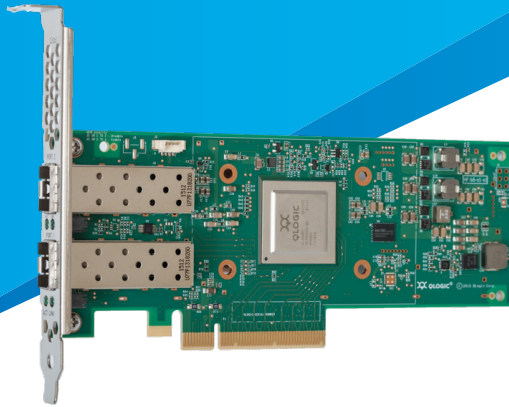# QLogic® FastLinQ™ QL4521x Series

25Gbps Ethernet-to-PCIe 3.0 Intelligent Ethernet Adapters

Note: Picture may not be representative of the final shipping product

- Industry's most powerful 25GbE adapter delivers the best price and performance ratio versus 10GbE

- Increase VM density and accelerate multitenant networks with full offload for tunneling protocols

- Build the most powerful scale-out storage systems with QLogic's unique support of multiple RDMA technologies (RoCE, RoCEv2, iWARP, and iSER)

- Accelerate the most demanding telco NFV workloads with QLogic DPDK high-speed packet processing engine

- Orchestrate and manage hyperscale OpenStack® deployments with QLogic cloud-enabled management framework

- 10GbE connectivity to manage migration from 10GbE infrastructure

OVERVIEW

QLogic® FastLinQ™ QL45211HLCU (Single-port) and QL45212HLCU (Dual-port) Intelligent Ethernet Adapters leverage QLogic's fifth-generation technology to deliver true 25Gb per second (25Gbps) Ethernet performance. Integrated, advanced networking eliminates I/O bottlenecks and conserves CPU cycles. Optimized for use across enterprises, managed service providers (MSPs), and large public and scalable public cloud deployments, the QL4521x Series enables organizations to achieve new levels of performance in physical, virtual, and cloud environments.

The 25Gb Ethernet (25GbE) specification enables network bandwidth to be cost-effectively scaled in support of next-generation server and storage solutions residing in cloud and Web-scale data center environments. 25GbE results in a single-lane connection similar to existing 10GbE technology—but it delivers 2.5 times greater bandwidth. Compared to 40GbE solutions, 25GbE technology provides superior switch port density by requiring just a single lane (versus four lanes with 40GbE), along with lower costs and power requirements. QLogic is a leading innovator driving 25GbE technologies across enterprise and cloud market segments.

QLogic FastLinQ QL4521x Series 25GbE adapters deliver advanced Ethernet solutions that are designed to meet requirements from leading enterprise and cloud providers. QLogic features that collectively deliver the most advanced 25GbE adapter include:

- Cutting-edge server virtualization technologies—single-root I/O virtualization (SR-IOV) and NIC

- Network virtualization—offloads for Virtual Extensible LAN (VXLAN), Generic Network Virtualization Encapsulation (GENEVE), and Network Virtualization using Generic Routing Encapsulation (NVGRE)

- Multiple Remote Direct Memory Access (RDMA) technologies—RDMA over Converged Ethernet (RoCE), RoCEv2, iSCSI Extensions for RDMA (iSER), and Internet wide area RDMA protocol (iWARP)

REDUCE CAPITAL EXPENDITURE AND OPERATING EXPENSE

QLogic QL4521x Series 25GbE technology delivers better price-per-gigabit versus 10GbE. This technology enables cloud providers and large-scale data center operators to reduce operating expense while continuing to scale their network of server and storage nodes to meet increasing demands of the future. QLogic 25GbE technology is cost-efficient and power-efficient because it utilizes a single lane in comparison to other alternatives such as quad-lane 40GbE. QL4521x Series 25GbE technology is compatible with 25Gbps lanes used in 100GbE, paving the way to a seamless upgrade path to 100GbE and protecting critical business investments.

