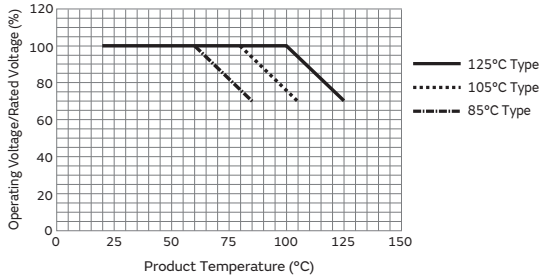
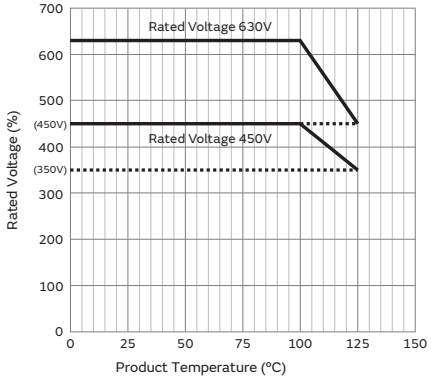
Explanation of Symbols in This Catalog

WEB	Links are provided to the latest information from the PDF version of the catalog, which is available on the web.

General	For applications that do not require a particular reliability. such as general equipment.
Info-tainment	Infotainment for Automotive The product for entertainment equipment like car navigations, car audios, and body control equipment like wipers, power windows.
Power-train	Powertrain/Safety for Automotive Products use for applications (running, turning, stopping, and safety devices) that particularly concern human life, such as in devices for automotive.
Medical Device	Medical-grade products for Implanted Medical Devices These products are intended for use in implanted medical devices such as cardiac pacemakers, cochlear implants, insulin pumps, and gastric electrostimulators. They are suitable for use in non-critical circuits .*1 *1 Non-critical circuits This term refers to circuits in implanted medical devices that are not directly linked to life support, i.e. circuits that will not directly endanger the life of the patient should the functionality of the device be reduced or halted by failure of the circuit.
AEC-Q200	AEC-Q200 compliant product
Safety standard	Safety Standard Certified Product Products that acquired safety standard certification IEC60384-14 and products based on the Electrical Appliance and Material Safety Law of Japan.
High Q	Low dissipation for high frequency By devising ceramic materials and electrode materials, low dissipation is achieved in frequency bands of VHF, UHF, and microwave or beyond.
Low ESL	Low inductance This capacitor is designed so that the parasitic inductance component (ESL) that the capacitor has on the high frequency side becomes lower.
Fail safe	Fail safe product This capacitor is designed to prevent failures as much as possible by short mode.
Deflecting crack	Product resistant to deflection cracking This capacitor is designed to prevent failures as much as possible by short mode caused by cracking when there is board deflection.
Soldering crack	Product with solder cracking suppression This capacitor is configured with metal terminals and leads connected to the chip. The metal terminals and leads relieve the stress from expansion and contraction of the solder, to suppress solder cracking.
Anti-noise	Product suitable for acoustic noise reduction and low distortion This product suppresses acoustic noise, which occurs when a ceramic capacitor is used, by devising the materials and configuration.

Effective Cap	No DC bias characteristics Polymer capacitor is no capacitance change with DC bias due to aluminum oxidized film for dielectric.
EMI FIL®	Low-inductance product suitable for noise suppression. This product has extremely low ESL and is suitable for suppression of noise, including high frequencies. This product can also be used as a low-ESL, high-performance bypass capacitor.
Bonding	Product for bonding Since gold is used for the external electrodes, the capacitor can be mounted by die bonding/wire bonding.
D1 Derating 1	Derating 1 This product is suitable when a voltage continuously applied to a capacitor in an operating circuit, is used below (derated) the rated voltage of the capacitor. This model guarantees the test conditions in the endurance test, at a rated voltage x 100% at the maximum operating temperature. A reliability assurance level equivalent to a common product can be secured, by using this product within the voltage and temperature derated conditions recommended in the figure below. Recommended Conditions of the Derating Operating Voltage and Temperature 
D2 Derating 2	Derating 2 When the product temperature exceeds 105°C, please use this product within the voltage and temperature derated conditions in the figure below. 
D3 Derating 3	Derating 3 Please apply the derating curve according to the operating temperature. Please refer to detailed specifications sheet for details.

Selection Guide for Capacitors

			AEC-Q200	Safety standard	High Q	Low ESL	Anti-noise	Fail safe	Deflecting crack	Soldering crack	Effective Cap	EMI FIL®	Other
General	GRM	P24											
	GRM	WEB											For LED backlight only
	GA2	WEB											
	GA3	WEB											
	GJM	P91											
	GMA	P113											Wire bondable
	GMD	P116											Wire bondable
	GQM	P119											
	GR3	P130											
	GR4	WEB											For communication / information devices
	GR7	WEB											Limited to camera flashes
	GRJ	P132											
	KR3	P147											
	KRM	P144											
	LLA	P136											
	LLL	P138											
	LLM	P140											
	LLR	P142											
	NFM	P150											
	DE1	WEB											
	DE2	WEB											
	DEJ	WEB											
	DHR	WEB											
	RDE	WEB											
	DHK	WEB											
	DHS	WEB											
	ECAS	WEB											
Medical Device	GCH	P152											For Implanted Medical Devices
Info-tainment	GRT	WEB											
Power-train	GCM	WEB											
	GC3	WEB											
	GCD	WEB											
	GCE	WEB											
	GCG	WEB											Limited to conductive glue mounting
	GCJ	WEB											
	KC3	WEB											
	KCA	WEB											
	KCM	WEB											
	NFM	WEB											
	DE6	WEB											
	RCE	WEB											
	RH	WEB											

● Part Numbering

Chip Monolithic Ceramic Capacitors for General

WEB

(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
GC	H	For implantable medical devices (Non-critical circuits)
GJ	M	High Q type for high frequency
GM	A	Wire bondable vertical electrode type
	D	Wire bondable/AuSn solderable type
GQ	M	High Q type for high frequency and high power
GR	3	High effective capacitance & High allowable ripple current
	J	Soft termination type
	M	General purpose products
KR	3	Metal terminal type/High effective capacitance & High allowable ripple current
	M	Metal terminal type
LL	A	8 terminal low ESL type
	L	LW reversed low ESL type
	M	10 terminal low ESL type
	R	ESR controlled low ESL type

❸Chip Dimensions (LxW)

Code	Dimensions (LxW)	EIA
02	0.4x0.2mm	01005
0D	0.38x0.38mm	015015
03	0.6x0.3mm	0201
05	0.5x0.5mm	0202
08	0.8x0.8mm	0303
1U	0.6x1.0mm	02404
15	1.0x0.5mm	0402
18	1.6x0.8mm	0603
21	2.0x1.25mm	0805
22	2.8x2.8mm	1111
31	3.2x1.6mm	1206
32	3.2x2.5mm	1210
42	4.5x2.0mm	1808
43	4.5x3.2mm	1812
55	5.7x5.0mm	2220

Continued on the following page.↗

(Part Number)

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

Continued from the preceding page. ↘

❹Height Dimension (T) (Except **KR**□)

Code	Dimension (T)
1	0.125mm
2	0.2mm
3	0.3mm
4	0.4mm
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
M	1.15mm
Q	1.5mm
S	2.8mm
X	Depends on individual standards.

❹Height Dimension (T) (**KR**□ Only)

Code	Dimension (T)
E	1.8mm
F	1.9mm
K	2.7mm
L	2.8mm
Q	3.7mm
T	4.8mm
W	6.4mm

❺Temperature Characteristics

Temperature Characteristic Codes			Temperature Characteristics			Operating Temperature Range	Capacitance Change Each Temperature (%)					
Code	Public STD Code		Reference Temperature	Temperature Range	Capacitance Change or Temperature Coefficient		−55°C		*4		−10°C	
							Max.	Min.	Max.	Min.	Max.	Min.
1X	SL	JIS	20°C	20 to 85°C	+350 to −1000ppm/°C	−55 to 125°C	-	-	-	-	-	-
2C	CH	JIS	20°C	20 to 125°C	0±60ppm/°C	−55 to 125°C	0.82	−0.45	0.49	−0.27	0.33	−0.18
3C	CJ	JIS	20°C	20 to 125°C	0±120ppm/°C	−55 to 125°C	1.37	−0.9	0.82	−0.54	0.55	−0.36
3U	UJ	JIS	20°C	20 to 85°C	−750±120ppm/°C	−25 to 85°C	-	-	4.94	2.84	3.29	1.89
4C	CK	JIS	20°C	20 to 125°C	0±250ppm/°C	−55 to 125°C	2.56	−1.88	1.54	−1.13	1.02	−0.75
5C	C0G	EIA	25°C	25 to 125°C	0±30ppm/°C	−55 to 125°C	0.58	−0.24	0.4	−0.17	0.25	−0.11
5G	X8G	*2	25°C	25 to 150°C	0±30ppm/°C	−55 to 150°C	0.58	−0.24	0.4	−0.17	0.25	−0.11
7U	U2J	EIA	25°C	25 to 125°C *3	−750±120ppm/°C	−55 to 125°C	8.78	5.04	6.04	3.47	3.84	2.21
B1	B *1	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	-	-	-	-	-	-
R1	R *1	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	-	-	-	-	-	-

*1 Capacitance change is specified with 50% rated voltage applied.
*2 Murata Temperature Characteristic Code.
*3 Rated Voltage 100Vdc max: 25 to 85°C
*4 −25°C (Reference Temperature 20°C) / −30°C (Reference Temperature 25°C)

Continued on the following page. ↗

(Part Number)

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

Continued from the preceding page. ↘

❻Rated Voltage

Code	Rated Voltage
0E	DC2.5V
0G	DC4V
0J	DC6.3V
1A	DC10V
1C	DC16V
1E	DC25V
1H	DC50V
1J	DC63V
1K	DC80V
2A	DC100V
2D	DC200V
2E	DC250V
2W	DC450V
2H	DC500V
2J	DC630V
3A	DC1kV
3D	DC2kV
3F	DC3.15kV
YA	DC35V

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.
If any alphabet, other than "**R**", is included, this indicates the specific part number is a non-standard part.

Ex.)

Code	Capacitance
R50	0.50pF
1R0	1.0pF
100	10pF
103	10000pF

❽Capacitance Tolerance

Code	Capacitance Tolerance
B	±0.1pF
C	±0.25pF
D	±0.5pF (Less than 10pF)
	±0.5% (10pF and over)
F	±1%
G	±2%
J	±5%
K	±10%
M	±20%
W	±0.05pF

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/E/W	ø180mm Paper Taping
K	ø330mm Embossed Taping
J/F	ø330mm Paper Taping
B	Bulk
C	Bulk Case
T	Bulk Tray

Please contact us if you find any part number not provided in this table.

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

How to read the Capacitance Table

L×W (mm)	0.4×0.2		0.6		
T max. (mm)	0.22		0		
Rated Voltage (Vdc)	25		50		
Cap. / TC Code	C0G	CΔ	C0G	CK	CJ
0.10pF					
0.20pF	p92	p95	p98	p98	
1.0pF	p92	p95		p98	
2.0pF	p92	p95		p98	
3.0pF	p92	p95			p98

The values can be narrowed down in the order of size, rated voltage, and temperature characteristics.

Refers to the page of the part number list.
Check the part number list for the applicable product number.

Temperature Characteristics Table

The Table is colored by temperature characteristic codes.
Refer to the following Table for the meaning of each code.

EIA: C0G U2J X7R X7S X7T X7U X6S X6T X5R
JIS: CK CJ CH SL UJ R B
Murata Temperature Characteristic: X8G

Temperature Characteristic Codes		Temperature Characteristics			Operating Temperature Range	Capacitance Change Each Temperature (%)					
Public STD Code		Reference Temperature	Temperature Range	Capacitance Change or Temperature Coefficient		−55°C		*3		−10°C	
						Max.	Min.	Max.	Min.	Max.	Min.
C0G	EIA	25°C	25 to 125°C	0±30ppm/°C	−55 to 125°C	0.58	−0.24	0.4	−0.17	0.25	−0.11
CK	JIS	20°C	20 to 125°C	0±250ppm/°C	−55 to 125°C	2.56	−1.88	1.54	−1.13	1.02	−0.75
CJ	JIS	20°C	20 to 125°C	0±120ppm/°C	−55 to 125°C	1.37	−0.9	0.82	−0.54	0.55	−0.36
CH	JIS	20°C	20 to 125°C	0±60ppm/°C	−55 to 125°C	0.82	−0.45	0.49	−0.27	0.33	−0.18
SL	JIS	20°C	20 to 85°C	+350 to −1000ppm/°C	−55 to 125°C	-	-	-	-	-	-
U2J	EIA	25°C	25 to 125°C *2	−750±120ppm/°C	−55 to 125°C	8.78	5.04	6.04	3.47	3.84	2.21
UJ	JIS	20°C	20 to 85°C	−750±120ppm/°C	−25 to 85°C	-	-	4.94	2.84	3.29	1.89
X8G	*1	25°C	25 to 150°C	0±30ppm/°C	−55 to 150°C	0.58	−0.24	0.4	−0.17	0.25	−0.11
X7R	EIA	25°C	−55 to 125°C	±15%	−55 to 125°C	-	-	-	-	-	-
X7S	EIA	25°C	−55 to 125°C	±22%	−55 to 125°C	-	-	-	-	-	-
X7T	EIA	25°C	−55 to 125°C	+22%, −33%	−55 to 125°C	-	-	-	-	-	-
X7U	EIA	25°C	−55 to 125°C	+22%, −56%	−55 to 125°C	-	-	-	-	-	-
R	JIS	20°C	−55 to 125°C	±15%	−55 to 125°C	-	-	-	-	-	-
X6S	EIA	25°C	−55 to 105°C	±22%	−55 to 105°C	-	-	-	-	-	-
X6T	EIA	25°C	−55 to 105°C	+22%, −33%	−55 to 105°C	-	-	-	-	-	-
X5R	EIA	25°C	−55 to 85°C	±15%	−55 to 85°C	-	-	-	-	-	-
B	JIS	20°C	−25 to 85°C	±10%	−25 to 85°C	-	-	-	-	-	-

*1 Murata Temperature Characteristic Code.
*2 Rated Voltage 100Vdc max: 25 to 85°C
*3 −25°C (Reference Temperature 20°C) / −30°C (Reference Temperature 25°C)

