Advanced Techniques US Inc.

Micro BGA Rework

Introduction

Also referred to as micro BGA's, Chip Scale Packages (CSP) although similar to traditional BGA components differ in overall size and diameter of solder spheres. Their size is typically smaller and solder spheres are about ½ the diameter of BGA's which range from 0.55mm to 0.75mm. This article details rework of a CSP on a test board using an AT-GDP Rework Station. A Lead Free profile has been applied during removal and installation processes.

Components

The CSP measures 7mm x 6mm and contains 46 spheres (Figure 1). Solder spheres measure 0.35mm in diameter with a pitch of 0.75mm. Test board measures 70mm x 165mm.

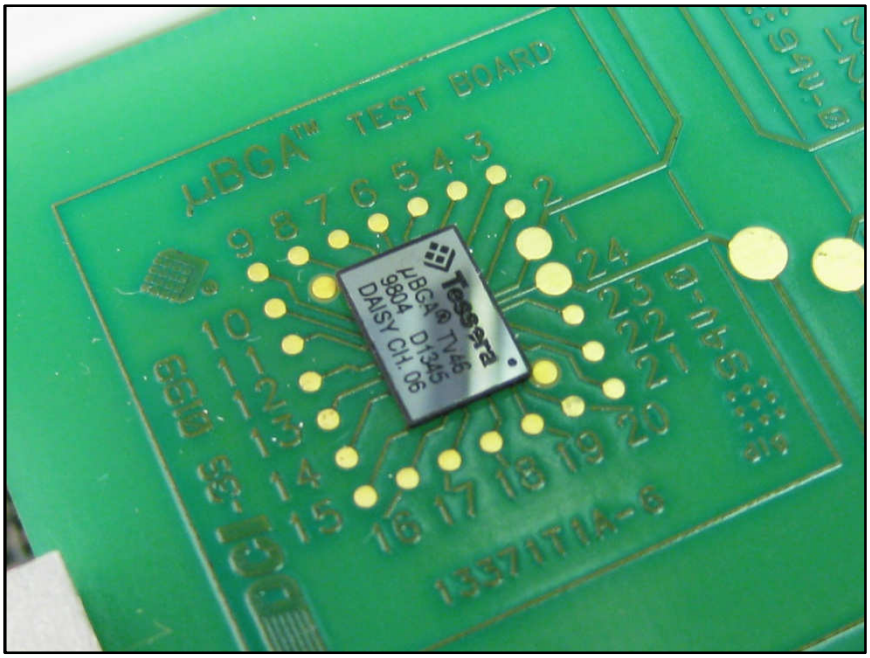

Figure 1: CSP on a test board

Removal

After securing the test board by the board holder's clamps, an operator installs a vacuum pick up tip and nozzle suitable for the CSP device. Implementing machine's optics, the nozzle is aligned over the component. A pre-established profile is selected from the software' library and Start icon is selected. At this point the process is hands-off. Rework station automatically drives the nozzle down to a board and covers the CSP. Machine then activates vacuum pick up tip so as to remove the component once reflow is achieved and the heating cycle is initiated. Figure 2 shows a nozzle covering the device during reflow.

Heating is precisely controlled by the software (Figure 3). It mimics an original profile with heat applied from both top and bottom sides of a board. Source of bottom heating is Quartz IR while the top side is forced air or nitrogen convection. As is shown in the video of removal, upon completion of reflow, the machine lifts a CSP off a board and moves nozzle up along Z axis to its starting point.

