# Bengal

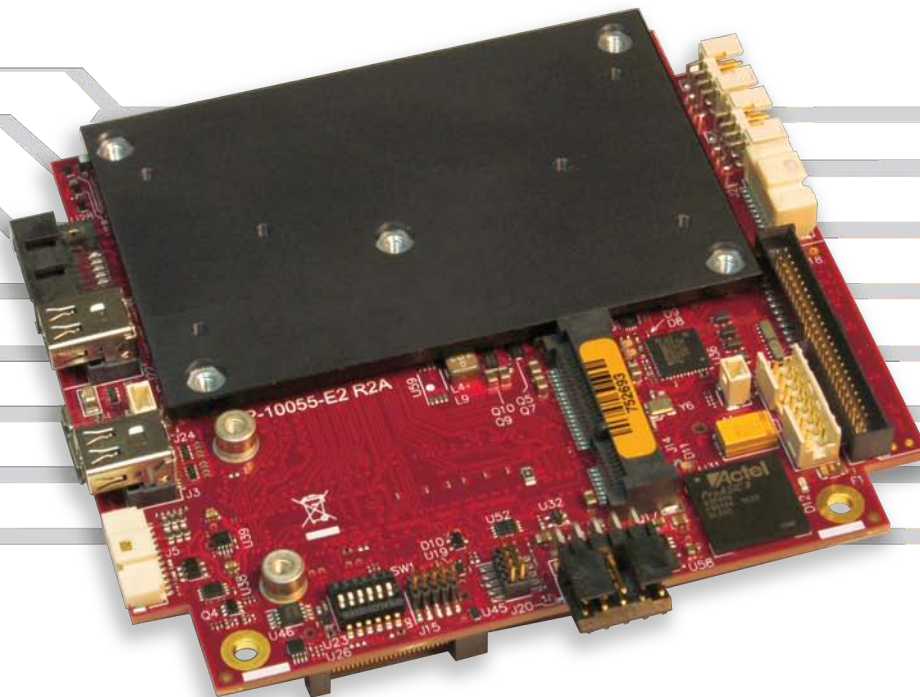## PC/104 Format Single Board Computer



## Overview

The Bengal is a low-power / high-performance single board computer (SBC) with a full complement of on-board I/O. Driven by the low power Intel® 22nm Silvermont microarchitecture, the Bengal provides up to 1.9 GHz of performance with quad, dual, and single-core processor options. Based on the industry-standard PC/104 format (4.23 x 3.77 inches), this SBC is an excellent solution for size, weight and power (SWaP) constrained applications.

Bengal is built on the new "PCIe/104 OneBank" format. Compatible with the PCI/104-Express format, it includes a legacy PCI connector, and a single bank high-speed PCIe connector. This provides flexible system expansion, while leaving more on-board space available for product features. The single bank connector is mechanically and electrically compatible with the existing PCI/104-Express Type 1 and Type 2 modules.

As with all VersaLogic products, the Bengal is designed to support OEM applications where high reliability and long-term availability are required. From application design-in support, to its 5+ year production life guarantee, the Bengal provides a durable embedded computer solution with an excellent cost of ownership.

## Highlights

- -40° to +85°C Operating Temperature
- Shock & vibration per MIL-STD-202G
- PCI/104 OneBank™ form factor
- 4th Generation Intel® Atom™ processor ("Bay Trail")
  - E3845 (quad core) or
  - E3826 (dual core) or
  - E3815 (single core)
- Trusted Platform Module (TPM) security chip
- Up to 8GB SO-DIMM RAM
- Gigabit Ethernet (2 ports)
- VGA and dual mini DisplayPorts
- Mini PCIe Socket / with mSATA support
- USB 3.0 and USB 2.0 ports
- Serial I/O
- SATA
- Digital I/O (18 lines)
- Fanless versions
- VersaAPI programming support
- Customization available in quantities as low as 100 pcs.

# Features

**1 Intel Atom "Bay Trail" Processor**

Up to 1.9 GHz clock rate. Quad, dual or single core options. Low power consumption.

**2 High-performance Video**

Integrated Intel Gen 7 graphics core supports DirectX 11, OpenGL 4.0, and H.264, MPEG-2 encoding/decoding.
Analog and Dual mini DisplayPort video outputs; both outputs support multiple display modes including Extended Desktop and Clone.

