

# Reference Manual

DOC. REV. 7/18/2014

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## **Falcon** **(VL-EPU-2610)**

Intel® Atom E6x0T-based  
Embedded Processing Unit with  
SATA, Ethernet, USB, Serial,  
Video, HD Audio, Mini PCIe  
Socket, and microSD



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VersaLogic reserves the right to revise this product and associated documentation at any time without obligation to notify anyone of such changes.

## Product Revision Notes

**Revision 1.00** – Commercial release.

## Technical Support

The Falcon support page, at <http://www.versalogic.com/private/falconsupport.asp>, contains additional information and resources for this product including:

- Reference Manual (PDF format)
- Datasheets and manufacturers' links for chips used in this product
- Photograph of the circuit board
- BIOS information and upgrades

The VersaTech KnowledgeBase is an invaluable resource for resolving technical issues with your VersaLogic product.

**[VersaTech KnowledgeBase](#)**

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## Description

### FEATURES AND CONSTRUCTION

The Falcon (VL-EPU-2610) is a feature-packed Embedded Processing Unit (EPU) That has been engineered and tested to meet the embedded industry's evolving requirements to develop smaller, lighter and lower power embedded systems while adhering to stringent regulatory standards. Roughly the size of a credit card and less than one inch thick, the Falcon is the embedded industry's smallest, lightest, ultra-rugged, embedded x86 computer. This embedded computer, equipped with an Intel Atom E6x0T processor, is designed to withstand extreme temperature, impact and vibration. Its features include:

- Intel® Atom™ E680T (1.6 GHz), E640T (1.0 GHz), or custom model E620T (0.6 GHz) processor
- 1GB or 2GB soldered-on DDR2 800 MT/s RAM
- Intel EG20T Platform Controller Hub (PCH)
- One 10BaseT/100BaseTX/1000BaseT Ethernet interface with ruggedized 8-pin latching connector
- Integrated Intel GMA600 2D/3D graphics core
- Full ACPI support
- Four USB 2.0 ports
- Four RS-232/422 COM ports, one with RS-232 handshake line support
- Two microSD sockets
- One LVDS interface
- One Mini PCIe/ mSATA socket
- One SATA II port, 3.0 Gb/s
- Intel High Definition Audio (HDA) compatible
- Four user I/O lines, independently configurable
- Watchdog Timer, prescaler of approximately 1  $\mu$ s to 10 min.
- Speaker out
- Heat plate or heatsink thermal solutions
- Optional mounting plate
- Field upgradeable AMI UEFI BIOS with enhancements
- RoHS compliant
- Extended temperature operation
- Customization available

The Falcon is compatible with popular operating systems including Windows 7/XP/WES7/XPe, Linux, VxWorks, and QNX (see the [VersaLogic OS Compatibility Chart](#)).

Falcon EPUs are subjected to 100% functional testing and are backed by a limited two-year warranty. Careful parts sourcing and US-based technical support ensure the highest possible quality, reliability, service, and product longevity for this exceptional EPU.

## Technical Specifications

Specifications are typical at +25°C with +12V supply unless otherwise noted.

### Board Size:

Heat plate models: 55 x 84 x 22 mm (2.17 x 3.31 x 0.87")

Heatsink models: 55 x 84 x 38.5 mm (2.17 x 3.31 x 1.51")

### Storage Temperature:

-40° to +85°C

### Operating Temperature:

-40° to +85°C. Derate -1.1°C per 305m (1,000 ft.) above 2,300m (7,500 ft.).

### Airflow Requirements:

Heat plate models: zero airflow to 85°C based on customer supplied heat removal system. User must keep the heat plate below 90°C, measured topside center point of heat plate.

Heatsink models: -40° to +60°C with zero airflow, +60° to + 85°C with 300 LFM

**Power Requirements:** *(at +25°C and +12V supply running Windows 7 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.)*

VL-EPU-2610-EBxx: 8.2W idle, 9.0W typical, 9.8W max., 3.4W S3

VL-EPU-2610-ECxx and EDxx: 9.7W idle, 10.6W typical, 11.6W max., 3.4W S3

### System Reset:

Push-button power reset via paddleboard  
Watchdog timeout (warm/cold reset)

### DRAM:

Soldered-on 1 GB or 2 GB, DDR2 SDRAM, 800 MT/s

### Video Interface:

LVDS – 3.3V compatible, 18/24-bit, up to 1280 x 768 resolution (60 Hz)

### SATA Interface:

One SATA II port, 3 Gb/s

### Flash Storage:

Two microSD sockets, each up to 32 GB  
Mini PCIe/mSATA socket

### Ethernet Interface:

One IEEE802.3 compliant Gigabit Ethernet MAC, 10BaseT/100BaseTX/1000BaseT

### COM Interface:

COM1-2 – RS-232/422 to DB-9 on paddleboard

COM3-4 – RS-232/422 to screw terminal on paddleboard

COM1 supports RS-232 handshake lines

### USB:

Four USB 2.0 host ports to Type-A connectors on paddleboard

### GPIO:

Four independent lines (Intel Atom E6xx GPIO-SUS 1-4; GPIO-SUS 0 and 5-8 are reserved)

### Audio:

Intel High-Definition Audio CODEC  
Stereo HD audio line in/out

### BIOS:

AMI Aptio UEFI BIOS with OEM enhancements, field programmable

### Weight:

Heatsink models - 0.360 lbs (0.163 kg)

Specifications are subject to change without notification.

