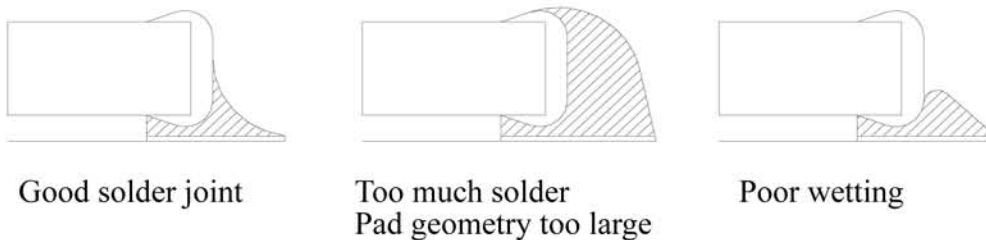


Precautions to the user for Surface Mount Varistor:

1. When mounting surface mount varistor on the PC board, the improper soldering temperature and time out of the limits may reduce the adhesive strength of their terminals. The welding time of the component is up to 53 seconds and it is able to be reworked. Please refer the recommended soldering temperature profiles on page 54, 55.
2. Put the proper volume of solder (the height of fillet) on PC board for installing surface mount varistors, because it directly affects the installed varistors. The design of copper pad patterns and dimensions should be set, so that the proper volume of solder can provide.

Solder joint profiles for silver/nickel/tin terminations



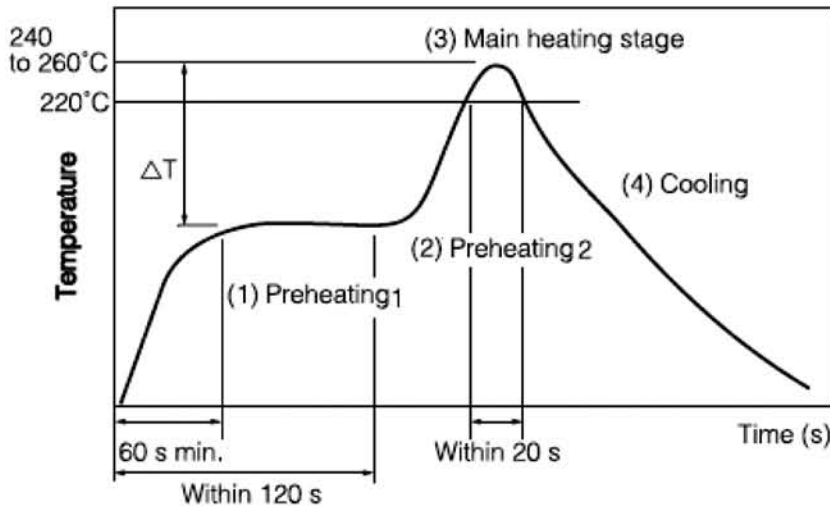
3. Rosin-based and non-activated soldering flux is recommended. The content of halogen in the soldering flux should be 0.2 wt% or less. In case of water-soluble type soldering flux being applied, the flux residue on the surface of PC board may have influences on the reliability of the components and be the cause of deterioration and failures.
4. Do not use solvents such as thinner and acetone, which dissolve or make the exterior covering of varistor deteriorate. Ultrasonic cleaning shall be so set that the vibration can not travel the assembly boards. When an ultrasonic cleaning is applied to the mounted Varistors on PC boards, the following conditions are recommended for preventing failures or damages of the devices due to the vibration energy and the resonance caused by the ultrasonic waves.
 - (1) Frequency 29MHz max
 - (2) Radiated Power 20w/liter max
 - (3) Period 5minuets max
5. Store varistors at temperature of -10 to $+40^{\circ}\text{C}$ and relative humidity of less than 75%. Max. relative humidity (Without condensation) : $<75\%$ annual average, $<95\%$ on max. 30 days per annum. Avoid storing in environment of rapid changes in temperature, direct sunlight, corrosive, gas or dust.
6. Be available with Nickel/Tin end terminations (electroplating Ni-Sn) , the component should be left in the original packing in order to avoid soldering problems caused by oxidized terminals and used within 12 months, if possible.

Soldering:

* Reflow soldering

Rapid heating, partial heating or rapid cooling will easily cause defect of the component, so preheating and gradual cooling process is suggested. It is essential that the soldering process shall be controlled by the following recommended conditions and precautions.

ΔT : Within 150°C



(1) Preheating 1:

The mounted components shall be preheated sufficiently for 60 to 90 seconds so that the surface temperatures of them to be 140 to 160°C.

(2) Preheating 2:

After "Preheating 1", the mounted components shall be heated to the elevated temperature of 150 to 220°C for 2 to 5 seconds.

(3) Soldering:

Heating section : 220°C or above within 20 sec.

(4) Cooling:

After the soldering, the mounted components shall be gradually cooled to room ambient temperature for preventing mechanical damages such as cracking of the devices.

