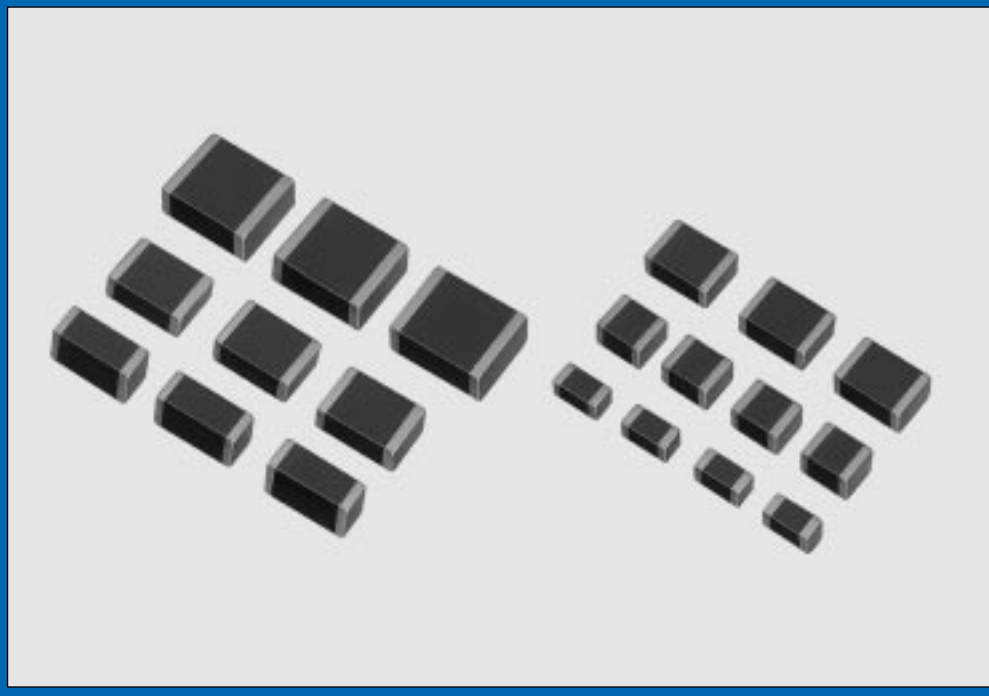
MEDIUM-VOLTAGE CHIP MONOLITHIC CERAMIC CAPACITOR
DC250V-3.15kV/AC250V (r.m.s.) GHM Series

MEDIUM-VOLTAGE CHIP MONOLITHIC CERAMIC CAPACITOR



muRata Innovator in Electronics
Murata Manufacturing Co., Ltd.

Cat.No.C16E-3

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■PART NUMBERING

(✻Please specify the part number when ordering.)

(Ex.) GHM10 ❶ | 40 ❷ | SL ❸ | 101 ❹ | J ❺ | 3K ❻ | ❼

❶Type

GHM××

GHM plus two digits denote the series.

Code	Series	Feature
GHM10	GHM1000	Low dissipation
GHM15	GHM1500	High-capacitance General electrical equipment
GHM21	GHM2000	AC-rated capacitor
GHM22	GHM2000	AC-rated capacitor
GHM30	GHM3000	Safety standard recognized Y capacitor
GHM31	GHM3000	Safety standard recognized X capacitor

❷Dimension

Code (EIA Code)	Dimension (mm)	Code (EIA Code)	Dimension (mm)
25 (0805)	2.0×1.25	**40 (1812)**	4.5×3.2
30 (1206)	3.2×1.6	**43 (2211)**	5.7×2.8
35 (1210)	3.2×2.5	**45 (2220)**	5.7×5.0
38 (1808)	4.5×2.0		

❸Temperature Characteristics

Code	Temp. Coeff./Cap. Change	Temp.Range (℃)	Remarks
SL	+350 to −1000 ppm/℃	20 to 85	
B	±10%	−25 to 85	Equivalent to X7R*
R	±15%	−55 to 125	Equivalent to X7R*
X7R	±15%	−55 to 125	

✻ Except GHM2000 series

❹Nominal Capacitance

The first two digits represent significant figures;
the last digit represents the multiplier of 10 in pF.

Code (Ex.)	Value (pF)	Code (Ex.)	Value (pF)
100	10	**223**	22,000
121	120	**104**	100,000
472	4,700	—	—

❺Capacitance Tolerance

Code	Tolerance
D	±0.5pF
J	± 5%
K	±10%
M	±20%

❻Rated Voltage

Code	Voltage
250	DC250V
630	DC630V
2K	DC2kV
3K	DC3.15kV
AC250	AC250V (r.m.s.)

✻ Not apply to GHM3000 series [Rated Voltage : AC250V (r.m.s.)]

❼Type Designation

Code	Type Designation
-GC	Type GC
-GB	Type GB

✻ Apply to GHM3000 series.

■CAPACITANCE TABLE

Type	Temp. Char.	Rated Voltage	Nominal Capacitance Range (pF)
			10 50 100 500 1,000 5,000 10,000 50,000 100,000 500,000
GHM1030	**R**	**DC630V**	100–1,000
GHM1040	**SL**	**DC2kV**	120–220
GHM1038	**SL**	**DC3.15kV**	10–82
GHM1040	**SL**	**DC3.15kV**	100
GHM1525	**B**	**DC250V**	1,000–10,000
GHM1530	**B**	**DC250V**	15,000–47,000
		DC630V	1,000–10,000
GHM1535	**B**	**DC250V**	68,000 • 100,000
		DC630V	15,000 • 22,000
GHM1540	**B**	**DC250V**	150,000 • 220,000
		DC630V	33,000–100,000
GHM1545	**B**	**DC250V**	330,000 • 470,000
		DC630V	150,000 • 220,000
GHM2143	**B**	**AC250V (r.m.s.)**	10,000–47,000
GHM2145	**B**	**AC250V (r.m.s.)**	100,000
GHM2243	**B**	**AC250V (r.m.s.)**	470–4,700
GHM3045	**X7R**	**AC250V (r.m.s.)**	100–4,700
GHM3145	**X7R**	**AC250V (r.m.s.)**	10,000–33,000

MONOLITHIC CERAMIC CAPACITOR

Medium voltage Low Dissipation **GHM1000** Series

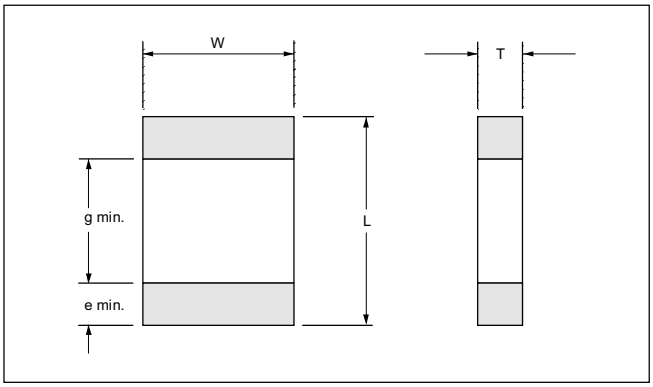
■FEATURES

1. Murata's original internal electrode structure realizes high Flash-over Voltage.
2. A new monolithic structure for small, surface-mountable devices capable of operating at high-voltage levels.
3. Sn-plated external electrodes allow mounting without silver compound solder.
4. The GHM1030 type for flow and reflow soldering, and other types for reflow soldering.
5. Low-loss and suitable for high-frequency circuits.

