TESTING TODD

Flex and Rigid-Flex Circuit Testing: Challenges & Solutions

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Although flex circuits are nothing new in today's technology roadmap, the testing of unpopulated flexible circuits can be challenging. These circuits can be very thin, have challenging geometrical configurations and in some cases be a combination of rigid bare board and flex. There are basically three different methods available to test these challenging circuits: manual, fixture and flying probe.

Manual Test

Manual testing simply involves a digital volt meter (DVM) where the circuits are "rang out" by testing the continuity (opens) and discontinuity (shorts) of the individual nets. However many semi-affordable DVMs can only provide continuity measurements true to the IPC and MIL specifications as the resistance resolution for discontinuity (shorts) testing cannot test to the isolation requirements of the specifications.

Fixture Test

Flex circuits, in many cases, can be tested by the use of both dedicated (wired) and universal grid (pinned) fixtures. Both of these fixtures are desired when high volume is manufactured. However, the challenge is registering the product to the actual fixture. Some, but not all, flex circuits have mounting holes that can be used to register the circuit to the fixture, which makes the use of fixtures optimal for high volume. Unfortunately, mounting holes may be non-plated and the repeatability of registration may be compromised. In other cases, there may be no mounting holes at all as the flex circuit is "clamped" to a connector, making fixture registration difficult. To overcome the challenge, "dams" or registration barriers may be designed into the fixtures so that the flex circuit may still repeatedly register to the fixture. This can be extremely difficult as many current flex circuits have extremely tight designs and very small landing pads (lans.) Mis-registration on these very small pads can result in "mouse biting" or full destruction of the pad itself, resulting in scrap.

Flying Probe Test

This method can be the most advantageous option for testing low to medium volumes. The first advantage is of course cost. The fixture is eliminated as well as the time taken to build it. With only front-end programming required, this is an excellent option for prototypes and

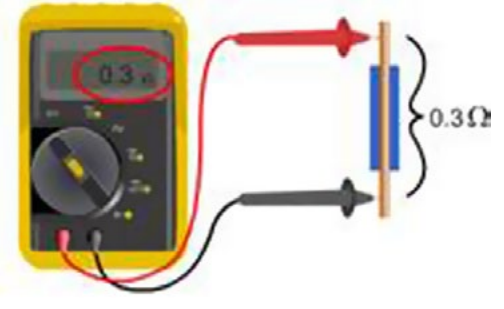

Figure 1: Standard DVM probe test.

Figure 2: Fixture with dams.

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small to medium batches. The newer flying probes have some advantages over fixtures:

- Registration holes are not required for alignment
- Pad sizes down to .003" can be tested successfully without the mis-registration and damage a fixture could induce
- Machines can compensate for minor mis-registration by the use of multiple fiducials, adjusting test point hit location and enhanced localized area registration algorithms.

The use of stretch frames comes in to play here and is a great advantage. The circuit is placed in the clamping system of the machine and then is stretched tight to provide the robust contact area as a rigid board. The circuit can then be tested either single or double sided. Another option if only single sided and a complex geometrical layout the circuit can be attached to a rigid plate and then placed into the machine and tested. As noted earlier, the system can also compensate for minor misregistration by adjusting test point targeting. Another advantage that circuits with embedded passives such as resistor cores can be reliably tested. The only real disadvantage in this method is time. However with the time and cost required to build some of todays' flex and rigid-flex circuits the tradeoff of time vs reliable/repeatable and damage free results is a small price to pay.

Flex technology can only get more advanced. Airline manufacturers and military have been using flex for a long time, and increasingly, by the automoive industry—so it is not going anywhere. Testing flex is a challenge, but today's equipment is highly suitable to combat this challenge. **PCB**

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