Cisco MDS 9000 Family Pluggable Transceivers

Product Overview

The Cisco® Small Form-Factor Pluggable (SFP), Enhanced SFP (SFP+), and X2 devices are hot-swappable transceivers. The transceivers plug into Cisco MDS 9000 Family director switching modules and fabric switch ports. They allow you to choose different cabling types and distances on a port-by-port basis.

You can use them with the MDS 9000 Family products as shown in Table 1.

Table 1. Cisco SFP, SFP+, and X2 Transceivers Available for Use with the Cisco MDS 9000 Family

Switching Module and Fabric Switch	DS-SFP-FC-2G-xx	DS-SFP-FC4G-xx	DS-SFP-FC8G-xx	DS-SFP-FC10G-xx	DS-SFP-FCGE-xx	DS-SFP-GE-T	DS-X2-FC10G-xx (non CX4)B	DS-SFP-FC16G-xx/DS-SFP-FC16G-xxx	
DS-X9032	Yes				Yes				
DS-X9032-SSM	Yes				Yes				
DS-X9112		Yes[2]							
DS-X9124		Yes[2]							
DS-X9148		Yes[2]							
DS-X9248-48K9		Yes[2]	Yes[2]						
DS-X9224-96K9		Yes[2]	Yes[2]						
DS-X9248-96K9		Yes[2]	Yes[2]						
DS-X9232-256K9		Yes[2, 10]	**Yes[2]**	**Yes[2]**					
DS-X9248-256K9		**Yes[2, 10]**	**Yes[2]**	**Yes[2]**					
DS-X9302-14K9	Yes				Yes	Yes			
DS-X9304-18K9		Yes[2]			Yes[1]	Yes[D]			
DS-X9304-SMIP					Yes	Yes			
DS-X9308-SMIP					Yes	Yes			
DS-X9316-SSNK9					**Yes[F]**	**Yes[F, 16]**			
DS-X9704							Yes[2]		
DS-C9216A-K9	Yes				Yes				
DS-C9216i-K9	Yes				Yes	Yes			
DS-C9222i-K9		Yes[2]			Yes[1]	Yes[D]			
DS-C9120-K9	Yes				Yes				
DS-C9124-K9		Yes[2]							
DS-C9134-K9		Yes[2]					Yes[2, 5]		
DS-C9140-K9	Yes				Yes				
DS-C9148-K9		**Yes[2, 7]**	**Yes[2, 11]**						
DS-C9020-20K9		Yes							
DS-X9448-768K9			**Yes[2]**	**Yes[2]**				**Yes[2]**	
DS-C9250I-K9			**Yes[2]**					**Yes[2]**	

DS-C9396S-K9			**Yes[2]**	**Yes[2]**					**Yes[2]**		
DS-C9148S-K9			**Yes[2]**						**Yes[2]**		
DS-X9824-960K9									**Yes[2]**		

