ThinkSystem NVIDIA ConnectX-7 NDR InfiniBand OSFP400 Adapters

Product Guide

The ThinkSystem NVIDIA ConnectX-7 NDR InfiniBand OSFP400 Adapters offer 400 Gb/s InfiniBand connectivity for high-performance connectivity when running HPC, cloud, storage and machine learning applications.

The following figure shows the ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter (the standard heat sink has been removed in this photo).

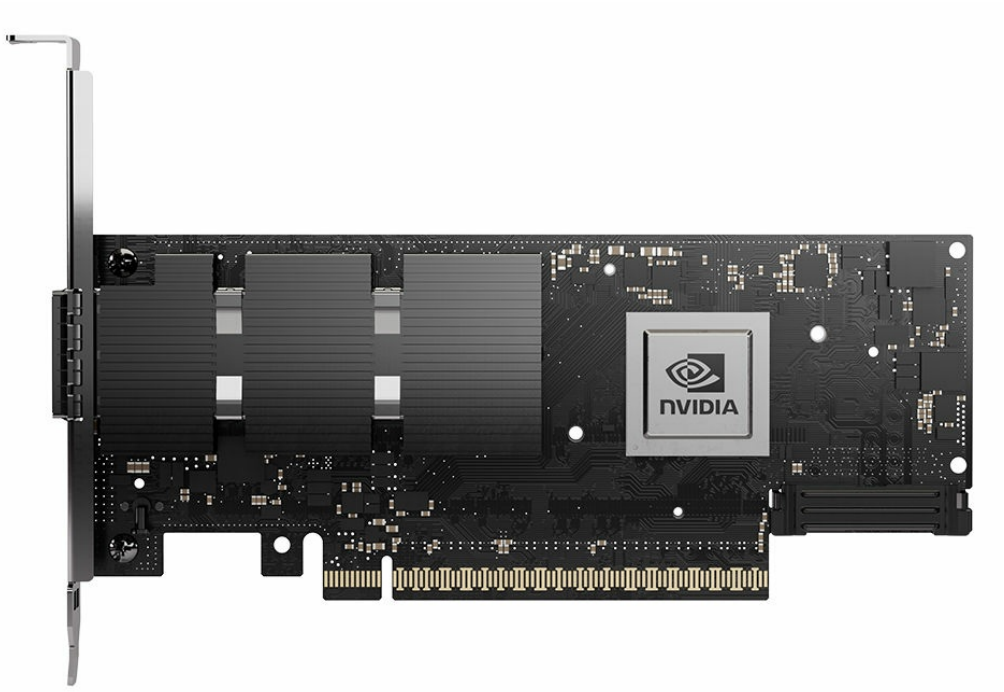


Figure 1. ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter

Did you know?

The ConnectX-7 NDR adapters are optimized to deliver accelerated networking for modern cloud, artificial intelligence, and traditional enterprise workloads. ConnectX-7 provides a broad set of software-defined, hardware-accelerated networking, storage, and security capabilities which enable organizations to modernize and secure their IT infrastructures.

Part number information

The following table shows the part numbers for the adapters.

CTO orders: For configure-to-order builds, these adapters are only available when you select one of the HPC & AI modes in the DCSC configurator. Not available in General Purpose mode of DCSC.

Table 1. Ordering information

Part number	Feature code	NVIDIA equivalent	Description
Air-cooled adapter			
4XC7A80289	BQ1N	MCX75510AAS-NEAT	ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter
Water-cooled adapters			
4XC7A86671	BKSN	MCX75510AAS-NEAT-DWC	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter DWC
4XC7A86670	BKSP	MCX75510AAS-NEAT-DWC	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter (SharedIO) DWC

Non-DWC adapter part numbers includes the following:

- One NVIDIA adapter with full-height (3U) adapter bracket attached
- Low-profile (2U) adapter bracket
- Documentation

Supported transceivers and cables

The ConnectX-7 NDR adapters have an empty OSFP400 cage for connectivity. The following table lists the supported transceivers.

Table 2. Transceivers for ConnectX-7 NDR adapters

Part number	Feature code	Description
400Gb transceivers		
4TC7A81826	BQJT	ThinkSystem NDR OSFP400 IB Multi Mode Solo-Transceiver

The following table lists the supported fiber optic cables and Active Optical Cables.

