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SwitchX 56Gb/s InfiniBand Blade Switch I/O Module for PowerEdge M-Series User Manual

PN: M4001F, M4001Q

Rev 1.0

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InfiniBand Blade Switch I/O Module for PowerEdge M-Series

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Revision History

Table 1 - Revision History Table

Date	Revision	Description
November 2011	1.0	Initial release

About this Manual

This manual describes the installation and basic use of the SwitchX M4001F 56 Gb/s, and the M4001Q 40 Gb/s InfiniBand blade switch I/O modules for the PowerEdge M-Series chassis.

Intended Audience

This manual is intended for users and system administrators responsible for installing and setting up the switch platforms listed above.

The manual assumes familiarity with the InfiniBand® Architecture Specification.

Related Documentation

The documentation set accompanying the Mellanox M4001[F, Q] includes the following:

Table 2 - Reference Documents

<i>InfiniBand Architecture Specification Volume 1 Release 1.2.1 and Volume 2 release 1.2.1</i>	InfiniBand architecture specification descriptions
<i>Mellanox Firmware Tools (MFT) User's Manual Document # 2329</i>	The MFT (Mellanox Firmware Tools) package is a set of firmware tools. The manual supplied with this package provides an overview of the firmware its installation and replacement. The MFT can be downloaded with its documentation at: http://www.mellanox.com > Downloads > Firmware Tools.

Online Resources

- Mellanox Technologies Web pages: <http://www.mellanox.com>
- Dell Support Web pages: <http://support.dell.com>

Conventions

Throughout this manual, the names M4001F and M4001Q and the terms switch, I/O module, and IOM are used to describe the M4001F 56 Gb/s, and the M4001Q 40 Gb/s InfiniBand blade switch I/O modules, unless explicitly indicated otherwise.

The following pictures are used throughout this document to indicate information that is important to the user.



This symbol makes recommendations to the user.



This symbol indicates information that is helpful to the user.



This symbol indicates a situation that can potentially cause damage to hardware or software.



BEWARE! This symbol indicates a situation that can potentially cause personal injury or damage to hardware or software.

1 Overview

The SwitchX M4001F 56 Gb/s, and the M4001Q 40 Gb/s InfiniBand blade switch I/O module for the PowerEdge M-Series chassis provides a high bandwidth, low latency fabric for Enterprise Data Centers (EDC), High-Performance Computing (HPC), and Embedded environments. Based on the 5th generation InfiniBand switch device (1st Generation SwitchX). This I/O module (IOM) delivers up to 56Gb/s at FDR speed and 40 Gb/s at QDR speed full bisectional bandwidth per port. When used in conjunction with ConnectX®-3 InfiniBand dual port Mezzanine I/O cards, clustered data bases, parallelized applications and transactional services applications these switches will achieve significant performance improvements resulting in reduced completion time and lower cost per operation.

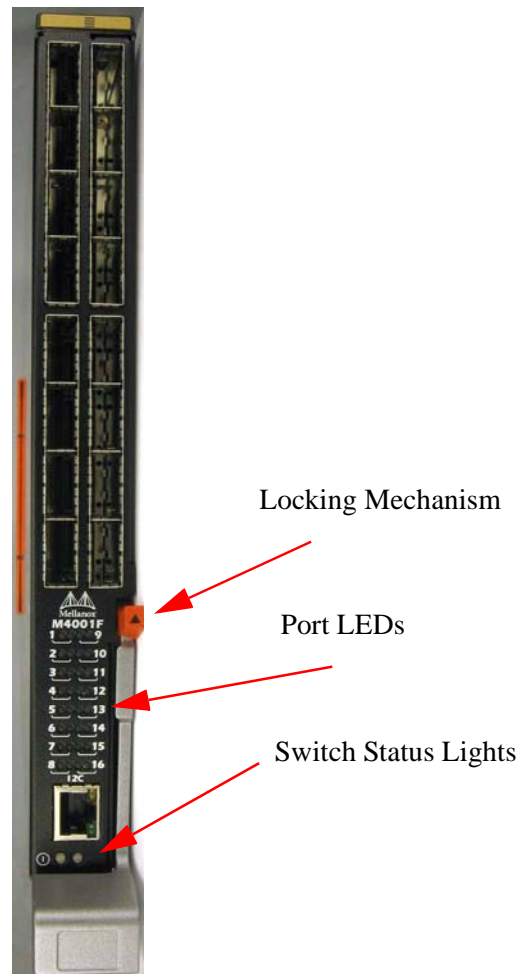
The I/O module comes pre-installed with all necessary firmware, and configured for standard operation within an InfiniBand fabric, and only requires an InfiniBand compliant Subnet Manager running from one of the hosts. All that is required for normal operation is to follow the usual precautions for installation and connection from the switch to the HCAs or other switches. Once connected, the Subnet Management software automatically configures the switch and begins utilizing the switch.

