ConnectX®-6 Dx Ethernet SmartNIC

Smart Network Interface Cards

Industry's most secure and advanced cloud network interface cards (NIC), accelerating mission-critical data-center applications, e.g., security, virtualization, SDN/NFV, big data, machine learning, and storage, and delivering the highest return on investment (ROI)

Providing up to two ports of 100Gb/s or single-port of 200Gb/s Ethernet connectivity, ConnectX-6 Dx is a member of Mellanox's world-class, award-winning ConnectX series of network adapters. Powered by leading 50Gb/s (PAM4) and 25/10 Gb/s (NRZ) SerDes technology and novel capabilities that accelerate cloud and data-center payloads.

Security From Zero Trust to Hero Trust

In an era where privacy of information is key and zero trust is the rule, ConnectX-6 Dx adapters offer a range of advanced built-in capabilities that bring security down to the end-points with unprecedented performance and scalability, including:

Crypto – IPsec and TLS data-in-motion inline encryption and decryption offload, and AES-XTS block-level data-at-rest encryption and decryption offload.

Probes & DoS Attacks Protection – ConnectX-6 Dx enables a hardware-based L4 firewall by ASAP² offloading of stateful connection tracking.

NIC Security – Hardware Root-of-Trust (RoT) Secure Boot and secure firmware update using RSA cryptography, and cloning-protection, via a device-unique secret key.

Advanced Virtualization

ConnectX-6 Dx delivers another level of innovation to enable building highly efficient virtualized cloud data centers:

Virtualization – Mellanox ASAP² - Accelerated Switch and Packet Processing® technology for vSwitch/vRouter hardware offload, delivers orders of magnitude higher performance vs. software-based solutions. ConnectX-6 Dx ASAP² offers both SR-IOV and VirtIO in-hardware offload capabilities, and supports up to 8 million rules.

Advanced Quality of Service – Includes traffic shaping, and classification-based data policing.

Industry-leading RoCE

Following the Mellanox ConnectX tradition of industry-leading RoCE capabilities, ConnectX-6 Dx adds another layer of innovation to enable more scalable, resilient and easy-to-deploy RoCE solutions.

Zero Touch RoCE – Simplifying RoCE deployments ConnectX-6 Dx allows RoCE payloads to run seamlessly on existing networks without requiring special configuration on the network (no PFC, no ECN). ConnectX-6 Dx's new features ensure resiliency and efficiency at scale of such deployments.

Configurable Congestion Control – API to build user-defined congestion control algorithms, best serving various environments and RoCE and TCP/IP traffic patterns.

Efficient Storage Solutions

With its NVMe-oF target and initiator offloads, ConnectX-6 Dx brings further optimization to NVMe-oF, enhancing CPU utilization and scalability. Additionally, ConnectX-6 Dx supports hardware offload for ingress/egress of T10-DIF/PI/CRC32/CRC64 signatures, as well as AES-XTS encryption/decryption offload enabling user-based key management and a one-time-FIPS-certification approach.

Wide Selection of NICs

ConnectX-6 Dx NICs are available in several form factors including low-profile PCIe, OCP2.0 and OCP3.0 cards, with various network connection types (SFP28/56, QSFP28/56, or SFP-DD). The ConnectX-6 Dx portfolio also provides options for Mellanox Multi-Host® and Mellanox Socket Direct® configurations.

Mellanox Multi-Host® connects multiple compute or storage hosts to a single interconnect adapter and enables designing and building new scale-out compute and storage racks. This enables better power and performance management, while reducing capital and operational expenses.

Mellanox Socket Direct® Technology brings improved performance to multi-socket servers, by enabling each CPU in a multi-socket server to directly connect to the network through its dedicated PCIe interface. This enables data to bypass the QPI (UPI) and the other CPU, improving latency, performance and CPU utilization.

HIGHLIGHTS

SmartNIC Portfolio

- 1/10/25/40/50/100/200 Gb/s Ethernet, PAM4/NRZ
- Various form factors:
  - PCIe low-profile
  - OCP 3.0 Small Form Factor (SFF)
  - OCP 2.0
- Connectivity options:
  - SFP28, SFP56, QSFP28, QSFP56, SFP-DD
- PCIe Gen 3.0/4.0 x16 host interface
- Multi host and single host flavors
- Crypto and non-crypto versions

Features

- Up to 200Gb/s bandwidth
- Message rate of up to 215Mpps
- Sub 0.8usec latency
- Flexible programmable pipeline for new network flows
- Mellanox Multi-Host with advanced QoS
- ASAP² - Accelerated Switching and Packet Processing for virtual switches/routers
- Overlay tunneling technologies
- IPsec and TLS in-line crypto acceleration
- Block crypto acceleration for data-at-rest
- Hardware Root-of-Trust and secure firmware update
- Connection Tracking offload
- Advanced RoCE capabilities
- Best in class PTP for TSN applications
- GPUDirect® for GPU-to-GPU communication
- Host chaining technology for economical rack design
- Platform agnostic: x86, Power, Arm
- ODCC compatible

Solutions

- Cloud-native, Web 2.0, hyperscale
- Enterprise data-centers
- Cyber security
- Big data analytics
- Scale-out compute and storage infrastructure
- Telecom and Network Function Virtualization (NFV)
- Cloud storage
- Machine Learning (ML) & Artificial intelligence (AI)
- Media and Entertainment

† For illustration only. Actual products may vary.

