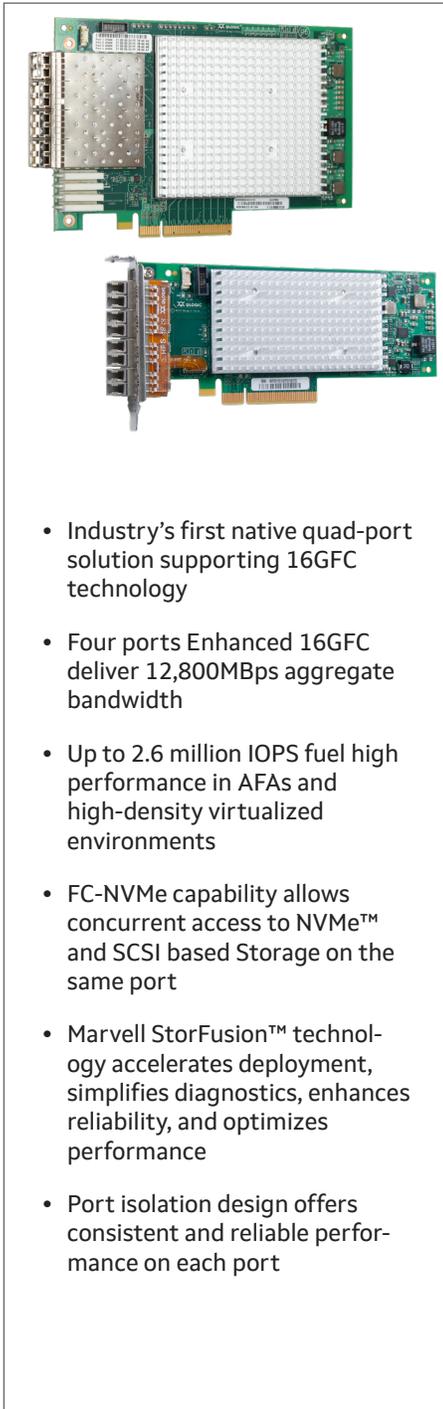


# Marvell® QLogic® QLE2694/2694L

## Quad-port Enhanced 16GFC Fibre Channel Adapters



- Industry's first native quad-port solution supporting 16GFC technology
- Four ports Enhanced 16GFC deliver 12,800MBps aggregate bandwidth
- Up to 2.6 million IOPS fuel high performance in AFAs and high-density virtualized environments
- FC-NVMe capability allows concurrent access to NVMe™ and SCSI based Storage on the same port
- Marvell StorFusion™ technology accelerates deployment, simplifies diagnostics, enhances reliability, and optimizes performance
- Port isolation design offers consistent and reliable performance on each port

The Marvell QLogic QLE2694/2694L quad-port adapters are the industry's first Enhanced 16GFC (16GFC) adapters, boasting industry-leading native FC performance with low CPU usage and full hardware offloads.

### Enhanced 16GFC

Marvell's unique Enhanced 16GFC technology provides the industry's first native quad-port 16GFC adapter in both low-profile (QLE2694L) and standard height (QLE2694) form factors. Marvell's Enhanced 16GFC solution offers higher per-port performance (up to 650K IOPS) with lower power consumption (3W per port). In addition, Marvell StorFusion technology delivers streamline provisioning, guaranteed QoS, and improved resiliency while addressing the needs of IT organizations that require reliability, integrated management, and guaranteed network performance.

Enhanced 16GFC technology resolves data center complexities by enabling a storage network infrastructure that supports powerful virtualization features, application-aware services, and simplified management. The QLE2694/2694L Adapters provide advanced storage networking features capable of supporting the most demanding virtualized and private cloud environments while fully leveraging the capabilities of high-performance 16GFC and All-Flash Arrays (AFAs). Powerful management tools automate and simplify SAN provisioning to help reduce cost and complexity, while the unmatched 16GFC performance eliminates potential I/O bottlenecks in today's powerful multiprocessor, multicore servers.

### Superior Performance

The QLE2694/2694L Adapters provide industry-leading application performance by up to 2.6 million IOPS for physical, virtual, and private cloud environments. Marvell QLogic adapters deliver the best throughput performance in virtualized and non-virtualized environments with 12,800MBps of aggregate throughput per-second. Integrated Marvell StarPower™ technology delivers dynamic power management, which ensures that the PCIe® host bus link uses the minimum number of PCIe lanes to meet the required bandwidth.

