

Cisco MDS 9000 Family Pluggable Transceivers

The Cisco® Small Form-Factor Pluggable (SFP), and X2 devices for use on the Cisco MDS 9000 Family are hot-swappable transceivers that plug into ports on the Cisco MDS 9000 Family director switching modules and fabric switches. These transceivers give users the flexibility to choose different cabling types and distances on a port-by-port basis.

Cisco SFP and X2 transceivers are available for use in conjunction with the Cisco MDS 9000 Family products as outlined in Table 1, below.

Table 1. MDS 9000 Family Switching Module/Fabric Switch Transceiver Support

Switching Module, Fabric Switch	DS-SFP-FC-2G-xx	DS-CWDM-xxxx=	DWDM-SFP-xxxx= ^A	DS-SFP-FCGE-xx	DS-SFP-GE-T
DS-X9016	Yes	Yes	Yes	Yes	
DS-X9032	Yes	Yes	Yes	Yes	
DS-X9032-SSM	Yes	Yes	Yes	Yes	
DS-X9112		Yes	Yes ²		
DS-X9124		Yes	Yes ²		
DS-X9148		Yes	Yes ²		
DS-X9302-14K9	Yes	Yes	Yes	Yes	Yes
DS-X9304-18K9		Yes	Yes ²	Yes ¹	
DS-X9304-SMIP				Yes	Yes
DS-X9308-SMIP				Yes	Yes
DS-X9704					
DS-C9216A-K9	Yes	Yes	Yes	Yes	
DS-C9216i-K9	Yes	Yes	Yes	Yes	Yes
DS-C9222i-K9		Yes	Yes ²	Yes ¹	
DS-C9120-K9	Yes	Yes	Yes	Yes	
DS-C9124-K9		Yes ³			
DS-C9134-K9		Yes ³			
DS-C9140-K9	Yes	Yes	Yes	Yes	
DS-C9020-20K9					

Switching Module, Fabric Switch	DS-SFP-FC4G-xx	DS-CWDM4Gxxx x= ^A	DS-X2-FC10G-xx (non-CX4) ^B	DS-X2-FC10G-CX4= ^C	DS-X2-E10G-SR= ^A
DS-X9016					
DS-X9032					
DS-X9032-SSM					
DS-X9112	Yes ²	Yes ²			
DS-X9124	Yes ²	Yes ²			
DS-X9148	Yes ²	Yes ²			
DS-X9302-14K9					
DS-X9304-18K9	Yes ²	Yes ²			

Switching Module, Fabric Switch	DS-SFP-FC4G-xx	DS-CWDM4Gxxx x= ^A	DS-X2-FC10G-xx (non-CX4) ^B	DS-X2-FC10G-CX4= ^C	DS-X2-E10G-SR= ^A
DS-X9304-SMIP					
DS-X9308-SMIP					
DS-X9704			Yes ²		Yes ²
DS-C9216A-K9					
DS-C9216i-K9					
DS-C9222i-K9	Yes ²	Yes ²			
DS-C9120-K9					
DS-C9124-K9	Yes ²	Yes ^{2, 4}			
DS-C9134-K9	Yes ²	Yes ⁴	Yes ^{2,5}	Yes ²	
DS-C9140-K9					
DS-C9020-20K9	Yes				

A: Supported on switches running Cisco MDS SAN-OS Release 3.1(3) or later

B: DS-X2-FC10G-ER supported on switches running Cisco MDS SAN-OS Release 3.1(3) or later

C: Supported on switches running Cisco MDS SAN-OS Release 3.2(1) or later

1: Supported in Ethernet ports only

2: Digital Diagnostic Monitoring Supported

3: Limited to 60km

4: Limited to 30km

5: DS-X2-FC10G-ER not supported

2-Gbps Cisco Fibre Channel SFPs

The Cisco 2-Gbps Fibre Channel SFPs are designed to provide cost-effective Fibre Channel connectivity for the Cisco MDS 9000 Fibre Channel switching modules. There are two types of 2-Gbps Fibre Channel SFPs: the Fibre Channel Shortwave SFP (part number DS-SFP-FC-2G-SW) and the Fibre Channel Longwave SFP (part number DS-SFP-FC-2G-LW). Each product offers 1/2-Gbps autosensing Fibre Channel connectivity.

Figure 1. Cisco MDS 9000 2-Gbps Fibre Channel SFPs



Technical Specifications

Connectors and Cabling

Connectors: Dual LC Connector

Table 2. 2-Gbps Fibre Channel SFP Cabling Specifications

SFP	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
DS-SFP-FC-2G-SW	850	MMF	62.5	1.0625	300 m (984 ft)
			62.5	2.125	150 m (492 ft)
			50.0—OM2	1.0625	500 m (1640 ft)
			50.0—OM2	2.125	300 m (984 ft)
DS-SFP-FC-2G-LW	1310	SMF	9.0	1.0625	10 km (6.2 miles)
			9.0	2.125	10 km (6.2 miles)

Note: The minimum cable distance for all SFPs listed (multimode fiber [MMF] and single-mode fiber [SMF]) is 6.5 feet (2 m).

