	Series	Dimensions (mm)	Capacitance Range (F)	Page
Ultra-miniaturized	GRM33	0.6 x 0.3	1pF – 1000pF	30
For General Electronics Equipment	GRM36	1.0 x 0.5	0.5pF – 1μF	7 - 9, 11, 13 - 15
	GRM39	1.6 x 0.8	0.5pF – 1μF	
	GRM40	2.0 x 1.25	0.5pF – 2μF	7 - 9, 12 - 15
	GRM42-6	3.2 x 1.6	2700pF – 10μF	7-9, 12-14, 16, 26-28
	GRM42-2	3.2 x 2.5	6800pF – 10μF	7-8, 10, 13-14, 16, 26-28
	GRM43-2	4.5 x 3.2	8200pF – 1.5μF	
	GRM44-1	5.7 x 5.0	0.012μF – 4.7μF	
Tip & Ring	GRM43-2	4.5 x 3.2	.33μF – .47μF	24 - 25
	GRM43-4	4.6 x 6.4	.47pF – 1μF	
	GRM44-1	5.7 x 5.0	.47pF – 1μF	
	GRM44	5.6 x 6.4	.47pF – 1μF	
Low Distortion Series	GRM420	1.6 x 0.8	1000pF – 0.01μF	19 - 23
	GRM425	2.0 x 1.25	1000pF – 0.033μF	
	GRM430	3.2 x 1.6	0.018μF – 0.1μF	
	GRM435	3.2 x 2.5	0.1μF	
Smoothing Series	GRM220	1.6 x 0.8	1μF	17 - 18
	GRM225	2.0 x 1.25	10μF	
	GRM230	3.2 x 1.6	4.7μF – 10μF	
	GRM235	3.2 x 2.5	1μF – 47μF	
High-Voltage Type	GHM1030	3.2 x 1.6	10pF – 1000pF	44 - 47
	GHM1035	3.2 x 2.5	27pF – 82pF	
	GHM1038	4.5 x 2.0	10pF – 82pF	
	GHM1040	4.5 x 3.2	100pF – 220pF	
	GHM1525	2.0 x 1.25	1000pF – 0.01μF	
	GHM1530	3.2 x 1.6	1000pF – 0.047μF	
	GHM1535	3.2 x 2.5	0.015μF – 0.1μF	
	GHM1540	4.5 x 3.2	0.033μF – 0.22μF	
	GHM1545	5.7 x 5.0	0.15μF – 0.47μF	
AC250V Type	GHM2143	5.7 x 2.8	0.01μF – 0.047μF	48 - 51
	GHM2145	5.7 x 5.0	0.1μF	
	GHM2243	5.7 x 2.8	470pF – 4700pF	
Safety Std. Recognition	GHM3045	5.7 x 5.0	100pF – 4700pF	
	GHM3145	5.7 x 5.0	0.01μF – 0.033μF	
Array	GNM30-401	3.2 x 1.6	10pF – 0.15μF	31
Low ESL Wide Width Type	LL0306	0.8 x 1.6	2200pF – 0.068μF	32 - 33
	LL0508	1.25 x 2.0	4700pF – 0.33μF	
	LL0612	1.6 x 3.2	0.01μF – 1μF	

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
COG AND TEMPERATURE COMPENSATING TYPES
GRM36/39/40/42-6/42-2/43-2/44-1 Series

FEATURES
- Miniature size
- No Polarity
- Nickel Barrier Termination Standard – highly resistant to metal migration
- Uniform dimensions and configuration
- Suitable for reflow soldering
- GRM39, 40 and 42-6 suitable for wave soldering
- Minimum series inductance
- Tape and Reel Packaging
- Bulk Case Packaging available for GRM40 and smaller
- Wide selection of capacitance values and voltages
- Largest production capacity and volume in the world

PART NUMBERING SYSTEM

GRM40 – – – COG 101 J 050 A D

CAPACITOR TYPE AND SIZE
See below and following pages.

3-digit code appears as necessary to indicate special thickness requirements. Please consult your local sales office for details.

TEMPERATURE CHARACTERISTICS
COG
COH
P2H
R2H
S2H
T2H
U2J
SL

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For fractional values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

CAPACITANCE TOLERANCE
*= Standard
≤ 5pf:
B = ±.1pf
*C = ±.25pf
>5pf to 10pf:
B = ±.1pf
C = ±.25pf
*D = ±.5pf
>10pf:
K = ±10%
*J = ±5%
G = ±2%
F = ±1%

VOLTAGE
Identified by a three-digit number.

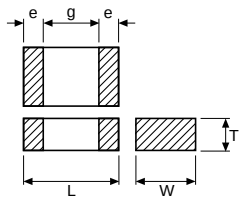
MARKING
A = Unmarked

PACKAGING

Reel Diameter/ Tape Material	Code
7″ Paper Tape	D
7″ Plastic Tape	L
13″ Paper Tape	J
13″ Plastic Tape	K
Bulk	B
Bulk Cassette	C
7″ Paper 2mm pitch	Q

See pages 115 - 118 for labeling and packaging information.

CHIP DIMENSIONS



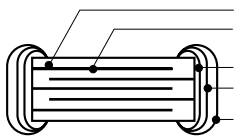
Dimensions: mm	Size	EIA Code	L Length	W Width	T Thickness	e (min.) Termination	g (min.) Insulation
	GRM36	0402	1.0 ± 0.05	0.5 ± 0.05	0.5 ± 0.05	0.15 ~ 0.3	0.4
	GRM39*	0603	1.6 ± 0.1	0.8 ± 0.1	0.8 ± 0.1	0.2 ~ 0.5	0.5
	GRM40	0805	2.0 ± 0.1	1.25 ± 0.1	0.6 ± 0.1	0.2 ~ 0.7	0.7
					0.85 ± 0.1		
					1.25 ± 0.1		
	GRM42-6	1206	3.2 ± 0.15	1.6 ± 0.15	0.85 ± 0.1	0.3 ~ 0.8	1.5
					1.15 ± 0.1		
			3.2 ± 0.2	1.6 ± 0.2	1.6 ± 0.2		
	GRM42-2	1210	3.2 ± 0.3	2.5 ± 0.2	1.15 ± 0.1	0.3 min.	1.0
					1.35 ± 0.15		
					1.8 ± 0.2		
					2.5 ± 0.2		
	GRM43-2	1812	4.5 ± 0.4	3.2 ± 0.3	2.0 max.	0.3 min.	2.0
	GRM44-1	2220	5.7 ± 0.4	5.0 ± 0.4	2.0 max.	0.3 min.	2.0

*Bulk case packaging is L = 1.6 ± 0.07, W, T = 0.8 ± 0.07.

CHIP TERMINATION DIAGRAMS

Nickel Barrier Layer (Standard)

GRM Series



*Size 0402 – Solder Plated

All products on this page are available as standard through authorized Murata Electronics Distributors.

GENERAL

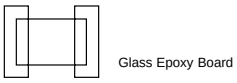
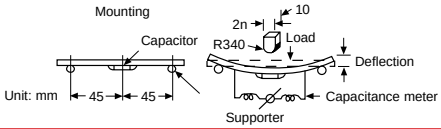
Temperature Coefficient	Temperature Range
C0G = 0 ± 30 ppm*	–55° to +125°C
C0H = 0 ± 60 ppm	–55° to +125°C
P2H = N150 ± 60 ppm	–55° to +85°C
R2H = N220 ± 60 ppm	–55° to +85°C
S2H = N330 ± 60 ppm	–55° to +85°C
T2H = N470 ± 60 ppm	–55° to +85°C
U2J = N750 ± 120 ppm	–55° to +85°C
SL = N1000 to P350	–55° to +85°C

***TC Tolerance for COG**
Refer to EIA-RS198E for other limitations

ELECTRICAL

TEST	
Capacitance & Q (Frequency & Voltage):	≤1000pF 1MHz ± 100Hz @ 1.0 ± .2 Vrms >1000pF 1kHz ± 100Hz @ 1.0 ± .2 Vrms
Q Limits	≤30pF: 400 + (20xC (pF)) >30pF: 1000 minimum
Insulation Resistance (I.R.)	100,000 megohms or 1000 megohms – mfd (whichever is less) with rated voltage applied for 2 minutes max with 50mA limiting current
Dielectric Strength (Flash)	250% of rated voltage for 5 seconds with series resistor limiting charging current to 50mA max.; 200% for 500V
Aging	Negligible

MECHANICAL

TEST	TEST METHOD	POST TEST LIMITS
Terminal Adhesion		≤0603 1.0 lbs. ≥0805 2.2 lbs. No evidence of termination peeling
Deflection		1mm deflection (Glass epoxy board) No mechanical damage Cap., DF, IR meet initial limits
Solderability	MIL-STD-202 Method 208F	Contact factory for test limits

ENVIRONMENTAL

TEST	TEST METHOD	POST TEST LIMITS
Thermal Shock (Air to Air)	MIL-STD-202, Method 107, Condition A Post thermal Shock measurement shall be taken after 24 hours stabilization.	Appearance: No visual damage ΔC: = ±2.0% or ±0.5pF (whichever is greater) Q: >30pF = 1,000 min., ≤ 30pF = 400 + [20 x C(pF)] I.R.: = 100,000MΩ min. or 1,000MΩ•μF (whichever is less)
Humidity, Steady State	Maintain the capacitor at 40 ± 2°C and 90 to 95% humidity for 500 ± 12 hours. Remove and let sit for 24 ± 2 hours at room temperature, then measure.	Appearance: No defects Capacitance: Within ±5% or ±.0.5pF (whichever is greater) Q/D.F.: 30pF and over: Q≥350; 10pf to 30pf: Q≥275+5/2C 10pf and below: Q≥200±10C I.R.: 1,000MΩ or 50MΩ F (whichever is less) C: Nominal Capacitance (pF)
Humidity Load	Apply the rated voltage at 40 ± 2°C and 90 to 95% humidity for 500 ± 12 hours. Remove and let sit for 24 ± 2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.	Appearance: No defects Capacitance: Within ±7.5% or ±.0.75pF (whichever is greater) Q/D.F.: 30pF and over: Q≥200; 30pf and below: Q≥100±10/3C I.R.: 500MΩ or 25MΩ F (whichever is less) C: Nominal Capacitance (pF)
Life Test	Apply 200% of rated voltage for 1000 ± 12 hours at maximum operating temperature; 150% for 500V. Upon completion of above test wait 24 hours prior to performing post testing.	Appearance: No defects Capacitance: ±3% or ±.3pF (whichever is greater) Q: >30pF = 500 min., ≤30pF = 200 + [10 x C(pF)] I.R.: 1,000MΩ or 50MΩ F (whichever is less) Flash: 250% rated voltage

STORAGE LIFE

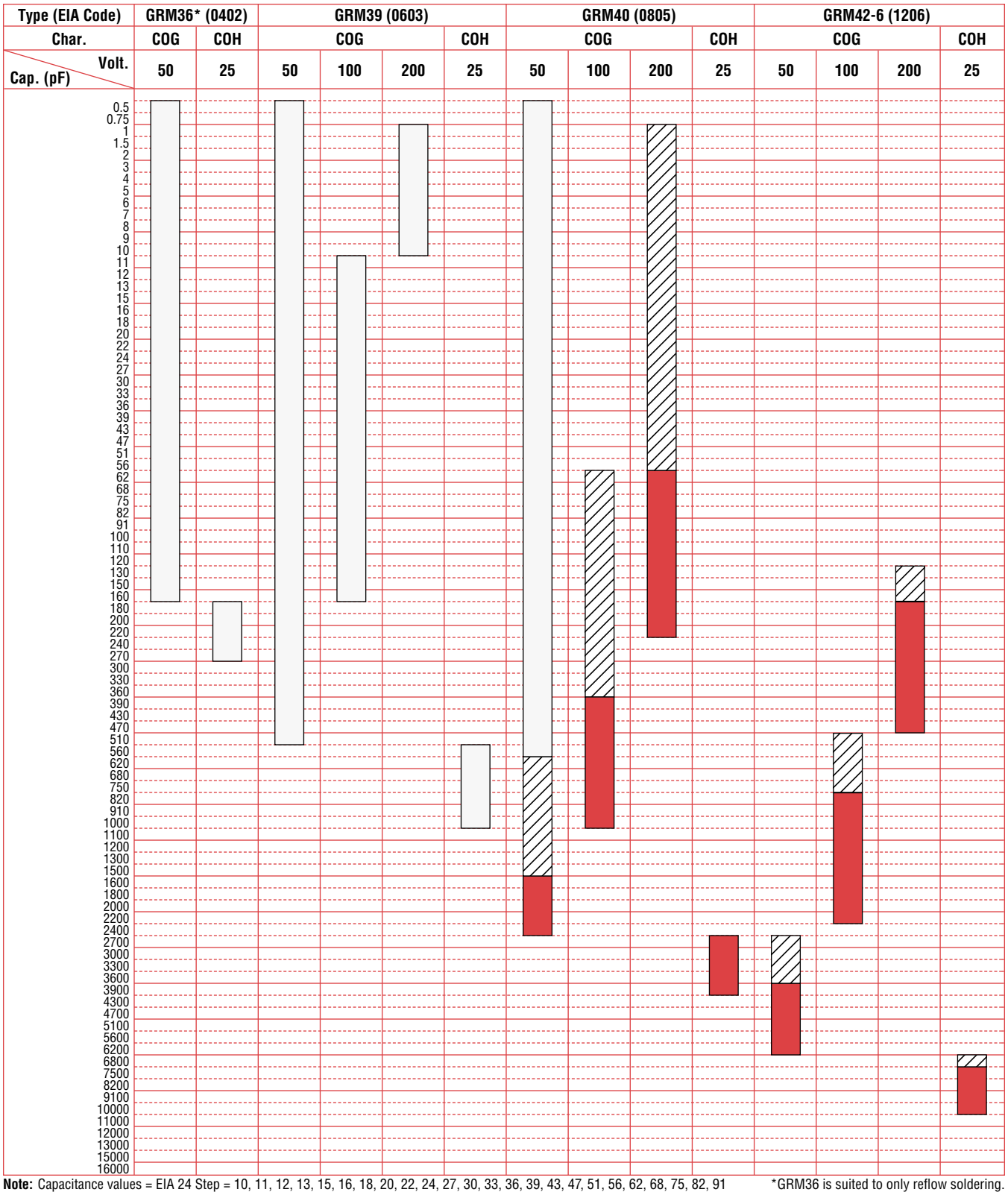
Chip component terminations should generally be protected from moisture. In addition, they should also be protected from materials containing chlorine, sulfur compounds or any harmful gases that could cause degradation of the solder.

1. All chip components, including tape and reel, should be kept in an area where the temperature is between 5°C and 40°C and where the humidity is 20% to 70%.
2. The chip components should be used within six months.
3. The solderability of the chip components should be rechecked in the event that they are not used in six months.
4. Peel strength and shelf life of tape are guaranteed for 1 year when stored under afore said conditions.

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
COG/COH TYPE–25V/50V/100V/200V

muRata
Innovator in Electronics

GRM36/39/40/42-6 Series



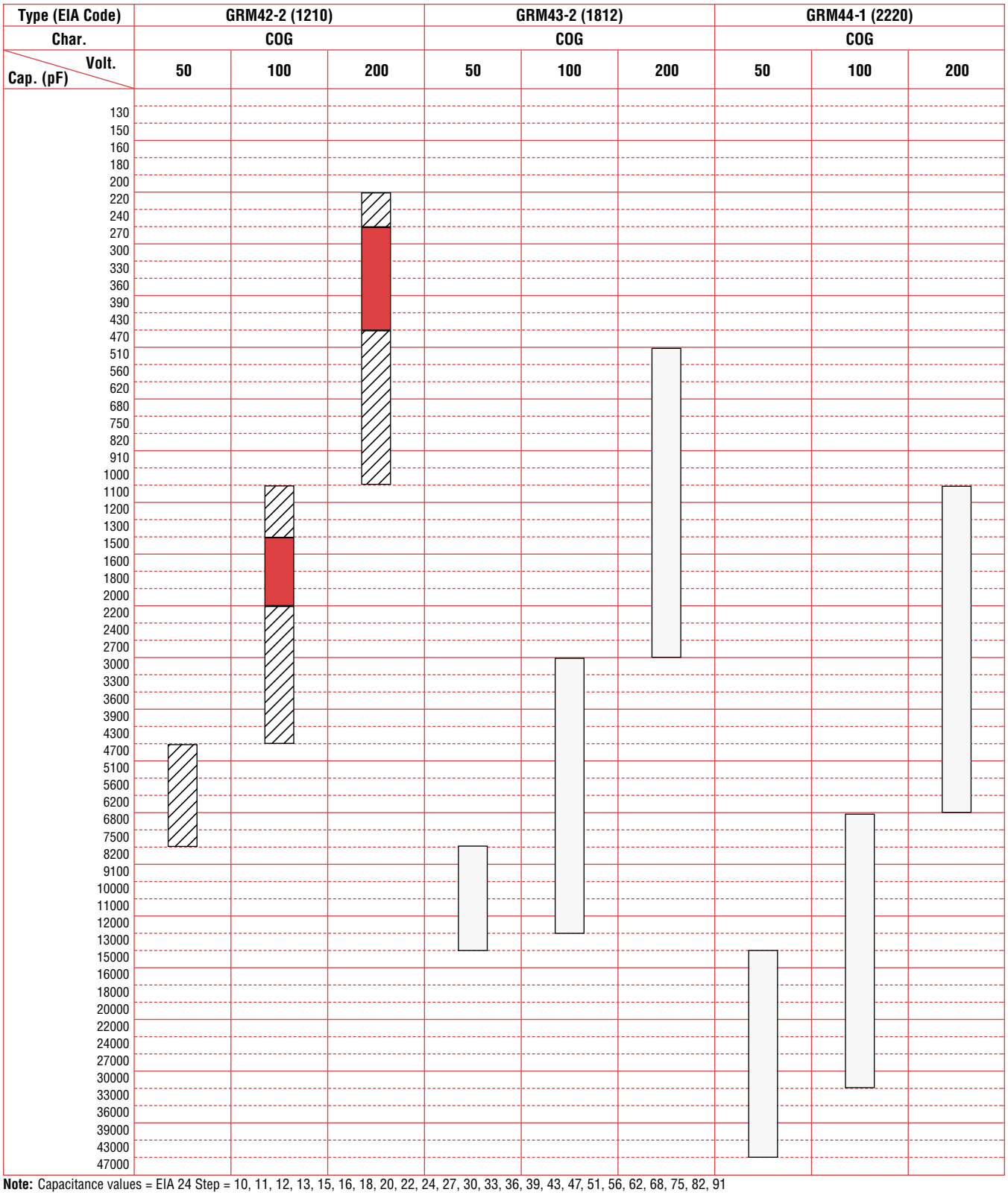
Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91

*GRM36 is suited to only reflow soldering.

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)[1]	Bulk Case (pcs./case)
GRM36	: 0.5 ± 0.05	1000	10000	50000
GRM39	: 0.8 ± 0.1[2]	1000	4000	15000
GRM40	: 0.6 ± 0.1	1000	4000	10000
	: 0.85 ± 0.1	1000	4000	—
	: 1.25 ± 0.1	1000	3000	5000
GRM42-6	: 0.85 ± 0.1	1000	4000	—
	: 1.15 ± 0.1	1000	3000	—

[1]ϕ330mm reel is available on request. [2]Bulk case packaging is T = 0.8 ± 0.07.



Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91

THICKNESS AND PACKAGING TYPES/QUANTITY

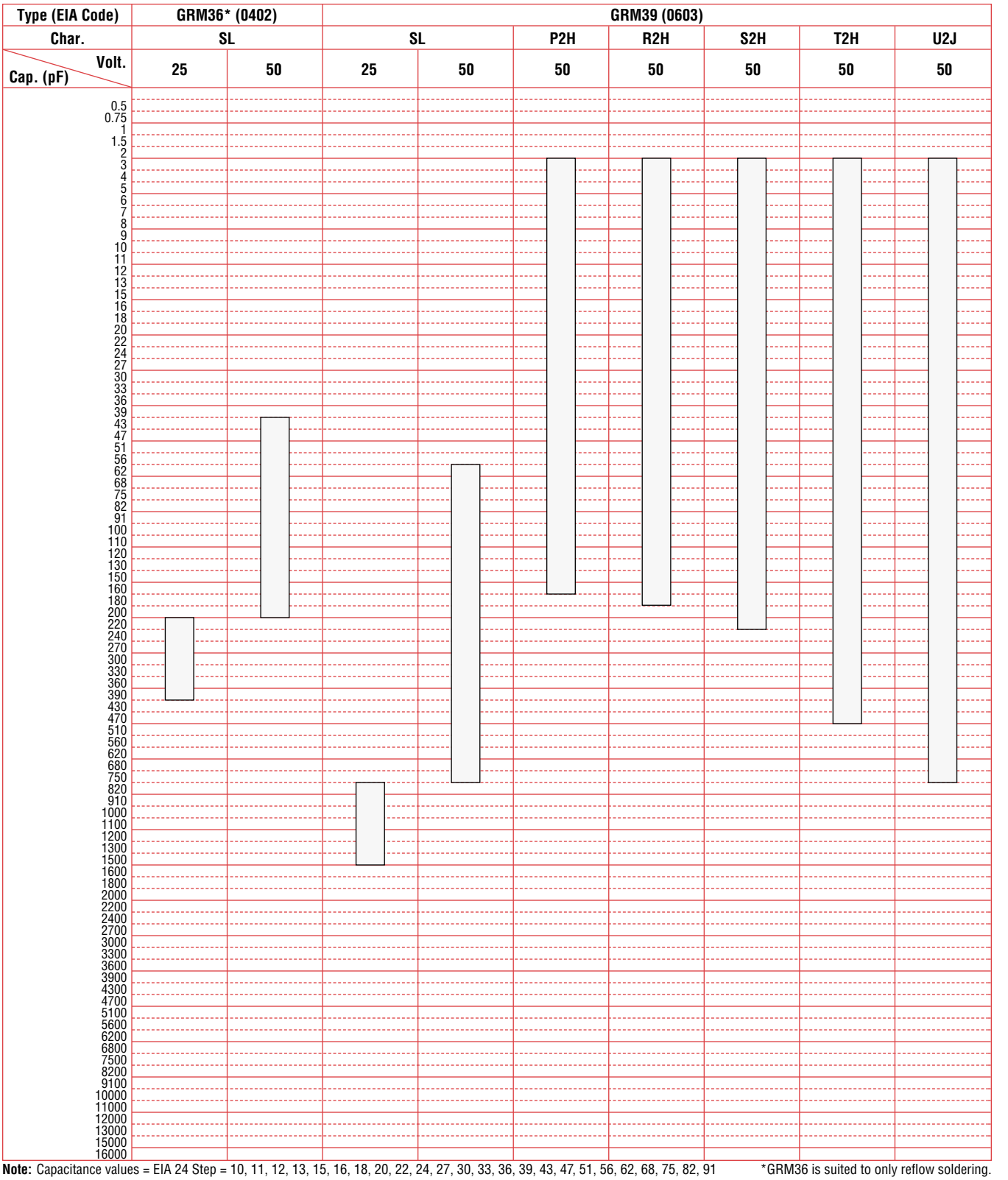
Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*
GRM42-2	▭: 1.35 ± 0.15	1000	2000
GRM43-2	▭: 2.0 max.	1000	1000
GRM44-1	▭: 2.0 max.	1000	1000

*ϕ330mm reel is available on request.

