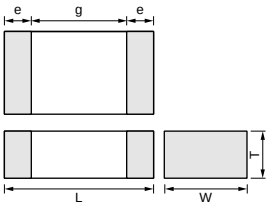
Monolithic Ceramic Capacitors GR_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

High Dielectric Constant Type 6.3/16/25/50V



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM155	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4
GRM188*	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
GRM216	2.0 ±0.1	1.25 ±0.1	0.6 ±0.1	0.2 to 0.7	0.7
GRM219			0.85 ±0.1		
GRM21B			1.25 ±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		
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)

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM155R61A683KA01	X5R (EIA)	10	68000pF±10%	1.0	0.5	0.50
GRM155R61A104KA01	X5R (EIA)	10	0.1µF±10%	1.0	0.5	0.50
GRM188R61A334KA61	X5R (EIA)	10	0.33 µF±10%	1.6	0.8	0.80
GRM188R61A474KA61	X5R (EIA)	10	0.47µF±10%	1.6	0.8	0.80
GRM188R61A684KA61	X5R (EIA)	10	0.68µF±10%	1.6	0.8	0.80
GRM188R61A105KA61	X5R (EIA)	10	1µF ±10%	1.6	0.8	0.80
GRM188R60J105KA01	X5R (EIA)	6.3	1µF ±10%	1.6	0.8	0.80
GRM219R61A105KC01	X5R (EIA)	10	1µF ±10%	2.0	1.25	0.90
GRM21BR61A225KA01	X5R (EIA)	10	2.2µF ±10%	2.0	1.25	1.25
GRM219R60J155KC01	X5R (EIA)	6.3	1.5µF ±10%	2.0	1.25	0.90
GRM21BR60J225KA01	X5R (EIA)	6.3	2.2µF ±10%	2.0	1.25	1.25
GRM21BR60J335KA11	X5R (EIA)	6.3	3.3µF ±10%	2.0	1.25	1.25
GRM21BR60J475KA11	X5R (EIA)	6.3	4.7µF ±10%	2.0	1.25	1.25
GRM319R61A225KC01	X5R (EIA)	10	2.2µF ±10%	3.2	1.6	0.90
GRM31XR61A335KC12	X5R (EIA)	10	3.3µF ±10%	3.2	1.6	1.30
GRM31CR61A475KA01	X5R (EIA)	10	4.7µF ±10%	3.2	1.6	1.60
GRM31MR60J475KC11	X5R (EIA)	6.3	4.7µF ±10%	3.2	1.6	1.15
GRM31CR61A106KA01	X5R (EIA)	10	10µF ±10%	3.2	1.6	1.60
GRM31CR60J106KA01	X5R (EIA)	6.3	10µF ±10%	3.2	1.6	1.60
GRM31CR60J226ME20	X5R (EIA)	6.3	22µF ±20%	3.2	1.6	1.60
GRM32ER61A106KC01	X5R (EIA)	10	10µF ±10%	3.2	2.5	2.50
GRM55DR61H106KA01	X5R (EIA)	50	10µF ±10%	5.7	5.0	2.00
GRM15XR71H221KA86	X7R (EIA)	50	220pF±10%	1.0	0.5	0.25
GRM155R71H221KA01	X7R (EIA)	50	220pF±10%	1.0	0.5	0.50
GRM15XR71H331KA86	X7R (EIA)	50	330pF±10%	1.0	0.5	0.25
GRM155R71H331KA01	X7R (EIA)	50	330pF±10%	1.0	0.5	0.50
GRM15XR71H471KA86	X7R (EIA)	50	470pF±10%	1.0	0.5	0.25
GRM155R71H471KA01	X7R (EIA)	50	470pF±10%	1.0	0.5	0.50
GRM15XR71H681KA86	X7R (EIA)	50	680pF±10%	1.0	0.5	0.25
GRM155R71H681KA01	X7R (EIA)	50	680pF±10%	1.0	0.5	0.50
GRM15XR71H102KA86	X7R (EIA)	50	1000pF±10%	1.0	0.5	0.25
GRM155R71H102KA01	X7R (EIA)	50	1000pF±10%	1.0	0.5	0.50
GRM15XR71H152KA86	X7R (EIA)	50	1500pF±10%	1.0	0.5	0.25
GRM155R71H152KA01	X7R (EIA)	50	1500pF±10%	1.0	0.5	0.50
GRM155R71H222KA01	X7R (EIA)	50	2200pF±10%	1.0	0.5	0.50

