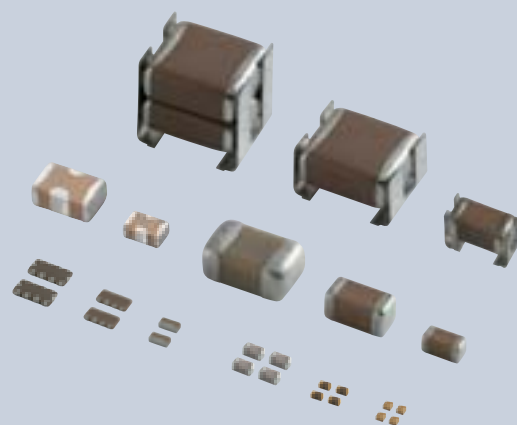


Chip Multilayer Ceramic Capacitors for General



2018

Safety Standard Certified Chip Multilayer Ceramic Capacitors for General Purpose / IEC60384-14 Class X2

GA3 Series Type GB



IEC60384-14 X2 Class Certified Product

Features

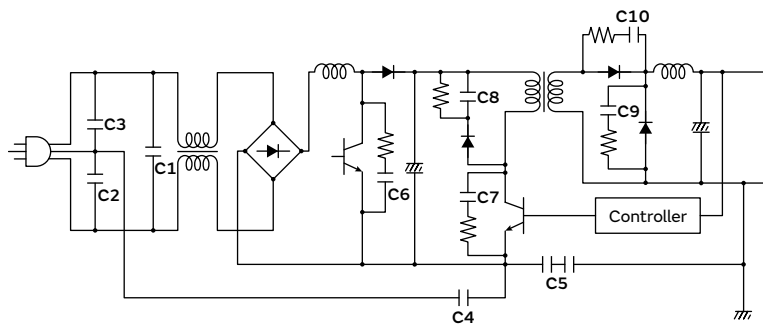
- 1 International Standard (IEC60384-14) certified product.

Please down load Safety Standard Certification (Type GB: X2) from here.



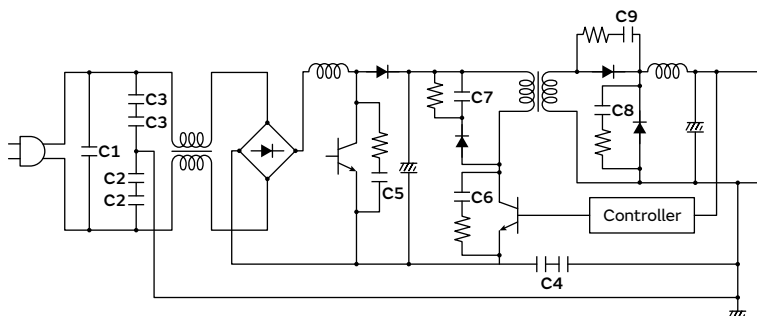
- 2 Can be used as a Class X2 capacitor.

- Switching Power Supply - Class 1 Equipment



No.	Application	Recommend MLCC Type
C1	X Cap	Type: GB
C2	Y Cap	Type: GF
C3		
C4		
C5	Primary - Secondary Coupling	Type: GF×2

- Switching Power Supply - Class 2 Equipment

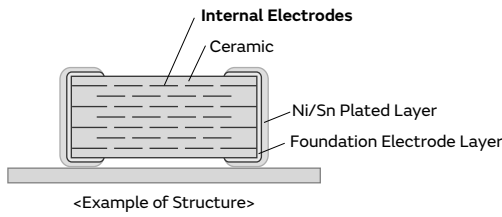


No.	Application	Recommend MLCC Type
C1	X Cap	Type: GB
C2	Y Cap	Type: GF×2
C3		
C4	Primary - Secondary Coupling	

- GRM
- GR3
- GRJ
- GR4
- GR7
- GJM
- GQM
- GA2
- GA3 GB
- GA3 GD
- GA3 GF
- LLL
- LLA
- LLM
- LLR
- NFM
- KRM
- KR3
- GMA
- GMD
- △Caution /Notice

GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution /Notice

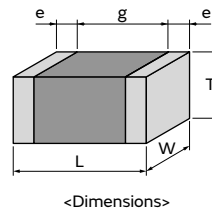
- 3 Realized large capacitance value and small size while maintaining high withstand voltages by the multilayer structure.



- 4 Compared with conventional lead type capacitors, this product realized great reductions in size and height, with a volume of 1/10 or less, and height of 1/4 or less.
- 5 This product is only for reflow soldering.

Specifications

Size (mm)	5.7×5.0mm
Rated Voltage	250Vac
Capacitance	10000pF to 56000pF
Main Applications	AC-DC power supply



This catalog contains only a portion of the product lineup.
 Please refer to the capacitor search tool on the Murata Web site for details.

GA3 Series Type GB High Dielectric Constant Type Part Number List

5.7×5.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.5mm	250Vac	X7R	10000pF	±10%	GA355QR7GB103KW01#	p192
			15000pF	±10%	GA355QR7GB153KW01#	p192
2.0mm	250Vac	X7R	22000pF	±10%	GA355DR7GB223KW01#	p192
2.5mm	250Vac	X7R	33000pF	±10%	GA355ER7GB333KW01#	p192
			47000pF	±10%	GA355ER7GB473KW01#	p192
2.9mm	250Vac	X7R	56000pF	±10%	GA355XR7GB563KW06#	p192

GRM

GR3

GRJ

GR4

GR7

GJM

GQM

GA2

**GA3
GB**

GA3
GD

GA3
GF

LLL

LLA

LLM

LLR

NFM

KRM

KR3

GMA

GMD

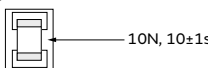
⚠Caution
/Notice

*: Refers to the page of the "Specifications and Test Methods".

Part number # indicates the package specification code.

1

GA3 Series Type GB Specifications and Test Methods (1)

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)												
1	Appearance	No defects or abnormalities.	Visual inspection.												
2	Dimension	Within the specified dimensions.	Using calipers and micrometers.												
3	Voltage Proof	No defects or abnormalities.	Measurement Point: Between the terminations Test Voltage: DC1075V Applied Time: 60±1s Charge/discharge current: 50mA max.												
4	Insulation Resistance (I.R.)	6000MΩ or more	Measurement Point: Between the terminations Measurement Voltage: DC500±50V Charging Time: 60±5s Measurement Temperature: Room Temperature												
5	Capacitance	Shown in Rated value.	Measurement Temperature: Room Temperature												
6	Dissipation Factor (D.F.)	0.025 max.	Measurement Frequency: 1.0±0.1kHz Measurement Voltage: AC1.0±0.2V (r.m.s.)												
7	Temperature Characteristics of Capacitance	R7: Within ±15% (-55 to +125°C)	The capacitance change should be measured after 5 minutes at each specified temp. stage. Capacitance value as a reference is the value in step 3. <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp. ±3</td> </tr> <tr> <td>3</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp. ±3</td> </tr> <tr> <td>5</td> <td>Reference Temp. ±2</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h. at room condition*.	Step	Temperature (°C)	1	Reference Temp. ±2	2	Min. Operating Temp. ±3	3	Reference Temp. ±2	4	Max. Operating Temp. ±3	5	Reference Temp. ±2
Step	Temperature (°C)														
1	Reference Temp. ±2														
2	Min. Operating Temp. ±3														
3	Reference Temp. ±2														
4	Max. Operating Temp. ±3														
5	Reference Temp. ±2														
8	Vibration	Appearance	No defects or abnormalities.												
		Capacitance	Within the specified initial value.												
		D.F.	Within the specified initial value.												
9	Solderability	95% of the terminations is to be soldered evenly and continuously.	Test Method: Solder bath method Flux: Solution of rosin ethanol 25 (wt)% Preheat: 80 to 120°C for 10 to 30s Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 245±5°C Immersion time: 2±0.5s Immersing in speed: 25±2.5mm/s.												
10	Resistance to Soldering Heat	Appearance	No defects or abnormalities.												
		Capacitance Change	Within ±10%												
		I.R.	1000MΩ or more												
		Voltage Proof	No defects.												
11	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	Solder the capacitor on the test substrate A shown in "Complement of Test Method".  Applied Direction: In parallel with the test substrate and vertical with the capacitor side.												
12	Substrate Bending Test	No defects or abnormalities.	Solder the capacitor on the test substrate B shown in "Complement of Test Method". Then apply the force in the direction shown in "Test Method of Substrate Bending Test" of "Complement of Test Method". Flexure: 1mm Holding Time: 5±1s Soldering Method: Reflow soldering												

* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

Continued on the following page. ➤

GRM
GR3
GRJ
GR4
GR7
GJM
GQM
GA2
GA3 GB
GA3 GD
GA3 GF
LLL
LLA
LLM
LLR
NFM
KRM
KR3
GMA
GMD
⚠Caution /Notice

GA3 Series Type GB Specifications and Test Methods (1)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)
13	Temperature Sudden Change	Appearance	No defects or abnormalities.
		Capacitance Change	Within±15%
		D.F.	0.05 max.
		I.R.	3000MΩ or more
		Voltage Proof	No defects.
14	High Temperature High Humidity (Steady)	Appearance	No defects or abnormalities.
		Capacitance Change	Within±15%
		D.F.	0.05 max.
		I.R.	3000MΩ or more
		Voltage Proof	No defects.
15	Durability	Appearance	No defects or abnormalities.
		Capacitance Change	Within ±20%
		D.F.	0.05 max.
		I.R.	3000MΩ or more
		Voltage Proof	No defects.