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
TEMPERATURE COMPENSATING TYPE–25V/50V

muRata
Innovator in Electronics

GRM36/39 Series

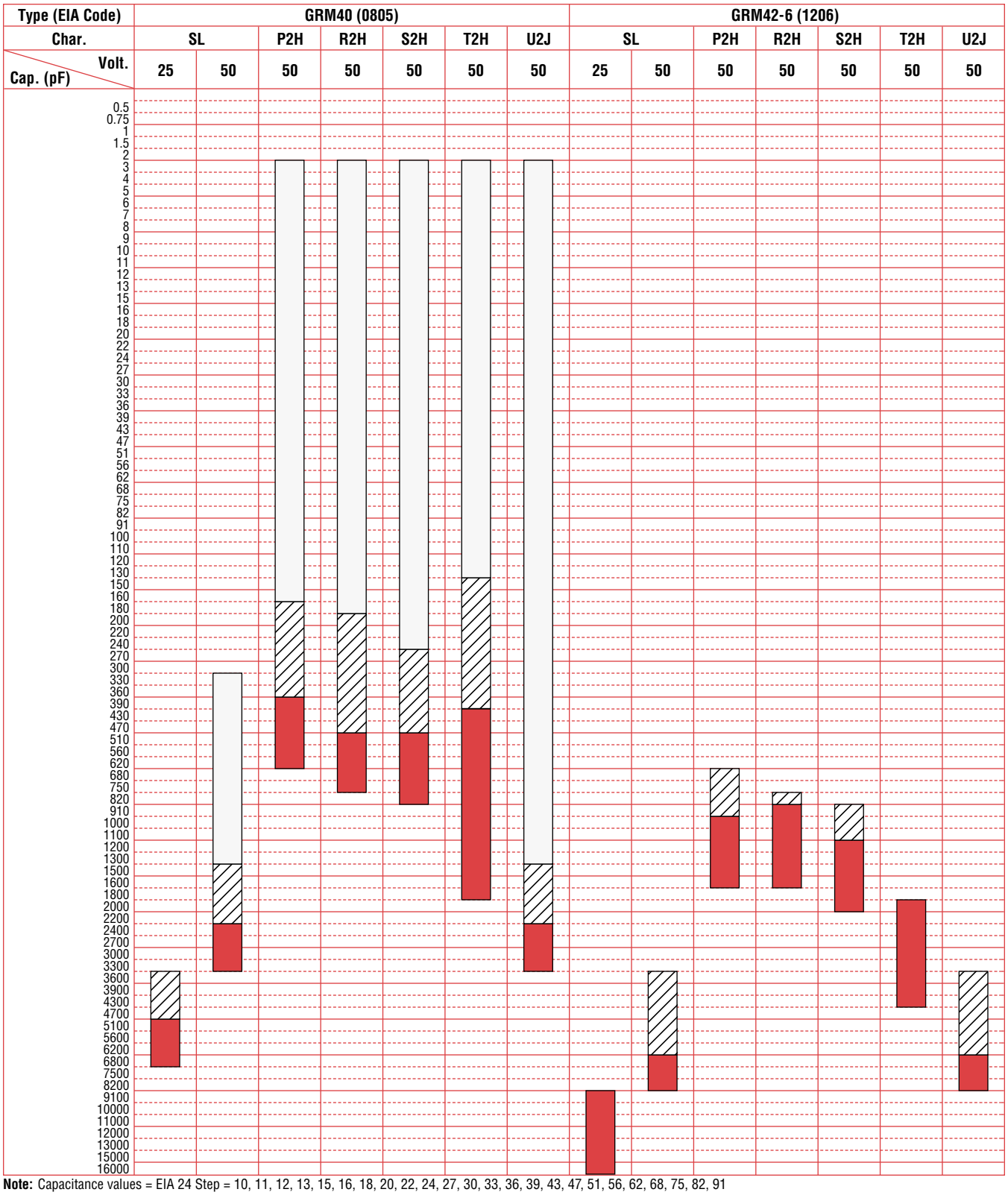


Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91 *GRM36 is suited to only reflow soldering.

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)[1]	Bulk Case (pcs./case)
GRM36	▭: 0.5 ± 0.05	1000	10000	50000
GRM39	▭: 0.8 ± 0.1[2]	1000	4000	15000

[1]ϕ330mm reel is available on request. [2]Bulk case packaging is T = 0.8 ± 0.07.



Note: Capacitance values = EIA 24 Step = 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*	Bulk Case (pcs./case)	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*	Bulk Case (pcs./case)
GRM40	: 0.6 ± 0.1	1000	4000	10000	GRM42-6	: 0.85 ± 0.1	1000	4000	—
	: 0.85 ± 0.1	1000	4000	—		: 1.15 ± 0.1	1000	3000	—
	: 1.25 ± 0.1	1000	3000	5000	*ϕ330mm reel is available on request.				

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
HIGH DIELECTRIC CONSTANT TYPE
GRM36/39/40/42-6/42-2/43-2/44-1 Series

FEATURES
- Miniature size
- No Polarity
- Nickel Barrier Termination Standard – highly resistant to metal migration
- Uniform dimensions and configuration
- Suitable for reflow soldering
- GRM39, 40 and 42-6 suitable for wave soldering
- Minimum series inductance
- Tape and Reel Packaging
- Bulk Case Packaging available for GRM40 and smaller
- Wide selection of capacitance values and voltages
- Largest production capacity and volume in the world

PART NUMBERING SYSTEM

GRM40 – – – X7R 103 K 050 A D

CAPACITOR TYPE AND SIZE See below and following pages.

3-digit code appears as necessary to indicate special thickness requirements. Please consult your local sales office for details.

TEMPERATURE CHARACTERISTICS
X5R
X7R
Y5V

CAPACITANCE VALUE Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
X7R/X5R:
K = ±10%
M = ±20%
Non-standard
J = ±5%
Y5V: Z = $^{+80}_{-20}$%

VOLTAGE Identified by a three-digit number.

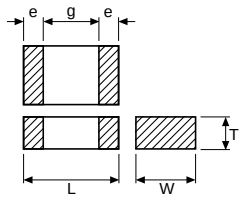
MARKING A = Unmarked

PACKAGING

Reel Diameter/ Tape Material	Code
7″ Paper Tape	D
7″ Plastic Tape	L
13″ Paper Tape	J
13″ Plastic Tape	K
Bulk	B
Bulk Cassette	C
7″ Paper 2mm pitch	Q

See pages 33-36 for labeling and packaging information.

CHIP DIMENSIONS



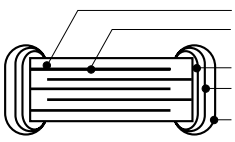
Dimensions: mm	Size	EIA Code	L Length	W Width	T Thickness	e (min.) Termination	g (min.) Insulation
	GRM36	0402	1.0 ± 0.05	0.5 ± 0.05	0.5 ± 0.05	0.15 ~ 0.3	0.4
	GRM39*	0603	1.6 ± 0.1	0.8 ± 0.1	0.8 ± 0.1	0.2 ~ 0.5	0.5
	GRM40	0805	2.0 ± 0.1	1.25 ± 0.1	0.6 ± 0.1	0.2 ~ 0.7	0.7
					0.85 ± 0.1		
					1.25 ± 0.1		
	GRM42-6	1206	3.2 ± 0.15	1.6 ± 0.15	0.85 ± 0.1	0.3 ~ 0.8	1.5
					1.15 ± 0.1		
			3.2 ± 0.2	1.6 ± 0.2	1.6 ± 0.2		
	GRM42-2	1210	3.2 ± 0.3	2.5 ± 0.2	1.15 ± 0.1	0.3 min.	1.0
					1.35 ± 0.15		
					1.8 ± 0.2		
					2.5 ± 0.2		
	GRM43-2	1812	4.5 ± 0.4	3.2 ± 0.3	2.0 max.	0.3 min.	2.0
	GRM44-1	2220	5.7 ± 0.4	5.0 ± 0.4	2.0 max.	0.3 min.	2.0

*Bulk case packaging is L = 1.6 ± 0.07, W, T = 0.8 ± 0.07.

CHIP TERMINATION DIAGRAMS

Nickel Barrier Layer (Standard)

GRM Series



*Size 0402 – Solder Plated

All products on this page are available as standard through authorized Murata Electronics Distributors.

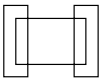
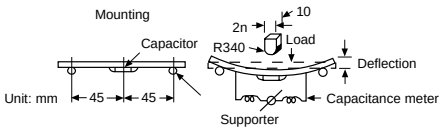
GENERAL/ELECTRICAL

Capacitance Change with Temperature:	X5R: ±15% ΔCX –55°C to +85°C X7R: ±15% ΔCX –55°C to +125°C Y5V: $^{+22\%}_{-82\%}$ ΔCX –30°C to +85°C
Capacitance & D.F. (Frequency & Voltage)	X5R, X7R: 1kHz ±100Hz @ 1.0 ±.2Vrms Y5V: 1kHz ±100Hz @ 1.0 ±.2Vrms
Dissipation Factor (D.F.)	

	Min. 25V	16V	10V	6.3V
X5R	2.5%	3.5%	3.5%	5%
X7R	2.5%	3.5%	3.5%	5%
Y5V	5.0%	9.0%	12.5%	12.5%

Insulation Resistance (I.R.)	X5R/X7R 100,000 megohms or 1000 megohms-mfd (whichever is less) Y5V 10,000 megohms or 500 megohms–mfd (whichever is less)
Dielectric Strength (Flash)	250% of rated voltage for 5 seconds with series resistor limiting charge current to 50mA max.; 200% for 500V
Typ. Aging (per Decade)	X5R/X7R 3% Y5V 7%

MECHANICAL

TEST	TEST METHOD	POST TEST LIMITS
Terminal Adhesion	 Glass epoxy board	<0603 1.0 lbs. ≥0805 2.2 lbs. No evidence of termination peeling
Deflection		1 mm deflection (Glass epoxy board) No mechanical damage Cap., DF, IR meet initial limits
Solderability	MIL-STD-202 Method 208F	Meets Requirement For specific details contact factory

ENVIRONMENTAL

TEST	TEST METHOD	POST TEST LIMITS
Thermal Shock (Air to Air)	MIL-STD-202, Method 107, Condition A Prior to starting Thermal Shock test, capacitors shall be heat treated (deaged) for one (1) hour at 150°C. Allow capacitors to stabilize at room temperature for 48 hours prior to taking initial measurements. Post thermal Shock measurement shall be taken after 48 hours stabilization.	Appearance: No visual damage ΔC: X5R/X7R = ±12.5% Y5V = ±30.0% D.F.: X5R/X7R = 2.5% max. @ 25°C, (3.5% max. @ 25°C for 16V & 10V Series) (7.5% max. @ 25°C for 6.3V Series) Y5V = 5.0% max. @ 25°C, (9.0% max. @ 25°C for 16V Series) (15% max. @ 25°C for 10V & 6.3V Series) I.R.: X5R/X7R = 100,000MΩ min. of 1,000MΩ•μF (whichever is less) Y5V = 10,000Ω or 500MΩ•μF min. (whichever is less)
Humidity, Steady State	Maintain the capacitor at 40 ± 2°C and 90 to 95% humidity for 500 ± 12 hours. Remove and let sit for 48 ± 4 hours at room temperature, then measure.	Appearance: No defects Capacitance: X5R, X7R within ±12.5%; Z5U, Y5V within ±30% Q/D.F.: See chart below. I.R.: 1,000MΩ or 50Ω F (whichever is less)
Humidity Load	Apply the rated voltage at 40 ± 2°C and 90 to 95% humidity for 500 ± 12 hours. Remove and let sit for 48 ± 4 hours at room temperature, then measure. The charge/discharge current is less than 50mA. • Initial measurement for Y5V/10V max. Apply the rated DC voltage for 1 hour at 40 ± 20°C. Remove and let sit for 48 ± 4 hours at room temperature. Perform initial measurement.	Appearance: No defects Capacitance: X5R, X7R within ±12.5%; Z5U within ±30%; Y5V within +30/-40% (10Vmax), within ±30% (others)

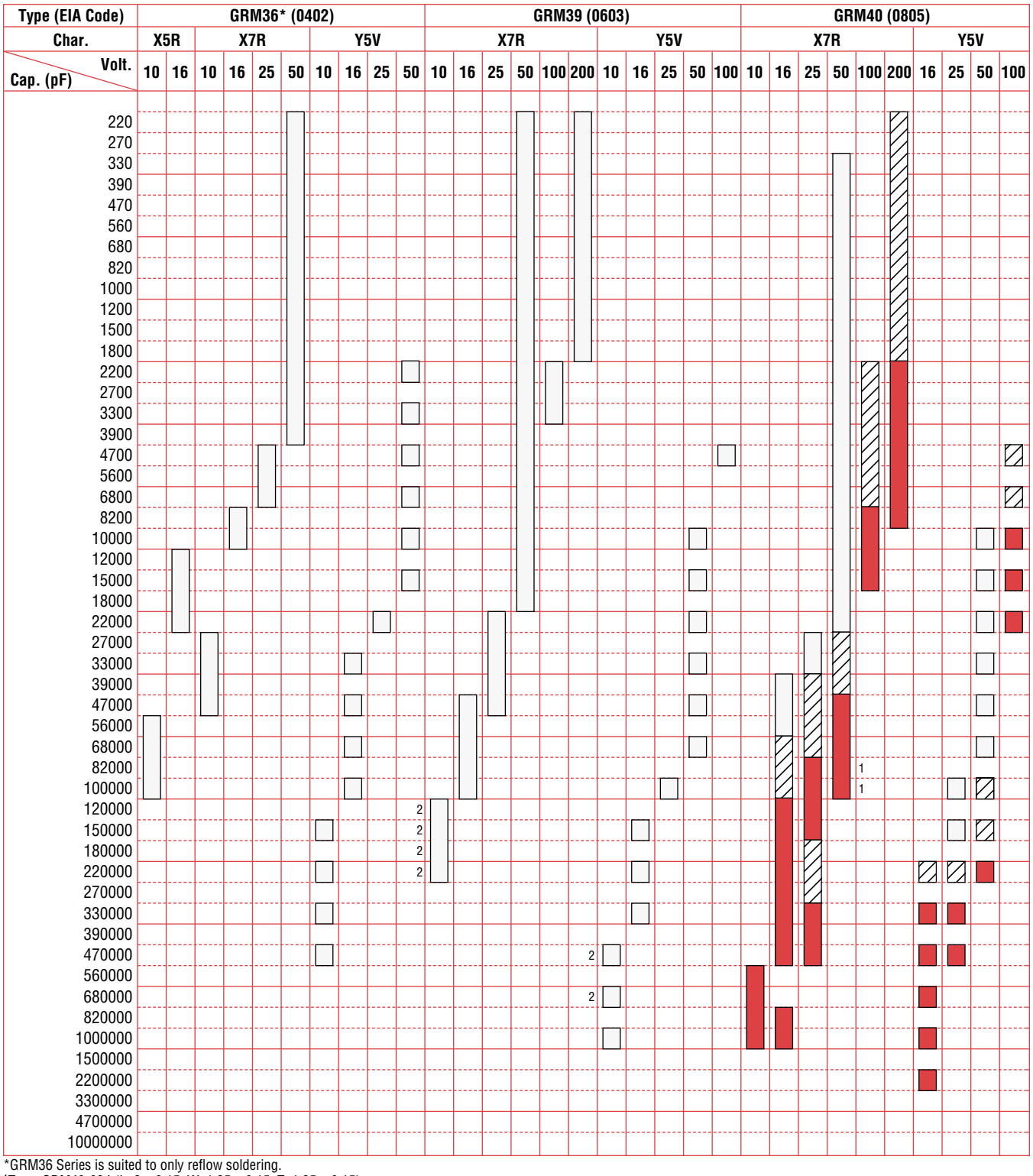
	Char.	25V min.	16V	10V	6.3V
Q/D.F.	X5R X7R	0.05 max.	0.05 max.	0.05 max.	0.075 max.
	Z5U	0.05 max.	—	—	—
	Y5V	0.075 max.	0.1 max. (C<1.0μF) 0.125 max. (C≥1.0μF)	0.15 max.	0.15 max.

	I.R.: 500MΩ or 25Ω F (whichever is less) Dielectric Strength: No failure
Life Test	Apply 200% of rated voltage for 1000 ± 12 hours at maximum operating temperature; 150% for 500V Upon completion of above test wait 48 hours prior to performing post testing.	Appearance: No defects Capacitance: X5R/X7R ± 12.5% ΔCX, Z5U/Y5V ±30% ΔCX D.F.: X5R/X7R = 3.0% max. @ 25°C, (5% max. @ 25°C for 16V & 10V Series) (7.5% max. @ 25°C for 6.3V Series) Y5V = 7.5% max. @ 25°C, (10% max. @ 25°C for 16V Series) (15% max. @ 25°C for 10V & 6.3V Series) I.R.: X5R/X7R 1,000MΩ or 50MΩ-mfd. (whichever is less) Y5V 1,000MΩ or 50MΩ-mfd. (whichever is less) Flash: 250% rated voltage

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
HIGH DIELECTRIC CONSTANT X5R/X7R/Y5V TYPES

muRata
Innovator in Electronics

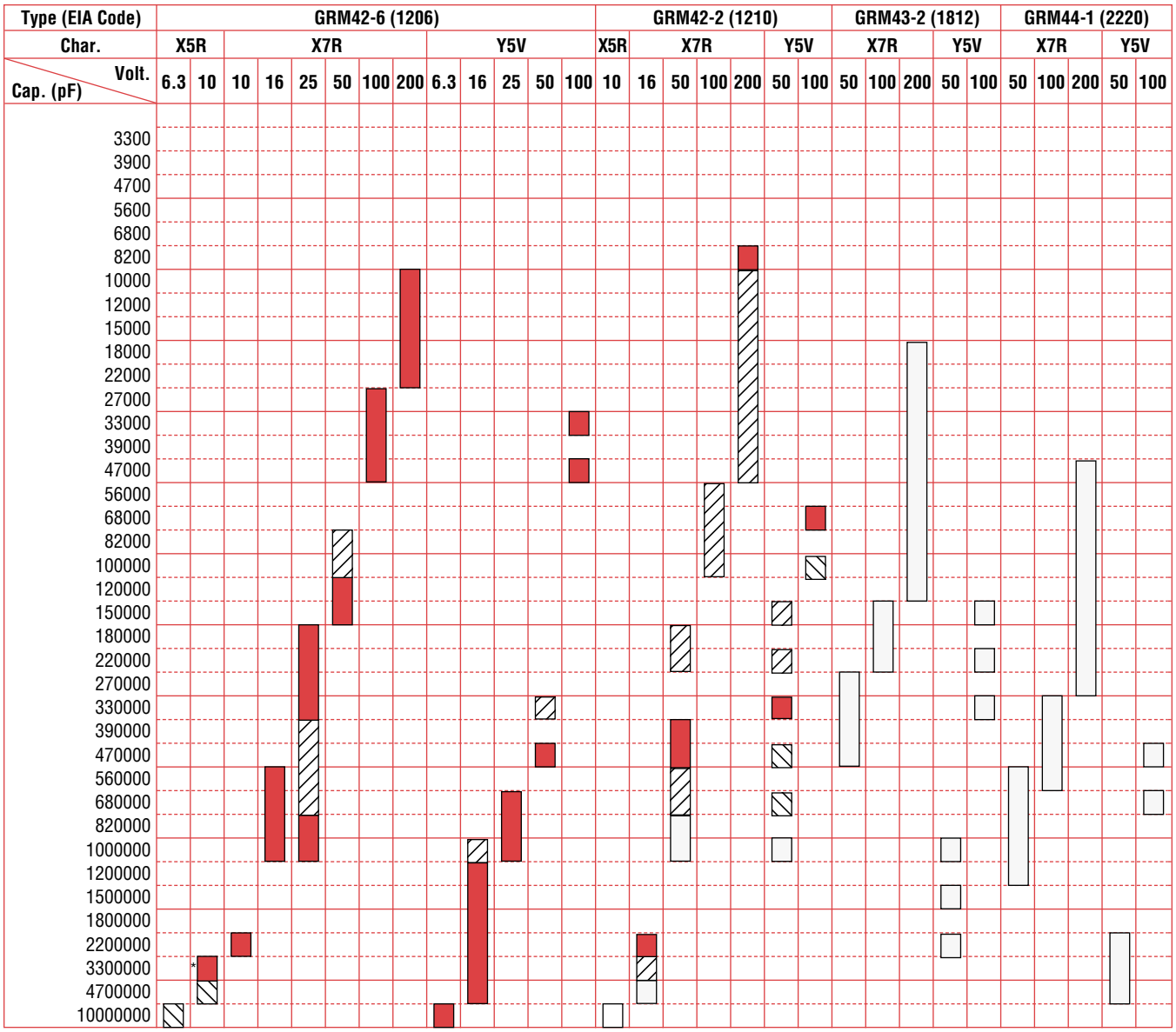
GRM36/39/40 Series



*GRM36 Series is suited to only reflow soldering.
[1]Type: GRM40-034 (L: 2 ± 0.15, W: 1.25 ± 0.15, T: 1.25 ± 0.15)
[2]Only for taping

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)[3]	Bulk Case (pcs./case)	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)[3]	Bulk Case (pcs./case)
GRM36	: 0.5 ± 0.05	1000	10000	50000	GRM40	: 0.85 ± 0.1	1000	4000	—
GRM39	: 0.8 ± 0.1[4]	1000	4000	15000		: 1.25 ± 0.1	1000	3000	5000
GRM40	: 0.6 ± 0.1	1000	4000	10000	[3]ϕ330mm reel is available on request. [4]Bulk case packaging is T = 0.8 ± 0.07.				



*Type: GRM42-631 (L: 3.2 ± 0.2, W: 1.6 ± 0.2, T: 1.3 $^{+0}_{-0.2}$)

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)[1]
GRM42-6	: 0.85 ± 0.1	1000	4000
	: 1.15 ± 0.1	1000	3000
	: 1.6 ± 0.2	1000	2000
GRM42-2	: 1.15 ± 0.1	1000	3000
	: 1.35 ± 0.15	1000	2000

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)[1]
GRM42-2	: 1.8 ± 0.2	1000	1000
	: 2.5 ± 0.2	1000	1000
GRM43-2	: 2.0 max.	1000	1000
GRM44-1	: 2.0 max.	1000	1000

[1]ϕ330mm reel is available on request.

Note: Capacitance Values = EIA 12 step: X7R = 10,12,15,18,22,27,33,39,47,56,68,82
6 step: Y5V = 10,15,22,33,47,68. For other values contact your local Murata Sales Office

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
TANTALUM
REPLACEMENT TYPE–SMOOTHING APPLICATION

muRata
Innovator in Electronics

GRM200 Series

FEATURES
- Large capacitance at low cost because of the use of base-metal materials
- Terminations are made of metal highly resistant to migrations.
- Heat generation is low at high frequency because of low dielectric loss.
- Compared with aluminum electrolytic capacitors, capacitance can be lower to obtain the same smoothing performance.
- Ceramic capacitor has no polarity and ensures long life time. Ideal replacement for tantalum capacitors.

