

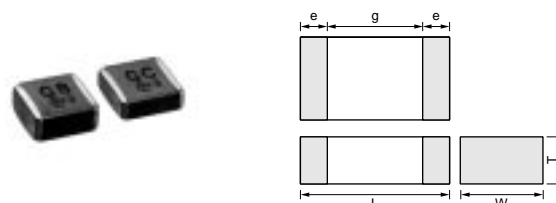
# Chip Monolithic Ceramic Capacitors

**muRata**

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

### ■ Features

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



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
<b>GA355D</b>	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0

### ■ Applications

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

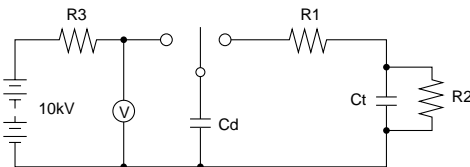
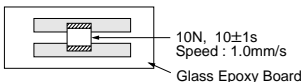
### ■ Standard Recognition

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

\*: Line-By-Pass only


Part Number	Rated Voltage (V)	TC Code (Standard)	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g min. (mm)	Electrode e (mm)
<b>GA355DR7GC101KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	100 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC151KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	150 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC221KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	220 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC331KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	330 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC471KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	470 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC681KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	680 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC102KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	1000 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC152KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	1500 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC222KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	2200 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC332KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	3300 ±10%	5.7	5.0	2.0	4.0	0.3 min.
<b>GA355DR7GC472KY02L</b>	AC250 (r.m.s.)	X7R (EIA)	4700 ±10%	5.7	5.0	2.0	4.0	0.3 min.

## GA3 Series Specifications and Test Methods

No.	Item		Specifications	Test Method								
1	Operating Temperature Range		−55 to +125℃	—								
2	Appearance		No defects or abnormalities	Visual inspection								
3	Dimensions		Within the specified dimensions	Using calipers								
4	Dielectric Strength		No defects or abnormalities	No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. <table><tr><th></th><th>Test voltage</th></tr><tr><td>Type GB</td><td>DC1075V</td></tr><tr><td>Type GC/GD/GF</td><td>AC1500V (r.m.s.)</td></tr></table>		Test voltage	Type GB	DC1075V	Type GC/GD/GF	AC1500V (r.m.s.)		
	Test voltage											
Type GB	DC1075V											
Type GC/GD/GF	AC1500V (r.m.s.)											
5	Pulse Voltage (Application: Type GD/GF)		No self healing break downs or flash-overs have taken place in the capacitor.	10 impulse of alternating polarity is subjected. (5 impulse for each polarity) The interval between impulse is 60 sec. Applied Voltage : 2.5kV zero to peak								
6	Insulation Resistance (I.R.)		More than 6,000MΩ	The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.								
7	Capacitance		Within the specified tolerance	The capacitance/Q/D.F. should be measured at 20℃ at a frequency of 1±0.2kHz (SL char. : 1±0.2MHz) and a voltage of AC1±0.2V (r.m.s.).								
8	Dissipation Factor (D.F.) Q		<table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≤0.025</td></tr><tr><td>SL</td><td>Q≥400+20C<sup>*2</sup> (C&lt;30pF) Q≥1000 (C≥30pF)</td></tr></table>	Char.	Specification	X7R	D.F.≤0.025	SL	Q≥400+20C <sup>*2</sup> (C<30pF) Q≥1000 (C≥30pF)	•Pretreatment for X7R char. Perform a heat treatment at 150±18℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.		
Char.	Specification											
X7R	D.F.≤0.025											
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9	Capacitance Temperature Characteristics		<table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table> Temperature characteristic guarantee is −55 to +125℃ <table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to -1000ppm/℃</td></tr></table> Temperature characteristic guarantee is +20 to +85℃	Char.	Capacitance Change	X7R	Within ±15%	Char.	Temperature Coefficient	SL	+350 to -1000ppm/℃	The range of capacitance change compared with the 25℃ (SL char. : 20℃) value within −55 to +125℃ should be within the specified range. •Pretreatment for X7R char. Perform a heat treatment at 150±18℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.
Char.	Capacitance Change											
X7R	Within ±15%											
Char.	Temperature Coefficient											
SL	+350 to -1000ppm/℃											
10	Discharge Test (Application: Type GC)	Appearance	No defects or abnormalities	As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified.  Ct : Capacitor under test   Cd : 0.001μF R1 : 1,000Ω   R2 : 100MΩ   R3 : Surge resistance								
		I.R.	More than 1,000MΩ									
		Dielectric Strength	In accordance with item No.4									
11	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.  10N, 10±1s Speed : 1.0mm/s Glass Epoxy Board								

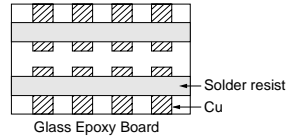
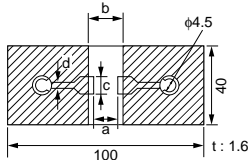
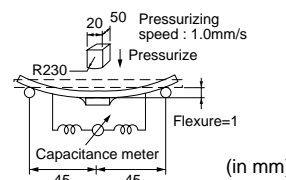
\*1 "Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

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Continued on the following page. 