## Block Diagram

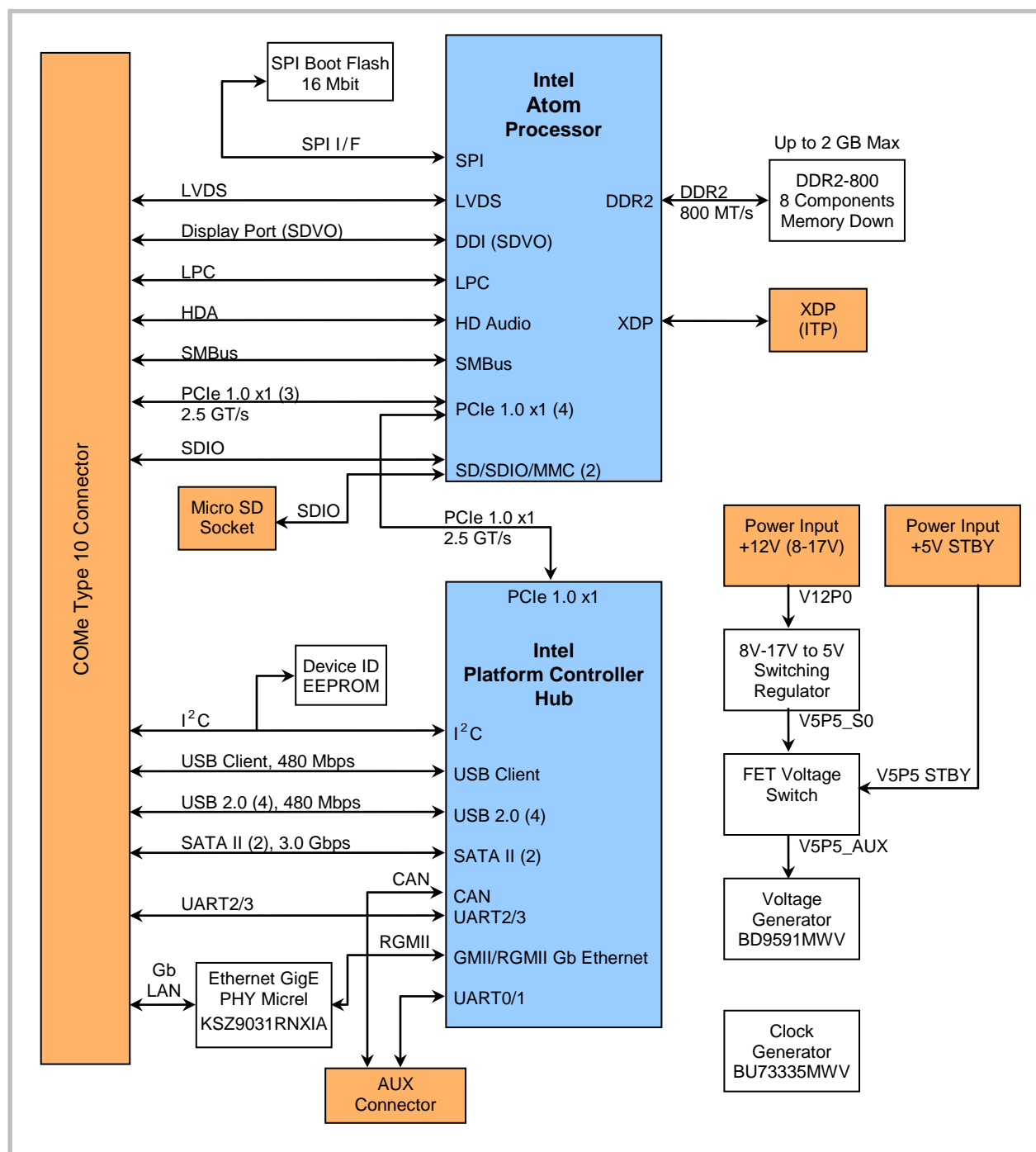


Figure 1. CPU Module Block Diagram



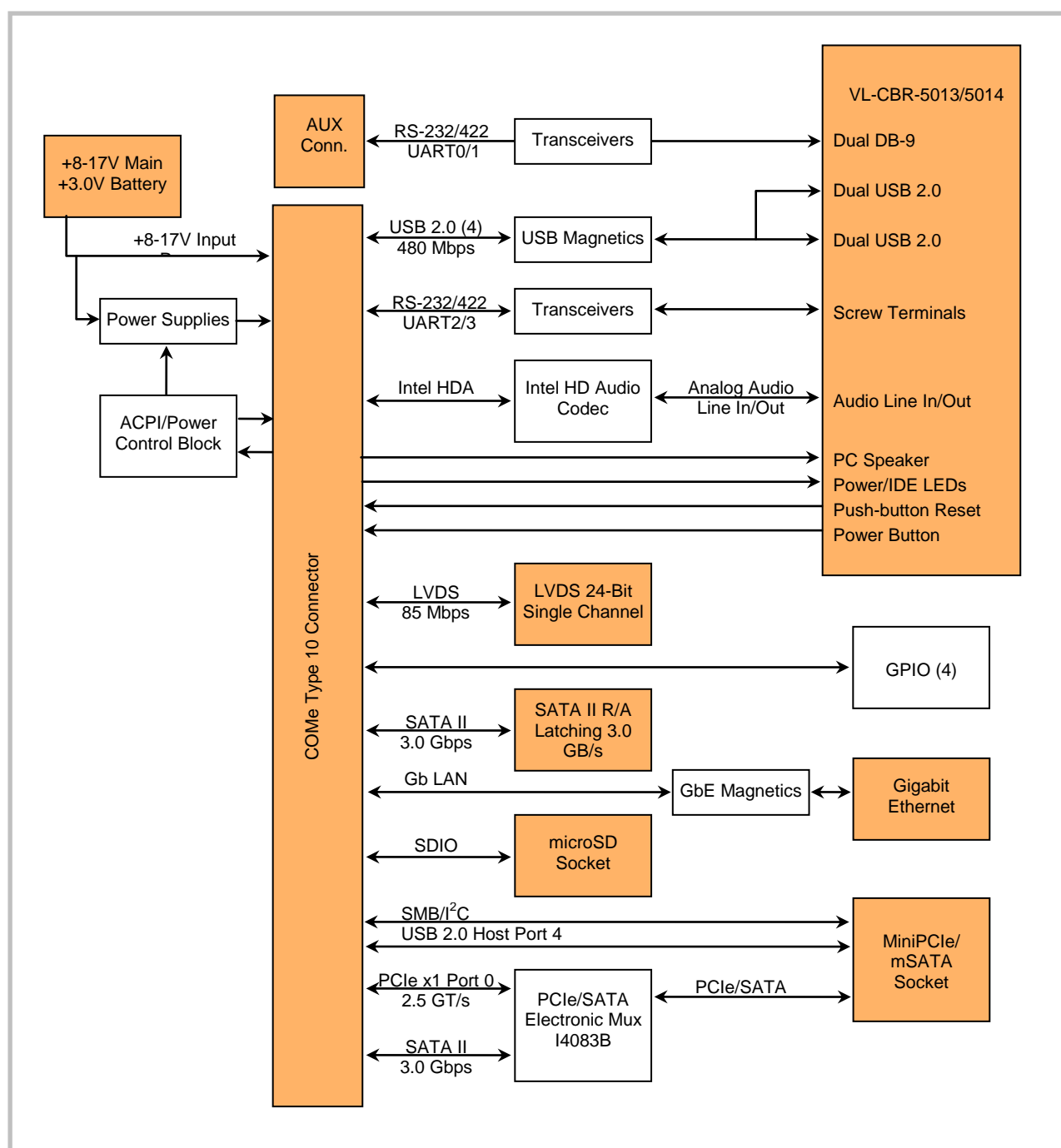


Figure 2. Baseboard Block Diagram

## Warnings

### ELECTROSTATIC DISCHARGE

**Warning!** Electrostatic discharge (ESD) can damage circuit boards, disk drives, and other components. The circuit board must only be handled at an ESD workstation. If an approved station is not available, some measure of protection can be provided by wearing a grounded antistatic wrist strap. Keep all plastic away from the board, and do not slide the board over any surface.

After removing the board from its protective wrapper, place the board on a grounded, static-free surface, component side up. Use an antistatic foam pad if available.

The board should also be protected inside a closed metallic antistatic envelope during shipment or storage.

**Note:** The exterior coating on some metallic antistatic bags is sufficiently conductive to cause excessive battery drain if the bag comes in contact with the bottom side of the Falcon.

### HANDLING CARE

**Warning!** Care must be taken when handling the board not to touch the exposed circuitry with your fingers. Though it will not damage the circuitry, it is possible that small amounts of oil or perspiration on the skin could have enough conductivity to cause the contents of CMOS RAM to become corrupted through careless handling, resulting in CMOS resetting to factory defaults.

## Thermal Considerations

### CPU DIE TEMPERATURE

The CPU die temperature is affected by numerous conditions, such as CPU utilization, CPU speed, ambient air temperature, air flow, thermal effects of adjacent circuit boards, external heat sources, and many others.

The thermal management for the Intel Atom E6xx series of processors consists of a sensor located in the core processor area. The processor contains multiple techniques to help better manage thermal attributes of the processor. It implements thermal-based clock throttling and thermal-based speed step transitions. There is one thermal sensor on the processor and this is used for triggering Intel's thermal monitor. The temperature at which the thermal sensor triggers the thermal monitor is set during the fabrication of the processor. Triggering of this sensor is visible to software by means of the thermal interrupt LVT entry in the local APIC. (See the [Intel Atom E6xx Datasheet](#) for complete information.)

Two thermal configurations are available:

- Heat plate mounted via the four corner mounting holes.
- Low-profile heatsink mounted via the four corner mounting holes. The heatsink covers the entire module, including the heat plate.

## Technical Support

If you are unable to solve a problem after reading this manual, please visit the Falcon product support web page below. The support page provides links to component datasheets, device drivers, and BIOS and PLD code updates.

**[Falcon \(VL-EPU-2610\) Support Page](#)**

The VersaTech KnowledgeBase contains a wealth of technical information about VersaLogic products, along with product advisories. Click the link below to see all KnowledgeBase articles related to the Falcon.

**[VersaTech KnowledgeBase](#)**

If you have further questions, contact VersaLogic Technical Support at (503) 747-2261. VersaLogic support engineers are also available via e-mail at [Support@VersaLogic.com](mailto:Support@VersaLogic.com).

**REPAIR SERVICE**

If your product requires service, you must obtain a Returned Material Authorization (RMA) number by calling (503) 747-2261.

Please provide the following information:

- Your name, the name of your company, your phone number, and e-mail address
- The name of a technician or engineer that can be contacted if any questions arise
- Quantity of items being returned
- The model and serial number (barcode) of each item
- A detailed description of the problem
- Steps you have taken to resolve or recreate the problem
- The return shipping address

**Warranty Repair**

All parts and labor charges are covered, including return shipping charges for UPS Ground delivery to United States addresses.

**Non-warranty Repair**

All approved non-warranty repairs are subject to diagnosis and labor charges, parts charges, and return shipping fees. Please specify the shipping method you prefer and provide a purchase order number for invoicing the repair.

**Note:**

Please mark the RMA number clearly on the outside of the box before returning.

## Initial Configuration

The following components are recommended for a typical development system with the Falcon EPU :

- ATX power supply
- VL-CBR-5013/5014 paddleboard and cable
- USB keyboard and mouse
- SATA hard drive
- USB CD-ROM drive
- LVDS monitor

You will also need an operating system (OS) installation CD-ROM.

## Basic Setup

The following steps outline the procedure for setting up a typical development system. The Falcon should be handled at an ESD workstation or while wearing a grounded antistatic wrist strap.

Before you begin, unpack the Falcon and accessories. Verify that you received all the items you ordered. Inspect the system visually for any damage that may have occurred in shipping. Contact [Support@VersaLogic.com](mailto:Support@VersaLogic.com) immediately if any items are damaged or missing.

Gather all the peripheral devices you plan to attach to the Falcon and their interface and power cables.

It is recommended that you attach standoffs to the board (see Hardware Assembly) to stabilize the board and make it easier to work with.

The following diagram shows a typical setup for the Falcon in the development environment.

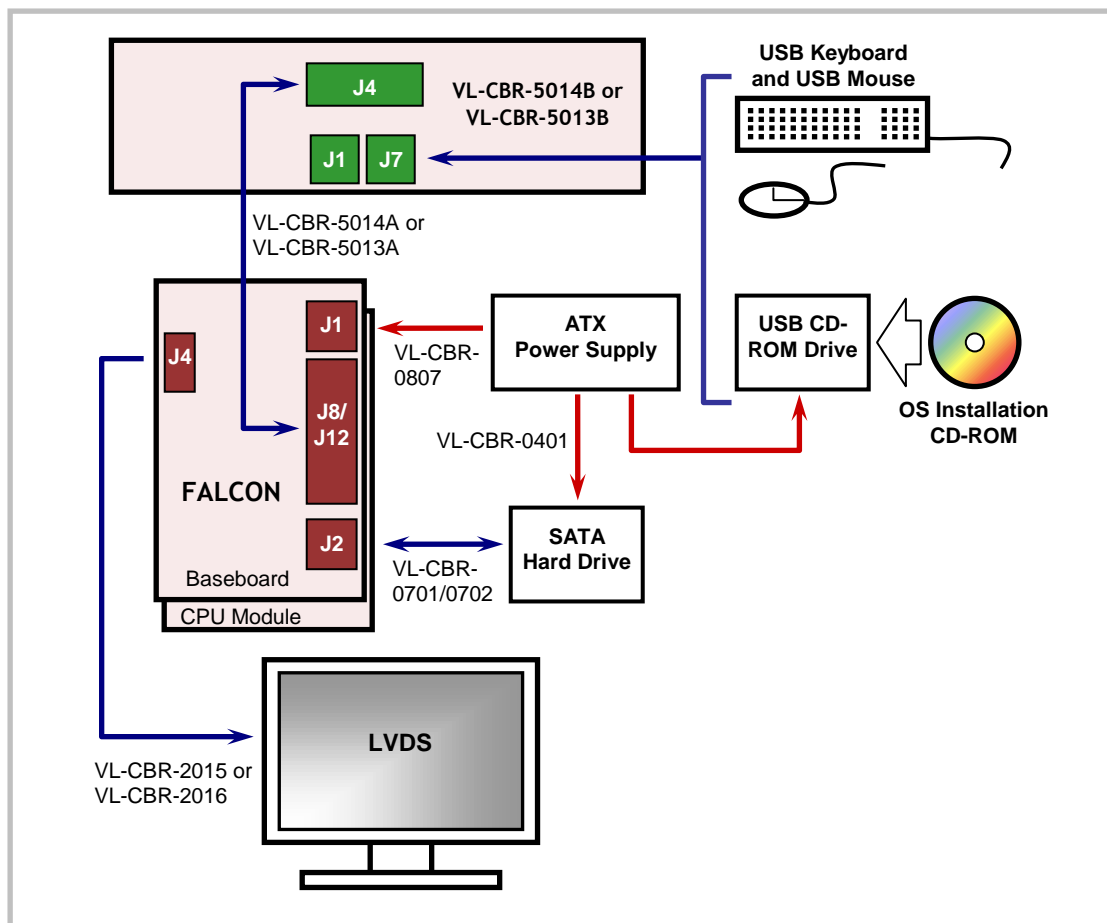


Figure 3. Typical Development Configuration

## 1. Attach Cables and Peripherals

- Attach an LVDS monitor to connector J4 of the baseboard using the VL-CBR-2015 or VL-CBR-2016 cable.
- Attach SATA hard disk to connector J2 of the baseboard using the VL-CBR-0701 or VL-CBR-0702 cable.
- Attach the user I/O paddleboard, VL-CBR-5013 or VL-CBR-5014, to connector J8/J12 of the baseboard.
- Connect a USB keyboard and USB mouse to one of the USB Type-A connectors (J1 or J7) on the paddleboard.
- Attach a USB CD-ROM drive to one of the USB Type-A connectors (J1 or J7) on the paddleboard.

## 2. Attach Power

- Plug the power adapter cable VL-CBR-0807 into socket J1 of the baseboard. Attach the motherboard connector of the ATX power supply to the adapter.
- Attach an ATX power cable to any 3.5" drive that is not already attached to the power supply (hard drive or CD-ROM drive).

### 3. Review Configuration

- Before you power up the system, double check all the connections. Make sure all cables are oriented correctly and that adequate power will be supplied to the Falcon and peripheral devices.

### 4. Power On

- Turn on the ATX power supply and the video monitor. If the system is correctly configured, a video signal should be present.

### 5. Install Operating System

- Install the OS according to the instructions provided by the OS manufacturer.

**Note:** If you intend to operate the Falcon under Windows XP or Windows XP Embedded, be sure to use Service Pack 3 (SP3) for full support of the latest device features.

## Operating System Installation

The standard PC architecture used on the Falcon makes the installation and use of most of the standard x86-based operating systems very simple. The operating systems listed on the [VersaLogic OS Compatibility Chart](#) use the standard installation procedures provided by the maker of the OS. Special optimized hardware drivers for a particular OS, or a link to the drivers, are available at the [Falcon Product Support web page](#).

