



NVIDIA ConnectX-6 Ethernet Adapter

Cards User Manual

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About This Manual

This User Manual describes NVIDIA® ConnectX®-6 Ethernet adapter cards. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the board, and relevant documentation.

Legacy (EOL) Ordering Part Numbers

NVIDIA SKU	Legacy OPN	Marketing Description
900-9X6B4-0056-DT1	MCX614106A-CCAT	ConnectX®-6 EN adapter card, 100GbE , dual-port QSFP56, Socket Direct 2x PCIe3.0 x16 , tall bracket
900-9X6B4-0018-DT1	MCX614105A-VCAT	ConnectX®-6 EN adapter card, 200GbE , single-port QSFP56, Socket Direct 2x PCIe3.0 x16 , tall bracket
900-9X6B4-0058-DT1	MCX614106A-VCAT	ConnectX®-6 EN adapter card, 200GbE , dual-port QSFP56, Socket Direct 2x PCIe3.0 x16 , tall bracket
900-9X6AF-0058-MT1	MCX613106A-VDAT	ConnectX®-6 EN adapter card, 200GbE , dual-port QSFP56, PCIe4.0 x16 , tall bracket

Intended Audience

This manual is intended for the installer and user of these cards. The manual assumes basic familiarity with Ethernet network and architecture specifications.

Technical Support

Customers who purchased NVIDIA products directly from NVIDIA are invited to contact us through the following methods:

- URL: <https://www.nvidia.com> > Support
- E-mail: enterprisesupport@nvidia.com

Customers who purchased NVIDIA Global Support Services, please see your contract for details regarding Technical Support.

Customers who purchased NVIDIA products through an NVIDIA-approved reseller should first seek assistance through their reseller.

Related Documentation

<i>MLNX_OFED for Linux User Manual and Release Notes</i>	User Manual describing OFED features, performance, band diagnostic, tools content and configuration. See MLNX_OFED for Linux Documentation .
<i>WinOF-2 for Windows User Manual and Release Notes</i>	User Manual describing WinOF-2 features, performance, Ethernet diagnostic, tools content and configuration. See WinOF-2 for Windows Documentation .
<i>NVIDIA VMware for Ethernet User Manual</i>	User Manual and release notes describing the various components of the NVIDIA ConnectX® NATIVE ESXi stack. See VMware® ESXi Drivers Documentation .

<i>NVIDIA Firmware Utility (mlxup) User Manual and Release Notes</i>	NVIDIA firmware update and query utility used to update the firmware. Refer to Firmware Utility (mlxup) Documentation .
<i>NVIDIA Firmware Tools (MFT) User Manual</i>	User Manual describing the set of MFT firmware management tools for a single node. See MFT User Manual .
<i>IEEE Std 802.3 Specification</i>	IEEE Ethernet Specifications
<i>PCI Express Specifications</i>	Industry Standard PCI Express Base and Card Electromechanical Specifications. Refer to PCI-SIG Specifications .
LinkX Interconnect Solutions	NVIDIA LinkX Ethernet cables and transceivers are designed to maximize the performance of High-Performance Computing networks, requiring high-bandwidth, low-latency connections between compute nodes and switch nodes. NVIDIA offers one of the industry's broadest portfolio of 40Gb/s, 56Gb/s, 100Gb/s, and 200Gb/s cables, including Direct Attach Copper cables (DACs), copper splitter cables, Active Optical Cables (AOCs), and transceivers in a wide range of lengths from 0.5m to 10km. In addition to meeting Ethernet standards, NVIDIA tests every product in an end-to-end environment ensuring a Bit Error Rate of less than 1E-15. Read more at LinkX Cables and Transceivers .

Document Conventions

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

Revision History

A list of the changes made to this document is provided in [Document Revision History](#).

1 Introduction

1.1 Product Overview

This is the *User Manual* for Ethernet adapter cards based on the ConnectX®-6 integrated circuit device. ConnectX®-6 connectivity provides the highest performing low latency and most flexible interconnect solution for PCI Express Gen 3.0/4.0 servers used in enterprise data centers and high-performance computing environments.

ConnectX-6 Virtual Protocol Interconnect® adapter cards provide up to two ports of 200Gb/s for InfiniBand and Ethernet connectivity, sub-600ns latency and 215 million messages per second, enabling the highest performance and most flexible solution for the most demanding High-Performance Computing (HPC), Storage, and data center applications. ConnectX-6 is a groundbreaking addition to the NVIDIA ConnectX series of industry-leading adapter cards. In addition to all the existing innovative features of past ConnectX versions, ConnectX-6 offers a number of enhancements that further improve the performance and scalability of datacenter applications. Please refer to [Feature and Benefits](#) for more details.



Please make sure to install the ConnectX-6 cards in a PCIe slot that is capable of supplying the required power as stated in [Specifications](#).

The following section provides the ordering part number, port speed, number of ports, and PCI Express speed.

1.1.1 ConnectX-6 PCIe x16 Card

ConnectX-6 with a PCIe x16 slot can support a bandwidth of up to 100GbE in a PCIe Gen 3.0/4.0 slot, or up to 200GbE in a PCIe Gen 4.0 slot.

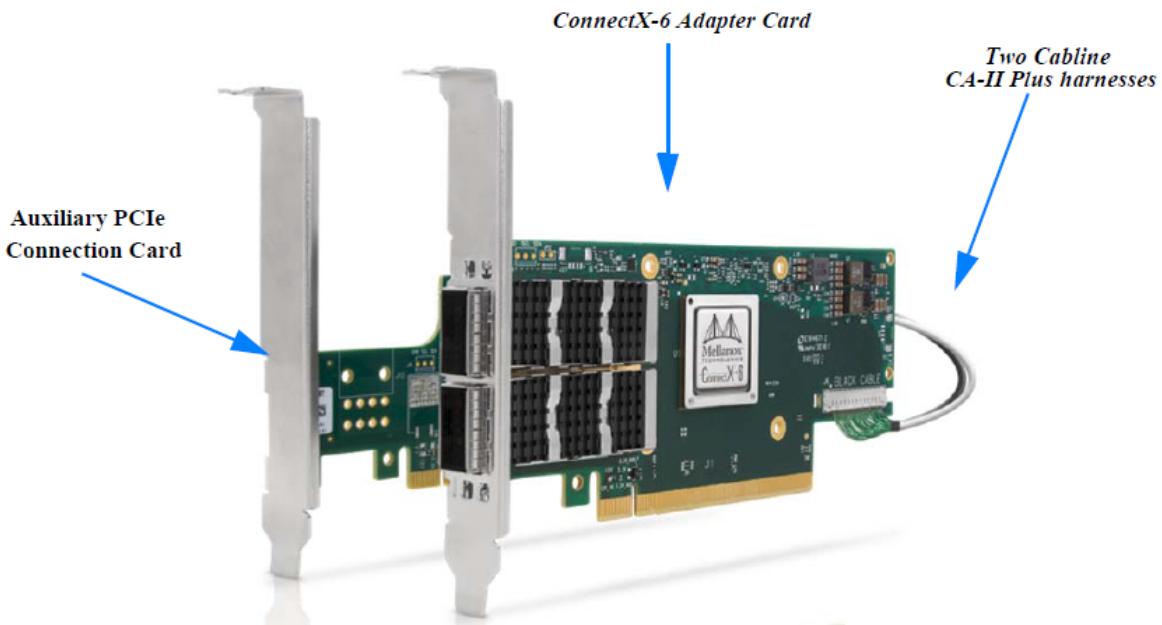


Part Number	MCX613106A-VDAT
Form Factor/Dimensions	PCIe Half Height, Half Length / 167.65mm x 68.90mm
Data Transmission Rate	Ethernet: 10/25/40/50/100/200 Gb/s
Network Connector Type	Dual-port QSFP56
PCIe x16 through Edge Connector	PCIe Gen 3.0 / 4.0 SERDES @ 8.0GT/s / 16.0GT/s
RoHS	RoHS Compliant
Adapter IC Part Number	MT28908A0-XCCF-HVM

1.1.2 ConnectX-6 Socket Direct Cards (2x PCIe x16)

In order to obtain 200Gb/s speed, NVIDIA offers ConnectX-6 Socket Direct that enable 200Gb/s connectivity also for servers with PCIe Gen 3.0 capability. The adapter's 32-lane PCIe bus is split

into two 16-lane buses, with one bus accessible through a PCIe x16 edge connector and the other bus through an x16 Auxiliary PCIe Connection card. The two cards should be installed into two PCIe x16 slots and connected using two Cabline SA-II Plus harnesses, as shown in the below figure.



ConnectX-6 Ethernet Socket Direct Adapter Cards

Model	ConnectX-6 Ethernet Socket Direct Adapter Cards				
Part Number	MCX614105A-VCAT	MCX614106A-VCAT	MCX614106A-CCAT		
Form Factor / Dimensions	PCIe Full Height, $\frac{3}{4}$ Length Adapter Card Size: 6.6 in. x 2.71 in. (167.65mm x 68.90mm) Auxiliary PCIe Connection Card Size: 5.09 in. x 2.32 in. (129.30mm x 59.00mm) Cabline CA-II Plus harness Length: 35cm				
Ethernet Data Rate	10/25/40/50/100/200 GbE		10/25/40/50/100 GbE		
Network Connector Type	Single-port QSFP56	Dual-port QSFP56			
PCI Express Connectors	Adapter Card Edge Connector: PCIe Gen 3.0/4.0 SERDES @ 16.0GT/s x16 Auxiliary Connection Card: PCIe Gen 3.0 SERDES @ 16.0GT/s x16				
RoHS	RoHS Compliant				
IC Part Number	MT28908A0-XCCF-HVM				

For more detailed information see [Specifications](#).

1.2 Features and Benefits

- ⚠** This section describes hardware features and capabilities. Please refer to the relevant driver and/or firmware release notes for feature availability.

Feature	Description
PCI Express (PCIe)	<p>Uses the following 2x PCIe x16 interfaces:</p> <ul style="list-style-type: none"> • PCIe Gen 3.0/4.0 SERDES@ 8.0GT/s / 16.0GT/s through Edge Connector • PCIe Gen 3.0 SERDES@ 8.0GT/s through Auxiliary Card
Up to 25 Gigabit Ethernet	<p>NVIDIA adapters comply with the following IEEE 802.3 standards: 200GbE / 100GbE / 50GbE / 40GbE / 25GbE / 10GbE / 1GbE</p> <ul style="list-style-type: none"> - IEEE 802.3bj, 802.3bm 100 Gigabit Ethernet - IEEE 802.3by, Ethernet Consortium25, 50 Gigabit Ethernet, supporting all FEC modes - IEEE 802.3ba 40 Gigabit Ethernet - IEEE 802.3by 25 Gigabit Ethernet - IEEE 802.3ae 10 Gigabit Ethernet - IEEE 802.3ap based auto-negotiation and KR startup - IEEE 802.3ad, 802.1AX Link Aggregation - IEEE 802.1Q, 802.1P VLAN tags and priority - IEEE 802.1Qau (QCN) - Congestion Notification - IEEE 802.1Qaz (ETS) - IEEE 802.1Qbb (PFC) - IEEE 802.1Qbg - IEEE 1588v2 - Jumbo frame support (9.6KB)
Memory	<ul style="list-style-type: none"> • PCI Express - stores and accesses Ethernet fabric connection information and packet data. • SPI Quad - includes 256Mbit SPI Quad Flash device (MX25L25645GXDI-08G device by Macronix) • FRU EEPROM - Stores the parameters and personality of the card. The EEPROM capacity is 128Kbit. FRU I²C address is (0x50) and is accessible through the PCIe SMBus. (Note: Address 0x58 is reserved.)
Overlay Networks	<p>In order to better scale their networks, data center operators often create overlay networks that carry traffic from individual virtual machines over logical tunnels in encapsulated formats such as NVGRE and VXLAN. While this solves network scalability issues, it hides the TCP packet from the hardware offloading engines, placing higher loads on the host CPU. ConnectX-6 effectively addresses this by providing advanced NVGRE and VXLAN hardware offloading engines that encapsulate and de-capsulate the overlay protocol.</p>
RDMA and RDMA over Converged Ethernet (RoCE)	<p>ConnectX-6, utilizing IBTA RDMA (Remote Data Memory Access) and RoCE (RDMA over Converged Ethernet) technology, delivers low-latency and high-performance over Ethernet networks. Leveraging data center bridging (DCB) capabilities as well as ConnectX-6 advanced congestion control hardware mechanisms, RoCE provides efficient low-latency RDMA services over Layer 2 and Layer 3 networks.</p>
NVIDIA PeerDirect™	<p>PeerDirect™ communication provides high-efficiency RDMA access by eliminating unnecessary internal data copies between components on the PCIe bus (for example, from GPU to CPU), and therefore significantly reduces application run time. ConnectX-6 advanced acceleration technology enables higher cluster efficiency and scalability to tens of thousands of nodes.</p>

Feature	Description
CPU Offload	Adapter functionality enables reduced CPU overhead leaving more CPU resources available for computation tasks. Open vSwitch (OVS) offload using ASAP ^{2(TM)} <ul style="list-style-type: none"> Flexible match-action flow tables Tunneling encapsulation/decapsulation
Quality of Service (QoS)	Support for port-based Quality of Service enabling various application requirements for latency and SLA.
Hardware-based I/O Virtualization	ConnectX-6 provides dedicated adapter resources and guaranteed isolation and protection for virtual machines within the server.
Storage Acceleration	A consolidated compute and storage network achieves significant cost-performance advantages over multi-fabric networks. Standard block and file access protocols can leverage <ul style="list-style-type: none"> RDMA for high-performance storage access NVMe over Fabric offloads for target machine Erasure Coding T10-DIF Signature Handover
SR-IOV	ConnectX-6 SR-IOV technology provides dedicated adapter resources and guaranteed isolation and protection for virtual machines (VM) within the server.
High-Performance Accelerations	<ul style="list-style-type: none"> Tag Matching and Rendezvous Offloads Adaptive Routing on Reliable Transport Burst Buffer Offloads for Background Checkpointing

1.3 Operating Systems/Distributions

- RHEL/CentOS
- Windows
- FreeBSD
- VMware
- OpenFabrics Enterprise Distribution (OFED)
- OpenFabrics Windows Distribution (WinOF-2)

1.4 Connectivity

- Interoperable with 1/10/25/40/50/100/200 Gb/s Ethernet switches
- Passive copper cable with ESD protection
- Powered connectors for optical and active cable support

1.5 Manageability

ConnectX-6 technology maintains support for manageability through a BMC. ConnectX-6 PCIe stand-up adapter can be connected to a BMC using MCTP over SMBus or MCTP over PCIe protocols as if it is a standard NVIDIA PCIe stand-up adapter. For configuring the adapter for the specific manageability solution in use by the server, please contact NVIDIA Support.

