# MONOLITHIC CERAMIC CAPACITOR

## GRM Series for General Electronic Equipment

1

## ■FEATURES

1. Terminations are made of metal highly resistant to migration.
2. The GRM series is a complete line of chip ceramic capacitors in 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0Δ to Y5V.
3. A wide selection of sizes is available, from the miniature GRM36 (LXWXT : 1.0X0.5X0.5mm) to the larger sized GRM44-1 (LXWXT : 5.7X5.0X2.0mm).
   GRM39, GRM40 and GRM42-6 types are suited to flow and reflow soldering.
   GRM36, GRM42-2 and larger types are suited to reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placements on PCBs.
5. The GRM series is available in both paper and plastic embossed tape and reel packaging for automatic placement. Bulk case packaging is also available. (GRM 36, GRM39, GRM40 (T : 0.6, 1.25))

## ■APPLICATION

General electronic equipment.

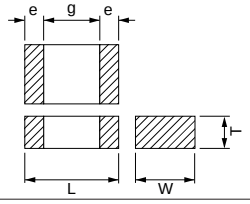
## ■PART NUMBERING

(✻Please specify the part number when ordering)

| (Ex.) | GRM40 | X7R | 102 | K | 50 | | PT |
|---|---|---|---|---|---|---|---|
| | ❶ | ❷ | ❸ | ❹ | ❺ | ❻ | ❼ |

❶Type
❷Temperature Characteristics
❸Capacitance
❹Capacitance Tolerance
❺Rated Voltage
❻Murata's Control No.
❼Packaging

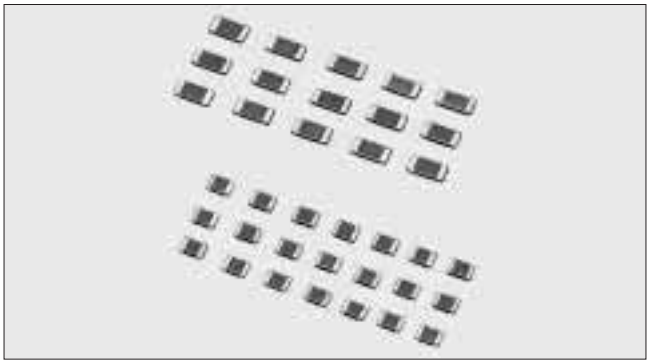
## ❶TYPE AND DIMENSIONS




(in mm)

| Type (EIA Code) | L | W | T | e | g min. |
|---|---|---|---|---|---|
| GRM36 (0402) | 1.0±0.05 | 0.5±0.05 | 0.5±0.05 | 0.15 to 0.3 | 0.4 |
| GRM39✻ (0603) | 1.6±0.1 | 0.8±0.1 | 0.8±0.1 | 0.2 to 0.5 | 0.5 |
| GRM40 (0805) | 2.0±0.1 | 1.25±0.1 | 0.6±0.1 | 0.2 to 0.7 | 0.7 |
| | | | 0.85±0.1 | | |
| | | | 1.25±0.1 | | |
| GRM42-6 (1206) | 3.2±0.15 | 1.6±0.15 | 0.85±0.1 | 0.3 to 0.8 | 1.5 |
| | | | 1.15±0.1 | | |
| | 3.2±0.2 | 1.6±0.2 | 1.6±0.2 | | |
| GRM42-2 (1210) | 3.2±0.3 | 2.5±0.2 | 0.85±0.1 | 0.3 min. | 1.0 |
| | | | 1.15±0.1 | | |
| | | | 1.35±0.15 | | |
| | | | 1.8±0.2 | | |
| | | | 2.5±0.2 | | |
| GRM43-2 (1812) | 4.5±0.4 | 3.2±0.3 | 2.0 max. | 0.3 min. | 2.0 |
| GRM44-1 (2220) | 5.7±0.4 | 5.0±0.4 | 2.0 max. | 0.3 min. | 2.0 |

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



## ❷TEMPERATURE CHARACTERISTICS

• Temperature Compensating Type

| Code | C0G | C0H | P2H | R2H | S2H | T2H | U2J | SL |
|---|---|---|---|---|---|---|---|---|
| Temp. range | −55 to +125℃ | | −55 to +85℃ | | | | | |
| Temp. coeff. (ppm/℃) | 0±30 | 0±60 | −150±60 | −220±60 | −330±60 | −470±60 | −750±120 | +350 to −1000 |

• High Dielectric Constant Type

| Code | X5R | X7R | Z5U | Y5V |
|---|---|---|---|---|
| Temp. range | −55 to +85℃ | −55 to +125℃ | +10 to +85℃ | −30 to +85℃ |
| Cap. change (%) | ±15 | ±15 | +22 −56 | +22 −82 |

## ❸CAPACITANCE (Ex.)

| Code | Capacitance (pF) | Code | Capacitance (pF) |
|---|---|---|---|
| 0R5 | 0.5 | 100 | 10 |
| R75 | 0.75 | 101 | 100 |
| 010 | 1 | 103 | 10,000 |

## ❹CAPACITANCE TOLERANCE

| Code | Tol. | Capacitance range |
|---|---|---|
| C | ±0.25pF | 10pF and below |
| D | ±0.5 pF | |
| J | ±5% | More than 10pF |
| K | ±10% | |
| M | ±20% | |
| Z | +80, −20% | |

