White Paper

REDUCE TOTAL TEST COST OF OWNERSHIP WHILE ACHIEVING HIGH PRODUCT QUALITY AND ON-TIME DELIVERY

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SANMINA PROVIDES COST-EFFECTIVE TEST SOLUTIONS FOR THE ENTIRE PRODUCT LIFE CYCLE

A unique test simulation tool enables the optimization and cost modeling of end-to-end test strategy

EXECUTIVE SUMMARY

Every product on the market — in any market — aspires to reach the highest level of quality at the lowest cost in the shortest possible time. If the product is a multilayered printed circuit board assembly (PCBA) the goal is no different, but product development in line with that goal is often hampered by testing procedures that are time-consuming, expensive and often, less than perfect even if time and cost are eliminated from the equation.

Everyone involved in board production knows that existing test processes for PCBAs are imperfect. They pose an intractable problem that must be endured by designers and manufacturers. That, at least, is the conventional wisdom.

With its Test Strategy Simulation Tool (TSST), Sanmina has found a way past the testing bottleneck. TSST, a proprietary tool, finds the most efficient and cost-effective test coverage for a given product. Before the first prototype is even built, TSST can reliably predict first-pass functional test yield using a variety of highly accurate structural test techniques. The result is an end-to-end test strategy that incorporates a cost model and a return-on-investment analysis for that strategy.

Where traditional models have failed, TSST applies a completely new approach to PCBA testing, replacing the time-intensive and expensive approach that once plagued the testing of integrated, miniaturized technologies across the entire product life cycle.

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THE CHALLENGE: HOW MUCH TESTING IS ENOUGH?

The pressures are well known to OEM design, test and manufacturing engineers. Reducing time to market requires shrinking all phases of the product life cycle. To ensure product quality it's necessary to develop structural, functional and system-testing strategies fast. Then it is essential to deploy and execute a comprehensive test strategy utilizing best practices to rein in the total test cost of ownership.

All this leads to an inevitable dilemma: How much testing is enough? Experienced experts offer their best guesses, but somehow the metrics and analytics needed to optimize the testing process beyond trial and error are often missing.

Years ago, Sanmina recognized this void in forecasting models and the lack of dependable tools to solve the problem. Today, Sanmina offers a full spectrum of industry-leading test solutions throughout the product life cycle — from components to functional board tests to system level integration tests and environmental tests throughout the product life cycle. Beyond that, these proven solutions contribute to cost-effective test strategies with predictive, highly accurate cost models across the most demanding industries and technology applications.

INDUSTRIES SERVED BY SANMINA

- Communications Networks
- Computing & Storage
- Medical Systems
- Defense & Aerospace
- Multimedia
- Clean Technologies
- Industrial
- Automotive

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TEST OPTIMIZATION: BALANCING THREE CRITICAL FACTORS

There's an old maxim in business operations that among quality, time and cost, you can pick (or promise) any two. In the world of manufacturing high-mix, high-volume, highly complex electronics, as elsewhere, reality means finding a prudent balance, the point of true optimization. Sanmina Test Engineering develops test solutions aimed at balancing and optimizing all three competing factors.

Time in this calculation translates to the time spent in test development, determining the best possible coverage, and time in test execution. Therefore, in testing shorthand, time equals test coverage.

