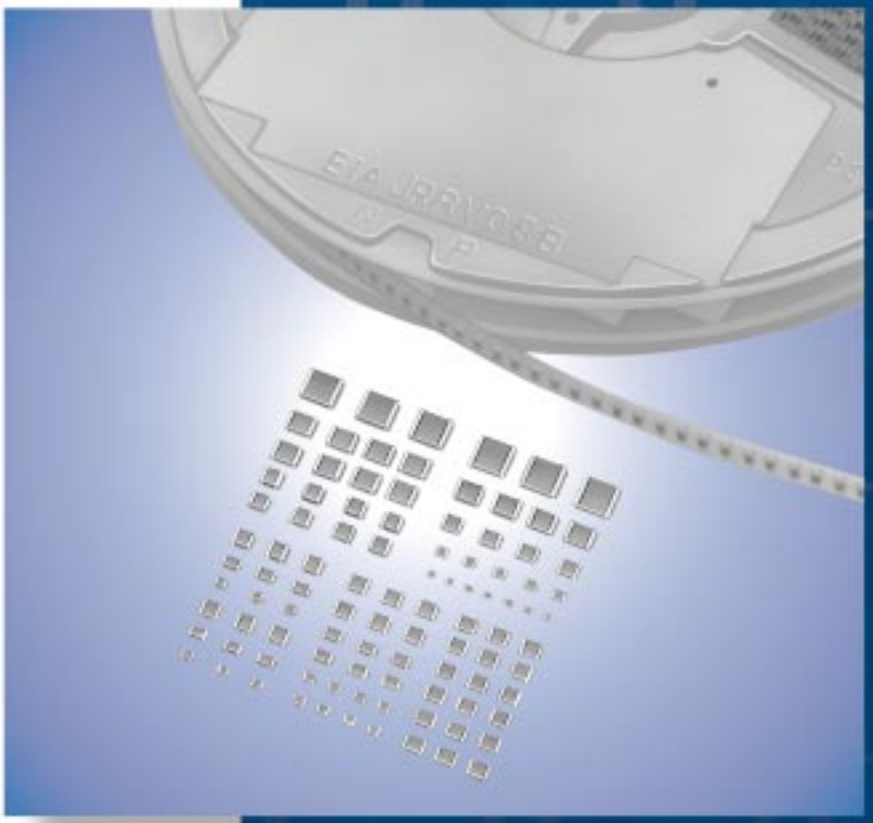
Chip Monolithic Ceramic Capacitors



Innovator in Electronics

Murata Manufacturing Co., Ltd.

Cat.No.C02E-16

Part Numbering

Chip Monolithic Ceramic Capacitors

(Part Number)

GR	M	18	8	B1	1H	102	K	A01	D
❶	❷	❸	❹	❺	❻	❼	❽	❾	❿

❶Product ID

❷Series

Product ID	Code	Series
GR	J	Soft Termination Type
	M	Tin Plated Layer
	4	Only for Information Devices / Tip & Ring
	7	Only for Camera Flash Circuit
GQ	M	High Frequency for Flow/Reflow Soldering
GM	A	Monolithic Microchip
	D	For Bonding
GN	M	Capacitor Array
LL	L	Low ESL Type
	R	Controlled ESR Low ESL Type
	A	8-termination Low ESL Type
	M	10-termination Low ESL Type
GJ	M	High Frequency Low Loss Type
GA	2	For AC250V (r.m.s.)
	3	Safety Standard Certified Type

❸Dimensions (L×W)

Code	Dimensions (L×W)	EIA
02	0.4×0.2mm	01005
03	0.6×0.3mm	0201
05	0.5×0.5mm	0202
08	0.8×0.8mm	0303
0D	0.38×0.38mm	015015
0M	0.9×0.6mm	0302
15	1.0×0.5mm	0402
18	1.6×0.8mm	0603
1M	1.37×1.0mm	0504
21	2.0×1.25mm	0805
22	2.8×2.8mm	1111
31	3.2×1.6mm	1206
32	3.2×2.5mm	1210
42	4.5×2.0mm	1808
43	4.5×3.2mm	1812
52	5.7×2.8mm	2211
55	5.7×5.0mm	2220

❹Dimension (T) (Except **GNM**)

Code	Dimension (T)
2	0.2mm
3	0.3mm
5	0.5mm
6	0.6mm
7	0.7mm
8	0.8mm
9	0.85mm
A	1.0mm
B	1.25mm
C	1.6mm
D	2.0mm
E	2.5mm
F	3.2mm
M	1.15mm
N	1.35mm
Q	1.5mm
R	1.8mm
S	2.8mm
X	Depends on individual standards.

