Flip Chip Installation using AT-GDP Rework Station

Introduction

An increase in implementation of Flip Chips, Dies, and other micro SMD devices with hidden joints within PCB and IC assembly sectors requires capability to precisely install and rework such devices. This article details the installation process of a Flip Chip onto a BGA IC substrate using an AT-GDP Rework Station. A Eutectic Soldering process is being applied.

Components

The Flip Chip measures 8.25mm x 6mm while the BGA substrate is 35mm x 35mm (Figure 1). Flip Chip contains 560 solder bumps with each bump measuring 65µm in diameter and the pitch is as fine as 180 µm. Figure 2 shows an actual image of a Flip Chip captured on the AT-GDP Rework Station's camera view screen. Figure 3 displays the corresponding pads on a BGA substrate.

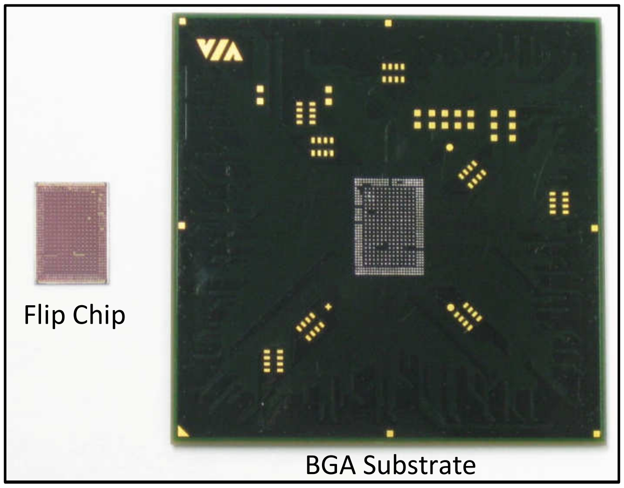

Figure 1: Components

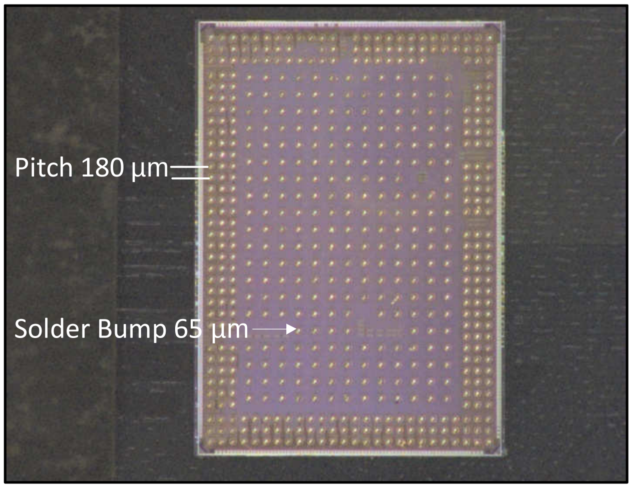

Figure 2: Camera view of Flip Chip

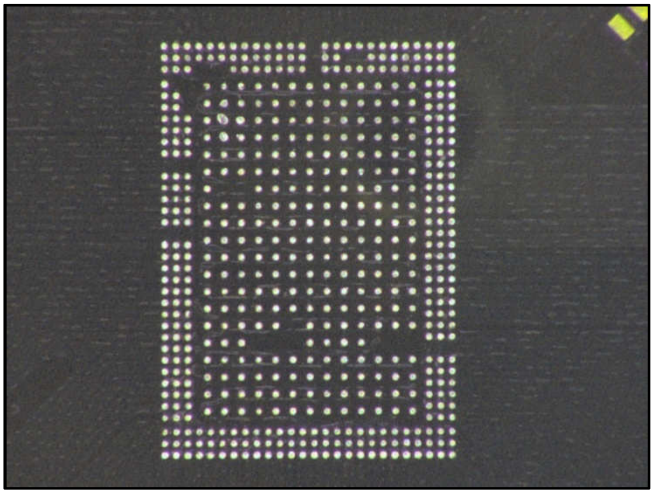

Figure 3: Camera view of pads on BGA Substrate

Set-Up

The BGA Substrate has been placed inside a custom fixture which in turn is secured by the board holder's clamps (Figure 4). The fixture prevents clamps from making contact with BGA spheres on the underneath thus, eliminating a possibility of having spheres deforming during reflow. Fixture also minimizes heat transfer from the substrate to the clamps. Next, the operator installs a vacuum pick up tip and nozzle suitable for the Flip Chip device.