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

GRM Series Temperature Compensating Type

p00 ← Part Number List JIS: CK CJ CH SL UJ EIA: C0G U2J

L×W (mm)	0.4×0.2						0.6×0.3						1.0×0.5									1.6×0.8							
T max. (mm)	0.22						0.33						0.55									0.5						0.9	
Rated Voltage (Vdc)	50		25		16		100		50		25		100		50		10			50			10			100	
Cap. / TC Code	C0G	CΔ	C0G	CH	C0G	CH	C0G	CΔ	C0G	CΔ	C0G	CH	C0G	CΔ	C0G	CΔ	SL	U2J	UJ	SL	U2J	UJ	SL	U2J	UJ	C0G	CΔ
0.10pF							p32	p35	p38	p41			p45	p48	p52	p55											
0.20pF	p25	p28					p32	p35	p38	p41			p45	p48	p52	p55											
0.50pF	p25	p28					p32	p35	p38	p41			p45	p49	p52	p55										p59	p63
1.0pF	p25	p28					p32	p35	p38	p41			p45	p49	p52	p56										p60	p63
2.0pF	p25	p28					p32	p35	p38	p42			p46	p49	p52	p56										p60	p63
3.0pF	p25	p29					p32	p35	p39	p42			p46	p49	p53	p56										p60	p63
4.0pF	p26	p29					p33	p36	p39	p42			p46	p49	p53	p56										p60	p64
5.0pF	p26	p29					p33	p36	p39	p43			p46	p50	p53	p57										p61	p64
6.0pF	p26	p30					p33	p36	p40	p43			p47	p50	p53	p57										p61	p64
7.0pF	p27	p30					p34	p37	p40	p43			p47	p50	p54	p57										p61	p65
8.0pF	p27	p30					p34	p37	p40	p44			p47	p51	p54	p58										p62	p65
9.0pF	p27	p31					p34	p37	p41	p44			p48	p51	p55	p58										p62	p65
10pF	p28	p31					p35	p38	p41	p44			p48	p52	p55	p59										p63	p66
11pF	p28	p31																									
12pF	p28	p31					p35	p38	p41	p44			p48	p52	p55	p59										p63	p66
13pF	p28	p31																									
15pF	p28	p31					p35	p38	p41	p44			p48	p52	p55	p59										p63	p66
16pF	p28	p31																									
17pF	p28	p31																									
18pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
19pF	p28	p31																									
20pF	p28	p31																									
21pF	p28	p31																									
22pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
23pF	p28	p31																									
24pF	p28	p31																									
27pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
30pF	p28	p31																									
33pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
36pF	p28	p31																									
39pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
43pF	p28	p31																									
47pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
51pF	p28	p31																									
56pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
62pF	p28	p31																									
68pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
75pF	p28	p31																									
82pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
91pF	p28	p31																									
100pF	p28	p31							p41	p45			p48	p52	p55	p59										p63	p66
120pF			p31	p31	p31	p31			p41	p45					p55	p59										p63	p66
150pF			p31	p31	p31	p32			p41	p45					p55	p59										p63	p66
180pF			p31	p31	p31	p32			p41	p45					p55	p59										p63	p66
220pF			p31	p31	p31	p32			p41	p45					p55	p59										p63	p66
270pF											p45	p45			p55	p59										p63	p66
330pF											p45	p45			p55	p59										p63	p66
390pF											p45	p45			p55	p59										p63	p66
470pF											p45	p45			p55	p59										p63	p66
560pF											p45	p45			p55	p59										p63	p66
680pF											p45	p45			p55	p59										p63	p66
820pF											p45	p45			p55	p59										p63	p66
910pF											p45																
1000pF											p45	p45			p55	p59										p63	p66
1200pF																	p59	p59	p59							p63	p66
1500pF																	p59	p59	p59							p63	p66
1800pF																	p59	p59	p59								
2200pF																	p59	p59	p59	p59	p59	p59					
2700pF																	p59	p59	p59	p59	p59	p59					
3300pF																	p59	p59	p59	p59	p59	p59					
3900pF																	p59	p59	p59	p59	p59	p59					
4700pF																	p59	p59	p59	p59	p59	p59					
5600pF																							p59	p59	p59		
6800pF																							p59	p59	p59		
8200pF																							p59	p59	p59		
10000pF																							p59	p59	p59		
12000pF																											
15000pF																											
18000pF																											
22000pF																											
27000pF																											
33000pF																											
39000pF																											
47000pF																											
56000pF																											
68000pF																											
82000pF																											
0.10μF																											
0.12μF																											

The indication for every 0.1 pF has been omitted for less than 10 pF. Refer to the Part Number List for details.

Continued on the following page. ↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series Temperature Compensating Type)

p00 ← Part Number List JIS: CK CJ CH SL UJ EIA: C0G U2J

L×W (mm)	1.6×0.8								2.0×1.25															
T max. (mm)	0.9								0.7							0.95					1.0			
Rated Voltage (Vdc)	50					10			100		50					50				10	250		200	
Cap. / TC Code	C0G	CΔ	SL	U2J	UJ	SL	U2J	UJ	C0G	CH	C0G	CH	SL	U2J	UJ	C0G	CH	SL	U2J	UJ	SL	U2J	UJ	C0G	U2J	C0G	U2J
0.10pF																											
0.20pF																											
0.50pF	p66	p69																									
1.0pF	p66	p70																									
2.0pF	p66	p70																									
3.0pF	p67	p70																									
4.0pF	p67	p70																									
5.0pF	p67	p71																									
6.0pF	p68	p71																									
7.0pF	p68	p71																									
8.0pF	p68	p72																									
9.0pF	p69	p72																									
10pF	p69	p73																						p74		p75	
11pF																											
12pF	p69	p73																						p74		p75	
13pF																											
15pF	p69	p73																						p74		p75	
16pF																											
17pF																											
18pF	p69	p73																						p74		p75	
19pF																											
20pF																											
21pF																											
22pF	p69	p73																						p74		p75	
23pF																											
24pF																											
27pF	p69	p73																						p74		p75	
30pF																											
33pF	p69	p73																						p74		p75	
36pF																											
39pF	p69	p73																						p74		p75	
43pF																											
47pF	p69	p73																						p74		p75	
51pF																											
56pF	p69	p73																						p74		p75	
62pF																											
68pF	p69	p73																						p74		p75	
75pF																											
82pF	p69	p73																						p74		p75	
91pF																											
100pF	p69	p73							p73	p74														p74	p74	p75	p75
120pF	p69	p73							p73	p74														p74	p74	p75	p75
150pF	p69	p73							p73	p74														p74	p74	p75	p75
180pF	p69	p73							p73	p74														p74	p74	p75	p75
220pF	p69	p73							p73	p74														p74	p74	p75	p75
270pF	p69	p73							p73	p74														p74	p74	p75	p75
330pF	p69	p73							p73	p74														p74	p74	p75	p75
390pF	p69	p73							p73	p74														p74	p74		p75
470pF	p69	p73							p73	p74														p74	p75		p75
560pF	p69	p73							p73	p74														p74	p75		p75
680pF	p69	p73							p73	p74														p74	p75		p75
820pF	p69	p73							p73	p74														p74	p75		p75
910pF																											
1000pF	p69	p73			p73				p73	p74														p74	p75		p75
1200pF	p69	p73	p73	p73	p73				p73	p74	p74	p74												p74	p75		p75
1500pF	p69	p73	p73	p73	p73				p73	p74	p74	p74												p74	p75		p75
1800pF	p69	p73	p73	p73	p73				p74	p74	p74	p74												p74	p75		p75
2200pF	p69	p73	p73	p73	p73				p74	p74	p74	p74												p74	p75		p75
2700pF	p69	p73	p73	p73	p73				p74	p74	p74	p74												p74			
3300pF	p69	p73	p73	p73	p73				p74	p74	p74	p74															
3900pF	p69	p73	p73	p73	p73						p74	p74															
4700pF	p69	p73	p73	p73	p73						p74	p74															
5600pF	p69	p73	p73	p73	p73											p74	p74										
6800pF	p69	p73	p73	p73	p73											p74	p74										
8200pF	p69	p73	p73	p73	p73											p74	p74										
10000pF	p69	p73	p73	p73	p73										p74	p74	p74										
12000pF						p73	p73	p73					p74	p74	p74	p74	p74										
15000pF						p73	p73	p73					p74	p74	p74	p74	p74										
18000pF						p73	p73	p73					p74	p74	p74												
22000pF						p73	p73	p73										p74	p74	p74							
27000pF																		p74	p74	p74							
33000pF																											
39000pF																											
47000pF																											
56000pF																					p74	p74	p74				
68000pF																											
82000pF																											
0.10μF																											
0.12μF																											

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series Temperature Compensating Type)

p00 ← Part Number List JIS: CK CJ CH SL UJ EIA: C0G U2J

L×W (mm)	2.0×1.25														3.2×1.6													
T max. (mm)	1.0			1.35								1.45			0.95							1.0						
Rated Voltage (Vdc)	50			50					10			250		200	100		50					2000		1000		630		500
Cap. / TC Code	SL	U2J	UJ	C0G	CH	SL	U2J	UJ	SL	U2J	UJ	C0G	U2J	U2J	C0G	CH	C0G	CH	SL	U2J	UJ	U2J	C0G	U2J	C0G	U2J	C0G	
0.10pF																												
0.20pF																												
0.50pF																												
1.0pF																												
2.0pF																												
3.0pF																												
4.0pF																												
5.0pF																												
6.0pF																												
7.0pF																												
8.0pF																												
9.0pF																												
10pF																						p76	p76	p76	p76	p76	p77	
11pF																												
12pF																						p76	p76	p76	p76	p76	p77	
13pF																												
15pF																						p76	p76	p76	p76	p76	p77	
16pF																												
17pF																												
18pF																						p76	p76	p76	p76	p76	p77	
19pF																												
20pF																												
21pF																												
22pF																						p76	p76	p76	p76	p77	p77	
23pF																												
24pF																												
27pF																						p76	p76	p76	p76	p77	p77	
30pF																												
33pF																						p76	p76	p76	p76	p77	p77	
36pF																												
39pF																						p76	p76	p76	p76	p77	p77	
43pF																												
47pF																						p76	p76	p76	p76	p77	p77	
51pF																												
56pF																						p76	p76	p76	p76	p77	p77	
62pF																												
68pF																						p76	p76	p76	p76	p77	p77	
75pF																												
82pF																							p76	p76	p76	p77	p77	
91pF																												
100pF																							p76	p76	p76	p77	p77	
120pF																							p76	p76	p76	p77	p77	
150pF																							p76	p76	p76	p77	p77	
180pF																							p76	p76	p76	p77	p77	
220pF																							p76	p76	p76	p77	p77	
270pF																							p76	p76	p76	p77	p77	
330pF																							p76	p76	p76	p77	p77	
390pF																							p76		p76	p77	p77	
470pF																							p76		p76	p77	p77	
560pF																									p76	p77	p77	
680pF																										p77		
820pF																										p77		
910pF																												
1000pF																										p77		
1200pF																									p76	p77		
1500pF																									p76	p77		
1800pF															p75	p75									p76	p77		
2200pF															p75	p75										p77		
2700pF													p75	p75	p75	p75												
3300pF												p75	p75	p75	p75	p75												
3900pF												p75	p75	p75	p75	p75												
4700pF												p75	p75	p75	p75	p75												
5600pF													p75	p75	p75	p76												
6800pF															p75	p76												
8200pF															p75	p76												
10000pF															p75	p76												
12000pF															p75	p76	p76	p76										
15000pF															p75	p76	p76	p76										
18000pF				p75	p75										p75	p76	p76	p76										
22000pF				p75	p75										p75	p76	p76	p76										
27000pF															p75	p76	p76	p76										
33000pF	p75	p75	p75												p75	p76	p76	p76										
39000pF						p75	p75	p75							p75	p76	p76	p76										
47000pF						p75	p75	p75																				
56000pF																			p76	p76	p76							
68000pF									p75	p75	p75																	
82000pF									p75	p75	p75																	
0.10μF									p75	p75	p75																	
0.12μF																												

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series Temperature Compensating Type)

p00 ← Part Number List JIS: CK CJ CH SL UJ EIA: C0G U2J

L×W (mm)	3.2×1.6																											
T max. (mm)	1.0				1.25															1.8							
Rated Voltage (Vdc)	500	250		200	1000		630		500		250		200	100		50				1000		630		500		250	
Cap. / TC Code	U2J	C0G	U2J	U2J	C0G	U2J	C0G	U2J	C0G	U2J	C0G	U2J	U2J	C0G	UH	C0G	CH	SL	U2J	UJ	C0G	U2J	C0G	U2J	U2J	C0G	U2J
0.10pF																											
0.20pF																											
0.50pF																											
1.0pF																											
2.0pF																											
3.0pF																											
4.0pF																											
5.0pF																											
6.0pF																											
7.0pF																											
8.0pF																											
9.0pF																											
10pF	p77																										
11pF																											
12pF	p77																										
13pF																											
15pF	p77																										
16pF																											
17pF																											
18pF	p77																										
19pF																											
20pF																											
21pF																											
22pF	p77																										
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24pF																											
27pF	p77																										
30pF																											
33pF	p77																										
36pF																											
39pF	p77																										
43pF																											
47pF	p77																										
51pF																											
56pF	p77																										
62pF																											
68pF	p77																										
75pF																											
82pF	p77																										
91pF																											
100pF	p77																										
120pF	p77																										
150pF	p77																										
180pF	p77																										
220pF	p77																										
270pF	p77																										
330pF	p77																										
390pF	p77	p77					p77																				
470pF	p77	p77					p77																				
560pF	p77	p77			p77	p77																					
680pF	p77	p77			p77	p77	p78		p78																		
820pF	p77	p77					p78		p78												p78	p78					
910pF																											
1000pF	p77	p77					p78		p78												p78	p78					
1200pF	p77	p77																									
1500pF	p77	p77																									
1800pF	p77	p77																									
2200pF	p77	p77					p78																				
2700pF		p77	p77	p77			p78	p78		p78																	
3300pF		p77	p77	p77				p78		p78												p78					
3900pF		p77	p77	p77																			p78	p78			
4700pF		p77	p77	p77																			p78	p78			
5600pF		p77	p77	p77																							
6800pF		p77											p78	p78													
8200pF											p78	p78	p78														
10000pF											p78	p78	p78														
12000pF											p78	p78															
15000pF																										p78	p78
18000pF																											p78
22000pF																											p78
27000pF																											
33000pF																											
39000pF																											
47000pF														p78	p78	p78	p78										
56000pF														p78	p78	p78	p78										
68000pF																		p78	p78	p78							
82000pF																		p78	p78	p78							
0.10μF																		p78	p78	p78							
0.12μF																											

