

# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS

## CERAMIC CHIP CAPACITORS

### SAFETY STANDARD APPROVED – 250VAC



### FEATURES

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

### APPLICATIONS

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

### GHM2143/2243

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

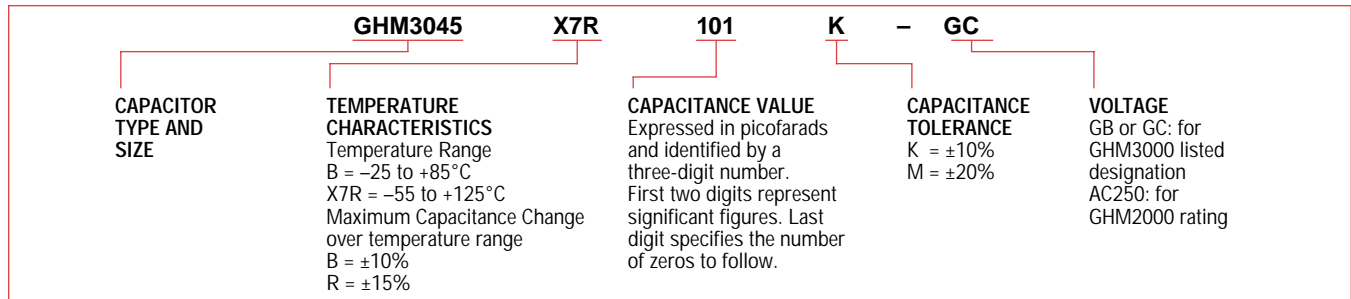
### GHM3045

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

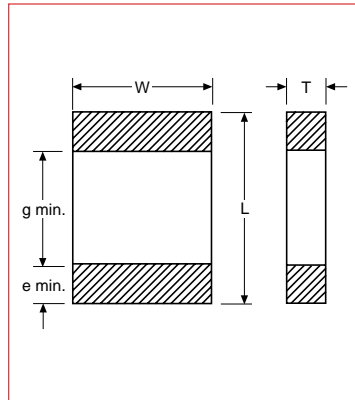
### GHM3145

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

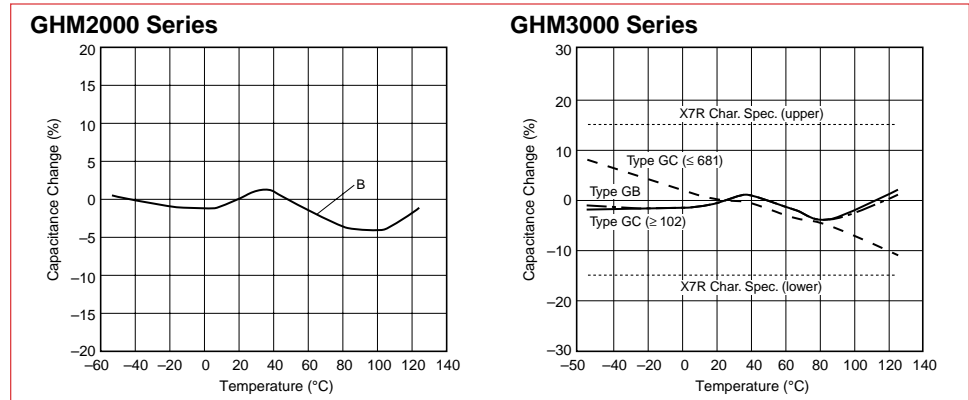
### PART NUMBERING SYSTEM



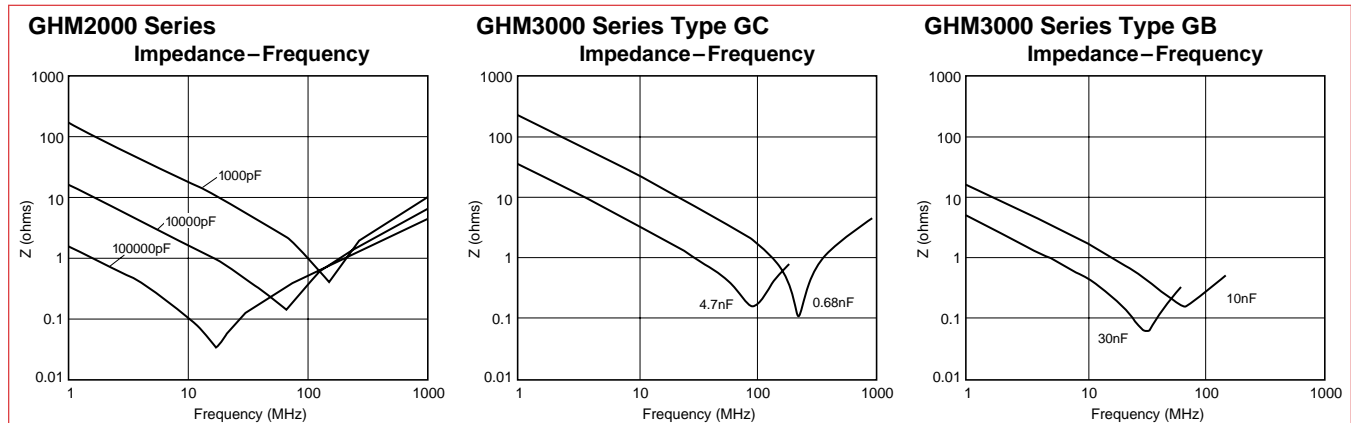
### DIMENSIONS: mm



### CAPACITANCE – TEMPERATURE CHARACTERISTICS



### FREQUENCY CHARACTERISTICS



**SURFACE MOUNT MONOLITHIC CHIP CAPACITORS**  
**CERAMIC CHIP CAPACITORS**  
**SAFETY STANDARD APPROVED – 250VAC**



**GHM2000/3000 Series**

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

