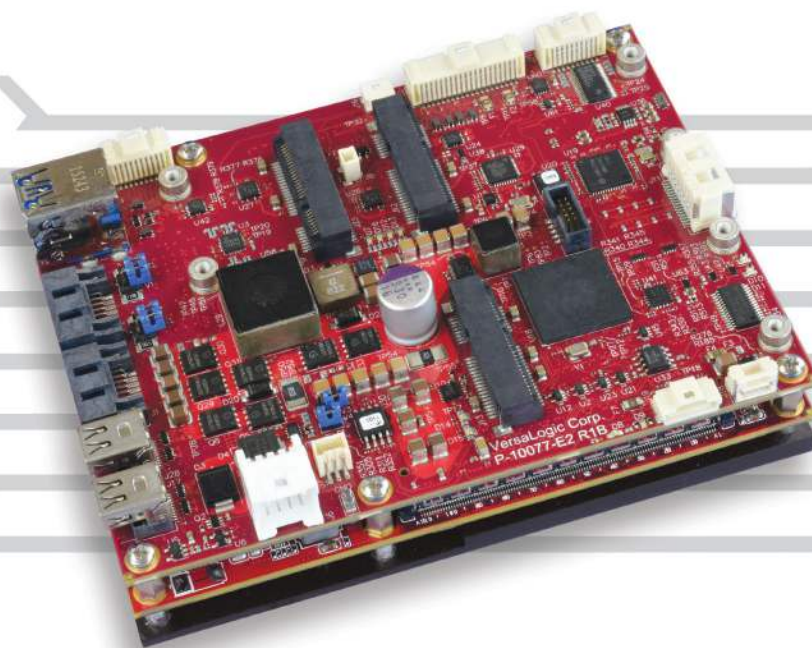


# Blackbird

## Embedded Processing Unit



95 x 125 x 37 mm  
(3.7 x 4.9 x 1.5")

### Overview

The Blackbird is a compact, rugged x86 type board-level embedded computer. It has been engineered and tested to meet the military and medical industries' evolving requirements to develop smaller, lighter, and lower power embedded systems while adhering to stringent regulatory standards. The Blackbird is a member of the VersaLogic family of ultra-rugged EPU embedded computers. Using fully integrated COM components, the Blackbird is supplied fully assembled and tested, including heat plate, ready to install in a system. In addition to providing a very compact footprint, it is designed to withstand extreme temperature, impact, and vibration.

The Skylake processor options feature quad- and dual-core CPUs along with Hyper-Threading logic allowing up to 8 simultaneous threads to be executed. The Blackbird provides great performance and I/O features, moderate power consumption (15 to 22 W typical depending on model), and a compact package. The Blackbird provides compatibility with a broad range of standard x86 application development tools for reduced development time.

The on-board Power Management Unit greatly simplifies system power supply requirements. It features a wide input voltage range of 8 to 30 volts so it is fully compatible with 12 or 24V vehicle applications. It also includes reverse voltage protection,

*continued* ►

### Highlights

- -40° to +85°C operating temperature models
- Trusted Platform Module (TPM) security chip
- Shock & vibration per MIL-STD-202G
- 6th Generation Intel® Core™ “Skylake” processor
  - i7-6822EQ (quad core) or
  - i5-6442EQ (quad core) or
  - i5-6300U (dual core) or
  - i3-6100U (dual core)
- On-board Power Management
  - 8 to 30 volt DC input (12 and 24 volt system compatible)
  - Over- and reverse-voltage protection
  - RF noise filtering
  - Transient voltage protection
- A complete x86 embedded computer
- COM Basic size: (95 x 125 x 37 mm)
- Up to 32 GB DDR4 RAM
- Two Gigabit Ethernet
- Two mini DisplayPort and LVDS video outputs
- Three Mini PCIe Sockets
- Two USB 3.0 port, four USB 2.0 ports
- Serial I/O ports, SATA, Digital I/O
- Analog Inputs (8 chan.)
- Analog Outputs (4 chan.)
- HD Audio
- Customization available
- VersaAPI software support

# Overview *...continued*

over voltage protection, RF noise filtering, and transient voltage protection, to provide enhanced durability and reliability in the field.