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series Temperature Compensating Type)

p00 ← Part Number List JIS: CK CJ CH SL UJ EIA: C0G U2J

L×W (mm)	3.2×1.6								3.2×2.5												4.5×2.0	4.5×3.2		
T max. (mm)	1.8								1.0			1.25				1.5				2.0					1.0	1.5		
Rated Voltage (Vdc)	100		50		25		16		2000	630	500	2000	1000	630	500	1000	630	500	250	1000	630	500	250	3150	1000	630	500
Cap. / TC Code	C0G	CH	C0G	CH	C0G	CH	C0G	CH	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J
0.10pF																											
0.20pF																											
0.50pF																											
1.0pF																											
2.0pF																											
3.0pF																											
4.0pF																											
5.0pF																											
6.0pF																											
7.0pF																											
8.0pF																											
9.0pF																											
10pF																								p79			
11pF																											
12pF																								p79			
13pF																											
15pF																								p79			
16pF																											
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30pF																											
33pF																								p79			
36pF																											
39pF																								p79			
43pF																											
47pF																								p79			
51pF																											
56pF																								p79			
62pF																											
68pF																								p79			
75pF																											
82pF									p78															p79			
91pF																											
100pF									p78															p79			
120pF									p78																		
150pF									p78																		
180pF												p78															
220pF												p78															
270pF																											
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560pF																											
680pF																											
820pF																											
910pF																											
1000pF																											
1200pF										p78	p78		p78														
1500pF										p78	p78					p78											
1800pF										p78	p78									p78							
2200pF										p78	p78									p78							
2700pF																									p79		
3300pF																									p79		
3900pF																											
4700pF																											
5600pF														p78	p78												
6800pF																	p78	p78									
8200pF																					p78	p78					
10000pF																					p78	p78					
12000pF																										p79	p79
15000pF																											
18000pF																											
22000pF																											
27000pF																			p78								
33000pF																							p78				
39000pF																							p78				
47000pF																							p78				
56000pF																											
68000pF	p78	p78	p78	p78																							
82000pF	p78	p78	p78	p78																							
0.10µF	p78	p78	p78	p78																							
0.12µF					p78	p78	p78	p78																			

Continued on the following page. ↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series Temperature Compensating Type)

p00 ← Part Number List JIS: CK CJ CH SL UJ EIA: C0G U2J

L×W (mm)	4.5×3.2			5.7×5.0					
T max. (mm)	2.0			1.5			2.0		
Rated Voltage (Vdc)	1000	630	500	1000	630	500	1000	630	500
Cap. / TC Code	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J	U2J
0.10pF									
0.20pF									
0.50pF									
1.0pF									
2.0pF									
3.0pF									
4.0pF									
5.0pF									
6.0pF									
7.0pF									
8.0pF									
9.0pF									
10pF									
11pF									
12pF									
13pF									
15pF									
16pF									
17pF									
18pF									
19pF									
20pF									
21pF									
22pF									
23pF									
24pF									
27pF									
30pF									
33pF									
36pF									
39pF									
43pF									
47pF									
51pF									
56pF									
62pF									
68pF									
75pF									
82pF									
91pF									
100pF									
120pF									
150pF									
180pF									
220pF									
270pF									
330pF									
390pF									
470pF									
560pF									
680pF									
820pF									
910pF									
1000pF									
1200pF									
1500pF									
1800pF									
2200pF									
2700pF									
3300pF									
3900pF	p79								
4700pF	p79								
5600pF				p79					
6800pF				p79					
8200pF							p79		
10000pF							p79		
12000pF									
15000pF		p79	p79						
18000pF		p79	p79						
22000pF		p79	p79						
27000pF					p79	p79			
33000pF								p79	p79
39000pF								p79	p79
47000pF								p79	p79
56000pF									
68000pF									
82000pF									
0.10μF									
0.12μF									

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

GRM Series High Dielectric Constant Type

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	0.4×0.2							0.6×0.3												1.0×0.5				
T max. (mm)	0.22							0.33												0.22				
Rated Voltage (Vdc)	16	10		6.3	4		2.5	50		35	25			16		10		6.3		4	10	6.3		4
Cap. / TC Code	X7R	X7R	X5R, B	X5R, B	X6T	X5R	X6T	X7R	B	X5R	X7R, R	X6S	X5R, B	X7Δ, R	X6S	X5R, B	X7Δ, R	X5R, B	X7R, R	X6S	X5R, B	X6S	X5R, B	X6S	X5R, B	X7T	X6Δ
100pF	p80	p80	p80 p80					p81	p81		p81															
150pF	p80	p80	p80 p80					p81	p81		p81															
220pF	p80	p80	p80 p80					p81	p81		p81															
330pF	p80	p80	p80 p80					p81	p81		p81															
470pF	p80	p80	p80 p80					p81	p81		p81															
680pF		p80	p80 p80					p81	p81		p81															
820pF		p80																								
1000pF	p80	p80	p80 p80	p80 p80				p81	p81		p81 p81		p81													
1500pF			p80 p80	p80 p80				p81	p81		p81 p81		p81													
2200pF			p80 p80	p80 p80							p81		p81	p81 p81		p82										
3300pF			p80 p80	p80 p80							p81		p81	p81 p81		p82										
4700pF			p80 p80	p80 p80							p81		p81	p81			p82 p82	p82 p82	p82 p82	p82 p82		p82				
6800pF			p80 p80	p80 p80							p81		p81	p81			p82 p82	p82 p82	p82 p82	p82 p82		p82				
10000pF			p80 p80	p80 p80							p81		p81 p81	p81		p81 p82	p82 p82	p82		p82 p82						
15000pF				p80		p80										p81 p82		p82 p82			p82	p82				
22000pF				p80		p80										p81 p82		p82 p82			p82	p82				
33000pF				p80		p81										p81 p82		p82 p82			p82	p82				
47000pF				p80		p81										p82 p82		p82 p82			p82					
68000pF				p80		p81										p82 p82		p82 p82			p82					
0.10μF				p80	p80	p81	p81			p81		p81	p81	p81	p81	p82 p82	p82	p82 p82			p82		p82	p83	p83 p83	p83	p83
0.15μF																											
0.22μF																		p82			p82	p82	p82	p82	p83 p83	p83	p83
0.33μF																											
0.47μF																									p83 p83		p83
0.68μF																											
1.0μF																									p83		p83
2.2μF																											
4.7μF																											
10μF																											
22μF																											
47μF																											
100μF																											
150μF																											
220μF																											

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Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	1.0×0.5																											
T max. (mm)	0.22		0.3							0.33				0.55														
Rated Voltage (Vdc)		2.5	50		25		16		10	10	6.3		4	100	50			35		25			16			10	
Cap. / TC Code	X5R	X7T	X7R, R	B	X7R	B	X7R	B	X5R	X5R, B	X6T	X5R, B	X6T	X7R	X7R, R	X6S	X5R, B	X6S	X5R	X7R, R	X6S	X5R, B	X7R, R	X6S	X5R, B	X7R	X6S
100pF																												
150pF																												
220pF			p83	p83	p83									p83	p83	p84	p84											
330pF			p83	p83	p83									p83	p83	p84	p84											
470pF			p83	p83	p83									p83	p83	p84	p84											
680pF			p83	p83	p83									p83	p83	p84	p84											
820pF																												
1000pF			p83	p83	p83									p83	p83	p84	p84											
1500pF			p83	p83	p83									p83	p83	p84	p84											
2200pF					p83	p83								p83	p83	p84	p84			p84		p84						
3300pF							p83	p83						p83	p83	p84	p84											
4700pF							p83	p83						p83	p84	p84	p84						p85					
6800pF							p83	p83							p84	p84	p84			p84								
10000pF							p83	p83							p84	p84	p84			p84	p84	p84	p85		p85			
15000pF									p83						p84		p84			p84	p84	p84						
22000pF									p83						p84		p84			p84	p84	p84						
33000pF									p83						p84	p84	p84			p84	p84	p84						
47000pF															p84	p84	p84			p84	p84	p85						
68000pF															p84	p84	p84			p84		p84 p85	p85	p85				
0.10μF		p83													p84		p84 p84			p84		p84 p85						
0.15μF																							p85					
0.22μF		p83																p84	p84		p84	p84	p85		p85	p85		
0.33μF																												
0.47μF																			p84			p84		p85	p85	p85		
0.68μF																												
1.0μF	p83									p83	p83	p83	p83	p83	p83							p84	p85		p85	p85		p85
2.2μF																												
4.7μF																												
10μF																												
22μF																												
47μF																												
100μF																												
150μF																												
220μF																												

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	1.0×0.5																								1.6×0.8			
T max. (mm)	0.55							0.6						0.65		0.7									0.5			
Rated Voltage (Vdc)	10	6.3			4			35	25	16	6.3	4	2.5	10	6.3	25	16		10		6.3	4	2.5	25	16	6.3	4
Cap. / TC Code	X5R, B	X7R	X6S	X5R, B	X7R	X6S	X5R	X5R	X6S	X6S	X5R, B	X5R, B	X6T	X5R	X6S	X5R	X6S	X5R	X7S	X6S	X7S	X5R	X5R	X5R, B	X5R, B	X5R	X5R
100pF																											
150pF																											
220pF																											
330pF																											
470pF																											
680pF																											
820pF																											
1000pF																											
1500pF																											
2200pF																											
3300pF																											
4700pF																											
6800pF																											
10000pF																											
15000pF																											
22000pF																											
33000pF	p85																										
47000pF																											
68000pF																											
0.10μF	p85			p85																							
0.15μF	p85 p85			p85 p85																							
0.22μF	p85 p85		p85	p85 p85		p85																					
0.33μF	p85 p85			p85 p85																							
0.47μF	p85 p85			p85 p85																							
0.68μF	p85 p85			p85 p85																							
1.0μF	p85 p85	p85		p85 p85	p85		p85	p85	p85	p85														p86	p86 p86	p86	
2.2μF	p85		p85	p85												p86	p86	p86	p86	p86	p86						
4.7μF											p85	p85	p85 p85	p86	p86	p86											
10μF																						p86	p86			p86	p86
22μF																											
47μF																											
100μF																											
150μF																											
220μF																											

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Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	1.6×0.8																											
T max. (mm)	0.55					0.9														0.95					1.0		
Rated Voltage (Vdc)	16	10		6.3		250	200	50	35	25		16			10		6.3		4	25	16		10		50	35	
Cap. / TC Code	X5R	X6S	X5R	X7T	X6S	X7R	X7R	X5R, B	X7R	X7R	X5R, B	X7R	X6S	X5R, B	X7R	X5R	X6S	X5R, B	X5R	X5R	X6S	X5R, B	X7S	X5R, B	X5R	X6S	X5R
100pF																											
150pF																											
220pF						p86	p86																				
330pF						p86	p86																				
470pF						p86	p86																				
680pF						p86	p86																				
820pF																											
1000pF						p86	p86																				
1500pF						p86	p86																				
2200pF						p86	p86																				
3300pF																											
4700pF																											
6800pF																											
10000pF																											
15000pF																											
22000pF																											
33000pF																											
47000pF																											
68000pF																											
0.10μF																											
0.15μF																											
0.22μF																											
0.33μF																											
0.47μF									p86																		
0.68μF																											
1.0μF								p86	p86	p86	p86	p86	p86	p86	p86	p86											
2.2μF											p86	p86		p86	p86	p86	p86									p86	p86	
4.7μF	p86	p86	p86	p86	p86								p86	p86						p86	p86	p86	p86	p86				p86
10μF																	p86	p86	p86			p86			p86	p86		
22μF																												
47μF																												
100μF																												
150μF																												
220μF																												

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Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	1.6×0.8										2.0×1.25															
T max. (mm)	1.0										0.7	0.95														1.0
Rated Voltage (Vdc)	25			16		10	6.3		4		16	50	35		25			16		10		6.3		4		2.5	500
Cap. / TC Code	X7S	X6S	X5R	X7S	X6S	X7T	X7T	X5R, B	X6S	X5R, B	X6S	X5R, B	X6S	X5R	X7R	X6S	X5R, B	X7R	X5R, B	X7Δ	X5R, B	X6S	X5R, B	X6S	X5R	X6T	X7R
100pF																											
150pF																											
220pF																											
330pF																											
470pF																											
680pF																											
820pF																											
1000pF																											p87
1500pF																											p87
2200pF																											p87
3300pF																											p87
4700pF																											p87
6800pF																											p87
10000pF																											
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0.22μF																											
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0.47μF																											
0.68μF																											
1.0μF											p87	p87 p87			p87												
2.2μF	p87	p87		p87								p87 p87	p87			p87	p87 p87	p87		p87							
4.7μF		p87												p87			p87		p87 p87	p87							
10μF			p87		p87	p87	p87										p87 p87		p87 p87			p87		p87			
22μF								p87 p87	p87	p87 p87											p87 p87		p87 p87				
47μF																									p87	p87	
100μF																											
150μF																											
220μF																											

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Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	2.0×1.25																										
T max. (mm)	1.0							1.35					1.4											1.45			
Rated Voltage (Vdc)	250	200	35	25		16		50	25		16		50	25		16		10		6.3		4		500	250	200	50
Cap. / TC Code	X7R	X7R	X6S	X7S	X6S	X7S	X5R	X5R, B	X6S	X5R, B	X7R	X5R, B	X5R, B	X7R, R	X5R, B	X7R	X6S	X7R	B	X7R	X6S	X7U	X6S	X7R	X7R	X7R	X7S
100pF																											
150pF																											
220pF																											
330pF																											
470pF																											
680pF																											
820pF																											
1000pF	p87	p87																									
1500pF	p87	p87																									
2200pF	p87	p87																									
3300pF	p87	p87																									
4700pF	p87	p87																									
6800pF	p87	p87																									
10000pF																								p88	p88	p88	
15000pF																									p88	p88	
22000pF																									p88	p88	
33000pF																											
47000pF																											
68000pF																											
0.10μF																											
0.15μF																											
0.22μF																											
0.33μF																											
0.47μF																											
0.68μF																											
1.0μF								p87	p87					p88	p88												
2.2μF										p87	p88		p88	p88	p88												
4.7μF			p87	p87	p87	p87			p87	p87	p87		p88	p88	p88	p88		p88									p88
10μF												p88	p88			p88	p88	p88	p88	p88							
22μF							p87												p88		p88	p88	p88				
47μF																											
100μF																											
150μF																											
220μF																											

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	2.0×1.25																	3.2×1.6								
T max. (mm)	1.45																	0.95					1.0	1.25		
Rated Voltage (Vdc)	50	35			25			16			10			6.3		4		2.5	35	16	10	6.3		630	1000	630	500
Cap. / TC Code	X6S	X7S	X6S	X5R	X7S	X6S	X5R	X7S	X6S	X5R	X7T	X6S	X5R	X7T	X5R, B	X6S	X5R, B	X6S	X5R	X5R, B	X5R, B	X6S	X5R, B	X7R	X7R	X7R	X7R
100pF																											
150pF																											
220pF																											
330pF																											
470pF																								p88			
680pF																								p88			
820pF																											
1000pF																								p88	p88		
1500pF																								p88	p89		
2200pF																								p88	p89		
3300pF																								p88	p89		
4700pF																								p88	p89		
6800pF																								p88		p89	
10000pF																								p88			
15000pF																											p89
22000pF																											p89
33000pF																											
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68000pF																											
0.10μF																											
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0.33μF																											
0.47μF																											
0.68μF																											
1.0μF																											
2.2μF																											
4.7μF	p88	p88			p88																						
10μF			p88	p88	p88	p88		p88											p88	p88 p88							
22μF							p88		p88	p88	p88	p88	p88	p88						p88 p88	p88 p88	p88	p88	p88	p88 p88			
47μF													p88		p88 p88	p88	p88 p88										
100μF															p88	p88		p88									
150μF																											
220μF																											