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Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM155R71H332KA01	X7R (EIA)	50	3300pF±10%	1.0	0.5	0.50
GRM155R71H472KA01	X7R (EIA)	50	4700pF±10%	1.0	0.5	0.50
GRM15XR71E182KA86	X7R (EIA)	25	1800pF±10%	1.0	0.5	0.25
GRM15XR71E222KA86	X7R (EIA)	25	2200pF±10%	1.0	0.5	0.25
GRM155R71E682KA01	X7R (EIA)	25	6800pF±10%	1.0	0.5	0.50
GRM155R71E103KA01	X7R (EIA)	25	10000pF±10%	1.0	0.5	0.50
GRM15XR71C332KA86	X7R (EIA)	16	3300pF±10%	1.0	0.5	0.25
GRM15XR71C472KA86	X7R (EIA)	16	4700pF±10%	1.0	0.5	0.25
GRM15XR71C682KA86	X7R (EIA)	16	6800pF±10%	1.0	0.5	0.25
GRM155R71C153KA01	X7R (EIA)	16	15000pF±10%	1.0	0.5	0.50
GRM155R71C223KA01	X7R (EIA)	16	22000pF±10%	1.0	0.5	0.50
GRM155R71A333KA01	X7R (EIA)	10	33000pF±10%	1.0	0.5	0.50
GRM155R71A473KA01	X7R (EIA)	10	47000pF±10%	1.0	0.5	0.50
GRM188R71H221KA01	X7R (EIA)	50	220pF±10%	1.6	0.8	0.80
GRM188R71H331KA01	X7R (EIA)	50	330pF±10%	1.6	0.8	0.80
GRM188R71H471KA01	X7R (EIA)	50	470pF±10%	1.6	0.8	0.80
GRM188R71H681KA01	X7R (EIA)	50	680pF±10%	1.6	0.8	0.80
GRM188R71H102KA01	X7R (EIA)	50	1000pF±10%	1.6	0.8	0.80
GRM188R71H152KA01	X7R (EIA)	50	1500pF±10%	1.6	0.8	0.80
GRM188R71H222KA01	X7R (EIA)	50	2200pF±10%	1.6	0.8	0.80
GRM188R71H332KA01	X7R (EIA)	50	3300pF±10%	1.6	0.8	0.80
GRM188R71H472KA01	X7R (EIA)	50	4700pF±10%	1.6	0.8	0.80
GRM188R71H682KA01	X7R (EIA)	50	6800pF±10%	1.6	0.8	0.80
GRM188R71H103KA01	X7R (EIA)	50	10000pF±10%	1.6	0.8	0.80
GRM188R71H153KA01	X7R (EIA)	50	15000pF±10%	1.6	0.8	0.80
GRM188R71H223KA01	X7R (EIA)	50	22000pF±10%	1.6	0.8	0.80
GRM188R71E333KA01	X7R (EIA)	25	33000pF±10%	1.6	0.8	0.80
GRM188R71E473KA01	X7R (EIA)	25	47000pF±10%	1.6	0.8	0.80
GRM188R71E683KA01	X7R (EIA)	25	68000pF±10%	1.6	0.8	0.80
GRM188R71E104KA01	X7R (EIA)	25	0.1µF±10%	1.6	0.8	0.80
GRM188R71C104KA01	X7R (EIA)	16	0.1µF±10%	1.6	0.8	0.80
GRM188R71A154KA01	X7R (EIA)	10	0.15µF±10%	1.6	0.8	0.80
GRM188R71A224KA01	X7R (EIA)	10	22000pF±10%	1.6	0.8	0.80
GRM219R71H333KA01	X7R (EIA)	50	33000pF±10%	2.0	1.25	0.90
GRM21BR71H473KA01	X7R (EIA)	50	47000pF±10%	2.0	1.25	1.25
GRM21BR71H683KA01	X7R (EIA)	50	68000pF±10%	2.0	1.25	1.25
GRM21BR71H104KA01	X7R (EIA)	50	0.1µF±10%	2.0	1.25	1.25
GRM21BR71H154KA01	X7R (EIA)	50	0.15µF±10%	2.0	1.25	1.25
GRM21BR71H224KA01	X7R (EIA)	50	22000pF±10%	2.0	1.25	1.25
GRM21BR71E104KA01	X7R (EIA)	25	0.1µF±10%	2.0	1.25	1.25
GRM21BR71E154KA01	X7R (EIA)	25	0.15µF±10%	2.0	1.25	1.25
GRM219R71E224KC01	X7R (EIA)	25	22000pF±10%	2.0	1.25	0.90
GRM21BR71E334KC01	X7R (EIA)	25	0.33 µF±10%	2.0	1.25	1.25
GRM21BR71E474KC01	X7R (EIA)	25	0.47µF±10%	2.0	1.25	1.25
GRM219R71C474KC01	X7R (EIA)	16	0.47µF±10%	2.0	1.25	0.90
GRM219R71C684KC01	X7R (EIA)	16	0.68µF±10%	2.0	1.25	0.90
GRM21BR71C105KA01	X7R (EIA)	16	1µF ±10%	2.0	1.25	1.25
GRM319R71H334KA01	X7R (EIA)	50	0.33 µF±10%	3.2	1.6	0.90
GRM31MR71H474KA01	X7R (EIA)	50	0.47µF±10%	3.2	1.6	1.15
GRM319R71E684KC01	X7R (EIA)	25	0.68µF±10%	3.2	1.6	0.90
GRM31MR71E105KC01	X7R (EIA)	25	1µF ±10%	3.2	1.6	1.15
GRM319R71C105KC11	X7R (EIA)	16	1µF ±10%	3.2	1.6	0.90
GRM31MR71C155KC11	X7R (EIA)	16	1.5µF ±10%	3.2	1.6	1.15
GRM31MR71C225KA35	X7R (EIA)	16	2.2µF ±10%	3.2	1.6	1.15
GRM319R71A105KC01	X7R (EIA)	10	1µF ±10%	3.2	1.6	0.90