Designed and tested for industrial temperature (-40° to +85°C) operation, the rugged Blackbird also meets MIL-STD-202G specifications for shock and vibration. Latching SATA,

Ethernet, power, and main I/O connectors provide additional ruggedization for use in harsh environments.

Blackbird is compatible with a variety of popular x86 operating systems including Windows, Windows Embedded, Linux, and VxWorks.

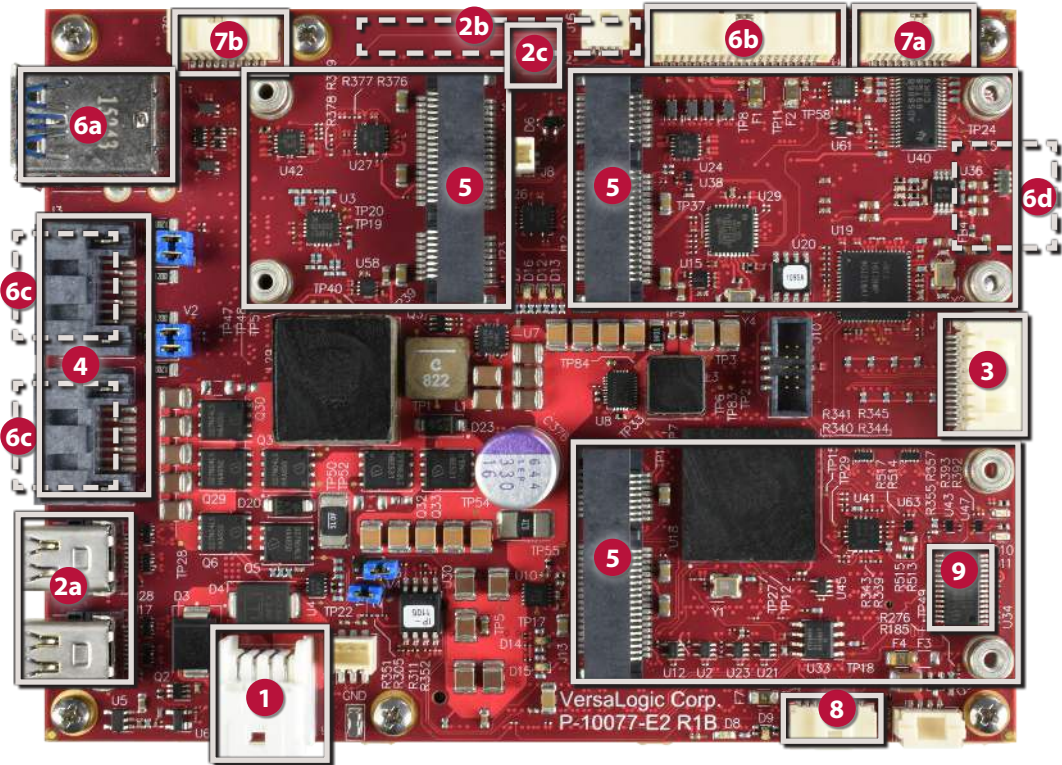
COTS modifications are available, even in low OEM quantities. Modifications include conformal coating, BIOS / splash screen configuration, application specific testing, BOM revision locks, custom labeling, etc. ■

## Features

- 1 On-board Power Management**  
Accepts 8 to 30 volts DC, and provides OVP, reverse polarity protection, RF noise filtering, and transient voltage suppression.
- 2 High-performance Video**  
Integrated Intel HD Graphics Gen 9 core supports DirectX 12, OpenGL 4.4, and H.264, MPEG-2 encoding/decoding. Two Mini DisplayPorts (2a) and a dual-channel LVDS video output (2b on back side). LVDS backlight control (2c).
- 3 Network**  
Two Gigabit Ethernet (GbE) ports. One port with remote boot support.
- 4 SATA**  
Two 6 Gb/s SATA ports support bootable SATA hard drives.
- 5 Mini PCIe Card Sockets**  
Two full- and one half-sized sockets. Supports Wi-Fi modems, GPS, MIL-STD-1553, Ethernet, flash data storage with auto-detect mSATA flash storage support, and other mini PCIe modules.
- 6 Industrial I/O**  
Two USB 3.0 ports (6a) and four USB 2.0 ports (6b) support keyboard, mouse, and other devices.  
  
