CHIP MONOLITHIC CERAMIC CAPACITOR

muRata

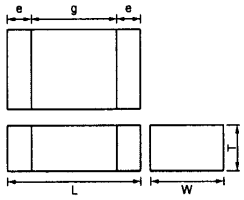
for High-voltage GHM3000 Series Safety Recognized

■ Features

1. Chip monolitic 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.
6. +125 degree C guaranteed.
7. Only for reflow soldering.

■ Application

1. Ideal use as Y capacitor or X capacitor for various switching power supply.
2. Ideal use as linefilter for MODEM.



Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GHM3045	5.7 ±0.4	5.0 ±0.4	2.0 ±0.3	0.3	4.0
GHM3145			2.0 ±0.3		
			2.7 ±0.3		

■ Standard Recognition

	Standard No.	Status of Recognition		Rated Voltage
		Type GB	Type GC	
UL	UL1414	–	◎*	AC250V (r.m.s.)
BSI	EN132400	–	◎	
VDE		◎	◎	
SEV		◎	◎	
SEMKO		◎	◎	
EN132400 Class		X2	X1, Y2	

* : Line By Pass only

GC Type

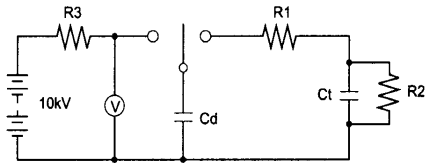
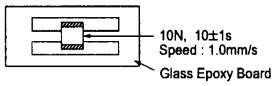
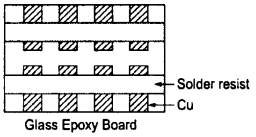
Part Number	Rated Voltage (V)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM3045X7R101K-GC	AC250 (r.m.s.)	X7R	100 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R151K-GC	AC250 (r.m.s.)	X7R	150 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R221K-GC	AC250 (r.m.s.)	X7R	220 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R331K-GC	AC250 (r.m.s.)	X7R	330 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R471K-GC	AC250 (r.m.s.)	X7R	470 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R681K-GC	AC250 (r.m.s.)	X7R	680 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R102K-GC	AC250 (r.m.s.)	X7R	1000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R152K-GC	AC250 (r.m.s.)	X7R	1500 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R222K-GC	AC250 (r.m.s.)	X7R	2200 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R332K-GC	AC250 (r.m.s.)	X7R	3300 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3045X7R472K-GC	AC250 (r.m.s.)	X7R	4700 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.

GB Type

Part Number	Rated Voltage (V)	TC Code	Capacitance (pF)	Length L (mm)	Width W (mm)	Thickness T (mm)	Electrode g (mm)	Electrode e (mm)
GHM3145X7R103K-GB	AC250 (r.m.s.)	X7R	10000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3145X7R153K-GB	AC250 (r.m.s.)	X7R	15000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3145X7R223K-GB	AC250 (r.m.s.)	X7R	22000 +10,-10%	5.7	5.0	2.0	4.0 min.	0.3 min.
GHM3145X7R333K-GB	AC250 (r.m.s.)	X7R	33000 +10,-10%	5.7	5.0	2.7	4.0 min.	0.3 min.

Dielectric Strength: DC1075V, 60+/- 1s.

Specifications and Test Methods

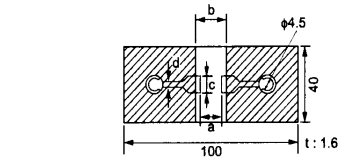
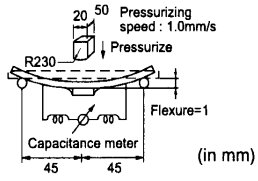
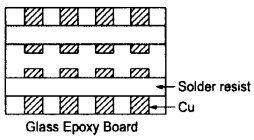
No.	Item		Specification	Test Method
1	Operating Temperature Range		−55 to +125℃	−
2	Appearance		No defects or abnormalities.	Visual inspection.
3	Dimensions		Within the specified dimensions.	Using calipers.
4	Dielectric Strength		No defects or abnormalities.	No failure shall be observed when voltage 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 6,000MΩ	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 compared 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 : 1,000Ω R2 : 100MΩ R3 : Surge resistance
		I.R.	More than 1,000MΩ	
		Dielectric Strength	Pass the item No.4.	
10	Adhesive Strength of Termination		No removal of the terminations or other defect 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.	