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GRM319R71A225KA01	X7R (EIA)	10	2.2µF ±10%	3.2	1.6	0.90
GRM32NR71H684KA01	X7R (EIA)	50	0.68µF±10%	3.2	2.5	1.35
GRM32RR71H105KA01	X7R (EIA)	50	1µF ±10%	3.2	2.5	1.80
GRM32RR71E225KC01	X7R (EIA)	25	2.2µF ±10%	3.2	2.5	1.80
GRM32MR71C225KC01	X7R (EIA)	16	2.2µF ±10%	3.2	2.5	1.15
GRM32NR71C335KC01	X7R (EIA)	16	3.3µF ±10%	3.2	2.5	1.35
GRM32RR71C475KC01	X7R (EIA)	16	4.7µF ±10%	3.2	2.5	1.80
GRM43ER71H225KA01	X7R (EIA)	50	2.2µF ±10%	4.5	3.2	2.50
GRM55RR71H105KA01	X7R (EIA)	50	1µF ±10%	5.7	5.0	1.80
GRM55RR71H155KA01	X7R (EIA)	50	1.5µF ±10%	5.7	5.0	1.80
GRM155F51H222ZA01	Y5V (EIA)	50	2200pF +80%, -20%	1.0	0.5	0.50
GRM155F51H472ZA01	Y5V (EIA)	50	4700pF +80%, -20%	1.0	0.5	0.50
GRM155F51H103ZA01	Y5V (EIA)	50	10000pF +80%, -20%	1.0	0.5	0.50
GRM155F51E223ZA01	Y5V (EIA)	25	22000pF +80%, -20%	1.0	0.5	0.50
GRM155F51C473ZA01	Y5V (EIA)	16	47000pF +80%, -20%	1.0	0.5	0.50
GRM155F51C104ZA01	Y5V (EIA)	16	10000pF +80%, -20%	1.0	0.5	0.50
GRM188F51H103ZA01	Y5V (EIA)	50	10000pF +80%, -20%	1.6	0.8	0.80
GRM188F51H223ZA01	Y5V (EIA)	50	22000pF +80%, -20%	1.6	0.8	0.80
GRM188F51H473ZA01	Y5V (EIA)	50	47000pF +80%, -20%	1.6	0.8	0.80
GRM188F51H104ZA01	Y5V (EIA)	50	10000pF +80%, -20%	1.6	0.8	0.80
GRM188F51E104ZA01	Y5V (EIA)	25	10000pF +80%, -20%	1.6	0.8	0.80
GRM188F51C224ZA01	Y5V (EIA)	16	22000pF +80%, -20%	1.6	0.8	0.80
GRM188F51C474ZA01	Y5V (EIA)	16	0.47µF +80%, -20%	1.6	0.8	0.80
GRM188F51A474ZC01	Y5V (EIA)	10	0.47µF +80%, -20%	1.6	0.8	0.80
GRM188F51A105ZA01	Y5V (EIA)	10	1µF +80%, -20%	1.6	0.8	0.80
GRM219F51H104ZA01	Y5V (EIA)	50	10000pF +80%, -20%	2.0	1.25	0.90
GRM21BF51H224ZA01	Y5V (EIA)	50	22000pF +80%, -20%	2.0	1.25	1.25
GRM219F51E224ZA01	Y5V (EIA)	25	22000pF +80%, -20%	2.0	1.25	0.90
GRM21BF51E474ZA01	Y5V (EIA)	25	0.47µF +80%, -20%	2.0	1.25	1.25
GRM219F51E105ZA01	Y5V (EIA)	25	1µF +80%, -20%	2.0	1.25	0.90
GRM21BF51E225ZA01	Y5V (EIA)	25	2.2µF +80%, -20%	2.0	1.25	1.25
GRM219F51C105ZA01	Y5V (EIA)	16	1µF +80%, -20%	2.0	1.25	0.90
GRM21BF51C225ZA01	Y5V (EIA)	16	2.2µF +80%, -20%	2.0	1.25	1.25
GRM219F51A105ZA01	Y5V (EIA)	10	1µF +80%, -20%	2.0	1.25	0.90
GRM21BF51A225ZA01	Y5V (EIA)	10	2.2µF +80%, -20%	2.0	1.25	1.25
GRM21BF51A475ZA01	Y5V (EIA)	10	4.7µF +80%, -20%	2.0	1.25	1.25
GRM31MF51H474ZA01	Y5V (EIA)	50	0.47µF +80%, -20%	3.2	1.6	1.15
GRM31MF51E105ZA01	Y5V (EIA)	25	1µF +80%, -20%	3.2	1.6	1.15
GRM31MF51E475ZA01	Y5V (EIA)	25	4.7µF +80%, -20%	3.2	1.6	1.15
GRM319F51C105ZA01	Y5V (EIA)	16	1µF +80%, -20%	3.2	1.6	0.90
GRM31MF51C225ZA01	Y5V (EIA)	16	2.2µF +80%, -20%	3.2	1.6	1.15
GRM31MF51C475ZA12	Y5V (EIA)	16	4.7µF +80%, -20%	3.2	1.6	1.15
GRM319F51A225ZA01	Y5V (EIA)	10	2.2µF +80%, -20%	3.2	1.6	0.90
GRM31MF51A475ZA01	Y5V (EIA)	10	4.7µF +80%, -20%	3.2	1.6	1.15
GRM31MF51A106ZA01	Y5V (EIA)	10	10µF +80%, -20%	3.2	1.6	1.15
GRM31MF50J106ZA01	Y5V (EIA)	6.3	10µF +80%, -20%	3.2	1.6	1.15
GRM32RF51H105ZA01	Y5V (EIA)	50	1µF +80%, -20%	3.2	2.5	1.80
GRM329F51E475ZA01	Y5V (EIA)	25	4.7µF +80%, -20%	3.2	2.5	0.90
GRM32NF51E106ZA01	Y5V (EIA)	25	10µF +80%, -20%	3.2	2.5	1.35
GRM32NF51C106ZA01	Y5V (EIA)	16	10µF +80%, -20%	3.2	2.5	1.35
GRM188E41H103MA01	Z5U (EIA)	50	10000pF±20%	1.6	0.8	0.80
GRM188E41H223MA01	Z5U (EIA)	50	22000pF±20%	1.6	0.8	0.80
GRM216E41H473MA01	Z5U (EIA)	50	47000pF±20%	2.0	1.25	0.60
GRM219E41H104MA01	Z5U (EIA)	50	10000pF±20%	2.0	1.25	0.90
GRM319E41H224MA01	Z5U (EIA)	50	22000pF±20%	3.2	1.6	0.90