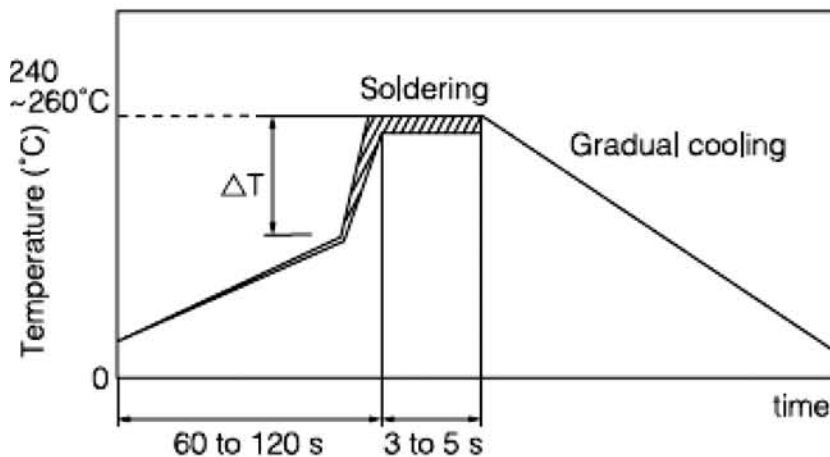
※ Perform adequate test in advance as the reflow temperature profile will vary according to the conditions of the manufacturing process, and the specification of the reflow furnace.

(5) When the components are immersed into a cleaning solvent, it shall be confirmed that the surface temperature of devices do not exceed 100°C.

(6) Two times of reflow soldering under the conditions shown in the above figure do not cause any problems. However, fully pay attention to the possible warp and bending of the PC board.

* **flow soldering**

In flow soldering process, abnormal and large thermal and mechanical stresses, caused by “Temperature Gradient” between the mounted components and melted solder in a soldering bath, may be applied directly to the components, resulting in failures and damages of the components. It is essential that the soldering process shall be controlled by the following recommended conditions.



(1) Application of Soldering flux:

The soldering flux shall be applied to the mounted components thinly and uniformly by foaming method.

(2) Preheating:

The mounted components shall be preheated sufficiently so that the “Temperature Gradient” between the components and the melted solder shall be 150°C max. (100 to 130°C)

(3) Immersion into Soldering Bath

The mounted components shall be immersed into a soldering bath of 240 to 260°C for 3 to 5 seconds.

(4) Cooling:

After the soldering, the mounted components shall be gradually cooled to room ambient temperature with the cooling temperature rates of 8°C/s max. from 250°C to 170°C, and 4°C/s max. from 170°C to 130°C.

(5) Flux Cleaning:

When the components are immersed into a cleaning solvent, it shall be confirmed that the surface temperature of devices do not exceed 100°C.

(6) One time of flow soldering under the conditions shown in the above figure does not cause any problems. However, fully pay attention to the possible warp and bending of the PC board.

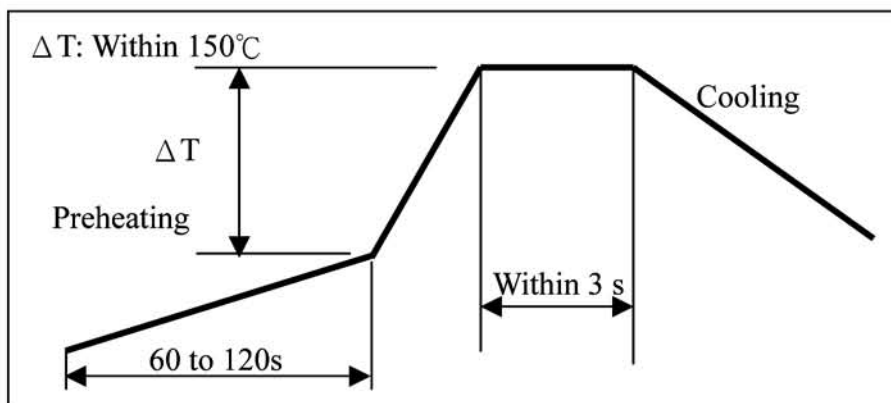
Soldering Notes:

- Iron soldering should be avoided, hot air methods are recommended for repair purposes.
- If needed for test on PCB by “Hand Soldering”, please be cautioned the following:
In hand soldering of the SMD Varistors, a large temperature gradient between preheated SMD Varistors and the tip of soldering iron may cause electrical failures and mechanical damages such as cracking or breaking of the device. The soldering should be carefully controlled and carried out, so that the temperature gradient is kept at a minimum by the following recommended conditions for hand soldering.

Condition 1 (With preheating):

- (1) Solder:
Ø 1 mm thick eutectic solder with soldering flux in the core.
Rosin-based, and non-activated flux is recommended.
- (2) Preheating:
The Varistors should be preheated so that “Temperature Gradient” between the devices and the tip of soldering iron is 150°C or below.
- (3) Soldering Iron:
Temperature of soldering iron tip: 300°C max. (The required amount of solder should be melted in advance on the soldering tip.)
- (4) Cooling:
After soldering, the Varistors should be cooled gradually to room ambient temperature.

Recommended Soldering Temperature-Time Profile (Hand Soldering)



Condition 2 (Without preheating):

Hand Soldering is acceptable for modification as long as the following conditions are met.

- (1) Soldering iron tip should not have a direct contact with ceramic dielectric.
- (2) Soldering iron tip should be fully preheated before applying the soldering iron tip to the external electrode of the SMD Varistors.

* Conditions of Hand soldering without preheating

	Conditions
Temperature	270°C max.
Wattage	20W max.
Shape of iron tip	Ø3 mm max.
Time while contacting	Within 3 s



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