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

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

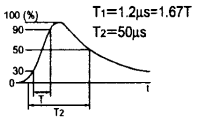
No.	Item		Specification	Test Method
12	Deflection		No cracking or marking defects shall occur.  LXW (mm) / Dimension (mm): a 4.5, b 8.0, c 5.6, d 1.0 (5.7X5.0) Fig.2	Solder the capacitor to the testing jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction 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.  (in mm) Fig.3
13	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). Immerse in eutectic solder solution for 2±0.5 s at 235±5℃. Immersing speed : 25±2.5mm/s
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 1,000MΩ	
		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 3,000MΩ	
		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±12 h. 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 3,000MΩ	
		Dielectric Strength	Pass the item No.4.	

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

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

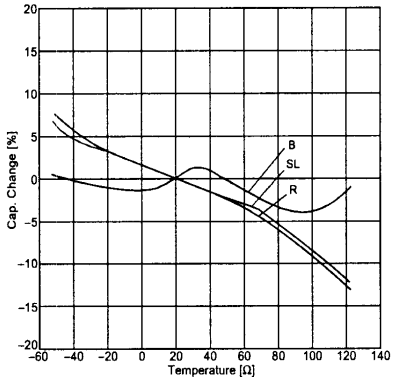
No.	Item		Specification	Test Method
17	Life	Appearance	No marking defects.	Impulse Voltage Each individual capacitor shall be subjected to a 2.5kV (Type GC:5kV) Impulses (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.  Apply voltage as Table for 1,000 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 AC1,000V (r.m.s.) for 0.1s. GC: AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1s.
		Capacitance Change	Within ±20%	
		D.F.	0.05 max.	
		I.R.	More than 3,000MΩ	
		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 for 24±2 h at room condition, then measure.
		Capacitance Change	Within ±15%	
		D.F.	0.05 max.	
		I.R.	More than 3,000MΩ	
		Dielectric Strength	Pass the item No.4.	

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

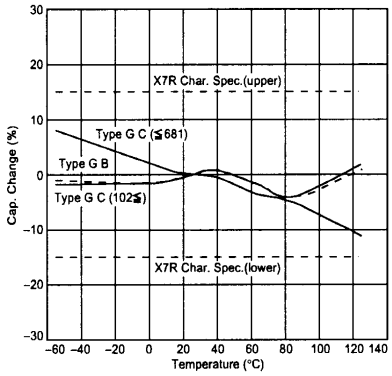
GHM Series Data

■ Capacitance-Temperature Characteristics

GHM1000/1500/2000 Series

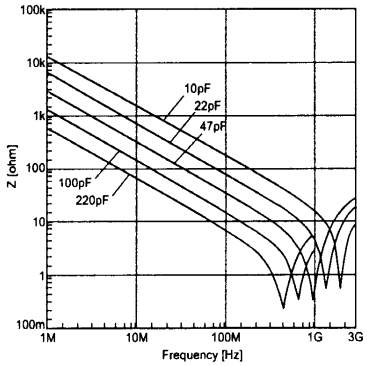


GHM3000 Series

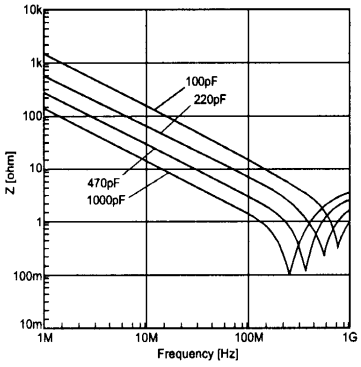


■ Impedance-Frequency Characteristics

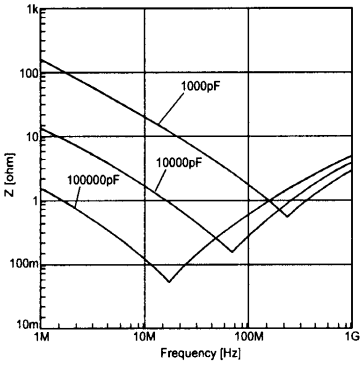
GHM1000 Series(SL)



