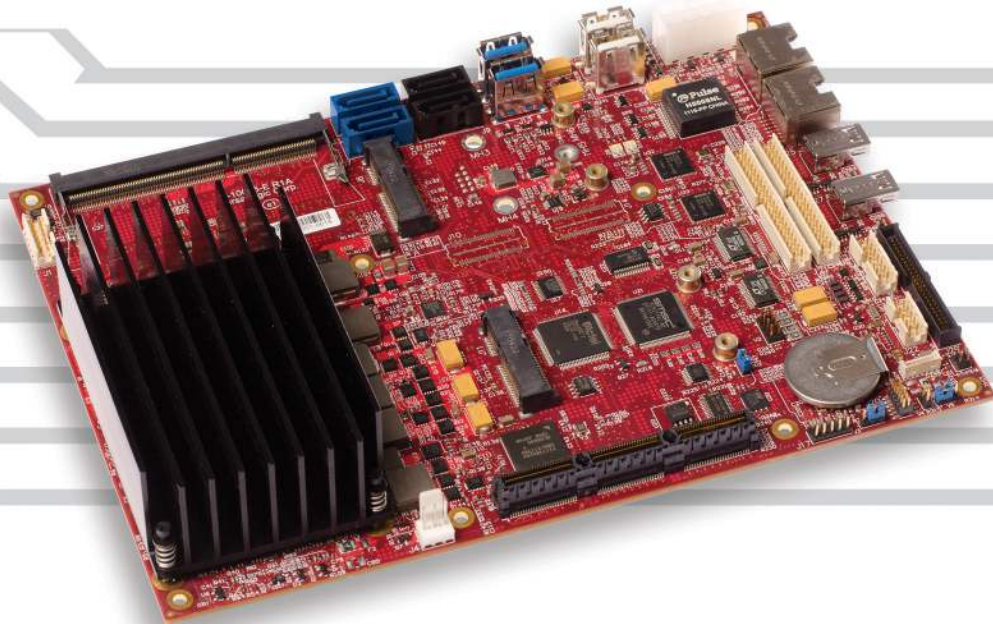# Copperhead
EBX Single Board Computer

Overview

The Copperhead is a high-performance embedded computer powered by the 3rd Generation Intel "Ivy Bridge" family of processors. Its performance level and extensive I/O allows for the integration of multiple high-bandwidth functions, such as digital signal processing and real-time video processing, onto a single board. This can drastically reduce system cost and size when used to replace multi-board chassis-based systems or custom hardware.

For systems that require video processing or intense computation, the Copperhead features a high-speed memory interface, up to 16 GB on-board RAM capacity, and up to three independent display outputs. The PCIe/104 expansion site with a PCIe x16 lane is ideal for add-on cards, such as frame grabbers.

Based on the industry-standard EBX format, the Copperhead provides a choice of Intel core i7, core i3, and Celeron processor options to meet a variety of price/performance application requirements. It features several heat management configurations and offers options for I/O interfaces and interface connectors. The Copperhead enables scalability, simplifies design, and lowers overall system cost.

Highlights

- Industrial temp (-40° to +85°C) operating temperature versions
- Shock & vibration per MIL-STD-202G
- EBX™ form factor
- Very high performance!
- 3rd Generation Intel processor ("Ivy Bridge")
  - Core i7-3615QE (quad core) or
  - Core i7-3517UE (dual core) or
  - Core i3-3217UE (dual core) or
  - Celeron 1047UE (dual core)
- Up to 16 GB SO-DIMM RAM system memory
- Wide input voltage (9V–15V)
- PCIe/104 or SUMIT expansion

- Gigabit Ethernet
- VGA, LVDS, and mini DisplayPort video
- Mini PCIe socket / with mSATA support
- USB 3.0 and USB 2.0 ports
- Serial I/O (4 RS-232/422)
- SATA (6 Gb/s and 3 Gb/s)
- Digital I/O (32 lines)
- Fanless versions
- Trusted Platform Module (TPM) security chip (optional)
- VersaAPI programming support
- Customization available in quantities as low as 100 pcs.