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■ Specifications and Test Methods

No.	Item	Specifications		Test Method
		Temperature Compensating Type	High Dielectric Type	
1	Operating Temperature Range	−55 to +125℃	B1, B3, F1 : −25℃ to +85℃ R1, R7 : −55℃ to +125℃ E4 : +10℃ to +85℃ F5 : −30℃ to +85℃	Reference Temperature : 25℃ (2Δ, 3Δ, 4Δ, B1, B3, F1, R1 : 20℃)
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
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.
6	Insulation Resistance	C≦0.047μF : More than 10,000MΩ C>0.047μF : 500Ω • F 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		The capacitance/D.F. should be measured at 20℃/25℃ at the frequency and voltage shown in the table.
8	Q/ Dissipation Factor (D.F.)	30pF and over : Q≧1000 30pF and below : Q≧400+20C C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≧0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	

Char. / Item	ΔC to ΔU, 1X (1000pF and below)	ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1	E4
Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz
Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.05Vrms

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No.	Item	Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
9	Capacitance Temperature Characteristics	Within the specified tolerance (Table A-1)	B1, B3 : Within±10% (−25℃ to +85℃) R1, R7 : Within±15% (−55℃ to +125℃) R6 : Within±15% (−55℃ to +85℃) E4 : Within +22/−56% (+10℃ to +85℃) F1 : Within +30/−80% (−25℃ to +85℃) F5 : Within +22/−82% (−30℃ to +85℃)	The capacitance change should be measured after 5min. at each specified temp. stage. (1)Temperature Compensating Type The temperature coefficient is determind using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5 (5C : +25℃ to +125℃/ΔC : +20℃ to +125℃ : other temp. coeffs. : +25℃ to +85℃/+20℃ to +85℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1. The capacitance drift is caluculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.
				(2) High Dielectric Constant Type The ranges of capacitance change compared with the 20℃ 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.
	Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger.) ∗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 48±4 hours at room temperature. Perform the initial measurement.	
10	Adhesive Strength of Termination	No removal of the terminations or other defect should occur		Solder the capacitor to 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±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. ∗2N (GR□03), 5N (GR□15, GRM18)

