BGA inspection and rework with HR 600/2

Failure analysis and assembly repair

Even today some assemblies including BGA components still show soldering failures that require as a consequence to rework the BGA. The following example can be seen as a typical case for today's inspection and rework demands.

Case description

On a relatively small ~ 15 x 15 cm (5,9 x 5,9 inch) assembly a BGA style component shows multiple failures after manufacturing. The customer requested Ersascope inspection and was interested to see a method of repairing the boards.

x- ray analysis

Before Ersascope inspection the assembly has been x-rayed, with the idea to offer the customer a comparison of x-ray and Ersascope inspection and the option to utilize both technologies in combination for failure analysis. On different boards the same type of errors appeared: multiple bridging and ball size variations.

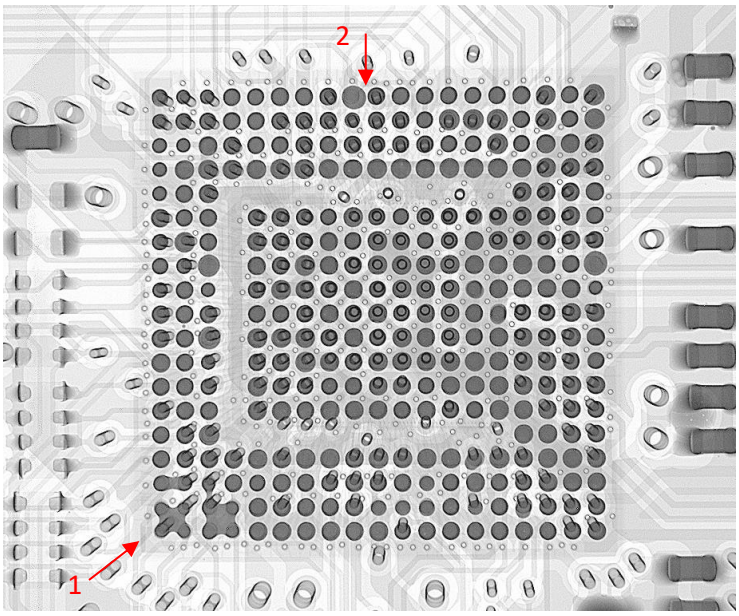


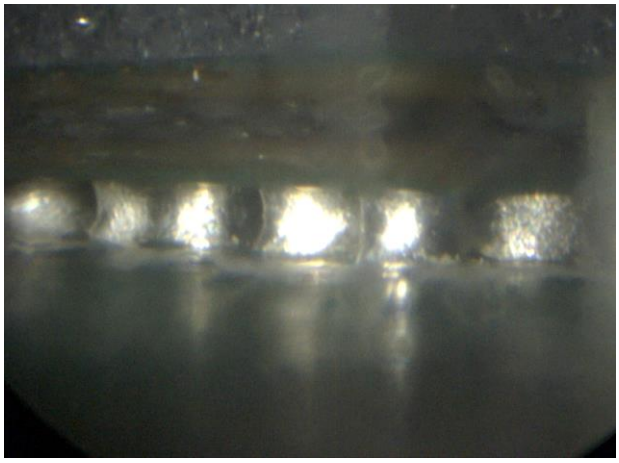
Figure 1: BGA on assembly with multiple bridging (1) and extended ball size (2)

Result:

x-ray inspection offers a clear failure identification – reasons for the detected effects are not fully explainable.

Potentially related to the PCB layout (vias), pad shape and / or to the paste printing and reflow process (paste amount, thermal profile).