2 Interfaces

2.1 Ethernet QSFP56 Interfaces

The network ports of the ConnectX-6 adapter card are compliant with the IEEE 802.3 Ethernet standards listed in [Features and Benefits](#). Ethernet traffic is transmitted through the QSFP56 connector on the adapter card.

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

2.2 PCI Express Interface

ConnectX®-6 adapter cards support PCI Express Gen 3.0/4.0 (1.1 and 2.0 compatible) through x16 edge connectors. The device can be either a master initiating the PCI Express bus operations, or a subordinate responding to PCI bus operations.

The following lists PCIe interface features:

- PCIe Gen 3.0 and 4.0 compliant, 2.0 and 1.1 compatible
- 2.5, 5.0, 8.0, or 16.0 GT/s link rate x16 lanes
- Auto-negotiates to x16, x8, x4, x2, or x1
- Support for MSI/MSI-X mechanisms

2.3 LED Interface

There are two I/O LEDs per port to indicate speed and link status. LED1 is a bicolor LED (amber and green) and LED2 is a single color LED (green).

Link Indications

State	LED1 - Link speed	LED2 (Green) - Link/Activity
Beacon command for locating the adapter card	1Hz Blinking amber/green according to high/low speeds	OFF
Error	4Hz Blinking Amber indicates a problem with the link	ON
Physical Activity	The Green LED will blink.	Blinking
Link Up	The Green LED will be solid.	ON

2.4 SMBus Interface

ConnectX-6 technology maintains support for manageability through a BMC. ConnectX-6 PCIe stand-up adapter can be connected to a BMC using MCTP over SMBus or MCTP over PCIe protocols as if it is a standard NVIDIA PCIe stand-up adapter. For configuring the adapter for the specific manageability solution in use by the server, please contact NVIDIA Support.

2.5 Voltage Regulators

The voltage regulator power is derived from the PCI Express edge connector 12V supply pins. These voltage supply pins feed on-board regulators that provide the necessary power to the various components on the card.

3 Hardware Installation

Installation and initialization of ConnectX-6 adapter cards require attention to the mechanical attributes, power specification, and precautions for electronic equipment.

3.1 Safety Warnings

 Safety warnings are provided here in the English language. For safety warnings in other languages, refer to the [Adapter Installation Safety Instructions](#).

Please observe all safety warnings to avoid injury and prevent damage to system components.

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3.2 Installation Procedure Overview

The installation procedure of ConnectX-6 adapter cards involves the following steps:

Step	Procedure	Direct Link
1	Check the system's hardware and software requirements.	System Requirements
2	Pay attention to the airflow consideration within the host system	Airflow Requirements
3	Follow the safety precautions	Safety Precautions
4	Unpack the package	Unpack the package
5	Follow the pre-installation checklist	Pre-Installation Checklist
6	(Optional) Replace the full-height mounting bracket with the supplied short bracket	Bracket Replacement Instructions
7	Install the ConnectX-6 PCIe x16 adapter card in the system	ConnectX-6 PCIe x16 Adapter Cards Installation Instructions
	Install the ConnectX-6 2x PCIe x16 Socket Direct adapter card in the system	ConnectX-6 Socket Direct (2x PCIe x16) Installation Instructions
8	Connect cables or modules to the card	Cables and Modules
9	Identify ConnectX-6 in the system	Identifying Your Card

3.3 System Requirements

3.3.1 Hardware Requirements



Unless otherwise specified, NVIDIA products are designed to work in an environmentally controlled data center with low levels of gaseous and dust (particulate) contamination.

The operating environment should meet severity level G1 as per ISA 71.04 for gaseous contamination and ISO 14644-1 class 8 for cleanliness level.



For proper operation and performance, please make sure to use a PCIe slot with a corresponding bus width and that can supply sufficient power to your card. Refer to the [Specifications](#) section of the manual for more power requirements.

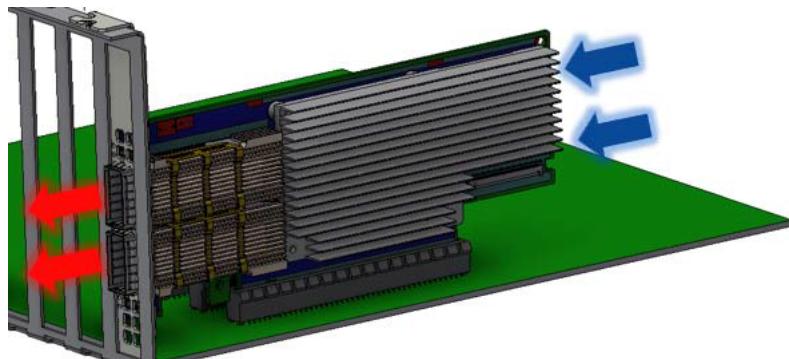
ConnectX-6 Configuration	Hardware Requirements
PCIe x16	A system with a PCI Express x16 slot is required for installing the card.
Socket Direct 2x PCIe x8 in a row (single slot)	A system with a custom PCI Express x16 slot (four special pins) is required for installing the card.
Socket Direct 2x PCIe x16 (dual slots)	A system with two PCIe x16 slots is required for installing the cards.

3.3.2 Airflow Requirements

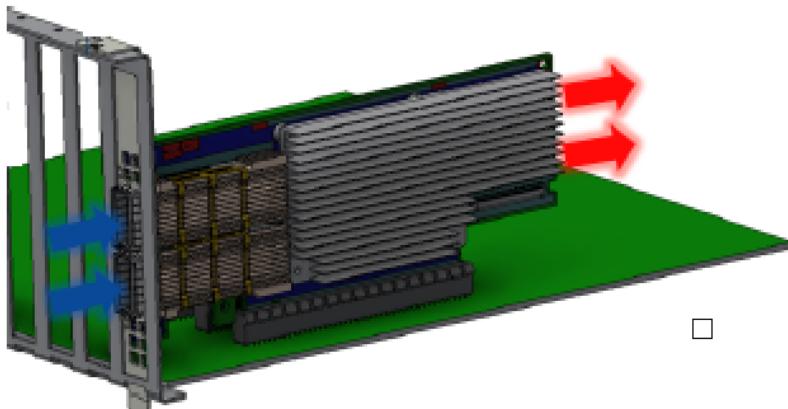
ConnectX-6 adapter cards are offered with two airflow patterns: from the heatsink to the network ports, and vice versa, as shown below.

Please refer to the [Specifications](#) section for airflow numbers for each specific card model.

Airflow *from the heatsink* to the network ports:



Airflow *from the network ports* to the heatsink:



All cards in the system should be planned with the same airflow direction.

3.3.3 Software Requirements

- See [Operating Systems/Distributions](#) section under the Introduction section.
- Software Stacks - NVIDIA OpenFabric software package MLNX_OFED for Linux, WinOF-2 for Windows, and VMware. See the [Driver Installation](#) section.

3.4 Safety Precautions

The adapter is being installed in a system that operates with voltages that can be lethal. Before opening the case of the system, observe the following precautions to avoid injury and prevent damage to system components.

- Remove any metallic objects from your hands and wrists.
- Make sure to use only insulated tools.
- Verify that the system is powered off and is unplugged.
- It is strongly recommended to use an ESD strap or other antistatic devices.

3.5 Pre-Installation Checklist

- Unpack the ConnectX-6 Card. Check against the [Package Contents](#) list that all the parts have been sent. Check the parts for visible damage that may have occurred during shipping. Please note that the cards must be placed on an antistatic surface.



Please note that if the card is removed hastily from the antistatic bag, the plastic ziplock may harm the EMI fingers on the networking connector. Carefully remove the card from the antistatic bag to avoid damaging the EMI fingers.

- Shut down your system if active; Turn off the power to the system, and disconnect the power cord. Refer to the system documentation for instructions.

- (Optional) Check the mounting bracket on the ConnectX-6 or PCIe Auxiliary Connection Card; If required for your system, replace the full-height mounting bracket that is shipped mounted on the card with the supplied low-profile bracket. Refer to [Bracket Replacement Instructions](#).

3.6 Bracket Replacement Instructions

The ConnectX-6 card and PCIe Auxiliary Connection card are usually shipped with an assembled high-profile bracket. If this form factor is suitable for your requirements, you can skip the remainder of this section and move to [Installation Instructions](#). If you need to replace the high-profile bracket with the short bracket that is included in the shipping box, please follow the instructions in this section.



Due to risk of damaging the EMI gasket, it is not recommended to replace the bracket more than three times.

To replace the bracket you will need the following parts:

- The new brackets of the proper height
- The 2 screws saved from the removal of the bracket

Removing the Existing Bracket

1. Using a torque driver, remove the two screws holding the bracket in place.
2. Separate the bracket from the ConnectX-6 card.



Be careful not to put stress on the LEDs on the adapter card.

3. Save the two screws.

Installing the New Bracket

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



Do not force the bracket onto the adapter card.

2. Screw on the bracket using the screws saved from the bracket removal procedure above.



Use a torque driver to apply up to 2 lbs-in torque on the screws.

3.7 Installation Instructions

This section provides detailed instructions on how to install your adapter card in a system.

Choose the installation instructions according to the ConnectX-6 configuration you have purchased.

OPNs	Installation Instructions
------	---------------------------

MCX653105A-HDAT MCX653106A-HDAT MCX653105A-ECAT MCX653106A-ECAT MCX653105A-EFAT MCX653106A-EFAT	ConnectX-6 (PCIe x16) Adapter Card
MCX654105A-HCAT MCX654106A-HCAT MCX654106A-ECAT	ConnectX-6 Socket Direct (2x PCIe x16) Adapter Card

3.8 Cables and Modules

Cable Installation

1. All cables can be inserted or removed with the unit powered on.
2. To insert a cable, press the connector into the port receptacle until the connector is firmly seated.
 - a. 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.
 - b. 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.
 - c. 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.
 - d. Make sure that the connector locks in place.



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.

3. 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). See [LED Interface](#) under the Interfaces section.
4. After plugging in a cable, lock the connector using the latching mechanism particular to the cable vendor. When data is being transferred the Green LED will blink. See [LED Interface](#) under the Interfaces section.
5. Care should be taken as not to impede the air exhaust flow through the ventilation holes. Use cable lengths which allow for routing horizontally around to the side of the chassis before bending upward or downward in the rack.
6. To remove a cable, disengage the locks and slowly pull the connector away from the port receptacle. LED indicator will turn off when the cable is unseated.