## ❺RATED VOLTAGE

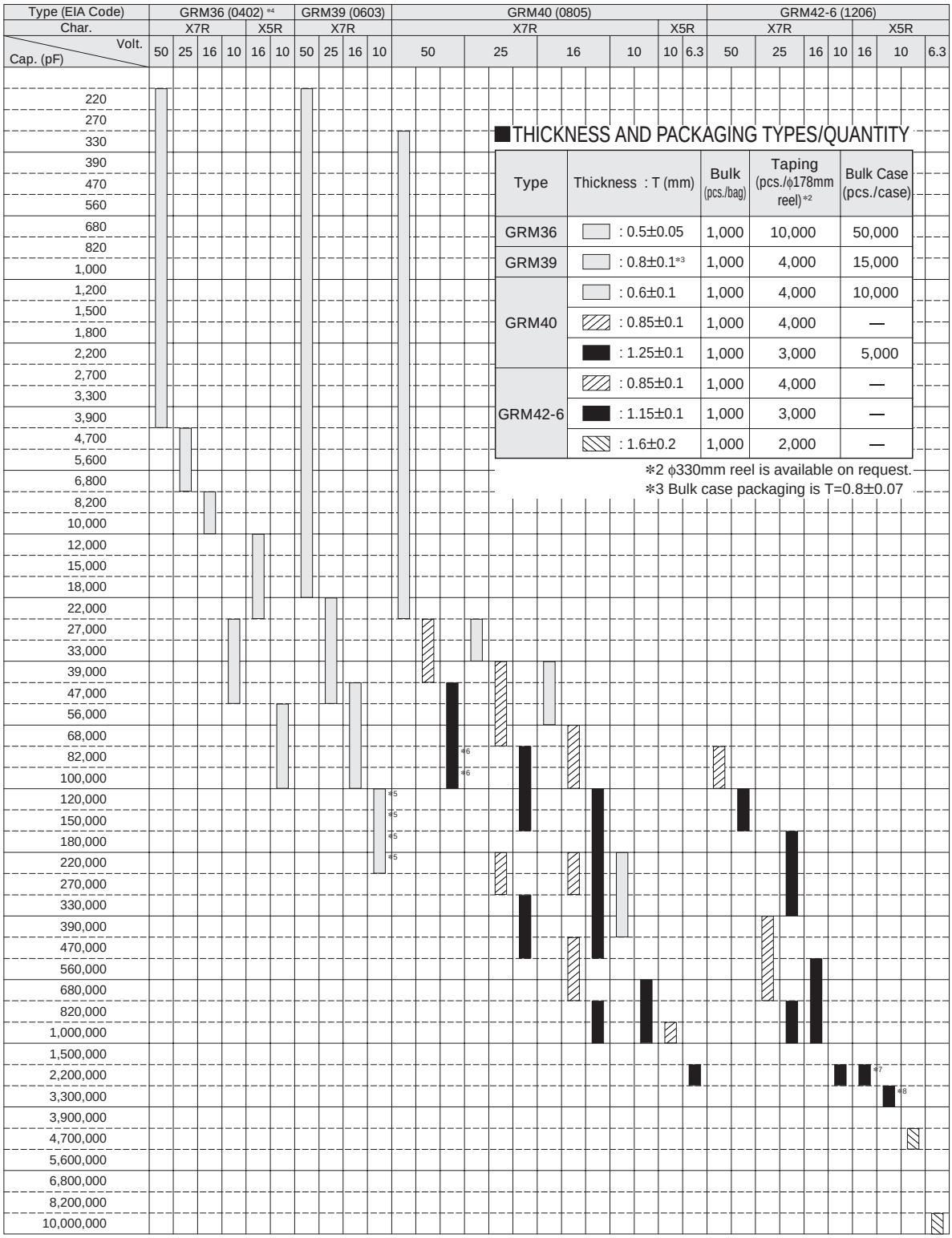
| Code | DC Rated voltage (V) |
|---|---|
| 6.3 | 6.3 |
| 10 | 10 |
| 16 | 16 |
| 25 | 25 |
| 50 | 50 |
| 100 | 100 |
| 200 | 200 |
| 500 | 500 |

## ❼PACKAGING CODE

| Code | Packaging |
|---|---|
| PB | Bulk packaging in a bag |
| PT | Tape carrier packaging |
| PC | Bulk case packaging |

# FOR FLOW AND REFLOW SOLDERING

## High Dielectric Constant Type 50V/25V/16V/10V/6.3V Char. X7R/X5R




### ■THICKNESS AND PACKAGING TYPES/QUANTITY

| Type | Thickness : T (mm) | Bulk (pcs./bag) | Taping (pcs./φ178mm reel)*2 | Bulk Case (pcs./case) |
|---|---|---|---|---|
| GRM36 | : 0.5±0.05 | 1,000 | 10,000 | 50,000 |
| GRM39 | : 0.8±0.1*3 | 1,000 | 4,000 | 15,000 |
| GRM40 | : 0.6±0.1 | 1,000 | 4,000 | 10,000 |
| | : 0.85±0.1 | 1,000 | 4,000 | — |
| | : 1.25±0.1 | 1,000 | 3,000 | 5,000 |
| GRM42-6 | : 0.85±0.1 | 1,000 | 4,000 | — |
| | : 1.15±0.1 | 1,000 | 3,000 | — |
| | : 1.6±0.2 | 1,000 | 2,000 | — |

*2 φ330mm reel is available on request.
*3 Bulk case packaging is T=0.8±0.07

*4 GRM36 series is suited to only reflow soldering.
*5 Only for taping
*6 Type : GRM40-034 (L : 2±0.15, W : 1.25±0.15, T : 1.25±0.15)
*7 L : 3.2±0.2, W : 1.6±0.2, T : 1.15±0.15
*8 Type : GRM42-631 (L : 3.2±0.2, W : 1.6±0.2, T : $1.3^{+0}_{-0.2}$)

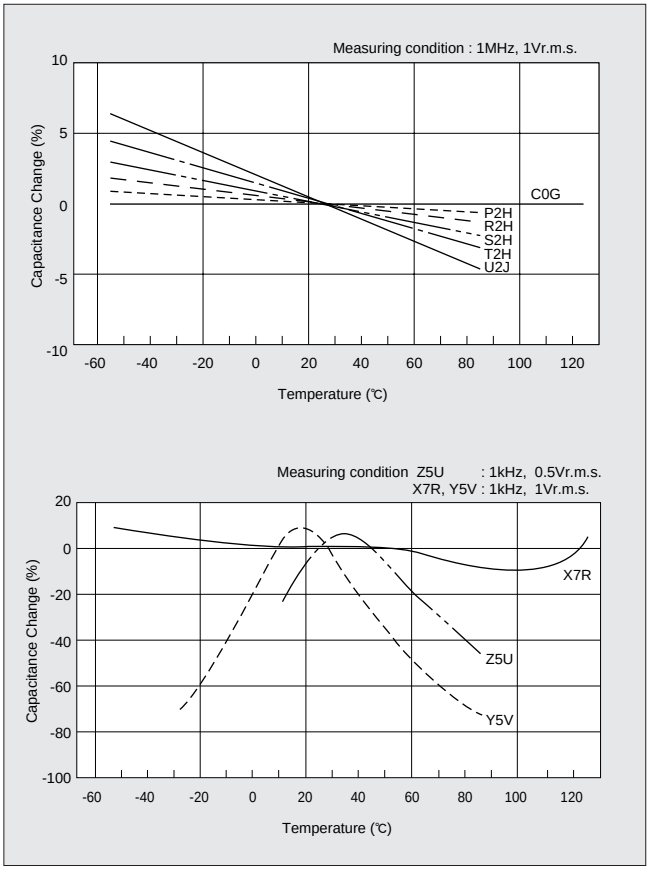
### ■CAPACITANCE TOLERANCE

X7R/X5R Characteristics
K : ±10% (E12 Series)
M : ±20% (E6 Series)

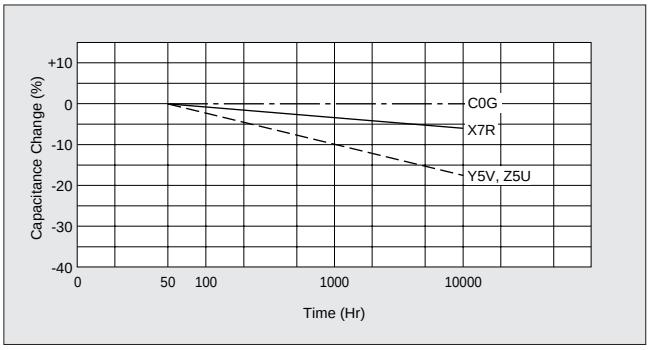
## ■CHARACTERISTICS (REFERENCE DATA)

- SELECTION OF CERAMIC CAPACITORS
  When selecting capacitors, consider the voltage characteristics (AC & DC) and aging characteristics.