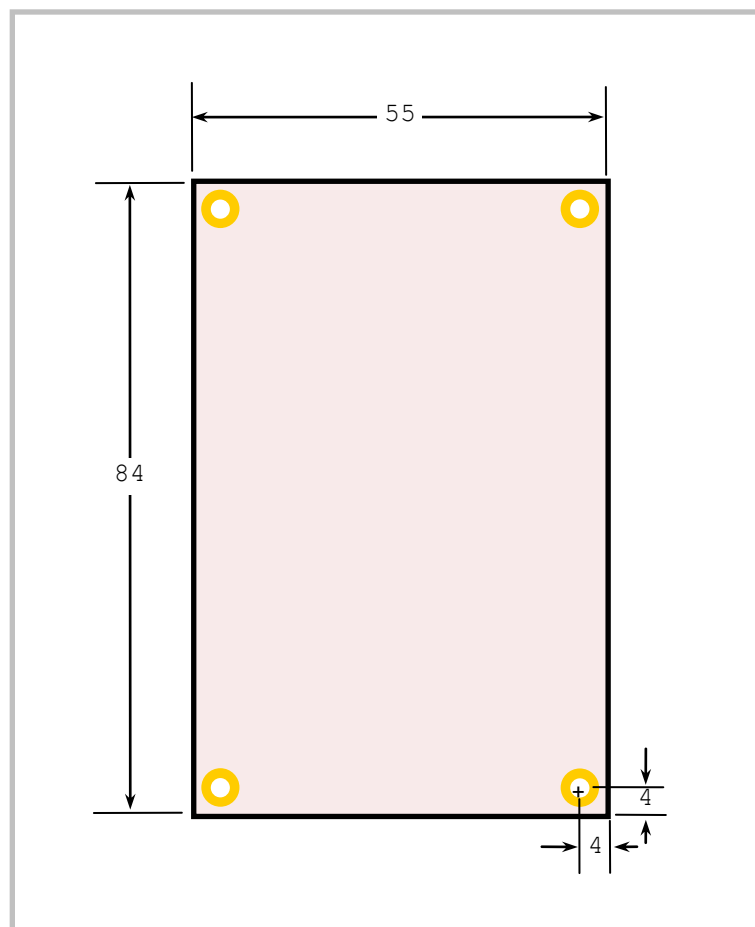
## BIOS Setup

See KnowledgeBase article [VT1710 Falcon \(VL-EPU-2610\) BIOS Setup Reference](#) for complete information on how to configure the Falcon BIOS.

## Dimensions and Mounting

### FALCON DIMENSIONS

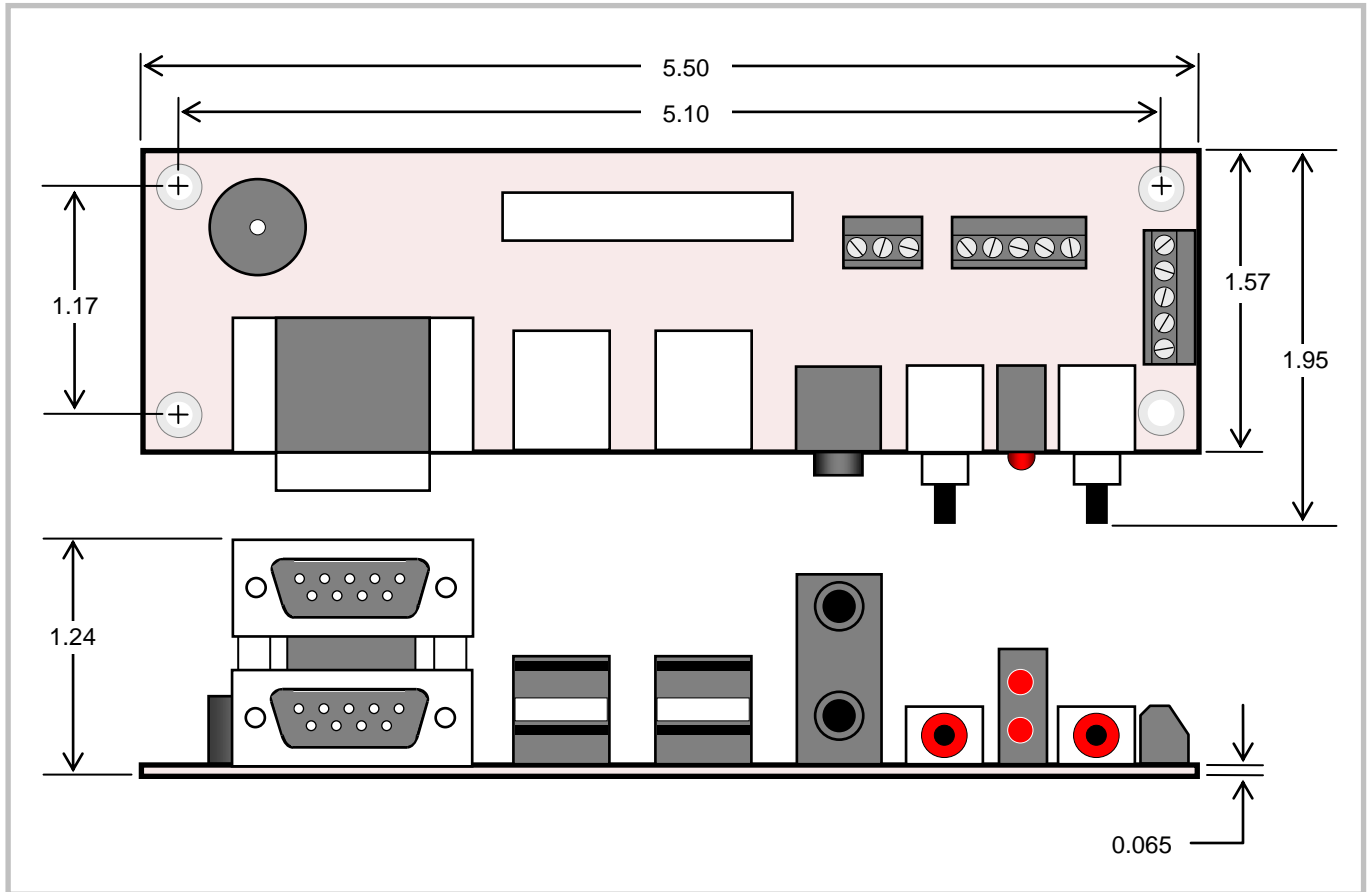
The Falcon complies with the COM Express mini form factor standard. Dimensions are given below to help with pre-production planning and layout.



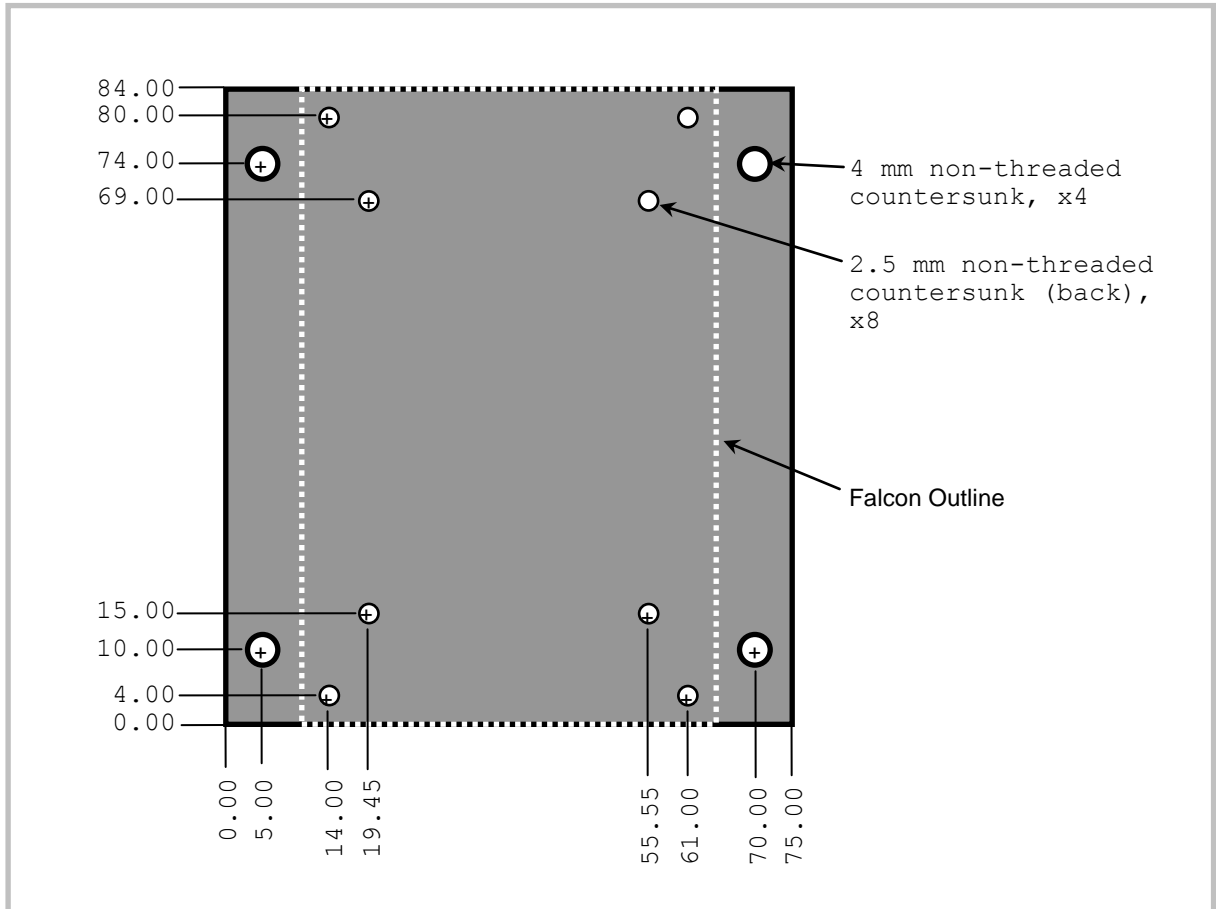
**Figure 4. Falcon Dimensions and Mounting Holes**

*(Not to scale. All dimensions in millimeters.)*



**VL-CBR-5013/5014 PADDLEBOARD DIMENSIONS**

**Figure 5. VL-CBR-5013/5014 Dimensions**  
(Not to scale. All dimensions in inches.)

**VL-HDW-405 MOUNTING PLATE DIMENSIONS**

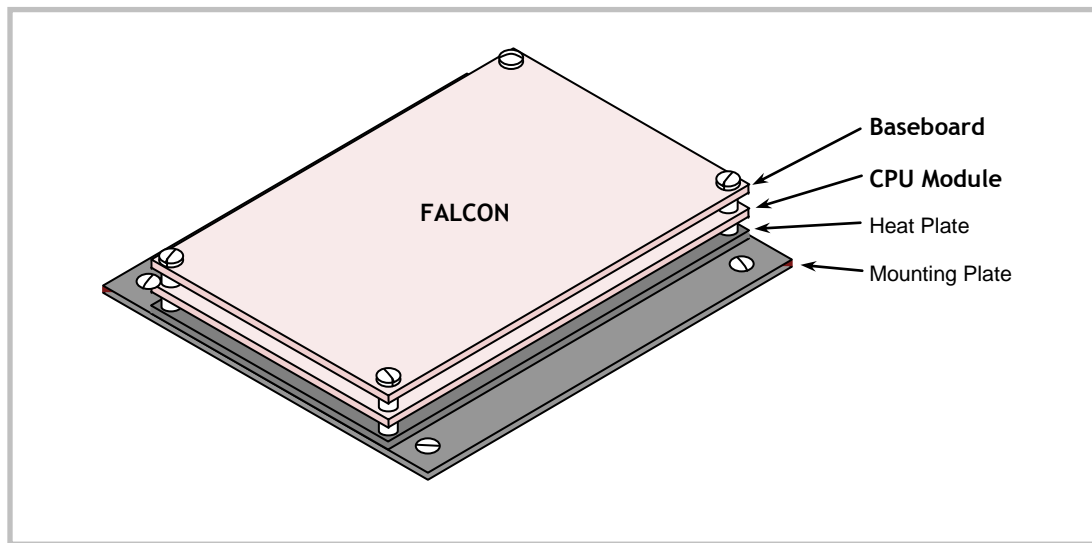
**Figure 6. Mounting Plate Dimensions**  
(Not to scale. All dimensions in millimeters.)