■APPLICATIONS

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

■DIMENSIONS



Type (EIA Code)	Dimensions (mm)				
	L	W	T	g	e
GHM1030 (1206)	3.2±0.2	1.6±0.2	See "STANDARD LIST"	1.5	0.3
GHM1038 (1808)	4.5±0.3	2.0±0.2		2.9	
GHM1040 (1812)	4.5±0.3	3.2±0.3			

■STANDARD LIST

Temperature Compensating Type SL Characteristic (+350 to −1000ppm/℃)

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	DC Rated Volt. (V)	Packaging Qty. (pcs./reel)
	L	W	T				
GHM1040 SL 121 J 2K	4.5±0.3	3.2±0.3	$2.0^{+0}_{-0.3}$	120	±5%	2k	1,000
GHM1040 SL 151 J 2K				150			
GHM1040 SL 181 J 2K				180			
GHM1040 SL 221 J 2K				220			
GHM1038 SL 100 D 3K	4.5±0.3	2.0±0.2	2.0±0.3	10	±0.5pF	3.15k	2,000
GHM1038 SL 120 J 3K				12	±5%		
GHM1038 SL 150 J 3K				15			
GHM1038 SL 180 J 3K				18			
GHM1038 SL 220 J 3K				22			
GHM1038 SL 270 J 3K				27			
GHM1038 SL 330 J 3K				33			
GHM1038 SL 390 J 3K				39			
GHM1038 SL 470 J 3K				47			
GHM1038 SL 560 J 3K				56			
GHM1038 SL 680 J 3K				68			
GHM1038 SL 820 J 3K				82			
GHM1040 SL 101 J 3K	4.5±0.3	3.2±0.3	$2.5^{+0}_{-0.3}$	100			500

✻ We also have small DC 2kV (less than 100pF) products. Please contact for more details.

High Dielectric Constant Type R Characteristic (±15%)

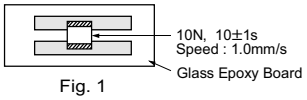
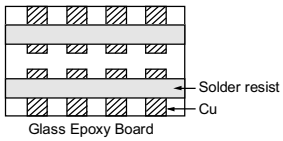
Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	DC Rated Volt. (V)	Packaging Qty. (pcs./reel)
	L	W	T				
GHM1030 R 101 K 630	3.2±0.2	1.6±0.2	$1.0^{+0}_{-0.3}$	100	±10%	630	4,000
GHM1030 R 151 K 630				150			
GHM1030 R 221 K 630				220			
GHM1030 R 331 K 630				330			
GHM1030 R 471 K 630			$1.25^{+0}_{-0.3}$	470			3,000
GHM1030 R 681 K 630				680			
GHM1030 R 102 K 630				1,000			

✻ We also have DC 1kV products. Please contact for more details.

MONOLITHIC CERAMIC CAPACITOR

Medium voltage Low Dissipation GHM1000 Series

■SPECIFICATIONS AND TEST METHODS

No.	Item		Specification		Test Method
			Temperature Compensating Type(SL Char.)	High Dielectric Constant Type (R Char.)	
1	Operating Temperature Range		−55 to +125℃		–
2	Appearance		No defects or abnormalities.		Visual inspection.
3	Dimensions		Within the specified dimension.		Using Calipers.
4	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 Less than DC1kV: 150% of the rated voltage
5	Insulation Resistance (I.R.)		More than 10000MΩ		The insulation resistance shall be measured with 500±50V and within 60±5 s of charging.
6	Capacitance		Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 20℃ at the frequency and voltage shown as follows. (1) Temperature Compensating Type Frequency : 1±0.2MHz Voltage : 0.5 to 5V (r.m.s.) (2) High Dielectric Constant Type Frequency : 1±0.2kHz Voltage : 1±0.2V (r.m.s.)
7	Q/ Dissipation Factor (D.F.)		C≧30pF : Q≧1000 C<30pF : Q≧400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	
8	Capacitance Temperature Characteristics		Temp. Coefficient +350 to −1000 ppm/℃ (Temp. Range : +20 to +85℃)	Cap. Change Within ±15%	(1) 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 ℃) the capacitance shall be within the specified tolerance for the temperature coefficient. Step / Temperature (℃) 1: 20±2 2: Min. Operating Temp.±3 3: 20±2 4: Max. Operating Temp.±2 5: 20±2 (2) High Dielectric Constant Type The range of capacitance change compared to the 20℃ value within -55 to 125℃ shall be within the specified range. •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition.
9	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
10	Vibration Resistance	Appearance	No defects or abnormalities.		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 3 mutually perpendicular directions (total of 6 h). 
		Capacitance	Within the specified tolerance.		
		Q/D.F.	C≧30pF : Q≧1000 C<30pF : Q≧400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

No.	Item		Specification: Temperature Compensating Type(SL Char.)	Specification: High Dielectric Constant Type (R Char.)	Test Method
11	**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.
12	**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% rin in weight proportion). Immerse in eutectic solder solution for 2±0.5 s at 235±5℃. Immersing speed : 25±2.5mm/s
13	**Resistance to Soldering Heat**	**Appearance**	No marking defects		Preheat the capacitor at 120 to 150℃* for 1 min. Immerse the capacitor in eutectic solder solution at 260±5℃ 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 $150^{+}_{-10}{}^{0}$℃ for 60±5 min and then let sit for 24±2 h at room condition. *Preheating for more than 3.2×2.5mm
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C≧30pF : Q≧1000 C<30pF : Q≧400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	
		I.R.	More than 10000MΩ		
		Dielectric Strength	Pass the item No.4.		
14	**Temperature Cycle**	**Appearance**	No marking defects		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. •Pretreatment for high dielectric constant type Perform a heat treatment at $150^{+}_{-10}{}^{0}$℃ for 60±5 min and then let sit for 24±2 h at room condition.
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C≧30pF : Q≧1000 C<30pF : Q≧400+20C C : Nominal Capacitance (pF)	D.F.≦0.01	
		I.R.	More than 10000MΩ		
		Dielectric Strength	Pass the item No.4.		
15	**Humidity (Steady State)**	**Appearance**	No marking defects		Sit the capacitor at 40±2℃ 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 $150^{+}_{-10}{}^{0}$℃ for 60±5 min and then let sit for 24±2 h at room condition.
		Capacitance Change	Within ±5.0% or ±0.5pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C≧30pF : Q≧350 C<30pF : Q≧275+$\frac{5}{2}$C C : Nominal Capacitance (pF)	D.F.≦0.01	
		I.R.	More than 1000MΩ		
		Dielectric Strength	Pass the item No.4.		
16	**Life**	**Appearance**	No marking defects		Apply the voltage in following table for 1000^{+48}_{0}h at maximum operating temperature±3℃. 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.
		Capacitance Change	Within ±3.0% or ±0.3pF (Whichever is larger)	Within ±10%	
		Q/D.F.	C≧30pF : Q≧350 C<30pF : Q≧275+$\frac{5}{2}$C C : Nominal Capacitance (pF)	D.F.≦0.02	
		I.R.	More than 1000MΩ		
		Dielectric Strength	Pass the item No.4.		

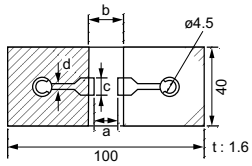


Fig. 2

L×W (mm)	Dimension (mm) a	b	c	d
3.2×1.6	2.2	5.0	2.0	1.0
4.5×2.0	3.5	7.0	2.4	
4.5×3.2	3.5	7.0	3.7	

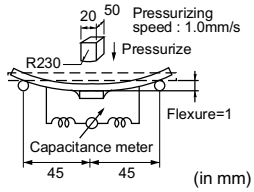


Fig. 3

*Preheating for more than 3.2×2.5mm

Step	Temperature	Time
1	100℃ to 120℃	1 min
2	170℃ to 200℃	1 min

Step	Temperature (℃)	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

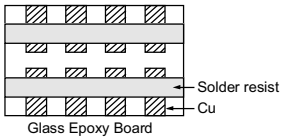


Fig. 4

Rated voltage	Test voltage
More than DC1kV	Rated voltage
Less than DC1kV	120% of the rated voltage

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

MONOLITHIC CERAMIC CAPACITOR

High-capacitance for General Electrical Equipment GHM1500 Series

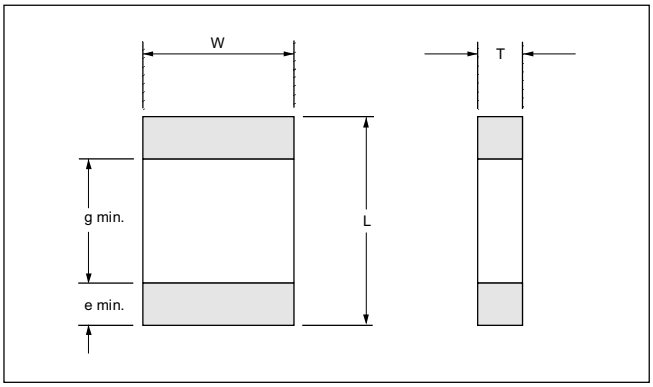
■FEATURES

1. A new monolithic structure for small, high-capacitance capable of operating at high-voltage levels.
2. Sn-plated external electrodes allow mounting without silver compound solder.
3. The GHM1525/1530 type for flow and reflow soldering, and other types for reflow soldering.