It is recommended that Mellanox OpenFabrics software package be installed on all nodes connected to the M4001[F, Q]. The software package provides a subnet manager and network management tools as well as connectivity software for servers and storage, and is available on the Mellanox web site. See Chapter 3 for more information.

Basic installation, hot-swapping components and hardware maintenance is covered in “Installation and Basic Operation” on page 11.

The M4001F and M4001Q switches have a Hot Swap controller and a PSOC Management IC.

Figure 1: Switch Front Panel and Locking Mechanism



1.1 InfiniBand Connectors

This switch has 16 QSFP connectors through the front panel. The remaining 16 interfaces are through the Midplane Connector out of the back of the switch. Figure 1 shows the front 16 ports.

Each of the InfiniBand ports has two LEDs located between the connectors and the I2C interface. The green LED, when lit, indicates that a valid physical connection to the other system (switch or HCA port) exists. See Figure 2, “Physical and Logical Link Indication LEDs” for more details.

Figure 2: Physical and Logical Link Indication LEDs

LED Name	Connection Status
Physical Link - Green	Off – No Physical Link ON – Physical Link
Data Activity - Yellow	Blinking – indicates Data Transfer Constant on – indicates Link exists with no Data Transfer taking place Off with green LED lit – indicates that the Subnet Manager may not be running



1.2 Switch Status Lights

The switch Status lights indicate whether the switch is receiving power from the chassis, and the state of the switch.

Figure 3: Indicator LEDs







The IO Module is on and ready when both the blue and green LEDs are lit.



This LED can be blue or amber. A fault is indicated when the amber LED is blinking. See Table 3.

Table 3 - IOM states and LED configurations:

Indication	LED		Switch Status
	Green	Status	
	OFF	OFF	OFF
	ON	OFF	Boot in Progress Switch not ready

LED			Switch Status
Indication	Green	Status	
 Blinking Blue	ON	BLINKING BLUE	The CMC is identifying the newly installed switch
	ON	ON BLUE	Switch is on and operating Normally
	ON	ON or BLINKING AMBER	Fault in System Self-diagnosed
	OFF	ON or BLINKING AMBER	Fault in System CMC-detected

1.3 I2C Interface RJ-45 Connector

There is an “I2C” interface on the front panel.

Figure 4: I2C RJ-45 Interface



The I2C connection provides access to Flash and EEPROMs. The I2C connector is used to update firmware should in-band firmware update **not work**. You will need to order an RJ-45 to DB9 I2C adapter to make use of the I2C interface. You can order this adapter from Mellanox Technologies. The Ordering Part Number is MTUSB-1.



All firmware updates should be done in-band using Mellanox Firmware Management Tools. This is for Advanced users and FAEs only.

These switches are Plug and Play and all firmware updates should be done in-band. The I2C connection should only be used if the FW image was corrupted to the point that the regular FW tools cannot successfully return the correct image.

2 Installation and Basic Operation

Installation and initialization of the I/O module are straightforward processes, requiring attention to the normal mechanical, power, and thermal precautions for rack-mounted equipment. The I/O module does not require any programming or configuration to operate as a basic InfiniBand switch and includes all of the necessary functionality to operate with external standard InfiniBand Subnet Management software.

This section describes the installation process and basic operation of the I/O module. Please first read the warnings sub-section carefully before carrying on with installation procedures.



Suitable electrical, mechanical and fire enclosure shall be provided by the end user.

2.1 Installation Safety Warnings

1. Installation Instructions



Read all installation instructions before connecting the equipment to the power source.

2. Over-temperature



This equipment should not be operated in an area with an ambient temperature exceeding the maximum recommended: 40°C (104°F). Moreover, to guarantee proper air flow, allow at least 8cm (3 inches) of clearance around the ventilation openings.

3. Stacking the Chassis



The chassis should not be stacked on any other equipment. If the chassis falls, it can cause bodily injury and equipment damage.