## HARDWARE ASSEMBLY

There are two basic assembly methods: heat plate down (in relation to the enclosure) or heatsink up. An optional mounting plate, VL-HDW-405, can be used with either method. These assembly methods are shown below. (See Appendix A – Mounting Options for mounting configuration details.)

### Heat Plate Down

Use this assembly method if your Falcon is equipped with a heat plate only (no heatsink). The figure below shows the assembly including the mounting plate.



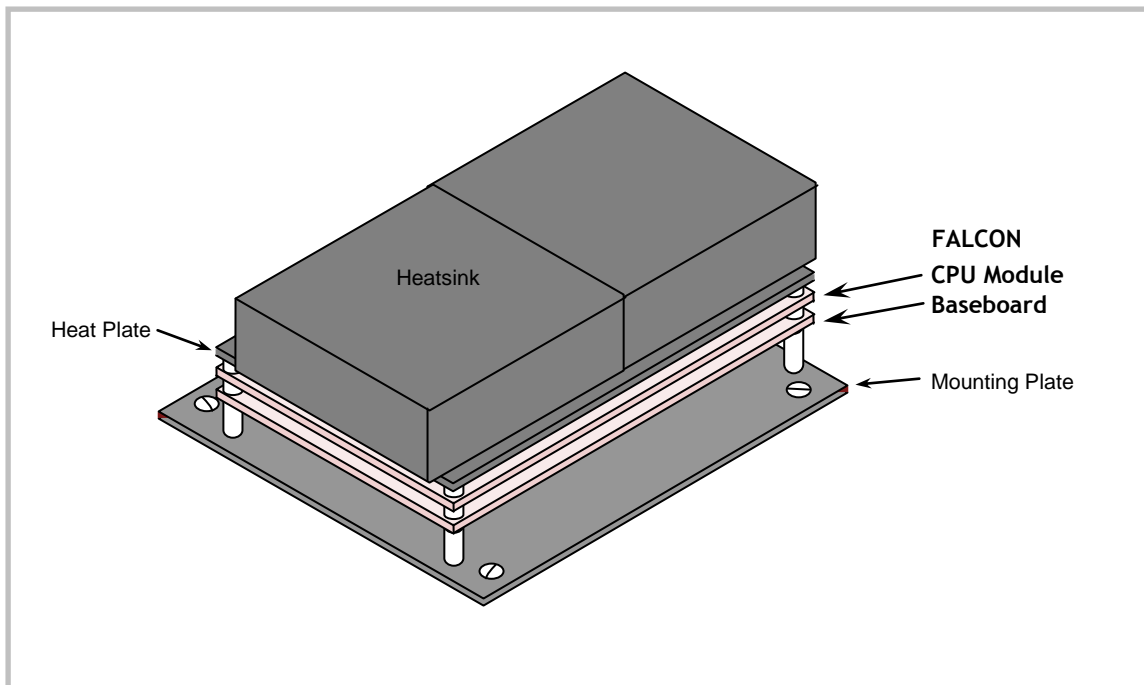
**Figure 7. Hardware Assembly with Heat Plate Down**

The recommended method is to attach the Falcon heat plate to the mounting plate (VL-HDW-405), and attach the mounting plate to the enclosure.

A thermal interface compound must be applied to the heat plate to thermally bond it to the mounting plate or other surface to which the Falcon is mounted. Spread the compound thinly and evenly across the entire heat plate surface before mounting. The compound is supplied in the VL-CKR-FALC-N/L cable kit or sold separately as part number VL-HDW-401.

### Heatsink Up

Use this assembly method if your Falcon is equipped with a heat plate and heatsink. The figure below shows the assembly including the mounting plate.

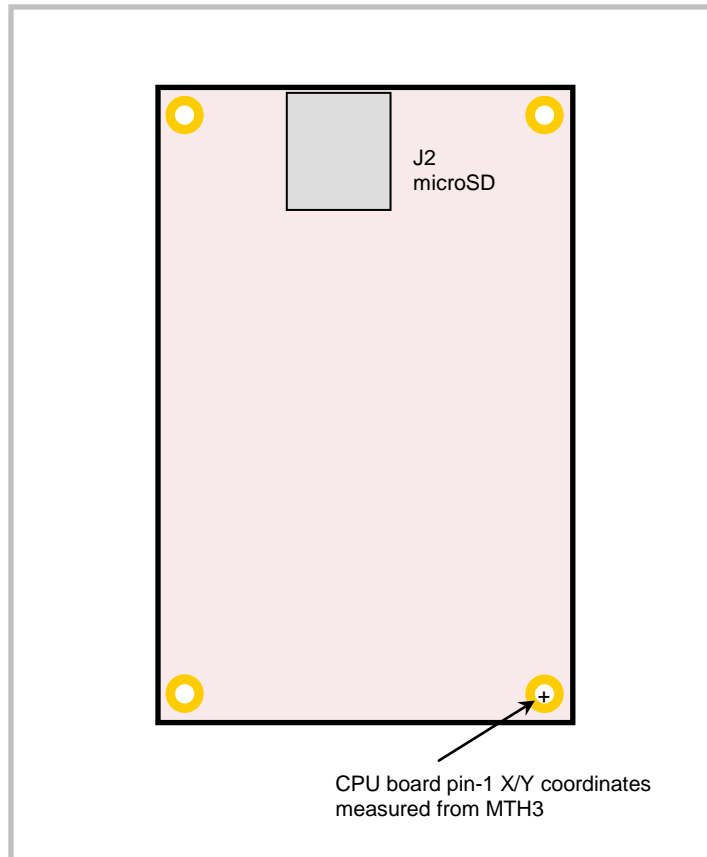


**Figure 8. Hardware Assembly with Heatsink Up**

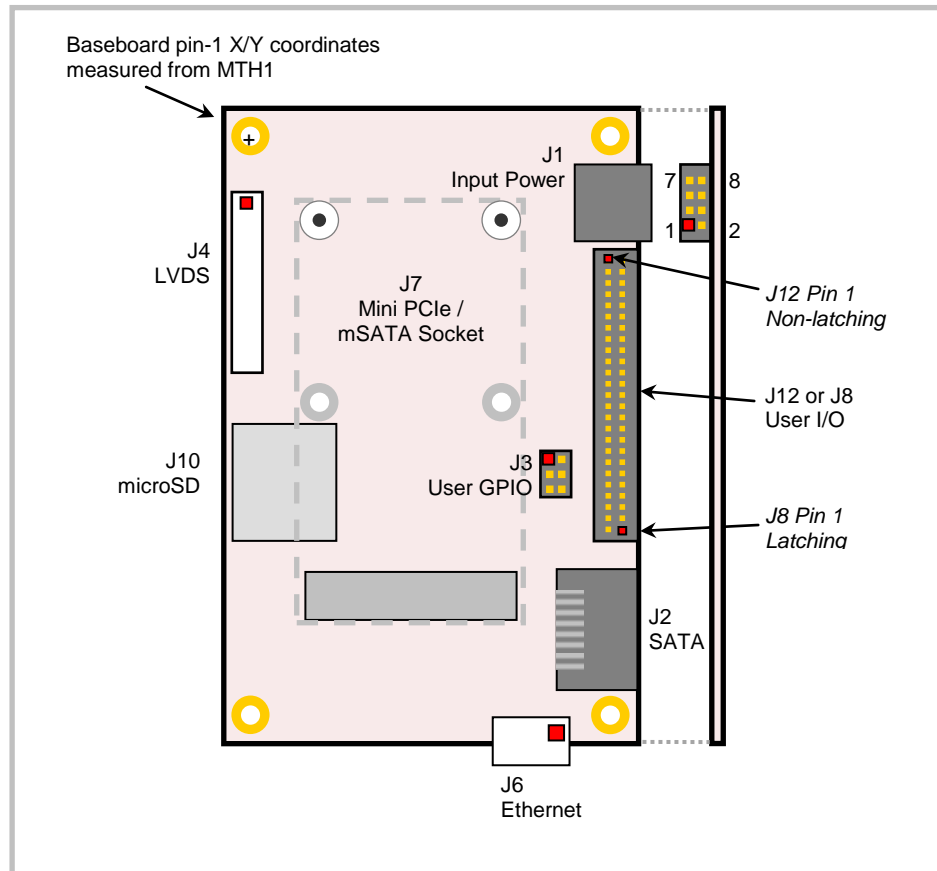
The recommended method is to attach the baseboard to the mounting plate (VL-HDW-405) and attach the mounting plate to the enclosure.

## External Connectors

### FALCON CONNECTOR LOCATIONS – CPU MODULE



**Figure 9. Connector Locations (CPU Module)**

**FALCON CONNECTOR LOCATIONS – BASEBOARD****Figure 10. Connector Locations (Baseboard)**

## FALCON CONNECTOR FUNCTIONS AND INTERFACE CABLES

Table 1 provides information about the function, mating connectors, and transition cables for Falcon connectors. Page numbers indicate where a detailed pinout or further information is available. (BB = baseboard, CPU = CPU board.)

**Table 1: Connector Functions and Interface Cables**

Connector <sup>1</sup>	Function	Mating Connector	Transition Cable	Cable Description	Page	Pin 1 Location X Coord. Y Coord. <sup>2</sup>	
J1 BB	Input power	Hirose DF11-8DS-2C (housing), Hirose DF11-22SC x8 (crimp socket)	VL-CBR-0807	12" 8-pin ATX power cable adapter	22	12mm	43 mm
J2 CPU	microSD	VL-F41-xxxx microSD Flash Drive	—	—	30	75.9406 mm	29.5981 mm
J2 BB	SATA II port	Latching SATA	VL-CBR-0702	19.75" latching SATA cable	27	59.12 mm	40.24 mm
J3 BB	User GPIO	—	—	(customer supplied cable for 2 x 3 2 mm header)	37	41.5 mm	38.8 mm
J4 BB	LVDS	Hirose DF19G-20S-1C (housing), Hirose DF19-2830SCFA x19 (crimp socket)	VL-CBR-2015 or VL-CBR-2016	20" 18- or 24-bit LVDS cable (attaches to optional VL-CBR-2014, LVDS to VGA adapter)	32	9.55 mm	-1.305 mm
J6 BB	Ethernet	FCI 10073599-008LF (housing), 2mm Minitex, AWG 22-24 x8 (crimp terminal)	VL-CBR-0804	Latching Ethernet cable	26	74.2 mm	39.9 mm
J7 BB	Mini PCIe / mSATA socket	Mini PCIe card or VL-MPEs-F1E Series mSATA Flash Drive	—	—	27	63.05 mm	9.8 mm
J8 BB	User I/O Latching	Samtec ISDF-25-D-M (housing), Samtec CC03L-2830-01-G (crimp pins)	VL-CBR-5014	12" 1.27 mm IDC 50-pin to 50-pin	25	49.51 mm <sup>3</sup>	44.57 mm
J10 BB	microSD	VL-F41-xxxx microSD Flash Drive	—	—	30	48.5625 mm	0.3625 mm
J12 BB	User I/O Non-latching	Oupiin 1204-50G00B2A	VL-CBR-5013	12" 1.27 mm IDC 50-pin to 50-pin	25	19.0404 mm	46.7492 mm

1. Connectors not listed are either not installed, for factory use only, or used for CPU module / baseboard interconnect.
2. Coordinates are measured on the baseboard from the mounting hole on the upper left as shown in Figure 10 and on the CPU board from the lower right mounting hole as shown in Figure 9. All measurements in millimeters.
3. The square solder pad, which usually indicates pin 1, indicates pin 50 on the J8 connector.

