APR
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Profile Building Guidelines

PROFILE HEATING ZONES

When reworking a component, it is important to understand the thermal activation zones of the reflow process. A typical reflow profile is made up of four heating zones and one cooling zone.

NOTE: Consult the thermal characteristics recommended by the solder paste manufacturer in their datasheet to build an effective thermal profile.

1. **Pre-heat** – Heats the circuit board evenly to reduce the risk of thermal shock and remove flux volatiles
   a. Typical Ramp Rate: 1 – 3ºC/second
   b. Temperature: Up to 150ºC for lead-free components
   c. Typical Duration: 45 – 60 seconds

2. **Soak** – Cleans the solder connections on the component and circuit board pads and provides equal heating across the entire circuit board
   a. Temperature: 150 – 190°C for lead-free components
   b. Typical Duration: 60 – 120 seconds

3. **Ramp** – Prepares the component and circuit board for solder reflow
   a. Typical Ramp Rate: 1 – 3ºC/second
   b. Temperature: Up to 217ºC for lead-free components

4. **Reflow** – Creates the mechanical and electrical bonds between the solder and component pads of the component and board
   a. Temperature: 235 - 245°C for lead-free components.
   b. Typical Duration: 45 – 75 seconds Time Above Liquidous (TAL)

5. **Cooling** – Cools the circuit board and solidifies the solder joints
   a. Typical Cooling Rate: 4ºC/second
   b. Typical Duration: 60 seconds

An effective thermal profile can be realized by following the 5 zone temperatures and times recommended by the solder paste manufacturer.

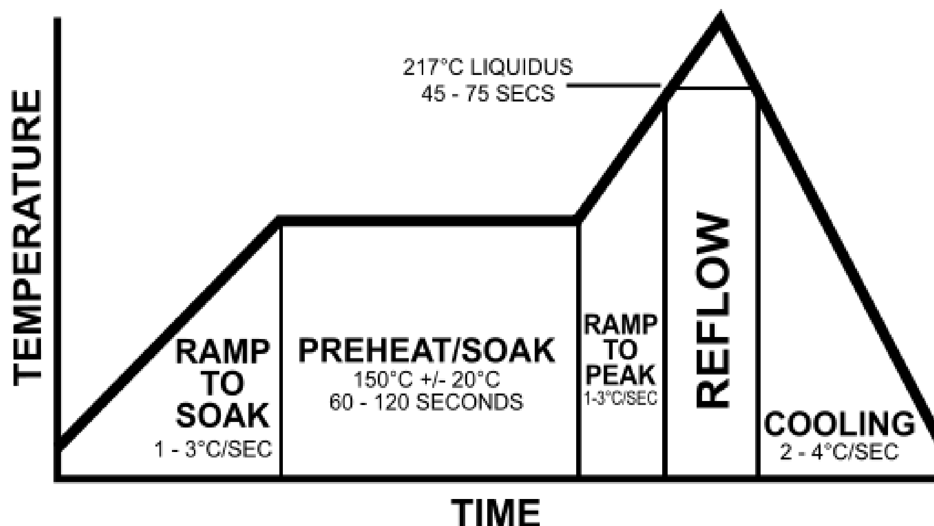

Figure 1. Typical thermal profile

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PROFILE SETUP PROCEDURE

1. Place the circuit board in the board holder, and center the targeted component over the small pre-heater.

2. Connect a thermocouple into the TC1 port. Use Kapton tape to secure the opposite end of the thermocouple underneath the BGA chip to be removed. This thermocouple will be used to monitor the temperature of the solder joints. Use an ultra-fine 40-gauge thermocouple for 1.0 mm pitch BGA or CSP components. Use a 36-gauge thermocouple for standard 1.27 mm pitch components.

3. Left click New Remove Profile.

4. Left click Autoprofile.

5. Unlock the profile, and adjust the black line set temperatures if needed.

6. Change the heater settings to a potential profile for the current project. Extend each heating zone to give extra time to make possible on-the-fly adjustments.

   NOTE: Consult the solder paste datasheet to view its recommended thermal profile characteristics.

7. Use the camera to center the reflow nozzle over the component. Lower the reflow head to the circuit board. Turn on the vacuum.

8. Use the Z-axis adjustment knob at the top of the reflow head to slowly lower the head until its vacuum seal indicator LED illuminates.

9. Start the profile. The thermal profile can be changed “on-the-fly” while the profile is running. The recommended procedure is to:
   i. Add a zone
   ii. Lower or raise the temperatures of the heaters in the new zone
   iii. Use the Cycle Advance feature to advance the profile to the new zone

10. While the profile is running, make the changes noted above to achieve the thermal profile specifications recommended by the solder paste manufacturer.

11. The vacuum tube will retract with the component once the cooling zone starts. Lift and return the reflow head to its home position. Use the included nozzle removal pad to catch the component once the vacuum turns off.

    It may take the user 2-3 attempts before a successful thermal profile is achieved. Experienced users often achieve successful thermal profiles on the first attempt.

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