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

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

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

**GHM3045 (X1, Y2)**

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

**GHM3145 (X2)**

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

**APPROVAL STANDARDS AND RECOGNIZED NUMBERS**

**GHM3045**

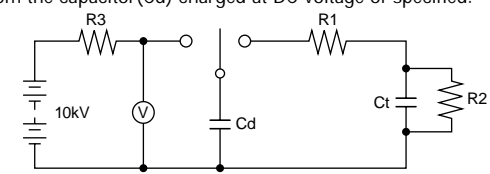
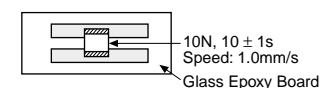
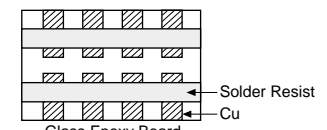
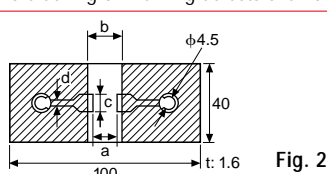
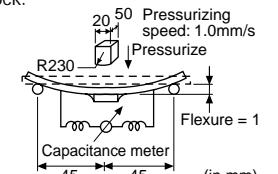
	Standard Number	Recognized Number
UL	UL1414 (Line By Pass)	E37921
SEMKO	IEC384-14 2nd Edition (EN132400) CLASS X1/Y2	9614021 01
SEV		96.1 10333.02
VDE		94671
BSI		228163

**GHM3145**

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

# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS SPECIFICATIONS AND TEST METHODS

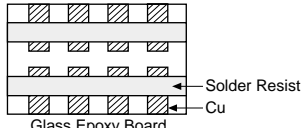
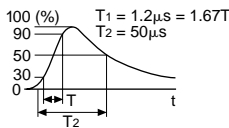
## GHM2000/3000 Series

