

Preparation for Reflow Profiling

Preparation is the key for successful lead-free reflow profiling.

There is a smaller process window and a much narrower margin of error when creating and using lead-free reflow profiles for surface mount parts on printed circuit boards (PCBs). Solder balls, dewetting, tombstones, voids, and head-on-pillow problems will occur much more frequently because lead-free alloys behave differently than eutectic pastes. Problems are compounded due to the extra heat necessary for some lead-free pastes to reach their melting points.

Additional preparation is necessary to ensure that the reflow profile is correct and can be used repeatedly. Preparing and checking the surface mount parts, the screen printer, and the pick and place machine are integral preliminary steps to performing a lead-free reflow profile. Analyzing the size of the assembly, the density and mix of its large and small components, and having all the necessary paste product data, is also required.

Checking the moisture sensitivity of surface mount parts, like ball grid arrays (BGAs) or quad flat packs (QFPs), is an important step. If moisture is absorbed within these parts, flash boiling or popcorning can occur, destroying the part and ruining the PCB. A part's moisture level (on the outside of the bag) indicates which parts need to be baked, and the time and temperature required.

Using parts that are not lead-free with lead-free paste will cause placement problems. BGAs for lead-free boards must also be RoHS compliant or an effect (similar to head-on-pillow) may appear to be a processing problem, when it is really a materials issue. Oxidation on parts should also be checked and avoided.

Since solder balls, voids, and tombstones often occur even in well constructed lead-free reflow profiles, the need for accuracy and precision in the stencil printer and the pick and place machine is intensified. With the equipment set up properly, any shifting parts, mid-chip solder balls, or other process indicators, are the result of the reflow oven profile and not another factor.

A proper print is crucial for determining whether the reflow profile is correct. Verify that your stencil has apertures designed to accommodate lead-free paste. Lead-free pastes have a high surface tension and do not flow on the pad surface like other pastes. The paste can not extend beyond the pad, and voiding or smudges (Figure 1) can not be present. A poor print can cause problems with determining whether a profile is accurate and repeatable.

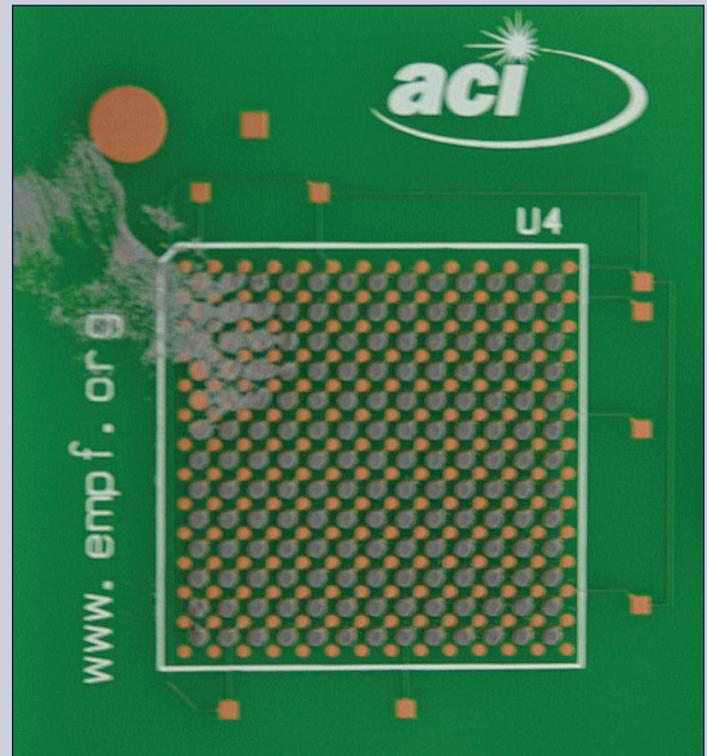


Figure 1: Avoid paste smudges.

Precise placement of the part on the pad is now more critical than ever. Unlike eutectic pastes, which have properties which pull the part into place, lead-free solder does very little to help with alignment when

melted. Parts continually shifting or tombstoning (Figure 2) during reflow are an indicator that an adjustment needs to be made.

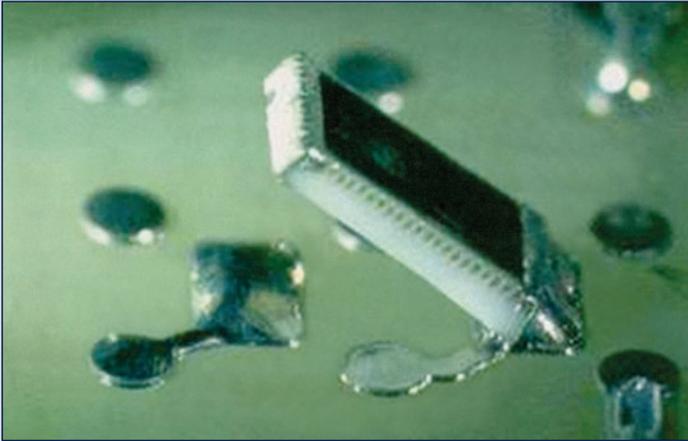


Figure 2: An example of tombstoning.

Technical data sheets provided by the manufacturer will provide the operator all the information they need about the paste. These sheets include composition and reflow profile information. Data sheets are also provided by the PCB and part manufacturer. An analysis of the paste, the size of the assembly, density of the components, and combination of small and large components should be used to create a repeatable lead-free reflow process.

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