PCBs Cut PCB Test Time

Wireless fixtures simplify the process.

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For the past three decades, the printed circuit industry has used wire-wrapped clamshell fixtures for testing printed circuit boards. This is a good, reliable technology and will surely continue to be used—but it's also an expensive and time-consuming technology that's difficult to execute.

The Wireless Alternative

The wireless clamshell fixture is a well-developed technology that's experiencing increasing use. By replacing bundles of wires with a print-and-etch image of the testing connections, wireless clamshell fixtures are saving money as well as time.

The wireless fixture's bottom-side multiplate is designed and built as it always has been. The topside fixture requires four drilled plates, reusable spring probes, and a single-sided print-and-etch circuit board for the wiring layout.

The most difficult part of the new system lies in routing the connections from the topside unit under test pins to the topside translator pins and updating the netlist to reflect these connections. Conventional autorouters are not designed for this job; therefore, the early wireless fixture technology required manual routing techniques. While manual routing allows efficient use of available real estate, the amount of time and operator talent involved kept some shops from considering the wireless fixture process. The recent introduction of the Ditta-Hill autorouter, however, enables the topside fixture to be routed in a fully automatic mode in minutes, making the fixture design process both practical and cost-effective.

Making the Test Fixture

The design and fabrication of the wireless test fixture is straightforward. The autorouter can be integrated with virtually any test fixture design software, including the TCAD system. Gerber, extended Gerber, or IPC 350 data is received and read into the software system, where all nets are automatically identified. A simple point-and-click user interface allows the operator to combine the netlisted printed circuit board information with the desired test fixture configuration. A test strategy is selected, such as end points only, and the system proceeds to automatically construct the fixture. The test points chosen by the system are presented to the operator, who may edit the test point selection or accept the system selection.

The software then creates all the bottom fixture plates along with a Gerber file for the top wiring plate showing all the top test points, the translator areas, and the tooling holes. The top plate file is then given to the autorouter for automatic connection to the predetermined translation areas. The netlist file is updated based on the connections made by the autorouter. Next, is output and a Gerber file, given to the photoplotter to create the working film for the top wiring board. The appropriate plates for the top and bottom fixtures are drilled and loaded with reusable probes; the completed wiring board is mounted on the top fixture, and the assembly fasteners are tightened.

The top plate is generally 0.093”- to 0.125’’-thick FR-4 with 1/2-oz. copper on its bottom side, predrilled with 10 to 15 assembly and tooling holes before printing and etching and automatic optical inspection. The topside probes are off-the-shelf spring probes with a barrel diameter of 0.027” to 0.040” and a barrel length of 0,5”, The probe plunger is approximately

0.021” in diameter and 0.100” to 0.135” long. No receptacle is required. The overall height of the top fixture is only 0.6”, making it suitable for almost any currently used universal-grid test system.

Second and third body plates can be made of FR-4 or polycarbonate, 0.250” thick to accommodate the barrel length of the probes. They are drilled with the same tooling hole pattern as the top printed circuit board plate, with additional and somewhat larger holes drilled for the probes. The bottom retainer plate consists of 0.015”- to 0.040’’-thick FR-4, with the same hole locations as the body plates but with its probe holes of slightly smaller diameters to hold the barrel probes firmly in place.

Fixture assembly is easy. The body and retainer plates are preassembled using alignment holes and drill rods for registration. Probes are loaded from the topside by hand or automatically, and the topside printed circuit board is mounted with its circuitry facing down. Screw and post fasteners hold the assembly together. The wireless printed circuit board fixture can be easily replicated for occasions when fixtures are needed for multiple test systems. Its easily removable topside printed circuit board facilitates *cleaning* the system or replacing damaged pins.

capabilities

From 700 to 1,000 connections can be made with a single-layer printed circuit board topside board. Wireless fixtures have been designed with up to 3,000 topside test points using three single-sided top printed circuit boards, which seems to be the practical limit with standard probes. However, the use of double-ended probes can increase the number of wiring layers to eight or 10. This approach, using multiple single-sided print-and-etch layers, seems far more practical and cost-effecfive than creating a plated through-hole multilayer wiring board to provide additional test connections.

Conclusions

After 30 years of wire-wrapping test fixtures, the time has come to investigate a new approach. Shorter cycle times and higher testing costs emphasize this need. Wireless test fixtures now represent a viable alternative. **FAB**

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