APPLICATIONS
- DC-DC converter
- Noise elimination for LCD bias circuit (Use for only alumina, paper or glass epoxy board.)
- Reflow soldering only

PART NUMBERING SYSTEM

GRM230 Y5V 106 Z 010 A D

CAPACITOR TYPE AND SIZE

TEMPERATURE CHARACTERISTICS
Y5V

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
Y5V: Z = +80–20%

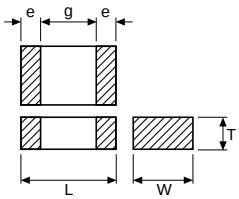
VOLTAGE
Identified by a three-digit number.

MARKING
A = Unmarked

PACKAGING CODE

Reel Diameter/ Tape Material	Code
7″ Paper Tape	D
13″ Paper Tape	J
7″ Embossed Tape	L
13″ Embossed Tape	K

TYPE AND DIMENSIONS

Dimensions: mm	Type	EIA Code	L Length	W Width	T Thickness	e (min.) Termination	g (min.) Insulation
	GRM220	0603	1.6 ± 0.1	0.8 ± 0.1	Please refer to the capacitance range table	0.2 ~ 0.5	0.5
	GRM225	0805	2.0 ± 0.1	1.25 ± 0.1		0.2 ~ 0.7	0.7
	GRM230	1206	3.2 ± 0.15	1.6 ± 0.15		0.3 ~ 0.8	1.5
	GRM235	1210	3.2 ± 0.3	2.5 ± 0.2		0.3	1.0

CAPACITANCE RANGE TABLE (μF)

Type	EIA Code	Thickness T (mm)	DC Rated Voltage 100V	50V	25V	16V	10V	6.3V
GRM220	0603	0.8 ± 0.1	—	—	—	—	1	—
GRM225	0805	1.25 ± 0.1	—	—	—	—	—	10
GRM230	1206	1.15 ± 0.1	—	—	—	4.7	10	—
GRM235	1210	1.35 ± 0.15	—	—	6.8	6.8, 10	22	—
		1.8 ± 0.2	1	4.7	10	—	—	—
Capacitance Tolerance*			Z: $^{+80}_{-20}$%					

*Cap. + DF Test Frequency ≤10MFD 1KHZ 1.0VRMS
>10MFD 120HZ 0.5VRMS

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	EIA Code	Thickness T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)
GRM220	0603	0.8 ± 0.1	1000	4000
GRM225	0805	1.25 ± 0.1	—	3000
GRM230	1206	1.15 ± 0.1	—	3000
GRM235	1210	$1.5\ ^{+0}_{-0.3}$	—	2000
		$2.0\ ^{+0}_{-0.4}$	—	1000

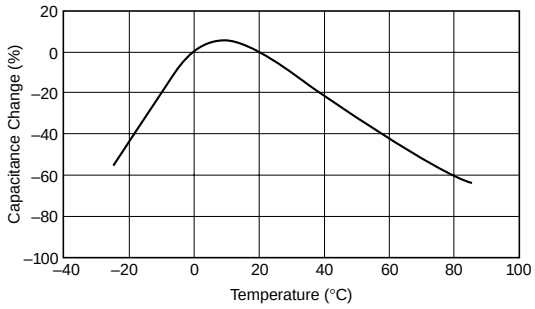
CHARACTERISTICS (REFERENCE DATA)

Selection of Ceramic Capacitors

When selecting capacitors, consider the DC voltage characteristics (AC & DC) and aging characteristics.

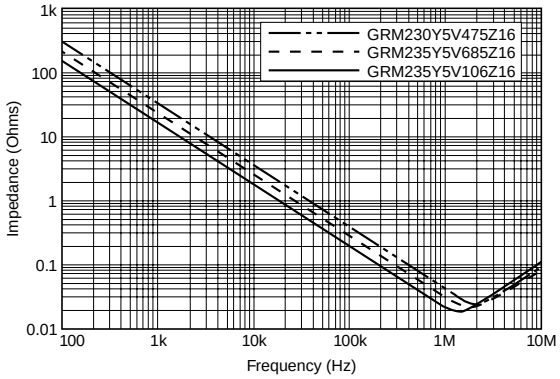
CAPACITANCE VS. TEMPERATURE

Samples: GRM230 Y5V 106Z 10
Equipment: HP4284A
Measuring conditions: 1kHz, 1Vr.m.s.



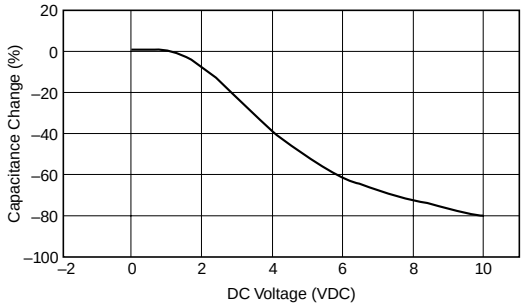
IMPEDANCE VS. FREQUENCY

Equipment: HP4192A



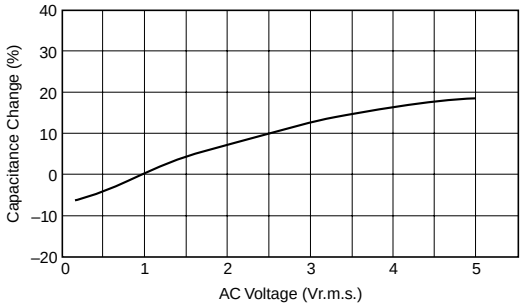
CAPACITANCE VS. DC VOLTAGE

Samples: GRM230 Y5V 106Z 10
Equipment: HP4284A
Measuring conditions: 1kHz, 1Vr.m.s.
Applied DC voltage per 30 sec.



CAPACITANCE VS. AC VOLTAGE

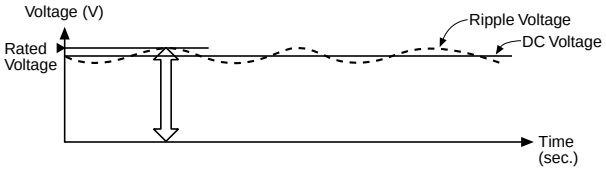
Samples: GRM230 Y5V 106Z 10
Equipment: HP4284A
Measuring conditions: 1kHz, 1Vr.m.s.
Applied AC voltage per 30 sec.



ALLOWABLE RIPPLE CURRENT

Ripple current should be less than “Allowable Ripple Current Value” shown in the following table, and temperature rise of the chip surface (ΔT) should be below 20°C.
When AC and DC voltage are superimposed, keep the peak value of the voltage within the rated voltage.

Chip Size	100kHz ≦ f < 300kHz	300kHz ≦ f < 500kHz	500kHz ≦ f ≦ 1MHz
Rated Voltage: 6.3V			
GRM225	1.4 Ar.m.s.	1.5 Ar.m.s.	1.6 Ar.m.s.
Rated Voltage: 10V			
GRM220	1.4 Ar.m.s.	1.5 Ar.m.s.	1.6 Ar.m.s.
GRM230	1.5 Ar.m.s.	1.6 Ar.m.s.	1.6 Ar.m.s.
GRM235	1.7 Ar.m.s.	1.8 Ar.m.s.	2.0 Ar.m.s.
Rated Voltage: 16V			
GRM230	1.5 Ar.m.s.	1.6 Ar.m.s.	1.6 Ar.m.s.
GRM235	1.7 Ar.m.s.	1.8 Ar.m.s.	2.0 Ar.m.s.
Rated Voltage: 25V/50V			
GRM235	2.0 Ar.m.s.	2.2 Ar.m.s.	2.2 Ar.m.s.
Rated Voltage: 100V			
GRM235	1.6 Ar.m.s.	1.7 Ar.m.s.	1.8 Ar.m.s.



SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
LOW DISTORTION TYPE

muRata
Innovator in Electronics

GRM400 Series

FEATURES
- Features a low dissipation factor and low distortion
- Low shock noise* is realized without piezoelectric effects.
- Suited to both flow and reflow soldering techniques without the need for silver
- Suitable for most automatic placement equipment

*Noise resulting form mechanical stress

APPLICATIONS
- Low distortion in general electronic equipment

PART NUMBERING SYSTEM

GRM425 B 103 K 050 A D

CAPACITOR TYPE AND SIZE

TEMPERATURE CHARACTERISTICS
Capacitance Change
B: within ±10%
R: within ±15%
Temperature Range
–25 to +85°C

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
K: ±10% (E12 Series)
M: ±20% (E6 Series)

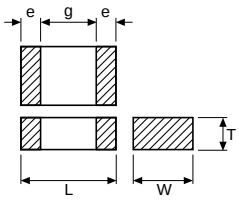
RATED VOLTAGE
016: 16V
050: 50V

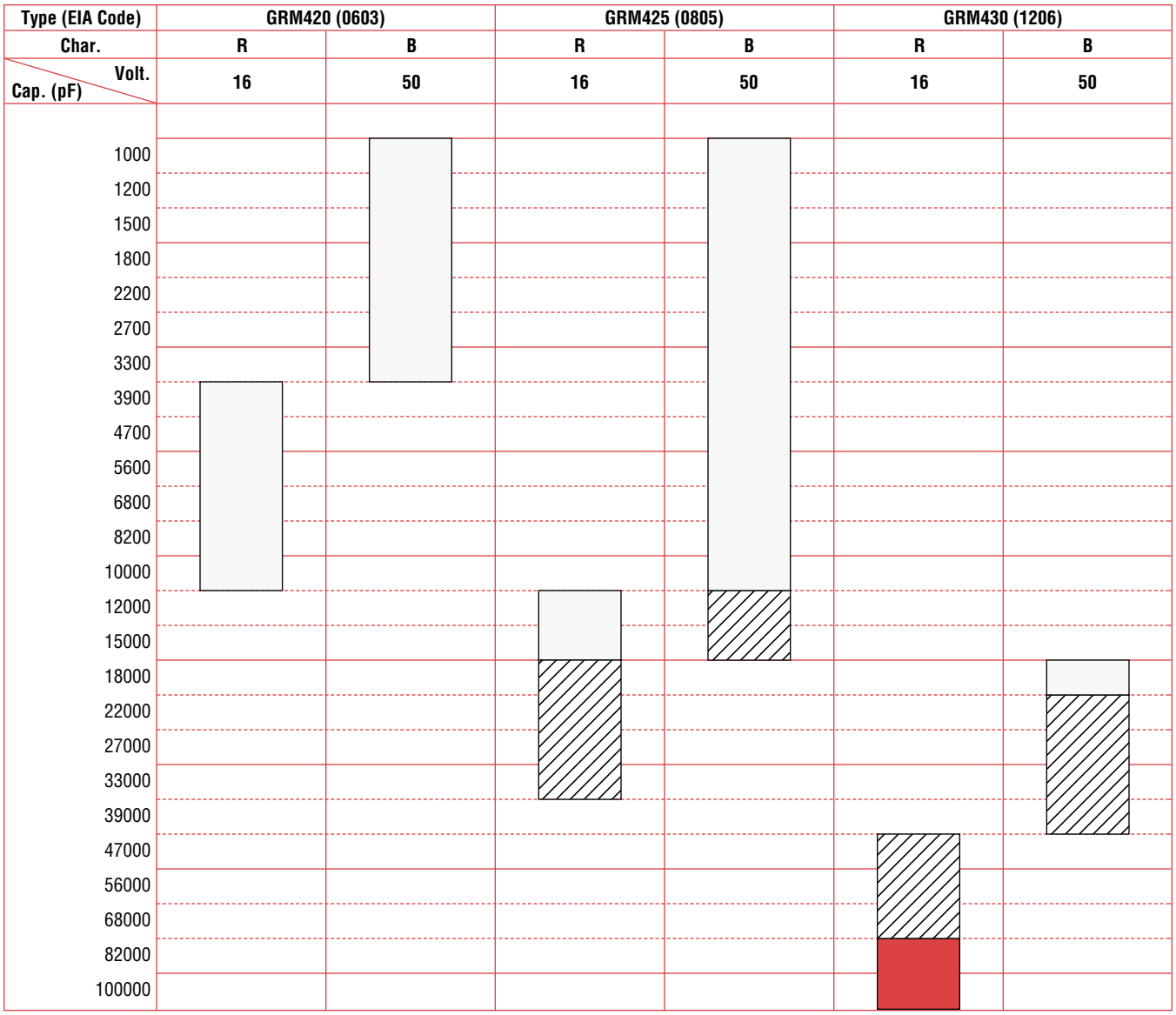
MARKING
A: Unmarked

PACKAGING CODE

Code	Packaging
PB	Bulk packaging in a bag
PT	Tape carrier packaging

TYPE AND DIMENSIONS

Dimensions: mm	Type	EIA Code	L Length	W Width	T Thickness	e Termination	g (min.) Insulation
	**GRM420**	0603	1.6 ± 0.1	0.8 ± 0.1	Please refer to the capacitance range table.	0.2 ~ 0.5	0.5
	GRM425	0805	2.0 ± 0.1	1.25 ± 0.1		0.2 ~ 0.7	0.7
	GRM430	1206	3.2 ± 0.15	1.6 ± 0.15		0.3 ~ 0.8	1.5



THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*
GRM420	: 0.8 ± 0.1	1000	4000	GRM430	: $0.7^{+0}_{-0.2}$	1000	4000
GRM425	: $0.7^{+0}_{-0.2}$	1000	4000		: $1.0^{+0}_{-0.2}$	1000	4000
	: $1.0^{+0}_{-0.2}$	1000	4000		: $1.25^{+0}_{-0.2}$	1000	3000

*ϕ330mm reel is available on request.

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification	Test Method
1	**Operating Temperature Range**	B, R: –25°C to +85°C	—
2	**Rated Voltage**	See previous page.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V_{P-P} or V_{0-P}, whichever is larger, shall be maintained within the rated voltage range.
3	**Appearance**	No defects or abnormalities.	Visual inspection.
4	**Dimensions**	Within the specified dimension.	Using calipers.
5	**Dielectric Strength**	No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.
6	**Insulation Resistance (I.R.)**	C ≤ 0.047μF: 10000M ohms min. C > 0.047μF: 500 ohms • F min. C: Nominal Capacitance (μF)	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity, and within 2 minutes of charging.
7	**Capacitance**	Within the specified tolerance.	The capacitance shall be measured at 20°C at a frequency of 1 ± 0.1kHz and a voltage of ±0.2Vr.m.s.
8	**Dissipation Factor (D.F.)**	B, R: 0.01 max.	D.F. shall be measured under the same conditions as the capacitance.
9	**Capacitance Temperature Characteristics**		The ranges of capacitance change, compared with the 20°C value over the temperature ranges shown in the table, shall be within the specified ranges.

Char.	Temp. Range	Capacitance Change	
		Without Voltage	With 50% Rated Voltage
B	–25 ~ +85°C	Within ±10%	Within $^{+10}_{-20}$%
R		Within ±15%	Within $^{+15}_{-20}$%

No.	Item	Specification	Test Method
10	**Distortion**	50V: –90dB max. 16V: –80dB max.	The distortion shall be measured using the third harmonic distortion, 10 ± 1kHz in frequency and 1 ± 0.2Vr.m.s. in voltage.
11	**Adhesive Strength of Termination**	No removal of the terminations or other defects shall occur.	Solder the capacitor to the test jig shown in Fig. 1e using a eutectic solder. Then apply 10N* force in the direction of the arrow. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock. *5N (GRM420)

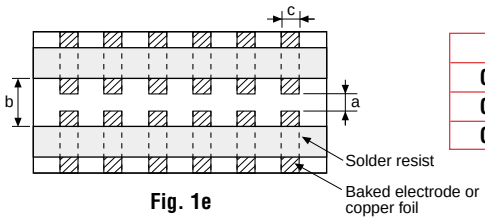


Fig. 1e

Type	a	b	c
GRM420	1.0	3.0	1.2
GRM425	1.2	4.0	1.65
GRM430	2.2	5.0	2.0

(in mm)

No.	Item	Specification	Test Method
12	**Vibration Resistance**	The measured and observed characteristics shall satisfy the specifications in the following table.	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (11). The capacitor shall be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).

Item	Specification
Appearance	No marked defect
Capacitance	Within the specified tolerance
D.F.	0.01 max.

No.	Item	Specification	Test Method
13	**Deflection**	No cracks or marking defects shall occur.	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 2e using a eutectic solder. Then apply force in the direction shown in Fig. 3e for 5 ± 1 sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.

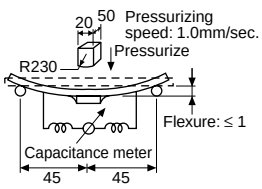


Fig. 3e

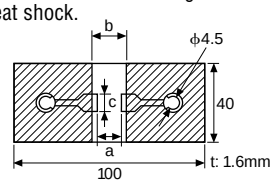


Fig. 2e

Type	a	b	c
GRM420	1.0	3.0	1.2
GRM425	1.2	4.0	1.65
GRM430	2.2	5.0	2.0

(in mm)

SPECIFICATIONS AND TEST METHODS

No.	Item	Specification	Test Method
14	**Solderability of Termination**	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2 ± 0.5 seconds at 230 ± 5°C.
15	**Resistance to Soldering Heat**	The measured and observed characteristics shall satisfy the specifications in the following table. **Item** / **Specification** **Appearance**: No marked defect **Capacitance Change**: Within ±7.5% **I.R.**: More than 10000M ohms or 500 ohms • F (Whichever is smaller) **D.F.**: 0.01 max. **Dielectric Strength**: No failure	Perform a heat treatment at 150 $^{+0}_{-10}$°C for one hour and then let sit for 48 ± 4 hours at room temperature. Measure initial values. Preheat the capacitor for 1 minute at 120 to 150°C. Immerse the capacitor in a eutectic solder solution at 270 ± 5°C for 10 ± 0.5 seconds (flow soldering bath). Let sit for 48 ± 4 hours at room temperature, then measure values of items in table.
16	**Temperature Cycle**	The measured and observed characteristics shall satisfy the specifications in the following table. **Item** / **Specification** **Appearance**: No marked defect **Capacitance Change**: Within ±7.5% **I.R.**: More than 10000M ohms or 500 ohms • F (Whichever is smaller) **D.F.**: 0.01 max. **Dielectric Strength**: No failure	Perform a heat treatment at 150 $^{+0}_{-10}$°C for one hour and then let sit for 48 ± 4 hours at room temperature. Measure initial values of items in table. Fix capacitor to the supporting jig in the same manner and under the same conditions as in (11). Perform the five cycles according to the four heat treatments shown in the following table. Let sit for 48 ± 4 hours at room temperature, then measure final values of items in table. **Step** 1: Temp. (°C) Min. Operating Temp. $^{+0}_{-3}$; Time (min.) 30 ± 3 **Step** 2: Temp. (°C) Room Temp.; Time (min.) 2 to 3 **Step** 3: Temp. (°C) Min. Operating Temp. $^{+3}_{-0}$; Time (min.) 30 ± 3 **Step** 4: Temp. (°C) Room Temp.; Time (min.) 2 to 3
17	**Humidity Steady State**	The measured and observed characteristics shall satisfy the specifications in the following table. **Item** / **Specification** **Appearance**: No marked defect **Capacitance Change**: Within ±12.5% **I.R.**: More than 1000M ohms or 50 ohms • F (Whichever is smaller) **D.F.**: 0.015 max.	Set the capacitor at 40 ± 2°C and 90 to 95% humidity for 500 ± 12 hours. Remove and let sit for 48 ± 4 hours at room temperature, then measure values of items in table.
18	**Humidity Load**	The measured and observed characteristics shall satisfy the specifications in the following table. **Item** / **Specification** **Appearance**: No marked defect **Capacitance Change**: Within ±12.5% **I.R.**: More than 500M ohms or 25 ohms • F (Whichever is smaller) **D.F.**: 0.015 max.	Apply the rated voltage at 40 ± 2°C and 90 to 95% humidity for 500 ± 12 hours. Remove and let sit for 48 ± 4 hours at room temperature, then measure values of items in table. The charge/discharge current is less than 50mA.
19	**High Temperature Load**	The measured and observed characteristics shall satisfy the specifications in the following table. **Item** / **Specification** **Appearance**: No marked defect **Capacitance Change**: Within ±12.5% **I.R.**: More than 1000M ohms or 50 ohms • F (Whichever is smaller) **D.F.**: 0.015 max.	Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Let sit for 48 ± 4 hours at room temperature, then measure initial values of items in table. Apply 200% of the rated DC voltage for 1000 ± 12 hours at maximum operating temperature ±3°C. Remove and let sit for 48 ± 4 hours at room temperature, then measure final values of items in table. The charge/discharge current is less than 50mA.

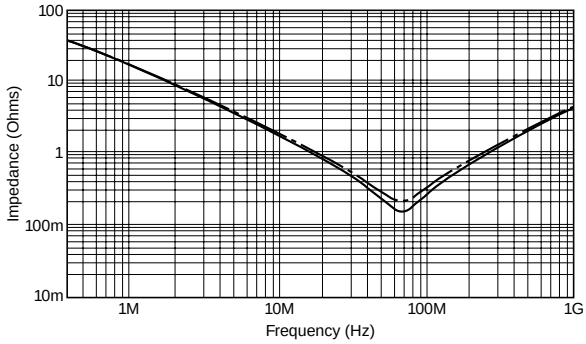
CHARACTERISTICS

Selection of Ceramic Capacitors

When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

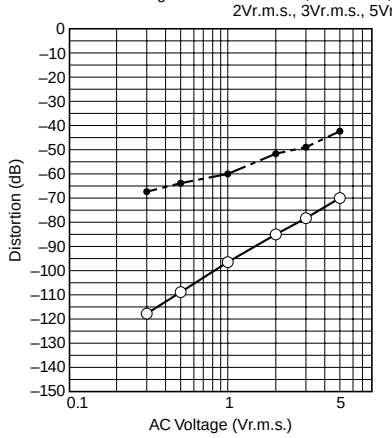
IMPEDANCE – FREQUENCY CHARACTERISTICS

Samples: GRM425B103K50V
GRM40B103K50V
Equipment: HP8753A



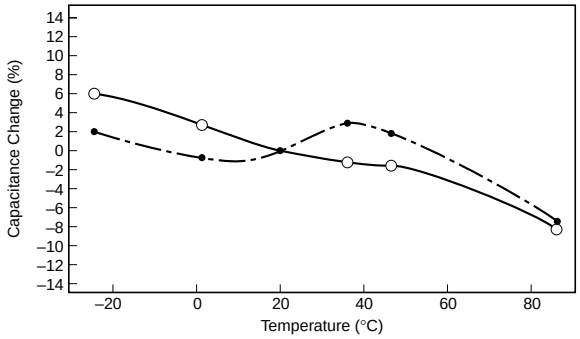
THIRD HARMONIC DISTORTION

Samples: GRM425B103K50V
GRM40B103K50V
Equipment: Third harmonic distortion meter CLT-I
Measuring conditions: Frequency.....10kHz
Voltage .....0.3Vr.m.s., 0.5Vr.m.s., 1Vr.m.s., 2Vr.m.s., 3Vr.m.s., 5Vr.m.s.



