

Cisco MDS 9700 48-port 64-Gbps Fibre Channel Switching Module

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The Cisco MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module meets the performance, availability, scalability, and efficiency needs of the most demanding modern NVMe-based data centers.

Product overview

The Cisco MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module (Figure 1) delivers predictable performance, scalability, and innovative features to support modern data centers. The 64-Gbps 48-port Fibre Channel switching module meets the high-performance needs for Non-Volatile Memory Express (NVMe) over Fibre Channel and flash memory storage. It offers innovative services including full end-to-end NVMe support, onboard advanced Fibre Channel analytics engine, virtual machine awareness, Dynamic Rate Limiting Ingestion (DIRL), E-port and F-port diagnostics, integrated VSANs, Advanced Inter-VSAN Routing (IVR), and port channels. It delivers full-duplex aggregate performance of 3072 Gbps, making it well suited for high-speed 64-Gbps storage subsystems, 64-Gbps Inter-Switch Links (ISLs), high-performance virtualized servers, and NVMe and all-flash arrays.



Figure 1.
Cisco MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module

The MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module enables administrators to scale and consolidate SAN deployments with fewer hardware components. Your SAN administrators can consolidate workloads from hundreds of high-performance virtual machines and scale them with incremental updates as your SAN grows while protecting your existing investment.

This switching module ships with an advanced built-in analytics engine. The engine analyzes real-time Fibre Channel exchanges and reports on various performance metrics in detail, enabling comprehensive and timely monitoring of any potential performance problems among SAN edge devices. The onboard Network Processing Unit (NPU) in the module allows I/O-level metrics to be computed at every switch. The NPU can monitor all flows on all ports at line rates. In conjunction with the main processor, the NPU examines every exchange passing through the 64-Gbps Application-Specific Integrated Circuit (ASIC) to capture flow metrics such as exchange completion time, maximum number of outstanding exchanges, data access latency, read and write I/O Operations Per Second (IOPS), throughput, Logical Unit Number (LUN) access pattern (sequential or random), and I/O block sizes.

The 64G switching module is hot swappable and compatible with older 16- and 32-Gbps Fibre Channel modules (all previously sold modules on Cisco MDS 9700 Director can work simultaneously with the new module). The 64G module supports hot-swappable Enhanced Small Form-Factor Pluggable (SFP+) transceivers. Individual ports can be configured with Cisco® 64-, 32-, and 16-Gbps SFP+ transceivers. Each port on the new 64G switching module can autonegotiate port speed to 64-, 32-, 16- or 8-Gbps. Each port supports 1000 buffer credits for exceptional extensibility without the need for additional licenses. With the [Cisco® MDS 9000 Family Enterprise Package](#), up to 16,000 buffer credits can be allocated to an individual port, enabling full link bandwidth over long distances with no degradation in link utilization.

The 64-Gbps Fibre Channel switching module also provides existing features such as predictable performance, high availability, advanced traffic management capabilities, integrated VSAN and IVR, resilient high-performance ISLs, hardware-assisted slow-drain support, comprehensive security frameworks, fault detection and isolation of errored packets, and sophisticated diagnostics.

Main benefits

The Cisco MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module offers the following benefits:

- Lower Total Cost of Ownership (TCO) with SAN consolidation: With the exponential growth of data in today's business environment, organizations need to deploy large-scale SANs in the most efficient and cost-effective ways. To meet scalability requirements while managing TCO, the MDS 9700 Series directors offer the following:
 - Industry-leading port density of up to 768 line-rate 64-Gbps Fibre Channel ports per Cisco MDS 9718 chassis
 - 3-Tbps Fibre Channel nonblocking and non-oversubscribed I/O per slot
 - Up to 48-Tbps front-panel Fibre Channel line-rate nonblocking and non-oversubscribed system-level switching
 - Built-in network processing unit for advanced inline analytics
 - Ability to reuse currently supported Cisco 16- and 32-Gbps SFP+ optics
 - Exceptional capabilities with intelligent fabric services; for example, VSAN, IVR, QoS, etc.
 - VSANs for consolidating individual physical SAN islands while maintaining logical boundaries
 - IVR for sharing resources across VSANs
 - Enterprise-ready features to enable the consolidation of an organization's data assets into fewer, larger, and more manageable SANs, thus reducing the hardware footprint and associated capital and operating expenses; for example, enhanced zoning in MDS, Cisco Smart Zoning, enhanced device alias, etc.
- End-to-end NVMe support with analytics: All currently shipping Cisco products support the latest NVMe over Fibre Channel (FC) protocols. In addition to supporting NVMe over FC traffic, the built-in analytics engine also collects real-time performance data that supports the data center workloads' high performance requirements.

