

# CHIP MONOLITHIC CERAMIC CAPACITOR FOR GENERAL GRM155R61A224KE19\_ (0402, X5R, 0.22uF, 10Vdc)

\_: packaging code Reference Sheet

# 1.Scope

This product specification is applied to Chip Monolithic Ceramic Capacitor used for General Electronic equipment.

# 2.MURATA Part NO. System

(Ex.)	GRM	15	5	R6	1A	224	K	E19	D
		(1)L/W Dimensions	(2)T Dimensions	(3)Temperature Characteristics	(4)DC Rated Voltage	(5)Nominal Capacitance	(6)Capacitance Tolerance	(7)Murata's Control Code	(8)Packaging Code

# 3. Type & Dimensions



(Unit:mm)

1

(1)-1 L	(1)-2 W	(2) T	е	g
1.0±0.05	0.5±0.05	0.5±0.05	0.15 to 0.35	0.3 min.

### 4.Rated value

(3) Temperature (Public STD Co	(4) DC Rated	(5) Nominal	(6) Capacitance	Specifications and Test Methods	
Temp. coeff or Cap. Change	Temp. Range (Ref.Temp.)	Voltage	Capacitance	Tolerance	(Operationg Temp. Range)
-15 to 15 %	-55 to 85 °C (25 °C)	10 Vdc	0.22 uF	±10 %	-55 to 85 °C

### 5.Package

mark	(8) Packaging	Packaging Unit	
D	φ180mm Reel PAPER W8P2	10000 pcs./Reel	
W	φ180mm Reel PAPER W8P1	20000 pcs./Reel	
J	φ330mm Reel PAPER W8P2	50000 pcs./Reel	

Product specifications in this catalog are as of Jan.26,2013,and are subject to change or obsolescence without notice. Please consult the approval sheet before ordering.

Please read rating and !Cautions first.

# ■SPECIFICATIONS AND TEST METHODS

Operating	m	Specification	Test Method			
Temperature		B1,B3,F1 : -25°C to 85°C	Standard Temperature : 20°C			
Temperature Range R1,R7,D7: -55°C to 125°C C6,R6: -55°C to 85°C			(R6,R7,C6,C7,C8,D7,D8,E7,F5:25°C)			
		Co, Ro : -55 °C to 55 °C C7, E7 : -55 °C to 125 °C				
		C8,D8:-55°C to 105°C				
<u> </u>		F5:-30°C to 85°C				
Rated Voltag	е	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.			
			When AC voltage is superimposed on DC voltage, V <sup>P-P</sup> or V <sup>O-P</sup> ,			
			whichever is larger, should be maintained within the rated voltage range			
<del>                                     </del>						
Appearance		No defects or abnormalities.	Visual inspection.			
Dimension		Within the specified dimensions.	Using calipers. (GRM02 size is based on Microscope)			
Dielectric Str	enath	No defects or abnormalities.	No failure should be observed when 250% of the rated voltage is			
	9		applied between the terminations for 1 to 5 seconds, provided the			
			charge/discharge current is less than 50mA.			
Insulation		More than 50Ω · F	The insulation registeres should be massured with a DC voltage set.			
Resistano	ce	More than 2007 . E	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at Standard Temperature and 75%RH materials.			
			and within 1 minutes of charging, provided the charge/discharge curre			
			is less than 50mA.			
		Med a grant of the last	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7			
Capacitance		Within the specified tolerance.	The capacitance / D.F. should be measured at Standard Temperature at the frequency and voltage shown in the table.			
Dissipation F	actor	B1,R1,B3,R6,R7,C6,C7,C8,E7,D7: 0.1 max.	Capacitance Frequency Voltage			
(D.F.)		D8,GRM31CR60J107 : 0.15 max *Table 1	*1 C<10uE			
		F1,F5 : 0.2 max GRM033 B3/R6 1A 123 to 823 GRM033 B3/R6 1A 104	(10V min.) 1±0.1kH2 1.0±0.2VIIIS			
		GRM155 B3/R6 1A 124 to 105	*2 C≦10μF (6.3V max.) 1±0.1kHz 0.5±0.1Vrms			
		GRM185 B3/R6 1C/1A 105 GRM185 C8/D7 1A 105	C>10µF 120±24Hz 0.5±0.1Vrms			
		GRM188 B3/R6 1C/1A 225				
		GRM188 R7/C8/D7 1A 225 GRM188 B3/R6 1A 335	*1 For items listed in Table 1 on the left, the capacitance should be			
		GRM219 B3/R6 1C/1A 475	measured using a voltage of 0.5±0.1Vrms instead of 1.0±0.2Vrms.			
		GRM219 C8 1A 475 GRM219 B3/R6 1A 106	*2 For item GRM188R70J105, the capacitance should be measured using a voltage of 1.0±0.2Vrms instead of 0.5±0.1Vrms.			
		GRM21B B3/R6 1C/1A 106	incasured using a voltage of 1.010.2 viiiis instead of 0.010.1 viiiis.			
		GRM21B R7/C8 1A 106 GRM319 B3/R6 1C/1A 106				
	1					
Capacitance	No bias	B1,B3 : Within ±10% (-25°C to +85°C)	The capacitance change should be measured after 5min. at each			
Temperature Characteristics		R1,R7 : Withn ±15% (-55°C to +125°C) R6 : Within ±15% (-55°C to +85°C)	specified temp.stage.  The ranges of capacitance change compared with the Standard			
Ondraotonotio		F1 : Within +30/-80% (-25°C to +85°C)	Temperature value over the temperature ranges shown in the table			
		C6 : Within ±22% (-55°C to +85°C)	should be within the specified ranges.			
		C7 : Within±22% (-55°C to +125°C)	In case of applying voltage, the capacitance change should be			
		C8 : Within ±22% (-55°C to +105°C)	measured after 1 more min. with applying voltage in equilibration			
		E7 : Within +22/-56% (-55°C to +125°C) D7 : Within +22/-33% (-55°C to +125°C)	of each temp. stage.  · Measurement Voltage			
		D8 : Within +22/-33% (-55°C to +105°C)	GRM152 B3 0J 104/224, GRM155 B1 0J 124 to 334,			
		F5 : Within +22/-82% (-30°C to +85°C)	GRM155 B3 0J 394 to 824, GRM155 B3 1A 124 to 105,			
			GRM188 B1 0G 106, GRM21B B1 0J 106, GRM32R C6 0G 157,			
			GRM32R D8 0E 157 only : 0.2±0.05Vrms			
			GRM188 R7 1C 105 K/M E15, GRM21B R7 1A/1C 475 K/M E51, GRM219 R7 1A/1C 225 only : 0.5±0.1Vrms			
			GRM43 B1/B3/R6 0J/1A 336/476 only : 1.0±0.2Vrms			
			GRM188 R6 1H 474 only : 1.5±0.3Vrms			
			Step Temperature(°C) Applying Voltage(V)			
	1		1 20±2*			
			-55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8)			
			2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) -30±3(for F5) No bias *R6 R7 C6 C7 C8 D7			
			-55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2			
			2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±32(for B1,B3,F1) -30±3(for F5) 3 20±2" 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for R1,R7,C7,E7,D7)			
			2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) -30±3(for F5) 3 20±2* 85±3(for B1,B3,F1,F5,R6,C6) *R6,R7,C6,C7,C8,D7,D8,E7,F5:25±2°C			
	50% of	R1 · Within + 10 / 30%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1) - 30±3(for F5) -3 -20±2* - 85±3(for B1,B3,F1,F5,R6,C6) -4 -125±3(for R1,R7,C7,E7,D7) -125±3(for C8,D8) -5 -20±2 -6 -55±3(for R1)/			
	50% of the rated	B1: Within +10/-30% R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) 3 -20±2* 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for B1,B3,F1,F5,R6,C6) 105±3(for C8,D8) 5 20±2 65±2(for B1,B1,F1,F1,F2,F1,F2,F1,F2,F1,F2,F2,F1,F2,F1,F2,F1,F2,F1,F2,F1,F2,F1,F2,F1,F2,F1,F2,F1,F2,F1,F1,F2,F1,F1,F2,F1,F1,F2,F1,F1,F2,F1,F1,F1,F1,F1,F1,F1,F1,F1,F1,F1,F1,F1,			
		B1: Within +10/-30% R1: Within +15/-40% F1: Within +30/-95%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1,F5,R6,C6) -4 -125±3(for R1,B7,C7,E7,D7) -125±3(for R1,R7,C7,E7,D7) -25±3(for R1)/ -25±3(for R1)/ -25±3(for R1)/ -25±3(for R1)/ -25±3(for R1)/ -20±2 -8 -125±3(for R1)/ -20±2 -8 -125±3(for R1)/ -20±2 -4 -125±3(for R1)/ -20±2			
	the rated	R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1)			
	the rated	R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1,F5,R6,C6) -4 125±3(for R1,R7,C7,E7,D7) -125±3(for R1,R7,C7,E7,D7) -20±2 -6 -55±3(for B1,F1) -7 20±2 -8 125±3(for R1)/8 8±3(for B1,F1) -7 15±3(for B1,F1) -7 15±3			
	the rated	R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1,F5,R6,C6) -4 125±3(for R1,R7,C7,E7,D7) -105±3(for R1,R7,C7,E7,D7) -105±3(for R1)/ -25±3(for R1)/ -25±3(for B1,F1) -7 20±2 -8 125±3(for R1)/ -8 8 325(for B1,F1) -105±3(for B1,F1) -10			
	the rated	R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1,F5,R6,C6) -4 -125±3(for B1,B3,F1,F5,R6,C6) -4 -125±3(for R1,R7,C7,E7,D7) -105±3(for R1,R7,C7,E7,D7) -105±3(for R1)/ -25±3(for R			
	the rated	R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) -25±3(for B1,B3,F1) -30±3(for B1,B3,F1) -30±3(for B1,B3,F1) -15,E7,E7,E7,E7) -15±3(for R1,R7,C7,E7,D7) -105±3(for R1,R7,C7,E7,D7) -105±3(for R1,P1) -25±3(for R1)/ -25±3(for R1)/ -25±3(for R1)/ -15±3(for R1)			
Adhesive Str	the rated voltage	R1: Within +15/-40%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) 3 -20±2" 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for R1,R7,C7,E7,D7) 105±3(for R1,R7,C7,E7,D7) 5 -20±2 6 -55±3(for R1)/ 7 -20±2 8 125±3(for R1)/ 8 125±3(for R1)/ 8 125±3(for R1)/ 8 125±3(for R1)/ 105±3(for R1)/ 105±3(f			
Adhesive Str Termination	the rated voltage	R1: Within +15/-40% F1: Within +30/-95%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) 3 20±2* 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for R1,R7,C7,E7,D7) 105±3(for R1,R7,C7,E7,D7) 105±3(for R1)/ 6 -25±3(for R1)/ 7 20±2 8 125±3(for R1)/ 8 8 125±3(for R1)/ 8 125±3(for B1,F1)  - Initial measurement 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.  Solder the capacitor on the test jig (glass epoxy board) shown in Fig.3 using an eutectic solder.			
	the rated voltage	R1: Within +15/-40% F1: Within +30/-95%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) 3 -20±2* 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for R1,R7,C7,E7,D7) 105±3(for R1,R7,C7,E7,D7) 5 -20±2 6 -55±3(for R1)/ 6 -25±3(for R1)/ 7 -20±2 8 125±3(for R1)/ 8 8 85±3(for B1,F1) 7 -20±2 10fittial measurement 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.  Solder the capacitor on the test jig (glass epoxy board) shown in Fig.3 using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10+/-1sec.			
	the rated voltage	R1: Within +15/-40% F1: Within +30/-95%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) 3 -20±2* 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for R1,R7,C7,E7,D7) 105±3(for R1,R7,C7,E7,D7) 5 -20±2 6 -55±3(for R1)/ 7 -20±2 8 125±3(for R1)/ 8 125±3			
	the rated voltage	R1: Within +15/-40% F1: Within +30/-95%	2 -55±3(for R1,R6,R7,C6,C7,C8,E7,D7,D8) 2 -25±3(for B1,B3,F1) 3 -20±2* 85±3(for B1,B3,F1,F5,R6,C6) 4 125±3(for R1,R7,C7,E7,D7) 105±3(for R1,R7,C7,E7,D7) 5 -20±2 6 -55±3(for R1)/ 6 -25±3(for R1)/ 7 -20±2 8 125±3(for R1)/ 8 8 85±3(for B1,F1) 7 -20±2 10fittial measurement 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.  Solder the capacitor on the test jig (glass epoxy board) shown in Fig.3 using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10+/-1sec.			

