# Reballing Rework – Bright New Future

Components are continuing to evolve. One of those evolutions is the Ball Grid Array or BGA. Add in the advent of the RoHS and WEEE directives and rework of the BGA is becoming a very exciting topic. In order to rework (remove and replace) a BGA or, in some cases to simply install a BGA on a Lead Free assembly, a single process stands out as necessary… reballing. This article will look at the history, the why and the wow of reballing, specifically looking at a new reballing technique which offers ease of use and reliability.

## History

BGA's evolved to fill a need. Components were getting more complex and yet smaller at the same time. Electronic assemblies also shrank; leaving less total realestate. Lead pitch gradually reached the limit of solderability without bridging. Enter the Area Array Packages. By placing the leads on the bottom of the component, the space available for connections increased significantly (30% - 50% increase) without increasing package size. Component designers quickly realized the potential of area array packages and moved to implement them in the electronics industry. In a perfect world, the area array package, specifically the BGA, would solve all the electronic industry's component realestate problems and would never need to be removed or replaced. Since we live in a less than perfect world, BGA's do need to be removed and replaced with regularity.

**Why Reball?**

When a BGA is removed, replaced, and in some cases before it is placed the first time, the solder balls must be replaced. Let's address the last case first. The RoHS and WEEE directives have made life more interesting for those of us in the electronics industry. The first thought is that BGA's which were manufactured to be used in a Tin-lead assembly operation would have to be reballed if the component is to be used in a lead-free assembly operation. This is a correct thought. However, there is a flip side to that issue as well. Many component manufacturers are streamlining their operations and making all of their components lead-free. For electronic assemblers dealing with health care or military applications, lead-free components create a problem. In some cases the customer may REQUIRE a small amount of lead in the final assembly; for example, there are contracts from the U.S. Defense Department which state that a minimum of 1% lead must be present in the solder used for electronic components. In these cases a pure lead-free balled BGA will need to be reballed before initial placement onto the electronic assembly. The other case I've mentioned – remove and replace – will require reballing of the device if the BGA is to be reused in an electronic assembly.

To understand the HOW of reballing, it is useful to understand what happens to the BGA connections in removing the BGA from the assembly. I'm going to use an example of a removal process using a stand-alone rework station incorporating a nozzle, hot gas reflow and automated removal probe. To remove the BGA there must be a Time Temperature Profile (TTP). The TTP is the set of instructions used by the reflow oven or rework

station and defines how long to heat the device at what temperature. The goal of the TTP is to melt the solder alloy particles within the solder paste or BGA ball, without overheating and damaging the electrical components. Use the same TTP used to place the BGA onto the original assembly as a starting point to develop the correct TTP for removal of the BGA.

As the assembly heats, the balls of the BGA will reach a point where the solder alloy will change to its liquid form. Above the liquidous state of the solder, the BGA package can be removed without damage to the BGA or the circuit board. Some of the solder balls will adhere to the circuit board, some will split between the circuit board and the device, and still others will adhere completely to the bottom of the BGA device. Here is the first reason the device must be reballed before attempting to place the device on another assembly. The BGA balls must be even across the surface of the BGA in order to ensure that the device is parallel to the circuit board in the final assembly. The second reason that the removed device must be reballed is that the solder has now been heated multiple times. When solder is heated multiple times it begins to breakdown. The bonds formed with this “old” solder are not as strong and therefore not as reliable as newly formed solder connections.

**How?**

You now have a device that is either A) removed from an assembly and has old, uneven solder balls or, B) has been manufactured with Tin-lead solder balls which cannot be used in a lead-free assembly (or vice versa). From this point, the HOW is the same.

First the solder balls must be removed from the bottom of the BGA. This procedure is as simple as cleaning a circuit land in preparation for placement of a component. Use a soldering iron with an appropriately sized tip, flux and solder wick to remove the solder balls from the bottom surface of the BGA.

Next the device must be cleaned. Use isopropyl alcohol – or other cleaning process as approved for your assembly operation – and a lint free cloth to wipe off the BGA device pads (Figure 1).

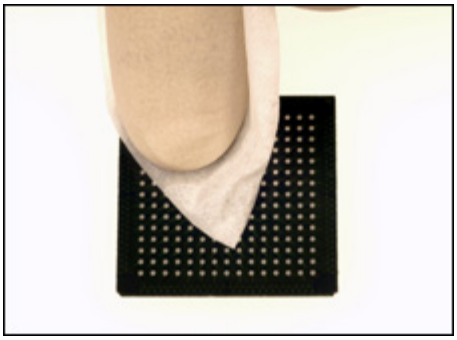
Figure 1

To replace the solder balls, select the appropriately sized and configured single-use reballing platform. The single-use reballing platform can be customized to any BGA size and ball configuration (Figure 2).

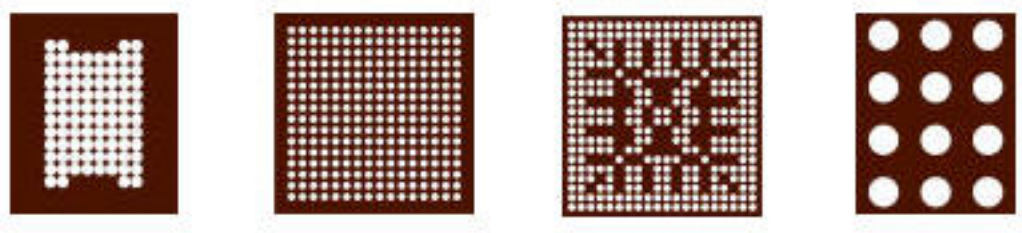

Figure 2 – Just 4 of the standard patterns available with single-use reballing platform

Apply paste flux to the bottom of the BGA device and align the device to the single-use reballing platform preform.

Reflow the device using either a reflow oven, rework system or even a toaster oven set to the appropriate temperature. What temperature and how long? That depends on your device. Check with the device or solder ball manufacturer for the proper TTP of your BGA device.

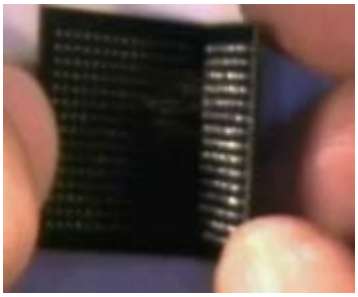

Figure 3

When the device has completely cooled, simply peel the polyimide tape away from the device (Figure 3). Clean the BGA as before. You now have a reballed device ready to be placed on an electronic assembly. (Figure 4)

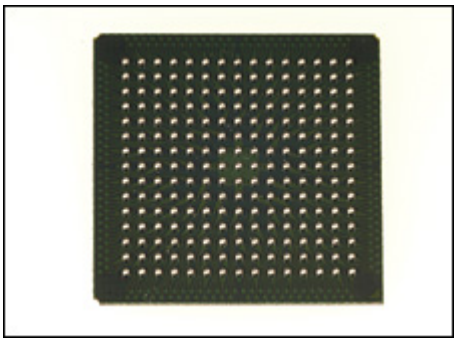
Figure 4

The BGA has come a long way in a short time. It has gone from the “new kid on the block” to a widely used solution to the ever-shrinking assembly. With the proper Time Temperature Profile and the single-use reballing platform preform, reballing of the BGA isn’t a thing to fear. BGA reballing now has a bright future.