



Date: April 14, 2010

Application Note: Solder Flow recommendations Lead Free solder

This recommendation is written for 93.6Sn-4.7Ag-1.7Cu lead-Free solder. Table 1 provides alternate lead-Free solder characteristics.

There are four stages to the solder reflow profile

Preheat stage

Pre-flow stage

Reflow stage

Package and board cool down

Preheat stage

The preheat stage is to bring the package up to about +150°C ($\pm 25^\circ\text{C}$) the rate of increase from ambient to 150 °C should be approximately 2 to 3°C per second. Too high of a rate of increase may cause the solder paste to bubble and splatter distributing solder balls on the circuit. Component damage may also occur from the stresses caused by too rapid a change in temperature.

Pre-flow stage

The Pre-flow section of the solder profile is a gradual transition from the 150°C Preheat section to the point of eutectic transformation (+210°C) this stage allows the entire board to achieve an equilibrium near the melting point of the solder. The rate of temperature change should be between 0.5 to 1 degree per second. That would be between 60 to 120 seconds depending upon the rate of change. Rates slower than recommended will cause the solder to oxidize and solder balls to form. The temperature should arrive at 210°C but not exceed that temperature.

Reflow stage

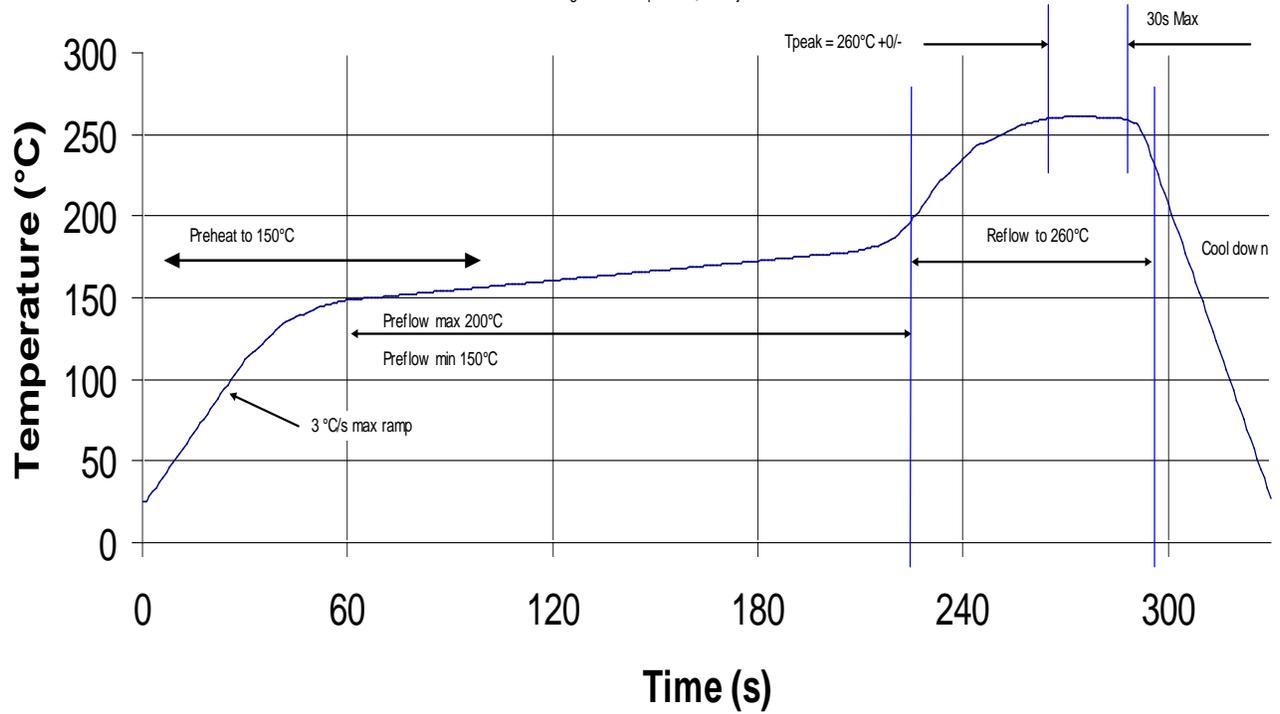
This is the portion of the profile where the solder changes from a solid to a liquid and the actual flux and flow action occur. Solder will flow to all areas not protected by solder mask. MwT recommends that a rapid rise to a maximum temperature of 260°C with the dwell time above 250°C to be below 30 seconds. The total time above 217°C should be less than 150 seconds. Post dwell above 217°C should transition directly into the package and board cool down ramp.

Package and board cool down

As the package and board drops below the solder liquidus point of +217°C the cool down temperature ramp controls the solder grain size and fatigue resistance. The cool down rate should be approximately 3 to 5°C per second. Do not exceed 6°C per second

Lead Free solder Profile

Profile for 93.6Sn-4.7Ag-1.7Cu composition, modify for alternate solders



Alloy	Composition	Solidus (°C)	Liquidus (°C)	Note
Sn-Ag-Cu	93.6Sn-4.7Ag-1.7Cu	216	216	Eutectic
Sn-Ag-Cu-Sb	96.2Sn-2.5Ag-0.8Cu-0.5Sb	210	217	
Sn-Ag	96.5Sn - 3.5Ag	221	221	Eutectic
Sn-Ag	95Sn - 5Ag	221	~250	

Table 1 Alternate lead-Free solder characteristics