600-2712
PCI EXPRESS EXPANSION SYSTEM
USER'S MANUAL

Revision 1.1, October 2017

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

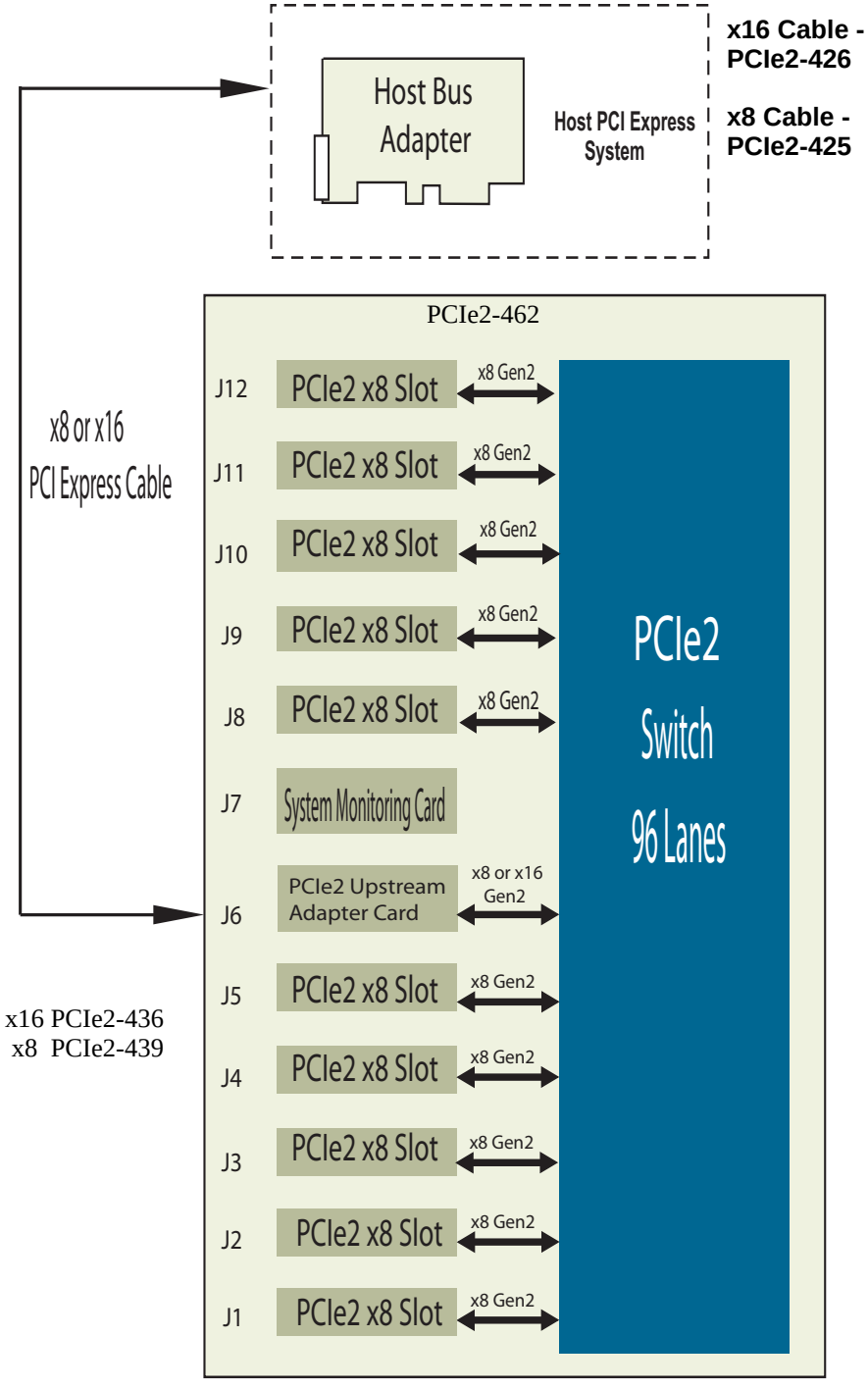
The Cyclone Microsystems PCIe2-2712 is a PCI Express (PCIe) Gen2 Expansion System that supports the addition of up to ten PCI Express I/O cards to a single host computer. Most host computers contain few PCI Express slots making them poorly suited for building complex systems requiring many different I/O boards and co-processor resources. The PCIe2-2712 Expansion System has been designed for applications requiring multiple PCIe I/O and co-processing resources.

PCIe2-2712 system is composed of three elements: a PCI Express Host Bus-to-Cable Adapter, an Expansion cable, and an Expansion Chassis. The PCIe2-2712 system can be configured with either a x8 or a x16 interface between the host computer and the expansion backplane. For the x8 configuration, a PCIe2-425 Host Bus-to-Cable Adapter card is inserted into a host computer's x8 PCIe Gen2 slot. A x8 PCIe external cable links the PCIe host to the expansion chassis. For the x16 configuration, a PCIe2-426 Host Bus-to-Cable Adapter card is inserted into a host computer's x16 PCIe Gen2 slot. A x16 PCIe external cable links the PCIe host to the expansion chassis. The expansion chassis is populated with a ten slot x8 switched backplane, an up-stream cable adapter (either x8 or x16), and, optionally, a system monitor board. All expansion slots use open back x8 connectors which accommodate full length cards with a x1, x4, x8, or x16 PCIe interface. The backplane and add-in cards are cooled by four 77 CFM fans. The PCIe2-2712 is avaliable with either a 3240 W or 2180 W N+1 redundant power supply in a 5U chassis, or a 1200 W standard ATX supply in a 4U chassis.

The PCIe-2712 Expansion System supports 160 or 80 Gb/s bi-directional traffic to and from the host system. The system utilizes low latency PCIe Bus repeaters and non-blocking PCI Express switches for excellent peer-to-peer I/O bandwidth. For host computers with modern BIOSs, the PCIe2-2712 Expansion System is recognized by the host system upon boot-up, requires no hardware specific drivers, and is entirely host operating system independent.

PCI Express is a high performance, general purpose I/O inter-connect defined for a wide variety of computing and communication platforms. Key PCI attributes, such as its usage model, load-store architecture, and software interfaces are maintained, whereas its parallel bus implementation is replaced by a serial interface. PCI Express take advantage of recent advances in point-to-point inter-connects, switch-based technology, and packetized protocol to deliver new levels of performance.

Figure 1-1. PCIe2-2712 Block Diagram



1.2 SPECIFICATIONS

The specifications in Table 1-1 detail the PCIe2-2712 Expansion System chassis including the PCIe2-462 expansion backplane, PCIe2-436 or PCIe2-439 Upstream Cable adapter and chassis/power supply. The chassis also includes Four 77 CFM fans.

Table 1-1. Physical/Environmental Characteristics

Height	8.75 inches (5U Chassis) 7 inches (4U Chassis)
Width	17 inches
Depth	27 inches
Weight	80 lbs (5U chassis) 50 lbs (4U chassis)
Operating Temperature	0 to 50 Degrees Celsius
Relative Humidity	0% to 95% (non-condensing)
Storage Temperature	-20 to 70 Degrees Celsius

Table 1-2. 3240W N+1 Redundant Power Supply Characteristics

Voltage	90-264 VAC		
Frequency	47-63 Hz.		
Input Current	45A (115 VAC), 22.5A (240 VAC)		
Maximum Inrush Current	30A (115 VAC), 15A (230 VAC) per Module		
Total DC Output	3240W		
DC Output Specs	**Output Voltage**	**Output Current Min**	**Output Current Max**
	+5V	1	24
	+12V	6	263
	-12V	0	1.5
	+3.3V	1	24
	+5VSB	0.1	4

Table 1-3. 2180W N+1 Redundant Power Supply

Voltage	90-264 VAC		
Frequency	47-63 Hz.		
Input Current	30A (115 VAC), 15A (230 VAC)		
Maximum Inrush Current	30A (115 VAC), 15A (230 VAC) per Module		
Total DC Output	2180W		
DC Output Specs	**Output Voltage**	**Output Current Min**	**Output Current Max**
	+5V	1	24
	+12V	6	178
	-12V	0	1.5
	+3.3V	1	24
	+5VSB	0.1	4

Table 1-4. 1200W Power Supply Characteristics

Voltage	90-264 VAC		
Frequency	47-63 Hz.		
Input Current	15A (100 VAC), 7.5A (240 VAC)		
Maximum Inrush Current	50A (115 VAC), 100A (230 VAC)		
Total DC Output	1200W		
DC Output Specs	**Output Voltage**	**Output Current Min**	**Output Current Max**
	+5V	0	25
	+12V	0.6	100
	-12V	0	0.5
	+3.3V	0	25
	+5VSB	0	3

1.3 STANDARDS

PCI Express Base Specification Revision 2.0

PCI Express Card Electro Mechanical Specification 2.0

PCI Express External Cabling Specification 2.0

1.4 ORDERING INFORMATION

The expansion system is avaliable with one or three meter cable, standard or low profile panels on the Host Bus adapter (PCIe-426), 1200W, 2180W or 3240W power supply, and the optional Chassis Monitor board.