Dimensions

Dimensions (H x W x D): 8.5 mm x 13.75 mm x 55.2 mm

Environmental Conditions and Power Requirements

Table 3. Optical Parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)
	Max	Min	Max	Min	
DS-SFP-FC-2G-SW	-1.2	-10.0	0	—	2.1 (62.5 micron), 2.62 (50.0 micron—OM2)
DS-SFP-FC-2G-LW	-3	-11.7	-3	—	7.8

Table 4. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Max	Min	Max	Min
DS-SFP-FC-2G-SW	40°C	0°C	85°C	-40°C
DS-SFP-FC-2G-LW	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

- Compliant with Fibre Channel FC-PI 200-SM-LC-L, FC-PI 200-M5-SN-I and 200-M6-SN-I 2.125 GBd specifications
- Compliant with Fibre Channel FC-PI 100-SM-LC-L, FC-PI 100-M5-SN-I and FC-PI 100-M6-SN-I, and the FC-PH2 100-SM-LC-L, FC-PH2 100-M5-SN-I, FC-PH2 100-M6-SN-I 1.0625 GBd specifications
- Laser Class I 21CFR1040

Ordering Information

Table 5. Ordering Cisco 2-Gbps Fibre Channel SFPs

Part Number	Description
DS-SFP-FC-2G-SW	1/2-Gbps Fibre Channel—Shortwave, SFP, LC
DS-SFP-FC-2G-SW=	1/2-Gbps Fibre Channel—Shortwave, SFP, LC, Spare
DS-FC-SW-4PK=	1/2-Gbps Fibre Channel—Shortwave, SFP, LC, 4 pack, Spare
DS-SFP-FC-2G-LW	1/2-Gbps Fibre Channel—Longwave, SFP, LC
DS-SFP-FC-2G-LW=	1/2-Gbps Fibre Channel—Longwave, SFP, LC, Spare

4-Gbps Cisco Fibre Channel SFPs

The Cisco 4-Gbps Fibre Channel SFPs are designed to provide cost-effective Fibre Channel connectivity for the 1/2/4-Gbps ports on the Cisco MDS 9000 platform. There are three types of 4-Gbps Fibre Channel SFPs: the Fibre Channel Shortwave SFP (part number DS-SFP-FC4G-SW), the 4 km Fibre Channel Longwave SFP (part number DS-SFP-FC4G-MR), and the 10-km Fibre Channel Longwave SFP (part number DS-SFP-FC4G-LW). Each product offers 1/2/4-Gbps autosensing Fibre Channel connectivity.

Figure 2. Cisco MDS 9000 4-Gbps Fibre Channel SFPs



Technical Specifications

Connectors and Cabling
Connectors: Dual LC Connector

Table 6. 4-Gbps Fibre Channel SFP Cabling Specifications

SFP	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
DS-SFP-FC4G-SW	850	MMF	62.5	1.0625	300 m (984 ft)
			62.5	2.125	150 m (492 ft)
			62.5	4.250	70 m (230 ft)
			50.0—OM2	1.0625	500 m (1640 ft)
			50.0—OM2	2.125	300 m (984 ft)
			50.0—OM2	4.250	150 m (492 ft)
			50.0—OM3	1.0625	860 m (2821 ft)

SFP	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
			50.0—OM3	2.125	500 m (1640 ft)
			50.0—OM3	4.250	380 m (1246 ft)
DS-SFP-FC4G-MR	1310	SMF	9.0	1.0625	4 km (2.4 miles)
			9.0	2.125	4 km (2.4 miles)
			9.0	4.250	4 km (2.4 miles)
DS-SFP-FC4G-LW	1310	SMF	9.0	1.0625	10 km (6.2 miles)
			9.0	2.125	10 km (6.2 miles)
			9.0	4.250	10 km (6.2 miles)

Note: The minimum cable distance for all SFPs listed (multimode fiber [MMF] and single-mode fiber [SMF]) is 6.5 feet (2 m).