- Enterprise-class availability: The Cisco MDS 9700 Series Multilayer Director was specifically designed from the beginning for high-availability and mission-critical environments. Beyond meeting the basic requirements of nondisruptive software upgrades and redundancy of all critical hardware components, the MDS 9700 Series software architecture offers outstanding greater than five-nines availability.
- Virtual machine-aware SAN deployment: Cisco SAN Analytics available on the MDS switches natively provides end-to-end visibility into Virtual Machine-Initiator-Target-LUN (VM-ITL) flow for SCSI operations or Virtual Machine-Initiator-Target-Namespace (VM-ITN) flow for NVMe operations. Also, Cisco Data Center Network Manager (DCNM) provides end-to-end visibility from virtual machines to storage devices. Resource allocation, performance measurements, and predictions are available on a per-virtual machine basis to enable rapid troubleshooting in mission-critical virtualized environments.
- Advanced traffic management: The following advanced traffic management capabilities, integrated into every MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module, simplify deployment and optimization of large-scale fabrics:
 - The Virtual Output Queue (VOQ) helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.
 - Up to 16,000 buffer-to-buffer credits can be assigned to any individual port for optimal bandwidth utilization across distances.
 - Port channels allow up to 16 physical ISLs to be aggregated into a single logical bundle, providing optimized bandwidth utilization across all links. The bundle can be a mix of any port from any module in the chassis. This approach helps ensure that the bundle can remain active even if a module fails.
 - Fabric Shortest Path First (FSPF)-based multipathing provides the intelligence to load balance across up to 16 equal-cost paths and dynamically reroute traffic if a switch fails.
 - QoS helps manage bandwidth and control latency to prioritize critical traffic and is available on every port.
 - The lossless network-wide in-order delivery guarantee helps ensure that frames are never reordered within a switch. This guarantee extends across the entire multistitch fabric where the fabric is stable and no topology changes have been made.
- Cisco Dynamic Ingress Rate Limiting (DIRL): MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module supports the new feature of dynamic ingress rate limiting. 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.

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- Advanced diagnostics and troubleshooting tools: The MDS 9700 Series integrates proactive diagnostics, tools to verify connectivity and route latency and to capture and analyze traffic, thereby simplifying the management of large-scale storage networks. The Power-On Self-Test (POST) and online diagnostics provide proactive health monitoring. The powerful Cisco Generic Online Diagnostics (GOLD) framework is a suite of diagnostic facilities that verify whether the hardware and internal data paths are operating as designed. Boot-time diagnostics, continuous monitoring, standby fabric loopback tests, and on-demand and scheduled tests are part of the GOLD feature set. This industry-leading diagnostics subsystem enables rapid fault isolation and continuous system monitoring, which are critical features in today's continuously operating environments.

Integrated hardware functions support diagnostic capabilities such as Fibre Channel traceroute to identify the exact path and timing of flows, and Cisco Switched Port Analyzer (SPAN) and Remote SPAN (RSPAN) to intelligently capture network traffic. The captured Fibre Channel traffic can be analyzed using Cisco Fabric Analyzer software. Comprehensive port-based and flow-based statistics enable sophisticated performance analysis and Service-Level Agreement (SLA) accounting.

- Comprehensive solution for robust security: Addressing the need for stringent security in storage networks, the MDS 9700 Series 64-Gbps Fibre Channel line card offers an extensive security framework to protect the highly sensitive data crossing today's enterprise networks. The MDS 9700 Series employs intelligent packet inspection at the port level, including the application of ACLs for hardware enforcement of zones, VSANs, and advanced port security features. VSANs are used to achieve greater security and stability by providing complete isolation of devices that are connected to the same physical SAN. IVR enables controlled sharing of resources between VSANs.