#### ■SPECIFICATIONS AND TEST METHODS

Section   Sect	17   Visitation   Appearance   No Selection of abnormalises.   Solidar Tex equipation on the feeting glasse spoot bound in the measurement of the same confidence (10).			em	Specification	Test Method
Resistance   Capacitance   C	Resistance    Capacitance   Ca					
Page   Capability   Capabilit	Capacitance			rppearance	The defects of abhormanics.	, , , , , , , , , , , , , , , , , , , ,
DF.   SIR1BS.RE.RY.CR.CYGS.EF.D7 : 0.1 max.   monitor having a total amplitude of 1.5mm, the frequency proportion of 10 common to 10	DF. B1R1-B3-R6-R7-C6-C7-C8-E7-D7 - O.1 max.			Capacitance	Within the specified tolerance.	
DF.   DistRIBSTREAM CONTROL TO T. 0.1 miss. DistRIBSTREAM CONTROL TO T. 0.15 miss. DistRIBSTRE	DF   BILR BURRAR FOR COCT CREET DY : 0.1 max   Dol. Graw   Dol. Graw Conditions   Dol. G					· · · · · · · · · · · · · · · · · · ·
Residence	GRAND CR71E108 : 0.125 max month and better transment in approximately 1 minute. This PLFC 12 max month and both position for partial of hours in each 3 minute. The month and both position for partial of hours in cash 3. Minute preparations of 6 hours.)  75 May defects or abnormalities.  Solder the requirement on the resign (place place) by the effort method and should be conducted with case so that the education of the conductivity of 1 minutes. The month of the conductivity of 1 minutes and continuously.  75 May the summations is to be soldered evenly and continuously.  76 May defects or abnormalities.  17 Solderability of 1 minutes.  18 Solderability of 1 minutes. The month of the minutes of adequate and an electric place of adequate and an electric place of adequate and an electric place. The soldering deput depth of the prefix of method and should be conducted with case so that the electricity is uniform and retired or adequate the conductivity of 1 minutes. The minutes of adequate the conductivity of the minutes of adequate the conductivity of adequate the conductivity of the minutes. All preferred and an electricity of adequate the conductivity of the minutes. All preferred and an electricity of adequate the conductivity of the minutes. All preferred and an electricity of adequate the conductivity of the minutes. All preferred and an electricity of adequate the conductivity of the minutes. All preferred and an electricity of the conductivity of the minutes. All preferred and an electricity of the minutes. All preferred and an electricity of the conductivity of the minutes. The preferred and an electricity of the minutes. The property of the minutes of the minutes of the minutes. The preferred and an electricity of the minutes. The preferred and an electricity of the minutes. The preferred and an electricity of t			D.F.	B1,R1,B3,R6,R7,C6,C7,C8,E7,D7 : 0.1 max.	<del></del>
Page-12   Page	PLFS   1.0.2 max   modion about be explosed for a period of 2 hours in each 3 modified and section for 2 hours in each 3 modified middle properties of 5 hours in the period in an addition does not be considered in the period of 5 hours in the period of 5 hours in the period in an addition does not only in the period of 5 hours in the period o				D8,GRM31CR60J107 : 0.15 max	and 55Hz. The frequency range, from 10 to 55Hz and return
Deficiency   Appearance   App	Deflection   Appearance   No deflects or abnormalities.   Soutce the Capacidance   C				GRM31CR71E106 : 0.125 max	to 10Hz, should be traversed in approximately 1 minute. This
Special Procession	Appearance   No defects or abnormalities.   Solder the capacitance in the testing (glass specy beauti) abnoral in Fig. 2 for 54-/1 sec. The soldering should be force by the reflow method and should be forced by the reflect method and should be forced by the reflection shown in Fig. 2 for 5 should be forced by the reflection of the reflection should be forced by the ref				F1,F5 : 0.2 max	motion should be applied for a period of 2 hours in each 3
Soldsentity	Capacitance   Within s10%   Soldensity   S					mutually perpendicular directions(total of 6 hours).
Capacitance   Change	Capacitance   Change	12	Deflection	Appearance	No defects or abnormalities.	Solder the capacitor on the test jig (glass epoxy board)
Solderability of Termination   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly and continuously.   75% of the terminations is to be soldered evenly.   75% of the terminations is to be soldered evenly.   75% of the terminations is to be soldered evenly.   75% of the terminations is to be soldered evenly.   75% of the terminations is to be soldered evenly.   75% of the terminations is to be soldered evenly.   75% of the terminations is to be soldered evenly.   75% of the termination of the termination of the termination of the termination.   75% of the termination of the termination of the termination.   75% of the termination of the termination of the termination of the termination.   75% of the termination of the termi	Solderability of Termination   75% of the terminations is to be soldered evenly and continuously.					shown in Fig.1 using an eutectic solder. Then apply a force
Solderaphility of Tormination   Total terminations is to be soldered evenly and continuously.   Total terminations is to be soldered evenly and continuously.   Imministration	Consideration of the solidering support of support of the solidering support of support of the solidering support of support of the support			Capacitance	Within ±10%	in the direction shown in Fig 2 for 5+/-1 sec. The soldering
Solderbally of Termination   75% of the terminations is to be soldered evently and continuously.   75% of the terminations is to be soldered evently and continuously.   1	13 Solderability of Termination and Continuously.  14 Professional to Professional to Solderability and continuously.  15 Resistance to Resist			Change		should be done by the reflow method and should be
13 Soldering Heat   Termination   Terminat	Temperature					· ·
and rosin (JBS-K-9502) (29% rosin in weight proposion). Perheating immerse in an eutectic solder solution for 24-05 seconds at 2034-76 to 30 seconds. After preheating, immerse in an eutectic solder solution for 24-05 seconds at 2034-76 or 54-0.04,05 Cto 30 seconds at 2034-76 or 54-0.04	and cosni, (JB-K-9802) (29% rosin in weight proportion). Perheats at 50 to 120°C for 10 to 3 seconds. After preheating, immerse in an outcide codes solution for 24-05 seconds at 230-15°C for 10 sins 200-100°C for 34-050-05°C observable to 34-05°C for 58-03-050-05°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C observable to 34-05°C for 11 minute. The second at 230-15°C for 11 minute. The secon					
Perbeat at 80 to 120°C for 10 to 30 seconds.	Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immores in an aductic solidor solution for 24°-0.5 seconds at 220°-4.5°C or Sn-3.0Ago.5°Cu solder solution for 24°-0.5 seconds at 220°-4.5°C or Sn-3.0Ago.5°Cu solder solution for 24°-0.5 seconds at 220°-4.5°C or Sn-3.0Ago.5°Cu solder solution for 24°-0.5 seconds at 220°-4.5°C or Sn-3.0Ago.5°Cu solder solution for 27°-4.05 seconds at 220°-4.5°C or Sn-3.0Ago.5°Cu solder solution for 27°-4.05 seconds at 220°-4.5°C for 1 minute. Immore the capacition in an exictic solder solution at 270°-4.5°C for 1 minute. Immore the capacition in an exictic solder solution at 270°-4.5°C for 1 minute. Immore the capacition in an exictic solder solution at 270°-4.5°C for 1 minute. Immore the capacition in an exictic solder solution at 270°-4.5°C for 1 minute. Immore the capacition and solder solution at 270°-4.5°C for 1 minute. Immore the capacition and contemporation for 24°-4.2°C for 3°C for	13			The state of the s	
After preheating, immerse in an executor solder solden for 2+4-5 seconds at 24-9-5 seconds at 24-9-5. Seconds at 24-9-5.   Agreement   A	After proteosing, immores in an outderic solder solution for 24-05 seconds at 2040-167 or 5ns 30.4po 30 to solder 34-05 or 5ns 30.4po 30 to 50 to 50 to 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the capacitor in 12 to 15 for 1 minute. Immore the 15 for 12 to 15 for 1 minute. Immore the 15 for 24 to 24 for 1 minute.		of Termina	ation	and continuously.	, ,,
Appearance   No defects or abnormalities.	24-0.5 seconds at 239-t-5°C or Srs-3.0Ag0.5Cu solder solution to 224-05 seconds at 239-t-5°C or Srs-3.0Ag0.5Cu solder solution to 224-05 seconds at 246-95.   Appearance   Capacitance					
Resistance to Soldoning Heal	Resistance to   Repearance   Soldering Heat					
Appearance   App	Appearance   Appearance   Appearance   Appearance   Soldering Heat   Soldering Heat   Appearance   Soldering Heat					· ·
Soldering   Heat	Soldering Heat   Capacitanese   Change   St R1.83.R6.R7.C6.C7.C8.E7.D7.D8   Within a 12.5%   Change   FI.5   Change   F					solution for 2+/-0.5 seconds at 245+/-5.
Capacitance   Change   Chang	Capacitance   Al. R. B.3.8.6.R.7.C6.C7.C8.E.7.D7.D8   Within ±2.5%	14		Appearance	No defects or abnormalities.	· ·
Change	Change		Soldering Heat			<b>→</b>
P.F.   B   R.F.   R.F.   B   R.F.   R.F.   R.F.   B   R.F.	P.F.   B.I.R.1,B.3,R6,R7.C6,C7.C8,E7.D7: 0.1 max.					· ·
DF.   B1.R1.B3.R6.R7,C6.C7.C8.E7.D7:0.1 max. D8.GRM31CR7E106 : 0.125 max F1.F5 : 0.2 max F1.F5 : 0.2 max Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature (and the set of	D.F.   B.I.R.1,B.3,R6,R7.C6,C7.C8,E7,D7: 0.1 max   C.R.			Change		·
D.F.   B1.R1B.3.R6.R7,C6.C7,C8.F7.D7.D1 max   Disease   F1.F5   Single	D.F.   B1.R1.B3.R6.R7.C6.C7.C8.E7.D7: 0.1 max   D8.GRM31CR21E106   0.1.25 max   F1.F5   0.2 max				F1,F5 : Within ±20%	, and the second
D. B. GRM31CR60J107	DB_GRM31CR71E106					*Not apply to GRM02
Fi.F5	CRM31CR71E10B : 0.125 max   Perform a heat treatment at 150-0/-10°C for one hour and then set at room temperature 242 hours. Perform the initial measurement.			D.F.		
F1,F5   : 0.2 max   temperature for 24±2 bours.   Perform the initial measurement.	F1,F5   : 0.2 max				-,-	
R.   More than 500 · F	Perform the risk measurement.					
IR   More than 50Ω · F	IR				F1,F5 : 0.2 max	
Preheating for GRAI32/43/55   Sep   Terroperature   Time   1   100°C to 120°C   1 min.	Preheating for GRA32/43/55   Strength   Preheating for Gras2/43/55   Strength   Preh			LD	Mars there 500 . F	Perform the initial measurement.
Delectric Strength   Delect	Delectric Strength   No defects   No defects   No defects or abnormalities.			I.R.	More than 50Ω · F	
Delectric Strength   No defects   Temperature Sudden   Appearance   Appearance   Size   Appearance   Size   Appearance   Size   Appearance   Appe	Delectric Strength					
Strength   Appearance   Sudden   Change   Change   Change   Change   Change   Change   E7   Sudden   Change   E7   Sudden   Change   E7   Substitute ±30%   E	Strength					
Second color   Sudden   Sudd	Appearance   Appearance   No defects or abnormalities.   Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).				No defects.	
Sudden   Change   B1,R1,B3,R6,R7,C6,C7,C8,D7,D8 : Within ±3.9%   F1,F5   : Within ±3.9%   E7   : Within ±3.9%   F1,F5   : Within ±3.0%   : Within ±3.0%   F1,F5   : Within ±3.0%   : Within	Sudden Change   Change   Change   Change   Change   St. Rt. R. B. R. R. R. R. C.			orrength		2   170 C to 200°C   1 IIIIII.
Sudden   Change   B1,R1,B3,R6,R7,C6,C7,C8,D7,D8 : Within ±3.9%   F1,F5   : Within ±3.9%   E7   : Within ±3.9%   F1,F5   : Within ±3.0%   : Within ±3.0%   F1,F5   : Within ±3.0%   : Within	Sudden Change   Change   Change   Change   Change   St. Rt. R. B. R. R. R. R. C.	15	T	Annogrance	No defeate or chapraglitics	Fix the consister to the supporting its in the same
Change	Change   Capacitance   E7   Within ±3.0%   F1,F5   Within ±20%   Set for 24+/2 hours at room temperature, then measure.	15		Appearance	No defects of abnormalities.	
Change   E7	Change   F7			Canacitanas	P1 P1 P2 P6 P7 C6 C7 C9 D7 D9 · Within +7 59/	` '
F1,F5	PF1,F5   SWithin ±20%   Set for 244-/2 hours at room temperature, then measure.		Change			, ,