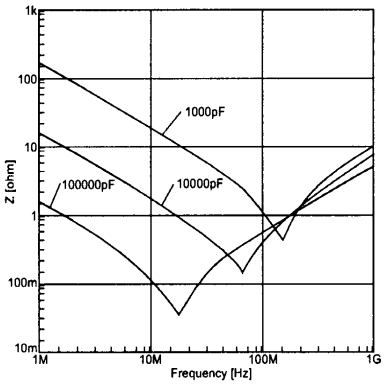
GHM1000 Series(R)



GHM1500 Series



GHM2000 Series



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GHM Series Data

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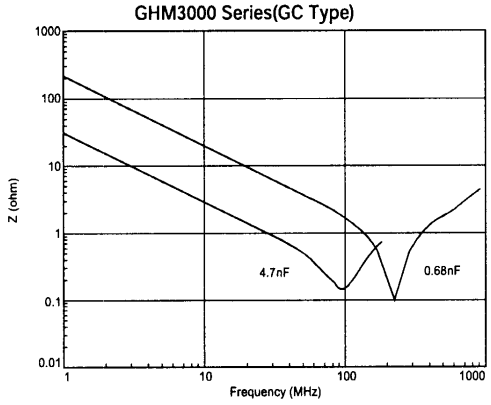
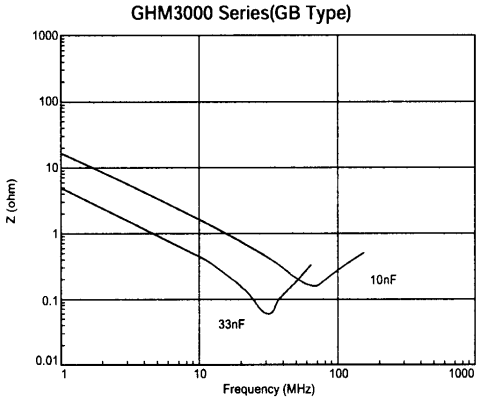
■ Impedance-Frequency Characteristics

GHM3000 Series(GC Type)

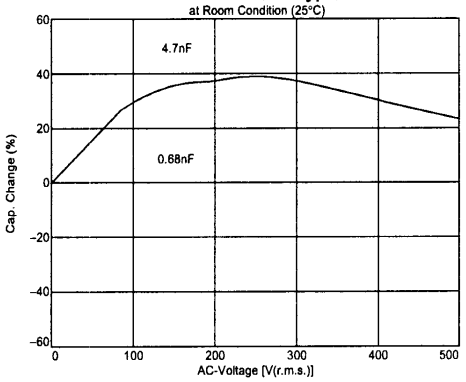


GHM3000 Series(GB Type)

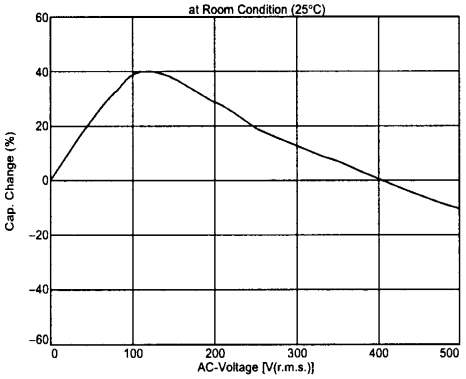


■ Capacitance-AC Voltage Characteristics

GHM3000 Series(GC Type)



GHM3000 Series(GB Type)



Taping is standard packaging method.