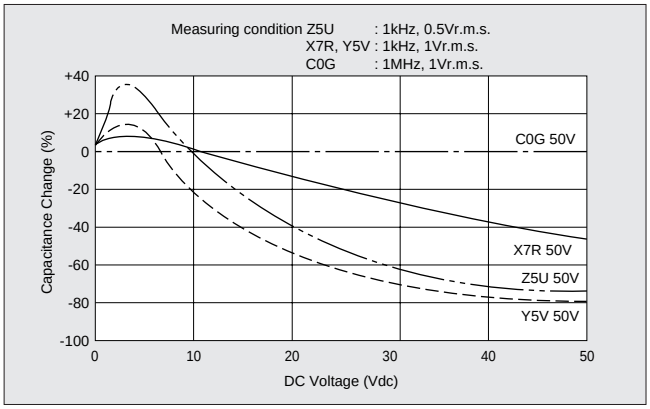
- Capacitance-Temperature Characteristics



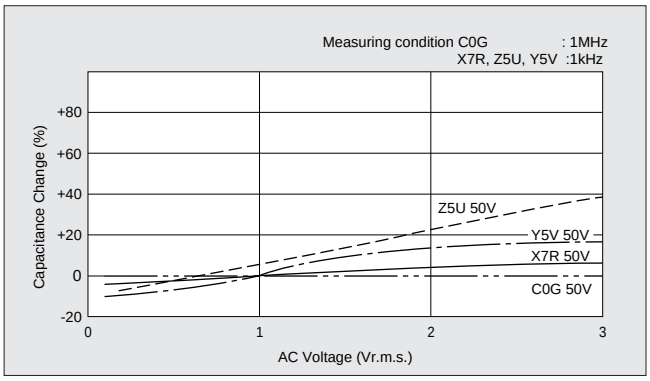

- Capacitance Change- Aging




- Capacitance- DC Voltage Characteristics

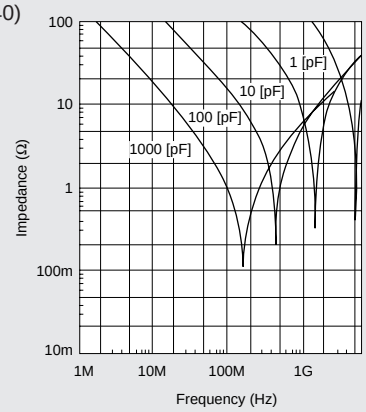



- Capacitance- AC Voltage Characteristics

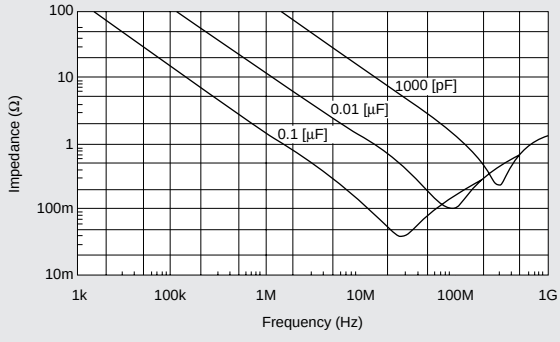



- Impedance- Frequency Characteristics

C0G (GRM40)



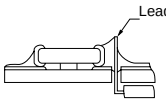
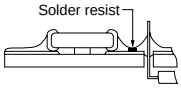
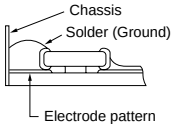
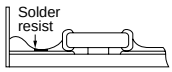
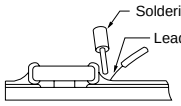
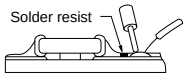
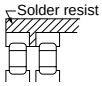

X7R, Y5V (GRM40)




1

## ■NOTICE

| Process | Cautions | Control Points | Reference Data |
|---|---|---|---|
| 1. Storage of Chips | • Chip monolithic ceramic capacitors (chips) can experience degradation of termination solderability when subjected to high temperature or humidity, or if exposed to sulfur or chlorine gases. | • Storage environment must be at an ambient temperature of 5-40℃ and an ambient humidity of 20-70% RH. Use chips within 6 months. If 6 months or more have elapsed, check solderability before use.<br>• For GR series and GR500 series, do not unpack the minimum package until immediately before use. After unpacking, re-seal promptly or store with a desiccant.<br>• Avoid mechanical shock (ex. falling) to the capacitor to prevent mechanical cracking inside of the ceramic dielectric due to its own weight. | Data 1 Solderability |
| 2. Circuit Design | • These capacitors on this catalog are not safety recognized products. | | |
| 3. PCB Design | • Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate. They are also more sensitive to mechanical and thermal stresses than leaded components. Excess solder fillet height can multiply these stresses and cause chip cracking. | • When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.<br>• [Pattern Forms] | Data 2 Board bending strength for solder fillet height<br>Data 3 Temperature cycling for solder fillet height<br>Data 4 Board bending strength for board material |

| | Incorrect | Correct |
|---|---|---|
| Placing of chip components and leaded components |  |  |
| Placing close to chassis |  |  |
| Placing of leaded components after chip components |  |  |
| Lateral mounting |  |  |

[Land Dimensions]