3.9 Identifying the Card in Your System

On Linux

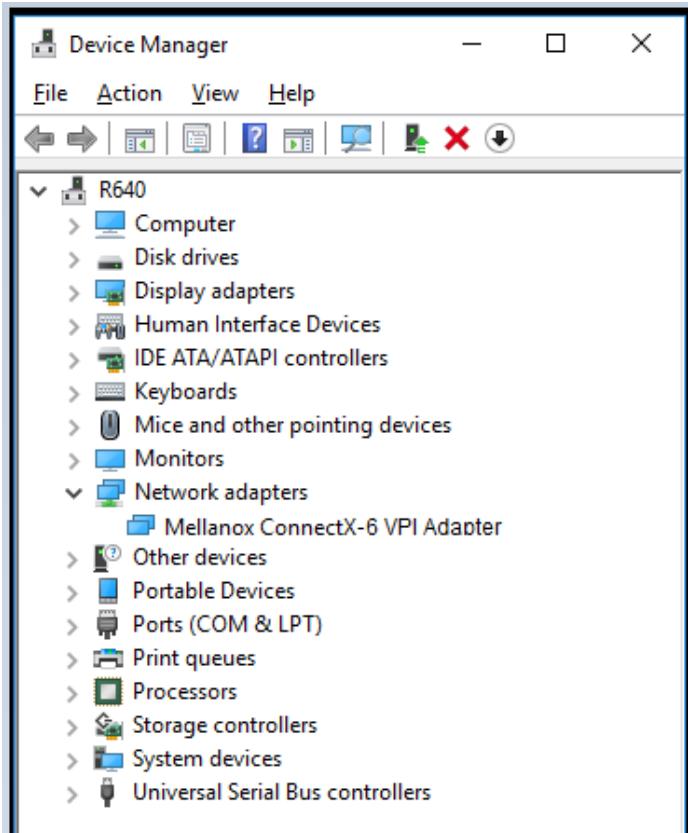
Get the device location on the PCI bus by running `lspci` and locating lines with the string “Mellanox Technologies”:

ConnectX-6 Card Configuration	<code>lspci</code> Command Output Example
Single-port Socket Direct Card (2x PCIe x16)	<pre>[root@mftqa-009 ~]# lspci grep mellanox -i a3:00.0 Infiniband controller: Mellanox Technologies MT28908 Family [ConnectX-6] e3:00.0 Infiniband controller: Mellanox Technologies MT28908 Family [ConnectX-6]</pre>
Dual-port Socket Direct Card (2x PCIe x16)	<pre>[root@mftqa-009 ~]# lspci grep mellanox -i 05:00.0 Infiniband controller: Mellanox Technologies MT28908A0 Family [ConnectX-6] 05:00.1 Infiniband controller: Mellanox Technologies MT28908A0 Family [ConnectX-6] 82:00.0 Infiniband controller: Mellanox Technologies MT28908A0 Family [ConnectX-6] 82:00.1 Infiniband controller: Mellanox Technologies MT28908A0 Family [ConnectX-6]</pre> <p>In the output example above, the first two rows indicate that one card is installed in a PCI slot with PCI Bus address 05 (hexadecimal), PCI Device number 00 and PCI Function number 0 and 1. The other card is installed in a PCI slot with PCI Bus address 82 (hexa-decimal), PCI Device number 00 and PCI Function number 0 and 1. Since the two PCIe cards are installed in two PCIe slots, each card gets a unique PCI Bus and Device number. Each of the PCIe x16 busses sees two network ports; in effect, the two physical ports of the ConnectX-6 Socket Direct adapter are viewed as four net devices by the system.</p>
Single-port PCIe x16 Card	<pre>[root@mftqa-009 ~]# lspci grep mellanox -i 3:00.0 Infiniband controller: Mellanox Technologies MT28908 Family [ConnectX-6]</pre>
Dual-port PCIe x16 Card	<pre>[root@mftqa-009 ~]# lspci grep mellanox -i 86:00.0 Network controller: Mellanox Technologies MT28908A0 Family [ConnectX-6] 86:00.1 Network controller: Mellanox Technologies MT28908A0 Family [ConnectX-6]</pre>

On Windows

1. Open Device Manager on the server. Click Start => Run, and then enter `devmgmt.msc`.
2. Expand System Devices and locate your NVIDIA ConnectX-6 adapter card.
3. Right click the mouse on your adapter's row and select Properties to display the adapter card properties window.
4. Click the Details tab and select Hardware Ids (Windows 2012/R2/2016) from the Property pull-down menu.

PCI Device (Example)



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 1018 (for ConnectX-6) - this is a valid Mellanox Technologies PCI Device ID.

⚠ The PCI device does not have a NVIDIA adapter ID, return to Step 2 to check another device.

⚠ The list of PCI Device IDs can be found in the [PCI ID repository](#).

3.10 ConnectX-6 PCIe x16 Installation Instructions

3.10.1 Installing the Card

⚠ Applies to MCX613106A-VDAT.

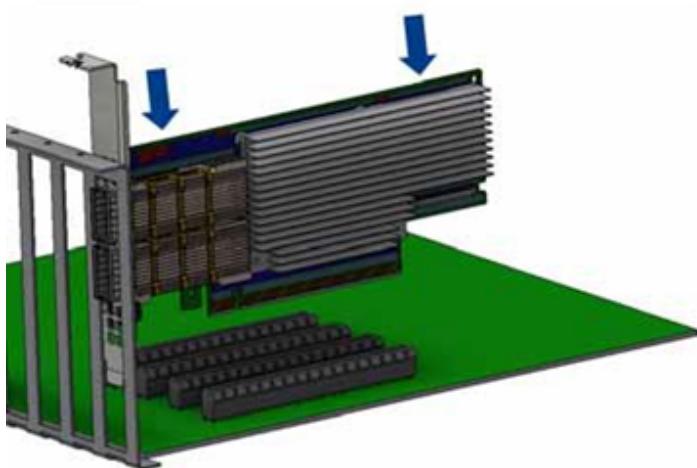
⚠ Please make sure to install the ConnectX-6 cards in a PCIe slot that is capable of supplying the required power and airflow as stated in [Specifications](#).

➤ Connect the adapter card in an available PCI Express x16 slot in the chassis.

Step 1: Locate an available PCI Express x16 slot and insert the adapter card to the chassis.



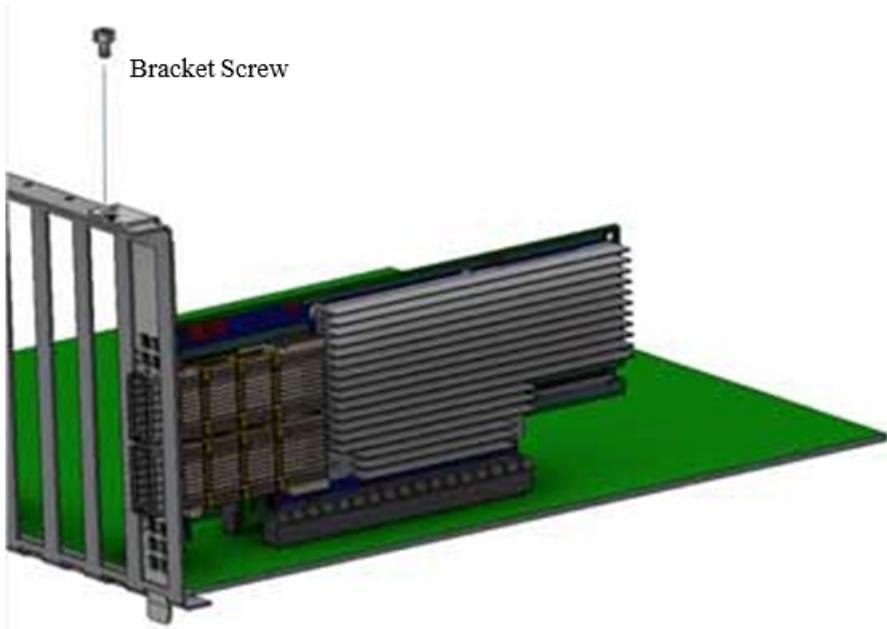
Step 2: Hold the card by its edges and bracket, avoiding contact with the component or print side. Apply even pressure to both edges and carefully insert the adapter into the PCI Express slot until firmly seated.



- Avoid touching the components on the adapter card.
- Avoid applying excessive force when seating the card, as this could damage the system or the adapter card components.

➤ Secure the adapter card to the chassis.

Step 1: Secure the bracket to the chassis with the bracket screw.



3.10.2 Uninstalling the Card

Safety Precautions

The adapter is installed in a system that operates with voltages that can be lethal. Before uninstalling the adapter card, please observe the following precautions to avoid injury and prevent damage to system components.

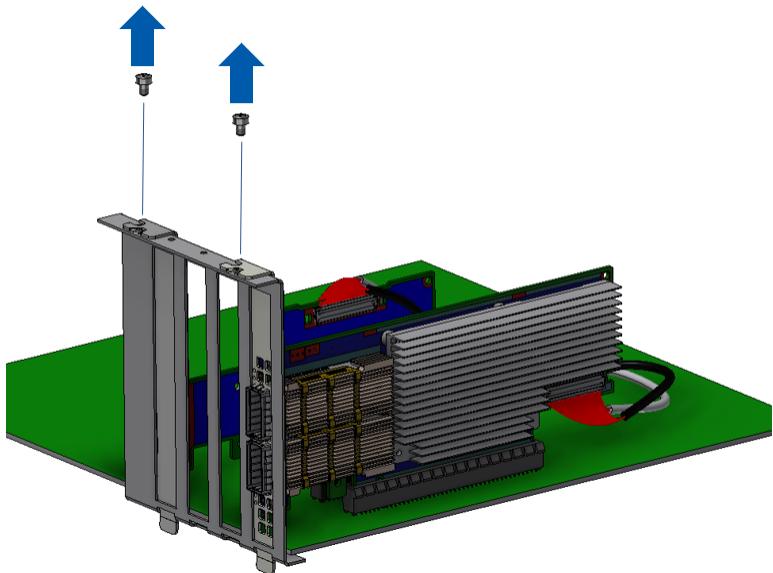
1. Remove any metallic objects from your hands and wrists.
2. It is strongly recommended to use an ESD strap or other antistatic devices.
3. Turn off the system and disconnect the power cord from the server.

Card Removal

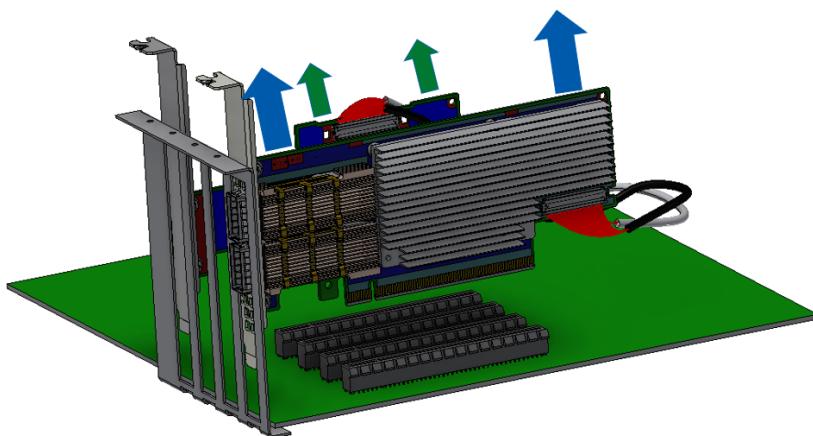


Please note that the following images are for illustration purposes only.

1. Verify that the system is powered off and unplugged.
2. Wait 30 seconds.
3. To remove the card, disengage the retention mechanisms on the bracket (clips or screws).



4. Holding the adapter card from its center, gently pull the ConnectX-6 card out of the PCI Express slot.



3.11 ConnectX-6 Socket Direct (2x PCIe x16) Installation Instructions



Applies to MCX614106A-CCAT, MCX614105A-VCAT and MCX614106A-VCAT.

The hardware installation section uses the terminology of white and black harnesses to differentiate between the two supplied cables. Due to supply chain variations, some cards may be supplied with

two black harnesses instead. To clarify the difference between these two harnesses, one black harness was marked with a “WHITE” label and the other with a “BLACK” label.

The Cabline harness marked with “WHITE” label should be connected to the connector on the ConnectX-6 and PCIe card engraved with “White Cable” while the one marked with “BLACK” label should be connected to the connector on the ConnectX-6 and PCIe card engraved with “Black Cable”.

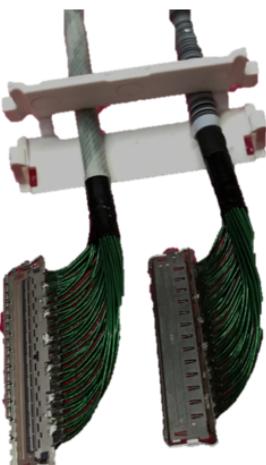
- ⚠ The harnesses' minimal bending radius is 10[mm].

3.11.1 Installing the Card

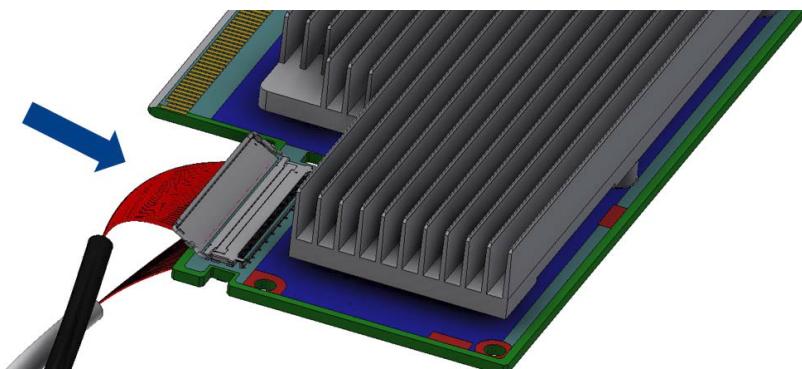
- ⚠ Applies to MCX654105A-HCAT, MCX654106A-HCAT and MCX654106A-ECAT.
- ⚠ The installation instructions include steps that involve a retention clip to be used while connecting the Cabline harnesses to the cards. Please note that this is an optional accessory.
- ⚠ Please make sure to install the ConnectX-6 cards in a PCIe slot that is capable of supplying the required power and airflow as stated in [Specifications](#).