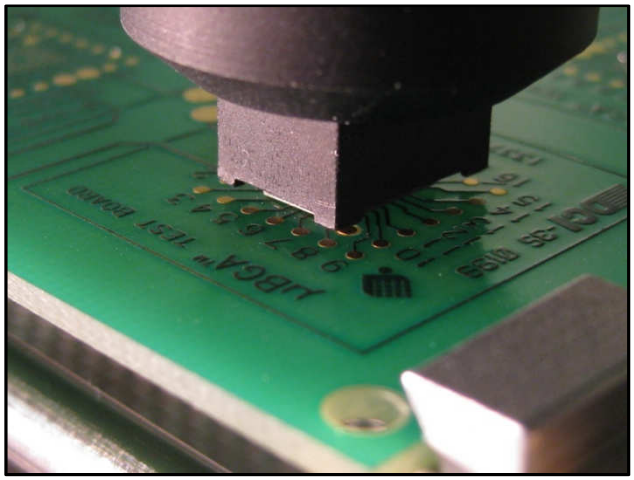

Figure 2: Nozzle covering CSP during reflow

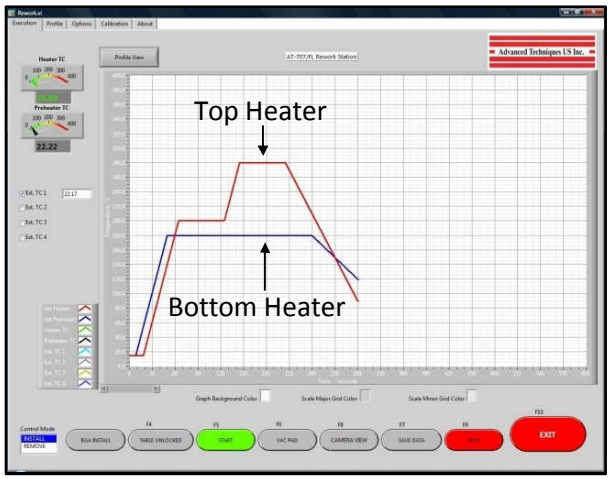

Figure 3: Screenshot of a profile

Residual solder remains on the board after removing a component. It takes the shape of Hershey's kisses candy due to surface tension of molten solder (Figure 4). As a result of its uneven shape and volume, solder must be removed prior to installing a new component. This is commonly performed using a solder wick method.

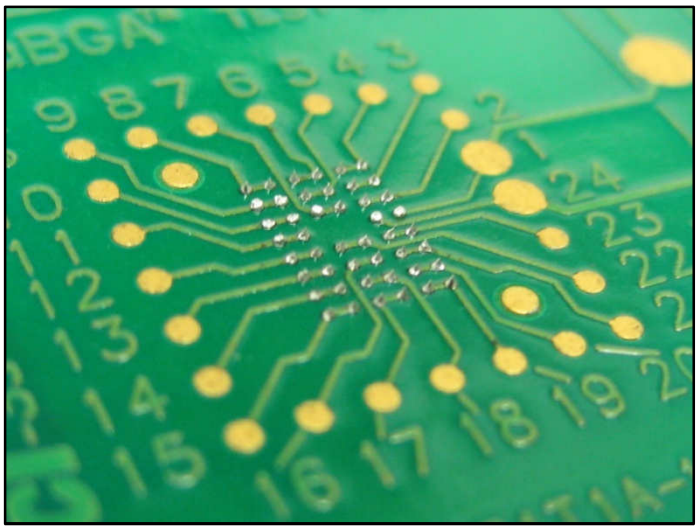

Figure 4: Residual solder after CSP removal

Installation

Once pads on a board have been cleaned to remove residual solder, the component may be installed. After the CSP has been picked up by the rework station, the next step involves transferring flux or solder paste to spheres of a device. Both may be applied by dipping the component in a universal plate. Implementing tacky rework flux however, is more common. As displayed in Figure 5, the CSP is dipped into a Flux Transfer Plate (Part: FTP-ATGDP) that contains a pool of tacky flux 200µm deep. Imprint in the plate shows that flux has been applied to tips of all 46 solder spheres (Figure 6).

