then to Soldering 15 let sit for 24±2 hrs. at room condition*. Heat *Preheating Dielectric Step In accordance with item No.4 Temperature Time Strength 100 to 120℃ 1 min 2 170 to 200℃ 1 min. Fix the capacitor to the supporting jig (glass epoxy board) shown No marking defects Appearance in Fig. 4. Capacitance Within ±15% Perform the 5 cycles according to the 4 heat treatments listed in Change the following table. D.F. 0.05 max. Let sit for 24±2 hrs. at room condition*, then measure. Temperature (°C) Time (min.) I.R. More than $2,000M\Omega$ Step 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 Temperature 16 Cycle Pretreatment Perform a heat treatment at 150⁺₁₀ °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*. Dielectric In accordance with item No.4 Strength *m m m* Glass Epoxy Board

Continued on the following page.

Fig. 4



^{* &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued from the preceding page.

No.	Ite	m	Specifications	Test Method			
		Appearance	No marking defects				
	Humidity	Capacitance Change	Within ±15%	Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ±20 hrs. Remove and let sit for 24±2 hrs. at room condition*, then			
17	(Steady	D.F.	0.05 max.	measure.			
	State)	I.R.	More than 1,000M Ω	•Pretreatment Perform a heat treatment at 150 ± 10 °C for 60±5 min. and then			
		Dielectric Strength	In accordance with item No.4	Perform a heat treatment at 150 [±] ₁ 8° for 60±5 min. and then let sit for 24±2 hrs. at room condition*.			
		Appearance	No marking defects	Apply voltage and time as Table at 85±2℃. Remove and let sit			
	Life	Capacitance Change	Within ±20%	for 24 ±2 hrs. at room condition*, then measure. The charge / discharge current is less than 50mA.			
		D.F.	0.05 max.	Nominal Capacitance Test Time Test voltage C≥10,000pF 1,000 ^{±,48} hrs. AC300V (r.m.s.)			
18		I.R.	More than 1,000M Ω	C<10,000pF 1,500 ⁺⁴⁸ _o hrs. AC500V (r.m.s.)*			
	0	Dielectric Strength	In accordance with item No.4	* Except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at room condition*.			
		Appearance	No marking defects				
		Capacitance Change	Within ±15%	Apply the rated voltage at 40±2°C and relative humidity of 90 to 95% for 500±26 hrs. Remove and let sit for 24±2 hrs. at room condition*, then			
19	Humidity Loading	D.F.	0.05 max.	measure.			
	Loading	I.R.	More than 1,000M Ω	Pretreatment Apply test voltage for 60±5 min. at test temperature.			
		Dielectric Strength	In accordance with item No.4	Remove and let sit for 24±2 hrs. at room condition*.			

^{* &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Chip Monolithic Ceramic Capacitors



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

■ Features

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

Applications

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



		-	L	→ W	<u> </u>
Part Number		Dir	nensions (m	nm)	
Part Number	L	W	T	e min.	g min.
GA355D	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0

■ Standard Recognition

	Standard No.	Status of R	Rated	
	Standard No.	Type GB	Type GC	Voltage
UL	UL1414	_	0*	
BSI		_	0	
VDE	EN132400	0	0	AC250V
SEV	EN132400	0	0	(r.m.s.)
SEMKO		0	0	
EN13240	0 Class	X2	X1, Y2	

*: Line By-pass only

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

Chip Monolithic Ceramic Capacitors



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

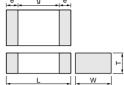
■ Features

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

Applications

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





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

Standard Recognition

	Standard	Class	Status of Recognition	Rated
	No.		Type GD	Voltage
SEMKO	EN132400	Y3	0	AC250V(r.m.s.)