Cyclone Part Numbers	
600-2712-1-12SA	Expansion System with 1 meter cable and 1200W Power Supply (4U chassis) x16 host link
600-2712-3-12SA	Expansion System with 3 meter cable and 1200W Power Supply (4U chassis) x16 host link
600-2712-1-21SA	Expansion System with 1 meter cable and 2180W Power Supply (5U chassis) x16 host link
600-2712-3-21SA	Expansion System with 3 meter cable and 2180W Power Supply (5U chassis) x16 host link
600-2712-1-32SA	Expansion System with 1 meter cable and 3240W Power Supply (5U chassis) x16 host link
600-2712-3-32SA	Expansion System with 3 meter cable and 3240W Power Supply (5U chassis) x16 host link
600-2712-1-12SB	Expansion System with 1 meter cable and 1200W Power Supply (4U chassis) x8 host link
600-2712-3-12SB	Expansion System with 3 meter cable and 1200W Power Supply (4U chassis) x8 host link
600-2712-1-21SB	Expansion System with 1 meter cable and 2180W Power Supply (5U chassis) x8 host link
600-2712-3-21SB	Expansion System with 3 meter cable and 2180W Power Supply (5U chassis) x8 host link
600-2712-1-32SB	Expansion System with 1 meter cable and 3240W Power Supply (5U chassis) x8 host link
600-2712-3-32SB	Expansion System with 3 meter cable and 3240W Power Supply (5U chassis) x8 host link

1.5 PCIE2-2712 MAJOR COMPONENTS

- 600-R2051 4 U Chassis
- 600-R2032 5U Chassis
- PCIe2-462 Expansion Backplane
- x16 Cable Version
  - > x16 Cable - 1 or 3 meters
  - > PCIe2-436 x16 upstream card (installed on PCIe2-462 Backplane)
  - > PCIe2-426 x16 HBA

- x8 Cable Version
  - > x8 Cable - 1 or 3 meters
  - > PCIe2-439 x8 upstream card (installed on PCIe2-462 Backplane)
  - > PCIe2-425 x8 HBA
- Optional Cyclone CM027 System Monitor Board
- Optional Rack Mount Glide Rails and Rack Mount Ears

Figure 1-2. PCIe2-2712 Front View Open

Figure 1-3. PCIe2-2712 Top View with HBA

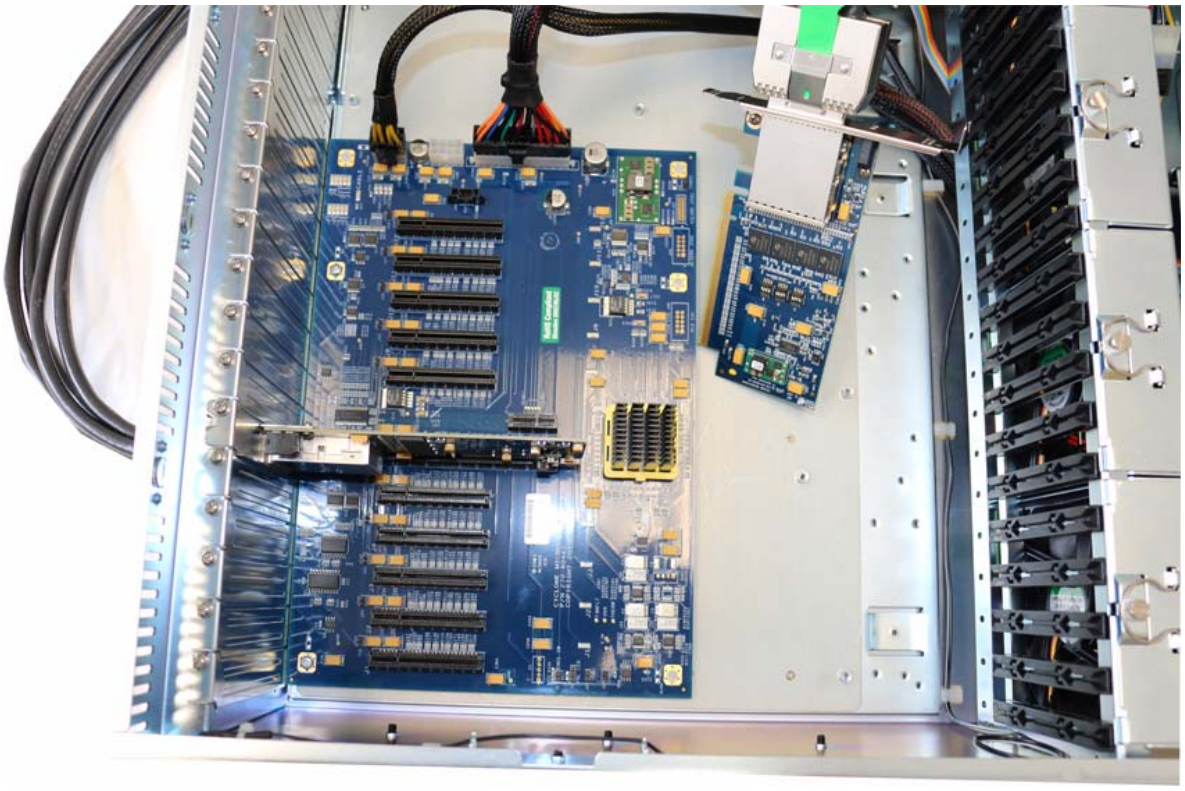


Figure 1-4. PCIe2-2712 Top View

CHAPTER 2
THEORY OF OPERATION

2.1 THEORY OF OPERATION

The basic PCI Express link consists of dual unidirectional differential links, implemented as a transmit pair and a receive pair. The signaling rate for PCI Express Gen2 is 5.0 Gigabits/second/Lane/direction. A link supports at least one lane.

The PCI Express link from the PCIe2-426 over the cable to the PCIe2-462 is a sixteen lane (x16) link. The PCI Express link from the PCIe2-425 over the cable to the PCIe2-462 is an eight lane (x8) link. The PCIe2-462 provides ten slots which are populated mechanically with x8 connectors. All sots can accommodate either a single lane (x1), x4, x8, or x16 add-in cards. Although not expressly permitted by the PCI Express Specification, all slots accommodate “down-shifting” a x16 card into x8 slot due to the PCIe2-462 backplane’s usage of open back PCIe connectors. Plugging a smaller link card into a larger link connector is fully allowed.

Once the PCIe2-426 or PCIe2-425 is installed into the host PC, the cable connected to the PCIe2-2712 chassis, the chassis plugged into an AC power outlet and any desired add-in cards are installed, the system is ready to be turned on. When the host is turned on, a signal from the PCIe2-426/PCIe2-425 will turn on the PCIe2-2712 chassis. A number of things happen at this point. First, the PCI Express links are initialized. This is a purely hardware initialization where each PCI Express link is set up following a negotiation of lane widths by the two ends of each link. No firmware or operating system software is involved. Once the links are initialized or “trained”, there are LED indicators on each of the Cyclone Microsystems cards that indicate that the links are trained. A detailed explanation of the LEDs follows later in this manual.

One essential requirement for system initialization is the ability of the host system’s BIOS to be able to enumerate the many bridges inherent in a complex PCI Express design. The links from the PCIe2-426/425 to the PCIe2-462 are created with PCI Express Switches. Each link looks like a PCI-to-PCI bridge to the Host’s BIOS. The number of bridges can add up quickly. Older BIOS may not have the resources to enumerate a large number of bridges. Make sure that the BIOS packages on the host computer has the latest updates. If required, contact the host system’s manufacturer to make sure that the BIOS used can handle the large number of bridges that it will see in the system.

CHAPTER 3
GETTING STARTED (INSTALLATION)

3.1 Installing HBA in Host

The PCIe2-425 or PCIe2-426 HBA is installed into the Host System following directions for installing add-in PCIe cards provided by the Host System. The PCIe2-425 requires a x8 or greater slot and the PCIe2-426 requires a x16 slot.

3.1.1 Connecting Expansion System to Host

Connect the PCIe cable to the HBA mounted in the host and to the upstream card in the Expansion Chassis. Confirm that the mechanical latch is secure to assure good electrical connections.