Four RS-232/422/485 serial ports (6c on back side), three 8254 timer/counters, I2C support, and audio output (6d on back side).
- 7 Analog + Digital I/O**  
On-board data acquisition support. Eight multi-range analog inputs, four analog outputs (7a), and twenty four 3.3V digital I/O lines (7b).
- 8 SPI Interface**  
Supports SPI and SPX devices, including low cost analog and digital modules.
- 9 Trusted Platform Module**  
On-board TPM security chip can lock out unauthorized hardware and software.

- Intel Core “Skylake” Processor**  
*(not shown)*  
Up to 2.6 GHz clock rate. Quad- and dual-core options.
- RAM** *(not shown)*  
Up to 32 GB DDR4 RAM.
- Industrial Temperature Operation**  
-40° to +85°C operation for harsh environments.

- MIL-STD-202G**  
Qualified for high shock/vibration environments.
- Software Support**  
Compatible with a variety of popular x86 operating systems including Windows, Windows Embedded, Linux, and VxWorks.



### Tailor Blackbird to Your Exact Requirements

COTS modifications are available in quantities as low as 100 pieces.

- Conformal Coating
- Custom Cabling
- Connector & I/O Changes
- Custom Testing
- Custom Labeling
- BIOS Modifications
- Software and Drivers
- Environmental Screening
- Revision Locks
- Application-Specific Testing
- And more –