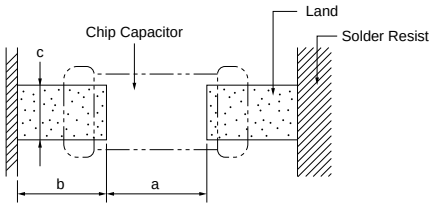



Table 1 Flow soldering method (in mm)

| | | GRM39 GRM420 | GRM40 GRM425 | GRM42-6 GRM430 | LL0508 | LL0612 | GRH706 | GRH708 | GRH110 |
|---|---|---|---|---|---|---|---|---|---|
| Dimensions | L | 1.6 | 2.0 | 3.2 | 1.25 | 1.6 | 1.25 | 2.0 | 1.4 |
| | W | 0.8 | 1.25 | 1.6 | 2.0 | 3.2 | 1.0 | 1.25 | 1.4 |
| a | | 0.6–1.0 | 1.0–1.2 | 2.2–2.6 | 0.4–0.7 | 0.6–1.0 | 0.4–0.6 | 1.0–1.2 | 0.5–0.8 |
| b | | 0.8–0.9 | 0.9–1.0 | 1.0–1.1 | 0.5–0.7 | 0.8–0.9 | 0.6–0.8 | 0.9–1.0 | 0.8–0.9 |
| c | | 0.6–0.8 | 0.8–1.1 | 1.0–1.4 | 1.4–1.8 | 2.6–2.8 | 0.8–1.0 | 0.8–1.0 | 1.0–1.2 |

# NOTICE

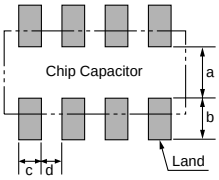
| Process | Cautions | Control Points | Reference Data |
|---|---|---|---|
| 3. PCB Design | | | |

Table 2 Reflow soldering method (in mm)

| | | GRM33 | GRM36 GRM615 | GRM39 GRM420 GRM220 | GRM40 GRM425 GRM225 | GRM42-6 GRM430 GRM230 | GRM42-2 GRM235 GRM435 | GRM43-2 GRM240 | GRM44-1 | LL0306 | LL0508 | LL0612 | GRH706 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimensions | L | 0.6 | 1.0 | 1.6 | 2.0 | 3.2 | 3.2 | 4.5 | 5.7 | 0.8 | 1.25 | 1.6 | 1.25 |
| | W | 0.3 | 0.5 | 0.8 | 1.25 | 1.6 | 2.5 | 3.2 | 5.0 | 1.6 | 2.0 | 3.2 | 1.0 |
| a | | 0.2-0.3 | 0.3 -0.5 | 0.6-0.8 | 1.0-1.2 | 2.2-2.4 | 2.0-2.4 | 3.0-3.5 | 4.0-4.6 | 0.2-0.4 | 0.4-0.6 | 0.6-0.8 | 0.4-0.6 |
| b | | 0.2-0.35 | 0.35-0.45 | 0.6-0.7 | 0.6-0.7 | 0.8-0.9 | 1.0-1.2 | 1.2-1.4 | 1.4-1.6 | 0.3-0.4 | 0.3-0.5 | 0.6-0.7 | 0.6-0.8 |
| c | | 0.2-0.4 | 0.4 -0.6 | 0.6-0.8 | 0.8-1.1 | 1.0-1.4 | 1.8-2.3 | 2.3-3.0 | 3.5-4.8 | 1.0-1.4 | 1.4-1.8 | 2.6-2.8 | 0.8-1.0 |

| | | GRH708 | GRH710 | GRH110 | GRH111 | GR530 | GR535 | GR540 | GR545 | GR550 | GR555 | GR580 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimensions | L | 2.0 | 3.2 | 1.4 | 2.8 | 4.5 | 5.6 | 10.6 | 10.6 | 11.8 | 16.0 | 28.1 |
| | W | 1.25 | 2.5 | 1.4 | 2.8 | 3.8 | 5.0 | 5.0 | 10.0 | 10.6 | 5.0 | 13.2 |
| a | | 1.0-1.2 | 2.2-2.5 | 0.4-0.8 | 1.8-2.1 | 3.2-3.4 | 4.2-4.5 | 8.5-9.0 | 8.5- 9.0 | 9.0-9.5 | 13.0-13.5 | 25.0-25.5 |
| b | | 0.6-0.8 | 0.8-1.0 | 0.6-0.8 | 0.7-0.9 | 0.9-1.2 | 0.9-1.2 | 1.3-1.5 | 1.3- 1.5 | 1.8-2.0 | 1.8- 2.0 | 2.2- 2.4 |
| c | | 0.8-1.0 | 1.9-2.3 | 1.0-1.2 | 2.2-2.6 | 3.0-3.8 | 4.0-5.0 | 4.0-5.0 | 8.0-10.0 | 8.0-10.0 | 4.0- 5.0 | 10.0-13.0 |

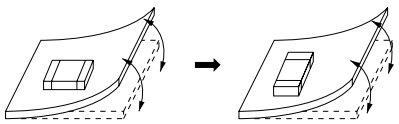
Table 3 GNM Series for reflow soldering method




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

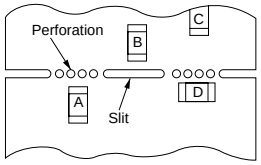
- Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



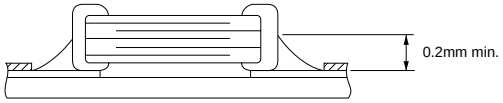
Locate chip horizontal to the direction in which stress acts

[Chip Mounting Close to Board Separation point]



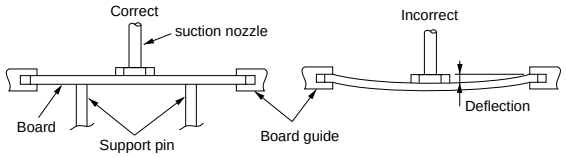
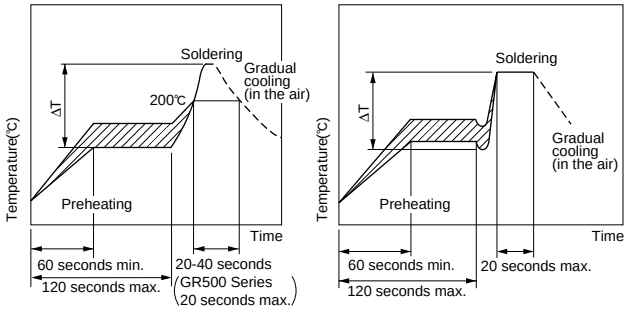
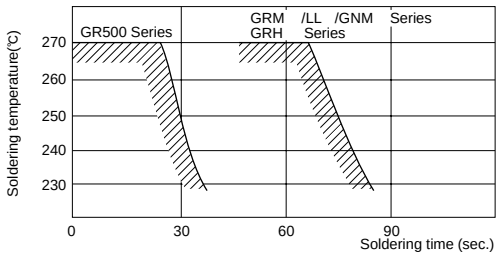

