DataSourceCD Q1-2003: Xilinx Packaging and Thermal Characteristics
Reflow Soldering Process Guidelines

Contents

This section contains the following information:

Solder Reflow Process

To implement and control the production of surface mount assemblies, the dynamics of the solder reflow process and how each element of the process is related to the end result must be thoroughly understood.

The primary phases of the reflow process are as follows:

1. Melting the particles in the solder paste
2. Wetting the surfaces to be joined
3. Solidifying the solder into a strong metallurgical bond

The sequence of five actions that occur during this process is shown in Figure 1.

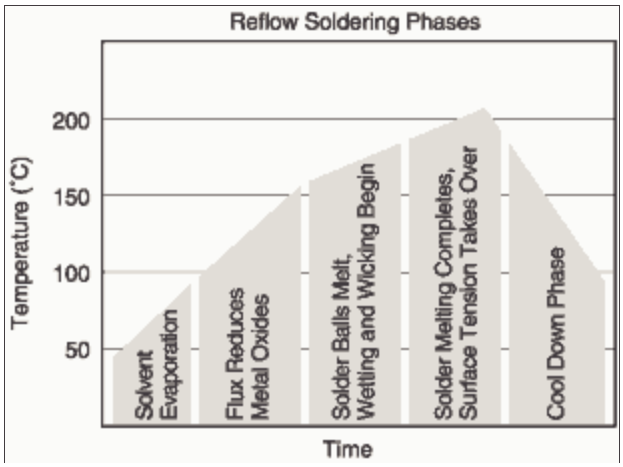

Figure 1: **Soldering Sequence**

Soldering Problems Summary

Each phase of a surface mount reflow profile has min/max limits that should be viewed as a process window. The process requires a careful selection and control of the materials, geometries of the mating surfaces (package footprint vs. PCB land pattern geometries) and the time temperature of the profile. If all of the factors of the process are sufficiently optimized, there will be good solder wetting and fillet formation (between component leads and the land

patterns on the substrate). If factors are not matched and optimized there can be potential problems as summarized in Figure 2.

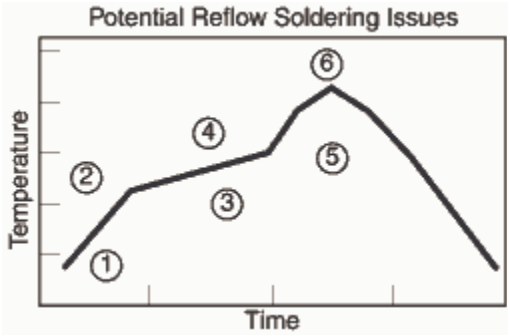

Figure 2: **Soldering Problems Summary**

Notes:
1. Insufficient Temperature to Evaporate Solvent
2. Component Shock and Solder Splatter
3. Insufficient Flux Activation
4. Excessive Flux Activity and Oxidation
5. Trapping of Solvent and Flux, Void Formation
6. Component and/or Board Damage

Typical Conditions for IR Reflow Soldering

Figure 3 and Figure 4 show typical conditions for solder reflow processing using IR/Convection or Vapor Phase. Both IR and Convection furnaces are used for BGA assembly. The moisture sensitivity of Plastic Surface Mount Components (PSMCs) must be verified prior to surface mount flow. See the preceding sections for a more complete discussion on PSMC moisture sensitivity.

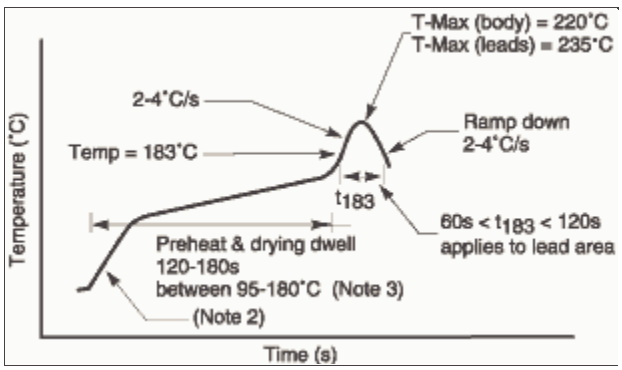

Figure 3: **Typical Conditions for IR Reflow Soldering**

Notes:
1. Max temperature range = 220°C(body), 220°C-235°C (leads). Time at temp 30-60 seconds
2. Preheat drying transition rate 2-4°C/s
3. Preheat dwell 95-180°C for 120-180 seconds
4. IR reflow shall be performed on dry packages
5. For MPM BGAs, do not reflow with lid on bottom

Typical Conditions for Vapor Phase Reflow Soldering

The IR process is strongly dependent on equipment and loading differences. Components may overheat due to lack of thermal constraints. Unbalanced loading may lead to significant temperature variation on the board. This guideline is intended to assist users in avoiding damage to the components; the actual profile should be determined by the users using these guidelines. For complete information on package moisture / reflow classification and package reflow conditions, refer to the Joint IPC/JEDEC Standard J-STD-020A.

The peak reflow temperature of the PSMC body should not be more than 220°C in order to avoid internal package delamination. For multiple BGAs in a single board, it is recommended to check all BGA sites for varying temperatures because of differences in surrounding components.

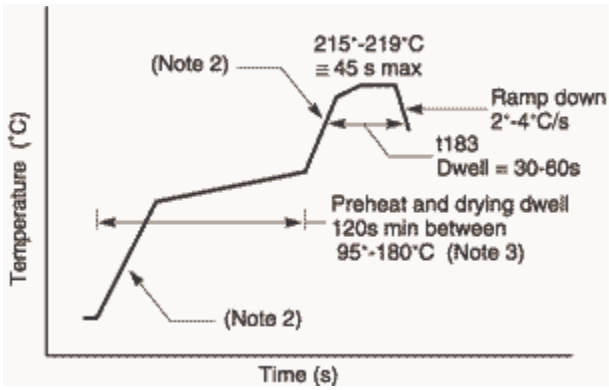

Figure 4: **Typical Conditions for Vapor Phase Reflow Soldering**

Notes:

1. Solvent - FC5312 or equivalent - ensures temperature range of leads @ 215-219°C
2. Transition rate 4-5°C/s
3. Dwell is intended for partial dryout and reduces the difference in temperature between leads and PCB land patterns.
4. These guidelines are for reference. They are based on laboratory runs using dry packages. It is recommended that actual packages with known loads be checked with the commercial equipment prior to mass production.

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