## GA3 Series Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications	Test Method																											
12	Vibration Resistance	Appearance	No defects or abnormalities	<p>Solder the capacitor to the test jig (glass epoxy board).</p> <p>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.).</p> 																											
		Capacitance	Within the specified tolerance																												
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13	Deflection		No cracking or marking defects should occur.	<p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <table><tr><th>LxW (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th></th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="4">1.0</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7×2.8</td><td>4.5</td><td>8.0</td><td>3.2</td></tr><tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table> <p>Fig. 2</p>  <p>Fig. 3</p>	LxW (mm)	Dimension (mm)					a	b	c	d	4.5×2.0	3.5	7.0	2.4	1.0	4.5×3.2	3.5	7.0	3.7	5.7×2.8	4.5	8.0	3.2	5.7×5.0	4.5	8.0	5.6
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14	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	<p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 2±0.5 sec. at 235±5°C. Immersing speed : 25±2.5mm/s</p>																											
15	Resistance to Soldering Heat	Appearance	No marking defects	<p>Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at 260±5°C for 10±1 sec. Let sit at *1room condition for 24±2 hrs., then measure.</p> <p>•Immersing speed : 25±2.5mm/s</p> <p>•Pretreatment for X7R char. Perform a heat treatment at 150±,8°C for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.</p> <p>*Preheating</p> <table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100°C to 120°C</td><td>1 min.</td></tr><tr><td>2</td><td>170°C to 200°C</td><td>1 min.</td></tr></table>	Step	Temperature	Time	1	100°C to 120°C	1 min.	2	170°C to 200°C	1 min.																		
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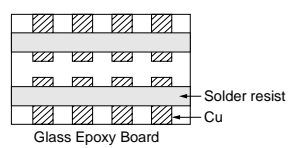
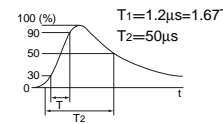
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\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page. 

## GA3 Series Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications	Test Method															
16	Temperature Cycle	Appearance	No marking defects															
		Capacitance Change	<table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr></table>	Char.	Capacitance Change	X7R	Within ±15%	SL	Within ±2.5% or ±0.25pF (Whichever is larger)									
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I.R.	More than 3,000MΩ																	
Dielectric Strength	In accordance with item No.4																	
<div>Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.</div> <div>Perform the 5 cycles according to the 4 heat treatments listed in the following table.</div> <div>Let sit for 24±2 hrs. at *room condition, then measure.</div> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table> <div>•Pretreatment for X7R char.</div> <div>Perform a heat treatment at 150 ±,8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</div> <div><p>Fig. 4</p></div>				Step	Temperature (°C)	Time (min.)	1	Min. Operating Temp.±3	30±3	2	Room Temp.	2 to 3	3	Max. Operating Temp.±2	30±3	4	Room Temp.	2 to 3
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17	Humidity (Steady State)	Appearance	No marking defects															
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I.R.	More than 3,000MΩ																	
Dielectric Strength	In accordance with item No.4																	
<div>Let the capacitor sit at 40±2 °C and relative humidity of 90 to 95% for 500±12 hrs.</div> <div>Remove and let sit for 24±2 hrs. at *room condition, then measure.</div> <div>•Pretreatment for X7R char.</div> <div>Perform a heat treatment at 150 ±,8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</div>																		
18	Life	Appearance	No marking defects															
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I.R.	More than 3,000MΩ																	
Dielectric Strength	In accordance with item No.4																	
<div>Impulse Voltage</div> <div>Each individual capacitor should be subjected to a 2.5kV (Type GC/GF : 5kV) Impulses (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.</div> <div>Apply voltage as Table for 1,000 hrs. at 125 ±,8 °C, relative humidity 50% max.</div> <table><tr><th>Type</th><th>Applied voltage</th></tr><tr><td>GB</td><td>AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr><tr><td>GC</td><td rowspan="3">AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr><tr><td>GD</td></tr><tr><td>GF</td></tr></table> <div>Let sit for 24±2 hrs. at *room condition, then measure.</div> <div>•Pretreatment for X7R char.</div> <div>Perform a heat treatment at 150 ±,8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</div> <div></div>				Type	Applied voltage	GB	AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.	GC	AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.	GD	GF							
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\*1 "Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page. ↗

## GA3 Series Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications		Test Method
19	Humidity Loading	Appearance	No marking defects		Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 <sup>±2</sup> <sub>4</sub> hrs. Remove and let sit for 24±2 hrs. at *1room condition, then measure. •Pretreatment for X7R char. Perform a heat treatment at 150 <sup>±1</sup> <sub>0</sub> ℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.
		Capacitance Change	Char.	Capacitance Change	
			X7R	Within ±15%	
			SL	Within ±5.0% or ±0.5pF (Whichever is larger)	
		D.F. Q	Char.	Specification	
			X7R	D.F. ≤0.05	
SL	Q≥275+5/2C* <sup>2</sup> (C<30pF) Q≥350 (C≥30pF)				
I.R.	More than 3,000MΩ				
Dielectric Strength	In accordance with item No.4				

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