D.F.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7:0.1 max.   D8,GRM31CR60J107   : 0.15 max   GRM31CR71E106   : 0.125 max   F1,F5   : 0.2 max     1	D.F.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7:0.1 max.   D.S.GRM31CR00J107 : 0.15 max   GRM31CR71E106 : 0.125 max   F1,F5 : 0.2 max   S1,F5 : 0.			Change		· ·
D.F.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7:0.1 max   D8,GRM31CR0J107 : 0.15 max   GRM31CR71E106 : 0.125 max   F1,F5 : 0.2 max   2   Room Tamp   2 to 3   3   Operating Temp-3/0.3   30±3   2   Room Tamp   2 to 3   4   Room Tamp   2 to 3   Room Tamp	D.F.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5%   Hamiltonian				F1,F3 . WIUIII1 ±20%	
D8,GRM31CR60J107	DB,GRM31CR60J107			D.F.	B1 R1 B3 R6 R7 C6 C7 C8 F7 D7 : 0.1 max	
Capacitance   P.F.	Room Temp   2 to 3   3   2   1   2   1   3   3   2   3   3   3   3   3   4   1   3   3   4   3   3   4   3   3   3   3			D		
F1,F5   : 0.2 max   3   Coperating Tarump   30±3     4   Room Tump   2 to 3     I.R.   More than 50Ω · F   Initial measurement	F1,F5   : 0.2 max   3   Coverning Temp.+3-0   30.63   4   Room Tamp   2 to 3				l '	
LR.   More than 50Ω · F   Initial measurement   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.	I.R.   More than 50Ω · F   Initial measurement   Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 24±2 bours. The charge/discharge charge (Steady)					3 Max. 30±3
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.   Perform the initial measurement.   Perform the initial measurement.   Perform the initial measurement.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at	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.    Perform the initial measurement.				. ,, ,	
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.   Perform the initial measurement.   Perform the initial measurement.   Perform the initial measurement.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at	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.    Perform the initial measurement.					
at room temperature for 24±2 hours. Perform the initial measurement.    Perform the initial measurement.	at room temperature for 24±2 hours. Perform the initial measurement.    Dielectric Strength			I.R.	More than 50Ω · F	Initial measurement
at room temperature for 24±2 hours. Perform the initial measurement.    Perform the initial measurement.	at room temperature for 24±2 hours. Perform the initial measurement.    Dielectric Strength					
Dielectric Strength	Dielectric Strength   Dielectric Dielectr					Perform a heat treatment at 150+0/-10°C for one hour and then set
Dielectric Strength	Dielectric Strength   Dielectric Dielectr					
Strength   Strength   GRM188B30J106M:   Measurement after test   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.	Strength   Strength   GRM188B30J106M:   Measurement after test   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.					at room temperature for 24±2 hours.
Measurement after test	Measurement after test   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.			Dielectric	No defects.	at room temperature for 24±2 hours.
Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.    Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.    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.    Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.    Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.    Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Perform a heat treatment and then let sit for 24+/-2 hours at the maximum operating temperature +/-3°C. The charge/ discharge current is less than 50mA.    Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at the maximum operating temperature +/-3°C. The charge/ discharge current is less than 50mA.    Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at the maximum operating temperature at 150+0/-10°C for one hour and then let sit for 24+2 hours at treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.    Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+2 hours at room temperature.	Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.				No defects.	at room temperature for 24±2 hours. Perform the initial measurement.
Appearance   Appearance   Appearance   Appearance   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.    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.    D.F.	Appearance   Appearance   Appearance   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.				No defects.	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M:
Temperature High High Humidity (Steady)  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5%	Temperature High High Homidity (Steady)  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% F1,F5  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5  I.R.  More than 12.5Ω · F  Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/discharge current is less than 50mA.  humidity for 500+/-12 hours. The charge/discharge current is less than 50mA.  hitial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C. The charge/discharge current is less than 50mA.  hitial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  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.  No defects or abnormalities.  F1,F5  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5  C3 and More than 25Ω · F  Perform the initial measurement.  No defects or abnormalities.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/discharge current is less than 50mA.  No chasurement at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  Perform the initial measurement.  No defects or abnormalities.  Perform the intial measurement.  No defects or abnormalities.  Perform the intial measurement.  No defects or abnormalities.  Perform the intial meas				No defects.	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test
Temperature High High Humidity (Steady)  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5%	Temperature High High Homidity (Steady)  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% F1,F5  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5  I.R.  More than 12.5Ω · F  Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/discharge current is less than 50mA.  humidity for 500+/-12 hours. The charge/discharge current is less than 50mA.  hitial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C. The charge/discharge current is less than 50mA.  hitial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  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.  No defects or abnormalities.  F1,F5  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5  C3 and More than 25Ω · F  Perform the initial measurement.  No desurement at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  Perform the initial measurement.  No desurement after test Perform the initial measurement.  No desurement after test Perform the initial measurement.				No defects.	at room temperature for 24±2 hours.  Perform the initial measurement.  GRM188B30J106M:  Measurement after test  Perform a heat treatment and then let sit for 24+/-2 hours at room
High Humidity (Steady)  Capacitance Change Humidity (Steady)  D.F.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% : Within ±30%  D.F.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max  F1,F5 : 0.4 max  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% : Within ±30%  D.F.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. 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.	High Humidity (Steady)    Capacitance Change   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% : Within ±30%   Initial measurement	16	High	Strength		at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.
Humidity (Steady)   Change   F1,F5   : Within ±30%   Initial measurement	Humidity (Steady)   Change   F1,F5   : Within ±30%   Initial measurement	16		Strength		at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Apply the rated voltage at 40+/-2°C and 90 to 95%
Steady)   Steady    Ste	Steady)   D.F.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max.   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.   Measurement after test   Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.   Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.   The charge/ discharge current is less than 50mA.   Initial measurement   Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at the maximum operating temperature +/-3°C.   The charge/ discharge current is less than 50mA.   Initial measurement   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.   Perf	16	Temperature	Strength	No defects or abnormalities.	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply the rated voltage at 40±/-2°C and 90 to 95% humidity for 500±/-12 hours. The charge/discharge
D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max 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	D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max 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. · Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Appearance No defects or abnormalities.  Appearance Capacitance Change F1,F5 : Within ±12.5% F1,F5 : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24+/-2 hours at room temperature.  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  - Initial measurement - Perform the initial measurement Measurement after test - Perform the neatment at 150+0/-10°C for one hour and then let sit for 24±/-2 hours at room - Perform the initial measurement Measurement after test - Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±/-2 hours at room	16	Temperature High	Strength  Appearance  Capacitance	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5%	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply the rated voltage at 40±/-2°C and 90 to 95% humidity for 500±/-12 hours. The charge/discharge
F1,F5 : 0.4 max for 24±2 hours at room temperature.  Perform the initial measurement. ·Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Appearance No defects or abnormalities. Apply 150% of the rated voltage for 1000±/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change F1,F5 : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max 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.	F1,F5 : 0.4 max for 24±2 hours at room temperature.  Perform the initial measurement.  - Measurement and then let sit for 24+/-2 hours at room temperature, then measure.  Applearance No defects or abnormalities.  Applearance No defects or abnormalities.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change F1,F5 : Within ±12.5%  F1,F5 : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±/-2 hours at room temperature.  - Measurement perform the initial measurement.  - Measurement after test - Measurement and then let sit for 24+/-2 hours at room	16	Temperature High Humidity	Strength  Appearance  Capacitance	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5%	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  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.
Perform the initial measurement.  - Measurement after test  I.R. More than 12.5Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Appearance  Appearance  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% -Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5	Perform the initial measurement.	16	Temperature High Humidity	Appearance Capacitance Change	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  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.  *Initial measurement