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	3.2×1.6																											
T max. (mm)	1.25					1.8																					1.9	
Rated Voltage (Vdc)	250	200	50		25	1000	630	500	250	200	100	50		25		16		10		6.3			4		100	25
Cap. / TC Code	X7R	X7R	X7R	B	X5R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X5R, B	X7R	X5R, B	X7R	X6S	X5R, B	X7R	X5R, B	X7Δ	X6S	X5R, B	X7U	X6S	X7R	X6S
100pF																											
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4700pF																											
6800pF						p89																					
10000pF						p89																					
15000pF	p89	p89					p89																				
22000pF	p89	p89					p89																				
33000pF								p89	p89	p89																	
47000pF								p89	p89	p89																	
68000pF	p89	p89																									
0.10μF									p89	p89																	
0.15μF																											
0.22μF																											
0.33μF																											
0.47μF																											
0.68μF																											
1.0μF			p89	p89							p89																
2.2μF												p89	p89													p89	
4.7μF												p89	p89	p89		p89											
10μF					p89								p89	p89	p89	p89											
22μF															p89	p89	p89	p89	p89	p89		p89					p89
47μF																			p89	p89	p89	p89	p89	p89	p89	p89	
100μF																											
150μF																											
220μF																											

Continued on the following page.↗

Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	3.2×1.6										3.2×2.5															
T max. (mm)	1.9										1.5					1.8	2.0					2.2		2.7			
Rated Voltage (Vdc)	16		10	6.3		4			2.5		1000	630	500	250	200	100	1000	630	500	250	200	100	25	100	80	63	50
Cap. / TC Code	X7S	X5R	X6S	X6T	X5R	X7U	X6Δ	X5R	X6S	X5R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7S	X7R	X7R	X7R	X7R	X7R
100pF																											
150pF																											
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68000pF													p89	p89	p89												
0.10μF																			p89	p89	p89						
0.15μF														p89	p89												
0.22μF																				p89	p89						
0.33μF																											
0.47μF																											
0.68μF																											
1.0μF																p89											
2.2μF																								p89			
4.7μF																						p89			p89		p90
10μF																							p89			p90	p90
22μF	p89																										
47μF		p89	p89																								
100μF				p89	p89	p89	p89	p89																			
150μF					p89		p89	p89	p89																		
220μF								p89		p89																	

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Capacitance Table

p00 Each number in the Part Number List refers to the page number printed at the bottom of the page.

(→ GRM Series High Dielectric Constant Type)

p00 ← Part Number List JIS: R B EIA: X7R X7S X7T X7U X6S X6T X5R

L×W (mm)	3.2×2.5													4.5×3.2									5.7×5.0				
T max. (mm)	2.7													1.5				2.0					2.0				
Rated Voltage (Vdc)	50	35		25		16			10		6.3		4	630	500	250	200	1000	630	500	250	200	1000	630	500	250	200
Cap. / TC Code	X5R, B	X7R	X5R, B	X7R	X5R, B	X7R	X6S	X5R, B	X7R	X5R, B	X7Δ	X5R, B	X7U	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R	X7R
100pF																											
150pF																											
220pF																											
330pF																											
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4700pF																											
6800pF																											
10000pF																											
15000pF																											
22000pF																											
33000pF																		p90									
47000pF																		p90									
68000pF														p90									p90				
0.10μF																			p90				p90				
0.15μF															p90	p90	p90							p90			
0.22μF																				p90	p90	p90		p90			
0.33μF																					p90	p90			p90	p90	p90
0.47μF																					p90	p90			p90	p90	p90
0.68μF																										p90	p90
1.0μF																										p90	p90
2.2μF																											
4.7μF																											
10μF	p90	p90	p90	p90	p90																						
22μF				p90	p90	p90	p90																				
47μF							p90	p90	p90	p90	p90	p90	p90														
100μF											p90	p90	p90	p90	p90	p90	p90										
150μF																											
220μF																											

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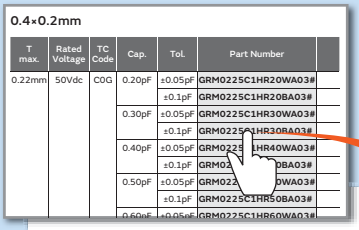
Specifications and Test Methods, Package, Chart of Characteristic Data, please refer to the search web page.
http://www.murata.com/en-global/products/capacitor



Links are provided to the product detail pages on the web, and are shown below in the product number table from the PDF version of the catalog which is available on the web.

Data Sheet

The product details page can be output in PDF.

Status and Features Icons

The status and features of products can be checked at once. When ? is clicked, a description of each icon will be displayed.

Characteristics & Applications

This links to the introduction page of each series.

Detailed Specifications Sheet

- Rated value
- Specifications and Test Methods
- Package
- Caution, Notice
  (Storage, Soldering and Mounting, ...etc.)

Characteristics Data

The following characteristics data of the main products can be acquired.

- SPICE Netlist (mod type)
- S parameter (S2P type)
- Reliability Test Data *Typical data

- Shape (Dimensions)
- Rated Values

- Specification by Packaging Code/ Minimum Order Quantity
- Weight (1 pc/ø180mm reel)

Chart of Characteristic Data

The main products published characteristic data.

- Frequency characteristics (ESR, Impedance)
- DC bias characteristics
- AC voltage characteristics
- Capacitance - temperature characteristics
- Calorific property by ripple current

Design Tools SimSurfing

The SimSurfing design tools are useful for displaying the graph, downloading CSV data and overwriting the product number graph.

General Purpose Monolithic Ceramic Capacitors

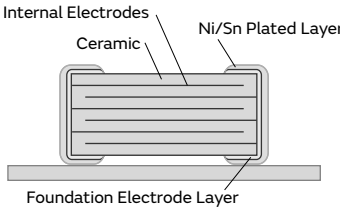
GRM Series

WEB

This is Murata primary products renowned for both small size and large capacitance value with latest advanced technology.

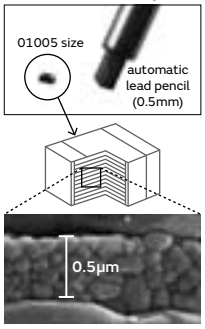
Features

1 Achieves large-capacity and small size in a multilayer structure.

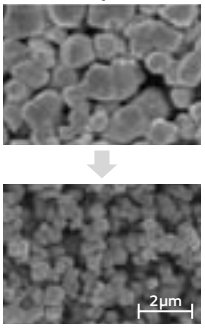


<Example of Structure>

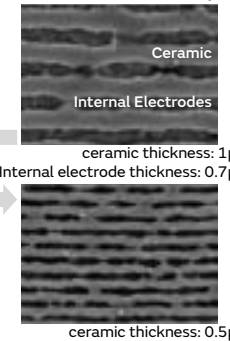
"Thin Layer Technology"
for thinner layers



"Fine Particle Technology"
for finer particles



"High Precision Lamination Technology"
for more accuracy



ceramic thickness: 1µm
Internal electrode thickness: 0.7µm

ceramic thickness: 0.5µm
Internal electrode thickness: 0.4µm

2 Sn plating is applied to the external electrodes; excellent solderability.

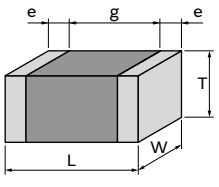
3 High reliability with no polarity.

	Ceramic Capacitors	Tantalum Capacitor	Aluminum Electrolytic Capacitor	Conductive Polymer Capacitor
Price	○	○	◎	○
Comparison between Impedance Frequency Characteristics	◎	△	△	○
Capacitance temperature characteristics	○	◎	○	○
DC breakdown voltage	◎	△	△	△
Polarity	No	Yes	Yes	Yes
Pulse response	◎	△	△	○
Allowable ripple current	◎	△	△	△
Reliability	◎	○	○	○
DC bias characteristics	△	◎	◎	◎

◎: Particularly excellent ○: Excellent △: Inferior

Specifications

Size (mm)	0.25×0.125mm to 5.7×5.0mm
Rated Voltage	2.5Vdc to 3150Vdc
Capacitance	0.10pF to 330µF
Main Applications	1. Rated voltage 100V Max. High Dielectric Constant Type · · · For decoupling and smoothing circuits Temperature Compensating Type · · · For tuning circuits, oscillating circuits, and high frequency filter circuits 2. Rated voltage 200V min. High Dielectric Constant Type · · · For clamp snubber circuits and smoothing circuits Temperature Compensating Type · · · Power supply damper snubber



<Dimensions>

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 Series Temperature Compensating Type Part Number List

4.5×2.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	
1.0mm	3150Vdc	U2J	10pF	±5%	**GRM42A7U3F100JW31#**	
			12pF	±5%	**GRM42A7U3F120JW31#**	
			15pF	±5%	**GRM42A7U3F150JW31#**	
			18pF	±5%	**GRM42A7U3F180JW31#**	
			22pF	±5%	**GRM42A7U3F220JW31#**	
			27pF	±5%	**GRM42A7U3F270JW31#**	
			33pF	±5%	**GRM42A7U3F330JW31#**	
			39pF	±5%	**GRM42A7U3F390JW31#**	
			47pF	±5%	**GRM42A7U3F470JW31#**	
			56pF	±5%	**GRM42A7U3F560JW31#**	
			68pF	±5%	**GRM42A7U3F680JW31#**	
			82pF	±5%	**GRM42A7U3F820JW31#**	
			100pF	±5%	**GRM42A7U3F101JW31#**	

4.5×3.2mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	
1.5mm	1000Vdc	U2J	2700pF	±5%	**GRM43Q7U3A272JW31#**	
			3300pF	±5%	**GRM43Q7U3A332JW31#**	
	630Vdc	U2J	12000pF	±5%	**GRM43Q7U2J123JW31#**	
	500Vdc	U2J	12000pF	±5%	**GRM43Q7U2H123JW31#**	
2.0mm	1000Vdc	U2J	3900pF	±5%	**GRM43D7U3A392JW31#**	
			4700pF	±5%	**GRM43D7U3A472JW31#**	
	630Vdc	U2J	15000pF	±5%	**GRM43D7U2J153JW31#**	
			18000pF	±5%	**GRM43D7U2J183JW31#**	
			22000pF	±5%	**GRM43D7U2J223JW31#**	
	500Vdc	U2J	15000pF	±5%	**GRM43D7U2H153JW31#**	
			18000pF	±5%	**GRM43D7U2H183JW31#**	
			22000pF	±5%	**GRM43D7U2H223JW31#**	

5.7×5.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	
1.5mm	1000Vdc	U2J	5600pF	±5%	**GRM55Q7U3A562JW31#**	
			6800pF	±5%	**GRM55Q7U3A682JW31#**	
	630Vdc	U2J	27000pF	±5%	**GRM55Q7U2J273JW31#**	
	500Vdc	U2J	27000pF	±5%	**GRM55Q7U2H273JW31#**	
2.0mm	1000Vdc	U2J	8200pF	±5%	**GRM55D7U3A822JW31#**	
			10000pF	±5%	**GRM55D7U3A103JW31#**	
	630Vdc	U2J	33000pF	±5%	**GRM55D7U2J333JW31#**	
			39000pF	±5%	**GRM55D7U2J393JW31#**	
			47000pF	±5%	**GRM55D7U2J473JW31#**	
	500Vdc	U2J	33000pF	±5%	**GRM55D7U2H333JW31#**	
			39000pF	±5%	**GRM55D7U2H393JW31#**	
			47000pF	±5%	**GRM55D7U2H473JW31#**	

Part number # indicates the package specification code.

GRM Series High Dielectric Constant Type Part Number List

(→ 3.2×2.5mm)

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	
2.7mm	63Vdc	X7R	10μF	±10%	GRM32ER71J106KA12#	D1
				±20%	GRM32ER71J106MA12#	D1
	50Vdc	X7R	4.7μF	±10%	GRM32ER71H475KA88#	
			10μF	±10%	GRM32ER71H106KA12#	
				±20%	GRM32ER71H106MA12#	
		X5R	10μF	±10%	GRM32ER61H106KA12#	
				±20%	GRM32ER61H106MA12#	
		B	10μF	±10%	GRM32EB31H106KA12#	
				±20%	GRM32EB31H106MA12#	
	35Vdc	X7R	10μF	±10%	GRM32ER7YA106KA12#	
				±20%	GRM32ER7YA106MA12#	
		X5R	10μF	±10%	GRM32ER6YA106KA12#	
				±20%	GRM32ER6YA106MA12#	
		B	10μF	±10%	GRM32EB3YA106KA12#	
				±20%	GRM32EB3YA106MA12#	
	25Vdc	X7R	22μF	±20%	GRM32ER71E226ME15#	
		X5R	22μF	±20%	GRM32ER61E226ME15#	
		B	22μF	±20%	GRM32EB31E226ME15#	
	16Vdc	X7R	22μF	±20%	GRM32ER71C226MEA8#	
		X6S	47μF	±20%	GRM32EC81C476ME15#	D1
		X5R	47μF	±20%	GRM32ER61C476ME15#	
		B	47μF	±20%	GRM32EB31C476ME15#	
	10Vdc	X7R	47μF	±20%	GRM32ER71A476ME15#	
		X5R	47μF	±20%	GRM32ER61A476ME20#	
			100μF	±20%	GRM32ER61A107ME20#	D1
		B	47μF	±20%	GRM32EB31A476ME20#	
	6.3Vdc	X7R	47μF	±20%	GRM32ER70J476ME20#	
		X7U	100μF	±20%	GRM32EE70J107ME15#	D1
		X5R	100μF	±20%	GRM32ER60J107ME20#	
		B	100μF	±20%	GRM32EB30J107ME16#	
	4Vdc	X7U	100μF	±20%	GRM32EE70G107ME19#	

4.5×3.2mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	
1.5mm	630Vdc	X7R	68000pF	±10%	GRM43QR72J683KW01#	
	500Vdc	X7R	0.15μF	±10%	GRM43QR72H154KW10#	
	250Vdc	X7R	0.15μF	±10%	GRM43QR72E154KW01#	
	200Vdc	X7R	0.15μF	±10%	GRM43QR72D154KW01#	
2.0mm	1000Vdc	X7R	33000pF	±10%	GRM43DR73A333KW01#	
			47000pF	±10%	GRM43DR73A473KW01#	
	630Vdc	X7R	0.10μF	±10%	GRM43DR72J104KW01#	
	500Vdc	X7R	0.22μF	±10%	GRM43DR72H224KW10#	
	250Vdc	X7R	0.22μF	±10%	GRM43DR72E224KW01#	
			0.33μF	±10%	GRM43DR72E334KW01#	
			0.47μF	±10%	GRM43DR72E474KW01#	
	200Vdc	X7R	0.22μF	±10%	GRM43DR72D224KW01#	
			0.33μF	±10%	GRM43DR72D334KW01#	
			0.47μF	±10%	GRM43DR72D474KW01#	

5.7×5.0mm

T max.	Rated Voltage	TC Code	Cap.	Tol.	Part Number	
2.0mm	1000Vdc	X7R	68000pF	±10%	GRM55DR73A683KW01#	
			0.10μF	±10%	GRM55DR73A104KW01#	
	630Vdc	X7R	0.15μF	±10%	GRM55DR72J154KW01#	
			0.22μF	±10%	GRM55DR72J224KW01#	
	500Vdc	X7R	0.33μF	±10%	GRM55DR72H334KW10#	
			0.47μF	±10%	GRM55DR72H474KW10#	
	250Vdc	X7R	0.33μF	±10%	GRM55DR72E334KW01#	
			0.47μF	±10%	GRM55DR72E474KW01#	
			0.68μF	±10%	GRM55DR72E684KW01#	
			1.0μF	±10%	GRM55DR72E105KW01#	
	200Vdc	X7R	0.33μF	±10%	GRM55DR72D334KW01#	
			0.47μF	±10%	GRM55DR72D474KW01#	
			0.68μF	±10%	GRM55DR72D684KW01#	
			1.0μF	±10%	GRM55DR72D105KW01#	

Part number # indicates the package specification code.

