
Curtiss-Wright's CHAMP-AV6 VPX DSP Engine Achieves Unmatched 8.68 GB/s Sustained Inter-Card Data Rates

Performance Tests Measured SRIO Data Streams Between Dual CHAMP-AV6 Cards: Delivers 92% of SRIO "Wire-Speed"

LEESBURG VA -- April 2, 2008 – Curtiss-Wright Controls Embedded Computing, a leading designer and manufacturer of rugged deployed commercial off-the-shelf (COTS) VME, VPX and CompactPCI products for the Aerospace and Defense market (A&D), has announced the results of recent performance testing for its CHAMP-AV6 VPX digital signal processor (DSP) engine. In the test, two quad FreeScale 8641 Power Architecture-based CHAMP-AV6s delivered a previously unachievable sustained intercard data rate of 8.68 GB/s, highlighting the performance advantages of Serial RapidIO (SRIO) over the new VPX bus architecture. The test results, which indicate a 16x improvement (approximate) over a quad PowerPC-based VME-based DSP engine using StarFabric underline the advantages of the VPX standard, collaboratively developed by COTS industry leaders and prime military integrators, which delivers a high-speed serial interconnect with a form-factor and feature set specifically designed to meet the most demanding A&D applications.

“While many frequently focus on CPU performance as figure of merit, experienced signal processing engineers know that inter-processor bandwidth often defines the limits of performance,” said Lynn Patterson, Vice President and General Manager of Curtiss Wright’s Modular Solutions group. “A recent survey re-confirmed this with 77% of respondents identifying processor-to-processor bandwidth of key importance to their signal processing algorithms.”

Designed to meet today’s most challenging computing applications, such as radar and image processing, the VPX bus architecture supports high bandwidth data rates. The two CHAMP-AV6 cards achieved the sustained 8.68GB/s inter-card data rate through use of the VPX’s four high-speed serial ports. In comparison, the VXS bus architecture only provides two high-speed serial ports. The ability of VPX to deliver 2x the peak bandwidth available from VXS enables the implementation of distributed switch fabric systems without the use of the separate switch card required with VXS.

“This test result is a great demonstration of the real-world benefits of SRIO in high-performance embedded computers,” said Tracy Richardson, Vice President of Marketing for Tundra Semiconductor Corp. “Tundra designed the Tsi568A/Tsi578 SRIO switches to support next generation system architectures such as the VPX standard. We are delighted to see Curtiss-Wright harnessing the speed and low-overhead of SRIO for these bandwidth intensive applications”

The high data rates in the CHAMP-AV6 testing were achieved without using specially optimized benchmark software code. Instead, Curtiss-Wright's standard IPC communications library was used, highlighting the inherently low overhead of both SRIO and the IPC library, which together were able to deliver approximately 92% of the "wire speed" of the SRIO links. This impressive result was accomplished with almost zero loading on the 8641 processor cores, illustrating the ability of the CHAMP-AV6 hardware and software to take advantage of multiple SRIO links between two cards while maintaining high levels of simultaneous compute capability.

Vigorous, Demanding Tests

In December, 2007, the CHAMP-AV6 was subjected to a battery of harsh environment testing to ensure its survivability in A&D applications where extreme conditions may range from the heat of a desert tarmac to the intense cold of high-altitude flight. These tests included operating over the -40°C to 85°C card-edge temperature range. The conduction-cooled card was also subjected to, and successfully survived, 40g shock, 10g sine vibration and 0.1g² random vibration tests. Full details of the environmental specifications are available on the Curtiss-Wright website, www.cwcembedded.com

The CHAMP-AV6

The CHAMP-AV6, introduced in January, 2006, is the industry's first VPX DSP board. It was an integral component in the first live demonstration of a working VPX system in January, 2007. The announcement of its successful environmental qualification articulates that the development of new VPX hardware continues, as expected, to meet the roadmap timetable that Curtiss-Wright has committed to its customers.

