# ConnectX®-3 VPI Single and Dual QSFP+ Port Adapter Card User Manual

P/N:

MCX353A-FCBT, MCX353A-TCBT, MCX353A-QCBT, MCX354A-FCBT, MCX354A-TCBT, MCX354A-QCBT

Rev 1.6

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Mellanox Technologies
350 Oakmead Parkway Suite 100
Sunnyvale, CA 94085
U.S.A.
www.mellanox.com
Tel: (408) 970-3400

Mellanox Technologies, Ltd.
Beit Mellanox
PO Box 586 Yokneam 20692
Israel
www.mellanox.com
Tel: +972 (0)74 723 7200

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# Revision History

This document was printed on November 14, 2012.

***Table 1 - Revision History Table***

| Date | Rev | Comments/Changes |
|---|---|---|
| November 2012 | 1.6 | • Updated Web links in the following locations:<br>- Section 4.5.1, "Hardware and Software Requirements," on page 36<br>- Table 11, "MCX353A-QCBT Specifications Table," on page 39<br>- Table 12, "MCX354A-QCBT Specifications Table," on page 40<br>- Table 13, "MCX353A-TCBT Specifications Table," on page 41<br>- Table 14, "MCX354A-TCBT Specifications Table," on page 42<br>- Table 15, "MCX353A-FCBT Specifications Table," on page 43<br>- Table 16, "MCX354A-FCBT Specifications Table," on page 44 |
| October 2012 | 1.56 | • Fixed Table 9, "Jumper Configuration," on page 21<br>• Updated figures in Section 4.1.2, "Windows," on page 32 by providing ConnectX-3 examples |
| August 2012 | 1.4 | • Added operational and non-operational temperature and humidity level to the following tables:<br>- Table 11, "MCX353A-QCBT Specifications Table," on page 39<br>- Table 12, "MCX354A-QCBT Specifications Table," on page 40<br>- Table 13, "MCX353A-TCBT Specifications Table," on page 41<br>- Table 14, "MCX354A-TCBT Specifications Table," on page 42<br>- Table 15, "MCX353A-FCBT Specifications Table," on page 43<br>- Table 16, "MCX354A-FCBT Specifications Table," on page 44 |
| January 2012 | 1.2 | • Minor edits<br>• Updated LED functions in Section 2.1.5, "LED Assignment," on page 19<br>• Formatted specification tables in Appendix A, "Specifications," on page 39 |
| October 2011 | 1.1 | Added new OPNs based on ConnectX-3 Step A1 devices |
| July 2011 | 1.0 | Minor edits |
| July 2011 | 0.10 | First Release |

# About this Manual

This *User Manual* describes Mellanox Technologies ConnectX®-3 VPI Single and Dual QSFP+ port PCI Express x8 adapter cards. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the board, and relevant documentation.

## Intended Audience

This manual is intended for the installer and user of these cards.

The manual assumes basic familiarity with InfiniBand® and Ethernet networks and architecture specifications.

## Related Documentation

***Table 2 - Documents List***

| | |
|---|---|
| *Mellanox Firmware Tools (MFT) User Manual* Document no. 2204UG | User Manual describing the set of MFT firmware management tools for a single node. See http://www.mellanox.com => Support => Download Firmware Tools |
| *IBTA Specification Release 1.2.1* | InfiniBand Architecture Specification |
| *IEEE Std 802.3 Specification* | This is the IEEE Ethernet specification http://standards.ieee.org/getieee802 |
| PCI Express 3.0 Specifications | Industry Standard PCI Express 3.0 Base and Card Electromechanical Specifications |

## Document Conventions

When discussing memory sizes, MB and MBytes are used in this document to mean size in mega bytes. The use of Mb or Mbits (small b) indicates size in mega bits. IB is used in this document to mean InfiniBand. In this document PCIe is used to mean PCI Express.

## Technical Support

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- E-mail: support@mellanox.com
- Tel: +1.408.916.0055

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or use the following link to go directly to the Mellanox Support Download Assistant page,

http://www.mellanox.com/supportdownloader/.

# 1 Overview

This document is a *User Manual* for Mellanox Technologies VPI adapter based on the ConnectX®-3 VPI integrated circuit device. The cards described in this manual have the following main features:

- Virtual Protocol Interconnect (VPI)
- InfiniBand Architecture Specification v1.2.1 compliant
- IEEE Std. 802.3 compliant
- PCI Express 3.0 (1.1 and 2.0 compatible) through an x8 edge connector up to 8GT/s
- Single and Dual-port options available
  - ESD protection on the network connector
- Compliant with QSFP+ MSA spec Rev. 1.0
- Compatible with copper cables and optical cables with the use of QSFP connectors. Support for SFP+ cables is available through QSA (Quad to Serial)
- CORE-Direct® application off-load
- GPUDirect application off-load
- RDMA over Converged Ethernet (RoCE)
- End-to-end QoS and congestion control
- Hardware-based I/O virtualization
- TCP/UDP/IP stateless off-load
- Ethernet encapsulation (EoIB)
- RoHS-R6 compliant
- Two bracket heights: short and tall

## 1.1 Supported Network Protocol Standards

### 1.1.1 InfiniBand FDR

FDR is a pre-standard InfiniBand data rate, where each lane of a 4X port runs a bit rate of 14.0625Gb/s with a 64b/66b encoding, resulting in an effective bandwidth of 54.54Gb/s. The FDR physical layer is an IBTA specified physical layer using different block types, deskew mechanism and framing rules.

### 1.1.2 InfiniBand FDR10

FDR10 is an InfiniBand transport and link layer running over a physical layer using the PCS encoding of 64b/66b and a bit rate of 10.3125Gb/s per lane. Consequently, the effective bandwidth is 25% higher than the InfiniBand-specification standard QDR rate, which uses an 8b/10b encoding. The FDR10 implementation on the adapter device can use the optional Forward Error Correction (FEC) supported by the FDR pre-standard.

### 1.1.3 InfiniBand QDR

QDR is a standard InfiniBand data rate, where each lane of a 4X port runs a bit rate of 10Gb/s.

### 1.1.4 10 and 40 Gigabit Ethernet

10 and 40 Gigabit Ethernet are Ethernet network protocol standards for LANs specifying data transfer rates of 10 and 40Gb/s, respectively. Mellanox adapters comply with the following IEEE 802.3* standards:

- IEEE Std 802.3-2008 Ethernet
- IEEE Std 802.3ae 10 Gigabit Ethernet
- IEEE Std 802.3ba 40 Gigabit Ethernet
- IEEE Std 802.3ad Link Aggregation and Failover

## 1.2 Adapter Cards Covered in this Manual

Table 3 lists the single and dual-port QDR adapter cards.

Table 4 lists the single and dual-port FDR10 adapter cards

Table 5 lists the single and dual-port FDR adapter cards.

***Table 3 - Single and Dual-port QDR Adapter Cards***

| Ordering Part Number (OPN) | PCI Express SERDES Speed | Data Transmission Rate/ # of ports | RoHS | Adapter IC Part Number | Device ID (decimal) |
|---|---|---|---|---|---|
| MCX353A-QCBT | PCIe 3.0 x8 8GT/s | 40 Gb/s QDR IB, 10GigE single-port QSFP+ | R6 | MT27508A1-FCCR-QV | • 4099 for Physical Function<br>• 4100 for Virtual Function |
| MCX354A-QCAT (Legacy product) | PCIe 3.0 x8 8GT/s | 40 Gb/s QDR IB, 10 GigE dual-port QSFP+ | R6 | MT27508A0-FCCR-QV | |
| MCX354A-QCBT | PCIe 3.0 x8 8GT/s | 40 Gb/s QDR IB, 10GigE dual-port QSFP+ | R6 | MT27508A1-FCCR-QV | |

***Table 4 - Single and Dual-port FDR10 Adapter Cards***

| Ordering Part Number (OPN) | PCI Express SERDES Speed | Data Transmission Rate/ # of ports | RoHS | Adapter IC Part Number | Device ID (decimal) |
|---|---|---|---|---|---|
| MCX353A-TCBT | PCIe 3.0 x8 8GT/s | 40 Gb/s FDR10 IB, 10GigE single-port QSFP+ | R6 | MT27508A1-FCCR-TV | • 4099 for Physical Function<br>• 4100 for Virtual Function |
| MCX354A-TCAT (Legacy product) | PCIe 3.0 x8 8GT/s | 40 Gb/s FDR10 IB, 10GigE dual-port QSFP+ | R6 | MT27508A0-FCCR-TV | |
| MCX354A-TCBT | PCIe 3.0 x8 8GT/s | 40 Gb/s FDR10 IB, 10GigE dual-port QSFP+ | R6 | MT27508A1-FCCR-TV | |

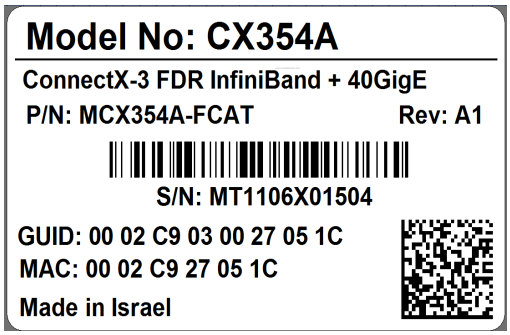
***Table 5 - Single and Dual-port FDR Adapter Cards***

| Ordering Part Number (OPN) | PCI Express SERDES Speed | Data Transmission Rate/ # of ports | RoHS | Adapter IC Part Number | Device ID (decimal) |
|---|---|---|---|---|---|
| MCX353A-FCBT | PCIe 3.0 x8 8GT/s | 56 Gb/s FDR IB, 40GigE single-port QSFP+ | R6 | MT27508A1-FCCR-FV | • 4099 for Physical Function<br>• 4100 for Virtual Function |
| MCX354A-FCAT (Legacy product) | PCIe 3.0 x8 8GT/s | 56 Gb/s FDR IB, 40GigE dual-port QSFP+ | R6 | MT27508A0-FCCR-FV | |
| MCX354A-FCBT | PCIe 3.0 x8 8GT/s | 56 Gb/s FDR IB, 40GigE dual-port QSFP+ | R6 | MT27508A1-FCCR-FV | |

## 1.3 Finding the GUID/ MAC and Serial Number on the Adapter Card

Each Mellanox adapter card has a label on the print side that shows the card serial number, the card MAC for the Ethernet protocol and the card GUID for the InfiniBand protocol. VPI cards have both a GUID and a MAC (derived from the GUID).

***Figure 1: Card Product Label (Example)***




Port 1 uses the GUID or MAC described on the label. To obtain the GUID or MAC for Port 2, add 1 to that of Port 1.

## 1.4 Safety Warnings

Below is a list of safety warnings in English. For safety warnings in other languages, please refer to the appendices in this user manual.

### 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: 55°C (131°F).
To guarantee proper air flow, allow at least 8cm (3 inches) of clearance around the ventilation openings.