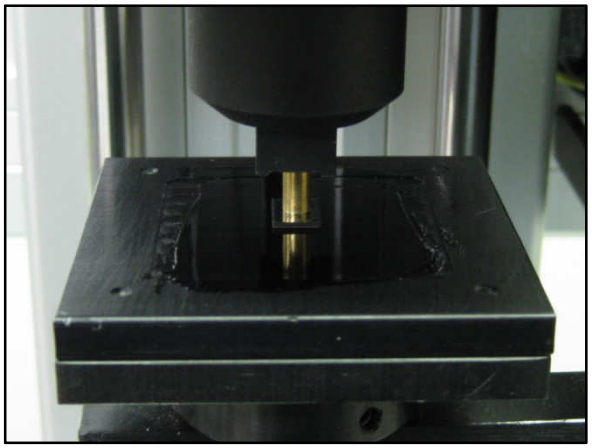

Figure 5: CSP dipped in flux

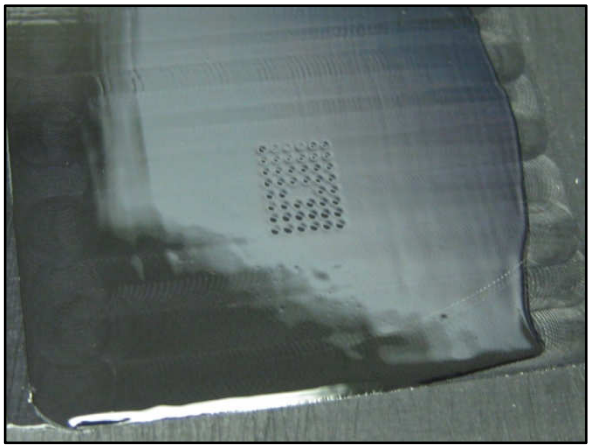

Figure 6: CSP's imprint in flux plate

Component is now ready to be optically aligned on a test board. As the Split Vision Optics arm is moved into position (Figure 7). It enables viewing solder spheres of a CSP and pads of a board simultaneously on the same screen at a high magnification. LED lights may be adjusted to create optimum contrast between the two images. Figure 8 shows a close-up view of a CSP being held by vacuum tip during alignment. By adjusting the X-Y micrometers of the vacuum lockable board holder and theta rotation adjustment, CSP's spheres were aligned over board's pads.