App	licati	ions

Size	Switching power supplies	Communication network devices such as a modem
4.5×3.2mm and under	I	0

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

Chip Monolithic Ceramic Capacitors



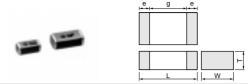
Safety Standard Recognized Type GF (IEC60384-14 Class Y2, X1/Y2)

■ Features

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

Applications

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



Part Number	Dimensions (mm)						
Part Number	L	W	T	e min.	g min.		
GA342A			1.0 +0, -0.3				
GA342D	4.5 ±0.3	2.0 ±0.2	2.0 ±0.2*		2.5		
GA342Q]		1.5 +0, -0.3	0.3			
GA352Q		2.8 ±0.3	1.5 +0, -0.3	0.3			
GA355D	5.7 ±0.4	5.0 ±0.4	2.0 +0, -0.3		4.0		
GA355Q		3.0 <u>1</u> 0.4	1.5 +0, -0.3				

^{*} GA342D1X: 2.0±0.3

Standard Recognition

7	\			Status of R		
		Standard	Class	Туре	Rated	
		No.	Class	Size : 4.5×2.0mm	Size : 5.7×2.8mm and over	Voltage
	UL	UL1414	X1, Y2	_	0	AC250V
-	SEMKO	EN132400	Y2	0	0	(r.m.s.)

Applications							
Size	Switching power supplies	Communication network devices such as a modem					
4.5×2.0mm	_	0					
5.7×2.8mm and over	0	0					

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

Chip Monolithic Ceramic Capacitors



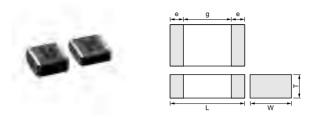
Safety Standard Recognized Type GB (IEC60384-14 Class X2)

■ Features

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

Applications

Ideal for use as X capacitor for various switching power supplies



Part Number	Dimensions (mm)						
Part Number	L	W	T	e min.	g min.		
GA355D	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0		
GA355X	3.7 ±0.4		2.7 ±0.3	0.3			

Standard Recognition

	Standard No.	Status of R	Rated	
	Standard No.	Type GB	Type GC	Voltage
UL	UL1414	_	0*	
BSI		_	0	
VDE	EN133400	0	0	AC250V
SEV	EN132400	0	0	(r.m.s.)
SEMKO		0	0	
EN132400 Class		X2	X1, Y2	

*: Line By-pass only

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

No.	Ite	em	Specifications		Test Method	
1	Operating Temperatu	ıre Range	−55 to +125°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 should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. Test Voltage Type GB DC1075V		
				Type GC/GD/GF	AC1500V (r.m.s.)	
5	Pulse Vol (Applicati GD/GF)		No self healing breakdowns or flash-overs have taken place in the capacitor.	10 impulse of alternating (5 impulse for each polar The interval between imp Applied Voltage: 2.5kV zo	ity) oulse is 60 sec.	
6	Insulation F (I.R.)	Resistance	More than $6{,}000M\Omega$	The insulation resistance and within 60±5 sec. of c	should be measured with DC500±50V charging.	
7	Capacita	nce	Within the specified tolerance			
8	Dissipation 3 Factor (D.F.) Q		Char. Specification X7R D.F.≦0.025 SL Q≥400+20C*² (C<30pF)	The capacitance/Q/D.F. should be measured at a frequency of 1±0.2kHz (SL char.: 1±0.2MHz) and a voltage of AC1±0.2V (r.m.s.).		
	Capacitance 9 Temperature			The capacitance measur specified in Table. Step	ement should be made at each step Temperature (°C)	
9			Char. Capacitance Change X7R Within ±15% Temperature characteristic guarantee is −55 to +125°C Char. Temperature Coefficient SL +350 to −1000ppm/°C	1 2 3 4 5	25±2 (20±2 for SL char.) Min. Operating Temp.±3 25±2 (20±2 for SL char.) Max. Operating Temp.±2 25±2 (20±2 for SL char.)	
	Character	ISUCS	SL +350 to -1000ppm/°C Temperature characteristic guarantee is +20 to +85°C	SL char.: The capacitance should be measured at even 85°C between step 3 and step 4. •Pretreatment for X7R char. Perform a heat treatment at 150± ₁ 8°C for 60±5 min. and then let sit for 24±2 hrs. at room condition**.		
		Appearance	No defects or abnormalities	As in Fig., discharge is m	ade 50 times at 5 sec. intervals from	
		I.R.	More than 1,000MΩ	the capacitor (Cd) charge	ed at DC voltage of specified.	
10	Discharge Test (Application: Type GC)	Dielectric Strength	In accordance with item No.4		R1 Ct R2 or under test Cd: 0.001μF : 100MΩ R3: Surge resistance	
11	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.	Solder the capacitor to the in Fig. 1. Then apply 10N force in should be done using the	the direction of the arrow. The soldering ereflow method and should be not the soldering is uniform and free of	