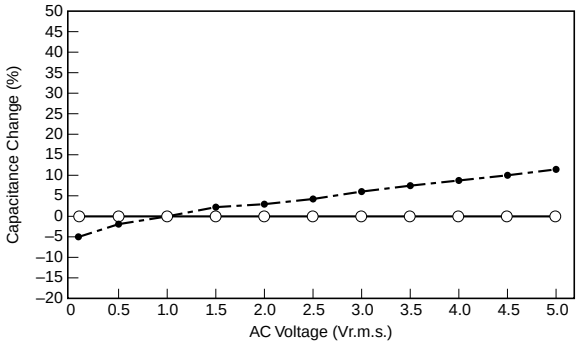
CAPACITANCE – TEMPERATURE CHARACTERISTICS

Samples: GRM425B103K50V
GRM40B103K50V
Equipment: HP4274A
Measuring condition: 1kHz, 1Vr.m.s.



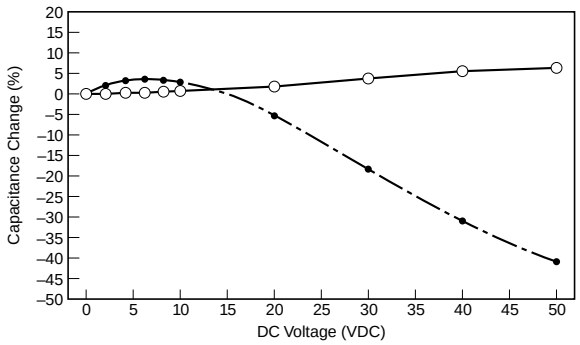
CAPACITANCE – AC VOLTAGE CHARACTERISTICS

Samples: GRM425B103K50V
GRM40B103K50V
Equipment: HP4274A
Measuring condition: 1kHz, 10 sec.



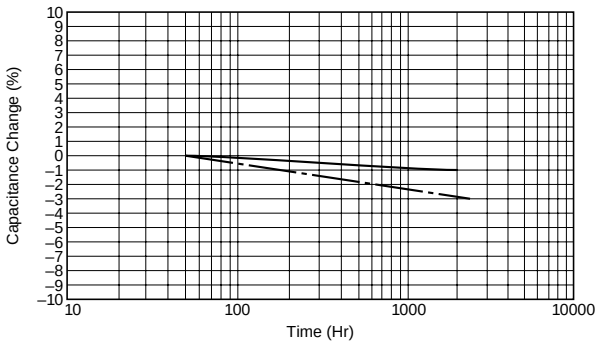
CAPACITANCE – DC VOLTAGE CHARACTERISTICS

Samples: GRM425B103K50V
GRM40B103K50V
Equipment: HP4274A
Measuring condition: 1kHz, 1Vr.m.s., 10 sec.

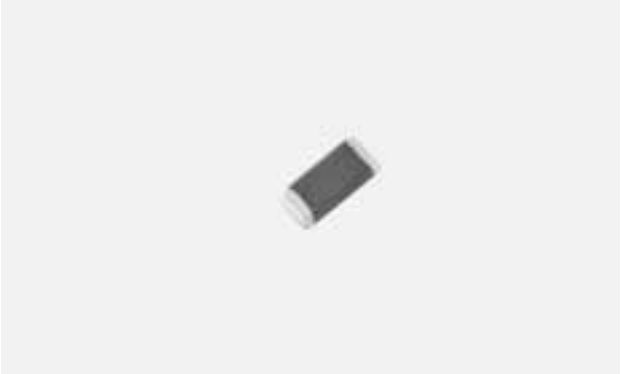


CAPACITANCE CHANGE – AGING

Samples: GRM425 Series
GRM40 Series
Pre-heating: 150°C, 1 hour
Equipment: HP4274A
Measuring condition: 1kHz, 1Vr.m.s., 25 ± 2°C, 45 to 85%RH



GRM43-2/43-4/44-1/44 Series



Ceramic chip capacitors used to block the “OFF HOOK” DC Voltage and pass the AC “Ring signal”.

FEATURES

- SMT compatibility
- Save board space
- Standard EIA case size
- Replace film caps
- 250VDC Telco rating
- Nickel barrier

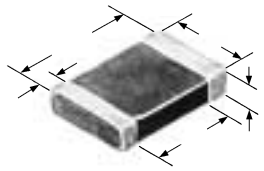
APPLICATIONS

- Modems
- Telecommunication Circuits

ELECTRICAL DATA

D. F.	2.5% max. (1±0.1KHz @ 1±0.2Vrms)
I. R.	100Gohm or 1Gohm/mF (whichever less)
Dielectric Strength	120% of rated voltage for 5 sec.
	(50mA maximum charge current)

SPECIFICATIONS



EIA Type		L	W	g min.	e	T max.	Capacitance Range (μF)	Packaging	
								Bulk	7” Reel
1812*	GRM43-2	4.6 ± 0.3	3.2 ± 0.2	2.0	.63 ± 0.38	2.0	0.33 ~ 0.47	1000pcs	1000pcs
1825	GRM43-4	4.6 ± 0.3	6.35 ± 0.4	2.0	.63 ± 0.38	2.0	0.47 ~ 1.0	1000pcs	1000pcs
2220*	GRM44-1	5.6 ± 0.3	5.1 ± 0.4	2.0	.63 ± 0.38	2.0	0.47 ~ 1.0	1000pcs	1000pcs
2225	GRM44	5.6 ± 0.3	6.35 ± 0.4	2.0	.63 ± 0.38	2.0	0.47 ~ 1.0	1000pcs	1000pcs

*Preferred case size

PART NUMBERING SYSTEM

GRM44-1 X7R 105 K 250 A –

CAPACITOR TYPE AND SIZE GRM:
Nickel Barrier
Tin Plated

TEMPERATURE COEFFICIENT
±15%

CAPACITANCE VALUE
474 = 0.47μF
105 = 1μF

CAPACITANCE
TOLERANCE
K = ±10%

VOLTAGE (DC)

MARKING
A = Unmarked
B = Marked

PACKAGING
7” Plastic Tape
13” Plastic Tape
Bulk

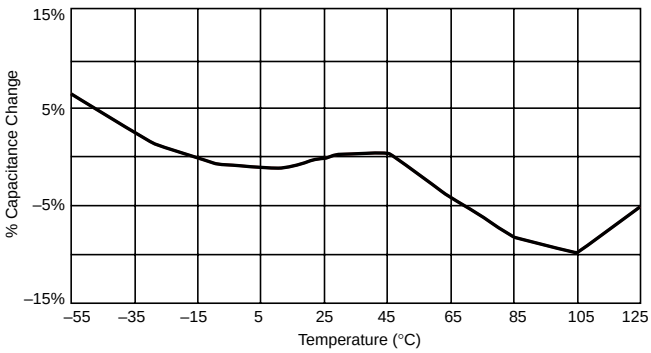
STANDARD PART NUMBER OFFERING

PART NUMBER	PART NUMBER
GRM43-2X7R334K250AL*	GRM44-1X7R474K250AL*
GRM43-2X7R474K250AL*	GRM44-1X7R105K250AL*
GRM43-4X7R474K250AL	GRM44X7R474K250AL
GRM43-4X7R105K250AL	GRM44X7R105K250AL

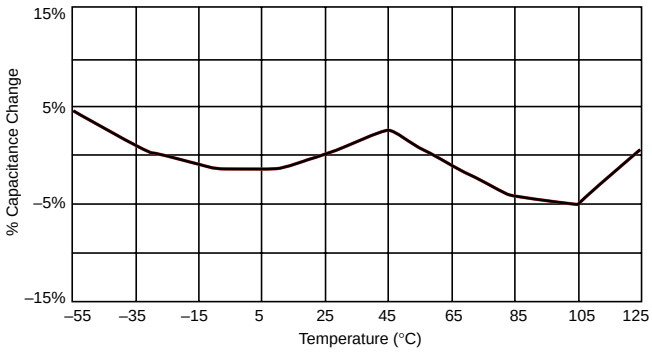
*Preferred Parts

TEMPERATURE COEFFICIENT OF CAPACITANCE

GRM43-2 X7R 474K 250

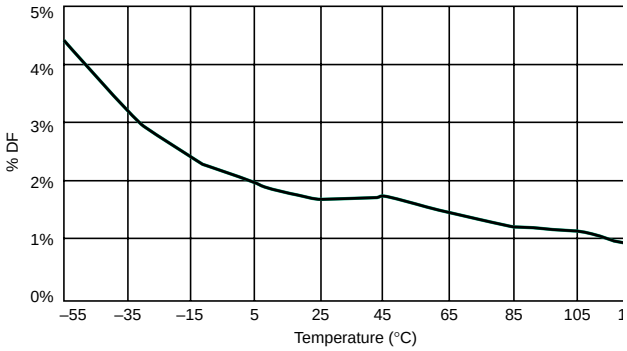


GRM44 X7R 105K 250

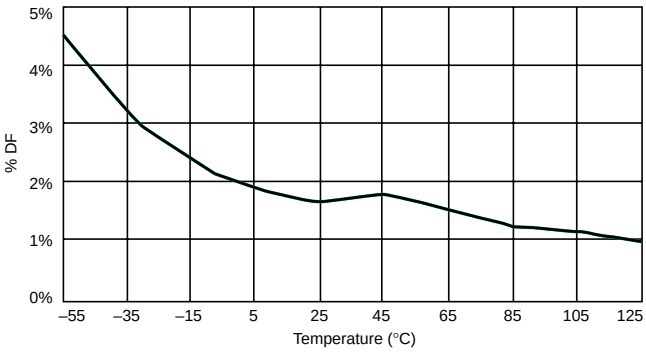


% DISSIPATION FACTOR VERSUS TEMPERATURE

GRM43-2 X7R 474K 250

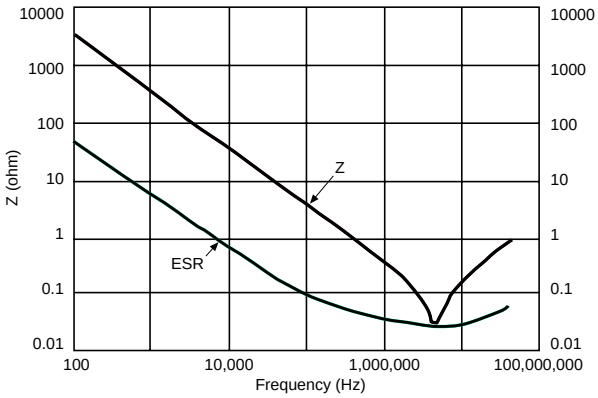


GRM44 X7R 105K 250

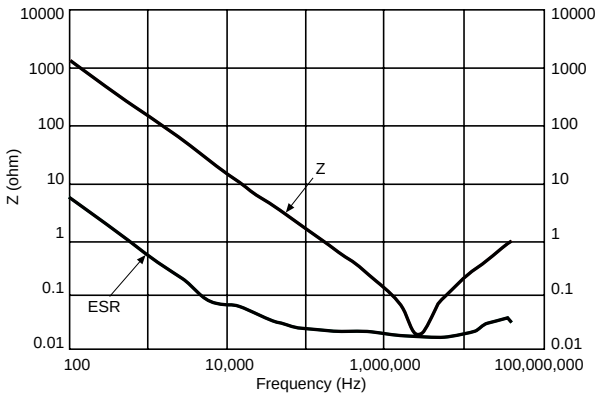


FREQUENCY PERFORMANCE (Z, ESR)

GRM43-2 X7R 474K 250



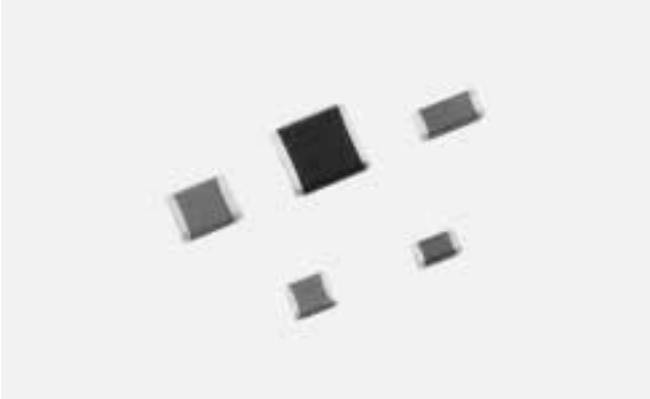
GRM44 X7R 105K 250



SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
500V RATED COG & X7R TYPE

muRata
Innovator in Electronics

GRM42-6/42-2/43-2/44-1 Series



These new surface mount components are designed to meet the growing demand for miniature, reliable chip capacitors, especially where high volume automation is required. Applications include solid state relays, telecom, instrumentation, modems, computer peripherals, and others.

FEATURES
- Standard E.I.A. sizes
- Up to 2X rated voltage tested
- –55°C to +125°C rated

BENEFITS
- Compatible with SMT equipment
- Improves long term reliability
- Suitable for harsh environments

PART NUMBERING SYSTEM

GRM 42-2 – X7R 103 K 500 A L

CAPACITOR TYPE AND SIZE
GRM-Nickel Barrier Plated Tin (Standard)
GR-Palladium-Silver (Non-preferred)

Two or 3-digit code appears as necessary to indicate special thickness requirements. Please consult your local MENA Sales Office for details.

TEMPERATURE CHARACTERISTICS
Standard TC's
COG = 0±30ppm
X7R = ±15%

CAPACITANCE VALUE
Identified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow. For fractional values below 10pF, the letter "R" is used as the decimal point and the last digit becomes significant.

CAPACITANCE TOLERANCE
COG: (10pF or less)
C = ±.25pF
D = ±.5pF
(Over 10pF)
J = ±5%
K = ±10%
X7R: K = ±10%

VOLTAGE
Identified by a three-digit number. Others available upon request. (1,000 volts codes as 1KV)

MARKING
A = Unmarked

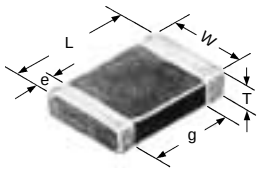
PACKAGING

Reel Diameter/ Tape Material	EIA-481-1 Standard
7" Plastic Tape	L
13" Plastic Tape	K
Bulk	B

Some values cannot be taped. Consult your local MENA Sales Office for additional marking and packaging information.

★Contact your local Murata Sales Office for available standards.

CHIP DIMENSIONS — EIA PREFERRED SIZE

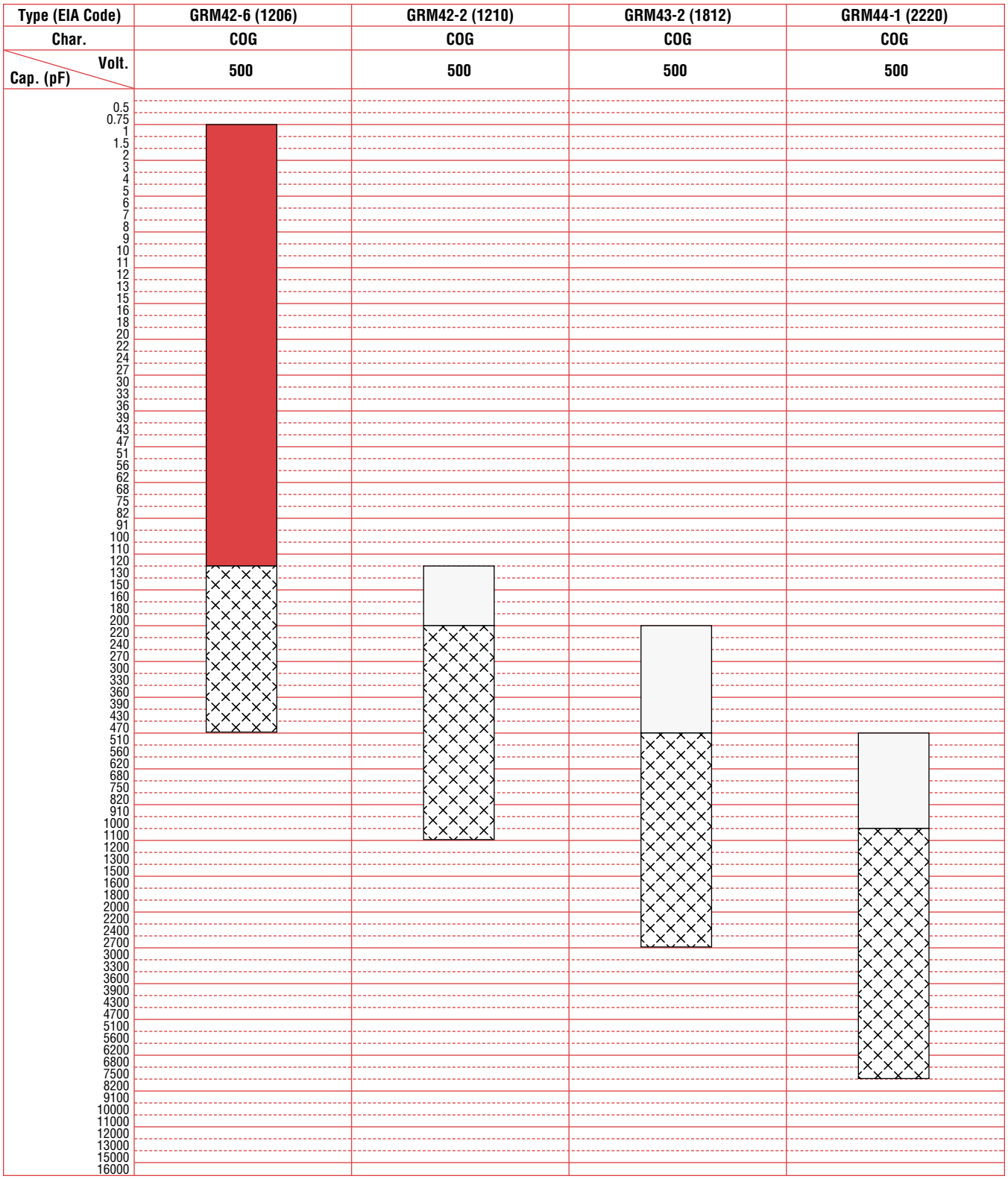
Dimensions: mm	Size	EIA Code	L Length	W Width	T* Thickness	g (min.) Insulation	e (min.) Termination
	**GRM 42-6**	1206	3.2 ± 0.2	1.5 ± 0.2	1.5 max.	1.0	0.25
	GRM 42-2	1210	3.2 ± 0.2	2.5 ± 0.2	1.5 max.	1.0	0.25
	GRM 43-2	1812	4.6 ± 0.3	3.2 ± 0.2	2.75 max.	2.0	0.25
	GRM 44-1	2220	5.6 ± 0.3	$5.1^{+0.25}_{-0.5}$	2.75 max.	2.0	0.25

*Shown for maximum capacitance value.
Note: For greater than 500V see pages 130-131 of the ASC section.
All products on this page are available as standard through authorized Murata Electronics Distributors.

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
500V RATED COG TYPE

muRata
Innovator in Electronics

GRM42-6/42-2/43-2/44-1 Series



THICKNESS AND PACKAGING TYPES/QUANTITY

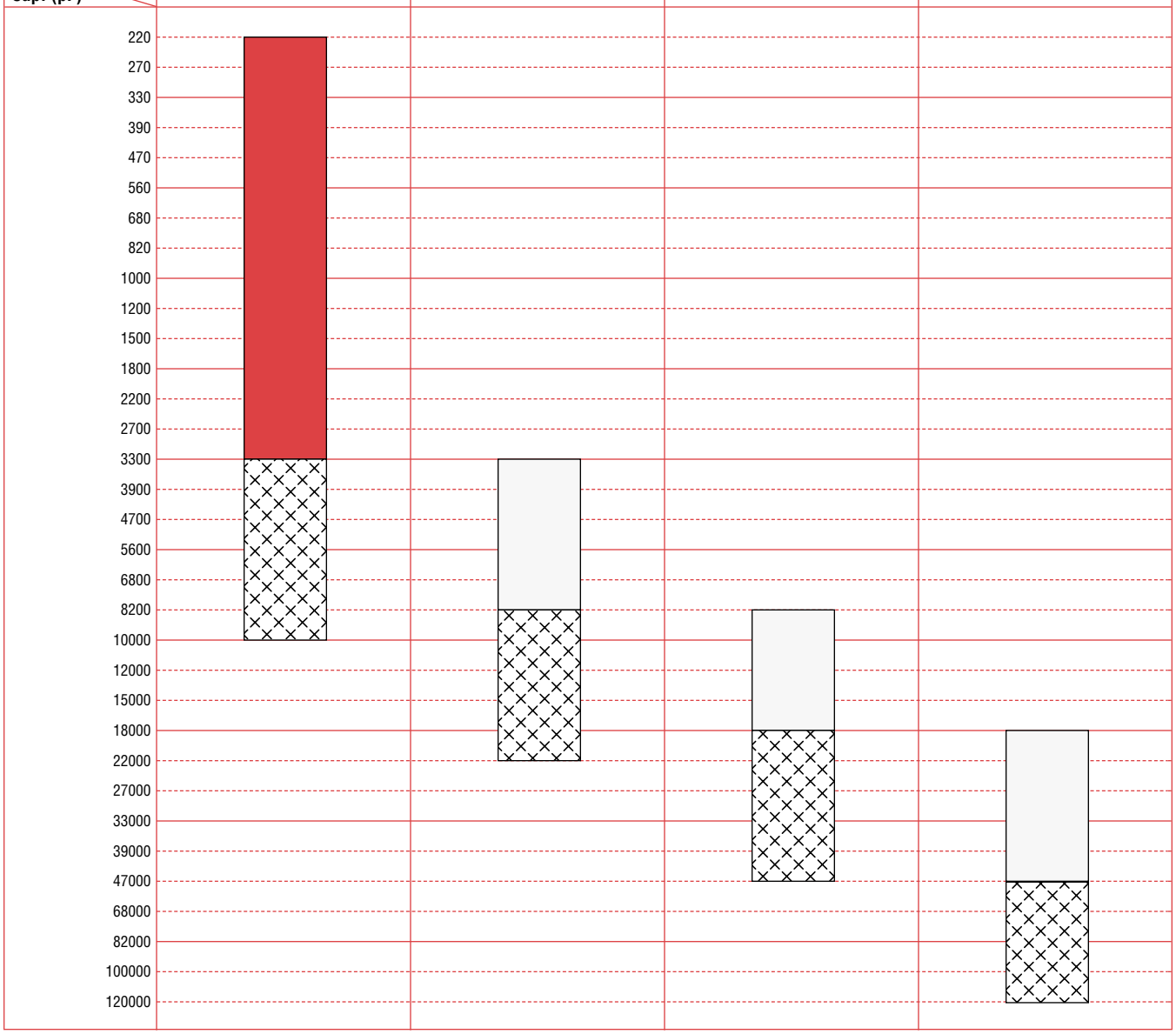
Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*
GRM42-6	: 1.15 ± 0.1	1000	3000	GRM43-2	: 2.0 max.	1000	1000
GRM42-2	: 1.35 ± 0.15	1000	2000	GRM44-1	: 2.0 max.	1000	1000

: Consult factory for thickness, reel quantity, and availability.

*ϕ330mm reel is available on request.

