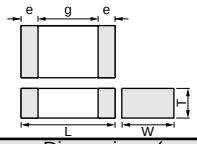
Chip Monolithic Ceramic Capacitors

Medium-voltage High-Capacitance for General-Use

■ Features

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



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

* GRM55DR73A : 2.5mm min.

■ Applications

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

Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM188R72E221KW07D	DC250	X7R (EIA)	220pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E331KW07D	DC250	X7R (EIA)	330pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E471KW07D	DC250	X7R (EIA)	470pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E681KW07D	DC250	X7R (EIA)	680pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM188R72E102KW07D	DC250	X7R (EIA)	1000pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM21AR72E102KW01D	DC250	X7R (EIA)	1000pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM188R72E152KW07D	DC250	X7R (EIA)	1500pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM21AR72E152KW01D	DC250	X7R (EIA)	1500pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM188R72E222KW07D	DC250	X7R (EIA)	2200pF ±10%	1.6	0.8	0.8	0.4	0.2 to 0.5
GRM21AR72E222KW01D	DC250	X7R (EIA)	2200pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21AR72E332KW01D	DC250	X7R (EIA)	3300pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21AR72E472KW01D	DC250	X7R (EIA)	4700pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21AR72E682KW01D	DC250	X7R (EIA)	6800pF ±10%	2.0	1.25	1.0	0.7	0.3 min.
GRM21BR72E103KW03L	DC250	X7R (EIA)	10000pF ±10%	2.0	1.25	1.25	0.7	0.3 min.
GRM31BR72E153KW01L	DC250	X7R (EIA)	15000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72E223KW01L	DC250	X7R (EIA)	22000pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31CR72E333KW03L	DC250	X7R (EIA)	33000pF ±10%	3.2	1.6	1.6	1.2	0.3 min.
GRM31CR72E473KW03L	DC250	X7R (EIA)	47000pF ±10%	3.2	1.6	1.6	1.2	0.3 min.
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.
GRM31BR72J222KW01L	DC630	X7R (EIA)	2200pF ±10%	3.2	1.6	1.25	1.2	0.3 min.

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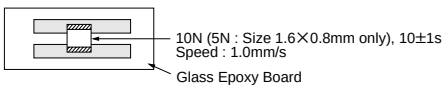
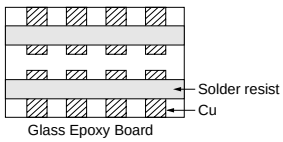
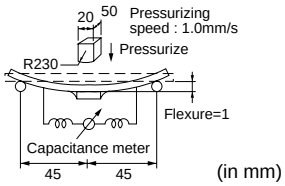
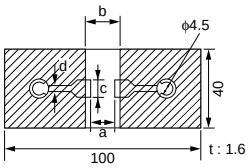
Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
GRM31BR72J332KW01L	DC630	X7R (EIA)	3300pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J472KW01L	DC630	X7R (EIA)	4700pF ±10%	3.2	1.6	1.25	1.2	0.3 min.
GRM31BR72J682KW01L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

Specifications and Test Methods

No.	Item	Specifications	Test Method
1	Operating Temperature Range	−55 to +125℃	−
2	Appearance	No defects or abnormalities	Visual inspection
3	Dimensions	Within the specified dimensions	Using calipers
4	Dielectric Strength	No defects or abnormalities	No failure should be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage : DC250V, 120% of the rated voltage in case of rated voltage : DC1kV) is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.
5	Insulation Resistance (I.R.)	C≧0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ	The insulation resistance should be measured with DC500±50V (DC250±50V in case of rated voltage : DC250V) and within 60±5 sec. of charging.
6	Capacitance	Within the specified tolerance	The capacitance/D.F. should be measured at 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.s.) •Pretreatment Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.
7	Dissipation Factor (D.F.)	0.025 max.	
8	Capacitance Temperature Characteristics	Cap. Change Within ±15% (Temp. Range : −55 to +125℃)	The range of capacitance change compared with the 25℃ value within −55 to +125℃ should be within the specified range. •Pretreatment Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.
9	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 1
10	Vibration Resistance — Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.). 
	Vibration Resistance — Capacitance	Within the specified tolerance	
	Vibration Resistance — D.F.	0.025 max.	
11	Deflection	No cracking or marking defects should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 3



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

Fig. 2

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

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Specifications and Test Methods

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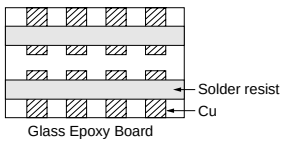
No.	Item		Specifications	Test Method
12	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 2±0.5 sec. at 235±5℃. Immersing speed : 25±2.5mm/s
13	Resistance to Soldering Heat	Appearance	No marking defects	Preheat the capacitor at 120 to 150℃* for 1 min. Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure. •Immersing speed : 25±2.5mm/s •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. *Preheating for more than 3.2×2.5mm Step / Temperature / Time 1 / 100℃ to 120℃ / 1 min. 2 / 170℃ to 200℃ / 1 min.
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	C≧0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ	
		Dielectric Strength	In accordance with item No.4	
14	Temperature Cycle	Appearance	No marking defects	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. Perform the 5 cycles according to the 4 heat treatments listed in the following table. Let sit for 24±2 hrs. at *room condition, then measure. Step / Temperature (℃) / Time (min.) 1 / Min. Operating Temp.±3 / 30±3 2 / Room Temp. / 2 to 3 3 / Max. Operating Temp.±2 / 30±3 4 / Room Temp. / 2 to 3 •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.  Fig. 4
		Capacitance Change	Within ±7.5%	
		D.F.	0.025 max.	
		I.R.	C≧0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ	
		Dielectric Strength	In accordance with item No.4	
15	Humidity (Steady State)	Appearance	No marking defects	Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500$^{+24}_{-0}$hrs. Remove and let sit for 24±2 hrs. at *room condition, then measure. •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	
16	Life	Appearance	No marking defects	Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage : DC250V, 110% of the rated voltage in case of rated voltage : DC1kV) for 1,000$^{+48}_{-0}$hrs. at maximum operating temperature ±3℃. Remove and let sit for 24 ±2 hrs. at *room condition, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at *room condition.
		Capacitance Change	Within ±15% (rated voltage : DC250V, DC630V) Within ±20% (rated voltage : DC1kV)	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	
17	Humidity Loading (Application : DC250V, DC630V item)	Appearance	No marking defects	Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500$^{+24}_{-0}$hrs. Remove and let sit for 24±2 hrs. at *room condition, then measure. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at *room condition.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ	
		Dielectric Strength	In accordance with item No.4	

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