## Specifications

|   |   |                         |                 |  |
|---|---|-------------------------|-----------------|--|
| <b>General</b>                              |   |                         |                 |  |
| <b>Board Size</b>                           | 95 x 125 x 37 mm (3.74 x 4.92 x 1.45")  |                         |                 |  |
| <b>Weight</b>                               | 378 grams (13.33 oz.)   |                         |                 |  |
| <b>Processor</b>                            | Intel 6th Gen Core platform. 8 MB SmartCache. Intel 64-bit instructions, Hyper-Threading, Virtualization Technology (VT), SpeedStep Technology, and AES New Instructions.   |                         |                 |  |
| <b>Battery</b>                              | Connection for 3.0V RTC backup battery  |                         |                 |  |
| <b>Power Requirements (@ +12V) †</b>        | <i>Model</i>  | <i>Idle</i>             | <i>Typical</i>  | <i>Max.</i>                                |
|   | VL-EPU-4462-xAP-08  | 7.7W                    | 15.3W           | 23.0W                                      |
|   | VL-EPU-4462-xBP-16  | 7.4W                    | 15.6W           | 23.8W                                      |
|   | VL-EPU-4562-xBP-16  | 12.0W                   | 21.0W           | 30.0W                                      |
|   | VL-EPU-4562-xCP-16  | 12.0W                   | 21.6W           | 31.2W                                      |
| VL-EPU-4562-xCP-32                          | 12.0W   | 22.2W                   | 32.4W           |  |
| <b>Input Voltage</b>                        | 8V – 30V DC   |                         |                 |  |
| <b>Input Protections</b>                    | Over-voltage protection. Self resetting when input falls to a safe level. Reverse voltage input protection to -30V. RF noise filtering (900 MHz, 2.5/5 GHz) - Minimum of 30 dB RF attenuation above 100 MHz. Transient voltage protection (inductive kickback / lightning) clamp at ~+60V / -40V - MSL level 1, per J-STD-020, LF maximum peak of 260°C |                         |                 |  |
| <b>System Reset &amp; Hardware Monitors</b> | All voltage rails monitored. Watchdog timer with programmable timeout. Push-button sleep, reset, and power.   |                         |                 |  |
| <b>Regulatory Compliance</b>                | RoHS (EU 2015/863), Conflict Minerals compliant.  |                         |                 |  |
| <b>Environmental</b>                        |   |                         |                 |  |
| <b>Thermal Management</b>                   | Bolt-on heat plate standard. Optional heat sink, fan, heat pipe, and other thermal accessories available.   |                         |                 |  |
| <b>Operating Temperature</b> ◊              | <i>Model</i>  | <i>HeatPlate**</i>      | <i>HeatSink</i> | <i>HeatSink + Fan or Heat Pipe Adapter</i> |
|   | EPU-4x62-E  | -40° to +85°C           | -40° to +85°C   | -40° to +85°C                              |
|   | EPU-4562-W  | -20° to +70°C           | -20° to +70°C   | -20° to +70°C                              |
|   | Ranges shown assume 90% CPU utilization. For detailed thermal information and exceptions, refer to the VL-EPU-4562 Reference Manual. ** Heat plate must be kept below 90°C (80°C for EPU-4562-ECP)  |                         |                 |  |
| <b>Airflow Requirements</b>                 | Refer to the VL-EPU-4462/4562 Reference Manual for detailed airflow requirements.   |                         |                 |  |
| <b>Storage Temperature</b>                  | -40° to +85°C   |                         |                 |  |
| <b>Altitude</b> *                           | Operating   | To 4,570m (15,000 ft.)  |                 |  |
|   | Storage   | To 12,000m (40,000 ft.) |                 |  |
| <b>Thermal Shock</b>                        | 5°C/min. over operating temperature   |                         |                 |  |
| <b>Humidity</b>                             | Less than 95%, noncondensing  |                         |                 |  |
| <b>Vibration, Sinusoidal Sweep</b> □        | MIL-STD-202G, Method 204, Modified Condition A: 2g constant acceleration from 5 to 500 Hz, 20 min. per axis   |                         |                 |  |
| <b>Vibration, Random</b> □                  | MIL-STD-202G, Method 214A, Condition A: 5.35g rms, 5 min. per axis  |                         |                 |  |
| <b>Mechanical Shock</b> □                   | MIL-STD-202G, Method 213B, Condition G: 20g half-sine, 11 ms duration per axis  |                         |                 |  |
| <b>Security</b>                             |   |                         |                 |  |
| <b>TPM</b>                                  | Intel Trusted Platform Module 2.0 device.   |                         |                 |  |

† Represents operation at +25°C and +12V supply running Windows 10 with LVDS display, SATA, GbE, COM, and USB keyboard/mouse. Typical power computed as the mean value of Idle and Maximum power specifications. Maximum power measured with 95% CPU utilization.

◊ Derate -1.1°C per 305m (1,000 ft.) above 2,300m (7,500 ft.)

\* Extended altitude specifications available upon request

‡ TVS protected port (enhanced ESD protection)