➤ Connect the adapter card with the Auxiliary connection card using the supplied Cabline CA-II Plus harnesses.

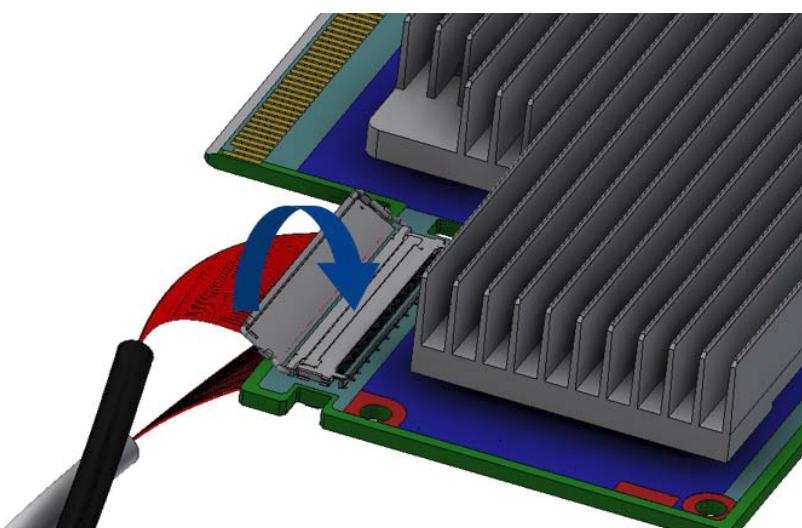
Step 1: Slide the black and white Cabline CA-II Plus harnesses through the retention clip while making sure the clip opening is facing the plugs.



Step 2: Plug the Cabline CA-II Plus harnesses on the ConnectX-6 adapter card while paying attention to the color-coding. As indicated on both sides of the card; plug the black harness to the component side and the white harness to the print side.



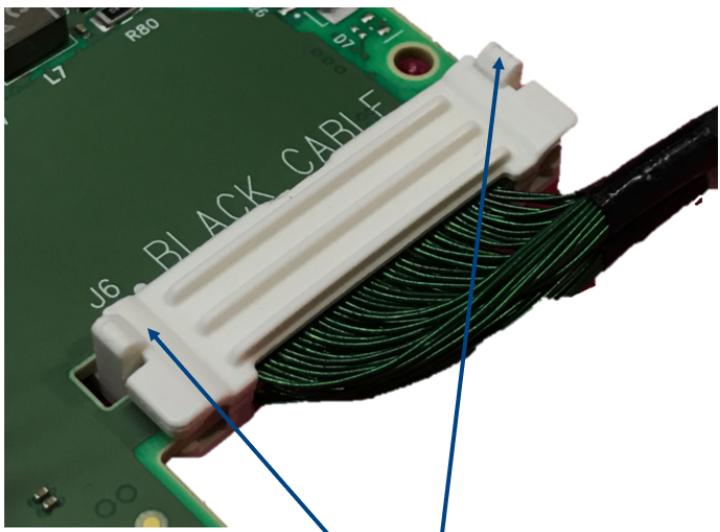
Step 2: Verify the plugs are locked.



Step 3: Slide the retention clip latches through the cutouts on the PCB. The latches should face the annotation on the PCB.



Step 4: Clamp the retention clip. Verify both latches are firmly locked.



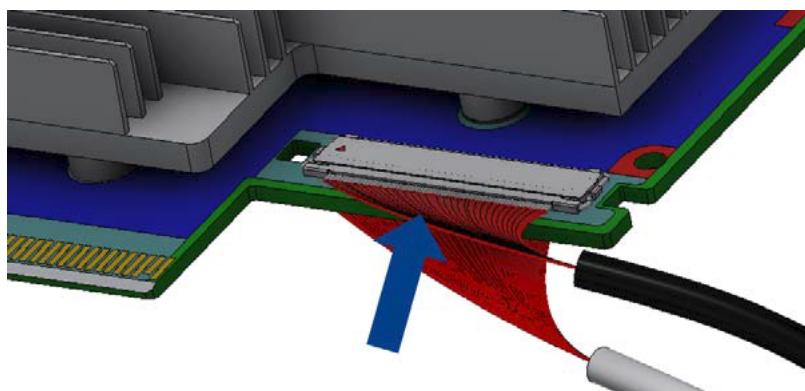
Verify that both latches are firmly snapped



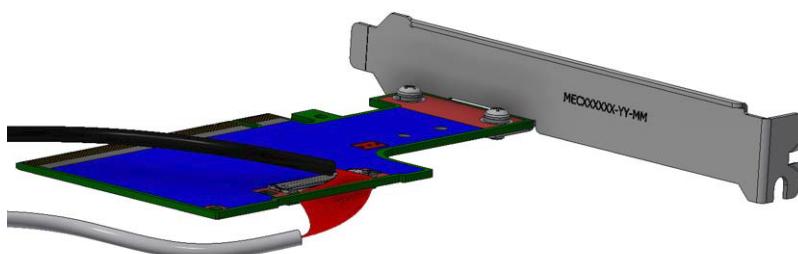
Step 5: Slide the Cabline CA-II Plus harnesses through the retention clip. Make sure that the clip opening is facing the plugs.



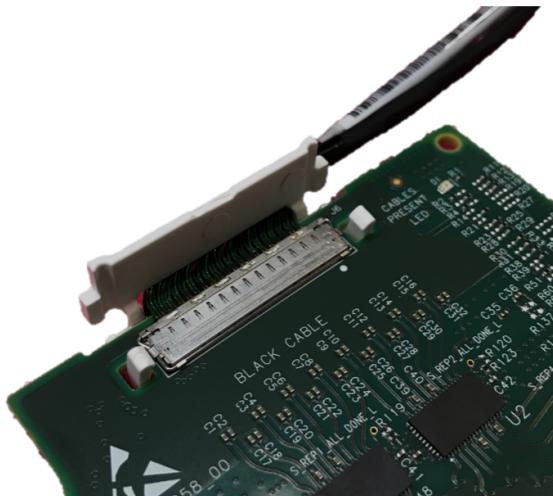
Step 6: Plug the Cabline CA-II Plus harnesses on the PCIe Auxiliary Card. As indicated on both sides of the Auxiliary connection card; plug the black harness to the component side and the white harness to the print side.



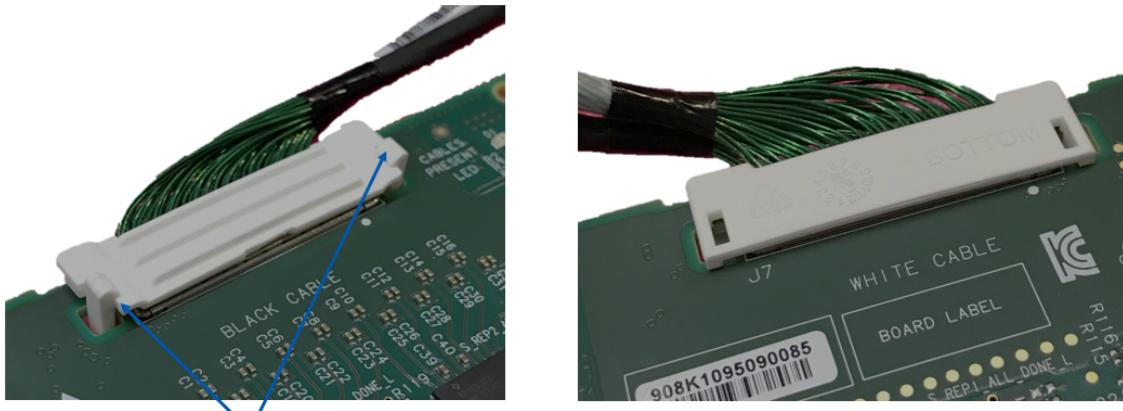
Step 7: Verify the plugs are locked.



Step 8: Slide the retention clip through the cutouts on the PCB. Make sure latches are facing "Black Cable" annotation as seen in the below picture.



Step 9: Clamp the retention clip. Verify both latches are firmly locked.

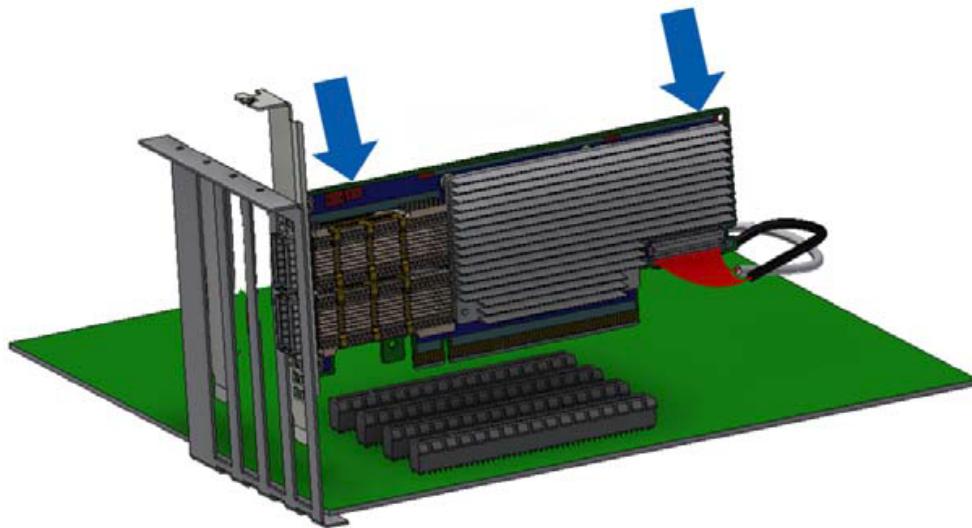


Verify that both latches are firmly snapped

➤ Connect the ConnectX-6 adapter and PCIe Auxiliary Connection cards in available PCI Express x16 slots in the chassis.

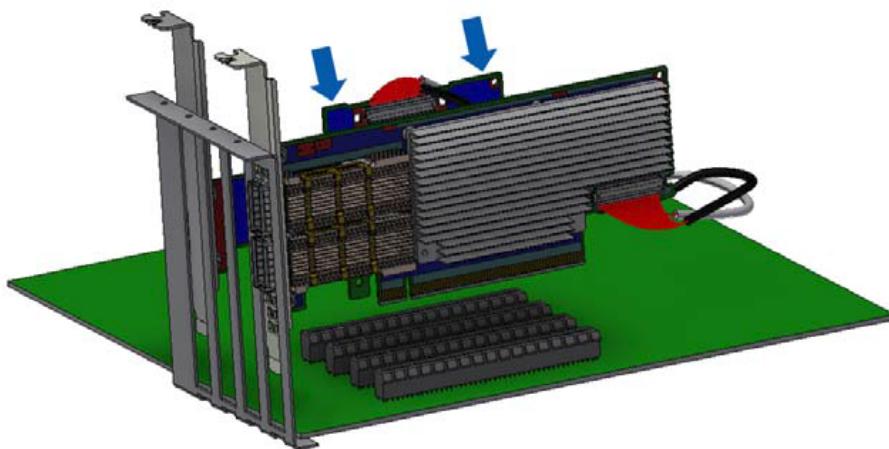
Step 1: Locate two available PCI Express x16 slots.

Step 2: Hold the card by its edges and bracket, avoiding contact with the component or print side. Apply even pressure to both edges and carefully insert the adapter into the PCI Express slot until firmly seated.



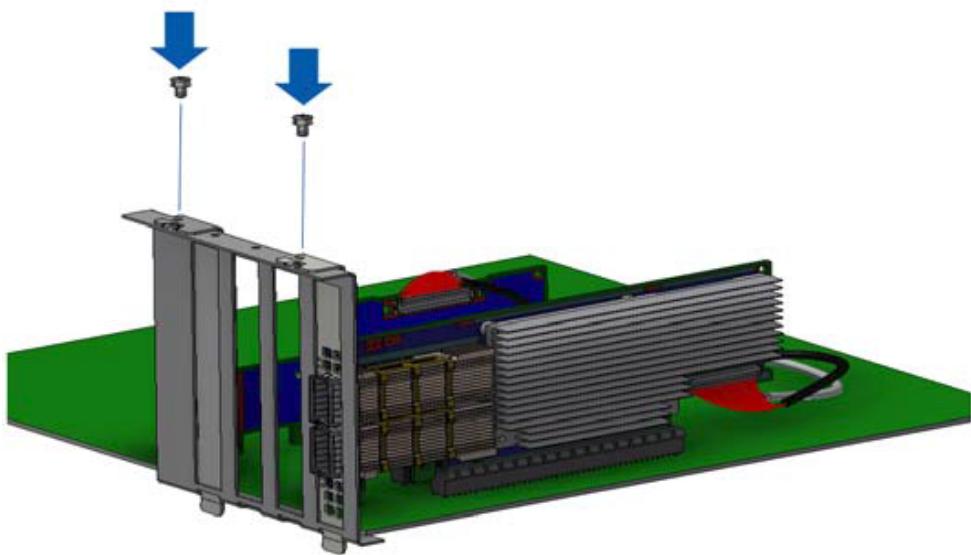
- Avoid touching the components on the adapter card.
- Avoid applying excessive force when seating the card, as this could damage the system or the adapter card components.

