

Agilent E2920 Verification Tools, PCI Series

Case Study

Customer: Altera Corporation
(Altera), San Jose, California.

Challenge: Create a new PCI core that customers can drop directly into their own card designs.

Solution: Use the Agilent E2920 Verification Tools, PCI Series to bring up, debug, and validate the design.

Results:

- A more reliable, virtually bug-free design.
- Faster time to market.
- Competitive advantage.

Agilent E2920 Verification Tools, PCI Series Gives Altera Corporation Competitive Advantage

"Altera firmly believes that using the Agilent E2920 analyzer gives us a competitive advantage and fortifies our status as the number one producer of high density programmable logic devices," remarks Ziad Abu-Lebdeh.

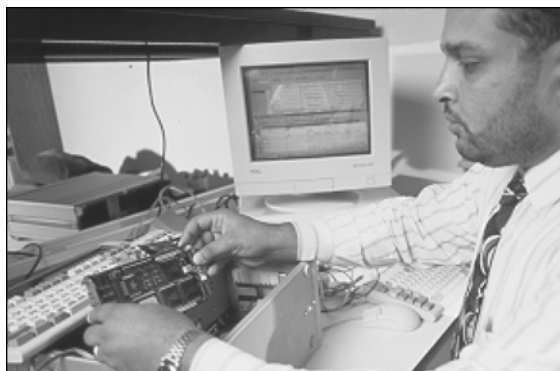
Introduction

The competition in the programmable logic arena revolves around supplying higher density devices incorporating increasing functionality. Altera Corporation currently leads the field in these areas. To help maintain its position, the company recently released a new PCI core design for exclusive use by its programmable logic customers. Applying the Agilent Technologies E2920 PCI Series of Computer Verification Tools to the validation of the core design enabled Altera to release a more reliable, higher quality design to market much more quickly than would otherwise have been possible. Altera finds that customers appreciate their application of Agilent tools to their design evaluation, and that this appreciation translates into a competitive advantage for Altera in their market.

The company

Altera Corporation of San Jose, California, is the number one producer of high density programmable logic devices worldwide. Its FLEX 10K product line leads the marketplace in density and speed of device design. Altera integrates an entire system into the confines of a single device-glue logic, DMA engine, FIFO, control logic, and whatever else the customer needs to meet performance requirements. The FLEX 10K family is the largest programmable logic device family on the market.

What makes Altera the leader, according to Ziad Abu-Lebdeh, Senior MegaCore Development Engineer, is its execution and its time-to-market. In the case of the recently released PCI Bus Master/Target MegaCore (tm) Function, Abu-Lebdeh credits Altera's use of the E2920 PCI Series of Computer Verification Tools with enabling the company to achieve a very fast time-to-market by confidently performing multiple tests on a single platform to produce a virtually bug-free product for its customers.



Abu-Lebdeh, Senior MegaCore Development Engineer, tests the PCI MegaCore with the Agilent E2920 Verification Tools, PCI Series.



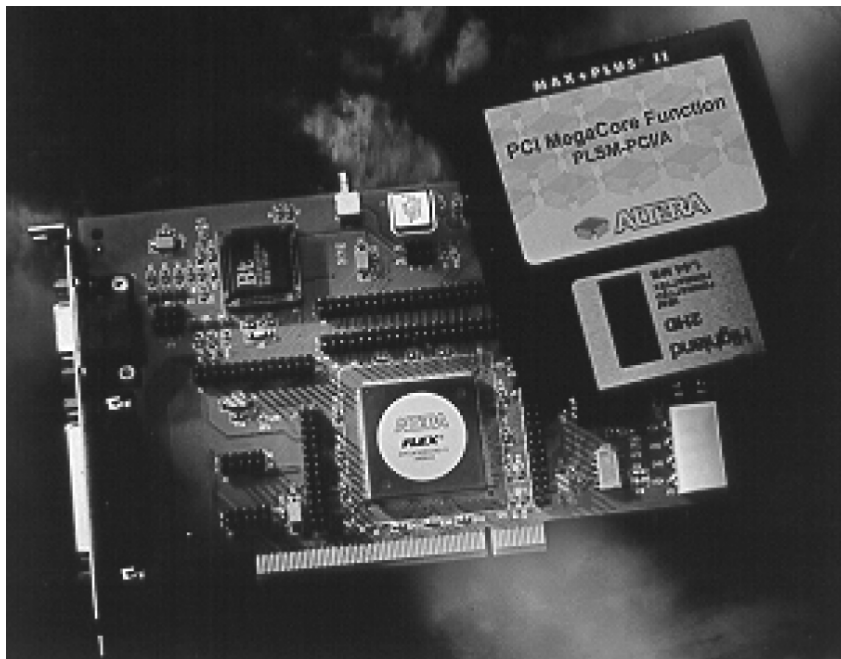
Agilent Technologies

A considerable service

Since the FLEX 10K family release in the fall of 1995, Altera has seen an increase in PCI-based systems using FLEX 10K devices. To ensure their customers' success in PCI design and to shorten their customers' design cycles, Altera chose to develop a core that could be sold independently and incorporated by Altera's customers into their own designs as needed.

The result was the PCI Bus Master/ Target MegaCore Function (PCI/A), which provided a 32-bit PCI bus supporting 33 MHz operation and zero-wait-state burst mode. The MegaCore can perform a zero-wait-state PCI read at a peak PCI Bus throughput of 107 Mbytes/second and a zero-wait-state write at a peak PCI Bus throughput rate of 102 Mbytes/second. This approach represents a considerable service to Altera's customers. For the customer to develop a PCI interface on their own could mean adding a good six months to the time-to-market of the product at hand. Having a known and reliable core supplied to them by Altera, that can simply be dropped into its proposed design, provides customers with a substantial boost in time-to-market.