## VL-CBR-5013/5014 CONNECTOR LOCATIONS

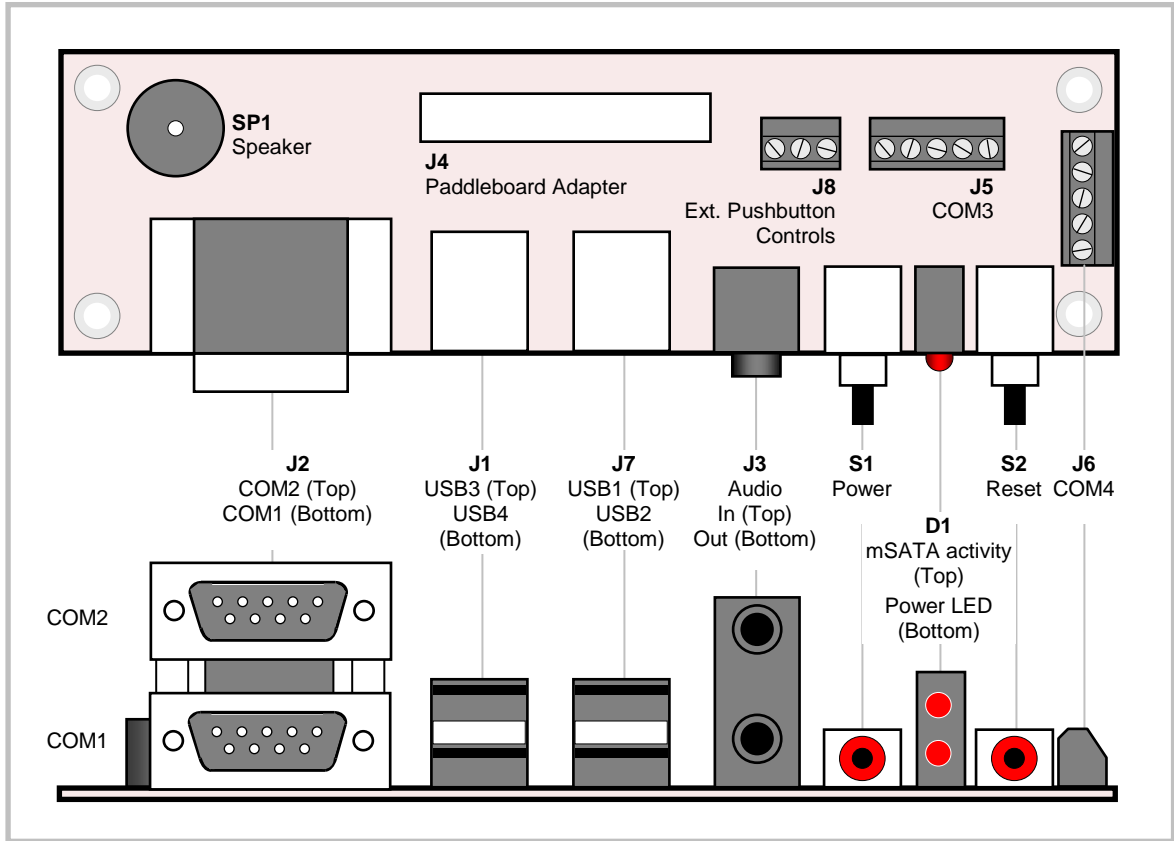


Figure 11. VL-CBR-5013/5014 Connector Locations

## VL-CBR-5013/5014 CONNECTOR FUNCTIONS

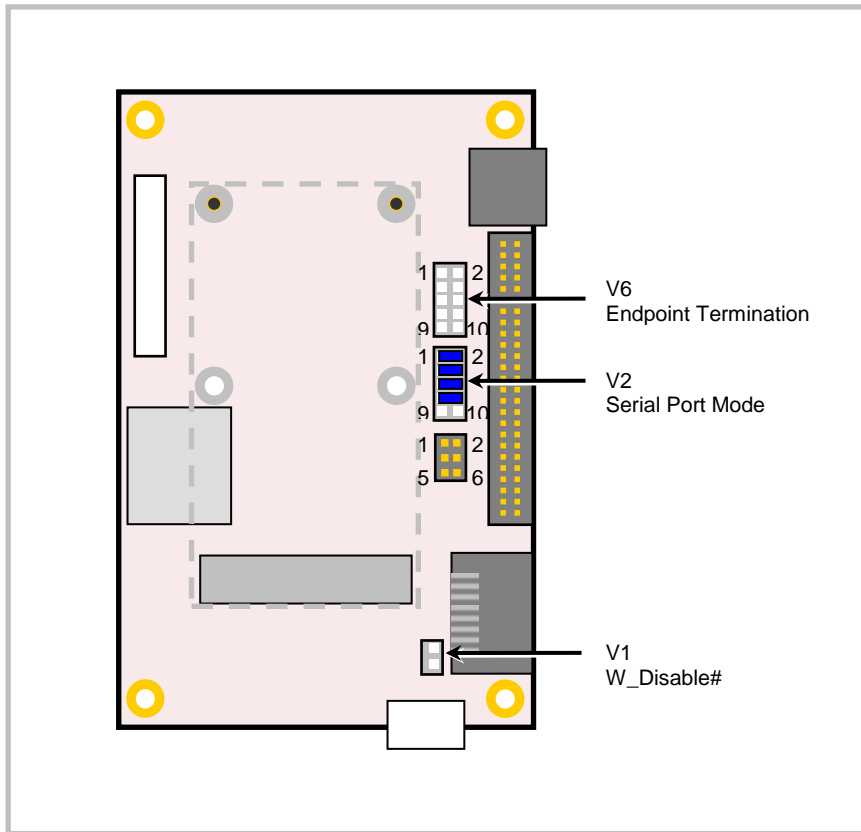
Table 2: VL-CBR-5013/5014 Connector Functions and Interface Cables

Connector	Function	PCB Connector	Description
J1	USB3, USB4	USB Type-A	USB Host
J2	COM1, COM2	Kycon K42-E9P/P-A4N	Dual DB-9 male
J3	Audio In/Out	3.5 mm dual audio jack	–
J4	High Density Connector	FCI 98414-F06-50ULF	2 mm, 50-pin, keyed header
J5	COM3	Conta-Clip 10250.4	5-pin screw terminal
J6	COM4	Conta-Clip 10250.4	5-pin screw terminal
J7	USB1, USB2	USB Type-A	USB Host
J8	External Reset and Power Buttons	Conta-Clip 10250.4	3-pin screw terminal
D1	mSATA activity (top), Power LED (bottom)	LED	–
S1	Power Button	Push-button	–
S2	Reset Button	Push-button	–
SP1	Speaker	Piezo speaker	–



## Jumper Blocks

### JUMPERS AS-SHIPPED CONFIGURATION



## JUMPER SUMMARY

Table 3: Falcon Jumper Summary

Jumper Block	Description	As Shipped
V1[1-2]	<b>Wireless Disable</b> In – Wireless radio operation disabled on Mini PCIe card Out – Wireless radio operation enabled	Out
V2[1-2]	<b>COM1 Mode</b> In – RS-232 Out – RS-422	In
V2[3-4]	<b>COM2 Mode</b> In – RS-232 Out – RS-422	In
V2[5-6]	<b>COM3 Mode</b> In – RS-232 Out – RS-422	In
V2[7-8]	<b>COM4 Mode</b> In – RS-232 Out – RS-422	In
V2[9-10]	<b>Non-volatile RAM clear.</b> With pins 2-4 of connector J3, clears MVRAM. In and J3[2-4] in: Clears NVRAM Out: Normal operation	Out
V6[1-2]	<b>Push-button required</b> In – Push-button required to start board from low power state Out – Push-button not required	Out
V6[3-4]	<b>COM1 termination</b> In – Endpoint termination Out – Not terminated	Out
V6[5-6]	<b>COM2 termination</b> In – Endpoint termination Out – Not terminated	Out
V6[7-8]	<b>COM3 termination</b> In – Endpoint termination Out – Not terminated	Out
V6[9-10]	<b>COM4 termination</b> In – Endpoint termination Out – Not terminated	Out

## Power Supply

Main input power is applied to the Falcon through an 8-pin power connector at location J1.

### POWER REQUIREMENTS

The Falcon requires a single +8-17V DC supply of 2A (24W) or better. The input DC supply is used to create both the standby and payload voltages provided to the CPU module.

The exact power requirements for the Falcon depend on several factors, including memory configuration, CPU speed, peripheral connections, and attached devices, etc. For example, driving long RS-232 lines at high speed can increase power demand.

The VersaLogic VL-PS-ATX12-300A is a 1U size ATX power supply designed for use with the Falcon. Use the VL-CBR-0807 adapter cable to attach the power supply to the J1 connector.

**Table 4: Main Power Connector Pinout**

J1 Pin	Signal Name	Description
1	V12P0_IN	+12VDC Power Input
2	V12P0_IN	+12VDC Power Input
3	V12P0_IN	+12VDC Power Input
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	V3P3_RTC	+2.75V to +3.3V Battery
8	SLP_R#	Sleep#

### POWER DELIVERY CONSIDERATIONS

Using the VersaLogic approved power supply (VL-PS-ATX12-300A) and power cable (VL-CBR-0807) will ensure high quality power delivery to the board. Customers who design their own power delivery methods should take into consideration the guidelines below to ensure good power connections.

Also, the specifications for typical operating current do not include any off-board power usage that may be fed through the Falcon power connector. Expansion boards and USB devices plugged into the board will source additional power through the Falcon power connector.

- Do not use wire smaller than 22 AWG. Use high quality UL 1007 compliant stranded wire.
- The length of the wire should not exceed 18".

- Avoid using any additional connectors in the power delivery system.
- The power and ground leads should be twisted together, or as close together as possible to reduce lead inductance.
- A separate conductor must be used for each of the power pins.
- All power input pins and all ground pins must be independently connected between the power source and the power connector.
- Use a high quality power supply that can supply a stable voltage while reacting to widely varying current draws.

## CPU

The Intel Atom Processor E6x0T series with Intel Platform Controller Hub EG20T features integrated 3D graphics, video encode and decode, and memory and display controllers in one package.

## System RAM

The Falcon has soldered-on DDR2 SDRAM with the following characteristics:

- |                    |               |
|--------------------|---------------|
| ▪ Storage Capacity | 1 GB or 2 GB  |
| ▪ Voltage          | +1.8V         |
| ▪ Speed            | 800 MT/s DDR2 |

## Clearing Non-Volatile RAM (NVRAM)

Jumper block V2[9-10] and connector J3[2-4] are used to clear NVRAM. When clearing the NVRAM:

1. Power off the Falcon.
2. Place jumpers on V2[9-10] and connector J3[2-4].
3. Power on the Falcon, and remove power after the Boot menu appears.
4. Remove both jumpers.
5. Power on the Falcon.

## Default BIOS Settings

The Falcon permits you to store user-defined BIOS settings. This allows you to retrieve those settings from cleared or corrupted CMOS RAM, or battery failure. All BIOS defaults can be changed, except the time and date. BIOS defaults can be updated with the BIOS Update Utility.

**Warning!** If BIOS default settings make the system unbootable and prevent the user from entering BIOS Setup, the Falcon needs to be serviced by the factory.

## DEFAULT BIOS SETUP VALUES

After CMOS RAM is cleared, the system will load default BIOS parameters the next time the board is powered on. The default CMOS RAM setup values will be used in order to boot the system whenever the main CMOS RAM values are blank, or when the system battery is dead or has been removed from the board.