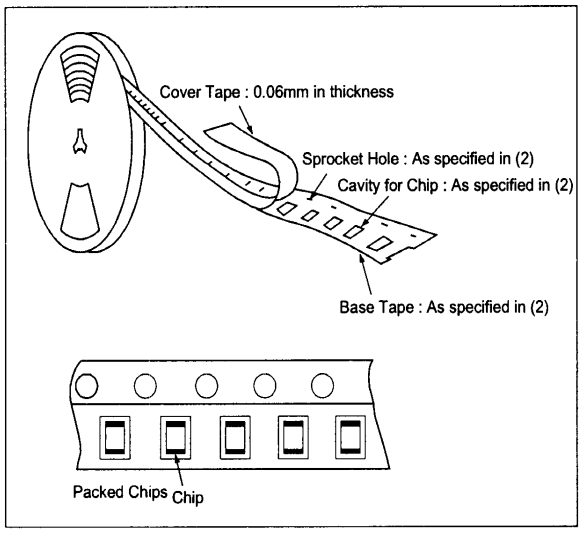
■ Minimum Quantity Guide

Part Number		Dimensions (mm)			Quantity (pcs.) φ180mm reel	
		L	W	T	Paper Tape	Plastic Tape
High-voltage	GHM1030	3.2	1.6	1.0	4,000	-
				1.25	-	3,000
	GHM1035	3.2	2.5	1.5	-	2,000
	GHM1038	4.5	2.0	2.0	-	2,000
	GHM1040	4.5	3.2	2.0	-	1,000
				2.5	-	500
	GHM1525	2.0	1.25	1.0	4,000	-
				1.25	-	3,000
	GHM1530	3.2	1.6	1.0	4,000	-
				1.25	-	3,000
				1.6	-	2,000
	GHM1535	3.2	2.5	1.5	-	2,000
				2.0	-	1,000
	GHM1540	4.5	3.2	1.5	-	1,000
				2.0	-	1,000
				2.5	-	500
				2.6	-	500
	GHM1545	5.7	5.0	2.0	-	1,000
				2.7	-	500
AC250V	GHM2143	5.7	2.8	2.0	-	1,000
	GHM2145	5.7	5.0	2.0	-	1,000
	GHM2243	5.7	2.8	2.0	-	1,000
Safty Std. Recognition	GHM3045	5.7	5.0	2.0	-	1,000
	GHM3145	5.7	5.0	2.0	-	1,000
				2.7	-	500

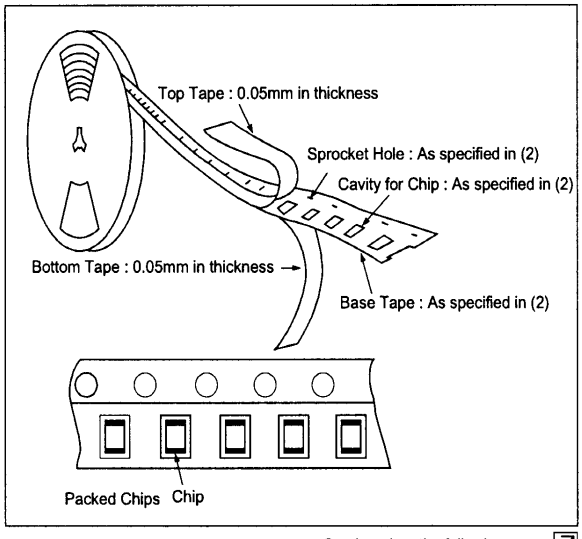
■ Tape Carrier Packaging

(1) Appearance of Taping

① Plastic Tape



② Paper Tape



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Package

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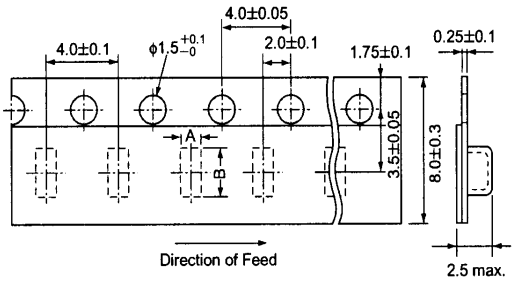
(2) Dimensions of Tape

