Soldering and Reflow Profile

Application Note 5558

Solder Paste recommendation

The soldering and reflow profile recommended is from JEDEC standard JSTD020D-01. Refer to the JEDEC standard for latest updates.

The recommended solder for mounting surface mount package is Sn63 (63% SN 37% Pb) because it is a eutectic compound with a melting point (183°C) not high enough to exceed the standard operating limit of the devices. Furthermore, it is low enough to avoid damaging circuitry during solder reflow operations.

The recommended lead free solder for SMT reflow is Sn-Ag-Cu (95.5% Tin / 3.8% Silver/ 0.7% Copper). This lead free solder paste has a melting point of 217°C (423°F), the ternary eutectic of Sn-Ag-Cu system, giving it the advantage of being the lowest melting lead free alternative. This temperature is still low enough to avoid damaging the internal circuitry during solder reflow operations provided the time of exposure at peak reflow temperature versus time is shown in Figure 1.

The solder paste used in this evaluation is RX 303-92 SK HO(S) by Nihon Handa. Profile in Figure 1 is recommended in automated reflow process to ensure reliable finished joints. However, profile will vary among different solder paste from different manufacturers. Other factors that may affect the profile includes the density and type of components on the board, type of solder and type of board or substrate material being used. The profile shows the actual temperature that should occur on the surface of a test board at or near a central solder joint. During this type of reflow soldering, the circuit board and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit because it has a large surface area, absorbs thermal energy more efficiently, and then distributes this heat to the components.

Reflow temperature profiles designed for tin/ lead alloys will need to be revised accordingly to cater for the melting point of the lead free solder being 34°C (93°F) higher than that of tin / lead eutectic or near eutectic alloys. Outlined below is a typical convection reflow lead free profile. However, this should only be taken as a guideline from which to start from.

Remarks

1. **Ramp**

   Max slope for this zone is limited to 2°C/ sec. Higher than 2°C may result in excessive solder balling and slump.

2. **Preheat**

   Preheating setting is usually calculated from 100°C to 150°C with typical time setting of between 70-100 seconds. If possible, do not preheat beyond the time setting recommended to prevent excessive oxidation to the solder surface.

3. **Reflow**

   The peak reflow temperature is calculated by adding ~30°C to the melting point of the solder alloy 92 SK, which melts at 217°C. The peak reflow temperature is 217°C +30°C =247°C (-0°C+5°C). The time at peak is not critical and usually not measured as it is very dependent on the type of oven used.

   Time over 217°C is however critical as it will determine the appearance of the solder joints after reflow. Typical time over 217°C for solder alloy 92 is from 40-60 seconds. Longer reflow time may result in dull and gritty solder joints and charring of flux residues. Time below 30 seconds may result in insufficient wetting and poor inter-metallic formation.

4. **Cooling**

   Max slope for cooling is limited to 4°C/ sec. Cooling at a faster rate may result in cracked solder joints. Slower cooling may result in dull solder joints.

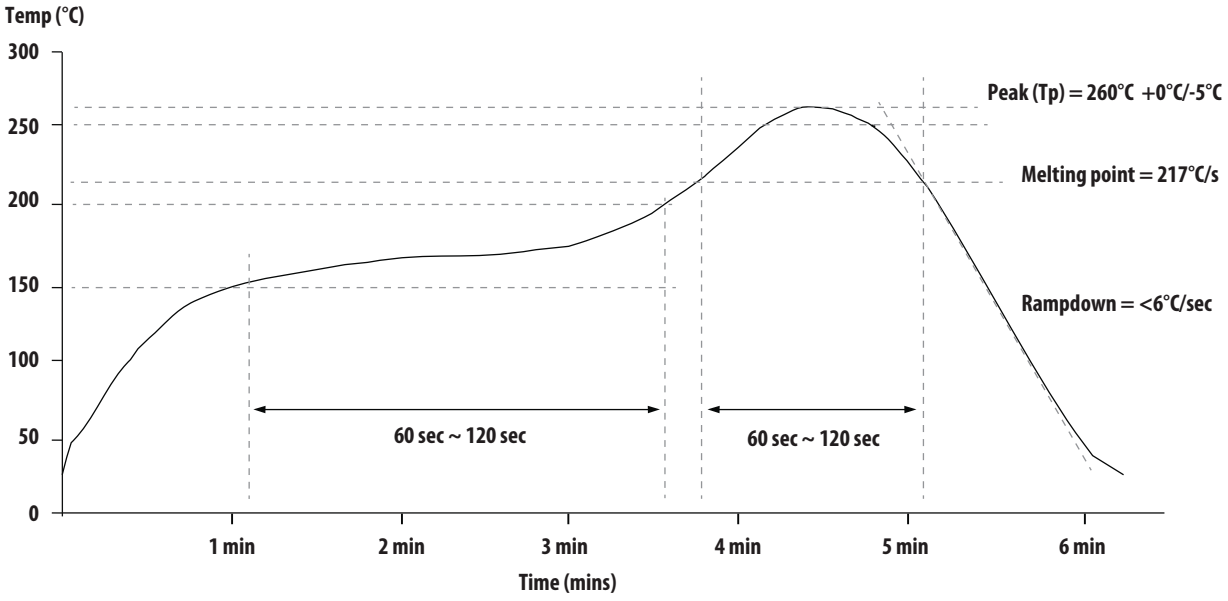

Figure 1. Recommended Reflow profile

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