Table 3. Optical cables

Part number	Feature code	Description
NVIDIA NDR Multi Mode Fibre Cables		
4X97A81748	BQJN	Lenovo 3M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81749	BQJP	Lenovo 5M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81750	BQJQ	Lenovo 7M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81751	BQJR	Lenovo 10M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A81752	BQJS	Lenovo 20M NVIDIA NDR Multi Mode MPO12 APC Optical Cable
4X97A85349	BSN6	Lenovo 30M NVIDIA NDR Multi Mode MPO12 APC Optical Cable

The following table lists the supported direct-attach copper (DAC) cables.

Table 4. Copper cables

Part number	Feature code	Description
NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Splitter Copper Cables		
4X97A81827	BQJV	Lenovo 1M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable
4X97A81828	BQJW	Lenovo 1.5M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable
4X97A81829	BQJX	Lenovo 2M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable
4X97A81830	BQJY	Lenovo 3M NVIDIA NDRx2 OSFP800 to 2x NDR OSFP400 Passive Copper Splitter Cable

Features

The adapters have the following features:

- **Accelerated Networking and Security**

  ConnectX-7 provides a broad set of software-defined, hardware-accelerated networking, storage, and security capabilities which enable organizations to modernize and secure their IT infrastructures. Moreover, ConnectX-7 empowers agile and high-performance solutions from edge to core data centers to clouds, all while enhancing network security and reducing the total cost of ownership.

- **Accelerate Data-Driven Scientific Computing**

  ConnectX-7 provides ultra-low latency, extreme throughput, and innovative NVIDIA In-Network Computing engines to deliver the acceleration, scalability, and feature- rich technology needed for today's modern scientific computing workloads.

- **Accelerate Software- Defined Networking**

  NVIDIA ASAP^2 technology accelerates software-defined networking, delivering line-rate performance with no CPU penalty.

- **Provide Security from Edge to Core**

  Hardware engines in ConnectX-7 offload and accelerate security, with in-line encryption/decryption of TLS, IPsec, and MACsec.

- **Enhance Storage Performance**

  ConnectX-7 enables high- performance and efficient data storage by leveraging RDMA/RoCE, GPUDirect Storage, and hardware-based NVMe-oF offload engines.

- **SharedIO (4XC7A86670 only)**

  SharedIO (Shared I/O or Multi-Host) is an implementation of Sockets Direct that is offered in Lenovo direct water-cooled (DWC) servers such as the SD650 V3, where there are two server nodes per DWC tray. In this implementation, the ConnectX-7 adapter is installed in a PCIe slot in one node and the adapter is connected via a cable to a PCIe connector on the second node. The result is that the two nodes share the network connection of the adapter with significant savings both in the cost of the adapters but also the cost of switch ports.

Technical specifications

The adapters have the following technical specifications:

- Networking interfaces
  - One OSPF400 cage for 400 Gb/s connectivity
- InfiniBand connectivity
  - Support for InfiniBand NDR
  - InfiniBand Trade Association Spec 1.5 compliant
  - RDMA, send/receive semantics
  - 16 million input/output (IO) channels
  - 256 to 4Kbyte maximum transmission unit (MTU), 2Gbyte messages
- Enhanced InfiniBand Networking
  - Hardware-based reliable transport
  - Extended Reliable Connected (XRC)
  - Dynamically Connected Transport (DCT)
  - GPUDirect RDMA
  - GPUDirect Storage
  - Adaptive routing support
  - Enhanced atomic operations
  - Advanced memory mapping, allowing user mode registration (UMR)
  - On-demand paging (ODP), including registration-free RDMA memory access
  - Enhanced congestion control
  - Burst buffer offload
  - Single root IO virtualization (SR-IOV)
  - Optimized for HPC software libraries including: NVIDIA HPC-X, UCX, UCC, NCCL, OpenMPI, MVAPICH, MPICH, OpenSHMEM, PGAS
  - Collective operations offloads
  - Support for NVIDIA Scalable Hierarchical Aggregation and Reduction Protocol (SHARP)
  - Rendezvous protocol offload
  - In-network on-board memory
- Storage Accelerations
  - Block-level encryption: XTS-AES 256/512-bit key
  - NVMe over Fabrics (NVMe-oF)
  - NVMe over TCP (NVMe/TCP)
  - T10 Data Integrity Field (T10-DIF) signature handover
  - SRP, iSER, NFS over RDMA, SMB Direct
- Management and Control
  - NC-SI, MCTP over SMBus, and MCTP over PCIe
  - PLDM for Monitor and Control DSP0248
  - PLDM for Firmware Update DSP0267
  - PLDM for Redfish Device Enablement DSP0218
  - PLDM for FRU DSP0257
  - SPDM DSP0274
  - Serial Peripheral Interface (SPI) to flash
  - JTAG IEEE 1149.1 and IEEE 1149.6
- Remote Boot
  - Remote boot over InfiniBand
  - Remote boot over iSCSI
  - UEFI
  - PXE
- Cybersecurity
  - Inline hardware IPsec encryption and decryption: AES-GCM 128/256-bit key, IPsec over RoCE