In addition, FC-SP1 provides switch-to-switch and host-to-switch Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) authentication supporting RADIUS or TACACS+ to help ensure that only authorized devices access protected storage networks. Cisco TrustSec1 Fibre Channel link encryption, available on the MDS 9700 Series 64-Gbps modules, allows you to transparently encrypt ISLs at up to line-rate speeds, providing an additional layer of protection for traffic within and between data centers. The MDS 9700 Series supports a fabric binding feature that helps ensure that ISLs are enabled only between specified switches in the fabric binding configuration.

- Integrated mainframe support:¹ The MDS 9700 Series is mainframe ready, with full support for IBM System Z Fibre Connection (FICON) and Linux environments. The MDS 9700 Series supports transport of the FICON protocol in both cascaded and noncascaded fabrics. It also supports a mix of FICON and open-systems Fibre Channel Protocol (FCP) traffic on the same switch.

¹ Mainframe support available in the future release of Cisco NX-OS.

Product specification

Table 1 lists the product technical specifications for the Cisco MDS 9700 48-Port 64-Gbps Fibre Channel Switching Modules.

Table 1. Technical specifications

Feature	Description
Product compatibility	Cisco MDS 9700 Series Multilayer Directors
Software compatibility	Cisco MDS 9000 NX-OS Software Release NX-OS 9.2(1)
Protocols	<ul style="list-style-type: none">• Fibre Channel standards<ul style="list-style-type: none">◦ FC-PI-6 (INCITS 512-2015)◦ FC-PI-7 (INCITS 543-2019)◦ FC-FS-4 (INCITS 488-2016)◦ FC-FS-5 (INCITS 545-2019)◦ FC-GS-7 (INCITS 510-2017)◦ FC-GS-8 (INCITS 548-2020)◦ FC-LS-3 (INCITS 487-2018)◦ FC-LS-4 (INCITS 553-2020)◦ FC-SW-6 (INCITS 511-2016)◦ FC-SW-7 (INCITS 547-2020)◦ FC-NVMe (INCITS 540-2018)◦ FC-NVMe-2 (INCITS 556-2020)• FC-PH, Revision 4.3 (ANSI INCITS 230-1994)• FC-PH, Amendment 1 (ANSI INCITS 230-1994/AM1-1996)• FC-PH, Amendment 2 (ANSI INCITS 230-1994/AM2-1999)• FC-PH-2, Revision 7.4 (ANSI INCITS 297-1997)• FC-PH-3, Revision 9.4 (ANSI INCITS 303-1998)• FC-PI, Revision 13 (ANSI INCITS 352-2002)• FC-PI-2, Revision 10 (ANSI INCITS 404-2006)• FC-PI-3, Revision 4 (ANSI INCITS 460-2011)• FC-PI-4, Revision 8 (ANSI INCITS 450-2008)• FC-PI-5, Revision 6 (ANSI INCITS 479-2011)• FC-FS, Revision 1.9 (ANSI INCITS 373-2003)• FC-FS-2, Revision 1.01 (ANSI INCITS 424-2007)• FC-FS-2, Amendment 1 (ANSI INCITS 424-2007/AM1-2007)• FC-FS-3, Revision 1.11 (ANSI INCITS 470-2011)• FC-LS, Revision 1.62 (ANSI INCITS 433-2007)• FC-LS-2, Revision 2.21 (ANSI INCITS 477-2011)• FC-SW-2, Revision 5.3 (ANSI INCITS 355-2001)• FC-SW-3, Revision 6.6 (ANSI INCITS 384-2004)• FC-SW-4, Revision 7.5 (ANSI INCITS 418-2006)• FC-SW-5, Revision 8.5 (ANSI INCITS 461-2010)• FC-GS-3, Revision 7.01 (ANSI INCITS 348-2001)• FC-GS-4, Revision 7.91 (ANSI INCITS 387-2004)

