



# ConnectX<sup>®</sup>-4 EN Card

## 100Gb/s Ethernet Adapter Card



### Single/Dual-Port 100-Gigabit Ethernet Adapter Cards

Mellanox ConnectX<sup>®</sup>-4 EN network controller cards with 100Gb/s Ethernet connectivity provides a high performance and flexible solution for Web 2.0, Cloud, data analytics, database, and storage platforms.

With the exponential growth of data being shared and stored by applications and social networks, the need for high-speed and high performance compute and storage data centers is skyrocketing. ConnectX-4 EN provides high performance for demanding data centers, public and private clouds, Web 2.0 and Big Data applications, and storage systems, enabling today's corporations to meet the demands of the data explosion.

ConnectX-4 EN provides an unmatched combination of 100Gb/s bandwidth in a single port, low latency, and specific hardware offloads, addressing both today's and the next generation's compute and storage data center demands.

### I/O Virtualization

ConnectX-4 EN SR-IOV technology provides dedicated adapter resources and guaranteed isolation and protection for virtual machines (VMs) within the server. I/O virtualization with ConnectX-4 EN gives data center administrators better server utilization while reducing cost, power, and cable complexity, allowing more Virtual Machines and more tenants on the same hardware.

### Overlay Networks

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. While this solves network scalability issues, it hides the TCP packet from the hardware offloading engines, placing higher loads on the host CPU. ConnectX-4 effectively addresses this by providing advanced NVGRE and GENEVE hardware offloading engines that encapsulate and de-encapsulate the overlay protocol headers, enabling the traditional offloads to be performed on the encapsulated traffic. With ConnectX-4, data center operators can achieve native performance in the new network architecture.

### RDMA over Converged Ethernet (RoCE)

ConnectX-4 EN supports RoCE specifications delivering low-latency and high-performance over Ethernet networks. Leveraging data center bridging (DCB) capabilities as well as ConnectX-4 EN advanced congestion control hardware mechanisms, RoCE provides efficient low-latency RDMA services over Layer 2 and Layer 3 networks.

## HIGHLIGHTS

### NEW FEATURES

- 100Gb/s Ethernet per port
- 1/10/25/40/50/56/100 Gb/s speeds
- Single and dual-port options available
- T10-DIF Signature Handover
- CPU offloading of transport operations
- Application offloading
- Mellanox PeerDirect communication acceleration
- Hardware offloads for NVGRE, VXLAN and GENEVE encapsulated traffic
- End-to-end QoS and congestion control
- Hardware-based I/O virtualization
- RoHS compliant
- ODCC compatible

### BENEFITS

- High performance silicon for applications requiring high bandwidth, low latency and high message rate
- World-class cluster, network, and storage performance
- Smart interconnect for x86, Power, Arm, and GPU-based compute and storage platforms
- Cutting-edge performance in virtualized overlay networks NVGRE and GENEVE
- Efficient I/O consolidation, lowering data center costs and complexity
- Virtualization acceleration
- Power efficiency
- Scalability to tens-of-thousands of nodes

## Mellanox PeerDirect

Mellanox 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-4 advanced acceleration technology enables higher cluster efficiency and scalability to tens of thousands of nodes.

## Storage Acceleration

Storage applications will see improved performance with the high bandwidth that ConnectX-4 EN delivers. Moreover, standard block and file access protocols can leverage RoCE for high-performance storage access. A consolidated compute and storage network achieves significant cost-performance advantages over multi-fabric networks.

## Signature Handover

ConnectX-4 EN supports hardware checking of T10 Data Integrity Field/Protection Information (T10-DIF/PI), reducing the CPU overhead and accelerating delivery of data to the application. Signature handover is handled by the adapter on ingress and/or egress packets, reducing the load on the CPU at the initiator and/or target machines.

## Host Management

Mellanox host management and control capabilities include NC-SI over MCTP over SMBus, and MCTP over PCIe - Baseboard Management Controller (BMC) interface, as well as PLDM for Monitor and Control DSP0248 and PLDM for Firmware Update DSP0267.

## Software Support

All Mellanox adapter cards are supported by Windows, Linux distributions, VMware, FreeBSD, and Citrix XENServer. ConnectX-4 EN adapters support OpenFabrics-based RDMA protocols and software and are compatible with configuration and management tools from OEMs and operating system vendors.