- Measurement after test  I.R. More than 12.5Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Appearance  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change  Change  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% F1,F5  : Within ±30%  Initial measurement 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.	Measurement after test	16	Temperature High Humidity	Appearance Capacitance Change	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max.	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  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.  *Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit
I.R.     More than 12.5Ω · F     Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.       17 Durability     Appearance     No defects or abnormalities.     Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.       Capacitance Change     B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% : Within ±30%     The charge/ discharge current is less than 50mA.       Initial measurement     Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.       D.F.     B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5     F1,F5       E0.4 max     Perform the initial measurement.	I.R. More than 12.5Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Appearance  Appearance  Appearance  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance  Change  Change  Change  Change  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  Initial measurement  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.  Measurement after test  I.R. More than 25Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room	16	Temperature High Humidity	Appearance Capacitance Change	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max.	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement Perform a heat treatment at 150±0/-10°C for one hour and then let sit for 24±2 hours at room temperature.
temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5 : 0.4 max temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  Initial measurement  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.	temperature, then measure.  Appearance  Appearance  No defects or abnormalities.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% F1,F5  : Within ±30%  Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  F1,F5  : 0.4 max  Perform the initial measurement.  - Measurement after test  I.R.  More than 25Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room	16	Temperature High Humidity	Appearance Capacitance Change	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max.	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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 defects or abnormalities.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% F1,F5  : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5  : 0.4 max  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  Initial measurement  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 defects or abnormalities.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  Capacitance Change F1,F5 : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max Perform the initial measurement.  - Measurement after test  I.R. More than 25Ω · F  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  - Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  - Measurement after test  - Perform a heat treatment and then let sit for 24+/-2 hours at room	16	Temperature High Humidity	Appearance Capacitance Change D.F.	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test
the maximum operating temperature +/-3°C.  Capacitance Change B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within ±12.5% F1,F5 : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5 : 0.4 max treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.	the maximum operating temperature +/-3°C.  Capacitance Change F1,F5 : Within ±30%  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max  Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  F1,F5 : 0.4 max  Perform the initial measurement Measurement after test  I.R. More than 25Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room	16	Temperature High Humidity	Appearance Capacitance Change D.F.	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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. Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room
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Change F1,F5 : Within ±30%  Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max Perform the initial measurement.	Change F1,F5 : Within ±30%  *Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.  D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. for 24±2 hours at room temperature.  Perform the initial measurement.  *Measurement after test  I.R. More than 25Ω · F  Perform a heat treatment and then let sit for 24+/-2 hours at room		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F.	No defects or abnormalities.  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : Within ±12.5% F1,F5 : Within ±30%  B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max  More than 12.5Ω · F	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  *Initial measurement 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.  *Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at
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D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max 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.	Perform a heat treatment at 150+0/-10°C for one hour and then let sit D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. F1,F5 : 0.4 max Perform the initial measurement.  - Measurement after test I.R. More than 25Ω · F Perform a heat treatment and then let sit for 24+/-2 hours at room		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F. I.R. Appearance Capacitance	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5: Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5: 0.4 max \\ More than 12.5\Omega \cdot F   No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ $	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.
D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. for 24±2 hours at room temperature. F1,F5 : 0.4 max Perform the initial measurement.	D.F. B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8 : 0.2 max. for 24±2 hours at room temperature. F1,F5 : 0.4 max Perform the initial measurement. • Measurement after test • More than 25Ω · F Perform a heat treatment and then let sit for 24+/-2 hours at room		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F. I.R. Appearance Capacitance	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5: Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5: 0.4 max \\ More than 12.5\Omega \cdot F   No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ $	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000±/-12 hours at the maximum operating temperature ±/-3°C.  The charge/ discharge current is less than 50mA.
F1,F5 : 0.4 max Perform the initial measurement.	F1,F5 : 0.4 max Perform the initial measurement.  Measurement after test  I.R. More than 25Ω · F Perform a heat treatment and then let sit for 24+/-2 hours at room		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F. I.R. Appearance Capacitance	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5: Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5: 0.4 max \\ More than 12.5\Omega \cdot F   No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ $	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000±/-12 hours at the maximum operating temperature ±/-3°C. The charge/ discharge current is less than 50mA.  Initial measurement
	$\begin{tabular}{ll} & & & & & & \\ \hline I.R. & & & & & \\ \hline I.R. & & & & \\ \hline More than $25\Omega \cdot F$ & Perform a heat treatment and then let sit for $24+/-2$ hours at room $1.500 \times 10^{-3}$ has been considered as $1.500 \times 10^{-3}$ has been considere$		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F.  I.R.  Appearance Capacitance Change	No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within $\pm 12.5\%$ F1,F5 : Within $\pm 30\%$ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. F1,F5 : 0.4 max   More than $12.5\Omega \cdot F$ No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within $\pm 12.5\%$ F1,F5 : Within $\pm 30\%$	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  *Initial measurement 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.  *Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  *Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit
wodouromont and toot	I.R. More than 25Ω · F Perform a heat treatment and then let sit for 24+/-2 hours at room		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F.  I.R.  Appearance Capacitance Change	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: \mbox{Within $\pm 12.5\%} \\ F1,F5 : \mbox{Within $\pm 30\%} \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 \mbox{max} \\ F1,F5 : 0.4 \mbox{max} \\ \mbox{More than } 12.5\Omega \cdot \mbox{F} \\ \mbox{No defects or abnormalities}. \\ \mbox{B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within $\pm 12.5\%$} \\ \mbox{F1,F5} : \mbox{Within $\pm 30\%} \\ \mbox{B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max}. $	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C. The charge/ discharge current is less than 50mA.  Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature.
I.R. More than 250 · F Perform a heat treatment and then let sit for 24+/-2 hours at room			Temperature High Humidity (Steady)	Appearance Capacitance Change D.F.  I.R.  Appearance Capacitance Change	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: \mbox{Within $\pm 12.5\%} \\ F1,F5 : \mbox{Within $\pm 30\%} \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 \mbox{max} \\ F1,F5 : 0.4 \mbox{max} \\ \mbox{More than } 12.5\Omega \cdot \mbox{F} \\ \mbox{No defects or abnormalities}. \\ \mbox{B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within $\pm 12.5\%$} \\ \mbox{F1,F5} : \mbox{Within $\pm 30\%} \\ \mbox{B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max}. $	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C. The charge/ discharge current is less than 50mA.  Initial measurement 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
			Temperature High Humidity (Steady)	Appearance Capacitance Change D.F.  I.R.  Appearance Capacitance Change D.F.	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5 : Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5 : 0.4 max \\ More than 12.5\Omega \cdot F   No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5 : Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5 : 0.4 max \\ E1,F5 : 0$	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  Initial measurement 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.  Measurement after test
	Tompodato, troit modulo.		Temperature High Humidity (Steady)	Appearance Capacitance Change D.F.  I.R.  Appearance Capacitance Change D.F.	No defects or abnormalities. $B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5 : Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5 : 0.4 max \\ More than 12.5\Omega \cdot F   No defects or abnormalities.   B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: Within \pm 12.5\% \\ F1,F5 : Within \pm 30\% \\ B1,R1,B3,R6,R7,C6,C7,C8,E7,D7,D8: 0.2 max. \\ F1,F5 : 0.4 max \\ E1,F5 : 0$	at room temperature for 24±2 hours. Perform the initial measurement.  GRM188B30J106M: Measurement after test Perform a heat treatment and then let sit for 24±/-2 hours at room temperature, then measure.  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.  Initial measurement 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.  Measurement after test Perform a heat treatment and then let sit for 24+/-2 hours at room temperature, then measure.  Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C.  The charge/ discharge current is less than 50mA.  Initial measurement 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.  Measurement after test