① Plastic Tape

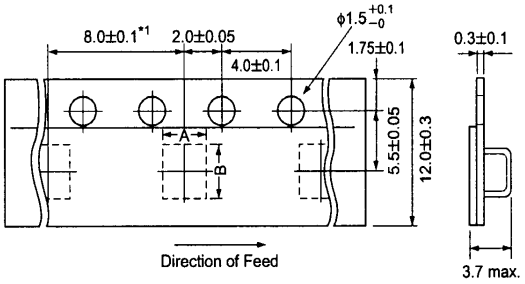
8mm width 4mm pitch Tape (T≧1.25 rank)



Part Number	A*	B*
GHMxx25	1.45	2.25
GHMxx30	2.0	3.6
GHMxx35	2.9	3.6

*Nominal Value

12mm width 8mm/4mm pitch Tape



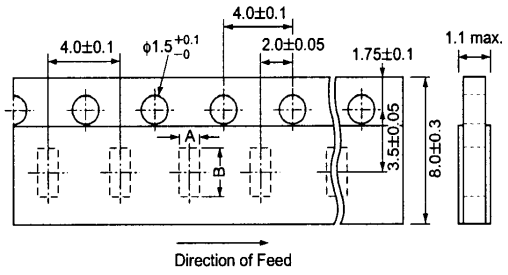
Part Number	A*	B*
GHMxx38	2.5	5.1
GHMxx40	3.6	4.9
GHMxx43	3.2	6.1
GHMxx45	5.4	6.1

*1 4.0±0.1mm in case of GHM1038 *Nominal Value

(in mm)

② Paper Tape

8mm width 4mm pitch Tape (T=1.0 rank)

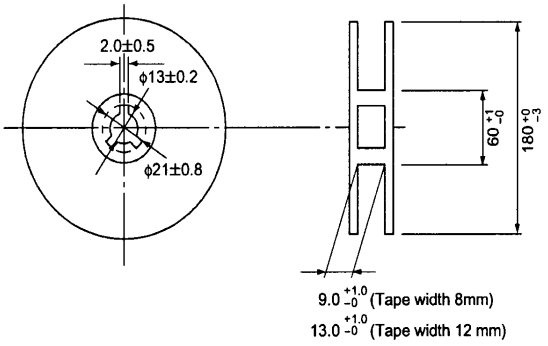


Part Number	A*	B*
GHMxx25	1.45	2.25
GHMxx30	2.0	3.6

*Nominal value

(in mm)

(3) Dimensions of Reel



(in mm)

Package

(4) Taping Method

① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.

② Part of the leader and part of the empty tape shall be attached to the end of the tape as follows.

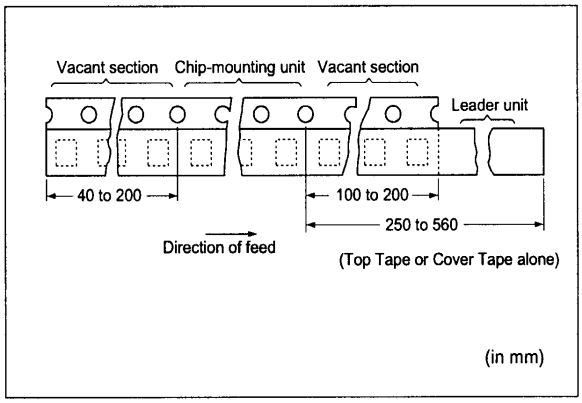
③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

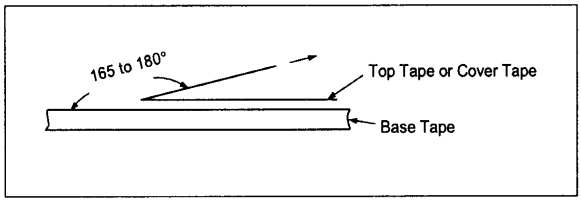
④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

⑤ The top tape or cover tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover sprocket holes.

⑥ Cumulative tolerance of sprocket holes, 10 pitches : ±0.3mm.

⑦ Peeling off force : 0.1 to 0.7N in the direction shown on the right.





⚠ Caution

■ Storage and Operating Conditions

Do not use or store capacitorsin 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 degrees centigrade and 20 to 70%. Use capacitors within 6 months.

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

■ Handling

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.

■ Caution (Rating)

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°C in B(X7R) characteristic products.