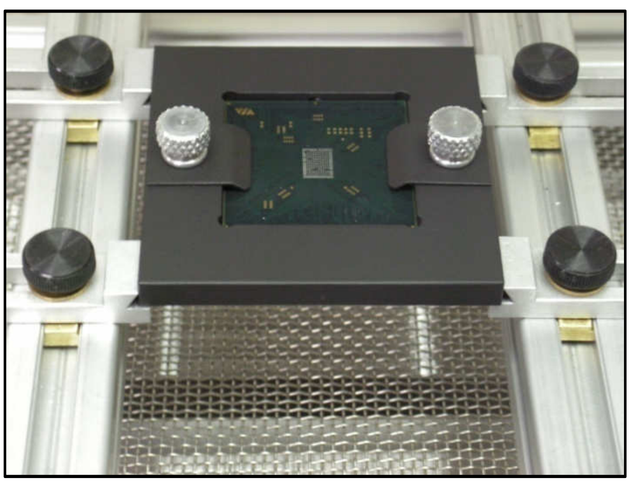

Figure 4: BGA Substrate secured in fixture

Flux Dipping

Once a Flip Chip has been picked up by the rework station, the next step involves transferring flux to solder bumps of a device. This step is required prior to aligning and placing the component. As displayed in Figure 5, the Flip Chip is dipped into a Flux Transfer Plate (Part: FTP-ATGDP) that contains a pool of tacky flux 50µm deep. Flux is thereby applied to the tips of all 560 solder bumps.

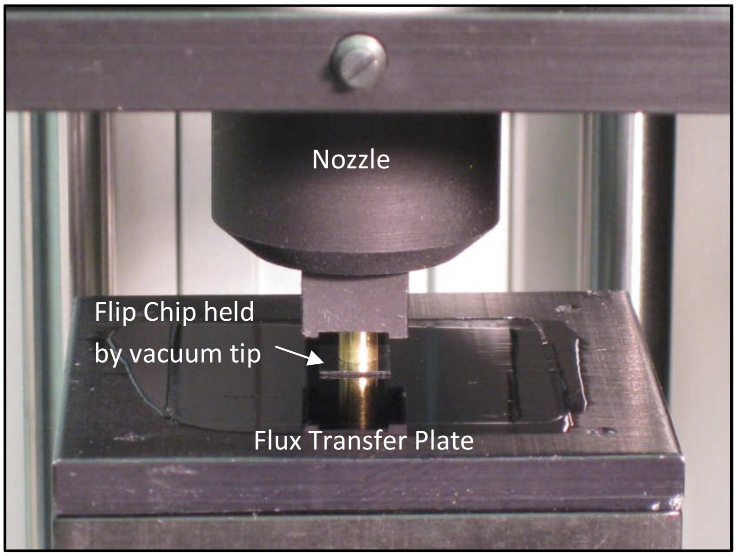

Figure 5: Flip Chip dipped in flux

Optical Alignment

As the Split Vision Optics arm is moved into position (Figure 8). It enables viewing solder bumps of a Flip Chip and pads of a BGA Substrate simultaneously on the same screen at a high magnification. LED lights may be adjusted to create optimum contrast between the two images. Figure 6 shows an actual camera view screenshot where solder bumps and pads are misaligned. By adjusting the X-Y micrometers of the vacuum lockable board holder and theta rotation adjustment, Flip Chip' bumps were aligned over substrate' pads (Figure 7). Component is now ready to be placed and soldered.