#### ■ SPECIFICATIONS AND TEST METHODS

Test method : Deflection

Test substrate

Material : Copper-clad laminated sheets for PCBs
(Glass fabric base, epoxy resin)

Thickness : 1.6mm(GRM02/03/GR□15: t:0.8mm)

Copper foil thickness : 0.035mm

Gray colored part of Fig.1: Solder resist

(Coat with heat resistant resin for solder)

Land

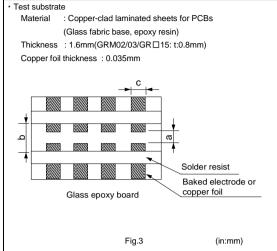
b

44.5

Fig.1 (in:mm)

Adhesive Strength of Termination, Vibration Resistance,

Temperature Sudden Change, High Temperature High Humidity(Steady) , Durability



Dimension (mm)

0.56

0.9

1.5

3.0

4.0

5.0

5.0

7.0

8.0

С

0.23

0.3

0.5

1.2

1.65

2.0

2.9

3.7

5.6

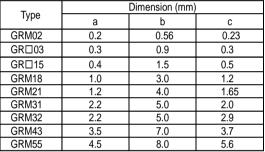
Tuno	
Type	а
GRM02	0.2
GR□03	0.3
GR□15	0.4
GRM18	1.0
GRM21	1.2
GRM31	2.2
GRM32	2.2

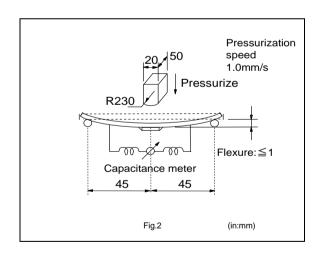
3.5

4.5

GRM43

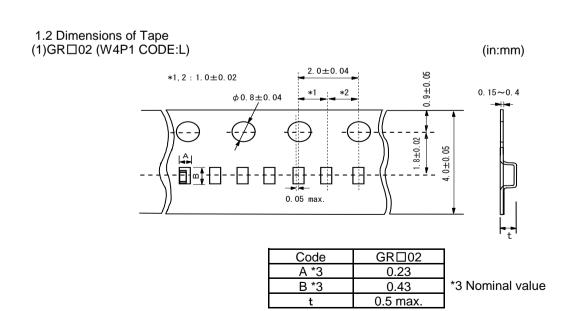
GRM55





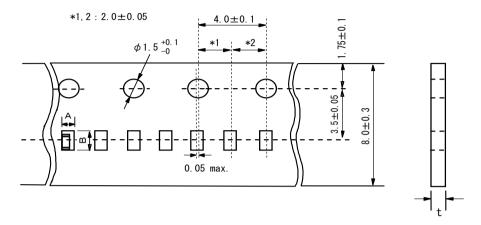
# 1.Tape Carrier Packaging(Packaging Code:D/E/W/F/L/J/K) 1.1 Minimum Quantity(pcs./reel)

			φ180mm reel	φ330mm reel		
	Туре	Pape	r Tape	Plastic Tape	Paper Tape	Plastic Tape
		Code:D/E	Code:W	Code:L	Code:J/ F	Code:K
GR□02				40000 (W4P1)		
GR□03		15000(W8P2)	30000(W8P1)		50000(W8P2)	
	2	20000			50000	
GR□15	3/X	10000			50000	
OKL 13	5 (Dimensions Tolerance:±0.05)	10000(W8P2)	20000(W8P1)		50000(W8P2)	
	5 (Dimensions Tolerance:±0.1min.)	10000			40000	
GR□18		4000			10000	
GR□21	5/6/9	4000		3000	10000	
ONUZI	A/B			3000		10000
	6/9	4000			10000	
GR□31	M/X			3000		10000
	С			2000		6000
	5/6/9	4000			10000	
	A/M			3000		10000
GR□32	N			2000		8000
	С			2000		6000
	R/D/E			1000		4000
	M			1000		5000
GR□43	N/C/R/D			1000		4000
OI\L43	E			500		2000
	S			500		1500
	M			1000		5000
GR□55	N/C/R/D			1000		4000
0111133	E			500		
	F/X			300		1500



(in:mm)

# (2)GR□03/15(W8P2 CODE:D/E/J/F)

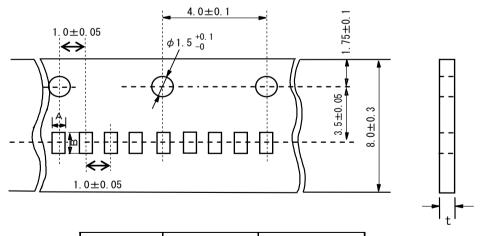


	GR□03	GR□03	GR□15	GR□15	GR□15	GR□15
Code	(Dimensions	(Dimensions	(Dimensions	(Dimensions	(Dimensions	(Dimensions
Code	Tolerance	Tolerance	Tolerance	Tolerance	Tolerance	Tolerance
	±0.03)	±0.05)	±0.05)	±0.1)	±0.15)	±0.2)
A*3	0.37	0.39	0.65	0.70	0.72	0.75
B*3	0.67	0.69	1.15	1.20	1.25	1.35
t	0.5max.	0.5 max.	0.8 max.	0.8 max.	0.8 max.	0.8 max.

<sup>\*3</sup> Nominal value

# (3)GRM03/15(W8P1 CODE:W)

(in:mm)

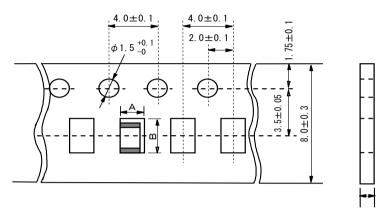


Code	GRM03	GRM15	
A*	0.37	0.65	
В*	0.67	1.15	
t	0.5max.	0.8max.	

<sup>\*</sup>Nominal value

(4)GR□18/21/31/32 T:0.85 rank max.

(in:mm)



0.8 max. (T=0.5mm) 1.15 max. (T $\leq$ 0.85mm)

Code	GR□18 (Dimensions Tolerance ±0.15within)	GR□18 (Dimensions Tolerance ±0.2)	GR□18 (Dimensions Tolerance L:±0.2/ W,T:±0.1)	GR□21	GR□31	GR□32
Α	1.05±0.1	1.10±0.1	1.05±0.1	1.55±0.15	2.0±0.2	2.8±0.2
В	1.85±0.1	2.00±0.1	2.00±0.1	2.3±0.15	3.6±0.2	3.6±0.2

(5)GR □ 21/31/32 T : 1.0 rank min. (in:mm)



	GR□21	GR□21	GR□31	GR□31	
Code	(Dimensions Tolerance:	(Dimensions Tolerance :	(Dimensions Tolerance:	(Dimensions Tolerance:	GR□32
	±0.1)	±0.15/±0.2)	±0.2 within)	±0.3)	
А	1.45±0.2	1.5±0.2	1.9±0.2	2.1±0.2	2.8±0.2
В	2.25±0.2	2.3±0.2	3.5±0.2	3.6±0.2	3.5±0.2

(6)GR□43/55 (in:mm)



Code	GR□43	GR□55
A *2	3.6	5.2
B *2	4.9	6.1

\*2 Nominal value

(in:mm)

W

8.0 max.