    - Inline hardware TLS encryption and decryption: AES-GCM 128/256-bit key
    - Inline hardware MACsec encryption and decryption: AES-GCM 128/256-bit key
    - Platform security: secure boot with hardware root-of-trust, secure firmware update, flash encryption, and device attestation
- PCI Express Interface
    - PCIe Gen 5.0 x16 host interface
    - Support for PCIe bifurcation
    - SharedIO (NVIDIA Multi-Host) supports connection of up to two hosts (on supported water-cooled nodes only)
    - Transaction layer packet (TLP) processing hints (TPH)
    - PCIe switch Downstream Port Containment (DPC)
    - Support for MSI/MSI-X mechanisms
    - Advanced error reporting (AER)
    - Access Control Service (ACS) for peer-to-peer secure communication
    - Process Address Space ID (PASID)
    - Address translation services (ATS)
    - Support for SR-IOV

NVIDIA Unified Fabric Manager

NVIDIA Unified Fabric Manager (UFM) is InfiniBand networking management software that combines enhanced, real-time network telemetry with fabric visibility and control to support scale-out InfiniBand data centers.

The two offerings available from Lenovo are as follows:

- **UFM Telemetry** for Real-Time Monitoring
  The UFM Telemetry platform provides network validation tools to monitor network performance and conditions, capturing and streaming rich real-time network telemetry information, application workload usage, and system configuration to an on-premises or cloud-based database for further analysis.
- **UFM Enterprise** for Fabric Visibility and Control
  The UFM Enterprise platform combines the benefits of UFM Telemetry with enhanced network monitoring and management. It performs automated network discovery and provisioning, traffic monitoring, and congestion discovery. It also enables job schedule provisioning and integrates with industry-leading job schedulers and cloud and cluster managers, including Slurm and Platform Load Sharing Facility (LSF).

The following table lists the subscription licenses available from Lenovo.

Table 5. NVIDIA Unified Fabric Manager subscriptions

Part number	Feature code (7S02CTO1WW)	Description
UFM Telemetry		
7S02003HWW	S88D	UFM Telemetry 1-year License and Gold-Support for Lenovo clusters. Per node.
7S02003JWW	S88E	UFM Telemetry 3-year License and Gold-Support for Lenovo clusters. Per node.
7S02003KWW	S88F	UFM Telemetry 5-year License and Gold-Support for Lenovo clusters. Per node.
UFM Enterprise		
7S02003LWW	S88G	UFM Enterprise 1-year License and Gold-Support for Lenovo clusters. Per node.
7S02003MWW	S88H	UFM Enterprise 3-year License and Gold-Support for Lenovo clusters. Per node.
7S02003NWW	S88J	UFM Enterprise 5-year License and Gold-Support for Lenovo clusters. Per node.

For more information, see the following web page:
https://www.nvidia.com/en-us/networking/infiniband/ufm/

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 6. Server support (Part 1 of 3)

Part Number	Description	Edge		1S Intel V2			AMD V3					Intel V3					Dense V3			
		SE350 (7Z46 / 7D1X)	SE450 (7D8T)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)	SR635 V3 (7D9H / 7D9G)	SR655 V3 (7D9F / 7D9E)	SR645 V3 (7D9D / 7D9C)	SR665 V3 (7D9B / 7D9A)	SR675 V3 (7D9Q / 7D9R)	ST650 V3 (7D7B / 7D7A)	SR630 V3 (7D72 / 7D73)	SR650 V3 (7D75 / 7D76)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SD665 V3 (7D9P)	SD665-N V3 (7DAZ)	SD650 V3 (7D7M)	SD650-I V3 (7D7L)
4XC7A80289	ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N
4XC7A86671	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter DWC	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y
4XC7A86670	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter (SharedIO) DWC	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N

Table 7. Server support (Part 2 of 3)