### 3. During Lightning - Electrical Hazard

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

### 4. Copper Cable Connecting/Disconnecting

Some copper cables are heavy and not flexible, as such they should be carefully attached to or detached from the connectors. Refer to the cable manufacturer for special warnings and instructions.

### 5. Equipment Installation

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

### 6. Equipment Disposal

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

### 7. Local and National Electrical Codes

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

## 8. Hazardous Radiation Exposure

Caution – Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

CLASS 1 LASER PRODUCT and reference to the most recent laser standards: IEC 60 825-1:1993 + A1:1997 + A2:2001 and EN 60825-1:1994+A1:1996+ A2:2001

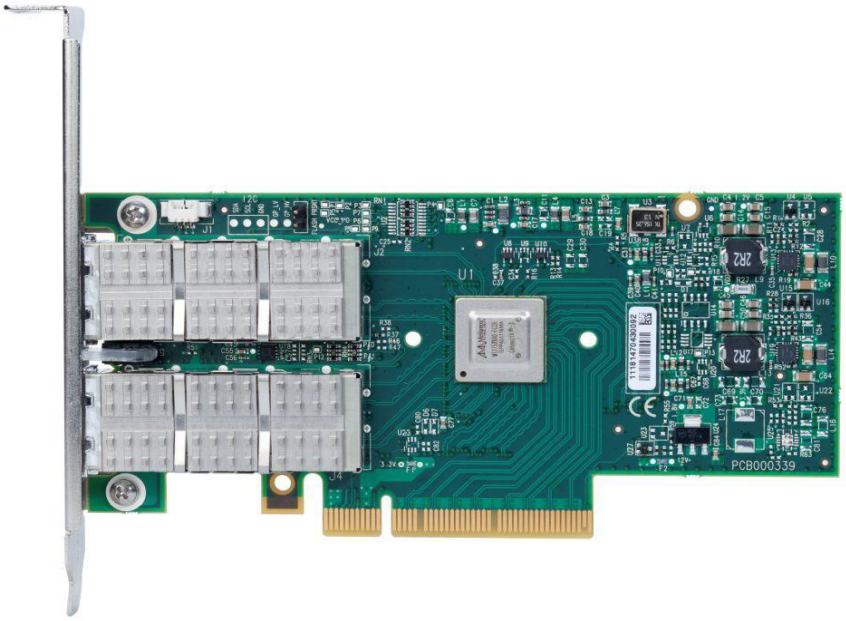
# 2 Adapter Card Interfaces

## 2.1 I/O Interfaces

Each adapter card includes the following interfaces:

- QSFP+ port(s)
- PCI Express (PCIe) x8 edge connector
- I/O panel LEDs
- $I^2C$-compatible connector (for debug)

***Figure 2: MCX354A-[QFT]CBT Card***



The adapter cards include special circuits to protect from ESD shocks to the card/server when plugging copper cables.

For dual-port cards, Port 1 connects to connector 1 of the device, while Port 2 connects to connector 2 of the device. See Figure 3 for the mechanical drawing of a dual-port bracket and Figure 4 for the mechanical drawing of a single-port bracket.

***Figure 3: Dual-port Bracket***

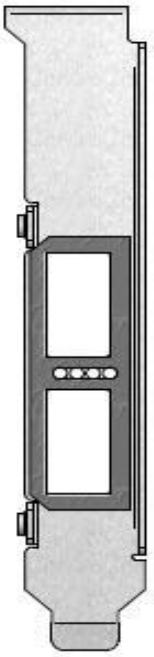
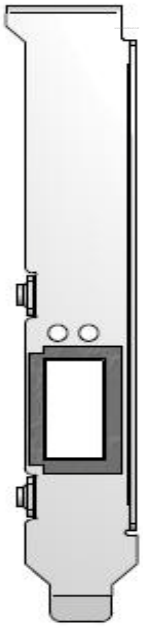


***Figure 4: Single-port Bracket***



### 2.1.1 InfiniBand Interface

The network ports of the ConnectX®-3 adapter cards are compliant with the *InfiniBand Architecture Specification, Release 1.2.1*. InfiniBand traffic is transmitted through the cards' QSFP+ connectors.

### 2.1.2 Ethernet Interface

The network ports of the ConnectX®-3 adapter cards are compliant with the IEEE 802.3 Ethernet standards listed in Section 1.1.4, “10 and 40 Gigabit Ethernet,” on page 11. Ethernet traffic is transmitted through the cards' QSFP+ connectors. For connecting to an SFP+ interface, you can use Mellanox QSA (QSFP to SFP+) adapter module (to be ordered separately).

### 2.1.3 VPI Port Configuration

VPI ports are auto-sensing but can be manually configured using a script.

Table 6 lists the configurations supported by dual-port VPI adapter cards.

***Table 6 - Supported Port Configurations***

| Port 1 | Port 2 |
|---|---|
| Ethernet | Ethernet |
| IB | IB |
| auto-sensing | auto-sensing |
| IB | Ethernet |
| IB | auto-sensing |
| auto-sensing | Ethernet |

Table 7 lists the configurations not supported by dual-port VPI adapter cards.

***Table 7 - Unsupported Port Configurations***

| Port 1 | Port 2 |
|---|---|
| Ethernet | IB |
| Ethernet | auto-sensing |
| auto-sensing | IB |

For port type configuration instructions please refer to Section 4.2, “Port Type Management Via Driver SW,” on page 32.

### 2.1.4 PCI Express Interface

The ConnectX®-3 adapter cards support PCI Express 3.0 (1.1 and 2.0 compatible) throughanx8 edge connector. The device can be either a master initiating the PCI Express bus operations or a slave responding to PCI bus operations.

### 2.1.5 LED Assignment

There are two I/O LEDs per port in dual-port designs. See Figure 5 for different LED functions in InfiniBand mode and Table 8 for different LED functions in Ethernet mode.

***Figure 5: Physical and Logical Link Indications (InfiniBand Mode)***

| LED | Function |
|---|---|
| Green - Physical link | • Constant on indicates a good physical link<br>• Blinking indicates a problem with the physical link<br>• If neither LED is lit, then the physical link has not been established |
| Yellow - Logical (data activity) link | • A constant yellow indicates a valid logical (data activity) link without data transfer.<br>• A blinking yellow indicates a valid logical link with data transfer<br>• If only the green LED is lit and the yellow LED is off, then the logical link has not been established |

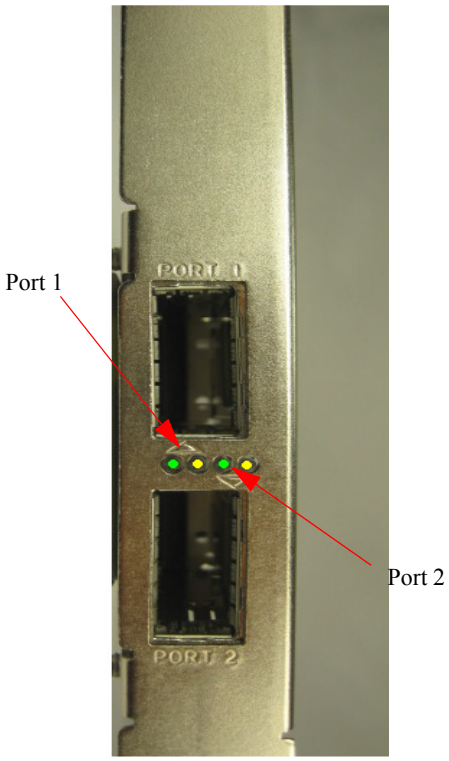



***Table 8 - Physical and Logical Link Indication (Ethernet Mode)***

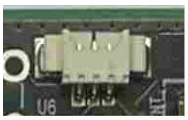
| LED | Function |
|---|---|
| Green - physical link | • Constant on indicates a good physical link<br>• If neither LED is lit, then the physical link has not been established |
| Yellow - logical (data activity link) | • A blinking yellow indicates activity (data transfer)<br>• Stays off when there is no activity |

The short bracket has the same port and LED footprints as the tall bracket.

### 2.1.6 I²C-compatible Interface

A three-pin header on the adapter cards is provided as the I²C-compatible interface. See Figure 11, “Mechanical Drawing of the Dual-port MCX354A-[QFT]CBT Adapter Card,” on page 46 for the location on the board.

***Figure 6: I²C-compatible Connector***



## 2.2 Power

All adapter cards receive 12V and 3.3V power from the PCI Express edge connector. All other required power voltages are generated by on-board switch mode regulators. See “Specifications” on page 39.

## 2.3 QSFP+ Power Level

The adapter cards support power levels according to SFF Committee SFF-84366 Specification for QSFP+ (Quad Small Form-factor Pluggable) Transceiver.

## 2.4 Memory

The adapter cards support multiple memory devices through the PCIe, SPI (Flash) and I²C interfaces.

### 2.4.1 System Memory

The adapter cards utilize the PCI Express interface to store and access InfiniBand and/or Ethernet fabric connection information and packet data on the system memory.

### 2.4.2 SPI

Each of the adapter cards includes one 16MB SPI Flash device (M25PX16-VMN6P device by ST Microelectronics) accessible via the SPI interface of the ConnectX®-3 VPI device.

When a jumper is inserted into the drill holes in the adapter it indicates to the device that the on-board Flash device should not be used for boot instructions. Contact your Mellanox support representative should you need to use this jumper. Table 9 provides information on this jumper. The jumper location on the board is illustrated in Appendix A.7, "Board Mechanical Drawing and Dimensions," on page 45.

***Table 9 - Jumper Configuration***

| Description | Option | Card Default Configuration |
|---|---|---|
| Flash present/ not present | connection open – Flash present connection shorted – Flash not present | connection open – Flash present |

## 2.4.3 EEPROM

Each board incorporates an EEPROM that is accessible through the $I^2C$-compatible interface. The EEPROM capacity is 4Kb. The EEPROM is used for storing the Vital Product Data (VPD).

