

Delphi Engineering Group's 3U VPX Digital Receiver Products Demonstrate Size, Weight, Power and Cost (SWaP-C) Benefits

Delphi Sensor Signal Processing and SWaP-C Benefits:

- Significantly Reduced Power Realization.
- Hi-Density ADC Data Conversion in a 3U form Factor.
- Increase in DSP Slices.
- Expanded System IO Performance.
- Compelling Product and Total Cost of Ownership Savings.

Today's Department of Defense (DoD) has a sharp focus on reducing embedded systems size, weight, power, and cost (SWaP-C) across virtually all military and aerospace applications. Now more than ever, SWaP-C technologies such as 3U VPX, demonstrate significant and measureable improvements in areas such as: sensor signal processing, increased mission life, and reduced total cost of system ownership (TCO). The performance, reliability, and modularity of the 3U VPX form factor has contributed to its emergence as the board of choice for new sensor systems and program refresh efforts.

In an era of DoD reduced budgets, size, weight and power reductions in electronics systems are simply not enough. The "C" for cost will need to be every bit as compelling as the technical advantages of moving to a 3U VPX system architecture. To meet this challenge, Delphi Engineering Group, Inc. (DEG) has developed a family of powerful digital receiver products that meet and exceed the DOD's SWaP-C initiatives.

The VPF, VP7, and VPU: Delphi 3U VPX Digital Receivers



The Delphi family of 3U VPX Digital Receiver products add the latest cutting-edge technology to the SWaP-C story. By incorporating the latest Xilinx Virtex-7 and Ultra-Scale FPGAs, as well as leading-edge data converters, Delphi provides the highest density and most capable digital receivers on the market. The Virtex-7 and UltraSCALE

FPGA families offer significant resource and IO speed improvements over previous VME offerings. Dual Xilinx Virtex-6 SX family FPGAs are commonly used on 6U VME/VXS form factor FPGA carriers. When compared to the Xilinx Virtex-6, improved FPGA processing capability is achieved on the digital receiver using a single Virtex-7 FPGA. A DSP rich FPGA, such as the Virtex-7 VX690T, makes for a much more powerful signal processing system and decreases application latency, which is a vital requirement in real-time, Electronic Warfare (EW) embedded computing platforms.

In addition to the performance enhancements offered by the Delphi VPX products, there are important cost savings realized as well. Reduced component count, coupled with lower core and IO voltages, result in much higher signal processing per watt than traditional VME/VXS digital receiver predecessors. Reduced board costs result in lower system TCO as well. The following table illustrates several advantages of the Delphi VP7 digital receiver as compared with a legacy 6U VME/VXS receiver.

VP7 SWaP and Performance Advantages Over 6U VME/VXS

Item	VP7-690 3U VPX	6U VME 64x/VXS	VP7 Advantage
ADC Channels	4 @ 1.8GS/s. Integrated Digital Receiver.	4 @ 1.8GS/s. Two FMCs Used in Addition to Carrier.	High Density ADC, Reduced Board Count
FPGA	Single Virtex-7 VX690 T.	Dual Virtex-6 SX315T.. 3 rd FPGA for Board Management.	Lower Power, Increased FPGA Fabric
DSP Slices	3,600	2,688 (1,344 x 2)	912 More DSP Slices
Size	3.94" W x 6.3" H	9.18" W x 6.3" H	63% less surface area
Total Weight w/Heat Sink	1.0 lbs.	2.40 lbs.	1.4 lbs less
Total Power	47W	150W+	103 less Watts
IO Performance	X8 PCIE GEN 3.0: - 7.87 GBytes/sec	VME 64x Bus - 320 MByte/s	25X the IO Performance
Typical Cost	~ \$28,000	~ \$56,000	~ \$28,000 Savings LRU