GRM42-6/42-2/43-2/44-1 Series

Type (EIA Code)	GRM42-6 (1206)	GRM42-2 (1210)	GRM43-2 (1812)	GRM44-1 (2220)
Char.	X7R	X7R	X7R	X7R
Volt. / Cap. (pF)	500	500	500	500



THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*	Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)*
GRM42-6	: 1.15 ± 0.1	1000	3000	GRM43-2	: 2.0 max.	1000	1000
GRM42-2	: 1.15 ± 0.1	1000	3000	GRM44-1	: 2.0 max.	1000	1000
	: 1.35 ± 0.15	1000	2000				

: Consult factory for thickness, reel quantity, and availability.

*ϕ330mm reel is available on request.

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
NICKEL BARRIER TERMINATION THIN TYPE

muRata
Innovator in Electronics

GRM40/42-6 Series

FEATURES
- This series is suited to flow and reflow soldering. Capacitor terminations are made of metal highly resistant to migration.
- Large capacitance values enable excellent by-pass effects to be realized.
- Its thin package makes this series ideally suited for the production of small electronic products and for mounting underneath ICs.

APPLICATIONS
- Thin equipment such as IC cards

PART NUMBERING SYSTEM

GRM42-625 Y5V 224 Z 025 A D

CAPACITOR TYPE AND SIZE
See Below

TEMPERATURE CHARACTERISTICS
COG
SL
X7R
Y5V

CAPACITANCE CODE
Expressed in picofarads and identified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
C = ±.25pF
D = ±.5pF
J = ±5%
K = ±10%
M = ±20%
Z = $^{+80}_{-20}$%

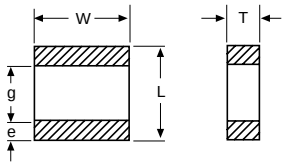
RATED VOLTAGE
Identified by a three-digit number.

MARKING
A = Unmarked

PACKAGING CODE

Packaging	Code
Bulk	B
7″ Paper Tape	D
13″ Paper Tape	J

DIMENSIONS: mm



Size	L Length	W Width	T Thickness	g (min.) Insulation	e (min.) Termination
GRM40-024	2.0 ± 0.1	1.25 ± 0.1	0.5 $^{+0}_{-0.2}$	0.7	0.2
GRM42-625	3.2 ± 0.15	1.6 ± 0.15	0.6 max.	0.7	0.3

SPECIFICATIONS

Type	Rated Voltage/Temp. Char.	COG	SL	X7R	Y5V
GRM40-024	50VDC	0.5 ~ 360	220 ~ 470	220 ~ 6,800	10,000
	25VDC	—	—	8,200 ~ 10,000	15,000 ~ 33,000
	16VDC	—	—	12,000 ~ 27,000	47,000 ~ 100,000
GRM42-625	25VDC	—	—	—	150,000 ~ 220,000

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
ULTRA-MINIATURIZED TYPE

NEW

muRata
Innovator in Electronics

GRM33 Series

FEATURES

- Small chip size (L x W x T: 0.6 x 0.3 x 0.3mm)
- Terminations are made of metal highly resistant to migration.
- GRM33 type is suited to only reflow soldering.
- Stringent dimensional tolerances allow highly reliable, high speed automatic chip placements on PCBs.
- GRM33 Series are suited to miniature microwave module, portable equipment and high-frequency circuit.

APPLICATIONS

- Miniature microwave module
- Portable equipment
- High-frequency circuit

PART NUMBERING SYSTEM

GRM33 X7R 102 K 016 A □

TYPE

TEMPERATURE CHARACTERISTICS
COG
X7R

CAPACITANCE CODE
Expressed in picofarads and identified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
COG: 5pF or less
C = ±.25pF
>6pF ≤10pF
D = ±.5pF
>10pF
J = ±5%
X7R: K = ±10%
M = ±20%

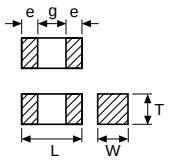
RATED VOLTAGE
016 = 16V
025 = 25V

UNMARKED

PACKAGING CODE

Packaging	Code
7″ Paper Tape	F
Bulk	B

DIMENSIONS AND PACKAGING TYPES/QUANTITY



Type	EIA Code	Dimensions: mm					Bulk (pcs./bag)	Taping (pcs./ ϕ178mm reel)
		L Length	W Width	T Thickness	e Termination	g (min.) Insulation		
GRM33	0201	0.6 ± 0.03	0.3 ± 0.03	0.3 ± 0.03	0.1 ~ 0.2	0.2	1000	15000

SPECIFICATIONS

Type	Temperature Characteristics	Temperature Coefficient	Temperature Range	Reference Temperature
GRM33	COG	0 ± 30ppm/°C	–55 ~ +125°C	25°C
	X7R	±15%		

CAPACITANCE RANGE TABLE (pF)

Type	Temperature Characteristics	DC Rated Voltage (V)	
		25	16
GRM33	COG	1 ~ 15	—
	X7R	—	100 ~ 1000

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
CAPACITOR ARRAYS

NEW

muRata
Innovator in Electronics

GNM Series

FEATURES
- High density mounting due to mounting space saving
- Mounting cost saving (one placement instead of four)
- Four capacitors on one chip

APPLICATIONS
- Cellular phones, pagers
- Camcorders
- Personal computers
- Audio
- LCD

PART NUMBERING SYSTEM

GNM30-401 X7R 103 K 050 A D

TYPE

TEMPERATURE CHARACTERISTICS
COG = 0 ± 30ppm/°C
SL = +350 ~ –1000ppm/°C
X7R = ±15%
Y5V = $^{+22}_{-82}$%

CAPACITANCE CODE
Expressed in picofarads and identified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
COG: 10pF
D = ±0.5pF
>10pF
J = ±5%
K = ±10%
X7R: >10pF
K = ±10%
M = ±20%
Y5V: Z = $^{+80}_{-20}$%

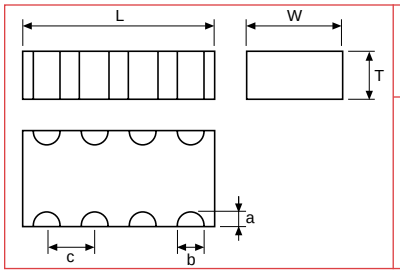
VOLTAGE
Identified by a three-digit number.

MARKING
A = Unmarked

PACKAGING CODE

Packaging	Code
Bulk	B
7″ Reel Paper Tape	D
13″ Reel Paper Tape	J

DIMENSIONS AND PACKAGING TYPES/QUANTITY



Type	EIA Code	Dimensions: mm						Bulk (pcs./bag)	Taping (pcs./ ϕ178mm reel)
		L Length	W Width	T Thickness	a	b	c		
GNM30-401	1206	3.2 ± 0.15	1.6 ± 0.15	0.8 ± 0.1	0.2 ± 0.1	0.4 ± 0.05	0.8 ± 0.1	1000	4000

SPECIFICATIONS: pF

Type	DC Rated Voltage (V)	Temperature Characteristics		
		COG	X7R	Y5V
GNM30-401	100	10 ~ 150	220 ~ 4700	680 ~ 4700
	50	10 ~ 330	390 ~ 15000	22000 ~ 47000
	25	—	18000	—
	16	—	22000 ~ 100000	68000 ~ 150000
Temperature Range		–55 ~ +125°C	–55 ~ +125°C	–30 ~ +85°C

SURFACE MOUNT MONOLITHIC CHIP CAPACITORS
LOW ESL WIDE WIDTH TYPE

NEW

muRata
Innovator in Electronics

LL Series

FEATURES
- Low ESL, good for noise reduction for high frequency
- Small, high capacitance

APPLICATIONS
- High speed microprocessor
- High frequency digital equipment

PART NUMBERING SYSTEM

LL0508 X7R 103 K 050 A D

TYPE

TEMPERATURE CHARACTERISTICS
X7R = ±15%
Y5V = +22, –56%
Z5U = +22, –82%

CAPACITANCE CODE
Expressed in picofarads and identified by a three-digit code. First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
K = ±10%
M = ±20%
Z = +80, –20%

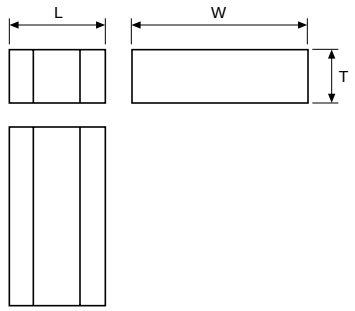
VOLTAGE
Identified by a three-digit number.

MARKING
A = Unmarked

PACKAGING CODE

Packaging	Code
7″ Reel Paper Tape	D
13″ Reel Paper Tape	J

DIMENSIONS: mm



Type	L Length	W Width	T Thickness
LL0306	0.8 ± 0.1	1.6 ± 0.1	0.6 max.
LL0508	1.25 ± 0.1	2.0 ± 0.1	1.0 max.
LL0612	1.6 ± 0.15	3.2 ± 0.15	0.7 ± 0.1
			1.15 ± 0.1

CAPACITANCE RANGE TABLE

Type	LL0306								LL0508								LL0612							
Temp. Char.	X7R			Z5U		Y5V			X7R			Z5U		Y5V			X7R			Z5U		Y5V		
DC Rated Volt. (V) / Cap. (pF)	16	25	50	25	50	16	25	50	16	25	50	25	50	16	25	50	16	25	50	25	50	16	25	50
2200																								
2700																								
3300																								
3900																								
4700																								
5600																								
6800																								
8200																								
10000																								
12000																								
15000																								
18000																								
22000																								
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39000																								
47000																								
56000																								
68000																								
82000																								
100000																								
120000																								
150000																								
180000																								
220000																								
270000																								
330000																								
470000																								
560000																								
680000																								
1000000																								

THICKNESS AND PACKAGING TYPES/QUANTITY

Type	Thickness: T (mm)	Bulk (pcs./bag)	Taping (pcs./ϕ178mm reel)
LL0306	□: 0.6max.	1000	4000
LL0508	□: 1.0 max.	1000	4000
LL0612	□: 0.7 ± 0.1	1000	4000
	▨: 1.15 ± 0.1	1000	3000

MENA STANDARD INNER PACKAGE LABEL

CODE KEY

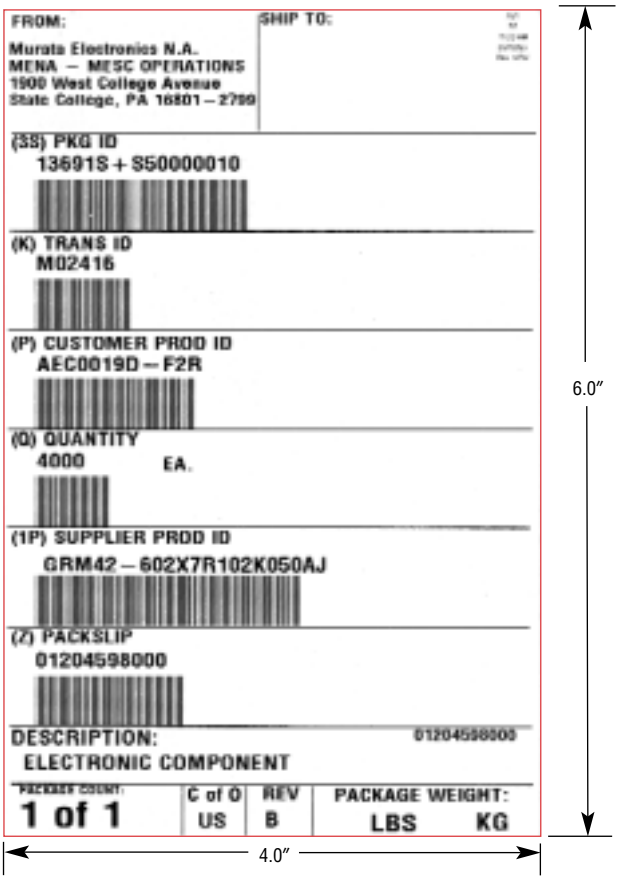
Customer Part Number
Quantity
MENA Part Number
Lot/Inspection Number & Supplier

DIMENSIONS: inches

MENA STANDARD SHIPPING LABEL EIA-556 FORMAT

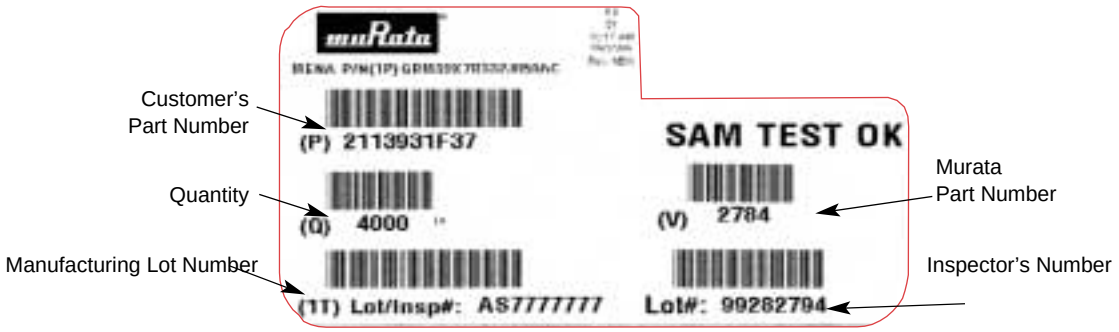
CODE KEY

Supplier/Ship Label
Pkg. I.D.
Package Order
Customer Part Number
Quantity
Murata Part Number
Pack Slip Number
Description/Pkg. Ct./Weight



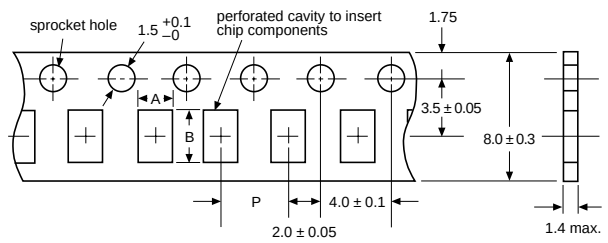
DIMENSIONS: inches

MENA STANDARD BULK CASE LABEL



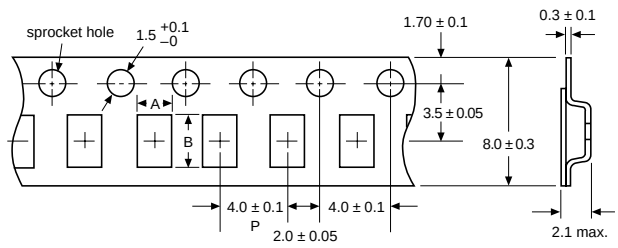
DIMENSIONS: mm

8 mm PUNCHED (PAPER)



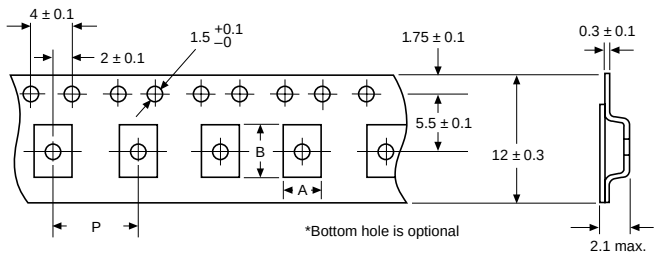
	GRM 36 0402	GRM 39 0603	GRM 40 0805	GRM 42-6 1206	GRM 42-2 1210
Tape A nom.	.65	1.2	1.65	2.2	2.95
Tape B nom.	1.15	2.0	2.4	3.8	3.65
Chip T max.	0.6	0.9	1.0	1.0	1.0
Tape Pitch: P	2.0 ± .05	4.0 ± 0.1	4.0 ± 0.1	4.0 ± 0.1	4.0 ± 0.1

8 mm EMBOSSED (PLASTIC)



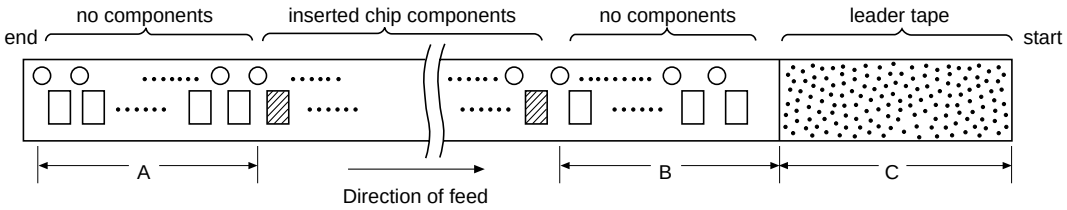
	GRM 40 0805	GRM 42-6 1206	GRM 42-2 1210
Tape A nom.	1.55	2.0	2.9
Tape B nom.	2.35	3.6	3.6
Chip T max.	1.35	1.5	1.5
Tape Pitch: P	4.0 ± 0.1	4.0 ± 0.1	4.0 ± 0.1

12 mm EMBOSSED (PLASTIC)



	GRM 43 1808	GRM 43-2 1812	GRM 44-1 2220
Tape A nom.	2.5	3.7	5.3
Tape B nom.	5.1	5.0	6.2
Chip T max.	2.0	2.0	2.0
Tape Pitch: P	4 ± 0.1	8 ± 0.1	8 ± 0.1

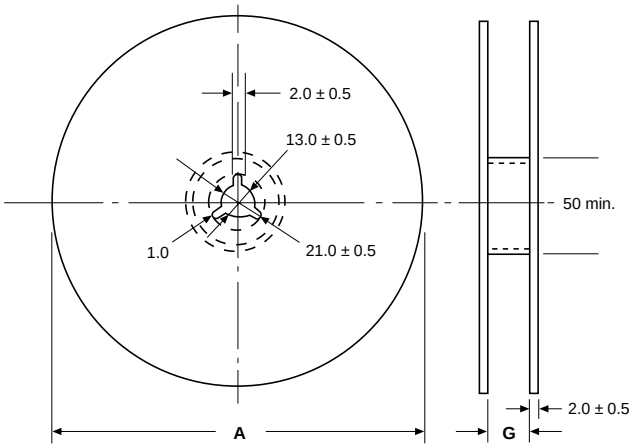
TAIL AND LEADER TAPE DIMENSIONS: mm



	Tail Tape (A)	Empty Cavities (B)	Leader Tape (C)
EIA-481-1	6.3 to 8.2 (160 to 200)	6.3 to 7.4 (160 to 188)*	9.0 to 9.8 (230 to 250)

*20 to 30mm must be unsealed with remaining portion of empty cavities sealed.

REEL DIMENSIONS: mm



Reel Diameter A	Width of Tape Carrier G	
	For 8mm Tape	For 12mm Tape
178 ± 2.0	$8.4^{+1.5}_{-0}$	$12.4^{+2.0}_{-0}$
330 ± 2.0		

CHIP PACKAGING QUANTITIES

Type	Thickness (mm) max.	Bulk Bags	Bulk Case	Tape			
				7″ Paper	13″ Paper	7″ Embossed	13″ Embossed
GRM36	—	1000	50000	10000	50000	—	—
GRM39	—	1000	15000	4000	10000	—	—
GRM40 GRM42-6 GRM42-2	1.00	1000	—	4000	10000	—	—
GRM42-6 GRM42-2	1.25	1000	—	—	—	3000	10000
GRM40	1.40	1000	—	—	—	3000	10000
GRM42-2	1.50	1000	—	—	—	2000	8000
GRM43	1.50	1000	—	—	—	2000	8000
GRM43-2 GRM44-1	1.50	1000	—	—	—	1000	4000
GRM43	2.00	1000	—	—	—	2000	8000
GRM43-2 GRM44-1	2.00	1000	—	—	—	1000	4000
GRM43-2 GRM44-1	2.50	1000	—	—	—	500	—
GRM43-2 GRM44-1	2.75	1000	—	—	—	500	—

BULK CASE PACKAGING

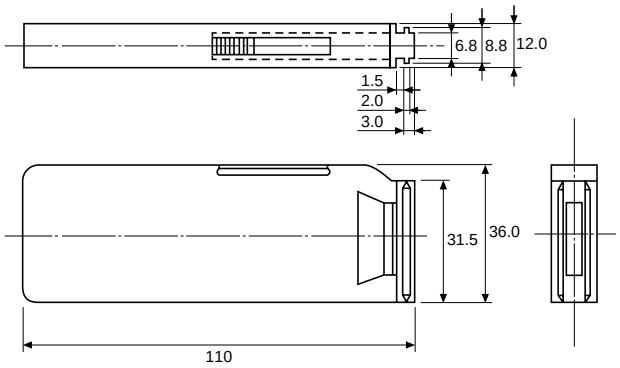
The state-of-the-art in automatic placement of surface mount monolithic ceramic chip capacitors has been greatly advanced with Murata Electronic's new bulk case packaging which offers an alternative to tape and reel. This new technique features a bulk case which can accommodate up to 50,000 pieces of GRM 36 (0402) and up to 15,000 pieces of GRM 39 (EIA 0603) capacitors which is considerably more than on a standard reel.

Additionally, this new packaging system facilitates standard bar coding and reduces storage and handling requirements. It also greatly reduces the possibility of mixing parts which is typical of other bulk packaging systems. Overall packaging placement costs are also greatly reduced. (Consult with placement equipment manufacturer to determine capability.)

FEATURES

- Prevents Mixture of Parts
- Reduces Labor Costs
- Reduces Stock Space
- Reduces Inventory Costs
- Improves Production Efficiency
- Reduces Waste
- Improved Inventory Control
- Bar Code Labeling
- Anti-Static Packaging
- Recyclable Packaging
- Placement Reliability
- Eliminates Leader/Tail Tape

BULK CASE DIMENSIONS: mm



Chip Size (EIA)	Dimensions: mm			Qty/Case
	L	W	T	
0402	1.0	0.5	0.5	50000
0603	1.6	0.8	0.8	15000
0805	2.0	1.25	0.6	10000
			1.25	5000

STORAGE OF CHIPS

Cautions

Chip monolithic ceramic capacitors (chips) can experience degradation of termination solderability when subjected to high temperature or humidity, or if exposed to sulfur or chlorine gases.

Control Points

- Storage environment must be at an ambient temperature of 5–40°C and an ambient humidity of 20–70% RH. Use chips within 6 months. If 6 months or more have elapsed, check solderability before use.
- For GR Series and GR500 Series, do not unpack the minimum package until immediately before use. After unpacking, re-seal promptly or store with a desiccant.
- Avoid mechanical shock (ex. falling) to the capacitor to prevent mechanical cracking inside of the ceramic dielectric due to its own weight.

CIRCUIT DESIGN

Cautions

The capacitors in this catalog are not safety recognized products.

PCB DESIGN

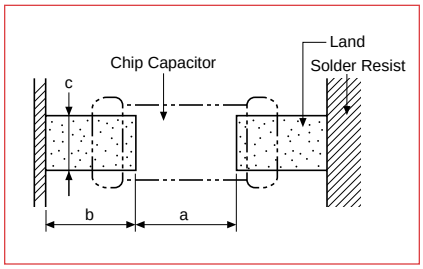
Cautions

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.

