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Swift Acoustic Inspection Rescues BGAs

Staff -- 10/1/2002
EP&P

When a contract manufacturer discovers that the heat of the reflow process is causing damage to IC packages, the hunt begins for the root cause of the problem — which could be in any of numerous earlier process steps. In the case of the damage occurring at an Asia contract manufacturer, the unknown cause of the problem seemed to originate with the maker of the plastic BGAs. The maker of the BGAs examined its processes and soon learned that the problem consisted of delaminations in the BT substrate. The BT substrate, in turn, was being supplied by a third company. The very thin delaminations, it was found, were present in the BT substrate when delivered by the vendor to the BGA maker

After encapsulation of the BGA by the manufacturer, the moisture that permeates all plastic packages was finding its way to the delaminations. During reflow by the contract manufacturer, this moisture was flashing into steam and the resulting pressure was destroying the BGA.



Finding a solution

The contract manufacturer was obviously too far downstream to be involved in finding a solution. The problem therefore existed between the BGA maker and the supplier of the BT substrate. The question was, which company was going to solve the problem?

The vendor could hardly deny that the delaminations existed in the BT substrates as delivered to the BGA maker, but it offered a financial solution rather than a technical solution. The vendor would continue to deliver the BT substrates with no change in quality, but would lower the price as a form of compensation. This move might permit the BGA maker to solve the problem in some fashion.

Not surprisingly, this proposal did not find favor with the BGA maker, and discussions went back and forth for a while. The problem was one of throughput. Everyone knew that the delaminations could be found by acoustic micro imaging, and that it was theoretically possible to identify and scrap the delaminated substrates before building the BGAs. But both the vendor and the BGA maker were envisioning the identification process as taking place in a failure analysis setting, a few units at a time. The throughput via this method would be far too slow to permit full-scale, defect-free production.

The solution to the problem (although not the end of the debate) appeared in the form of an automated C-SAM tray system manufactured by Sonoscan, similar in its imaging and data-collecting powers to a laboratory-based failure analysis system, but vastly different in its handling of parts.

Like a laboratory system, the automated system uses 10 MHz to 300 MHz ultrasound. The ultrasound is pulsed into a sample, and the return echoes are processed to gather data and, if desired, produce an image. Echoes from particular depths of interest can be selected to the exclusion of other depths, just as in a laboratory system.

Resolving the problem

Unlike a laboratory system the automated system handles parts in JEDEC-style trays, and scans an entire tray (rather than a single component) at a time. The trays are all the same size, and in normal operation a tray is scanned in around two minutes. The number of parts in the tray doesn't matter. The spatial resolution of the data-collection process can be adjusted over a wide range. The highest resolution, which is very useful when piloting the use of a system before installation, collects 4096 pixels on each scan of the tray's width. Once the critical minimum defect size is known, resolution can be reduced (and speed thereby increased) to as low as 128 pixels across the tray. In some applications, a tray is imaged in as little as 60 seconds.

The tug-of-war between the BGA maker and the vendor was finally resolved when the vendor agreed to use an automated system to perform 100 percent inspection on the BT substrates before shipment to the plant. This

solution positioned the solution to the problem at the earliest possible point in the process sequence, and permitted the vendor to maintain the current pricing structure. The manufacturer's evidence that the problem had been solved came in the resulting precipitous drop in the number of BGAs suffering damage during reflow.

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