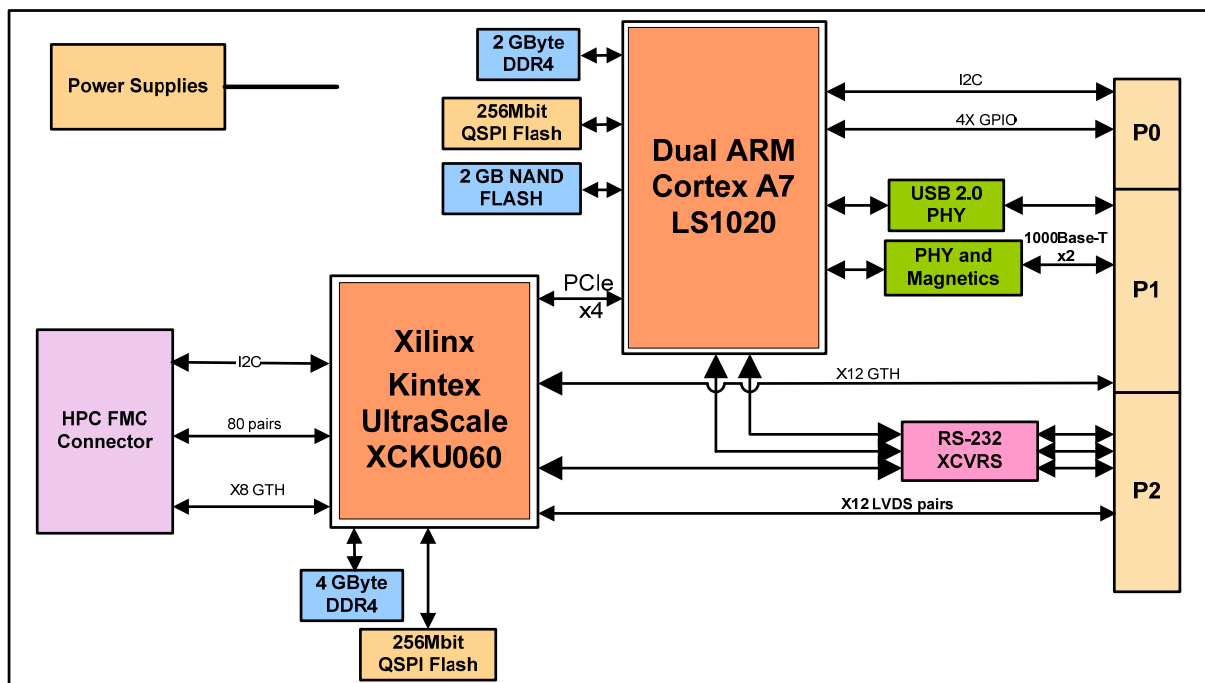
DEG VPU-060

Delphi's newest 3U VPX product, the VPU-060, provides even further SWaP-C benefits. This digital receiver employs a Xilinx UltraSCALE Kintex KU60 FPGA and an ARM Cortex-A7 processor. The powerful combination of FPGA and ARM processing leads to superior performance benefits within a 3U VPX framework. The VPU-060's ARM processor not only provides significant signal processing resources with its dual floating point engines, but also enables system control and communication functions, previously unavailable on FPGA only VME boards. The inclusion of the Dual ARM Cortex-A7 on the VPU-060 gives system designers the flexibility of using the VPU-060 for networking and control duties, in many cases eliminating a separate processor board used in similar VME/VXS systems.

DEG VPU Features

- Xilinx UltraSCALE Kintex 060
 - VITA 57 FMC Slot
 - 4 GB DDR4
 - 256 Mbit QSPI Flash
 - 12 GTH to VPX Connector
- NXP Dual-Core ARM A7 Processor (1 GHz)
 - 2 GB DDR4
 - 2 GB NAND Flash
 - 256 Mbit QSPI Flash
 - Dual 1Gbit Ethernet Ports

Delphi's VPU Block Diagram



For applications requiring high-speed throughput, as in Delphi’s DAQStream data acquisition systems, the high performance PCIE gen 3.0 interface of the VPU-060 facilitates optimal raw data capture and transfer between digital receiver and external memory storage.

The VPU-060 also includes a VITA 57 FMC slot, allowing user customization of the digital receiver through selection of one of Delphi’s many FMC digitizer products. The following table highlights the advantages of the Delphi VPU digital receiver as compared with a legacy 6U VME/VXS receiver.

VPU SWaP and Performance Advantages Over 6U VME/VXS

Item	VPU-060 3U VPX	6U VME 64x/VXS	VPU Advantage
ADC Channels	Quad 1.0 GS/s ADC FMC	a 1.0GS/s. Two FMCs Used.	High Density ADC
FPGA	Single UltraSCALE Kintex KU60	Dual Virtex-6 SX315T	Only One FPGA Required
DSP Slices	2,760	2,688 (1,344 x 2)	More DSP Slices
CPU	ARM Cortex-A7	None	Onboard Processor
Size	3.94” W x 6.3” H	9.18” W x 6.3” H	63% less surface area
Total Weight w/Heat Sink	1.0 Lbs.	2.40 Lbs.	1.4 lbs less
Total Power	45W	150+W	105 less Watts
IO Performance	X8 PCIE GEN 3.0: - 7.87 GBytes/sec	VME 64x Bus - 320 MByte/s	25X
Cost	~ \$25,000	~ \$51,000	~\$26,000 LRU Savings

The Delphi 3U VPX boards are designed to the VITA 46.1 standard. Delphi Engineering Group is a member of the VITA Standards Organization (VSO).

Conclusion

The DoD motto today is: “Do more, with less”. In keeping with this mindset, 3U VPX can deliver real cost savings for both next generation sensor platforms and program refreshes. The SWaP and processing performance benefits of the DEG VP7, VPF and VPU digitizers, offer a compelling technical case as well. The Delphi Engineering Group, with its portfolio of industry leading, digital receiver technology, is uniquely positioned to support the most demanding DoD sensor and EW program requirements.