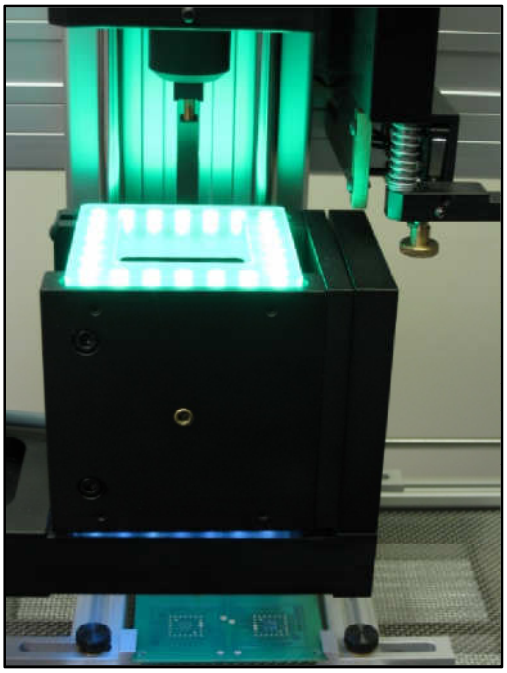

Figure 7: Split Vision Optics arm in position

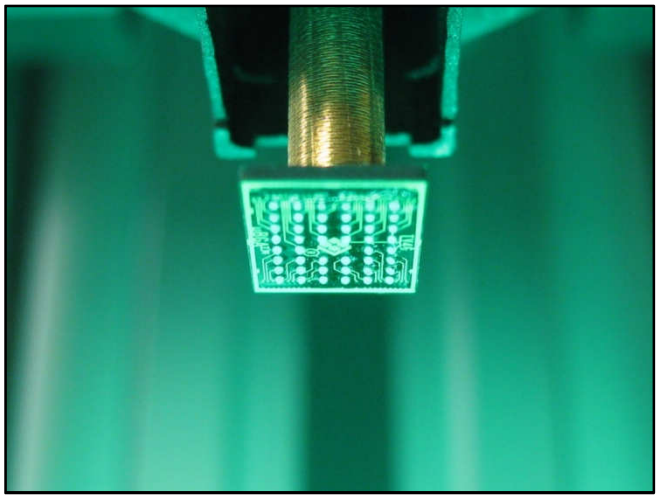

Figure 8: CSP held by vacuum tip during alignment

Upon moving the optics arm to its original position, the device may now be placed on a board and reflowed. As in the removal process, the same pre-established profile is selected from the software's library and a Start icon is selected. Sequence in an Install mode instructs the rework station to automatically places the CSP on a board, lifts up the vacuum tip away from component's surface, and begin heating. Figure 9 shows a nozzle covering the CSP during reflow. Heating is precisely controlled by the software (Figure 3). It mimics an original profile with heat applied from both top and bottom sides of a board. Uniform stream of cool air or nitrogen is directed through the nozzle to form strong, high quality joints. As is shown in the video of installation, upon completion of a cooling stage, machine moves the nozzle up along Z axis to its starting point. Installation process is now completed (Figure 10).

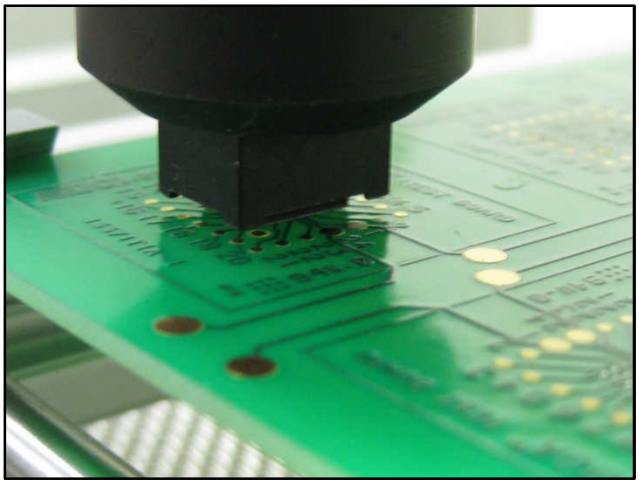

Figure 9: CSP being soldered

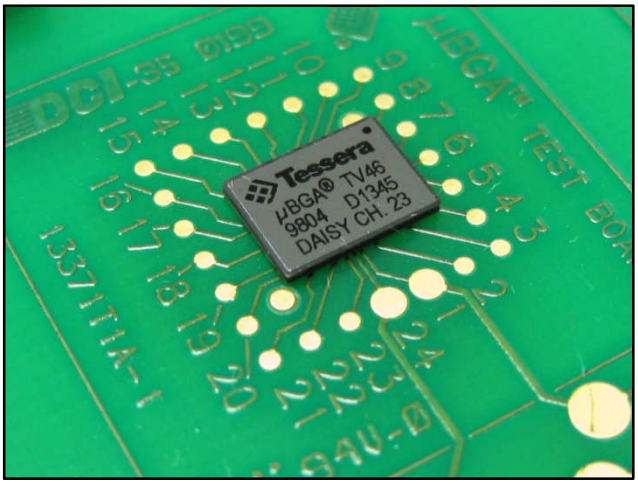

Figure 10: CSP installed on a board

Conclusion

Having the capability of reworking a CSP device is heavily dependent on type of equipment being implemented. It is essential for a rework station to contain features like split vision optics, software controlled sequencing and thermal management, and automation. These features not only simplify the process, but more importantly enable achieving high quality results on a consistent basis.

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Related Links:

Video of CSP Removal
Video of CSP Installation