**3 Trusted Platform Module** *(on back side)*

On-board TPM security chip can lock out unauthorized hardware and software.

**4 RAM** *(on back side)*

Up to 8 GB DDR3L socketed memory, one SO-DIMM.

**5 Network**

Dual Ethernet interfaces, autodetect 10BaseT / 100BaseTX / 1000BaseT with remote boot support.

**6 Industrial I/O**

OOne USB 3.0 port and five USB 2.0 ports support keyboard, mouse, and other devices. Dual RS-232/422/485 serial ports, three 8254 timer/counters, I2C, PWM output, and audio support.

**7 Digital I/O**

Eighteen 3.3V digital I/O lines.

**8 SATA**

3 Gb/s SATA port supports bootable SATA hard drive.

**9 Mini PCIe socket**

Supports Wi-Fi modems, GPS receivers, flash data storage with auto-detect mSATA flash storage support, and other mini PCIe modules.

**10 SPI Interface**

Supports SPI and SPX devices, including low cost analog and digital modules

**11 Main Power Input**

5V Input ±5%

**12 Stackable Expansion** *(on back side)*

Legacy stack-down PCI connector.

**13 Stackable Expansion** *(on back side)*

High speed stack-down PCIe/104 One Bank connector

**● Industrial Temperature**

-40° to +85°C operation for harsh environments.

**● PC/104™ Form Factor**

Industry-standard PC/104 OneBank™ expansion.

**● MIL-STD-202G**

Qualified for high shock/vibration operation.
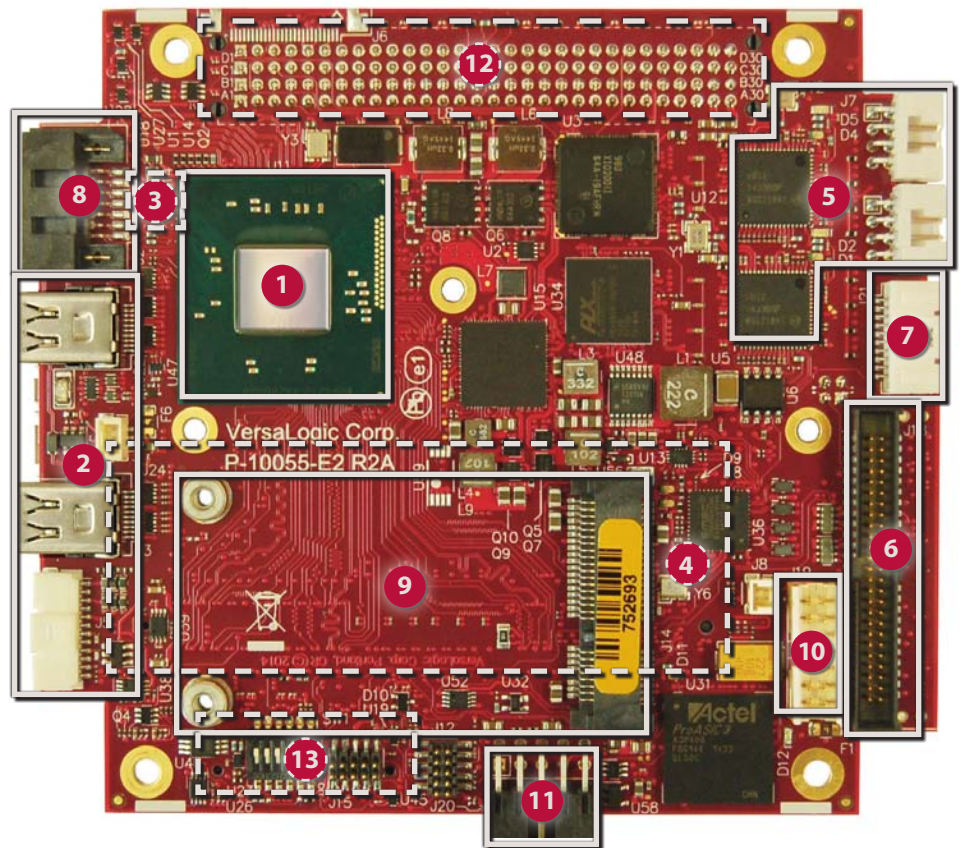


# Tailor Bengal to Your Exact Requirements

Customization options are available in quantities as low as 100 pieces.

