MDS-9124V, MDS-9148V
and MDS-9396V

Connectrix MDS 64Gb/s Fibre Channel Switches Specification Sheet

Newest generation Connectrix MDS 64 Gigabits per second (Gb/s) Fibre Channel switches provide high-speed Fibre Channel connectivity for all-flash arrays and high-performance hosts.

Product Overview

The Connectrix MDS 64Gigabits per second (Gb/s) switch models offer state-of-the-art analytics and telemetry capabilities built into their new Application-Specific Integrated Circuit (ASIC) chipset. The MDS 64b/s switches seamlessly transition to Fibre Channel Non-Volatile Memory Express (NVMe/FC) workloads whenever available without any hardware upgrade in the SAN. The MDS 64Gb/s switches empower small, midsize, and large enterprises that are rapidly deploying cloud-scale applications using extremely dense virtualized servers, providing the benefits of greater bandwidth, scale, and consolidation.

Some of the main benefits for a small-scale Storage Area Network (SAN) are automatic zoning, nonblocking forwarding, and smaller port groups of 24 ports. Benefits for a mid- to large-size SAN include higher scale for Fibre Channel control-plane functions, Virtual SANs, fabric login (FLOGI), device alias and name server scale, 48 ports of 64Gb/s non-oversubscribed line-rate ports, bidirectional airflow, and a fixed-form NVMe/FC SAN switch with enhanced Buffer-to-Buffer (B2B) credits and capable of hardware-assisted Fibre Channel link encryption. Large-scale SAN architectures built with SAN core directors can expand 64-Gbps connectivity to the server rack using these switches configured in either switch mode or Network Port Virtualization (NPV) mode. Additionally, the switch supports enhanced diagnostic features such as Inter-Switch Link (ISL) and Host-Bus- Adapter (HBA) diagnostics, remote SFP (Read Diagnostic Parameter) diagnostics, remote port beaconing (Link Cable Beaconing) and advanced reliability features such as link level Forward Error Correction (FEC) with HBA ports.

Main features and benefits

The main features of the Connectrix MDS 64Gb/s Fibre Channel Switch family includes:
- **High performance**: MDS 64Gb/s architecture, with centralized nonblocking arbitration, provides consistent 64Gb/s low-latency performance across all traffic conditions for every Fibre Channel port on the switch.

- **Fully integrated SAN Analytics**: This feature-rich switch also offers state-of-the-art data traffic analytics and telemetry capabilities that have been built into this hardware platform. This new state-of-the-art technology couples the next-generation port ASIC with a fully dedicated Network Processing Unit (NPU). Information is extracted by the port ASIC from passing line rate traffic and used by the NPU to calculate

performance data on board the switch in real time. Using an industry-leading open telemetry format, the data can be streamed to any analytics visualization platform.

- **Dynamic Ingress Rate Limiting (DIRL):** MDS 64Gb/s switches support the dynamic ingress rate limiting feature. Using DIRL, the MDS SAN can automatically detect any symptoms of congestion and then dynamically rate limits the congested and slow-drain devices so that adverse effects are not spread to other devices. DIRL dynamically adapts the rate-limiting to suit the traffic profile of the congestion or slow-drain device.

- **High availability:** MDS 64Gb/s switches are designed to provide 99.999% availability. The Connectrix MDS 64Gb/s platforms provide such outstanding availability and reliability by providing redundancy on all major components, such as the power supply and cooling subsystems. Dual power supplies also facilitate redundant power grids. In addition, port-channel link members can be striped across two 24-port port groups, thus providing additional high availability.

- **Reliability:** As part of the standard 64Gb/s Fibre Channel specification, Connectrix MDS provides FEC between switch ports and HBA ports on all 64Gb/s Fibre Channel fixed switches. This feature helps ensure any error introduced in flight gets corrected at the receive side of the link. In addition, MDS extends Buffer-to-Buffer State Change Notification (BBSCN) and buffer-to-buffer credit recovery, which is supported on all MDS switches between ISL ports, to the fabric ports attached to any end device.

- **Higher scalability:** Increased fabric scalability provides more flexibility for a variety of SAN architectures.