⚠Caution

Storage and Operation Conditions

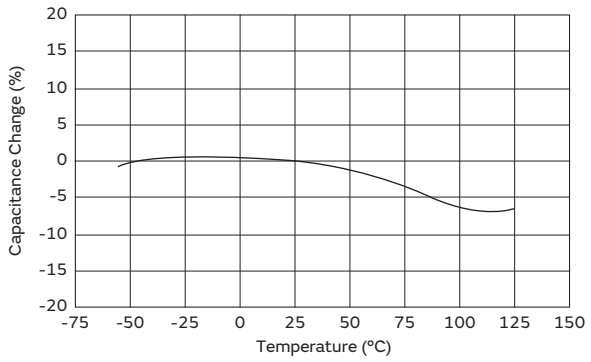
1. The performance of chip monolithic ceramic capacitors may be affected by the storage conditions.
   1-1. Store the capacitors in the following conditions: Room Temperature of +5°C to +40°C and a Relative Humidity of 20% to 70%.
      (1) Sunlight, dust, rapid temperature changes, corrosive gas atmosphere,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

Rating

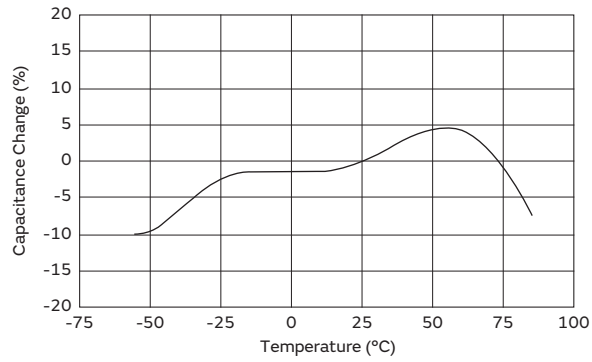
1. Temperature Dependent Characteristics

1. The electrical characteristics of a capacitor can change with temperature.
   1-1. For capacitors having larger temperature dependency, the capacitance may change with temperature changes.
   The following actions are recommended in order to ensure suitable capacitance values.
      (1) Select a suitable capacitance for the operating temperature range.
      (2) The capacitance may change within the rated temperature.
      When you use a high dielectric constant type capacitor in a circuit that needs a tight (narrow) capacitance tolerance (e.g., a time-constant circuit), please carefully consider the temperature characteristics, and carefully confirm the various characteristics in actual use conditions and the actual system.

[Example of Temperature Characteristics X7R (R7)]
Sample: 0.1μF, Rated Voltage 50VDC



[Example of Temperature Characteristics X5R (R6)]
Sample: 22μF, Rated Voltage 4VDC



2. Measurement of Capacitance

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

Continued on the following page.↗

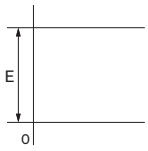
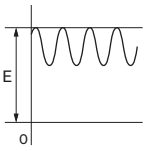
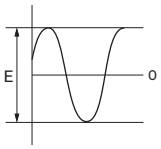
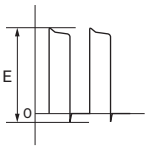
⚠Caution

Continued from the preceding page. ↘

3. Applied Voltage

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

Typical Voltage Applied to the DC Capacitor

DC Voltage	DC Voltage+AC	AC Voltage	Pulse Voltage
			

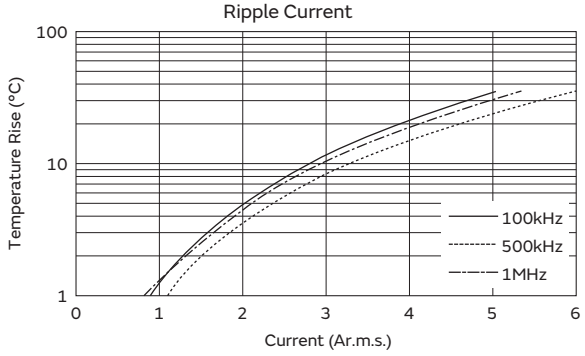
(E: Maximum possible applied voltage.)

   1-2. Influence of over voltage
   Over voltage that is applied to the capacitor may result in an electrical short circuit caused by the breakdown of the internal dielectric layers.
   The time duration until breakdown depends on the applied voltage and the ambient temperature.
2. Use a safety standard certified capacitor in a power supply input circuit (AC filter), as it is also necessary to consider the withstand voltage and impulse withstand voltage defined for each device.

4. Type of Applied Voltage and Self-heating Temperature

1. Confirm the operating conditions to make sure that no large current is flowing into the capacitor due to the continuous application of an AC voltage or pulse voltage.
   When a DC rated voltage product is used in an AC voltage circuit or a pulse voltage circuit, the AC current or pulse current will flow into the capacitor; therefore check the self-heating condition.
   Please confirm the surface temperature of the capacitor so that the temperature remains within the upper limits of the operating temperature, including the rise in temperature due to self-heating. When the capacitor is used with a high-frequency voltage or pulse voltage, heat may be generated by dielectric loss.
   <Applicable to Rated Voltage of less than 100VDC>
   1-1. The load should be contained to the level such that when measuring at atmospheric temperature of 25°C, the product's self-heating remains below 20°C and the surface temperature of the capacitor in the actual circuit remains within the maximum operating temperature.

[Example of Temperature Rise (Heat Generation) in Chip Monolithic Ceramic Capacitors in Contrast to Ripple Current]
Sample: R (R1) characteristics 10μF,
Rated voltage: DC10V



Continued on the following page. ↗

⚠Caution

Continued from the preceding page.↘

<Applicable to Temperature Characteristics X7R (R7), X7T (D7) beyond Rated Voltage of 200VDC>

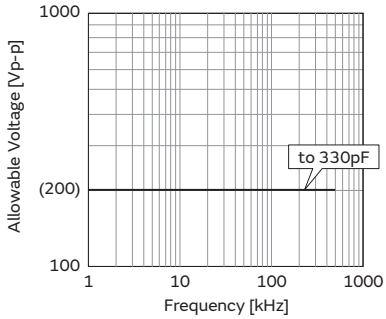
1-2. The load should be contained so that the self-heating of the capacitor body remains below 20°C, when measuring at an ambient temperature of 25°C. In addition, use a K thermocouple of ø0.1mm with less heat capacity when measuring, and measure in a condition where there is no effect from the radiant heat of other components or air flow caused by convection. Excessive generation of heat may cause deterioration of the characteristics and reliability of the capacitor. (Absolutely do not perform measurements while the cooling fan is operating, as an accurate measurement may not be performed.)

<Applicable to Temperature Characteristics U2J (7U), C0G (5C) beyond Rated Voltage of 200VDC>

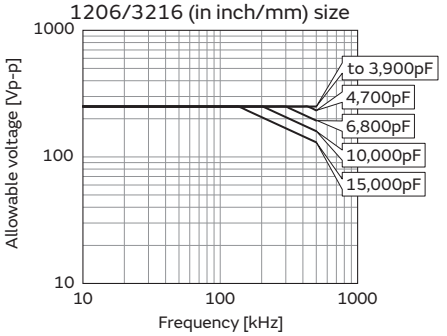
1-3. Since the self-heating is low in the low loss series, the allowable power becomes extremely high compared to the common X7R (R7) characteristics.
However, when a load with self-heating of 20°C is applied at the rated voltage, the allowable power may be exceeded. When the capacitor is used in a high-frequency voltage circuit of 1kHz or more, the frequency of the applied voltage should be less than 500kHz sine wave (less than 100kHz for a product with rated voltage of DC3.15kV), to limit the voltage load so that the load remains within the derating shown in the following figure. In the case of non-sine wave, high-frequency components exceeding the fundamental frequency may be included. In such a case, please contact Murata. The excessive generation of heat may cause deterioration of the characteristics and reliability of the capacitor.
(Absolutely do not perform measurements while the cooling fan is operating, as an accurate measurement may not be performed.)

The surface temperature of the capacitor: 125°C or less
(including self-heating)

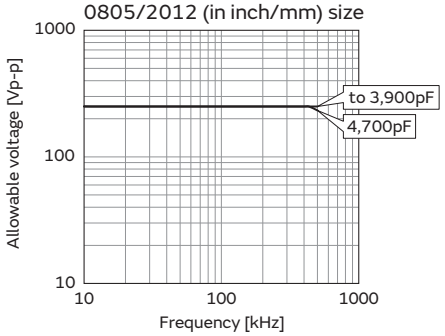
C0G (5C) char., Rated Voltage: DC200V



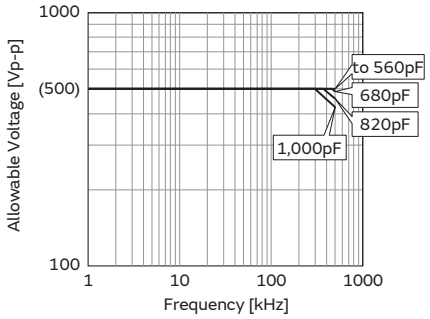
C0G (5C) char., Rated Voltage: DC250V
1206/3216 (in inch/mm) size



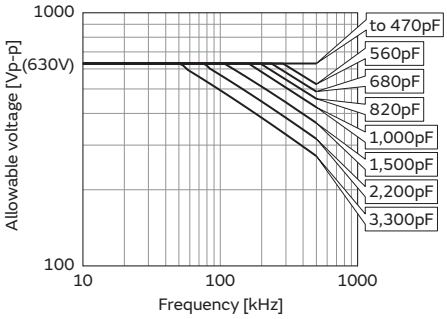
C0G (5C) char., Rated Voltage: DC250V
0805/2012 (in inch/mm) size



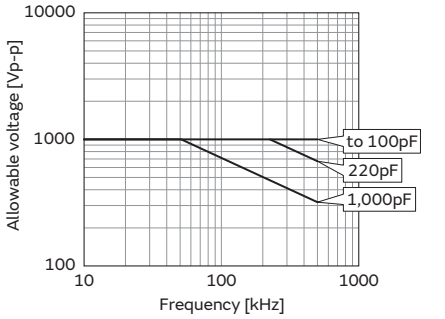
C0G (5C) char., Rated Voltage: DC500V



C0G char., Rated Voltage: DC630V



C0G char., Rated Voltage: DC1kV



The sine-wave frequency VS allowable voltage

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⚠Caution

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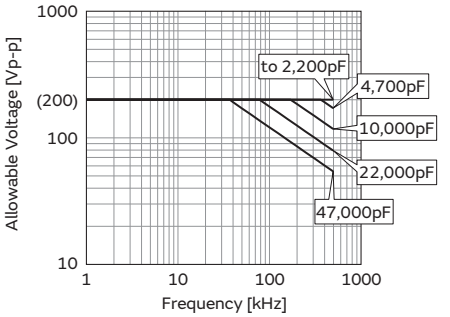
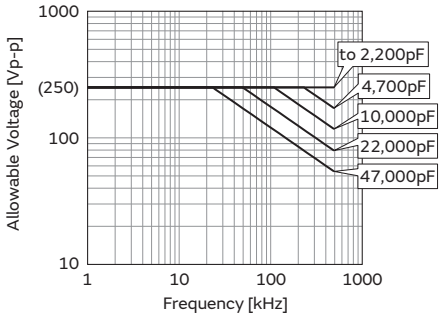
The surface temperature of the capacitor: 125°C or less
(including self-heating)