## Real-Time Clock (RTC)

The Falcon features a real-time clock/calendar (RTC) circuit. The Falcon supplies RTC voltage in S5, S3 and S0 states, but requires an external +2.75V to +3.3V battery connection to pin 7 of the J1 power connector to maintain RTC functionality and RTC CMOS RAM when the Falcon is not powered. The RTC can be set using the BIOS Setup.

## Watchdog Timer

The Falcon has a watchdog timer that contains a selectable prescaler approximately 1  $\mu$ s to 10 minutes. See the [Intel Atom E6x0T Datasheet](#) for configuration information.

## Console Redirection

The Falcon can be configured for remote access by redirecting the console to a serial communications port. BIOS Setup and some operating systems such as DOS can use this console for user interaction.

Console redirection settings are configured in the BIOS Setup. Console redirection is enabled by default. The decision to redirect the console is made early in BIOS execution and cannot be changed later.

Console redirection can be disabled or redirected to a different COM port. The default settings for the redirected console are 115.2 Kbps, 8 data bits, 1 stop bit, no parity, and no flow control.

### Null Modem

The following diagram illustrates a typical DB9 to DB9 RS-232 null modem adapter.

System 1 Name Pin	<-->	System 2 Pin Name
TX 3	<-->	2 RX
RX 2	<-->	3 TX
RTS 7	<-->	1 DCD
CTS 8		
DSR 6	<-->	4 DTR
DCD 1	<-->	7 RTS
		8 CTS
DTR 4	<-->	6 DSR
GND 5	<-->	5 GND

Pins 1, 4, and 6 are shorted together on each connector. Unlisted pins have no connection.

## User I/O Connector

The 50-pin user I/O connector (J12 or J8) incorporates the COM ports, four USB ports, programmable LED, power LED, push-button reset, power button, audio line in/out, and speaker interfaces. The table below illustrates the function of each pin. The pinout for this interface is different for non-latching and latching connectors. Both pinouts are shown below.

**Table 5: User I/O Connector Pinout**

J12 Pin <sup>1</sup> Non-Latching	J8 Pin <sup>2</sup> Latching	Paddleboard Connector	Signal	
			RS-232	RS-422
1	50	COM2	Ground	Ground
2	49	J2	RXD	RxD-
3	48	Top DB9	—	RxD+
4	47		Ground	Ground
5	46		TXD	TxD-
6	45		—	TxD+
7	44	COM1	Ground	Ground
8	43	J2	RXD	RxD-
9	42	Bottom DB9	CTS	RxD+
10	41		Ground	Ground
11	40		TXD	TxD-
12	39		RTS	TxD+
13	38	COM3	Ground	Ground
14	37	J5	RXD	RxD-
15	36		—	RxD+
16	35		Ground	Ground
17	34		TXD	TxD-
18	33		—	TxD+
19	32	COM4	Ground	Ground
20	31	J6	RXD	RxD-
21	30		—	RxD+
22	29		Ground	Ground
23	28		TXD	TxD-
24	27		—	TxD+

J12 Pin <sup>1</sup> Non-Latching	J8 Pin <sup>2</sup> Latching	Paddleboard Connector	Signal
25	26	USB0	USB0 +5.0V
26	25		Data +
27	24		Data -
28	23	USB1	USB1 +5.0V
29	22		Data +
30	21		Data -
31	20	USB2	USB2 +5.0V
32	19		Data +
33	18		Data -
34	17	USB3	USB3 +5.0V
35	16		Data +
36	15		Data -
37	14		+5.0V (Protected)
38	13	D1	mSATA activity
39	12	SP1	Speaker
40	11	S2, J8 Pin 1	Push-button Reset
41	10	S1, J8 Pin 3	Power Button
42	9		Ground
43	8	Audio In J3 Top	Audio In - Left
44	7		HDA ground (isolated)
45	6		Audio In - Right
46	5		HDA ground (isolated)
47	4	Audio Out J3 Bottom	Audio Out - Left
48	3		HDA ground (isolated)
49	2		Audio Out - Right
50	1		HDA ground (isolated)

1. Models EBPB, ECPB, EDPB, EBKN, ECKN, EDKN.  
2. Models EBPL, ECPL, EBKL, ECKL.

## Ethernet Interface

The Falcon features an on-board Micrel KSZ9031RNXIA PHY and EG20T embedded Ethernet controller. The controller provides a standard IEEE 802.3 Ethernet interface for 1000Base-T, 100Base-TX, and 10Base-T applications. An RJ-45 connector is located at location J6. Drivers are readily available to support a variety of operating systems.

### ETHERNET CONNECTOR

One rugged, 8-pin, right-angle, latching Ethernet connector (J6) is provided to make connection with a Category 5 or 6 Ethernet cable. The Ethernet controller auto-negotiates connection speed. The interface uses IEC 61000-4-2-rated TVS components to help protect against ESD damage.

**Table 6: Ethernet Connector Pinout**

J6 Pin	Signal Name	Function
1	MDI3_N	Bi-directional pair D–
2	MDI3_P	Bi-directional pair D+
3	MDI1_N	Bi-directional pair B–
4	MDI1_P	Bi-directional pair B+
5	MDI2_N	Bi-directional pair C–
6	MDI2_P	Bi-directional pair C+
7	MDI0_N	Bi-directional pair A–
8	MDI0_P	Bi-directional pair A+

### ETHERNET STATUS LEDs

A dual green/yellow status LED is provided at location D4. This LED provides an indication of the Ethernet status as shown in the following table.

**Table 7: On-board Ethernet Status LEDs (D4)**

LED	State	Description
Green/Yellow (Link / Activity)	Yellow	Activity
	Green	Link
	Off	No Link

## SATA Interface

The Falcon provides one serial ATA (SATA) port, which communicates at a rate of up to 3.0 GB/s (SATA II). The SATA connector at baseboard location J2 is a SATA II-compatible right-angle connector with latching capability. Power to SATA drive is supplied by the ATX power supply. Note that the standard SATA drive power connector is different than the common 4-pin Molex connector used on IDE drives. Most current ATX power supplies provide SATA connectors, and many SATA drives provide both types of power connectors. If the power supply you are using does not provide SATA connectors, adapters are available.

**Table 8: SATA Port Pinout**

J2 (baseboard)	Signal Name	Function
1	GND	Ground
2	TX+	Transmit +
3	TX-	Transmit -
4	GND	Ground
5	RX-	Receive -
6	RX+	Receive +
7	GND	Ground

## Mini PCIe / mSATA Socket

The socket at location J7 accepts a full- or half-height Mini PCI Express (PCIe) card or an mSATA module.

The Mini PCIe interface includes one PCIe x1 lane, one USB 2.0 channel, and the SMBus interface. The socket is compatible with plug-in Wi-Fi modems, GPS receivers, MIL-STD-1553, flash data storage, and other cards for added flexibility. An Intel Wi-Fi Link 5300 Mini PCIe card (VL-WD10-CBN) is available from VersaLogic. A Wi-Fi antenna (VL-CBR-ANT01) and a 12" Wi-Fi card to bulkhead RP-SMA transition cable (VL-CBR-0201) are also available. For more information, contact [Sales@VersaLogic.com](mailto:Sales@VersaLogic.com).

The VL-MPEs-F1E series of mSATA modules provide flash storage of 4 GB, 16 GB, or 32 GB.

To secure a Mini PCIe card or mSATA module to the on-board standoffs, use two M2.5 x 6 mm pan head Philips nylon screws. These screws are available in quantities of 10 in the VL-HDW-108 hardware kit from VersaLogic.



Table 9: Mini PCIe / mSATA Pinout

J7 Pin	Mini PCIe Signal Name	Mini PCIe Function	mSATA Signal Name	mSATA Function
1	WAKE#	Wake	Reserved	Not connected
2	3.3VAUX	3.3V auxiliary source	+3.3V	3.3V source
3	NC	Not connected	Reserved	Not connected
4	GND	Ground	GND	Ground
5	NC	Not connected	Reserved	Not connected
6	1.5V	1.5V power	+1.5V	1.5V power
7	CLKREQ#	Reference clock request	Reserved	Not connected
8	NC	Not connected	Reserved	Not connected
9	GND	Ground	GND	Ground
10	NC	Not connected	Reserved	Not connected
11	REFCLK-	Reference clock input –	Reserved	Not connected
12	NC	Not connected	Reserved	Not connected
13	REFCLK+	Reference clock input +	Reserved	Not connected
14	NC	Not connected	Reserved	Not connected
15	GND	Ground	GND	Ground
16	NC	Not connected	Reserved	Not connected
17	NC	Not connected	Reserved	Not connected
18	GND	Ground	GND	Ground
19	NC	Not connected	Reserved	Not connected
20	W_DISABLE#	Wireless disable	Reserved	Not connected
21	GND	Ground	GND	Ground
22	PERST#	Card reset	Reserved	Not connected
23	PERn0	PCIe receive –	+B	Host receiver diff. pair +
24	3.3VAUX	3.3V auxiliary source	+3.3V	3.3V source
25	PERp0	PCIe receive +	-B	Host receiver diff. pair –
26	GND	Ground	GND	Ground
27	GND	Ground	GND	Ground
28	1.5V	1.5V power	+1.5V	1.5V power
29	GND	Ground	GND	Ground
30	SMB_CLK	SMBus clock	Two Wire I/F	Two wire I/F clock
31	PETn0	PCIe transmit –	-A	Host transmitter diff. pair –
32	SMB_DATA	SMBus data	Two Wire I/F	Two wire I/F data
33	PETp0	PCIe transmit +	+A	Host transmitter diff. pair +
34	GND	Ground	GND	Ground
35	GND	Ground	GND	Ground
36	USB_D-	USB data –	Reserved	Not connected
37	GND	Ground	GND	Ground

J7 Pin	Mini PCIe Signal Name	Mini PCIe Function	mSATA Signal Name	mSATA Function
38	USB_D+	USB data +	Reserved	Not connected
39	3.3VAUX	3.3V auxiliary source	+3.3V	3.3V source
40	GND	Ground	GND	Ground
41	3.3VAUX	3.3V auxiliary source	+3.3V	3.3V source
42	LED_WWAN#	Wireless WAN LED	Reserved	Not connected
43	GND	mSATA Detect <sup>1</sup>	GND/NC	Ground/Not connected <sup>2</sup>
44	LED_WLAN#	Wireless LAN LED	Reserved	Not connected
45	NC	Not connected	Vendor	Not connected
46	LED_WPAN#	Wireless PAN LED	Reserved	Not connected
47	NC	Not connected	Vendor	Not connected
48	1.5V	1.5V power	+1.5V	1.5V power
49	Reserved	Reserved	DA/DSS	Device activity <sup>3</sup>
50	GND	Ground	GND	Ground
51	Reserved	Reserved	GND	Ground <sup>4</sup>
52	3.3VAUX	3.3V auxiliary source	+3.3V	3.3V source

**Notes:**

1. This pin is not grounded on the Falcon since it can be used to detect the presence of an mSATA module versus a Mini PCIe card.
2. This pin is not grounded on the Falcon to make it available for mSATA module detection.
3. This signal drives the top LED (D1) on the VL-CBR-5013/5014 paddleboard. This LED lights with mSATA disk activity (if supported by the mSATA module).
4. Some Mini PCIe cards use this signal as a second Mini PCIe card wireless disable input. On the Falcon, this signal is available for use for mSATA versus Mini PCIe card detection. There is an option on the VersaLogic Features BIOS setup screen for setting the mSATA detection method.