ACCELERATE ANY NETWORK WITH MULTI-RDMA OFFLOAD

QLogic QL4521x Series 25GbE technology supports RoCE acceleration to deliver low latency, low CPU utilization, and high performance on Windows Server® Message Block (SMB) Direct 3.0 and 3.02, and iSER. QL4521x Series 25GbE adapters have the unique capability to deliver multi-RDMA that enables RoCE, RoCEv2, and iWARP. QLogic multi-RDMA and emerging low latency I/O bus mechanisms such as NVMe Express® (NVMe) allow customers to accelerate access to data. QLogic's cutting-edge offloading technology increases cluster efficiency and scalability to many thousands of nodes.

HIGH DENSITY SERVER VIRTUALIZATION

The latest hypervisors and multicore systems use several technologies to increase the scale of virtualization. QLogic QL4521x Series 25GbE adapter supports:

- VMware® NetQueue
- Windows® Hyper-V® Virtual Machine Queue (VMQ)
- Linux® Multiqueue
- Windows, Linux, and VMware switch-independent NPAR
- Windows Hyper-V, Linux Kernel-based Virtual Machine (KVM), and VMware ESXi™ SR-IOV

These features provide ultimate flexibility, quality of service (QoS), and optimized host and virtual machine (VM) performance while providing full 25Gbps bandwidth per port. Public and private cloud virtualized server farms can now achieve 2.5 times the VM density for the best price and VM ratio.

WIRE-SPEED NETWORK VIRTUALIZATION

Enterprise-class data centers can be scaled using overlay networks to carry VM traffic over a logical tunnel using NVGRE, VXLAN, and GENEVE. Although overlay networks can resolve virtual Local Area Network (VLAN) limitations, native stateless offloading engines are bypassed, which places a higher load on the system's CPU. QLogic QL4521x Series 25GbE adapter efficiently handles this load with advanced NVGRE, VXLAN, and GENEVE stateless offload engines that access the overlay protocol headers. This access enables traditional stateless offloads of encapsulated traffic with native-level performance in the network. Additionally, QLogic QL4521x Series 25GbE technology supports VMware NSX® and Open vSwitch (OVS).

HYPER-SCALE ORCHESTRATION WITH OPENSTACK

QLogic QL4521x Series 25GbE technology supports the OpenStack open source infrastructure for constructing and supervising public, private, and hybrid cloud computing platforms. It provides for both networking and storage services (block, file, and object) for iSER. These platforms allow providers to rapidly and horizontally scale VMs over their entire, diverse, and widely spread network architecture to meet the real-time needs of their customers. QLogic's integrated, multiprotocol management utility, QConvergeConsole® (QCC), provides breakthrough features that allow customers to visualize the OpenStack-orchestrated data center using auto-discovery technology.

ACCELERATE TELCO NETWORK FUNCTION VIRTUALIZATION (NFV) WORKLOADS

In addition to OpenStack, QLogic QL4521x Series 25GbE technology supports NFV that allows decoupling of network functions and services from dedicated hardware (such as routers, firewalls, and load balancers) into hosted VMs. NFV enables network administrators to flexibly create network functions and services as they need them, reducing capital expenditure and operating expenses, and enhancing business and network services agility. QLogic 25GbE technology is integrated into the Data Plane Development Kit (DPDK) and can deliver up to 60 million packets per second to host the most demanding NFV workloads.

TRUSTED, RELIABLE, AND INTEROPERABLE

QLogic is an industry leader in 25GbE and was the first to demonstrate end-to-end interoperability for 25Gb and 100Gb Ethernet solutions. QLogic QL4521x Series 25GbE technology adheres to standards that ensure interoperability with a wide range of network solutions. In addition, QLogic technology provides an easy upgrade path to 100GbE networks that utilize multiple 25GbE lanes.

Note: All advertised features are enabled in the hardware. Actual feature availability is dependent on software driver releases. See the release notes.