Regarding R and SL characteristic products, the applied voltage should be limited in high frequency circuit.

Please contact our sales representatives or engineers for more details.

3. Test Condition for AC Withstanding Voltage

(1) Test Equipment

Test equipment for AC withstanding voltage shall be used with the performance of the wave similar to 50/60 Hz sine wave.

If the distorted sine wave or over load exceeding the specified voltage value is applied, the defective may be caused.

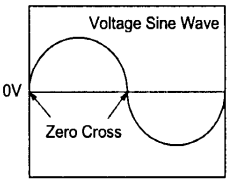
(2) Voltage Applied Method

When the withstanding voltage is applied, capacitor's lead or terminal shall be firmly connected to the out-put of the withstanding voltage test equipment, and then the voltage shall be raised from near zero to the test voltage. If the test voltage without the raise from near zero voltage would be applied directly to capacitor, test voltage should be applied with the *zero cross. At the end of the test time, the test voltage shall be reduced to near zero, and then capacitor's lead or terminal shall be taken off the out-put of the withstanding voltage test equipment.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, the surge voltage may arise, and therefore, the defective may be caused.

*ZERO CROSS is the point where voltage sine wave pass 0V.

-See the right figure-



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

⚠ Caution

■ Caution (Soldering and Mounting)

1. Vibration and Impact

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

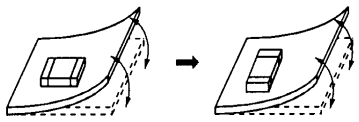
2. Circuit Board Material

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.

3. Land Layout for Cropping PC Board

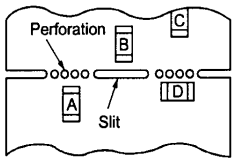
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[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

Continued on the following page.

⚠ Caution

Continued from the preceding page.

4. 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.

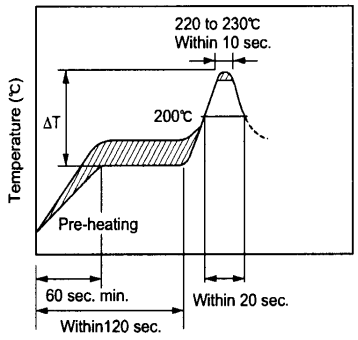
Carefully perform pre-heating so that temperature difference (ΔT) between the solder and component surface should be in the following range. When components are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100°C.

Soldering Method \ Chip Size	3.2×1.6mm and under	3.2×2.5mm and over
Reflow Method or Soldering Iron Method	ΔT≦190°C	ΔT≦130°C
Flow Method or Dip Soldering Method	ΔT≦150°C	—

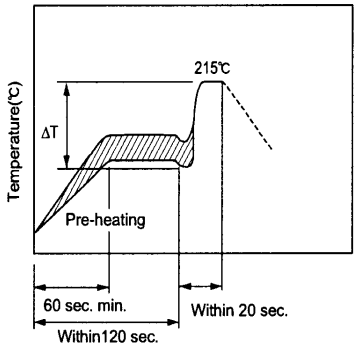
When soldering chips with a soldering iron, it should be performed in following conditions.

Item	Conditions	
Chip Size	≦2.0×1.25mm	3.2×1.6mm
Temperature of Iron-tip	300°C max.	270°C max.
Soldering Iron Wattage	20W max.	
Diameter of Iron-tip	φ 3.0mm max.	
Soldering Time	3 sec. max.	
Caution	Do not allow the iron-tip to directly touch the ceramic element.	

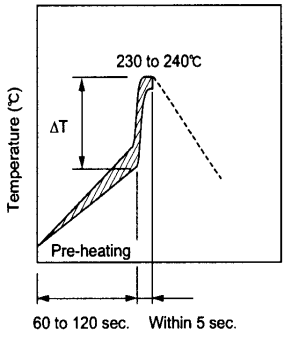
Infrared Reflow Soldering Conditions (Example)



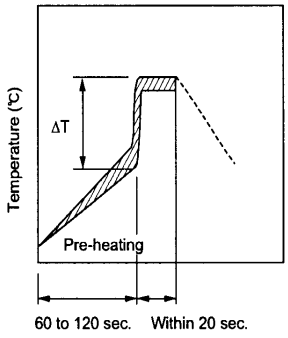
Vapor Reflow Soldering (VPS) Conditions (Example)



Flow Soldering Conditions (Example)



Dip Soldering/Soldering Iron Conditions (Example)



5. Soldering Method

GHM products whose sizes are 3.2×1.6mm 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 3.2×2.5mm 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.