Step 3: Applying even pressure at both corners of the cards, insert the Auxiliary Connection card in the PCI Express slots until firmly seated.



➤ Secure the ConnectX-6 adapter and PCIe Auxiliary Connection Cards to the chassis.

Step 1: Secure the brackets to the chassis with the bracket screw.



3.11.2 Uninstalling the Card

Safety Precautions

The adapter is installed in a system that operates with voltages that can be lethal. Before uninstalling the adapter card, please observe the following precautions to avoid injury and prevent damage to system components.

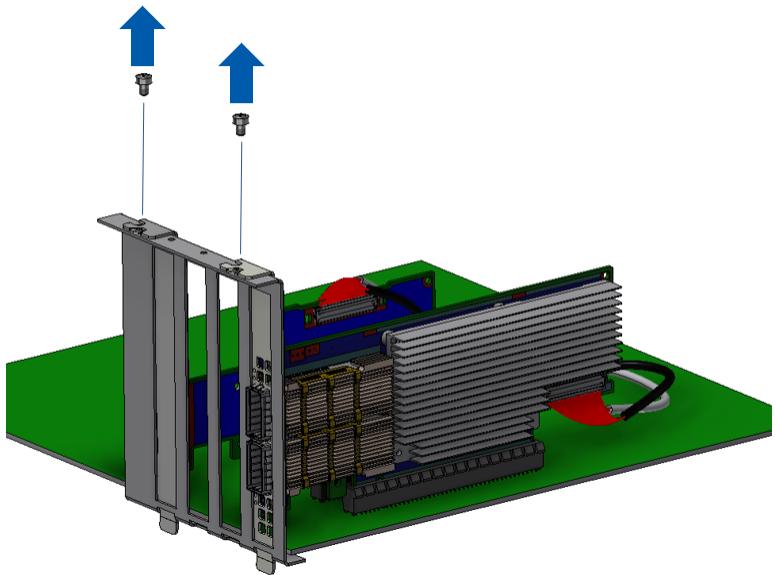
1. Remove any metallic objects from your hands and wrists.
2. It is strongly recommended to use an ESD strap or other antistatic devices.
3. Turn off the system and disconnect the power cord from the server.

Card Removal

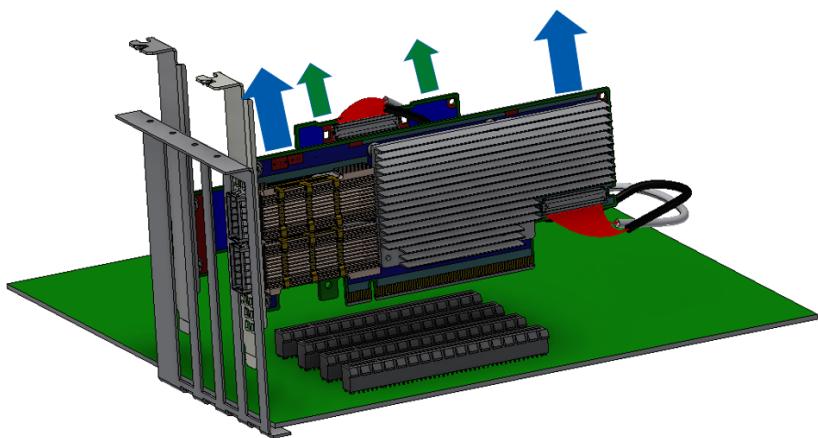


Please note that the following images are for illustration purposes only.

1. Verify that the system is powered off and unplugged.
2. Wait 30 seconds.
3. To remove the card, disengage the retention mechanisms on the bracket (clips or screws).



4. Holding the adapter card from its center, gently pull the ConnectX-6 and Auxiliary Connections cards out of the PCI Express slot.



4 Driver Installation

Please use the relevant driver installation section.

- [Linux Driver Installation](#)
- [Windows Driver Installation](#)
- [VMware Driver Installation](#)

4.1 Linux Driver Installation

This section describes how to install and test the MLNX_OFED for Linux package on a single server with a NVIDIA ConnectX-5 adapter card installed.

4.1.1 Prerequisites

Requirements	Description
Platforms	A server platform with a ConnectX-6 EN adapter card installed (firmware: fw-ConnectX6)
Required Disk Space for Installation	1GB
Operating System	Linux operating system. For the list of supported operating system distributions and kernels, please refer to the <i>MLNX_OFED Release Notes</i> file.
Installer Privileges	The installation requires administrator (root) privileges on the target machine.

For Linux driver installation, please refer to [NVIDIA DOCA Installation Guide for Linux](#).

4.2 Windows Driver Installation

For Windows, download and install the latest WinOF-2 for Windows software package available via the NVIDIA website at: [WinOF-2 webpage](#). Follow the installation instructions included in the download package (also available from the download page).

The snapshots in the following sections are presented for illustration purposes only. The installation interface may slightly vary, depending on the operating system in use.

4.2.1 Software Requirements

For the full list of supported operating systems, please refer to the [WinOF-2 Documentation](#) -> Release Notes.

4.2.2 Downloading WinOF-2 Driver

- To download the .exe file according to your Operating System, please follow the steps below:
1. Obtain the machine architecture.

- a. To go to the Start menu, position your mouse in the bottom-right corner of the Remote Desktop of your screen.
- b. Open a CMD console (Click Task Manager-->File --> Run new task and enter CMD).
- c. Enter the following command.

```
echo %PROCESSOR_ARCHITECTURE%
```

⚠ On an x64 (64-bit) machine, the output will be “AMD64”.

2. Go to the WinOF-2 web page at: <https://www.nvidia.com/en-us/networking/> > Products > Software > InfiniBand Drivers (Learn More) > Nvidia WinOF-2.
3. Download the .exe image according to the architecture of your machine (see [Step 1](#)). The name of the .exe is in the following format: MLNX_WinOF2-<version>_<arch>.exe.

⚠ Installing the incorrect .exe file is prohibited. If you do so, an error message will be displayed.
For example, if you install a 64-bit .exe on a 32-bit machine, the wizard will display the following (or a similar) error message: “The installation package is not supported by this processor type. Contact your vendor”

4.2.3 Installing WinOF-2 Driver

The snapshots in the following sections are for illustration purposes only. The installation interface may slightly vary, depending on the used operating system.

This section provides instructions for two types of installation procedures, and both require administrator privileges:

- [Attended Installation](#)
An installation procedure that requires frequent user intervention.
- [Unattended Installation](#)
An automated installation procedure that requires no user intervention.

4.2.3.1 Attended Installation

The following is an example of an installation session.

1. Double click the .exe and follow the GUI instructions to install MLNX_WinOF2.
2. [Optional] Manually configure your setup to contain the logs option (replace “LogFile” with the relevant directory).

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v"/l*vx [LogFile]"
```

3. [Optional] If you do not want to upgrade your firmware version (i.e., MT_SKIPFWUPGRD default value is False).

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v" MT_SKIPFWUPGRD=1"
```

4. [Optional] If you do not want to install the Rshim driver, run.

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v" MT_DISABLE_RSHIM_INSTALL=1"
```

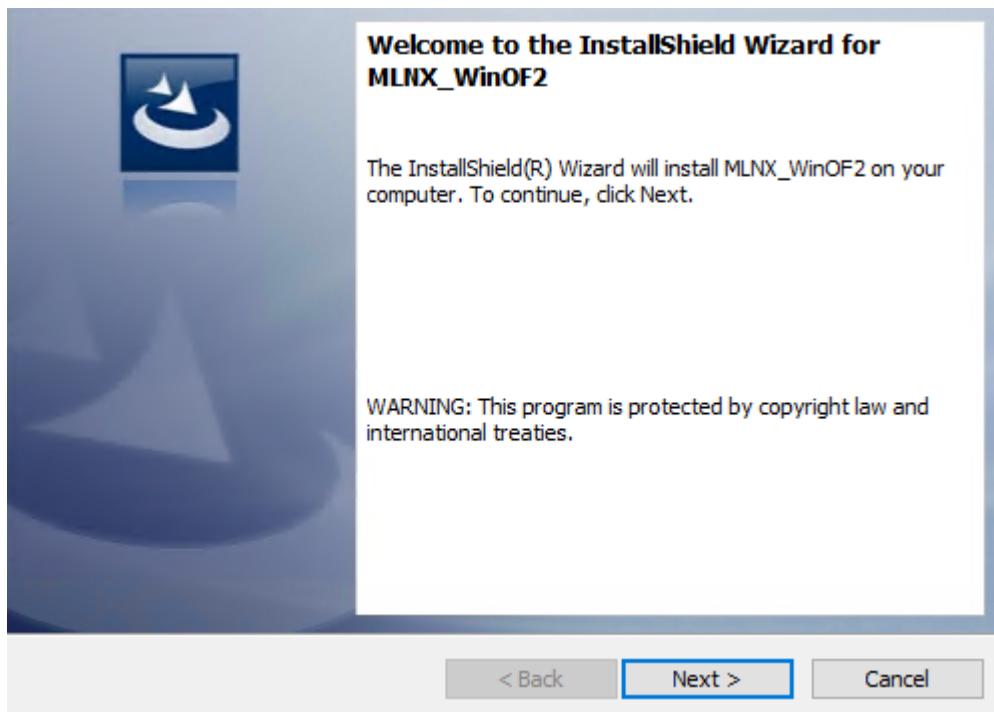
⚠ The Rshim driver installation will fail if a prior Rshim driver is already installed. The following fail message will be displayed in the log:

"ERROR!!! Installation failed due to following errors: MlxRshim drivers installation disabled and MlxRshim drivers Installed, Please remove the following oem inf files from driver store: <oem inf list>"

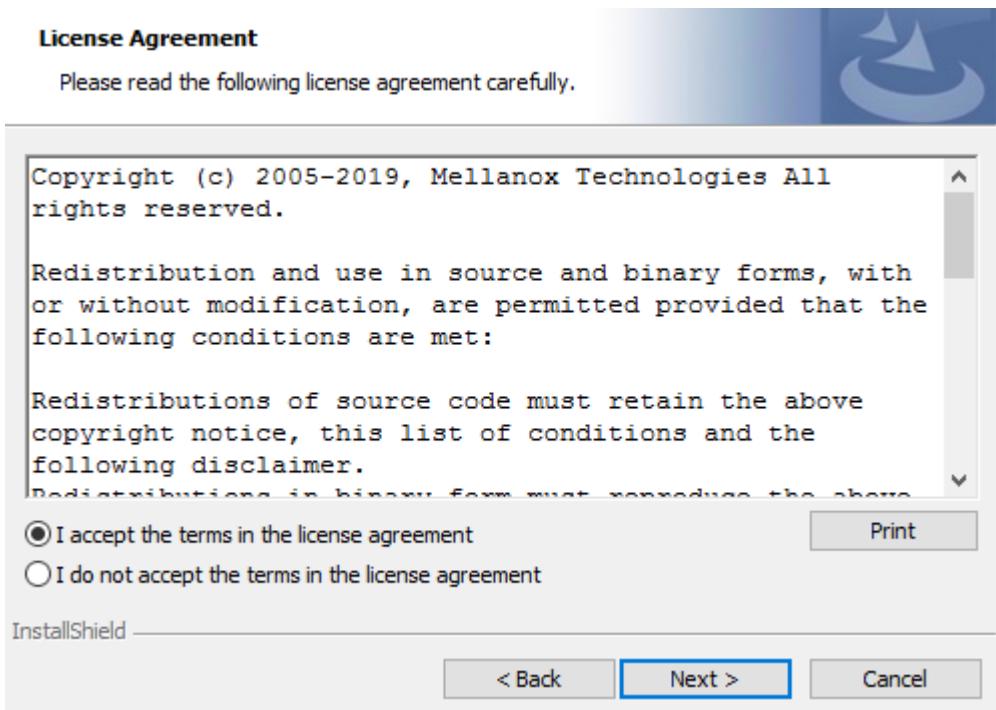
5. [Optional] If you want to skip the check for unsupported devices, run.

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v" SKIPUNSUPPORTEDDEVCHECK=1"
```