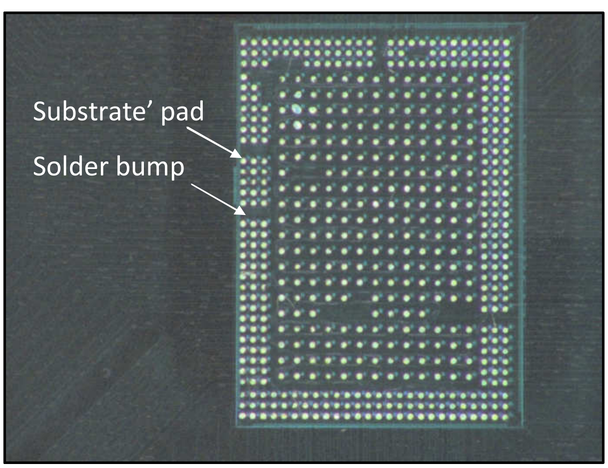

Figure 6: Solder bumps and pads misaligned

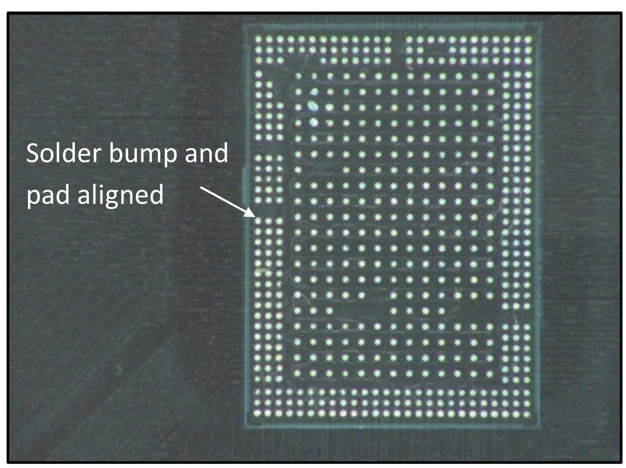

Figure 7: Solder bumps and pads aligned

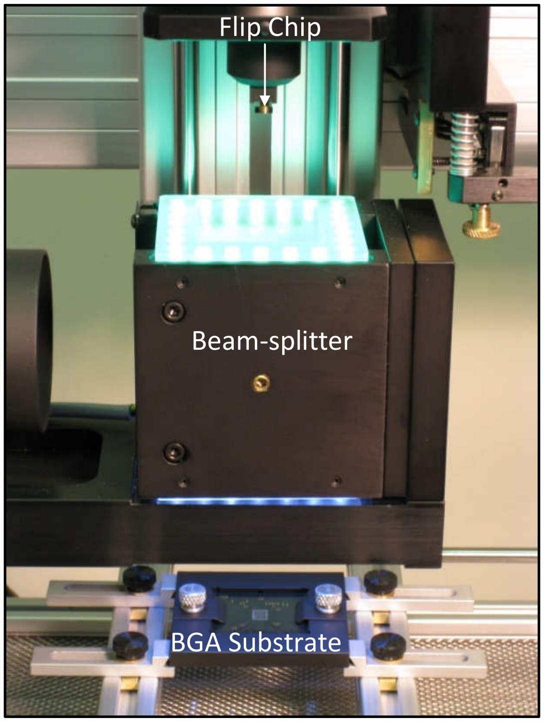

Figure 8: Split Vision Optics arm in position

Soldering

Upon moving the optics arm to its original position, the device may now be placed on a substrate and reflowed. A pre-established profile is selected from the software' library and a Start icon is selected. The rework station then automatically places the Flip Chip on a substrate, lifts up the vacuum tip away from dies surface, and begins heating. Figure 9 shows a nozzle covering the device during reflow. Heating is precisely controlled by the machine' control software (Figure 10). It mimics an original profile with heat applied from both top and bottom sides of a substrate. Source of bottom heating is Quartz IR while the top side is forced air or nitrogen convection.