4. During Lightning - Electrical Hazard



During periods of lightning activity, do not work on the equipment or connect or disconnect cables.

5. Copper InfiniBand Cable Connecting/Disconnecting



Copper InfiniBand cables are heavy and not flexible, as such they should be carefully attached to or detached from the connectors. Support the cable's weight using the rack and a cable management system. Refer to the cable manufacturer for special warnings and instructions.

6. Rack Mounting and Servicing



When this product is mounted or serviced in a rack, special precautions must be taken to ensure that the system remains stable. In general you should fill the rack with equipment starting from the bottom to the top.

7. Equipment Installation



This equipment should be installed, replaced, or serviced only by trained and qualified personnel.

8. Equipment Disposal



Disposal of this equipment should be in accordance to all national laws and regulations.

9. Local and National Electrical Codes

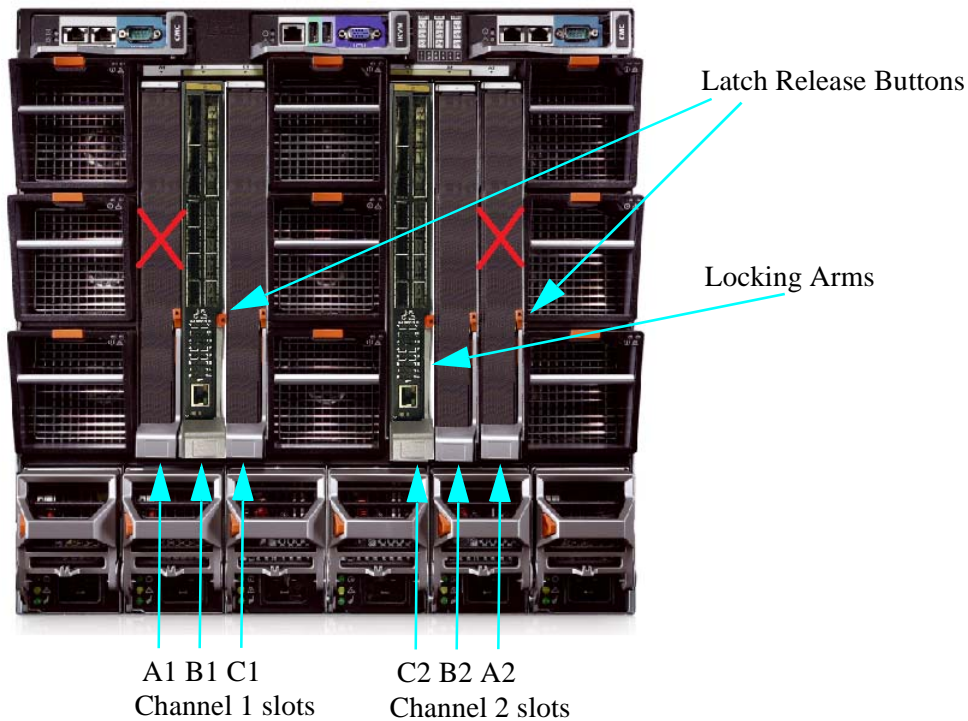


This equipment should be installed in compliance with local and national electrical codes.

2.2 Mechanical Installation

These switches are hot pluggable. It is not necessary to power down the Dell Chassis to install a new switch or to replace an old switch with a new one.

Figure 5: Rear View of the Dell PowerEdge M1000e Chassis



M4001[F, Q] blades are not allowed in the Fabric A slots.

The switch can only be placed in channel slots B1, C1, C2 or B2.

2.2.1 Removing an Old Switch From the Chassis

1. Remove any locking cables or screws that secure the old switch into the chassis.
2. Disconnect all of the InfiniBand cables from the front of the switch to be removed.
3. Unlock the switch from the chassis by pushing the red latch release button.
4. Pull the locking arm down to a position perpendicular to the front of the chassis.
5. Pull the switch out of the chassis using the locking arm.

2.2.2 Removing an I/O Module Blank From the Chassis

1. Unlock the I/O Module Blank by pushing the red latch release button.
2. Pull the locking arm down to a position perpendicular to the front of the chassis.
3. Pull the I/O Module Blank out of the chassis using the locking arm.

2.2.3 Installing the Mellanox M4001[F, Q] Switch Into the Dell Chassis



Make sure the rack is stable on a solid floor and that the rack is filled from the bottom up. This will keep the center of gravity as low as possible reducing risk of tipping.