Part Number	Description	2S Intel V2				AMD V1					Dense V2				4S V2		8S	4S V1		
		ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)	SR670 V2 (7Z22 / 7Z23)	SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR655 Client OS	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)	SD630 V2 (7D1K)	SD650 V2 (7D1M)	SD650-N V2 (7D1N)	SN550 V2 (7Z69)	SR850 V2 (7D31 / 7D32)	SR860 V2 (7Z59 / 7Z60)	SR950 (7X11 / 7X12)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)
4XC7A80289	ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XC7A86671	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter DWC	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XC7A86670	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter (SharedIO) DWC	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 8. Server support (Part 3 of 3)

Part Number	Description	1S Intel V1				2S Intel V1								Dense V1			
		ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)	ST550 (7X09 / 7X10)	SR530 (7X07 / 7X08)	SR550 (7X03 / 7X04)	SR570 (7Y02 / 7Y03)	SR590 (7X98 / 7X99)	SR630 (7X01 / 7X02)	SR650 (7X05 / 7X06)	SR670 (7Y36 / 7Y37)	SD530 (7X21)	SD650 (7X58)	SN550 (7X16)	SN850 (7X15)
4XC7A80289	ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XC7A86671	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter DWC	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4XC7A86670	ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter (SharedIO) DWC	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Operating system support

The adapters support the operating systems listed in the following tables.

- ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter, 4XC7A80289
- ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter DWC, 4XC7A86671
- ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-Port PCIe Gen5 x16 InfiniBand Adapter (SharedIO) DWC, 4XC7A86670

Tip: These tables are automatically generated based on data from Lenovo ServerProven.

Table 9. Operating system support for ThinkSystem Nvidia ConnectX-7 NDR OSFP400 1-port PCIe Gen5 x16 InfiniBand Adapter, 4XC7A80289

Operating systems	SR630 V3	SR635 V3	SR645 V3	SR650 V3	SR655 V3	SR665 V3
Microsoft Windows Server 2019	Y	Y	Y	Y	Y	Y
Microsoft Windows Server 2022	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.6	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 8.7	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 9.0	Y	Y	Y	Y	Y	Y
Red Hat Enterprise Linux 9.1	Y	Y	Y	Y	Y	Y
SUSE Linux Enterprise Server 15 SP4	Y	Y	Y	Y	Y	Y
Ubuntu 22.04 LTS	Y	Y	Y	Y	Y	Y
VMware vSphere Hypervisor (ESXi) 8.0 U1	Y [1]	N	N	N	N	N

[1] For limitation, please refer Support TIP 104278

Table 10. Operating system support for ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-port PCIe Gen5 x16 InfiniBand Adapter DWC, 4XC7A86671

Operating systems	SD650 V3
Red Hat Enterprise Linux 8.6	Y
Red Hat Enterprise Linux 9.0	Y
SUSE Linux Enterprise Server 15 SP4	Y
Ubuntu 22.04 LTS	Y

Table 11. Operating system support for ThinkSystem NVIDIA ConnectX-7 NDR OSFP400 1-port PCIe Gen5 x16 InfiniBand Adapter (SharedIO) DWC, 4XC7A86670

Operating systems	SD650 V3
Red Hat Enterprise Linux 8.6	Y
Red Hat Enterprise Linux 9.0	Y
SUSE Linux Enterprise Server 15 SP4	Y
Ubuntu 22.04 LTS	Y

Regulatory approvals

The adapters have the following regulatory approvals:

- Safety: CB / cTUVus / CE
- EMC: CE / FCC / VCCI / ICES / RCM / KC
- RoHS: RoHS Compliant

Operating environment

The adapters have the following operating characteristics:

- Maximum power available through OSFP port: 17W
- Temperature
  - Operational: 0°C to 55°C
  - Non-operational: -40°C to 70°C
- Humidity: 90% relative humidity

Warranty

One year limited warranty. When installed in a Lenovo server, the adapter assumes the server's base warranty and any warranty upgrades.

Related publications

For more information, refer to these documents:

- Networking Options for ThinkSystem Servers:
  https://lenovopress.com/lp0765-networking-options-for-thinksystem-servers
- ServerProven compatibility:
  http://www.lenovo.com/us/en/serverproven
- NVIDIA InfiniBand product page:
  https://www.nvidia.com/en-us/networking/infiniband-adapters/
- ConnectX-7 user manual:
  https://docs.nvidia.com/networking/display/ConnectX7VPI/Specifications

Related product families

Product families related to this document are the following:

- InfiniBand & Omni-Path Adapters

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