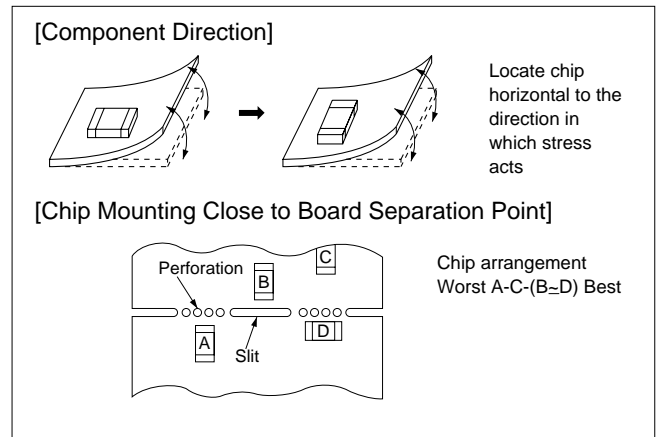


■ ⚠ Caution (Soldering and Mounting)

1. Mounting Position

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



(Reference Data 2. Board bending strength for solder fillet height)

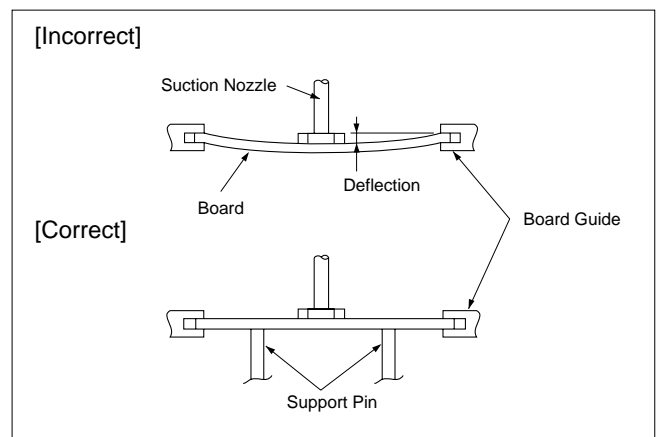
(Reference Data 3. Temperature cycling for solder fillet height)


(Reference Data 4. Board bending strength for board material)

2. Chip Placing

- An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. So adjust the suction nozzle's bottom dead point by correcting warp in the board. Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board. Nozzle pressure for chip mounting must be a 1 to 3N static load.
- 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. And the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically.

(Reference Data 5. Break strength)



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3. Reflow Soldering

- When the sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in table 1. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- Solderability of Tin plating termination chip might be deteriorated when low temperature soldering profile where peak solder temperature is below the Tin melting point is used. Please confirm the solderability of Tin plating termination chip before use.
- 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 table 1.

Table 1

| Part Number | Temperature Differential |
|--|-----------------------------------|
| GRM02/03/15/18/21/31 GJM03/15 LLL15/18/21/31 ERB18/21 GQM18/21 | $\Delta T \leq 190^\circ\text{C}$ |
| GRM32/43/55 LLA18/21/31 LLM21/31 GNM ERB32 | $\Delta T \leq 130^\circ\text{C}$ |

Recommended Conditions

| | Pb-Sn Solder | | Lead Free Solder |
|------------------|-----------------|--------------|-----------------------|
| | Infrared Reflow | Vapor Reflow | |
| Peak Temperature | 230-250°C | 230-240°C | 240-260°C |
| Atmosphere | Air | Air | Air or N ₂ |

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

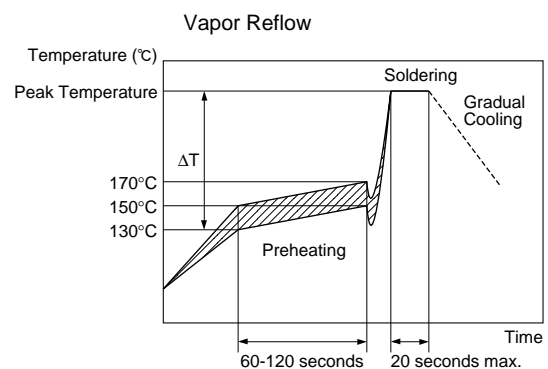
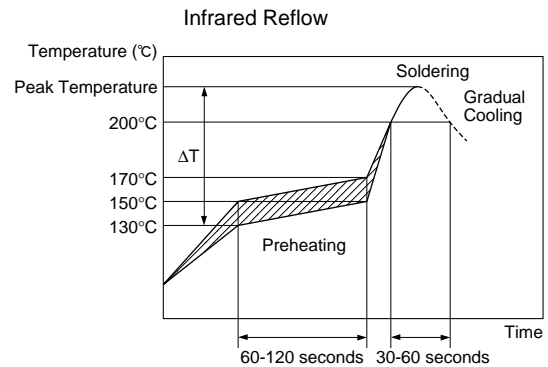
● Optimum Solder Amount for Reflow Soldering

- Overly thick application of solder paste results in excessive fillet height solder. This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.
- Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
- Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.