■APPLICATIONS

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

■DIMENSIONS



Type (EIA Code)	Dimension (mm)				
	L	W	T	g	e
GHM1525 (0805)	2.0±0.2	1.25±0.2	See "STANDARD LIST"	0.7	0.3
GHM1530 (1206)	3.2±0.2	1.6±0.2		1.5	
GHM1535 (1210)	3.2±0.3	2.5±0.2			
GHM1540 (1812)	4.5±0.4	3.2±0.3		2.5	
GHM1545 (2220)	5.7±0.4	5.0±0.4		3.5	

■STANDARD LIST

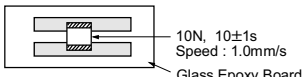
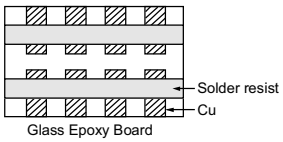
High Dielectric Constant Type B Characteristic (±10%)

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	DC Rated Volt. (V)	Packaging Qty. (pcs./reel)
	L	W	T				
GHM1525 B 102 K 250	2.0±0.2	1.25±0.2	$1.0^{+0}_{-0.3}$	1,000	±10%	250	4,000
GHM1525 B 152 K 250				1,500			
GHM1525 B 222 K 250				2,200			
GHM1525 B 332 K 250				3,300			
GHM1525 B 472 K 250				4,700			
GHM1525 B 682 K 250				6,800			
GHM1525 B 103 K 250			1.25±0.2	10,000			3,000
GHM1530 B 153 K 250	3.2±0.2	1.6±0.2	$1.0^{+0}_{-0.3}$	15,000			4,000
GHM1530 B 223 K 250				22,000			
GHM1530 B 333 K 250			$1.25^{+0}_{-0.3}$	33,000			3,000
GHM1530 B 473 K 250			1.6 ±0.2	47,000			2,000
GHM1535 B 683 K 250	3.2±0.3	2.5±0.2	$1.5^{+0}_{-0.3}$	68,000			
GHM1535 B 104 K 250			$2.0^{+0}_{-0.3}$	100,000			1,000
GHM1540 B 154 K 250	4.5±0.4	3.2±0.3		150,000			
GHM1540 B 224 K 250			$2.5^{+0}_{-0.3}$	220,000			500
GHM1545 B 334 K 250	5.7±0.4	5.0±0.4	$2.0^{+0}_{-0.3}$	330,000			1,000
GHM1545 B 474 K 250				470,000			
GHM1530 B 102 K 630	3.2±0.2	1.6±0.2	$1.25^{+0}_{-0.3}$	1,000		630	3,000
GHM1530 B 152 K 630				1,500			
GHM1530 B 222 K 630				2,200			
GHM1530 B 332 K 630				3,300			
GHM1530 B 472 K 630				4,700			
GHM1530 B 682 K 630				6,800			
GHM1530 B 103 K 630				10,000			
GHM1535 B 153 K 630	3.2±0.3	2.5±0.2	$1.5^{+0}_{-0.3}$	15,000			2,000
GHM1535 B 223 K 630				22,000			
GHM1540 B 333 K 630	4.5±0.4	3.2±0.3		33,000			1,000
GHM1540 B 473 K 630				47,000			
GHM1540 B 683 K 630			$2.0^{+0}_{-0.3}$	68,000			
GHM1540 B 104 K 630			$2.6^{+0}_{-0.3}$	100,000			500
GHM1545 B 154 K 630	5.7±0.4	5.0±0.4	$2.0^{+0}_{-0.3}$	150,000			1,000
GHM1545 B 224 K 630			$2.7^{+0}_{-0.3}$	220,000			500

MONOLITHIC CERAMIC CAPACITOR

High-capacitance for General Electrical Equipment GHM1500 Series

■SPECIFICATIONS AND TEST METHODS

No.	Item		Specification	Test Method
1	Operating Temperature Range		−55 to +125℃	–
2	Appearance		No defects or abnormalities.	Visual inspection.
3	Dimensions		Within the specified dimension.	Using Calipers.
4	Dielectric Strength		No defects or abnormalities.	No failure shall be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage: DC 250V) is applied between the terminations for 1 to 5 s, provided the charge/discharge current is less than 50mA.
5	Insulation Resistance (I.R.)		C≧0.01μF : More than 100MΩ · μF C<0.01μF : More than 10000MΩ	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.
6	Capacitance		Within the specified tolerance.	The capacitance/D.F. shall be measured at 20℃ at a frequency of 1±0.2kHz and a voltage of 1±0.2V (r.m.s.)
7	Dissipation Factor (D.F.)		0.025 max.	
8	Capacitance Temperature Characteristics		Cap. Change Within ±10% (Temp. Range : −25 to 85℃)	The range of capacitance change compeared with the 20℃ value within −25 to 85℃ shall be within the specified range. •Pretreatment Perform a heat treatment at 150$^{+0}_{-10}$℃ for 60±5 min and then let sit for 24±2 h at room condition.
9	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
10	Vibration Resistance	Appearance	No defects or abnormalities.	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 3 mutually perpendicular directions (total of 6 h). 
		Capacitance	Within the specified tolerance.	
		D.F.	0.025 max.	
11	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.
12	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℃. Immersing speed : 25±2.5mm/s

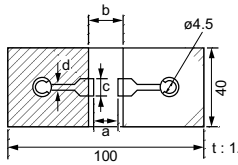


Fig. 2

LXW (mm)	Dimension (mm)			
	a	b	c	d
2.0×1.25	1.2	4.0	1.65	1.0
3.2×1.6	2.2	5.0	2.0	
3.2×2.5	2.2	5.0	2.9	
4.5×3.2	3.5	7.0	3.7	
5.7×5.0	4.5	8.0	5.6	

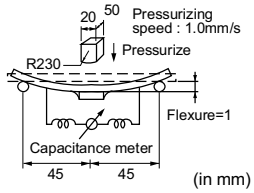
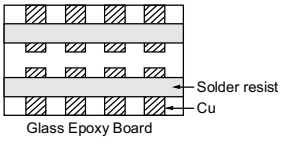


Fig. 3

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

MONOLITHIC CERAMIC CAPACITOR

High-capacitance for General Electrical Equipment GHM1500 Series

No.	Item		Specification	Test Method
13	Resistance to Soldering Heat	Appearance	No marking defects	Preheat the capacitor at 120 to 150℃* for 1 min. Immerse the capacitor in eutectic solder solution at 260±5℃ 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}℃ for 60±5 min and then let sit for 24±2 h at room condition. *Preheating for more than 3.2×2.5mm **Step** / **Temperature** / **Time** 1 / 100℃ to 120℃ / 1 min 2 / 170℃ to 200℃ / 1 min
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	C≧0.01μF : More than 100MΩ · μF C<0.01μF : More than 10000MΩ	
		Dielectric Strength	Pass the item No.4.	
14	Temperature Cycle	Appearance	No marking defects	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. **Step** / **Temperature (℃)** / **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 •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition.  Fig. 4
		Capacitance Change	Within ±7.5%	
		D.F.	0.025 max.	
		I.R.	C≧0.01μF : More than 100MΩ · μF C<0.01μF : More than 10000MΩ	
		Dielectric Strength	Pass the item No.4.	
15	Humidity (Steady State)	Appearance	No marking defects	Sit the capacitor at 40±2℃ 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}℃ for 60±5 min and then let sit for 24±2 h at room condition.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	C≧0.01μF : More than 10MΩ · μF C<0.01μF : More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	
16	Life	Appearance	No marking defects	Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage: DC250V) for 1000^{+48}_{-0} h at maximum operating temperature±3℃. Remove and let sit for 24 ±2 h at room condition, then measure. The charge / discharge current is less than 50mA. •**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.	C≧0.01μF : More than 10MΩ · μF C<0.01μF : More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	
17	Humidity Loading	Appearance	No marking defects	Apply the rated voltage at 40±2℃ 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.	C≧0.01μF : More than 10MΩ · μF C<0.01μF : More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

MONOLITHIC CERAMIC CAPACITOR

Ceramic Capacitor for AC250V **GHM2000** Series

Products which are based on the Standards of the Electrical Appliance And Material control Law of Japan

■FEATURES

1. Chip monolitic ceramic capacitor for AC line.
2. A new monolithic structure for small, high-capacitance capable of operating at high-voltage levels.
3. Sn-plated external electrodes allow mounting without silver compound solder.
4. Only for Reflow soldering.