❹Elements (**GNM** Only)

Code	Elements
2	2-elements
4	4-elements

Continued on the following page.

Please check the MURATA home page (http://www.murata.com/) if you cannot find the part number in the catalog.

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❺Temperature Characteristics

Temperature Characteristic Codes			Temperature Characteristics			Operating Temperature Range
Code	Public STD Code		Reference Temperature	Temperature Range	Capacitance Change or Temperature Coefficient	
1X	SL *1	JIS	20°C	20 to 85°C	+350 to -1000ppm/°C	-55 to 125°C
2C	CH *1	JIS	20°C	20 to 125°C	0±60ppm/°C	-55 to 125°C
2P	PH *1	JIS	20°C	20 to 85°C	-150±60ppm/°C	-25 to 85°C
2R	RH *1	JIS	20°C	20 to 85°C	-220±60ppm/°C	-25 to 85°C
2S	SH *1	JIS	20°C	20 to 85°C	-330±60ppm/°C	-25 to 85°C
2T	TH *1	JIS	20°C	20 to 85°C	-470±60ppm/°C	-25 to 85°C
3C	CJ *1	JIS	20°C	20 to 125°C	0±120ppm/°C	-55 to 125°C
3P	PJ *1	JIS	20°C	20 to 85°C	-150±120ppm/°C	-25 to 85°C
3R	RJ *1	JIS	20°C	20 to 85°C	-220±120ppm/°C	-25 to 85°C
3S	SJ *1	JIS	20°C	20 to 85°C	-330±120ppm/°C	-25 to 85°C
3T	TJ *1	JIS	20°C	20 to 85°C	-470±120ppm/°C	-25 to 85°C
3U	UJ *1	JIS	20°C	20 to 85°C	-750±120ppm/°C	-25 to 85°C
4C	CK *1	JIS	20°C	20 to 125°C	0±250ppm/°C	-55 to 125°C
5C	C0G *1	EIA	25°C	25 to 125°C	0±30ppm/°C	-55 to 125°C
5G	X8G *1	EIA	25°C	25 to 150°C	0±30ppm/°C	-55 to 150°C
6C	C0H *1	EIA	25°C	25 to 125°C	0±60ppm/°C	-55 to 125°C
6P	P2H *1	EIA	25°C	25 to 85°C	-150±60ppm/°C	-55 to 125°C
6R	R2H *1	EIA	25°C	25 to 85°C	-220±60ppm/°C	-55 to 125°C
6S	S2H *1	EIA	25°C	25 to 85°C	-330±60ppm/°C	-55 to 125°C
6T	T2H *1	EIA	25°C	25 to 85°C	-470±60ppm/°C	-55 to 125°C
7U	U2J *1	EIA	25°C	25 to 125°C *6	-750±120ppm/°C	-55 to 125°C
B1	B *2	JIS	20°C	-25 to 85°C	±10%	-25 to 85°C
B3	B	JIS	20°C	-25 to 85°C	±10%	-25 to 85°C
C7	X7S	EIA	25°C	-55 to 125°C	±22%	-55 to 125°C
C8	X6S	EIA	25°C	-55 to 105°C	±22%	-55 to 105°C
D7	X7T	EIA	25°C	-55 to 125°C	+22, -33%	-55 to 125°C
D8	X6T	EIA	25°C	-55 to 105°C	+22, -33%	-55 to 105°C
E7	X7U	EIA	25°C	-55 to 125°C	+22, -56%	-55 to 125°C
F1	F *2	JIS	20°C	-25 to 85°C	+30, -80%	-25 to 85°C
F5	Y5V	EIA	25°C	-30 to 85°C	+22, -82%	-30 to 85°C
L8	X8L	*3	25°C	-55 to 150°C	+15, -40%	-55 to 150°C
R1	R *2	JIS	20°C	-55 to 125°C	±15%	-55 to 125°C
R3	R	JIS	20°C	-55 to 125°C	±15%	-55 to 125°C
R6	X5R	EIA	25°C	-55 to 85°C	±15%	-55 to 85°C
R7	X7R	EIA	25°C	-55 to 125°C	±15%	-55 to 125°C
R9	X8R	EIA	25°C	-55 to 150°C	±15%	-55 to 150°C
W0	-	-	25°C	-55 to 125°C	±10% *4	-55 to 125°C
					+22, -33% *5	