Ersascope analysis



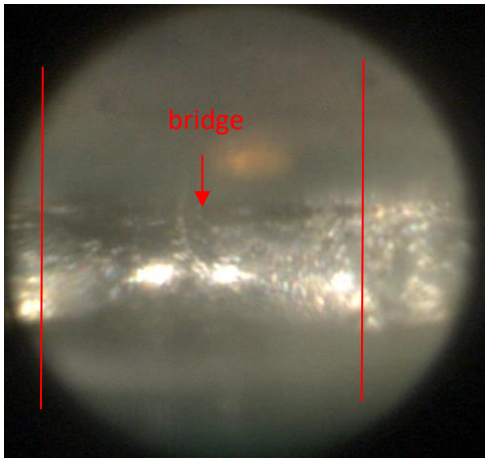


Figure 2 a: Multiple bridging (1) view with Ersascope & BGA head from left corner (see arrow in fig. 1)

2 b: flip chip head shows short (red = center of ball)

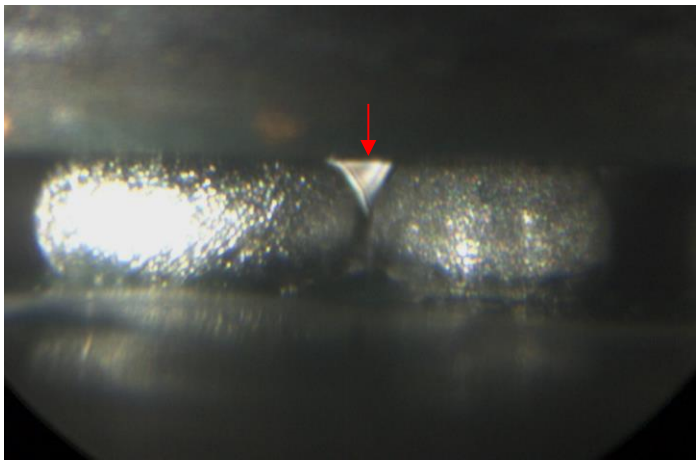


Figure 3: extended ball size (2) with Ersascope & BGA head straight view (see arrow in fig. 1)

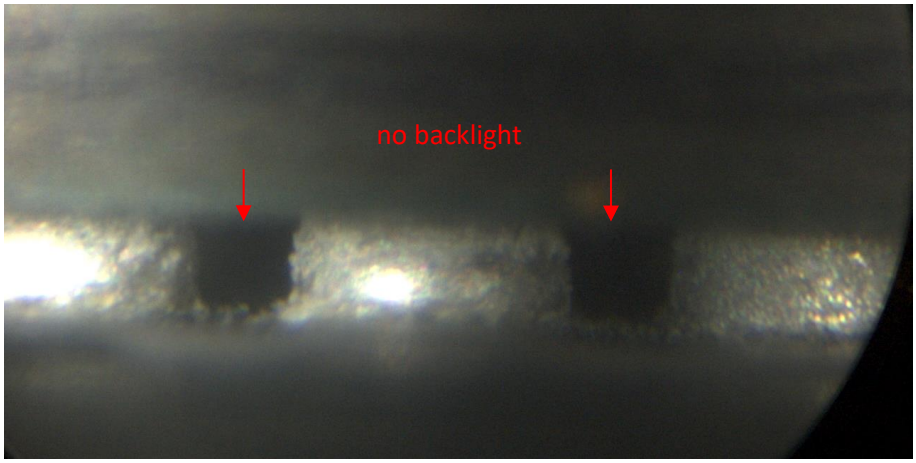


Figure 4: regular solder joints with no backlight visible between the balls

Result:

Ersascope inspection was carried out with BGA head. Due to chip population close to the BGA, inspection was not possible in all locations. In this case the flip chip head would offer additional information (less resolution). In the actual case (figures 2 to 4) three conclusions are relevant:

1. In the corner section (1) bridging is clearly visible balls are deformed concave instead of regular convex form.
2. At least one ball size (2) was extended and shortly before bridging to its next neighbour ball. The amount of solder in those 2 balls is different.
3. Inspecting regularly shaped balls even there the backlight is not visible from the front. At the same time x-ray inspection is showing no inside bridging.

To fully encounter the possible reasons for the fault it was decided to replace the BGA component.