^{*1 &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa



^{*2 &}quot;C" expresses nominal capacitance value (pF).

Continued from the preceding page.

No.		em	Specifications	Test Method
<u>12</u>	Appearance No defects or abnormalities Capacitance Within the specified tolerance			Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.). Solder resist Glass Epoxy Board
13	Deflection	n	No cracking or marking defects should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2. Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. 20 50 Pressurizing speed: 1.0mm/s Pressurize Pressurize Pressurize (in mm) Fig. 3
14	Solderab Terminati		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder
15	Resistance to Soldering Heat I.R.		No marking defects	Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at room condition*¹ for 24±2 hrs., then measure. •Immersing speed: 25±2.5mm/s •Pretreatment for X7R char. Perform a heat treatment at 150±18°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*¹. *Preheating
\$4 PP		Dielectric Strength	In accordance with item No.4	Step Temperature Time 1 100 to 120°C 1 min. 2 170 to 200°C 1 min.

^{*1 &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa





^{*2 &}quot;C" expresses nominal capacitance value (pF).

Continued from the preceding page Specifications No Item Test Method

Capacitance Change

Within ±15%

Within ±2.5% or ±0.25pF

Specification

D.F.≤0.05 Q≥400+20C*2 (C<30pF)

Specification

D.F.≦0.05

Q≥275+5/2C*2 (C<30pF)

Capacitance Change

Within ±20%

Within ±3.0% or ±0.3pF

Specification

D.F.≦0.05

Q≥275+5/2C*2 (C<30pF)

(C≥30pF)

(Whichever is larger)

(C≥30pF)

Q≥350

In accordance with item No.4

Q≥350

In accordance with item No.4

(C≥30pF)

(Whichever is larger)

Q≥1000

In accordance with item No.4

Fix the capacitor to the supporting jig (glass epoxy board) shown

Perform the 5 cycles according to the 4 heat treatments listed in the following table.

Let sit for 24±2 hrs. at room condition*1, then measure.

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

Pretreatment for X7R char.

Perform a heat treatment at 150⁺₋₁₀ °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.

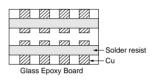


Fig. 4

Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ± 24 hrs.

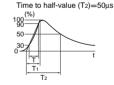
Remove and let sit for 24±2 hrs. at room condition*1, then measure.

Pretreatment for X7R char.

Perform a heat treatment at 150 ± 18 °C for 60±5 min, and then let sit for 24±2 hrs. at room condition*1.

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

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



Front time (T1)=1.2µs=1.67T

Apply voltage as Table for 1,000 hrs. at 125 ±2 °C, relative humidity 50% max.

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

Let sit for 24±2 hrs. at room condition*1, then measure.

Pretreatment for X7R char.

Perform a heat treatment at 150±10 °C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.

Appearance

Capacitance

Change

D.F.

I.R.

Dielectric

Strength

Appearance

D.F.

Q

I.R.

Dielectric

Strength

Appearance

Capacitance

Change

D.F.

Q

I.R.

Dielectric

Strength

Life 18

Temperature

Humidity

(Steady

State)

17

Cycle

No marking defects

Char

X7R

SI

Char.

X7R

SI

More than $3.000M\Omega$

No marking defects

Char

X7R

SL

Char.

X7R

SI

Char.

X7R

SL

More than $3,000M\Omega$

More than $3,000M\Omega$

No marking defects





^{*1 &}quot;Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

^{*2 &}quot;C" expresses nominal capacitance value (pF).