### NVM Express® Support

The QLE2694/2694L Adapters support the FC-NVMe (NVMe over Fibre Channel) protocol and can concurrently support FC-NVMe and FCP-SCSI storage traffic. NVMe storage offers exceptionally high performance at very low latencies. NVMe works best with a network that can provide lossless, low-latency, and high-performing transport.

The 2600 Enhanced 16GFC Adapters bring the best of both worlds by offering the highest performance and lowest latency access to NVMe and SCSI storage over an FC network.

## **Virtualization Optimized**

The QLE2694/2694L Adapters support standards-based virtualization features. Under VMware® ESXi 6.x and later, I/O requests and responses can be tagged with the virtual machine-ID (VM-ID) of the appropriate virtual machine, providing end-to-end visibility at the VM level. Support for N\_Port ID virtualization (NPIV) enables a single FC adapter port to provide multiple virtual ports for increased network scalability. NPIV allows a single FC adapter port to participate in multiple virtual fabric domains for improved availability. In addition, the 16GFC line rate per physical port delivers unmatched storage performance to maximize the number of virtual machines per physical server.

## **MARVELL StorFusion Technology**

Marvell QLogic's Enhanced 16GFC 16GFC adapters, powered by StorFusion technology, include advanced capabilities that are enabled when deployed with supported Brocade® and Cisco® switches. By implementing these industry-leading solutions together, SAN administrators can take advantage of enhanced features that improve availability, accelerate deployment, and increase network performance.

### **Improved Total Cost of Ownership and Reliability**

StorFusion technology delivers advanced link diagnostics, which improve availability and support for high performance fabrics. Using the Diagnostics Port feature with a Brocade switch that supports ClearLink®, administrators can quickly run a battery of automated diagnostic tests to assess the health of links and fabric components.

The QLE2694/2694L Adapters support link cable beacon (LCB), which enables administrators to visually identify both ends of a physical link. In a large data center with hundreds of ports and cables to manage, a simple command turns on port LED beacons on both ends of a link cable connection. Administrators can use LCB to quickly identify connection peer ports without tracing the cable.

Marvell technology includes the read diagnostic parameters (RDP) feature, which provides detailed port, media, and optics diagnostics. From any point in the fabric, an administrator can use RDP to easily discover and diagnose link-related errors and degrading conditions on any N\_Port-to-F\_Port link.

The extensive suite of diagnostic tools maximizes uptime and performance, allowing organizations to address problems before they impact operations.

### **Rapid Server Deployment and Orchestration**

StorFusion technology includes fabric pre-provisioning services that enable servers to be quickly deployed, replaced, and moved across the SAN. By leveraging fabric-assigned port world wide name (FA-WWN) and fabric-based boot LUN discovery (F-BLD) capabilities, the creation of zones, LUNs, and other services can be completed before the

servers arrive on site—eliminating time consuming, manual tasks that typically delay server deployment.

### **Marvell Universal SAN Congestion Mitigation Technology (USCM)**

Modern SANs are observing unprecedented data growth in several different vectors. 16GFC and 32GFC upgrades are added to original 4GFC and 8GFC investments to form diverse heterogeneous SANs. Mission critical applications that rely on SANs are expected to run at full capacity and capability 24x7, 365 days a year, while increasingly being accelerated by flash storage technology. Meanwhile modern and legacy applications are consolidated to increase utilization while new workloads and VMs are added to improve CapEx and OpEx. These conditions have the potential to create congestion in the SAN, which can significantly impact application performance. SAN Congestion typically occurs and quickly spreads when older, slower FC endpoints cannot accept frames at the rate generated by the source, referred to as oversubscription or slow-drain. It is critical that SAN congestion is timely detected, other components are made aware and decisive action is taken to isolate the problem.

Implementing industry standard Fabric Performance Impact Notifications (FPINs), Marvell's QLogic 2690 Series Adapters' USCM Technology works in coordination with Brocade and Cisco FC fabrics to avoid SAN congestion by receiving congestion notification, and participating in congestion avoidance. QLogic 2690 Series HBAs are made aware by upstream and downstream switches of congestion points and can enable the ability to take decisive actions such as transmit throttling, multi-path failover and load balancing.