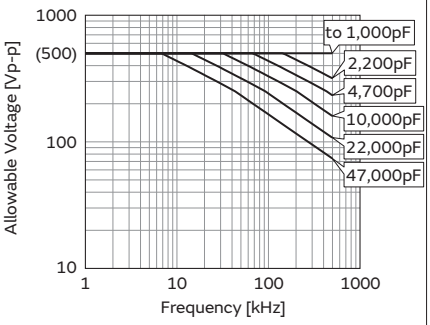
U2J (7U) char., Rated Voltage: DC200V



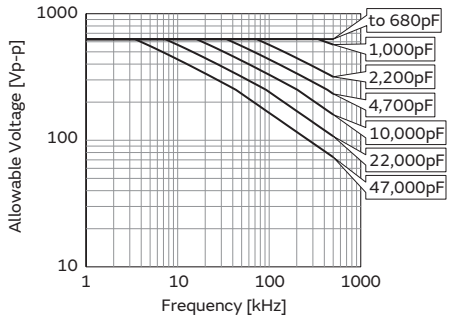
U2J (7U) char., Rated Voltage: DC250V



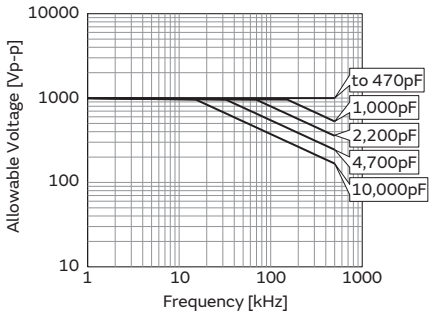
U2J (7U) char., Rated Voltage: DC500V



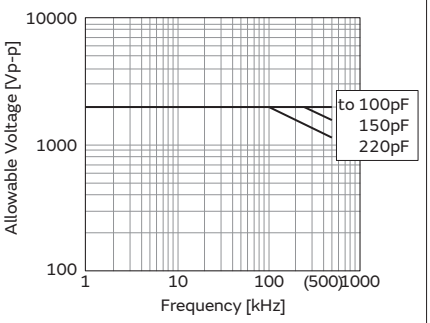
U2J (7U) char., Rated Voltage: DC630V



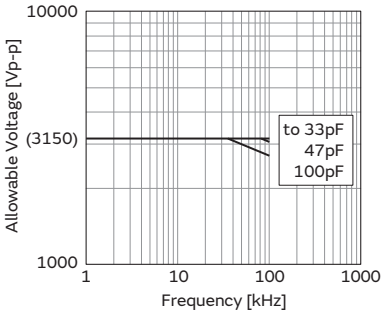
U2J (7U) char., Rated Voltage: DC1kV



U2J (7U) char., Rated Voltage: DC2kV



U2J (7U) char., Rated Voltage: DC3.15kV



The sine-wave frequency VS allowable voltage

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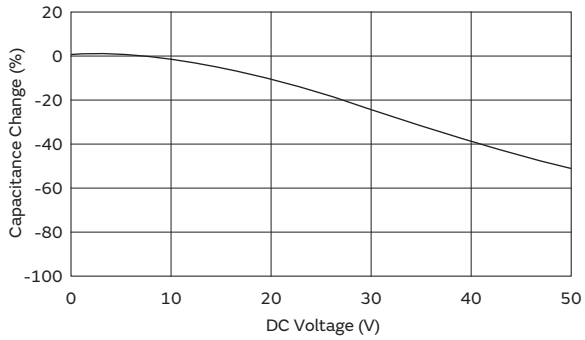
5. DC Voltage and AC Voltage Characteristics

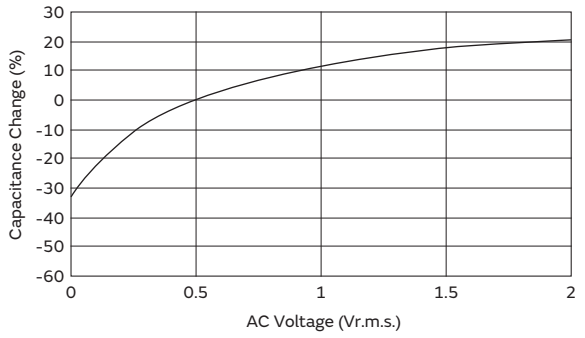
1. The capacitance value of a high dielectric constant type capacitor changes depending on the DC voltage applied. Please consider the DC voltage characteristics when a capacitor is selected for use in a DC circuit.
   1-1. The capacitance of ceramic capacitors may change sharply depending on the applied voltage (see figure). Please confirm the following in order to secure the capacitance.
   (1) Determine whether the capacitance change caused by the applied voltage is within the allowed range.
   (2) In the DC voltage characteristics, the rate of capacitance change becomes larger as voltage increases, even if the applied voltage is below the rated voltage. When a high dielectric constant type capacitor is used in a circuit that requires a tight (narrow) capacitance tolerance (e.g., a time constant circuit), please carefully consider the voltage characteristics, and confirm the various characteristics in the actual operating conditions of the system.

[Example of DC Voltage Characteristics]
Sample: X7R (R7) Characteristics 0.1μF,
Rated Voltage 50VDC



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

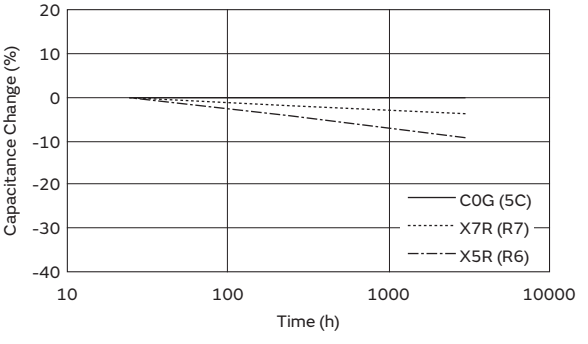
[Example of AC Voltage Characteristics]
Sample: X7R (R7) Characteristics 10μF,
Rated Voltage 6.3VDC



6. Capacitance Aging

1. The high dielectric constant type capacitors have an Aging characteristic in which the capacitance value decreases with the passage of time.
   When you use high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance (e.g., a time-constant circuit), please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. In addition, check capacitors using your actual appliances at the intended environment and operating conditions.

[Example of Change Over Time (Aging Characteristics)]



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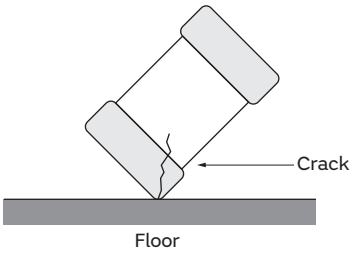
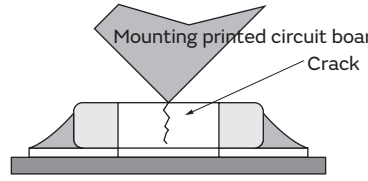
7. Vibration and Shock

1. Please confirm the kind of vibration and/or shock, its condition, and any generation of resonance.
   Please mount the capacitor so as not to generate resonance, and do not allow any impact on the terminals.
2. Mechanical shock due to being dropped may cause damage or a crack in the dielectric material of the capacitor.
   Do not use a dropped capacitor because the quality and reliability may be deteriorated.



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

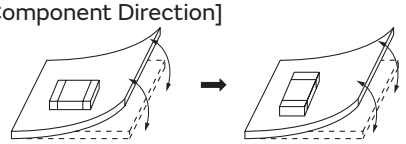


Soldering and Mounting

1. Mounting Position

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

[Component Direction]

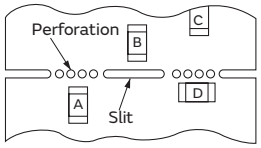


Locate chip horizontal to the direction in which stress acts.

[Chip Mounting Close to Board Separation Point]

It is effective to implement the following measures, to reduce stress in separating the board.
It is best to implement all of the following three measures; however, implement as many measures as possible to reduce stress.

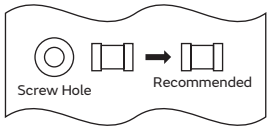
Contents of Measures	Stress Level
(1) Turn the mounting direction of the component parallel to the board separation surface.	A > D *1
(2) Add slits in the board separation part.	A > B
(3) Keep the mounting position of the component away from the board separation surface.	A > C



*1 A > D is valid when stress is added vertically to the perforation as with Hand Separation.
If a Cutting Disc is used, stress will be diagonal to the PCB, therefore A > D is invalid.

[Mounting Capacitors Near Screw Holes]

When a capacitor is mounted near a screw hole, it may be affected by the board deflection that occurs during the tightening of the screw. Mount the capacitor in a position as far away from the screw holes as possible.



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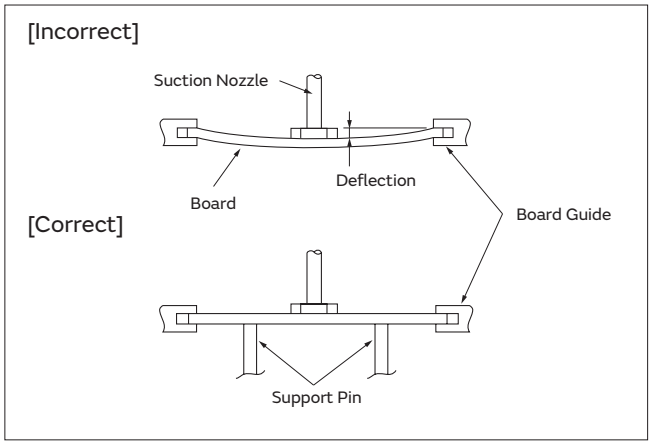
2. Information before Mounting

1. Do not re-use capacitors that were removed from the equipment.
2. Confirm capacitance characteristics under actual applied voltage.
3. Confirm the mechanical stress under actual process and equipment use.
4. Confirm the rated capacitance, rated voltage and other electrical characteristics before assembly.
5. Prior to use, confirm the solderability of capacitors that were in long-term storage.
6. Prior to measuring capacitance, carry out a heat treatment for capacitors that were in long-term storage.
7. The use of Sn-Zn based solder will deteriorate the reliability of the MLCC.
   Please contact our sales representative or product engineers on the use of Sn-Zn based solder in advance.
8. We have also produced a DVD which shows a summary of our recommendations, regarding the precautions for mounting. Please contact our sales representative to request the DVD.

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

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



2. Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes greater force upon the chip during mounting, causing cracked chips. Also, the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked, and replaced periodically.

<Applicable to ZRB Series>

3. To adjust the inspection tolerance for automated appearance sorting machine of mounting position, because ZRB series are easier to shift the mounting position than standard MLCC.
4. To check the overturn and reverse of chip.
5. To control mounting speed carefully, because ZRB series is heavier than standard MLCC.

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4-1. Reflow Soldering

1. When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB. Preheating conditions are shown in table 1. It is required to keep the temperature differential between the solder and the components surface (ΔT) as small as possible.
2. When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and the solvent within the range shown in table 1.

Table 1

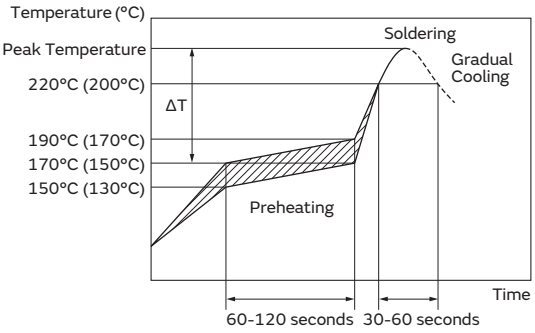
Seies	Chip Dimension Code (L/W)	Temperature Differential
GRM/GJM/GQM/GR3/ GRJ/KRM/LLR	**02/03/15/18/21/31**	ΔT≦190°C
LLL	**02/03/15/18/1U/21/31**	
ZRB	**15/18**	
GR3/GRJ/GRM/KR3/KRM	**32/43/55**	ΔT≦130°C
LLA/LLM	**18/21/31**	
GQM	**22**	

Recommended Conditions

	Pb-Sn Solder	Lead Free Solder
Peak Temperature	230 to 250°C	240 to 260°C
Atmosphere	Air	Air or N_2

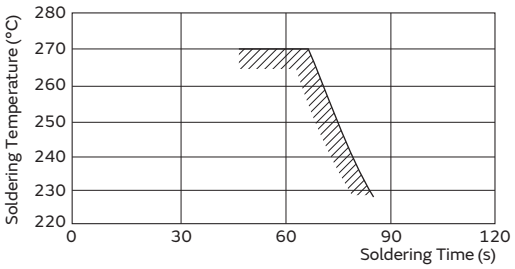
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Reflow Soldering]



Temperature
Incase of Lead Free Solder
( ): In case of Pb-Sn Solder

[Allowable Reflow Soldering Temperature and Time]



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

3. When a capacitor is mounted at a temperature lower than the peak reflow temperature recommended by the solder manufacturer, the following quality problems can occur. Consider factors such as the placement of peripheral components and the reflow temperature setting to prevent the capacitor's reflow temperature from dropping below the peak temperature specified. Be sure to evaluate the mounting situation beforehand and verify that none of the following problems occur.
   - Drop in solder wettability
   - Solder voids
   - Possible occurrence of whiskering
   - Drop in bonding strength
   - Drop in self-alignment properties
   - Possible occurrence of tombstones and/or shifting on the land patterns of the circuit board

Inverting the PCB

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

4. Optimum Solder Amount for Reflow Soldering
   4-1. Overly thick application of solder paste results in a excessive solder fillet height.
   This makes the chip more susceptible to mechanical and thermal stress on the board and may cause the chips to crack.
   4-2. Too little solder paste results in a lack of adhesive strength on the termination, which may result in chips breaking loose from the PCB.
   4-3. Please confirm that solder has been applied smoothly to the termination.

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⚠Caution

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4-2. Flow Soldering

1. Do not apply flow soldering to chips not listed in table 2.

Table 2

Seies	Chip Dimension Code (L/W)	Temperature Differential
GR3/GRM	18/21/31	ΔT≦150°C
GQM	18/21	
LLL	21/31	
GRJ	18/21/31	

2. When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the components. In order to prevent mechanical damage to the components, preheating is required for both of the components and the PCB. Preheating conditions are shown in table 2. It is required to keep the temperature differential between the solder and the components surface (ΔT) as low as possible.
3. Excessively long soldering time or high soldering temperature can result in leaching of the terminations, causing poor adhesion or a reduction in capacitance value due to loss of contact between the inner electrodes and terminations.
4. When components are immersed in solvent after mounting, be sure to maintain the temperature differential (ΔT) between the component and solvent within the range shown in the table 2.

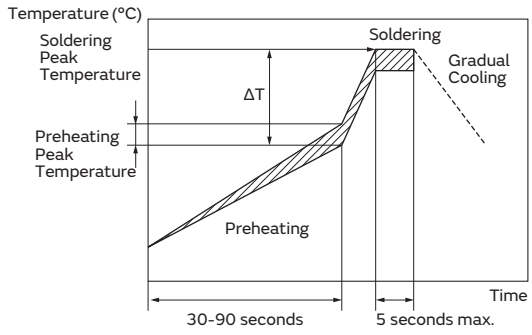
Recommended Conditions

	Pb-Sn Solder	Lead Free Solder
Preheating Peak Temperature	90 to 110°C	100 to 120°C
Soldering Peak Temperature	240 to 250°C	250 to 260°C
Atmosphere	Air	Air or N_2

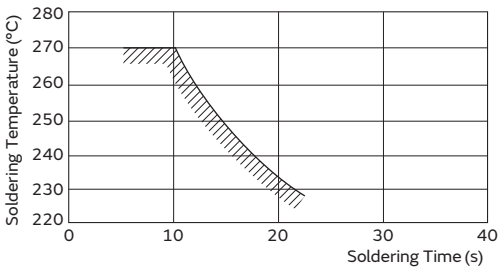
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

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

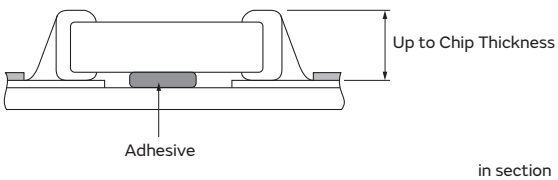
[Standard Conditions for Flow Soldering]



[Allowable Flow Soldering Temperature and Time]



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



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4-3. Correction of Soldered Portion

When sudden heat is applied to the capacitor, distortion caused by the large temperature difference occurs internally, and can be the cause of cracks. Capacitors also tend to be affected by mechanical and thermal stress depending on the board preheating temperature or the soldering fillet shape, and can be the cause of cracks. Please refer to "1. PCB Design" or "3. Optimum solder amount" for the solder amount and the fillet shapes.
Do not correct with a soldering iron for ZRB series.
Correction with a soldering iron for ZRB series may cause loss suppress acoustic noise, because the solder amount become excessive.