Dimensions

Dimensions (H x W x D): 8.5 mm x 13.75 mm x 55.2 mm

Environmental Conditions and Power Requirements

Table 7. Optical Parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)
	Max	Min	Max	Min	
DS-SFP-FC4G-SW	-1.2	-9	0	—	1.78 (62.5 micron), 2.06 (50.0 micron— OM2), 4.48 (50.0 micron—OM3)
DS-SFP-FC4G-MR	-3	-11.2	-1	—	4.8
DS-SFP-FC4G-LW	-3	-8.4	-1	—	7.8

Table 8. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Max	Min	Max	Min
DS-SFP-FC4G-SW	40°C	0°C	85°C	-40°C
DS-SFP-FC4G-MR	40°C	0°C	85°C	-40°C
DS-SFP-FC4G-LW	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

- Compliant with Fibre Channel FC-PI 400-SM-LC-L, FC-PI 400-SM-LC-M, FC-PI 400-M5-SN-I and FC-PI 400-M6-SN-I 4.25 GBd specifications
- Compliant with Fibre Channel FC-PI 200-SM-LC-L, FC-PI 200-M5-SN-I and 200-M6-SN-I 2.125 GBd specifications
- Compliant with Fibre Channel FC-PI 100-SM-LC-L, FC-PI 100-M5-SN-I and FC-PI 100-M6-SN-I, and the FC-PH2 100-SM-LC-L, FC-PH2 100-M5-SN-I, FC-PH2 100-M6-SN-I 1.0625 GBd specifications
- Laser Class I 21CFR1040

Ordering Information

Table 9. Ordering Cisco Fibre Channel SFPs

Part Number	Description
DS-SFP-FC4G-SW	1/2/4-Gbps Fibre Channel—Shortwave, SFP, LC
DS-SFP-FC4G-SW=	1/2/4-Gbps Fibre Channel—Shortwave, SFP, LC, Spare
DS-SFP-4G-SW-4=	1/2/4-Gbps Fibre Channel—Shortwave, SFP, LC, 4 pack, Spare
DS-SFP-FC4G-MR	1/2/4-Gbps Fibre Channel—Longwave 4-km, SFP, LC
DS-SFP-FC4G-MR=	1/2/4-Gbps Fibre Channel—Longwave 4-km, SFP, LC, Spare
DS-SFP-FC4G-LW	1/2/4-Gbps Fibre Channel—Longwave 10-km, SFP, LC
DS-SFP-FC4G-LW=	1/2/4-Gbps Fibre Channel—Longwave 10-km, SFP, LC, Spare

Tri-Rate Multiprotocol SFPs

To ease management and sparing concerns, Cisco offers SFPs that can be used in both Fibre Channel and Gigabit Ethernet ports. The Cisco MDS 9000 Tri-Rate Multiprotocol SFPs can run at 1-Gbps Fibre Channel, 2-Gbps Fibre Channel, and 1-Gbps Ethernet, thus allowing a user the option to use one type of SFP for all the ports on the Cisco MDS 9000 platform.

There are two types of Tri-rate Multiprotocol SFPs: the Tri-rate Multiprotocol Shortwave SFP (part number DS-SFP-FCGE-SW) and the Tri-rate Multiprotocol Longwave SFP (part number DS-SFP-FCGE-LW). Each product offers autosensing 1/2-Gbps Fibre Channel connectivity and 1-Gbps Ethernet connectivity.

Figure 3. Cisco Tri-Rate Multiprotocol SFPs



Technical Specifications

Connectors and Cabling

Connectors: Dual LC Connector

Table 10. SFP Port Cabling Specifications

SFP	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
DS-SFP-FCGE-SW	850	MMF	62.5	1.0625	300 m (984 ft)
			62.5	2.125	150 m (492 ft)
			50.0—OM2	1.0625	500 m (1640 ft)

SFP	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
			50.0—OM2	2.125	300 m (984 ft)
DS-SFP-FCGE-LW	1310	SMF	9.0	1.0625	10 km (6.2 miles)
			9.0	2.125	10 km (6.2 miles)

Note: The minimum cable distance for all SFPs listed (multimode fiber [MMF] and single-mode fiber [SMF]) is 6.5 feet (2 m).

Table 11. Optical Parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dBm)
	Max	Min	Max	Min	
DS-SFP-FCGE-SW	-1.2	-10.0 (FC), -9.5 (GE)	0	-17 (GE)	2.1 (FC:62.5 micron), 2.62 (FC:50.0 micron—OM2) 2.38 (GE:62.5 micron), 3.37 (GE:50.0 micron—OM2)
DS-SFP-FCGE-LW	-3	-11.0	-3	-19 (GE)	7.8 (FC) 4.57 (GE)

Note: Fiber Loss Budget is derived from taking the difference between the minimum average transmit power and the minimum average receive power and subtracting the link penalties. The specified Fiber Loss Budget should be used in calculating the maximum link distance.