- **Telemetry:** Fibre Channel and Small Computer System Interface (SCSI) or NVMe headers can be inspected without the need for any external taps or appliances. The resulting metrics can be analyzed on the switch and can additionally be exported using a dedicated 1Gb/s Small Form-Factor Pluggable Plus (SFP+) port for telemetry and analytics purposes.

  - **Intelligent services**: Auto-zone, Smart Zoning, slow-drain detection and isolation, Virtual SAN (VSAN) and Inter-VSAN Routing (IVR), and fabric-wide Quality of Service (QoS) enable migration from SAN islands to enterprise-wide storage networks. Traffic encryption is available to meet stringent security requirements.

  - **Sophisticated diagnostics:** The MDS 64Gb/s switch models provide intelligent diagnostics tools such as ISL diagnostics, HBA diagnostics, remote SFP-error collection, Switched Port Analyzer (SPAN), integrated Call Home capability, Slow Drain Monitoring and an Online Health Management System for greater reliability, faster problem resolution, and reduced service costs.

  - **Virtual-machine awareness:** The MDS 64Gb/s switch models provide visibility into all virtual machines that are accessing storage LUNs or namespaces in the fabric. This feature is available through HBAs capable of priority tagging the Virtual Machine Identifier (VMID) on every Fibre Channel frame. Virtual-machine awareness can be extended to intelligent fabric services such as analytics to visualize performance of every flow originating from each virtual machine in the fabric.

  - **Programmable fabric:** The MDS 64Gb/s switch models provide NX-API, a powerful RPC-style HTTP/HTTPS API to enable flexible and rapid programming of utilities for the SAN. This can be coupled with specific modules for Ansible and Python.

  - **Secure-boot and anti-counterfeiting technology:** The MDS 64Gb/s switch models uses onboard hardware that protects the entire system from malicious attacks by securing access to critical components such as the bootloader, system image loader, and Joint Test Action Group (JTAG) interface.

Connectrix MDS 64Gb/s Fibre Channel Switches

Features	Technical Specification
MDS Premier Subscription License	Optional subscription software license includes MDS Enterprise Package, Nexus Dashboard Fabric Controller (NDFC) and SAN Analytics licenses. Subscriptions available in 1-, 3- or 5-years.
MDS Advantage Subscription License	Optional subscription software license includes MDS Enterprise Package and Nexus Dashboard Fabric Controller (NDFC) Subscriptions available in 1-, 3-or 5-years.
MDS Software minimum revision	MDS-9124V NX-OS release 9.3(1) or later MDS-9148V NX-OS release 9.3(1) or later MDS-9396V NX-OS release 9.4(1) or later
Protocols	Fibre Channel standards
Fibre Channel ports	MDS-9124V – fixed switch form factor with 24 SFP+ ports MDS-9148V – fixed switch form factor with 48 SFP+ ports MDS-9396V – fixed switch form factor with 48 SFP+ base ports with support for up to 96-ports in 16 port increments
Security	VSAN fabric isolation Intelligent packet inspection at port level Hardware zoning by Access Control Lists (ACLs) Fibre Channel Security Protocol (FC-SP) switch-to-switch authentication FC-SP host-to-switch authentication Role-Based-Access-Control (RBAC) using RADIUS, TACACS+, or Lightweight Directory Access Protocol (LDAP) authentication, authorization and accounting AA functions Secure FTP (SFTP) Secure Shell Protocol Version 2 (SSHv2) Simple Network Management Protocol Version 3 (SNMPv3) implementing Advanced Encryption Standard (AES) Control plane security TrustSec payload encryption Secure Boot and Anti-counterfeit technology

Performance	Port speed: 8-, 16-, 32-, and 64-Gb/s autosensing with 64Gb/s of dedicated bandwidth per port
	Aggregate bandwidth:
	    1.5-Tb/s end-to-end full duplex for MDS-9124V
	    3-Tb/s end-to-end full duplex for MDS-9148V
	    6-Tb/s end-to-end full duplex for MDS-9396V
	Buffer credits: Up to 24,000 for a group of 24 ports, with a default of 1000 buffer credits per port and a maximum of 16,000 buffer credits for a single port in the group
	Port groups:
	    1 port group of 24 ports for MDS-9124V
	    2 port groups of 24 ports each for MDS-9148V
	    4 port groups of 24 ports each for MDS-9696V
	Port channel:
	    Up to 24 load-balanced physical links grouped in one port channel for MDS-9124V and MDS-9148V
	    Up to 16 load-balanced physical links grouped in one port channel for MDS-9396V