<u>BGA rework procedure (with HR 600/2)</u>

1. Removal of the BGA – even if the PCB had some internal mass layers, desoldering of the component was an easy job.

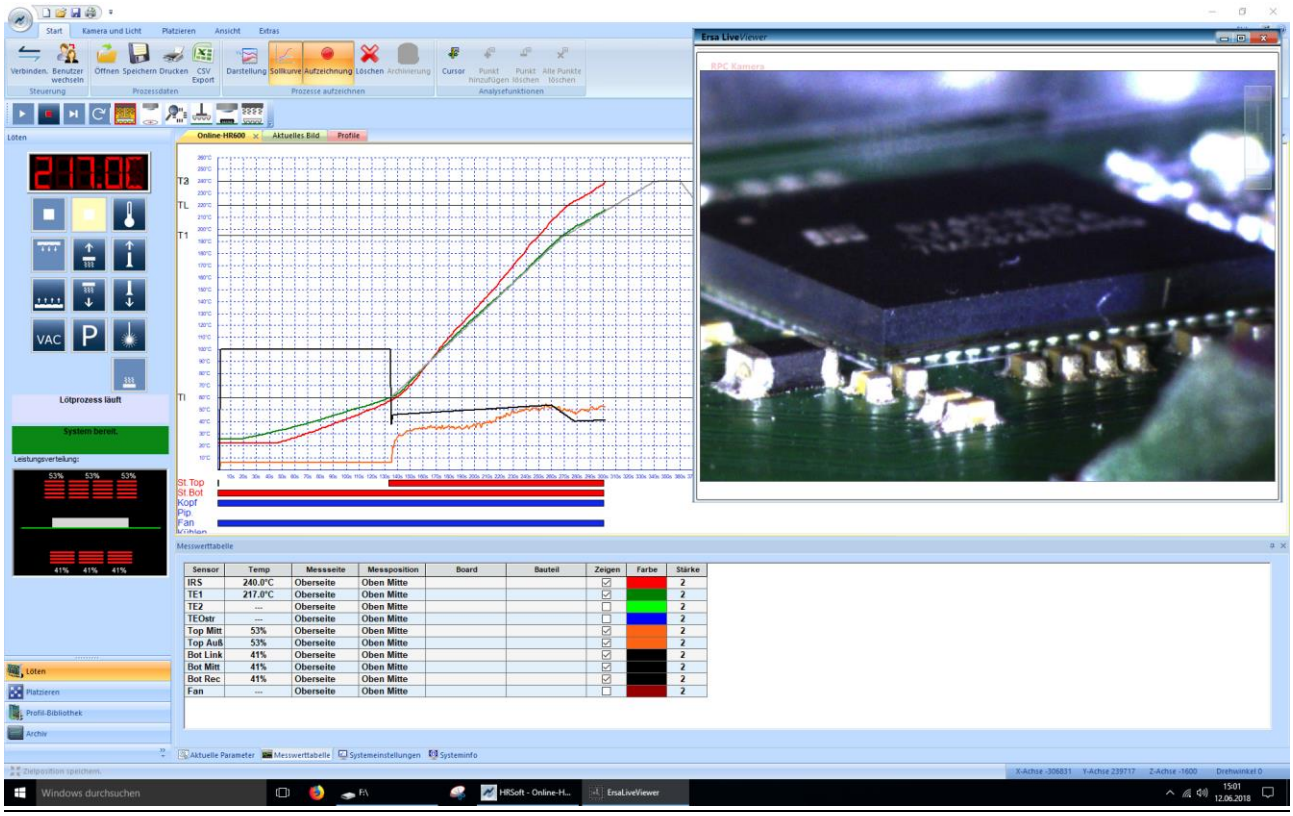


Figure 5: Desoldering BGA component with standard profile and reflow process camera observation

2. Pad cleaning on BGA landing area
   Using a soldering iron and a ZD and AD tip (series 102) the residual solder was removed. Pads were washed off with flux remover.