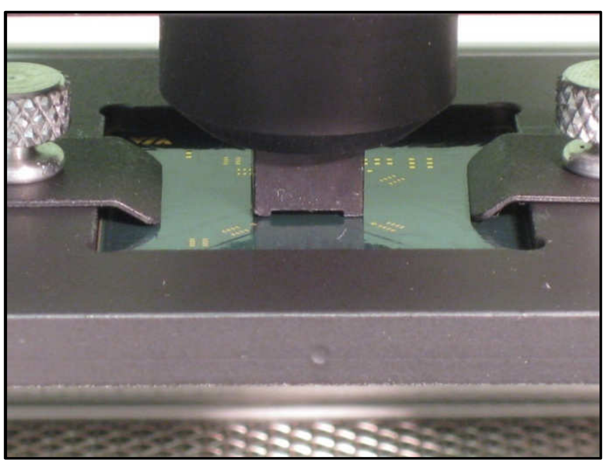

Figure 9: Flip Chip being soldered

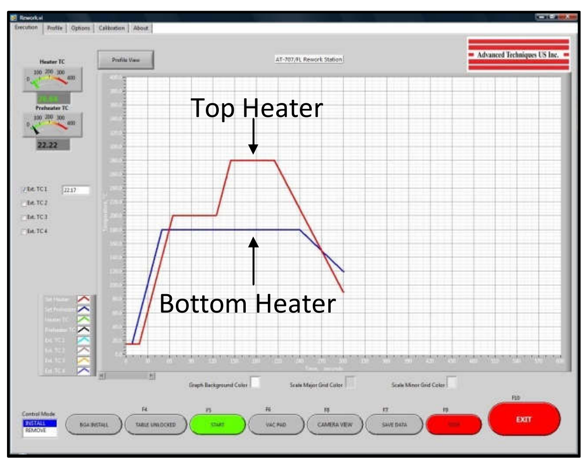

Figure 10: Screenshot of a profile

Conclusion

Once a reflow profile has been completed, the nozzle is automatically retracted from the substrate. Die is now soldered in place (Figure 11). Spheres of a BGA substrate, located on the bottom side, have not been adversely affected by the reflow cycle (Figure 12). Their geometry has been maintained throughout installation which in turn eliminates having to reball the device prior to placement. Underfill material may be applied around the perimeter of a Flip Chip as a side process. It must be noted that “reworkable” underfill should be used whenever possible. Doing so would greatly simplify the replacement process of a die.

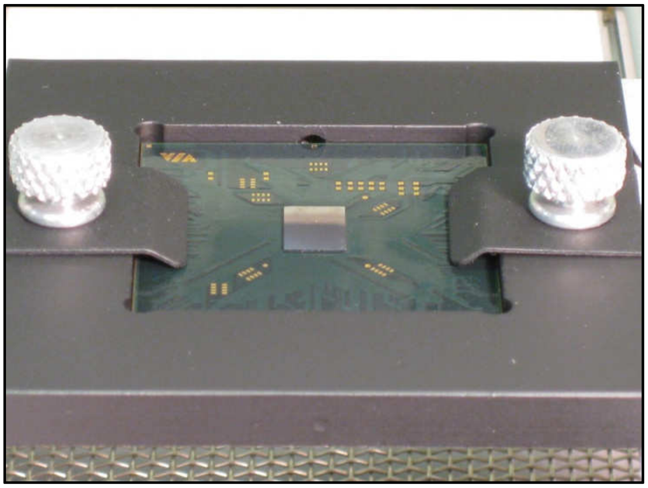

Figure 11: Flip Chip soldered to substrate

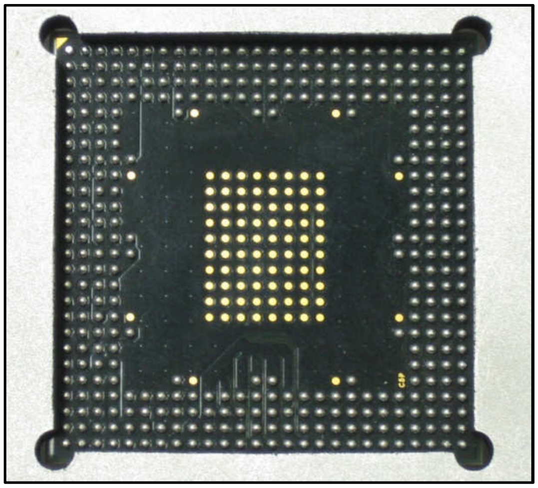

Figure 12: Underside of a fixture

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