*1 Please refer to table for Capacitance Change under reference temperature.
*2 Capacitance change is specified with 50% rated voltage applied.
*3 Murata Temperature Characteristic Code.
*4 Apply DC350V bias.
*5 No DC bias.
*6 Rated Voltage 100Vdc max : 25 to 85°C

Continued on the following page.

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●Capacitance Change from each temperature

JIS Code

Murata Code	Capacitance Change from 20°C (%)					
	–55°C		–25°C		–10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
1X	–	–	–	–	–	–
2C	0.82	–0.45	0.49	–0.27	0.33	–0.18
2P	–	–	1.32	0.41	0.88	0.27
2R	–	–	1.70	0.72	1.13	0.48
2S	–	–	2.30	1.22	1.54	0.81
2T	–	–	3.07	1.85	2.05	1.23
3C	1.37	–0.90	0.82	–0.54	0.55	–0.36
3P	–	–	1.65	0.14	1.10	0.09
3R	–	–	2.03	0.45	1.35	0.30
3S	–	–	2.63	0.95	1.76	0.63
3T	–	–	3.40	1.58	2.27	1.05
3U	–	–	4.94	2.84	3.29	1.89
4C	2.56	–1.88	1.54	–1.13	1.02	–0.75

EIA Code

Murata Code	Capacitance Change from 25°C (%)					
	–55°C		–30°C		–10°C	
	Max.	Min.	Max.	Min.	Max.	Min.
5C/5G	0.58	–0.24	0.40	–0.17	0.25	–0.11
6C	0.87	–0.48	0.59	–0.33	0.38	–0.21
6P	2.33	0.72	1.61	0.50	1.02	0.32
6R	3.02	1.28	2.08	0.88	1.32	0.56
6S	4.09	2.16	2.81	1.49	1.79	0.95
6T	5.46	3.28	3.75	2.26	2.39	1.44
7U	8.78	5.04	6.04	3.47	3.84	2.21

❻Rated Voltage

Code	Rated Voltage
0E	DC2.5V
0G	DC4V
0J	DC6.3V
1A	DC10V
1C	DC16V
1E	DC25V
YA	DC35V
1H	DC50V
2A	DC100V
2D	DC200V
2E	DC250V
YD	DC300V
2H	DC500V
2J	DC630V
3A	DC1kV
3D	DC2kV
3F	DC3.15kV
BB	DC350V (for Camera Flash Circuit)
E2	AC250V
GC	X1/Y2; AC250V (Safety Standard Certified Type GC)
GF	Y2, X1/Y2; AC250V (Safety Standard Certified Type GF)
GD	Y3; AC250V (Safety Standard Certified Type GD)
GB	X2; AC250V (Safety Standard Certified Type GB)

❼Capacitance

Expressed by three-digit alphanumerics. The unit is picofarad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two numbers.If there is a decimal point, it is expressed by the capital letter "**R**." In this case, all figures are significant digits.

Ex.)

Code	Capacitance
R50	0.5pF
1R0	1.0pF
100	10pF
103	10000pF

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Please check the MURATA home page (http://www.murata.com/) if you cannot find the part number in the catalog.