 $W_1$ 

5±1.5

Fig.1 Package Chips

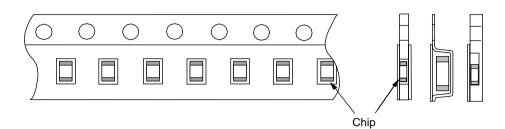


Fig.2 Dimensions of Reel

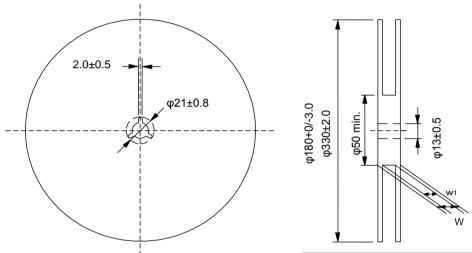
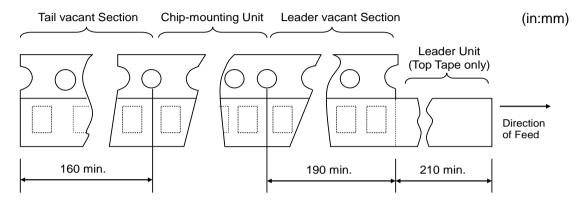


Fig.3 Taping Diagram



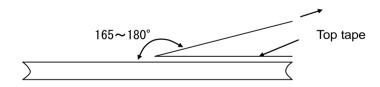
GR□02

- 1.3 Tapes for capacitors are wound clockwise shown in Fig.3. (The sprocket holes are to the right as the tape is pulled toward the user.)
- 1.4 Part of the leader and part of the vacant section are attached as follows.



- 1.5 Accumulate pitch: 10 of sprocket holes pitch = 40±0.3mm
- 1.6 Chip in the tape is enclosed by top tape and bottom tape as shown in Fig.1.
- 1.7 The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
- 1.8 There are no jointing for top tape and bottom tape.
- 1.9 There are no fuzz in the cavity.
- 1.10 Break down force of top tape : 5N min.

  Break down force of bottom tape : 5N min. (Only a bottom tape existence)
- 1.11 Reel is made by resin and appeaser and dimension is shown in Fig 2.
  There are possibly to change the material and dimension due to some impairment.
- 1.12 Peeling off force: 0.1N to 0.6N\* in the direction as shown below.
  - \* GR □ 02/03:0.05N ~ 0.5N



1.13 Label that show the customer parts number, our parts number, our company name, inspection number and quantity, will be put in outside of reel.



**△**Caution

#### ■ Limitation of use

Please contact our sales representatives or product engineers before using our products for the applications listed below which require of our products for other applications than specified in this product.

- ①Aircraft equipment ②Aerospace equipment ③Undersea equipment ④Power plant control equipment
- ⑤Medical equipment ⑥Transportation equipment(vehicles,trains,ships,etc.) ⑦Traffic signal equipment
- (8) Disaster prevention / crime prevention equipment (9) Data-processing equipment
- Mapplication of similar complexity and/or requirements to the applications listed in the above

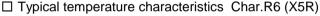
# ■ Storage and Operation condition

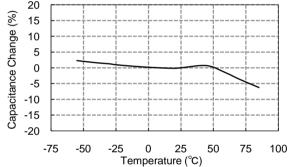
- 1. The performance of chip monolithic ceramic capacitors may be affected by the storage conditions.
- 1-1. Store capacitors in the following conditions: Temperature of +5°C to +40°C and a Relative Humidity of 20% to 70%.
- (1) Sunlight, dust, rapid temperature changes, corrosive gas atmosphere or high temperature and humidity conditions during storage may affect the solderability and the packaging performance Please use product within six months of receipt.
- (2) Please confirm solderability before using after six months. Store the capacitors without opening the original bag. Even if the storage period is short, do not exceed the specified atmospheric conditions.
- 1-2. Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor solderability. Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.).
- 1-3. Due to moisture condensation caused by rapid humidity changes, or the photochemical change caused by direct sunlight on the terminal electrodes and/or the resin/epoxy coatings, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or in high huimidity conditions

# ■ Rating

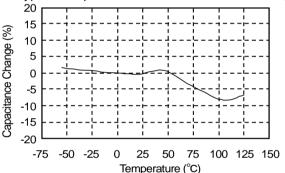
#### **1.Temperature Dependent Characteristics**

- 1. The electrical characteristics of the capacitor can change with temperature.
- 1-1. For capacitors having larger temperature dependency, the capacitance may change with temperature changes.
  - The following actions are recommended in order to insure suitable capacitance values.
- (1) Select a suitable capacitance for the operating temperature range.
- (2) The capacitance may change within the rated temperature.
  - When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance.
  - Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics.
  - And check capacitors using your actual appliances at the intended environment and operating conditions.

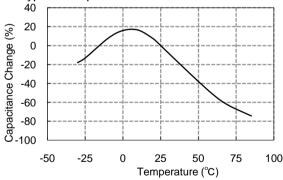




☐ Typical temperature characteristics Char.R7 (X7R)







# 2.Measurement of Capacitance

- 1. Measure capacitance with the voltage and the frequency specified in the product specifications.
- 1-1. The output voltage of the measuring equipment may decrease when capacitance is high occasionally. Please confirm whether a prescribed measured voltage is impressed to the capacitor.
- 1-2. The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied.
  - Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.

# 3.Applied Voltage

- 1. Do not apply a voltage to the capacitor that exceeds the rated voltage as called-out in the specifications.
- 1-1. Applied voltage between the terminals of a capacitor shall be less than or equal to the rated voltage.
  - (1) When AC voltage is superimposed on DC voltage, the zero-to-peak voltage shall not exceed the rated DC voltage.
    - When AC voltage or pulse voltage is applied, the peak-to-peak voltage shall not exceed the rated DC voltage.
  - (2) Abnormal voltages (surge voltage, static electricity, pulse voltage, etc.) shall not exceed the rated DC voltage.

Typical voltage applied to the DC capacitor

DC voltage

DC voltage

AC voltage

Pulse voltage

Pulse voltage

(E: Maximum possible applied voltage.)

#### 1-2. Influence of overvoltage

Overvoltage that is applied to the capacitor may result in an electrical short circuit caused by the breakdown of the internal dielectric layers .

The time duration until breakdown depends on the applied voltage and the ambient temperature.

# 4. Applied Voltage and Self-heating Temperature

- 1. When the capacitor is used in a high-frequency voltage, pulse voltage, application, be sure to take into account self-heating may be caused by resistant factors of the capacitor.
- 1-1. The load should be contained to the level such that when measuring at atomospheric temperature of 25°C, the product's self-heating remains below 20°C and surface temperature of the capacitor in the actual circuit remains wiyhin the maximum operating temperature.

# 5. DC Voltage and AC Voltage Characteristic

1. The capacitance value of a high dielectric constant type capacitor changes depending on the DC voltage applied.

Please consider the DC voltage characteristics when a capacitor is selected for use in a DC circuit.

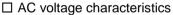
- 1-1. The capacitance of ceramic capacitors may change sharply depending on the applied voltage. (See figure) Please confirm the following in order to secure the capacitance.
- (1) Whether the capacitance change caused by the applied voltage is within the range allowed or not.

□ DC voltage characteristics

(2) In the DC voltage characteristics, the rate of capacitance change becomes larger as voltage increases. Even if the applied voltage is below the rated voltage. When a high dielectric constant type capacitor is in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.



2. The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied. Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.



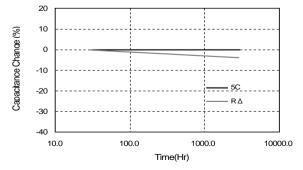


#### 6. Capacitance Aging

1. The high dielectric constant type capacitors have the characteristic in which the capacitance value decreases with passage of time.

When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics.

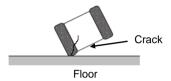
And check capacitors using your actual appliances at the intended environment and operating conditions.



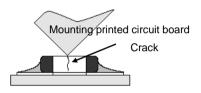
#### 7. Vibration and Shock

- 1. Please confirm the kind of vibration and/or shock, its condition, and any generation of resonance.

  Please mount the capacitor so as not to generate resonance, and do not allow any impact on the terminals.
- 2. Mechanical shock due to falling may cause damage or a crack in the dielectric material of the capacitor. Do not use a fallen capacitor because the quality and reliability may be deteriorated.



3. When printed circuit boards are piled up or handled, the corners of another printed circuit board should not be allowed to hit the capacitor in order to avoid a crack or other damage to the capacitor.

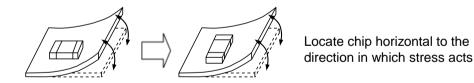


# ■ Soldering and Mounting

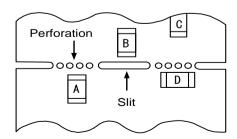
### 1.Mounting Position

- 1. Confirm the best mounting position and direction that minimizes the stress imposed on the capacitor during flexing or bending the printed circuit board.
- 1-1. Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

#### [Component Direction]



[Chip Mounting Close to Board Separation Point]



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

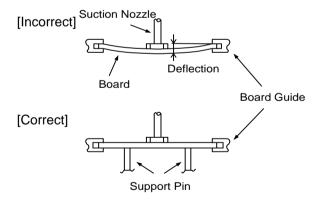
# 2.Information before mounting

- 1. Do Not re-use capacitors that were removed from the equipment.
- 2. Confirm capacitance characteristics under actual applied voltage.
- 3. Confirm the mechanical stress under actual process and equipment use.
- 4. Confirm the rated capacitance, rated voltage and other electrical characteristics before assembly.
- 5. Prior to use, confirm the Solderability for the capacitors that were in long-term storage.
- 6. Prior to measuring capacitance, carry out a heat treatment for capacitors that were in long-term storage.
- 7.The use of Sn-Zn based solder will deteriorate the reliability of the MLCC.

