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BGA Thermal Shock Testing

Results of Independent Testing for Best Inc.
BGA Stencil Repair Rework Samples
Solder Paste Only Reattachment

Purpose

The purpose of the testing was to compare the resistance and check for open circuit conditions of reworked BGA test samples made with and without StencilQuik™ after 500 thermal shock cycles. StencilQuick™ is a product of Best Inc. In this series of tests, the resistance of daisy chain resistance patterns running between the BGA and test board after exposure to thermal shock was measured. Samples were prepared in order to compare the two separate test groups. Each test group consists of 5 sample cards with 4 BGA devices per card.

Group 1 StencilQuik™ with Solder Paste Reattach

Group 2 Standard Reattach with Solder Paste

Discussion

Samples were prepared using BGA Daisy Chain Test Chips from Amkor with 484 I/O and pads at a 1.0 mm pitch. The daisy chain test cards are a single sided FR4 material with 1 oz. copper and a HASL finish. The card pad sizes were .025 inches with a 1mm pitch. As the BGA is configured, 4 separate Daisy Chain circuits exist for each BGA and 4 BGA's are contained on each test sample card. This results in a total of 16 Daisy Chain circuits per card.

Group 1 used the Best Inc. stencil rework technique (StencilQuik™, BETA version) and Group 2 used standard reattach methods. StencilQuik™ is a polyimide film with apertures corresponding to the BGA pads. A high temperature pressure sensitive acrylic adhesive is used to attach it to the board. The thickness of the adhesive is .004 inches and the film thickness is .004 inch for a total of .008 inch.

For assembly of Group 1, a polyimide film stencil is attached to the test cards with the BGA pads exposed through openings in the film. Solder Paste (Alpha Omnix 5000) is then applied using a .010 inch stainless steel handheld squeegee to each aperture opening, filling each of the apertures. The film stencil is not removed. A balled test BGA (.025 diameter / Sn63/Pb37 Ball) is placed on the stenciled card and reflowed using a standard developed profile.

For Group 2, where no StencilQuik™ is used, the same steps as above are used except for the application of the solder paste. The solder paste is applied by using a .008 inch stainless steel stencil and applying solder paste to the aperture openings. The stencil is then removed leaving the solder paste on the board. The balled test BGA is then placed on the circuit board.

The two card groups were then reflowed using the standard profile with a maximum temperature of 220 deg. C.

Thermal Shock Exposure Test Description

Temperatures - - 45 deg.C to 22 deg.C to +70 deg.C

Dwell - 10 Minutes per segment / 40 Minutes per cycle
36 Cycles per Day

Transition Time - Less Than 15 Seconds

Total Cycles - 500 Cycles

Test Samples - Single Sided PCB with Daisy Chain Pattern.
4 Daisy Chain circuits per BGA.

5 Samples StencilQuick™ and Solder Paste (20 BGA's)

5 Samples Solder Paste only (20 BGA's)

Test Monitoring - Manually Measure Resistance of each Daisy Chain Segment and record.

Record Data - Initial, 10 cycles, 50 cycles, 100 cycles, 300 cycles, 500 cycles

Test Data - 4 Segments x 20 BGA's x 2 Sample Types x 6 Data Pts.
960 Total Data Points

Failure Criteria - 20% increase in Resistance of any Segment from Initial Measurement.

Test temperatures are based on AGCS established Telecom testing history.
Neither the test boards nor the test itself follow IPC test standards for BGA testing.
Testing is done for comparison of the two repair techniques.

Results

After 500 thermal shock cycles the following results were noted:

Group 1	StencilQuick™ with Solder Paste	No Failures
Group 2	Standard Reattach with Solder Paste	No Failures

The test data shows that after 500 thermal shock cycles there was no detrimental impact to the reliability of the interconnect with the use of StencilQuick™. Additional testing or more cycles would be needed to determine if the StencilQuick™ would show a difference in long term reliability compared to the standard reattach.

This information is based on data and tests we believe to be accurate and intended for use by persons with adequate technical skill. Use of this information is beyond the control of AG Communication Systems. Information and test results are relevant only to the items submitted for testing.

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