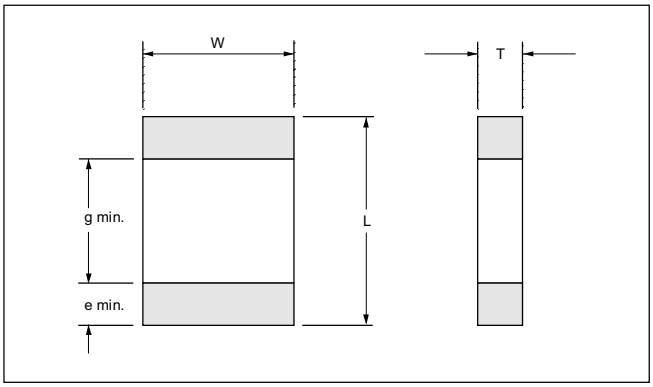
■APPLICATIONS

Noise filter for switching power supply, telephone, facsimile and modem.

■REFFERENCE STANDARD

- JIS C 5102
- JIS C 5150
- The standards of the electrical appliance and material control law of Japan, separated table 4.

■DIMENSIONS



Type (EIA Code)	Dimension (mm)				
	L	W	T	g	e
GHM2143 (2211)	5.7±0.4	2.8±0.3	2.0±0.3	3.5	0.3
GHM2145 (2220)		5.0±0.4			
GHM2243 (2211)		2.8±0.3			

■STANDARD LIST

B Characteristic (±10%)

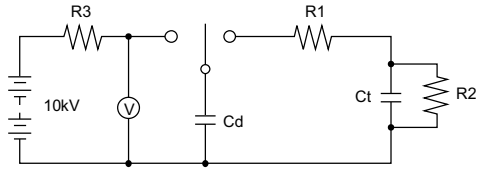
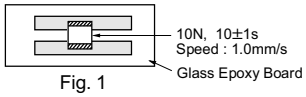
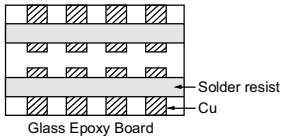
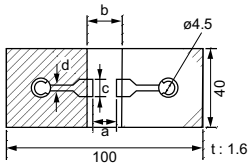
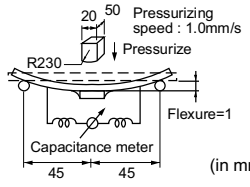
[GHM21xx (Line to line capacitor)]

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	AC Rated Volt. [V (r.m.s.)]	Packaging Qty. (pcs./reel)
	L	W	T				
GHM2143 B 103 M AC250	5.7±0.4	2.8±0.3	2.0±0.3	10,000	±20%	250	1,000
GHM2143 B 223 M AC250				22,000			
GHM2143 B 473 M AC250				47,000			
GHM2145 B 104 M AC250		5.0±0.4		100,000			

[GHM22xx (Line to earth capacitor)]

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	AC Rated Volt. [V (r.m.s.)]	Packaging Qty. (pcs./reel)
	L	W	T				
GHM2243 B 471 M AC250	5.7±0.4	2.8±0.3	2.0±0.3	470	±20%	250	1,000
GHM2243 B 102 M AC250				1,000			
GHM2243 B 222 M AC250				2,200			
GHM2243 B 472 M AC250				4,700			

■SPECIFICATIONS AND TEST METHODS

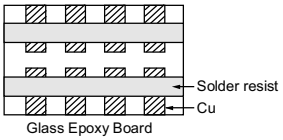
No.	Item	Specification	Test Method
1	**Operating Temperature Range**	−25 to +85℃	—
2	**Appearance**	No defects or abnormalities.	Visual inspection.
3	**Dimensions**	Within the specified dimension.	Using Calipers.
4	**Dielectric Strength**	No defects or abnormalities.	No failure shall be observed when voltage as table is applied between the terminations for 60±1 s, provided the charge/discharge current is less than 50mA. **GHM21xx**: AC575V (r.m.s.) **GHM22xx**: AC1500V (r.m.s.)
5	**Insulation Resistance (I.R.)**	More than 2000MΩ	The insulation resistance shall be measured with 500±50V and within 60±5 s of charging.
6	**Capacitance**	Within the specified tolerance.	The capacitance/D.F. shall be measured at 20℃ at a frequency of 1±0.2kHz and a voltage of 1±0.2V (r.m.s.)
7	**Dissipation Factor (D.F.)**	0.025 max.	
8	**Capacitance Temperature Characteristics**	Cap. Change Within ±10%	The range of capacitance change compeared with the 20℃ value within −25 to 85℃ shall be within the specified range. •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition.
9	**Discharge Test (Application: GHM22xx)** — **Appearance**	No defects or abnormalities.	As in Fig., 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 : 1000Ω R2 : 100MΩ R3 : Surge resistance
10	**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
11	**Vibration Resistance** — **Appearance**	No defects or abnormalities.	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 3 mutually perpendicular directions (total of 6 h). 
	Capacitance	Within the specified tolerance.	
	D.F.	0.025 max.	
12	**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.  Fig. 2 **L×W (mm)** / **Dimension (mm)**: a / b / c / d **5.7×2.8**: 4.5 / 8.0 / 3.2 / 1.0 **5.7×5.0**: 4.5 / 8.0 / 5.6 / 1.0  (in mm) Fig. 3
13	**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℃. Immersing speed : 25±2.5mm/s

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

MONOLITHIC CERAMIC CAPACITOR

Ceramic Capacitor for AC250V **GHM2000** Series

Products which are based on the Standards of the Electrical Appliance And Material control Law of Japan

No.	Item		Specification	Test Method
14	**Humidity Insulation**	**Appearance**	No marking defects.	The capacitor shall be subjected to 40±2℃, relative humidity of 90 to 98% for 8 h, and then removed in room condition for 16 h until 5 cycles.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	
15	**Resistance to Soldering Heat**	**Appearance**	No marking defects.	Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at 260±5℃ 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}℃ for 60±5 min and then let sit for 24±2 h at room condition. ✻**Preheating** **Step** / **Temperature** / **Time** 1 / 100℃ to 120℃ / 1 min 2 / 170℃ to 200℃ / 1 min
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	More than 2000MΩ	
		Dielectric Strength	Pass the item No.4.	
16	**Temperature Cycle**	**Appearance**	No marking defects.	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. **Step** / **Temperature (℃)** / **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 •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition.  Fig. 4
		Capacitance Change	Within ±7.5%	
		D.F.	0.025 max.	
		I.R.	More than 2000MΩ	
		Dielectric Strength	Pass the item No.4.	
17	**Humidity (Steady State)**	**Appearance**	No marking defects.	Sit the capacitor at 40±2℃ 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}℃ for 60±5 min and then let sit for 24±2 h at room condition.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	
18	**Life**	**Appearance**	No marking defects.	Apply voltage and time as Table at 85±2℃. Remove and let sit for 24 ±2 h at room condition, then measure. The charge / discharge current is less than 50mA. **Test Time** / **Test voltage** **GHM21xx** / 1000^{+48}_{0} h / AC300V (r.m.s.) **GHM22xx** / 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. Remove and let sit for 24±2 h at room condition.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	
19	**Humidity Loading**	**Appearance**	No marking defects.	Apply the rated voltage at 40±2℃ and relative humidity 90 to 95% for 500^{+24}_{0}h. Remove and let sit 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.	More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