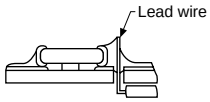
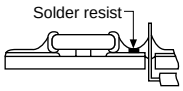
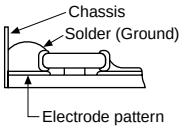
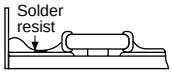
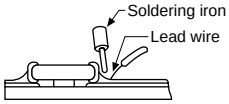
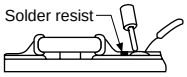
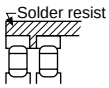
Control Points

- When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.

LAND DIMENSIONS



PATTERN FORMS

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

FLOW SOLDERING METHOD

Murata Designation		GRM39 GRM420 GRM706	GRM40 GRM425	GRM42-6 GRM430	LL0508	LL0612	GRM708	MA18
Dimensions: mm	L	1.6	2.0	3.2	1.25	1.6	2.0	1.4
	W	0.8	1.25	1.6	2.0	3.2	1.25	1.4
a		0.6 ~ 1.0	1.0 ~ 1.2	2.2 ~ 2.6	0.4 ~ 0.7	0.6 ~ 1.0	1.0 ~ 1.2	0.5 ~ 0.8
b		0.8 ~ 0.9	0.9 ~ 1.0	1.0 ~ 1.1	0.5 ~ 0.7	0.8 ~ 0.9	0.9 ~ 1.0	0.8 ~ 0.9
c		0.6 ~ 0.8	0.8 ~ 1.1	1.0 ~ 1.4	1.4 ~ 1.8	2.6 ~ 2.8	0.8 ~ 1.0	1.0 ~ 1.2

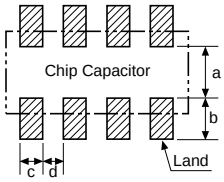
REFLOW SOLDERING METHOD

Murata Designation		GRM33	GRM36	GRM39 GRM420 GRM220	GRM40 GRM425 GRM225	GRM42-6 GRM430 GRM230	GRM42-2 GRM235	GRM43-2	GRM44-1	LL0306	LL0508	LL0612	GRM706
Dimensions: mm	L	0.6	1.0	1.6	2.0	3.2	3.2	4.5	5.7	0.8	1.25	1.6	1.6
	W	0.3	0.5	0.8	1.25	1.6	2.5	3.2	5.0	1.6	2.0	3.2	0.8
a		0.2 ~ 0.3	0.3 ~ 0.5	0.6 ~ 0.8	1.0 ~ 1.2	2.2 ~ 2.4	2.0 ~ 2.4	3.0 ~ 3.5	4.0 ~ 4.6	0.2 ~ 0.4	0.4 ~ 0.6	0.6 ~ 0.8	0.6 ~ 0.8
b		0.2 ~ 0.35	0.35 ~ 0.45	0.6 ~ 0.7	0.6 ~ 0.7	0.8 ~ 0.9	1.0 ~ 1.2	1.2 ~ 1.4	1.4 ~ 1.6	0.3 ~ 0.4	0.3 ~ 0.5	0.6 ~ 0.7	0.6 ~ 0.7
c		0.2 ~ 0.4	0.4 ~ 0.6	0.6 ~ 0.8	0.8 ~ 1.1	1.0 ~ 1.4	1.8 ~ 2.3	2.3 ~ 3.0	3.5 ~ 4.3	1.0 ~ 1.4	1.4 ~ 1.8	2.6 ~ 2.8	0.6 ~ 0.8

Murata Designation		GRM708	GRM710	MA18	MA28
Dimensions: mm	L	2.0	3.2	1.4	2.8
	W	1.25	2.5	1.4	2.8
a		1.0 ~ 1.2	2.2 ~ 2.5	0.4 ~ 0.8	1.8 ~ 2.1
b		0.6 ~ 0.8	0.8 ~ 1.0	0.6 ~ 0.8	0.7 ~ 0.9
c		0.8 ~ 1.0	1.9 ~ 2.3	1.0 ~ 1.2	2.2 ~ 2.6

GNM SERIES FOR REFLOW SOLDERING METHOD

Type	Dimensions: mm					
	L	W	a	b	c	d
GNM30-401	3.2	1.6	0.8 ~ 1.0	0.7 ~ 0.9	0.3 ~ 0.4	0.4 ~ 0.5

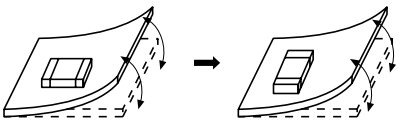


Control Points

- Choose a mounting postion that minimizes the stress imposed on the chip during flexing or bending the board.

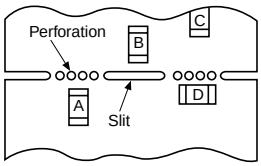
Component Direction

Incorrect → Correct



Locate chip horizontally to the direction in which stress acts.

Chip Mounting Close to Board Separation Point



Chip arrangement:
Worst A–C–(B≃D) Best

SOLDER PASTE PRINTING

Cautions

- Overly thick application of solder paste results in excessive fillet height solder.

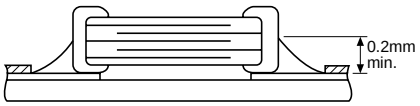
  This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.

- Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.

Control Points

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

Optimum Solder Amount for Reflow Soldering



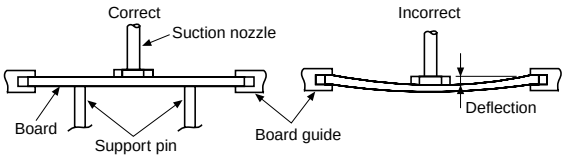
CHIP PLACING

Cautions

- An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips.
- Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes great force on the chip during mounting, causing cracked chips.
- The locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips.

Control Points

- Adjust the suction nozzle's bottom dead point by correcting warps in the board.
- Nozzle pressure for chip mounting must be a 1 to 3N static load.



- Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board.
- The suction nozzle and the locating claw must be maintained, checked and replaced periodically.

REFLOW SOLDERING

Cautions

- Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips.

Control Points

- When preheating, keep temperature differential, ΔT, within the range shown in Table 1. The smaller the ΔT, the less stress on the chip.

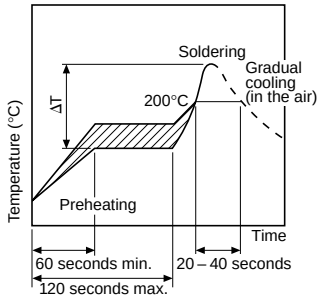
TABLE 1

Chip Size	Temperature Differential
GRM33/36/39/40/42-6 GRM420/425/430 GRM220/225/230 LL0306/0508/0612 GRM706/708/MA18	ΔT ≦ 190°C
GRM42-2/43-2/44-1 GRM710/MA28 GRM235/GNM30-401	ΔT ≦ 130°C

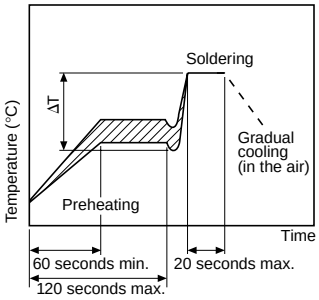
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and solvent within the range shown in Table 1.

Standard Conditions for Reflow Soldering

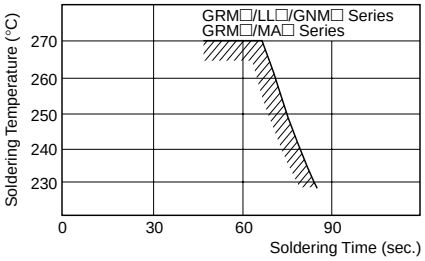
Infrared Reflow



Vapor Reflow



Allowable Soldering Temperature and Time



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

INVERTING THE PCB

Control Points

- Make sure not to impose an abnormal mechanical shock on the PCB.

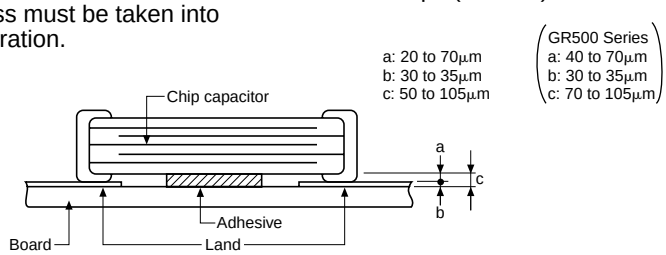
ADHESIVE APPLICATION

Cautions

- Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered.
- Low viscosity adhesive causes chips to slip after mounting.

Control Points

- The amount of adhesive must be more than dimension C shown in the drawing below to obtain enough bonding strength.The chip's electrode thickness and land thickness must be taken into consideration.
- Adhesive must have a viscosity of 500ps (at 25°C) min.



ADHESIVE CURING

Cautions

- Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption.

Control Points

- Control curing temperature and time in order to prevent insufficient hardening.

INVERTING THE BOARD

Control Points

- Make sure not to impose an abnormal mechanical shock on the PCB.

LEADED COMPONENT INSERTION

Cautions

- If the PCB is flexed when leaded components (such as transformers and IC's) are being mounted, chips may crack and solder joints may break.

Control Points

- Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping.

FLUX APPLICATION

Cautions

- An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability.
- Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned.

Control Points

- Apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
- Use flux with a halide content of 0.2wt% max. But do not use strongly acidic flux.
- Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned.

FLOW SOLDERING

Cautions

- Sudden heating of the chip results in thermal distortion causing cracked chips.
- An excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.

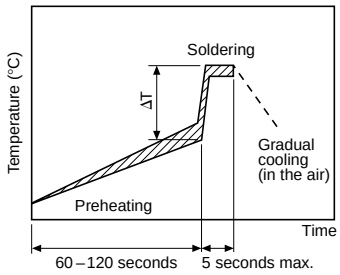
Control Points

- When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 2. The smaller the ΔT, the less stress on the chip.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.
- Do not apply flow soldering to chips not listed in Table 2.

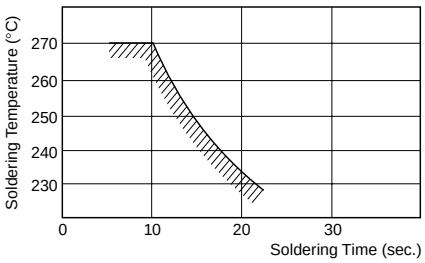
TABLE 2

Chip Size	Temperature Differential
GRM39/40/42-6 GRM420/425/430 LL0508/0612 GRM706/708/MA18	ΔT ≦ 150°C

Standard Conditions for Flow Soldering

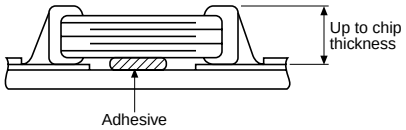


Allowable Soldering Temperature and Time



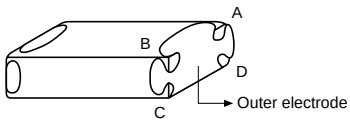
- In case of repeated soldering, the accumulated soldering time must be within the range shown above.

Optimum Solder Amount for Flow Soldering

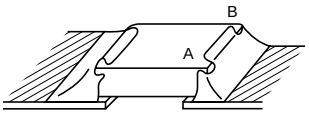


- Set temperature and time to ensure that leaching of the outer electrode does not exceed 25% of the chip end area as a single chip (full length of the edge A-B-C-D shown below) and 25% of the length A-B shown below as mounted on substrate.

As a single chip



As mounted on substrate



CORRECTION WITH A SOLDERING IRON

For chip type capacitors except GRM200 Series

Cautions

- Sudden heating of the chip results in distortion due to a high internal temperature differential, causing cracked chips.

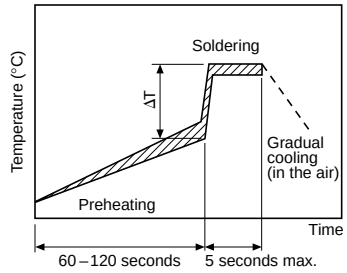
Control Points

- When preheating, keep temperature differential, ΔT, within the range shown in Table 3. The smaller the ΔT, the less stress on the chip.

TABLE 3

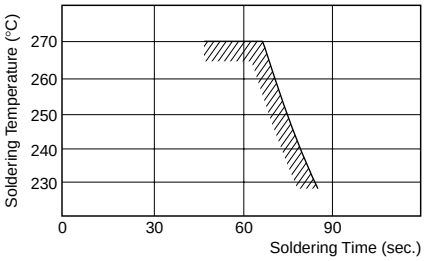
Chip Size	Temperature Differential
GRM36/39/40/42-6 GRM420/425/430 LL0306/0508/0612 GRM706/708/MA18	ΔT ≦ 190°C
GRM42-2/43-2/44-1 GNM30-401 GRM710/MA28	ΔT ≦ 130°C

Standard Conditions for Soldering Iron Temperature

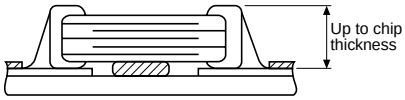


Allowable Time and Temperature for Making Corrections with a Soldering Iron

- The accumulated soldering time/ temperature including reflow/flow soldering must be within the range shown below.



Optimum Solder Amount When Corrections Are Made Using a Soldering Iron



- When correcting chips with a soldering iron, no preheating is required if the chip is listed in Table 4 and the following conditions (Table 4) are met.
- Preheating should be performed on chips not listed in Table 4.

TABLE 4

Item	Conditions	
Chip Size	GRM36/39/40 GRM420/425 LL0306/0508 GRM706/708/MA18	GRM42-6 GRM430 LL0612 GNM30-401
Temperature of Iron Tip	300°C max.	270°C max.
Soldering Iron Wattage	20W max.	
Diameter of Iron Tip	ϕ3mm max.	
Restriction	Do not allow the iron tip to directly touch the ceramic element.	

SOLDERING IRON METHOD *For GRM200 Series*

When solder GRM200 Series chip capacitor, keep the following conditions.

Item	Conditions	
Chip Type	GRM220	GRM225/230/235
Pre-heating	No pre-heating is possible	Δ ≦ 130°C
Temperature of Iron Tip	300°C max.	
Soldering Iron Wattage	20W max.	
Diameter of Iron Tip	ϕ3mm max.	
Soldering Time	5 sec. max.	
Solder Amount	≦ Chip thickness	≦ ½ of chip thickness
Restriction	Do not allow the iron tip to directly touch the ceramic element.	

For Microstrip Types

- Solder 1mm away from the ribbon terminal base, being careful that the solder tip does not directly contact the capacitor. Preheating is unnecessary.
- Complete soldering within 3 seconds with a soldering tip less than 270°C in temperature.

WASHING

Cautions

- Excessive output of ultrasonic oscillation during cleaning causes PCB's to resonate, resulting in cracked chips or broken solder.

Control Points

- Take note not to vibrate PCB's.

INSPECTION

Cautions

- Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints.

Control Points

- Provide support pins on the back side of the PCB to prevent warping or flexing.

RESIN COATING

Control Points

- When selecting resin materials, select those with low contraction.

BOARD SEPARATION (OR DEPANELIZATION)

Cautions

- Board flexing at the time of separation causes cracked chips or broken solder.

Control Points

- Severity of stresses imposed on the chip at the time of board break is in the order of:
  Pushback < Slitter < V Slot < Perforator.
- Board separation must be performed using special jigs, not with hands.

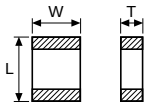
DC250V ~ DC3.15kV, AC250V(r.m.s.)

Series (Merit)	Rated Voltage	Cap. E-step	Dimensions (mm) L	W	T	Capacitance (pF) min.	max.	Part Number	Pack Qty. (pcs./reel) ϕ178mm reel)	EIA Size	Sample
GHM1000 (Low loss) S L (X7R)	DC3.15kV	E12	4.5 ± 0.3	2.0 ± 0.2	2.0 ± 0.3	—	10	**GHM1038SL100D3K**	2000	1808	
						12	82	**GHM1038SL□□□J3K**			
			4.5 ± 0.3	3.2 ± 0.3	2.5 $^{+0}_{-0.3}$	—	100	**GHM1040SL101J3K**	500	1812	
	DC2kV	E12	4.5 ± 0.3	3.2 ± 0.3	2.0 $^{+0}_{-0.3}$	120	220	**GHM1040SL□□□J2K**	1000		
GHM1000 (Low loss) R (X7R)	DC630V	E6	3.2 ± 0.2	1.6 ± 0.2	1.0 $^{+0}_{-0.3}$	100	330	**GHM1030R□□□K630**	4000	1206	
					1.25 $^{+0}_{-0.3}$	470	1000	**GHM1030R□□□K630**	3000		
GHM1500 (High Cap.) B (X7R)	DC630V	E6	3.2 ± 0.2	1.6 ± 0.2	1.25 $^{+0}_{-0.3}$	1000	10000	**GHM1530B□□□K630**	3000	1206	
			3.2 ± 0.3	2.5 ± 0.2	1.5 $^{+0}_{-0.3}$	15000	22000	**GHM1535B□□□K630**	2000	1210	
			4.5 ± 0.4	3.2 ± 0.3	1.5 $^{+0}_{-0.3}$	33000	47000	**GHM1540B□□□K630**	1000	1812	
					2.0 $^{+0}_{-0.3}$	—	68000	**GHM1540B683K630**	1000		
					2.6 $^{+0}_{-0.3}$	—	100000	**GHM1540B104K630**	500		
			5.7 ± 0.4	5.0 ± 0.4	2.0 $^{+0}_{-0.3}$	—	150000	**GHM1545B154K630**	1000	2220	
					2.7 $^{+0}_{-0.3}$	—	220000	**GHM1545B224K630**	500		
GHM1500 (High Cap.) B (X7R)	DC250V	E6	2.0 ± 0.2	1.25 ± 0.2	1.0 $^{+0}_{-0.3}$	1000	6800	**GHM1525B□□□K250**	4000	0805	
					1.25 ± 0.2	—	10000	**GHM1525B103K250**	3000		
			3.2 ± 0.2	1.6 ± 0.2	1.0 $^{+0}_{-0.3}$	15000	22000	**GHM1530B□□□K250**	4000	1206	
					1.25 $^{+0}_{-0.3}$	—	33000	**GHM1530B333K250**	3000		
					1.6 ± 0.2	—	47000	**GHM1530B473K250**	2000		
			3.2 ± 0.3	2.5 ± 0.2	1.5 $^{+0}_{-0.3}$	—	68000	**GHM1535B683K250**	2000	1210	
					2.0 $^{+0}_{-0.3}$	—	100000	**GHM1535B104K250**	1000		
			4.5 ± 0.4	3.2 ± 0.3	2.0 $^{+0}_{-0.3}$	—	150000	**GHM1540B154K250**	1000	1812	
					2.5 $^{+0}_{-0.3}$	—	220000	**GHM1540B224K250**	500		
			5.7 ± 0.4	5.0 ± 0.4	2.0 $^{+0}_{-0.3}$	330000	470000	**GHM1545B□□□K250**	1000	2220	
GHM2100 B	AC250Vrms (Test Voltage AC575V 60 sec.)	E3	5.7 ± 0.4	2.8 ± 0.3	2.0 ± 0.3	10000	47000	**GHM2143B□□□MAC250**	1000	2211	
			5.7 ± 0.4	5.0 ± 0.4	2.0 ± 0.3	—	100000	**GHM2145B104MAC250**	1000	2220	
GHM2200 (Y Cap.) B	AC250Vrms (Test Voltage AC1500V 60 sec.)	E3	5.7 ± 0.4	2.8 ± 0.3	2.0 ± 0.3	470	4700	**GHM2243B□□□MAC250**	1000	2211	
GHM3100 (X Cap.) X 7 R **TYPE GB**	AC250Vrms **SAFETY** VDE, SEV, SEMKO recognized class X2	E3	5.7 ± 0.4	5.0 ± 0.4	2.0 ± 0.3	10000	22000	**GHM3145X7R□□□K-GB**	1000	2220	
			5.7 ± 0.4	5.0 ± 0.4	2.7 ± 0.3	—	33000	**GHM3145X7R333K-GB**	500	2220	
GHM3000 (Y Cap.) X 7 R **TYPE GC**	AC250Vrms **SAFETY** VDE, SEV, SEMKO recognized class Y2, X1 and UL recognized LINE-BY-PASS	E6	5.7 ± 0.4	5.0 ± 0.4	2.0 ± 0.3	100	4700	**GHM3045X7R□□□K-GC**	1000	2220	

Nominal Capacitance (□□□ in P/N): the first two digits represent significant figure, the last digit represents the multiplier of 10 in pF (ex.: 100 = 10pF, 151 = 150pF, 223 = 22000pF).

CAPACITANCE STEP E-SERIES

E-3	1.0				2.2				4.7			
E-6	1.0		1.5		2.2		3.3		4.7		6.8	
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2



GHM1000/1500 Series

FEATURES

- A new multi-layer structure for small, surface-mountable devices capable of operating at high-voltage.
- Sn plated external electrodes allow mounting without silver compound solder.
- The GHM1030 type and 1525/1530 types for flow and reflow soldering. All other types for reflow soldering only.

APPLICATIONS

GHM1000

- Ideal use on high-frequency pulse circuit such as snubber circuit for switching power supply, DC-DC converter, ballast (inverter fluorescent lamp). (R Characteristics)
- Ideal for use as the ballast in liquid crystal back-lighting inverters. (SL Characteristics)

GHM1500

- Ideal use as hot-cold coupling for DC-DC converter.
- Ideal use on line filter and ringer detector for telephone, facsimile and modem.
- Ideal use on diode-snubber circuit for switching power supply.

PART NUMBERING SYSTEM

GHM1040 SL 121 J 2K

CAPACITOR TYPE AND SIZE

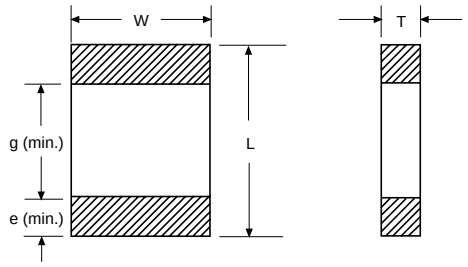
TEMPERATURE CHARACTERISTICS
Temperature Range
SL, R, & B = –55 to +125°C
Maximum Capacitance Change
SL = +350 to –1000ppm/°C
(+20 to +85°C)
R = ±15% (–55 to +125°C)
B = ±10% (–25 to +85°C)

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number.
First two digits represent significant figures. Last digit specifies the number of zeros to follow.