3.2 Powering Up

The expansion system is switched on by the Host System. A “Power On” signal is included in the cable indicating to the Expansion System to power on or off.

3.2.1 Installing Cards in Expansion System

PCIe add-in cards Should be installed in the Expansion Chassis with the Power OFF. The power for the expansion chassis is controlled by the host system. Powering down the host will be turn off power to the expansion chassis.

Table 3-1. Installing PCIe Add-in Cards

1	Power down Chassis
2	Remove top cover
4	Install PCIe Add-in Cards
5	Secure Add-in Card and panel with mounting screw
6	Replace cover

3.2.2 Seating of PCIe Add-In Cards

Unlike standard PC applications, the PCIe2-2712 Expansion Systems has a narrow lower gate that precisely engages the lower end of the PCI Express Add-In board’s face panel. The purpose is to ensure correct electrical connector mating of up-plugged boards. Failure to accurately mate the lower end of the face panel with the chassis lower gate will lead to the board not being recognized by the host.

Table 3-2. Slot Capabilities

Slot	Connector	Lanes	Width
J1	x8 connector	x8 lanes	single
J2	x8 connector	x8 lanes	single
J3	x8 connector	x8 lanes	single
J4	x8 connector	x8 lanes	single
J5	x8 connector	x8 lanes	single
J6	x16 connector	Upstream Cable Slot	single
J7	x1 connector	Monitor Slot	single
J8	x8 connector	x8 lanes	single
J9	x8 connector	x8 Lanes	single
J10	x8 connector	x8 Lanes	single
J11	x8 connector	x8 lanes	single
J12	x8 connector	x8 lanes	single

On the PCIe2-462, the slot connector size matches the slot width back to the backplane switch. All ten slots use open back connectors taht allow users to plug in larger add-in cards. Slots J6 and J7 use PCIe slot connectors but proprietary pin outs and are not for general purpose use. Slot J10 is for the Upstream cable Adapter and slot J7 is for the optional System Monitor board. Only Cyclone Microsystems Upstrean Cable Adapters and System Monitor boards should be installed in slots J6 and J7 respectively. Table-3-2 summarizes the slot capabilities.

CHAPTER 4
TROUBLE SHOOTING/SYSTEM OPERATIONS

4.1 PCIE LINK ISSUES

A PCI Express subsystem is comprised of a series of point-to-point connections. On start up, the devices on each end of each connection establish a link with each other through hardware mechanisms. Once linked, communication between the devices can occur. However, hardware problems can prevent the PCIe devices from linking properly.

On the PCIe2-2712 expansion system, the link status is between two devices is presented to the user by an LED (see section table 3.2). The potential LED states are listed in table 3.1 of this document. If an LED is not on after the PC boots, or is blinking at random intervals, then a hardware problem is occurring. Potential causes of a PCIe link issue are:

Table 4-1. PCIe Link Issue

Cause of Problem	Links Affected	Potential Solution
PCIe cable is not fully inserted on one/both ends of the cable	Cable	Carefully apply pressure to the cable while inserting it until it clicks into place.
Incompatible host system	Cable	Update BIOS and adjust BIOS options concerning PCI Express, or use alternative host system
Expansion system power supply not turning on	Cable/Slots	Ensure cable is fully inserted, then contact Cyclone Microsystems
No add-in card is installed in a given slot	Slots	No problem - Link LED should remain off.
Add-in card not seated properly in PCIe expansion slot	Slots	Carefully apply pressure to the top of the add-in card while inserting it until it click into place.
Auxiliary power connectors not installed on add-in cards	Slots with GPUs installed	Connect the appropriate 6 or 8-pin PCIe power connector to GPU.

4.2 BIOS CONCERNS

Per the PCIe specification, the PC BIOS should be able to handle the additional devices added to the system via the PCIe2-2712 expansion unit. However, on occasion, a BIOS may have a bug that prevents the system from allocating resources to all devices during the PCIe configuration process. Symptoms of this include:

- PC won't boot with expansion unit installed (monitor may not power on, or BIOS will hang)
- O/S will hang during boot sequence (typically during device driver initialization)
- Device Drivers will fail to operate properly for some of the boards installed (evident via Windows Device Manager)
- Installed devices missing in Windows Device Manager

If you suspect you are encountering a BIOS enumeration issue, try updating the BIOS to the latest version posted on the PC manufacturer's website. If the problem persists, use a different PC make and model, or contact the PC manufacturer for additional assistance.

Table 4-2. Link LED Indication

OFF	Link is down
ON	Link is up, all lanes, Gen2 (5GT/s) rate.
BLINK: 0.5 seconds ON, 0.5 seconds OFF	Link is up, reduced lanes, Gen2 (5GT/s rate)
BLINK: 1.5 seconds ON, 0.5 seconds OFF	Link is up, all lanes, Gen1 (2.5GT/s rate).
BLINK: 0.5 seconds ON, 1.5 seconds OFF	Link is up, reduced lanes, Gen1 (2.5GT/s rate).

CHAPTER 5
PCIE2-425/PCIE2-426 AND PCIE2-439/PCIE2-436

5.1 INTRODUCTION

Host Bus adapters (HBA) are the PCIe2-425 for x8 cables and the PCIe2-426 for x16 cables. They are repeater based.

5.2 INSTALLATION IN HOST

The PCIe2-426 Host Bus Cable Adapter is installed in a host computer's x16 Gen2 slot providing an interface from the host to the x16 cable and, in turn, the expansion chassis. It can also be plugged into a Gen1 slot, reducing performance.

5.3 PCIe2-426/425 LEDs

The bottom (or left) LED on the HBA front panel is the "Cable and Expasnion Chassis Detect" LED. When the LED is ON, the HBA is detecting the cable and expansion chassis. If this LED is OFF, there may be a problem with +3.3V power in the expansion chassis or the PCIe Expansion Cable is not connected properly.

The top (or right) LED on the panel is "Expansion System Signal Detect". The LED is on when the HBA detects a signal on Lanes 0-3 of the PCIe cable. The LED ON indicates normal operation. If the LED is not on, there is something wrong with the cable or the expansion system is not operating properly.

5.4 MECHANICAL

The PCIe2-426 and PCIe2-425 are low profile PCI Express add-in cards and are available with either a standard height front panel or a low profile front panel. For the PCIe2-426, see Figure 5-2 for a mechanical drawing of the card and Figure 5-1 for a front panel drawing. For PCIe2-425, see Figure 5-6 for a mechanical drawing of the card and figure 5-5 for a front panel drawing.

Table 5-1. PCIe2-426 or PCIe2-425 Power Requirements

Voltage	Current Typical	Current Maximum
+3.3V	1.09 Amps	1.60 Amps
+12V	0 Amps	0 Amps

* The PCIe-426 and PCIe2-425 does not use +12V

5.5 PCIe2-436/439 UPSTREAM ADAPTER CARDS

The PCIe2-436 adapts the PCIe2-462 expansion backplane to a x16 cable. The PCIe2-439 adapts the backplane to a x8 cable. The cards are low profile and can be shipped with a low profile end panel or a standard height end panel. These cards are designed to only be used in "upstream" slots on Cyclone Microsystems backplanes.

5.5.1 PCIe2-436/439 LEDs

The bottom (or left) LED on the front panel is the "Cable Present Detect" LED. This green LED reflects the status of the "CPRSNT#" signal in the PCIe Expansion Cable. When the LED is ON, it is indicating that the "CPRSNT#" signal is asserted. The chassis asserts "CPRSNT#" to indicate that it is present, the cable is connected, and power is good. If this LED is OFF, there may be a problem with +3.3V power in the expansion chassis or the PCIe Expansion Cable is not connected properly.

The top (or right) LED on the panel is a "PCIe Link Indicator". This yellow LED is ON solid when all cable lanes used and are operating at Gen2 rates. A cable link running at Gen1 rates and/or using less lanes than available will indicate status with a blinking LED. The blinking pattern is the same as the slot indicators, see Table 4-2

5.5.2 MECHANICAL

The PCIe2-436 and PCIe2-439 are low profile PCI Express form factor upstream cards and are available with either a standard height front panel or a low profile front panel. For the PCIe2-436, see Figure 5-4 for a mechanical drawing of the card and Figure 5-3 for a front panel drawing. For the PCIe2-439, see Figure 5-8 for a mechanical drawing of the card and Figure 5-7 for a front panel drawing.

5.5.3 PCIe2-436/439 Output Swing, De-Emphasis and Receive Equalization

The transceiver silicon used on the PCIe2-436/439 has eight steps of programmable de-emphasis, four steps of output swing and eight steps of receive equalization. The as-shipped-default configuration of the transceiver silicon is what Cyclone Microsystems has determined is the best setting for Gen2 operation with both 1m and 3m PCIe cables shipped with Cyclone PCIe Expansion systems. This configuration will also function adequately for Gen1 operation.