§ Power pins on this port are overload protected

¥ Bootable storage device capability

|                                    |  |                               |
|------------------------------------|--|-------------------------------|
| <b>Memory</b>                      |  |                               |
| <b>System RAM</b>                  | Up to 32 GB DDR4 SDRAM.  |                               |
| <b>Video</b>                       |  |                               |
| <b>General</b>                     | Integrated high-performance video. Intel HD 520 and 530 - Gen-9 compute architecture, 24 execution units, and GPU Turbo Boost. Supports 3 independent displays. Supports DirectX 12, OpenGL 4.4, OpenCL 2.0. |                               |
| <b>Hardware Based Acceleration</b> | Decode and Encode of JPEG, MJPEG, MPEG2, AVC, MVC, HEVC 8-bit, VC-1, VP8, VP9  |                               |
| <b>DisplayPort Interface</b> §     | Two Mini DisplayPort++ outputs. 24-bit. Up to 4096 x 2160 at 60 Hz.  |                               |
| <b>OEM Flat Panel Interface</b>    | Dual-channel LVDS interface. 18/24-bit. Up to 1920 x 1200. Backlight control signals.  |                               |
| <b>Mass Storage</b>                |  |                               |
| <b>Rotating Drive</b> ¥            | Two SATA 6 Gb/s ports. Latching SATA connectors.   |                               |
| <b>Flash / SSD</b> ¥               | Mini PCIe socket with mSATA support  |                               |
| <b>Network Interface</b>           |  |                               |
| <b>Ethernet</b> ‡                  | Two AutoDetect 10BaseT/100BaseTX/1000BaseT ports. Latching connector. One port with network boot option.   |                               |
| <b>Device I/O</b>                  |  |                               |
| <b>USB</b> ‡§                      | Two USB 3.0 / 2.0 ports and four USB 2.0 host ports  |                               |
| <b>COM Interface</b> ‡             | Four RS-232/422/485 selectable. 16C550 compatible. 1 Mbps max.   |                               |
| <b>Digital I/O</b>                 | Twenty four TTL I/O Lines 3.3V. Independently configurable.  |                               |
| <b>Analog Input</b>                | Eight channels. 12-bit. Single-ended. 500 ksp/s. Independently configurable +/- 0.64V to +/- 10.24V high input impedance inputs  |                               |
| <b>Analog Output</b>               | Four channels. 12-bit single-ended. 100 ksp/s.   |                               |
| <b>I2C</b>                         | Single I2C interface   |                               |
| <b>Counter / Timers</b>            | Three 8254 compatible Programmable Interval Timers (PITs).   |                               |
| <b>Audio Input / Output</b>        | <i>Connector</i>   | <i>Signal Characteristics</i> |
|                                    | Line Input - Latching  | 10 kΩ minimum                 |
|                                    | Line Output - Latching   | 600 Ω (to drive a 10 kΩ load) |
| <b>VersaLogic SPI Interface</b>    | Supports SPI and SPX devices. Supports up to two SPX modules.  |                               |
| <b>Mini PCIe Card Socket</b>       |  |                               |
| <b>Full size Socket #1</b>         | Supports Wi-Fi modems, GPS receivers, MIL-STD-1553, Ethernet channels, non-volatile flash data storage, and other plug-in modules. USB, SATA, and PCIe signaling. Autodetect mSATA support.                  |                               |
| <b>Full size Socket #2</b>         | PCIe and USB 2.0 signaling   |                               |
| <b>Half size Socket #3</b>         | PCIe and USB 2.0 signaling   |                               |
| <b>Software</b>                    |  |                               |
| <b>BIOS</b>                        | AMI Aptio UEFI BIOS with OEM enhancements. Field reprogrammable  |                               |
| <b>Sleep Mode</b>                  | ACPI 3.0. Support for S3 suspend and S4 hibernate states.  |                               |
| <b>Operating Systems</b>           | Compatible with most x86 operating systems including Windows, Windows Embedded, Linux, and VxWorks   |                               |

□ MIL-STD-202G shock and vibrate levels are used to illustrate the extreme ruggedness of this product in general. Testing at higher levels and/or different types of shock or vibration methods can be accommodated per the specific requirements of the application. Contact VersaLogic Sales for further information.

Specifications are subject to change without notification. Intel and Core are trademarks of Intel Corp. All other trademarks are the property of their respective owners.