Switching Module and Fabric Switch	DS-X2-FC10G-CX4=C	DS-X2-E10G-SR=A	DS-CWDM-xxxx=	DS-CWDM4Gxxxx=A	DS-CWDM8Gxxxx=	DWDM-SFP-xxxx=A	ONS-SC-4G-xx.x= G	SFP-10G-XX/DS-SFP-10GE-XX	SFP-H10GB-xCUM	DWDM-X2-xx.xx=E	DWDM-SFP10G-xx.xx=	QSFP-40G-SR4,CSR4,SR-BD
DS-X9016			Yes			Yes						
DS-X9032			Yes			Yes						
DS-X9032-SSM			Yes			Yes						
DS-X9112			Yes	Yes[2, 13]		Yes[2]	Yes[2]					
DS-X9124			Yes	Yes[2, 13]		Yes[2]	Yes[2]					
DS-X9148			Yes	Yes[2, 13]		Yes[2]	Yes[2]					
DS-X9248-48K9			Yes	Yes[2, 13]		Yes[2]	Yes[2]					
DS-X9224-96K9			Yes	Yes[2, 13]		Yes[2]	Yes[2]					
DS-X9232-256K9				**Yes[2, 13]**			**Yes[2]**	**Yes[8, 12]**				
DS-X9248-256K9				**Yes[2, 13]**			**Yes[2]**	**Yes[8, 12]**				
DS-X9248-96K9			Yes	Yes[2, 13]		Yes[2]	Yes[2]					
DS-X9302-14K9			Yes[6]			Yes						
DS-X9304-18K9			Yes[6]	Yes[2, 13]		Yes[2, 6]	Yes[2]					
DS-X9304-SMIP			Yes									
DS-X9308-SMIP			Yes									
DS-X9316-SSNK9			**Yes[F]**			**Yes[F]**						
DS-X9704	Yes[2]	Yes[2]								Yes[2]		
DS-X9708-K9								**Yes[8, 12]**	**Yes[9]**			
DS-C9216A-K9			Yes			Yes						
DS-C9216i-K9			Yes[6]			Yes						
DS-C9222i-K9			Yes[6]	Yes[2, 13]		Yes[2, 6]	Yes[2]					
DS-C9120-K9			Yes			Yes						
DS-C9124-K9			Yes[3]	Yes[2, 4]			Yes[2]					
DS-C9134-K9	Yes[2]	Yes[2, F]	Yes[3]	Yes[4]						Yes[2, F]		
DS-C9140-K9			Yes			Yes						
DS-C9148-K9				**Yes[2, 13]**	**Yes[2, 13, H]**		**Yes[2]**					
DS-C9020-20K9												
DS-X9448-768K9					**Yes[2, 13, H]**			**Yes[8]**				
DS-C9250I-K9					Yes[2, 13, H, 14]			**Yes[8]**	**Yes[9]**		**Yes[2,18]**	
DS-X9848-480K9								**Yes[8, 12]**	**Yes[9]**		**Yes[2]**	
DS-C9396S-K9					Yes[2, 13, 17]			**Yes[8]**				
DS-C9148S-K9					Yes[2, 13, 15]							
DS-X9824-960K9												**Yes**

A: Supported on switches running MDS 9000 SAN-OS Software Release 3.1(3) or later.
B: DS-X2-FC10G-ER supported on switches running MDS 9000 SAN-OS Software Release 3.1(3) or later.
C: Supported on switches running MDS 9000 SAN-OS Software Release 3.2(1) or later.
D: Supported on switches running MDS 9000 SAN-OS Software Release 3.3(1) or later.
E: Supported on switches running MDS 9000 NX-OS Software Release 4.1(1) or later.
F: Supported on switches running MDS 9000 NX-OS Software Release 4.2(1) or later.
G: Supported on switches running MDS 9000 NX-OS Software Release 5.0 or later.
H: Supported on switches running MDS 9000 NX-OS Software Release 6.2.5 or later.

1: Supported on Ethernet ports only.
2: Digital diagnostic monitoring supported.
3: Limited to 60 km.
4: Limited to 30 km.
5: DS-X2-FC10G-ER not supported.
6: Supported on both Fibre Channel and Ethernet ports.
7: Only DS-SFP-FC4G-SW is supported.
8: Only -SR, -LR, and -ER are supported.
9: Passive copper -CU1M, -CU3M, -CU5M, and active copper -ACU7M and -ACU10M Twinax cables are supported.
10: DS-SFP-4GF-MR is not supported.
11: Maximum distance with DS-SFP-FC8G-ER is limited to 31 km.
12: Maximum distance with SFP-10G-ER is limited to 20 km.
13: Maximum distance for coarse wavelength-division multiplexing (CWDM) optics is 25 km to account for dB loss in CWDM multiplexer and demultiplexer.
14: 8-Gbps CWDM optics are allowed in the top 20 ports (odd-numbered ports).
15: 8-Gbps CWDM is allowed only in ports 1 through 12.
16: Ethernet autonegotiation is not supported.
17. 8-Gbps CWDM optics are allowed in the upper odd-numbered ports.
18. Supported only for Fibre Channel over Ethernet (FCoE) ports prior to MDS 9000 NX-OS Release 6.2.15.

Note: Unless a specific software version is mentioned, the transceivers listed in Table 1 are supported in all versions of Cisco NX-OS Software for which corresponding line cards or chassis are supported.

Cisco 2-Gbps Fibre Channel SFP Modules

Cisco 2-Gbps Fibre Channel SFP modules (Figure 1) provide cost-effective Fibre Channel connectivity for MDS 9000 Family Fibre Channel switching modules. Two types are available: the Cisco Fibre Channel Shortwave SFP (part number DS-SFP-FC-2G-SW) and the Cisco Fibre Channel Longwave SFP (part number DS-SFP-FC-2G-LW). Each offers 1/2-Gbps autosensing Fibre Channel connectivity.