The PCI VPD (Vital Product Data) layout for each of the adapter cards complies with the format defined in the *PCI 3.0 Specification, Appendix I.*

***Table 10 - MCX35[34]A-[QFT]CBT VPD Layout***

| Offset (Decimal) | Item | Value | Format | Description |
|---|---|---|---|---|
| 0 | Large Resource Type ID String Tag (0x02) | 0x82 | | |
| 1 | Length [7:0] LSB | 0x18 | | |
| 2 | Length [15:8] MSB | 0x0 | | |
| 3 | Data | CX354A - ConnectX-3 QSFP | STR | |
| 27 | Large Resource Type VPD-R Tag (0x10) | 0x90 | | |
| 28 | Length [7:0] LSB | 0x4F | | |
| 29 | Length [15:8] MSB | 0x00 | | |
| 30 | VPD Keyword | PN | STR | Add in Card Part Number Example: MCX354A-FCBT |
| 32 | Length | 0x15 | | |
| 33 | Part Number | PN | %STR_SPC | |
| 54 | VPD Keyword | EC | STR | Engineering Change Level of the card (rev) |

***Table 10 - MCX35[34]A-[QFT]CBT VPD Layout***

| Offset (Decimal) | Item | Value | Format | Description |
|---|---|---|---|---|
| 56 | Length | 0x2 | | |
| 57 | Revision | RV | %STR | PCB revision<br>Example: “A1” |
| 59 | VPD Keyword | SN | STR | Serial Number |
| 61 | Length | 0x18 | | |
| 62 | SerialNumber | SN | %STR_SPC | “00..00XXXX..XX” |
| 86 | VPD Keyword | V0 | STR | Misc Information |
| 88 | Length | 0x10 | | |
| 89 | Data | PCIe Gen3 x8 | STR_SPC | |
| 105 | VPD Keyword | RV | STR | |
| 107 | Length | 0x1 | | |
| 108 | Data | 0,107 | %CS0 | |
| 109 | Large Resource Type VPD-W Tag (0x11) | 0x91 | | |
| 110 | Length [7:0] LSB | 0x8F | | |
| 111 | Length [15:8] MSB | 0xF | | |
| 112 | VPD Keyword | V1 | STR | EFI Driver version |
| 114 | Length | 0x6 | | |
| 115 | Data | N/A | STR_SPC | |
| 121 | VPD Keyword | YA | STR | Asset Tag |
| 123 | Length | 0x18 | | |
| 124 | Data | N/A | STR_SPC | “N/A” |
| 148 | VPD Keyword | RW | STR | Remaining read/write area |
| 150 | Length | 0x69 | | |
| 151 | Data | | STR_ZERO | Reserved (0x00) |
| 256 | VPD Keyword | RW | STR | Remaining read/write area |
| 258 | Length | 0xfd | | |
| 259 | Data | | STR_ZERO | Reserved (0x00) |
| 512 | VPD Keyword | RW | STR | Remaining read/write area |
| 514 | Length | 0xfd | | |
| 515 | Data | | STR_ZERO | Reserved (0x00) |
| 768 | VPD Keyword | RW | STR | Remaining read/write area |
| 770 | Length | 0xfd | | |
| 771 | Data | | STR_ZERO | Reserved (0x00) |
| 1024 | VPD Keyword | RW | STR | Remaining read/write area |
| 1026 | Length | 0xfd | | |
| 1027 | Data | | STR_ZERO | Reserved (0x00) |
| 1280 | VPD Keyword | RW | STR | Remaining read/write area |
| 1282 | Length | 0xfd | | |
| 1283 | Data | | STR_ZERO | Reserved (0x00) |
| 1536 | VPD Keyword | RW | STR | Remaining read/write area |
| 1538 | Length | 0xfd | | |
| 1539 | Data | | STR_ZERO | Reserved (0x00) |

***Table 10 - MCX35[34]A-[QFT]CBT VPD Layout***

| Offset (Decimal) | Item | Value | Format | Description |
|---|---|---|---|---|
| 1792 | VPD Keyword | RW | STR | Remaining read/write area |
| 1794 | Length | 0xfd | | |
| 1795 | Data | | STR_ZERO | Reserved (0x00) |
| 2048 | VPD Keyword | RW | STR | Remaining read/write area |
| 2050 | Length | 0xfd | | |
| 2051 | Data | | STR_ZERO | Reserved (0x00) |
| 2304 | VPD Keyword | RW | STR | Remaining read/write area |
| 2306 | Length | 0xfd | | |
| 2307 | Data | | STR_ZERO | Reserved (0x00) |
| 2560 | VPD Keyword | RW | STR | Remaining read/write area |
| 2562 | Length | 0xfd | | |
| 2563 | Data | | STR_ZERO | Reserved (0x00) |
| 2816 | VPD Keyword | RW | STR | Remaining read/write area |
| 2818 | Length | 0xfd | | |
| 2819 | Data | | STR_ZERO | Reserved (0x00) |
| 3072 | VPD Keyword | RW | STR | Remaining read/write area |
| 3074 | Length | 0xfd | | |
| 3075 | Data | | STR_ZERO | Reserved (0x00) |
| 3328 | VPD Keyword | RW | STR | Remaining read/write area |
| 3330 | Length | 0xfd | | |
| 3331 | Data | | STR_ZERO | Reserved (0x00) |
| 3584 | VPD Keyword | RW | STR | Remaining read/write area |
| 3586 | Length | 0xfd | | |
| 3587 | Data | | STR_ZERO | Reserved (0x00) |
| 3840 | VPD Keyword | RW | STR | Remaining read/write area |
| 3842 | Length | 0xfc | | |
| 3843 | Data | | STR_ZERO | Reserved (0x00) |
| 4095 | Small Resource Type END Tag (0x11) | 0x78 | | |

# 3 Adapter Card Installation

## 3.1 Hardware Requirements

A system with a PCI Express x8 slot is required for installing the card.

## 3.2 Installation Instructions

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

To change a tall bracket to a short bracket see Replacing a Tall Bracket With a Short Bracket on page 51.

The adapter cards listed above are standard PCI Express cards, each with a standard x8 edge connector. The cards require a PCI Express x8. Please consult the host machine documentation for instructions on how to install a PCI Express card.

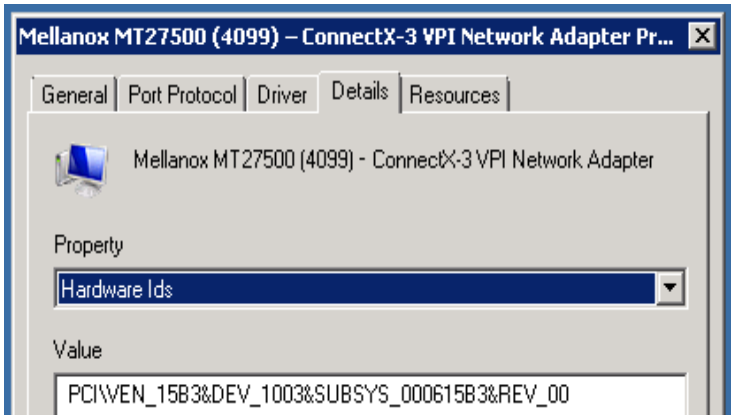
If the card is installed in a PCI slot with less lanes than the card requires then the adapter card will not provide the optimum data transfer.

## 3.3 Identify the Card in Your System

### 3.3.1 On Windows

1. Open Device Manager on the server. Click start => Run, and then enter “devmgmt.msc”.
2. Expand System Devices and locate your Mellanox ConnectX-3 adapter card.
3. Select Properties to display the adapter card properties window.
4. Click the Details tab and select **Device Instance Id** (Windows 2003) or **Hardware Ids** (Windows 2008/R2) from the Property pull-down menu.

***Figure 7: PCI Device***




5. In the Value display box, check the fields VEN and DEV (fields are separated by '&'). In the display example above, notice the sub-string "PCI\VEN_15B3&DEV_1003": VEN is equal to 0x15B3 – this is the Vendor ID of Mellanox Technologies; and DEV is equal to 1003 – this is a valid Mellanox Technologies PCI Device ID.

If the PCI device does not have a Mellanox adapter ID, return to Step 4 to check another device.

The list of Mellanox Technologies PCI Device IDs can be found in the PCI ID repository at http://pci-ids.ucw.cz/read/PC/15b3.

### 3.3.2 On Linux

Get the device location on the PCI bus by running lspci and locating lines with the string "Mellanox Technologies":

```
> lspci |grep -i Mellanox

27:00.0 Network controller: Mellanox Technologies MT27500 Family [ConnectX-3]
```

## 3.4 Cables and Modules

Please refer to “Mellanox Products Approved Cable Lists” at www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf.

### 3.4.1 Cable Installation

1. 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.
2. After inserting a cable into a port, the GREEN LED indicator 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).
3. After plugging in a cable, lock the connector using the latching mechanism particular to the cable vendor. When a logical connection is made the YELLOW LED will come on. When data is being transferred the yellow led will blink.

When installing cables make sure that the latches engage.

Always install and remove cables by pushing or pulling the cable and connector in a straight line with the card.

4. Care should be taken as not to impede the air exhaust flow through the ventilation holes. Cable lengths which allow for routing horizontally around to the side of the chassis before bending upward or downward in the rack should be used
5. To remove a cable, disengage the locks and slowly pull the connector away from the port receptacle. Both LED indicators will turn off when the cable is unseated.

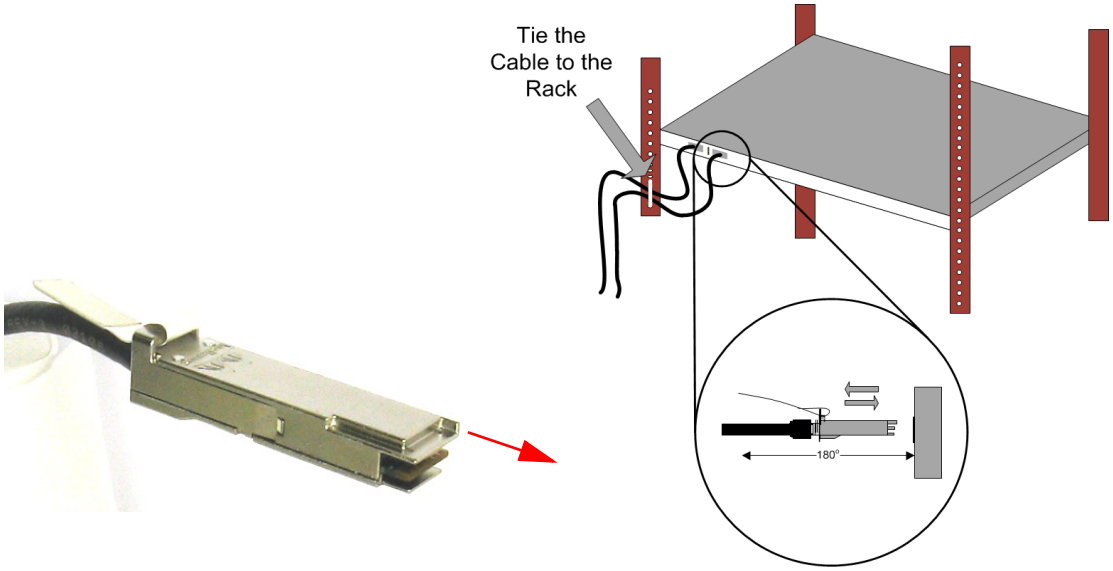
Cables, especially long copper cables, can weigh a substantial amount. Make sure that the weight of the cable is supported on its own and is not hanging from the adapter card.

#### 3.4.1.1 Inserting a Cable into the Adapter Card

1. Support the weight of the cable before connecting the cable to the adapter card. Do this by using a cable holder or tying the cable to the rack.
2. Determine the correct orientation of the connector to the card before inserting the connector. Do not try and insert the connector upside down. This may damage the adapter card.
3. Insert the connector into the adapter card. Be careful to insert the connector straight into the cage. Do not apply any torque, up or down, to the connector cage in the adapter card.

4. Make sure that the connector locks in place.

***Figure 8: Connector Orientation (Example)***




#### 3.4.1.2 Removing a Cable from the Adapter Card

1. Pull on the latch release mechanism thereby unlatching the connector and pull the connector out of the cage.
2. Do not apply torque to the connector when removing it from the adapter card.
3. Remove any cable supports that were used to support the cable's weight.