Chip arrangement
Worst A-C-(B≒D) Best

| | | | |
|---|---|---|---|
| 4. Solder Paste Printing | • Overly thick application of solder paste results in excessive fillet height solder. This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.<br>• Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB. | • Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.<br><br>[Optimum Solder Amount for Reflow Soldering] | |



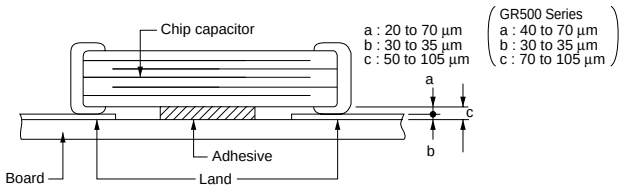
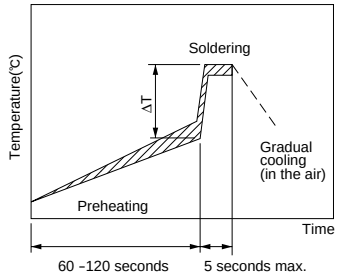

8

# NOTICE

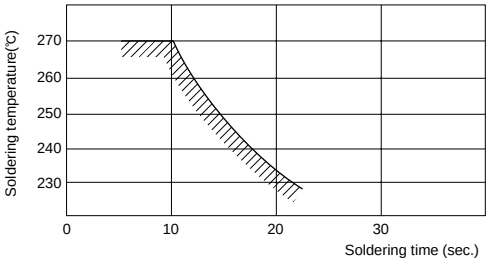
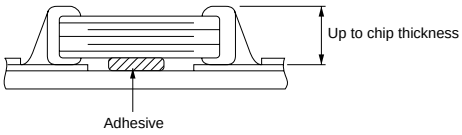
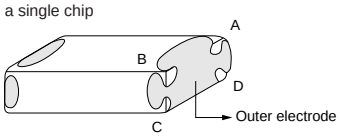
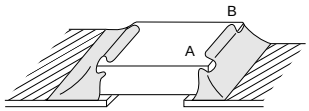
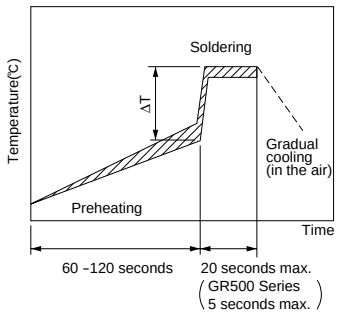
<table>
<tr><th>Process</th><th>Cautions</th><th>Control Points</th><th>Reference Data</th></tr>
<tr><td>5. Chip Placing</td><td>• An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips.<br>• Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes great force on the chip during mounting, causing cracked chips.<br>• The locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips.</td><td>• Adjust the suction nozzle's bottom dead point by correcting warps in the board.<br> 
<br>• Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board.<br>• Nozzle pressure for chip mounting must be a 1 to 3N static load.<br>• The suction nozzle and the locating claw must be maintained, checked and replaced periodically.</td><td>Data 5<br>Break Strength</td></tr>
<tr><td>6. Reflow Soldering</td><td>• Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips.</td><td>• When preheating, keep temperature differential, ΔT, within the range shown in Table 4. The smaller the ΔT, the less stress on the chip.<br>Table 4
<table>
<tr><th>Chip Size</th><th>Temperature Differential</th></tr>
<tr><td>GRM33/36/39/40/42-6<br>GRM420/425/430/615<br>GRM220/225/230<br>LL0306/0508/0612<br>GRH706/708/110</td><td>ΔT≦190℃</td></tr>
<tr><td>GRM42-2/43-2/44-1/240/435<br>GRH710/111<br>GRM235/GNM30-401<br>GR530/535/540/545/550/555/580</td><td>ΔT≦130℃</td></tr>
</table>
• When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and solvent within the range shown in the above table.<br><br>[Standard Conditions for Reflow Soldering]<br>• Infrared reflow • Vapor reflow<br> 
<br><br>[Allowable Soldering Temperature and Time]<br> 
<br>• In case of repeated soldering, the accumulated soldering time must be within the range shown above.</td><td></td></tr>
<tr><td>Inverting the PCB</td><td></td><td>• Make sure not to impose an abnormal mechanical shock on the PCB.</td><td></td></tr>
</table>

8

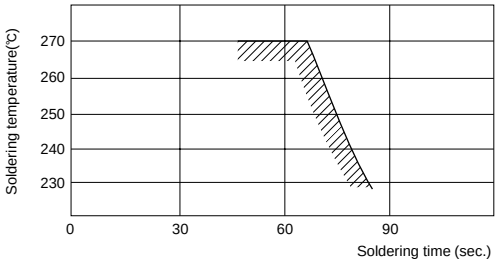
# NOTICE

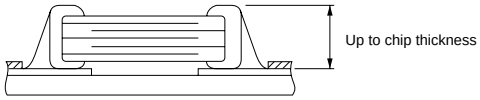
| Process | Cautions | Control Points | Reference Data |
|---|---|---|---|
| 7. Adhesive Application | • Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered.<br>• Low viscosity adhesive causes chips to slip after mounting. | • The amount of adhesive must be more than dimension C shown in the drawing below to obtain enough bonding strength. The chip's electrode thickness and land thickness must be taken into consideration.<br>• Adhesive must have a viscosity of 500ps (at 25℃) min.<br>  | |
| 8. Adhesive Curing | • Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption. | • Control curing temperature and time in order to prevent insufficient hardening. | |
| Inverting the board | | • Make sure not to impose an abnormal mechanical shock on the PCB.. | |
| 9. Leaded Component Insertion | • If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break. | • Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping. | |
| 10. Flux Application | • An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability.<br>• Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned. | • Apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).<br>• Use flux with a halide content of 0.2wt% max. But do not use strongly acidix flux.<br>• Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned. | |
| 11. Flow Soldering | • Sudden heating of the chip results in thermal distortion causing cracked chips.<br>• An excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination. | • When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 5. The smaller the ΔT, the less stress on the chip.<br>• When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 5.<br>• Do not apply flow soldering to chips not listed in Table 5.<br>Table 5<br>Chip Size: GRM39/40/42-6, GRM420/425/430, LL0508/0612, GRH706/708/110 — Temperature Differential: ΔT≦150℃<br>[Standard Conditions for Flow Soldering]<br>  | Data 6 Thermal shock<br><br>Data 7 Solder heat resistance |