Feature	Description
	<ul style="list-style-type: none"> • FC-GS-5, Revision 8.51 (ANSI INCITS 427-2007) • FC-GS-6, Revision 9.4 (ANSI INCITS 463-2010) • FCP, Revision 12 (ANSI INCITS 269-1996) • FCP-2, Revision 8 (ANSI INCITS 350-2003) • FCP-3, Revision 4 (ANSI INCITS 416-2006) • FCP-4, Revision 2b (ANSI INCITS 481-2011) • FC-SB-2, Revision 2.1 (ANSI INCITS 349-2001) • FC-SB-3, Revision 1.6 (ANSI INCITS 374-2003) • FC-SB-3, Amendment 1 (ANSI INCITS 374-2003/AM1-2007) • FC-SB-4, Revision 3.0 (ANSI INCITS 466-2011) • FC-SB-5, Revision 2.00 (ANSI INCITS 485-2014) • FC-BB-6, Revision 2.00 (ANSI INCITS 509-2014) • FC-BB-2, Revision 6.0 (ANSI INCITS 372-2003) • FC-BB-3, Revision 6.8 (ANSI INCITS 414-2006) • FC-BB-4, Revision 2.7 (ANSI INCITS 419-2008) • FC-BB-5, Revision 2.0 (ANSI INCITS 462-2010) • FC-VI, Revision 1.84 (ANSI INCITS 357-2002) • FC-SP, Revision 1.8 (ANSI INCITS 426-2007) • FC-SP-2, Revision 2.71 (ANSI INCITS 496-2012) • FAIS, Revision 1.03 (ANSI INCITS 432-2007) • FAIS-2, Revision 2.23 (ANSI INCITS 449-2008) • FC-IFR, Revision 1.06 (ANSI INCITS 475-2011) • FC-FLA, Revision 2.7 (INCITS TR-20-1998) • FC-PLDA, Revision 2.1 (INCITS TR-19-1998) • FC-Tape, Revision 1.17 (INCITS TR-24-1999) • FC-MI, Revision 1.92 (INCITS TR-30-2002) • FC-MI-2, Revision 2.6 (INCITS TR-39-2005) • FC-MI-3, Revision 1.03 (INCITS TR-48-2012) • FC-DA, Revision 3.1 (INCITS TR-36-2004) • FC-DA-2, Revision 1.06 (INCITS TR-49-2012) • FC-MSQS, Revision 3.2 (INCITS TR-46-2011) • Fibre Channel classes of service: Class 2, Class 3, and Class F • Fibre Channel standard port types: E, F, FL, and B • Fibre Channel enhanced port types: SD, ST, and TE
Cards, ports, and slots	<ul style="list-style-type: none"> • 48 autosensing 8/16/32/64-Gbps Fibre Channel ports • Can be used on any payload slot of the MDS 9700 Series directors • Can coexist with the MDS 9700 16-Gbps Fibre Channel module and the 32-Gbps Fibre Channel module without any restrictions on the location and the number of modules

Feature	Description
Features and functions	
Fabric services	<ul style="list-style-type: none"> • Name server • Registered State-Change Notification (RSCN) • Login services • Fabric Configuration Server (FCS) • Broadcast • In-order delivery • Congestion management with FPIN
Advanced functions	<ul style="list-style-type: none"> • VSAN • IVR • Port channel with multipath load balancing • Flow-based and zone-based QoS • N-Port ID Virtualization (NPIV) • Inline analytics
Diagnostics and troubleshooting tools	<ul style="list-style-type: none"> • POST diagnostics • Online diagnostics • Internal port loopbacks • SPAN and RSPAN • Fibre Channel traceroute • Fibre Channel ping • Fibre Channel debug • Cisco Fabric Analyzer • Syslog • Online system health • Port-level statistics • Real-time protocol debug • E-port and F-port diagnostics

Feature	Description
Network security	<ul style="list-style-type: none"> • VSANs • ACLs • Per-VSAN RBAC • Fibre Channel zoning <ul style="list-style-type: none"> ◦ N-port Worldwide Name (WWN) ◦ N-port Fibre Channel ID (FC-ID) ◦ Fx-port WWN ◦ Fx-port WWN and interface index ◦ Fx-port domain ID and interface index ◦ Fx-port domain ID and port number • FC-SP¹ <ul style="list-style-type: none"> ◦ DH-CHAP switch-to-switch authentication ◦ DH-CHAP host-to-switch authentication • Port security and fabric binding • Management access <ul style="list-style-type: none"> ◦ SSHv2 implementing AES ◦ SNMPv3 implementing AES ◦ SFTP • Cisco TrustSec Fibre Channel link-level encryption • SSHv2 implementing AES
Serviceability	<ul style="list-style-type: none"> • Configuration file management • Nondisruptive software upgrades for Fibre Channel interfaces • Cisco Call Home • Power-management LEDs • Port beaconing • System LED • SNMP traps for alerts • Network boot
Performance	<ul style="list-style-type: none"> • Port speed: 8/16-Gbps, 8/16/32-Gbps, and 8/16/32/64-Gbps autosensing Fibre Channel • Buffer credits: <ul style="list-style-type: none"> ◦ Default credits per port: 1000 ◦ With Enterprise license ◦ 24,000 shared among a single port group of 16 ports ◦ 16,000 maximum credits per port • Port channel: up to 16 ports