# 4 Driver Software and Firmware

## 4.1 Driver Software

### 4.1.1 Linux

For Linux, download and install the latest OpenFabrics Enterprise Distribution (OFED) software package available via the Mellanox web site at: http://www.mellanox.com => Products => Software/Drivers => InfiniBand & VPI Software/Drivers => Mellanox OFED => Download. Follow the installation instructions included in the download package (also available from the download page).To ensure that communication has been established follow the instructions below.

**Check the link status**

First check the network interface name by running the “ifconfig –a” command

```
> ifconfig -a
eth0      Link encap:Ethernet  HWaddr 5C:F3:FC:5F:40:EA
inet addr:10.7.5.170  Bcast:10.7.7.255  Mask:255.255.252.0
inet6 addr: fe80::5ef3:fcff:fe5f:40ea/64 Scope:Link
UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
RX packets:20009 errors:0 dropped:0 overruns:0 frame:0
TX packets:4492 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:7005902 (6.6 MiB)  TX bytes:399581 (390.2 KiB)
```

run: ethtool <interface>

```
> Host# ethtool eth0
    Settings for eth0:
    Supported ports: [ TP ]
    Supported link modes:   1000baseT/Full
                            10000baseT/Full
    Supports auto-negotiation: Yes
    Advertised link modes:    1000baseT/Full
                              10000baseT/Full
```

```
        Advertised auto-negotiation: N
        Speed: 1000Mb/s
        Duplex: Full
        Port: Twisted Pair
        PHYAD: 0
        Transceiver: internal
        Auto-negotiation: on
        Supports Wake-on: g
        Wake-on: d
        Link detected: yes
```

To check the IB link status, for IB and VPI cards, run "`ibstat`" and focus on the Physical state attributes.

Example:

```
> Host# ibstat
        LCA 'mlx4_0'
        CA type: MT4099
        Number of ports: 2
        Firmware version: 2.10.2000
        Hardware version: 0
        Node GUID: 0x0002c903002fefe0
        System image GUID: 0x0002c903002fefe3
        Port 1:
                State: Active
                Physical state: LinkUp
                Rate: 56
                Base lid: 4
                LMC: 0
                SM lid: 12
                Capability mask: 0x02514868
                Port GUID: 0x0002c903002fefe1
                Link layer: InfiniBand
        Port 2:
                State: Active
```

```
                Physical state: LinkUp
                Rate: 56
                Base lid: 8
                LMC: 0
                SM lid: 12
                Capability mask: 0x02514868
                Port GUID: 0x0002c903002fefe2
                Link layer: InfiniBand
```

**Check the OFED version**

To get the version of the running Mellanox OFED/BXOFED, run the following command:

```
# ofed_info |head -1
MLNX_OFED_LINUX-1.5.3-0.1.6 (OFED-1.5.3-0.1.6):
```

**Troubleshooting MLNX_OFED Installation**

For troubleshooting driver installation, please check Mellanox OFED driver user manual at: http://www.mellanox.com => Support => InfiniBand Software and Drivers => Mellanox OFED.

**Loading the Ethernet Driver**

By default, the Mellanox OFED stack loads mlx4_en. Run 'lsmod' to verify that the module is listed.

Example:

```
Host# lsmod |grep mlx4_en
```

```
mlx4_en               114184  0
mlx4_core             156512  2 mlx4_ib,mlx4_en
```

If you don't see the mlx4_en driver, run: `' modprobe mlx4_en'`

Another option is to use the command below to see which modules are active.

For example:

```
Edit "/etc/infiniband/openib.conf" which modules needs to load
from a service.
```

```
# Load MLX4_EN module
```

```
MLX4_EN_LOAD=yes
```

The “Usage: openibd {start|stop|restart|status}” command to modify this file and thereby control the drivers.

**Ethernet Driver Usage and Configuration**

To assign an IP address to the interface run:

where 'n' is the OS assigned interface number.

```
#> ifconfig eth<n> <ip>
```

- To check driver and device information run:

```
#> ethtool -i eth<n>
```

Example:

```
 > ethtool -i eth0
 driver:mlx4_en (MT_1020110019_CX-3)
 version: 1.5.6.33 (Oct 2011)
 firmware-version:2.10.0000
 bus-info: 0000:07:00.0
```

- The mlx4_en parameters can be found under /sys/module/mlx4_en (or /sys/module/mlx4_en/parameters, depending on the OS) and can be listed using the command:

```
#> modinfo mlx4_en
```

To set non-default values to module parameters, the following line should be added to the file/etc/modprobe.conf:

```
"options mlx4_en <param_name>=<value> <param_name>=<value> ..."
```

**Ethernet Network Tuning**

To improve network performance by tuning your network see the Mellanox Performance Tuning Guide located at:

http://www.mellanox.com => Products => Software/Drivers => Ethernet SW/Drivers => Linux Driver

### 4.1.2 Windows

For Windows, download and install the latest Mellanox WinOF VPI for Windows software package available via the Mellanox web site at: http://www.mellanox.com => Products => Software/Drivers =>InfiniBand & VPI Software/Drivers=> Mellanox WinOF VPI => Download. Follow the installation instructions included in the download package (also available from the download page). To ensure that communication has been established follow the instructions below.

Displaying the Device Manager will show the Mellanox adapter devices and an IPoIB (network) device for each port. Note that MLNX_VPI configures the ports of VPI cards – at installation time – to run the InfiniBand protocol.

## 4.2 Port Type Management Via Driver SW

### 4.2.1 Linux

If you wish to change the port type, use the connectx_port_config script after the driver is loaded. The script is installed as part of the Mellanox OFED for Linux package (under /sbin). See the Mellanox OFED for the Linux User Manual available at http://www.mellanox.com => Support => InfiniBand Products => Mellanox OFED. Running "/sbin/connectx_port_config -s" will show the current port configuration for all ConnectX®-3 devices.

Port configuration is saved in the file: /etc/infiniband/connectx.conf. This saved configuration is restored at driver restart only if done via "/etc/init.d/openibd restart".

Possible port types are:

- "eth" - Always Ethernet
- "ib" - Always InfiniBand
- "auto" - Link sensing mode - detect the port type based on the attached network type. If no link is detected, the driver retries link sensing every few seconds.

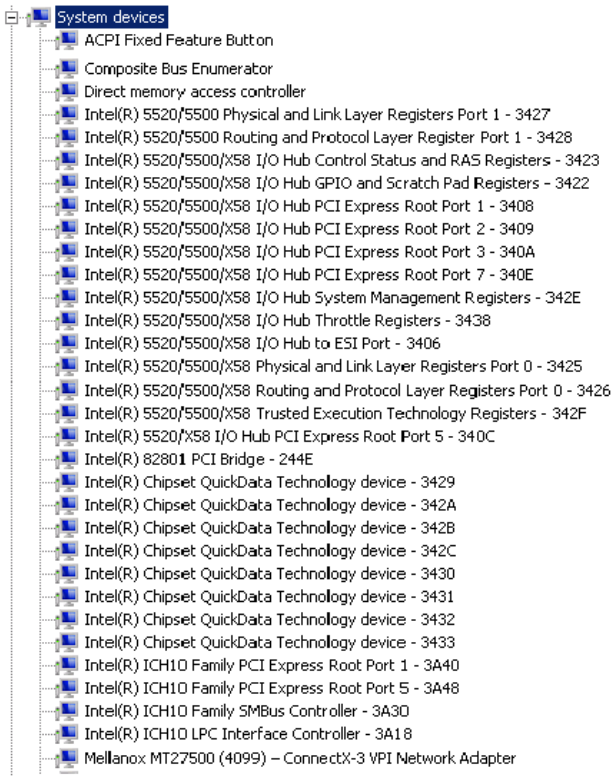
The port link type can be configured for each device in the system at run time using the "/sbin/connectx_port_config" script. This utility will prompt for the PCI device to be modified (if there is only one it will be selected automatically). At the next stage the user will be prompted for the desired mode for each port. The desired port configuration will then be set for the selected device. Note: This utility also has a non-interactive mode:

```
/sbin/connectx_port_config [[-d|--device <PCI device ID>] -c|--conf <port1,port2>]
```

### 4.2.2 Windows

After installing Mellanox WinOF VPI for Windows on your machine, you can change a port's protocol configuration. The following steps describe how to configure the port type:

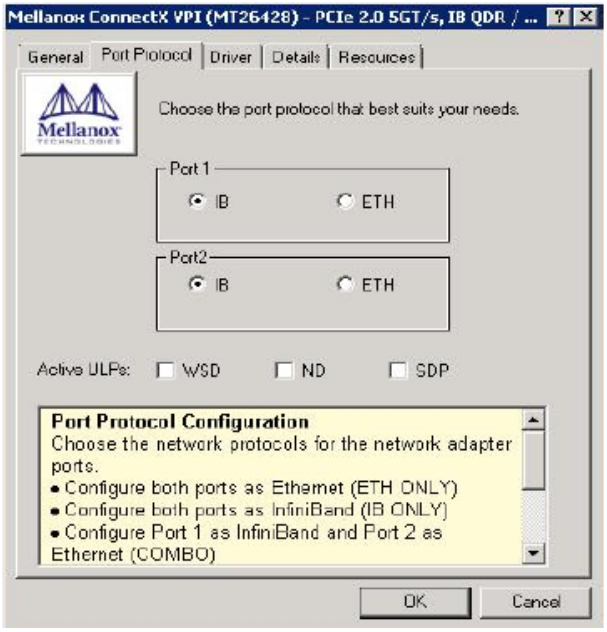
**Step 1** Display the Device Manager and expand “System Devices”




**Step 2.** Right-click on the Mellanox ConnectX VPI network adapter and left-click Properties. Select the Port Protocol tab from the Properties sheet.

Note: The "Port Protocol" tab is displayed only if the NIC is a VPI (IB and ETH). If the NIC is either only IB or ETH, the tab will not be shown.

Note: The figure below is an example of the displayed Port Protocol sheet for a dual-port VPI adapter card.




**Step 3.** In this step, you can perform two different functions: (a) Choose the desired port protocol for the available port(s), and (b) activate or deactivate the WSD, ND, and/or SDP ULPs

Note: IB *must* be always the first port in Port 1. If you choose ETH as your first port in Port 1, then the second port in Port 2 can be only ETH.

Note: WSD is not supported in Windows 7. Consequently, on this OS the WSD checkbox is grayed out and cannot be selected.

## 4.3 FlexBoot

FlexBoot enables remote boot over Ethernet, Boot over Ethernet (BoE), Boot over InfiniBand (BoIB) or Boot over iSCSI (Bo-iSCSI). This technology is based on the Preboot Execution Environment (PXE) standard specification, and FlexBoot software is based on the open source iPXE project (see www.ipxe.org). For more information go to _=> Products => Software/Drivers => InfiniBand & VPI Software/Drivers => FlexBoot => Download.