MONOLITHIC CERAMIC CAPACITOR

Safety Standard Recognized GHM3000 Series

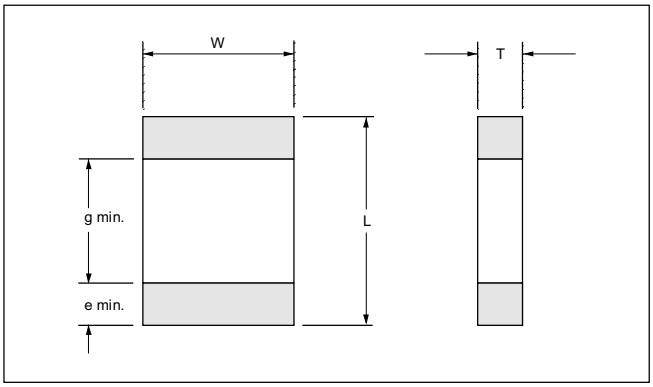
■FEATURES

1. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC line.
2. A new monolithic structure for small, high-capacitance capable of operating at high-voltage levels.
3. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
4. The type GB can be used as an X2-class capacitor.
5. The type GC can be used as an X1-class and Y2-class capacitor, line by pass capacitor in UL1414.
6. +125℃ guaranteed.
7. Only for Reflow soldering.

■APPLICATIONS

1. Ideal use as Y capacitor or X capacitor for various switching power supply.
2. Ideal use as line filter for modem.

■DIMENSIONS



Type (EIA Code)	Dimension (mm)				
	L	W	T	g	e
GHM3045 (2220)	5.7±0.4	5.0±0.4	See "STANDARD LIST"	4.0	0.3
GHM3145 (2220)					

■STANDARD NO.

	Standard No.	Status of Recognition		AC Rated Voltage [V (r.m.s.)]
		Type GB	Type GC	
UL	UL1414	—	◎*	250
BSI	IEC384-14 2nd edition (1993)	—	◎	
VDE		◎	◎	
SEV		◎	◎	
SEMKO		◎	◎	
IEC384-14 Class		X2	X1, Y2	

＊Line By Pass only

■STANDARD LIST

High Dielectric Constant Type X7R Characteristic (±15%)

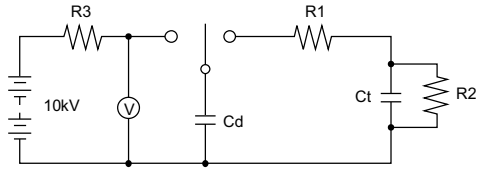
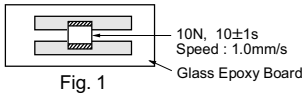
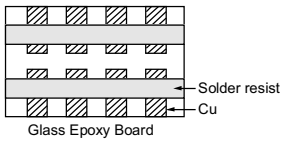
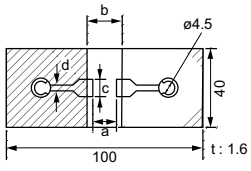
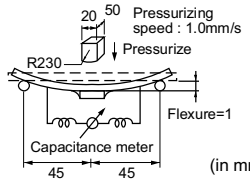
Type GC

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	AC Rated Volt. [V (r.m.s.)]	Packaging Qty. (pcs./reel)
	L	W	T				
GHM3045 X7R 101K -GC	5.7±0.4	5.0±0.4	2.0±0.3	100	±10%	250	1,000
GHM3045 X7R 151K -GC				150			
GHM3045 X7R 221K -GC				220			
GHM3045 X7R 331K -GC				330			
GHM3045 X7R 471K -GC				470			
GHM3045 X7R 681K -GC				680			
GHM3045 X7R 102K -GC				1,000			
GHM3045 X7R 152K -GC				1,500			
GHM3045 X7R 222K -GC				2,200			
GHM3045 X7R 332K -GC				3,300			
GHM3045 X7R 472K -GC				4,700			

Type GB

Part Number	Dimensions (mm)			Nom.Cap. (pF)	Cap. Tol.	AC Rated Volt. [V (r.m.s.)]	Packaging Qty. (pcs./reel)
	L	W	T				
GHM3145 X7R 103K -GB	5.7±0.4	5.0±0.4	2.0±0.3	10,000	±10%	250	1,000
GHM3145 X7R 153K -GB				15,000			
GHM3145 X7R 223K -GB				22,000			
GHM3145 X7R 333K -GB			2.7±0.3	33,000			500

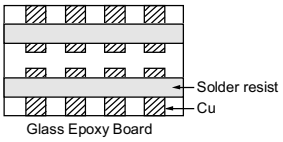
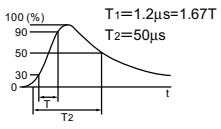
■SPECIFICATIONS AND TEST METHODS

No.	Item		Specification	Test Method
1	**Operating Temperature Range**		−55 to +125℃	−
2	**Appearance**		No defects or abnormalities.	Visual inspection.
3	**Dimensions**		Within the specified dimension.	Using Calipers.
4	**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. **Type GB**: DC1075V **Type GC**: AC1500V (r.m.s.)
5	**Insulation Resistance (I.R.)**		More than 6000MΩ	The insulation resistance shall be measured with 500±50V and within 60±5 s of charging.
6	**Capacitance**		Within the specified tolerance.	The capacitance/D.F. shall be measured at 20℃ at a frequency of 1±0.2kHz and a voltage of 1±0.2V (r.m.s.)
7	**Dissipation Factor (D.F.)**		0.025 max.	
8	**Capacitance Temperature Characteristics**		Cap. Change Within ±15%	The range of capacitance change compeared with the 25℃ value within −55 to 125℃ shall be within the specified range. •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition.
9	**Discharge Test (Application: Type GC)**	**Appearance**	No defects or abnormalities.	As in Fig., 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 : 1000Ω R2 : 100MΩ R3 : Surge resistance
		I.R.	More than 1000MΩ	
		Dielectric Strength	Pass the item No. 4.	
10	**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
11	**Vibration Resistance**	**Appearance**	No defects or abnormalities.	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 3 mutually perpendicular directions (total of 6 h). 
		Capacitance	Within the specified tolerance.	
		D.F.	0.025 max.	
12	**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.  Fig. 2 **L×W (mm)** / **Dimension (mm)**: a 4.5, b 8.0, c 5.6, d 1.0  (in mm) Fig. 3
13	**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℃. Immersing speed : 25±2.5mm/s

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

MONOLITHIC CERAMIC CAPACITOR

Safety Standard Recognized GHM3000 Series

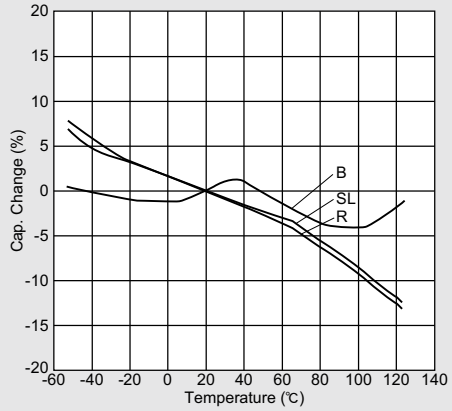
No.	Item		Specification	Test Method
14	Resistance to Soldering Heat	Appearance	No marking defects.	Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 s. Let sit at room condition for 24±2 h, then measure. •**Immersing speed** : 25±2.5mm/s •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition. ✻**Preheating** **Step** / **Temperature** / **Time** 1 / 100℃ to 120℃ / 1 min 2 / 170℃ to 200℃ / 1 min
		Capacitance Change	Within ±10%	
		I.R.	More than 1000MΩ	
		Dielectric Strength	Pass the item No.4.	
15	Temperature Cycle	Appearance	No marking defects.	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. **Step** / **Temperature (℃)** / **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 •**Pretreatment** Perform a heat treatment at 150^{+0}_{-10}℃ for 60±5 min and then let sit for 24±2 h at room condition.  Fig. 4
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 3000MΩ	
		Dielectric Strength	Pass the item No.4.	
16	Humidity (Steady State)	Appearance	No marking defects.	Sit the capacitor at 40±2℃ and relative humidity 90 to 95% for 500±12h. Remove and let sit for 24±2 h at room condition, then measure.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 3000MΩ	
		Dielectric Strength	Pass the item No.4.	
17	Life	Appearance	No marking defects.	Impulse Voltage Each individual capacitor shall be subjected to a 2.5kV (Type GC:5kV) Impulses (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}℃, 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 0.1s. GC / AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1s.
		Capacitance Change	Within ±20%	
		D.F.	0.05 max.	
		I.R.	More than 3000MΩ	
		Dielectric Strength	Pass the item No.4.	
18	Humidity Loading	Appearance	No marking defects.	Apply the rated voltage at 40±2℃ and relative humidity 90 to 95% for 500^{+24}_{-0}h. Remove and let sit 24±2 h at room condition, then measure.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 3000MΩ	
		Dielectric Strength	Pass the item No.4.	