Diagnostics	Power-On-Self-Test (POST) diagnostics
	Online Health Management System (CHMS) diagnostics
	Internal loopbacks
	SPAN
	Fibre Channel trace route
	Fibre Channel ping
	Fibre Channel debug
	Syslog
	Port-level statistics
	Link diagnostics (E-port and F-port links) Read diagnostic parameter (RDP)
Serviceability	Configuration file management
	Call home
	Port beaconing
	Link cable beacon
	System LEDs
	SNMP traps for alerts
Reliability and availability	In-Service Software Upgrades (ISSU)
	Hot-swappable, dual redundant power supplies
	Hot swappable fan tray with switch integrated temperature and power management
	Hot-swappable SFP+ optics
	Stateful process restart
	Any port configuration for port channels
	Fabric-based multipathing
	Per-VSAN fabric services
	Port tracking FEC with HBA ports Buffer-to-buffer state change notification with HBA ports
Network management	Management access through the following out-of-band Ethernet ports - mgmt0: 10/100/1000BASE-T port
	RS-232 serial console port
	MDS-9396V USB power-on auto-provision port
	Access protocols
	Command Line Interface (CLI) using the console and the Ethernet port
	SNMPv3 using the Ethernet port and in-band IP over Fibre Channel access
	Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S)
	NX-API for HTTP/HTTPS full programmability
	Distributed device alias service
	Network security
	Per VSAN RBAC using LDAP, RADIUS and TACACS+-based AAA functions
	Simple File Transfer Protocol (SFTP)
	SSHv2 implementing AES SNMPv3 implementing AES
Programming interface	Scriptable CLI
	Data Center Network Manager and Nexus Dashboard Fabric Controller web services API
	NX-API HTTP/HTTPS interfaces
	Onboard Python interpreter
	Embedded Event Manager
	NX-OS Software scheduler

Connectrix MDS 64Gb/s Switches

Physical dimensions (HxWxD) and weight	MDS-9124V: 1 Rack Unit (1RU) 1.72 x 17.299 x 18 inches (4.37 x 43.94 x 45.72 cm) excluding power supply unit (PSU) and fan trays 18.73 lbs. (8.5 kg) MDS-9148V: 1 Rack Unit (1RU) 1.72 x 17.299 x 18 inches (4.37 x 43.94 x 45.72 cm) excluding power supply unit (PSU) and fan trays 21.8 lbs. (9.8 kg) MDS-9396V: 2 Rack Unit (2RU) 3.4 x 17.4 x 23.9 in (8.64 x44.23 x 60.73cm) 44 lb (20 kg)
Power	80 Plus Platinum certified power supplies Power supply options MDS-9124V and MDS-9148V: - 500W in base model, port-side exhaust variant (2 per switch) - 500W AC in base model, port-side intake variant (2 per switch) - 1200W AC/HVAC/HVDC in base model, bidirectional airflow (2 per switch) Power supply options MDS-9396V: - 1400W AC port-side exhaust variant (2 per switch) - 1400W AC in base model, port-side intake (2 per switch - 2000W AC/HVAC/HVDC in base model, Port side intake (2 per switch) Power cord options MDS-9124V and MDS-9148V: - Notched C15 socket connector connecting to C16 plug on the power supply receptacle for 500W power supply - Standard CAB-HVAC-C14-2M IEC to Saf-d-grid connector on the power supply receptacle for 1200W power supply Power cord options MDS-9396V: - Notched C15 socket connector connecting to C16 plug on the power supply receptacle for 1400W power supply - Check Ordering Information table in this document for power cords specific regions Power MDS-9124V and MDS-9148V: - 500W PSU AC input: 100 to 240 VAC (10% range) - 1200W PSU AC INPUT: 90V TO 305V - 1200W PSU DC INPUT: 192V TO 400V Power MDS-9396V: - 1400W PSU AC low Line Input: 90V to 140V - 1400W PSU AC High Line Input: 180V to 264 V - 2000W PSU AC High Line Input: 90V to 140V - 2000W PSU DC Input: 192V to 400V Frequency: 50 to 60 Hz (nominal) Typical power consumption MDS-9124V and MDS-9148V: - 174W for 48-port switch in idle status with no optics modules - 228W for 48-port switch with 24 64Gb SW optics modules under 50% line rate - 286W for 48-port switch with 48 64Gb SW optics modules under 50% line rate Typical power consumption MDS-9396V: - 420W for 96-port switch in idle status with no optics modules - 540W for 96-port switch with 48 64G SW optics modules at 50%-line rate - 650W for 96-port switch with 9664G SW optics modules at 50%-line rate Airflow MDS-9124V and MDS-9148V: - Back to front (towards ports) using port-side exhaust fans - Front to back (inward from ports) using port-side intake fans - 50 Cubic Feet per Minute (CFM) through system fan assembly at 77 degrees F (25 degrees C) - 100 CFM maximum