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

# Specifications

## General

| | |
|---|---|
| **Board Size** | PC/104 Compliant: 108 mm x 96 mm (4.23" x 3.77") |
| **Processor** | Intel 4th Generation Atom E3845 (quad core), E3826 (dual core), or E3815 (single core). 512K L2 cache per core. Supports Intel 64-bit instructions, AES Instructions, Execute Disable Bit, and Virtualization Technology. |
| **Battery** | Connector for external 3.0V RTC backup battery |

**Power Requirements (+5V) †**

| Model | Idle | Typical | Max. |
|---|---|---|---|
| VL-EPMe-30EAP | 5.5W | 6.7W | 7.0W |
| VL-EPMe-30EBP | 6.5W | 7.0W | 7.5W |
| VL-EPMe-30ECP | 7.5W | 8.7W | 10.0W |

| | |
|---|---|
| **Input Voltage** | 5V ± 5% |
| **System Reset & Hardware Monitors** | Major voltage rails monitored. Watchdog timer with programmable timeout. CPU temperature and fan speed monitoring. Push-button reset and power. |
| **Stackable Buses** | PCI/104-Express OneBank format including: Legacy PCI connector and high speed OneBank connector (supports two PCIe x1 lanes) |
| **RoHS** | RoHS (EU 2015/863) |

## Environmental

| | |
|---|---|
| **Cooling Options** | Bolt-on heat plate standard. Optional Heat sink, Heat sink with fan, heat pipe, and other adaptors available. |

**Operating Temperature ◊**

| Model | Heat Plate** | Heat Sink | Heat Sink + Fan |
|---|---|---|---|
| All Models | -40°C to +85°C | -40°C to +85°C | -40°C to +85°C |

Ranges shown assume 90% CPU utilization. For detailed thermal information, refer to the VL-EPMe-30 Reference Manual.

**Heat plate must be kept below 90°C

| | |
|---|---|
| **Airflow Requirements** | Refer to the VL-EPMe-30 Reference Manual for detailed airflow requirements. |
| **Storage Temperature** | -40° to +85°C |

**Altitude**

| | |
|---|---|
| Operating* | To 15,000 ft. (4,570m) |
| Storage | To 40,000 ft. (12,000m) |

| | |
|---|---|
| **Thermal Shock** | 5°C/min. over operating temperature |
| **Humidity** | Less than 95%, noncondensing |
| **Vibration, Sinusoidal Sweep ¤** | MIL-STD-202G, Method 204, Modified Condition A: 2g constant acceleration from 5 to 500 Hz, 20 minutes per axis |
| **Vibration, Random ¤** | MIL-STD-202G, Method 214A, Condition A: 5.35g rms, 5 minutes per axis |
| **Mechanical Shock ¤** | MIL-STD-202G, Method 213B, Condition G: 20g half-sine, 11 ms duration per axis |

## Security

| | |
|---|---|
| **TPM** | Support for Intel Trusted Platform Module 1.2 device. Atmel - AT97SC3204-U2MA-20 |

† Represents operation at +25°C with +5V supply running Windows 7. Typical power computed as the mean value of Idle and Maximum power specifications. Maximum power is measured with 95% CPU utilization.

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

* For extended altitude information contact VersaLogic Sales Dept.

‡ TVS protected port (enhanced ESD protection)

§ Power pins on this port are overload protected

¥ Bootable storage device capability

¤ MIL-STD-202G shock and vibration 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

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## Memory

| | |
|---|---|
| **System RAM** | One SO-DIMM socket. Up to 8 GB DDR3L (1.35V) SDRAM. |
| **Memory Speed** | 1066 MHz or 1333 MHz, CPU dependent |

## Video

| | |
|---|---|
| **General** | Integrated high-performance video. Intel Gen-7 graphics core with 4 Execution Units and Turbo Boost.  Supports 2 independent displays. Supports DirectX 11, OpenGL 4.0, VP8, MPEG2, H.264, VC1, 2 HD streams (1080p@30fps), Flash and WMP support. |

| Hardware Based | Format |
|---|---|
| Decode | H.264, MPEG2,, MPEG4, MVC, VC-1, WMV9, VP8, MJPEG |
| Encode | H.264, MPEG2, MVC |

Analog and dual mini DisplayPort video interfaces support Extended Desktop, Clone, and Twin display modes. Optional video adapter card converts DisplayPort output to LVDS for flat panel operation.