Figure 5-1. PCIe2-426 LEDs

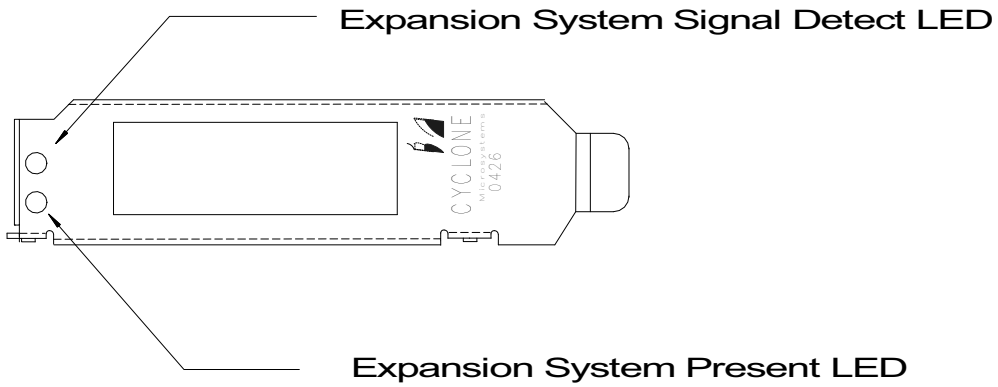


Figure 5-2. PCIe2-426 Physical Configuration

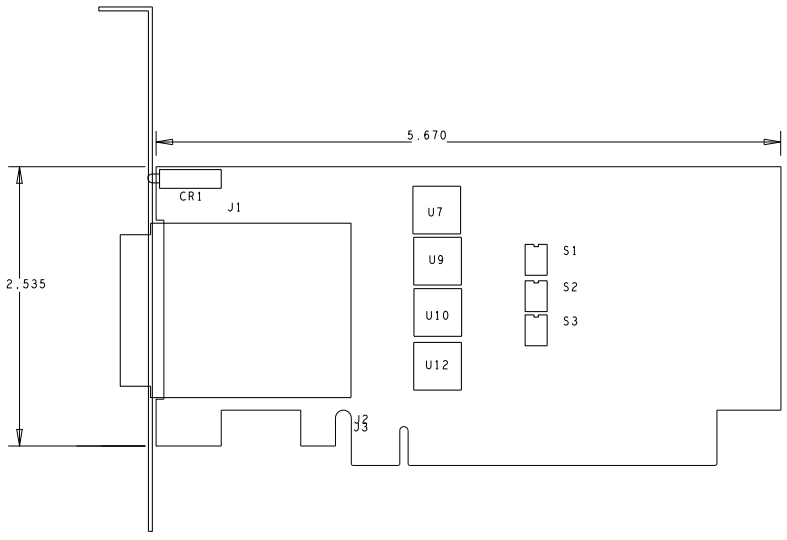


Figure 5-3. PCIe2-436 LEDs

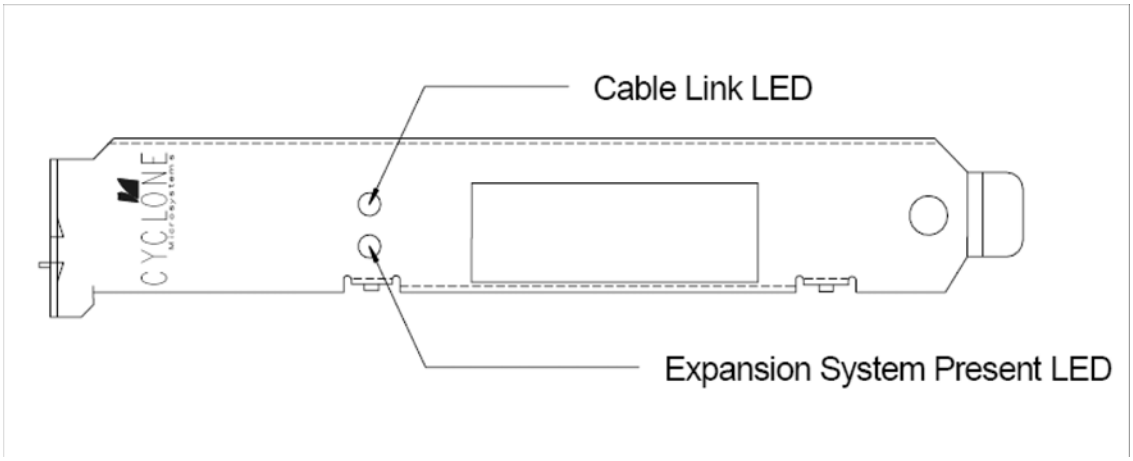


Figure 5-4. PCIe2-436 Physical Configuration

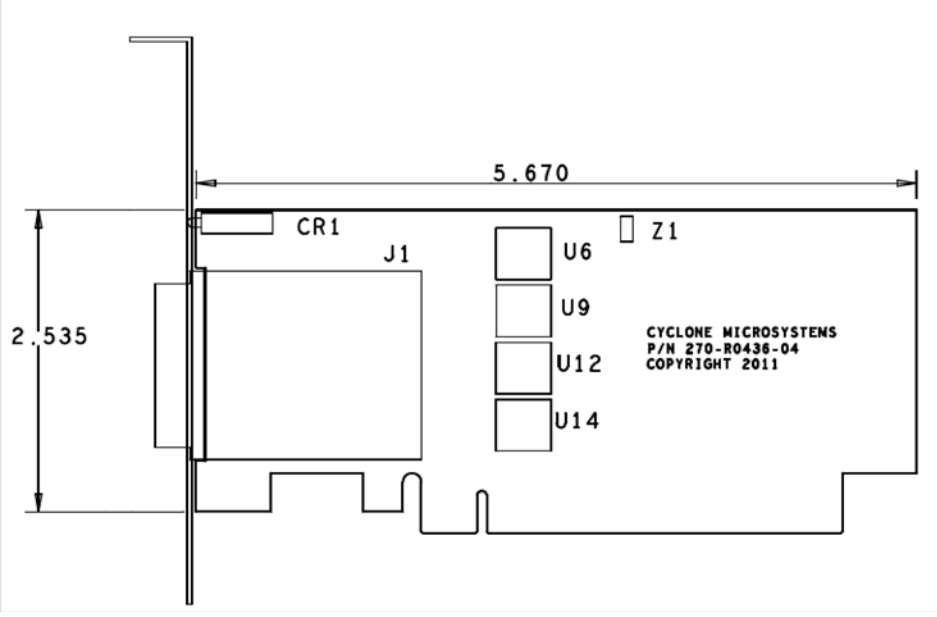


Figure 5-5. PCIe2-425 LEDs

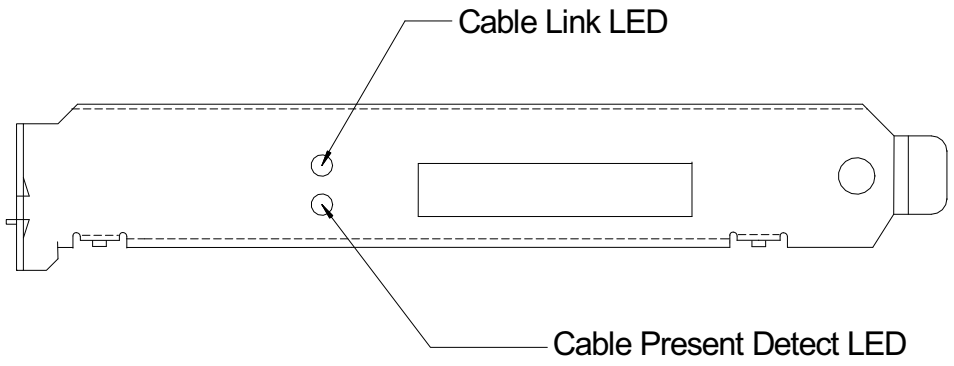


Figure 5-6. PCIe2-425 Physical Configuration

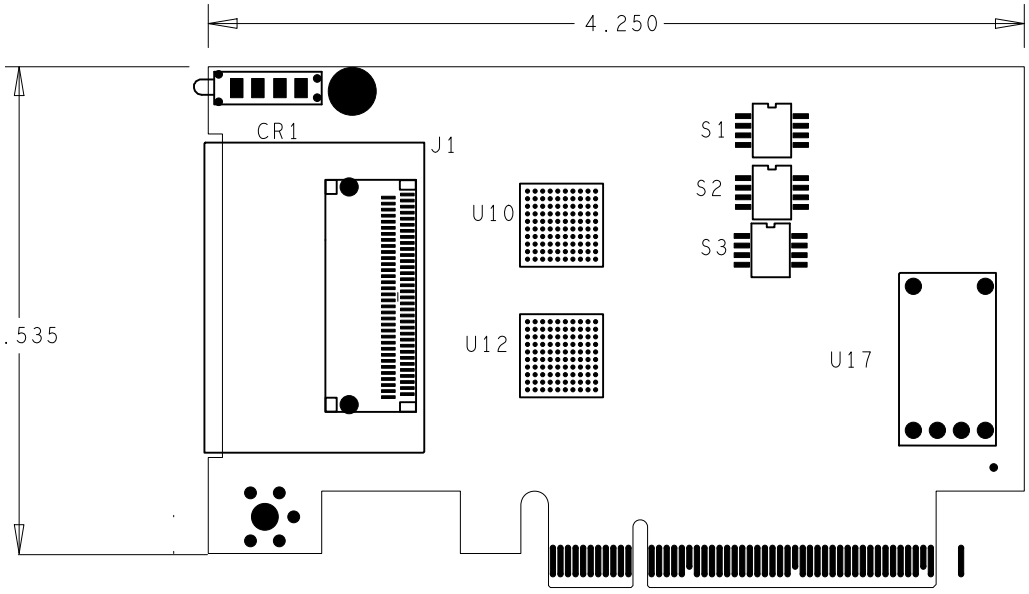


Figure 5-7. PCIe2-439 LEDs

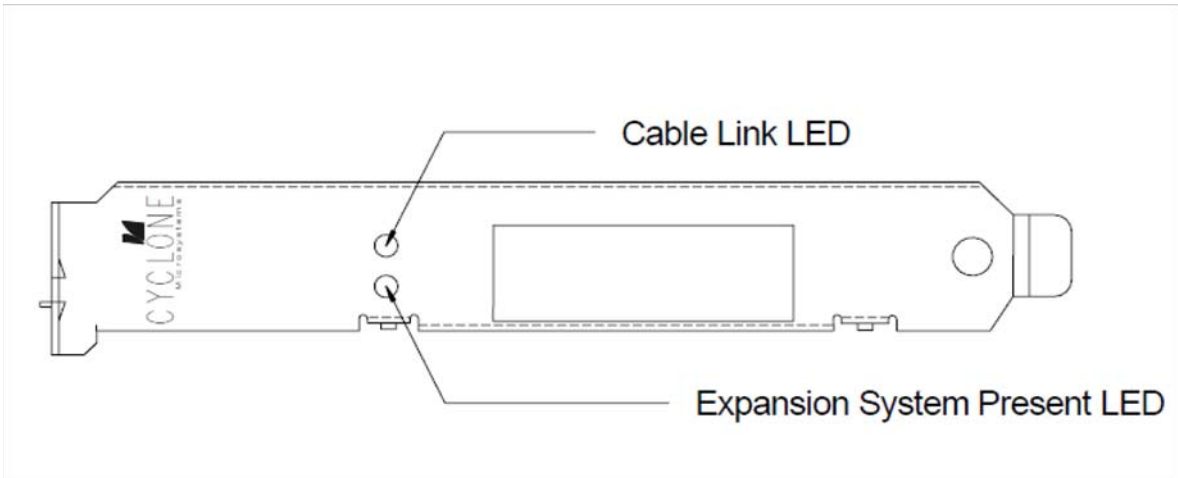
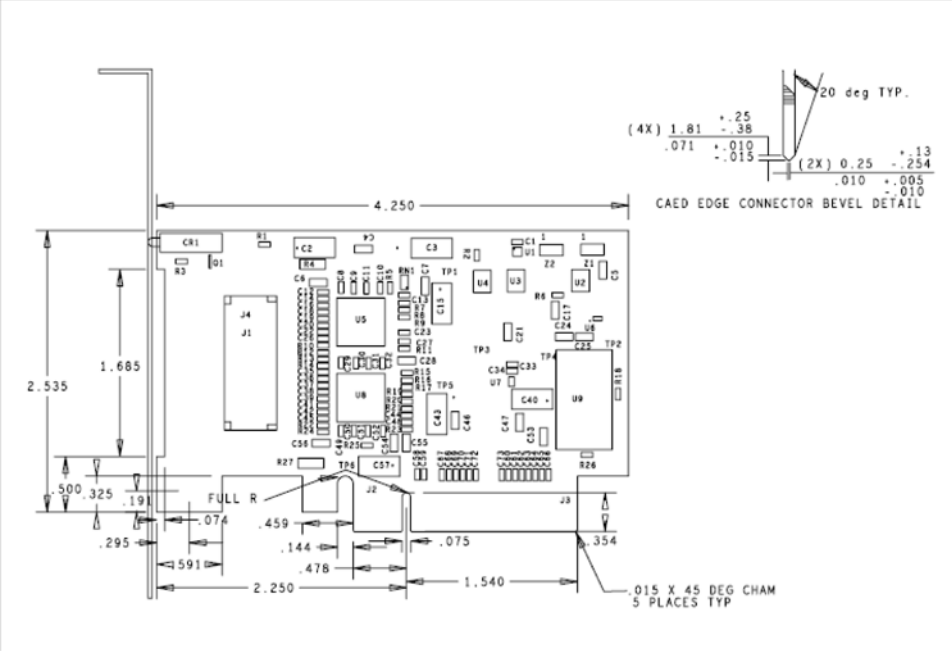


Figure 5-8. PCIe2-439 Physical Configuration



5.5.4 PCIe2-426/425 Output Swing, De-Emphasis and Receive Equalization

The transceiver silicon used on the PCIe2-426 and PCIe2-425 has eight steps of programmable de-emphasis, four steps of output swing and eight steps of receive equalization. The