  Please contact our sales representative or product engineers on the use of Sn-Zn based solder in advance.

### 3. Maintenance of the Mounting (pick and place) Machine

- 1. Make sure that the following excessive forces are not applied to the capacitors.
- 1-1. In mounting the capacitors on the printed circuit board, any bending force against them shall be kept to a minimum to prevent them from any bending damage or cracking. Please take into account the following precautions and recommendations for use in your process.
  - (1) Adjust the lowest position of the pickup nozzle so as not to bend the printed circuit board.
- (2) Adjust the nozzle pressure within a static load of 1N to 3N during mounting.



2.Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes greater force upon the chip during mounting, causing cracked chips. Also 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.





# 4-1.Reflow Soldering

- 1. When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board. Preheating conditions are shown in table 1. It is required to keep the temperature differential between the solder and the components surface ( $\Delta T$ ) as small as possible.
- 2. Solderability of Tin plating termination chips might be deteriorated when a low temperature soldering profile where the peak solder temperature is below the melting point of Tin is used. Please confirm the Solderability of Tin plated termination chips before use.
- 3. When components are immersed in solvent after mounting, be sure to maintain the temperature difference ( $\Delta T$ ) between the component and the solvent within the range shown in the table 1.

Table 1

Part Number	Temperature Differential	
GR□02/03/15/18/21/31	ΔΤ≦190°C	
GR□32/43/55	ΔΤ≦130°C	

#### **Recommended Conditions**

	Pb-Sn	Lead Free Solder	
	Infrared Reflow Vapor Reflow		
Peak Temperature	230∼250°C	230~240°C	240~260°C
Atmosphere	Air	Air	Air or N <sub>2</sub>

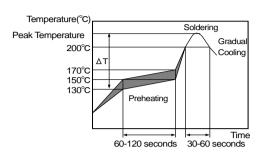
Pb-Sn Solder: Sn-37Pb Lead Free Solder: Sn-3.0Ag-0.5Cu

- 4. Optimum Solder Amount for Reflow Soldering
- 4-1. Overly thick application of solder paste results in a excessive solder fillet height. This makes the chip more susceptible to mechanical and thermal stress on the board and may cause the chips to crack.
- 4-2. 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.

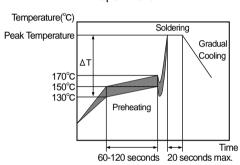
4-3. Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm\* min.

#### [Standard Conditions for Reflow Soldering]

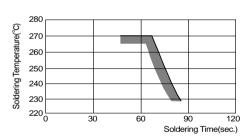
#### Infrared Reflow



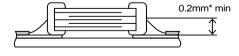
#### Vapor Reflow



#### [Allowable Soldering Temperature and Time]



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



\* GRM02/03: 1/3 of Chip Thickness min.

in section

Inverting the PCB Make sure not to impose any abnormal mechanical shocks to the PCB.



# 4-2.Flow Soldering

- 1. When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the 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 2. It is required to keep temperature differential between the solder and the components surface (ΔT) as small as possible.
- Excessively long soldering time or high soldering temperature can result 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.
- 3. When components are immersed in solvent after mounting, be sure to maintain the temperature difference ( $\Delta T$ ) between the component and solvent within the range shown in the table 2.
- 4. Do not apply flow soldering to chips not listed in Table 2.

Table 2

Part Number	Temperature Differential	
GR□18/21/31	ΔΤ≦150°C	

# **Recommended Conditions**

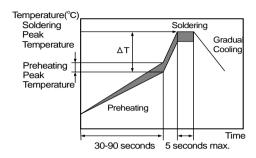
	Pb-Sn Solder	Lead Free Solder
Preheating Peak Temperature	90~110°C	100∼120°C
Soldering Peak Temperature	240~250°C	250~260°C
Atmosphere	Air	N <sub>2</sub>

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

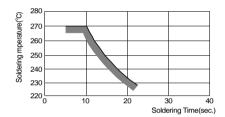
5. Optimum Solder Amount for Flow Soldering

5-1. The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessive, the risk of cracking is higher during board bending or any other stressful condition.

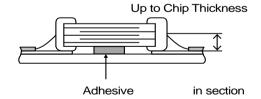
#### [Standard Conditions for Flow Soldering]



[Allowable Soldering Temperature and Time]



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





# 4-3. Correction with a Soldering Iron

- 1. When sudden heat is applied to the components when using a soldering iron, the mechanical strength of the components will decrease because the extreme temperature change can cause deformations inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board. Preheating conditions, (The "Temperature of the Soldering Iron tip", "Preheating Temperature", "Temperature Differential" between the iron tip and the components and the PCB), should be within the conditions of table 3. It is required to keep the temperature differential between the soldering Iron and the component surfaces (ΔT) as small as possible.
- 2. After soldering, do not allow the component/PCB to rapidly cool down.
- 3. The operating time for the re-working should be as short as possible. When re-working time is too long, it may cause solder leaching, and that will cause a reduction in the adhesive strength of the terminations.

Table 3

Part Number	Temperature of Soldering Iron tip	Preheating Temperature	Temperature Differential (ΔT)	Atmosphere
GR□03/15/18/21/31	350°C max.	150°C min.	ΔT≦190°C	Air
GR□32/43/55	280°C max.	150°C min.	ΔT≦130°C	Air

<sup>\*</sup>Applicable for both Pb-Sn and Lead Free Solder Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

- 4. Optimum Solder amount when re-working with a Soldering Iron
- 4-1. In case of sizes smaller than 0603, (GR □03/15/18), the top of the solder fillet should be lower than 2/3's of the thickness of the component or 0.5mm whichever is smaller. In case of 0805 and larger sizes, (GR □21/31/32/43/55), the top of the solder fillet should be lower than 2/3's of the thickness of the component. If the solder amount is excessive, the risk of cracking is higher during board bending or under any other stressful condition.



- 4-2. A Soldering iron with a tip of ø3mm or smaller should be used. It is also necessary to keep the soldering iron from touching the components during the re-work.
- 4-3. Solder wire with Ø0.5mm or smaller is required for soldering.

#### **4-4.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.Washing

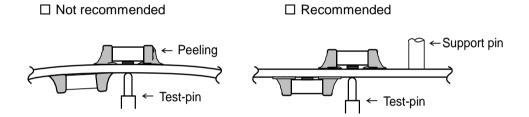
Excessive ultrasonic oscillation during cleaning can cause the PCBs to resonate, resulting in cracked chips or broken solder joints. Take note not to vibrate PCBs.

### **6.Electrical Test on Printed Circuit Board**

- 1. Confirm position of the support pin or specific jig, when inspecting the electrical performance of a capacitor after mounting on the printed circuit board.
- 1-1. Avoid bending printed circuit board by the pressure of a test pin, etc.

  The 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.
- 1-2. Avoid vibration of the board by shock when a test pin contacts a printed circuit board.



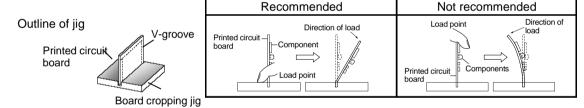
# 7.Printed Circuit Board Cropping

- 1. After mounting a capacitor on a printed circuit board, do not apply any stress to the capacitor that is caused by bending or twisting the board.
- 1-1. In cropping the board, the stress as shown right may cause the capacitor to crack. Try not to apply this type of stress to a capacitor.



- 2. Check of the cropping method for the printed circuit board in advance.
- 2-1. Printed circuit board cropping shall be carried out by using a jig or an apparatus to prevent the mechanical stress which can occur to the board.
  - (1) Example of a suitable jig

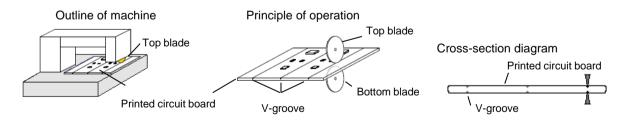
Recommended example: the board should be pushed as close to the near the cropping jig as possible and from the back side of board in order to minimize the compressive stress applied to capacitor. Not recommended example\* when the board is pushed at a point far from the cropping jig and from the front side of board as below, the capacitor may form a crack caused by the tensile stress applied to capacitor.

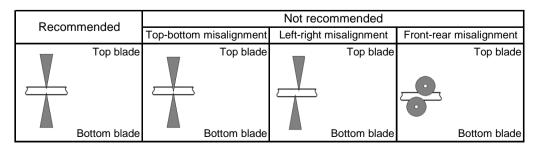


(2) Example of a suitable machine

An outline of a printed circuit board cropping machine is shown as follows. Along the lines with the V-grooves on printed circuit board, the top and bottom blades are aligned to one another when cropping the board.

The misalignment of the position between top and bottom blades may cause the capacitor to crack.