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❽Capacitance Tolerance

Code	Capacitance Tolerance	TC	Series	Capacitance Step	
W	±0.05pF	CΔ	**GRM/GJM**	≦9.9pF	0.1pF
B	±0.1pF	CΔ	**GRM/GJM**	≦9.9pF	0.1pF
			GQM	≦1pF	0.1pF
				1.1 to 9.9pF	1pF Step and E24 Series
C	±0.25pF	CΔ	**GRM/GJM**	≦9.9pF	0.1pF
		except CΔ	**GRM**	≦5pF	* 1pF
		CΔ	**GQM**	≦1pF	0.1pF
				1.1 to 9.9pF	1pF Step and E24 Series
D	±0.5pF	CΔ	**GRM/GJM**	5.1 to 9.9pF	0.1pF
		except CΔ	**GRM**	5.1 to 9.9pF	* 1pF
		CΔ	**GQM**	5.1 to 9.9pF	1pF Step and E24 Series
G	±2%	CΔ	**GJM**	≧10pF	E12 Series
		CΔ	**GQM**	≧10pF	E24 Series
J	±5%	CΔ, SL, U2J	**GRM/GA3**	≧10pF	E12 Series
		CΔ	**GQM/GJM**	≧10pF	E24 Series
K	±10%	B, R, X7R, X5R, ZLM	**GRJ/GRM/GR7/GA3**	E6 Series	
		C0G	**GNM**	E6 Series	
		B, R, X7R, X5R, ZLM	**GR4, GMD**	E12 Series	
M	±20%	B, R, X7R, X7S	**GRM/GMA**	E6 Series	
		X5R, X7R, X7S	**GNM**	E3 Series	
		X7R	**GA2**	E3 Series	
		X5R, X7R, X7S, X6S	**LLL/LLR/LLA/LLM**	E3 Series	
Z	+80%, -20%	F, Y5V	**GRM**	E3 Series	
R	Depends on individual standards.				

***** E24 series is also available.

❾Individual Specification Code (Except **LLR**)

Expressed by three figures.

❾ESR (**LLR** Only)

Code	ESR
E01	100mΩ
E03	220mΩ
E05	470mΩ
E07	1000mΩ

❿Packaging

Code	Packaging
L	ø180mm Embossed Taping
D	ø180mm Paper Taping
E	ø180mm Paper Taping (LLL15)
K	ø330mm Embossed Taping
J	ø330mm Paper Taping
F	ø330mm Paper Taping (LLL15)
B	Bulk
C	Bulk Case
T	Bulk Tray

Chip Monolithic Ceramic Capacitors

Safety Standard Certified GA3 Series IEC60384-14 Class Y2, X1/Y2 Type GF

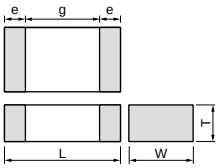
■ Features

1. Available for equipment based on IEC/EN60950 and UL1950. Besides, the GA352/355 types are available for equipment based on IEC/EN60065, UL1492, and UL6500.
2. Type GF can be used as a Y2-class capacitor.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
4. +125 degree C guaranteed
5. Only for reflow soldering

■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers
2. Ideal for use on line filters for information equipment
3. Ideal for use as Y capacitor or X capacitor for various switching power supplies (GA352/355 types only)

Do not use these products in any Automotive Power train or Safety equipment including Battery chargers for Electric Vehicles and Plug-in Hybrids. Only Murata products clearly stipulated as "for Automotive use" can be used for automobile applications such as Power train and Safety equipment.



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA342A	4.5 ±0.3	2.0 ±0.2	1.0 +0, -0.3	0.3	2.5
GA342D			2.0 ±0.2		
GA342Q			1.5 +0, -0.3		
GA352Q	5.7 ±0.4	2.8 ±0.3	1.5 +0, -0.3		4.0
GA355D		5.0 ±0.4	2.0 +0, -0.3		
GA355Q			1.5 +0, -0.3		

■ Standard Certification

	Standard No.	Class	Status of Certification		Rated Voltage
			Size : 4.5×2.0mm	Size : 5.7×2.8mm and over	
UL	UL1414	X1, Y2	—	◎	AC250V (r.m.s.)
	UL 60950-1	—	◎	—	
VDE	IEC 60384-14	X1, Y2	—	◎	
SEMKO	EN 60384-14	Y2	◎	◎	

Applications

Size	Switching power supplies	Communication network devices such as a modem
4.5×2.0mm	—	◎
5.7×2.8mm and over	◎	◎