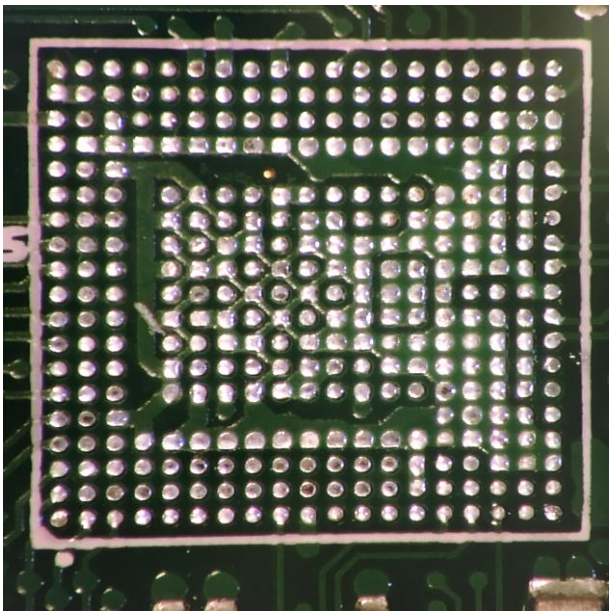


Figure 6: BGA pad pattern during rest solder removal indicates different pad geometries and via connections

3. Installation of a new BGA component
   For installation the same reflow profile has been selected like in the desoldering process. The component was dipped in a 150 µm flux stencil (with flux 4FMJF8300-005). No additional solder paste was added. The HR 600/2 used the automatic dip in function and located the component automatically on the right spot.

