

## Product Brief



### Accelerate Workload Performance for NVMe Data Centers

- Accelerate workloads with up to 3x better latency than the previous generation
- Speed up applications, AFAs, and handle peak workload I/O spikes with up to 5M IOPS—over 3x more than the previous generation
- Get faster data transfer speed with the industry's first single- and dual-port PCIe 4.0 HBAs delivering 2x more bandwidth per lane

### Easily Deploy, Manage, and Upgrade SANs

- Save time with no server reboots for firmware updates, queue depth changes, and optics replacements
- Meet SLAs with industry-leading HBA reliability—10M hours MTBF
- Easy performance upgrade from 32GFC to 64GFC with hot-plug optics kits
- Enable full end-to-end implementation of Brocade Fabric Vision from the HBA to the switch

# Emulex Gen 7 Fibre Channel HBAs LPe35000-Series

## Next-Gen HBAs for the Modern Data Center

The Emulex® LPe35000 Gen 7 Fibre Channel (FC) Host Bus Adapters (HBAs) by Broadcom® are designed for demanding mission-critical workloads and emerging applications. Applications continue to grow in size and scale and, to support them, enterprises are increasingly turning to new server technologies that contain hundreds of processor cores as well as high-performance storage solutions including low-latency NVMe, all-flash arrays (AFAs). NVMe can significantly increase the performance of storage area networks (SANs), making the selection of high-speed networking technology the critical element for achieving maximum system-wide performance. Fibre Channel is purpose-built for storage networks, meeting the requirements for high availability, scalability, predictable performance and low latency.

Compared to the previous generation, Emulex Gen 7 FC HBAs offer up to 2x higher bandwidth, 3x better latency, enhanced security, and operational efficiency for 32GFC and 64GFC SANs. Emulex LPe35000-series HBAs are available with single, dual, or quad 32GFC optics that can be upgraded with 64GFC optics to tackle the toughest workloads and future NVMe deployments. Gen 7 32GFC provides seamless backward compatibility to 16GFC and 8GFC networks.

## Performance

The Emulex Dynamic Multi-core Architecture delivers unparalleled performance and the most efficient port utilization with eight processing cores and 16 threads that dynamically apply ASIC resources to any port that requires them, ensuring SLAs are met. Compared to Gen 6, Emulex Gen 7 HBAs can support 64GFC to deliver up to 2x greater bandwidth. The LPe35000 series delivers 12,800 MB/s (two 32GFC ports) or 25,600 MB/s (when upgraded to two 64GFC ports) full duplex, 3x better hardware latency, and supports an industry-leading 5 million IOPS.

The fastpath design provides hardware acceleration for Emulex's Dynamic Multi-core architecture, reducing latency for each transaction by processing I/O requests in hardware, thereby operating significantly faster than software-based solutions. These performance advances enable Emulex Gen 7 HBAs to handle demanding workloads and I/O spikes experienced under peak workload conditions like no other Fibre Channel HBA in the industry.

Emulex Gen 7 HBAs support NVMe over Fibre Channel (NVMe/FC), providing significantly lower latency versus traditional Fibre Channel SCSI Protocol (SCSI FCP). Recent testing by independent performance labs has shown that NVMe/FC can deliver up to 50% more IOPs and 30% lower latency than traditional SCSI FCP.\* Emulex Gen 7 HBAs also support NVMe/FC and SCSI FCP concurrently, providing investment protection and allowing data centers to transition to end-to-end NVMe over FC SANs at their own pace.

*\*Emulex labs/Demartek, 2018.*

Emulex®  
**GEN7**  
FIBRE CHANNEL

## Fully Protect Data

- Thwart malicious firmware with a Silicon Root of Trust and digitally signed firmware
  - Complies with NIST 800-193 framework
  - Digital signature verification during firmware download and power-on
- Guarantee driver security with Broadcom digitally signed drivers
- Secure Boot guarantees UEFI boot code security with digitally signed boot code
- Data Integrity Field (T10 DIF) protects data from corruption

LPe35000-series port aggregation capability (also known as trunking) provides a method to aggregate physical ports together to form a single logical port. Aggregating physical ports to make a single high-bandwidth datapath increases the logical connection bandwidth for applications that need it, such as data warehousing and virtual machine migration.

## Operational Efficiency

LPe35000-series HBAs offer enhanced reliability, availability and serviceability (RAS) including port isolation and port-based error isolation that enables users to easily detect, isolate, and recover from errors.