| | |
|---|---|
| **VRAM** | Up to 224 MB shared DRAM |
| **Desktop Display Interface ‡** | Standard analog output (VGA). 24-bit. Up to 2560 x 1600 (60 Hz). |
| **DisplayPort Interface §** | Support DisplayPort Standard Version 1.1 Mini DisplayPort and Mini DisplayPort++ outputs. 24-bit. Up to 2560 x 1600. Mini DisplayPort++ supports DisplayPort and HDMI signaling (Video and Audio outputs). |

## Mass Storage

| | |
|---|---|
| **Rotating Drive ¥** | Single SATA (Revision 2.0) port. Latching SATA connector. |
| **Flash / SSD ¥** | mSATA modules (SATA signaling, bootable) |

## Network Interface

| | |
|---|---|
| **Ethernet ‡** | Two autodetect 10BaseT/100BaseTX/1000BaseT ports. On-board status LEDs and external LED header. IEEE 1588 Precision Time Protocol (PTP) slave compatible. Latching headers |
| **Network Boot Option** | Via on-board BIOS extension |

## Device I/O

| | |
|---|---|
| **USB ‡§** | Five USB 2.0 host ports and a single USB 3.0 host port. |
| **COM 1 / 2  Interface ‡** | RS-232/422/485 selectable. 16C550 compatible. 460 Kbps. |
| **Digital I/O** | Sixteen TTL I/O lines (3.3V). Independently configurable. Two General Purpose I/O lines (3.3V) |
| **I2C** | Single I2C interface (3.3V) |
| **Audio** | DisplayPort and HDMI interfaces, or use optional part VL-ADR-01 Audio interface. |
| **Counter/Timers** | Three 8254 compatible Programmable Interval Timers (PITs). |

## Other I/O

| | |
|---|---|
| **Mini PCIe / Socket** | Full-size Mini PCIe socket. Supports Wi-Fi modems, GPS receivers, non-volatile flash data storage with auto-detect mSATA support, and other plug-in modules. |
| **SPI Interface** | Supports SPI and SPX devices. Supports up to four SPX modules. |

## Software

| | |
|---|---|
| **BIOS** | Phoenix Technologies UEFI BIOS. Field reprogrammable. Support for USB keyboard/mouse and USB boot. |
| **VersaAPI** | VersaLogic Application Programming Interface to support on-board I/O devices. |
| **Sleep Mode** | ACPI 3.0. Support for  S3 and S4 suspend states and C1 processor state. |
| **Operating Systems** | Compatible with most x86 operating systems including Windows, Windows Embedded, Linux, VxWorks, and QNX. |

## Ordering Information

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

| Model | Processor | Cores | Speed | DDR Max Speed | Graphics Frequency (Normal/Turbo) | Operating Temp. | Cooling | Trusted Platform Module | Conformal Coating |
|---|---|---|---|---|---|---|---|---|---|
| VL-EPMe-30EAP | Atom E3815 | Single | 1.46 GHz | 1066 MHz | 400 MHz / none | -40° to +85°C | Heat Plate | Yes | None |
| VL-EPMe-30EBP | Atom E3826 | Dual | 1.46 GHz | 1066 MHz | 533 MHz/ 667 MHz | -40° to +85°C | Heat Plate | Yes | None |
| VL-EPMe-30EBPA | Atom E3826 | Dual | 1.46 GHz | 1066 MHz | 533 MHz/ 667 MHz | -40° to +85°C | Heat Plate | Yes | Acrylic |
| VL-EPMe-30ECP | Atom E3845 | Quad | 1.91 GHz | 1333 MHz | 542 MHz/ 792 MHz | -40° to +85°C | Heat Plate | Yes | None |

