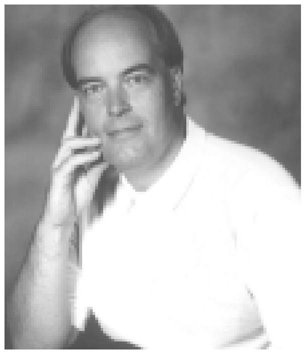
Solderability - Production Testing Made Easy



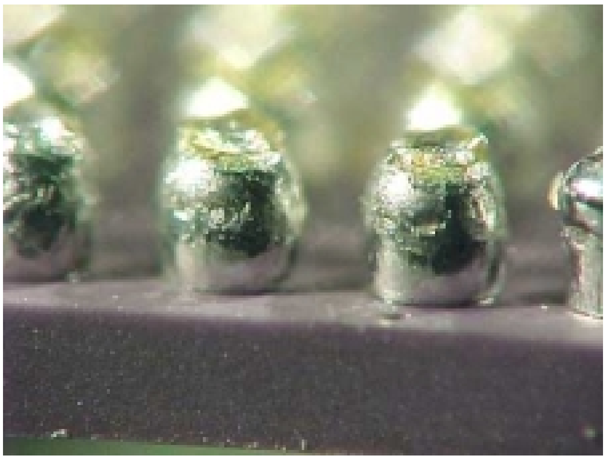
Bob Willis Process Guides

Solderability problems do exist in the industry and can cause open circuit joints and increase the incidence of solder short formation through slow wetting. The growing issue of component obsolescence means that companies are purchasing larger batches of components as a one time buy. These may be purchased for the complete product build and possibly for future product support which is often now a contract requirement.

Longer storage can inevitably mean solderability problems with a component termination's failure to form reliable joints. Generally a purchaser should expect the parts to provide a minimum of 12 months shelf life. Many suppliers guarantee two years from date of supply, but how can this be monitored easily in production?

Traditional solderability testing requires sample components taken from a batch which will probably have to be scrapped. Manual or automated testing may damage components or cause problems with the lead coplanarity. Solderability testing can be an expensive service and take a couple of days to complete.

The testing of BGAs is not a possibility with a traditional wetting balance or dip and inspect techniques. Solderability issues are not normally an issue with plastic parts as the termination's are tin/lead but ceramic parts have high temperature lead rich balls which can become heavily oxidised leading to wetting problems. The same can occur with CGA Column Grid Arrays which are essentially BGAs with high temperature lead/tin column acting as termination points. These parts are specifically used for high reliability and high end processes generating significant heat.



The example ceramic BGA below shows a series of high temperature balls with marginal wetting.

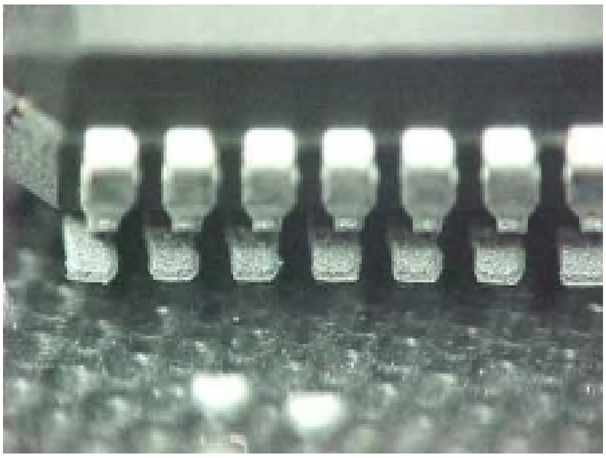
The following is a simple test method which can be used in production and provide a pass/fail results in a few minutes and indicate if the parts are suitable for immediate production use.

Shop Floor Solderability Test Method

Take a glass microscope slide of a suitable size to accommodate the components to be tested. Print a solder paste pattern on to the surface of the glass using a test stencil or the appropriate area from the production stencil. Ideally the surrounding component stencil apertures should be masked out using Kapton tape. This allows only the paste required to be printed on the test site.

The stencil thickness should be the same as used in production. The same type of squeegee blade should be used for test to maintain the same paste volume for solderability assessment.

Place a sample component into the solder paste deposit. It is advisable to include a number of sample parts to provide a better assessment of the batch of parts being examined. Provided proper handling and ESD controls are observed expensive components can be used in production, provided they are satisfactory. If the parts are demonstrated to be satisfactory there will be a nice fresh coating of solder on the terminations.