PCIe2-426/425 has three DIP switches to adjust these settings on the cable interface. The as-shipped-default DIP switch configuration is what Cyclone Microsystems has determined is the best setting for Gen1 or Gen2 operation with both the 1m and 3m PCIe cables shipped with Cyclone PCIe Expansion systems. Users should not change the DIP switch settings unless they have the proper test equipment to verify their results. Users change de-emphasis, output swing and receive equalization at their own peril. The default DIP switch configuration is shown below:

Table 5-2. PCIe2-426 Default DIP Switch Configuration

POSITION	SWITCH S1	SWITCH S2	SWITCH S3
1	OFF	OFF	ON
2	OFF	ON	ON
3	ON	ON	ON
4	ON	ON	OFF

Table 5-3. PCIe2-425 Default DIP Switch Configuration

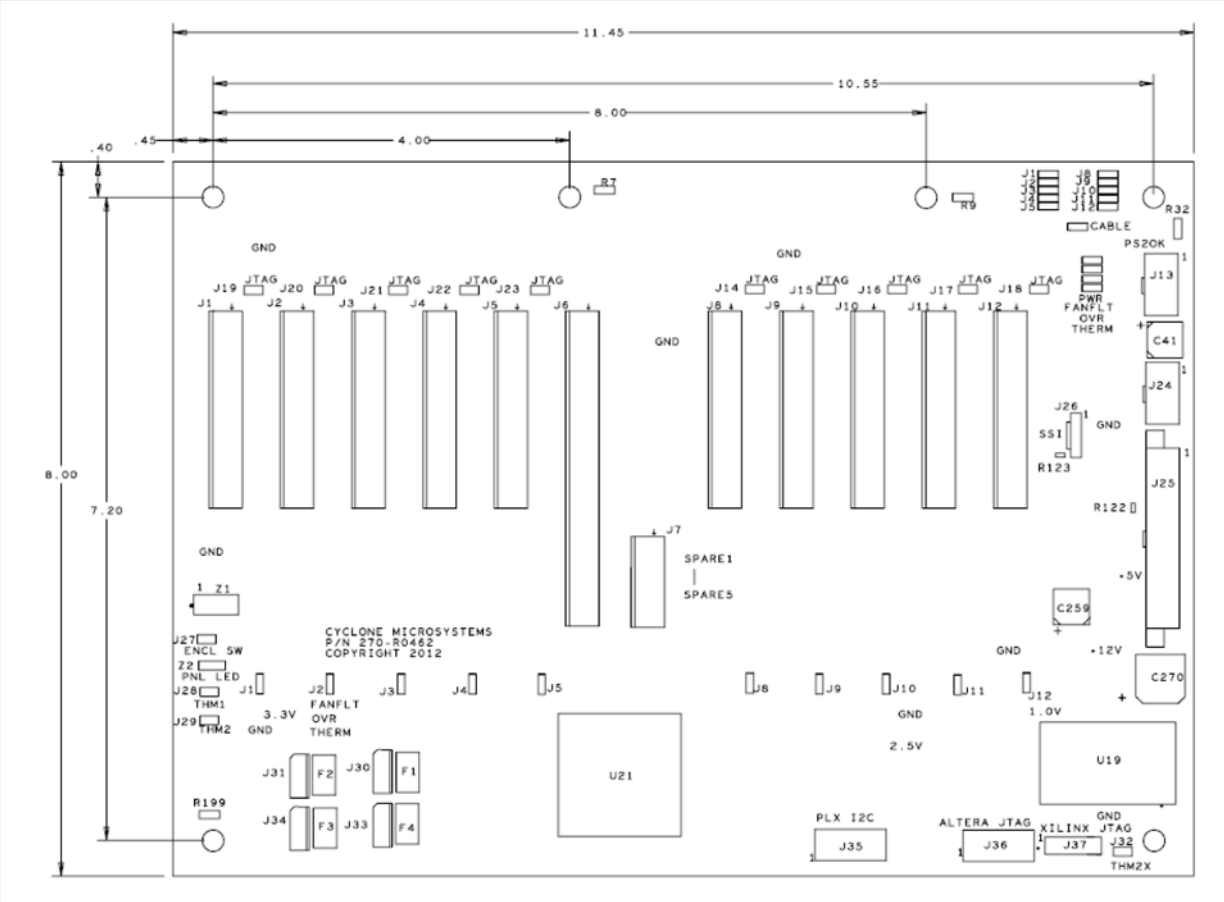
POSITION	SWITCH S1	SWITCH S2	SWITCH S3
1	OFF	OFF	ON
2	OFF	ON	ON
3	ON	OFF	ON
4	ON	OFF	OFF

