LTX-Credence Realizes Breakthrough Productivity Gains with MDO4000 Mixed Domain Oscilloscope

Customer Solution Summary

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Challenge

In the semiconductor ATE segment, speed is of the essence. For LTX-Credence being able to quickly demonstrate a viable test solution helps build customer confidence in the company's ability to meet the tight time-to-market requirements of its latest RF devices. Configuring test sets to mate a device to an ATE often requires time-correlated views of RF and digital signals that were difficult to achieve with conventional bench equipment.

Solution

The Tektronix MDO4000 mixed domain oscilloscope with four analog, 16 digital and one RF input, provides time-correlated views across time and frequency domains and supports in-depth analysis.

Benefits

LTXC engineers take advantage of the ability to see across two domains to quickly debug test set-ups for customers. With push-button insight into root causes, ATE set-ups that used to take a half day or more can now be reliably accomplished in minutes.

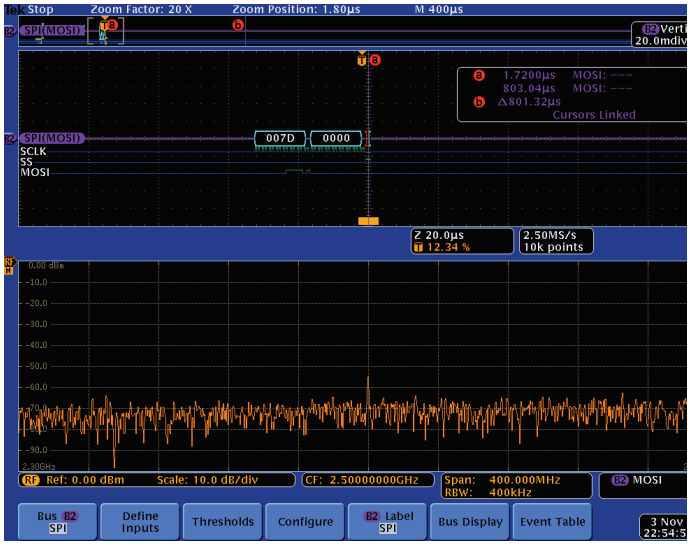

Figure 1
This illustrates the use of SPI bus data to initiate a trigger on the spectrum analyzer, in this case on the 007D 0000 data pattern.

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The Need for Speed

When it comes to semiconductor design and manufacturing, production test is at the end of the line. More often than not, chip designers are running behind schedule on their designs. And since automated test equipment (ATE) solutions can't be put in place until the chip design is completed, this inevitably puts the pressure on ATE suppliers such as LTX-Credence Corp. (LTXC) to help get the project back on schedule.

"In this business, time to market is critical," says Craig Vieira, senior RF applications engineer for LTXC. "Test is the last in line when a customer is already behind the curve. They know they need production test and need it fast. In reality they needed it two months ago."

RF front-end devices such as those often tested by LTXC customers present a difficult RF test challenge. By definition, the RF front end includes any of the components between an antenna and the baseband device. Testing these devices typically involves creating a custom test board for each new device to be tested. The test board is used to mate the device under test signals with the ATE system resources.

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Time	MOSI	MISO
-3.63E-05	0058 0005	
1.75E-06	00C5 0034	
3.78E-04	0000 04B3	
7.63E-04		

Figure 2
An event table provides instant verification of packets sent. Above is a SPI event table downloaded to an Excel spreadsheet.

Figure 3
The MDO4000's Spectrum Time (orange bar in the top half of the display) feature allowed LTXC engineer Craig Vieira to step through the different sections of a capture and see how the RF signal changed over time.

In a typical job, LTXC engineers such Vieira start with a data sheet that provides the details of the device to be tested. Tests can include power measurements or power consumption on the DC side as well as RF tests to look at critical parameters, such as the adjacent channel power. LTXC engineers then develop a test plan, configure the test system, design the test board and write test applications.

Correlation Challenges

During development and debug of the ATE application, LTXC engineers in the past turned to a combination of spectrum analyzers, oscilloscopes and logic analyzers. One of the more time-consuming aspects was correlating digital input signals with RF responses, such as measuring the RF settling time of a synthesizer. This involved a complex test configuration to allow different instruments to communicate and often some manual counting of 1s and 0s. All told, this aspect alone could take a half a day to complete — a problem when the clock is ticking.

Not surprisingly, when word about the new MDO4000 mixed domain oscilloscope arrived in LTXC labs, there was considerable interest as to whether it could indeed speed up test system debug. Based on the popular MSO4000 mixed signal oscilloscope that combines analog and digital inputs, the MDO4000 is the first oscilloscope to also include a full spectrum analyzer in a single instrument. It features four analog inputs, 16 digital inputs and one RF input. For LTXC, the real highlight was integrated timing and triggering across the time and frequency domains.

Rapid Insight

To see if the MDO4000 was a good fit for LTXC's busy lab environment, Vieira took on the task of putting the instrument to the test. Thanks to the MDO4000's familiar and intuitive user interface, it didn't take long for Vieira to obtain a result — about 30 minutes compared to hours using the older method.

The evaluation test consisted of setting up an SPI bus (using three digital channels in a bus configuration with lines for CLK, DATA and ENABLE) and triggering. The objective was to measure the settling time of a synthesizer. The first step was to initiate a trigger on the "007D 0000" data set as shown in Figure 1. The upper left corner shows a zoomed-in window and the signals below the SPI bus data represent the individual data signals that make up the bus. Not only did this immediately show the programmed information, but the data could be used as a triggering mechanism for the MDO4000's spectrum analyzer. Vieira then set up the vertical (time) cursor "A" to indicate the start of the settling time calculation. The RF spectrum shows a small signal at 2.5GHz, the frequency Vieira programmed into the synthesizer.

Next, Vieira discovered that an event table could be displayed and also saved in .csv format. This is helpful for debugging pattern data without counting 1s and 0s. Data showing which packets were sent could be instantly verified, as shown in Figure 2, using Microsoft Excel.

> *"[Regarding the MDO4000's Spectrum Time] If you look past the window in the immediate view (very top shows the entire capture) later on in time it looked like the phase starts walking and has some glitches. Without this feature, this could have been troublesome to detect and debug,"*
> Craig Vieira,
> Senior RF Applications Engineer, LTXC

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Figure 3 shows a single capture analyzed after the initial trigger. The bottom half of the screen is the spectral display, showing the settled 2.5GHz signal. By moving the MDO4000's Spectrum Time (orange bar in the top half of the display) through the acquisition, Vieira was able to step through the different sections of the capture and see how the RF signal changed over time. The top half of the screen also shows RF versus time traces (amplitude, frequency and phase.) For LTXC's purposes, the signal could be considered settled when all three settled out. With the cursor set at "B" the delta is shown as 202 µs settling time.

Beyond determining settling times, Vieira also noticed that the MDO4000 provided new insight that could be useful for debug. "If you look past the window in the immediate view (very top shows the entire capture) later on in time it looked like the phase starts walking and has some glitches. Without this feature, this could have been troublesome to detect and debug," he notes.

Portable and Versatile

Based on Vieira's evaluation, LTXC added an MDO4000 to its lab instrument lineup. The reception has been extremely positive among the more than 10 engineers in the RF group. Thanks to its portability and versatility, the MDO4000 sees daily use for a variety of test and measurement tasks both large and small. And when it comes to decoding SPI or 12C bus data and matching it to RF signals, the MDO4000 is the only fully integration solution available on the market today.

Adds Vieira, "Maybe the MDO4000 get us the business because we can get the data sets and test boards to our customers that much quicker."

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