The image shows a component placed on the surface of the paste deposit previously printed on the glass slide.

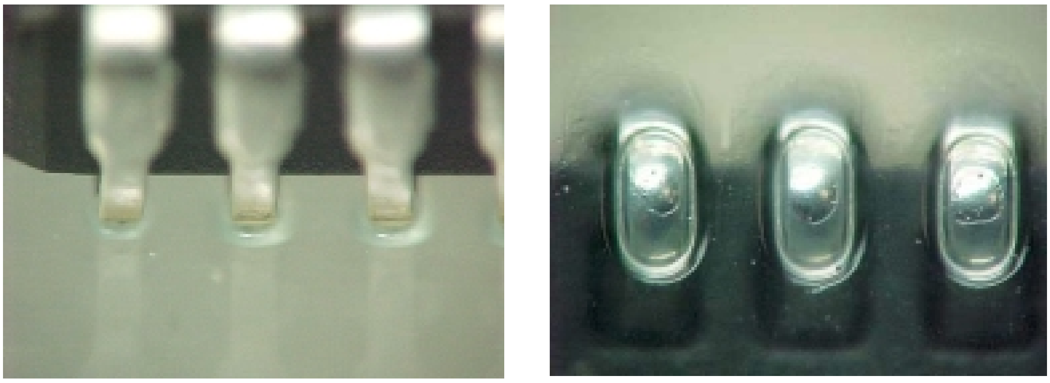
The glass test slide is placed on a sample PCB and passed through the reflow oven under the standard reflow conditions used on the production board in question. Provided care is taken the glass and the components will not be dislodged from the PCB. After the reflow operation the slide is allowed to cool on the surface of the PCB prior to examination. It should be fairly easy to see if complete wetting has taken place. There should be no solder left on the glass it should all have wetted the lead terminations fully.

Inspection of the component terminations can now be conducted at 10-30X magnification. As a glass slide is used as a base for assessment both the base of the lead, top and sides can be examined for complete wetting and solder rise up the termination points. All the solder paste should have reflowed, coalesced and formed a perfect coating on the lead or termination.

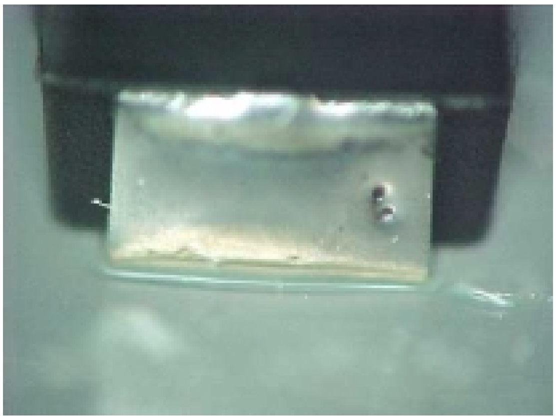
The beauty of this type of shop floor test is its simplicity, it requires no additional expensive test equipment and the criteria used in the industry Dip & Inspect method may still be applied. Basically this requires the solder to wet all the terminations with no wetting or pin holes in the surface coating. Some specifications allow 95% coverage with a 5% non coated areas.

There are occasions where companies need to establish the solderability of parts for immediate production. Weaker test fluxes used in traditional solderability tests could demonstrate failures which would not be representative of the actual process yield when reflow soldering with activated pastes. That is where this type of test is so beneficial. Watching reflow during this test method it is quick to see how slow wetting of leads can lead to solder shorts.

Using this production test method the solder paste provides the flux test medium. Although the flux used is active it directly relates to the production process. Using the reflow soldering process is truly representative of the production process and will confirm the process problem is component related or eliminate from the equation. This is ideal for component assessment for immediate use. It may also be used for trials with reflow parameters to look at wetting of terminations under different soak, peak reflow and dwell times.



Satisfactory solder wetting on all PLCC leads after reflow test. The second PLCC sample shows a close up of the base of the leads through the glass test substrate. Figure 3 & 4.



The example shows satisfactory wetting of capacitor terminations with a minor pin hole in the upper region which would not affect the joint area.

This test has been used in many production line trials. It has aided fast component assessment without the cost of PCB's it points the finger at the components or demonstrates they are not the root cause of the problem

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