Dimensions

Dimensions (H x W x D): 8.5 mm x 13.75 mm x 55.2 mm

Environmental Conditions and Power Requirements

Table 12. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Max	Min	Max	Min
DS-SFP-FCGE-SW	40°C	0°C	85°C	-40°C
DS-SFP-FCGE-LW	40°C	0°C	85°C	-40°C

Warranty

Standard warranty: One year

Regulatory and Standards Compliance

- Compliant with Fibre Channel FC-PI 200-SM-LC-L, FC-PI 200-M5-SN-I and FC-PI 200-M6-SN-I 2.125 GBd specifications and the IEEE 802.3 Gigabit Ethernet (1.25 GBd) 1000BASE-SX specification
- Compliant with the Fibre Channel FC-PI 100-SM-LC-L, FC-PI 100-M5-SN-I and FC-PI 100-M6-SN-I, and the FC-PH2 100-SM-LC-L, FC-PH2 100-M5-SN-I, and FC-PH2 100-M6-SN-I 1.0625 GBd specifications
- Laser Class I 21CFR1040

Ordering Information

Table 13. Ordering Cisco Tri-Rate Multiprotocol SFPs

Part Number	Description
DS-SFP-FCGE-SW	1/2-Gbps Fibre Channel and Gigabit Ethernet—Shortwave, SFP, LC
DS-SFP-FCGE-SW=	1/2-Gbps Fibre Channel and Gigabit Ethernet—Shortwave, SFP, LC, Spare
DS-SFP-FCGE-LW	1/2-Gbps Fibre Channel and Gigabit Ethernet—Longwave, SFP, LC
DS-SFP-FCGE-LW=	1/2-Gbps Fibre Channel and Gigabit Ethernet—Longwave, SFP, LC, Spare

Copper Gigabit Ethernet SFPs

To allow even more cabling flexibility, the Cisco MDS 9000 Family offers a copper Gigabit Ethernet SFP. Based on the 1000Base-T standard, the Cisco Copper Gigabit Ethernet SFP provides cost-effective connectivity for datacenter applications. The Copper Gigabit Ethernet SFP (part number DS-SFP-GE-T) allows a user to use standard Category-5 UTP cabling for Ethernet connectivity.

Figure 4. Cisco Copper Gigabit Ethernet SFP



Technical Specifications

Connectors and Cabling

Connectors: RJ-45 Connector

Table 14. SFP Port Cabling Specifications

SFP	Cable Type	Cable Distance
DS-SFP-GE-T	Category 5 UTP	100M (328 ft)

Dimensions

Dimensions (H x W x D): 13.75 mm x 13.75 mm x 67.8 mm

Environmental Conditions and Power Requirements

Table 15. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Max	Min	Max	Min
DS-SFP-GE-T	40°C	0°C	85°C	-40°C

Warranty

Standard warranty: One year

Regulatory and Standards Compliance

Compliant with the IEEE 802.3 Gigabit Ethernet (1.25 GBd) 1000BASE-T specification.

Ordering Information

Table 16. Ordering Cisco Copper Gigabit Ethernet SFP

Part Number	Description
DS-SFP-GE-T	1-Gbps Copper Gigabit Ethernet SFP, 1000Base-T, RJ-45
DS-SFP-GE-T=	1-Gbps Copper Gigabit Ethernet SFP, 1000Base-T, RJ-45, Spare

10-Gbps Fibre Channel X2 Transceivers

The Cisco Fibre Channel X2 transceivers are designed to provide high-performance Fibre Channel connectivity for the 10-Gbps Fibre Channel Ports on the Cisco MDS 9000 platform. There are three types of 10-Gbps Fibre Channel X2 transceivers for transmission on optical cables—Short Reach (up to 300m, part number DS-X2-FC10G-SR), Long Reach (up to 10km, part number DS-X2-FC10G-LR), and Extended Reach (up to 40km, part number DS-X2-FC10G-ER). There is also a 10-Gbps Fibre Channel X2 transceiver for transmission on copper cable (up to 15m, part number DS-X2-FC10G-CX4). Each product offers 10-Gbps Fibre Channel connectivity.

Figure 5. Cisco MDS 9000 10-Gbps Fibre Channel X2 Transceiver (DS-X2-FC10G-SR, DS-X2-FC10G-LR, DS-X2-FC10G-ER)



Figure 6. Cisco MDS 9000 10-Gbps Fibre Channel CX4 X2 Transceiver (DS-X2-FC10G-CX4)



Technical Specifications

Connectors and Cabling

Connectors: Dual SC Connector (DS-X2-FC10G-SR, DS-X2-FC10G-LR, DS-X2-FC10G-ER), CX4 Connector (DS-X2-FC10G-CX4)

Table 17. X2 Port Cabling Specifications

X2	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
DS-X2-FC10G-SR	850	MMF	62.5	10.51875	33 m (108 ft)
			50.0—OM3	10.51875	300 m (984 ft)
DS-X2-FC10G-LR	1310	SMF	9.0	10.51875	10 km (6.2 miles)
DS-X2-FC10G-ER	1550	SMF	9.0	10.51875	40 km (24.8 miles)
DS-X2-FC10G-CX4	--	Copper	-	10.51875	15m (49.2 ft)

Note: The minimum cable distance for all listed transceivers (multimode fiber [MMF] and single-mode fiber [SMF]) except CX4 is 6.5 feet (2 m).

