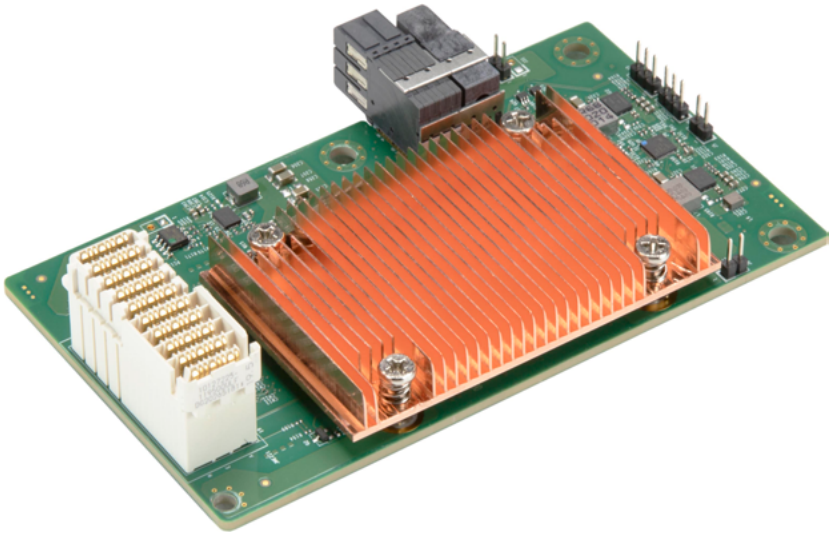




AOC-IBH-X6HS



User's Guide

Revision 1.0a

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Manual Revision 1.0a

Release Date: March 14, 2023

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Preface

About this User's Guide

This user's guide is written for system integrators, PC technicians, and knowledgeable PC users. It provides information for the installation and use of the AOC-IBH-X6HS add-on card.

About this Add-on Card

This product is sold only as part of an integrated solution with Supermicro server systems.

An Important Note to the User

All images and layouts shown in this user's guide are based upon the latest PCB revision available at the time of publishing. The card you have received may or may not look exactly the same as the graphics shown in this user's guide.

Returning Merchandise for Service

A receipt or copy of your invoice marked with the date of purchase is required before any warranty service will be rendered. You can obtain service by calling your vendor for a Returned Merchandise Authorization (RMA) number. When returning the add-on-card to the manufacturer, the RMA number should be prominently displayed on the outside of the shipping carton, and the shipping package is mailed prepaid or hand-carried. Shipping and handling charges will be applied for all orders that must be mailed when service is complete. For faster service, You can also request a RMA authorization online (<http://www.supermicro.com>).

This warranty only covers normal consumer use and does not cover damages incurred in shipping or from failure due to the alternation, misuse, abuse, or improper maintenance of products.

During the warranty period, contact your distributor first for any product problems.

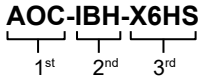
Conventions Used in the User's Guide

Pay special attention to the following symbols for proper system installation and to prevent damage to the system or injury to yourself:



Note: Additional information given to differentiate between various models or provides information for correct system setup.

Naming Convention



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Chapter 1


Overview

1-1 Overview

Congratulations on purchasing your add-on card from an acknowledged leader in the industry. Supermicro products are designed with the utmost attention to detail to provide you with the highest standards in quality and performance. For product support and updates, please refer to our website at <https://www.supermicro.com/en/products/superblade/networking>.

1-2 Key Features

The key features of this add-on card include:

- Supermicro Blade Mezzanine Card
- Mellanox ConnectX-6 VPI InfiniBand HDR controller
- Up to 200Gbps InfiniBand
- Virtual Protocol Interconnect (VPI)
- SR-IOV for virtualization
- NC-SI for remote management
- RDMA
- RoHS compliant 6/6 

1-3 Specifications

General

- Supermicro Blade Mezzanine Card
- Mellanox ConnectX-6 VPI InfiniBand HDR controller

InfiniBand

- IBTA specification 1.3 compliant
- RDMA, Send/Receive semantics
- Hardware-based congestion control
- 16 million I/O channels
- 256 to 4Kbyte MTU, 2Gbyte messages
- 8 virtual lanes + VL15
- HDR / HDR100 / EDR / FDR / QDR / DDR / SDR
- Atomic operations

Ethernet

- 200GbE / 100GbE / 50GbE / 40GbE / 25GbE / 10GbE / 1GbE
- IEEE 802.3bj, 802.3bm 100 Gigabit Ethernet
- IEEE 802.3by, Ethernet Consortium 25, 50 Gigabit Ethernet, supporting all FEC modes
- IEEE 802.3ba 40 Gigabit Ethernet
- IEEE 802.3ae 10 Gigabit Ethernet
- IEEE 802.3az Energy Efficient 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)

Enhanced Features

- Hardware-based reliable transport
- Collective operations offloads
- Vector collective operations offloads
- Mellanox PeerDirectT RDMA communication acceleration
- 64/66 encoding
- Extended Reliable Connected transport (XRC)
- Dynamically Connected transport (DCT)
- Enhanced Atomic operations
- Advanced memory mapping support, allowing user mode registration and re-mapping of memory (UMR)
- On demand paging (ODP) – registration free RDMA memory access
- MPI Tag Matching
- Rendezvous protocol offload
- Out-of-order RDMA supporting Adaptive Routing
- Burst buffer offload
- In-Network Memory registration-free RDMA memory access

CPU Offloads

- RDMA over Converged Ethernet (RoCE)
- TCP/UDP/IP stateless offload
- LSO, LRO, checksum offload
- Intelligent interrupt coalescence
- RSS (also on encapsulated packet), TSS, HDS, VLAN and MPLS tag insertion/stripping, Receive flow steering
- Data Plane Development Kit (DPDK) for kernel bypass applications
- Open vSwitch (OVS) offload using ASAP2
- Flexible match-action flow tables
- Tunneling encapsulation/decapsulation
- Header rewrite supporting hardware offload of NAT router

