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IPC-7530

Guidelines for Temperature Profiling for Mass Soldering Processes (Reflow & Wave)

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A guide developed by IPC

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1 INTRODUCTION

1.1 Scope This guideline document addresses the issues pertinent to temperature profiling of electronic assemblies for mass soldering processes (reflow and wave).

1.2 Background During mass soldering, it is important that all solder joints reach the minimum soldering temperature. The minimum soldering temperature is the minimum temperature necessary to assure metallurgical bonding of the solder alloy and the base metals to be soldered. Metallurgical bonding requires that both surfaces to be soldered, as well as the solder, reach this minimum soldering temperature for a sufficient time to allow the wetting of the solder surfaces and the formation of a layer(s) of intermetallic compound(s) of some of the base metal(s) with one or more constituents of the solder alloy. As a practical matter, the minimum soldering temperature is somewhat (~25°C) above the melting temperature (Liquidus temperature) of the solder alloy. The solder joint on a given assembly that reaches the minimum soldering temperature last (typically on or underneath one of the most massive components) has to be the one that determines the temperature profile setting for a given assembly and a given soldering process/machine.

Mass soldering requires controlled rates of heating and subsequent cooling. However, too rapid a heating rate can damage printed wiring boards (PWBs) as well as components. High cooling rates can damage components and can result in temperature gradients of sufficient magnitude to warp PWBs and larger components and may fracture solder joints.

It is for these reasons that appropriate temperature profiling is essential to assure solder joints of high quality.

1.3 Purpose This document provides guidelines for the construction of appropriate profiling test vehicles and various techniques and methodologies for temperature profiling.

2 REFERENCES

2.1 IPC[1]

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-CA-821 General Requirements for Thermally Conductive Adhesives

IPC-9501 PWB Assembly Process Simulation for Evaluation of Electronic Components

IPC-9502 PWB Assembly Soldering Process Guideline for Electronic Components

IPC-9504 Assembly Process Simulation for Evaluation of Non-IC Components (Preconditioning Non-IC Components)

2.2 Joint Industry Standard[1]

IPC/EIA J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies

3 GENERIC PROCESS PROFILES

3.1 Wave Soldering When profiling assemblies for wave soldering, the following areas shall be monitored as seen in Figure 3-1.

Ramp Up: The rate of temperature increase is controlled to ensure the PWB, components and flux have sufficient time to reach soldering temperatures without degradation.

Thermal Spike: Thermal spike is measured to ensure components are not exposed to excessive shock that can result in damage.

Dwell Time: Dwell time is measured to ensure excessive time in the solder does not occur which could result in damage to components and degrade flux.

Maximum Topside Temperature: Maximum topside temperature is monitored to ensure solder joints formed by reflow do not revert to a liquid state.

3.2 Reflow Soldering When profiling assemblies for solder reflow and adhesive cure, the following areas shall be monitored as seen in Figure 3-2 for solder paste.

Note: An example of adhesive, underfill or other material curing profile is shown in Figure 3-3.

Ramp: This is the portion of the profile where the assembly is heated from ambient temperature at a predetermined rate. Controlling the ramp is necessary to prevent component damage. It also allows the flux solvents to evaporate prior to the flux being fully active.

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