Features*

Virtualization
- VirtIO in-hardware
- Single Root IOV
  - 1K VFs per port
  - 64 PFs (16 per host)
- VMware NetQueue support
- Per VM QoS
- Hardware offloads
  - Connection tracking
  - Header rewrite
  - Stateless offloads for overlay network tunneling protocols
  - Encapsulation and decapsulation of VXLAN, NVGRE, GENEVE and more overlay networks

Cyber Security
- IPsec encryption and decryption
  - AES-GCM 128/256 bit key
- TLS encryption and decryption
  - AES-GCM 128/256 bit key
- AES-XTS data-at-rest encryption and decryption
- AES-GCM 128/256 bit key
- Hardware root-of-trust for Secure Boot
- Secure firmware update

Networking Offloads
- TCP/UDP/IP stateless offload
- LSO, LRO, checksum offload
- RSS (also on encapsulated packet), TSS, VLAN and MPLS tag insertion/stripping, Receive flow steering

Networking Accelerations
- Data Plane Development Kit (DPDK)
- Hardware-based and software-enabled XDP acceleration

Storage
- NVMe over Fabric offloads for target
- Storage protocols: SRP, iSER, NFSoRDMA, SMB Direct, NVMe-oF and more
- T10 DIF - signature handover
- CRC16, CRC32 and CRC64 signature offloads

Time Seventieths Networking (PTP)
- Clock synchronization accuracy better than 16ns
- Software controlled hardware clock
- Full wire-speed hardware time stamping
- PPS in/out with programmable frequency
- High precision oscillator options
- Accurate package scheduling
- IEEE 1588v2 (PTP)
  - Supports OC, SC, BC, MC PTP clocks
  - One & two step sync methods
  - E2E and P2P
  - Integrated with any PTP daemon

RDMA over Converged Ethernet (RoCE)
- Zero-touch Network configuration
- Selective Repeat
- Programmable congestion control mechanism
- Mellanox PeerDirect® RDMA (aka GPUDirect®)
- Dynamically Connected transport (DCT)
- Burst buffer offload
- RoCE over overlay networks

Management & Control
- NC-SI, MCTP over SMBus and MCTP over PCIe - Baseboard Management Controller interface
- PLDM for Monitor and Control DSP0248
- PLDM for Firmware Update DSP026
- I2C interface for device control and configuration

Media & Entertainment
- SMPTE 2110 streaming offload
  - 2110-10, 20 ,21N, 30, 40, 50
  - ST2022-6/7
  - SMPTE ST-2059-2 PTP profile
  - Windows and Linux OS support

Mellanox Multi-Host**
- Independent PCIe interfaces to independent hosts
- Two PCIe x8 to two hosts, or four PCIe x4 to four hosts
- Mellanox Multi-Host congestion handling
- Independent SMBus interfaces
- Independent stand-by and wake-on-LAN signals
- Supports ECN marking capability in the hardware

Remote Boot
- Remote boot over Ethernet
- Remote boot over iSCSI
- UEFI support
- PXE Boot

Host Interface
- PCIe Gen 4.0, 3.0, 2.0, 1.1
- 2.5, 5.0, 8, 16GT/s link rate
- 16 lanes of PCIe
- Support for PCIe x1, x2, x4, x8, and x16 configurations
- Mellanox Socket Direct® for overcoming QPI bottlenecks in multi-socket servers
- Advanced Error Reporting (AER)
- Access Control Service (ACS) for peer-to-peer secure communication
- Process Address Space ID (PASID) Address Translation Services (ATS)
- IBM CAPIv2 (Coherent Accelerator Processor Interface)
- Support for MSI/MSI-X mechanisms

Standards*

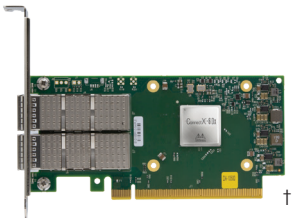
- IEEE 802.3bs, 200 Gigabit Ethernet
- IEEE 802.3cd, 50, 100 and 200 Gigabit Ethernet
- IEEE 802.3bj, 802.3bm 100 Gigabit Ethernet
- IEEE 802.3by, 25, 50 Gigabit Ethernet supporting all FEC modes
- IEEE 802.3ba 40 Gigabit Ethernet
- IEEE 802.3ae 10 Gigabit Ethernet
- IEEE 802.3az Energy Efficient Ethernet (supports only "Fast-Wake" mode)
- 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 802.1Qaz (ETS)
- IEEE 802.1Qbb (PFC)
- IEEE 802.1Qbg
- 25/50 Ethernet Consortium "Low Latency FEC" for 50GE/100GE/200GE PAM4 links
- PCI Express Gen 3.0 and 4.0

* This section describes hardware features and capabilities. Please refer to the driver and firmware release notes for feature availability.
** When using Mellanox Socket Direct or Mellanox Multi-Host in virtualization or dual-port use cases, some restrictions may apply. For further details, contact Mellanox Customer Support.