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)
GA342D1XGF100JY02L	AC250 (r.m.s.)	SL (JIS)	10 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF120JY02L	AC250 (r.m.s.)	SL (JIS)	12 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF150JY02L	AC250 (r.m.s.)	SL (JIS)	15 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF180JY02L	AC250 (r.m.s.)	SL (JIS)	18 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGF220JY02L	AC250 (r.m.s.)	SL (JIS)	22 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342A1XGF270JW31L	AC250 (r.m.s.)	SL (JIS)	27 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF330JW31L	AC250 (r.m.s.)	SL (JIS)	33 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF390JW31L	AC250 (r.m.s.)	SL (JIS)	39 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF470JW31L	AC250 (r.m.s.)	SL (JIS)	47 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF560JW31L	AC250 (r.m.s.)	SL (JIS)	56 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF680JW31L	AC250 (r.m.s.)	SL (JIS)	68 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGF820JW31L	AC250 (r.m.s.)	SL (JIS)	82 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342QR7GF101KW01L	AC250 (r.m.s.)	X7R (EIA)	100 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GF151KW01L	AC250 (r.m.s.)	X7R (EIA)	150 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342DR7GF221KW02L	AC250 (r.m.s.)	X7R (EIA)	220 ±10%	4.5	2.0	2.0	2.5	0.3 min.
GA342DR7GF331KW02L	AC250 (r.m.s.)	X7R (EIA)	330 ±10%	4.5	2.0	2.0	2.5	0.3 min.
GA342QR7GF471KW01L	AC250 (r.m.s.)	X7R (EIA)	470 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA352QR7GF471KW01L	AC250 (r.m.s.)	X7R (EIA)	470 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA342QR7GF681KW01L	AC250 (r.m.s.)	X7R (EIA)	680 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA352QR7GF681KW01L	AC250 (r.m.s.)	X7R (EIA)	680 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA342DR7GF102KW02L	AC250 (r.m.s.)	X7R (EIA)	1000 ±10%	4.5	2.0	2.0	2.5	0.3 min.
GA352QR7GF102KW01L	AC250 (r.m.s.)	X7R (EIA)	1000 ±10%	5.7	2.8	1.5	4.0	0.3 min.

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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)
GA352QR7GF152KW01L	AC250 (r.m.s.)	X7R (EIA)	1500 ±10%	5.7	2.8	1.5	4.0	0.3 min.
GA355QR7GF182KW01L	AC250 (r.m.s.)	X7R (EIA)	1800 ±10%	5.7	5.0	1.5	4.0	0.3 min.
GA355QR7GF222KW01L	AC250 (r.m.s.)	X7R (EIA)	2200 ±10%	5.7	5.0	1.5	4.0	0.3 min.
GA355QR7GF332KW01L	AC250 (r.m.s.)	X7R (EIA)	3300 ±10%	5.7	5.0	1.5	4.0	0.3 min.
GA355DR7GF472KW01L	AC250 (r.m.s.)	X7R (EIA)	4700 ±10%	5.7	5.0	2.0	4.0	0.3 min.

Chip Monolithic Ceramic Capacitors

Safety Standard Certified GA3 Series IEC60384-14 Class Y3 Type GD

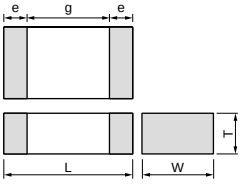
■ Features

1. Available for equipment based on IEC/EN60950 and UL1950.
2. Type GD can be used as a Y3-class capacitor.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
4. +125 degree C guaranteed
5. Only for reflow soldering

■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers
2. Ideal for use on line filters for information equipment

Do not use these products in any Automotive Power train or Safety equipment including Battery chargers for Electric Vehicles and Plug-in Hybrids. Only Murata products clearly stipulated as "for Automotive use" can be used for automobile applications such as Power train and Safety equipment.



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA342A	4.5 ±0.3	2.0 ±0.2	1.0 +0, -0.3	0.3	2.5
GA342D			2.0 ±0.2		
GA342Q			1.5 +0, -0.3		
GA343D	4.5 ±0.4	3.2 ±0.3	2.0 +0, -0.3		
GA343Q			1.5 +0, -0.3		

■ Standard Certification

	Standard No.	Class	Rated Voltage
UL	UL 60950-1	Y3	AC250V(r.m.s.)
SEMKO	IEC 60384-14 EN 60384-14		

Applications

Size	Switching power supplies	Communication network devices such as a modem
4.5×3.2mm and under	—	◎

