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Revolutionize automated test equipment

Manufacturers of consumer gadgets and appliances have answered customers' demands for enhanced capability and productivity. Portable electronics now feature more battery life; phones and PDAs have merged functions and features; toys and games deliver better graphics and control; automobiles are now more closely aligned to modern PCs than the iron and aluminum cores they were built from; and wireless applications using WLAN, WiMAX, Bluetooth and Zigbee devices are proliferating.

The active growth cycle in these segments puts a severe strain on manufacturing capacity, and requires a higher degree of performance and flexibility than what has been available so far. In addition, rapid product adoption requires the lowest possible selling price, as the shelf-life of these devices can be less than nine months. Manufacturing capacity needs to be adaptable to fluctuating market trends. At the same time, manufacturing costs must be reduced to lower the test-per-device cost.

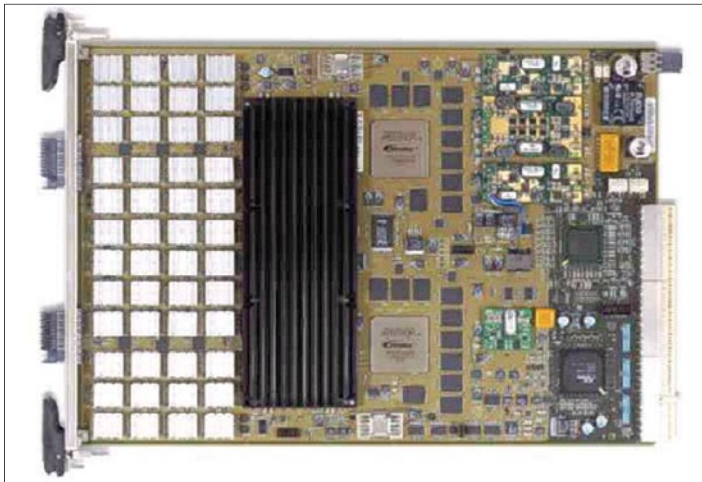

Figure 1: Sapphire D series has high-density and highly efficient digital, analog and power channels.

Feature-rich gadgets are also contributing to the significant increase in the content mix of ICs in each application. A typical camera contains digital, analog and mixed-signal ICs, as well as flash memory. The same is true for many cellphones, MP3 players, GPS and automotive subsystems, even though many of these also contain RF ICs. However, a closer look at the IC composition of these high-volume applications will show that the largest growth segments driving the market are MCUs, display drivers and cellular baseband devices.

To meet these requirements, Credence has added Sapphire D-40 to its Sapphire D series, which includes Sapphire D-10, a multi-purpose wafer sort and final test solution designed to address the economic requirements of the MCU, wireless baseband, display driver and low-cost consumer mixed-signal device markets. Sapphire D-10 is also optimized for the 200Mbps probe market and supports multisite production.

Sapphire D-40 promises four times the performance of the Sapphire D-10. Incorporating Credence's Modulated Vector Network Analysis (MVNA) technology, the new solution expands Sapphire D's scope to include wireless test capabilities for cellphone, WLAN, WiMAX and Zigbee devices.

Design balance

The Sapphire D series merges core Credence IP with advanced data-infrastructure technologies to integrate more features, functions and performance into an ultracompact test system. Credence-derived ASICs provide high-channel density for digital instrumentation. When combined with an infrastructure supporting high-speed data links, the architecture lowers the platform cost and provides performance needed for feature-rich growth segments.

The size of Sapphire D solutions scales from desktop debug and characterization to full-volume production on the same platform. This product series consumes less power than similar systems. It is air-cooled, and most configurations can be powered from any outlet supporting 100-240Vac. The portable Sapphire D series does not require complicated fixtures or an environmental infrastructure. Portability allows debug and characterization to be accomplished without using production time on the test floor. A user-friendly software interface facilitates rapid debug and test development, thus improving time-to-market for new products.

Digital resources—Sapphire D series has high-density and highly efficient digital, analog and power channels—hence, its compact size. Sapphire D-10 supports up to 798 digital channels and 16 power channels in a system not much bigger than a medium tower PC. Following Sapphire D-10, Sapphire D-40 has four times the performance and a footprint only 25 percent larger than a single Sapphire D-10. One of the keys to these high-density digital channels is Credence's patented Omni ASIC. Each DPIN96 instrument card in a Sapphire D series platform contains two Omnis, each supporting 48 channels. This power ASIC implements the edge and period timing, APG and some pattern-sequencing functions on the same chip.