Storage Offloads

- Block-level encryption: XTS-AES 256/512 bit key
- NVMe over Fabric offloads for target machine
- T10 DIF - signature handover operation at wire speed, for ingress and egress traffic
- Storage Protocols: SRP, iSER, NFS RDMA, SMB Direct, NVMe-Of

Overlay Networks

- Stateless offloads for overlay networks and tunneling protocols
- Hardware offload of encapsulation and decapsulation of VXLAN, NVGRE, and GENEVE overlay networks
- RoCE over overlay networks

Hardware-Based I/O Features Virtualization

- Single root IOV
- Address translation and protection
- VMware NetQueue support

Virtualization

- SR-IOV: Up to 1K virtual functions
- SR-IOV: Up to 8 physical functions per host
- Virtualization hierarchies (e.g., NPAR)
- Virtualizing Physical Functions on a physical port
- SR-IOV on every Physical Function
- Configurable and user-programmable QoS
- Guaranteed QoS for VMs

Mellanox Multi-Host

- Independent PCIe interfaces to independent hosts
- Two PCIe x16 to two hosts, or four PCIe x8 to four hosts, or eight PCIe x4 to eight hosts
- Independent NC-SI SMBus interfaces
- Independent stand-by and wakeon-LAN signals
- Mellanox Multi-Host / Socket Direct – overcoming the QPI bottlenecks

HPC Software Libraries

- HPC-X, OpenMPI, MVAPICH, MPICH, OpenSHMEM, PGAS and varied commercial packages

Remote Boot

- Remote boot over InfiniBand, Ethernet, and iSCSI
- PXE and UEFI

Management Features

- NC-SI, MCTP over SMBus, and MCTP over PCIe - Baseboard Management Controller interface
- PLDM for Monitor and Control DSP0248
- PLDM for Firmware Update DSP026
- SDN management interface for managing the eSwitch
- I2C interface for device control and configuration
- General Purpose I/O pins
- SPI interface to flash
- JTAG IEEE 1149.1 and IEEE 1149.6

Operating System Support

- Linux
- Windows
- FreeBSD
- VMware

Power Consumption

- Typical power consumption: 21.1W
- Maximum power consumption: 21.1W

Operating Conditions

- Operating temperature: 0°C to 55°C (32°F to 131°F)
- Storage temperature: -40°C to 70°C (-40°F to 158°F)
- Storage humidity: 90% non-condensing relative humidity at 35°C

Physical Dimensions

- Card PCB dimensions: 75.1mm (2.95in) x 132mm (5.19in) x 2.31mm (0.09in) (W x L x D)

Supported Platforms

- Supermicro® SuperBlade motherboard with mezzanine slot



Note: This product is sold only as part of an integrated solution with Supermicro blade systems.

1-4 Available SKUs

SKUs	Part Number	Description
AOC-IBH-X6HS	AOC-IBH-X6HS	Mezzanine Card for InfiniBand HDR Single Port based on Mellanox ConnectX-6 VPI, RoHS

Chapter 2

Hardware Components

2-1 Add-On Card Image and Layout

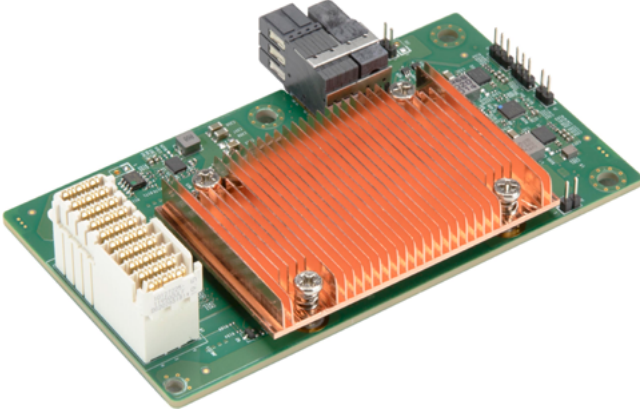


Figure 2-1. Image of AOC-IBH-X6HS

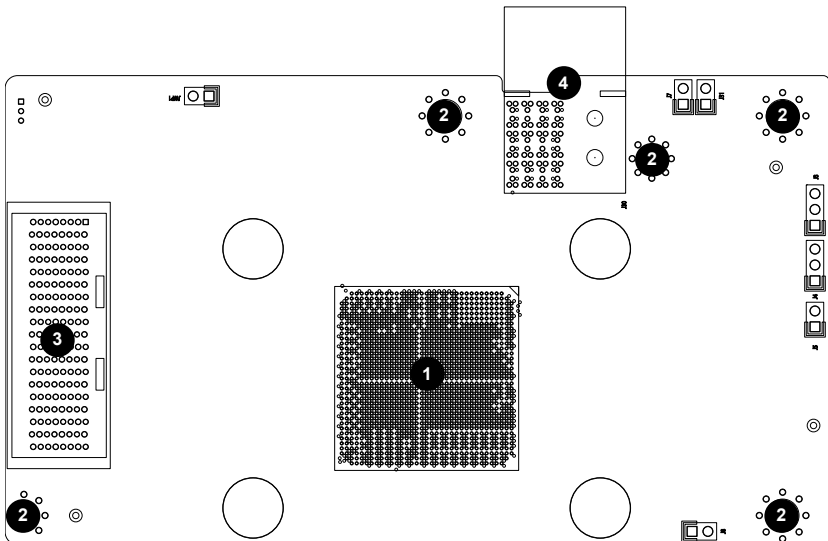


Figure 2-2. Layout of AOC-IBH-X6HS

1. Mellanox ConnectX-6 VPI InfiniBand HDR	3. ExaMEZZ® Connector
2. Mounting Holes	4. Board to Board Connector

2-2 Major Components

The following major components are built-in on the AOC-IBH-X6HS:

1. One (1) Mellanox ConnectX-6 VPI InfiniBand HDR controller
2. Five (5) Mounting Holes
3. One (1) ExaMEZZ Connector
4. One (1) Board to Board Connector

Chapter 3

Installation

3-1 Static-Sensitive Devices

Electrostatic Discharge (ESD) can damage electronic components. To avoid damaging your add-on card, it is important to handle it very carefully. The following measures are generally sufficient to protect your equipment from ESD.