1. Correction with a Soldering Iron
   1-1. In order to reduce damage to the capacitor, be sure to preheat the capacitor and the mounting board. Preheat to the temperature range shown in Table 3. A hot plate, hot air type preheater, etc. can be used for preheating.
   1-2. After soldering, do not allow the component/PCB to cool down rapidly.
   1-3. Perform the corrections with a soldering iron as quickly as possible. If the soldering iron is applied too long, there is a possibility of causing solder leaching on the terminal electrodes, which will cause deterioration of the adhesive strength and other problems.

Table 3

Seies	Chip Dimension Code (L/W)	Temperature of Soldering Iron Tip	Preheating Temperature	Temperature Differential (ΔT)	Atmosphere
GJM/GQM/GR3/GRJ/GRM	**03/15/18/21/31**	350°C max.	150°C min.	ΔT≦190°C	Air
GRJ/GRM	**32/43/55**	280°C max.	150°C min.	ΔT≦130°C	Air
GQM	**22**				

*Applicable for both Pb-Sn and Lead Free Solder.
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu
*Please manage ΔT in the temperature of soldering iron and the preheating temperature.

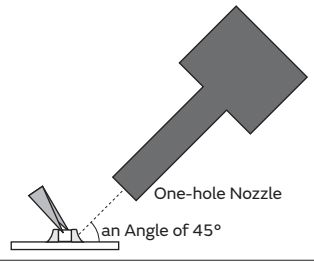
2. Correction with Spot Heater
   Compared to local heating with a soldering iron, hot air heating by a spot heater heats the overall component and board, therefore, it tends to lessen the thermal shock. In the case of a high density mounted board, a spot heater can also prevent concerns of the soldering iron making direct contact with the component.
   2-1. If the distance from the hot air outlet of the spot heater to the component is too close, cracks may occur due to thermal shock. To prevent this problem, follow the conditions shown in Table 4.

Table 4

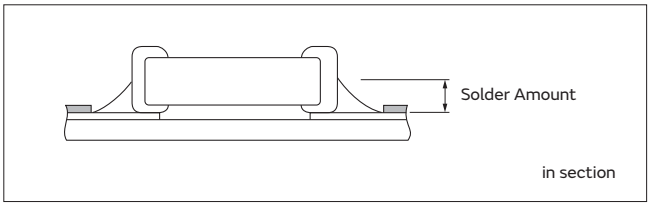
Distance	5mm or more
Hot Air Application Angle	45° *Figure 1
Hot Air Temperature Nozzle Outlet	400°C max.
Application Time	Less than 10 seconds (1206 (3216 in mm) size or smaller)
	Less than 30 seconds (1210 (3225 in mm) size or larger)

   2-2. In order to create an appropriate solder fillet shape, it is recommended that hot air be applied at the angle shown in Figure 1.

[Figure 1]



3. Optimum solder amount when re-working with a soldering iron
   3-1. If the solder amount is excessive, the risk of cracking is higher during board bending or any other stressful condition.
   Too little solder amount results in a lack of adhesive strength on the termination, which may result in chips breaking loose from the PCB.
   Please confirm that solder has been applied smoothly and rising to the end surface of the chip.



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3-2. A soldering iron with a tip of ø3mm or smaller should be used. It is also necessary to keep the soldering iron from touching the components during the re-work.

3-3. Solder wire with ø0.5mm or smaller is required for soldering.

<Applicable to KR3/KRM Series>

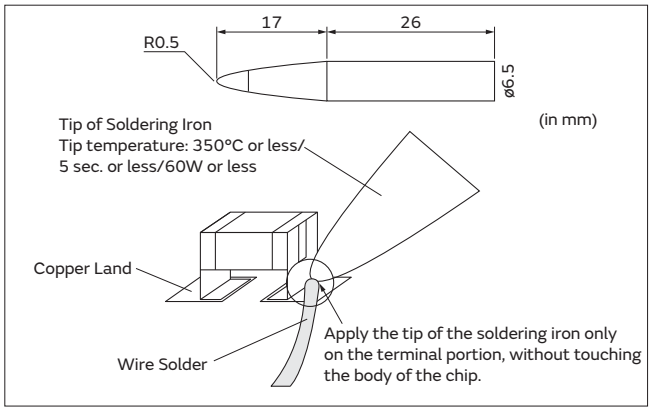
4. For the shape of the soldering iron tip, refer to the figure on the right.
Regarding the type of solder, use a wire diameter of ø0.5mm or less (rosin core wire solder).

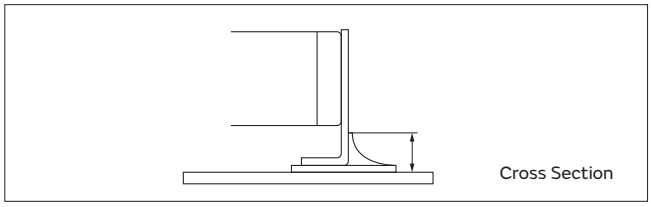
4-1. How to Apply the Soldering Iron
Apply the tip of the soldering iron against the lower end of the metal terminal.

1) In order to prevent cracking caused by sudden heating of the ceramic device, do not touch the ceramic base directly.

2) In order to prevent deviations and dislocating of the chip, do not touch the junction of the chip and the metal terminal, and the metal portion on the outside directly.

4-2. Appropriate Amount of Solder
The amount of solder for corrections by soldering iron, should be lower than the height of the lower side of the chip.





5. Washing

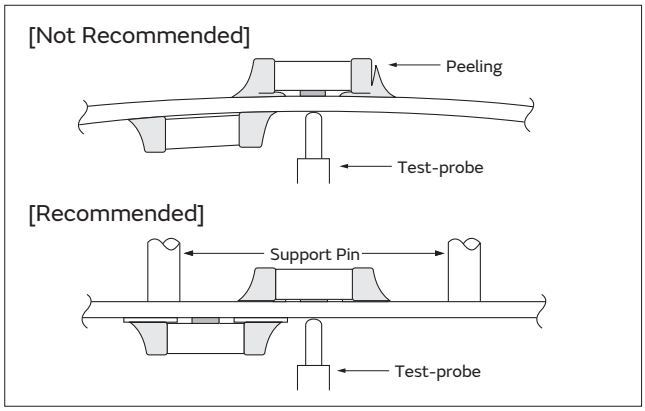
Excessive ultrasonic oscillation during cleaning can cause the PCBs to resonate, resulting in cracked chips or broken solder joints. Take note not to vibrate PCBs.

6. Electrical Test on Printed Circuit Board

1. Confirm position of the support pin or specific jig, when inspecting the electrical performance of a capacitor after mounting on the printed circuit board.

1-1. Avoid bending the printed circuit board by the pressure of a test-probe, etc.
The thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints. Provide support pins on the back side of the PCB to prevent warping or flexing. Install support pins as close to the test-probe as possible.

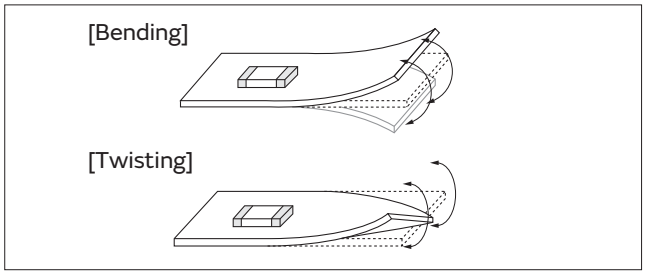
1-2. Avoid vibration of the board by shock when a test-probe contacts a printed circuit board.



7. Printed Circuit Board Cropping

1. After mounting a capacitor on a printed circuit board, do not apply any stress to the capacitor that causes bending or twisting the board.

1-1. In cropping the board, the stress as shown at right may cause the capacitor to crack.
Cracked capacitors may cause deterioration of the insulation resistance, and result in a short.
Avoid this type of stress to a capacitor.



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⚠Caution

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2. Check the cropping method for the printed circuit board in advance.

2-1. Printed circuit board cropping shall be carried out by using a jig or an apparatus (Disc separator, router type separator, etc.) to prevent the mechanical stress that can occur to the board.

Board Separation Method	Hand Separation Nipper Separation	(1) Board Separation Jig	Board Separation Apparatus	
			(2) Disc Separator	(3) Router Type Separator
Level of stress on board	High	Medium	Medium	Low
Recommended	×	△*	△*	○
Notes	Hand and nipper separation apply a high level of stress. Use another method.	· Board handling · Board bending direction · Layout of capacitors	· Board handling · Layout of slits · Design of V groove · Arrangement of blades · Controlling blade life	Board handling

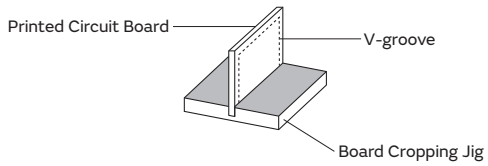
* When a board separation jig or disc separator is used, if the following precautions are not observed, a large board deflection stress will occur and the capacitors may crack. Use router type separator if at all possible.

(1) Example of a suitable jig

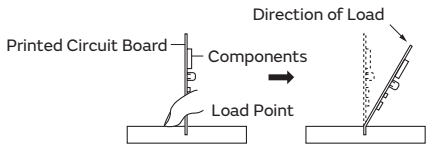
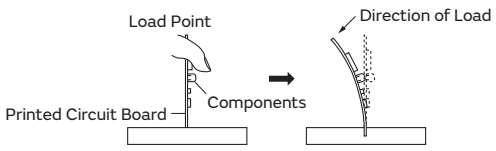
[In the case of Single-side Mounting]

An outline of the board separation jig is shown as follows. Recommended example: Stress on the component mounting position can be minimized by holding the portion close to the jig, and bend in the direction towards the side where the capacitors are mounted. Not recommended example: The risk of cracks occurring in the capacitors increases due to large stress being applied to the component mounting position, if the portion away from the jig is held and bent in the direction opposite the side where the capacitors are mounted.

[Outline of Jig]



Hand Separation

Recommended	Not Recommended
	

[In the case of Double-sided Mounting]

Since components are mounted on both sides of the board, the risk of cracks occurring can not be avoided with the above method.
Therefore, implement the following measures to prevent stress from being applied to the components.

(Measures)

(1) Consider introducing a router type separator.
If it is difficult to introduce a router type separator, implement the following measures. (Refer to item 1. Mounting Position)

(2) Mount the components parallel to the board separation surface.

(3) When mounting components near the board separation point, add slits in the separation position near the component.

(4) Keep the mounting position of the components away from the board separation point.

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⚠Caution

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(2) Example of a Disc Separator

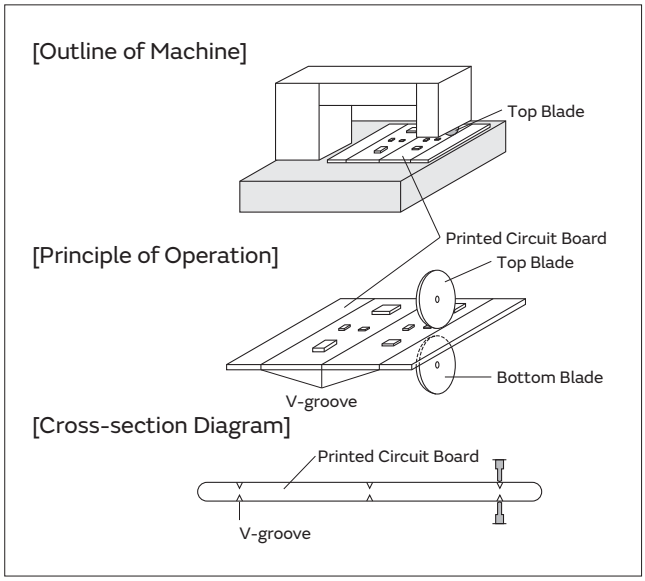
An outline of a disc separator is shown as follows. As shown in the Principle of Operation, the top blade and bottom blade are aligned with the V-grooves on the printed circuit board to separate the board.

In the following case, board deflection stress will be applied and cause cracks in the capacitors.

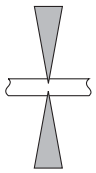
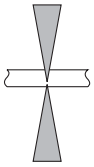
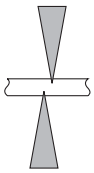
(1) When the adjustment of the top and bottom blades are misaligned, such as deviating in the top-bottom, left-right or front-rear directions

(2) The angle of the V groove is too low, depth of the V groove is too shallow, or the V groove is misaligned top-bottom

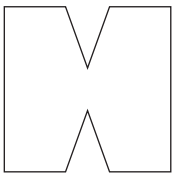
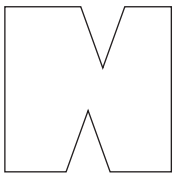
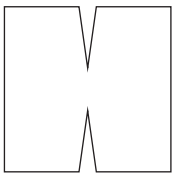
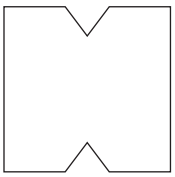
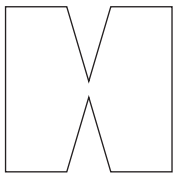
IF V groove is too deep, it is possible to brake when you handle and carry it. Carefully design depth of the V groove with consideration about strength of material of the printed circuit board.



Disc Separator

Recommended	Not Recommended		
	Top-bottom Misalignment	Left-right Misalignment	Front-rear Misalignment
			
Top Blade Bottom Blade	Top Blade Bottom Blade	Top Blade Bottom Blade	Top Blade Bottom Blade

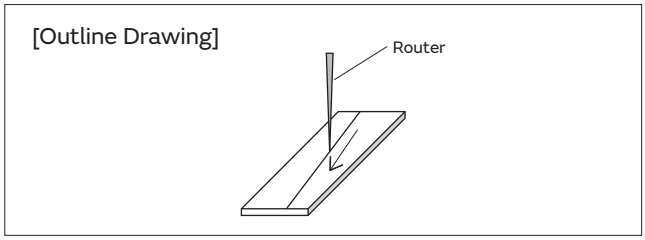
V-groove Design

Example of Recommended V-groove Design	Not Recommended			
	Left-right Misalignment	Low-Angle	Depth too Shallow	Depth too Deep
				

(3) Example of Router Type Separator

The router type separator performs cutting by a router rotating at a high speed. Since the board does not bend in the cutting process, stress on the board can be suppressed during board separation.

