Reflow Soldering Requirements for Plug-in Power Surface Mount Products

All Texas Instruments surface mount Plug-in Power Products are designed to be compatible with industry standard low temperature solder reflow processes and aqueous washes. This application note identifies requirements for soldering Plug-in Power modules to a host PCB.

Soldering Requirements

1 - Low Temperature Solder Process:
Plug-in Power modules must be attached to the host PCB using industry standard low-temperature solder reflow processes. The solder paste should be 63% tin, 37% lead or similar solder, with a nominal melting point of 183°C.

2 - Quantity of Solder:
Power components usually require more solder paste than other SMT devices to ensure an electrically and mechanically reliable solder joint. Power component leads can have 5 or more amperes of current flowing through a single solder joint, and use larger leads for attachment to a host PCB. For these reasons, a solder paste thickness of 0.008 to 0.010 inches is recommended for the Plug-in Power modules as opposed to 0.006 inches for typical SMT components. A solder stencil with varying height, (step screen) is one method of applying thicker paste to only the power component solder pads.

3 - Reflow Profile:
TO AVOID COMPONENT DAMAGE AND POTENTIAL OPENS OR SHORTS DUE TO EXCESSIVE TEMPERATURE OR INTERNAL SOLDER REFLOW WITHIN THE PRODUCT, USE THE FOLLOWING MAXIMUM REFLOW PARAMETERS:

A. PREHEAT AND COOL DOWN RAMPS SHOULD NOT EXCEED 2°C/SECOND TO PREVENT INTERNAL COMPONENT FAILURES DUE TO THERMAL STRESS.

B. DO NOT ELEVATE THE PRODUCT'S CASE, PIN, OR INTERNAL COMPONENT TEMPERATURES ABOVE A PEAK OF 215°C.

C. DO NOT EXCEED 183°C PIN OR CASE TEMPERATURE FOR A TIME PERIOD GREATER THAN 120 SECONDS.

Developing Your Own Reflow Profile

A reliable profile for soldering power modules to a host PCB may be developed using at least three small gauge (30 to 36 Awg) thermocouples secured to the test unit in the following locations:

- Product signal pin near the module's PCB
- Center of the case
- Product ground pin near customers PCB

Monitor thermocouples as the unit passes through the oven to verify that the pin temperature exceeds 183°C for at least 40 to 60 seconds, and that the soldering requirements detailed herein are not exceeded.

Power Module Construction

Plug-in Power Products are constructed on FR-4 or ceramic printed circuit boards using surface mount components. The components are soldered in place using 96.5% tin, 3.5% silver, high temperature solder. This solder has a melting temperature of 221 ±4°C.

Connecting pins and solderable case connections use 100% tin plating and are lead free. Typical plating for both is 200 to 300 microinches of 100% tin over 50 to 100 microinches of Nickel. All soldering surfaces meet and are routinely tested to the solderability requirements of ANSI/J-STD-002, Category 3.

Surface Mount Soldering Qualification

All Texas Instruments Plug-in Power Products are qualified to have no degradation from reflow/IR soldering and aqueous washing by verification through rigorous testing. Sample batches are subjected to three passes through a convection reflow oven and an aqueous wash cleaner, with a cool down between passes to room temperature. The convection reflow oven is set to achieve a 215°C peak temperature on the components. These parts are subsequently used for thermal shock, humidity and life qualification testing. All products must pass this initial qualification testing with zero failures before being released to production.

Additional Considerations

Each host PCB and Plug-in Power module assembly may be physically different. Each assembly should be individually verified to be within these soldering requirements.

The Plug-in Power modules are designed to be thermally efficient in transfering heat from their internal components through convection, conduction, and radiation. During soldering, heat therefore flows easily into the power module. As a result, the module's internal components and solder joints may heat at different rates than the host PCB and it's SMT components.

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