Precautions

- Use a grounded wrist strap designed to prevent static discharge.
- Touch a grounded metal object before removing the add-on card from the antistatic bag.
- Handle the add-on card by its edges only; do not touch its components.
- Put the add-on card back into the antistatic bags when not in use.
- For grounding purposes, make sure that your system chassis provides excellent conductivity between the power supply, the case, the mounting fasteners and the add-on card.

Unpacking

The add-on card is shipped in antistatic packaging to avoid static damage. When unpacking your component or system, make sure you are static protected.



Note: To avoid damaging your components and to ensure proper installation, always connect the power cord last, and always unplug it before adding, removing, or changing any hardware components.

3-2 Before Installation

Before you install the add-on card, follow the instructions below.

1. Use industry-standard anti-static equipment such as gloves or a wrist strap and follow the precautions on [page 3-1](#) to avoid damage caused by ESD.
2. Familiarize yourself with the server, motherboard, and/or chassis documentation.
3. Confirm that your operating system includes the latest updates and hotfixes.

3-3 Add-on Card Installation

Follow the steps below to install the add-on card into your system.

Note: This add-on card does not support hot plug.

1. Remove the CPU Blade from the enclosure.
2. Position the add-on card in front of the corresponding slot on the motherboard and gently push the card until it slides into the slot.

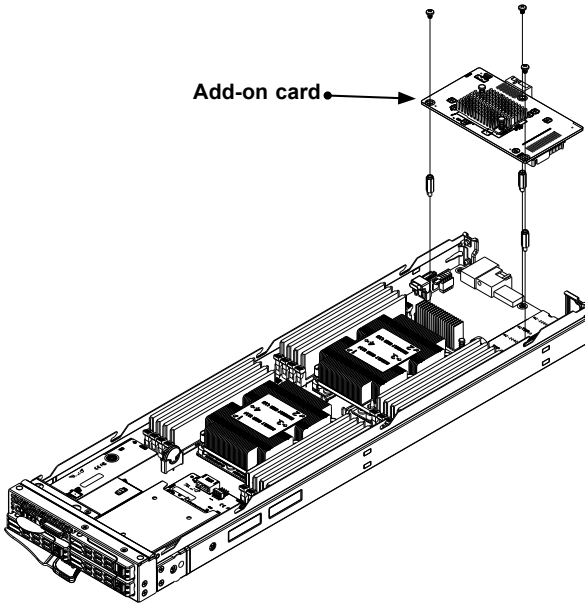


Figure 3-1. Installing the Add-on Card

3. Insert the screws into the add-on card's and motherboard's mounting holes.
4. Secure the add-on card and motherboard to the chassis using the screws.
Note: To avoid the motherboard being damaged, **DO NOT** overtighten the screws.
5. Re-insert the CPU Blade into the enclosure.

3-4 Installing Drivers on Windows

Follow the steps below to install the drivers for Windows.

1. Check for driver support at https://www.mellanox.com/support/firmware/winof_matrix?mtag=windows_sw_drivers.

Mellanox WinOF-2: Firmware - Driver Compatibility Matrix

Below is a list of the recommend Mellanox WinOF-2 driver / firmware sets for Mellanox products.

WinOF-2 Supported OS(s)	Driver Version	Device	Firmware Version
Windows Server SAC 1909 Windows Server 2019 Windows Server 2016 Windows Server 2012 R2 Windows Server 2012 Windows 10 Client 2004 (64 bit only) Windows 10 Client 1809 (64 bit only) Windows 10 Client 1607 (64 bit only) Windows 8.1 Client (64 bit only)	2.50.51000	BlueField™-2	24.28.2006 and above
		ConnectX®-6 Lx	26.28.2006 and above
		ConnectX®-6 Dx	20.28.2006 and above
		ConnectX®-6 VPI	20.28.2006 and above
		BlueField™	18.27.2006 and above
		ConnectX®-5 EN	16.28.2006 and above
		ConnectX®-5 VPI	16.28.2006 and above
		ConnectX®-4 Lx EN	14.28.2006 and above
		ConnectX®-4 VPI	12.28.2006 and above
		ConnectX®-4 EN	12.28.2006 and above

2. Visit the driver download website at <https://www.mellanox.com/products/adapt-er-software/ethernet/windows/winof-2>.
3. Save the file named MLNX_WinOF2-2_60_50000_All_x64.