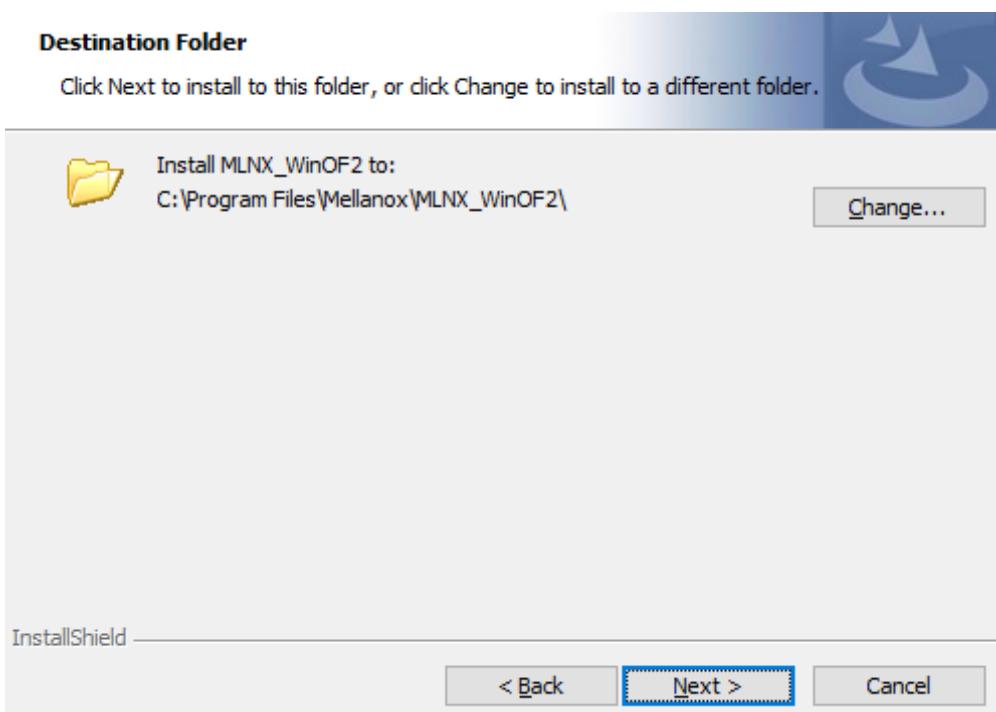
6. Click Next in the Welcome screen.



7. Read and accept the license agreement and click Next.



8. Select the target folder for the installation.



9. The firmware upgrade screen will be displayed in the following cases:

- If the user has an OEM card. In this case, the firmware will not be displayed.
- If the user has a standard NVIDIA® card with an older firmware version, the firmware will be updated accordingly. However, if the user has both an OEM card and a NVIDIA® card, only the NVIDIA® card will be updated.

Firmware Upgrade

- Upgrade the HCA's firmware version (Recommended).
Upgrading the firmware version will reboot your machine.

Note: One or more of your HCA adapters has an old firmware version. We recommend upgrading to a newer firmware version to enable improved functionality and support driver's capabilities.

InstallShield

< Back

Next >

Cancel

10. Select a Complete or Custom installation, follow [Step a](#) onward.

Setup Type

Choose the setup type that best suits your needs.

Please select a setup type.

Complete



All program features will be installed. (Requires the most disk space.)

Custom



Choose which program features you want installed and where they will be installed. Recommended for advanced users.

InstallShield

< Back

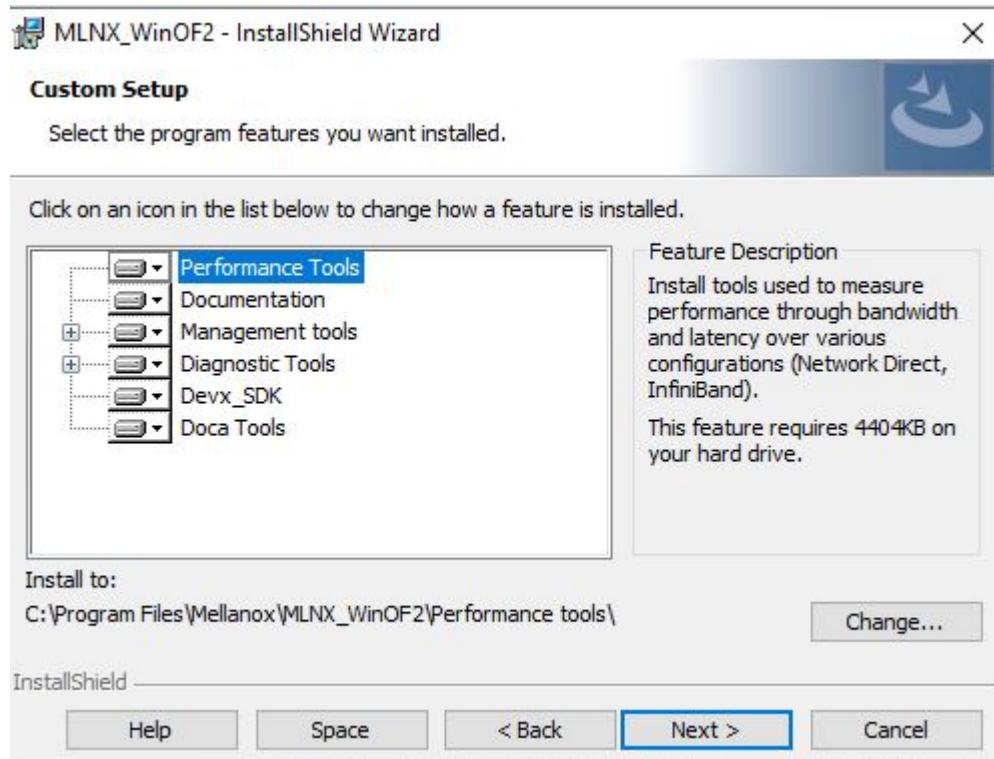
Next >

Cancel

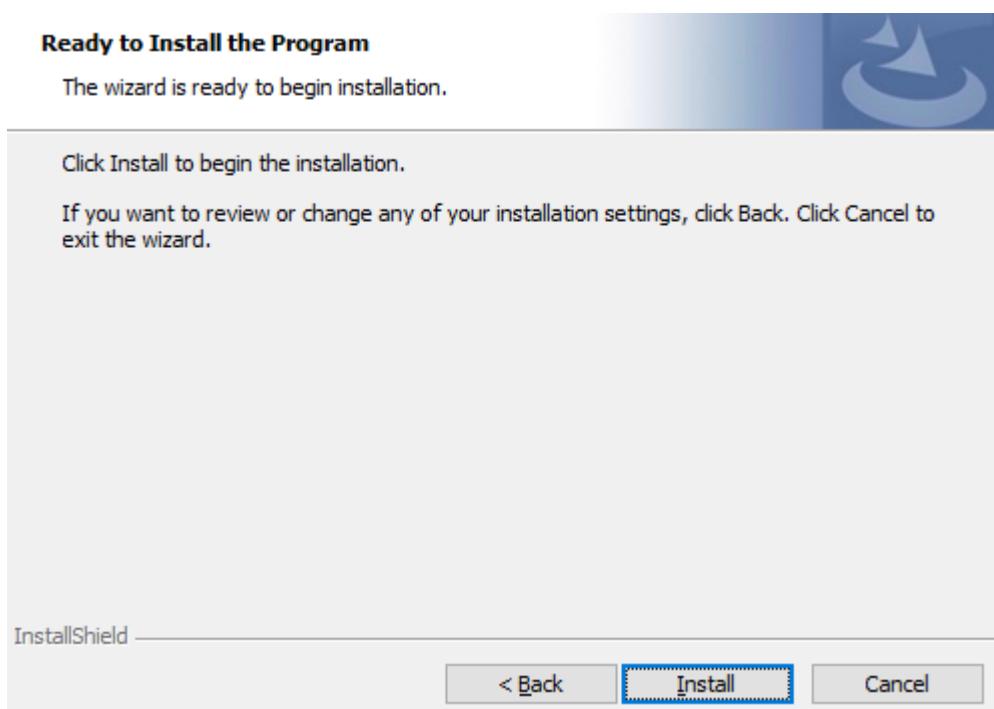
a. Select the desired feature to install:

- Performances tools - install the performance tools that are used to measure performance in user environment
- Documentation - contains the User Manual and Release Notes

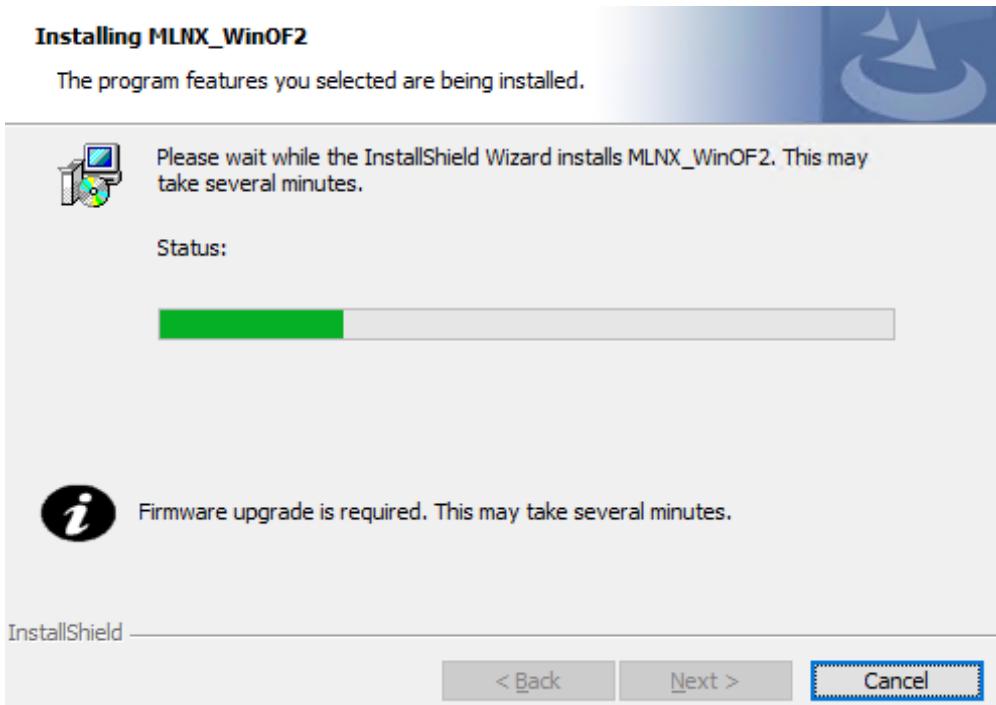
- Management tools - installation tools used for management, such as mlxstat
 - Diagnostic Tools - installation tools used for diagnostics, such as mlx5cmd
- b. Click Next to install the desired tools.



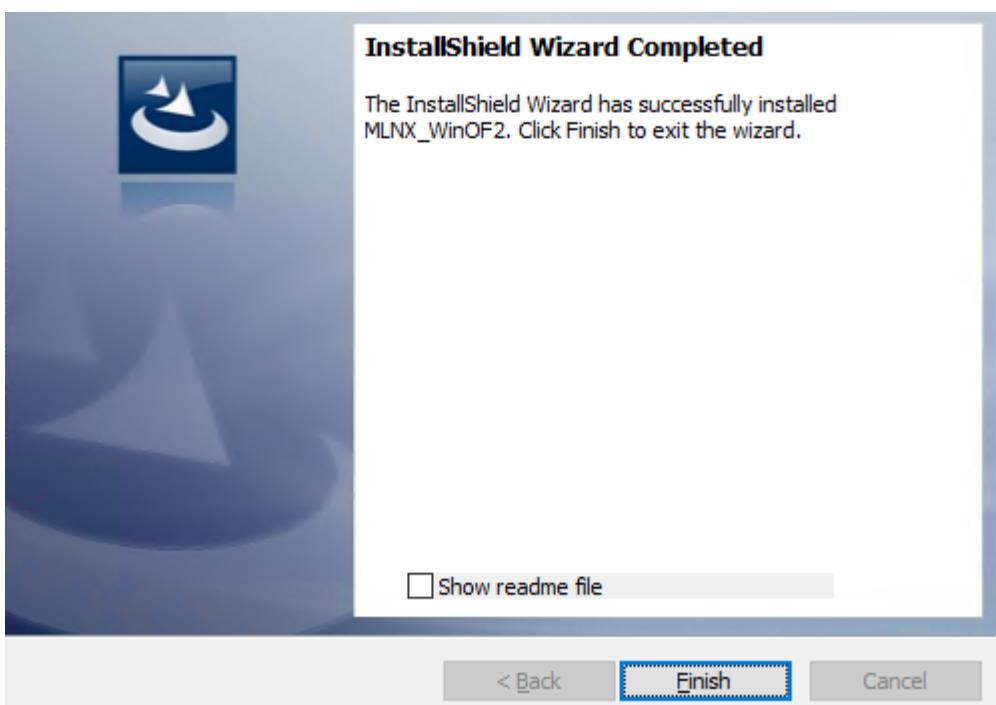
11. Click Install to start the installation.



12. In case firmware upgrade option was checked in [Step 7](#), you will be notified if a firmware upgrade is required (see ).