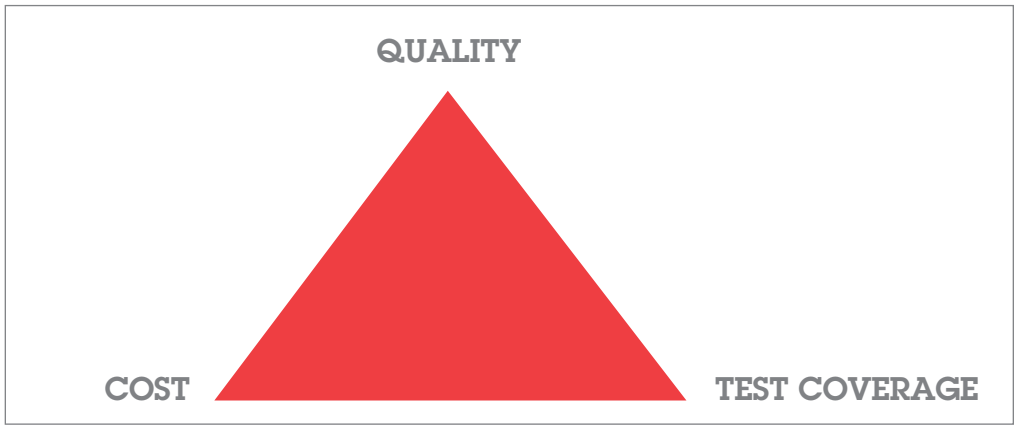

Fig. 1: Balancing the trade-offs of three factors is the key to finding the point of true optimization.

Evaluating these critical three factors — product quality, cost and test coverage — allows OEM executives and engineers to consider important trade-offs in advance and achieve the right balance for their company, their specific product and their market situation. The ideal result is an end-to-end test plan customized to pre-approved priorities that delivers the product on time and on budget.

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SHRINKING TCO: A COMPREHENSIVE APPROACH

Reducing the total test cost of ownership is one of the fundamental methods for driving down overall product cost. In order to accomplish this objective, while achieving other important goals, a cost-effective test strategy must be an end-to-end strategy.

An end-to-end test strategy ensures that testability and manufacturability are integral parts of product development from the outset and delivers predictable product yield and volume within expected parameters.

Sanmina Test Engineering develops and delivers comprehensive test solutions — from components to functional board tests to system level integration tests and environmental tests throughout the product life cycle — for prototypes, New Product Introduction (NPI), volume manufacturing and field repairs.

The determination of the best overall test plan takes into consideration a number of interdependent design factors. Among them:

1. Product design (including design for testability and manufacturability analyses)
2. Process design (including assessment of manufacturing capabilities)
3. Test design end-to-end (including development and execution of structural, functional and system tests)

Limited access to miniaturized components and continually evolving standards are, of course, considerations that exacerbate test issues. Moreover, integrating a mix of digital, analog, RF, microwave, opto-electronics and photonics technologies presents its own set of hurdles. Attention is also given to reducing the debug-rework-retest cycle, along with providing early detection and closed-loop feedback to fix root causes. This effort builds on top of optimized test coverage to further boost product yield, minimize field returns, and trim scrap and warranty costs.

In addition, Sanmina's turnkey test solutions are fully documented and scalable, which can be commissioned and deployed at any of Sanmina's 70+ manufacturing locations worldwide.

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ENABLING GREATER PREDICTABILITY THROUGH SIMULATION

The TSST tool identifies the most efficient and cost-effective test coverage for a product. It can predict the product yield at various test gates, and provide a payback analysis for the selected test strategy. A TSST cost-benefit analysis further helps identify where costs can be eliminated in the testing process.

Sanmina has performed more than 500 simulations with the accuracy of plus or minus a few percentage points, when comparing predicted first-pass functional test yields with actual first-pass functional test yields. TSST has proven reliable under a variety of structural testing techniques, including: Automated X-Ray Inspection (AXI), Automated Optical Inspection (AOI), In-Circuit Test (ICT) and Flying Probe Test (FPT).

The TSST also takes into consideration several more product-specific, interdependent factors, including: product complexity, Design for Testability (DFT), Design for Manufacturability (DFM), Defects per Million Opportunities (DPMO) analysis and volume requirements.

Now, before the first dollar is spent on test development, there can be a definitive answer to the pivotal question: how much testing is enough? In addition, there can be a calculation of the total test cost of ownership — encompassing test development and the testing process start to finish. That's optimization and a practical path for delivering high-quality products on time, on budget.

For further information, visit: www.sanmina.com

WHO IS SANMINA?

Sanmina Corporation is a leading integrated manufacturing solutions provider serving the fastest-growing segments of the global Electronics Manufacturing Services (EMS) market. Recognized as a technology leader, Sanmina provides end-to-end manufacturing solutions, delivering superior quality and support to Original Equipment Manufacturers (OEMs) primarily in the medical, communications networks, defense and aerospace, industrial and semiconductor systems, multimedia, computing and storage, automotive and clean technology sectors. Sanmina has facilities strategically located in key regions throughout the world.