1. Mounting of Chips

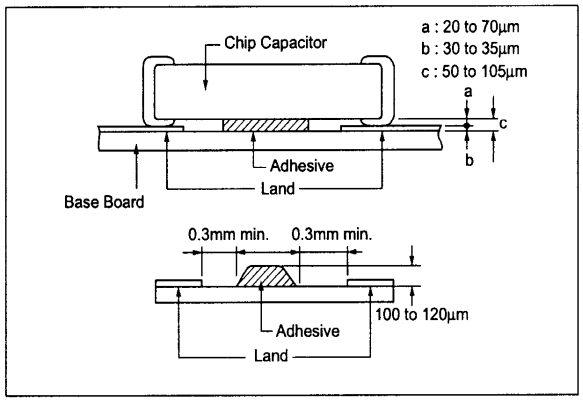
● Mechanical shock of the chip placer

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.

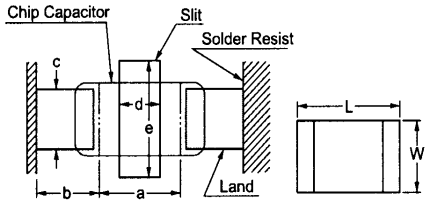
Termination Thickness of Chip Capacitor and Desirable Thickness of Adhesives Applied



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 pre-vent 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

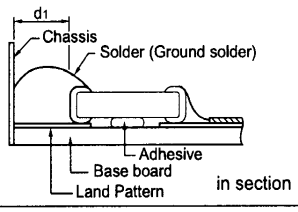
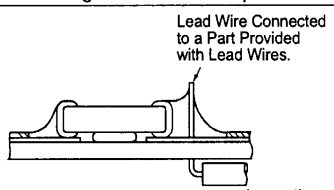
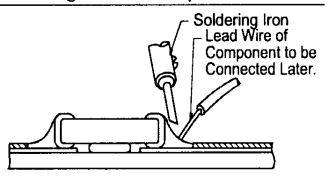
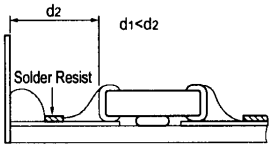
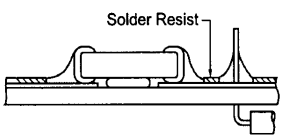
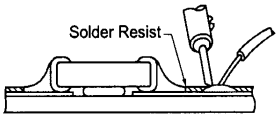
LXW	a	b	c
2.0X1.25	1.0-1.2	0.9-1.0	0.8-1.1
3.2X1.6	2.2-2.6	1.0-1.1	1.0-1.4

Reflow Soldering

LXW	a	b	c	d	e
2.0X1.25	1.0-1.2	0.9-1.0	0.8-1.1	-	-
3.2X1.6	2.2-2.4	0.8-0.9	1.0-1.4	1.0-2.0	3.2-3.7
3.2X2.5	2.0-2.4	1.0-1.2	1.8-2.3	1.0-2.0	4.1-4.6
4.5X2.0	2.8-3.4	1.2-1.4	1.4-1.8	1.0-2.8	3.6-4.1
4.5X3.2	2.8-3.4	1.2-1.4	2.3-3.0	1.0-2.8	4.8-5.3
5.7X2.8	4.0-4.6	1.4-1.6	2.1-2.6	1.0-4.0	4.4-4.9
5.7X5.0	4.0-4.6	1.4-1.6	3.5-4.8	1.0-4.0	6.6-7.1

(in mm)

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	 in section	 in section	 in section
Examples of Improvements by the Land Division	 in section	 in section	 in section

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Notice

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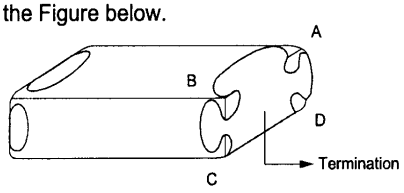
3. Soldering

(Care for minimizing loss of the terminations.)