Refer to the Dell PowerEdge M1000e Hardware Owners Manual for more information.

1. Follow the instructions in Section 2.2.1 or Section 2.2.2 to remove an old switch or an I/O Module Blank.
2. On the new switch, push the red latch release button.
3. Pull the lever forward until the lever is perpendicular to the front panel.
4. Push the switch into the slot until the latching mechanism is against the bar.
5. Push the lever on the latching mechanism up, making sure that the latching mechanism catches the locking bar. The lever should now be parallel to the front panel.
6. Check the indicator lights to make sure the switch has power.



The rack mounting is designed to fit the PowerEdge Chassis. Take precautions to guarantee proper ventilation for air intake at the front of the chassis and exhaust at the rear in order to maintain good airflow at ambient temperature. Cable routing in particular should not impede the air exhaust from the chassis.

2.3 Power Connections and Initial Power On

The I/O module will automatically power up when AC power is applied. There is no power switch. Immediately upon closing the latching mechanism check to make sure that the green switch LED is lit.

2.4 InfiniBand Cable Installation

All cables can be inserted or removed with the unit powered on. To insert a cable, press the connector into the port receptacle until the connector is firmly seated. The green LED indicator accompanying each port will light when the physical connection is established (that is, when the unit is powered on and a cable is plugged into the port with the other end of the connector plugged into a functioning port). After plugging in a cable, lock the connector using the latching mechanism particular to the cable vendor. The yellow LED will light if the subnet manager is running (non blinking indicating that no data is being transferred yet). When a logical connection is made the yellow LED will blink signifying data is being transferred.

To remove, disengage the locks and slowly pull the connector away from the port receptacle. Both LED indicators will turn off when the cable is unseated.

Care should be taken not to impede the air exhaust flow through the chassis.



Cable lengths should be used which allow for routing horizontally around to the side of the chassis before bending upward or downward in the rack.

3 Cluster Management and Firmware

3.1 Network Management and Clustering Software

Download and install, on all nodes, the Mellanox OpenFabric software package for Linux, Windows, or other operating systems from the Mellanox software website:

<http://www.mellanox.com> > Downloads > InfiniBand SW/Drivers.

This software package provides connectivity for server and storage systems utilizing High Performance Computing (HPC) or enterprise data center (EDC) applications across an InfiniBand fabric. It also provides a Subnet Manager for simple network configuration, network administration, and diagnostic tools for network management.

3.2 Updating Firmware

The switch is delivered with the latest Firmware available at the time of production. New firmware versions will be posted on the Mellanox firmware download page. Firmware can be updated in-band using the Mellanox Firmware Tools (MFT).

You will need the Mellanox Firmware Tools package available in MLNX_OFED to update firmware for this switch. It also can be downloaded from:

<http://www.mellanox.com> > Downloads > Firmware Tools.

The latest firmware can be found at:

<http://www.mellanox.com> > Support > Dell.

3.2.1 Instructions for Reprogramming Over the InfiniBand Network

To reprogram the switch see http://mellanox.com/content/pages.php?pg=firmware_table_dell for the latest firmware and the burning instructions.

4 Troubleshooting

As soon as a switch is inserted in make sure that the power LED comes on.

The power LED for the switch does not come on:

1. Check that the chassis has power.
2. Remove and reinstall the switch.

The status LED for the switch is blinking amber:

1. Remove the switch from the chassis and re-insert it (verify that the switch is all the way in the chassis and the lever is firmly closed).
2. If the amber LED continues to blink, replace the switch.

The link LED for the InfiniBand connector does not come on:

1. Check that both ends of the cable are connected.
2. Check that the locks on the ends are secured.
3. Make sure that the latest FW version is installed on both the Mezzanine I/O card and the switch.
4. Make sure that at least one blade has a matching Mezzanine I/O card installed to support data flow.
5. If media adapters are used check that the all connections are good, tight, and secure.

The activity LED does not come on:

Check that the Subnet Manager has been started.

The power LED for the switch shuts off:

1. Check that there is adequate ventilation.
2. Make sure that there is nothing blocking the front or rear ventilation openings of the chassis.

