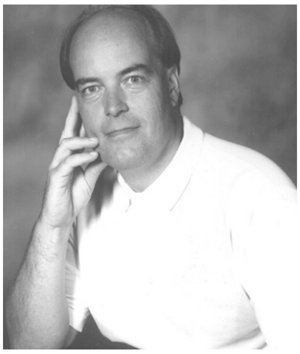
Home Made BGA's

- Cost Effective Solution to Dummy Components



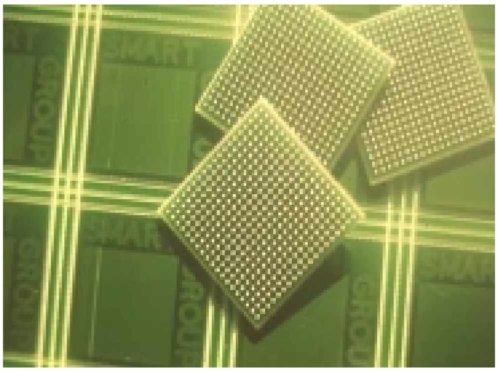
Bob Willis

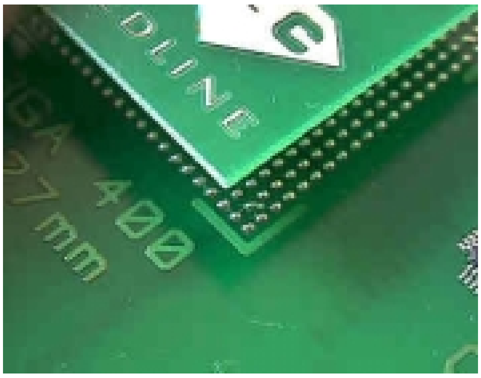
Bob Willis Process Guides

Ball Grid Array (BGA) is becoming a widely used technology in a vast range of products including consumer, telecommunications and office based systems. As an area array device it provides high packing density with a relatively easy introduction cycle. The bulk of applications using BGA are telecommunications, office computer and consumer products which means that it is for volume applications.

With any new technology it is inevitable that engineers must consider production trials on assembly, rework and inspection. This is necessary to define process parameters, demonstrate capability to customers and allow the training of production staff with theses new devices. Often parts are necessary for equipment trials if new machines are required for product introduction. One of the major issues is the cost of fully functional or dummy BGA components for these very necessary projects. Parts can range in price from £15-40 each.

Having faced the same financial problems in the past when setting up production lines and practical demonstrations at exhibitions a solution needed to be found. So why not just make your own devices for a few pounds using existing manufacturing facilities. It should be bore in mind that a number of BGA manufacturers effectively do this on there products.





Examples of home made BGA dummy devices

The demonstration BGA's have been used successful in production for the last few years. They are an ideal solution to the problem on component availability. Quite simply they are just 1.6mm FR4 laminate circuits with 63% tin 37% lead solder terminations formed by screen printing paste and reflow. First a circuit panel approximately 200mm x 400mm is produced on double sided copper laminate.

A multiple pattern of 361 0.025" round pads are etched on to one side of the panel with a company logo on the alternative side. Obviously if different pin out devices are required they can be produced in the same way. Remember if you are already laying out a new design you have the necessary pattern. The panels after etching are coated with solder resist and imaged to expose the round copper pads. Alternative pad sizes can be used to gain experience in processing the parts.

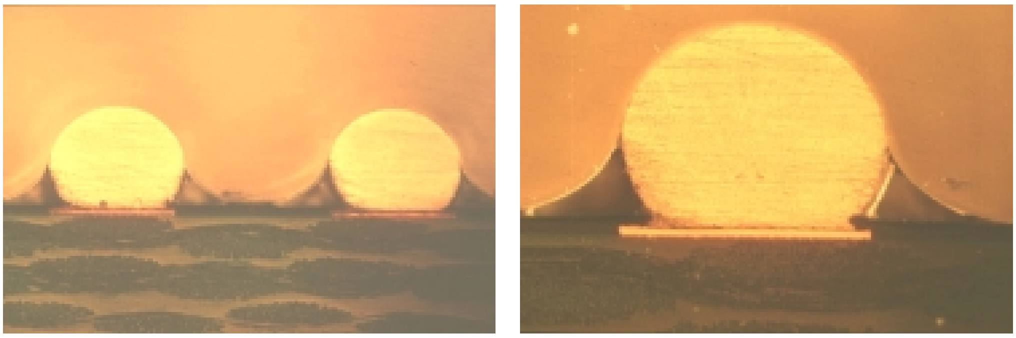
The final fabrication operation is "V" scoring the panel to allow each of the parts to be removed at a latter stage. The scoring operation defines the BGA size. The exposed copper pads are treated with an OSP coating to preserve the solderability. The OSP is used as this is the simplest process.