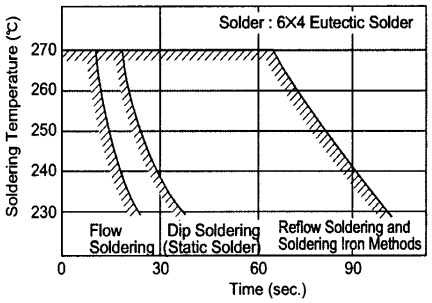
Limit of losing effective area of the terminations and conditions needed for soldering.

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.

(2) Flux and Solder

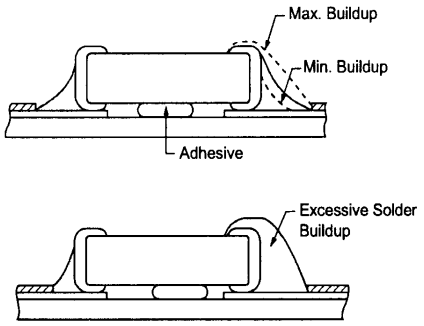
- Use rosin-type flux and do not use a highly acidic flux (any containing a minimum of 0.2wt% chlorine).
- Please use 6Z4 eutectic solder, or 5Z5 solder. (Do not use solder with silver.)

(3) Solder Buildup

① Flow soldering and iron soldering

Use as little solder as possible, and confirm that the solder is securely placed.

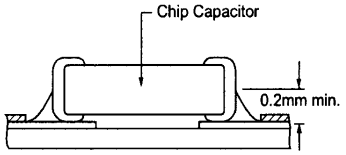
[Solder Buildup by Flow Method and Soldering Iron Method]



② Reflow soldering

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

[Solder Buildup by Reflow Method]



4. Cleaning

To perform ultrasonic cleaning, observe the following conditions on the right.

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

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 or ISO9002 certificate.

Plant	Certified Date	Organization	Registration NO.
Fukui Murata Manufacturing Co.,Ltd.	Mar. 31, '95	RCJ★ ISO9001	RCJ-85M-01C
Izumo Murata Manufacturing Co.,Ltd.	May. 11, '95		RCJ-93M-05A
Murata Electronics Singapore (Pte.) Ltd.	Aug. 13, '92	SISIR★★ ISO9002	SG MES 91M001A
Murata Manufacturing (UK) Ltd.	Nov. 18, '92	BSI★★★ ISO9002	FM 22169
Murata Amazonia Industria Comercio Ltda.	Sep. '93	RCJ★ ISO9002	RCJ-(B)-93M-01
Murata Electronics North America State College Plant	Jun. '94	UL★★★★ ISO9002	A1734

★ RCJ : Reliability Center for Electronic Components of Japan
★★ SISIR : Singapore Institute of Standards and Industrial Research
★★★ BSI : British Standards Institution
★★★★ UL : Underwriters Laboratories Inc.

⚠Note:

1. Export Control
   〈For customers outside Japan〉
   Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.
   〈For customers in Japan〉
   For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.
2. Please contact our sales representatives or product engineers before using our products listed in this catalog for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property, or when intending to use one of our products for other applications than specified in this catalog.
   ① Aircraft equipment
   ② Aerospace equipment
   ③ Undersea equipment
   ④ Power plant equipment
   ⑤ Medical equipment
   ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment
   ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment
   ⑩ Application of similar complexity and/or reliability requirements to the applications listed in the above
3. Product specifications in this catalog are as of July 2000. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before your ordering. If there are any questions, please contact our sales representatives or product engineers.
4. The parts numbers and specifications listed in this catalog are for information only. You are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.
5. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or third party's intellectual property rights and other related rights in consideration of your using our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.
6. None of ozone depleting substances (ODS) under the Montreal Protocol is used in manufacturing process of us.

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