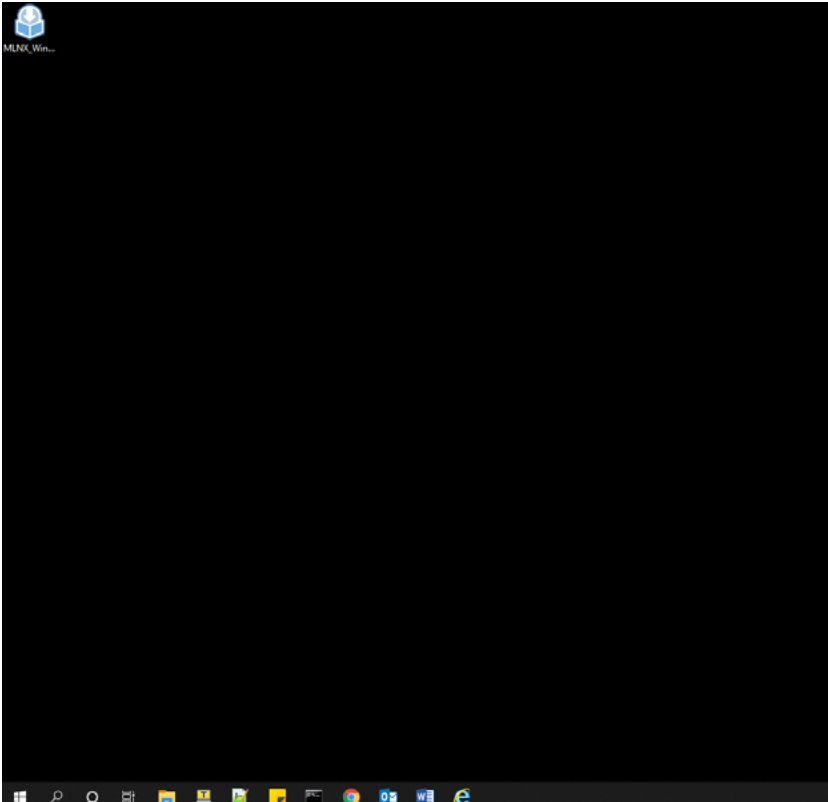


WinOF-2 Download Center

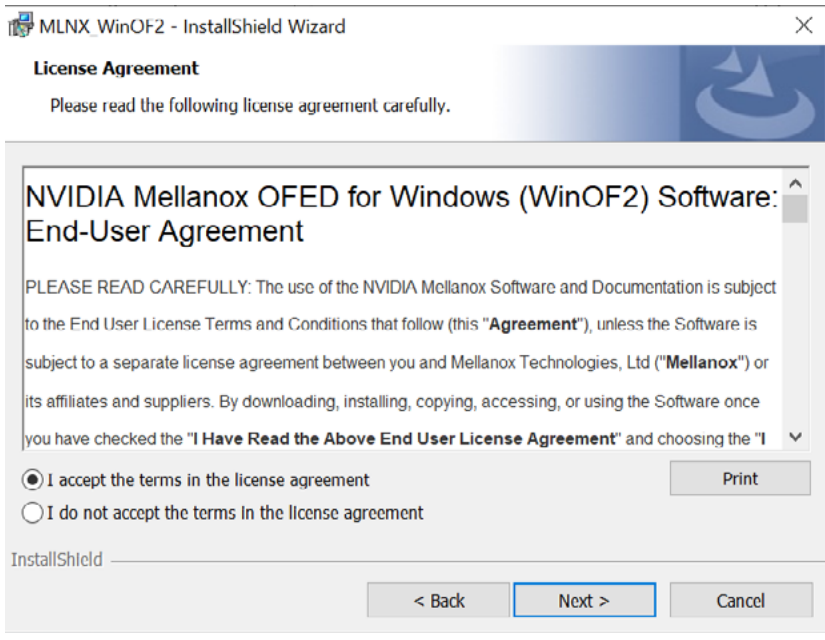
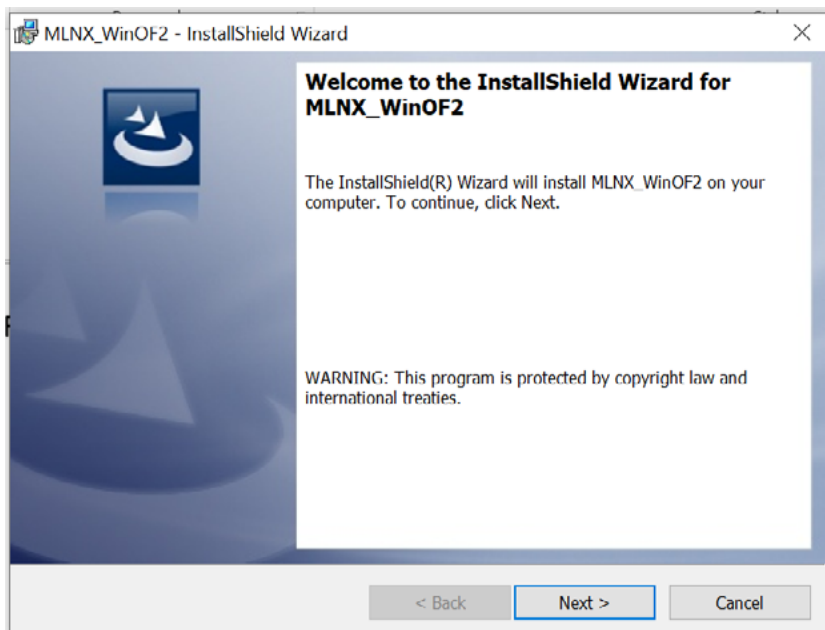
Current Versions | Archive Versions START OVER