## Ordering Information

Call VersaLogic Sales at (503) 747-2261 for more information!

| Model              | Operating Temp.† | Processor | Cores | Hyper-Threads / Threading | CPU Clock / Turbo Speed | Graphics Core | Graphics Base Clock / Max Dynamic Speed | Memory | Cooling    |
|--------------------|------------------|-----------|-------|---------------------------|-------------------------|---------------|---|--------|------------|
| VL-EPU-4462-EAP-08 | -40° to +85°C    | i3-6100U  | 2     | Yes / 4                   | 2.3 GHz / NA            | HD 520        | 300 MHz / 1.0 GHz                       | 8 GB   | Heat Plate |
| VL-EPU-4462-EBP-16 | -40° to +85°C    | i5-6300U  | 2     | Yes / 4                   | 2.4 / 3.0 GHz           | HD 520        | 300 MHz / 1.0 GHz                       | 16 GB  | Heat Plate |
| VL-EPU-4562-WCP-16 | -20° to +70°C    | i7-6822EQ | 4     | Yes / 8                   | 2.0 GHz / 2.8 GHz       | HD 530        | 350 MHz / 1.0 GHz                       | 16 GB  | Heat Plate |
| VL-EPU-4562-WCP-32 | -20° to +70°C    | i7-6822EQ | 4     | Yes / 8                   | 2.0 GHz / 2.8 GHz       | HD 530        | 350 MHz / 1.0 GHz                       | 32 GB  | Heat Plate |
| VL-EPU-4562-EBP-16 | -40° to +85°C    | i5-6442EQ | 4     | No / 4                    | 1.9 GHz / 2.7 GHz       | HD 530        | 350 MHz / 1.0 GHz                       | 16 GB  | Heat Plate |
| VL-EPU-4562-ECP-16 | -40° to +85°C    | i7-6822EQ | 4     | Yes / 8                   | 2.0 GHz / 2.8 GHz       | HD 530        | 350 MHz / 1.0 GHz                       | 16 GB  | Heat Plate |
| VL-EPU-4562-ECP-32 | -40° to +85°C    | i7-6822EQ | 4     | Yes / 8                   | 2.0 GHz / 2.8 GHz       | HD 530        | 350 MHz / 1.0 GHz                       | 32 GB  | Heat Plate |

† Final operating temperature is dependent on the customer thermal solution

## Accessories

| Part Number            | Description   |
|------------------------|---|
| <b>Cable Kit</b>       |   |
| VL-CKR-BLACKBIRD       | BLACKBIRD Eval. cable kit. Includes VL-CBR-4005, 1014 (x2), 0702, 1604, 2004, 2005, 2032, 0809, 0810, HDW-401, and 108. |
| VL-CBR-4005            | System I/O paddleboard  |
| VL-CBR-0702            | SATA cable – rugged latching, 20"   |
| VL-CBR-1604            | Dual Ethernet cable, 16-pin Clik-Mate to 2 RJ-45 – rugged latching, 12"   |
| VL-CBR-2004            | Analog I/O cable and paddleboard, 1mm 20-pin, 12"   |
| VL-CBR-2005            | Digital I/O cable and paddleboard, 1mm 20-pin, 12"  |
| VL-CBR-2032            | miniDisplayPort to VGA adapter, 6"  |
| VL-CBR-0809            | Power adapter cable, 12V medium-power. ATX12 to Blackbird. 12"  |
| VL-CBR-0810            | Stereo Audio Cable, 8-pin Pico-Clasp to 3.5mm Jacks, 0.5m   |
| VL-CBR-1014 x2         | RS232 Dual channel cable 2xDsub (9-pin), Latching, 12"  |
| VL-HDW-401             | Thermal compound paste. For heat sink attachment.   |
| VL-HDW-108             | Mini PCIe / mSATA hardware kit (metric thread) 2.5 mm (10ea)  |
| <b>Cables</b>          |   |
| VL-CBR-0203            | 2-pin Latching Battery Module, 6"   |
| VL-CBR-0401            | ATX to SATA power cable, 6.25"  |
| VL-CBR-0404            | LED Back Light, 3-pin Pico-Clasp / 4-pin IDE Power to 6-pin 12V, 500mm  |
| VL-CBR-0503            | USB 2.0 Male A to Male Micro-B Cable, 0.5 m   |
| VL-CBR-0901            | Pico-Clasp to Dual SPX Cable, 9-pin. 9"   |
| VL-CBR-2014            | LVDS to VGA adapter board   |
| VL-CBR-2031            | miniDisplayPort to miniDisplayPort, 36"   |
| VL-CBR-2033            | miniDisplayPort to HDMI active adapter, 6"  |
| VL-CBR-3001            | 20" 2-Ch LVDS 30-pin JAE to 30-pin JAE, RoHS  |
| VL-CBR-3002            | 20" 1-Ch LVDS 30-pin JAE to 1.25mm 20-pin Hirose, RoHS  |
| VL-CBR-3003            | 20" 1-Ch LVDS 30-pin JAE to 20-pin JAE, RoHS  |
| <b>Hardware</b>        |   |
| VL-PS-ATX12-300A       | ATX development power supply  |
| VL-HDW-111             | Half- to Full-Size Mini PCIe Adapter kit. Metal adapter and screws (2)  |
| <b>Thermal Options</b> |   |
| VL-HDW-417             | Passive Heat Sink. Mounts to heat plate on standard product 95 x 125 x 15 mm  |
| VL-HDW-418             | 12V Cooling fan for optional use with HDW-417 heat sink.  |
| VL-HDW-423             | Heat Pipe Adapter Plate   |