8

| Process | Cautions | Control Points | Reference Data |
|---|---|---|---|
| 11. Flow Soldering | | [Allowable Soldering Temperature and Time]<br>  <br><br>In case of repeated soldering, the accumulated soldering time must be within the range shown above.<br><br>[Optimum Solder Amount for Flow Soldering]<br>  <br><br>• Set temperature and time to ensure that leaching of the outer electrode does not exceed 25% of the chip end area as a single chip (full length of the edge A-B-C-D shown below) and 25% of the length A-B shown below as mounted on substrate.<br><br>As a single chip<br>  <br><br>As mounted on substrate<br>  <br> | |
| 12. Correction with a Soldering iron | <For chip type capacitors except GRM200 series><br>• Sudden heating of the chip results in distortion due to a high internal temperature differential, causing cracked chips. | • When preheating, keep temperature differential, ΔT, within the range shown in Table 6. The smaller theΔT, the less stress on the chip.<br><br>Table 6<br><br>| Chip Size | Temperature Differential |<br>|---|---|<br>| GRM36/39/40/42-6<br>GRM420/425/430/615<br>LL0306/0508/0612<br>GRH706/708/110 | ΔT≦190℃ |<br>| GRM42-2/43-2/44-1/435<br>GNM30-401<br>GRH710/111<br>GR530/535/540/545/550/555/580 | ΔT≦130℃ |<br><br>[Standard Conditions for Soldering Iron Temperature]<br>  <br> | Data 8<br>Thermal shock when making a correction with a soldering iron |

# NOTICE

<table>
<tr><th>Process</th><th>Cautions</th><th>Control Points</th><th>Reference Data</th></tr>
<tr><td>12. Correction with a Soldering iron</td><td></td><td>[Allowable Time and Temperature for Making Corrections with a Soldering Iron]<br><br>The accumulated soldering time/temperature including reflow/flow soldering must be within the range shown below :<br> 

<br>[Optimum Solder Amount when Corrections Are Made Using a Soldering Iron]<br> 

<br>• When correcting chips with a soldering iron, no preheating is required if the chip is listed in Table 7 and the following conditions (Table 7) are met.<br>Preheating should be performed on chips not listed in Table 7.<br>Table 7
<table>
<tr><th>Item</th><th colspan="2">Conditions</th></tr>
<tr><td>Chip Size</td><td>GRM36/39/40<br>GRM420/425/615<br>LL0306/0508<br>GRH706/708/110</td><td>GRM42-6<br>GRM430<br>LL0612<br>GNM30-401</td></tr>
<tr><td>Temperature of iron tip</td><td>300℃ max.</td><td>270℃ max.</td></tr>
<tr><td>Soldering iron wattage</td><td colspan="2">20W max.</td></tr>
<tr><td>Diameter of iron tip</td><td colspan="2">ϕ 3mm max.</td></tr>
<tr><td>Restriction</td><td colspan="2">Do not allow the iron tip to directly touch the ceramic element.</td></tr>
</table></td><td>Data 8<br>Thermal shock when making a correction with a soldering iron</td></tr>
<tr><td></td><td><For GRM200 series></td><td>• When solder GRM200 series chip capacitor, keep the following conditions.<br><Soldering iron method>
<table>
<tr><th>Item</th><th colspan="2">Conditions</th></tr>
<tr><td>Chip type</td><td>GRM220</td><td>GRM225/230/235/240</td></tr>
<tr><td>Pre-heating</td><td>no pre-heating is possible</td><td>Δ≦130℃</td></tr>
<tr><td>Temperature of iron tip</td><td colspan="2">300℃ max.</td></tr>
<tr><td>Soldering iron wattage</td><td colspan="2">20W max.</td></tr>
<tr><td>Diameter of iron tip</td><td colspan="2">ϕ 3mm max.</td></tr>
<tr><td>Soldering time</td><td colspan="2">5 sec. max.</td></tr>
<tr><td>Solder amount</td><td>≦Chip thickness</td><td>≦1/2 of chip thickness</td></tr>
<tr><td>Restriction</td><td colspan="2">Do not allow the iron tip to directly touch the ceramic element.</td></tr>
</table></td><td></td></tr>
<tr><td></td><td><For Microstrip types></td><td>• Solder 1mm away from the ribbon terminal base, being careful that the solder tip does not directly contact the capacitor. Preheating is unnecessary.<br>• Complete soldering within 3 seconds with a soldering tip less than 270℃ in temperature.</td><td></td></tr>
<tr><td>13. Washing</td><td>• Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder.</td><td>• Take note not to vibrate PCBs.</td><td></td></tr>
<tr><td>14. Inspection</td><td>• Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints.</td><td>• Provide support pins on the back side of the PCB to prevent warping or flexing.</td><td></td></tr>
<tr><td>15. Resin Coating</td><td></td><td>• When selecting resin materials, select those with low contraction.</td><td></td></tr>
<tr><td>16. Board Separation (or Depanelization)</td><td>• Board flexing at the time of separation causes cracked chips or broken solder.</td><td>• Severity of stresses imposed on the chip at the time of board break is in the order of : Pushback<Slitter<V Slot<Perforator.<br>Board separation must be performed using special jigs, not with hands.</td><td></td></tr>
</table>

8

# MONOLITHIC CERAMIC CAPACITOR

## High-capacitance for General Electrical Equipment **GHM1500** Series

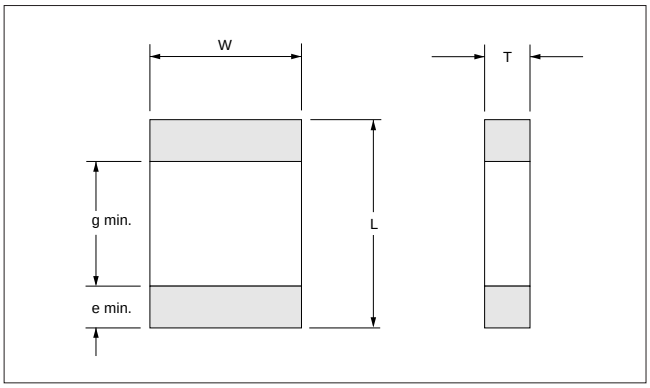
## ■FEATURES

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) | Dimensions (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%)

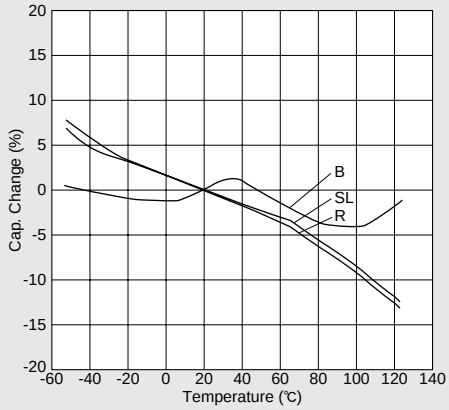
| Part Number | Dimensions (mm) | | | Nom.Cap. (pF) | Cap. Tol. | DC Rated Volt. (V) | Packaging Qty. (pcs./reel) |
|---|---|---|---|---|---|---|---|
| | L | W | T | | | | |
| GHM1525 B 102 K 250 | 2.0±0.2 | 1.25±0.2 | 1.0 +0/−0.3 | 1,000 | ±10% | 250 | 4,000 |
| GHM1525 B 152 K 250 | | | | 1,500 | | | |
| 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 |