Feature	Description		
Supported Cisco optics, media, and transmission distances	Speed	Media	Distance
	<ul style="list-style-type: none"> • 64-Gbps² shortwave LC, SFP+ • 32-Gbps shortwave LC, SFP+ • 32-Gbps longwave, LC, SFP+ • 16-Gbps shortwave, LC, SFP+ • 16-Gbps longwave, LC, SFP+ 	<ul style="list-style-type: none"> • 9/125-micron single mode • 9/125-micron single mode • 50/125-micron multimode • 9/125-micron single mode • 50/125-micron multimode 	<ul style="list-style-type: none"> • 70m OM3 and 100m OM4. • 70m OM3 and 100m OM4. • 10 km • 100m OM3 and 125m OM4 • 10 km • 150m OM3 and 190m OM4 • 10 km
Reliability and availability	<ul style="list-style-type: none"> • Hot-swappable module • Hot-swappable SFP+ transceivers • Online diagnostics • Stateful process restart • Nondisruptive supervisor failover • Any-module, any-port configuration for port channels • Fabric-based multipathing • Per-VSAN fabric services • Port tracking • Virtual Routing Redundancy Protocol (VRRP) for management 		
Network management	<ul style="list-style-type: none"> • Access methods through MDS 9700 Series Supervisor-4 Module <ul style="list-style-type: none"> ◦ Out-of-band 10/100/1000 Ethernet port (Supervisor-4) ◦ RS-232 serial console port ◦ In-band IP over Fibre Channel • Access protocols <ul style="list-style-type: none"> ◦ Command-Line Interface (CLI) through console and Ethernet ports ◦ SNMPv3 through Ethernet port and in-band IP over Fibre Channel access • Distributed Device Alias service • Network security <ul style="list-style-type: none"> ◦ Per-VSAN RBAC using RADIUS- and TACACS+-based Authentication, Authorization, and Accounting (AAA) functions ◦ SFTP ◦ SSHv2 implementing AES ◦ SNMPv3 implementing AES • Management applications <ul style="list-style-type: none"> ◦ Cisco MDS 9000 Family CLI ◦ Cisco DCNM ◦ Cisco Device Manager • Dynamic Ingestion Rate Limiting (DIRL) <ul style="list-style-type: none"> ◦ FPIN-based ingestion notification ◦ Patented technology to intelligently manage traffic • Improve traffic consistency in performance 		

² 64-Gbps optics supported starting with NX-OS version 9.3.1

Feature	Description
Programming interfaces	<ul style="list-style-type: none"> • Scriptable CLI • Cisco Prime DCNM web services API • Cisco Prime DCNM GUI • Representational State Transfer (REST) API • NX-API • On-switch Python • Ansible
SAN Analytics	<ul style="list-style-type: none"> • In-line and non-disruptive visibility into at least 40,000 flows per MDS 9700 director and at least 20,000 flows per module • Collect at least 70 metrics per flow • Granularity of Virtual Machine-Initiator-Target-LUN (VM-ITL) flow for SCSI operations or Virtual Machine-Initiator-Target-Namespace (VM-ITN) flow for NVMe operations • Real-time visibility in microseconds • SAN Analytics is available on host ports, storage ports, and ISL ports. • Export SAN Analytics metrics directly from the MDS switches in an open format for easy third-party integration
Congestion detection and prevention	<ul style="list-style-type: none"> • Slow drain (Tx B2B credit starvation) detection at 2.5 microseconds granularity • Congestion due to over-utilization detection at 10 seconds granularity • Microburst detection multiple times in 10 seconds duration • Congestion prevention by dynamically rate limiting the congested devices using DIRM feature • Automatic congestion isolation and de-isolation of congested devices to a dedicated virtual link • Congestion recovery by dropping traffic to congestion device using no-credit-drop timeout and congestion-drop timeout • Timestamped logging of congestion events for easy troubleshooting • Fabric-wide DCNM slow-drain analysis for single-pane of glass visibility across the entire MDS SAN fabric
Environmental	<ul style="list-style-type: none"> • Temperature, ambient operating: 32 to 104° F (0 to 40° C) • Temperature, ambient nonoperating and storage: -40 to 158° F (-40 to 70° C) • Relative humidity, ambient (noncondensing) operating: 10% to 90% • Relative humidity, ambient (noncondensing) nonoperating and storage: 10% to 95% • Altitude, operating: -197 to 6500 ft (-60 to 2000m)
Physical dimensions	<ul style="list-style-type: none"> • Dimensions (H x W x D): 1.75 x 15.9 x 21.8 in. (4.4 x 40.39 x 55.37 cm) • Weight: 17.5 lb (7.94 kg)