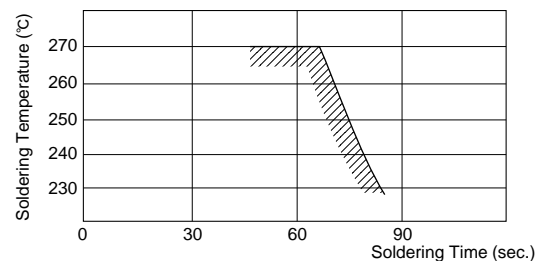
Inverting the PCB

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

[Standard Conditions for Reflow Soldering]

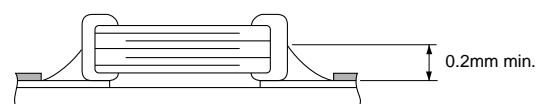


[Allowable Soldering Temperature and Time]



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

[Optimum Solder Amount for Reflow Soldering]



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4. 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.

5. Flow Soldering

- When the sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. And 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.
- In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in table 2. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.

When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.

Do not apply flow soldering to chips not listed in Table 2.

Table 2

| Part Number | Temperature Differential |
|-------------|-----------------------------------|
| GRM18/21/31 | $\Delta T \leq 150^\circ\text{C}$ |
| LLL21/31 | |
| ERB18/21 | |
| GQM18/21 | |

Recommended Conditions

| | Pb-Sn Solder | Lead Free Solder |
|------------------|--------------|------------------|
| Peak Temperature | 240-250°C | 250-260°C |
| Atmosphere | Air | N ₂ |

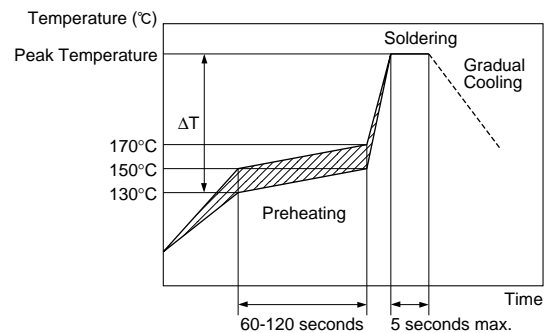
Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

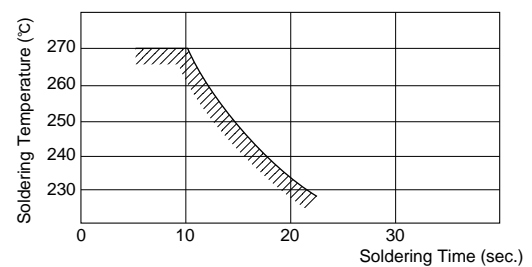
- Optimum Solder Amount for Flow Soldering

The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions.

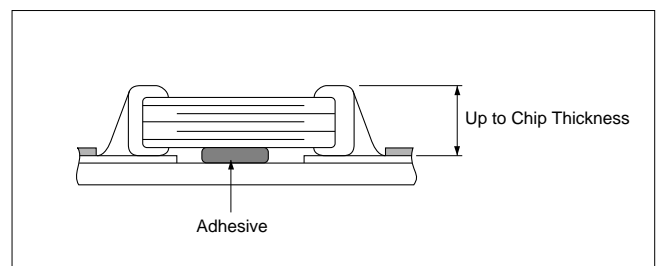
[Standard Conditions for Flow Soldering]



[Allowable Soldering Temperature and Time]



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



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6. Correction with a Soldering Iron

(1) For Chip Type Capacitors

- When the sudden heat is given to the components by soldering iron, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in table 3. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible. After soldering, it is not allowed to cool it down rapidly.

Table 3

| Part Number | Temperature Differential | Peak Temperature | Atmosphere |
|---|-----------------------------------|---|------------|
| GRM15/18/21/31 GJM15 LLL15/18/21/31 GQM18/21 ERB18/21 | $\Delta T \leq 190^\circ\text{C}$ | 300°C max. 3 seconds max. / termination | Air |
| GRM32/43/55 GNM LLA18/21/31 LLM21/31 ERB32 | $\Delta T \leq 130^\circ\text{C}$ | 270°C max. 3 seconds max. / termination | Air |

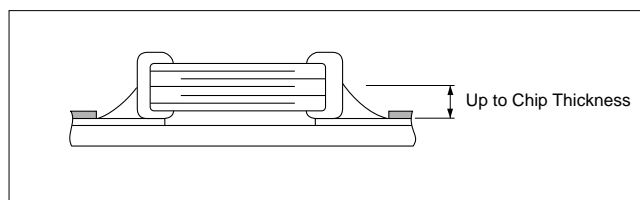
*Applicable for both Pb-Sn and Lead Free Solder.

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

- Optimum Solder Amount when Corrections Are Made Using a Soldering Iron

The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions. Soldering iron $\phi 3\text{mm}$ or smaller should be required. And it is necessary to keep a distance between the soldering iron and the components without direct touch. Thread solder with $\phi 0.5\text{mm}$ or smaller is required for soldering.



7. Washing

Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder. Take note not to vibrate PCBs.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCTS IS USED.

Die Bonding/Wire Bonding (GMA or GMD Series)

1. Die Bonding of Capacitors

- Use the following materials Braze alloy:
Au-Sn (80/20) 300 to 320 degree C in N₂ atmosphere
- Mounting
 - Control the temperature of the substrate so that it matches the temperature of the braze alloy.
 - Place braze alloy on substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation in 1 minute.

2. Wire Bonding

- Wire
Gold wire:
20 micro m (0.0008 inch), 25 micro m (0.001 inch) diameter
- Bonding
 - Thermocompression, ultrasonic wedge or ball bonding.
 - Required stage temperature : 200 to 250 degree C
 - Required wedge or capillary weight : 0.5N to 2N (GMA Series), 0.2N to 0.4N (GMD Series).
 - Bond the capacitor and base substrate or other devices with gold wire.