Dimensions

Dimensions (H x W x D): 19.2 mm x 41.8 mm x 90.8 mm

Environmental Conditions and Power Requirements

Table 18. Optical Parameters

X2	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dBm)
	Max	Min	Max	Min	
DS-X2-FC10G-SR	-1.2	-7.3	-1.0	-9.9	2.6 (50.0 micron—OM3)
DS-X2-FC10G-LR	0.5	-8.2	0.5	-14.4	6.2
DS-X2-FC10G-ER	4.0	-4.7	-1.0	-15.8	11.1

Note: DS-X2-FC10G-CX4 is not an optical module and is therefore not listed in the above table.

Table 19. Operating and Storage Temperature Ranges

X2	Operating		Storage	
	Max	Min	Max	Min
DS-X2-FC10G-SR	40°C	0°C	85°C	-40°C
DS-X2-FC10G-LR	40°C	0°C	85°C	-40°C
DS-X2-FC10G-ER	40°C	0°C	85°C	-40°C
DS-X2-FC10G-CX4	40°C	0°C	85°C	-40°C

Ordering Information

Table 20. Ordering Cisco 10-Gbps Fibre Channel X2 Transceivers

Part Number	Description
DS-X2-FC10G-SR	10-Gbps Fibre Channel—Short-reach, X2, SC
DS-X2-FC10G-SR=	10-Gbps Fibre Channel—Short-reach, X2, SC, Spare
DS-X2-FC10G-LR	10-Gbps Fibre Channel—Long-reach, X2, SC
DS-X2-FC10G-LR=	10-Gbps Fibre Channel—Long-reach, X2, SC, Spare

Part Number	Description
DS-X2-FC10G-ER	10-Gbps Fibre Channel—Extended-reach, X2, SC
DS-X2-FC10G-ER=	10-Gbps Fibre Channel—Extended-reach, X2, SC, Spare
DS-X2-FC10G-CX4	10-Gbps Fibre Channel—Copper Transceiver, X2, CX4
DS-X2-FC10G-CX4=	10-Gbps Fibre Channel—Copper Transceiver, X2, CX4, Spare
DS-CAB-15M=	15m Cable for 10G Copper X2 transceiver, spare
DS-CAB-1M=	1m Cable for 10G Copper X2 transceiver, spare

Regulatory and Standards Compliance

- Compliant with Fibre Channel 10GFC 1200-M6-SN-I, 10GFC 1200-M5-SN-I, 10GFC 1200-M5E-SN-I, 10GFC 1200-SM-LL-L 10.51875 GBd specifications
- Compliant with IEEE 802.3 10GBASE-ER
- Compliant with IEEE 802.3 10GBASE-CX4
- Laser Class I 21CFR1040

10-Gbps Ethernet X2 Transceiver

The Cisco Ethernet X2 transceiver Short Reach (up to 300m, part number DS-X2-E10G-SR) enables high-performance Fibre Channel connectivity for the Cisco MDS 9000 10-Gbps Fibre Channel switching module to an existing Ethernet DWDM transponder. The data format transmitted by DS-X2-E10G-SR onto the fiber is identical to that transmitted by DS-X2-FC10G-SR, except that the Fibre Channel packets are clocked at 10GE rate. This allows Fibre Channel packets to be carried over an existing 10-Gbps Ethernet DWDM infrastructure. The Cisco MDS 9000 10-Gbps Fibre Channel switching module will automatically detect DS-X2-FC10G-SR and DS-X2-E10G-SR—no software configuration is required.

Figure 7. Cisco MDS 9000 10-Gbps Ethernet X2 Transceiver



Technical Specifications

Connectors and Cabling

Connectors: Dual SC Connector

Table 21. X2 Port Cabling Specifications

X2	Wavelength (nanometer)	Fiber Type	Core Size (micron)	Baud Rate (GBd)	Cable Distance
DS-X2-E10G-SR	850	MMF	62.5	10.3125	33 m (108 ft)
			50.0—OM3	10.3125	300 m (984 ft)

Note: The minimum cable distance for all transceivers listed (multimode fiber [MMF] and single-mode fiber [SMF]) is 6.5 feet (2 m).