CHAPTER 6
EXPANSION CHASSIS

6.1 CHASSIS FEATURES

Figure 6-1. PCIe2-462 Physical Configuration

Figure 6-1 is a physical diagram (not to scale) of the PCIe2-462 backplane, showing the location designators of jumpers, connectors, and major ICs.



6.2 LINK INDICATION-LED DEFINITION PCIE2-462

The PCIe2-462 has twenty-one green LEDs to indicate the link status of each slot and the cable. Each slot has two, redundant, LED link status indicators. Eleven surface mount LEDs, one for each slot, and one for the cable interface, are arranged in a group in the corner of the board near the power supply connections.

Ten surface mount LEDs are place adjacent to each slot. The LEDs are placed just off-axis to the botoom side of the installed board so as not be obscured by components on the board. The LEDs are labeled J1 through J5 and J8 through J12.

A fully functional link (all laned up and operating at Gen2 rates) will have its LED ON solid. A link running at Gen1 rates and/or using less PCIe lanes that available will indicate its status with a blinking LED. The LEDs indicate link status as follows:

OFF	Link is down
ON	Link is up, all lanes, Gen2 (5GT/s) rate.
BLINK: 0.5 seconds ON, 0.5 seconds OFF	Link is up, reduced lanes, Gen2 (5GT/s rate)
BLINK: 1.5 seconds ON, 0.5 seconds OFF	Link is up, all lanes, Gen1 (2.5GT/s rate).
BLINK: 0.5 seconds ON, 1.5 seconds OFF	Link is up, reduced lanes, Gen1 (2.5GT/s rate).

6.3 CONNECTORS, HEADERS AND JUMPERS

6.3.1 PCIe2-462 Jumpers and Headers

Most of the PCIe2-462 headers and jumpers use 0.025in square posts on 0.100in centers. Exceptions are the fan connectors, the SSI Auxiliary Signal Connector and the Xilinx JTAG header. See the respective sections for a description of the connector type.

6.3.2 J27 “ENCL SW” Chassis Intrusion Switch Connector

A normally open switch attaches here. NO polarity required on this connection. In normal operation, an installed enclosure cover actuates the switch. If the cover is removed, the switch opens and the Monitor Board Circuity can detect the change in state.

6.3.3 J26 “SSI” SSI Auxiliary Signal Connector

An Entry-level Electronics Bay Specification (SSI) compatible power supply with an Auxiliary Signal connector would attach its Auxiliary Signal connector to J26. The pinout of J26 is as shown. Monitor Board circuitry can communicate with the SSI power supply through the SSI Auxiliary connection. The connector on the BP-462 is a 5-pin Molex 70545-0004 or equivalent.

Table 6-1. SSI Auxiliary Signal Connector

Pin	Signal
1	SMClk
2	SMDat
3	PS Alert
4	ReturnS
5	3.3RS

6.3.4 Z2 "PNL LED" Front Panel LED Connector

A front panel LED power-on indicator c an attach at Z2. The connector pin out is as shown below. The +3.3V is current limited with 150ohms. The connector is not polarized but pin 1 is indicated by a "1" in the silk screen at Z2.

Table 6-2. Front Panel LED Connector

Pin	Signal	LED Connection
1	+3.3V	LED Anode
2	n/c	none
3	GND	LED Cathode

6.3.5 J30, J31, J33 Fan Connectors

Chassis cooling fans connect here. The connectors conform an Intel 4-wire PWN specification, however there is currently no PWN circuitry enabled on the PCIe2-462 to vary fan speed. The connectors are keyed and three wire fans will mate to the 4 wire headers without issues. The third wire in a three wire fan is sense or tachometer output. Fans with tach outputs that pulse twice per revolution can be monitored by the Monitor board circuitry. The Monitor board circuitry can detect a slowing (failing) or stopped (failed) fan. The fan connector pin out is shown below. The connector is Moles 47054-1000 or equivalent.

Table 6-3. Fan Connectors

Pin	Signal
1	GND
2	+12V
3	Sense
4	Control

6.3.6 J28, J29, J32 “THM1”, “THM2”, THM2X” Thermistor Connectors

Remotely placed thermistors attach here. The Monitor board circuitry can provide remote temperature sensing for specific enclosure locations through thermistors attached at these connectors. The Monitor board circuitry requires a 10Kohm NTC thermistor such as US Sensor p/n USP10982. There is no polarity requirement. Note that location J32 “THM2X” is not enabled. It is an alternate location for “THM2” on the opposite side of the PCIe2-462. Board components must be moved to enable “THM2X” and disable “THM2”.

6.3.7 J35 “PLX I2C” PEX Device Editor Connector

Normally not installed. This connector allows access to the PLX PCIe switch on the PCIe2-462. PLX supplied software and hardware is required.

6.3.8 J36 “ALTERA JTAG” JTAG Connector, J36 “XILINX JTAG” JTAG Connector, J19-J23 “JTAG”, JTAG Bypass Jumper for Slots J1-15, J14-J18 “JTAG”, JTAG Bypass Jumpers for Slots J8-J12

Normally not installed. A JTAG chain is implemented on the PCIe2-462 from the JTAG connector thru each PCIe slot back to the JTAG connector. Two JTAG connectors are provided, one to a Altera specification (J36) and one to Xilinx specification (J37). The two JTAG connectors are wired in parallel and using only one at a time is anticipated. The Xilinx connector is Molex 87831-1420 or equivalent. The JTAG chain passes thru JTAG devices on installed boards at each slot. In the event a board is not installed, the JTAG chain is broken. The JTAG bypass jumpers at each slot allow the JTAG chain to be mended.

Table 6-4. J36 ALTERA JTAG Connector

Pin	Signal
1	TCK
2	GND
3	TDO
4	+3.3V
5	TMS
6	no connection
7	no connection
8	no connection
9	TDI
10	GND

Table 6-5. J37 XILINX JTAG Connector

Pin	Signal
1	GND
2	+3.3V
3	GND
4	TMS
5	GND
6	TCK
7	GND
8	TDO
9	GND
10	TDI
11	GND
12	no connection
13	GND
14	no connection

Table 6-6. Jumpers

Reference Designator	Additional PCB Label	Function	Notes
J19	“JTAG”	JTAG jumper bypass for slot J1	
J20	“JTAG”	JTAG jumper bypass for slot J2	
J21	“JTAG”	JTAG jumper bypass for slot J3	
J22	“JTAG”	JTAG jumper bypass for slot J4	
J23	“JTAG”	JTAG jumper bypass for slot J5	
J14	“JTAG”	JTAG jumper bypass for slot J8	
J15	“JTAG”	JTAG jumper bypass for slot J9	
J16	“JTAG”	JTAG jumper bypass for slot J10	
J17	“JTAG”	JTAG jumper bypass for slot J11	
J18	“JTAG”	JTAG jumper bypass for slot J12	

Table 6-7. Headers

Reference Designator	Additional PCB Label	Function	Notes
J26	“SSI	SSI Auxiliary Signal Connector	
J27	“ENCL SW”	Chassis intrusion switch connector	
Z2	“PNL LED”	Front panel LED connector	
J28	“THM1”	Thermistor connector	
J29	“THM2”	Thermistor connector	
J32	“THM2X”	Alternate thermistor connector	
Z1	none	Monitor board I2C bus connector	Not populated
J30	none	Fan connector	
J31	none	Fan connector	
J33	none	Fan connector	Not populated
J34	none	Fan connector	
J35	“PLX I2C”	PLX I2C monitor connector	Not populated
J36	“Altera JTAG”	Altera type JTAG connector	Not populated
J37	“SILINX JTAG”	Xilinx type JTAG connector	Not populated

6.4 CHASSIS COOLING

Airflow in the PCIe2-2712 chassis is provided by four 77 CFM fans located midship across the full width of the chassis.

