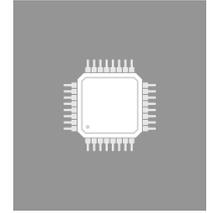


Electronic component technology



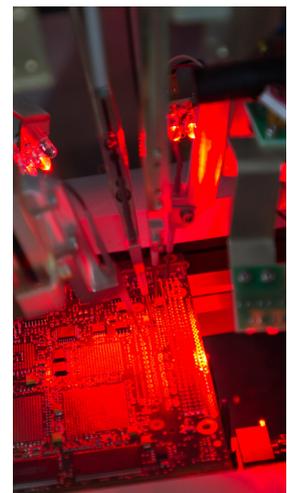
How to test electric continuity on a BGA without a specific test socket.

BGA packages have now been in existence for long enough to fall victim to obsolescence. For purchases from brokers, it is usual to carry out an electric continuity test on complex electronic components to make sure that the connections with the chip are still there. For the test to be complete, all the connections need to be tested, which can represent over a thousand balls on a single BGA. Furthermore, the variability of the packages in terms of numbers, diameters and ball positioning will often force us to use an unavailable test socket or one that has delivery lead times that are incompatible with the deadlines to return bad parts to the manufacturer.

THE EQUIPMENT

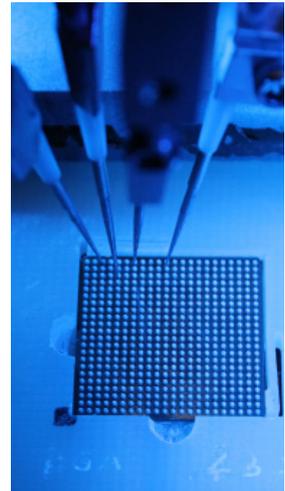
Firstly, how can we get rid of the need for a test socket without going back to voltmeters? Voltmeters are obviously very useful as they can adapt to all types of package, but they don't guarantee measurement conditions, or the non-deterioration of the balls by the operators, or the deterioration of the operators themselves after having tested 8 components with 500 balls...

We therefore need to find equipment that has sufficient mechanical flexibility to adapt to the package, a control on contact positioning and control over the electric measurement conditions: we naturally turned to a flying probe tester, equipment that is very frequently used as part of first level testing in electronic board production. The only mechanical part that remains to be produced is the interface between the tester and the component, making it possible to immobilise it throughout the measurements without damaging it, while adapting to very wide dimensional variations from one package to the other.



THE PROGRAM

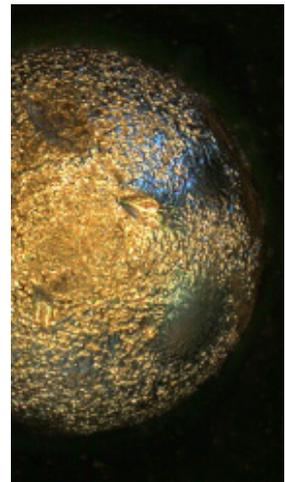
It is rare to functionally test this type of complex component when buying from a broker. Usually, a check is made that the ball is connected to the chip by measuring the ESD protection diodes present on most of the component I/Os. In practise, a current in the order of 10 to 100 μ A is injected and the voltage at the diode terminals is measured. The purpose of these measurements is to check that all the components behave consistently or, in the best case scenario, to check that their behaviour is similar to that of a reference component. Programming then comes down to making the flying probe tester think it is measuring diodes on a PCB when it is actually measuring the diode voltage between the component I/Os and GND. Thus, using its mechanical drawing, we describe all the coordinates of the balls on which a probe will be connected, then, for each protection diode to measure, we describe which ball positions they correspond to. Similarly, we can also check not diodes, but simple continuity between all the balls connected to the GND and between all the balls of the different Vcc.



AND IN REALITY...

The main unknown was whether the probe heads would deform the balls or not. In practice, there is a slight mark at the contact point which is within the acceptable ball deformation limits. Furthermore, the flying probe tester algorithms make it possible to come into contact with the GND only once to carry out all the different diode measurements, without having to strike a GND ball for each measurement. It is also possible to configure approach and contact speeds on the balls to make sure they are as gentle as possible.

The result is very repeatable measurements, that do not deteriorate the components, with a measurement speed of several balls per second (depending on the number of probes available on the tester). Of course, the test is only carried out at room temperature, but it has the advantage of covering all the component I/O at very reduced costs and tool creation times.



STANDARDS

MIL-STD-883 Method 2009 : Test Method Standard – Microcircuits – External Visual

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