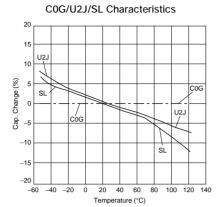
No. It	em	Specifications	Test Method		
10.	Appearance	No marking defects	rest interior		
	Capacitance Change	Char. Capacitance Change X7R Within ±15% SL Within ±5.0% or ±0.5pF (Whichever is larger)	Before this test, the test shown in the following is performed. Item 11 Adhesive Strength of Termination (apply force is 5N) Item 13 Deflection		
Humidity Loading	D.F. Q I.R. Dielectric	$\begin{tabular}{ c c c c }\hline Char. & Specification \\\hline X7R & D.F. \le 0.05 \\\hline SL & Q \ge 275 + 5/2C^{*2} \ (C < 30pF) \\\hline Q \ge 350 & (C \ge 30pF) \\\hline More than $3,000M\Omega$\\\\ In accordance with item No.4\\\\\hline \end{tabular}$	Apply the rated voltage at 40±2°C and relative humidity of 90 to 95% for 500±26 hrs. Remove and let sit for 24±2 hrs. at room condition*1, then measure. •Pretreatment for X7R char. Perform a heat treatment at 150±10°C for 60±5 min. and then let sit for 24±2 hrs. at room condition*1.		
Active Flammability		The cheesecloth should not be on fire.	The capacitor should be individually wrapped in at least one but not more than two complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The UAC should be maintained for 2 min. after the last discharge. C1,2: 1µF±10% C3: 0.033µF±5% 10kV L1 to 4: 1.5mH±20% 16A Rod core choke Ct: 3µF±5% 10kV R: 100Ω±2% Cx: Capacitor under test UAC: UR±5% F: Fuse, Rated 16A UR: Rated Voltage Ut: Voltage applied to Ct Ux Type Ui GB, GD 2.5kV GC, GF 5kV		
Passive Flammability		The burning time should not exceed 30 sec. The tissue paper should not ignite.	The capacitor under test should be held in the flame in the position which best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec. Length of flame: 12±1mm Gas burner : Length 35mm min. Inside Dia. 0.5±0.1mm Outside Dia. 0.9mm max. Gas : Butane gas Purity 95% min. Test Specimen Tissue About 10mm Thick Board		

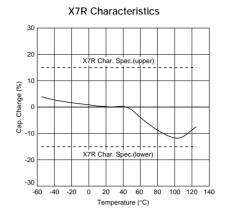
^{*1 &}quot;Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

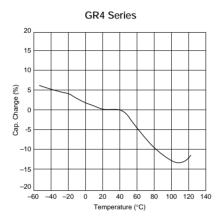
^{*2 &}quot;C" expresses nominal capacitance value (pF).

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

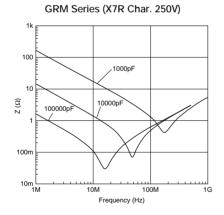
Capacitance - Temperature Characteristics



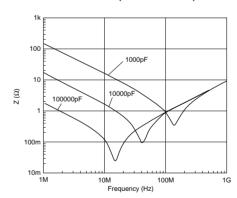




■ Impedance - Frequency Characteristics



GRM Series (X7R Char. 630V)



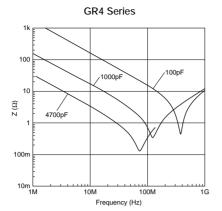


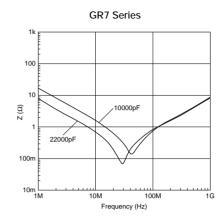


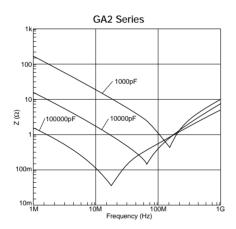
GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

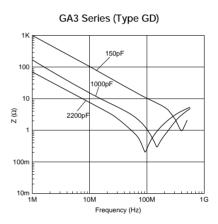
Continued from the preceding page.