	Airflow MDS-9396V
	• Back to front (toward prts) using port-side exhaust fans
	• Front to back (inward from ports) using port-side intake fans
	• 192 Cubic Feet per Minute (CFM) through system fan assembly at 77 degrees F (25 degrees C)
	• 480 CFM maximum
Temperature range	Temperature, ambient operating: 32 to 104 degrees F (0 to 40 degrees C) with port-side exhaust and intake airflow variants
	Temperature, ambient nonoperating and storage: -40 to 158 degrees F (-40 to 70 degrees C)
	Relative humidity, ambient (noncondensing) operating and storage: 10% to 90%
	MDS-9124V and MDS-9148V: Relative humidity, ambient (noncondensing) nonoperating and storage: 10% to 95%
	MDS-9396V: Relative humidity, ambient (noncondensing) nonoperating and storage: 10% to 90%
	MDS-9396V: Relative humidity, ambient (noncondensing) nonoperating and storage: 5% to 95%
	Altitude, operating: ~197 to 6500 feet (~60 to 2000 meters
Approvals and compliance	Safety compliance
	CE Marking
	UL 60950
	CAN/CSA-C22.2 No. 60950
	EN 60950
	IEC 60950
	TS 001
	AS/NZS 3260
	IEC60825
	EN60825
	21 CFR 1040
	EMC Compliance
	FCC Part 15 (CFR 47) Class A
	ICES-003 Class A
	EN-55022 Class A
	CISPR 22 ClassA
	AS/NZS 3548 Class A
	VCCI Class A
	EN 55024
	EN 50082-1
	EN 61000-6-1
	EN 61000-3-2
	EN 61000-3-3
Fabric services	Name server
	Registered State Change Notification (RSCN)
	Login services
	Fabric Configuration Server (FCS)
	Broadcast
	In-order delivery
Advanced functions	VSAN
	IVR
	NPV
	Port Channel with multipath load balancing
	Flow and zone-based QoS

64Gb/s Fibre Channel SAN architecture benefits

64Gb/s fabric switches address the requirement for highly scalable, virtualized, intelligent SAN infrastructure in current-generation data center environments.

This solution offers several important benefits:

- **Server port consolidation**: The demand for 64Gb/s fabric switches will increase as hyperscale virtualization doubles the virtual machine density per rack, increasing the need for higher bandwidth HBA ports per rack of blade or standalone servers. Soon 64Gb/s HBA ports will consolidate the current 16Gb/s HBA installed base, with the need to increase the server capacity in the same rack. Hence, the 24- and 48-port in a 1RU form factor, provides an excellent solution.

- **Simplification**: Through consolidation, the SAN administrator can reduce complexity and simplify management. With an MDS 64Gb/s switch in N_Port ID Virtualization (NPIV) core mode and Fibre Channel switches connecting to it in N_Port Virtualization (NPV) mode, device ports can scale very cost-effectively over time without adding the burden of managing the NPV switches. Auto-zoning facilitates zero-touch automatic zoning without any need for configuring zoning on the 64Gb/s fixed switches that are deployed in SANs with single switch topology.