VERSALOGIC CORPORATION

Features

1 Intel® 3rd Generation Core™ Processor

Core i7, Core i3, and Celeron CPU options allow selecting best price/performance for the application. Copperhead provides high performance with advanced technology features: Intel Turbo Boost 2.0*, Intel vPro*, Hyper-threading* (two threads per core), and Advanced Vector Extensions* (AVX).

2 Intel QM77 Platform Controller Hub

The PCH provides extensive I/O support to the CPU

3 High-performance Video

Integrated Intel HD graphics core with GPU Turbo Boost*. DirectX 11, MPEG-2, H.264, OGL 3.1 compliant and MPEG-2 video encoding and decoding. Supports up to three independent displays. Standard video outputs include LVDS (**3a** – *on back side*) for flat panel displays, dual mini DisplayPort™ (**3b**), and an analog VGA output (**3c**). All outputs support multiple display modes including Extended Desktop and Clone.

4 Network Support

Dual Ethernet interfaces, autodetect 10BaseT / 100BaseTX / 1000BaseT with network boot capability.

5 RAM

Up to 16 GB DDR3L socket memory up to 1600 MT/s., two SO-DIMM sockets (one each on top and bottom.)

6 SATA

Two SATA 6 Gb/s (**6a**) and two SATA 3 Gb/s (**6b**) ports support high-capacity storage (rotating media or solid-state drives).
Includes hardware RAID 0/1/5/10 support

7 Device I/O

Two USB 3.0 ports (**7a**), ten USB 2.0 ports (**7b**) support keyboard, mouse, and other devices.
Four RS-232/422 serial ports, three 8254 timer/counters (**7c**), and Intel High Definition Audio (HDA) compatible.

8 Analog + Digital I/O

On-board data acquisition support. Sixteen analog inputs, eight analog outputs, and thirty-two digital I/O lines.

9 Mini PCIe Socket

Supports Wi-Fi modems, Ethernet, Analog I/O, Serial ports, GPS, MIL-STD-1553, Ethernet, solid-state storage, and other plug-in devices.

10 Flash Memory

Dedicated mSATA socket (**10a**) and eUSB interface (**10b** – *on back side*) provides additional solid-state drive (SSD) options.

11 Wide Input Voltage Range

Accepts 9 to 15 volts (12V nominal) simplifies system power supply requirements. Copperhead is fully compatible with 12V automotive applications.

12 Trusted Platform Module *(optional)*

On-board security option defends against attacks from unauthorized hardware and software for applications that require enhanced hardware-level security functions.

13 SPX Expansion

Add low cost analog, digital, and CANbus modules. SPX interface supports up to four external SPX devices.

14 EBX™ Format

Industry-standard format with SUMIT™(**14a**) or PCIe/104 Type 1 (**14b**) expansion.

● Industrial Temperature Versions

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

● MIL-STD-202G

Qualified for high shock and vibration environments.