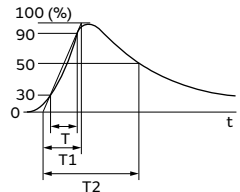
Step	Temp. (°C)	Time (min)
1	Min. Operating Temp. +0/-3	30±3
2	Room Temp.	2 to 3
3	Max. Operating Temp. +3/-0	30±3
4	Room Temp.	2 to 3

Fix the capacitor to the supporting test substrate A (glass epoxy board) shown in "Complement of Test Method".
 Perform the 5 cycles according to the four heat treatments shown in the following table.

Exposure Time: 24±2h at room condition*.
 • Pretreatment
 Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.

Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method".
 Before this test, the test shown in the following is performed.
 • No.11 Adhesive Strength of Termination (apply force: 5N)
 • No.12 Substrate Bending Test
 Test Temperature: 40±2°C
 Test Humidity: 90 to 95%RH
 Test Time: 500+24/-0h
 Applied Voltage: Rated voltage
 Exposure Time: 24±2h at room condition*.
 • Pretreatment
 Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.

Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method".
 Before this test, the test shown in the following is performed.
 • No.11 Adhesive Strength of Termination (apply force: 5N)
 • No.12 Substrate Bending Test
 Next, Impulse Voltage test is performed.
 Each individual capacitor shall be subjected to a 2.5kV Impulse (the voltage value means zero to peak) for 3 times.
 Then the capacitors are applied to life test.



Front time (T1) = 1.2μs=1.67T
 Time to half-value (T2) = 50μs

Apply voltage as Table for 1000h at 125+2/-0°C, relative humidity 50% max.

Applied Voltage
 AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.

Exposure Time: 24±2h at room condition*.
 • Pretreatment
 Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.

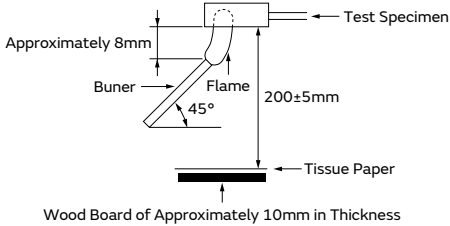
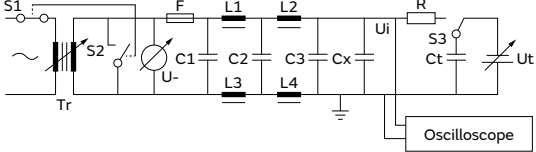
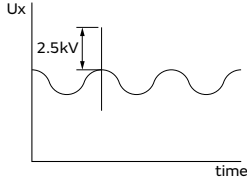
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

Continued on the following page. ↗

- GRM
- GR3
- GRJ
- GR4
- GR7
- GJM
- GQM
- GA2
- GA3 GB
- GA3 GD
- GA3 GF
- LLL
- LLA
- LLM
- LLR
- NFM
- KRM
- KR3
- GMA
- GMD
- ⚠Caution / Notice

GA3 Series Type GB Specifications and Test Methods (1)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)
16	Passive Flammability	The burning time shall not be exceeded the time 30s. The tissue paper shall not ignite.	<p>The capacitor under test shall be held in the flame in the position which best promotes burning. Each specimen shall only be exposed once to the flame. Time of exposure to flame: 30s Length of flame: 12±1mm Gas burner: Length 35mm min. Inside dia: 0.5±0.1mm Outside dia: 0.9mm max. Gas: Butane gas purity 95% min.</p> 
17	Active Flammability	The cheesecloth shall not be on fire.	<p>The specimens shall be individually wrapped in at least one but more than two complete layers of cheesecloth. The specimens shall be subjected to 20 discharges. The interval between successive discharges shall be 5s. The UAC shall be maintained for 2min after the last discharge.</p>  <p>C1,C2: Filter capacitor 1μF±10% C3: Capacitor 0.033μF±5% L1 to L4: Rod coa choke 1.5mH±20%, 16A R: Resistor 100Ω±2% Cx < 0.068μF Ct: Tank capacitor 3μF±5% 10kV Cx ≤ 1μF U-: UR±5% UR: Rated voltage Cx: Capacitor under test F: Slow-blow fuse, rated 16A Ut: Voltage to which the tank capacitor Ct is charged</p> 

GA3 Series Type GB Specifications and Test Methods (1)

Continued from the preceding page. ↘

Complement of Test Method

1. Test Substrate

The test substrate should be Substrate A or Substrate B as described in “Specifications and Test Methods”.

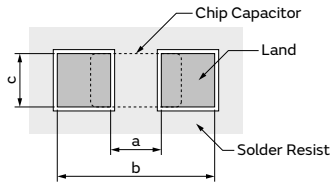
The specimen should be soldered by the conditions as described below.

Soldering Method: Reflow soldering

Solder: Sn-3.0Ag-0.5Cu

(1) Test Substrate A

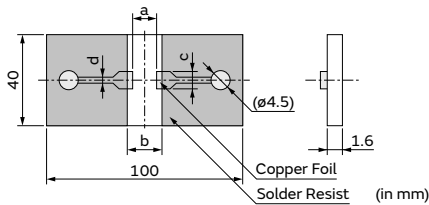
• Land Dimensions



Part Number	Dimension (mm)		
	a	b	c
GA355	4.5	8.0	5.6

- Material: Glass Epoxy Board
- Thickness: 1.6mm
- Thickness of Copper Foil: 0.035mm

(2) Test Substrate B

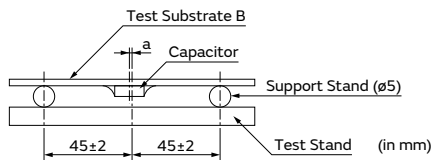


Part Number	Dimension of Pattern (mm)			
	a	b	c	d
GA355	4.5	8.0	5.6	1.0

- Material: Glass Epoxy Board
- Thickness of Copper Foil: 0.035mm

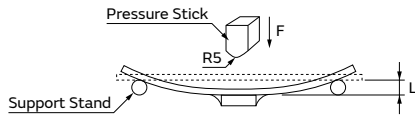
2. Test Method of Substrate Bending Test

(a) Support State

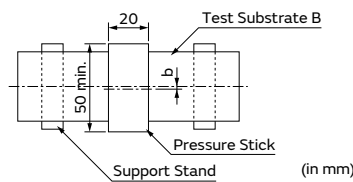


a: ± 2 gap between support stand center and test stand

- Material of Test Stand and Pressure Stick
 The material should be a metal where a remarkable transformation and the distortion are not caused even if it is pressurized.
- Pressurizing Speed
 The pressurizing speed is pressurized at the speed of about 1mm/s until the flexure reaches a regulated value.



(b) Test State



b: ± 5 gap between support stand center and test stand center

GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution / Notice

Safety Standard Certified Chip Multilayer Ceramic Capacitors for General Purpose / Acquired certifications of UL60950-1

GA3 Series Type GD



UL60950-1 Certified Product

Features

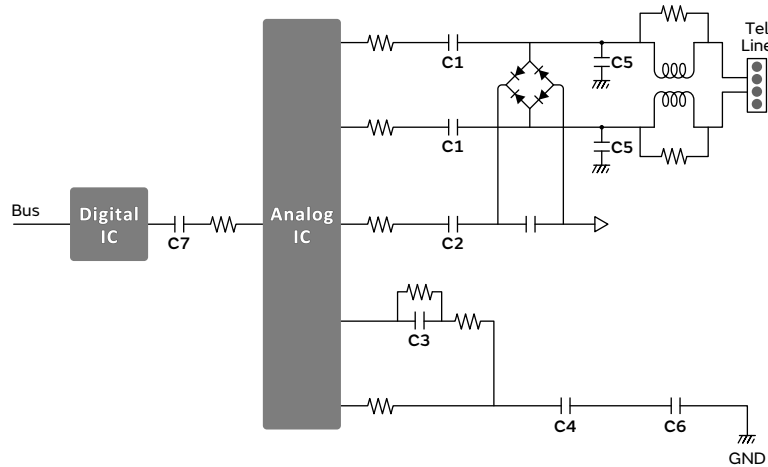
- 1 International Standard (IEC60384-14) certified product.

Please download Safety Standard Certification (Type GD) from here.



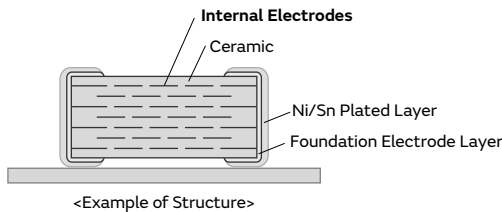
- 2 Can be used for UL60950-1 devices.

● DAA Modem - Transformer Less



No.	Application	Recommend MLCC Type
C5	Lighting Surge Absorption	Type: GD / GF
C6	Noise Immunity	
C7	D/A Isolation Barrier	

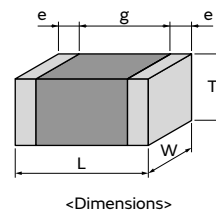
- 3 Realized large capacitance value and small size while maintaining high withstand voltages by the multilayer structure.