"room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

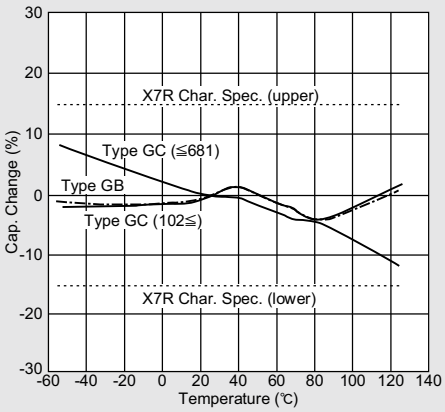
TYPICAL CHARACTERISTICS DATA

•Capacitance-Temp. Char.

GHM1000 Series · GHM2000 Series

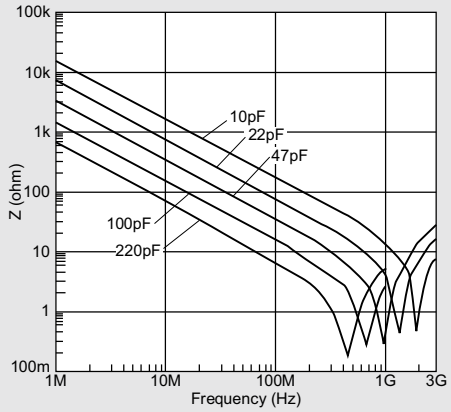


GHM3000 Series

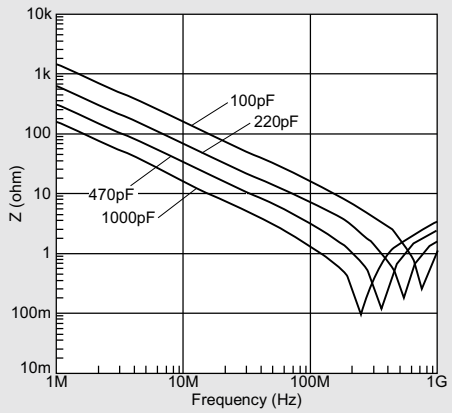


•Impedance-Freq. Char.

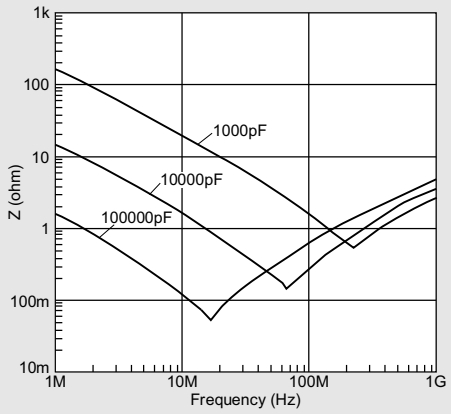
GHM1000 Series [SL Char.]



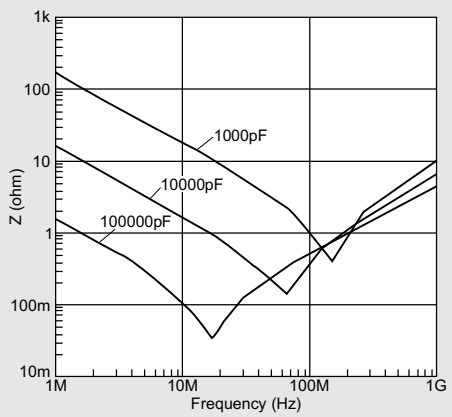
GHM1000 Series [R Char.]



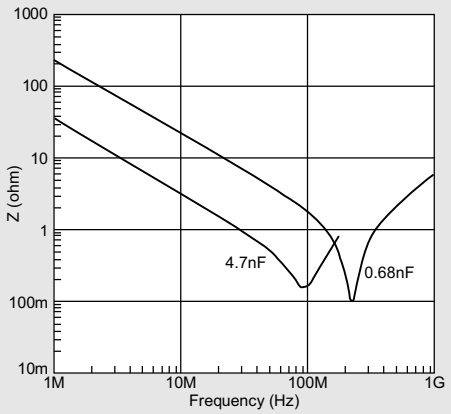
GHM1500 Series



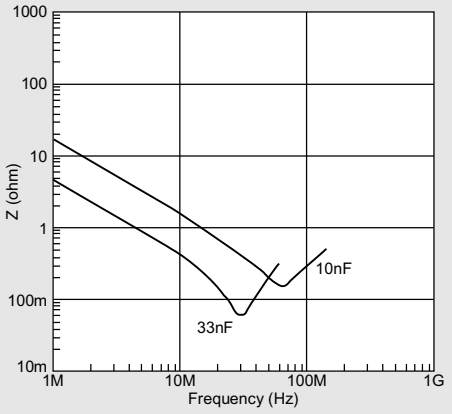
GHM2000 Series



GHM3000 Series (Type GC)



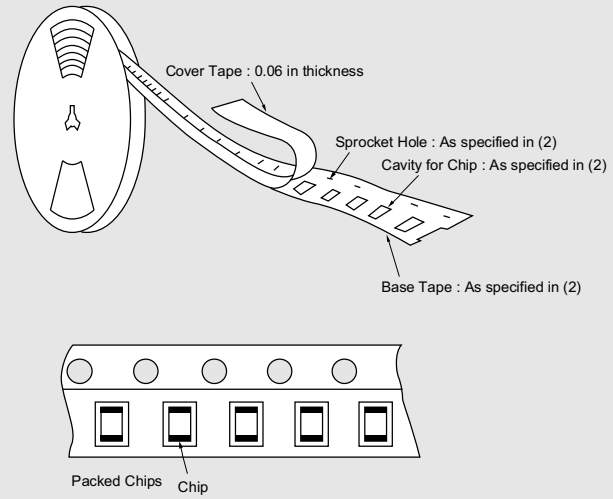
GHM3000 Series (Type GB)



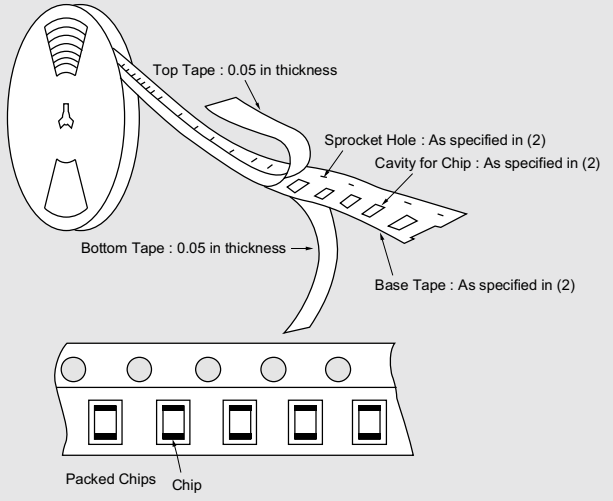
PACKAGING (Taping is standard packaging method.)