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

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

# SURFACE MOUNT MONOLITHIC CHIP CAPACITORS SPECIFICATIONS AND TEST METHODS

## GHM2000/3000 Series

No.	Item	Specification	Test Method													
12	Resistance to Soldering Heat	Capacitance Change	Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at $260 \pm 5^\circ\text{C}$ for $10 \pm 1$ s. Let sit at room condition for $24 \pm 2$ h, then measure. <b>Immersing speed:</b> $25 \pm 2.5\text{mm/s}$ <b>Pretreatment</b> Perform a heat treatment at $150_{-10}^{+0}^\circ\text{C}$ for $60 \pm 5$ min. and then let sit for $24 \pm 2$ h at room condition. *Preheating													
		I.R.		GHM2000: >2000M ohms GHM3000: >1000M ohms												
		Dielectric Strength		See item 2.												
		<table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><math>100^\circ\text{C}</math> to <math>120^\circ\text{C}</math></td> <td>1 min</td> </tr> <tr> <td>2</td> <td><math>170^\circ\text{C}</math> to <math>200^\circ\text{C}</math></td> <td>1 min</td> </tr> </tbody> </table>		Step	Temperature	Time	1	$100^\circ\text{C}$ to $120^\circ\text{C}$	1 min	2	$170^\circ\text{C}$ to $200^\circ\text{C}$	1 min				
Step	Temperature	Time														
1	$100^\circ\text{C}$ to $120^\circ\text{C}$	1 min														
2	$170^\circ\text{C}$ to $200^\circ\text{C}$	1 min														
13	Temperature Cycle	Capacitance Change	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 $24 \pm 2$ h at room condition, then measure.													
		D.F.		GHM2000: 0.025 max. GHM3000: 0.05 max.												
		I.R.		GHM2000: >2000M ohms GHM3000: >3000M ohms												
		Dielectric Strength		See item 2.												
<table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (<math>^\circ\text{C}</math>)</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. Operating Temp. <math>\pm 3</math></td> <td><math>30 \pm 3</math></td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> <tr> <td>3</td> <td>Max. Operating Temp. <math>\pm 2</math></td> <td><math>30 \pm 3</math></td> </tr> <tr> <td>4</td> <td>Room Temp.</td> <td>2 to 3</td> </tr> </tbody> </table>		Step	Temperature ( $^\circ\text{C}$ )	Time (min)	1	Min. Operating Temp. $\pm 3$	$30 \pm 3$	2	Room Temp.	2 to 3	3	Max. Operating Temp. $\pm 2$	$30 \pm 3$	4	Room Temp.	2 to 3
Step	Temperature ( $^\circ\text{C}$ )	Time (min)														
1	Min. Operating Temp. $\pm 3$	$30 \pm 3$														
2	Room Temp.	2 to 3														
3	Max. Operating Temp. $\pm 2$	$30 \pm 3$														
4	Room Temp.	2 to 3														
<b>Pretreatment</b> Perform a heat treatment at $150_{-10}^{+0}^\circ\text{C}$ for $60 \pm 5$ min. and then let sit for $24 \pm 2$ h at room condition.																
 <p style="text-align: right;"><b>Fig. 4</b></p>																
14	Humidity (Steady State)	Capacitance Change	Sit the capacitor at $40 \pm 2^\circ\text{C}$ and relative humidity 90 to 95% for $500_{-0}^{+24}$ h. Remove and let sit for $24 \pm 2$ h at room condition, then measure. <b>Pretreatment</b> Perform a heat treatment at $150_{-10}^{+0}^\circ\text{C}$ for $60 \pm 5$ min. and then let sit for $24 \pm 2$ h at room condition.													
		D.F.		0.05 max.												
		I.R.		GHM2000: >1000M ohms GHM3000: >3000M ohms												
		Dielectric Strength		See item 2.												
15	Life	Capacitance Change	<b>GHM2000:</b> Apply voltage and time as Table at $85 \pm 2^\circ\text{C}$ . Remove and let sit for $24 \pm 2$ h at room condition, then measure. The charge/discharge current is less than 50mA.													
		D.F.		0.05 max.												
		I.R.		GHM2000: >1000M ohms GHM3000: >3000M ohms												
		Dielectric Strength		See item 2.												
<table border="1"> <thead> <tr> <th></th> <th>Test Time</th> <th>Test Voltage</th> </tr> </thead> <tbody> <tr> <td>GHM21□□</td> <td><math>1000_{-0}^{+48}</math> h</td> <td>AC300V(r.m.s.)</td> </tr> <tr> <td>GHM22□□</td> <td><math>1500_{-0}^{+48}</math> h</td> <td>AC500V(r.m.s.)*</td> </tr> </tbody> </table>			Test Time	Test Voltage	GHM21□□	$1000_{-0}^{+48}$ h	AC300V(r.m.s.)	GHM22□□	$1500_{-0}^{+48}$ h	AC500V(r.m.s.)*						
	Test Time	Test Voltage														
GHM21□□	$1000_{-0}^{+48}$ h	AC300V(r.m.s.)														
GHM22□□	$1500_{-0}^{+48}$ h	AC500V(r.m.s.)*														
*Except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s. <b>Pretreatment</b> Apply test voltage for $60 \pm 5$ min. at test temperature.																
<b>GHM3000:</b> Impulse Voltage Each individual capacitor shall be subjected to a 2.5kV (Type GC: 5kV) Impulse (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.																
 <p style="text-align: right;"><math>T_1 = 1.2\mu\text{s} = 1.67\text{T}</math> <math>T_2 = 50\mu\text{s}</math></p>																
Apply voltage as Table for 1000 h at $125_{-0}^{+2}^\circ\text{C}$ , relative humidity 50% max.																
<table border="1"> <thead> <tr> <th>Type</th> <th>Applied Voltage</th> </tr> </thead> <tbody> <tr> <td>GB</td> <td>AC312.5V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.</td> </tr> <tr> <td>GC</td> <td>AC425V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.</td> </tr> </tbody> </table>		Type	Applied Voltage	GB	AC312.5V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.	GC	AC425V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.									
Type	Applied Voltage															
GB	AC312.5V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.															
GC	AC425V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 s.															
16	Humidity Loading	Appearance	Apply the rated voltage at $40 \pm 2^\circ\text{C}$ and relative humidity 90 to 95% for $500_{-0}^{+24}$ h. Remove and let sit for $24 \pm 2$ h at room condition, then measure. <b>Pretreatment</b> Apply test voltage for $60 \pm 5$ min. at test temperature. Remove and let sit for $24 \pm 2$ h at room condition.													
		Capacitance Change		Within $\pm 15\%$												
		D.F.		0.05 max.												
		I.R.		GHM2000: >1000M ohms GHM3000: >3000M ohms												
		Dielectric Strength		See item 2.												

\*room condition" Temperature: 15 to  $35^\circ\text{C}$ ; Relative humidity: 45 to 75%; Atmosphere pressure: 86 to 106kPa