- 4 This product is only for reflow soldering.

Specifications

Size (mm)	4.5×2.0mm to 4.5×3.2mm
Rated Voltage	250Vac
Capacitance	10pF to 4700pF
Main Applications	Modem



This catalog contains only a portion of the product lineup.
 Please refer to the capacitor search tool on the Murata Web site for details.

GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution /Notice

GA3 Series Type GD Temperature Compensating Type Part Number List

4.5×2.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.0mm	250Vac	SL	10pF	±5%	GA342A1XGD100JW31#	p199
			12pF	±5%	GA342A1XGD120JW31#	p199
			15pF	±5%	GA342A1XGD150JW31#	p199
			18pF	±5%	GA342A1XGD180JW31#	p199
			22pF	±5%	GA342A1XGD220JW31#	p199
			27pF	±5%	GA342A1XGD270JW31#	p199
			33pF	±5%	GA342A1XGD330JW31#	p199
			39pF	±5%	GA342A1XGD390JW31#	p199
			47pF	±5%	GA342A1XGD470JW31#	p199
			56pF	±5%	GA342A1XGD560JW31#	p199
			68pF	±5%	GA342A1XGD680JW31#	p199
			82pF	±5%	GA342A1XGD820JW31#	p199

GRM

GR3

GRJ

GR4

GR7

GJM

GQM

GA2

GA3
GB

GA3
GD

GA3
GF

LLL

LLA

LLM

LLR

NFM

KRM

KR3

GMA

GMD

⚠Caution
/Notice

*: Refers to the page of the "Specifications and Test Methods".

Part number # indicates the package specification code.

GA3 Series Type GD High Dielectric Constant Type Part Number List

4.5×2.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.5mm	250Vac	X7R	100pF	±10%	GA342QR7GD101KW01#	p203
			150pF	±10%	GA342QR7GD151KW01#	p203
			220pF	±10%	GA342QR7GD221KW01#	p203
			330pF	±10%	GA342QR7GD331KW01#	p203
			470pF	±10%	GA342QR7GD471KW01#	p203
			680pF	±10%	GA342QR7GD681KW01#	p203
			1000pF	±10%	GA342QR7GD102KW01#	p203
			1500pF	±10%	GA342QR7GD152KW01#	p203

4.5×3.2mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.5mm	250Vac	X7R	1800pF	±10%	GA343QR7GD182KW01#	p203
			2200pF	±10%	GA343QR7GD222KW01#	p203
2.0mm	250Vac	X7R	4700pF	±10%	GA343DR7GD472KW01#	p203

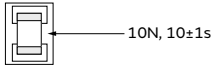
- GRM
- GR3
- GRJ
- GR4
- GR7
- GJM
- GQM
- GA2
- GA3 GB
- GA3 GD**
- GA3 GF
- LLL
- LLA
- LLM
- LLR
- NFM
- KRM
- KR3
- GMA
- GMD
- ⚠Caution /Notice

*: Refers to the page of the "Specifications and Test Methods".

Part number # indicates the package specification code.

1

GA3 Series Type GD Specifications and Test Methods (1)

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)												
1	Appearance	No defects or abnormalities.	Visual inspection.												
2	Dimension	Within the specified dimensions.	Using calipers and micrometers.												
3	Voltage Proof	No defects or abnormalities.	Measurement Point: Between the terminations Test Voltage: AC1500V (r.m.s.) Applied Time: 60±1s Charge/discharge current: 50mA max.												
4	Impulse Voltage	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 60s. Applied Voltage: 2.5kVo-p												
5	Insulation Resistance (I.R.)	6000MΩ or more	Measurement Point: Between the terminations Measurement Voltage: DC500±50V Charging Time: 60±5s Measurement Temperature: Room Temperature												
6	Capacitance	Shown in Rated value.	Measurement Temperature: Room Temperature Measurement Frequency: 1.0±0.1MHz Measurement Voltage: AC1.0±0.2V (r.m.s.)												
7	Q	C ≥ 30pF: 1000 or more C < 30pF: 400+20C or more C: Nominal Capacitance (pF)													
8	Temperature Characteristics of Capacitance	1X: +350 to -1000 ppm/°C (Temp.Range:+20 to +85°C)	The capacitance change should be measured after 5 minutes at each specified temp. stage. Capacitance value as a reference is the value in step 3. <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp. ±3</td> </tr> <tr> <td>3</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp. ±3</td> </tr> <tr> <td>5</td> <td>Reference Temp. ±2</td> </tr> </tbody> </table> <p>However, the capacitance shall be measured at even 85°C between step 3 and step 4.</p>	Step	Temperature (°C)	1	Reference Temp. ±2	2	Min. Operating Temp. ±3	3	Reference Temp. ±2	4	Max. Operating Temp. ±3	5	Reference Temp. ±2
Step	Temperature (°C)														
1	Reference Temp. ±2														
2	Min. Operating Temp. ±3														
3	Reference Temp. ±2														
4	Max. Operating Temp. ±3														
5	Reference Temp. ±2														
9	Vibration	Appearance	Solder the capacitor on the test substrate A shown in "Complement of Test Method". Kind of Vibration: A simple harmonic motion 10Hz to 55Hz to 10Hz (1min) Total amplitude: 1.5mm This motion should be applied for a period of 2h in each 3 mutually perpendicular directions (total of 6h).												
		Capacitance													
		Q													
10	Solderability	95% of the terminations is to be soldered evenly and continuously.	Test Method: Solder bath method Flux: Solution of rosin ethanol 25 (wt)% Preheat: 80 to 120°C for 10 to 30s Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 245±5°C Immersion time: 2±0.5s Immersing in speed: 25±2.5mm/s.												
11	Resistance to Soldering Heat	Appearance	Test Method: Solder bath method Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 260±5°C Immersion time: 10±1s Immersing in speed: 25±2.5mm/s. Exposure Time: 24±2h at room condition*. Preheat: GA342 size: 100 to 120°C for 1min and 170 to 200°C for 1min												
		Capacitance Change													
		I.R.													
		Voltage Proof													
12	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	Solder the capacitor on the test substrate A shown in "Complement of Test Method".  Applied Direction: In parallel with the test substrate and vertical with the capacitor side.												
13	Substrate Bending Test	No defects or abnormalities.	Solder the capacitor on the test substrate B shown in "Complement of Test Method". Then apply the force in the direction shown in "Test Method of Substrate Bending Test" of "Complement of Test Method". Flexure: 1mm Holding Time: 5±1s Soldering Method: Reflow soldering												

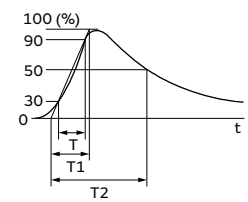
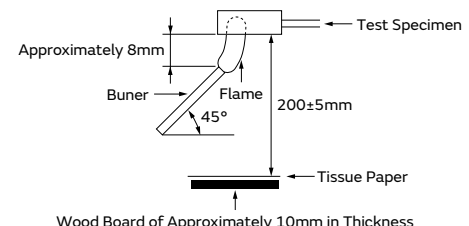
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

Continued on the following page. ↗

GRM
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GA3 GD
GA3 GF
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LLM
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NFM
KRM
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⚠Caution /Notice

GA3 Series Type GD Specifications and Test Methods (1)