9

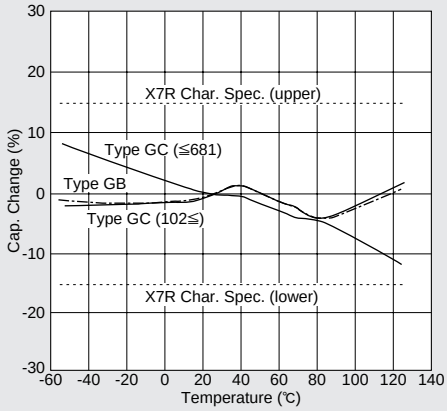
# TYPICAL CHARACTERISTICS DATA

## •Capacitance-Temp. Char.

GHM1000 Series · GHM2000 Series

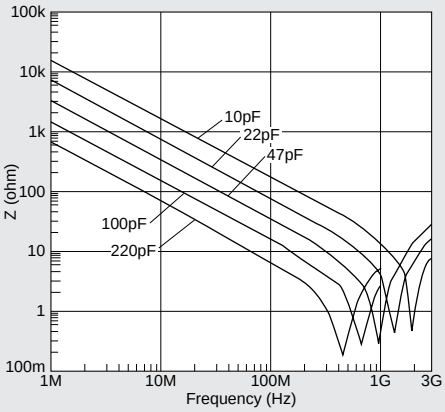



GHM3000 Series

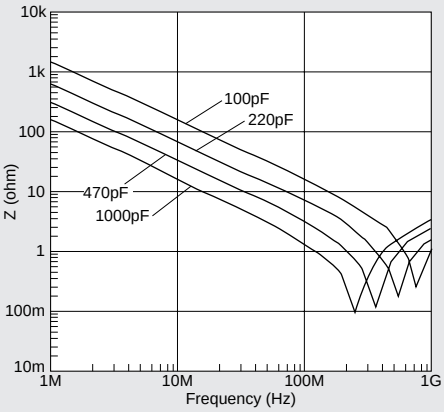



## •Impedance-Freq. Char.

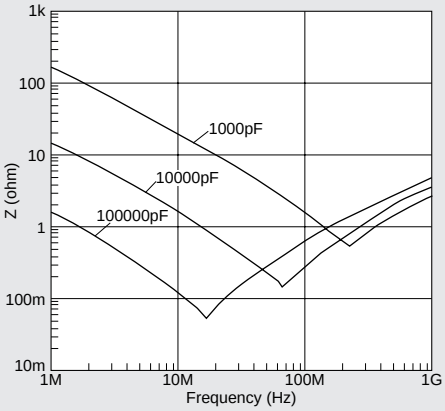
GHM1000 Series [ SL Char.]



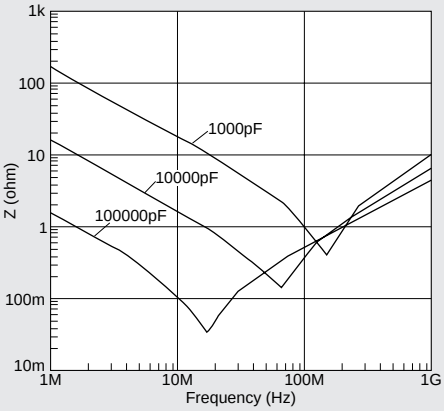

GHM1000 Series [ R Char.]



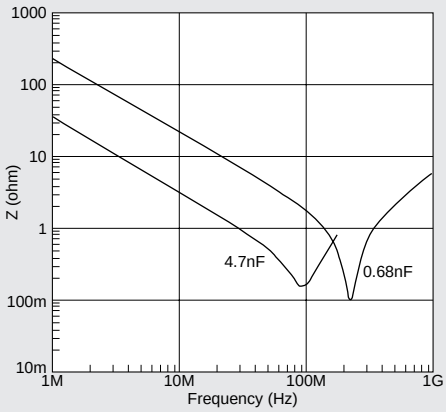

GHM1500 Series



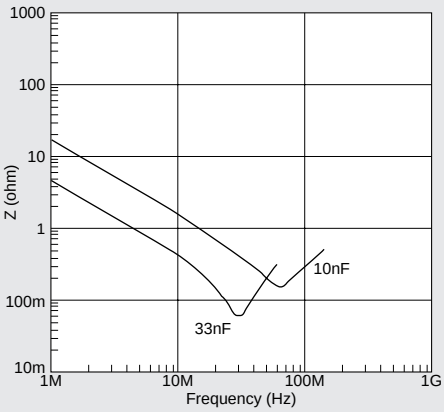

GHM2000 Series




GHM3000 Series (Type GC)




GHM3000 Series (Type GB)




9

## ⚠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 storage environment
   Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present and avoid exposure to moisture.
   Before cleaning, bonding or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment.
   Store the capacitors where the temperature and relative humidity do not exceed 5 to 40℃ and 20 to 70%.
   Use capacitors within 6 months.

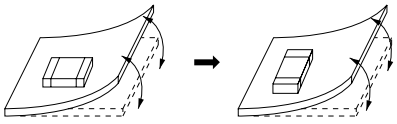
4. Vibration and impact
   Do not expose a capacitor to excessive shock or vibration during use.

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

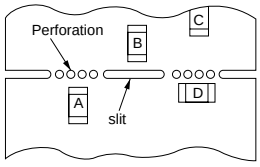
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[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

9

## ⚠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.

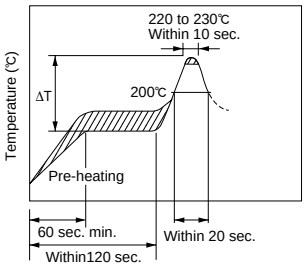
| Soldering method \ Chip Size | 3.2×1.6mm and under | 3.2×2.5mm and over |
|---|---|---|
| Reflow method or Soldering iron method | ΔT≦190℃ | ΔT≦130℃ |
| Flow method or Dip Soldering method | ΔT≦150℃ | —— |

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

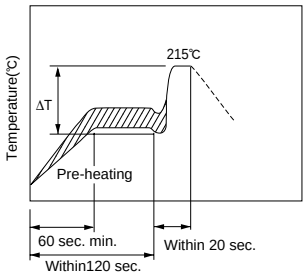
When soldering chips with a soldering iron, it should be performed in following conditions.

| Item | Conditions | |
|---|---|---|
| Chip size | ≦2.0×1.25mm | 3.2×1.6mm |
| Temperature of iron-tip | 300℃ max. | 270℃ 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. | |

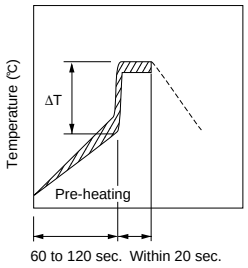
• Infrared reflow soldering conditions (Example)



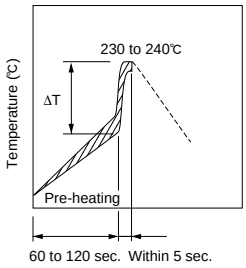

• Vapor reflow soldering (VPS) conditions (Example)




• Dip soldering/Soldering iron conditions (Example)




• Flow soldering conditions (Example)




8. 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.

