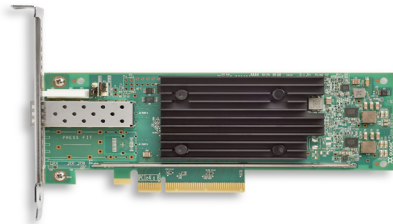
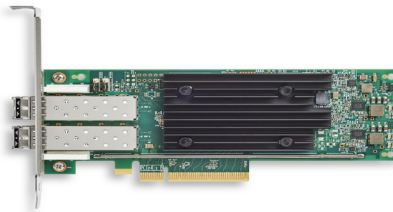


# Marvell® QLogic® 2770 Series

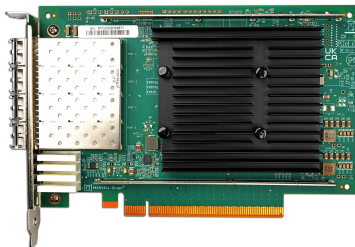
## Enhanced 32GFC, PCIe® 4.0 Fibre Channel Adapters



**Single Port: QLE2770**



**Dual Port: QLE2772**



**Quad Port: QLE2774**

- Industry leading performance of up to 4 million IOPS and 25,600MBps of aggregate throughput
- Improve database transactional performance, enable faster business decisions with up to 2x faster data mining, and host more VMs
- Supports PCIe 4.0 systems
- Available in single, dual, and quad-port versions
- Hardware Root of Trust ensures SAN Integrity with Cryptographically Secured Firmware

The Marvell QLogic 2770 Series Adapters are Enhanced 32-Gigabit Fibre Channel (GFC) HBAs that secure mission critical data with hardware-based Root of Trust (RoT). The adapters are available in single, dual, and quad ports across standard form factors.

Leveraging over 20 years of market leadership, the 2770 Series FC HBAs are designed from the ground up for customers looking to accelerate databases, host more virtual machines (VMs), and reduce total cost of ownership (TCO), while leveraging their investment in nonvolatile memory express (NVMe)-based all flash arrays. Marvell QLogic 2770 Series FC (32GFC) HBAs provide full backward compatibility with 16GFC and 8GFC SANs.

### NVMe® Over Fibre Channel (FC-NVMe)

Workloads that demand higher throughput, IOPS, and lower latency are moving to flash. The NVMe protocol has been designed from the ground up for flash and features deep parallelism, random access, and flash access over PCI Express (PCIe) to maximize bandwidth.

NVMe works best when coupled with a network that can provide lossless, low-latency, and high-performing transport. FC-NVMe extends these benefits over a Fibre Channel fabric.

The 2770 Series Adapters support low-latency access to scale out with full support for the FC-NVMe-2 protocol. The 2770 Series Adapters can simultaneously support FC-NVMe and FCP-SCSI storage traffic on the same physical port, enabling customers to migrate to NVMe at their own pace.

The 2770 Series FC Adapters bring the best of both worlds by offering up to 4 million IOPS and line rate 32GFC performance, while delivering low-latency access to NVMe and SCSI storage over a Fibre Channel network.

### Firmware Integrity Protection With Hardware Root of Trust

Security threats continue to evolve and increase, driving Chief Information Officers towards securing the server all the way down to the firmware at the lowest layers of the server platform, where attacks are the most difficult to detect. To address this issue, the Marvell QLogic 2770 Series Adapters incorporate a hardware RoT that prevents malicious firmware from hijacking the FC HBA. The 2770 Series RoT enables both integrity and authenticity during adapter firmware updates by both validating firmware embedded signatures with hardware embedded keys to ensure that only bonafide firmware executes, and protecting firmware updates that are applied over public networks.

- Improve scale out NVMe efficiencies by delivering concurrent support for FCP and FC-NVMe™
- Marvell StorFusion™ technology accelerates deployment, simplifies diagnostics, enhances reliability, and optimizes performance
- Virtual Lanes enables prioritization and segregation of the traffic as low, medium or high priority.
- Port isolation design delivers deterministic and scalable performance on each port

## Fully Featured FC Technology

Marvell QLogic FC technology provides the industry's most fully featured 32GFC adapter, designed to meet and exceed the requirements of modern SANs. Marvell's FC solution offers 50-percent higher performance than previous generations (Over 1 million IOPS per-port) than previous generations; and its power-efficient, port-isolated design enables data centers to reduce their carbon footprint.

Marvell QLogic 2770 Series FC HBAs resolve data center complexities by enabling a storage network infrastructure that supports powerful virtualization features like N\_Port ID virtualization (NPIV), application-aware services with standards based quality of service (QoS), and simplified management.

Marvell StorFusion technology delivers streamlined provisioning, improved resiliency with built-in forward error correction (FEC). These features address the needs of agile IT organizations that run hybrid cloud infrastructures and require mission-critical reliability, guaranteed network performance, and the ability to scale their SANs to business needs.