Continued from the preceding page. ↘

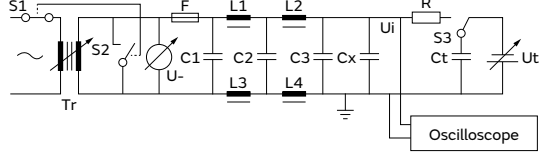
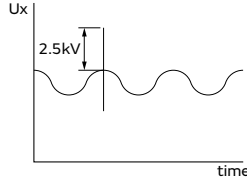
No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)															
14	Temperature Sudden Change	Appearance	No defects or abnormalities.															
		Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)															
		Q	Within the specified initial value.															
		I.R.	3000M Ω or more															
		Voltage Proof	No defects.															
			Fix the capacitor to the supporting test substrate A (glass epoxy board) shown in "Complement of Test Method" Perform the 5 cycles according to the four heat treatments shown in the following table.															
			<table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. Operating Temp. +0/-3</td> <td>30\pm3</td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> <tr> <td>3</td> <td>Max. Operating Temp. +3/-0</td> <td>30\pm3</td> </tr> <tr> <td>4</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> </tbody> </table>	Step	Temp. (°C)	Time (min)	1	Min. Operating Temp. +0/-3	30 \pm 3	2	Room Temp.	2 to 3	3	Max. Operating Temp. +3/-0	30 \pm 3	4	Room Temp.	2 to 3
Step	Temp. (°C)	Time (min)																
1	Min. Operating Temp. +0/-3	30 \pm 3																
2	Room Temp.	2 to 3																
3	Max. Operating Temp. +3/-0	30 \pm 3																
4	Room Temp.	2 to 3																
			Exposure Time: 24 \pm 2h at room condition*.															
15	High Temperature High Humidity (Steady)	Appearance	No defects or abnormalities.															
		Capacitance Change	Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)															
		Q	C \geq 30pF: 350 or more C < 30pF: 275+5/2C or more C: Nominal Capacitance (pF)															
		I.R.	3000M Ω or more															
		Voltage Proof	No defects.															
			Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending Test Test Temperature: 40 \pm 2°C Test Humidity: 90 to 95%RH Test Time: 500+24/-0h. Applied Voltage: Rated voltage Exposure Time: 24 \pm 2h at room condition*.															
16	Durability	Appearance	No defects or abnormalities.															
		Capacitance Change	Within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)															
		Q	C \geq 30pF: 350 or more C < 30pF: 275+5/2C or more C: Nominal Capacitance (pF)															
		I.R.	3000M Ω or more															
		Voltage Proof	No defects.															
			Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending Test Next, Impulse Voltage test is performed. Each individual capacitor shall be subjected to a 2.5kV Impulse (the voltage value means zero to peak) for 3 times. Then the capacitors are applied to life test.															
			 <p>Front time (T1) = 1.2μs=1.67T Time to half-value (T2) = 50μs</p>															
			Apply voltage as Table for 1000h at 125+2/-0°C, relative humidity 50% max.															
			<table border="1"> <thead> <tr> <th colspan="2">Applied voltage</th> </tr> </thead> <tbody> <tr> <td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.</td> <td></td> </tr> </tbody> </table>	Applied voltage		AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.												
Applied voltage																		
AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.																		
			Exposure Time: 24 \pm 2h at room condition*.															
17	Passive Flammability	The burning time shall not be exceeded the time 30s. The tissue paper shall not ignite.	The capacitor under test shall be held in the flame in the position which best promotes burning. Each specimen shall only be exposed once to the flame. Time of exposure to flame: 30s Length of flame: 12 \pm 1mm Gas burner: Length 35mm min. Inside dia: 0.5 \pm 0.1mm Outside dia: 0.9mm max. Gas: Butane gas purity 95% min.															
																		

* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

Continued on the following page. ↗

GA3 Series Type GD Specifications and Test Methods (1)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)
18	Active Flammability	The cheesecloth shall not be on fire.	<p>The specimens shall be individually wrapped in at least one but more than two complete layers of cheesecloth. The specimens shall be subjected to 20 discharges. The interval between successive discharges shall be 5s. The UAC shall be maintained for 2min after the last discharge.</p>  <p>C1, C2: Filter capacitor $1\mu\text{F}\pm 10\%$ C3: Capacitor $0.033\mu\text{F}\pm 5\%$ L1 to L4: Rod coa choke $1.5\text{mH}\pm 20\%$, 16A R: Resistor $100\Omega\pm 2\%$ $C_x < 0.068\mu\text{F}$ Ct: Tank capacitor $3\mu\text{F}\pm 5\%$ 10kV $C_x \leq 1\mu\text{F}$ U-: $UR\pm 5\%$ UR: Rated voltage Cx: Capacitor under test F: Slow-blow fuse, rated 16A Ut: Voltage to which the tank capacitor Ct is charged</p> 

GRM

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GR4

GR7

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GQM

GA2

GA3

GA3

GA3

LLL

LLA

LLM

LLR

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KR3

GMA

GMD

⚠Caution / Notice

201

GA3 Series Type GD Specifications and Test Methods (1)

Continued from the preceding page. ↘

Complement of Test Method

1. Test Substrate

The test substrate should be Substrate A or Substrate B as described in "Specifications and Test Methods".

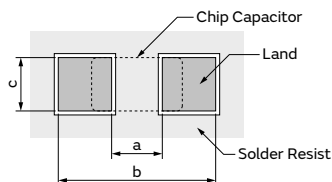
The specimen should be soldered by the conditions as described below.

Soldering Method: Reflow soldering

Solder: Sn-3.0Ag-0.5Cu

(1) Test Substrate A

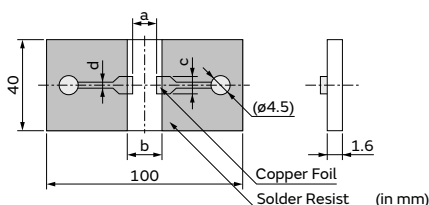
• Land Dimensions



- Material: Glass Epoxy Board
- Thickness: 1.6mm
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension (mm)		
	a	b	c
GA342	3.5	7.0	2.4

(2) Test Substrate B

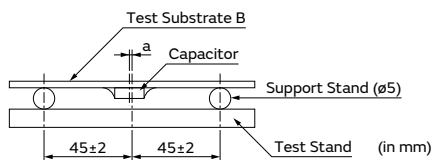


- Material: Glass Epoxy Board
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension of Pattern (mm)			
	a	b	c	d
GA342	3.5	7.0	2.4	1.0

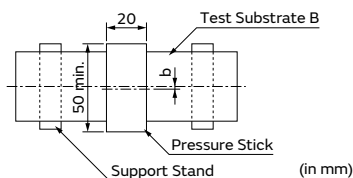
2. Test Method of Substrate Bending Test

(a) Support State



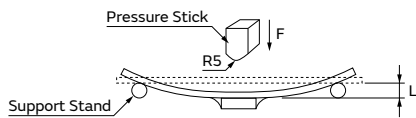
a: ±2 gap between support stand center and test stand

(b) Test State



b: ±5 gap between support stand center and test stand center

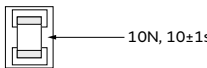
- Material of Test Stand and Pressure Stick
 The material should be a metal where a remarkable transformation and the distortion are not caused even if it is pressurized.
- Pressurizing Speed
 The pressurizing speed is pressurized at the speed of about 1mm/s until the flexure reaches a regulated value.



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 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
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 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 Caution / Notice

2

GA3 Series Type GD Specifications and Test Methods (2)

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)												
1	Appearance	No defects or abnormalities.	Visual inspection.												
2	Dimension	Within the specified dimensions.	Using calipers and micrometers.												
3	Voltage Proof	No defects or abnormalities.	Measurement Point: Between the terminations Test Voltage: AC1500V (r.m.s.) Applied Time: 60±1s Charge/discharge current: 50mA max.												
4	Impulse Voltage	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 60s. Applied Voltage: 2.5kVo-p												
5	Insulation Resistance (I.R.)	6000MΩ or more	Measurement Point: Between the terminations Measurement Voltage: DC500±50V Charging Time: 60±5s Measurement Temperature: Room Temperature												
6	Capacitance	Shown in Rated value.	Measurement Temperature: Room Temperature Measurement Frequency: 1.0±0.1kHz												
7	Dissipation Factor (D.F.)	0.025 max.	Measurement Voltage: AC1.0±0.2V (r.m.s.)												
8	Temperature Characteristics of Capacitance	R7: Within ±15% (-55 to +125°C)	The capacitance change should be measured after 5 minutes at each specified temp. stage. Capacitance value as a reference is the value in step 3. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp. ±3</td> </tr> <tr> <td>3</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp. ±3</td> </tr> <tr> <td>5</td> <td>Reference Temp. ±2</td> </tr> </tbody> </table> • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.	Step	Temperature (°C)	1	Reference Temp. ±2	2	Min. Operating Temp. ±3	3	Reference Temp. ±2	4	Max. Operating Temp. ±3	5	Reference Temp. ±2
Step	Temperature (°C)														
1	Reference Temp. ±2														
2	Min. Operating Temp. ±3														
3	Reference Temp. ±2														
4	Max. Operating Temp. ±3														
5	Reference Temp. ±2														
9	Vibration	Appearance	Solder the capacitor on the test substrate A shown in "Complement of Test Method". Kind of Vibration: A simple harmonic motion 10Hz to 55Hz to 10Hz (1min) Total amplitude: 1.5mm This motion should be applied for a period of 2h in each 3 mutually perpendicular directions (total of 6h).												
		Capacitance													
		D.F.													
10	Solderability	95% of the terminations is to be soldered evenly and continuously.	Test Method: Solder bath method Flux: Solution of rosin ethanol 25 (wt)% Preheat: 80 to 120°C for 10 to 30s Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 245±5°C Immersion time: 2±0.5s Immersing in speed: 25±2.5mm/s.												
11	Resistance to Soldering Heat	Appearance	Test Method: Solder bath method Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 260±5°C Immersion time: 10±1s Immersing in speed: 25±2.5mm/s. Exposure Time: 24±2h at room condition*. Preheat: GA342/43 size: 100 to 120°C for 1min and 170 to 200°C for 1min • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.												
		Capacitance Change													
		I.R.													
		Voltage Proof													
12	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	 Applied Direction: In parallel with the test substrate and vertical with the capacitor side.												