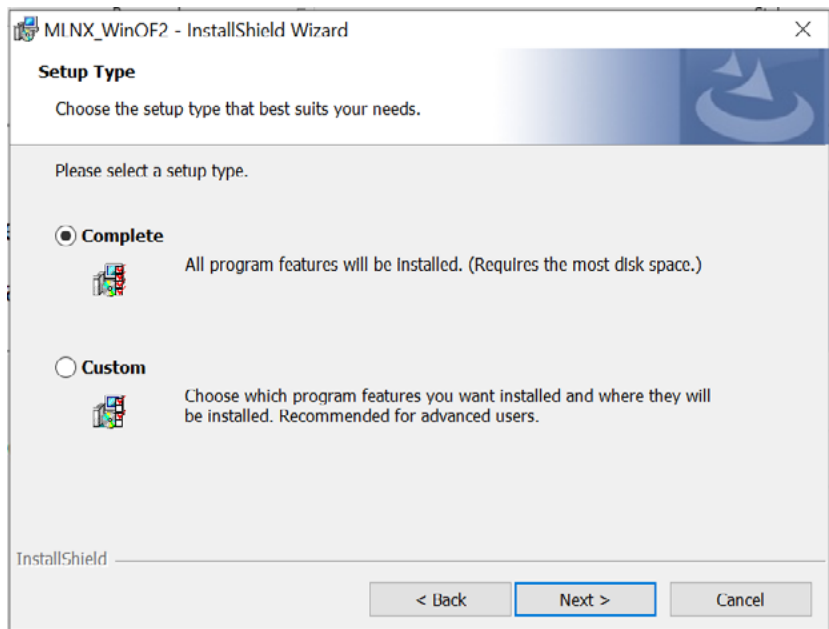
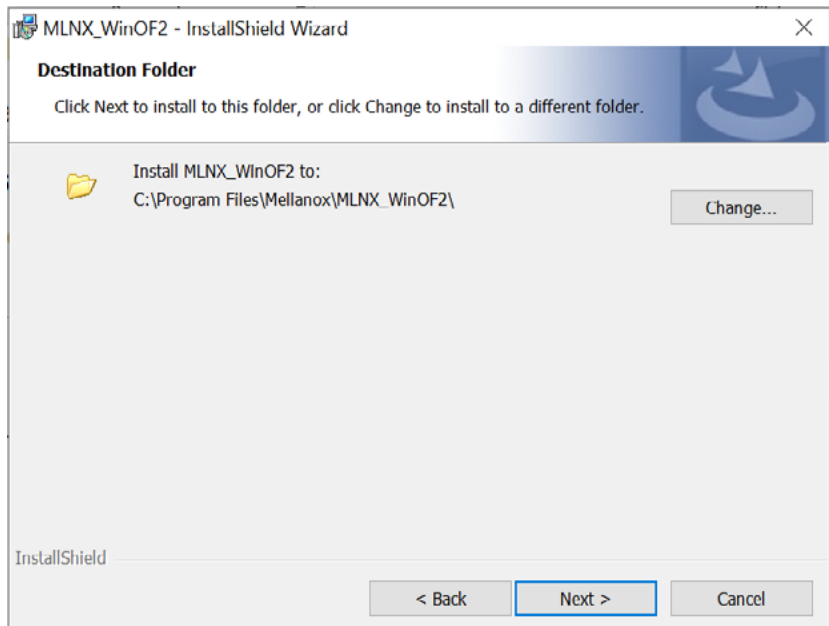
Version (Current)	OS Distribution	OS Distribution Version	Download / Documentation
2.60	Windows Server Windows Client	8.1 10 2004 10 1809 10 1607	<p>WinOF Driver: MLNX_WinOF2-2_60_50000_All_x64.exe</p> <p>MD5SUM: 6eb03c0c6648090bc3a7708c3e6b003</p> <p>SHA256: 2c6b28e4cff1011a130c524e95b610cc3e7a9603bd6f0dcca6a0e650bbdb32af</p> <p>Release Date: 47.5MB</p> <p>Documentation: Release Notes User Manual</p>

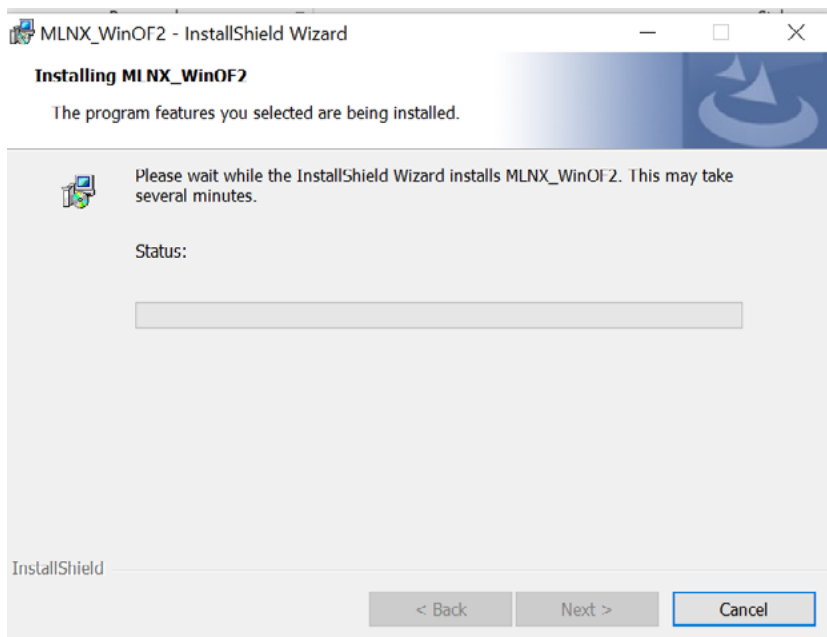
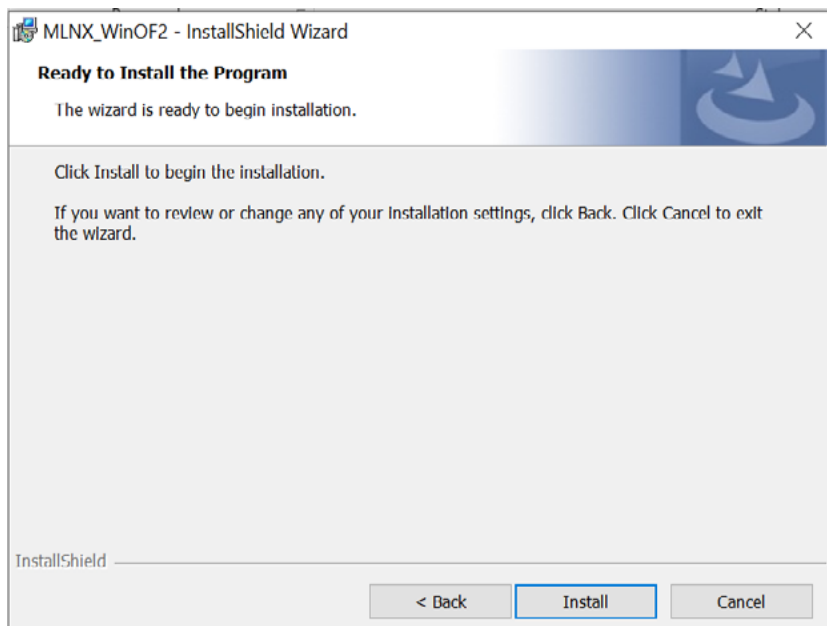
4. Execute MLNX_WinOF2-2_60_50000_All_x64.exe.