(1) Appearance of taping

Plastic Tape

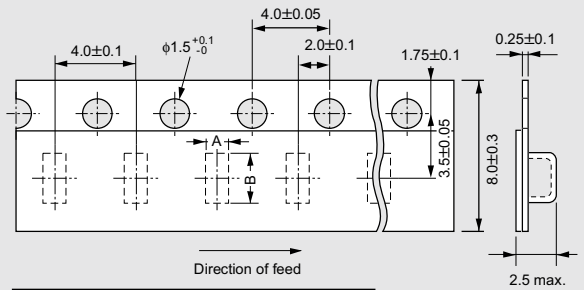


Paper Tape

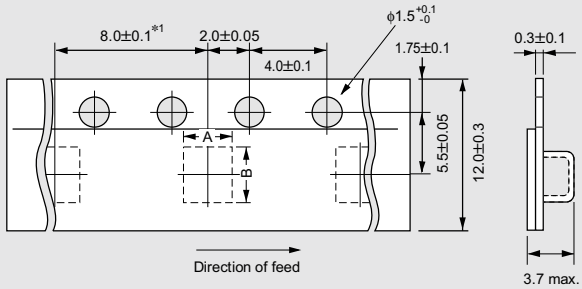


(2) Dimensions of Tape

Plastic Tape (T≧1.25 rank)



Type	*A	*B
GHMxx25	1.45	2.25
GHMxx30	2.0	3.6
GHMxx35	2.9	3.6



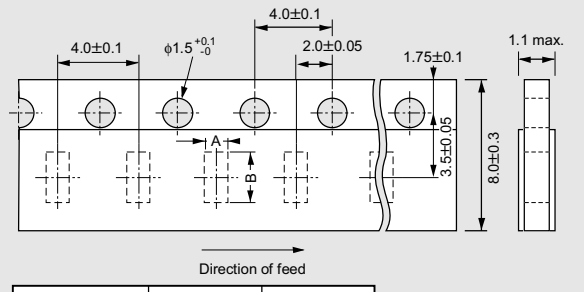
Type	*A	*B
GHMxx38	2.5	5.1
GHMxx40	3.6	4.9
GHMxx43	3.2	6.1
GHMxx45	5.4	6.1

*Nominal value

*1 4.0±0.1mm in case of GHM1038

(in mm)

Paper Tape (T=1.0 rank)

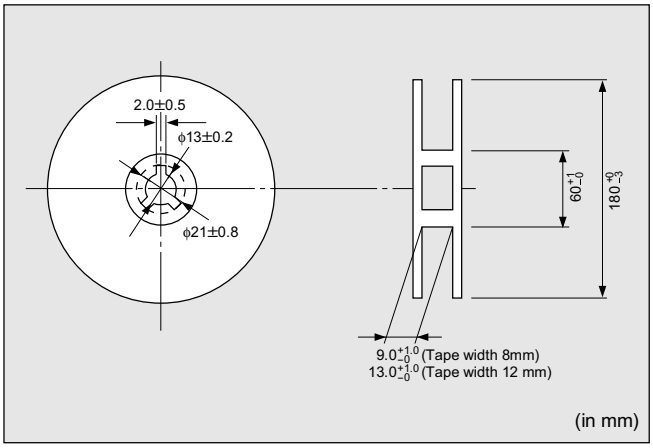


Type	*A	*B
GHMxx25	1.45	2.25
GHMxx30	2.0	3.6

*Nominal value

(in mm)

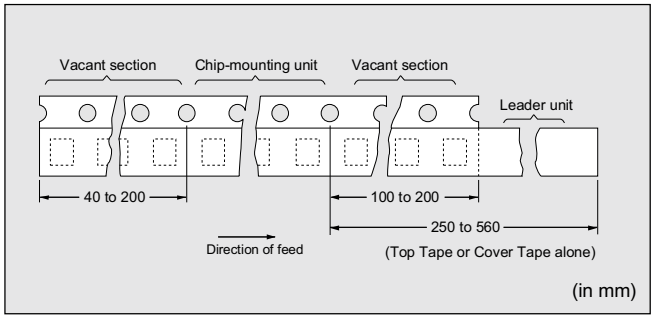
(3) Dimensions of Reel



(4) Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.

PACKAGING (Taping is standard packaging method.)

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



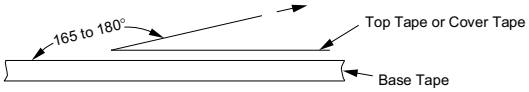
(6) The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

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

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

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

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



⚠CAUTION

1. 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 voltage circuits, be sure to maintain the Vp-p value of the applied voltage within the rated voltage range.

2. 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 voltage circuit or the like, it may produce heat due to dielectric loss.
Keep such self-generated temperature below 20℃.

3. Operating and strage 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 do not exceed 5 to 40℃ and 20 to 70%.
Use capacitors within 6 months.

4. Vibration and impact

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

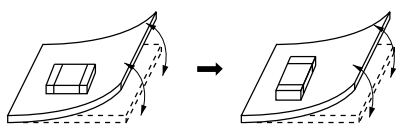
5. Circuit board material

Please contact our sales representatives or engineers in case that GHM products (size 4.5×3.2mm and over) are to be mounted upon a metal-board or metal-frame. Soldering heat causes the expansion and shrinkage of a board or frame, which may result in chip-cracking.

6. Land layout for cropping PC Board

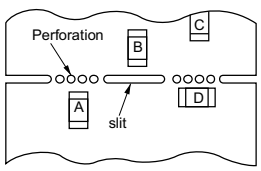
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component direction]



Locate chip horizontal to the direction in which stress acts.

[Chip Mounting Close to Board Separation Point]



Chip arrangement
Worst A>C>B≈D Best

⚠CAUTION

7. Soldering (Prevention of the thermal shock)

If a chip component is heated or cooled abruptly during soldering, it may crack due to the thermal shock. To prevent this, adequate soldering condition should be taken following our recommendation below.

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

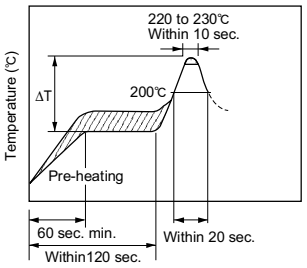
Soldering method \ Chip Size	3.2X1.6mm and under	3.2X2.5mm and over
Reflow method or Soldering iron method	ΔT≦190℃	ΔT≦130℃
Flow method or Dip Soldering method	ΔT≦150℃	————

When components are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100℃.

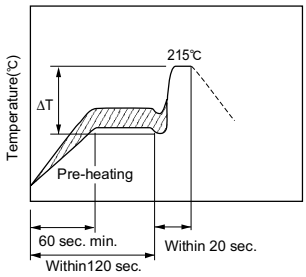
When soldering chips with a soldering iron, it should be performed in following conditions.

Item	Conditions	
Chip size	≦2.0X1.25mm	3.2X1.6mm
Temperature of iron-tip	300℃ max.	270℃ 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.	

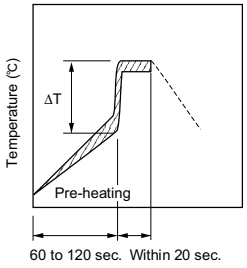
• Infrared reflow soldering conditions (Example)



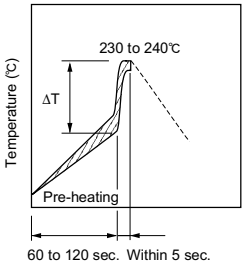
• Vapor reflow soldering (VPS) conditions (Example)



• Dip soldering/Soldering iron conditions (Example)



• Flow soldering conditions (Example)



8. Soldering method

GHM products whose sizes are 3.2X1.6mm and under for flow and reflow soldering, and other sizes for reflow soldering.