Card Portfolio & Ordering Information

Table 1 - PCIe HHHL Form Factor

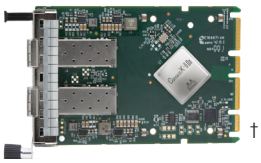
Max Network Speed	Interface Type	Supported Ethernet Speeds [GbE]	Host Interface [PCIe]	OPNs Without Crypto	OPNs With Crypto[1]
2x25 GbE	SFP28	1/10/25	Gen4.0 x8	MCX621102AN-ADAT	MCX621102AC-ADAT
			Gen4.0 x16	MCX623102AN-ADAT	MCX623102AC-ADAT
2x50 GbE	SFP56	1/10/25/50	Gen4.0 x16	MCX623102AN-GDAT	MCX623102AC-GDAT
2x100 GbE	QSFP56	1/10/25/40/50[3]/100[4]	Gen4.0 x16	MCX623106AN-CDAT	MCX623106AC-CDAT
	SFP-DD	1/10/25/50[3]/100	Gen4.0 x16	Contact Mellanox	Contact Mellanox
	DSFP		Gen4.0 x16	Contact Mellanox	Contact Mellanox
1x 200 GbE	QSFP56	10/25/40/50[3]/100[4]/200	Gen4.0 x16	MCX623105AN-VDAT	MCX623105AC-VDAT


†

1. OPNs with Crypto enabled are also with Secure Boot and secure firmware update.
2. Contact Mellanox for other supported options.
3. 50G can be supported as either 2x25G NRZ or 1x50G PAM4 when using QSFP56.
4. 100G can be supported as either 4x25C NRZ or 2x50G PAM4 when using QSFP56.
5. By default, the above products are shipped with a tall bracket mounted; a short bracket is included as an accessory.

Table 2 - OCP 3.0 Small Form Factor

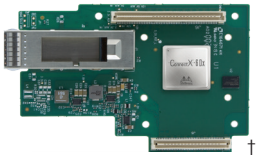
Max Network Speed	Interface Type	Supported Ethernet Speeds [GbE]	Host Interface [PCIe]	OPNs Without Crypto	OPNs With Crypto[1]
2x25 GbE	SFP28	1/10/25	Gen4.0 x16	MCX623432AN-ADAB	MCX623432AC-ADAB
2x50 GbE	SFP56	1/10/25/50	Gen4.0 x16	MCX623432AN-GDAB	MCX623432AC-GDAB
2x100 GbE	QSFP56	1/10/25/40/50[5]/100[6]	Gen4.0 x16	MCX623436AN-CDAB	MCX623436AC-CDAB
1x200 GbE	QSFP56	1/10/25/40/50[5]/100[6]/200	Gen4.0 x16	MCX623435AN-VDAB	MCX623435AC-VDAB


†

1. OPNs with Crypto enabled are also with Secure Boot and secure firmware update.
2. Above OPNs are Single Host; contact Mellanox for OCP OPNs with Mellanox Multi-Host support.
3. The above OCP3.0 OPNs come with Thumbscrew (pull tab) brackets; contact Mellanox for additional bracket types, such as Internal Lock or Ejector latch.
4. Contact Mellanox for other supported options.
5. 50G can be supported as either 2x25G NRZ or 1x50G PAM4 when using QSFP56.
6. 100G can be supported as either 4x25G NRZ or 2x50G PAM4 when using QSFP56.

Table 3 - OCP 2.0 Form Factor

Max Network Speed	Interface Type	Supported Ethernet Speeds [GbE]	Host Interface [PCIe]	OPNs Without Crypto	OPNs With Crypto[1]
1x100 GbE	QSFP56	1/10/25/40/50[5]/100[6]	Gen 4.0 x16	MCX623405AN-CDAN	MCX623405AC-CDAN
1x200 GbE	QSFP56	1/10/25/40/50[5]/100[6]/200	Gen 4.0 x16	Contact Mellanox	Contact Mellanox


†

1. OPNs with Crypto enabled are also with Secure Boot and secure firmware update.
2. Above OPNs are Single Host; contact Mellanox for OCP OPNs with Mellanox Multi-Host or Mellanox Socket Direct support.
3. ConnectX-6 Dx PCIe 4.0 cards are backward compatible.
4. Contact Mellanox for other supported options.
5. 50G can be supported as either 2x25G NRZ or 1x50G PAM4 when using QSFP56.
6. 100G can be supported as either 4x25G NRZ or 2x50G PAM4 when using QSFP56.

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