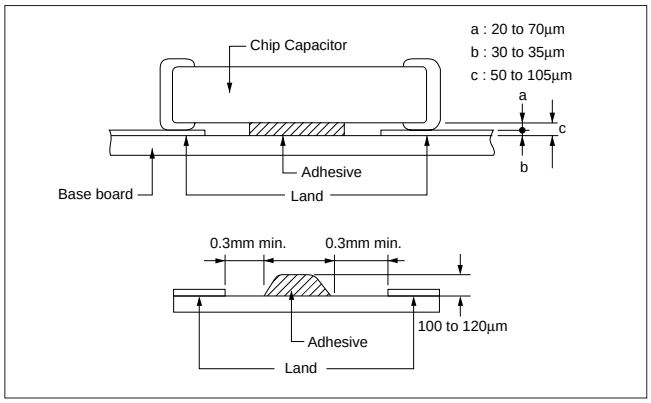
Failure to follow the above cautions may result, worst case, in a short circuit and fuming when the product is used.

9

# 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.

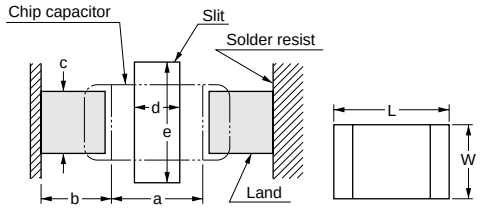
Careful checking and maintenance are necessary to prevent unexpected trouble.

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.

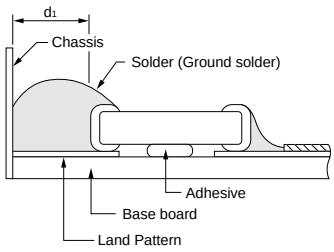
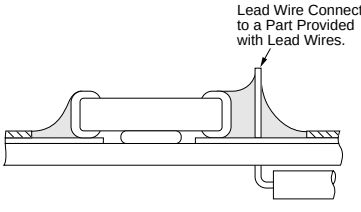
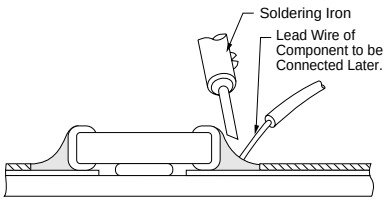
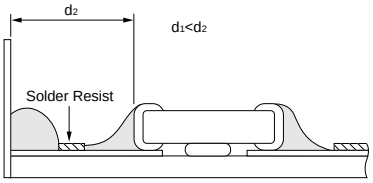
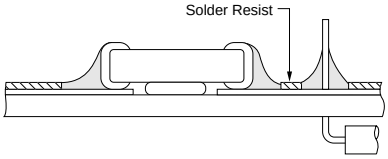
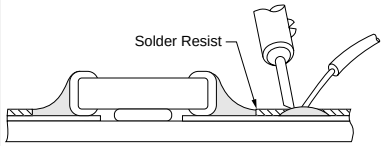
● Flow soldering (in mm)

| L×W | 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)

| L×W | 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 |   |   |   |

9

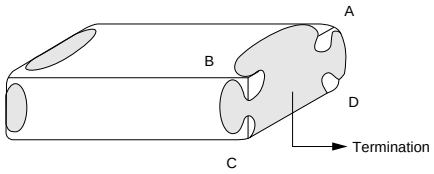
# NOTICE

## 3. SOLDERING

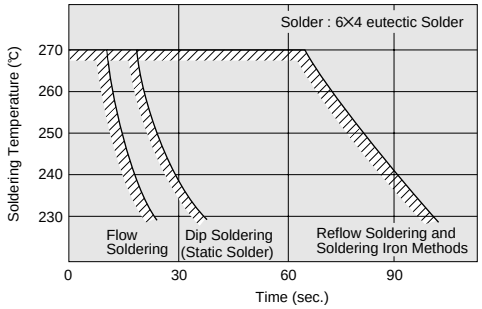
(Care for minimizing loss of the terminations)

● 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.

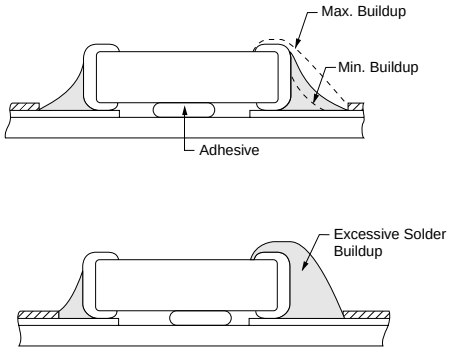
(Flux and Solder)

- Use rosin-type flux and do not use a highly acidic flux (any containing a minimum of 0.2wt% chlorine).
- Please use 6X4 eutectic solder, or 5X5 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).



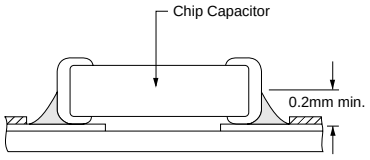

Solder buildup by flow method and soldering iron methods.

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).

9

## ⚠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 Medical equipment
   ⑤ Transportation equipment (vehicles, trains, ships,etc.)
   ⑥ Traffic signal equipment
   ⑦ Disaster prevention / crime prevention equipment
   ⑧ Data-processing equipment
   ⑨ 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 1999. 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.

muRata **Murata Manufacturing Co., Ltd.** http://www.murata.co.jp/products/

**Head Office**
2-26-10, Tenjin Nagaokakyo-shi, Kyoto 617-8555, Japan Phone:81-75-955-6502

**International Division**
3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan
Phone:81-3-5469-6123 Fax:81-3-5469-6155 E-mail:intl@murata.co.jp