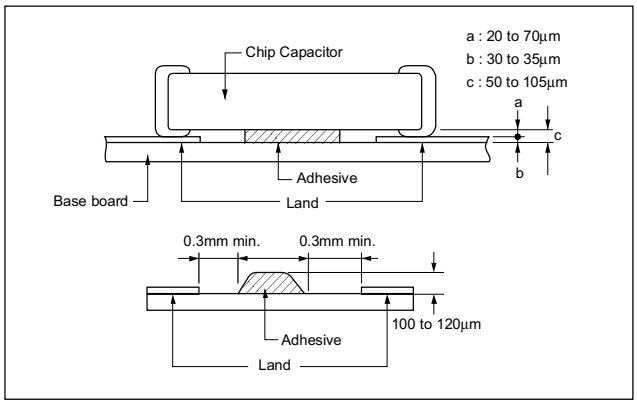
Be sure to contact our sales representatives or engineers in case that GHM products (size 3.2X2.5mm and over) are to be mounted with flow soldering. It may crack due to the thermal shock.

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

NOTICE

1. 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.

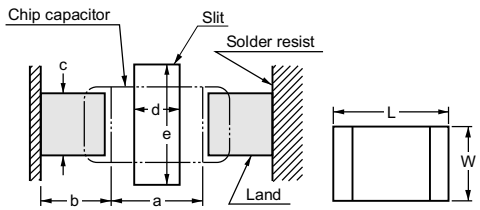
Careful checking and maintenance are necessary to prevent unexpected trouble.

An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. Please set the suction nozzle's bottom dead point on the upper surface of the board.

2. 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 (example)



Preparing slit help flux cleaning and resin coating on the back of the capacitor.

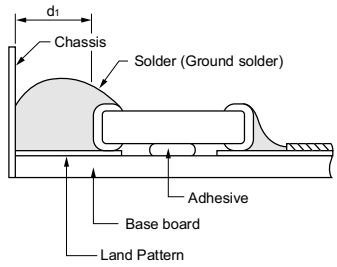
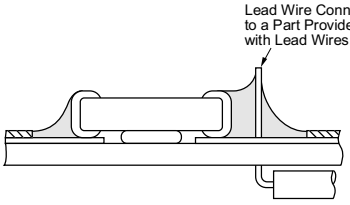
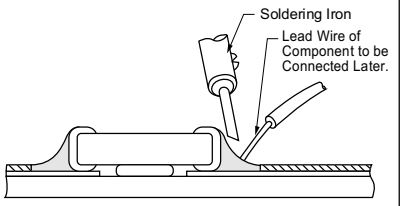
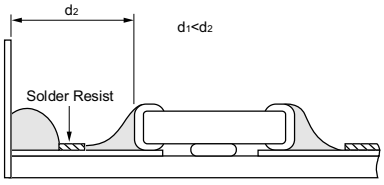
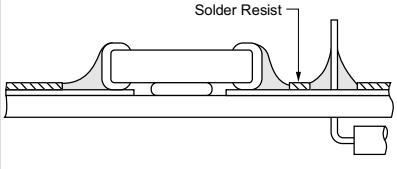
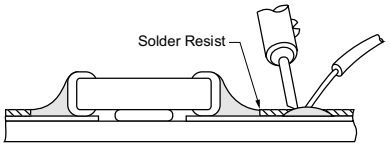
● Flow soldering (in mm)

LXW	a	b	c
2.0×1.25	1.0–1.2	0.9–1.0	0.8–1.1
3.2×1.6	2.2–2.6	1.0–1.1	1.0–1.4

● Reflow soldering (in mm)

LXW	a	b	c	d	e
2.0×1.25	1.0–1.2	0.9–1.0	0.8–1.1	——	——
3.2×1.6	2.2–2.4	0.8–0.9	1.0–1.4	1.0–2.0	3.2–3.7
3.2×2.5	2.0–2.4	1.0–1.2	1.8–2.3	1.0–2.0	4.1–4.6
4.5×2.0	2.8–3.4	1.2–1.4	1.4–1.8	1.0–2.8	3.6–4.1
4.5×3.2	2.8–3.4	1.2–1.4	2.3–3.0	1.0–2.8	4.8–5.3
5.7×2.8	4.0–4.6	1.4–1.6	2.1–2.6	1.0–4.0	4.4–4.9
5.7×5.0	4.0–4.6	1.4–1.6	3.5–4.8	1.0–4.0	6.6–7.1

● 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			

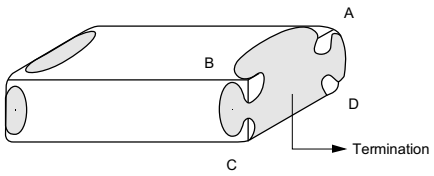
NOTICE

3. SOLDERING

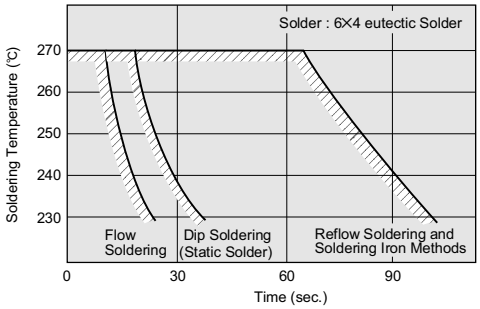
(Care for minimizing loss of the terminations)

● 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 any possible loss of the effective area on the terminations will securely remain minimum 25% on all edge length 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.

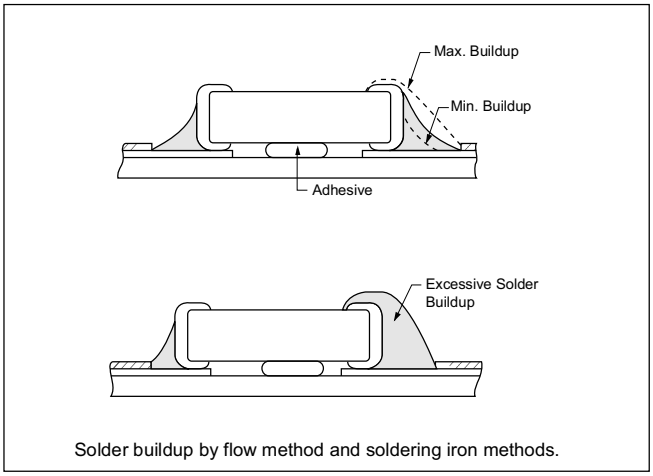
(Flux and Solder)

- Use rosin-type flux and do not use a highly acidic flux (any containing a minimum of 0.2wt% chlorine).
- Please use 6×4 eutectic solder, or 5×5 solder. (Do not use solder with silver.)

(Solder Buildup)

(i) Flow soldering and iron soldering
Use as little solder as possible (as shown in Fig.1), and confirm that the solder is securely placed.

(ii) Reflow soldering
When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations (as shown in Fig.2).



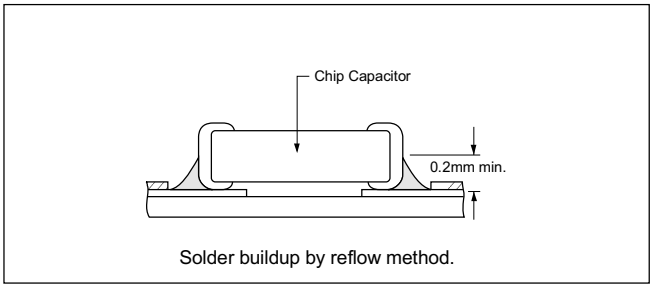
Solder buildup by flow method and soldering iron methods.

Fig.1

4. 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.



Solder buildup by reflow method.

Fig.2

5. 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).

■ISO9000 CERTIFICATIONS

Manufacturing plants of these products in this catalog have obtained the ISO9001 quality system certificate.

Plant	Certified Date	Organization	Registration NO.
Izumo Murata Manufacturing Co.,Ltd.	May. 11, '95	RCJ* ISO9001	RCJ-93M-05A

*RCJ : Reliability Center for Electronic Components of Japan

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Murata Manufacturing Co., Ltd.

http://www.murata.co.jp/

Head office
2-26-10, Tenjin Nagaokakyo-shi, Kyoto 617-8555, Japan Phone:81-75-951-9111

Marketing Group
1874 Sumiyoshi-cho Kizuki, Nakahara-ku Kawasaki, 211-0021, Japan
Phone:81-44-422-5153 Fax:81-44-433-0798