The Enhanced 32GFC 2770 Series also incorporate a secure hardware-based RoT to protect against rogue firmware.

## Innovations that Improve Business Productivity and Integrity

Marvell QLogic FC Adapters powered by StorFusion technology include advanced capabilities 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.

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

SAN congestion, although rare, has the potential to quickly spread and significantly disrupt application performance leading to lost business. Modern SANs, specifically those with flash storage and mix of Fibre Channel endpoint speeds can be prone to congestion. SAN congestion typically occurs when slower FC endpoints cannot accept responses generated by flash/NVMe storage, a condition referred to as oversubscription/over-utilization. Rarely, a misbehaving FC device can also lead to SAN congestion when it is unable to replenish credits which are key to reliable Fibre Channel transmissions, a condition referred to as slow-drain. SAN congestion when timely detected, can be isolated and decisive actions applied. A Fibre Channel standard, Fabric Performance Impact Notifications (FPINs) bring congestion awareness to FC endpoints.

Utilizing FPINs, Marvell's QLogic 2770 Series Adapters implement Universal SAN Congestion Mitigation Technology (USCM). USCM uniquely works both Brocade and Cisco SAN fabrics to keep applications running at peak performance by providing an in-band and zero touch SAN congestion detection, notification, and avoidance system. QLogic 2770 Series HBAs interact with Cisco and Brocade SANs using both the more reliable FC primitive signaling as well as protocol events to bring awareness of the presence of congestion, peer congestion, link integrity, lost frames etc. QLogic 2770 Series HBAs also have the ability to enable decisive actions such as fine-grained I/O

throttling, automatic path failover, load balancing, and flow quarantining to ensure that SAN congestion is mitigated with minimum impact to application performance.

Marvell QLogic USCM technology, offered at no additional cost, brings strong awareness of SAN congestion and implements decisive actions to prevent application degradation. It is highly recommended for modern SANs.

### **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 or Cisco switch that supports Fibre Channel diagnostics, administrators can quickly run a battery of automated diagnostic tests to assess the health of links and fabric components.

The Marvell QLogic 2770 Series Adapters support link cable beacon (LCB) technology, which enables administrators to visually identify both ends of a physical link.

Read diagnostic parameters (RDP) provide optics and media diagnostics while the link is in service, enabling identification of link-related errors and degrading conditions on the HBA-to-FC switch link.

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.

### **Single-Pane-of-Glass Management for Simplified Management**

The Marvell 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 the VMware vCenter™ and Brocade Network Advisor.

## **Unparalleled Insight and QoS for Virtualized Deployments**

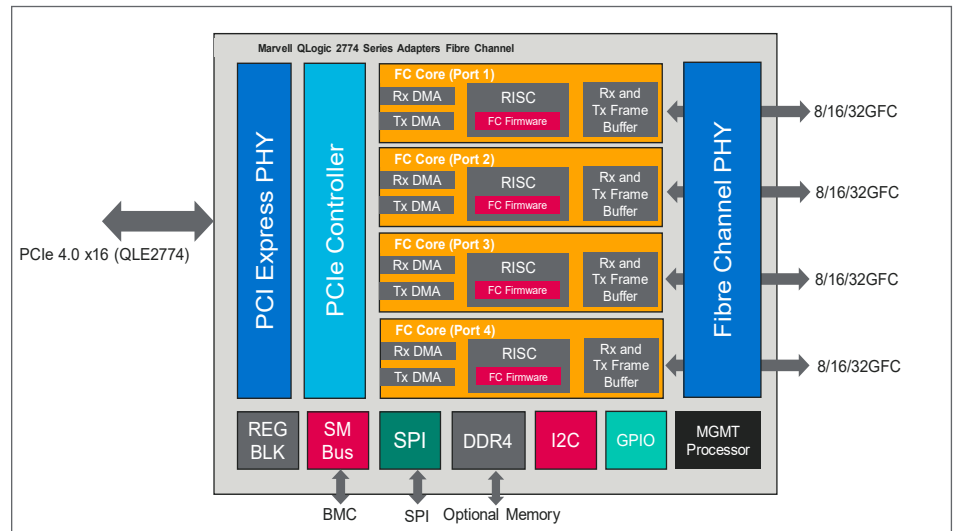
The Marvell 2770 Series Adapters support several standards-based virtualization features that optimize virtual server deployment, troubleshooting, and application performance.

Marvell QLogic virtual machine ID (VM-ID) technology seamlessly integrates with Brocade and Cisco switches to allow customers to effectively monitor and manage their Fibre Channel storage networks, load balancing VM clusters with storage to ensure efficient use of the storage resources. Supported for VMware ESXi 7.x and later, I/O requests and responses can be tagged with the VM-ID of the appropriate virtual machine, providing end-to-end visibility at the VM level.