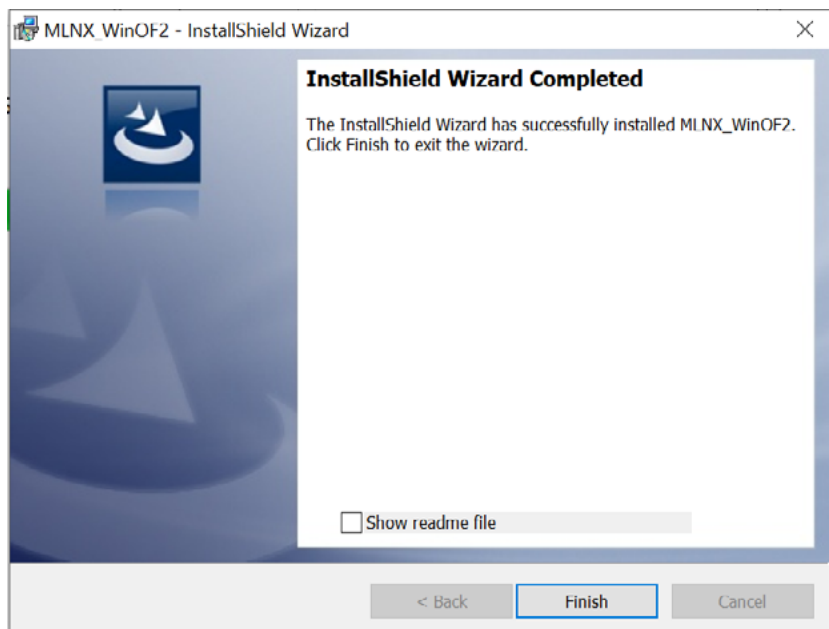
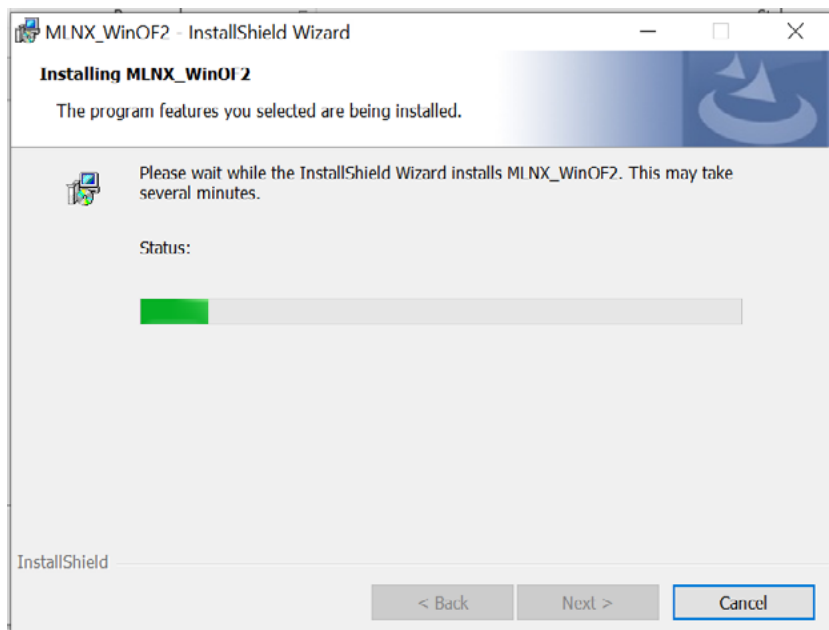


5. Follow the prompts to complete the installation.









3-5 Installing Drivers on Linux

Follow the steps below to install the drivers in Linux.

Build a Binary RPM Package

1. Run 'rpmbuild -tb <filename.tar.gz>'
2. Replace <filename.tar.gz> with the specific filename of the driver.

Note: For the build to work properly, the current running kernel MUST match the version and configuration of the installed kernel sources. If you have just recompiled the kernel, reboot the system at this time.

Follow the instructions below to build the driver manually.

1. Move the base driver tar file to the directory of your choice. For example:

```
/home/username/ixgbe
```

or

```
/usr/local/src/ixgbe
```

2. Untar/unzip the archive, where <x.x.x> is the version number for the driver tar file:

```
tar zxf ixgbe-x.x.x.tar.gz
```

3. Change to the driver src directory, where <x.x.x> is the version number for the driver tar:

```
cd ixgbe-x.x.x/src/
```

4. Compile the driver module:

```
make install
```

The binary will be installed as:

```
/lib/modules/[KERNEL_VERSION]/kernel/drivers/net/ixgbe/ixgbe.[k]o
```

The install locations listed above are the default locations. They may not be correct for certain Linux distributions. For more information, see the ldistrib.txt file included in the driver tar.