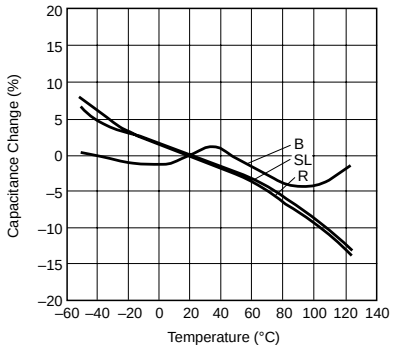
CAPACITANCE TOLERANCE
D = ±0.5pF
J = ±5%
K = ±10%

VOLTAGE
250 = 250VDC
630 = 630VDC
2K = 2KVDC
3K = 3.15KVDC

DIMENSIONS: mm

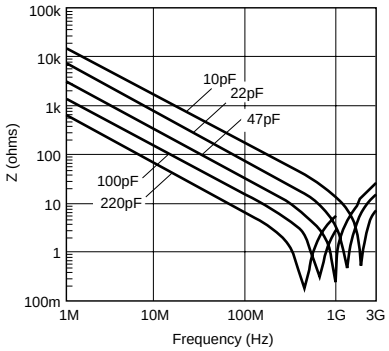


CAPACITANCE – TEMPERATURE CHARACTERISTICS

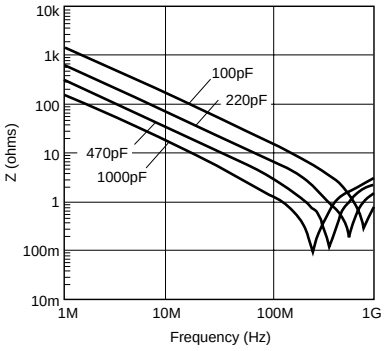


IMPEDANCE – FREQUENCY CHARACTERISTICS

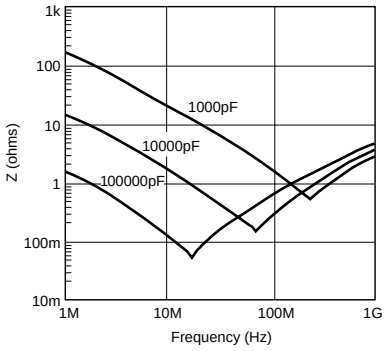
GHM1000 Series (SL Char.)



GHM1000 Series (R Char.)



GHM1500 Series (B Char.)



TEMPERATURE COMPENSATING TYPE SL Characteristic (+350 to –1000ppm/°C)

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	DC Rated Voltage (V)	Dimensions (mm) L	W	T	g	e	Packaging Qty. (pcs./reel)
GHM1040SL121J2K	120	±5%	2k	4.5 ± 0.3	3.2 ± 0.3	2.0 $^{+0}_{-0.3}$	2.9	0.3	1000
GHM1040SL151J2K	150								
GHM1040SL181J2K	180								
GHM1040SL221J2K	220								
GHM1038SL100D3K	10	±0.5pF	3.15k		2.0 ± 0.2	2.0 ± 0.3			2000
GHM1038SL120J3K	12	±5%							
GHM1038SL150J3K	15								
GHM1038SL180J3K	18								
GHM1038SL220J3K	22								
GHM1038SL270J3K	27								
GHM1038SL330J3K	33								
GHM1038SL390J3K	39								
GHM1038SL470J3K	47								
GHM1038SL560J3K	56								
GHM1038SL680J3K	68								
GHM1038SL820J3K	82								
GHM1040SL101J3K	100				3.2 ± 0.3	2.5 $^{+0}_{-0.3}$			500

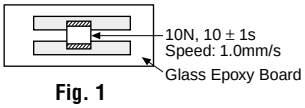
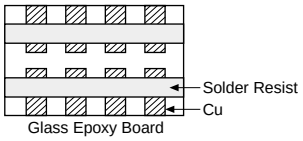
*1k VDC product also available. Please contact us for further details.

HIGH DIELECTRIC CONSTANT TYPE R Characteristic (±15%)

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	DC Rated Voltage (V)	Dimensions (mm) L	W	T	g	e	Packaging Qty. (pcs./reel)
GHM1030R101K630	100	±10%	630	3.2 ± 0.2	1.6 ± 0.2	1.0 $^{+0}_{-0.3}$	1.5	0.3	4000
GHM1030R151K630	150								
GHM1030R221K630	220								
GHM1030R331K630	330								
GHM1030R471K630	470					1.25 $^{+0}_{-0.3}$			3000
GHM1030R681K630	680								
GHM1030R102K630	1000								

HIGH DIELECTRIC CONSTANT TYPE B Characteristic (±15% from –55 to +125°C; ±10% within –25 to +85°C)

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	DC Rated Voltage (V)	Dimensions (mm) L	W	T	g	e	Packaging Qty. (pcs./reel)
GHM1525B102K250	1000	±10%	250	2.0 ± 0.2	1.25 ± 0.2	1.0 $^{+0}_{-0.3}$	0.7	0.3	4000
GHM1525B152K250	1500								
GHM1525B222K250	2200								
GHM1525B332K250	3300								
GHM1525B472K250	4700								
GHM1525B682K250	6800								
GHM1525B103K250	10000					1.25 ± 0.2			3000
GHM1530B153K250	15000			3.2 ± 0.2	1.6 ± 0.2	1.0 $^{+0}_{-0.3}$	1.5		4000
GHM1530B223K250	22000								
GHM1530B333K250	33000					1.25 $^{+0}_{-0.3}$			3000
GHM1530B473K250	47000					1.6 ± 0.2			2000
GHM1535B683K250	68000			3.2 ± 0.3	2.5 ± 0.2	1.5 $^{+0}_{-0.3}$			
GHM1535B104K250	100000					2.0 $^{+0}_{-0.3}$			1000
GHM1540B154K250	150000			4.5 ± 0.4	3.2 ± 0.3		2.5		
GHM1540B224K250	220000					2.5 $^{+0}_{-0.3}$			500
GHM1545B334K250	330000			5.7 ± 0.4	5.0 ± 0.4	2.0 $^{+0}_{-0.3}$	3.5		1000
GHM1545B474K250	470000								
GHM1530B102K630	1000		630	3.2 ± 0.2	1.6 ± 0.2	1.25 $^{+0}_{-0.3}$	1.5		3000
GHM1530B152K630	1500								
GHM1530B222K630	2200								
GHM1530B332K630	3300								
GHM1530B472K630	4700								
GHM1530B682K630	6800								
GHM1530B103K630	10000								
GHM1535B153K630	15000			3.2 ± 0.3	2.5 ± 0.2	1.5 $^{+0}_{-0.3}$			2000
GHM1535B223K630	22000								
GHM1540B333K630	33000			4.5 ± 0.4	3.2 ± 0.3		2.5		1000
GHM1540B473K630	47000								
GHM1540B683K630	68000					2.0 $^{+0}_{-0.3}$			
GHM1540B104K630	100000					2.6 $^{+0}_{-0.3}$			500
GHM1545B154K630	150000			5.7 ± 0.4	5.0 ± 0.4	2.0 $^{+0}_{-0.3}$	3.5		1000
GHM1545B224K630	220000					2.7 $^{+0}_{-0.3}$			500

No.	Item		Specification: Temperature Compensating Type (SL Char.)	Specification: High Dielectric Constant Type (R or B Char.)	Test Method
1	**Operating Temperature Range**		–55 to +125°C		—
2	**Dielectric Strength**		No defects or abnormalities.		No failure shall be observed when voltage in Table is applied between the terminations for 1 to 5 s, provided the charge/discharge current is less than 50mA. **Rated Voltage** / **Test Voltage** **More than DC1kV**: 120% of the rated voltage **630V**: 150% of the rated voltage **250V**: 200% of the rated voltage
3	**Insulation Resistance (I.R.)**		C ≥ 0.01μF: More than 100M ohms • μF C < 0.01μF: More than 10000M ohms		The insulation resistance shall be measured with 500 ± 50V (250 ± 50V in case of rated voltage: DC 250V) and within 60 ± 5 s of charging.
4	**Capacitance**		Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 20°C at the frequency and voltage shown as follows: ■ Temperature Compensating Type Frequency: 1 ± 0.2MHz Voltage: 0.5 to 5V(r.m.s.) ■ High Dielectric Constant Type Frequency: 1 ± 0.2kHz Voltage: 1 ± 0.2V(r.m.s.)
5	**Q/ Dissipation Factor (D.F.)**		C ≥ 30pF: Q ≥ 1000 C < 30pF: Q ≥ 400 + 20C C: Nominal Capacitance (pF)	D.F. ≤ 0.01 (R Char.) D.F. ≤ 0.025 (B Char.)	
6	**Capacitance Temperature Characteristics**		Temp. Coefficient +350 to –1000ppm/°C (Temp. Range: +20 to +85°C)	Cap. Change within ±15% (R Char.) Cap. Change within ±10% (B Char. for –25 to +85°C)	■ Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5 (+20 to +85°C) the capacitance shall be within the specified tolerance for the temperature coefficient. **Step** / **Temperature (°C)** **1**: 20 ± 2 **2**: Min. Operating Temp. ±3 **3**: 20 ± 2 **4**: Max. Operating Temp. ±2 **5**: 20 ± 2 ■ High Dielectric Constant Type The range of capacitance change compared to the 20°C value within –55 to +125°C (–25 to +85°C for B Char.) shall be within the specified range. **Pretreatment** Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition.
7	**Adhesive Strength of Termination**		No removal of the terminations or other defects shall occur.		Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  **Fig. 1**
8	**Vibration Resistance**	**Capacitance**	Within the specified tolerance.		Solder the capacitor to the testing jig (glass epoxy board). The capacitor shall be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 min. This motion shall be applied for a period of 2 h in each 3 mutually perpendicular directions (total of 6 h). 
		Q/D.F.	C ≥ 30pF: Q ≥ 1000 C < 30pF: Q ≥ 400 + 20C C: Nominal Capacitance (pF)	D.F. ≤ 0.01 (R Char.) D.F. ≤ 0.025 (B Char.)	

"room condition" Temperature: 15 to 35°C; Relative humidity: 45 to 75%; Atmosphere pressure: 86 to 106kPa

No.	Item		Specification: Temperature Compensating Type (SL Char.)	Specification: High Dielectric Constant Type (R or B Char.)	Test Method
9	**Deflection**		No cracking or marking defects shall occur.		Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
10	**Solderability of Termination**		75% of the terminations are to be soldered evenly and continuously.		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 2 ± 0.5 s at 235 ± 5°C. Immersing speed: 25 ± 2.5mm/s
11	**Resistance to Soldering Heat**	**Capacitance Change**	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10%	Preheat the capacitor at 120 to 150°C* for 1 min. Immerse the capacitor in eutectic solder solution at 260 ± 5°C for 10 ± 1 s. Let sit at room condition for 24 ± 2 h, then measure. **Immersing speed:** 25 ± 2.5mm/s ■ Pretreatment for high dielectric constant type Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition. *Preheating for more than 3.2 x 2.5mm
		Q/D.F.	C ≥ 30pF: Q ≥ 1000 C < 30pF: Q ≥ 400 + 20C C: Nominal Capacitance (pF)	D.F. ≤ 0.01 (R Char.) D.F. ≤ 0.025 (B Char.)	
		I.R.	C ≥ 0.01μF: More than 100M ohms • μF C < 0.01μF: More than 10000M ohms		
		Dielectric Strength	See item 2.		
12	**Temperature Cycle**	**Capacitance Change**	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10% (R Char.) Within ±7.5% (B Char.)	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24 ± 2 h at room condition, then measure.
		Q/D.F.	C ≥ 30pF: Q ≥ 1000 C < 30pF: Q ≥ 400 + 20C C: Nominal Capacitance (pF)	D.F. ≤ 0.01 (R Char.) D.F. ≤ 0.025 (B Char.)	
		I.R.	C ≥ 0.01μF: More than 100M ohms • μF C < 0.01μF: More than 10000M ohms		
		Dielectric Strength	See item 2.		■ Pretreatment for high dielectric constant type Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition.
13	**Humidity (Steady State)**	**Capacitance Change**	Within ±5.0% or ±0.5pF (Whichever is larger)	Within ±10% (R Char.) Within ±7.5% (B Char.)	Place the capacitor at 40 ± 2°C and relative humidity 90 to 95% for 500 $^{+24}_{-0}$h. Remove and let sit for 24 ± 2 h at room condition, then measure. ■ Pretreatment for high dielectric constant type Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition.
		Q/D.F.	C ≥ 30pF: Q ≥ 350 C < 30pF: Q ≥ 275 + 5/2C C: Nominal Capacitance (pF)	D.F. ≤ 0.01 (R Char.) D.F. ≤ 0.05 (B Char.)	
		I.R.	C ≥ 0.01μF: More than 10M ohms • μF C < 0.01μF: More than 1000M ohms		
		Dielectric Strength	See item 2.		
14	**Life**	**Capacitance Change**	Within ±3.0% or ±0.3pF (Whichever is larger)	Within ±10% (R Char.) Within ±15% (B Char.)	Apply the voltage in following table for 1000 $^{+48}_{-0}$h at maximum operating temperature ±3°C. Remove and let sit for 24 ± 2 h at room condition, then measure. The charge/discharge current is less than 50mA. ■ Pretreatment for high dielectric constant type Apply test voltage for 60 ± 5 min. at test temperature. Remove and let sit for 24 ± 2 h at room condition.
		Q/D.F.	C ≥ 30pF: Q ≥ 350 C < 30pF: Q ≥ 275 + 5/2C C: Nominal Capacitance (pF)	D.F. ≤ 0.02 (R Char.) D.F. ≤ 0.05 (B Char.)	
		I.R.	C ≥ 0.01μF: More than 10M ohms • μF C < 0.01μF: More than 1000M ohms		
		Dielectric Strength	See item 2.		

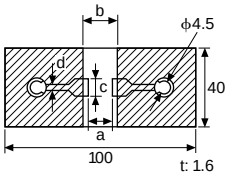


Fig. 2

L x W (mm)	Dimensions (mm) a	b	c	d
2.0 x 1.25	1.2	4.0	1.65	1.0
3.2 x 1.6	2.2	5.0	2.0	
3.2 x 2.5	2.2	5.0	2.9	
4.5 x 2.0	3.5	7.0	2.4	
4.5 x 3.2	3.5	7.0	3.7	
5.7 x 5.0	4.5	8.0	5.6	

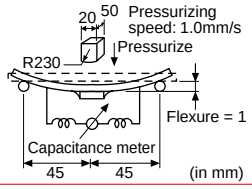


Fig. 3

Step	Temperature	Time
1	100°C to 120°C	1 min
2	170°C to 200°C	1 min

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

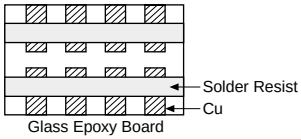


Fig. 4

Rated Voltage	Test Voltage
More than DC1kV	Rated voltage
630V	120% of the rated voltage
250V	150% of the rated voltage

"room condition" Temperature: 15 to 35°C; Relative humidity: 45 to 75%; Atmosphere pressure: 86 to 106kPa

FEATURES

- Chip monolithic ceramic capacitor for AC line
- Sn plated external electrodes allow mounting without silver compound solder.
- Reflow soldering

APPLICATIONS

- Ideal use for X/Y capacitor (GHM3000) or noise filter (GHM2000) on switching power supply, ballast, telephone, facsimile, modem

GHM2143/2243

- NOT safety approved. Made to the standards of the electrical appliance and material control law of Japan, separated table 4.
- Rated voltage: 250VAC
- Test voltage
  GHM2243: 1500VACrms, 60 sec.
  GHM2143: 575VACrms, 60 sec.

GHM3045

- Safety approved: VDE, SEV, SEMKO, BSI, and UL
- Rated voltage: 250VAC
- Test voltage: 1500VACrms, 60 sec.
- Recognized as X1/Y2 by IEC384-14 2nd ed. (EN132400) and as line by-pass by UL1414

GHM3145

- Safety approved: VDE, SEV, SEMKO
- Rated voltage: 250VAC
- Test voltage: 1075VDC, 60 sec.
- Recognized as X2 by IEC384-14 2nd ed. (EN132400)

PART NUMBERING SYSTEM

GHM3045 X7R 101 K – GC

CAPACITOR TYPE AND SIZE

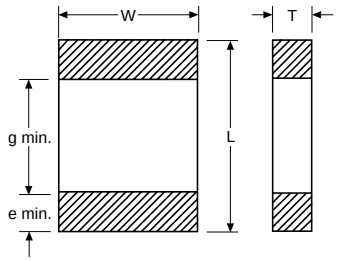
TEMPERATURE CHARACTERISTICS
Temperature Range
B = –25 to +85°C
X7R = –55 to +125°C
Maximum Capacitance Change over temperature range
B = ±10%
R = ±15%

CAPACITANCE VALUE
Expressed in picofarads and identified by a three-digit number.
First two digits represent significant figures. Last digit specifies the number of zeros to follow.

CAPACITANCE TOLERANCE
K = ±10%
M = ±20%

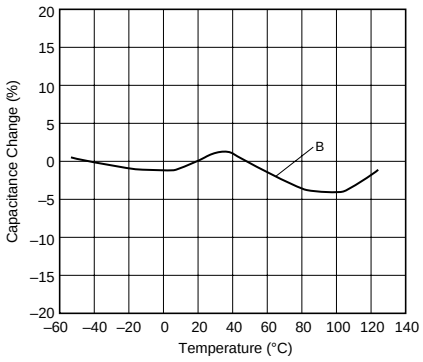
VOLTAGE
GB or GC: for GHM3000 listed designation
AC250: for GHM2000 rating

DIMENSIONS: mm

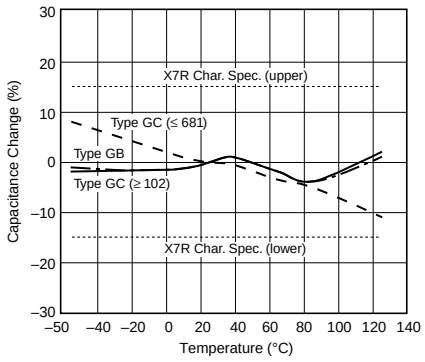


CAPACITANCE – TEMPERATURE CHARACTERISTICS

GHM2000 Series

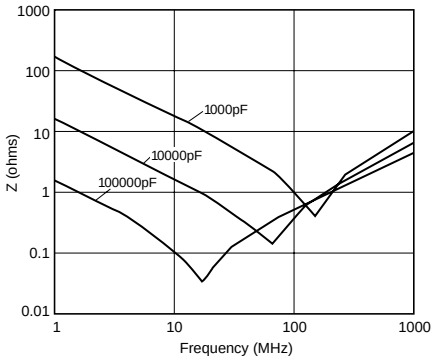


GHM3000 Series

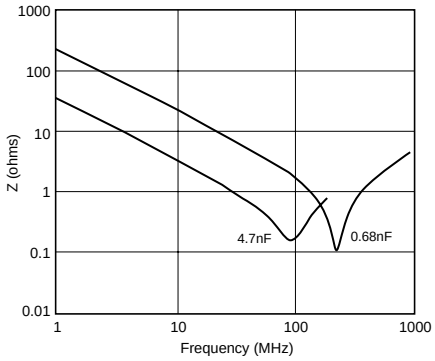


FREQUENCY CHARACTERISTICS

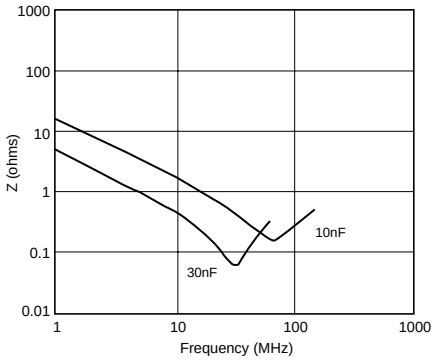
GHM2000 Series
Impedance – Frequency



GHM3000 Series Type GC
Impedance – Frequency



GHM3000 Series Type GB
Impedance – Frequency



GHM21□□ (Line to Line Capacitor) **NOT Safety Approved**

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	Dimensions: mm					AC Rated Voltage [V(r.m.s.)]	Packaging Quantity (pcs/reel)
			L	W	T	g	e		
GHM2143B103MAC250	10000	±20%	5.7 ± 0.4	2.8 ± 0.3	2.0 ± 0.3	3.5	0.3	250	1000
GHM2143B223MAC250	22000								
GHM2143B473MAC250	47000								
GHM2145B104MAC250	100000			5.0 ± 0.4					

GHM22□□ (Line to Earth Capacitor) **NOT Safety Approved**

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	Dimensions: mm					AC Rated Voltage [V(r.m.s.)]	Packaging Quantity (pcs/reel)
			L	W	T	g	e		
GHM2243B471MAC250	470	±20%	5.7 ± 0.4	2.8 ± 0.3	2.0 ± 0.3	3.5	0.3	250	1000
GHM2243B102MAC250	1000								
GHM2243B222MAC250	2200								
GHM2243B472MAC250	4700								

GHM3045 (X1, Y2)

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	Dimensions: mm					Rated Voltage (VAC)	Packaging Quantity (pcs/reel)
			L	W	T	g	e		
GHM3045X7R101K-GC	100	±10%	5.7 ± 0.4	5.0 ± 0.4	2.0 ± 0.3	4.0	0.3	250	1000
GHM3045X7R151K-GC	150								
GHM3045X7R221K-GC	220								
GHM3045X7R331K-GC	330								
GHM3045X7R471K-GC	470								
GHM3045X7R681K-GC	680								
GHM3045X7R102K-GC	1000								
GHM3045X7R152K-GC	1500								
GHM3045X7R222K-GC	2200								
GHM3045X7R332K-GC	3300								
GHM3045X7R472K-GC	4700								

GHM3145 (X2)

Part Number	Nominal Capacitance (pF)	Capacitance Tolerance	Dimensions: mm					Rated Voltage (VAC)	Packaging Quantity (pcs/reel)
			L	W	T	g	e		
GHM3145X7R103K-GB	10000	±10%	5.7 ± 0.4	5.0 ± 0.4	2.0 ± 0.3	4.0	0.3	250	1000
GHM3145X7R153K-GB	15000								
GHM3145X7R223K-GB	22000								
GHM3145X7R333K-GB	33000				2.7 ± 0.3				500

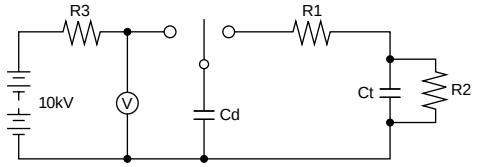
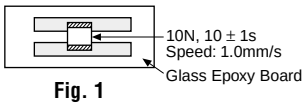
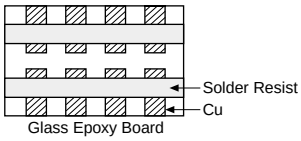
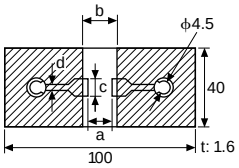
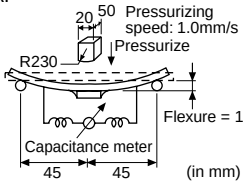
APPROVAL STANDARDS AND RECOGNIZED NUMBERS

GHM3045

	Standard Number	Recognized Number
UL	UL1414 (Line By Pass)	E37921
SEMKO	IEC384-14 2nd Edition (EN132400) CLASS X1/Y2	9614021 01
SEV		96.1 10333.02
VDE		94671
BSI		228163

GHM3145

	Standard Number	Recognized Number
SEMKO	IEC384-14 2nd Edition (EN132400) CLASS X2	9614020 01
SEV		96.1 10333.02
VDE		94729

No.	Item		Specification	Test Method
1	**Operating Temperature Range**		GHM2000: –25 to +85°C GHM3000: –55 to +125°C	—
2	**Dielectric Strength**		No defects or abnormalities.	No failure shall be observed when voltage as table is applied between the terminations for 60 ± 1 s, provided the charge/discharge current is less than 50mA. **Test Voltage** **GHM21□□**: AC575V(r.m.s.) **GHM22□□**: AC1500V(r.m.s.) **GHM3000 Type GB**: 1075VDC **GHM3000 Type GC**: AC1500V(r.m.s.)
3	**Insulation Resistance (I.R.)**		GHM2000: >2000M ohms GHM3000: >6000M ohms	The insulation resistance shall be measured with 500 ± 50V and within 60 ± 5 s of charging.
4	**Capacitance**		Within the specified tolerance.	The capacitance/D.F. shall be measured at 20°C at a frequency of 1 ± 0.2kHz and a voltage of 1 ± 0.2V(r.m.s.)
5	**Dissipation Factor (D.F.)**		0.025 max.	
6	**Capacitance Temperature Characteristics**		Cap. Change GHM2000: ±10% GHM3000: ±15%	The range of capacitance change compared with the 20°C value within –25 to +85°C (–55 to +125°C for GHM3000) shall be within the specified range. **Pretreatment** Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition.
7	**Discharge Test (Application: GHM22□□)**	**Appearance**	No defects or abnormalities.	As in figure below, discharge is made 50 times at 5 s intervals from the capacitor(Cd) charged at DC voltage of specified.  Ct: Capacitor under test Cd: 0.001μF R1: 1000 ohms R2: 100M ohms R3: Surge resistance
	(Application: Type GC)	**I.R.**	More than 1000M ohms.	
		Dielectric Strength	See item 2.	
8	**Adhesive Strength of Termination**		No removal of the terminations or other defects shall occur.	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  **Fig. 1**
9	**Vibration Resistance**	**Capacitance**	Within the specified tolerance.	Solder the capacitor to the test jig (glass epoxy board). The capacitor shall be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 min. This motion shall be applied for a period of 2 h in each of 3 mutually perpendicular directions (total of 6 h). 
		D.F.	0.025 max.	
10	**Deflection**		No cracking or marking defects shall occur.  **Fig. 2** **L x W (mm)** / **Dimensions (mm)**: a, b, c, d 5.7 x 2.5: 4.5, 8.0, 3.2, 1.0 5.7 x 5.0: 4.5, 8.0, 5.6,	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.  **Fig. 3**
11	**Solderability of Termination**		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 2 ± 0.5 s at 235 ± 5°C. Immersing speed: 25 ± 2.5mm/s

"room condition" Temperature: 15 to 35°C; Relative humidity: 45 to 75%; Atmosphere pressure: 86 to 106kPa

No.	Item		Specification	Test Method
12	**Resistance to Soldering Heat**	**Capacitance Change**	Within ±10%	Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at 260 ± 5°C for 10 ± 1 s. Let sit at room condition for 24 ± 2 h, then measure. **Immersing speed:** 25 ± 2.5mm/s **Pretreatment** Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition. *Preheating
		I.R.	GHM2000: >2000M ohms GHM3000: >1000M ohms	
		Dielectric Strength	See item 2.	