Dimensions

Dimensions (H x W x D): 19.2 mm x 41.8 mm x 90.8 mm

Environmental Conditions and Power Requirements

Table 22. Optical Parameters

X2	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget
	Max	Min	Max	Min	
DS-X2-E10G-SR	-1.2	-7.3	-1.0	-9.9	2.6 (50.0 micron—OM3)

Table 23. Operating and Storage Temperature Ranges

X2	Operating		Storage	
	Max	Min	Max	Min
DS-X2-E10G-SR	40°C	0°C	85°C	-40°C

Ordering Information

Table 24. Ordering Cisco 10-Gbps Ethernet X2 Transceiver

Part Number	Description
DS-X2-E10G-SR=	10-Gbps Ethernet—Short-reach, X2, SC, Spare

Regulatory and Standards Compliance

- Compliant with IEEE 802.3 10GBASE-SR
- Laser Class I 21CFR1040

CWDM Extended Distance SFP Solution

The Cisco MDS 9000 Family offers cost-effective multiprotocol extended distance connectivity that optimizes use of a customer's existing optical infrastructure through the Cisco Coarse Wavelength-Division Multiplexing (CWDM) SFP solution. The Cisco CWDM SFP solution has two main components: a set of eight wavelength-specific SFPs and a set of CWDM optical add-drop modules (OADMs). A Cisco CWDM chassis enables rack-mounting up to two of the Cisco CWDM OADMs. The Cisco CWDM OADMs are passive and require no power or configuration.

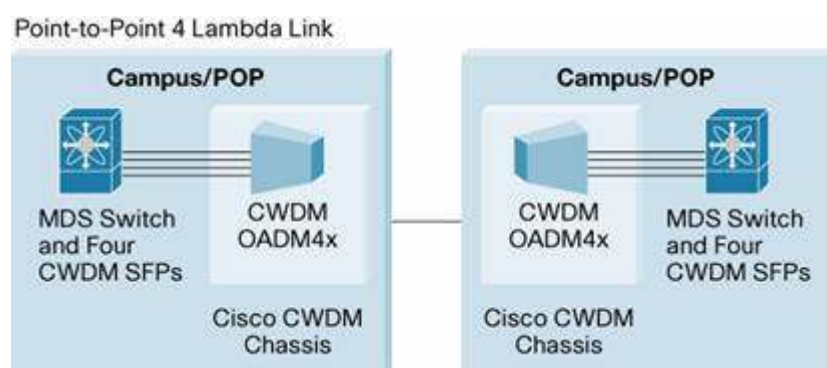
Figure 8. Cisco Multiprotocol CWDM Extended Distance SFP Solution



The Cisco CWDM SFP solution enables the transport of up to eight channels over one pair of single-mode fiber strands. This enables enterprises to increase the bandwidth of an existing optical infrastructure without adding new fiber strands. The solution can be used in parallel with other Cisco SFP devices on the same platform.

Figure 7 illustrates a common point-to-point deployment scenario for the Cisco MDS 9000 Family using the Cisco CWDM solution. Two endpoints are directly connected through a fiber link. The Cisco CWDM SFP solution enables customers to add or drop as many as eight channels into a pair of single-mode fiber strands. As a result, the need for additional fiber is minimized. Redundant point-to-point links are possible by adding or dropping redundant channels into a second pair of single-mode fiber strands.

Figure 9. Point-to-Point Architecture (Dual-Fiber Link)



Technical Specifications for Cisco 1/2-Gbps CWDM SFPs

Connectors and Cabling

- Equipment: Standard SFP interface
- Network: Dual LC connector

Dimensions

Dimensions (H x W x D): 8.5 mm x 13.75 mm x 55.2 mm

Environmental Conditions and Power Requirements

- Operating temperature range: 0–40°C
- Storage temperature range: -40–85°C

Table 25. Optical Parameters for Cisco 2-Gbps CWDM SFPs

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes/Conditions
Transmitter Center Wavelength	lambdac	(x-4)	—	(x+7)	nm	Available center wavelengths are 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nm
Side-Mode Suppression Ratio	SMSR	30	—	—	dB	—
Transmitter Optical Output Power	Pout	0.0	—	5.0	dBm	Average power coupled into single-mode fiber
Receiver Optical Input Power (BER <10 ⁻¹² with	Pin	-28.0	—	-7.0	dBm	At 2.12 Gbps, 140°F (60°C) case temperature

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes/Conditions
PRBS 2-7-1)						
Receiver Optical Input Power (BER <10 ⁻¹² with PRBS 2-7-1)	Pin	-29.0	—	-7.0	dBm	At 1.25 Gbps, 140°F (60°C) case temperature
Receiver Optical Input Wavelength	Lambda_in	1450	—	1620	nm	—
Transmitter Extinction Ratio	OMI	9	—	—	dB	—
Dispersion Penalty at 100 km (62.1 miles)	—	—	—	3	dB	At 2.12 Gbps
Dispersion Penalty at 100 km (62.1 miles)	—	—	—	2	dB	At 1.25 Gbps

Note: Parameters are specified over temperature and at end of life unless otherwise noted.