Note: IXGBE_NO_LRO is a compile time flag. The user can enable it at compile time to remove support for LRO from the driver. The flag is used by adding CFLAGS_EXTRA="-DIXGBE_NO_LRO" to the make file when it's being compiled.

```
make CFLAGS_EXTRA="-DIXGBE_NO_LRO" install
```

5. Load the module:

For kernel 2.6.x, use the modprobe command:

```
modprobe ixgbe <parameter>=<value>
```

For 2.6 kernels, the *insmod* command can be used if the full path to the driver module is specified. For example:

```
insmod /lib/modules/<KERNEL_VERSION>/kernel/drivers/net/  
ixgbe/ixgbe.ko
```

In addition, when using 2.6-based kernels, make sure that older ixgbe drivers are removed from the kernel before loading the new module. To do this, use:

```
rmmod ixgbe; modprobe ixgbe
```

6. Assign an IP address to the interface by entering the following, where x is the interface number:

```
ifconfig ethx <IP_address> netmask <netmask>
```

7. Verify that the interface works. Enter the following, where <IP_address> is the IP address for another machine on the same subnet as the interface that is being tested:

```
ping <IP_address>
```

3-6 Installing Drivers on FreeBSD

Follow the instructions below to install the drivers in FreeBSD kernel 4.8 or later. In the instructions below, x.x.x is the driver version as indicated in the name of the drive tar file.

Note: You must have kernel sources installed in order to compile the driver module.

1. Move the base driver tar file to the directory of your choice. For example, use `/home/username/ixgb` or `/usr/local/src/ixgb`.

2. Untar/unzip the archive:

```
tar xzf ixgb-x.x.x directory
```

3. To install man page:

```
cd ixgb-x.x.x
```

```
gzip -c ixgb.4 > /usr/share/man/man4/ixgb.4.gz
```

4. To load the driver onto a running system, perform the following steps:

```
cd ixgb-x.x.x
```

```
make
```

or

```
cd ixgb-x.x.x/src
```

```
make load
```

5. To assign an IP address to the interface, enter the following:

```
ifconfig ixgb<interface_num> <IP_address>
```

6. Verify that the interface works. Enter the following, where `<IP_address>` is the IP address for another machine on the same subnet as the interface that is being tested:

```
ping <IP_address>
```

7. If you want the driver to load automatically when the system is booted:

```
cd ixgb-x.x.x/src
make load
cp if_ixgb.ko /modules
```

Edit `/boot/loader.conf`, and add the following line:

```
if_ixgb_load="YES"
```

or

compile the driver into the kernel (see item 8). Edit `/etc/rc.conf`, and create the appropriate `ifconfig_ixgb<interface_num>` entry:

```
ifconfig_ixgb<interface_num>="<ifconfig_settings>"
```

Example usage:

```
ifconfig_ixgb0="inet 192.168.10.1 netmask 255.255.255.0"
```

8. If you want to compile the driver into the kernel, enter:

```
cd ixgb-x.x.x/src
mkdir /usr/src/sys/dev/ixgb
cp if_ixgb* /usr/src/sys/dev/ixgb
cp ixgb* /usr/src/sys/dev/ixgb
cp Makefile.kernel /usr/src/sys/modules/ixgb/Makefile
```

Edit the `/usr/src/sys/conf/files.i386` file, and add the following line:

```
dev/ixgb/ixgb_hw.c optional ixgb
dev/ixgb/ixgb_ee.c optional ixgb
dev/ixgb/if_ixgb.c optional ixgb
```

Remove the following lines from the `/usr/src/sys/conf/files.i386` file if they exist:

```
/dev/ixgb/if_ixgb_fx_hw.c optional ixgb
/dev/ixgb/if_ixgb_phy.c optional ixgb
```

Edit the kernel configuration file (i.e., `GENERIC` or `MYKERNEL`) in `/usr/src/sys/i386/conf`, and ensure the following line is present:

```
device ixgb
```

Compile and install the kernel. Reboot the system for the kernel updates to take effect.

3-7 Installing Drivers (for Mellanox ConnectX-6 VPI)

Use the procedures below to install drivers for Linux.

Linux Drivers

Use the following procedures to install drivers on the Linux operating system.

Installing InfiniBand Drivers for the Linux Operating System

1. Download the driver from the Supermicro CDR-NIC LAN driver CD, the Mellanox® Support website that contains the latest driver, or go to the Supermicro site at https://www.supermicro.com/wftp/Networking_Drivers/Mellanox/. Go to the following directory: Mellanox > Linux.
2. Choose the desired InfiniBand Linux driver package file.
3. Install the driver by entering the following commands:

```
tar xzvf MLNX_OFED_LINUX-<ver>.tgz
cd MLNX_OFED_LINUX-<ver>
./mlnxofedinstall --without-fw-update
```

This installs the Linux driver to your system. For more driver installation information, please refer to the Mellanox Support website.

Windows Drivers

Use the following procedures to install drivers on the Windows operating system.

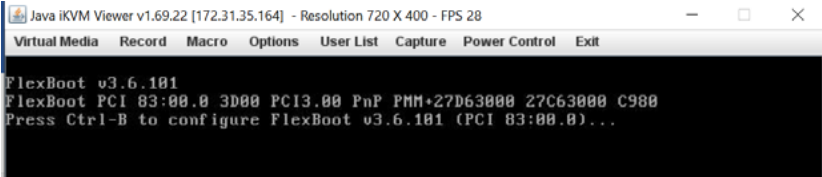
Installing InfiniBand Drivers for the Windows Operating System

1. Download the driver from the Supermicro CDR-NIC LAN driver CD, the Mellanox Support website that contains the latest driver, or go to the Supermicro site at https://www.supermicro.com/wftp/Networking_Drivers/Mellanox/. Go to the following directory: Mellanox > Windows.
2. Choose the desired InfiniBand Windows driver package file.
3. Double-click to run and install the driver package file.

3-8 Using the Mellanox Controller for PXE Boot

Please follow the instructions below to use PXE boot.