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)
GA342D1XGD100JY02L	AC250 (r.m.s.)	SL (JIS)	10 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD120JY02L	AC250 (r.m.s.)	SL (JIS)	12 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD150JY02L	AC250 (r.m.s.)	SL (JIS)	15 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD180JY02L	AC250 (r.m.s.)	SL (JIS)	18 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342D1XGD220JY02L	AC250 (r.m.s.)	SL (JIS)	22 ±5%	4.5	2.0	2.0	2.5	0.3 min.
GA342A1XGD270JW31L	AC250 (r.m.s.)	SL (JIS)	27 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD330JW31L	AC250 (r.m.s.)	SL (JIS)	33 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD390JW31L	AC250 (r.m.s.)	SL (JIS)	39 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD470JW31L	AC250 (r.m.s.)	SL (JIS)	47 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD560JW31L	AC250 (r.m.s.)	SL (JIS)	56 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD680JW31L	AC250 (r.m.s.)	SL (JIS)	68 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342A1XGD820JW31L	AC250 (r.m.s.)	SL (JIS)	82 ±5%	4.5	2.0	1.0	2.5	0.3 min.
GA342QR7GD101KW01L	AC250 (r.m.s.)	X7R (EIA)	100 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD151KW01L	AC250 (r.m.s.)	X7R (EIA)	150 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD221KW01L	AC250 (r.m.s.)	X7R (EIA)	220 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD331KW01L	AC250 (r.m.s.)	X7R (EIA)	330 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD471KW01L	AC250 (r.m.s.)	X7R (EIA)	470 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD681KW01L	AC250 (r.m.s.)	X7R (EIA)	680 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD102KW01L	AC250 (r.m.s.)	X7R (EIA)	1000 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA342QR7GD152KW01L	AC250 (r.m.s.)	X7R (EIA)	1500 ±10%	4.5	2.0	1.5	2.5	0.3 min.
GA343QR7GD182KW01L	AC250 (r.m.s.)	X7R (EIA)	1800 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GA343QR7GD222KW01L	AC250 (r.m.s.)	X7R (EIA)	2200 ±10%	4.5	3.2	1.5	2.5	0.3 min.
GA343DR7GD472KW01L	AC250 (r.m.s.)	X7R (EIA)	4700 ±10%	4.5	3.2	2.0	2.5	0.3 min.

Chip Monolithic Ceramic Capacitors

Safety Standard Certified GA3 Series IEC60384-14 Class X2 Type GB

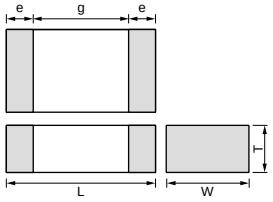
■ Features

1. Type GB can be used as an X2-class capacitor.
2. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC lines.
3. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
4. 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.
5. +125 degree C guaranteed
6. Only for reflow soldering

■ Applications

Ideal for use as X capacitor for various switching power supplies

Do not use these products in any Automotive Power train or Safety equipment including Battery chargers for Electric Vehicles and Plug-in Hybrids. Only Murata products clearly stipulated as "for Automotive use" can be used for automobile applications such as Power train and Safety equipment.



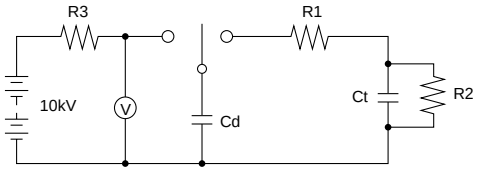
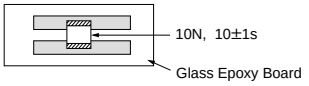
Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GA355Q	5.7 ±0.4	5.0 ±0.4	1.5 +0,-0.3	0.3	3.0
GA355D			2.0 +0,-0.3		
GA355E			2.5 +0,-0.3		
GA355X			2.9 +0,-0.4		

■ Standard Certification

	Standard No.	Class	Rated Voltage
VDE	IEC 60384-14 EN 60384-14	X2	AC250V (r.m.s.)
SEMKO			
ESTI			

