

A Primer on Test Options

ICT remains the best option for high-volume manufacturing.

NO MATTER HOW good manufacturing processes and machines are, some defects are to be expected due to human error, wrong component values, dead devices (for example: ESD-damaged), assembly process or placement errors, or electrical hazard defects during mass production. Hence, it is obvious that testing is necessary to capture defects and ensure product quality. The most common electrical test methods are in-circuit, flying probe and functional. This month, we explore these three options and see how they fit into the overall electrical test needs of manufacturers.

In-circuit test (ICT) is a powerful tool for high-volume printed circuit board assembly testing. ICT can effectively perform node-oriented open shorts testing and component value testing for virtually all electrical components very quickly, with “bed-of-nails” fixture access simultaneously. It also can perform unpowered vectorless tests, digital vector tests, JTAG boundary scans and mixed tests relatively quickly compared to other electrical testers, as all the connections are in place in the fixture.

Test program generation is automated and sophisticated circuit analysis used to create optimal tests. Defect detection is the fastest of the three primary test options. Diagnostic routines are fairly short; as a result, testing costs are lower than other electrical systems that might need skilled support engineers. This makes ICT attractive for production use.

Node access is becoming more challenging due to board compactness as component geometry continues to shrink. The move to higher speed operation further drives intra-device spacing to smaller distances, hence increasing the signal routing problems for test pad access. However, it is still possible to achieve good coverage, as the core test challenges have been resolved with limited nodal access test methodologies. Test coverage can be further improved by adding external circuitry or hardware such as counter modules for measuring very high frequencies (>100 MHz) and photo-detectors to test LED color and intensity.

Flying probe uses a generic board holder with multiple probes accessing individual nodes of the board with software control. The software can be developed relatively quickly from the PCB design files, permitting easy changes as pad positions or components change. No mechanical test fixture is required, and fixture fabrication time is not needed.

The operating speed of flying probe testers is slow compared to other types of automated test equipment

because the probes have to physically move to each position in turn. For an ICT system, all the connections are in place in the fixture. Flying probe is not always able to achieve higher levels of electrical fault detection. It is suitable for low-volume production and prototype applications due to their speed limitation and flexibility, low development costs and short development time.

ICT can be improved by **ADDING COUNTER MODULES FOR MEASURING HIGH FREQUENCIES** and photo-detectors for LEDs.

Functional test can be considered as any form of electronics or electrical testing that exercises the function of a circuit. However, functional testing is a very challenging solution in high-volume manufacturing for a number of reasons:

- Test execution takes much longer per board; hence, test cost increases as more functional test stations are required.
- It is tricky and time-consuming to diagnose failures; extensive experience is required and takes a considerable investment in resources and training.
- It is difficult to predict test coverage up to the component level.

The functional test platform is better used for verifying that manufactured products meet their performance specifications. It is more useful as a quality gate rather than defect finder.

ICT has been and remains successful and dominant in testing boards where the economics of board cost, complexity, volume and quality justify the capital expense of an ICT system, and most manufacturers should strive to use this test method. **CA**

WEE-SHENG

YONG is a technical marketing engineer at Agilent Technologies (agilent.com); wee-sheng_yong@agilent.com.





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