**W\_DISABLE# SIGNAL**

The W\_DISABLE# is for use with optional wireless Ethernet Mini PCIe cards. The signal allows you to disable a wireless card's radio operation in order to meet public safety regulations or when otherwise desired. The W\_DISABLE# signal is an active low signal that when driven low (shorted to ground) disables radio operation on the Mini PCIe card wireless device. When the W\_DISABLE# is not asserted, or in a high impedance state, the radio may transmit if not disabled by other means such as software.

**MINI PCIE CARD WIRELESS STATUS LEDs**

Three wireless status LEDs are provided on the Falcon at locations D5 and D6:

- D5 Yellow – Wireless WAN
- D6 Green – Wireless LAN
- D6 Yellow – Wireless PAN

These LEDs light when the associated device is installed and capable of transmitting.

## microSD Sockets

The Falcon provides two microSD sockets, one on the CPU board (J2) and one on the baseboard (J10). The VL-F41 series of microSD cards provide solid-state storage of 2 GB, 4 GB, or 8 GB. The microSD sockets will accommodate cards with up to 32 GB of storage capacity.

## USB Interface

The Falcon provides four USB 2.0 ports.

The USB interface on the Falcon is UHCI (Universal Host Controller Interface) and EHCI (Enhanced Host Controller Interface) compatible, which provides a common industry software/hardware interface. The Falcon provides dual Type-A USB host connectors at locations J1 and J7 on the VL-CBR-5013/5014 paddleboard. One more USB channel is available through the Mini PCIe card connector at J7.

## Serial Ports

The Falcon features four on-board 16550-based serial communications channels located at standard PC I/O addresses. All ports can be operated in RS-232 or RS-422 mode. Only COM1 provides RS-232 handshake signals. IRQ lines are chosen in CMOS Setup. COM ports can share interrupts with other COM ports, but not with other devices. The UARTs on the Falcon use a 48 MHz clock and the OS should configure the clock rate in the UART Driver and UARTClock in the Packet Hub Driver for proper functionality.

### COM PORT CONFIGURATION

Jumper block V2 is used to configure serial ports for RS-232 or RS-422 operation. See “Jumper Summary” for details. The termination resistor should be enabled for RS-422 endpoint stations. Termination is not used for RS-232 intermediate stations.

## SERIAL PORT CONNECTORS

The pinouts of the DB9M connectors apply to the serial connectors on the VersaLogic breakout board VL-CBR-5013/5014.

These connectors use IEC 61000-4-2-rated TVS components to help protect against ESD damage.

**Table 10: COM1 Pinout – VL-CBR-5013/5014 Connector J2**

Bottom DB9 J2 Pin	RS-232	RS-422
1	—	—
2	RXD*	RxD-
3	TXD*	TxD-
4	—	—
5	Ground	Ground
6	—	—
7	RTS	TxD+
8	CTS	RxD+
9	—	—

**Table 11: COM2 Pinout – VL-CBR-5013/5014 Connector J2**

Top DB9 J2 Pin	RS-232	RS-422
1	—	—
2	RXD*	RxD-
3	TXD*	TxD-
4	—	—
5	Ground	Ground
6	—	—
7	—	TxD+
8	—	RxD+
9	—	—

**Table 12: COM3-4 Pinout – VL-CBR-5013/5014 Connectors J5-6**

COM3 J5 Pin	COM4 J6 Pin	RS-232	RS-422
1	1	Ground	Ground
2	2	RXD	RxD-
3	3	—	RxD+
4	4	TXD	TxD-
5	5	—	TxD+

## Video

The Intel Atom E6x0T processor series contains an integrated graphics engine with advanced 2D/3D graphics, video decode and encode capabilities, and a display controller. The Falcon supports one LVDS display.

### LVDS FLAT PANEL DISPLAY CONNECTOR

The integrated LVDS flat panel display in the Falcon is an ANSI/TIA/EIA-644-1995 specification-compliant interface. It can support 18 or 24 bits of RGB pixel data plus 3 bits of timing control (HSYNC/VSYNC/DE) on the 4 differential data output pairs. The LVDS interface supports a maximum resolution of 1280 x 768 (60 Hz).

The Falcon has one LVDS connector at location J4.

BIOS setup provides several options for standard LVDS flat panel types. If these options do not match the requirements of the panel you are using, contact [Support@VersaLogic.com](mailto:Support@VersaLogic.com) for a custom video BIOS.

**Table 13: LVDS Flat Panel Display Pinout**

<b>J4 Pin</b>	<b>Signal Name</b>	<b>Function</b>
1	GND	Ground
2	NC	Not Connected
3	LVDSA3	Diff. Data 3 (+)
4	LVDSA3#	Diff. Data 3 (-)
5	GND	Ground
6	LVDSCLK0	Differential Clock (+)
7	LVDSCLK0#	Differential Clock (-)
8	GND	Ground
9	LVDSA2	Diff. Data 2 (+)
10	LVDSA2#	Diff. Data 2 (-)
11	GND	Ground
12	LVDSA1	Diff. Data 1 (+)
13	LVDSA1#	Diff. Data 1 (-)
14	GND	Ground
15	LVDSA0	Diff. Data 0 (+)
16	LVDSA0#	Diff. Data 0 (-)
17	GND	Ground
18	GND	Ground
19	+3.3V	+3.3V (Protected)
20	+3.3V	+3.3V (Protected)

The +3.3V power provided to pins 19 and 20 of J3 is protected by a software-controllable power switch (1 Amp max.). This switch is controlled by the LVDD\_EN signal from the LVDS interface controller in the CPU.

## VGA OUTPUT

A VGA monitor can be attached to the J4 connector using the VL-CBR-2014 LVDS to VGA adapter card. Follow the procedure below to do this.

1. Plug the "Host End" of the LVDS cable VL-CBR-2015 into connector J4 of the Falcon.
2. Plug the LVDS cable into connector J1 of the VL-CBR-2014 adapter card (see Figure 12).
3. Attach the VGA monitor data cable to connector CN1 of the VL-CBR-2014 adapter cable.

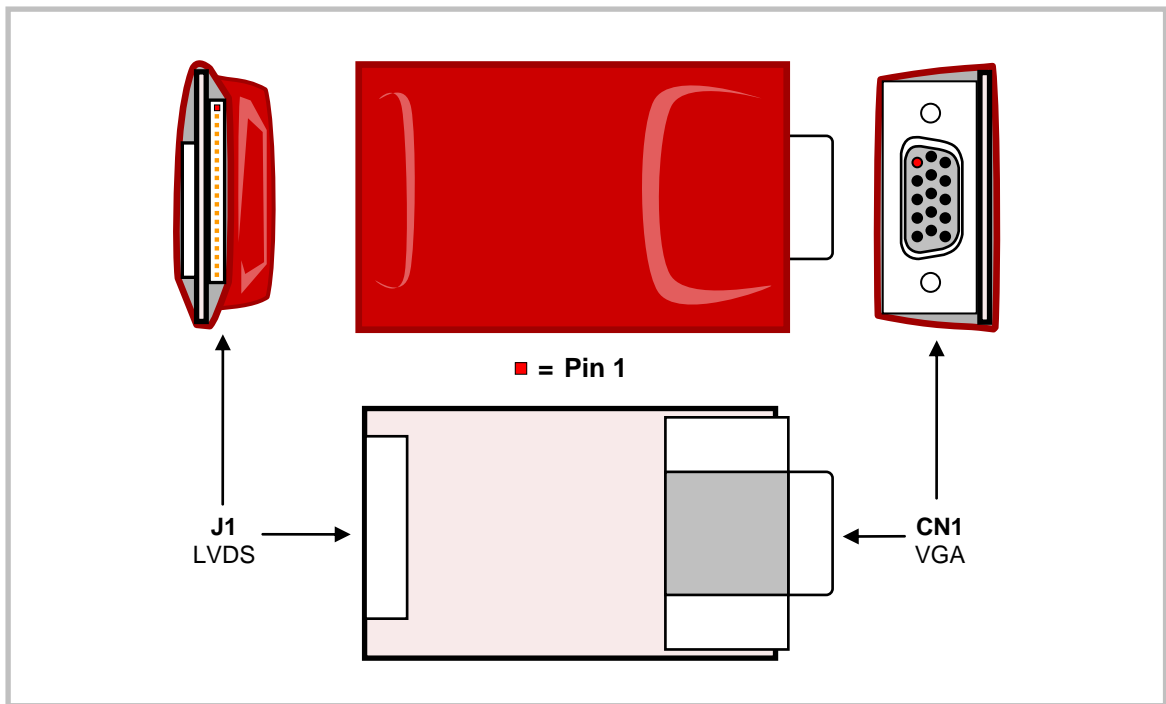


Figure 12. VL-CBR-2014 LVDS to VGA Adapter Card

## Audio

The audio interface on the Falcon is implemented using an Integrated Device Technology, Inc. 92HD87B1X5 audio codec. This interface is Intel High Definition Audio (HDA) compatible. Drivers are available for most Windows-based and Linux operating systems. To obtain the most current versions, consult the Falcon Product Support Page.

The J8 main I/O connector provides the line-level stereo input and line-level stereo output connection points. The outputs will drive most amplified PC speaker sets.

The following table shows the pinout of the audio connector J3 on the VL-CBR-5013/5014 breakout board.

**Table 14: VL-CBR-5013/5014 J3 Audio Connector Pinout**

J3 Pin	Signal Name	Function
1	LINE_INL	Line-In Left
2	LINE_INR	Line-In Right
3	HDA_GND	HDA Ground
4	LINE_OUTL	Line-Out Left
5	LINE_OUTR	Line-Out Right
6	HDA_GND	HDA Ground

**Note:** In Windows, the rear line-in audio input is configured by default as a microphone input. To configure it for audio input, disable the microphone boost to eliminate audio distortion.

## Push-button Reset

Connector J8 includes an input for a push-button reset switch. Shorting J8 pin 40 to ground causes the Falcon to reboot. This must be a mechanical switch or an open-collector or open-drain active switch with less than a 0.5V low-level input when the current is 1 mA. There must be no pull-up resistor on this signal.

This connector uses IEC 61000-4-2-rated TVS components to help protect against ESD damage.

A reset button is provided on the VL-CBR-5013/5014 breakout board. Terminal block J8 on the breakout board also provides a reset signal on pin 1 and ground on pin 2.



## Power Button

Connector J8 includes an input for a power button. A momentary short to ground or assertion of J8 pin 41 will cause a power button ACPI event. The button event can be configured in Windows to enter an S3 power state (Sleep, Standby, or Suspend-to-RAM), an S4 power state (Hibernate or Suspend-to-Disk), or an S5 power state (Shutdown or Soft-Off). A short or assertion with a duration of more than 4 seconds will cause an abrupt hardware power down to S5.

This connector uses IEC 61000-4-2-rated TVS components to help protect against ESD damage.

A power button is provided on the VL-CBR-5013/5014 breakout board. Terminal block J8 also provides a power button signal on pin 3 and ground on pin 2.

In configurations where a power button is not connected to the board, if the system is put into an S5 state, power can be restored by turning off the power supply and turning it back on if jumper V6[1-2] is not installed.

### SUPPORTED POWER STATES

The Falcon supports the following power states:

- S0 (G0): Working.
- S1 (G1-S1): All processor caches are flushed and the CPU stops executing instructions. Power to the CPU and RAM is maintained. Devices that do not indicate they must remain on may be powered down.
- S3 (G1-S3): Commonly referred to as Standby, Sleep, or Suspend-to-RAM. RAM remains powered.
- S4 (G1-S4): Hibernation or Suspend-to-Disk. All content of main memory is saved to non-volatile memory, such as a hard drive, and is powered down.
- S5 (G2): Soft Off. Almost the same as G3 Mechanical Off, except that the power supply still provides power, at a minimum, to the power button to allow return to S0. A full reboot is required. No previous content is retained. Other components may remain powered so the computer can "wake" on input from the keyboard, clock, modem, or LAN.
- G3: Mechanical off (ATX supply switch turned off).