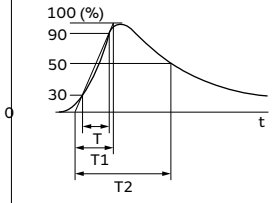
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

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 GA3 GF
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 LLM
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 KPM
 KR3
 GMA
 GMD
 ⚠Caution / Notice

GA3 Series Type GD Specifications and Test Methods (2)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)															
13	Substrate Bending Test	No defects or abnormalities.	Solder the capacitor on the test substrate B shown in "Complement of Test Method". Then apply the force in the direction shown in "Test Method of Substrate Bending Test" of "Complement of Test Method" Flexure: 1mm Holding Time: 5±1s Soldering Method: Reflow soldering															
14	Temperature Sudden Change	Appearance	Fix the capacitor to the supporting test substrate A (glass epoxy board) shown in "Complement of Test Method". Perform the 5 cycles according to the four heat treatments shown in the following table. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. Operating Temp. +0/-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. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> </tbody> </table> Exposure Time: 24±2h at room condition*. • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.	Step	Temp. (°C)	Time (min)	1	Min. Operating Temp. +0/-3	30±3	2	Room Temp.	2 to 3	3	Max. Operating Temp. +3/-0	30±3	4	Room Temp.	2 to 3
		Step		Temp. (°C)	Time (min)													
		1		Min. Operating Temp. +0/-3	30±3													
		2		Room Temp.	2 to 3													
		3		Max. Operating Temp. +3/-0	30±3													
4	Room Temp.	2 to 3																
Capacitance Change	Within±15%																	
D.F.	0.05 max.																	
I.R.	3000MΩ or more																	
Voltage Proof	No defects.																	
15	High Temperature High Humidity (Steady)	Appearance	Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending Test Test Temperature: 40±2°C Test Humidity: 90 to 95%RH Test Time: 500+24/-0h Applied Voltage: Rated voltage Exposure Time: 24±2h at room condition*. • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.															
		Capacitance Change		Within±15%														
		D.F.		0.05 max.														
		I.R.		3000MΩ or more														
		Voltage Proof		No defects.														
16	Durability	Appearance	Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending Test Next, Impulse Voltage test is performed. Each individual capacitor shall be subjected to a 2.5kV Impulse (the voltage value means zero to peak) for 3 times. Then the capacitors are applied to life test.  Front time (T1) = 1.2μs=1.67T Time to half-value (T2) = 50μs Apply voltage as Table for 1000h at 125+2/-0°C, relative humidity 50% max. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Applied Voltage</th> </tr> </thead> <tbody> <tr> <td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.</td> </tr> </tbody> </table> Exposure Time: 24±2h at room condition*. • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.	Applied Voltage	AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.													
		Applied Voltage																
		AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.																
		Capacitance Change		Within ±20%														
		D.F.		0.05 max.														
I.R.	3000MΩ or more																	
Voltage Proof	No defects.																	

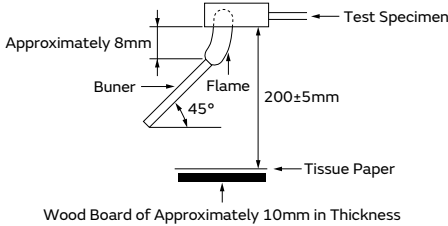
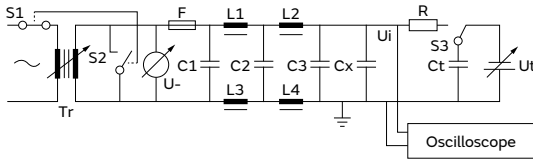
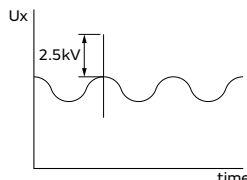
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

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LLR
NFM
KRM
KR3
GMA
GMD
Caution / Notice

GA3 Series Type GD Specifications and Test Methods (2)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)
17	Passive Flammability	The burning time shall not be exceeded the time 30s. The tissue paper shall not ignite.	<p>The capacitor under test shall be held in the flame in the position which best promotes burning. Each specimen shall only be exposed once to the flame. Time of exposure to flame: 30s Length of flame: 12±1mm Gas burner: Length 35mm min. Inside dia: 0.5±0.1mm Outside dia: 0.9mm max. Gas: Butane gas purity 95% min.</p> 
18	Active Flammability	The cheesecloth shall not be on fire.	<p>The specimens shall be individually wrapped in at least one but more than two complete layers of cheesecloth. The specimens shall be subjected to 20 discharges. The interval between successive discharges shall be 5s. The UAC shall be maintained for 2min after the last discharge.</p>  <p>C1, C2: Filter capacitor 1μF±10% C3: Capacitor 0.033μF±5% L1 to L4: Rod coa choke 1.5mH±20%, 16A R: Resistor 100Ω±2% Cx < 0.068μF Ct: Tank capacitor 3μF±5% 10kV Cx ≤ 1μF U-: UR±5% UR: Rated voltage Cx: Capacitor under test F: Slow-blow fuse, rated 16A Ut: Voltage to which the tank capacitor Ct is charged</p> 

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 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution / Notice

GA3 Series Type GD Specifications and Test Methods (2)

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Complement of Test Method

1. Test Substrate

The test substrate should be Substrate A or Substrate B as described in "Specifications and Test Methods".

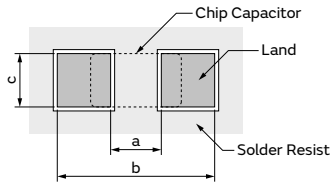
The specimen should be soldered by the conditions as described below.

Soldering Method: Reflow soldering

Solder: Sn-3.0Ag-0.5Cu

(1) Test Substrate A

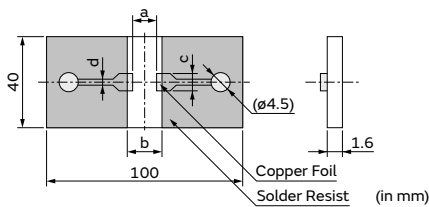
- Land Dimensions



- Material: Glass Epoxy Board
- Thickness: 1.6mm
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension (mm)		
	a	b	c
GA342	3.5	7.0	2.4
GA343	3.5	7.0	3.7

(2) Test Substrate B

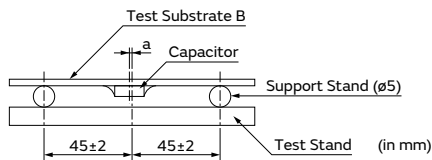


- Material: Glass Epoxy Board
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension of Pattern (mm)			
	a	b	c	d
GA342	3.5	7.0	2.4	1.0
GA343	3.5	7.0	3.7	1.0

2. Test Method of Substrate Bending Test

(a) Support State

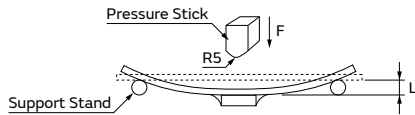


a: ±2 gap between support stand center and test stand

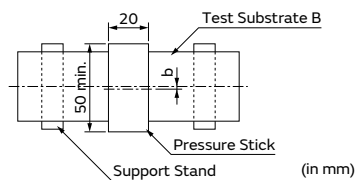
- Material of Test Stand and Pressure Stick
 The material should be a metal where a remarkable transformation and the distortion are not caused even if it is pressurized.

- Pressurizing Speed

The pressurizing speed is pressurized at the speed of about 1mm/s until the flexure reaches a regulated value.



(b) Test State



b: ±5 gap between support stand center and test stand center

GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 Caution / Notice

Safety Standard Certified Chip Multilayer Ceramic Capacitors for General Purpose / Acquired certifications of IEC60384-14 Class X1/Y2 and UL60950-1

GA3 Series Type GF



Size 4.5x2.0mm: This product is applicable only for the instruments certified by EN/IEC60950-1
Size 5.7x2.8mm or 5.7x5.0mm: This product is applicable as X or Y capacitor

Features

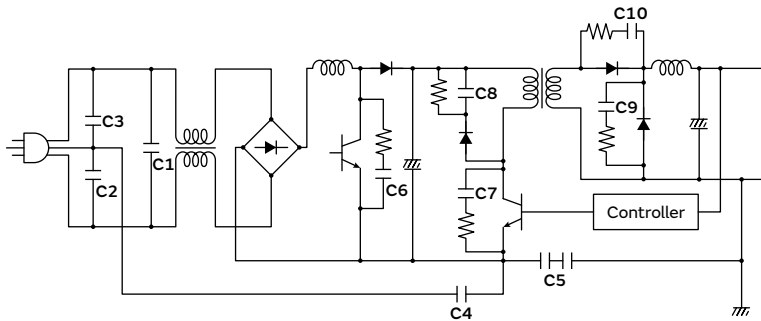
① **International Standard (IEC60384-14) certified product.**

Please down load Safety Standard Certification (Type GF: X1/Y2) from here.