● Software Support

Compatible with a variety of popular x86 operating systems including Windows, Windows Embedded, Linux, and VxWorks.
Supports VersaAPI programming support for onboard I/O devices.
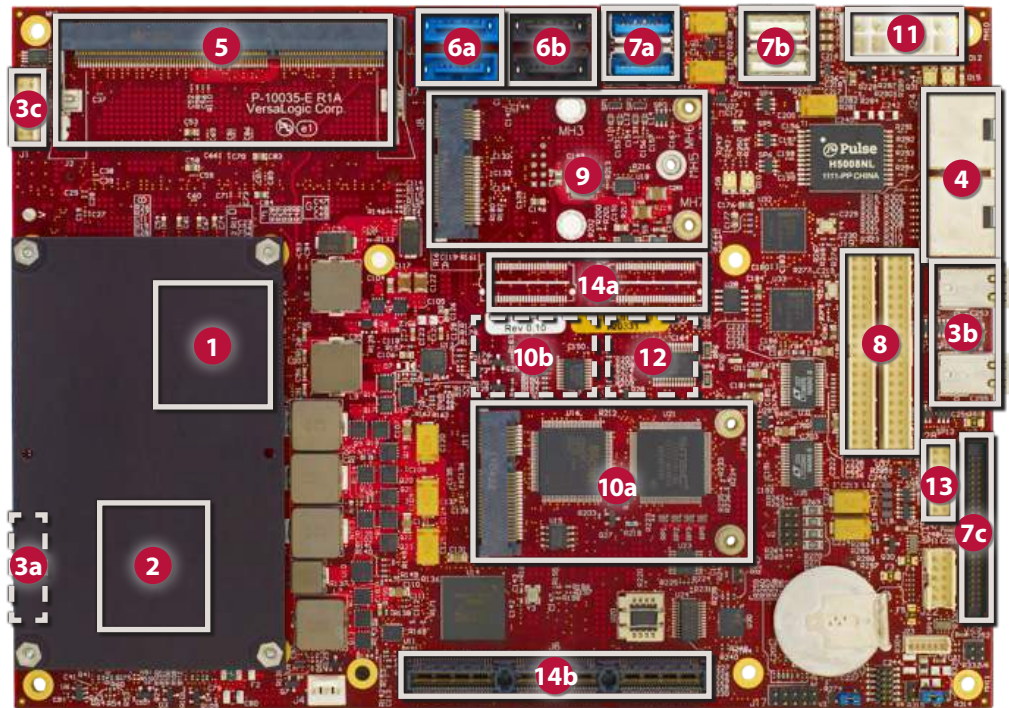
* CPU model dependent, see specifications for more details.

Tailor Copperhead 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	EBX standard: 5.75" x 8" (146 mm x 203 mm)
Processor	Intel 3rd Generation 64-bit CPU platform.

Processor	L3 Cache Size	AES New Instructions	Trusted Execution Technology
i7-3615QE	6 MB	Yes	Yes
i7-3517UE	4 MB	Yes	Yes
i3-3217UE	3 MB	No	No
Celeron 1047UE	2 MB	No	No

Controller Hub	Embedded Intel QM77
Input Voltage	12V (9V–15V)

Power Requirements (@ +12V) §	Model	Idle	Typical	Max.
	VL-EBXe-41SJF	16.2W	37.2W	58.1W
	VL-EBXe-41EJP	16.2W	37.2W	58.1W
	VL-EBXs-41SAK	7.6W	20.7W	33.7W
	VL-EBXs-41EAF	7.6W	20.7W	33.7W
	VL-EBXe-41EHF	7.6W	20.7W	33.7W
	VL-EBXe-41ELF	8.8W	14.4W	20.0W
	VL-EBXe-41SLK	8.8W	14.4W	20.0W
	VL-EBXe-41SMK	9.8W	13.3W	16.9W
	VL-EBXe-41EMF	9.8W	13.3W	16.9W

System Reset & Hardware Monitors	All voltage rails monitored. Two watchdog timers with programmable timeout. CPU temperature and fan speed monitoring. Push-button sleep, reset, and power.
Stackable Bus	SUMIT or PCIe/104 Type 1 expansion site
Manufacturing Standards	Standard — IPC-A-610 Class 2 modified
	Special Order — IPC-A-610 Class 3 modified
RoHS	Compliant

Environmental

Operating Temperature ◊	0° to +60°C and -40° to +85°C *See Ordering Information for Specific Models*
Storage Temperature	-40° to +85°C
Altitude	Operating * — To 4,570m (15,000 ft.)
	Storage — To 12,000m (40,000 ft.)

Airflow Requirements	Thermal Solution	Temp. Range	Airflow
	Heat plate (Heat plate must be kept below 90°C)	0° to +60°C	Zero airflow
		-40° to +85°C	100 Linear Feet per Minute (0.5 Linear Meters per Second)
	Heat sink (fanless)	0° to +60°C	100 Linear Feet per Minute (0.5 Linear Meters per Second)
	Fan + Heat sink	-40° to +85°C	100 Linear Feet per Minute (0.5 Linear Meters per Second)

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 min. per axis
Vibration, Random ¥	MIL-STD-202G, Method 214A, Condition A: 5.35g rms, 5 min. per axis
Mechanical Shock ¥	MIL-STD-202G, Method 213B, Condition G: 20g half-sine, 11 ms duration per axis

