

# Emulex Gen 7 Fibre Channel HBAs LPe36000/35000-D-Series

## Next-Gen HBAs for the Modern Data Center

The Emulex® LPe36000/35000-series 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 64GFC and 32GFC SANs. The Emulex LPe35000-series provide seamless backward compatibility to 16GFC and 8GFC networks. The LPe36000-series provides backward compatibility to 32GFC and 16GFC networks.

Emulex fully supports new industry standards that further enhance Broadcom autonomous SAN<sup>1</sup> innovations to self-learn, self-optimize, and self-heal, proactively keeping the SAN running at maximum speed and avoiding downtime. The new industry standards supported by Emulex around fabric performance impact notifications (FPINs) include Link integrity notification (FPIN-LI), congestion notification (FPIN-CN), peer congestion notification (FPIN-PN), and delivery notification (FPIN-DN). The Emulex SAN Manager<sup>2</sup> application is the first application in the industry that uses the FPIN-CN standard to automatically identify, minimize, and mitigate application performance problems caused by SAN congestion.

## 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. The LPe35000-series deliver 12,800 MB/s (two 32GFC ports) or 25,600 MB/s (two 64GFC ports) full duplex, 3x better hardware latency, and supports an industry-leading up to 10 million IOPS.<sup>3</sup>

The fastpath design provides hardware acceleration for Emulex 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). Testing by independent performance labs has shown that NVMe/FC can deliver up to 50% more IOPs and 30% lower latency<sup>4</sup> than traditional SCSI FCP, and up to 3.4x higher online transaction processing (OLTP) transactions per minute than traditional SCSI FCP.<sup>5</sup> Emulex Gen 7 HBAs also support NVMe/FC and SCSI FCP concurrently, providing investment



## 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 10M IOPS—over 3x more than the previous generation
- Get faster data transfer speed with the industry's first PCIe 4.0 HBA 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
- Enable full end-to-end implementation of Brocade® Fabric Vision® from the HBA to the switch

## 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

protection and allowing data centers to transition to end-to-end NVMe over FC SANs at their own pace.

The LPe36000/35000-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.

1. The Emulex SAN Manager application is available separately, contact Broadcom Sales for information. [Broadcom Autonomous Self-Healing SANs](#)
2. [Emulex SAN Manager](#)
3. [Tolly Test Report- LPe36002 HBA](#)
4. [Demartek- Performance Benefits of NVMe/FC](#)
5. [Tolly Test Report- NVMe/FC vs. SCSI](#)

## Operational Efficiency

The LPe36000/35000-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.

OpenManage Enterprise systems management allows administrators to monitor, manage, update, troubleshoot, and remediate Dell servers from any location, without the use of agents and regardless of OS or hypervisor presence or state.

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 Emulex HBA Manager application provides centralized management of current and previous generations of Emulex FC HBAs. Emulex HBA troubleshooting is simplified with Emulex HBA

Capture, an Emulex utility that gathers system, adapter, and device driver information. Data collected by HBA Capture 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.

The Emulex Gen 7 HBAs provide unmatched security features for Fibre Channel environments. LPe36000/35000-series feature 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.

The Emulex 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 LPe36000/35000-series FC HBAs are powered by the XE601 controller and utilize an eight-lane (x8) PCIe 4.0 bus (backward compatibility to PCIe 3.0 supported)—the architecture enables resources to be applied to any port that needs them, delivering up to 10M IOPS on the LPe36000-series and up to 5M IOPS on the LPe35000-series..

### 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/AMI
- Legacy ANSI/IETF Standards: FC-PI-4; FC-FS-3; FC-FS-4; 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

### Dual-port LPe36002

- Supports 64GFC, 32GFC and 16GFC link speeds, automatically negotiated

### Single-port LPe35000/Dual-port LPe35002

- Supports 32GFC, 16GFC, and 8GFC link speeds, automatically negotiated

## Comprehensive OS and Hypervisor Support

- Microsoft Windows
- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server
- VMware vSphere
- Oracle Linux, UEK
- Citrix

## Hardware Environments

- Dell 16G/15G/14G PowerEdge servers (64G HBAs not available for 14G servers)

## Optical

- Data rates: 64GFC (28.9 GBaud PAM4), 32GFC (28.05 GBaud NRZ), 16GFC (14.025 GBaud NRZ), 8GFC (8.5 GBaud NRZ), automatically detected (8GFC supported for LPe35000-series HBAs only)
- Optics: Short-wave lasers with LC-type connector
- Cable:
  - 0.5m to 70m at 64GFC/32GFC on 50/125  $\mu$ m OM3 MMF
  - 0.5m to 100m at 64GFC/32GFC on 50/125  $\mu$ m OM4 MMF
  - 0.5m to 100m at 64GFC/32GFC on 50/125  $\mu$ m OM5 MMF
  - 10 km at 32GFC/16GFC on 9/125- $\mu$ m single-mode fiber when Emulex-approved long-wave transceivers are used

## Physical Dimensions

- Short, low-profile PCIe card
- 167.64 mm x 68.91 mm (6.60 in. x 2.71 in.)

## Environmental Requirements

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

Description	Factory Install Part Number	Customer Install Part Number
LPe36002-D Dual-port 64GFC HBA - Full Height	540-BDNN	540-BDNO
LPe36002-D Dual-port 64GFC HBA - Low Profile	540-BDNU	540-BDNS
LPe35002-D Dual-port 32GFC HBA - Full Height	406-BBMP	406-BBMR
LPe35002-D Dual-port 32GFC HBA - Low Profile	406-BBMO	406-BBMQ
LPe35000-D Single-port 32GFC HBA - Full Height	406-BBPV	406-BBQJ
LPe35000-D Single-port 32GFC HBA - Low Profile	406-BBPW	406-BBQK

## 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

### LPe36000/35000-D-Series

- Dell HBAs are available to order from Dell, using the following part numbers and model numbers.