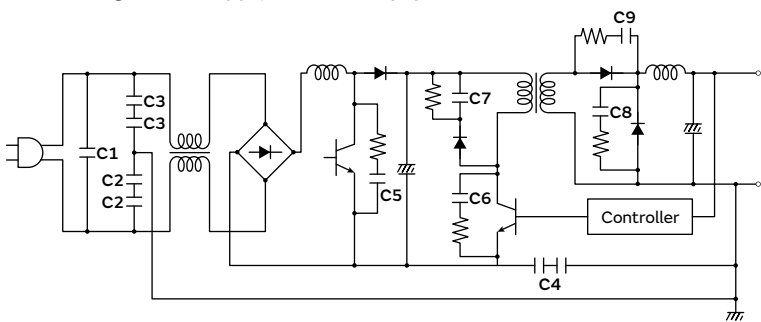
② **Can be used as a Class Y2 capacitor.**

● **Switching Power Supply - Class 1 Equipment**



No.	Application	Recommend MLCC Type
C1	X Cap	Type: GB
C2	Y Cap	Type: GF
C3		
C4		
C5	Primary - Secondary Coupling	Type: GF×2

● **Switching Power Supply - Class 2 Equipment**

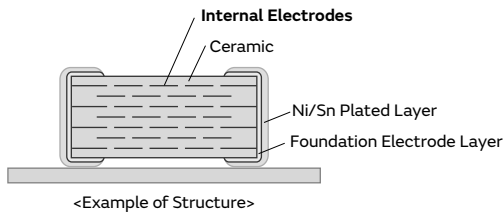


No.	Application	Recommend MLCC Type
C1	X Cap	Type: GB
C2	Y Cap	Type: GF×2
C3		
C4	Primary - Secondary Coupling	

- GRM
- GR3
- GRJ
- GR4
- GR7
- GJM
- GQM
- GA2
- GA3 GB
- GA3 GD
- GA3 GF**
- LLL
- LLA
- LLM
- LLR
- NFM
- KRM
- KR3
- GMA
- GMD
- ⚠Caution / Notice

GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution /Notice

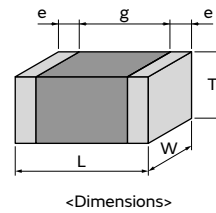
3 Realized large capacitance value and small size while maintaining high withstand voltages by the multilayer structure.



4 This product is only for reflow soldering.

Specifications

Size (mm)	4.5×2.0mm to 5.7×5.0mm
Rated Voltage	250Vac
Capacitance	10pF to 4700pF
Main Applications	AC-DC power supply



This catalog contains only a portion of the product lineup.
 Please refer to the capacitor search tool on the Murata Web site for details.

GA3 Series Type GF Temperature Compensating Type Part Number List

4.5×2.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.0mm	250Vac	SL	10pF	±5%	GA342A1XGF100JW31#	p211
			12pF	±5%	GA342A1XGF120JW31#	p211
			15pF	±5%	GA342A1XGF150JW31#	p211
			18pF	±5%	GA342A1XGF180JW31#	p211
			22pF	±5%	GA342A1XGF220JW31#	p211
			27pF	±5%	GA342A1XGF270JW31#	p211
			33pF	±5%	GA342A1XGF330JW31#	p211
			39pF	±5%	GA342A1XGF390JW31#	p211
			47pF	±5%	GA342A1XGF470JW31#	p211
			56pF	±5%	GA342A1XGF560JW31#	p211
			68pF	±5%	GA342A1XGF680JW31#	p211
			82pF	±5%	GA342A1XGF820JW31#	p211

- GRM
- GR3
- GRJ
- GR4
- GR7
- GJM
- GQM
- GA2
- GA3 GB
- GA3 GD
- GA3 GF**
- LLL
- LLA
- LLM
- LLR
- NFM
- KRM
- KR3
- GMA
- GMD
- ⚠Caution /Notice

*: Refers to the page of the "Specifications and Test Methods".

Part number # indicates the package specification code.

GA3 Series Type GF High Dielectric Constant Type Part Number List

4.5×2.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.5mm	250Vac	X7R	100pF	±10%	GA342QR7GF101KW01#	p215
			150pF	±10%	GA342QR7GF151KW01#	p215
			470pF	±10%	GA342QR7GF471KW01#	p215
			680pF	±10%	GA342QR7GF681KW01#	p215
2.2mm	250Vac	X7R	220pF	±10%	GA342DR7GF221KW02#	p215
			330pF	±10%	GA342DR7GF331KW02#	p215
			1000pF	±10%	GA342DR7GF102KW02#	p215

5.7×2.8mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.5mm	250Vac	X7R	100pF	±10%	GA352QR7GF101KW31#	p215
			150pF	±10%	GA352QR7GF151KW31#	p215
			220pF	±10%	GA352QR7GF221KW31#	p215
			330pF	±10%	GA352QR7GF331KW31#	p215
			470pF	±10%	GA352QR7GF471KW01#	p215
			680pF	±10%	GA352QR7GF681KW01#	p215
			1000pF	±10%	GA352QR7GF102KW01#	p215
			1500pF	±10%	GA352QR7GF152KW01#	p215

5.7×5.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	p*
1.5mm	250Vac	X7R	1800pF	±10%	GA355QR7GF182KW01#	p215
			2200pF	±10%	GA355QR7GF222KW01#	p215
			3300pF	±10%	GA355QR7GF332KW01#	p215
2.0mm	250Vac	X7R	4700pF	±10%	GA355DR7GF472KW01#	p215

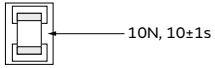
GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution /Notice

*: Refers to the page of the "Specifications and Test Methods".

Part number # indicates the package specification code.

1

GA3 Series Type GF Specifications and Test Methods (1)

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)												
1	Appearance	No defects or abnormalities.	Visual inspection.												
2	Dimension	Within the specified dimensions.	Using calipers and micrometers.												
3	Voltage Proof	No defects or abnormalities.	Measurement Point: Between the terminations Test Voltage: AC2000V (r.m.s.) Applied Time: 60±1s Charge/discharge current: 50mA max.												
4	Impulse Voltage	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 60s. Applied Voltage: 2.5kVo-p												
5	Insulation Resistance (I.R.)	6000MΩ or more	Measurement Point: Between the terminations Measurement Voltage: DC500±50V Charging Time: 60±5s Measurement Temperature: Room Temperature												
6	Capacitance	Shown in Rated value.	Measurement Temperature: Room Temperature Measurement Frequency: 1.0±0.1MHz Measurement Voltage: AC1.0±0.2V (r.m.s.)												
7	Q	C ≥ 30pF: 1000 or more C < 30pF: 400+20C or more C: Nominal Capacitance (pF)													
8	Temperature Characteristics of Capacitance	1X: +350 to -1000 ppm/°C (Temp.Range:+20 to +85°C)	<p>The capacitance change should be measured after 5 minutes at each specified temp. stage. Capacitance value as a reference is the value in step 3.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp. ±3</td> </tr> <tr> <td>3</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp. ±3</td> </tr> <tr> <td>5</td> <td>Reference Temp. ±2</td> </tr> </tbody> </table> <p>However, the capacitance shall be measured at even 85°C between step 3 and step 4.</p>	Step	Temperature (°C)	1	Reference Temp. ±2	2	Min. Operating Temp. ±3	3	Reference Temp. ±2	4	Max. Operating Temp. ±3	5	Reference Temp. ±2
Step	Temperature (°C)														
1	Reference Temp. ±2														
2	Min. Operating Temp. ±3														
3	Reference Temp. ±2														
4	Max. Operating Temp. ±3														
5	Reference Temp. ±2														
9	Vibration	Appearance	Solder the capacitor on the test substrate A shown in "Complement of Test Method". Kind of Vibration: A simple harmonic motion 10Hz to 55Hz to 10Hz (1min) Total amplitude: 1.5mm This motion should be applied for a period of 2h in each 3 mutually perpendicular directions (total of 6h).												
		Capacitance													
		Q													
10	Solderability	95% of the terminations is to be soldered evenly and continuously.	Test Method: Solder bath method Flux: Solution of rosin ethanol 25 (wt)% Preheat: 80 to 120°C for 10 to 30s Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 245±5°C Immersion time: 2±0.5s Immersing in speed: 25±2.5mm/s.												
11	Resistance to Soldering Heat	Appearance	Test Method: Solder bath method Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 260±5°C Immersion time: 10±1s Immersing in speed: 25±2.5mm/s. Exposure Time: 24±2h at room condition*. Preheat: GA342 size: 100 to 120°C for 1min and 170 to 200°C for 1min												
		Capacitance Change													
		I.R.													
		Voltage Proof													
12	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	<p>Solder the capacitor on the test substrate A shown in "Complement of Test Method".</p>  <p>Applied Direction: In parallel with the test substrate and vertical with the capacitor side.</p>												
13	Substrate Bending Test	No defects or abnormalities.	Solder the capacitor on the test substrate B shown in "Complement of Test Method". Then apply the force in the direction shown in "Test Method of Substrate Bending Test" of "Complement of Test Method". Flexure: 1mm Holding Time: 5±1s Soldering Method: Reflow soldering												

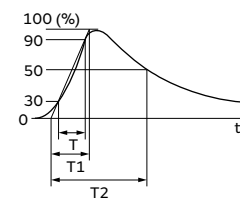
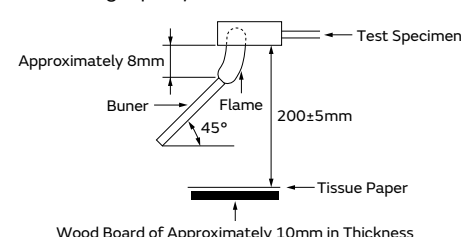
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

Continued on the following page. ↗

GRM
GR3
GRJ
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GR7
GJM
GQM
GA2
GA3 GB
GA3 GD
GA3 GF
LLL
LLA
LLM
LLR
NFM
KRM
KR3
GMA
GMD
⚠Caution /Notice