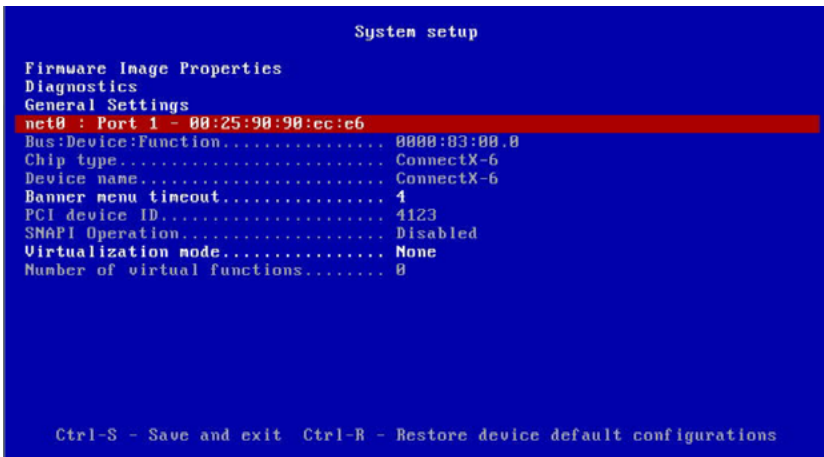
1. Boot up the system and wait for the FlexBoot v3.6.101 Message to appear.



```

Java iKVM Viewer v1.69.22 [172.31.35.164] - Resolution 720 X 400 - FPS 28
Virtual Media Record Macro Options User List Capture Power Control Exit
FlexBoot v3.6.101
FlexBoot PCI 83:00:0 3D00 PCI3.00 PnP PMM+27D63000 27C63000 C980
Press Ctrl-B to configure FlexBoot v3.6.101 (PCI 83:00:0)...
  
```

2. Press CTRL+B to enter the System setup page. When it appears, select "net0: Port1".



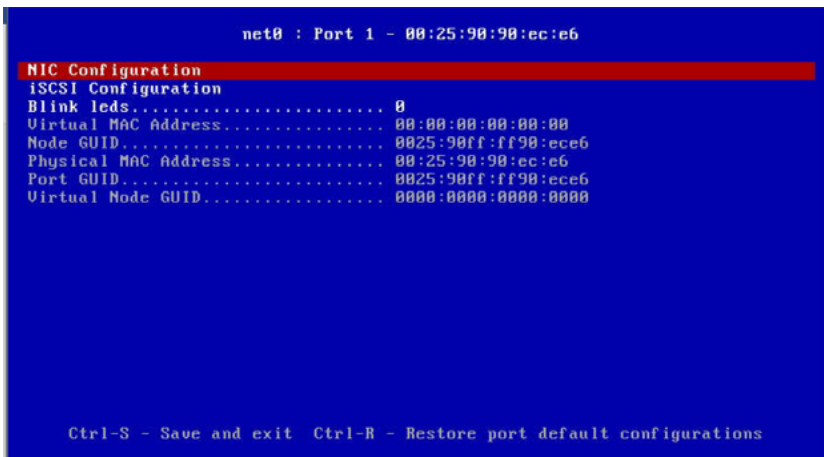
```

                          System setup

Firmware Image Properties
Diagnostics
General Settings
net0 : Port 1 - 00:25:90:90:ec:e6
Bus:Device:Function..... 0000:83:00:0
Chip type..... ConnectX-6
Device name..... ConnectX-6
Banner menu timeout..... 4
PCI device ID..... 4123
SMAPI Operation..... Disabled
Virtualization mode..... None
Number of virtual functions..... 0

Ctrl-S - Save and exit  Ctrl-R - Restore device default configurations
  
```

3. Click on "NIC Configuration".



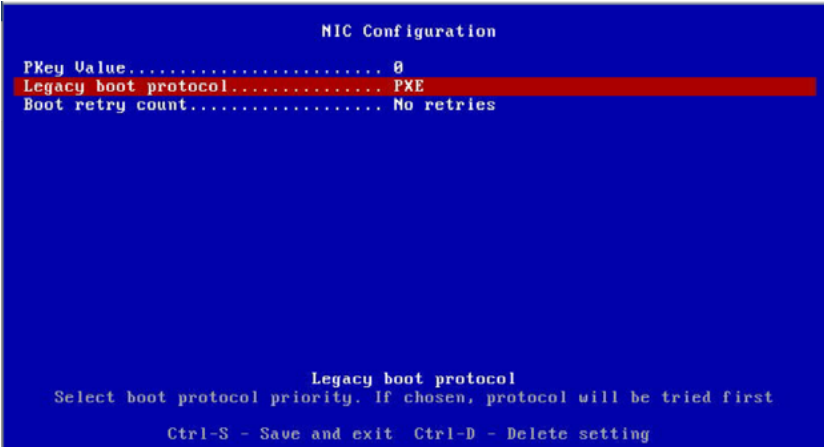
```

net0 : Port 1 - 00:25:90:90:ec:e6

NIC Configuration
iSCSI Configuration
Blink leds..... 0
Virtual MAC Address..... 00:00:00:00:00:00
Node GUID..... 0025:90ff:ff90:ec:e6
Physical MAC Address..... 00:25:90:90:ec:e6
Port GUID..... 0025:90ff:ff90:ec:e6
Virtual Node GUID..... 0000:0000:0000:0000

Ctrl-S - Save and exit  Ctrl-R - Restore port default configurations
  
```

4. Select "PXE" under "Legacy boot protocol", then press CTRL+S to save the setting.



5. Go to BIOS. From the top of the tool bar, select "Boot" to enter the submenu. Select "Network Drive BBS Priorities" and then select "FlexBoot v3.6.101..." under Boot Option #1.



6. To boot from PXE automatically, make sure Boot Option #1 is "Network: Flex boot" as the image shown below.