- **Multiprotocol convergence:** 64Gb/s links benefit from lower latency when compared to lower bandwidth links, bringing better network throughput to your storage array workloads. Greater bandwidth also helps ensure less ISL congestion for the newer storage protocols that are expected to be available on externally attached storage arrays: for instance, NVMe over Fibre channel can coexist on the same link as existing SCSI workloads.

- **Scale and performance**: This fixed form-factor switch supports the performance and scale required to deploy a dedicated and standalone Fibre Channel SAN connecting both initiators and targets without requiring any other switching infrastructure.

Connectrix MDS VSANs

VSANs are ideal for efficient, secure SAN consolidation, enabling more efficient storage network utilization by creating hardware-based isolated environments with a single physical SAN fabric or switch. Each VSAN can be zoned as a typical SAN and maintains its own fabric services for added scalability and resilience. VSANs ensure the complete segregation of traffic and retaining independent control of configuration on a VSAN-by-VSAN basis.

Inter-VSAN Routing (IVR)

In another step toward deploying efficient, cost effective, consolidated storage networks, the Connectrix MDS-9148V supports IVR, which is a routing function for Fibre Channel. IVR allows selective transfer of data between initiators and targets on different VSANs while maintaining isolation of control plane traffic within each VSAN. With IVR, data can transit VSAN boundaries while maintaining control plane isolation, thereby maintaining fabric stability and availability. IVR is one of the feature enhancements requiring a license and eliminates the need for external routing appliances, greatly increasing routing scalability while delivering line rate routing performance, simplifying management, and eliminating the challenges associated with maintaining separate systems. Under the right circumstances, deploying IVR means lower total cost of SAN ownership.

Robust Network Security

To address the need for enhanced security in storage networks, the Connectrix MDS-9148V includes as standard an extensive security framework to protect highly sensitive data crossing today's enterprise networks:

- **Smart Zoning:** When the Smart Zoning feature is enabled, MDS 9000 fabrics provision the hardware access control entries specified by the zone set more efficiently, avoiding the superfluous entries that would allow servers (initiators) to communicate to other servers, or allow storage devices (targets) to communicate to other storage devices. This feature makes larger zones with multiple initiators and multiple targets feasible without excessive consumption of hardware resources. Thus, smart zones can correspond to applications, application clusters, hypervisor clusters, or other data center entities, saving the time that administrators previously spent creating many small zones, and enabling the automation of zoning tasks.

- Intelligent packet inspection is provided at the port level, including the application of ACLs for hardware enforcement of zones, VSANs, and advanced port security features.

- Switch-to-switch and host-to-switch authentication helps eliminate disruptions that may occur because of unauthorized devices connecting to a large enterprise fabric.

- FC-SP ESP payload encryption, which supports encrypted data to flow through the switch, is supported.

- Port security locks down the mapping of an entity to a switch port to help ensure that SAN security is not compromised by the connection of unauthorized devices to a switch port.

- VSAN-based access control allows customers to define roles in which the scope of the roles is limited to certain VSANs.

- FC-SP provides switch-switch and host-switch Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) authentication, supporting RADIUS and TACACS+, to help ensure that only authorized devices access protected storage networks.

- Digital certificates are issued by a trusted third party and are used as electronic passports to prove the identity of certificate owners.
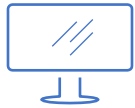
Dell Services

Installation and configuration
Trust our experts to lead enterprise deployments for hardware and software. ProDeploy Plus the most complete deployment offer available in the market. It is the fastest and most reliable method to add more capacity to an existing Storage Area Network (SAN) or migrate and replace outdated SAN devices with newer, more advanced technology. Ideal for customers seeking on-site cutover assistance to mitigate risk when migrating to the new network. The ProDeploy suite offers a variety of installation and configuration services to meet the needs of every budget and skillset. Trust Dell for expert implementation and peace of mind.

Health Check and pre-deployment design service
Although Fibre Channel networks are highly reliable and robust, no network is immune to congestion and backpressure that can slow network traffic or cause outages, especially when there is a mixture of old and new infrastructure. The Fibre Channel Infrastructure Assessment service is ideal for large or medium size enterprises that require unbiased facts and professional expertise to identify performance issues and help guide capacity planning, using specialized software monitoring and analytic tools. Get results with the Fibre Channel Infrastructure Assessment.