Step	Temperature (℃)
1	Reference Temperature±2
2	−55±3 (for ΔC)/−25±3 (for other TC)
3	Reference Temperature±2
4	125±3 (for ΔC)/85±3 (for other TC)
5	Reference Temperature±2

Step	Temperature (°C)	Applying Voltage (V)
1	Reference Temperature±2	No bias
2	–55±3 (for R1, R7, R6) –25±3 (for B1, B3, F1) –30±3 (for F5)/10±3 (for E4)	
3	Reference Temperature±2	
4	125±3 (for R1, R7)/ 85±3 (for B1, B3, R6 F1, F5, E4)	
5	Reference Temperature±2	50% of the rated voltage
6	–55±3 (for R1)/ –25±3 (for B1, F1)	
7	Reference Temperature±2	
8	125±3 (for R1)/ 85±3 (for B1, F1)	

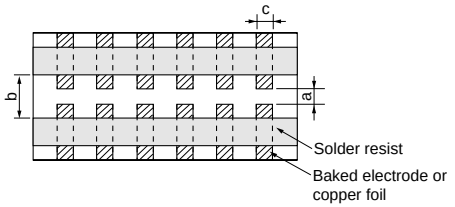

Fig. 1a

(in mm)

Type	a	b	c
GR□03	0.3	0.9	0.3
GR□15	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

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No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
11	Vibration Resistance	Appearance	No defects or abnormalities		Solder the capacitor on 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 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 3 mutually perpendicular directions (total of 6 hours).
		Capacitance	Within the specified tolerance		
		Q/D.F.	30pF and over : Q≧1000 30pF and below : Q≧400+20C C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≧0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	
12	Deflection		No crack or marked defect should occur		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 for 5±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.
13	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 propotion) . Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5℃.
14	Resistance to Soldering Heat	Appearance	No defects or abnormalities		Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in an eutectic solder solution at 270±5℃ for 10±0.5 seconds. Set at room temperature for 24±2 hours (temperature compensating tyoe) or 48±4 hours (high dielectric constant type), then measure. •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 48±4 hours. Perform the initial measurement. •Preheating for GRM32/43/55
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7 : Within ±7.5% F1, F5, E4 : Within ±20%	
		Q/D.F.	30pF and over : Q≧1000 30pF and below : Q≧400+20C C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≧0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)		
		Dielectric Strength	No defects		

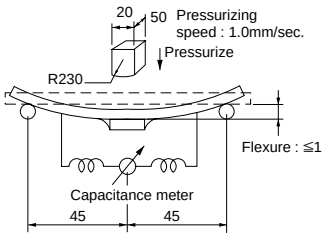

Fig. 3a

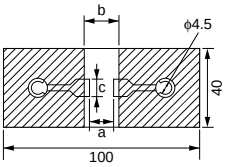

Fig. 2a

t : 1.6mm (GR□03/15 : t : 0.8mm)

Type	a	b	c
GR□03	0.3	0.9	0.3
GR□15	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

(in mm)

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

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No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
15	Temperature Cycle		The measured and observed characteristics should safisfy the specifications in the following table		Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table. Set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. Step / Temp. (℃) / Time (min.) 1: Min. Operating Temp.+0/−3 / 30±3 2: Room Temp. / 2 to 3 3: Max. Operating Temp.+3/−0 / 30±3 4: Room Temp. / 2 to 3 •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 48±4 hours. Perform the initial measurement.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7 : Within ±7.5% F1, F5, E4 : Within ±20%	
		Q/D.F.	30pF and over : Q≧1000 30pF and below : Q≧400+20C C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≧0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)		
		Dielectric Strength	No defects		
16	Humidity (Steady State)		The measured and observed characteristics should satisfy the specifications in the following table		Set the capacitor at 40±2℃ and in 90 to 95% humiduty for 500±12 hours. Remove and set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.
		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 : Within ±30%	
		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, R1, R6, R7, E4] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V/4V : 0.075max. (C<3.3μF) : 0.125max. (C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.075max. (C<0.1μF) : 0.125max. (C≧0.1μF) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.	
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)		