## 4.4 NVIDIA GPUDirect Support

Utilizing the high computational power of the Graphics Processing Unit (GPU), the GPU-to-GPU method has proven valuable in various areas of science and technology. The Mellanox ConnectX®-3 based adapter cards provide the required high throughput and low latency for GPU-to-GPU communications.

### 4.4.1 Hardware and Software Requirements

Software:

- Operating system: RHEL5.4 2.6.18-164.el5 x86_64 or later
- Mellanox OFED with GPUDirect support
- NVIDIA Development Driver for Linux version 195.36.15 or later

Hardware:

- Mellanox ConnectX®-3 adapter card
- NVIDIA Tesla series

### 4.4.2 Installation

For complete installation instructions visit: www.mellanox.com => Products => Software/Drivers => InfiniBand & VPI SW/Driver => Mellanox OFED GPUDirect => Download.

#### 4.4.2.1 Kernel Installation

Use Red Hat Package Manager (RPM) to install the Kernel RPM files:

```
- Install the required RPMs, for example, run:
  # rpm --force -ivh *.rpm
- Modify the boot loader configuration file if needed
  (e.g., edit /etc/grub.conf)
- Reboot the machine with the new kernel
  # reboot
```

#### 4.4.2.2 MLNX OFED Drivers Installation

The MLNX driver is called MLNX_OFED_LINUX-Nvidia-1.5.1.

```
- Mount the ISO file:
    # mount -o ro, loop MLNX_OFED_<version>.iso /mnt
- Run the installation script:
  # /mnt/mlnxofed install
- Restart the driver:
  # /etc/init.d/openibd restart
- To make sure that GPUDirect is enabled, run:
  # cat /sys/module/ib_core/parameters/gpu_direct_enable =>
1
```

The number of shared pages by GPUDirect is reported under:

```
# cat /sys/module/ib_core/parameters/gpu_direct_shares
```

#### 4.4.2.3 NVIDIA Driver Installation

Install NVIDIA Development Driver for Linux x86_64, available under:

```
http://developer.nvidia.com/object/cuda_3_0_downloads.html
```

For example:

```
- Run: devdriver_3.0_linux_64_195.36.15.run
- Follow the installation wizard instructions
```

To make sure that the NVIDIA driver was installed successfully:

```
- Load nvidia driver:
  # modprobe nvidia
- Check the driver version, for example:
  # cat /proc/driver/nvidia/version =>  version 195.36.15
(or later)
```

## 4.5 RDMA over Converged Ethernet

ConnectX®-3 connected to an Ethernet fabric provides all of the basic NIC functionality plus RDMA over Converged Ethernet (RoCE). RoCE utilizes advances in Data Center Bridging (DCB) to enable efficient and low cost implementations of RDMA over Ethernet, supporting the entire breadth of RDMA and low latency features. This includes reliable connected service, datagram service, RDMA and send/receive semantics, atomic operations, user level multicast, user level I/O access, kernel bypass, and zero copy. This capability is enabled when using the Mellanox OFED or WinOF VPI drivers.

ConnectX®-3 EN with RoCE based network management is the same as that for any Ethernet and DCB-based network management, eliminating the need for IT managers to learn new technologies.

### 4.5.1 Hardware and Software Requirements

Software:

- Mellanox OFED 1.5.1 or WinOF 2.1.2 or later. To download these packages go to http://www.mellanox.com => Products => Software/Drivers => InfiniBand & VPI SW/Driver.

Hardware:

- ConnectX®-3 card

## 4.6 Updating Adapter Card Firmware

Each card is shipped with the latest version of qualified firmware at the time of manufacturing. Firmware is updated occasionally, and the most recent firmware can be obtained from: => Support => Download Firmware. Check that the firmware on your card is the latest found on the Mellanox site, if not update to the latest version found on the Mellanox web site.

Firmware can be updated on the stand alone single card using the **flint** tool of the *Mellanox Firmware Tools (MFT)* package. This package is available for download, along with its user manual, from the Mellanox Firmware Tools page. See http://www.mellanox.com => Support => Download Firmware Tools.

A firmware binaries table lists a binary file per adapter card. The file name of each such binary is composed by combining the firmware name, the firmware release version, and the card part number. Please contact Mellanox System Support if you cannot find the firmware binary for your adapter card.

The following steps describe how to retrieve the PSID (firmware identification) and programmed firmware version of your adapter card. They also describe how to update the card with the latest firmware version available.

1. Retrieve the PSID and firmware version:
   a. Install the MFT package. The package is available at http://www.mellanox.com => Products => Software/Drivers => InfiniBand & VPI Software/Drivers => Firmware Tools. Make sure to download the package corresponding to your computer's operating system.
   b. Enter: mst start.
   c. Get the Mellanox *mst device name* using the command "mst status". The mst device name will be of the form: /dev/mst/mt4099_pci_cr0.
   d. Get the PSID (firmware identification) and programmed firmware version using the command.

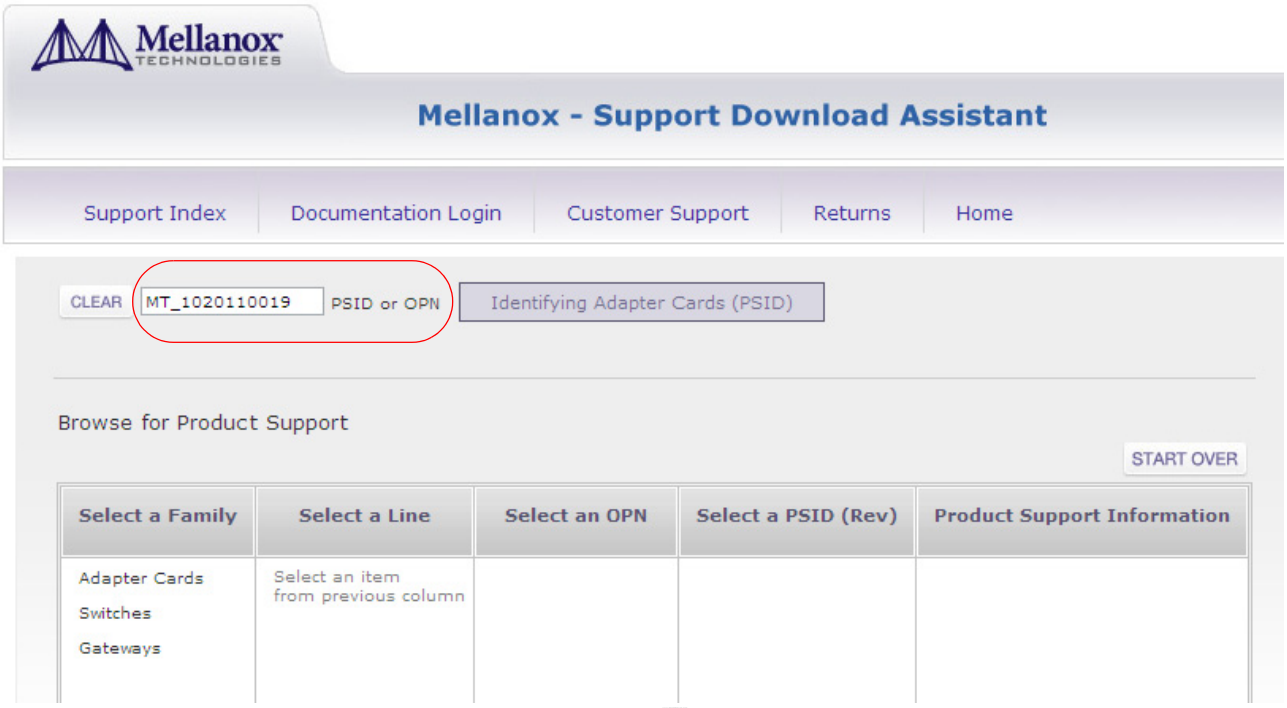
```
> flint -d /dev/mst/mt4099_pci_cr0  q
Image type:      ConnectX
FW Version:     2.9.4000
Device ID:         4099
Chip Revision:  0
Description:     Node                  Port1
Port2                        Sys image
GUIDs:              000002c900000200 000002c900000201
000002c900000202 000002c900000203
MACs:
000002c90200         000002c90201
Board ID:           (MT_1020110019)
VSD:
PSID:                 MT_1020110019
```

2. Compare the programmed firmware version with the latest available.

a. Go to Mellanox's web site: http://www.mellanox.com/supportdownloader. See Figure 9.

b. Enter your card PSID to display the latest firmware.

***Figure 9: Support Download Assistant***




3. If a newer firmware version exists for your adapter card, update the firmware as follows:

a. Download the firmware image zip file from the Download Center (see Step 2a above).

b. Unzip the firmware image.

c. Burn the firmware image. Enter:

```
> flint -d /dev/mst/mt4099_pci_cr0 -i <binary image> burn
```

d. Reboot the computer.

e. Enter: mst start.

f. Verify that the card firmware was updated successfully.

```
> flint -d /dev/mst/mt4099_pci_cr0  q
Image type:      ConnectX
FW Version:     2.9.4100
Device ID:         4099
...
```

# Appendix A: Specifications

## A.1 MCX353A-QCBT Specifications

***Table 11 - MCX353A-QCBT Specifications Table***

| | |
|---|---|
| **Physical** | **Size:** 2.12in. x5.6 in. (53.59mm x 142.25 mm) |
| | **Connector:** QSFP+ 40Gb/s InfiniBand (Copper and optical) |
| **Protocol Support** | **InfiniBand:** IBTA v1.2.1<br>Auto-Negotiation[a]: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane) |
| | **Ethernet:** 10GBASE-CX4, 10GBASE-R, and 1000BASE-R |
| | **Data Rate:** 40Gb/s QDR– InfiniBand<br>1/10Gb/s – Ethernet |
| | **PCI Express Gen3:** SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible) |
| **Power and Environmental** | **Voltage:** 12V, 3.3V |
| | **Typ Power:** Passive Cables 5.63W<br>Active Cables 6.28W[b] |
| | **Max Power:** Passive Cables 6.61W<br>Active Cables 7.36W |
| | **Temperature:** Operational 0°C to 55°C<br>Non-operational 0°C to 70°C |
| | **Humidity:** 90% relative humidity[c] |
| | **Air Flow:** 200LFM[d] |
| **Regulatory** | **EMC:** Refer to the following link:<br>www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf |
| | **Safety:** IEC/EN 60950-1:2006<br>ETSI EN 300 019-2-2<br>IEC 60068-2- 64, 29, 32 |
| | **RoHS:** RoHS-R6 |
| **Cable Support** | PPlease refer to "Mellanox Products Approved Cable Lists" at:<br>www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf |

a. The ConnectX-3 adapters supplement the IBTA auto-negotiation specification to get better bit error rates and longer cable reaches. This supplemental feature only initiates when connected to another Mellanox InfiniBand product.
b. These power numbers were measured using Mellanox cable MC22062xx-0xx-x.
c. For both operational and non-operational states
d. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