To form the terminations panels are printed with solder paste with a stencil on a conventional printer before reflowing the panels. The solder paste apertures are 0.030" etched in a 0.010-0.012" stencil. Increasing the stencil thickness can be done but the amount of paste defined in such a small area tends to make the stencil stick to the board and lift it at the end of the printing operation. During the reflow operation the solder paste reflows, wets the pads and due to surface tension the solder paste forms a ball like termination. Ideally this is conducted in a nitrogen environment to preserve the surface of the ball terminations. The use of nitrogen also provides a more ball like appearance.

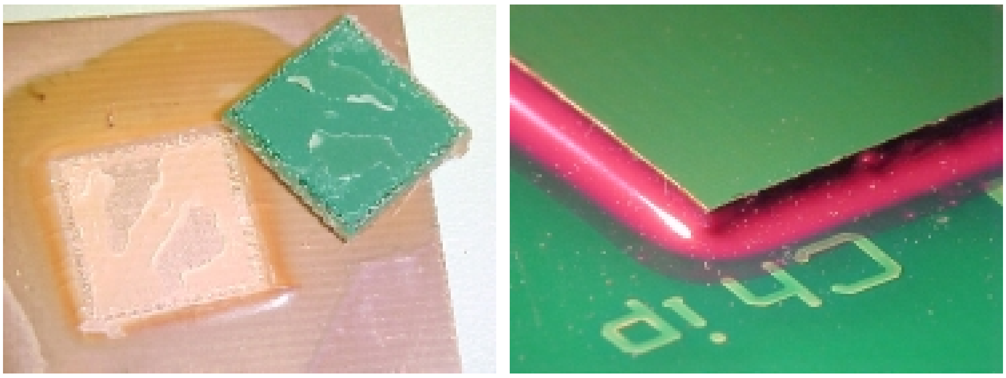
Depending on the solder paste activity used the panels may be cleaned at this stage. A key factor of the paste is that it must not slump during reflow as it will cause multiple shorts if it does. The yield in terms of BGA devices from this manufacturing technique will be between 80-85%.

It is difficult to achieve the same volume of solder in the balls using this method but for all practical purposes this is not so important. When the panels are broken up there are hundreds of parts available for production trials. Using this technique guarantees that plenty of the components are available for production trials and more importantly for operator training. Often due to the cost of normal parts operators are just given one or two to play with. To gain experience before working on real products its important that repair operators get some first hand experience before moving on to the real and expensive parts.

The same technique has been used for CSP and flip chip parts. The flip chip parts were much more demanding and the yield was much less but still proved to be a cheaper option. Both tin/lead and lead-free parts have been produced using these methods. The following examples were produced for Cookson Electronics Flip Chip Hand On Workshops in Europe.



Microsections taken through ball terminations after reflow



Flip chip examples produced with the same process for soldering trials with no-flow underfill and soldering and underfilling after reflow

Bob Willis is a process engineer providing engineering support in conventional and surface mount assembly processes. He runs production lines at exhibitions and also provides reflow soldering seminars and workshops world wide. He is often called to advice suppliers and customers on process issues and is able to undertake process improvement projects on site. He has one of the largest collection of training videos, interactive CD-ROMs and training material in the industry. Bob produced the first training video tapes on BGA technology and CD ROMs. With Peter Grundy of Siemens he also ran the first hand on BGA workshops in the UK.

Bob will be presenting four Master Classes at APEX in California, he will also be presenting classes at SMT Nuremberg in Germany for those engineers visiting the show. For further information on how Bob may be able to support your staff contact him via his web site **www.bobwillis.co.uk**

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