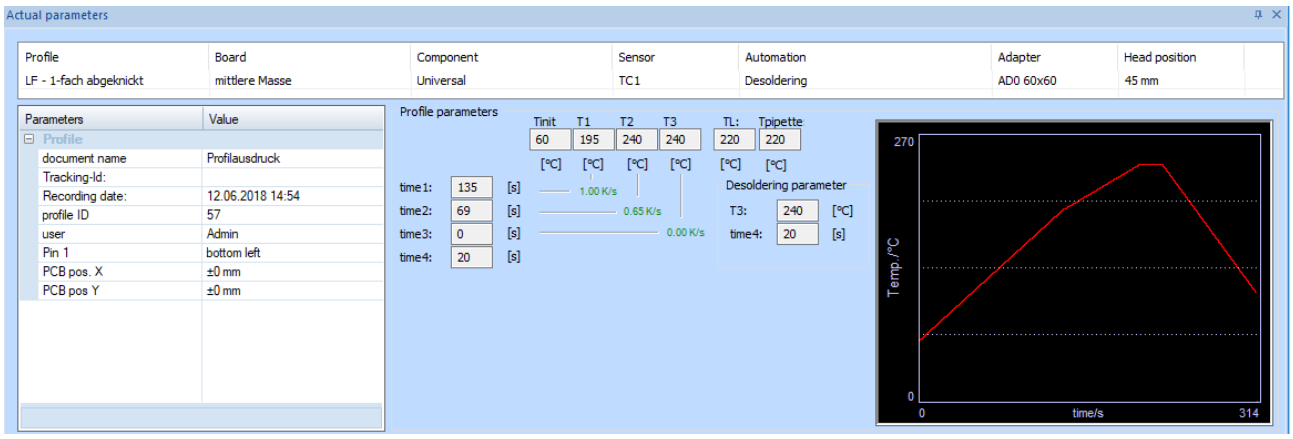


Figure 7: profile settings for BGA installation

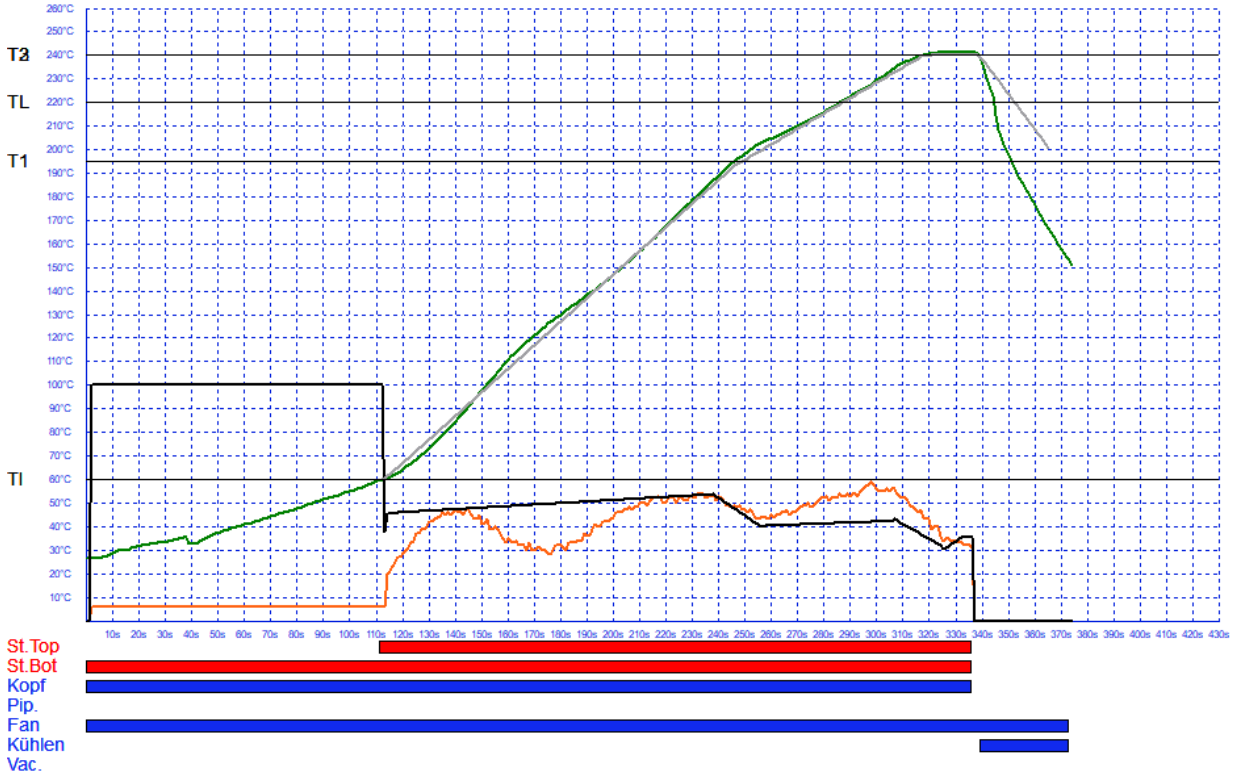


Figure 8: recorded soldering profile of BGA installation

<u>Final inspection after new component installation</u>

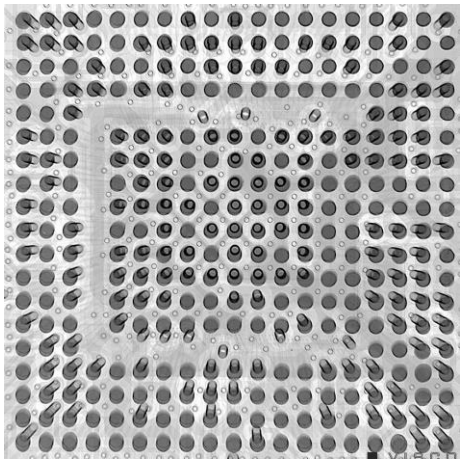


Figure 9: new BGA installed, no anomalies

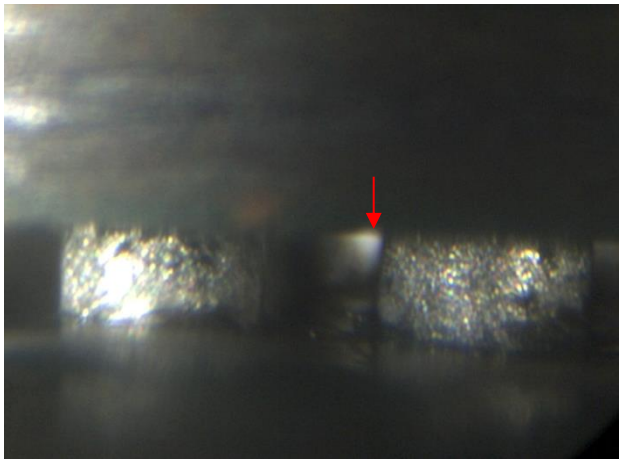


Figure 10: solder balls with backlight visible

<u>Over all summary:</u>

1. On BGA installations x-ray and Ersascope inspection can identify the same issue.
2. A combination of both inspection technologies can help to identify the reason for the failures
3. Reworking BGA applications with Ersa Rework system will result in production like or even better conditions.

ERSA GmbH