When attaching or removing boards to/from the router type separator, carefully handle the boards to prevent bending.



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⚠Caution

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8. Assembly

1. Handling

If a board mounted with capacitors is held with one hand, the board may bend. Firmly hold the edges of the board with both hands when handling.

If a board mounted with capacitors is dropped, cracks may occur in the capacitors.

Do not use dropped boards, as there is a possibility that the quality of the capacitors may be impaired.

2. Attachment of Other Components

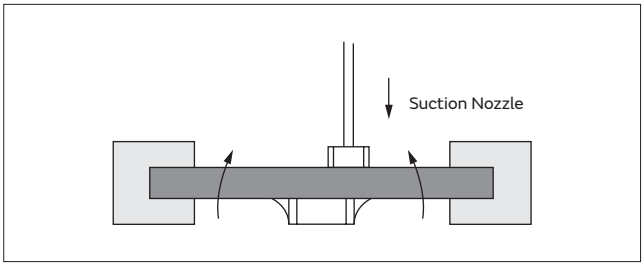
2-1. Mounting of Other Components

Pay attention to the following items, when mounting other components on the back side of the board after capacitors have been mounted on the opposite side.

When the bottom dead point of the suction nozzle is set too low, board deflection stress may be applied to the capacitors on the back side (bottom side), and cracks may occur in the capacitors.

· After the board is straightened, set the bottom dead point of the nozzle on the upper surface of the board.

· Periodically check and adjust the bottom dead point.



2-2. Inserting Components with Leads into Boards

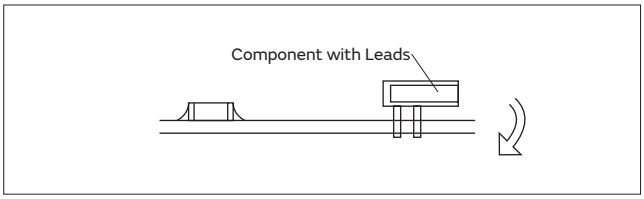
When inserting components (transformers, IC, etc.) into boards, bending the board may cause cracks in the capacitors or cracks in the solder.

Pay attention to the following.

· Increase the size of the holes to insert the leads, to reduce the stress on the board during insertion.

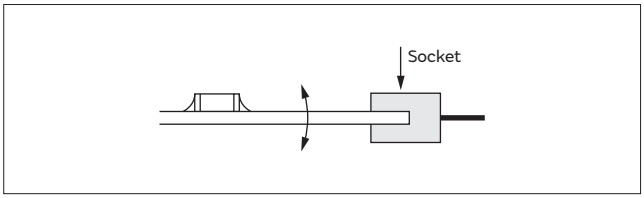
· Fix the board with support pins or a dedicated jig before insertion.

· Support below the board so that the board does not bend. When using multiple support pins on the board, periodically confirm that there is no difference in the height of each support pin.



2-3. Attaching/Removing Sockets

When the board itself is a connector, the board may bend when a socket is attached or removed. Plan the work so that the board does not bend when a socket is attached or removed.



2-4. Tightening Screws

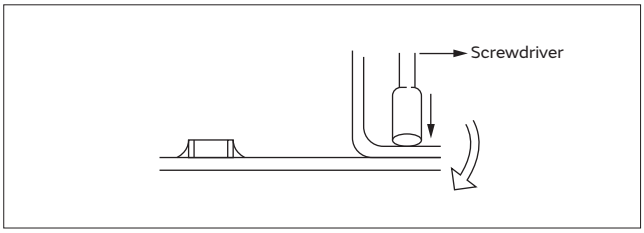
The board may be bent, when tightening screws, etc. during the attachment of the board to a shield or chassis.

Pay attention to the following items before performing the work.

· Plan the work to prevent the board from bending.

· Use a torque screwdriver, to prevent over-tightening of the screws.

· The board may bend after mounting by reflow soldering, etc. Please note, as stress may be applied to the chips by forcibly flattening the board when tightening the screws.



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⚠Caution

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<Applicable to GMA or GMD Series>

9. Die Bonding/Wire Bonding

1. Die Bonding of Capacitors

1-1. Use the following materials for the Brazing alloys:
Au-Sn (80/20) 300 to 320 °C in N_2 atmosphere

1-2. Mounting

(1) Control the temperature of the substrate so it matches the temperature of the brazing alloy.

(2) Place the brazing alloy on the substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation within 1 minute.

2. Wire Bonding

2-1. Wire
Gold wire: 25 micro m (0.001 inch) diameter

2-2. Bonding

(1) Thermo compression, ultrasonic ball bonding.

(2) Required stage temperature: 150 to 200 °C

(3) Required wedge or capillary weight: 0.2N to 0.5N

(4) Bond the capacitor and base substrate or other devices with gold wire.

Other

1. Under Operation of Equipment

1-1. Do not touch a capacitor directly with bare hands during operation in order to avoid the danger of an electric shock.

1-2. Do not allow the terminals of a capacitor to come in contact with any conductive objects (short-circuit). Do not expose a capacitor to a conductive liquid, including any acid or alkali solutions.

1-3. Confirm the environment in which the equipment will operate is under the specified conditions.
Do not use the equipment under the following environments.

(1) Being spattered with water or oil.

(2) Being exposed to direct sunlight.

(3) Being exposed to ozone, ultraviolet rays, or radiation.

(4) Being exposed to toxic gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.)

(5) Any vibrations or mechanical shocks exceeding the specified limits.

(6) Moisture condensing environments.

1-4. Use damp proof countermeasures if using under any conditions that can cause condensation.

2. Other

2-1. In an Emergency

(1) If the equipment should generate smoke, fire, or smell, immediately turn off or unplug the equipment.
If the equipment is not turned off or unplugged, the hazards may be worsened by supplying continuous power.

(2) In this type of situation, do not allow face and hands to come in contact with the capacitor or burns may be caused by the capacitor's high temperature.

2-2. Disposal of Waste
When capacitors are disposed of, they must be burned or buried by an industrial waste vendor with the appropriate licenses.

2-3. Circuit Design

(1) Addition of Fail Safe Function
Capacitors that are cracked by dropping or bending of the board may cause deterioration of the insulation resistance, and result in a short.
If the circuit being used may cause an electrical shock, smoke or fire when a capacitor is shorted, be sure to install fail-safe functions, such as a fuse, to prevent secondary accidents.

(2) Capacitors used to prevent electromagnetic interference in the primary AC side circuit, or as a connection/insulation, must be a safety standard certified product, or satisfy the contents stipulated in the Electrical Appliance and Material Safety Law. Install a fuse for each line in case of a short.

(3) The GJM, GMA, GMD, GQM, GR3, GRJ, GRM, KR3, KRM, LLA, LLL, LLM, LLR and ZRB series are not safety standard certified products.

2-4. Remarks
Failure to follow the cautions may result, worst case, in a short circuit and smoking when the product is used.
The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions.
Select optimum conditions for operation as they determine the reliability of the product after assembly.
The data herein are given in typical values, not guaranteed ratings.

Notice

Rating

1. Operating Temperature

1. The operating temperature limit depends on the capacitor.
   1-1. Do not apply temperatures exceeding the maximum operating temperature.
   It is necessary to select a capacitor with a suitable rated temperature that will cover the operating temperature range.
   It is also necessary to consider the temperature distribution in equipment and the seasonal temperature variable factor.
   1-2. Consider the self-heating factor of the capacitor.
   The surface temperature of the capacitor shall not exceed the maximum operating temperature including self-heating.

2. Atmosphere Surroundings (gaseous and liquid)

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

3. Piezo-electric Phenomenon

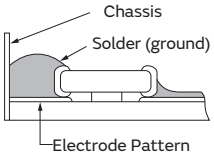
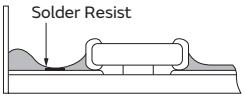
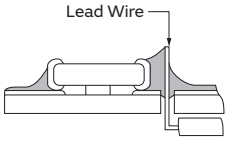
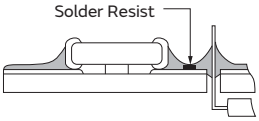
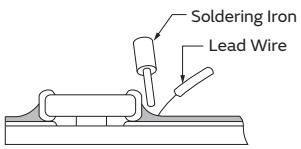
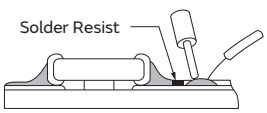
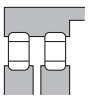
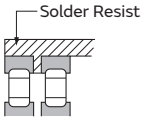
1. When using high dielectric constant type capacitors in AC or pulse circuits, the capacitor itself vibrates at specific frequencies and noise may be generated.
   Moreover, when the mechanical vibration or shock is added to the capacitor, noise may occur.

Soldering and Mounting

1. PCB Design

1. Notice for Pattern Forms
   1-1. Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate.
   They are also more sensitive to mechanical and thermal stresses than leaded components.
   Excess solder fillet height can multiply these stresses and cause chip cracking. When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.
   1-2. There is a possibility of chip cracking caused by PCB expansion/contraction with heat, because stress on a chip is different depending on PCB material and structure. When the thermal expansion coefficient greatly differs between the board used for mounting and the chip, it will cause cracking of the chip due to the thermal expansion and contraction.
   When capacitors are mounted on a fluorine resin printed circuit board or on a single-layered glass epoxy board, it may also cause cracking of the chip for the same reason.

Pattern Forms

	Prohibited	Correct
Placing Close to Chassis		
Placing of Chip Components and Leaded Components		
Placing of Leaded Components after Chip Component		
Lateral Mounting		

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Notice

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2. Land Dimensions

2-1. Chip capacitors can be cracked due to the stress of PCB bending, etc. if the land area is larger than needed and has an excess amount of solder.
Please refer to the land dimensions in table 1 for flow soldering, table 2 for reflow soldering, table 3 for reflow soldering for ZRB Series, table 4 for reflow soldering for LLA Series, table 5 for reflow soldering for LLM Series.
Please confirm the suitable land dimension by evaluating of the actual SET / PCB.

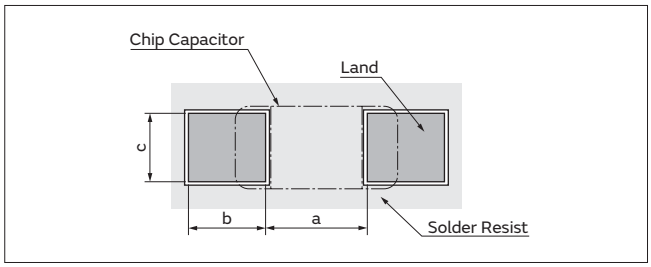

Table 1 Flow Soldering Method

Seies	Chip Dimension Code (L/W)	Chip (L×W)	a	b	c
GQM/GR3/GRJ/GRM	18	1.6×0.8	0.6 to 1.0	0.8 to 0.9	0.6 to 0.8
GQM/GR3/GRJ/GRM	21	2.0×1.25	1.0 to 1.2	0.9 to 1.0	0.8 to 1.1
GR3/GRJ/GRM	31	3.2×1.6	2.2 to 2.6	1.0 to 1.1	1.0 to 1.4
LLL	21	1.25×2.0	0.4 to 0.7	0.5 to 0.7	1.4 to 1.8
LLL	31	1.6×3.2	0.6 to 1.0	0.8 to 0.9	2.6 to 2.8

Flow soldering can only be used for products with a chip size from 1.6x0.8mm to 3.2x1.6mm.

(in mm)

Table 2 Reflow Soldering Method

Seies	Chip Dimension Code (L/W)	Chip (L×W)	a	b	c
GJM/GRM	02	0.4×0.2	0.16 to 0.2	0.12 to 0.18	0.2 to 0.23
GJM/GRM	03	0.6×0.3 (±0.03)	0.2 to 0.25	0.2 to 0.3	0.25 to 0.35
		0.6×0.3 (±0.05)	0.2 to 0.25	0.25 to 0.35	0.3 to 0.4
		0.6×0.3 (±0.09)	0.23 to 0.3	0.25 to 0.35	0.3 to 0.4
GJM/GRM	15	1.0×0.5 (within ±0.10)	0.3 to 0.5	0.35 to 0.45	0.4 to 0.6
		1.0×0.5 (±0.15/±0.20)	0.4 to 0.6	0.4 to 0.5	0.5 to 0.7
GQM/GR3/GRJ/GRM	18	1.6×0.8 (within ±0.10)	0.6 to 0.8	0.6 to 0.7	0.6 to 0.8
		1.6×0.8 (±0.15/±0.20)	0.7 to 0.9	0.7 to 0.8	0.8 to 1.0
GQM	21	2.0×1.25	1.0 to 1.2	0.6 to 0.7	0.8 to 1.1
GR3/GRJ/GRM	21	2.0×1.25 (within ±0.10)	1.2	0.6	1.25
		2.0×1.25 (±0.15)	1.2	0.6 to 0.8	1.2 to 1.4
		2.0×1.25 (±0.20)	1.0 to 1.4	0.6 to 0.8	1.2 to 1.4
GR3/GRJ/GRM	31	3.2×1.6 (within ±0.20)	1.8 to 2.0	0.9 to 1.2	1.5 to 1.7
		3.2×1.6 (±0.30)	1.9 to 2.1	1.0 to 1.3	1.7 to 1.9
GR3/GRJ/GRM	32	3.2×2.5	2.0 to 2.4	1.0 to 1.2	1.8 to 2.3
GR3/GRJ/GRM	43	4.5×3.2	3.0 to 3.5	1.2 to 1.4	2.3 to 3.0
GR3/GRJ/GRM	55	5.7×5.0	4.0 to 4.6	1.4 to 1.6	3.5 to 4.8
LLL	15	0.5×1.0	0.15 to 0.2	0.2 to 0.25	0.7 to 1.0
LLL	1U	0.6×1.0	0.20 to 0.25	0.25 to 0.35	0.7 to 1.0
LLL/LLR	18	0.8×1.6	0.2 to 0.3	0.3 to 0.4	1.4 to 1.6
LLL	21	1.25×2.0	0.4 to 0.5	0.4 to 0.5	1.4 to 1.8
LLL	31	1.6×3.2	0.6 to 0.8	0.6 to 0.7	2.6 to 2.8
GQM	22	2.8×2.8	2.2 to 2.5	0.8 to 1.0	1.9 to 2.3

(in mm)

<Applicable to Part Number KR3/KRM>

Seies	Chip Dimension Code (L/W)	Chip (L×W)	a	b	c
KRM	21	2.0×1.25	1.0 to 1.2	0.6 to 0.7	0.8 to 1.1
KRM	31	3.2×1.6	2.2 to 2.4	0.8 to 0.9	1.0 to 1.4
KR3/KRM	55	5.7×5.0	2.6	2.7	5.6

(in mm)

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