## External Speaker

Connector J8 includes a speaker output signal at pin 39. The VL-CBR-5013/5014 breakout board provides a Piezo electric speaker.

## LEDs

### MSATA ACTIVITY LED

Connector J8 includes an output signal for an mSATA activity LED, which corresponds to the top LED at position D1 on the VL-CBR-5013/5014 breakout board.

### POWER LED

The power LED on the VL-CBR-5013/5014 indicates that the paddle board is being powered by the 5V supply (though it does not indicate that all S0 power supplies are good). The LED is lit only when the board is in the S0 power state. If the board enters a Sleep or Hibernate mode, the LED will not be lit.

### OTHER LEDs

- D12: Blue S0 power state LED indicates the board is in an S0 power state. This LED is not easily visible when the heatplate and heat sink are installed.
- D11: Blue S3 power state LED is on in power states S3 and S0.
- D5: Green always-on LED is on in every power state except G3.

## General Purpose I/O (GPIO)

Connector J3 provides four independently-configurable user I/O lines.

See the [Intel Atom Processor E6xx Series Datasheet](#) for configuration information. Connector J3 supplies GPIO signals 1-4 only. GPIO 0 and 5-8 are reserved.

J3 Pin	Signal Name	Function
1	V1P8	+1.8V
2	GND	Ground
3	TNC_GPIO_SUS4	User GPIO line 1
4	TNC_GPIO_SUS3	User GPIO line 2
5	TNC_GPIO_SUS2	User GPIO line 3
6	TNC_GPIO_SUS1	User GPIO line 4

## Appendix A – Mounting Options



### Falcon Mounting Configurations

The following illustrations show the mounting options for the Falcon.

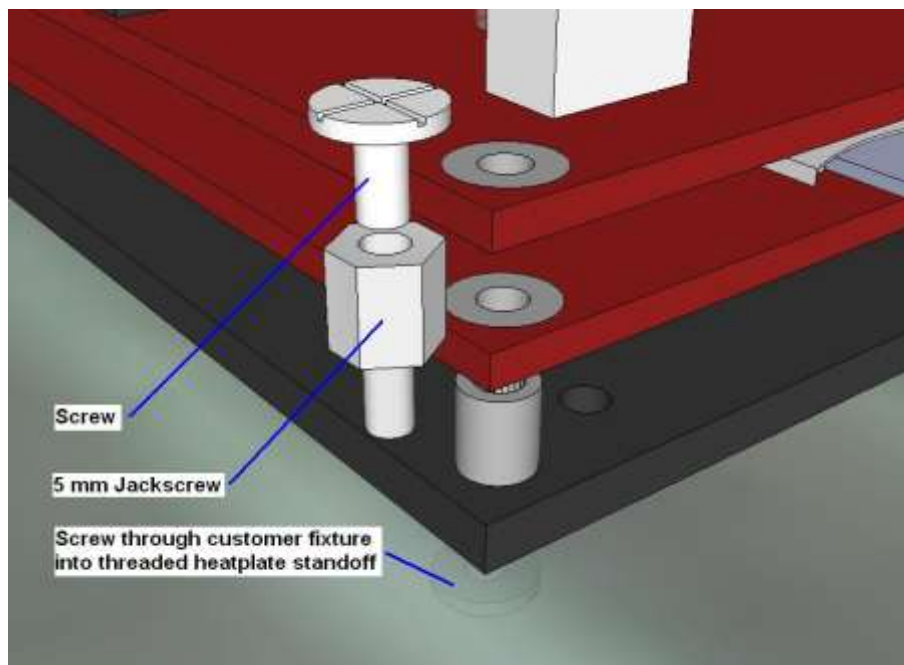


Figure 13. Bolt-through Heat Plate

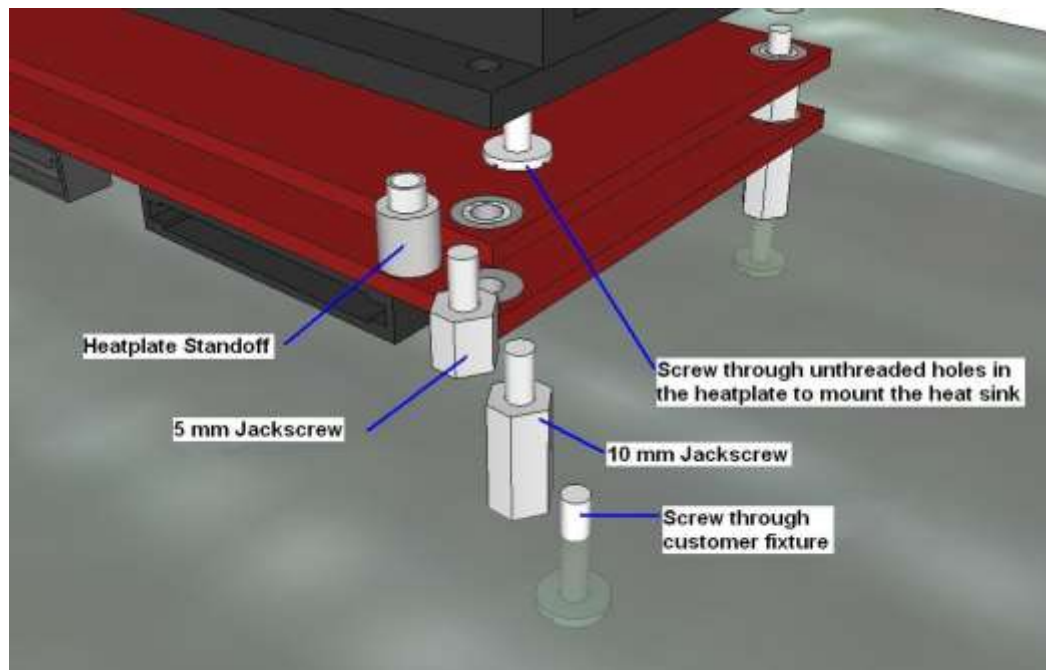


Figure 14. Bolt-through Heatsink

## Mounting Plate Configurations

The following illustrations show options for installing the Falcon with the VL-HDW-405 mounting plate.

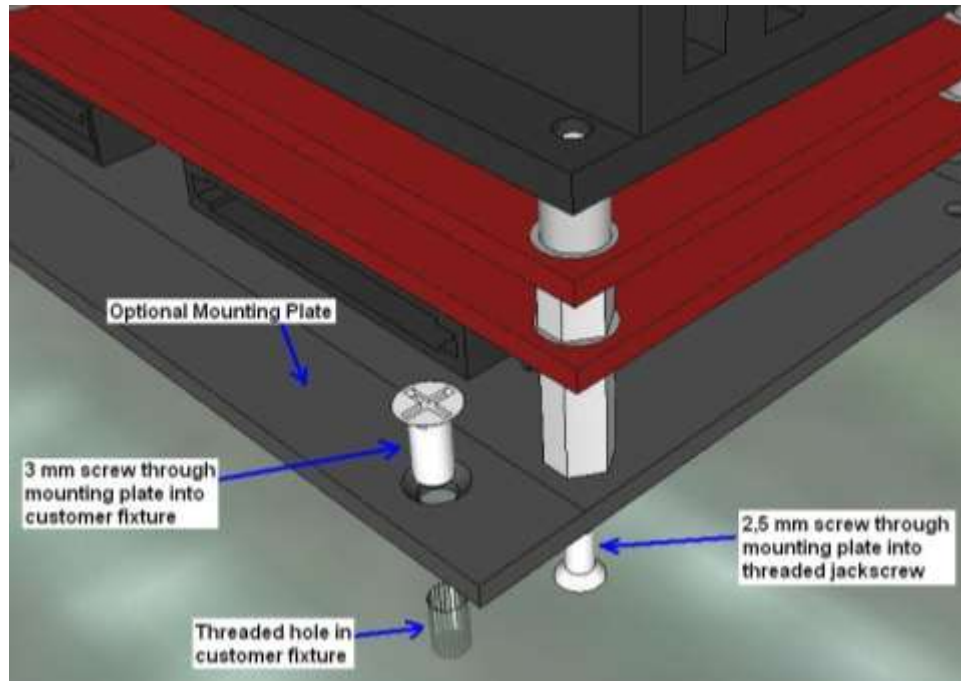


Figure 15. Mounting Plate Option 1

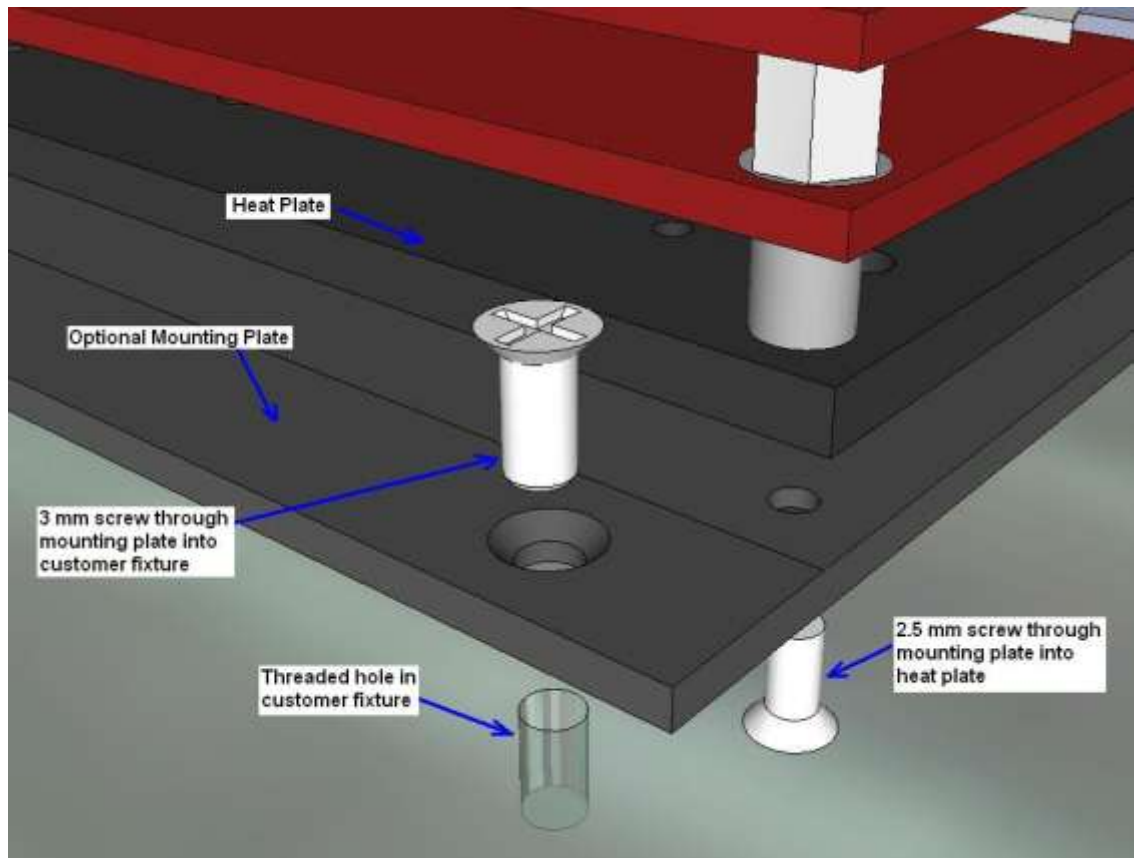


Figure 16. Mounting Plate Option 2