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No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
17	Humidity Load		The measured and observed characteristics should satisfy the specifications in the following table		Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temprature, then muasure. 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℃. Remove and set for 48±4 hours at room temperature. Perform initial measurement.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	B1, B3, R1, R6, R7 : Within ±12.5% F1, F5, E4 : Within ±30% [W.V. : 10Vmax.] F1, F5 : Within +30/−40%	
		Q/D.F.	30pF and over : Q≧200 30pF and below : Q≧100+10C/3 C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V : 0.075max. (C<3.3μF) : 0.125max. (C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.075max. (C<0.1μF) : 0.125max. (C≧0.1μF) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.	
		I.R.	More than 500MΩ or 25Ω • F (Whichever is smaller)		
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table		Apply 200% of the rated voltage at the maximum operating temperature ±3℃ for 1000±12 hours. Set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage at the maximun operating temperature ±3℃ for one hour. Remove and set for 48±4 hours at room temperature. Perform initial measurement.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	B1, B3, R1, R6, R7 : Within ±12.5% F1, F5, E4 : Within ±30% [Exept 10Vmax. and. C≧1.0μF] F1, F5 : Within +30/−40% [10Vmax. and. C≧1.0μF]	
		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, R1, R6, R7, E4] W.V. : 25Vmin. : 0.04max. W.V. : 16/10V : 0.05max. W.V. : 6.3V : 0.075max.(C<3.3μF) : 0.125max.(C≧3.3μF) [F1, F5] W.V. : 25Vmin. : 0.075max.(C<0.1μF) : 0.125max.(C≧0.1μF) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.	
		I.R.	More than 1,000MΩ or 50Ω•F (Whichever is smaller)		

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Table A-1

(1)

Char.	Nominal Values (ppm/℃)*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
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	−	−	−	−	−	−

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

(2)

Char.	Nominal Values (ppm/℃)*2	Capacitance Change from 20℃ (%)					
		−55		−25		−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

∗2Nominal values denote the temperature coefficient within a range of 20℃ to 125℃ (for ΔC)/85℃ (for other TC).

Monolithic Ceramic Capacitors GR_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

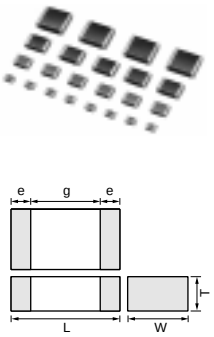
High Dielectric Constant Type 100V

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM188R72A222KD01	X7R (EIA)	100	2200pF±10%	1.6	0.8	0.80
GRM188R72A332KD01	X7R (EIA)	100	3300pF±10%	1.6	0.8	0.80
GRM219R72A472KA01	X7R (EIA)	100	4700pF±10%	2.0	1.25	0.90
GRM219R72A682KA01	X7R (EIA)	100	6800pF±10%	2.0	1.25	0.90
GRM21BR72A103KA01	X7R (EIA)	100	10000pF±10%	2.0	1.25	1.25
GRM31MR72A333KA01	X7R (EIA)	100	33000pF±10%	3.2	1.6	1.15
GRM31MR72A473KA01	X7R (EIA)	100	47000pF±10%	3.2	1.6	1.15
GRM32NR72A683KA01	X7R (EIA)	100	68000pF±10%	3.2	2.5	1.35
GRM32NR72A104KA01	X7R (EIA)	100	0.1µF±10%	3.2	2.5	1.35
GRM43RR72A154KA01	X7R (EIA)	100	0.15µF±10%	4.5	3.2	1.80
GRM43RR72A224KA01	X7R (EIA)	100	22000pF±10%	4.5	3.2	1.80
GRM43DR72A474KA01	X7R (EIA)	100	0.47µF±10%	4.5	3.2	2.00
GRM55DR72A105KA01	X7R (EIA)	100	1µF ±10%	5.7	5.0	2.00
GRM188F52A472ZD01	Y5V (EIA)	100	4700pF +80%, -20%	1.6	0.8	0.80
GRM32NF52A104ZA01	Y5V (EIA)	100	10000pF +80%, -20%	3.2	2.5	1.35
GRM55RF52A474ZA01	Y5V (EIA)	100	0.47µF +80%, -20%	5.7	5.0	1.80

Monolithic Ceramic Capacitors GR_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

Thin Layer Large-Capacitance type

Part Number	Dimensions (mm)				
	L	W	T	e min.	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 0.3	0.4
GRM185	1.6 ±0.1	0.8 ±0.1	0.5 +0/-0.2	0.2 to 0.5	0.5
GRM188	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
GRM216	2.0 ±0.1	1.25 ±0.1	0.6 ±0.1	0.2 to 0.7	0.7
GRM219			0.85 ±0.1		
GRM21B			1.25 ±0.1		
GRM316	3.2 ±0.15	1.6 ±0.15	0.6 ±0.1	0.3 to 0.8	1.5
GRM319			0.85 ±0.1		
GRM31M			1.15 ±0.1		
GRM31C	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2		
GRM32D	3.2 ±0.3	2.5 ±0.2	2.0 ±0.2	0.3	1.0
GRM32E			2.5 ±0.2		
GRM43D	4.5 ±0.4	3.2 ±0.3	2.0 ±0.2	0.3	2.0
GRM43E			2.5 ±0.2		
GRM43S			2.8 ±0.2		
GRM55F	5.7 ±0.4	5.0 ±0.4	3.2 ±0.2	0.3	2.0



Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM155R60J154KE01	X5R (EIA)	6.3	0.15µF±10%	1.0	0.5	0.50
GRM155R60J224KE01	X5R (EIA)	6.3	22000pF±10%	1.0	0.5	0.50
GRM155R60J334KE01	X5R (EIA)	6.3	0.33 µF±10%	1.0	0.5	0.50
GRM155R60J474KE19	X5R (EIA)	6.3	0.47µF±10%	1.0	0.5	0.50
GRM188R60J225KE01	X5R (EIA)	6.3	2.2µF ±10%	1.6	0.8	0.80
GRM219R60J475KE01	X5R (EIA)	6.3	4.7µF ±10%	2.0	1.25	0.90
GRM21BR60J106KE01	X5R (EIA)	6.3	10µF ±10%	2.0	1.25	1.25
GRM21BR60J106ME01	X5R (EIA)	6.3	10µF ±20%	2.0	1.25	1.25
GRM32DR60J226KA01	X5R (EIA)	6.3	22µF ±10%	3.2	2.5	2.00
GRM32ER60J476ME20	X5R (EIA)	6.3	47µF ±20%	3.2	2.5	2.50
GRM43SR60J107ME20	X5R (EIA)	6.3	100µF ±20%	4.5	3.2	2.80
GRM55FR60J107KA01	X5R (EIA)	6.3	100µF ±10%	5.7	5.0	3.20
GRM55FR60J107MA01	X5R (EIA)	6.3	100µF ±20%	5.7	5.0	3.20
GRM21BF50J106ZE01	Y5V (EIA)	6.3	10µF +80%, -20%	2.0	1.25	1.25

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td>Operating Temperature Range</td><td>B1, B3, F1 : −25℃ to +85℃
R6 : −55℃ to +85℃
F5 : −30℃ to +85℃
C8 : −55℃ to +105℃, C7 : -55℃ to +125℃</td><td>Reference Temperature : 25℃
(B1, B3, F1 : 20℃)</td></tr>
<tr><td>2</td><td>Rated Voltage</td><td>See the previous pages</td><td>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.</td></tr>
<tr><td>3</td><td>Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td>Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>5</td><td>Dielectric Strength</td><td>No defects or abnormalities</td><td>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.</td></tr>
<tr><td>6</td><td>Insulation Resistance</td><td>More than 50Ω • F</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at Reference Temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>7</td><td>Capacitance</td><td>Within the specified tolerance
∗Table 1
GRM155 B3/R6 1A 124 to 224
GRM185 B3/R6 1A 105
GRM188 B3/R6 1C/1A 225
GRM219 B3/R6 1A 475
GRM21B B3/R6 1C/1A 106</td><td>The capacitance should be measured at Reference Temperature at the frequency and voltage shown in the table.
Capacitance / Frequency / Voltage
C≦10μF (10V min.)∗1 / 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
∗1 However the Voltage is 0.5+/−0.1Vrms about Table 1 items on the left side.</td></tr>
<tr><td>8</td><td>Dissipation Factor (D.F.)</td><td>B1, B3, R6, C7, C8 : 0.1 max.
F1, F5 : 0.2 max.
∗Table 1
GRM155 B3/R6 1A 124 to 224
GRM185 B3/R6 1A 105
GRM188 B3/R6 1C/1A 225
GRM219 B3/R6 1A 475
GRM21B B3/R6 1C/1A 106</td><td>The D.F. should be measured at Reference Temperature at the frequency and voltage shown in the table.
Capacitance / Frequency / Voltage
C≦10μF (10V min.)∗1 / 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
∗1 However the Voltage is 0.5+/−0.1Vrms about Table 1 items on the left side.</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Capacitance Temperature Characteristics</td><td>No bias</td><td>B1, B3 : Within +/−10% (−25℃ to +85℃)
F1 : Within +30/−80% (−25℃ to +85℃)
R6 : Within +/−15% (−55℃ to +85℃)
F5 : Within +22/−82% (−30℃ to +85℃)
C7 : Within +/−22% (−55℃ to +125℃)
C8 : Within +/−22% (−55℃ to +105℃)</td><td rowspan="2">The capacitance change should be measured after 5min. at each specified temp. stage.
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.
∗GRM43 B1/R6 0J/1A 336/476 only : 1.0±0.2Vrms
Step / Temperature (°C) / Applying Voltage (V)
1 / Reference Tempereture±2 / No bias
2 / –55±3 (for R6, C7, C8)/ –25±3 (for B1, B3, F1) –30±3 (for F5) / No bias
3 / Reference Tempereture±2 / No bias
4 / 85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8)/ / No bias
5 / 20±2 / 50% of the rated voltage
6 / –25±3 (for B1, F1) / 50% of the rated voltage
7 / 20±2 / 50% of the rated voltage
8 / 85±3 (for B1, F1) / 50% of the rated voltage
•Initial measurement for high dielectric constant type
Perform a heat treatment at 150 +0/−10°C for one hour and then set for 48±4 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>50% of the Rated Voltage</td><td>B1: Within +10/−30%
F1: Within +30/−95%</td></tr>
</table>