### **Performance SLA Enforcement with VM-level Quality of Service**

Network performance can be dramatically improved by implementing the industry-standard class-specific control (CS\_CTL)-based frame prioritization QoS, which helps alleviate network congestion. When Marvell QLogic adapters with StorFusion technology are connected to supported SAN fabrics, traffic is classified as it arrives at the switch, and is then processed on the basis of configured priorities. Traffic can be prioritized for delivery or subjected to limited delivery options. As a result, mission-critical workloads can be assigned a higher priority than less time-sensitive network traffic to achieve optimized performance.

### **Higher Resiliency and Performance with Automatic Error Recovery**

Forward error correction (FEC) improves performance and link integrity to support higher end-to-end data rates by automatically recovering from many transmission errors without re-sending the frames. FEC automatically detects and recovers from bit errors, which results in higher availability and performance.

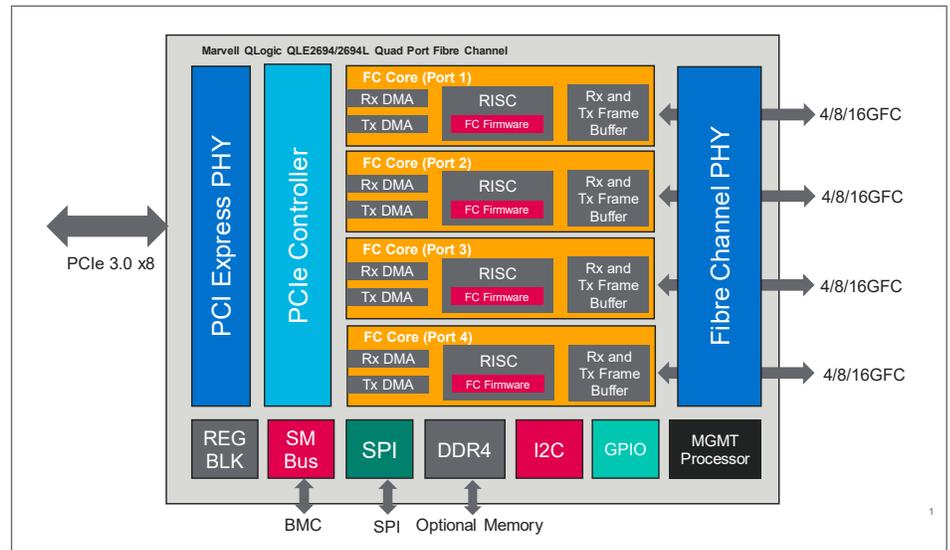
Automatic buffer-to-buffer credit recovery (BB-CR) helps overcome performance degradation, congestion, and link resets caused by buffer credit loss, especially on longer distance and high-loss fiber connections.

## Simplified Management

Marvell’s unified management application, QConvergeConsole® (QCC), provides single-pane-of-glass management across generations of Marvell QLogic FC adapters. In addition, Marvell supports all major APIs for deployment flexibility and integration with third-party management tools, including VMware vCenter™ and Brocade Network Advisor.

## High Availability and Reliability

Marvell QLogic Enhanced 16GFC Adapters continue the tradition of complete port-level isolation across the FC controller architecture. This architecture, unlike other vendor solutions, provides independent function, transmit and receive buffers, an on-chip CPU, DMA channels, and a firmware image for each port. These features enable complete port-level isolation, prevent errors and firmware crashes from propagating across all ports, and provide predictable and scalable performance across all ports. The Marvell architecture delivers ultimate reliability to meet the needs of mission-critical enterprise applications with lower power and fewer CPU cycles, all while maintaining peak performance. See Figure 1.



**Figure 1. QLE2694/2694L Block Diagram**

In addition, overlapping protection domains (OPDs) ensure the highest level of reliability as data moves to and from the PCI® bus and FC network.

The QLE2694/2694L Adapters also provide end-to-end data integrity with support for T10 Protection Information (T10 PI), which prevents the risk of silent data corruption in environments running Oracle® Linux® with the Unbreakable Enterprise Kernel.

## Leadership, Confidence, and Trust

The QLE2694/2694L Adapters are compatible with the same FC software driver stack that has been tested and validated across all major hardware platforms and all major hypervisors and operating systems. The adapters are backward compatible with existing 4GFC and 8GFC infrastructure, leveraging existing SAN investments.