## Accessories

| Part Number | Description |
|---|---|
| **Cable Kit** | |
| VL-CKR-BENGAL | Development cable kit . Includes VL-CBR-5015, 2005, 1008, 1204, 0804 (x2), 0702, 1015, and VL-HDW-105. |
| VL-CBR-5015 | System I/O paddleboard |
| VL-CBR-2005 | 12" 1mm 20-pin DIO cable and paddleboard |
| VL-CBR-1008 | 12" ATX power adapter cable |
| VL-CBR-1204 | 12" VGA Interface Cable, 12-pin PicoClasp Cable to 15-pin VGA |
| VL-CBR-0804 | 12" Ethernet cable (Qty. 2) |
| VL-CBR-0702 | 20" SATA cable – latching |
| VL-CBR-1015 | 1 m USB 3.0 Micro A plug to 3.0 Micro B plug |
| VL-HDW-105 | 0.6" standoff package, metric thread |
| **Thermal Options** | |
| VL-HDW-401 | Thermal Compound Paste. For attaching heat plates and sinks. |
| VL-HDW-406 | Passive Heat Sink to mount on product heat plate. |
| VL-HDW-407 | Cooling fan for HDW-406 passive heat sink. |
| VL-HDW-408 | Heat Pipe system to mount on product heat plate. |
| **Cables** | |
| VL-CBR-0401 | 6.25" ATX to SATA power cable |
| VL-CBR-0503 | 0.5 m USB 2.0 Male A to Male Micro-B Cable |
| VL-CBR-0701 | 19.75" SATA cable (non-latching) |
| VL-CBR-1206 | 18" 12-pin Pico-Clasp / 15-pin VGA, RoHS |
| VL-CBR-1401 | Cable assembly for (2) SPX modules |
| VL-CBR-1402 | Cable assembly for (4) SPX modules |
| VL-CBR-2031 | 36" miniDisplayPort to MiniDisplayPort |
| VL-CBR-2033 | miniDisplayPort to HDMI Active Adapter, 6" (Commercial Temp.) |
| VL-CBR-2034 | 6" 20-pin (F) ATX to 24-pin (M)  ATX adapter cable (use with PS-ATX12-300A) |
| **Development** | |
| VL-PS200-ATX | 200W ATX-style power supply (20+4+4-pin ATX connector) |
| VL-DEV-USB-VV1 | VersaViewer: A real-time viewer for embedded hardware developers |
| VL-PS-ATX12-300A | ATX development power supply (requires VL-CBR-2034) |
| **Audio** | |
| VL-ADR-01S | USB to Audio Adapter, -25° to +85°C |
| **Memory** | |
| VL-MM9-xxEBN | DDR3 PC3-12800 SO-DIMM memory module (1.35v) |
| **Hardware** | |
| VL-HDW-108 | Mini PCIe Module / mSATA hardware kit (metric thread) 2.5 mm |
| **Miscellaneous** | |
| VL-HDW-111 | Half to Full Size MiniPCIe Adapter kit. Metal adapter and screws (2) |
| VL-HDW-203 | PC/104 extractor tool (metal) |
| VL-EPH-V6 | Display Port to Dual Channel LVDS converter |

## Expansion Modules

| Part Number | Description | Form Factor |
|---|---|---|
| **Network** | | |
| VL-MPEe-FW1E | 1394 Firewire Module, industrial temperature | Mini PCIe |
| VL-MPEe-E4E | Gigabit Ethernet Over Fiber Optic media | Mini PCIe |
| VL-MPEe-E3E | Gigabit Ethernet adapter | Mini PCIe |
| **Serial I/O** | | |
| VL-MPEe-U2E | Quad serial plus twelve GPIOs | Mini PCIe |
| **Analog & Digital I/O** | | |
| VL-MPEe-A1E | Analog input (12-bit resolution) | Mini PCIe |
| VL-MPEe-A2E | Analog input (16-bit resolution) | 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 |
| **GPS** | | |
| VL-MPEu-G2E | GPS receiver | Mini PCIe |
| VL-MPEu-G3E | Precision GPS Receiver, industrial temperature | |
| **Solid-State Storage (flash memory)** | | |
| VL-MPEs-F1Exx | mSATA module  (4/16/32 GB) (SATA) | Mini PCIe |
| **Adapters** | | |
| VL-MPEs-S3E | SATA adapter | Mini PCIe |
| VL-EPMp-P2E | Dual Mini PCIe adapter | PCI-104 |
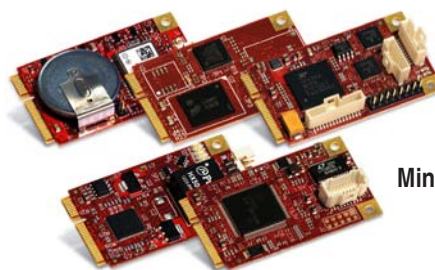


**Mini PCIe Modules**

### 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.