With four on-board Power Architecture (PowerPC) processors, this DSP engine is kept cool using Curtiss-Wright latest conduction-cooling techniques to ensure efficient cooling and optimal performance. Curtiss-Wright is an established leader in the development of innovative cooling techniques for embedded A&D hardware and holds several conduction-cooling technology patents. Also helpful in maintaining optimal operating temperatures is the board's use of the 1.0" pitch option defined by the VPX-REDI standard (VITA 48) that enables the use of several enhanced mechanical design elements to achieve higher power dissipation. The CHAMP-AV6 is also available in a Line-Replaceable Module (LRM) variant that comprises front and rear protective metal covers to ensure safe repair and replacement in-the-field.

The CHAMP-AV6's VPX format provides backplane connectors capable of handling signaling speeds in excess of 6.25 Gbits/sec. The VPX connectors also enable multi-gigabit/sec I/O to be handled from the board's onboard XMC/PMC site. The board features four Freescale 8641 single/dual-core processors. The 8641, FreeScale's latest AltiVec-enabled processor, has dual integrated 64-bit memory controllers and offers vastly increased memory read performance compared to prior generations of PowerPC processors. This enhanced performance translates directly to reduced execution times for user application software. For numeric-intense processing the 8641 offers the powerful

AltiVec instruction set extension which performs up to 8 floating point operations per cycle. For a dual-core device operating at 1 GHz this is 16 GFLOPS of peak floating point performance.

Multi-processor systems based on the CHAMP-AV6 benefit from the 10 GB/s full duplex bandwidth provided by the board's four Serial RapidIO (SRIO) ports; this represents a data throughput rate approximately 10x faster than prior generation VME/StarFabric implementations. Streaming data applications benefit from the board's 8.5 GB/s memory bandwidth and up to 4 GB of DDR2 SDRAM.

The CHAMP-AV6 also provides board-level support for 2-level maintenance requirements. 2-level maintenance can significantly reduce sparing and logistics requirements, thus reducing the total life-cycle cost of the systems in which the

CHAMP-AV6 is deployed. The board's VPX connectors include an ESD protection mechanism that, coupled with top and bottom covers at the module level, enable the board to be safely handled in deployed environments where standard ESD precautions are not practical. This support for 2-level maintenance requirements can significantly reduce sparing and logistics requirements, thus reducing the total life-cycle cost of the systems within which the CHAMP-AV6 is used.

CHAMP-AV6 Performance Features

- Four PowerPC single/dual-core 8641 CPUs @ 1GHz
- Up to 1Gbyte DDR2 SDRAM with ECC per processor
- 256 Mbytes Flash with write protection
- Permanent Alternate Boot Flash
- 128 Kbytes NVRAM
- Multi-board synchronous time-stamping feature
- Real Time Clock
- Temperature sensors
- VITA 48 1.0" pitch format
- VxWorks® BSP
- Continuum Vector DSP function library
- Continuum Inter-processor communications library
- Continuum Insights multi-processor development tools
- Range of air and conduction-cooled ruggedization levels available

CHAMP-AV6 I/O Features

- On-board Serial RapidIO interconnect
- Four Serial RapidIO ports to the VITA 46 core fabric
- Option for PCI Express (PCIe) port to the VITA 46 core fabric
- Gigabit Ethernet (GbE) with on-board switch
- Each processor has GbE connection to on-board GbE switch

- Two ports from GbE switch routed to backplane
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- One XMC site with x8 PCIe interface
- Additional x8 PCIe interface to the backplane
- Four EIA-232 serial ports
- Two EIA-422 serial ports
- Sixteen discrete LVTTTL I/O signals

Software for the CHAMP-AV6 includes support for operating systems including VxWorks and Linux (planned). Curtiss-Wright provides signal processing libraries and a high performance Inter-Processor Communications Library for message passing and bulk data transfers, extending to multiple boards connected via Serial RapidIO.

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Curtiss-Wright Controls Embedded Computing is the industry's most comprehensive and experienced single source for embedded solutions, ranging from Processing, Subsystems, Data Communication, DSP, and Video & Graphics to the most advanced board level components and fully integrated custom systems. The Embedded Computing group serves the defense, aerospace, commercial and industrial markets and is part of Curtiss-Wright Controls Inc. For more information about Curtiss-Wright visit www.cwembedded.com.

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