Appendix A: Specifications

Table 4 - M4001[F, Q] Specification Data

Physical		Power and Environmental	
H x W x D:	12.2 x 1.34 x 10.7 inches 310.7 x 34.1 x 271.8 mm	Typ Power:	
Weight:	2.6Kg fully configured	FDR	
Mounting:	Vertically mounted rack	Passive:	80.66W or 275.22BTUs/hr
		Active:	108.26W or 369.40BTUs/hr
SerDes Speeds	10, 20, 40, 56 Gb/s per port	QDR	
Connectors:	QSFP	Passive:	60.42W or 206.16BTUs/hr
	16 external QSFP connectors	Active:	88.02W or 300.34BTUs/hr
	16 internal backplane connectors	Max Power:	
		FDR	
		Passive:	84.46W or 288.19BTUs/hr
		Active:	112.06 or 382.36BTUs/hr
		QDR	
		Passive:	75.83W or 258.74BTUs/hr
		Active:	103.43W or 352.92BTUs/hr
		Dissipated Power:	
		Power through	
		connector:	2.0 W per port maximum
		Temperature:	0°C to 40°C
		Humidity:	10% - 90% non-condensing
Protocol Support		Regulatory Compliance	
InfiniBand:	Auto-Negotiation of 10Gb/s, 20Gb/s, or 40 Gb/s, or 56Gb/s	Safety:	US/Canada: cTUVus EU: IEC60950 International: CB TUV Bauart
QoS:	9 InfiniBand Virtual Lanes for all ports 8 Data transport lanes and 1 management lane	EMC:	USA: FCC, Class A Canada: ICES, Class A EU: CE Mark (EN55022 Class A, EN55024, EN61000-3-2, EN61000-3-3) Japan: VCCI, Class A Korea: RRL (MIC), Class A Australia/New Zealand: C-Tick Class A
Management:	Baseboard, Performance, and Device management Agents for full InfiniBand In-Band Management	ENVIRONMENTAL	EU: IEC 60068-2-64: Random Vibration EU: IEC 60068-2-29: Shocks, Type I / II EU: IEC 60068-2-32: Fall Test

Physical		Power and Environmental
Scalability and Performance		
Switching Performance:	Simultaneous wire-speed any port to any port	
Addressing:	48K Unicast Addresses Max. per Subnet 16K Multicast Addresses per Subnet	
Switching Capacity	2.56 Tb/s	

Appendix B: EMC Certification Statements

Appendix B.1: FCC Statements (USA)

Class A Statements:

§ 15.21

Statement

Warning! Changes or modifications to this equipment not expressly approved by the party responsible for compliance (Mellanox Technologies) could void the user's authority to operate the equipment.

§15.105(a)

Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

B.1.1 EN Statements (Europe)

EN55022 Class A Statement:

Warning! This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

B.1.2 ICES Statements (Canada)

Class A Statement:

**“This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.”**

B.1.3 VCCI Statements (Japan)

Class A Statement:

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

(Translation - "This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.")

B.1.4 MIC Certification (Korea)

Korea's "Regulation for Certification of Information and Communication Equipment," requires EMC testing and certification for many electronic products. Korean EMC certifications are issued by Radio Research Laboratory (RRL), which is organized under the Ministry of Information and Communications (MIC). EMC testing includes electromagnetic emissions (EMI) and susceptibility (EMS). Certified equipment is labeled with the MIC mark and certification number.

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Translation:

Class A Device This device is registered for EMC requirements for industrial use. The seller or buyer should be aware of this. If this type was sold or purchased by mistake, it should be replaced with a residential-use type.