## A.2 MCX354A-QCBT Specifications

***Table 12 - MCX354A-QCBT Specifications Table***

| | |
|---|---|
| **Physical** | **Size:** 2.71n. x5.6 in. (68.90mm x 142.25 mm) |
| | **Connector:** QSFP+ 40Gb/s InfiniBand (Copper and optical) |
| **Protocol Support** | **InfiniBand:** IBTA v1.2.1<br>Auto-Negotiation[a]: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane) |
| | **Ethernet:** 10GBASE-CX4, 10GBASE-R, and 1000BASE-R |
| | **Data Rate:** 40Gb/s QDR– InfiniBand<br>1/10Gb/s – Ethernet |
| | **PCI Express Gen3:** SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible) |
| **Power and Environmental** | **Voltage:** 12V, 3.3V |
| | **Typ Power:** Passive Cables 6.78W<br>Active Cables 8.08W[b] |
| | **Max Power:** Passive Cables 7.76W<br>Active Cables 9.26W |
| | **Temperature:** Operational 0°C to 55°C<br>Non-operational 0°C to 70°C |
| | **Humidity:** 90% relative humidity[c] |
| | **Air Flow:** 200LFM[d] |
| **Regulatory** | **EMC:** Refer to the following link:<br>www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf |
| | **Safety:** IEC/EN 60950-1:2006<br>ETSI EN 300 019-2-2<br>IEC 60068-2- 64, 29, 32 |
| | **RoHS:** RoHS-R6 |
| **Cable Support** | Please refer to "Mellanox Products Approved Cable Lists" at:<br>www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf |

a. The ConnectX-3 adapters supplement the IBTA auto-negotiation specification to get better bit error rates and longer cable reaches. This supplemental feature only initiates when connected to another Mellanox InfiniBand product.
b. These power numbers were measured using Mellanox cable MC22062xx-0xx-x.
c. For both operationsal and non-operational states
d. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

## A.3 MCX353A-TCBT Specifications

***Table 13 - MCX353A-TCBT Specifications Table***

| | |
|---|---|
| **Physical** | **Size:** 2.12in. x5.6 in. (53.59mm x 142.25 mm) |
| | **Connector:** QSFP+ 40Gb/s InfiniBand (Copper and optical) |
| **Protocol Support** | **InfiniBand:** IBTA v1.2.1<br>Auto-Negotiation[a]: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (10.3125Gb/s per lane) |
| | **Ethernet:** 10GBASE-CX4, 10GBASE-R, and 1000BASE-R |
| | **Data Rate:** 40Gb/s FDR10 – InfiniBand<br>1/10Gb/s – Ethernet |
| | **PCI Express Gen3:** SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible) |
| **Power and Environmental** | **Voltage:** 12V, 3.3V |
| | **Typ Power:** Passive Cables 5.69W<br>Active Cables 6.34W[b] |
| | **Max Power:** Passive Cables 6.67W<br>Active Cables 7.42W |
| | **Temperature:** Operational 0°C to 55°C<br>Non-operational 0°C to 70°C |
| | **Humidity:** 90% relative humidity[c] |
| | **Air Flow:** 200LFM[d] |
| **Regulatory** | **EMC:** Refer to the following link:<br>www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf |
| | **Safety:** IEC/EN 60950-1:2006<br>ETSI EN 300 019-2-2<br>IEC 60068-2- 64, 29, 32 |
| | **RoHS:** RoHS-R6 |
| **Cable Support** | Please refer to "Mellanox Products Approved Cable Lists" at:<br>www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf |

a. The ConnectX-3 adapters supplement the IBTA auto-negotiation specification to get better bit error rates and longer cable reaches. This supplemental feature only initiates when connected to another Mellanox InfiniBand product.
b. These power numbers were measured using Mellanox cable MC22062xx-0xx-x.
c. For both operational and non-operational states
d. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

## A.4 MCX354A-TCBT Specifications

***Table 14 - MCX354A-TCBT Specifications Table***

| | |
|---|---|
| **Physical** | **Size:** 2.71n. x5.6 in. (68.90mm x 142.25 mm) |
| | **Connector:** QSFP+ 40Gb/s InfiniBand (Copper and optical) |
| **Protocol Support** | **InfiniBand:** IBTA v1.2.1<br>Auto-Negotiation[a]: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (10.3125Gb/s per lane) |
| | **Ethernet:** 10GBASE-CX4, 10GBASE-R, and 1000BASE-R |
| | **Data Rate:** 40Gb/s FDR10– InfiniBand<br>1/10Gb/s – Ethernet |
| | **PCI Express Gen3:** SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible) |
| **Power and Environmental** | **Voltage:** 12V, 3.3V |
| | **Typ Power:** Passive Cables 6.84W<br>Active Cables 8.14W[b] |
| | **Max Power:** Passive Cables 7.82W<br>Active Cables 9.32W |
| | **Temperature:** Operational 0°C to 55°C<br>Non-operational 0°C to 70°C |
| | **Humidity:** 90% relative humidity[c] |
| | **Air Flow:** 200LFM[d] |
| **Regulatory** | **EMC:** Refer to the following link:<br>www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf |
| | **Safety:** IEC/EN 60950-1:2006<br>ETSI EN 300 019-2-2<br>IEC 60068-2- 64, 29, 32 |
| | **RoHS:** RoHS-R6 |
| **Cable Support** | Please refer to "Mellanox Products Approved Cable Lists" at:<br>www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf |

a. The ConnectX-3 adapters supplement the IBTA auto-negotiation specification to get better bit error rates and longer cable reaches. This supplemental feature only initiates when connected to another Mellanox InfiniBand product.
b. These power numbers were measured using Mellanox cable MC22062xx-0xx-x.
c. For both operational and non-operational states
d. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

## A.5 MCX353A-FCBT Specifications

***Table 15 - MCX353A-FCBT Specifications Table***

| | |
|---|---|
| **Physical** | **Size:** 2.12in. x5.6 in. (53.59mm x 142.25 mm) |
| | **Connector:** QSFP+ InfiniBand (Copper and optical) |
| **Protocol Support** | **InfiniBand:** IBTA v1.2.1<br>Auto-Negotiation[a]: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (10.3125Gb/s per lane), FDR (14.0625Gb/s per lane) port |
| | **Ethernet:** 10GBASE-CX4, 10GBASE-R, and 1000BASE-R, 40GBASE-R4 |
| | **Data Rate:** Up to 56Gb/s FDR– InfiniBand<br>1/10/40Gb/s – Ethernet |
| | **PCI Express Gen3:** SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible) |
| **Power and Environmental** | **Voltage:** 12V, 3.3V |
| | **Typ Power:** Passive Cables 6.71W<br>Active Cables 8.41W[b] |
| | **Max Power:** Passive Cables 8.13W<br>Active Cables 10.13W |
| | **Temperature:** Operational 0°C to 55°C<br>Non-operational 0°C to 70°C |
| | **Humidity:** 90% relative humidity[c] |
| | **Air Flow:** 200LFM[d] |
| **Regulatory** | **EMC:** Refer to the following link:<br>www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf |
| | **Safety:** IEC/EN 60950-1:2006<br>ETSI EN 300 019-2-2<br>IEC 60068-2- 64, 29, 32 |
| | **RoHS:** RoHS-R6 |
| **Cable Support** | Please refer to "Mellanox Products Approved Cable Lists" at:<br>www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf |

a. The ConnectX-3 adapters supplement the IBTA auto-negotiation specification to get better bit error rates and longer cable reaches. This supplemental feature only initiates when connected to another Mellanox InfiniBand product.
b. These power numbers were measured using Mellanox cable MC2207310-0xx-x.
c. For both operational and non-operational states
d. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

## A.6 MCX354A-FCBT Specifications

*Table 16 - MCX354A-FCBT Specifications Table*

| | |
|---|---|
| **Physical** | **Size:** 2.71in. x5.6 in. (68.90mm x 142.25 mm) |
| | **Connector:** QSFP+ InfiniBand (Copper and optical) |
| **Protocol Support** | **InfiniBand:** IBTA v1.2.1<br>Auto-Negotiation[a]: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (10.3125Gb/s per lane), FDR (14.0625Gb/s per lane) port |
| | **Ethernet:** 10GBASE-CX4, 10GBASE-R, and 1000BASE-R, 40GBASE-R4 |
| | **Data Rate:** Up to 56Gb/s FDR– InfiniBand<br>1/10/40Gb/s – Ethernet |
| | **PCI Express Gen3:** SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible) |
| **Power and Environmental** | **Voltage:** 12V, 3.3V |
| | **Typ Power:** Passive Cables 7.94W<br>Active Cables 11.34W[b] |
| | **Max Power:** Passive Cables 9.35W<br>Active Cables 11.35W |
| | **Temperature:** Operational 0°C to 55°C<br>Non-operational 0°C to 70°C |
| | **Humidity:** 90% relative humidity[c] |
| | **Air Flow:** 200LFM[d] |
| **Regulatory** | **EMC:** Refer to the following link:<br>www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf |
| | **Safety:** IEC/EN 60950-1:2006<br>ETSI EN 300 019-2-2<br>IEC 60068-2- 64, 29, 32 |
| | **RoHS:** RoHS-R6 |
| **Cable Support** | Please refer to "Mellanox Products Approved Cable Lists" at:<br>www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf |

a. The ConnectX-3 adapters supplement the IBTA auto-negotiation specification to get better bit error rates and longer cable reaches. This supplemental feature only initiates when connected to another Mellanox InfiniBand product.
b. These power numbers were measured using Mellanox cable MC2207310-0xx-x.
c. For both operational and non-operational states
d. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