Additionally, support for NPIV enables a single FC adapter port to provide multiple virtual ports for increased network scalability. Standard class-specific control (CS\_CTL)-based QoS technology per NPIV port allows multi-level bandwidth controls and guarantees per VM. As a result, mission-critical workloads can be assigned a higher priority than less time-sensitive storage traffic for optimized performance.

## High Availability and Reliability

Marvell QLogic Enhanced 32GFC 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. Marvell QLogic 2774 Series Adapters Block Diagram**

Note: QLE2774 is represented in this block diagram. The QLE2772 and QLE2770 adapters have the same number of FC cores and FC ports (per adapter model), and utilize the PCIe 4.0 x8 bus interface.

The 2770 Series 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 Marvell 2770 Series Adapters are compatible with the same FC software driver stack that has been tested and validated across all major hardware platforms, all major hypervisors, and operating systems. Operating at 32GFC, these adapters are backward compatible with existing 16/8GFC infrastructure, leveraging existing SAN investments.

Marvell QLogic is the undisputed leader in FC adapters, with over 20 years of market history and more than 22 million ports shipped, and multiple generations of FC products that have been qualified by all major server OEMs. 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

- QLE2770: PCIe 4.0 ×8 (single-port)
- QLE2772: PCIe 4.0 ×8 (dual-port)
- QLE2774: PCIe 4.0 ×16 (quad-port)

### Host Interrupts

- INTx and MSI-X

### Compliance

- *PCIe Base Specification*, rev. 4.0
- *PCIe Card Electromechanical Specification*, rev. 4.0
- *PCI Bus Power Management Interface Specification*, rev. 1.2
- *PCI Hot Plug Specification*, rev. 1.1

## Fibre Channel Specifications

### Negotiation

- 32/16/8GFC auto-negotiation

### Throughput

- 6,400Mbps full duplex line rate per port(maximum)

### Logins

- Support for 2,048 concurrent logins and 2,048 active exchanges per port

### Port Virtualization

- NPIV

### Compliance

- *SCSI Fibre Channel Protocol-4 (FCP-4)*
- *Fibre Channel Tape (FC-TAPE) Profile*
- *Fibre Channel Generation Services-8 (FC-GS-8)*
- *Fibre Channel-Physical Interface-5 (FC-PI5)*
- *Fibre Channel-Physical Interface-6 (FC-PI6)*
- *Fibre Channel Link Services 4 (FC-LS-4)*
- *Fibre Channel Framing and Signalling-4 (FC-FS-4)*
- *Fibre Channel-NVMe-2 (FC-NVMe-2)*

## Tools and Utilities

### Management Tools and Device Utilities

- QConvergeConsole CLI: a unified management tool that supports multiple generations of Marvell FC adapters
- MCTP/PLDM
- ESXCLI Plug-in for vSphere
- MRVLFC PowerKit (cmdlets for Windows PowerShell)
- QCC Plug-ins for vSphere
- Marvell QLogic FC QCC Extension for Windows Admin Center

### Boot Support

- Unified Extensible Firmware Interface (UEFI)

### APIs

- SNIA HBA API V2
- SMI-S

### Operating Systems

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

## End-to-End Provisioning and Management Features

**The following features require a supported Brocade or Cisco switch.**

### Performance

- QoS CS\_CTL
- FEC for 16GFC
- BB-CR: automatic buffer credit loss detection and recovery
- FPIN and hardware signaling for Congestion Management

### 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

- QLE2770: single-port FC
- QLE2772: dual-port FC
- QLE2774: quad-port FC

### Form Factor

- Single port: low profile PCIe card (6.6 inches × 2.731 inches)
- Dual port: low profile PCIe card (6.6 inches × 2.731 inches)
- Quad port: standard height PCIe card (6.6 inches × 4.38 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

- Relative (noncondensing): 10% to 90%
- Storage: 5% to 95%

### Cable Distances

- Multimode optic:

Rate	Cable and Distance (m)		
	OM2	OM3	OM4/OM5
8GFC	50	150	190
16GFC	35	100	125
32GFC	20	70	100

## 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**

- EN55032
- 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

**UK**

- UKCA

**Ordering Information**

**QLE2770-SR-SP (Single Port)**

- Ships in an individually packed box with a standard-height bracket installed
- Ships with 32GFC SR optical transceiver installed

**QLE2772-SR-SP (Dual Port)**

- Ships in an individually packed box with a standard-height bracket installed
- Ships with 32GFC SR optical transceivers installed

**QLE2774-SR-SP (Quad Port)**

- Ships in an individually packed box with a standard-height bracket installed
- Ships with 32GFC SR 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 over 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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