6.5 CHASSIS POWER

There are three different power supply options available for the PCIe2-2712. The 1200W option provides ample power for the backplane and low-powered PCIe devices. The 2180W and 3240W options provide N+1 redundancy, and are intended for high-powered, multi-GPU applications.

6.5.1 1200W Power Supply Option

The 4U chassis option is powered by a front-mounted 1200W single mini-ATX power supply. Power entry is cabled to a receptacle located at the rear of the chassis. The supply outputs are modular, providing the 24-pin ATX, 8-pin EPS and 4-pin EPS power connectors required by the PCIe2-462 backplane. The 1200W supply can be configured to also provide up to eight 6+2 pin PCIe power connectors for use the GPUs and other high powered PCIe cards, as well as eleven Serial ATA power connectors for disk drives and other peripheral devices.

6.5.2 2180W/3240W Power Supply Options

The 5U chassis option is powered by an N+1 redundant supply providinig either 2180W or 3240W of total power. Four individual power supply units reside across the bottom rear of the chassis and slide into the redundant power supply housing. In this configuration, any one power supply module can fail and the chassis will still provide full power capacity.

Should one power supply unit fail, an alarm will sound. The supplies are hotswappable; an individual supply can be replaced while the unit remains powered on. Removing an individual supply is done by loosening the thumb screw, then pushing outwards on the release tab while pulling the supply out of the housing. Replacement power supply units are available from Cyclone.

The N+1 redundant supplies provide one 24-pin ATX power connector and two 8-pin EPS connectors that power the PCIe2-429 backplane. Additionally, the supplies provide eight six-pin PCIe power connectors, and eight six-plus-two pin PCIe power connectors for use with GPUs and other high-powered PCIe cards. There are also provides six SerialATA connectors for powering disk drives and other peripheral devices.

NOTE: Users should be aware that 2180W or 3240W systems may exceed the power available from a standard 15A or 20A AC circuit. When connecting to the AC mains, care should be taken to use multiple AC circuits. Otherwise, problems with tripping circuit breakers can result.

6.6 LIGHT LOADING

Because the power supply has been sized for a fully populated chassis, when placed under light loading, the supply may not stay in regulation. Symptoms of a supply that is not regulating properly are loss of link back to the host (“CABLE LINK” LEDs are not ON) or a chassis that powers up momentarily, then turns OFF.

Users of the N+1 chassis or those using their own chassis and power supplies need to be aware of the minimum loading requirements. The 1200W chassis minimum loading can be net by using the on-board jumpers. The N+1 chassis will need to have cards installed to meet the +12V minimum loading. Table 3-2 and Table 3-3 summarize the minimum loading requirements.

Table 6-8. 1200W Power Supply Minimum Loading

Voltage	Minimum Load	Status
+5VSB	0A	On board circuitry meets power supply minimum.
+5V	0A	On board circuitry meets power supply minimum.
+3.3V	0A	On board circuitry meets power supply minimum.
+12V	0.6A	On board circuitry meets power supply minimum.

Table 6-9. 2180W/3240W Power Supply Minimum Loading

Voltage	Minimum Load	Status
+5VSB	0.1A	On board circuitry meets power supply minimum.
+5V	1A	Chassis circuitry meets power supply minimum.
+3.3V	1A	On board circuitry meets power supply minimum.
+12V	6A	Cards must be installed to meet minimum load.

6.7 POWER CONSIDERATIONS

Table 3-4 through 3-6 show the power consumption for the Cyclone Microsystems boards and the power supplied to PCI Express slots. Note that the PCIe-426 is installed in and powered by the host supply. Consequently, the PCIe-426 should not be included as a component of the Expansion Chassis power budget.

Table 6-10. PCIe2-462 Power Requirements

Voltage	Current Typical	Current Maximum	Note
+5V SB	0.1A	0.1A	Not used. On board circuitry sets current draw.
+5V	0A	0A	Not used.
+3.3V	1.5A	1.5A + 30A	Maximum is PCIe2-462 circuitry plus 10 slots x3A per slot = 30A.
+12V	1A	2A + 55A	Maximum is PCIe2-462 circuitry plus 10 slots x5.5A per slot = 55A.

Table 6-11. PCIe2- 426/425 Power Requirements

Voltage	Current Typical	Current Maximum
+3.3V	1.09 Amps	1.60 Amps
+12V	0 Amps	0 Amps

* The PCIe-426 does not use +12V

Table 6-12. Power Supplied Per PCIe Slot

Voltage	Current Maximum	Voltage Tolerance
+3.3V	3.0 Amps	+/- 9%
+12V	5.5 Amps	+/- 8%

6.8 PCI-E AUXILARY POWER CONNECTORS

Some PCIe add-in cards, especially video cards, require more power than the PCIe spec of 75W per slot can provide. These cards will have a six or eight position Molex type power connector probably located at the top or rear edge of the card. The power supply in the expansion chassis has at least eight PCIe auxilary power cables labeled “PCI-E” available for these card types. GPU card users should verify that all external power connections to their cards have been made.

CHAPTER 7
REFERENCE

7.1 REFERENCE MANUALS

PEX 8696 96-Lane, 24-Port PCI Express Gen2 Multi-Root Switch Data Book Version 1.3
PLX Technology, Inc.
Sunnyvale, CA
(800) 759-3735
www.plxtech.com

PCI Express Base Specification Revision 2.0
PCI Express Card Electromechanical Specification Revision 2.0
PCI Express External Cabling Specification Revision 2.0
PCI Special Interest Group (PCISIG)
5440 SW Westgate Dr., #217 Portland OR 97221
(503) 291-2569
(503) 297-1090 (Fax)
www.pcisig.org

APPENDIX A
WARRANTY AND SERVICE

A.1 OVERVIEW

Cyclone Microsystems is a commercial manufacturer of PCIe Expansion Systems. Our standard repair cycle for in-warranty or out-of-warranty repair is two weeks. Most of our customers require 24 by 7 support that is far in excess of Cyclone Microsystems' current or anticipated capabilities. Consequently, we highly recommend that customers pursue high availability support from a support organization or pursue an on-site sparing policy in conjunction with a Cyclone Microsystems Expedited Repair Program. Please contact a Cyclone sales representative for a program proposal.

A.2 HARDWARE

Cyclone Microsystems, Inc. (Cyclone) for the period set out below, warrants that its standard products will be free from defects in workmanship or material under normal use and service. Cyclone's obligation under this warranty shall not arise until the Buyer returns the defective product, freight prepaid, to Cyclone. The only responsibilities of Cyclone under this warranty are at its option to replace or repair, without charge, any defective component of such products.

A.3 SOFTWARE AND FIRMWARE

Cyclone warrants that Software and Firmware supplied shall conform to the then current published documentation applicable to such programs. Cyclone, for the effective period of the warranty set out below, will upon written notice from the Buyer documenting the symptoms or the defect, expend its best efforts to resolve software bugs and/or fault. This service shall be without extra charge, and at Cyclone's option may include on-site visit(s) if in its opinion the conditions justify such visit(s).

A.4 EFFECTIVE PERIOD OF WARRANTY

One year from date of delivery.

A.5 REPAIRED OR REPLACEMENT PRODUCT (OUT-OF-WARRANTY)

Cyclone Microsystems, for a period of 30 days, warrants that its out-of-warranty products that are repaired or replaced shall be free from defects in workmanship or material under normal use and service.

Any repair or replacement shall not extend the period within which the warranty can be asserted.

The above warranties do not extend to and shall not apply to:

- Products which have been repaired or altered by other than Cyclone, unless the Buyer has properly altered or repaired the products in accordance with procedures previously approved, in writing, by Cyclone; or
- Products which have been subject to misuse, neglect, accident or improper installation; or
- Products not manufactured by Cyclone.

