Application Notes

Application Note 109

PFL780 fault locator proves invaluable post-ATE production test tool

NDS Broadcast is one of the world's leading manufacturers of turnkey digital video compression systems. The company recently started using a Polar Instruments PFL780 fault locator as an adjunct to its ATE, and now considers it an indispensable and very cost-effective production tool. In fact, the instrument has effectively paid for itself in three months.

NDS Broadcast produces a wide range of digital compression products at its main UK manufacturing facility in Southampton. The company is renowned for providing its customers with complete end-to-end signal processing solutions, covering everything from studio video and audio feeds, through to transmission and final reception by the end-user or service provider. Typical products include signal encoders, channel multiplexers, modulators and receiver/decoders, all of which comply with MPEG (Motion Picture Experts Group) standards. Many of the printed circuit boards in these products are necessarily complex, contain a large number of ASICs and have a high intrinsic value.

Like many medium to high volume electronics manufacturers, NDS Broadcast makes extensive use of automatic test equipment (ATE) to help shorten lead times, maximise throughput and maintain product quality levels. High-end in-circuit ATE is employed for process verification, followed by functional testing in automated rigs which simulate complete end-to-end systems. The rigs are based on 'rack and stack' instruments, controlled by specially-developed LabView software running on a central computer, with automatic datalogging of test results.

Despite this significant investment in ATE - most of which has been installed within the last three years, in line with the company's rapid expansion - NDS Broadcast still had a test problem. The PCBs which failed in-circuit or functional test were notoriously difficult and time-consuming to fault-find, but scrapping such high density boards was a far from viable option - the cost of a PCB loaded with a large number of custom devices can easily exceed £2,500.

NDS Broadcast looked at a number of PCB diagnostic tools on the market, but found that most were either excessively complicated to use - raising personnel training issues - or were dedicated to particular types of board or component, and consequently did not represent a flexible, long-term solution. Following a very successful on-site demonstration of Polar's PFL780 fault locator - which showed that the instrument could quickly locate virtually all types of PCB faults with pinpoint accuracy - the company immediately placed an order.

According to David Masters, Group Leader of Unit Build at NDS Broadcast's Southampton facility, "As well as the instrument's diagnostic accuracy, we particularly liked the fact that its comb-type test clips and built-in multi-channel scanner meant that signatures from high pin-count devices could be acquired very quickly and easily. And as a matter of interest, the demonstration system used DOS-based software, but during the ordering process Polar launched its new PFL software, so the system we took delivery of is even easier to use than the one which had impressed us in the first place."

Polar's PFL software is a true 32-bit application that runs under Windows 95 on the instrument's control PC, and employs a colour graphical user interface to guide the operator through every aspect of PCB fault diagnosis. Clear pictorial images and unambiguous instructions are used to provide an easy-to-follow route to accurate component-level fault location.

Many of the PCBs produced by NDS Broadcast are bus-structured designs, which can be very difficult to test because multiple devices on the bus - such as high performance processors and ASICs - often effectively mask the fault signature of a failing component. During in-circuit testing on an ATE system, this problem can be overcome by

selectively applying guard voltages to disable components surrounding the one under test, but developing the necessary test routines and guard algorithms for ASICs is very time consuming and expensive.

Furthermore, the exceptionally high component packing densities and small track sizes of today's PCBs make it difficult to design whole-board in-circuit test fixtures that provide sufficient test access. For these reasons, electronics manufacturers striving to meet short production deadlines usually elect to use in-circuit ATE for verifying the component placement phases of their process - looking for misplaced or incorrectly oriented devices and shorts caused by solder bridges - and rely on functional test to evaluate final product performance.

This is the approach adopted by NDS Broadcast, where boards that fail in-circuit or functional test undergo detailed inspection and analysis, using a variety of manual fault-finding tools. As David Masters points out, "Many of our digital video processor boards are extremely densely packed, containing as many as 24 surface-mount 184-pin ASICs. A failing PCB will typically have two or three devices with suspect I/O functionality, such as that caused by static damage. Finding faults like these used to be virtually impossible, especially when you were looking for something like one device with a stuck input on a 16-bit wide data bus. The PFL780 is superb at this task, enabling characteristic signatures to be easily acquired from any bus line or component. Our repair people are able to home-in on the suspect area of a board very quickly, and because faulty signatures are nearly always unambiguous, they can identify the component that needs to be replaced without any further work being needed."

"When we ordered the PFL780, we set a notional payback time of six months for the instrument. In fact, as a direct result of using it, we were able to repair twelve PCBs that failed ATE tests within three months, which more than justifies the purchase. And to be totally fair to Polar, this would almost certainly have come down to just one month, if we hadn't experienced problems with the PC we'd chosen to store our test data! The fault locator is a superb investment for post-ATE rework."

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