## A.7 Board Mechanical Drawing and Dimensions

All dimensions are in millimeters.
All the mechanical tolerances are +/- 0.1mm

***Figure 10: Mechanical Drawing of the Single-port MCX353A-[QFT]CBT Adapter Card***

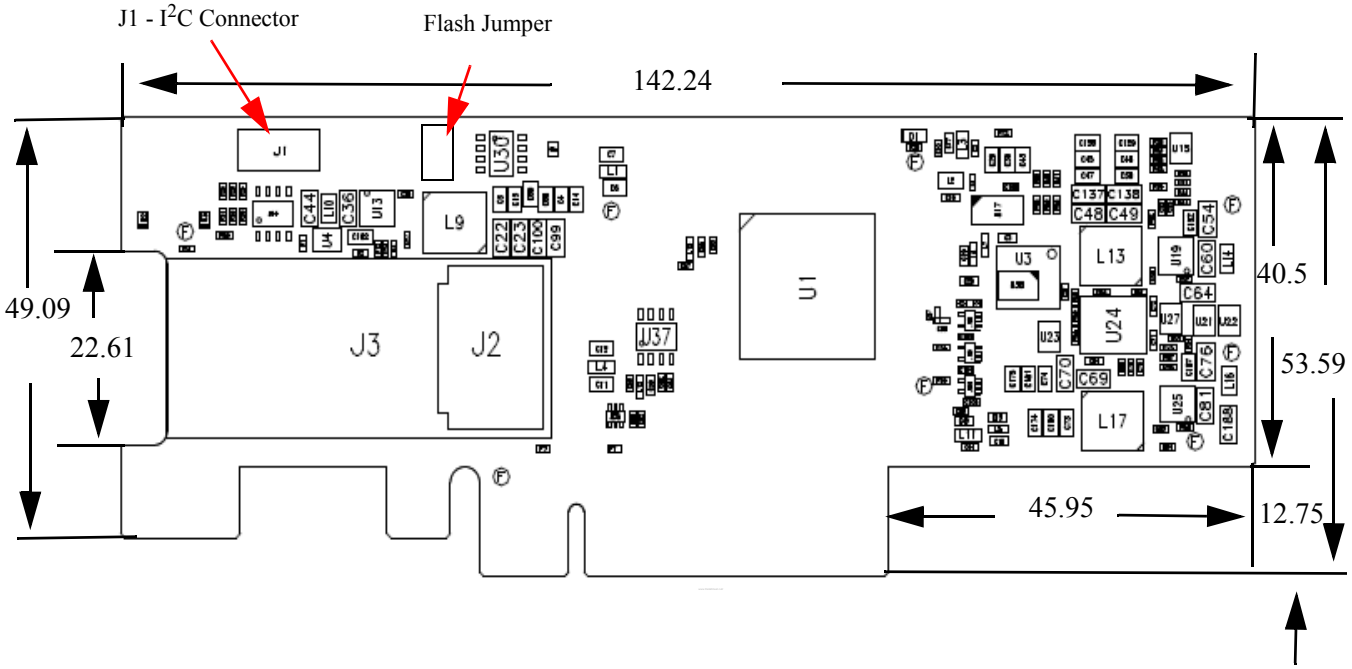
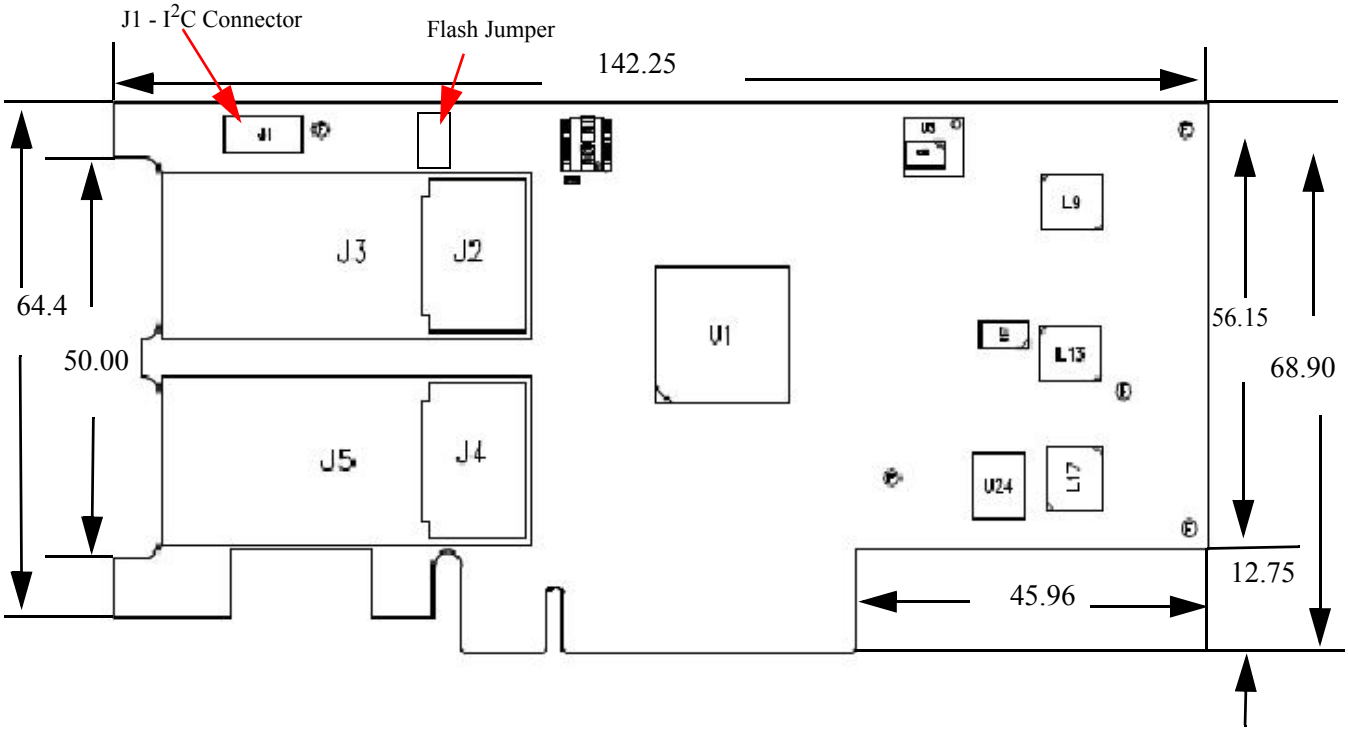


*Figure 11: Mechanical Drawing of the Dual-port MCX354A-[QFT]CBT Adapter Card*




## A.8 Regulatory Statements

For regulatory statements for all ConnectX®-3 cards please refer to:
http://www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf

# Appendix B: Interface Connectors Pinout

## B.1 I²C-compatible Connector Pinout

*Figure 12: Compatible Connector Plug and Pinout*

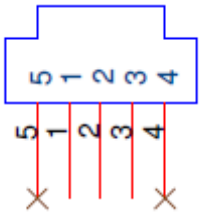


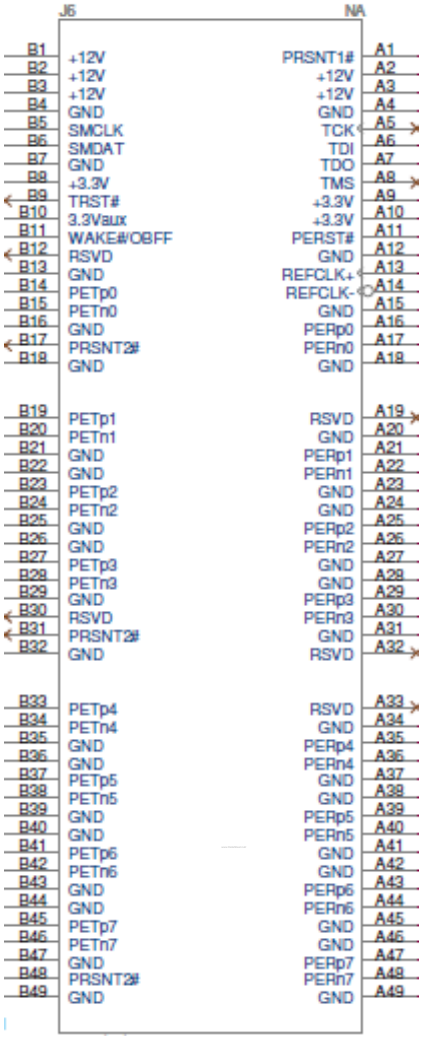

*Table 17 - I2C-compatible Connector Pinout*

| Connector Pin Number | Signal Name |
|---|---|
| 1 | SPSDA |
| 2 | SPSCL |
| 3 | GND |
| 4 | NC |
| 5 | NC |

## B.2 PCI Express x8 Connector Pinout

The adapter cards use a standard PCI Express x8 edge connector and the PCI Express x8 standard pinout according to the PCI Express 3.0 specification.

***Figure 13: PCIe Connector Pinout***



## B.3 QSFP+ Connector Pinout

***Figure 14: Connector and Cage Views***

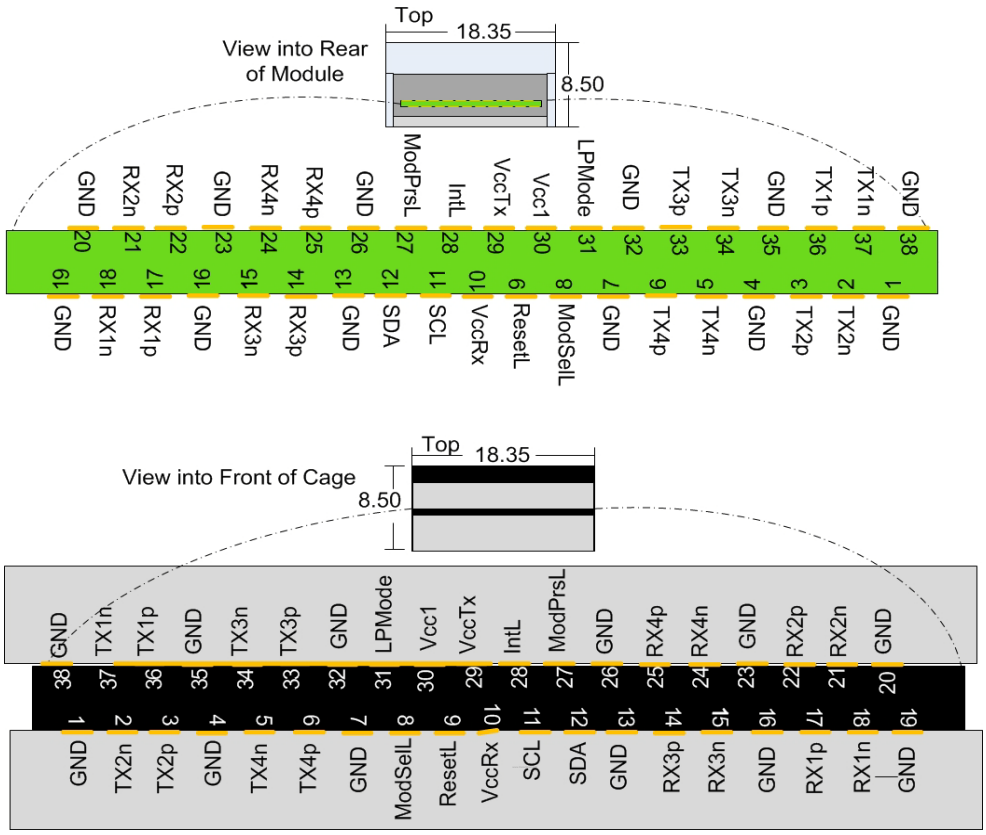


***Table 18 - Connector Pin Number and Name to Signal Name Map***

| Connector Pin Number | Connector Pin Name | Port A Signal Name |
|---|---|---|
| 1 | GND | GND |
| 2 | TXN_2 | Tx2n |
| 3 | TXP_2 | Tx2p |
| 4 | GND | GND |
| 5 | TXN_4 | Tx4n |
| 6 | TXP_4 | Tx4p |
| 7 | GND | GND |
| 8 | ModSelL_Port0 | ModSelL |
| 9 | ResetL_Port0 | ResetL |
| 10 | | VccRx |
| 11 | SCL | SCL |
| 12 | SDA | SDA |
| 13 | GND | GND |
| 14 | RXP_3 | Rx3p |
| 15 | RXN_3 | Rx3n |
| 16 | GND | GND |
| 17 | RXP_1 | Rx1p |
| 18 | RXN_1 | Rx1n |
| 19 | GND | GND |
| 20 | GND | GND |
| 21 | RXN_2 | Rx2n |
| 22 | RXP_2 | Rx2p |
| 23 | GND | GND |
| 24 | RXN_4 | Rx4n |
| 25 | RXP_4 | Rx4p |
| 26 | GND | GND |
| 27 | ModPrsl_Port0 | Mod PrsL |
| 28 | IntL | IntL |
| 29 | | VccTx |
| 30 | | Vcc1 |
| 31 | LPMode_Port0 | LPMode |
| 32 | GND | GND |
| 33 | TXP_3 | Tx3p |
| 34 | TXN_3 | Tx3n |
| 35 | GND | GND |
| 36 | TXP_1 | Tx1p |
| 37 | TXN_1 | Tx1n |
| 38 | GND | GND |

# Appendix C: Replacing a Tall Bracket With a Short Bracket

This section provides instructions on how to remove the tall bracket of a standard Mellanox Technologies adapter card and replace it with a short one.