Note: When shorter distances of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

Regulatory and Standards Compliance

- Compatible with 1000BASE-X standard as specified in IEEE 802.3z
- Compatible with Fibre Channel Draft Physical Interface Specification (FC-PI 10.0)
- Laser Class I 21CFR1040

Ordering Information

Table 26. Cisco 2-Gbps CWDM SFP Product Information

Part Number	Description	Color
DS-CWDM-1470=	1470 nm CWDM 1/2-Gbps Fibre Channel SFP	Gray
DS-CWDM-1490=	1490 nm CWDM 1/2-Gbps Fibre Channel SFP	Violet
DS-CWDM-1510=	1510 nm CWDM 1/2-Gbps Fibre Channel SFP	Blue
DS-CWDM-1530=	1530 nm CWDM 1/2-Gbps Fibre Channel SFP	Green
DS-CWDM-1550=	1550 nm CWDM 1/2-Gbps Fibre Channel SFP	Yellow
DS-CWDM-1570=	1570 nm CWDM 1/2-Gbps Fibre Channel SFP	Orange
DS-CWDM-1590=	1590 nm CWDM 1/2-Gbps Fibre Channel SFP	Red
DS-CWDM-1610=	1610 nm CWDM 1/2-Gbps Fibre Channel SFP	Brown

Technical Specifications for Cisco 4-Gbps CWDM SFPs

Connectors and Cabling

- Equipment: Standard SFP interface
- Network: Dual LC connector

Dimensions

Dimensions (H x W x D): 8.46 mm x 13.27 mm x 56.64 mm

Environmental Conditions and Power Requirements

- Operating temperature range: 0–40°C
- Storage temperature range: -40–85°C

Table 27. Optical Parameters for Cisco 4-Gbps CWDM SFPs

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes/Conditions
Transmitter Center Wavelength	lambda_c	(x-6)	x	(x+6)	nm	Available center wavelengths are 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nm
Side-Mode Suppression Ratio	SMSR	30	—	—	dB	—
Transmitter Optical Output Power	Pout	1.0	-	5.0	dBm	Average power coupled into single-mode fiber
Receiver Optical Input Power (BER <10 ⁻¹² with PRBS 2-23-1)	Pin	-15.7	-	0.0	dBm	140°F (60°C) case temperature
Link Budget	-	17.8	-	-	dB	
Receiver Optical Input Wavelength	Lambda_in	1450	-	1620	nm	-
Transmitter Extinction Ratio	OMI	4	-	-	dB	-
Dispersion Penalty at 25 km (15.5 miles)	-	-	-	3	dB	-

Note: In typical point-to-point deployments, all wavelengths have a minimum reach of 40km (24.8 miles).

Note: Parameters are specified over temperature and at end of life unless otherwise noted.

Note: When shorter distances of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

Note: A maximum of 24 4-Gbps CWDM SFPs are supported in a single MDS switching module.

Note: When interoperating a Cisco 4-Gbps CWDM SFP transceiver with a Cisco 1/2-Gbps CWDM transceiver, the port speeds on the Cisco 4-Gbps CWDM SFP transceiver must be manually configured to 1-Gbps or 2-Gbps

Regulatory and Standards Compliance

- Compatible with Fibre Channel Draft Physical Interface Specification (FC-PI -4 6.01)
- Laser Class I 21CFR1040

Ordering Information

Table 28. Cisco 4-Gbps CWDM SFP Product Information

Part Number	Description	Color
DS-CWDM4G1470=	1470 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Gray
DS-CWDM4G1490=	1490 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Violet
DS-CWDM4G1510=	1510 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Blue
DS-CWDM4G1530=	1530 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Green
DS-CWDM4G1550=	1550 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Yellow
DS-CWDM4G1570=	1570 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Orange
DS-CWDM4G1590=	1590 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Red
DS-CWDM4G1610=	1610 nm CWDM 1/2/4-Gbps Fibre Channel SFP	Brown

Technical Specifications for Cisco CWDM OADMs

The Cisco CWDM OADMs are passive devices that provide the ability to multiplex and demultiplex, or add and drop wavelengths from multiple fibers onto one fiber. The OADM connectors are interfaced to the color-matching Cisco CWDM SFPs on the equipment side. All modules are the same size. The Cisco CWDM chassis enables rack mounting for up to two Cisco CWDM OADMs in a single rack unit.