The foregoing warranty and remedies are exclusive and are made in lieu of all other warranties express or implied, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for use. Cyclone neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale, installation or use of its products, and Cyclone makes no warranty whatsoever for products not manufactured by Cyclone or with respect to any non-standard products which have been subject to misuse, neglect, accident, or have been modified by the Buyer. Cyclone shall have no liability for incidental or consequential damages of any kind arising out of the sale, installation, or use of its products.

A.6 SERVICE POLICY

Out-of-Warranty repair will be accomplished expeditiously at a charge published on the current price schedule plus shipping. A full description of the failure must be enclosed with the product.

Shipments arriving at Cyclone without a Return Material Authorization (RMA) number will not be accepted and will be returned to the customer at his cost regardless of warranty status.

Return Procedures

Upon determining that repair is required, the customer must:

- Call Cyclone Customer Support at (203) 786-5536 for a RMA number. Please have ready:
  - The serial number of the board (s)
  - The reason for return
- Enclose a detailed description of the failure with the failed unit in a static-shielded protective container.
- Ship unit to: Cyclone Microsystems, 25 Marne Street, Hamden, CT 06514, Attn: RMA number
- The RMA is valid for 30 days after issue.

APPENDIX B

Server Safety Information

This document applies to Cyclone PCIe Expansion Chassis (pedestal and rack-mount) and installed peripherals. To reduce the risk of bodily injury, electrical shock, fire, and equipment damage, read this document and observe all warnings and precautions in this guide before installing or maintaining your Cyclone server product.

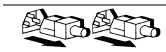
In the event of a conflict between the information in this document and information provided with the product or on the website for a particular product, the product documentation takes precedence.

Your Expansion Chassis should be integrated and serviced only by technically qualified persons.

You must adhere to the guidelines in this guide and the assembly instructions in your Expansion Chassis manuals to ensure and maintain compliance with existing product certifications and approvals. Use only the described, regulated components specified in this guide. Use of other products / components will void the UL Listing and other regulatory approvals of the product, and may result in noncompliance with product regulations in the region(s) in which the product is sold.

Safety Warnings & Cautions

To avoid personal injury or property damage, before you begin installing the product, read, observe, and adhere to all of the following safety instructions and information. The following safety symbols may be used throughout the documentation and may be marked on the product and / or the product packaging.

CAUTION	Indicates the presence of a hazard that may cause minor personal injury or property damage if the CAUTION is ignored.
WARNING	Indicates the presence of a hazard that may result in serious personal injury if the WARNING is ignored.
	Indicates potential hazard if indicated information is ignored.
	Indicates shock hazards that result in serious injury or death if safety instructions are not followed.
	Indicates hot components or surfaces.
	Indicates do not touch fan blades, may result in injury.
	Indicates to unplug all AC power cord(s) to disconnect AC power

Intended Application Uses

This product was evaluated as Information Technology Equipment (ITE), which may be installed in offices, schools, computer *rooms, and similar commercial type locations. The suitability of this product for other product categories and environments (such as medical, industrial, residential, alarm systems, and test equipment), other than an ITE application, may require further evaluation.*

Site Selection

The system is designed to operate in a typical office environment. Choose a site that is:

- Clean, dry, and free of airborne particles (other than normal room dust).
- Well-ventilated and away from sources of heat including direct sunlight and radiators.
- Away from sources of vibration or physical shock.
- Isolated from strong electromagnetic fields produced by electrical devices.
- In regions that are susceptible to electrical storms, we recommend you plug your system into a surge suppresser and disconnect telecommunication lines to your modem during an electrical storm.
- Provided with a properly grounded wall outlet.
- Provided with sufficient space to access the power supply cord(s), because they serve as the product's main power disconnect.

Equipment Handling Practices

Reduce the risk of personal injury or equipment damage:

- Conform to local occupational health and safety requirements when moving and lifting equipment.
- Use mechanical assistance or other suitable assistance when moving and lifting equipment.
- To reduce the weight for easier handling, remove any easily detachable components.

Power and Electrical Warnings

⚠ ***CAUTION***

Power is turned on and off by the host system in the cable. When off, stand-by power is ??, DOES NOT completely turn off the system AC power, 5V standby power is active whenever the system is plugged in. To remove power from system, you must unplug the AC power cord from the wall outlet. Your system may use more than one AC power cord. Make sure all AC power cords are unplugged. Make sure the AC power cord(s) is/are unplugged before you open the chassis, or add or remove any non hot-plug components.

Do not attempt to modify or use an AC power cord if it is not the exact type required. A separate AC cord is required for each system power supply.

The power supply in this product contains no user-serviceable parts. Do not open the power supply. Hazardous voltage, current and energy levels are present inside the power supply. Return to manufacturer for servicing.

When replacing a hot-plug power supply, unplug the power cord to the power supply being replaced before removing it from the server.

To avoid risk of electric shock, turn off the server and disconnect the power cord, telecommunications systems, networks, and modems attached to the server before opening it.

Power Cord Warnings

If an AC power cord was not provided with your product, purchase one that is approved for use in your country.

⚠ ***CAUTION***

To avoid electrical shock or fire, check the power cord(s) that will be used with the product as follows:

- Do not attempt to modify or use the AC power cord(s) if they are not the exact type required to fit into the grounded electrical outlets
- The power cord(s) must meet the following criteria:
  - — The power cord must have an electrical rating that is greater than that of the electrical current rating marked on the product.
  - — The power cord must have safety ground pin or contact that is suitable for the electrical outlet.
- The power supply cord(s) is/are the main disconnect device to AC power. The socket outlet(s) must be near the equipment and readily accessible for disconnection.
- The power supply cord(s) must be plugged into socket-outlet(s) that is /are provided with a suitable earth ground.

System Access Warnings

⚠ ***CAUTION***

To avoid personal injury or property damage, the following safety instructions apply whenever accessing the inside of the product:

- Turn off all peripheral devices connected to this product.
- Turn off the system by pressing the power button to off.
- Disconnect the AC power by unplugging all AC power cords from the system or wall outlet.
- Disconnect all cables and telecommunication lines that are connected to the system.
- Retain all screws or other fasteners when removing access cover(s). Upon completion of accessing inside the product, refasten access cover with original screws or fasteners.
- Do not access the inside of the power supply. There are no serviceable parts in the power supply. Return to manufacturer for servicing.
- Power down the server and disconnect all power cords before adding or replacing any non hot-plug component.
- When replacing a hot-plug power supply, unplug the power cord to the power supply being replaced before removing the power supply from the server.

CAUTION

If the server has been running, any installed processor(s) and heat sink(s) may be hot. Unless you are adding or removing a hot-plug component, allow the system to cool before opening the covers. To avoid the possibility of coming into contact with hot component(s) during a hot-plug installation, be careful when removing or installing the hot-plug component(s).

CAUTION

To avoid injury do not contact moving fan blades. If your system is supplied with a guard over the fan, do not operate the system without the fan guard in place.

Rack Mount Warnings

The equipment rack must be anchored to an unmovable support to prevent it from tipping when a server or piece of equipment is extended from it. The equipment rack must be installed according to the rack manufacturer's instructions.

Install equipment in the rack from the bottom up, with the heaviest equipment at the bottom of the rack.

Extend only one piece of equipment from the rack at a time.

You are responsible for installing a main power disconnect for the entire rack unit. This main disconnect must be readily accessible, and it must be labeled as controlling power to the entire unit, not just to the server(s).

To avoid risk of potential electric shock, a proper safety ground must be implemented for the rack and each piece of equipment installed in it.

Electrostatic Discharge (ESD)

CAUTION

ESD can damage disk drives, boards, and other parts. We recommend that you perform all procedures at an ESD workstation. If one is not available, provide some ESD protection by wearing an antistatic wrist strap attached to chassis ground -- any unpainted metal surface -- on your server when handling parts.

Always handle boards carefully. They can be extremely sensitive to ESD. Hold boards only by their edges. After removing a board from its protective wrapper or from the server, place the board component side up on a grounded, static free surface. Use a conductive foam pad if available but not the board wrapper. Do not slide board over any surface.

Other Hazards

Cooling and Airflow

⚠ *CAUTION*

Carefully route cables as directed to minimize airflow blockage and cooling problems.

For proper cooling and airflow, operate the system only with the chassis covers installed. Operating the system without the covers in place can damage system parts. To install the covers:

1. Check first to make sure you have not left loose tools or parts inside the system.
2. Check that cables, add-in boards, and other components are properly installed.
3. Attach the covers to the chassis according to the product instructions.