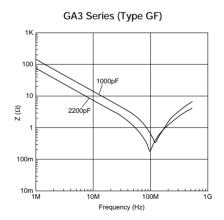
■ Impedance - Frequency Characteristics

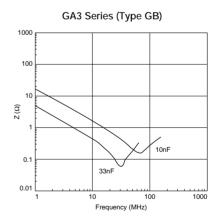










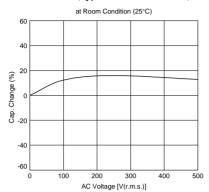




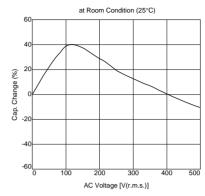
GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

Capacitance - AC Voltage Characteristics

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



GA3 Series (Type GB)





Package

Taping is standard packaging method.

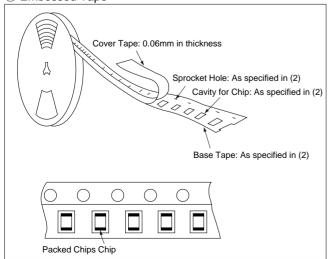
■ Minimum Quantity Guide

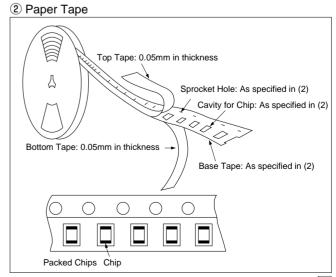
Part Number		Dimensions (mm)				ty (pcs.)
Part Nui	mber			ø180mm Reel		
		L	W	T	Paper Tape	Embossed Tape
	GRM18	1.6	0.8	0.8	4,000	-
	GRM21	2.0	1.25	1.0	4,000	-
				1.25	-	3,000
				1.0	4,000	-
	GRM31/GR731	3.2	1.6	1.25	-	3,000
				1.6	-	2,000
	GRM32			1.0	4,000	-
		3.2	2.5	1.25	-	3,000
Medium-voltage			2.5	1.5	-	2,000
				2.0	-	1,000
			2.0	1.0	-	3,000
	GRM42/GR442	4.5		1.5	-	2,000
				2.0	-	2,000
	GRM43/GR443	4.5	3.2	1.5	-	1,000
				2.0	-	1,000
				2.5	-	500
	GRM55/GR455	5.7	5.0	2.0	-	1,000
	GA242	4.5	2.0	1.5	-	2,000
			3.2	1.5	-	1,000
AC250V	GA243	4.5		2.0	-	1,000
	GA255	5.7	5.0	2.0	-	1,000
				1.0	-	3,000
	GA342	4.5	2.0	1.5	-	2,000
				2.0	-	2,000
Safety Std.				1.5	-	1,000
Recognition	GA343	4.5	3.2	2.0	-	1,000
	GA352	5.7	2.8	1.5	-	1,000
				1.5	-	1,000
	GA355	5.7	5.0	2.0	-	1,000
	GA333	5.7		2.7	-	500

muRata

■ Tape Carrier Packaging

- (1) Appearance of Taping
- ① Embossed Tape







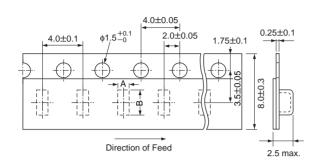
Package

Continued from the preceding page.

(2) Dimensions of Tape

① Embossed Tape

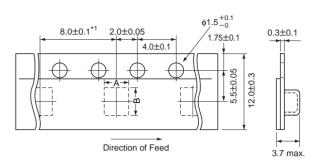
8mm width 4mm pitch Tape



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

*Nominal Value

12mm width 8mm/4mm pitch Tape



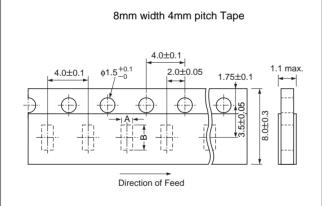
Part Number	A*	B*
GRM42/GR442/GA242/GA342	2.5	5.1
GRM43/GR443/GA243/GA343	3.6	4.9
GA352	3.2	6.1
GRM55/GR455/GA255/GA355	5.4	6.1

