Fixture Facts

An analysis of time, technology, and costs.

Griff Hill

Walk through any PCB production facility and you'll see more than one board testing system at work. Look at nearby shelves and you'll find hundreds of fixtures, which often represent a greater financial investment than the test equipment itself. Since fixtures have such an impact on total testing costs, they deserve major attention in making purchasing decisions. Knowing key fixturing facts helps fabricators make the best choices.

Fixture of Choice

For most applications the fixture of choice is the universal multiplate fixture. This configuration provides cost-effective fixturing, which is compatible with the following technologies:

- ball grid arrays
- PCMCIA cards
- ultrathin PCBs
- 0.20-mil or finer pitch
- single or simultaneous double-sided testing.

The universal multiplate fixture uses simple pins to replace wired spring probes, reducing the cost per test point from $4 to $0.075.

In the testing environment, the ends of the pins are interfaced at high density to the printed circuit board and at a density of 50, 75, or 100 pins to the tester grid field. Because each pin end has different spacing and the board pads and holes are not always on grid, the pins must be curved or tilted (leaning) to fit properly. En route from the tester to the board, pins pass through a series of plates, usually acrylic or plexiglass, that direct each pin to its target.

Curved pins (3.75" or longer) are recommended for small pads and high density circuits. By accommodating a 0.50" SMT-to-grid variation, they handle greater densities. Also, curved pins help ensure accurate test ing by making perpendicular contact with the pads, eliminat-

On-Site Contract Testing Follow-Up

Jerry Murray

Merix Corp. (Forest Grove, OR), formerly Tektronix's F-1 PCB facility, has a history of innovative management practices. The firm's technology arid worker exchange program with NEC of Japan was unprecedented, for example, and in the current prospectus describing Merix's initial stock offering, **it was announced that several other unique relationships have been established with the company's suppliers.**

Just over a year ego, Merix signed a contract designating ZD Test (Forest Grove, OR) as Merix's exclusive on-site bare-board electrical testing source. When asked about motives for the arrangement, Larry Neitling, Merix's president. cited economics (anticipated costs savings), technology (the expectation that ZD Test would develop new ET methodologies), and logistics (the ability to consistently meet customer delivery schedule requirements).

Neitling's expectations have been met, even es Merix's level of business has increased substantially in terms of both volume and technological demands. To keep up with this demand, ZD Test has invested in equipment, software, and engineering resources. Initially, an additional universal test system was installed to add throughput capacity and enhanced test parameters. This teeter, a Test Technology international Tustin, CA) model 3400, has bean in service for 10 months. More recently a CK Technologies (San Jose, CA) model 2050 was pieced in service to test vary complex dual-sided SMT products with topside universal fixtures.

ZD Test has also developed a number of new software technologies that reduce the expense of testing of vary large, dense dual-sided SMT boards. Fixturing innovations are selectively applied to specific jobs to balance technological and economic concerns.

Combined with logistical and operational developments like closely monitored probe recycling programs, the Merix/ZD Test partnering has allowed both parties to achieve technical gains and cost reductions. FAB

ing the possibility of skidding and associated board damage. With either type of pin, longer lengths provide the ability to test more closely spaced points.

Each universal-grid fixture contains three to seven plates that direct the pins from the tester to the board through drilled holes. With leaning pins, each plate has different covector holes, which complicates drilling by requiring interpolation of drill locations. Fixtures with fewer plates usually require less drilling time, while typically varying hole diameters and additional plates increase drilling time and cost.

Curved-pin fixtures need only three easily drilled plates. The two plates nearest the board are identical and are drilled based on the board pattern to be tested. Drilling the plate on the tester side (grid plate) is fast and inexpensive because it is on grid. While the drill program for the plates can be created directly from film, this is a very time-consuming and less accurate process. A preferable approach is to create the program from Gerber or CAD data, merged with normal production.

Manual pin loading is relatively easy, with guide plates in the fixture simplifying the process. As noted before, while short leading pins may be faster to install, they limit the level of printed circuit board technology that can be addressed. A typical rate for manually loading a 25-mil-pitch pattern fixture using guide plates with long, curved pins is 4,000 pins per hour. Pin loading times, pin lengths, pitch spacing, and other technical factors must be considered in the purchase of automatic pin-loading equipment.

The amount of time it takes to produce fixture is a critical consideration. All elements must be included: data processing, drilling of the fixture plates, pin loading, and the assembly of the fixture. The "fixture checkout" requirement is accomplished by using the test system to:

- correct any shorted pins
- achieve correct point count
- check alignment of the tooling pin with the board
- use the board to verify the netlist.

The processing time on a dual-sided fixture application of 2,500 to 3,000 test points should not exceed three to four hours. This is an important factor in meeting the fast-turn requirements of today's marketplace.

PCB Technology

With the increasing use of surface-mount technology, higher density, and other technical advancements in printed circuit board design, providing cost-effective solutions Becomes more challenging. A case in point is the fixturing and testing issues related to the shift of top-to-bottom image and/or a shift of images related to the tooling holes. While both mechanical methods and optical approaches can address this problem, there remains room for Improvement from a user's point of view. To provide a more user-friendly interface, these approaches need better integration within the software process and the test system.

Looking Ahead

Growing numbers of SMT boards require testing. A key element in meeting this challenge is selecting the fixture method to *reduce process time and address complex applications while keeping fixture costs in line.* FAB

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