§ Represents operation at +25°C and +12V running Windows 7 with 4 GB RAM, 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.
‡ TVS protected port (enhanced ESD protection)
# Power pins are overload protected
† IEEE 1588 Precision Time Protocol (PTP) compatible
◊ Derate -1.1°C per 305m (1,000 ft.) above 2,300m (7,500 ft.)
* For extended altitude information contact VersaLogic Sales Dept.
¥ MIL-STD-202G shock and vibe levels were used to illustrate the overall ruggedness of this product. Certification at higher levels or different types of shock or vibration methods per the specific requirements of the application is available. Contact a VersaLogic Sales Engineer for further information.

Specifications are subject to change without notification. Intel and Core are trademarks of Intel Corp. EBX and PCIe/104 are trademarks of the PC/104 Consortium. SUMIT is a trademark of the SFF-SIG. PCI Express is a registered trademark of the PCI-SIG. DisplayPort is a trademark of VESA. All other trademarks are the property of their respective owners.

Security

TPM (optional)	Support for Intel Trusted Platform Module 1.2 devices

Memory

System RAM	Two SO-DIMM sockets. Up to 16 GB DDR3L SDRAM total. Supports 1066, 1333, and 1600 MT/s. 1.35V.

Video

General	Integrated high-performance video.

Processor	Graphics Core	Simultaneous Independent Displays	Graphics Hardware Accel.
i7-3615QE	Intel HD Graphics 4000	3	Yes
i7-3517UE	Intel HD Graphics 4000	3	Yes
i3-3217UE	Intel HD Graphics 4000	3	Yes
Celeron 1047UE	Intel HD Graphics	2	No

VRAM	Up to 512 MB shared DRAM
Desktop Display Interface ‡	Standard analog output (VGA). Up to 2048 x 1536 (75 Hz). 32-bit.
OEM Flat Panel Interface #	LVDS interface. 18/24-bit. Up to 1280 x 800 (60 Hz). 8 bpp. CMOS-selectable TFT panel types. Support for LVDS Backlight Control and FPD power control.
DisplayPort	Two mini DisplayPort outputs. Up to 2560 x 1600 (60 Hz). 10 bpp.

Mass Storage

Rotating Drives / Flash / Solid-State Drives	- Two SATA 6 Gb/s ports (latching connectors) - Two SATA 3 Gb/s ports (latching connectors) Supports RAID 0, 1, 5, and 10.
	mSATA socket (SATA signaling, bootable)
	eUSB site (USB signaling, bootable)

Network Interface

Ethernet ‡ †	Two autodetect 10BaseT/100BaseTX/1000BaseT ports
	Standard — RJ45 connectors
	Special Order — Ruggedized connectors
Network Boot Option	Via BIOS extension built into Ethernet controller flash

Device I/O

USB # ‡	Ten USB 2.0 host ports. Two USB 3.0 host ports.
COM 1 / 2 / 3 / 4 ‡	RS-232/422 selectable. 16C550 compatible.
Analog Input	Sixteen channels. 12-bit single-ended. 100 Ksps. 16-bit by special order.
Analog Output	Eight channels. 12-bit single-ended. 100 Ksps.
Digital I/O	Thirty-two TTL I/O lines (3.3V). Independently configurable.
Audio	Intel High-Definition Audio (HDA)
Counter/Timers	Three general-purpose 16-bit timers

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.
VersaLogic SPX Interface	Supports low cost analog, digital, and CANbus SPX modules

Software

BIOS	American Megatrends (AMI) Aptio UEFI BIOS with OEM enhancements. Field reprogrammable. Support for USB keyboard/mouse and USB boot. User-configurable CMOS defaults.
VersaAPI	VersaLogic Application Programming Interface to support on-board I/O devices.
Sleep Mode	ACPI 4.0a. Support for S3 and S4 suspend states
Operating Systems	Compatible with most x86 operating systems including Windows, Windows Embedded, Linux, and VxWorks