Marvell technology makes it the undisputed leader in FC adapters, with over 20 years of experience, more than 20 million ports shipped, and multiple generations of FC products that have been the leading choice of Marvell customers. Marvell owns the most established, proven FC stack in the industry, with more FC ports shipped than any other vendor.

## Host Bus Interface Specifications

### Bus Interface

- QLE2694: PCI Express® 3.0 x8
- QLE2694L: PCI Express 3.0 x8

### Host Interrupts

- INTx and MSI-X

### 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*

## Fibre Channel Specifications

### Throughput

- 3,200Mbps bandwidth per port

### Logins

- Support for 2,048 concurrent logins and 2,048 active exchanges
- Expandable to 32K concurrent logins and 32K active exchanges (with DDR3 or host memory)

### Port Virtualization

- NPIV

### Compliance

- *SCSI-3 Fibre Channel Protocol (SCSI-FCP)*
- *Fibre Channel Tape (FC-TAPE) Profile*
- *SCSI Fibre Channel Protocol-2 (FCP-2)*
- *Second Generation Fibre Channel Generic Services (FC-GS-2)*
- *Third Generation Fibre Channel Generic Services (FC-GS-3)*
- *Fibre Channel Physical Interface 5 (FC-PI5)*

## Tools and Utilities

### Management Tools and Device Utilities

- QConvergeConsole: a unified management tool (GUI and CLI) that spans generations of QLogic FC adapters
  - VMware vCenter Server Plug-in
  - VMware vSphere™ Web Client Plug-in

### Boot Support

- BIOS
- Unified Extensible Firmware Interface (UEFI)
- FCode

## Tools and Utilities (continued)

### APIs

- SNIA HBA API V2
- SMI-S

### Operating Systems

- For the latest applicable operating system information, see [www.marvell.com](http://www.marvell.com)

## End-to-End Provisioning and Management Features

**The following features require a supported Brocade switch running Fabric OS® version 7.4.0a or later.**

### Performance

- QoS CS\_CTL
- FEC
- BB-CR: automatic buffer credit loss detection and recovery
- FPIN for Congestion Mitigation

### Diagnostics

- Diagnostics Port
- LCB
- RDP

### Deployment and Management

- FA-WWN
- F-BLD
- FC ping
- FC traceroute
- VM-ID
- Fabric device management interface (FDMI) enhancements

## Physical Specifications

### Ports

- Quad-port, 16GFC

### Form Factor

- QLE2694: Standard-height PCIe card (6.6 inches × 4.381 inches)
- QLE2694L: Low-profile PCIe card (6.6 inches × 2.731 inches)

## Environment and Equipment Specifications

### Temperature

- Operating: 0°C to 55°C (32°F to 131°F)
- Storage: -20°C to 70°C (-4°F to 158°F)

### Humidity

- Operating: 10% to 90%
- Storage: 5% to 95%

## Environment and Equipment Specifications (continued)

### Maximum Cable Distances

- Multimode optic:

Rate	Cable and Distance (m)			
	OM1	OM2	OM3	OM4
4GFC	70	150	380	400
8GFC	21	50	150	190
16GFC	Note 1	35	100	125

1. Not Supported

## Agency Approvals—Safety

### US and Canada

- UL 60950-1
- CSA C22.2

### Europe

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

## Agency Approvals—EMI and EMC (Class A)

### US and 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

### New Zealand and Australia

- AS/NZS: Class A

### Korea

- KC-RRA Class A

### Taiwan

- BSMI CNS 13438

**Ordering Information**

**QLE2694-SR-CK (Quad Port)**

- Ships in an individually packed box with a standard-height bracket installed
- Ships with SR optical transceivers installed

**QLE2694-SR-BK (Quad Port)**

- Ships with a standard-height bracket installed
- Ships with SR optical transceivers installed
- Minimum Order Quantity (MOQ): 20 units

**QLE2694L-CK (Quad Port)**

- Ships in an individually packed box with a low-profile bracket installed
- Ships with soldered small form factor (SFF) optical transceivers installed



To deliver the data infrastructure technology that connects the world, we're building solutions on the most powerful foundation: our partnerships with our customers. Trusted by the world's leading technology companies for 25 years, we move, store, process and secure the world's data with semiconductor solutions designed for our customers' current needs and future ambitions. Through a process of deep collaboration and transparency, we're ultimately changing the way tomorrow's enterprise, cloud, automotive, and carrier architectures transform—for the better.

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