Feature	Description
Approvals and compliance	<ul style="list-style-type: none"> • Regulatory compliance <ul style="list-style-type: none"> ◦ CE Markings per directives 2004/108/EC and 2006/95/EC • Safety compliance <ul style="list-style-type: none"> ◦ UL 60950-1 Second Edition ◦ CAN/CSA-C22.2 No. 60950-1 Second Edition ◦ EN 60950-1 Second Edition ◦ IEC 60950-1 Second Edition ◦ AS/NZS 60950-1 ◦ GB4943 2001 • EMC compliance <ul style="list-style-type: none"> ◦ 47CFR Part 15 (CFR 47) Class A ◦ AS/NZS CISPR22 Class A ◦ CISPR22 Class A ◦ EN55022 Class A ◦ ICES003 Class A ◦ VCCI Class A ◦ EN61000-3-2 • EN61000-3-3 • KN22 Class A • CNS13438 Class A • EN55024 • CISPR24 • EN300386 • KN24

Product sustainability

Information about Cisco's Environmental, Social, and Governance (ESG) initiatives and performance is provided in Cisco's CSR and sustainability [reporting](#).

Table 2. Product sustainability

Sustainability topic		Reference
General	Information on product-material-content laws and regulations	Materials
	Information on electronic waste laws and regulations, including our products, batteries, and packaging	WEEE Compliance
	Information on product takeback and reuse program	Cisco Takeback and Reuse Program
	Sustainability Inquiries	Contact: csr_inquiries@cisco.com
Material	Product packaging weight and materials	Contact: environment@cisco.com

Ordering information

Table 3 provides ordering information for the MDS 9000 Family 64-Gbps 48-Port Fibre Channel Switching Module.

Table 3. Ordering information

Part number	Product description
DS-X9748-3072-VK9	MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module with 48 64G short-wave optics
DS-X9748-3072-TK9	MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module with 48 32G short-wave optics
DS-SFP-FC64G-SW	64 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC32G-SW	32 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC32G-LW	32 Gbps Fibre Channel LW SFP+, LC
DS-SFP-FC32G-ELW	32 Gbps Fibre Channel ELW SFP+, LC
DS-SFP-FC16G-SW³	16 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC16G-LW	16 Gbps Fibre Channel LW SFP+, LC
DS-SFP-FC16G-ELW	16 Gbps Fibre Channel ELW SFP+, LC
Spare components	
DS-X9748-3072-VK9=	MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module with 48 64G short-wave optics, spare
DS-X9748-3072-TK9=	MDS 9700 48-Port 64-Gbps Fibre Channel Switching Module with 48 32G short-wave optics, spare
DS-SFP-FC64G-SW=	64 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC32G-SW=	32 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC32G-LW=	32 Gbps Fibre Channel LW SFP+, LC
DS-SFP-FC32G-ELW=	32 Gbps Fibre Channel ELW SFP+, LC
DS-SFP-FC16G-SW=	16 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC16G-LW=	16 Gbps Fibre Channel LW SFP+, LC
DS-SFP-FC16G-ELW=	16 Gbps Fibre Channel ELW SFP+, LC

³Supported only for 16- and 8-Gbps speeds; 4-Gbps is not supported.

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