Host Bus Interface Specifications

Bus Interface
- PCI Express® (PCIe®) 3.0 x8, 2.0 x8 (electrical)

Host Interrupts
- MSI-X

I/O Virtualization
- SR-IOV (up to 240 virtual functions)
- NPAR (up to 16 physical functions)

Compliance
- *PCI Express Base Specification,* rev. 3.1
- *PCI Express Card Electromechanical Specification,* rev. 3.0
- *PCI Bus Power Management Interface specification,* rev. 1.2

Ethernet Specifications

Throughput
- 25Gbps line rate per-port in 25GbE mode
- 10Gbps line rate per-port in 10GbE mode

Ethernet Frame
- Standard MTU sizes and jumbo frames up to 9,600 bytes

Stateless Offload
- IP, TCP, and user datagram protocol (UDP) checksum offloads
- TCP segmentation offload (TSO)
- Large send offload (LSO)
- Giant send offload (GSO)
- Large receive offload (LRO)
  - LRO (Linux)
  - Receive segment coalescing (RSC) (Windows)
- Receive side scaling (RSS)
- Transmit side scaling (TSS)
- Interrupt coalescing
- VMware NetQueue, Microsoft® Hyper-V VMQ, and Linux Multiqueue
- Remote Direct Memory Access (RDMA)

Tunneling Offloads
- Virtual Extensible LAN (VXLAN)
- Network Virtualization using Generic Routing Encapsulation (NVGRE)
- Generic Network Virtualization Encapsulation (GENEVE)

Compliance
- *IEEE Specifications:*
  - 802.3-2012 and Ethernet flow control)

- *IEEE Specifications (continued):*
  - 802.1q (VLAN)
  - IPv4 (RFQ 791)
  - IPv6 (RFC 2460)
  - 1588-2002 PTPv1 (Precision Time Protocol)
  - 1588-2008 PTPv2

RDMA Specifications

Converged Ethernet
- RoCE
- RoCEv2
- iWARP
- iSER

Tools and Utilities

Management Tools and Device Utilities
- QLogic Control Suite integrated network adapter management utility (CLI) for Linux and Windows
- QConvergeConsole integrated network management utility (GUI) for Linux and Windows
- QConvergeConsole Plug-ins for vSphere® (GUI) and ESXCLI plug-in for VMware
- Native OS management tools for networking

Boot Support
- Unified extensible firmware interface (UEFI)
- Pre-execution environment (PXE)

APIs
- SNIA HBA API v2, and SMI-S

Operating Systems
- For the latest applicable operating system information, see http://driverdownloads.qlogic.com

Physical Specifications

Ports
- QL45211HLCU: single 25Gbps Ethernet
- QL45212HLCU: dual 25Gbps Ethernet

Form Factor
- Low-profile PCIe card (6.60in. × 2.71in.)

Environment and Equipment Specifications

Temperature
- Operating: 0°C to 55°C (32°F to 131°F)
- Storage: −40°C to 65°C (−40°F to 149°F)

Humidity
- Operating: 10% to 80%
- Storage: 5% to 90%

Maximum Cable Distances
- Maximum DAC length: 3m
- Active Optical Cable (AOC): 30m

Agency Approvals—Safety

US/Canada
- UL 60950-1
- CSA C22.2

Europe
- TUV EN60950-1
- TUV IEC 60950-1
- CB Certified

Agency Approvals[1]—EMI and EMC (Class A)

US/Canada
- FCC Rules,CFR Title 47, Part 15, Subpart Class A
- Industry Canada, ICES-003: Class A

Europe
- EN55022
- EN55024
- EN61000-3-2
- EN61000-3-3

Japan
- VCCI: Class A

NewZealand/Australia
- AS/NZS: Class A

Korea
- KC-RRA Class A

Taiwan
- BSMI CNS 13438

Ordering Information

QL45211HLCU-CK/SP/BK (single-port, SFP28/direct-attach copper)
- Channel Kit (CK)
- Single-Pack (SP)
- Bulk Kit (BK)

QL45212HLCU-CK/SP/BK (dual-port, SFP28/direct-attach copper)
- Channel Kit (CK)
- Single-Pack (SP)
- Bulk Kit (BK)

1   Agency approvals have not been authorized at the time of publication; this list is preliminary.

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