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

*Nominal Value

(in mm)

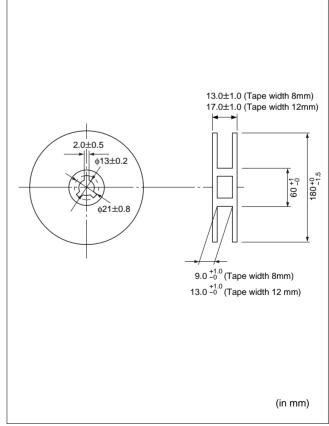
2 Paper Tape



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

*Nominal value (in mm)

(3) Dimensions of Reel

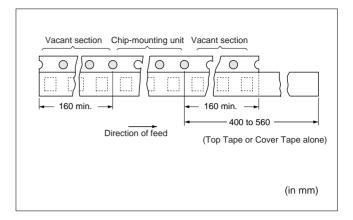


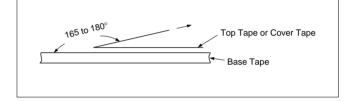
Package

Continued from the preceding page.

(4) Taping Method

- 1) Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
- 2 Part of the leader and part of the empty tape should be attached to the end of the tape as shown at right.
- 3 The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- 4 Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
- 5 The top tape or cover tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.
- 6 Cumulative tolerance of sprocket holes, 10 pitches:
- 7 Peeling off force: 0.1 to 0.6N in the direction shown at right.







Storage and Operating Conditions

Operating and storage environment
Do not use or store capacitors in a corrosive
atmosphere, especially where chloride gas, sulfide
gas, acid, alkali, salt or the like are present. And
avoid exposure to moisture. Before cleaning, bonding
or molding this product, verify that these processes
do not affect product quality by testing the
performance of a cleaned, bonded or molded product
in the intended equipment. Store the capacitors

where the temperature and relative humidity do not exceed 5 to 40 degrees centigrade and 20 to 70%. Use capacitors within 6 months after delivered. Check the solderability after 6 months or more.

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

■ Handling

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

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

⚠Caution

■ Caution (Rating)

1. Operating Voltage

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

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

Voltage	DC Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage (1)	Pulse Voltage (2)
Positional Measurement	V0-p	Vo-p	Vp-p	Vp-p	Vp-p

- 2. Operating Temperature, Self-generated Heat, and Lead Reduction at High-frequency voltage condition Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a highfrequency voltage, pulse voltage, it may self-generate heat due to dielectric loss.
- (1) In case of X7R char.

Applied voltage should be the load such as selfgenerated heat is within 20°C on the condition of atmosphere temperature 25°C. When measuring, use a thermocouple of small thermal capacity -K of Ø0.1mm in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)



⚠Caution

Continued from the preceding page.

(2) In case of C0G, U2J char.

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

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

<C0G char.>

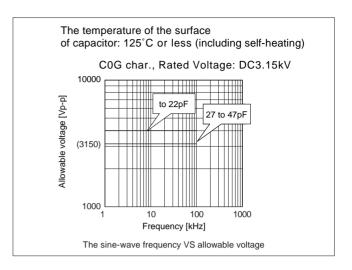
Therefore, in case of COG char., the frequency of the applied sine wave voltage should be less than 100kHz. The applied voltage should be less than the value shown in figure at right. The capacitors less than 22pF can be applied maximum 4.0kV peak to peak at 100kHz or less only for the ballast or the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