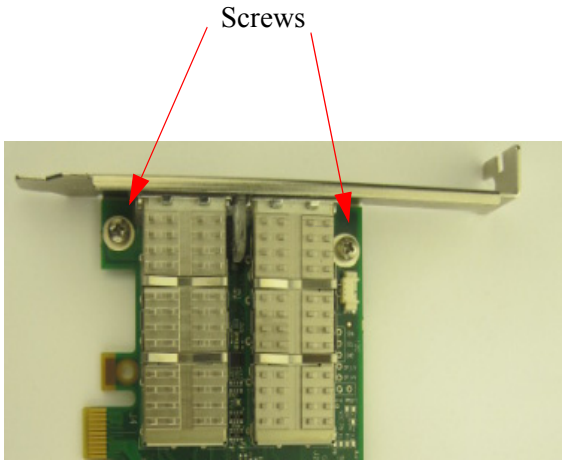
## C.1 Replacing a Bracket

To replace the bracket you will need the following parts:

- the new bracket of the proper height
- one new square gasket for each of the ports
- the 2 screws saved from the removal of the bracket
- the 2 fiber washers saved from the removal of the bracket

## C.2 Removing the Existing Bracket from the Adapter Card

***Figure 15: Bracket Screws***




1. Remove the two screws holding the bracket in place.
2. The bracket comes loose from the card.

Be careful not to put stress on the LEDs.

3. Save the two screws and the two fiber washers.

## C.3 Installing the New Bracket

1. Remove the paper to expose the adhesive on the gasket.
2. Place the gasket for each port onto the new bracket. Make sure to correctly align the gasket with the hole in the bracket.
3. If the old gaskets are still on the card, remove them before installing the new bracket. Make sure that only one gasket per port is used.

***Figure 16: Gasket Location on Adapter Card***

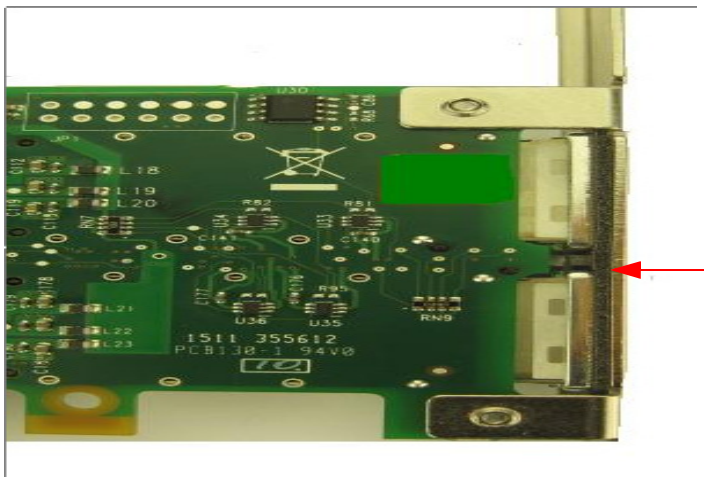
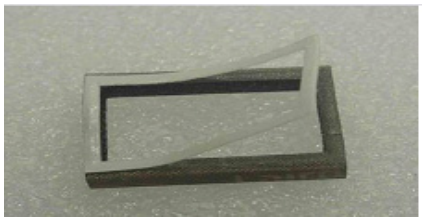
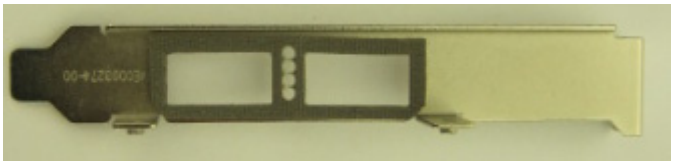



***Figure 17: Gasket Installation***



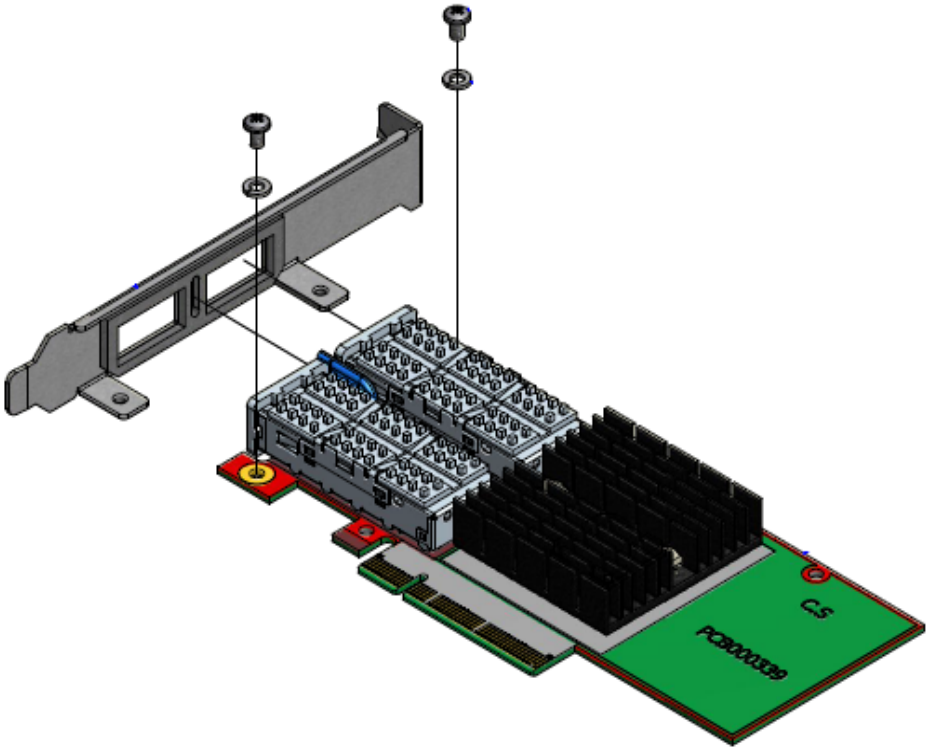


1. Place the bracket onto the card until the screw holes line up.

Do not force the bracket onto the card. You may have to gently push the LEDs using a small screwdriver to align the LEDs with the holes in the bracket.

2. Screw on the bracket using the screws and washers saved from the procedure above step 1.

***Figure 18: Placing the Bracket on the Card***



3. Make sure that the LEDs are aligned onto the bracket holes.
4. Use a torque driver to apply up to 2 lbs-in torque on the screws.

# Appendix D: Avertissements de sécurité d'installation (Warnings in French)

### 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 55°C (131°F). Un flux d'air de 200LFM à cette température ambiante maximale est nécessaire. 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. Orages – dangers électriques

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

### 4. Branchement/débranchement des câbles en cuivre

Les câbles 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.

### 5. Installation du matériel

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

### 6. Elimination du matériel

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

### 7. Codes électriques locaux et nationaux

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

### 8. Exposition au rayonnement grave

Mise en garde – l'utilisation de commandes ou de réglages ou l'exécution de procédures autres que ce qui est spécifié dans les présentes peut engendrer une exposition au rayonnement grave.

PRODUIT LASER DE CLASSE 1 » et références aux normes laser les plus récentes CEI 60 825-1:1993 + A1:1997 + A2:2001 et NE 60825-1:1994+A1:1996+ A2:2001

# Appendix E: Sicherheitshinweise (Warnings in German)

### 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 55°C (131°F) betrieben werden. Es ist ein Luftstrom von 200 LFM bei maximaler Umgebungstemperatur erforderlich. Außerdem sollten mindestens 8 cm (3 in.) Freiraum um die Belüftungsöffnungen sein, um einen einwandfreien Luftstrom zu gewährleisten.

### 3. Bei Gewitter - Elektrische Gefahr

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

### 4. Anschließen/Trennen von -Kupferkabel

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.

### 5. Geräteinstallation

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

### 6. Geräteentsorgung

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

### 7. Regionale und nationale elektrische Bestimmungen t

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

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

## 8. Strahlenkontak

Achtung – Nutzung von Steuerungen oder Einstellungen oder Ausführung von Prozeduren, die hier nicht spezifiziert sind, kann zu gefährlichem Strahlenkontakt führen..

Klasse 1 Laserprodukt und Referenzen zu den aktuellsten Lasterstandards : ICE 60 825-1:1993 + A1:1997 + A2:2001 und EN 60825-1:1994+A1:1996+ A2:2001

# Appendix F: Advertencias de seguridad para la instalación (Warnings in Spanish)

1. **Instrucciones de instalación**

Antes de conectar el equipo a la fuente de alimentación, leer todas las instrucciones de instalación.

2. **Sobrecalentamiento**

No se debe utilizar el equipo en un área con una temperatura ambiente superior a la máxima recomendada: 55°C(131°F). Además, para garantizar una circulación de aire adecuada, se debe dejar como mínimo un espacio de 8 cm (3 pulgadas) alrededor de las aberturas de ventilación.

3. **Cuando hay rayos: peligro de descarga eléctrica**

No utilizar el equipo ni conectar o desconectar cables durante períodos de actividad de rayos.

4. **Conexión y desconexión del cable Copper**

Dado que los cables de cobre son pesados y no son flexibles, su conexión a los conectores y su desconexión se deben efectuar con mucho cuidado. Para ver advertencias o instrucciones especiales, consultar al fabricante del cable.

5. **Instalación de equipos**

La instalación, el reemplazo y el mantenimiento de este equipo estarán a cargo únicamente de personal capacitado y competente.

6. **Eliminación de equipos**

La eliminación definitiva de este equipo se debe efectuar conforme a todas las leyes y reglamentaciones nacionales.

### 7. Códigos eléctricos locales y nacionales

Este equipo se debe instalar conforme a los códigos eléctricos locales y nacionales.

### 8. Exposición a niveles de radiación peligrosos

Precaución: el uso de controles o ajustes o la realización de procedimientos distintos de los que aquí se especifican podrían causar exposición a niveles de radiación peligrosos.

PRODUCTO LÁSER DE CLASE 1 y referencia a las normas de láser más recientes: IEC 60825-1:2007/03 y EN 60825-1:2007