Emulex HBAs are easy to manage and save administrators time and operating costs with features such as no reboots for firmware updates, queue depth changes, or optics replacements. Emulex Gen 7 hot plug (hot-swappable) optics enables optics to be removed and replaced without shutting down the system, allowing for uninterrupted service.

The OneCommand Manager application provides centralized management of current and previous generations of Emulex FC HBAs. Emulex HBA troubleshooting is simplified with OneCapture, an Emulex utility that gathers system, adapter, and device driver information. Data collected by OneCapture is compressed into a single file and can be sent to Broadcom Technical Support for analysis when debugging system issues or for diagnostic purposes.

Emulex HBAs fully support the Brocade Fabric Vision suite of features facilitating a solution from

the switch to the server end-points that have Emulex HBAs installed. Supported features include ClearLink (D\_port), Link Cable Beacons, Host Name Registration, Read Diagnostic Parameters, VMID, BB\_Credit Recovery, Fabric-assigned Boot LUN, Fabric-assigned PWWN, FC Trace Route, FC Ping, Rest APIs, and more.

Visit [www.broadcom.com](http://www.broadcom.com) for additional information on supported Fabric Vision features.

## Security

One of the key initiatives for enterprises is that their infrastructure is safe from network attacks. Fibre Channel has field proven security in protecting the world's most sensitive data in banking, finance, healthcare, government, and military for over 20 years. Fibre Channel is protected from threats coming from IP networks because there is no direct connectivity for an attack from the IP network. This makes Fibre Channel a very strong link in the security chain.

Emulex Gen 7 HBAs provide unmatched security features for Fibre Channel environments. LPe35000-series are the only Fibre Channel HBAs with Silicon Root of Trust security embedded into the hardware itself. Firmware digital signatures are verified each time the system is booted as well as before installing any new firmware, providing a tamper proof solution.

Emulex's digitally signed drivers are integrated with all the major enterprise operating systems. Drivers are digitally signed and are verified to be authentic code written by Broadcom before they can be installed.

## Standards

### General Specifications

- The LPe35000-series FC HBAs are powered by the XE601 controller and utilize an eight-lane (x8) PCIe 4.0 bus on the single- and dual-port models, with backward compatibility to PCIe 3.0 supported, and a PCIe 3.0 x 16 bus on the quad-port model. The architecture enables resources to be applied to any port that needs them, delivering up to 5M IOPS.

### Industry Standards

- Current ANSI/IETF Standards: FC-PI-7; FC-FS-5; FC-LS-3; FC-GS-7; FC-PI-5; FC-PI-6; FC-DA; FC-DA-2; FCP-4; SPC-4; SBC-3; SSC-4; FC-NVMe; FC-NVMe/AM1
- Legacy ANSI/IETF Standards: FC-PI-4; FC-FS-3; FC-LS-2; FC-GS-6; FC-PH; FC-PH-2; FC-PH-3; FC-PI; FC-PI-2; FC-PI-3; FC-FS; FC-GS-2/3/4/5; FCP-2/3; FC-HBA; FC-TAPE; FC-MI; SPC-3; SBC-2; SSC-2; SSC-3
- PCIe base spec 4.0
- PCIe card electromechanical spec 4.0
- Fibre Channel Class 3
- PHP hot plug-hot swap
- UEFI 2.5

## Architecture

### Single-port LPe35000, dual-port LPe35002 and quad-port LPe35004

- Supports 32GFC, 16GFC, and 8GFC link speeds, automatically negotiated
- With 64GFC optics kits installed, supports 64GFC, 32GFC, and 16GFC link speeds, automatically negotiated

## Comprehensive OS and Hypervisor Support

- Microsoft Windows
- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server
- VMware vSphere
- Oracle Linux; Oracle Linux with the Unbreakable Enterprise Kernel (UEK)
- Oracle Solaris
- Citrix

Additional support is available from OEMs and partners

## Hardware Environments

- Intel x64, Intel x86, and PowerPC

## Optical

- Data rates: 28.05 Gb/s (32GFC); 14.025 Gb/s (16GFC); 8.5 Gb/s (8GFC) automatically negotiated
- Optics: Short-wave lasers with LC-type connector
- Cable:
  - 0.5m to 70m at 64GFC/32GFC on 50/125 µm OM3 MMF
  - 0.5m to 100m at 64GFC/32GFC on 50/125 µm OM4 MMF
  - 0.5m to 100m at 64GFC/32GFC on 50/125 µm OM5 MMF
  - 10 km at 32GFC/16GFC on 9/125 µm singlemode fiber when Emulex approved longwave transceivers are used