MVNA RF measurement option—MVNA RF architecture is an integration of different technologies, including distributed signal processing, encapsulated measurement algorithms and high-performance front-end electronics. First introduced in the ASL3000RF, its purpose is to deliver RF measurement accuracy with short test times. The MVNA RF option provides highly efficient test program development with advanced signal processing algorithms that include modulation waveforms and error vector magnitude measurements for wireless communication standards, such as W-CDMA, WiMAX and 802.11n. The RF-measurement option is available in 16 and 32 ports, allowing the move beyond the dual and quad site test configurations common in today's wireless device testing. With four to eight parallel receivers, the MVNA RF option enables multisite testing, taking advantage of its DSP engine per receiver architecture to deliver parallelism with truly parallel processing.

Mixed-signal resources—Each arbitrary waveform generator and digitizer instrument supports four different channels, and can

Figure 2a: The Sapphire D-10 supports up to 798 digital channels and 16 power channels in a system not much bigger than a medium tower PC.

Figure 2b: The Sapphire D-40 has four times the performance and a footprint only 25 percent larger than a single Sapphire D-10

perform high-accuracy or high-frequency operations, selectable on-the-fly. The quad-channel, multiband architecture of these instruments targets efficient multisite testing or testing ICs with multiple ports supporting diverse mixed-signal functions.

For example, a highly integrated cellphone may include separate audio, video and baseband ports all on a single device. The different applications have significantly different performance needs. Audio applications typically demand high accuracy at low frequency, while video and baseband applications require less accuracy but higher frequency. On some competitive test platforms, separate instruments are needed to operate in these different frequency and performance ranges. Sapphire D series mixed-signal technology supports separate paths for higher precision and high frequency in the same instrument. A single wideband, high-performance instrument is a cost-effective way to test a variety of products, because the alternative method of having discrete instruments focused on audio or video is expensive and inflexible. Savings can be over $100,000 per system, especially when several devices must be tested simultaneously.

The high-density digital instruments and multiband mixed-signal instruments allow test system configurations to be simplified, because fewer instruments are required to deliver the required test capacity. Integrated instrumentation leads to simpler loadboards, docking hardware and manipulators. Integration also drastically reduces the number of components required for the design, thus lowering platform cost. In addition, fewer components mean higher reliability and less downtime, further reducing the overall cost-of-test and cost-of-ownership.

Modular architecture

Sapphire D series platforms easily adapt to new products or changing product mixes. This open plug-and-play architecture provides an any-slot-any-function capability with 10 interchangeable instrument slots on the Sapphire D-10 and 40 on the Sapphire D-40. These instrument slots allow for easy scaling from engineering applications to multisite production or from digital to mixed-signal applications.

Complete flexibility is possible with the industry-standard CompactPCI (cPCI) backplane. The system's instruments have been adapted to this protocol. They have been rigorously tested, and the methodologies for testing have been perfected. Extensive device libraries have been created while extended uses for these instruments have been implemented, refined and documented. Production-proven technology enables rapid test program development, provides streamlined test times and guarantees low-risk production testing.

The Sapphire D-40 uses a combination of Credence IP and broad-based industry standards, including Linux, cPCI, Standard Test Interface Language (STIL) and standard test data format to create a highly scalable data infrastructure similar to that used

Sapphire D series specifications		
	Sapphire D-10	Sapphire D-40
Instrument slots	10	40
Digital pins	768	3,000+
Analog pins	144	576
Mixed-signal pins	36	144
Test site capacity	256	1,022
Data rates	200Mbps	200Mbps
MVNA RF channels available	N/A	16 or 32
Power requirements	100-240Vac	190-240Vac
Cooling system	Air-cooled	Air-cooled

Table: The Sapphire D series' open architecture enables users to customize their configurations with third-party off-the-shelf instruments.

on the Internet. This data infrastructure allows users to grow data path bandwidth and power availability in segments as test needs grow.

The Sapphire D series' open architecture enables users to customize their configurations with third-party off-the-shelf instruments. In addition, custom instruments can be designed and integrated into the platform to meet unique testing requirements for special functions or characterization.

High throughput

The high-speed switched network infrastructure, the heart of the Sapphire D series' architecture, can move data transparently throughout the test system at data rates of up to 500MBps without significantly loading the host computer. These high-speed data rates help minimize test times, especially for consumer devices requiring extensive data capture, transport and processing.

Execution time is minimized, as the host controller allows datalog generation and test program sequencing to be a priority without considerable interruptions due to data transfer and processing. For example, Sapphire D-40 has been designed to move significant test data as quickly as possible from the device through the instrument and onto a Linux PC. It allows the user to take advantage of the rapid pace of PC processor performance gains that have been enabled by advanced multithread software. The technology and architecture used in Sapphire D series reduces test times and increases throughput.

This article is contributed by Credence Systems Corp.