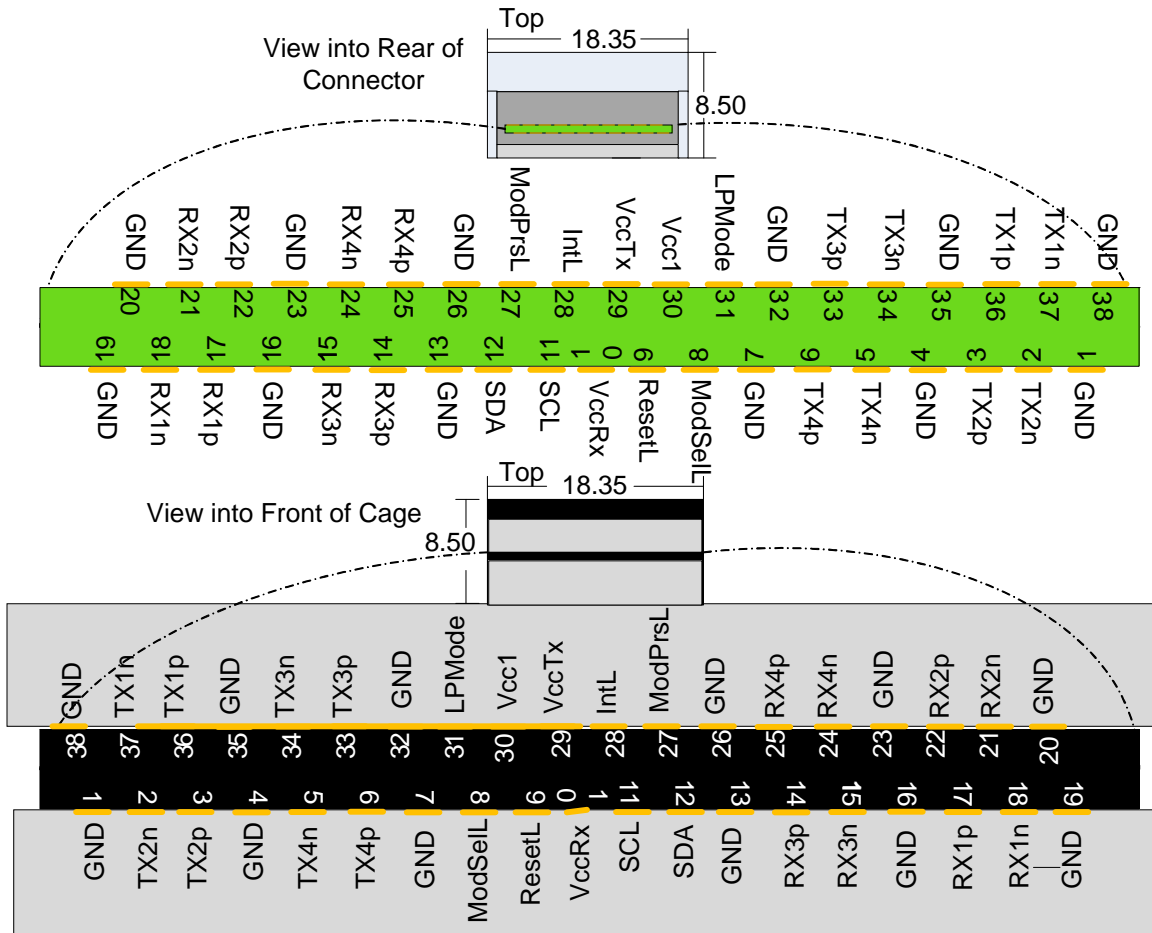
Appendix C: QSFP Interface

20	GND	GND	19
21	Rx2n	Rx1n	18
22	Rx2p	Rx1p	17
23	GND	GND	16
24	Rx4n	Rx3n	15
25	Rx4p	Rx3p	14
26	GND	GND	13
27	ModPrsL	SDA	12
28	IntL	SCL	11
29	VccTx	Vcc Rx	10
30	Vcc1	ResetL	9
31	LPMODE	ModSelL	8
32	GND	GND	7
33	Tx3p	Tx4p	6
34	Tx3n	Tx4n	5
35	GND	GND	4
36	Tx1p	Tx2p	3
37	Tx1n	Tx2n	2
38	GND	GND	1

Table 5 - InfiniBand QSFP Connector Pinout

Connector Pin Number	Connector Pin Name	Signal Description
1	GND	Ground
2	Tx2n	Transmitter Inverted Data Input
3	Tx2p	Transmitter Non-Inverted Data Input
4	GND	Ground
5	Tx4n	Transmitter Inverted Data Input
6	Tx4p	Transmitter Non-Inverted Data Input
7	GND	Ground
8	ModSelL	Module Select
9	ResetL	Module Reset
10	Vcc Rx	+3.3 V Power supply receiver
11	SCL	2-wire serial interface clock
12	SDA	2-wire serial interface data
13	GND	Ground
14	Rx3p	Receiver Non-Inverted Data Output
15	Rx3n	Receiver Inverted Data Output
16	GND	Ground
17	Rx1p	Receiver Non-Inverted Data Output
18	Rx1n	Receiver Inverted Data Output
19	GND	Ground
20	GND	Ground
21	Rx2n	Receiver Inverted Data Output 3
22	Rx2p	Receiver Non-Inverted Data Output 3
23	GND	Ground
24	Rx4n	Receiver Inverted Data Output 3
25	Rx4p	Receiver Non-Inverted Data Output 3
26	GND	Ground
27	ModPrsL	Module Present
28	IntL	Interrupt
29	Vcc Tx	+3.3 V Power supply transmitter
30	Vcc 1	+3.3 V Power Supply
31	LPMODE	Low Power Mode
32	GND	Ground
33	Tx3p	Transmitter Non-Inverted Data Input
34	Tx3n	Transmitter Inverted Data Input
35	GND	Ground
36	Tx1p	Transmitter Non-Inverted Data Input
37	Tx1n	Transmitter Inverted Data Input
38	GND	Ground