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)
GA355QR7GB103KW01L	AC250 (r.m.s.)	X7R (EIA)	10000 ±10%	5.7	5.0	1.5	3.0	0.3 min.
GA355QR7GB153KW01L	AC250 (r.m.s.)	X7R (EIA)	15000 ±10%	5.7	5.0	1.5	3.0	0.3 min.
GA355DR7GB223KW01L	AC250 (r.m.s.)	X7R (EIA)	22000 ±10%	5.7	5.0	2.0	3.0	0.3 min.
GA355ER7GB333KW01L	AC250 (r.m.s.)	X7R (EIA)	33000 ±10%	5.7	5.0	2.5	3.0	0.3 min.
GA355ER7GB473KW01L	AC250 (r.m.s.)	X7R (EIA)	47000 ±10%	5.7	5.0	2.5	3.0	0.3 min.
GA355XR7GB563KW06L	AC250 (r.m.s.)	X7R (EIA)	56000 ±10%	5.7	5.0	2.9	3.0	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 and micrometers
4	Dielectric Strength	No defects or abnormalities	No failure should be observed when voltage in the table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA. Type GB: DC1075V Type GC/GD: AC1500V (r.m.s.) Type GF: AC2000V (r.m.s.)
5	Pulse Voltage (Application: Type GD/GF)	No self healing breakdowns or flash-overs have taken place in the capacitor.	10 impulses of alternating polarity are subjected. (5 impulses for each polarity) The interval between impulses is 60 sec. Applied Pulse: 1.2/50μs Applied Voltage: 2.5kVo-p
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 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	Char. / Specification X7R: D.F.≦0.025 SL: Q≧400+20C*2 (C<30pF); Q≧1000 (C≧30pF)	
9	Capacitance Temperature Characteristics	Char. / Capacitance Change X7R: Within ±15% Temperature characteristic guarantee is −55 to +125℃ Char. / Temperature Coefficient SL: +350 to −1000ppm/℃ Temperature characteristic guarantee is +20 to +85℃	The capacitance measurement should be made at each step specified in the Table. Step / Temperature (℃) 1: 25±2 (20±2 for SL char.) 2: Min. Operating Temp.±3 3: 25±2 (20±2 for SL char.) 4: Max. Operating Temp.±2 5: 25±2 (20±2 for SL char.) SL char. : The capacitance should be measured at even 85℃ between step 3 and step 4. •Pretreatment for X7R char. Perform a heat treatment at 150$^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition.*1
10	Discharge Test (Application: Type GC)	Appearance: No defects or abnormalities I.R.: More than 1,000MΩ Dielectric Strength: In accordance with item No.4	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
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. Then apply 10N force in the direction of the arrow. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.  Fig. 1

*1 "Room condition" Temperature: 15 to 35℃, 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.

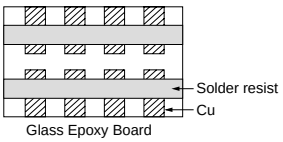
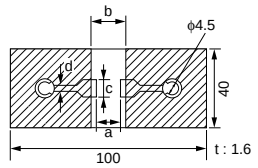
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="3">12</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).
The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each of 3 mutually perpendicular directions (total of 6 hrs.).
 
</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.
Q</td><td><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*2 (C<30pF)
Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>13</td><td colspan="2">Deflection</td><td>No marking defects
 

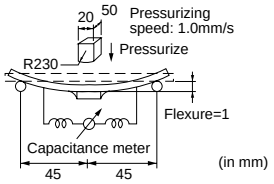
Fig. 2
<table><tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="4">1.0</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7×2.8</td><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></td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2.
Then apply a force in the direction shown in Fig. 3. The soldering should be done using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
 

Fig. 3</td></tr>
<tr><td>14</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).
Immerse in solder solution for 2±0.5 sec.
Immersing speed: 25±2.5mm/s
Temp. of solder: 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
<tr><td rowspan="4">15</td><td rowspan="4">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Preheat the capacitor as in table. Immerse the capacitor in solder solution at 260±5℃ for 10±1 sec. Let sit at room condition*1 for 24±2 hrs., then measure.
•Immersing speed: 25±2.5mm/s
•Pretreatment for X7R char.
Perform a heat treatment at 150$^{+\ 0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition.*1

∗Preheating
<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100 to 120℃</td><td>1 min.</td></tr><tr><td>2</td><td>170 to 200℃</td><td>1 min.</td></tr></table></td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±10%</td></tr><tr><td>SL</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

*1 "Room condition" Temperature: 15 to 35℃, 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.