Cisco MDS 9000 Family offers two CWDM OADMs and a Multiplexer/Demultiplexer:

- Dual Fiber 4-Channel OADMs (Part numbers DS-CWDMOADM4A=, DS-CWDMOADM4B=)
 - This device allows you to add and drop four channels (with different wavelengths) into one direction of an optical ring. The other wavelengths are passed through the OADM. Dual fiber is used for both network and SFP connections. The four wavelengths are set to 1470, 1490, 1510, and 1530 nm for DS-CWDMOADM4A=, and 1550, 1570, 1590, and 1610 nm for DS-CWDMOADM4B=.
- Dual Fiber 8-Channel Multiplexer/Demultiplexer (DS-CWDM-MUX8A=)
 - This device allows you to multiplex and demultiplex eight separate channels into one pair of fiber. Dual fiber is used for both network and SFP connections. The eight wavelengths are set to 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nm

OADM Comparison

Table 29. OADM Type Comparison

OADM Type	OADM versus Multiplexer/Demultiplexer	Architecture Options
DS-CWDMOADM4x=	OADM	Ring, point-to-point
DS-CWDM-MUX8A=	Multiplexer/demultiplexer	Ring, point-to-point

Table 30. Maximum Insertion Loss in dB for each passive CWDM filter

Model	Maximum Insertion Loss (dB)			
	Add/Drop	Pass 1550	Pass 1300	Monitor
DS-CWDMOADM4x=	1.8	2.1	2.1	23
DS-CWDM-MUX8A=	2.2	n/a	n/a	23

Connectors and Cabling

DS-CWDMOADM4x=, DS-CWDM-MUX8A=: Dual LC Connector

Environmental Conditions and Power Requirements

The operating temperature range is between -5 and 55°C (23 to 131°F), storage temperature range is -40 to 85°C (-40 to 185°F).

The Cisco CWDM OADMs and the Cisco CWDM chassis are passive components that do not require power.

Dimensions and Weight

All the different Cisco CWDM OADMs have the same dimensions—W x D x H: 21.2 cm x 3.0 cm x 26.5 cm. Two of these modules fit into one Cisco CWDM chassis. The Cisco CWDM chassis is 1-RU in height and fits in a standard 19 in. rack.

Warranty

Standard warranty: One year

Regulatory and Standards Compliance

Network Equipment Building Standards (NEBS) Level 3

Ordering Information

Table 31. Cisco CWDM OADM, Multiplexer/Demultiplexer and Cisco CWDM Chassis Ordering Information

Product Number	Description
DS-CWDMOADM4A=	4-channel (1470, 1490, 1510, and 1530 nm) optical add/drop multiplexer OADM
DS-CWDMOADM4B=	4-channel (1550, 1570, 1590, and 1610 nm) optical add/drop multiplexer OADM
DS-CWDM-MUX8A=	8-channel multiplexer/demultiplexer
DS-CWDMCHASSIS=	2-slot chassis for Cisco OADM and multiplexer/demultiplexer

DWDM Extended Distance Solution

2-Gbps DWDM SFP Transceiver

The Cisco® Dense Wavelength-Division Multiplexing (DWDM) Small Form Factor Pluggable (SFP) module enable enterprise companies and service providers to provide scalable and easy-to-deploy DWDM Fibre Channel services in their networks.

Main features of the Cisco DWDM SFP include:

- Support for International Telecommunication Union (ITU) 100-GHz wavelength grid
- Match for wavelength plan of Cisco 100-GHz ONS product family
- Fixed-wavelength SFP, with 32 different SFP models

Note: A maximum of 8 2-Gbps DWDM SFPs are supported in a single MDS switching module.

Refer to

http://www.cisco.com/en/US/products/hw/modules/ps5455/products_data_sheet0900aecd80582763.html for details.

Ordering Information

Table 32. Ordering Cisco 2-Gbps DWDM Transceiver

Part Number	Description
DWDM-SFP-6061=	Cisco 6061 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5979=	Cisco 5979 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5898=	Cisco 5898 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5817=	Cisco 5817 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5655=	Cisco 5655 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5575=	Cisco 5575 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5494=	Cisco 5494 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5413=	Cisco 5413 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5252=	Cisco 5252 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5172=	Cisco 5172 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-5092=	Cisco 5092 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare

Part Number	Description
DWDM-SFP-5012=	Cisco 5012 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4851=	Cisco 4851 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4772=	Cisco 4772 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4692=	Cisco 4692 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4612=	Cisco 4612 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4453=	Cisco 4453 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4373=	Cisco 4373 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4294=	Cisco 4294 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4214=	Cisco 4214 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-4056=	Cisco 4056 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3977=	Cisco 3977 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3898=	Cisco 3898 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3819=	Cisco 3819 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3661=	Cisco 3661 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3582=	Cisco 3582 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3504=	Cisco 3504 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3425=	Cisco 3425 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3268=	Cisco 3268 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3190=	Cisco 3190 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3112=	Cisco 3112 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DWDM-SFP-3033=	Cisco 3033 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare



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