#### Others

#### 1. Under Operation of Equipment

- 1-1. Do not touch a capacitor directly with bare hands during operation in order to avoid the danger of a electric shock.
- 1-2. Do not allow the terminals of a capacitor to come in contact with any conductive objects (short-circuit). Do not expose a capacitor to a conductive liquid, inducing any acid or alkali solutions.
- 1-3. Confirm the environment in which the equipment will operation is under the specified conditions. Do not use the equipment under the following environment.
  - (1) Being spattered with water or oil.
  - (2) Being exposed to direct sunlight.
  - (3) Being exposed to Ozone, ultraviolet rays or radiation.
  - (4) Being exposed to toxic gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
  - (5) Any vibrations or mechanical shocks exceeding the specified limits.
  - (6) Moisture condensing environments.
- 1-4. Use damp proof countermeasures if using under any conditions that can cause condensation.

#### 2. Others

# 2-1. In an Emergency

- (1) If the equipment should generate smoke, fire or smell, immediately turn off or unplug the equipment. If the equipment is not turned off or unplugged, the hazards may be worsened by supplying continuous power.
- (2) In this type of situation, do not allow face and hands to come in contact with the capacitor or burns may be caused by the capacitors high temperature.

#### 2-2. Disposal of waste

When capacitors are disposed, they must be burned or buried by the industrial waste vender with the appropriate licenses.

#### 2-3. Circuit Design

GRM Series capacitors in this specification are not safety recognized products.

#### 2-4. Remarks

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

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.

# Rating

#### 1. Operating Temperature

- 1. The operating temperature limit depends on the capacitor.
- 1-1.Do not apply temperatures exceeding the upper operating temperature.
  - It is necessary to select a capacitor with a suitable rated temperature which will cover the operating temperature range.
  - Also it is necessary to consider the temperature distribution in equipment and the seasonal temperature variable factor.
- 1-2. Consider the self-heating of the capacitor
  - The surface temperature of the capacitor shall be the upper operating temperature or less when including the self-heating factors.

### 2.Atmosphere surroundings (gaseous and liquid)

- 1. Restriction on the operating environment of capacitors.
- 1-1. The capacitor, when used in the above, unsuitable, operating environments may deteriorate due to the corrosion of the terminations and the penetration of moisture into the capacitor.
- 1-2. The same phenomenon as the above may occur when the electrodes or terminals of the capacitor are subject to moisture condensation.
- 1-3. The deterioration of characteristics and insulation resistance due to the oxidization or corrosion of terminal electrodes may result in breakdown when the capacitor is exposed to corrosive or volatile gases or solvents for long periods of time.

### 3.Piezo-electric Phenomenon

1. When using high dielectric constant type capacitors in AC or pulse circuits, the capacitor itself vibrates at specific frequencies and noise may be generated.

Moreover, when the mechanical vibration or shock is added to capacitor, noise may occur.

# ■ Soldering and Mounting

### 1.PCB Design

- 1. Notice for Pattern Forms
- 1-1. 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.

1-2. There is a possibility of chip crack caused by PCB expansion/contraction with heat. Because stress for chip is different depend on PCB material and structure. Especially metal PCB such as alumina has a greater risk of chip crack because of large difference of thermal expansion coefficient. In case of chip below 0402 size, there is also the same possibility of crack with a single-layered glass epoxy board.

### Pattern Forms

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

#### 2. Land Dimensions

2-1. Chip capacitor can be cracked due to the stress of PCB bending / etc if the land area is larger than needed and has an ex amount of solder.

Please refer to the land dimensions in table 1 for flow soldering, table 2 for reflow soldering.



Please confirm the suitable land dimension by evaluating of the actual SET / PCB.

Table 1 Flow Soldering Method

Table 1 Flow Soldering Method				
Dimensions Part Number	Chip (LxW)	а	b	С
GR□18	1.6×0.8	0.6~1.0	0.8~0.9	0.6~0.8
GR□21	2.0×1.25	1.0~1.2	0.9~1.0	0.8~1.1
GR□31	3.2×1.6	2.2~2.6	1.0~1.1	1.0~1.4
	-		<u> </u>	(in mm)

(in mm)

Table 2 Reflow Soldering Method

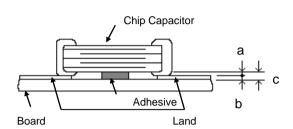
Dimensions Part Number	LxW (Dimensions Tolerance)	а	b	С
GR□02	0.4×0.2	0.16~0.2	0.12~0.18	0.2~0.23
GR□03	0.6×0.3	0.2~0.3	0.2~0.35	0.2~0.4
GR□15	$1.0 \times 0.5$ (within $\pm 0.10$ )	0.3~0.5	0.35~0.45	0.4~0.6
GKL 13	1.0×0.5 (±0.15/±0.20)	0.4~0.6	0.40~0.50	0.5~0.7
GR□18	1.6×0.8 (within ±0.10)	0.6~0.8	0.6~0.7	0.6~0.8
GRU10 -	1.6×0.8 (±0.15/±0.20)	0.7~0.9	0.7~0.8	0.8~1.0
	2.0×1.25 (within ±0.10)	1.2	0.6	1.25
GR□21	2.0×1.25 (±0.15)	1.2	0.6~0.8	1.2~1.4
	2.0×1.25 (±0.20)	1.0~1.4	0.6~0.8	1.2~1.4
GR□31	3.2×1.6 (within±0.20)	1.8~2.0	0.9~1.2	1.5~1.7
GNUST	3.2×1.6 (±0.30)	1.9~2.1	1.0~1.3	1.7~1.9
GR□32	3.2×2.5	2.0~2.4	1.0~1.2	1.8~2.3
GR□43	4.5×3.2	3.0~3.5	1.2~1.4	2.3~3.0
GR□55	5.7×5.0	4.0~4.6	1.4~1.6	3.5~4.8

(in mm)

# 2.Adhesive Application

 Thin or insufficient adhesive can cause the chips to loosen or become disconnected during flow soldering.
 The amount of adhesive must be more than dimension c, shown in the drawing at right, to obtain the correct bonding strength.

The chip's electrode thickness and land thickness must also be taken into consideration.



a=20~70μm b=30~35μm c=50~105μm

- 2. Low viscosity adhesive can cause chips to slip after mounting. The adhesive must have a viscosity of 5000Pa s (500ps) min. (at 25°C)
- 3. Adhesive Coverage

Part Number	Adhesive Coverage*
GR□18	0.05mg min.
GR□21	0.1mg min.
GR□31	0.15mg min.

\*Nominal Value

# **3.Adhesive Curing**

Insufficient curing of the adhesive can cause chips to disconnect during flow soldering and causes
deterioration in the insulation resistance between the outer electrodes due to moisture absorption.
Control curing temperature and time in order to prevent insufficient hardening.

### **4.Flux Application**

- 1. An excessive amount of flux generates a large quantity of flux gas, which can cause a deterioration of Solderability.
  - So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
- 2. Flux containing too a high percentage of halide may cause corrosion of the outer electrodes unless there is sufficient cleaning. Use flux with a halide content of 0.2% max.
- 3. Do not use strong acidic flux.
- Do not use water-soluble flux.
   (\*Water-soluble flux can be defined as non rosin type flux including wash-type flux and non-wash-type flux.)

#### 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 right) and 25% of the length A-B shown below as mounted on substrate.



### 6.Washing

- 1. Please evaluate a capacitor by actual cleaning equipment and condition surely for confirming the quality and select the applicable solvent.
- 2. Unsuitable cleaning solvent may leave residual flux, other foreign substances, causing deterioration of electrical characteristics and the reliability of the capacitors.
- 3. Select the proper cleaning conditions.
- 3-1. Improper cleaning conditions (excessive or insufficient) may result in the deterioration of the performance of the capacitors.

#### 7.Coating

1. A crack may be caused in the capacitor due to the stress of the thermal contraction of the resin during curing process.

The stress is affected by the amount of resin and curing contraction.

Select a resin with small curing contraction.

The difference in the thermal expansion coefficient between a coating resin or a molding resin and capacitor may cause the destruction and deterioration of the capacitor such as a crack or peeling, and lead to the deterioration of insulation resistance or dielectric breakdown.

Select a resin for which the thermal expansion coefficient is as close to that of capacitor as possible.

A silicone resin can be used as an under-coating to buffer against the stress.

2. Select a resin that is less hygroscopic.

Using hygroscopic resins under high humidity conditions may cause the deterioration of the insulation resistance of a capacitor.

An epoxy resin can be used as a less hygroscopic resin.

#### Others

#### 1.Transportation

- 1. The performance of a capacitor may be affected by the conditions during transportation.
- 1-1. The capacitors shall be protected against excessive temperature, humidity and mechanical force during transportation.
  - (1) Climatic condition
    - ─ low air temperature : ─40°C
    - change of temperature air/air : −25°C/+25°C
    - low air pressure : 30 kPa
    - change of air pressure : 6 kPa/min
  - (2) Mechanical condition

Transportation shall be done in such a way that the boxes are not deformed and forces are not directly passed on to the inner packaging.

- 1-2. Do not apply excessive vibration, shock, and pressure to the capacitor.
- (1) When excessive mechanical shock or pressure is applied to a capacitor, chipping or cracking may occur in the ceramic body of the capacitor.
- (2) When a sharp edge of an air driver, a soldering iron, tweezers, a chassis, etc. impacts strongly on the surface of capacitor, the capacitor may crack and short-circuit.
- 1-3. Do not use a capacitor to which excessive shock was applied by dropping etc.

  The capacitor dropped accidentally during processing may be damaged.



# **∧** NOTE

- 1.Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
- 2. Your are requested not to use our product deviating from this product specification.
- 3.We consider it not appropriate to include any terms and conditions with regard to the business transaction in the product specifications, drawings or other technical documents. Therefore, if your technical documents as above include such terms and conditions such as warranty clause, product liability clause, or intellectual property infringement liability clause, they will be deemed to be invalid.