<U2J char.>

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

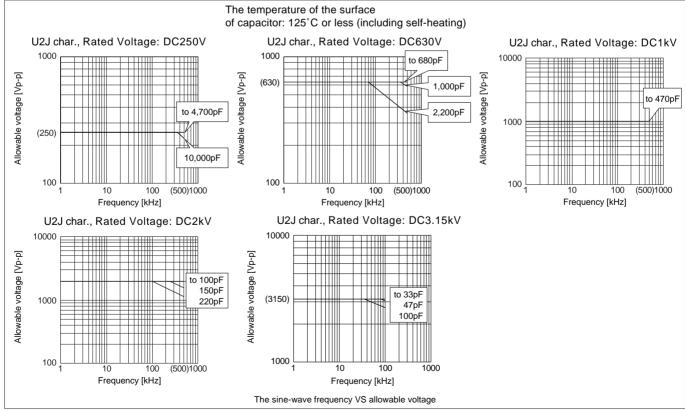
<Capacitor selection tool>

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



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

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





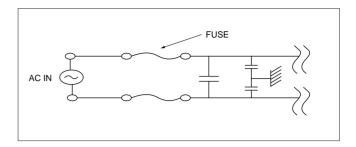
⚠Caution

Continued from the preceding page.

3. Fail-safe

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

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



4. Test condition for AC withstanding Voltage

(1) Test Equipment

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

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

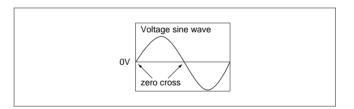
(2) Voltage applied method

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

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

- See the figure at right -

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





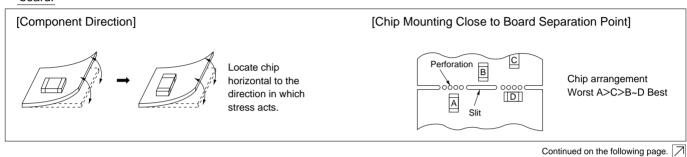
■ Caution (Soldering and Mounting)

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

2. Circuit Board Material

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

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







⚠Caution

Continued from the preceding page

4. Reflow Soldering

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

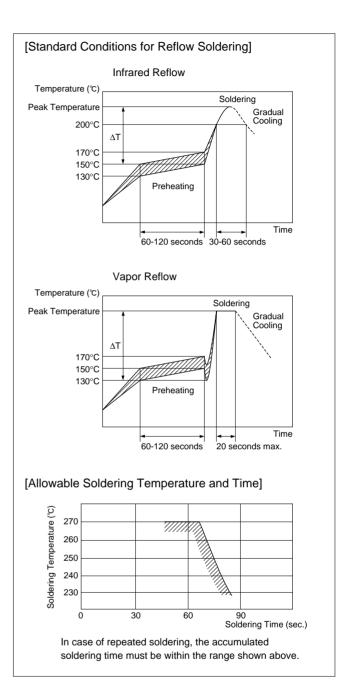
Table 1

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

Recommended Conditions

	Pb-Sn S	Pb-Sn Solder frared Reflow Vapor Reflow Lead Free	
	Infrared Reflow		
Peak Temperature	230-250°C	230-240°C	240-260°C
Atmosphere	Air	Air	Air or N2

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



Optimum Solder Amount for Reflow Soldering

- Overly thick application of solder paste results in excessive fillet height solder. This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked
- Too little solder paste results in a lack of adhesive

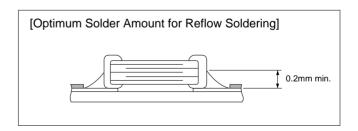
strength on the outer electrode, which may result in chips

 Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.

Inverting the PCB

breaking loose from the PCB.

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







Continued from the preceding page

5. Flow Soldering

- When sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. And an excessively long soldering time or high soldering temperature results in leaching by the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 2. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.

Do not apply flow soldering to chips not listed in Table 2.

Table 2

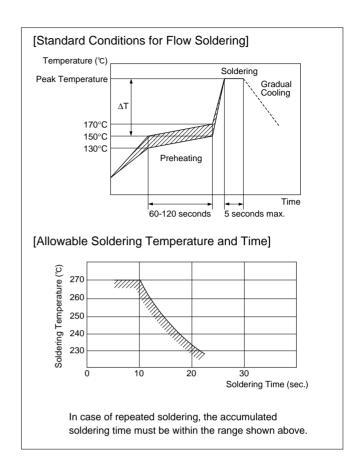
Part Number	Temperature Differential	
G□□18/21/31	ΔT≦150°C	

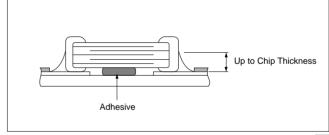
Recommended Conditions

	Pb-Sn Solder	Lead Free Solder
Peak Temperature	240-250°C	250-260°C
Atmosphere	Air	N ₂

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

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







⚠Caution

Continued from the preceding page.