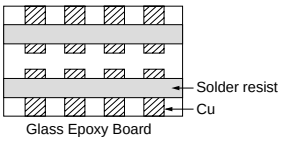
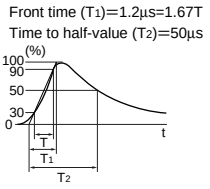
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4.
Perform the 5 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hrs. at room condition,*1 then measure.
<table><tr><th>Step</th><th>Temperature (℃)</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>•Pretreatment for X7R char.
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition.*1
 

Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td><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></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧400+20C*2 (C<30pF)
Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">17</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Before this test, the test shown in the following is performed.
·Item 11 Adhesive Strength of Termination (applied force is 5N)
·Item 13 Deflection

Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500$^{+24}_{0}$ hrs.
Remove and let sit for 24±2 hrs. at room condition,*1 then measure.
•Pretreatment for X7R char.
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition.*1</td></tr>
<tr><td>Capacitance Change</td><td><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 ±5.0% or ±0.5pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">18</td><td rowspan="5">Life</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Before this test, the test shown in the following is performed.
·Item 11 Adhesive Strength of Termination (apply force is 5N)
·Item 13 Deflection

Impulse Voltage
Each individual capacitor should be subjected to a 2.5kV (Type GC/GF: 5kV) Impulse (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.
 

Apply voltage as in Table for 1,000 hrs. at 125$^{+2}_{0}$℃, relative humidity 50% max.
<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
GF
GD</td><td>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></table>Let sit for 24±2 hrs. at room condition,*1 then measure.
•Pretreatment for X7R char.
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition.*1</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ±3.0% or ±0.3pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

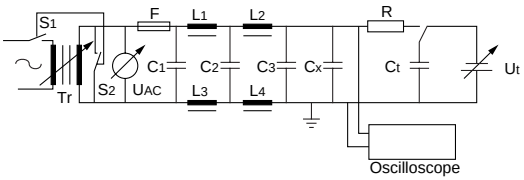
*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

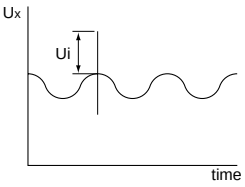
Continued on the following page.

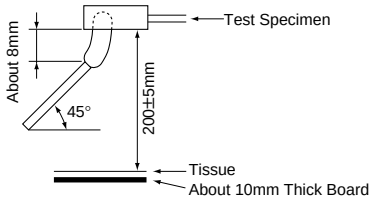
GA3 Series Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Humidity Loading</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Before this test, the test shown in the following is performed.
·Item 11 Adhesive Strength of Termination (apply force is 5N)
·Item 13 Deflection

Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500$^{+24}_{0}$hrs. Remove and let sit for 24±2 hrs. at room condition,*1 then measure.
•Pretreatment for X7R char.
Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at room condition.*1</td></tr>
<tr><td>Capacitance Change</td><td><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 ±5.0% or ±0.5pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.
Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)
Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>20</td><td colspan="2">Active Flammability</td><td>The cheesecloth should not be on fire.</td><td>The capacitor should be individually wrapped in at least one but not more than two complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The U_{AC} should be maintained for 2 min. after the last discharge.
 

$C_{1,2}$: 1μF±10% C_3 : 0.033μF±5% 10kV
$L_{1\ to\ 4}$: 1.5mH±20% 16A Rod core choke
C_t : 3μF±5% 10kV R : 100Ω±2%
C_x : Capacitor under test U_{AC} : U_R±5%
F : Fuse, Rated 16A U_R : Rated Voltage
U_t : Voltage applied to C_t
 

<table><tr><th>Type</th><th>Ui</th></tr><tr><td>GD, GB</td><td>2.5kV</td></tr><tr><td>GC, GF</td><td>5kV</td></tr></table></td></tr>
<tr><td>21</td><td colspan="2">Passive Flammability</td><td>The burning time should not exceed 30 sec.
The tissue paper should not ignite.</td><td>The capacitor under test should be held in the flame in the position which best promotes burning. Each specimen should be exposed to the flame only once. Time of exposure to flame: 30 sec.
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.
 
</td></tr>
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*1 "Room condition" Temperature: 15 to 35℃, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).