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## Compatibility

### PCI Express Interface

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

### Operating Systems/Distributions\*

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

### Connectivity

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

## Features\*

### Ethernet

- 100GbE / 56GbE / 50GbE / 40GbE / 25GbE / 10GbE / 1GbE
- IEEE 802.3bj, 802.3bm 100 Gigabit Ethernet
- 25G Ethernet Consortium 25, 50 Gigabit Ethernet
- 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
- Proprietary Ethernet protocols (20/40GBASE-R2, 50GBASE-R4); may be available on specific SKUs
- 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 PeerDirect RDMA (aka GPUDirect®) 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 remapping of memory (UMR)
- On demand paging (ODP) – registration free RDMA memory access

### CPU Offloads

- RDMA over Converged Ethernet (RoCE)
- TCP/UDP/IP stateless offload
- LSO, LRO, checksum offload
- RSS (can be done on encapsulated packet), TSS, HDS, VLAN insertion / stripping, Receive flow steering
- Intelligent interrupt coalescence

### Storage Offloads

- T10 DIF - Signature handover operation at wire speed, for ingress and egress traffic

### Overlay Networks

- Stateless offloads for overlay networks and tunneling protocols
- Hardware offload of encapsulation and decapsulation of NVGRE overlay networks

### Hardware-Based I/O Virtualization

- Single Root IOV
- Multi-function per port
- Address translation and protection
- Multiple queues per virtual machine
- Enhanced QoS for vNICs
- VMware NetQueue support

### Virtualization

- SR-IOV: Up to 256 Virtual Functions
- SR-IOV: Up to 16 Physical Functions per port
  - Virtualizing Physical Functions on a physical port
  - SR-IOV on every Physical Function
- 1K ingress and egress QoS levels
- Guaranteed QoS for VMs

### Protocol Support

- OpenMPI, IBM PE, OSU MPI (MVAPICH/2), Intel MPI,
- Platform MPI, UPC, Open SHMEM
- TCP/UDP, MPLS, VXLAN, NVGRE, GENEVE
- iSER, NFS RDMA, SMB Direct
- uDAPL

### Management and Control Interfaces

- NC-SI over MCTP over SMBus and NC-SI over MCTP over PCIe - Baseboard Management Controller interface
- PLDM for Monitor and Control DSP0248
- PLDM for Firmware Update DSP0267
- SDN management interface for managing the eSwitch
- I<sup>2</sup>C interface for device control and configuration
- General Purpose I/O pins
- SPI interface to Flash
- JTAG IEEE 1149.1 and IEEE 1149.6

### Remote Boot

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

\* This section describes hardware features and capabilities. Please refer to the driver and firmware release notes for feature availability.

Table 1 - Part Numbers and Descriptions

OPN	Description	Dimensions w/o Bracket
MCX415A-CCAT	ConnectX-4 EN network interface card, 100GbE single-port QSFP28, PCIe3.0 x16, tall bracket	14.2cm x 6.9cm (Low Profile)
MCX416A-CCAT	ConnectX-4 EN network interface card, 100GbE dual-port QSFP28, PCIe3.0 x16, tall bracket	
MCX415A-BCAT	ConnectX-4 EN network interface card, 40/56GbE single-port QSFP28, PCIe3.0 x16, tall bracket	
MCX416A-BCAT	ConnectX-4 EN network interface card, 40/56GbE dual-port QSFP28, PCIe3.0 x16, tall bracket	
MCX415A-GCAT	ConnectX-4 EN network interface card, 50GbE single-port QSFP28, PCIe3.0 x16, tall bracket	
MCX416A-GCAT	ConnectX-4 EN network interface card, 50GbE dual-port QSFP28, PCIe3.0 x16, tall bracket	
MCX413A-BCAT	ConnectX-4 EN network interface card, 40/56GbE single-port QSFP28, PCIe3.0 x8, tall bracket	
MCX414A-BCAT	ConnectX-4 EN network interface card, 40/56GbE dual-port QSFP28, PCIe3.0 x8, tall bracket	
MCX413A-GCAT	ConnectX-4 EN network interface card, 50GbE single-port QSFP28, PCIe3.0 x8, tall bracket	
MCX414A-GCAT	ConnectX-4 EN network interface card, 50GbE dual-port QSFP28, PCIe3.0 x8, tall bracket	

NOTE: All tall-bracket adapters are shipped with the tall bracket mounted and a short bracket as an accessory.



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