Figure 6: Pinout Looking Into the Rear of the Connector and the Front of the Cage



Appendix D: Avertissements de sécurité d'installation

1. Instructions d'installation



Lisez toutes les instructions d'installation avant de brancher le matériel à la source d'alimentation électrique.

2. Température excessive



Ce matériel ne doit pas fonctionner dans une zone avec une température ambiante dépassant le maximum recommandé de 40°C (104°F). En outre, pour garantir un bon écoulement de l'air, laissez au moins 8 cm (3 pouces) d'espace libre autour des ouvertures de ventilation.

3. Empilage du châssis



Le châssis ne doit pas être empilé sur un autre matériel. Si le châssis tombe, il peut provoquer des blessures corporelles et des dégradations de biens.

4. Orages – dangers électriques



Pendant un orage, il ne faut pas utiliser le matériel et il ne faut pas brancher ou débrancher les câbles.

5. Branchement/débranchement des câbles InfiniBand en cuivre



Les câbles InfiniBand en cuivre sont lourds et ne sont pas flexibles, il faut donc faire très attention en les branchant et en les débranchant des connecteurs. Consultez le fabricant des câbles pour connaître les mises en garde et les instructions spéciales.

6. Montage et entretien sur baie



Lorsque ce produit est monté ou entretenu sur baie, il faut prendre des précautions spéciales pour s'assurer que le système reste stable. En général, il faut remplir la baie avec du matériel de bas en haut.

7. Installation du matériel



Ce matériel ne doit être installé, remplacé ou entretenu que par du personnel formé et qualifié.

8. Elimination du matériel



L'élimination de ce matériel doit s'effectuer dans le respect de toutes les législations et réglementations nationales en vigueur.

9. Codes électriques locaux et nationaux



Ce matériel doit être installé dans le respect des codes électriques locaux et nationaux.

Appendix E: Installation - Sicherheitshinweise

1. Installationsanleitungen



Lesen Sie alle Installationsanleitungen, bevor Sie das Gerät an die Stromversorgung anschließen.

2. Übertemperatur



Dieses Gerät sollte nicht in einem Bereich mit einer Umgebungstemperatur über der maximal empfohlenen Temperatur von 40°C (104°F) betrieben werden. Außerdem sollten mindestens 8 cm (3 in.) Freiraum um die Belüftungslöffnungen sein, um einen einwandfreien Luftstrom zu gewährleisten.

3. Stapeln des Chassis



Das Chassis sollte nicht auf andere Geräte gestapelt werden. Wenn das Chassis herunterfällt, kann es zu Verletzungen und Beschädigungen an Geräten führen.

4. Bei Gewitter - Elektrische Gefahr



Arbeiten Sie während eines Gewitters und Blitzschlag nicht am Gerät, schließen Sie keine Kabel an oder ab.

5. Anschließen/Trennen von InfiniBand-Kupferkabel



InfiniBand-Kupferkabel sind schwer und nicht flexible. Deshalb müssen sie vorsichtig an die Anschlüsse angebracht bzw. davon getrennt werden. Lesen Sie die speziellen Warnungen und Anleitungen des Kabelherstellers.

6. Rack-Montage und Wartung



Wenn dieses Produkt in einem Rack montiert oder gewartet wird, sind besondere Vorsichtsmaßnahmen zu ergreifen, um die Stabilität des Systems zu gewährleisten. Im Allgemeinen sollten Sie das Gestell von unten nach oben mit Geräten füllen.

7. Geräteinstallation



Dieses Gerät sollte nur von geschultem und qualifiziertem Personal installiert, ausgetauscht oder gewartet werden.

8. Geräteentsorgung



Die Entsorgung dieses Geräts sollte unter Beachtung aller nationalen Gesetze Bestimmungen erfolgen.

9. Regionale und nationale elektrische Bestimmungen



Dieses Gerät sollte unter Beachtung der regionalen und nationalen elektrischen Bestimmungen installiert werden.