GA3 Series Type GF Specifications and Test Methods (1)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)															
14	Temperature Sudden Change	Appearance	No defects or abnormalities.															
		Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)															
		Q	Within the specified initial value.															
		I.R.	3000M Ω or more															
		Voltage Proof	No defects.															
			Fix the capacitor to the supporting test substrate A (glass epoxy board) shown in "Complement of Test Method". Perform the 5 cycles according to the four heat treatments shown in the following table.															
			<table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. Operating Temp. +0/-3</td> <td>30\pm3</td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> <tr> <td>3</td> <td>Max. Operating Temp. +3/-0</td> <td>30\pm3</td> </tr> <tr> <td>4</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> </tbody> </table>	Step	Temp. (°C)	Time (min)	1	Min. Operating Temp. +0/-3	30 \pm 3	2	Room Temp.	2 to 3	3	Max. Operating Temp. +3/-0	30 \pm 3	4	Room Temp.	2 to 3
Step	Temp. (°C)	Time (min)																
1	Min. Operating Temp. +0/-3	30 \pm 3																
2	Room Temp.	2 to 3																
3	Max. Operating Temp. +3/-0	30 \pm 3																
4	Room Temp.	2 to 3																
			Exposure Time: 24 \pm 2h at room condition*.															
15	High Temperature High Humidity (Steady)	Appearance	No defects or abnormalities.															
		Capacitance Change	Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)															
		Q	C \geq 30pF: 350 or more C < 30pF: 275+5/2C or more C: Nominal Capacitance (pF)															
		I.R.	3000M Ω or more															
		Voltage Proof	No defects.															
			Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending test Test Temperature: 40 \pm 2°C Test Humidity: 90 to 95%RH Test Time: 500+24/-0h Applied Voltage: Rated voltage Exposure Time: 24 \pm 2h at room condition*.															
16	Durability	Appearance	No defects or abnormalities.															
		Capacitance Change	Within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)															
		Q	C \geq 30pF: 350 or more C < 30pF: 275+5/2C or more C: Nominal Capacitance (pF)															
		I.R.	3000M Ω or more															
		Voltage Proof	No defects.															
			Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending test Next, Impulse Voltage test is performed. Each individual capacitor shall be subjected to a 5kV Impulse (the voltage value means zero to peak) for 3 times. Then the capacitors are applied to life test.															
			 <p>Front time (T1) = 1.2μs=1.67T Time to half-value (T2) = 50μs</p>															
			Apply voltage as Table for 1000h at 125+2/-0°C, relative humidity 50% max.															
			<table border="1"> <thead> <tr> <th>Applied voltage</th> </tr> </thead> <tbody> <tr> <td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.</td> </tr> </tbody> </table>	Applied voltage	AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.													
Applied voltage																		
AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.																		
			Exposure Time: 24 \pm 2h at room condition*.															
17	Passive Flammability	The burning time shall not be exceeded the time 30s. The tissue paper shall not ignite.	The capacitor under test shall be held in the flame in the position which best promotes burning. Each specimen shall only be exposed once to the flame. Time of exposure to flame: 30s Length of flame: 12 \pm 1mm Gas burner: Length 35mm min. Inside dia: 0.5 \pm 0.1mm Outside dia: 0.9mm max. Gas: Butane gas purity 95% min.															
																		

* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

Continued on the following page. ↗

GRM
GR3
GRJ
GR4
GR7
GJM
GQM
GA2
GA3 GB
GA3 GD
GA3 GF
LLL
LLA
LLM
LLR
NFM
KRM
KR3
GMA
GMD
Caution /Notice

GA3 Series Type GF Specifications and Test Methods (1)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)
18	Active Flammability	The cheesecloth shall not be on fire.	<p>The specimens shall be individually wrapped in at least one but more than two complete layers of cheesecloth. The specimens shall be subjected to 20 discharges. The interval between successive discharges shall be 5s. The UAC shall be maintained for 2min after the last discharge.</p> <p>C1, C2: Filter capacitor $1\mu\text{F}\pm 10\%$ C3: Capacitor $0.033\mu\text{F}\pm 5\%$ L1 to L4: Rod coa choke $1.5\text{mH}\pm 20\%$, 16A R: Resistor $100\Omega\pm 2\%$ $C_x < 0.068\mu\text{F}$ Ct: Tank capacitor $3\mu\text{F}\pm 5\%$ 10kV $C_x \leq 1\mu\text{F}$ U-: $UR\pm 5\%$ UR: Rated voltage Cx: Capacitor under test F: Slow-blow fuse, rated 16A Ut: Voltage to which the tank capacitor Ct is charged</p>

- GRM
- GR3
- GRJ
- GR4
- GR7
- GJM
- GQM
- GA2
- GA3 GB
- GA3 GD
- GA3 GF
- LLL
- LLA
- LLM
- LLR
- NFM
- KRM
- KR3
- GMA
- GMD
- ⚠Caution /Notice

GA3 Series Type GF Specifications and Test Methods (1)

Continued from the preceding page. ↘

Complement of Test Method

1. Test Substrate

The test substrate should be Substrate A or Substrate B as described in "Specifications and Test Methods".

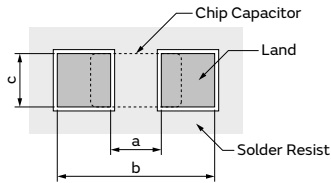
The specimen should be soldered by the conditions as described below.

Soldering Method: Reflow soldering

Solder: Sn-3.0Ag-0.5Cu

(1) Test Substrate A

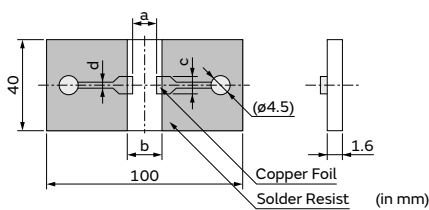
• Land Dimensions



- Material: Glass Epoxy Board
- Thickness: 1.6mm
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension (mm)		
	a	b	c
GA342	3.5	7.0	2.4

(2) Test Substrate B

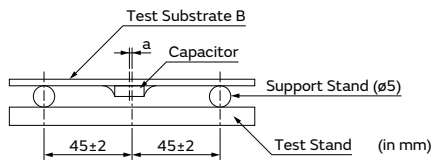


- Material: Glass Epoxy Board
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension of Pattern (mm)			
	a	b	c	d
GA342	3.5	7.0	2.4	1.0

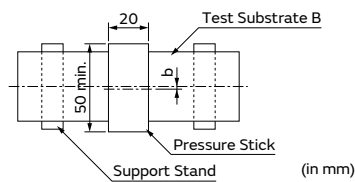
2. Test Method of Substrate Bending Test

(a) Support State



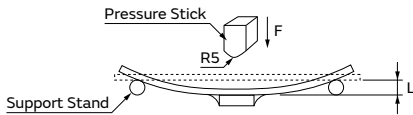
a: ±2 gap between support stand center and test stand

(b) Test State



b: ±5 gap between support stand center and test stand center

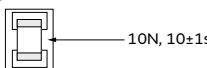
- Material of Test Stand and Pressure Stick
 The material should be a metal where a remarkable transformation and the distortion are not caused even if it is pressurized.
- Pressurizing Speed
 The pressurizing speed is pressurized at the speed of about 1mm/s until the flexure reaches a regulated value.



GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution /Notice

2

GA3 Series Type GF Specifications and Test Methods (2)

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)												
1	Appearance	No defects or abnormalities.	Visual inspection.												
2	Dimension	Within the specified dimensions.	Using calipers and micrometers.												
3	Voltage Proof	No defects or abnormalities.	Measurement Point: Between the terminations Test Voltage: AC2000V (r.m.s.) Applied Time: 60±1s Charge/discharge current: 50mA max.												
4	Impulse Voltage	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 60s. Applied Voltage: 2.5kVo-p												
5	Insulation Resistance (I.R.)	6000MΩ or more	Measurement Point: Between the terminations Measurement Voltage: DC500±50V Charging Time: 60±5s Charge/discharge current: 50mA max. Measurement Temperature: Room Temperature												
6	Capacitance	Shown in Rated value.	Measurement Temperature: Room Temperature Measurement Frequency: 1.0±0.1kHz Measurement Voltage: AC1.0±0.2V (r.m.s.)												
7	Dissipation Factor (D.F.)	0.025 max.													
8	Temperature Characteristics of Capacitance	R7: Within ±15% (-55 to +125°C)	The capacitance change should be measured after 5 minutes at each specified temp. stage. Capacitance value as a reference is the value in step 3. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp. ±3</td> </tr> <tr> <td>3</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp. ±3</td> </tr> <tr> <td>5</td> <td>Reference Temp. ±2</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*. 	Step	Temperature (°C)	1	Reference Temp. ±2	2	Min. Operating Temp. ±3	3	Reference Temp. ±2	4	Max. Operating Temp. ±3	5	Reference Temp. ±2
Step	Temperature (°C)														
1	Reference Temp. ±2														
2	Min. Operating Temp. ±3														
3	Reference Temp. ±2														
4	Max. Operating Temp. ±3														
5	Reference Temp. ±2														
9	Vibration	Appearance	No defects or abnormalities.												
		Capacitance	Within the specified initial value.												
		D.F.	Within the specified initial value.												
10	Solderability	95% of the terminations is to be soldered evenly and continuously.	Test Method: Solder bath method Flux: Solution of rosin ethanol 25 (wt)% Preheat: 80 to 120°C for 10 to 30s Solder: Sn-3.0Ag-0.5Cu (Lead Free Solder) Solder Temp.: 245±5°C Immersion time: 2±0.5s Immersing in speed: 25±2.5mm/s.												
11	Resistance to Soldering Heat	Appearance	No defects or abnormalities.												
		Capacitance Change	Within ±10%												
		I.R.	1000MΩ or more												
		Voltage Proof	No defects.												
12	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	Solder the capacitor on the test substrate A shown in "Complement of Test Method".  Applied Direction: In parallel with the test substrate and vertical with the capacitor side.												