However, before they can be convinced to buy instead of build, the customer must first be satisfied that the core meets two critical criteria: it conforms to the PCI specification and it is bug-free. Neither of these requirements is trivial. The PCI specification alone is embodied in a manual an inch thick.



Altera's PCI MegaCore Function

Developing MegaCore

Altera proceeded to develop its PCI MegaCore. Having created the design, they then considered three approaches to bringing it up and debugging it. First, they could try extended periods of simulation. However, even with untold hours or days of simulation, they concluded that the test coverage would still be insufficient because of the huge number of variables associated with PCI.

The second alternative was to allow customers to start designing with the MegaCore and take the approach that the company would respond to problems if and when they arose. Theoretically, this is a viable approach with programmable

logic. However, the risk is that the problems will fail to materialize until five to ten thousand units have been delivered. The cost of correcting errors at that point can be substantial in terms of creating and installing upgrades across the customer base. There is also the matter of damage to the company's reputation for reliability, a cost which can only be measured over the long term as sales inexorably diminish.

So, rather than trying to wring out the design solely through simulation, or have their customers do it for them, Altera chose to invest in the E2920 PCI Series of Computer Verification Tools.

The E2920's dual purpose

The purpose of the Agilent E2920 PCI series is two-fold. First, it enables developers to determine that the function under test meets all the specifications required by the PCI standard. Second, it exercises the functionality of the design itself, generating real-world traffic conditions and applying stress beyond what is possible with current off-the-shelf devices during system validation.

PCI provides a specification which tells designers what they can and can not do. But it leaves them with a wide array of design possibilities—implicit in the specification are millions of variations. In an actual PCI system, the developer builds an interface to talk to other PCI devices. Of course, these other devices will probably not be devices that the developer has created. They can come from anywhere in the world. For example, a designer in China interprets the specification one way while a designer in California comes at it from an entirely different approach. Each designer will choose different variations or a different way of implementing compliance in the PCI device. The result is a wide array of these devices, and it is simply unrealistic to attempt to test a PCI interface function against every one of them.

Multiple tests on single platform

Instead, the strategy is to test for all of these approaches within the same platform so that the designer can develop multiple variations of interfaces easily and accurately. The designer can design more creatively across a range of possibilities without having to physically plug it into different chips in order to solve problems that may surface in the factory.

The Agilent PCI series allows the designer to do just that. It enables them to, for example, vary the wait states, burst size, latency, termination types, and potential errors. For each one of these parameters, the user establishes the variables they want to test: zero-wait-state, one-wait-state, two-wait-states, three-wait-states, and so forth. They input the parameters for each one of these variables. The PCI series then pseudo-randomly picks and chooses those variables. Because permutation of random protocol variations, rather than structured tests, place the heaviest stress on the design, the E2920 may do one-wait-state with a parity error on the fifth DWORD, for example, to simulate a random occurrence.

Quick and accurate testing

Previously, Abu-Lebdeh would write software programs that enabled him to perform structured tests on his MegaCore design, but never received much information from his tests in the way of problem indications. Then he turned to the E2920 to perform some randomly structured tests on his design and immediately uncovered a few major problems. Because simulation is incapable of randomly exercising the Core, these problems would have remained hidden until the design was released to the field and customers began using it.

In addition to testing the functionality of the Core, the Agilent PCI series also permits the developer to test the timing of the Core, which is a very important part of PCI.

Altera also liked other testing aspects of the E2920 PCI series. If they had run the MegaCore in a system and uncovered a problem, they estimate that figuring out the nature of the problem could take anywhere from a week to six months. With the analyzer, Abu-Lebdeh was able to discover the nature of the problem within minutes.

According to Abu-Lebdeh, what makes the tool so efficient is the quality of information it provides. All the data, including all the waveforms for the problem time are available for analysis. This speeds problem resolution significantly.

Another aspect of the instrument that Abu-Lebdeh found useful was its convenience. Instead of an instrument in an R&D lab, surrounded by and cabled into a host of other instruments, the E2920 card is simply plugged into the PC in his office along with the board under test. This easy installation provides him with everything he needs to debug his design, while performing his other job functions.

Finally, Altera customers are pleased to know that the MegaCore design was debugged by the Agilent E2920. They are reassured that Altera has completely debugged the design using the best tools available before releasing it onto the market. Altera's test procedures also speak about the company's care for the quality of its products.

Related literature

• <i>Agilent E2925B 32bit, 33 MHz, Agilent E2926B 32/64bit, 33 MHz PCI Exerciser & Analyzer,</i>	5968-3501E
• <i>Agilent E2928A 32/64bit, 66 MHz, PCI Exerciser & Analyzer, technical overview</i>	5968-3506E
• <i>Agilent E2940A CompactPCI Exerciser & Analyzer, technical overview</i>	5968-1915E
• <i>Agilent E2929A PCI-X Exerciser & Analyzer, technical overview</i>	5968-8984E
• <i>Agilent E2922A PCI-X Master Target Card, technical overview</i>	5968-9577E
• <i>Agilent E2976A System Validation Pack, Agilent E2977A System Test Library, technical overview</i>	5968-3500E
• <i>Agilent E2920 Computer Verification Tools, PCI Series, brochure</i>	5968-9694E
• <i>Intel discusses basic concepts of PCI performance and efficient use of PCI with the Agilent E2920 series, brochure</i>	5988-0448ENDE
• <i>HP NSD stabilizes server designs quickly and completely with the Agilent E2920 PCI Series, case study</i>	5968-6948E
• <i>HP HSTC speeds high-end server testing and reduces engineering costs with the Agilent E2920 PCI Series, case study</i>	5968-6949E

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