Jeff Ferry

Waste Not, Want Not

Simplify BGA rework by reusing leftover solder.

Ball grid array (BGA) rework is a complicated procedure, but the operation can be simplified by saving steps whenever possible—as long as quality and reliability are not compromised. The following procedure outlines how to reuse the solder remaining on pads after BGA component removal.

Leftover solder is commonly removed from the site after rework, but prepping the pads, depositing fresh solder paste, placing the new BGA and heating the board takes time. When a BGA is removed, the operator must determine what to do with the solder remaining on the pads and decide how to prepare the location's pads to receive a new BGA. A skilled operator with many similar boards to process can save time by using the solder already on the pads to attach a new BGA, if done quickly and carefully.

When is Reusing Solder Appropriate?

Reusing solder is suitable for most straightforward BGA rework operations, but not all. If the component is being reworked due to a connectivity issue, then working with the solder in place may cause an operator to repeat the same defect. For example, if a board defect is under the pad (black pad syndrome), soldering a new BGA in place over an existing, unresolved problem would be pointless.

If the operator is unfamiliar with the board, the BGA will often heat unevenly when removed, leaving behind an irregular pattern of solder. The irregular solder pattern may result in opens or shorts with the replacement BGA and could cause irregular balls.

The procedure can only be accomplished when using eutectically balled components. BGAs with high-temperature balls or columns are inappropriate for the process, since high-temperature balls are not meant to melt during rework and will retain their spherical shape on the board.

High-temperature ball and lead types can present unforgiving solder volume issues, causing unacceptable variability of the solder left on the board. The high-temperature lead tends to slide off the uneven peaks and misalign. Mixed or corrupted alloys compromising solder joint strength or ductility are also a concern.

The rework procedure works well on smaller BGAs with fewer balls. In such cases, removing the old component and leaving a relatively uniform amount of solder on every pad of the array is fairly simple.

The Reuse Procedure

The removal process timing for this rework technique is more delicate than usual. Keep in mind that process parameters may change over the course of a shift as multiple boards see the same operation. Even performing the same operation on the same site on the same circuit assembly type in succession may expose the assembly to unexpected thermal variation, since the rework machine can build up residual heat and experience voltage of airflow variation. A skilled operator familiar with the nuances of the machine's operation time may be needed to tweak the settings over the course of a day.

Typically, BGAs are not fluxed for the removal cycle. Applying removal flux is of dubious value due to its inability to penetrate the inner areas on the underside of the BGA and the chance that the flux will spread over a greater area than intended. The spreading of flux to unaffected areas may have unintended consequences, such as stray voltage issues on reworked assemblies.

Removing BGAs without flux may result in unsightly solder dollops left on the pads, but they will be fine for reattachment—providing that they are uniform in height and quantity. Make sure that all solder joints are completely liquified before attempting to lift the BGA.

Assuming that the operation is straightforward, make the cycle time short. Keep the board warm between removal and replacement to eliminate a long preheat cycle and to minimize the potential for oxidation of the leftover solder on the pad metallization. Quickly place a new BGA over the old site using a handheld vacuum pickup or the rework machine's alignment/placement system. Achieving uniform solder on the pads may require the reheating of board/pads with or without flux to level them prior to BGA replacement.

Skilled operators who know their machines' heating characteristics can achieve excellent results by reusing the solder to quickly remove and replace multiple components, but this shortcut is not for beginners. ■

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