## Expansion Modules

| Part Number                               | Description  | Form Factor |
|---|--|-------------|
| <b>Network</b>                            |  |             |
| VL-MPEe-E4E                               | Gigabit Ethernet over Fiber adapter (PCIe signaling) | Mini PCIe   |
| VL-MPEe-E5E                               | Dual Gigabit Ethernet adapter (PCIe signaling)       | Mini PCIe   |
| VL-MPEe-E6E                               | Gigabit Ethernet adapter (PCIe signaling)            | Mini PCIe   |
| VL-MPEe-E6E-P                             | Gigabit Ethernet with PoE+ adapter (PCIe signaling)  | Mini PCIe   |
| VL-MPEe-FW1E                              | FireWire adapter (PCIe signaling)                    | Mini PCIe   |
| VL-MPEu-C1E                               | Dual CAN BUS Interface (USB signaling)               | Mini PCIe   |
| <b>Serial I/O</b>                         |  |             |
| VL-MPEe-U2E                               | Quad serial plus twelve GPIOs (PCIe signaling)       | Mini PCIe   |
| <b>Analog &amp; Digital I/O</b>           |  |             |
| VL-MPEe-A1E                               | Analog input (12-bit resolution) (PCIe signaling)    | Mini PCIe   |
| VL-MPEe-A2E                               | Analog input (16-bit resolution) (PCIe signaling)    | Mini PCIe   |
| VL-SPX-1                                  | Analog Input Module 8-Channels                       | SPX         |
| VL-SPX-2                                  | Digital I/O Module 16-lines                          | SPX         |
| VL-SPX-4                                  | Analog Output Module 4-channels 12-bit               | SPX         |
| VL-SPX-5                                  | Solid State Switch Module 8-channel                  | SPX         |
| <b>GPS</b>                                |  |             |
| VL-MPEu-G2E                               | GPS receiver (USB signaling)                         | Mini PCIe   |
| VL-MPEu-G3E                               | Advanced GPS receiver (USB signaling)                | Mini PCIe   |
| <b>Solid-State Storage (flash memory)</b> |  |             |
| VL-MPEs-F1Exx                             | mSATA module (4/16/32 GB) (SATA signaling)           | Mini PCIe   |
| <b>Adapters</b>                           |  |             |
| VL-MPEs-S3E                               | SATA adapter (SATA signaling)                        | Mini PCIe   |
| <b>Video</b>                              |  |             |
| VL-MPEe-V5E                               | VGA and LVDS Interface (PCIe signaling)              | Mini PCIe   |

### Take the Risk out of Embedded Computing

Whether it's selecting the optimum solution for your application, providing expert support during development, or on-time delivery of defect-free products, VersaLogic is here to make sure your project goes smoothly from initial concept through the extended life of your program. Contact VersaLogic today to learn more.