13. Click Finish to complete the installation.



4.2.3.2 Unattended Installation

- ⚠** If no reboot options are specified, the installer restarts the computer whenever necessary without displaying any prompt or warning to the user.
To control the reboots, use the */norestart* or */forcerestart* standard command-line options.

The following is an example of an unattended installation session.

1. Open a CMD console-> Click Start-> Task Manager File-> Run new task-> and enter CMD.
2. Install the driver. Run:

```
MLNX_WinOF2-[Driver/Version]_<revision_version>_All_Arch.exe /S /v/qn
```

3. [Optional] Manually configure your setup to contain the logs option:

```
MLNX_WinOF2-[Driver/Version]_<revision_version>_All_Arch.exe /S /v/qn /v"/l*vx [LogFile]"
```

4. [Optional] if you wish to control whether to install ND provider or not (i.e., *MT_NDPROPERTY default value is True*).

```
MLNX_WinOF2-[Driver/Version]_<revision_version>_All_Arch.exe /vMT_NDPROPERTY=1
```

5. [Optional] If you do not wish to upgrade your firmware version (i.e., *MT_SKIPFWUPGRD default value is False*).

```
MLNX_WinOF2-[Driver/Version]_<revision_version>_All_Arch.exe /vMT_SKIPFWUPGRD=1
```

6. [Optional] If you do not want to install the Rshim driver, run.

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v" MT_DISABLE_RSHIM_INSTALL=1"
```

- ⚠** The Rshim driver installation will fail if a prior Rshim driver is already installed. The following fail message will be displayed in the log:

"ERROR!!! Installation failed due to following errors: MlxRshim drivers installation disabled and MlxRshim drivers Installed, Please remove the following oem inf files from driver store: <oem inf list>"

7. [Optional] If you want to enable the default configuration for Rivermax, run.

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v"MT_RIVERMAX=1 /l*vx C:\Users\<user>\log.txt "
```

8. [Optional] If you want to skip the check for unsupported devices, run/

```
MLNX_WinOF2_<revision_version>_All_Arch.exe /v" SKIPUNSUPPORTEDDEVCHECK=1"
```

4.2.4 Firmware Upgrade

If the machine has a standard NVIDIA® card with an older firmware version, the firmware will be automatically updated as part of the NVIDIA® WinOF-2 package installation. For information on how to upgrade firmware manually, please refer to [MFT User Manual](#).

If the machine has a DDA (pass through) facility, firmware update is supported only in the Host. Therefore, to update the firmware, the following must be performed:

1. Return the network adapters to the Host.
2. Update the firmware according to the steps in the [MFT User Manual](#).
3. Attach the adapters back to VM with the DDA tools.

4.3 VMware Driver Installation

This section describes VMware Driver Installation.

4.3.1 Hardware and Software Requirements

Requirement	Description
Platforms	A server platform with an adapter card based on ConnectX®-6 (EN) (firmware: fw-ConnectX6)
Operating System	ESXi 6.5
Installer Privileges	The installation requires administrator privileges on the target machine.

4.3.2 Installing NATIVE ESXi Driver for VMware vSphere



Please uninstall all previous driver packages prior to installing the new version.

To install the driver:

1. Log into the ESXi server with root permissions.
2. Install the driver.

```
#> esxcli software vib install -d <path>/<bundle_file>
```

Example:

```
#> esxcli software vib install -d /tmp/MLNX-NATIVE-ESX-ConnectX-4-5_4.16.8.8-10EM-650.0.0.4240417.zipesxcli
```

3. Reboot the machine.
4. Verify the driver was installed successfully.

```
esxcli software vib list | grep nmlx
```

nmlx5-core	4.16.8.8-10EM.650.0.0.4240417	MEL	PartnerSupported 2017-01-31
nmlx5-rdma	4.16.8.8-10EM.650.0.0.4240417	MEL	PartnerSupported 2017-01-31

⚠ After the installation process, all kernel modules are loaded automatically upon boot.

4.3.3 Removing Earlier NVIDIA Drivers

⚠ Please unload the previously installed drivers before removing them.

To remove all the drivers:

1. Log into the ESXi server with root permissions.
2. List all the existing NATIVE ESXi driver modules. (See Step 4 in [Installing NATIVE ESXi Driver for VMware vSphere.](#))
3. Remove each module:

```
#> esxcli software vib remove -n nmlx5-rdma
#> esxcli software vib remove -n nmlx5-core
```

⚠ To remove the modules, you must run the command in the same order as shown in the example above.

4. Reboot the server.

4.3.4 Firmware Programming

1. Download the VMware bootable binary images v4.6.0 from the [Firmware Tools \(MFT\) site](#).
 - a. ESXi 6.5 File: mft-4.6.0.48-10EM-650.0.0.4598673.x86_64.vib
 - b. MD5SUM: 0804cff30913a7b4017445a0f0adbe1
2. Install the image according to the steps described in the [MFT User Manual](#).

⚠ The following procedure requires custom boot image downloading, mounting and booting from a USB device.

5 Updating Adapter Firmware

Each adapter card is shipped with the latest version of qualified firmware at the time of manufacturing. However, NVIDIA issues firmware updates occasionally that provide new features and bug fixes. To check that your card is programmed with the latest available firmware version, download the mlxup firmware update and query utility. The utility can query for available NVIDIA adapters and indicate which adapters require a firmware update. If the user confirms, mlxup upgrades the firmware using embedded images. The latest mlxup executable and documentation are available in [mlxup - Update and Query Utility](#).

Firmware Update Example

```
[server1]# ./mlxup
Querying Mellanox devices firmware ...
Device Type: ConnectX-6
Part Number: MCX614105A-VCAT
Description: ConnectX-6 EN adapter card, 200GbE, single-port QSFP56, 2x PCIe3.0 x16, tall bracket
PSID: MT_2190110032
PCI Device Name: 0000:06:00.0
Base GUID: e41d2d0300fd8b8a
Versions: Current Available
FW 16.23.1020 16.24.1000

Status: Update required

Device Type: ConnectX-6
Part Number: MCX614105A-VCAT
Description: ConnectX-6 EN adapter card, 200GbE, single-port QSFP56, 2x PCIe3.0 x16, tall bracket
PSID: MT_2170110021
PCI Device Name: 0000:07:00.0
Base MAC: 0000e41d2da206d4
Versions: Current Available
FW 16.24.1000 16.24.1000

Status: Up to date

Perform FW update? [y/N]: y
Device #1: Up to date
Device #2: Updating FW ... Done

Restart needed for updates to take effect.
Log File: /var/log/mlxup/mlxup-yyyymmdd.log
```

6 Troubleshooting

6.1 General Troubleshooting

Server unable to find the adapter	<ul style="list-style-type: none">• Ensure that the adapter is placed correctly• Make sure the adapter slot and the adapter are compatible Install the adapter in a different PCI Express slot• Use the drivers that came with the adapter or download the latest• Make sure your motherboard has the latest BIOS• Try to reboot the server
The adapter no longer works	<ul style="list-style-type: none">• Reseat the adapter in its slot or a different slot, if necessary• Try using another cable• Reinstall the drivers for the network driver files may be damaged or deleted• Reboot the server
Adapters stopped working after installing another adapter	<ul style="list-style-type: none">• Try removing and re-installing all adapters• Check that cables are connected properly• Make sure your motherboard has the latest BIOS
Link indicator light is off	<ul style="list-style-type: none">• Try another port on the switch• Make sure the cable is securely attached• Check you are using the proper cables that do not exceed the recommended lengths• Verify that your switch and adapter port are compatible
Link light is on, but with no communication established	<ul style="list-style-type: none">• Check that the latest driver is loaded• Check that both the adapter and its link are set to the same speed and duplex settings
Event message received of insufficient power	<ul style="list-style-type: none">• When [adapter's current power consumption] > [PCIe slot advertised power limit] - a warning message appears in the server's system even logs (Eg. dmesg: "Detected insufficient power on the PCIe slow")• It's recommended to use a PCIe slot that can supply enough power.• If a message of the following format appears - "mlx5_core 0003:01:00.0: port_module:254:(pid 0): Port module event[error]: module 0, Cable error, One or more network ports have been powered down due to insufficient/unadvertised power on the PCIe slot" please upgrade your Adapter's firmware.• If the message remains - please consider switching from Active Optical Cable (AOC) or transceiver to Direct Attached Copper (DAC) connectivity.

6.2 Linux Troubleshooting

Environment Information	<code>cat /etc/issue uname -a cat /proc/cupinfo grep 'model name' uniq ofed_info -s ifconfig -a ip link show ethtool <interface> ethtool -i <interface_of_Mellanox_port_num> ibdev2netdev</code>
Card Detection	<code>lspci grep -i Mellanox</code>
Mellanox Firmware Tool (MFT)	Download and install MFT: MFT Documentation Refer to the User Manual for installation instructions. Once installed, run: <code>mst start mst status flint -d <mst_device> q</code>
Ports Information	<code>ibstat ibv_devinfo</code>
Firmware Version Upgrade	To download the latest firmware version, refer to the NVIDIA Update and Query Utility .
Collect Log File	<code>cat /var/log/messages dmesg >> system.log journalctl (Applicable on new operating systems) cat /var/log/syslog</code>

6.3 Windows Troubleshooting

Environment Information	From the Windows desktop choose the Start menu and run: <code>msinfo32</code> To export system information to a text file, choose the Export option from the File menu. Assign a file name and save.
Mellanox Firmware Tool (MFT)	Download and install MFT: MFT Documentation Refer to the User Manual for installation instructions. Once installed, open a CMD window and run: <code>WinMFT mst start mst status flint -d <mst_device> q</code>
Ports Information	<code>vstat</code>
Firmware Version Upgrade	Download the latest firmware version using the PSID/board ID from here . <code>flint -d <mst_device> -i <firmware_bin_file> b</code>

Collect Log File

- Event log viewer
- MST device logs:
 - mst start
 - mst status
- flint -d <mst_device> dc > dump_configuration.log
- mstdump <mst_device> dc > mstdump.log

7 Specifications

⚠ Please make sure to install the ConnectX-6 card in a PCIe slot that is capable of supplying the required power and airflow as stated in the below table.

7.1 MCX614106A-CCAT Specifications

Physical	Adapter Card Size: 6.6 in. x 2.71 in. (167.65mm x 68.90mm)				
	Connector: Dual QSFP56 Ethernet (copper and optical)				
Protocol Support	Ethernet: 100GBASE-CR2, 100GBASE-CR4, 100GBASE-KR4, 100GBASE-SR4, 50GBASE-R2, 50GBASE-R4, 40GBASE-CR4, 40GBASE-KR4, 40GBASE-SR4, 40GBASE-LR4, 40GBASE-ER4, 40GBASE-R2, 25GBASE-R, 20GBASE-KR2, 10GBASE-LR, 10GBASE-ER, 10GBASE-CX4, 10GBASE-KX4, 10GBASE-CR, 10GBASE-KR, SGMII, 1000BASE-CX, 1000BASE-KX, 10GBASE-SR				
	Data Rate	Ethernet	1/10/25/40/50/100 Gb/s		
Gen3/4: SERDES @ 8.0GT/s/16GT/s, x16 lanes (2.0 and 1.1 compatible)					
Adapter Card Power and Airflow	Voltage: 12V, 3.3VAUX				
	Power	Cable			
	Typical Power^a	Passive Cables	21.0W		
	Maximum Power	Please refer to ConnectX-6 Ethernet Cards Power Specifications available at NVOnline following login.			
	Voltage: 3.3Aux Maximum current: 100mA				
	Maximum power available through QSFP56 port: 5W				
	Airflow (LFM) / Ambient Temperature	Cable Type	Airflow Direction		
			Heatsink to Port	Port to Heatsink	
		Passive Cables	350 LFM / 55 °C	250 LFM / 35 °C	
		NVIDIA Active 2.7W Cables	550 LFM / 55 °C	250 LFM / 35 °C	
Environmental	Temperature	Operational	0 °C to 55 °C		
		Non-operational	-40 °C to 70 °C ^b		
	Humidity	Operational	10% to 85% relative humidity		
		Non-operational	10% to 90% relative humidity		
	Altitude (Operational)	3050m			
Regulatory	Safety: CB / cTUVus / CE				
	EMC: CE / FCC / VCCI / ICES / RCM / KC				
	RoHS: RoHS Compliant				

a. Typical power for ATIS traffic load.

b. The non-operational storage temperature specifications apply to the product without its package.