## Physical Dimensions

- Short, low profile PCIe card
- 167.64 mm x 68.91 mm (6.60 in. x 2.71 in.)
- Standard bracket (low-profile bracket ships in box)
- LPe35004: 167.64 mm x 111.15 mm (6.60 in. x 4.376 in.), with a standard bracket

## Environmental Requirements

- Operating temperature: 0°C to 55°C (32°F to 131°F); 150 LFM (275 LFM for LPe35004-M2 model) required
- Storage temperature: -20°C to 85°C (-4°F to 185°F)
- Relative humidity: 5% to 95% non-condensing

## Agency and Safety Approvals

### North America

- FCC/ICES Class A
- UL/CSA Recognized

### Europe

- CE Mark
- EU RoHS compliant
- EU Low Voltage Directive

### Australia

- RCM Class A

### Japan

- VCCI Class A

### Korea

- KCC Class A

### China

- China RoHS Compliant

### Taiwan

- BSMI Class A

## Ordering Information

### LPe35000-M2 (upgradeable to 64GFC)

- 1-Port 32GFC Short Wave Optical LC SFP+

### LPe35002-M2 (upgradeable to 64GFC)

- 2-Port 32GFC Short Wave Optical LC SFP+

### LPe35004-M2 (upgradeable to 64GFC)

- 4-Port 32GFC Short Wave Optical LC SFP+

### Options

Only Emulex approved options are warranted and fully supported by Technical Support. Emulex options are denoted by a '-ELX' or '-EM' in the transceiver part number

- **LP32-LW-OPT-1** 32GFC Optic (long-wave laser with LC connector SFP+ transceiver): 1 pack

- **LP32-LW-OPT-2** 32GFC Optics (long-wave laser with LC connector SFP+ transceiver): 2 pack

- **ELX-SVC-PMaint-1** Enhanced Support for Emulex HBAs, 1 year (for Brocade Premier Support Customers)

## Additional Features

### Performance Features

- Doubling the maximum FC link rate from 16GFC to 32GFC and 64GFC (with optics upgrade) and support for NVMe over Fibre Channel help support data center modernization initiatives.
- Frame-level multiplexing increases link efficiency and maximizes HBA performance.
- Accelerates network access to SSDs with NVMe over Fibre Channel — supports the FC-NVMe INCITS T11 standard.

### Data Protection Features

- End-to-end data protection using hardware parity, CRC, ECC, and other advanced error checking and correction algorithms ensures data is safe from corruption.
- Enhanced data protection provided by T10 PI with high-performance offload. T10 PI provides additional data protection in environments such as Oracle Unbreakable Linux.

### Deployment and Management Features

- Universal boot capability allows the appropriate boot environment to be automatically selected for any given hardware.
- Boot from SAN capability reduces system management costs and increases uptime.
- Detailed, real-time event logging and tracing enables quick diagnosis of SAN problems.
- Beaconing feature flashes the HBA LEDs, simplifying their identification within server racks.
- Environmental monitoring feature helps optimize SAN availability.

### Management Features

- The Emulex OneCommand Manager application enables centralized discovery, monitoring, reporting, and administration of HBAs provided by Emulex on local and remote hosts. Powerful automation capabilities facilitate remote driver parameter, firmware and boot code upgrades.

- Advanced diagnostic features, such as adapter port beaconing and adapter statistics, help optimize management and network performance, while the environmental monitoring feature helps to maintain optimum host-to-fabric connections. In addition to the GUI interface, management functions can also be performed via a scriptable Command Line Interface (CLI).
- Troubleshoot optics and cables before critical errors affect your system with Brocade ClearLink supported Switches and Emulex HBAs.
- Meet SLAs and QoS with ExpressLane application prioritization on hosts.
- OneCommand Manager supports role-based management to facilitate administration of adapters throughout the data center without compromising security. Management privileges can be assigned based on LDAP and AD group memberships.
- Emulex's management instrumentation complies to open management standards, such as SMI-S and common HBA API support, which enables seamless upward integration into enterprise storage and server management solutions.

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Fibre Channel HBAs

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