Ordering Information

Model	Processor	Cores	Nominal Speed	Max Turbo Speed	Hyper-Threading	vPro Technology	AVX Instructions	Expansion	Operating Temp.	Cooling
VL-EBXe-41SJF	i7-3615QE	Quad	2.3 GHz	3.3 GHz	Yes	Yes	Yes	PCIe/104	0° to +60°C	Fan + heat sink
VL-EBXe-41EJP	i7-3615QE	Quad	2.3 GHz	3.3 GHz	Yes	Yes	Yes	PCIe/104	-40° to +85°C	Heat plate (fanless)
VL-EBXs-41SAK*	i7-3517UE	Dual	1.7 GHz	2.8 GHz	Yes	Yes	Yes	SUMIT	0° to +60°C	Heat sink (fanless)
VL-EBXs-41EAF*	i7-3517UE	Dual	1.7 GHz	2.8 GHz	Yes	Yes	Yes	SUMIT	-40° to +85°C	Fan + heat sink
VL-EBXe-41EHF*	I7-3517UE	Dual	1.7 GHz	2.8 GHz	Yes	Yes	Yes	PCIe/104	-40° to +85°C	Fan + heat sink
VL-EBXe-41ELF	i3-3217UE	Dual	1.6 GHz	N/A	Yes	No	Yes	PCIe/104	-40° to +85°C	Fan + heat sink
VL-EBXe-41SLK*	i3-3217UE	Dual	1.6 GHz	N/A	Yes	No	Yes	PCIe/104	0° to +60°C	Heat sink (fanless)
VL-EBXe-41SMK	Celeron 1047UE	Dual	1.4 GHz	N/A	No	No	No	PCIe/104	0° to +60°C	Heat sink (fanless)
VL-EBXe-41EMF*	Celeron 1047UE	Dual	1.4 GHz	N/A	No	No	No	PCIe/104	-40° to +85°C	Fan + heat sink

* Special Order Product – Contact VersaLogic Sales for minimum order quantities and lead time.

Accessories

Part Number	Description
Cable Kit	
VL-CKR-COPPR	Copperhead cable kit. Includes VL-CBR-0702, 0808, 1201, 4004, 5013, and VL-HDW-105 (x2).
VL-CBR-5013	Primary breakout cable (4 USB, 4 RS-232/422, programmable LED, speaker, audio, reset push button, power push button)
VL-CBR-1201	12-pin 2 mm (latching) / 15-pin VGA adapter
VL-CBR-0702	20" SATA cable. Latching.
VL-CBR-0808	12" power adapter cable. ATX12 to Copperhead.
VL-CBR-4004	Cable & paddleboard for the A/D, D/A, DIO, CTC
VL-HDW-105 (x2)	15.24 mm standoffs, metric thread (four per kit)
Cables	
VL-CBR-0401	6.25" ATX to SATA power cable
VL-CBR-1401	6" 14-pin cable assembly for (2) SPX modules
VL-CBR-1402	12" 14-pin cable assembly for (4) SPX modules
VL-CBR-2010	20" 18-bit LVDS flat panel cable (Hirose)
VL-CBR-2011	20" 18-bit LVDS flat panel cable (JAE)
VL-CBR-2012	20" 24-bit LVDS flat panel cable (Hirose)
VL-CBR-2031	36" miniDisplayPort to MiniDisplayPort
Memory	
VL-MM9-xxxx	DDR3 PC3-12800 SO-DIMM memory module (1.35v)
Drives	
VL-HDS35-xxx	3.5" hard drive (SATA)
VL-F15-xxxx	eUSB flash module
Hardware	
VL-PS-ATX12-300A	ATX12 development power supply
VL-HDW-106	0.6" standoffs, English thread (four per kit)
VL-HDW-108	Mini PCIe / mSATA hardware kit (metric thread) 2.5 mm
VL-HDW-109	eUSB hardware kit
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-HDW-401	Thermal compound paste (1.75g)
VL-EPH-V6	Display Port to Dual Channel LVDS converter

Expansion Modules

Part Number	Description	Form Factor
Network		
VL-MPEe-W2E	Wi-Fi 802.11 a/b/g/n	Mini PCIe
VL-SPX-3	CANbus Module single-channel V2.0B	SPX
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
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

Mini PCIe Modules