Step	Temperature	Time
1	100°C to 120°C	1 min
2	170°C to 200°C	1 min

No.	Item		Specification	Test Method
13	**Temperature Cycle**	**Capacitance Change**	GHM2000: within ±7.5% GHM3000: within ±15%	Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24 ± 2 h at room condition, then measure.
		D.F.	GHM2000: 0.025 max. GHM3000: 0.05 max.	
		I.R.	GHM2000: >2000M ohms GHM3000: >3000M ohms	
		Dielectric Strength	See item 2.	**Pretreatment** Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition.

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

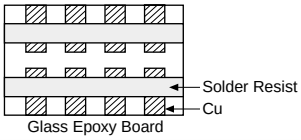


Fig. 4

No.	Item		Specification	Test Method
14	**Humidity (Steady State)**	**Capacitance Change**	Within ±15%	Sit the capacitor at 40 ± 2°C and relative humidity 90 to 95% for 500 $^{+24}_{-0}$h. Remove and let sit for 24 ± 2 h at room condition, then measure. **Pretreatment** Perform a heat treatment at 150 $^{+0}_{-10}$°C for 60 ± 5 min. and then let sit for 24 ± 2 h at room condition.
		D.F.	0.05 max.	
		I.R.	GHM2000: >1000M ohms GHM3000: >3000M ohms	
		Dielectric Strength	See item 2.	

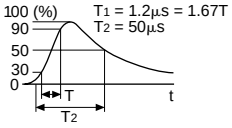
No.	Item		Specification	Test Method
15	**Life**	**Capacitance Change**	GHM2000: ±15% GHM3000: ±20%	**GHM2000:** Apply voltage and time as Table at 85 ± 2°C. Remove and let sit for 24 ± 2 h at room condition, then measure. The charge/discharge current is less than 50mA.
		D.F.	0.05 max.	
		I.R.	GHM2000: >1000M ohms GHM3000: >3000M ohms	
		Dielectric Strength	See item 2.	

	Test Time	Test Voltage
GHM21□□	1000 $^{+48}_{-0}$ h	AC300V(r.m.s.)
GHM22□□	1500 $^{+48}_{-0}$ h	AC500V(r.m.s.)*

*Except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.

Pretreatment
Apply test voltage for 60 ± 5 min. at test temperature.

GHM3000: Impulse Voltage
Each individual capacitor shall be subjected to a 2.5kV (Type GC: 5kV) Impulse (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.



Apply voltage as Table for 1000 h at 125 $^{+2}_{-0}$°C, relative humidity 50% max.

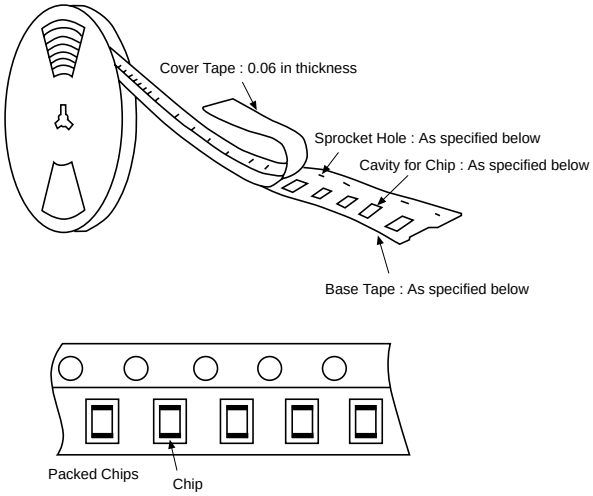
Type	Applied Voltage
GB	AC312.5V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.
GC	AC425V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.

No.	Item		Specification	Test Method
16	**Humidity Loading**	**Appearance**	No marking defects.	Apply the rated voltage at 40 ± 2°C and relative humidity 90 to 95% for 500 $^{+24}_{-0}$h. Remove and let sit for 24 ± 2 h at room condition, then measure. **Pretreatment** Apply test voltage for 60 ± 5 min. at test temperature. Remove and let sit for 24 ± 2 h at room condition.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	GHM2000: >1000M ohms GHM3000: >3000M ohms	
		Dielectric Strength	See item 2.	

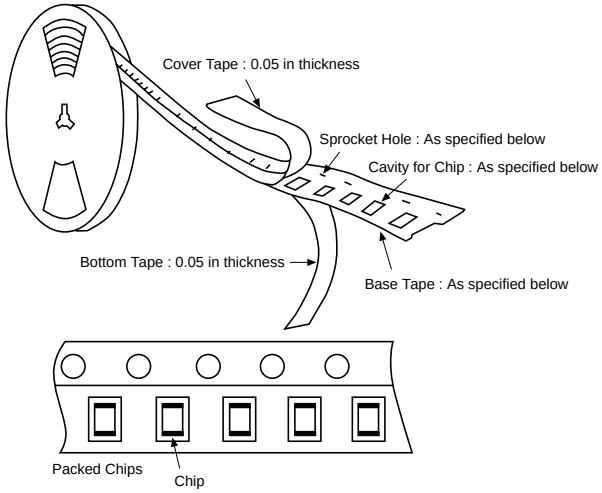
"room condition" Temperature: 15 to 35°C; Relative humidity: 45 to 75%; Atmosphere pressure: 86 to 106kPa

PACKAGING

Plastic Tape

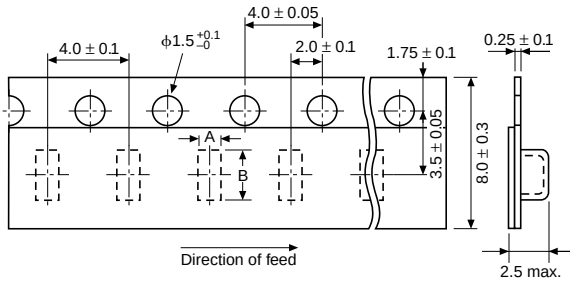


Paper Tape



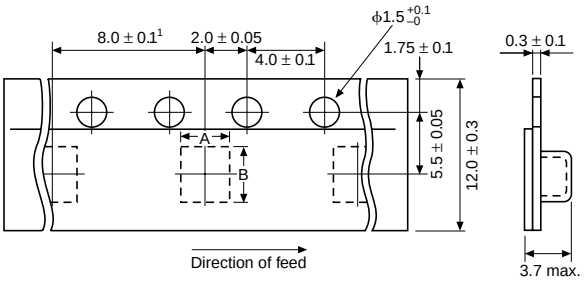
TAPE CARRIER DIMENSIONS: mm

Plastic Tape (T ≥ 1.25 rank)



Type	*A	*B
GHM□□25	1.45	2.25
GHM□□30	2.0	3.6
GHM□□35	2.9	3.6

*Nominal value

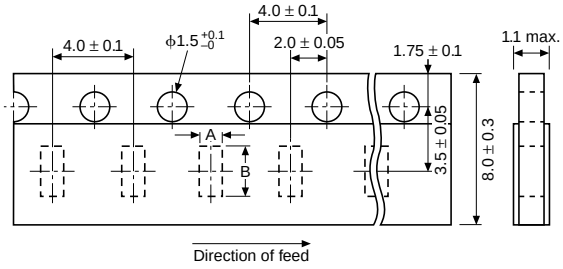


Type	*A	*B
GHM□□38	2.5	5.1
GHM□□40	3.6	4.9
GHM□□43	3.2	6.1
GHM□□45	5.4	6.1

*Nominal value

[1]4.0 ± 0.1mm in the case of GHM1038

Paper Tape (T = 1.0 rank)

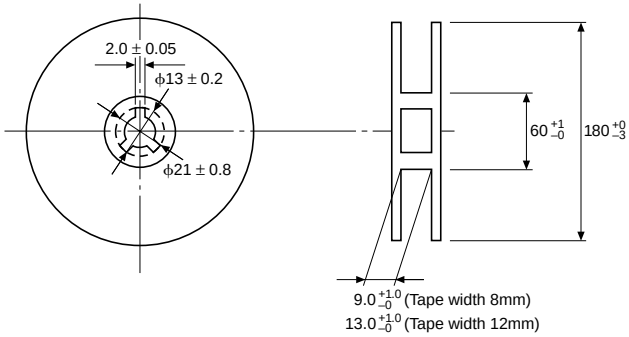


Type	*A	*B
GHM□□25	1.45	2.25
GHM□□30	2.0	3.6

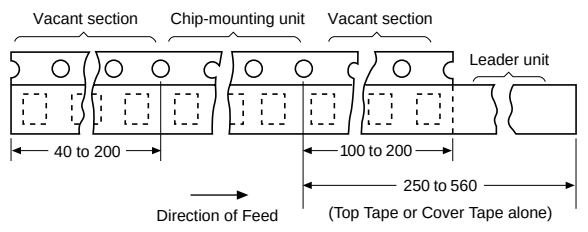
*Nominal value

Note: Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.

REEL DIMENSIONS: mm



Part of the leader and part of the empty tape shall be attached to the end of the tape as follows.



Dimensions: mm

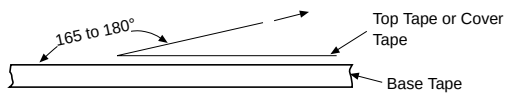
The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

The top tape or cover tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover sprocket holes.

Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.

Peeling off force: 0.1 to 0.7N in the direction shown below.



OPERATING VOLTAGE
Be sure to use a capacitor only within its rated operating voltage range. When DC-rated capacitors are to be used in AC or ripple current signal circuits, be sure to maintain the Vp-p value of the applied voltage signal within the rated voltage range.

OPERATING TEMPERATURE AND SELF-GENERATED HEAT
Keep the surface temperature of a capacitor within the rated operating temperature range. Be sure to take into account the heat produced by the capacitor itself. When a capacitor is used in a high-frequency circuit, pulse signal circuit or the like, it may produce heat due to dielectric loss. Keep such self-generated heat below 20°C. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability.

OPERATING AND STORAGE ENVIRONMENT
Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present and avoid exposure to moisture.

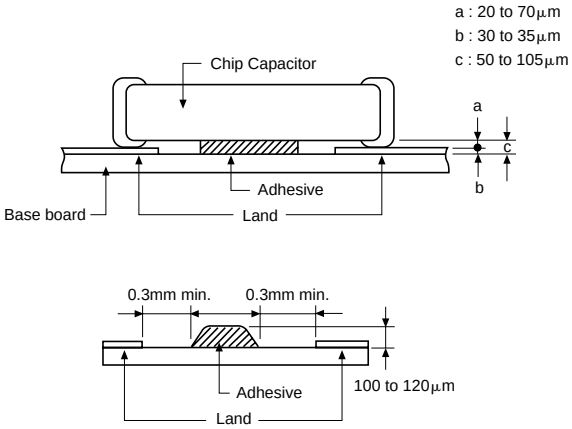
Before cleaning, bonding, or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded, or molded product in the intended equipment.

Store the capacitors where the temperature and relative humidity are 5 to 40°C and 20 to 70%RH. Use capacitors within 6 months.

VIBRATION AND IMPACT
Do not expose a capacitor to excessive shock or vibration during use.

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

MOUNTING OF CHIPS
Termination thickness of chip capacitor and desirable thickness of adhesives applied



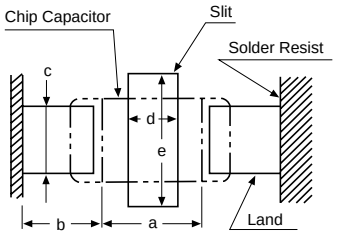
MECHANICAL SHOCK OF THE CHIP PLACER
When the positioning claws and pick up nozzle are worn, the load is applied to the chip while positioning is concentrated to one position, thus causing cracks, breakage, faulty positioning accuracy, etc.

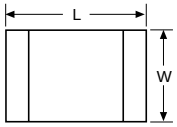
Careful checking and maintenance are necessary to prevent unexpected trouble.

CONSTRUCTION OF BOARD PATTERN
After installing chips, if solder is excessively applied to the circuit board, mechanical stress will cause destruction resistance characteristics to lower. To prevent this, be extremely careful in determining shape and dimension before designing the circuit board diagram.

CONSTRUCTION AND DIMENSIONS OF PATTERN

GHM1040 Type





Preparing slit aids flux cleaning of resign coating on the back of the capacitor.

Flow Soldering

L x W	a	b	c
3.2 x 1.6	2.2 ~ 2.6	1.0 ~ 1.1	1.0 ~ 1.4

Reflow Soldering

L x W	a	b	c	d	e
3.2 x 1.6	2.2 ~ 2.4	0.8 ~ 0.9	1.0 ~ 1.4	1.0 ~ 2.0	3.2 ~ 3.7
3.2 x 2.5	2.0 ~ 2.4	1.0 ~ 1.2	1.8 ~ 2.3	1.0 ~ 2.0	4.1 ~ 4.6
4.5 x 2.0	2.8 ~ 3.4	1.2 ~ 1.4	1.4 ~ 1.8	1.0 ~ 2.8	3.6 ~ 4.1
4.5 x 3.2	2.8 ~ 3.4	1.2 ~ 1.4	2.3 ~ 3.0	1.0 ~ 2.8	4.8 ~ 5.3
5.7 x 5.0	4.0 ~ 4.6	1.4 ~ 1.6	3.5 ~ 4.8	1.0 ~ 4.0	6.6 ~ 7.1

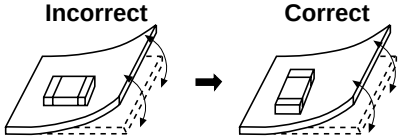
Dimensions: mm

LAND LAYOUT FOR CROPPING PC BOARD

Design layout of components on the PC board to minimize the stress imposed on the wrap or flexure of the board.

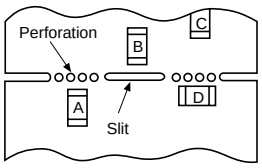
(Component direction)

Incorrect **Correct**



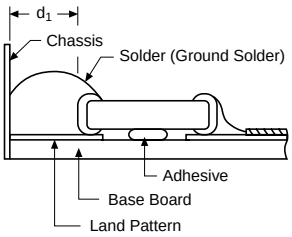
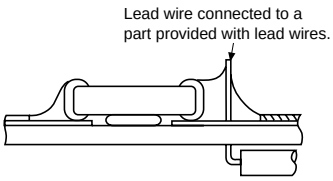
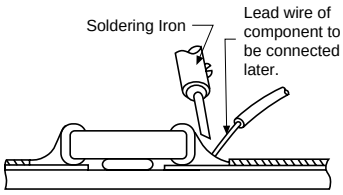
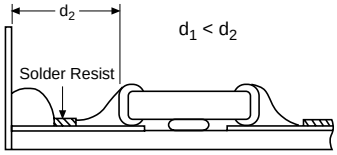
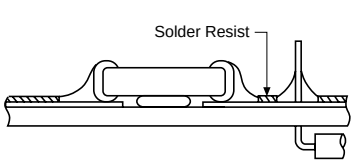
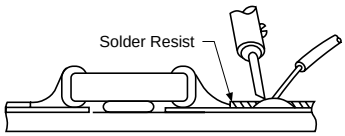
Place the component lateral to the direction in which stress occurs.

(Component layout close to board break)



Susceptibility to stress is in the order of:
A > C > B ≃ D

LAND LAYOUT TO PREVENT EXCESSIVE SOLDER

	Mounting close to a chassis	Mounting with leaded components	Mounting leaded components later
Examples of arrangements to be avoided			
Examples of improvements by the land division			

SOLDERING (Prevention of thermal shock)

Pre-heat conditions and examples

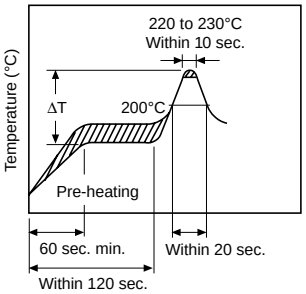
Carefully perform pre-heating so that temperature difference (ΔT) between the solder and component surface should be in the following range.

Chip Size/ Soldering method	3.2 x 1.6mm	All except 3.2 x 1.6mm
Reflow method or Soldering iron method	ΔT ≦ 190°C	ΔT ≦ 130°C
Flow method or Dip Soldering method	ΔT ≦ 150°C	—

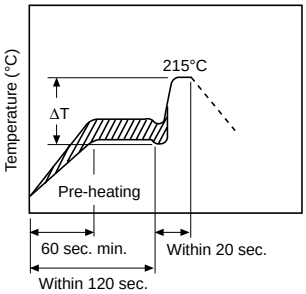
When components are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100°C. When correcting chips with a soldering iron, no pre-heating is required if the following conditions are met. (Pre-heating should be performed for chip size not listed in the following table.)

Item	Conditions
Chip size	3.2 x 1.6mm
Temperature of iron-tip	270°C max.
Soldering iron wattage	20W max.
Diameter of iron-tip	ϕ3.0mm max.
Soldering time	3 sec. max.
Caution	Do not allow the iron-tip to directly touch the ceramic element.

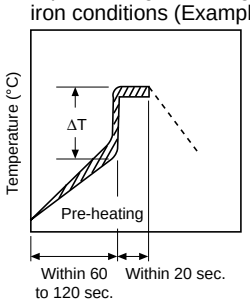
Infrared reflow soldering conditions (Example)



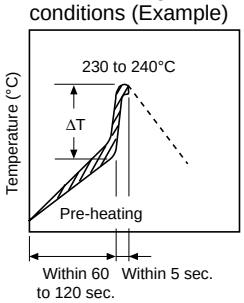
Vapor reflow soldering (VPS) conditions (Example)



Dip soldering/Soldering iron conditions (Example)



Flow soldering conditions (Example)

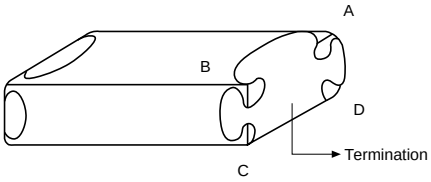


CARE FOR MINIMIZING LOSS OF THE TERMINATIONS

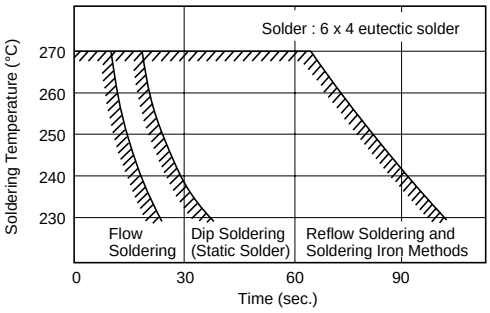
Limit of losing effective area of the terminations and conditions needed for soldering

Depending on the conditions of the soldering temperature and/or immersion (melting time), effective areas may be lost in some part of the terminations.

To prevent this, be careful in soldering so that after any possible loss of the effective area on the terminations, the remaining terminations will cover a minimum surface area of 25% on all edge lengths A-B-C-D of part with A, B, C, D, shown in the Figure below.



Soldering Allowance Time



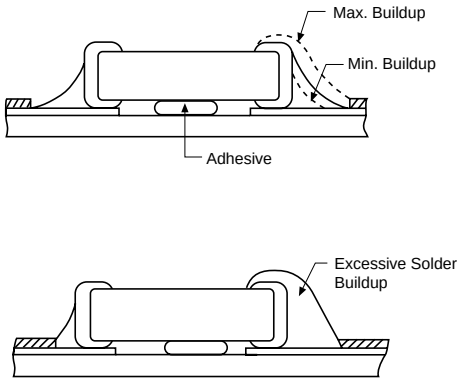
In case of repeated soldering, the accumulated soldering time must be within the range shown above.

FLUX AND SOLDER
Use rosin-type flux and do not use a highly acidic flux (any containing a minimum of 0.2wt% chlorine).

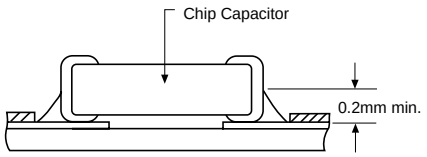
Use 6 x 4 eutectic solder, or 5 x 5 solder.
(Do not use solder with silver.)

SOLDER BUILDUP
Flow soldering and iron soldering
Use as little solder as possible, and confirm that the solder is securely placed.

Reflow soldering
When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations.



Solder buildup by reflow method and soldering iron methods.



Solder buildup by reflow method.

CLEANING
To perform ultrasonic cleaning, observe the following conditions.

Rinse bath capacity: Output of 20 watts per liter or less.
Rinsing time: 5 minutes maximum.

RESIN COATING
When selecting resin materials, select those with low contraction and low moisture absorption coefficient (generally epoxy resin is used).

Buffer coat can decrease the influence of the resin shrinking (generally silicone resin).