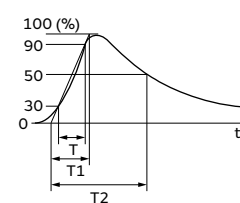
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

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GRM
 GR3
 GRJ
 GR4
 GR7
 GJM
 GQM
 GA2
 GA3 GB
 GA3 GD
 GA3 GF
 LLL
 LLA
 LLM
 LLR
 NFM
 KRM
 KR3
 GMA
 GMD
 ⚠Caution / Notice

GA3 Series Type GF Specifications and Test Methods (2)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)															
13	Substrate Bending Test	No defects or abnormalities.	Solder the capacitor on the test substrate B shown in "Complement of Test Method". Then apply the force in the direction shown in "Test Method of Substrate Bending Test" of "Complement of Test Method". Flexure: 1mm Holding Time: 5±1s Soldering Method: Reflow soldering															
14	Temperature Sudden Change	Appearance	Fix the capacitor to the supporting test substrate A (glass epoxy board) shown in "Complement of Test Method". Perform the 5 cycles according to the four heat treatments shown in the following table. <table border="1" style="margin: 10px auto;"><thead><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min)</th></tr></thead><tbody><tr><td>1</td><td>Min. Operating Temp. +0/-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. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></tbody></table> Exposure Time: 24±2h at room condition*. • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.	Step	Temp. (°C)	Time (min)	1	Min. Operating Temp. +0/-3	30±3	2	Room Temp.	2 to 3	3	Max. Operating Temp. +3/-0	30±3	4	Room Temp.	2 to 3
		Step		Temp. (°C)	Time (min)													
		1		Min. Operating Temp. +0/-3	30±3													
		2		Room Temp.	2 to 3													
		3		Max. Operating Temp. +3/-0	30±3													
4	Room Temp.	2 to 3																
Capacitance Change	Within±15%																	
D.F.	0.05 max.																	
I.R.	3000MΩ or more																	
Voltage Proof	No defects.																	
15	High Temperature High Humidity (Steady)	Appearance	Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending Test Test Temperature: 40±2°C Test Humidity: 90 to 95%RH Test Time: 500+24/-0h Applied Voltage: Rated voltage Exposure Time: 24±2h at room condition*. • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.															
		Capacitance Change		Within±15%														
		D.F.		0.05 max.														
		I.R.		3000MΩ or more														
		Voltage Proof		No defects.														
16	Durability	Appearance	Fix the capacitor to the supporting test substrate B (glass epoxy board) shown in "Complement of Test Method". Before this test, the test shown in the following is performed. • No.12 Adhesive Strength of Termination (apply force: 5N) • No.13 Substrate Bending Test Next, Impulse Voltage test is performed. Each individual capacitor shall be subjected to a 5kV Impulse (the voltage value means zero to peak) for 3 times. Then the capacitors are applied to life test.  Front time (T1) = 1.2μs=1.67T Time to half-value (T2) = 50μs Apply voltage as Table for 1000h at 125+2/-0°C, relative humidity 50% max. <table border="1" style="margin: 10px auto;"><thead><tr><th>Applied Voltage</th></tr></thead><tbody><tr><td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.</td></tr></tbody></table> Exposure Time: 24±2h at room condition*. • Pretreatment Perform a heat treatment at 150+0/-10°C for 1h±5min and then let sit for 24±2h at room condition*.	Applied Voltage	AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.													
		Applied Voltage																
		AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.																
		Capacitance Change		Within ±20%														
		D.F.		0.05 max.														
I.R.	3000MΩ or more																	
Voltage Proof	No defects.																	

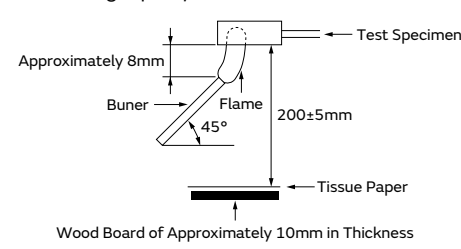
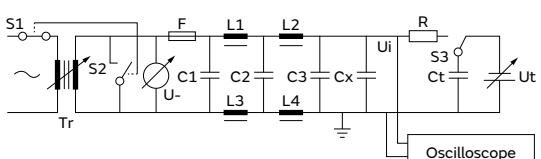
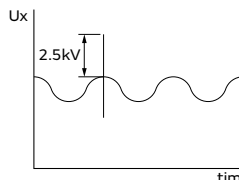
* Room Condition: Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmosphere pressure: 86 to 106kPa

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Caution / Notice

GA3 Series Type GF Specifications and Test Methods (2)

Continued from the preceding page. ↘

No	Item	Specification	Test Method (Ref. Standard: JIS C 5101, IEC60384)
17	Passive Flammability	The burning time shall not be exceeded the time 30s. The tissue paper shall not ignite.	<p>The capacitor under test shall be held in the flame in the position which best promotes burning. Each specimen shall only be exposed once to the flame. Time of exposure to flame: 30s Length of flame: 12±1mm Gas burner: Length 35mm min. Inside dia: 0.5±0.1mm Outside dia: 0.9mm max. Gas: Butane gas purity 95% min.</p> 
18	Active Flammability	The cheesecloth shall not be on fire.	<p>The specimens shall be individually wrapped in at least one but more than two complete layers of cheesecloth. The specimens shall be subjected to 20 discharges. The interval between successive discharges shall be 5s. The UAC shall be maintained for 2min after the last discharge.</p>  <p>C1, C2: Filter capacitor 1μF±10% C3: Capacitor 0.033μF±5% L1 to L4: Rod coa choke 1.5mH±20%, 16A R: Resistor 100Ω±2% Cx < 0.068μF Ct: Tank capacitor 3μF±5% 10kV Cx ≤ 1μF U-: UR±5% UR: Rated voltage Cx: Capacitor under test F: Slow-blow fuse, rated 16A Ut: Voltage to which the tank capacitor Ct is charged</p> 

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GA3 Series Type GF Specifications and Test Methods (2)

Continued from the preceding page. ↘

Complement of Test Method

1. Test Substrate

The test substrate should be Substrate A or Substrate B as described in "Specifications and Test Methods".

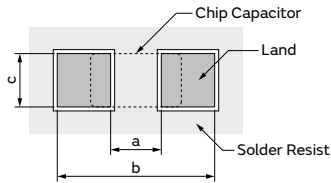
The specimen should be soldered by the conditions as described below.

Soldering Method: Reflow soldering

Solder: Sn-3.0Ag-0.5Cu

(1) Test Substrate A

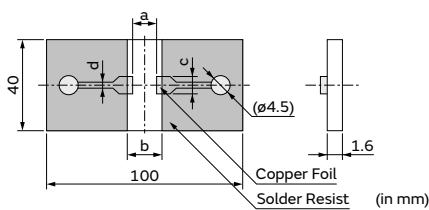
• Land Dimensions



- Material: Glass Epoxy Board
- Thickness: 1.6mm
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension (mm)		
	a	b	c
GA342	3.5	7.0	2.4
GA352	4.5	8.0	3.2
GA355	4.5	8.0	5.6

(2) Test Substrate B

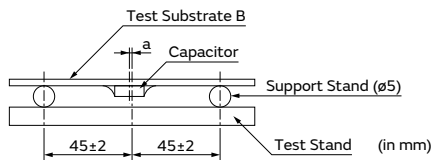


- Material: Glass Epoxy Board
- Thickness of Copper Foil: 0.035mm

Part Number	Dimension of Pattern (mm)			
	a	b	c	d
GA342	3.5	7.0	2.4	1.0
GA352	4.5	8.0	3.2	1.0
GA355	4.5	8.0	5.6	1.0

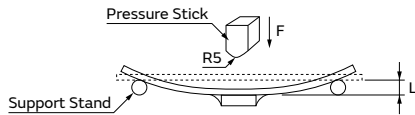
2. Test Method of Substrate Bending Test

(a) Support State

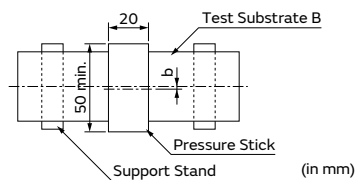


a: ±2 gap between support stand center and test stand

- Material of Test Stand and Pressure Stick
 The material should be a metal where a remarkable transformation and the distortion are not caused even if it is pressurized.
- Pressurizing Speed
 The pressurizing speed is pressurized at the speed of about 1mm/s until the flexure reaches a regulated value.



(b) Test State



b: ±5 gap between support stand center and test stand center

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