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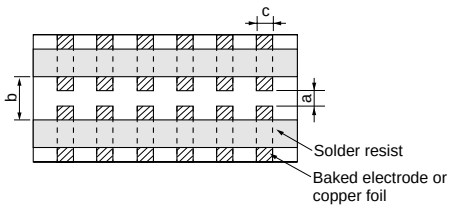
<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>10</td><td>Adhesive Strength of Termination</td><td>No removal of the terminations or other defects should occur
 

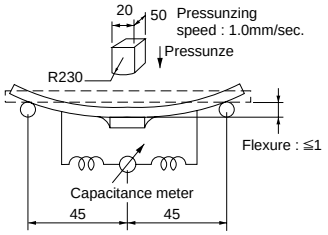
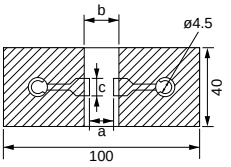
Fig. 1a</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10+/−1sec.
The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
*5N : GR□15/GRM18, 2N : GR□33
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr>
<tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr>
<tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr>
<tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr>
<tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr>
<tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr>
<tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table></td></tr>
<tr><td>11</td><td>Vibration
Appearance
Capacitance
D.F.</td><td>No defects or abnormalities
Within the specified tolerance
B1, B3, R6, C7, C8 : 0.1 max.
F1, F5 : 0.2 max.</td><td>Solder the capacitor on 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 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 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>12</td><td>Deflection</td><td>No cracking or marking defects should occur
 

Fig.3a</td><td>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 for 5+/−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.
 

t : 1.6mm
Fig. 2a
(GR□03, GR□15 : t : 0.8mm)
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr>
<tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr>
<tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr>
<tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr>
<tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr>
<tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr>
<tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table>
(in mm)</td></tr>
<tr><td>13</td><td>Solderability of Termination</td><td>75% of the terminations is to be soldered evenly and continuously</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight propotion) .
Preheat at 80 to 120℃ for 10 to 30 seconds.
After preheating, immerse in an eutectic solder solution for 2+/−0.5 seconds at 230+/−5℃.</td></tr>
</table>

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No.	Item		Specifications	Test Method
14	Resistance to Soldering Heat	Appearance	No defects or abnormalities	Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in an eutectic solder solution at 270+/−5℃ for 10+/−0.5 seconds. Set at room temperature for 24+/−2 hours (temperature compensating tyoe) or 48+/−4 hours (high dielectric constant type), then measure. •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 48+/−4 hours. Perform the initial measurement. *Preheating for GRM32/43/55
		Capacitance Change	B1, B3, R6, C7, C8 : Within ±7.5% F1, F5 : Within ±20%	
		Q/D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.	
		I.R.	More than 50Ω • F	
		Dielectric Strength	No defects	

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

No.	Item		Specifications	Test Method
15	Temperature Sudden Change	Appearance	No defects or abnormalities	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 shown in the following table. Set for 24+/−2 hours (temperature compensating type) or 48+/−4 hours (high dielectric constant type) at room temperature, then measure.
		Capacitance Change	B1, B3, R6, C7, C8 : Within ±7.5% F1, F5 : Within ±20%	
		D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.	
		I.R.	More than 50Ω • F	
		Dielectric Strength	No defects	

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

•Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/−10℃ for one hour and then set at room temperature for 48+/−4 hours.
Perform the initial measurement.

No.	Item		Specifications	Test Method
16	High Temperature High Humidity (Steady)	Appearance	No defects or abnormalities	Apply the rated voltage at 40+/−2℃ and 90 to 95% humidity for 500+/−12 hours. The charge/discharge currentis less than 50mA. •Initial measurement Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 48+/−4 hours at room temperature. Perform the initial measurement. •Measurement after test Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 48+/−4 hours at room temperature, then measure.
		Capacitance Change	B1, B3, R6, C7, C8 : Within ±12.5% F1, F5 : Within ±30%	
		D.F.	B1, B3, R6, C7, C8 : 0.2 max. F1, F5 : 0.4 max.	
		I.R.	More than 12.5Ω • F	
17	Durability	Appearance	No defects or abnormalities	Apply 150% of the rated voltage for 1000+/−12 hours at the maximum operating temperature +/−3℃. Let sit for 48+/−4 hours at room temperature, then measure. The charge/ discharge current is less than 50mA. •Initial measurement Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 48+/−4 hours at room temperature. Perform the initial measurement. •Measurement after test Perform a heat treatment at 150+0/−10℃ for one hour and then let sit for 48+/−4 hours at room temperature, then measure.
		Capacitance Change	B1, B3, R6, C7, C8 : Within ±12.5% F1, F5 : Within ±30%	
		D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.4 max.	
		I.R.	More than 25Ω • F	