6. Correction with a Soldering Iron

(1) For Chip Type Capacitors

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

Table 3

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

^{*}Applicable for both Pb-Sn and Lead Free Solder.

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

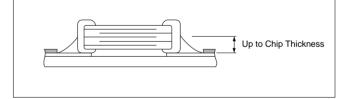
 Optimum Solder Amount when Corrections Are Made Using a Soldering Iron

The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions. Soldering iron ø3mm or smaller should be required. And it is necessary to keep a distance between the soldering iron and the components without direct touch. Thread solder with Ø0.5mm or smaller is required for soldering.



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

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



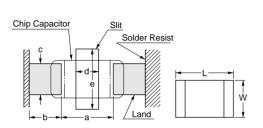
Notice

■ Notice (Soldering and Mounting)

1. Construction of Board Pattern

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

Construction and Dimensions of Pattern (Example)



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

Flow Soldering

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

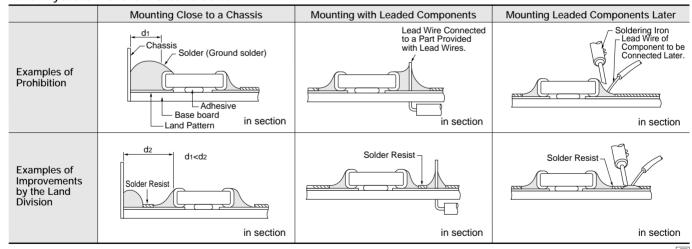
Flow soldering: 3.2×1.6 or less available.

Reflow Soldering

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

(in mm)

Land Layout to Prevent Excessive Solder







Notice



Continued from the preceding page.

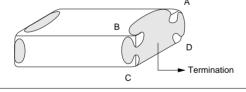
- 2. Mounting of Chips
- Thickness of adhesives applied Keep thickness of adhesives applied (50-105µm or more) to reinforce the adhesive contact considering the thickness of the termination or capacitor (20-70µm) and the land pattern (30-35µm).
- Mechanical shock of the chip placer When the positioning claws and pick-up nozzle are worn, the load is applied to the chip while positioning is concentrated in one position, thus causing cracks, breakage, faulty positioning accuracy, etc. Careful checking and maintenance are necessary to prevent unexpected trouble. An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. Please set the suction nozzle's bottom dead point on the upper surface of the board.

3. Soldering

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

Depending on the conditions of the soldering temperature and/or immersion (melting time), effective areas may be lost in some part of the terminations.

To prevent this, be careful in soldering so that any possible loss of the effective area on the terminations will securely remain at a maximum of 25% on all edge length A-B-C-D-A of part with A, B, C, D, shown in the Figure below.



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





Notice



Continued from the preceding page.

4. Cleaning

Please confirm there is no problem in the reliability of the product beforehand when cleaning it with the intended

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

5. Resin Coating

Please use it after confirming there is no influence on the product with a intended equipment beforehand when the resin coating and molding.

A cracked chip might be caused at the cooling/heating cycle by the amount of resin spreading and/or bias

The resin for coating and molding must be selected as the stress is small when stiffening and the hygroscopic is low as possible.

Rating

- 1. Capacitance change of capacitor
- (1) In case of X7R char.

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

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

2. Performance check by equipment

Before using a capacitor, check that there is no problem in the equipment's performance and the specifications.

Generally speaking, CLASS 2 (X7R char.) ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance. So, the capacitance value may change depending on the operating condition in the equipment. Therefore, be sure to confirm the apparatus performance of receiving influence in a capacitance value change of a capacitor, such as leakage current and noise suppression characteristics. Moreover, check the surge-proof ability of a capacitor in the equipment, if needed, because the surge voltage may exceed specific value by the inductance of the circuit.



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■ Qualified Standards

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