7.2 MCX614105A-VCAT Specifications

Physical	Adapter Card Size: 6.6 in. x 2.71 in. (167.65mm x 68.90mm) Auxiliary PCIe Connection Card Size: 5.09 in. x 2.32 in. (129.30mm x 59.00mm) Two Cabline CA-II Plus harnesses (white and black) Length: 35cm			
	Connector: Single QSFP56 Ethernet (copper and optical)			
Protocol Support	Ethernet: 200GBASE-CR4, 200GBASE-KR4, 200GBASE-SR4, 100GBASE-CR2, 100GBASE-CR4, 100GBASE-KR4, 100GBASE-SR4, 50GBASE-R2, 50GBASE-R4, 40GBASE-CR4, 40GBASE-KR4, 40GBASE-SR4, 40GBASE-LR4, 40GBASE-ER4, 40GBASE-R2, 25GBASE-R, 20GBASE-KR2, 10GBASE-LR, 10GBASE-ER, 10GBASE-CX4, 10GBASE-KX4, 10GBASE-CR, 10GBASE-KR, SGMII, 1000BASE-CX, 1000BASE-KX, 10GBASE-SR			
	Data Rate	Ethernet	1/10/25/40/50/100/200 Gb/s	
	Gen3: SERDES @ 8.0GT/s/, x16 lanes (2.0 and 1.1 compatible)			
Adapter Card Power	Voltage: 12V, 3.3VAUX			
	Power	Cable		
	Typical Power^a	Passive Cables	27.1W	
	Maximum Power	Please refer to ConnectX-6 Ethernet Cards Power Specifications available at NVOnline following login.		
	Voltage: 3.3Aux Maximum current: 100mA			
Maximum power available through QSFP56 port: 5W				
Active Auxiliary PCIe Connection Card Power	Typical Power	3.0W		
	Maximum Power	4.0W		
Airflow	Airflow (LFM) / Ambient Temperature	Cable Type	Airflow Direction	
		Passive Cables	600 LFM / 55°C	350 LFM / 35°C
		NVIDIA Active 4.7W Cables	600 LFM / 55°C ^b	350 LFM / 35°C
Environmental	Temperature	Operational	0°C to 55°C	
		Non-operational	-40°C to 70°C ^c	
	Humidity	Operational	10% to 85% relative humidity	
		Non-operational	10% to 90% relative humidity	
	Altitude (Operational)	3050m		
Regulatory	Safety: CB / cTUVus / CE			
	EMC: CE / FCC / VCCI / ICES / RCM / KC			
	RoHS: RoHS Compliant			

a. Typical power for ATIS traffic load.

b. For engineering samples - add 250LFM

c. The non-operational storage temperature specifications apply to the product without its package.

7.3 MCX614106A-VCAT Specifications

Physical	Low Profile Adapter Card Size: 6.6 in. x 2.71 in. (167.65mm x 68.90mm) Auxiliary PCIe Connection Card Size: 5.09 in. x 2.32 in. (129.30mm x 59.00mm) Two Cabline CA-II Plus harnesses (white and black) Length: 35cm			
	Connector: Dual QSFP56 Ethernet (copper and optical)			
Protocol Support	Ethernet: 200GBASE-CR4, 200GBASE-KR4, 200GBASE-SR4, 100GBASE-CR2, 100GBASE-CR4, 100GBASE-KR4, 100GBASE-SR4, 50GBASE-R2, 50GBASE-R4, 40GBASE-CR4, 40GBASE-KR4, 40GBASE-SR4, 40GBASE-LR4, 40GBASE-ER4, 40GBASE-R2, 25GBASE-R, 20GBASE-KR2, 10GBASE-LR, 10GBASE-ER, 10GBASE-CX4, 10GBASE-KX4, 10GBASE-CR, 10GBASE-KR, SGMII, 1000BASE-CX, 1000BASE-KX, 10GBASE-SR			
	Data Rate	Ethernet	1/10/25/40/50/100/200 Gb/s	
	Gen3: SERDES @ 8.0GT/s, x16 lanes (2.0 and 1.1 compatible)			
Adapter Card Power	Voltage: 12V, 3.3VAUX			
	Power			
	Typical Power^a	Passive Cables	31.4W	
	Maximum Power	Please refer to ConnectX-6 Ethernet Cards Power Specifications available at NVOnline following login.		
	Voltage: 3.3Aux Maximum current: 100mA			
Maximum power available through QSFP56 port: 5W				
Active Auxiliary PCIe Connection Card Power	Typical Power	3.0W		
	Maximum Power	4.0W		
Airflow	Temperature	Operational	0°C to 55°C	
		Non-operational	-40°C to 70°C	
	Humidity: 90% relative humidity ^c			
	Altitude (Operational)	3050m		
	Airflow (LFM) / Ambient Temperature	Cable Type	Airflow Direction	
			Heatsink to Port	Port to Heatsink
		Passive Cables	700 LFM / 55°C	400 LFM / 35°C
		NVIDIA Active 4.7W Cables	1050 LFM / 55°C 600 LFM / 48°C	400 LFM / 35°C
Environmental	Temperature	Operational	0°C to 55°C	
		Non-operational	-40°C to 70°C ^b	
	Humidity	Operational	10% to 85% relative humidity	
		Non-operational	10% to 90% relative humidity	

	Altitude (Operational)	3050m
Regulatory	Safety: CB / cTUVus / CE	
	EMC: CE / FCC / VCCI / ICES / RCM // KC	
	RoHS: RoHS Compliant	

- a. Typical power for ATIS traffic load.
b. The non-operational storage temperature specifications apply to the product without its package.

7.4 MCX613106A-VDAT Specifications

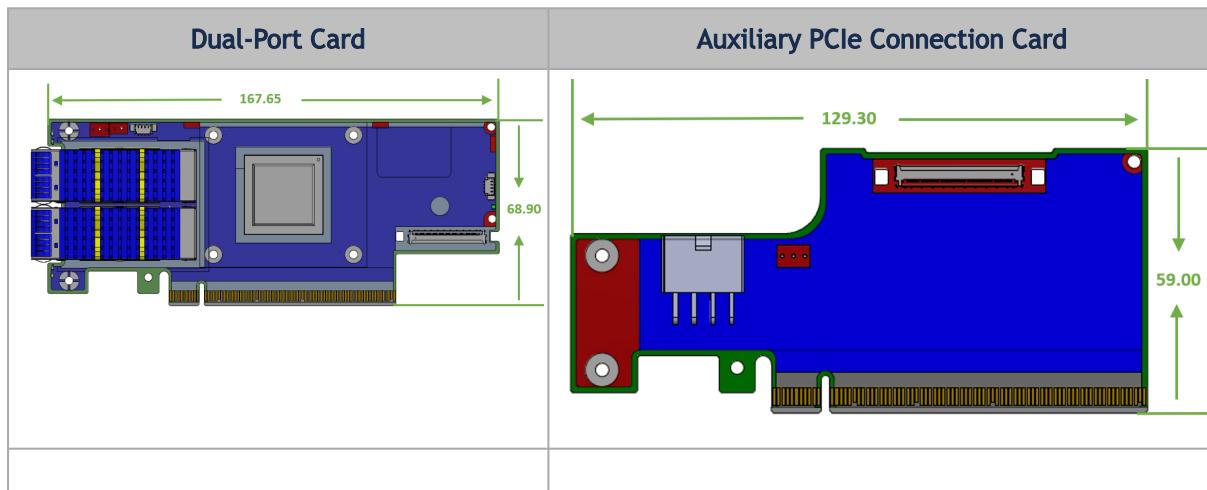
Physical	Adapter Card Size: 6.6 in. x 2.71 in. (167.65mm x 68.90mm) Connector: Dual QSFP56 Ethernet (copper and optical)				
Protocol Support	Ethernet: 200GBASE-CR4, 200GBASE-KR4, 200GBASE-SR4, 100GBASE-CR2, 100GBASE-CR4, 100GBASE-KR4, 100GBASE-SR4, 50GBASE-R2, 50GBASE-R4, 40GBASE-CR4, 40GBASE-KR4, 40GBASE-SR4, 40GBASE-LR4, 40GBASE-ER4, 40GBASE-R2, 25GBASE-R, 20GBASE-KR2, 10GBASE-LR, 10GBASE-ER, 10GBASE-CX4, 10GBASE-KX4, 10GBASE-CR, 10GBASE-KR, SGMII, 1000BASE-CX, 1000BASE-KX, 10GBASE-SR PCI Express Gen3/4: SERDES @ 8.0GT/s/16GT/s, x16 lanes (2.0 and 1.1 compatible)				
	Data Rate	Ethernet	1/10/25/40/50/100/200 Gb/s		
Adapter Card Power	Voltage: 12V, 3.3VAUX Power	Cable			
	Typical Power ^a	Passive Cables	23.6W		
	Maximum Power	Please refer to ConnectX-6 Ethernet Cards Power Specifications available at NVOnline following login.			
	Voltage: 3.3Aux Maximum current: 100mA				
	Maximum power available through QSFP56 port: 5W				
Airflow	Airflow (LFM) / Ambient Temperature	Cable Type	Airflow Direction		
			Heatsink to Port	Port to Heatsink	
		Passive Cables	400 LFM / 55 °C	300 LFM / 35 °C	
	NVIDIA Active 4.7W Cables		950 LFM / 55 °C 600 LFM / 48 °C	300 LFM / 35 °C	
Environmental	Temperature	Operational	0 °C to 55 °C		
		Non-operational	-40 °C to 70 °C ^b		
	Humidity	Operational	10% to 85% relative humidity		
		Non-operational	10% to 90% relative humidity		
	Altitude (Operational)	3050m			
Regulatory	Safety: CB / cTUVus / CE				
	EMC: CE / FCC / VCCI / ICES / RCM / KC				

- a. Typical power for ATIS traffic load.
- b. The non-operational storage temperature specifications apply to the product without its package.

7.5 Board Mechanical Drawing and Dimensions



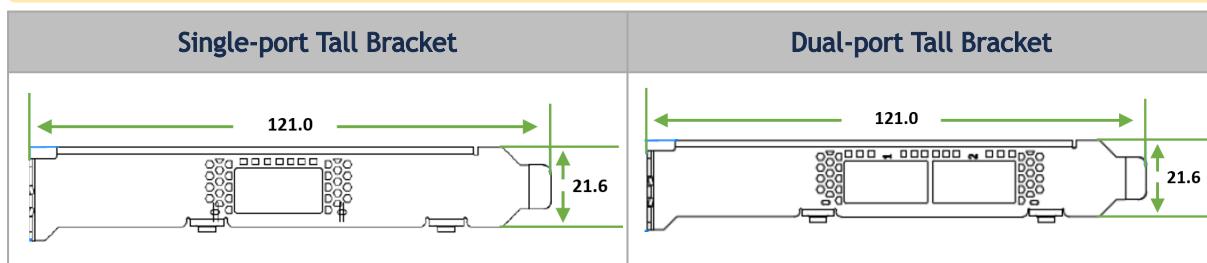
All dimensions are in millimeters. All the mechanical tolerances are +/- 0.1mm.



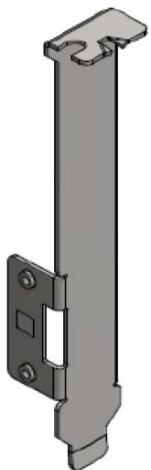
7.6 Bracket Mechanical Drawing



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



Auxiliary PCIe Connection Card Tall Bracket



8 Monitoring

8.1 Thermal Sensors

The adapter card incorporates the ConnectX IC, which operates in the range of temperatures between 0°C and 105°C.

Three thermal threshold definitions impact the overall system operation state:

- Warning - 105°C: On managed systems only: When the device crosses the 105°C threshold, a Warning Threshold message is issued by the management SW, indicating to system administration that the card has crossed the warning threshold. Note that this temperature threshold does not require nor lead to any action by hardware (such as adapter card shutdown).
- Critical - 115°C: When the device crosses this temperature, the firmware automatically shuts down the device.
- Emergency - 130°C: If the firmware fails to shut down the device upon crossing the critical threshold, the device automatically shuts down upon crossing the emergency (130°C) threshold.

The card's thermal sensors can be read through the system's SMBus. The user can read these thermal sensors and adapt the system airflow following the readouts and the needs of the above-mentioned IC thermal

8.2 Heatsink

The heatsink is attached to the ConnectX-6 IC in order to dissipate the heat from the ConnectX-6 IC. It is attached either by using four spring-loaded push pins that insert into four mounting holes or by screws.

ConnectX-6 IC has a thermal shutdown safety mechanism that automatically shuts down the ConnectX-6 card in cases of high-temperature events, improper thermal coupling, or heatsink removal.

For the required airflow (LFM) per OPN, please refer to [Specifications](#).

9 Finding the MAC on the Adapter Card

Each NVIDIA adapter card has a different identifier printed on the label: serial number and the card MAC for the Ethernet protocol.

- ⚠** The product revisions indicated on the labels in the following figures do not necessarily represent the latest revisions of the cards.

MCX614106A-CCAT Board Label (Example)



10 Document Revision History

Date	Description of Changes
Nov. 2023	Added the 100GBASE-CR2 protocol in Specifications tables
May. 2023	Updated Specifications to include non-operational storage temperature specifications
Aug. 2022	<ul style="list-style-type: none">• Updated the "Legacy (EOL) Ordering Part Numbers"• Added a note on the EEPROM memory component under the Features and Benefits table
Jan. 2022	Added table "Legacy (EOL) Ordering Part Numbers"
Jun. 2021	Updated " LED Interfaces "
Mar. 2021	Updated "Troubleshooting"
Jan. 2020	Migrated to on-line format; minor reorganization.
Feb. 2019	Updated power numbers in "Specifications"
Nov. 2018	First release

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