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Automating In-Circuit Test

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Automating In-Circuit Test

Inline ICT is not as cumbersome as it used to be, and in the longer run, will help manufacturers save costs.

THE IDEA OF operating in-circuit test as part of the surface mount technology line is not new. Options available to volume manufacturers include modifying ICT systems with bridge handlers to receive printed circuit board assemblies from the input line to the tester. Others link test units to increase throughput.

Conventional inline ICT may be serving its purpose to automate necessary board tests, but end-users still feel common pain points. These include the cost of implementing such systems, the sheer bulk of such automated systems occupying premium shop floor space, and the challenge of dealing with multiple equipment maintenance parties. The latter can be especially trying in cases where handlers are provided by third-party automation specialists. Line downtime equates with monetized loss of productivity. Time and energy wasted on pinpointing the ownership of fault repair responsibilities for such integrated solutions only adds to the burden.

Systems with integrated board handlers overcome some of these challenges by minimizing cost and shrinking the system into smaller footprints. This should help to shave some time lost when boards are lifted into handlers (as in older designs), simultaneously saving the need to invest in lifters along the conveyors.

Recent new products have shrunk the conventional ICT footprint by over 30%, while ensuring the line automation fits SMEMA criteria for a more seamless process flow on the SMT line. A typical ICT with a bridge handler can measure up to 2m (almost 80" in length), versus new integrated compact models, which can be as small as 850mm (33"). A smaller system means the PCB can traverse the span of the tester in a shorter time, a boon to throughput.

One important criterion to consider when integrating an ICT strategy into an inline model is how much resources can be conserved and reused, from hardware down to test programs. ICT solutions these days try to set an industry-leading benchmark using the ease of test transportability, repeatability and stability as key criteria. Translated to more tangible terms, these three criteria measure how easily both hardware and software can be transported and implemented, not just between products tested, but from one site to another, such as from a prototype validation environment to new product introduction and, further downstream, mass manufacturing environment.

For instance, test programs developed upstream and results obtained during offline design and prototype validation phases should be easily reusable when the product is ready for ramp and high-volume manufacturing. Regardless of manufacturing site, or whether a product was developed in California and moved to Shenzhen, an ideal test should be repeatable, yield steady results, and be capable of consistent results downstream, as any inconsistencies will add to the cost of test in terms of time and labor spent debugging and revalidating.

Fixture wiring of the ICT system is also a factor to look out for (FIGURE 1). Most ICT systems operate on long-wire fixtures. A common challenge for test engineers is the noise and loss of signal integrity over the long wires whenever a system has to be moved, affecting electrical test results for PCBs. Short wire fixture options are available for both offline and inline ICT systems. These tend to yield better signal integrity and faster turn time for test implementation.

One obvious change is rising labor costs. This is most evident in China. No longer a low-cost labor haven, manufacturers in China have lamented to the authors that the availability of job opportunities in the services sector has led to the new cohort of job-seekers preferring non-factory work environments. High turnover and retraining costs may make automation a more viable long-term solution.

Another driver is the move toward higher-sensitivity components. As the saying goes, it is human to err. On the production line, however, mishandling modern high-complexity circuit boards is a costly affair. Human mishandlings resulting in electrostatic discharge are an oft-cited cause of damage to sensitive chips. This is a common reason why some OEMs in the automotive and medical industries require contract manufacturers to minimize human contact on their PCBAs.

Given how fast ICT vendors are coming out with new ways to remove past pain points of deploying inline ICT, especially for higher node-count and greater coverage capabilities, automated ICT may soon be as common-place as your pick-and-place or wave solder machine on the SMT line. CA

FIGURE 1. Short wire fixture options come on both offline and inline ICTs and tend to yield better signal integrity and faster test implementation turn time.

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