Figure 1. Cisco 2-Gbps Fibre Channel SFP Modules

Technical Specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 2 summarizes the cabling specifications.

Table 2. Cisco 2-Gbps Fibre Channel SFP Cabling Specifications

SFP	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (gigabaud [GBd])	Cable Distance
DS-SFP-FC-2G-SW	850	MMF	62.5 62.5 50.0 (Optical Multimode 2 [OM2]) 50.0 (OM2)	1.0625 2.125 1.0625 2.125	300m (984 ft) 150m (492 ft) 500m (1640 ft) 300m (984 ft)
DS-SFP-FC-2G-LW	1310	SMF	9.0 9.0	1.0625 2.125	10 km (6.2 mi) 10 km (6.2 mi)

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

Dimensions

The dimensions (H x W x D) are 8.5 x 13.75 x 55.2 mm

Environmental Conditions and Power Requirements

Table 3 presents the optical parameters, and Table 4 presents temperature ranges.

Table 3. Optical Parameters

SFP	Average Transmit Power (decibels per milliwatt [dBm])		Average Receive Power (dBm)		Fiber Loss Budget (decibels [dB])
	Maximum	**Minimum**	**Maximum**	**Minimum**	
DS-SFP-FC-2G-SW	-2.5	-10.0	0	-	2.1 (62.5 microns) and 2.62 (50.0 microns [OM2])
DS-SFP-FC-2G-LW	-3	-11.7	-3	-	7.8

Table 4. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
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 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 5 provides ordering information.

Table 5. Cisco 2-Gbps Fibre Channel SFP Ordering Information

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

Cisco 4-Gbps Fibre Channel SFP Modules

Cisco 4-Gbps Fibre Channel SFP modules (Figure 2) provide cost-effective Fibre Channel connectivity for 1/2/4-Gbps ports on the MDS 9000 Family platform. Three types are available: the Cisco Fibre Channel Shortwave SFP (part number DS-SFP-FC4G-SW), the Cisco 4-km Fibre Channel Longwave SFP (part number DS-SFP-FC4G-MR), and the Cisco 10-km Fibre Channel Longwave SFP (part number DS-SFP-FC4G-LW). Each offers 1/2/4-Gbps autosensing Fibre Channel connectivity.

Figure 2. Cisco 4-Gbps Fibre Channel SFP Modules

Technical Specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 6 summarizes the cabling specifications.

Table 6. Cisco 4-Gbps Fibre Channel SFP Cabling Specifications

SFP	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
DS-SFP-FC4G-SW	850	MMF	62.5 62.5	1.0625 2.125	300m (984 ft) 150m (492 ft)

SFP	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
			62.5	4.250	70m (230 ft)
			50.0 (OM2)	1.0625	500m (1640 ft)
			50.0 (OM2)	2.125	300m (984 ft)
			50.0 (OM2)	4.250	150m (492 ft)
			50.0 (OM3)	1.0625	860m (2821 ft)
			50.0 (OM3)	2.125	500m (1640 ft)
			50.0 (OM3)	4.250	380m (1246 ft)
DS-SFP-FC4G-MR	1310	SMF	9.0	1.0625	4 km (2.4 mi)
			9.0	2.125	4 km (2.4 mi)
			9.0	4.250	4 km (2.4 mi)
DS-SFP-FC4G-LW	1310	SMF	9.0	1.0625	10 km (6.2 mi)
			9.0	2.125	10 km (6.2 mi)
			9.0	4.250	10 km (6.2 mi)

Note: The minimum cable distance for all SFP modules listed (MMF and SMF) is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 8.5 x 13.75 x 55.2 mm.

Environmental Conditions and Power Requirements

Table 7 presents the optical parameters, and Table 8 presents temperature ranges.

Table 7. Optical Parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)
	Maximum	Minimum	Maximum	Minimum	
DS-SFP-FC4G-SW	-2.5	-9	0	-	1.78 (62.5 microns), 2.06 (50.0 microns [OM2]), and 2.88 (50.0 microns [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	
	Maximum	Minimum	Maximum	Minimum
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 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 9 provides ordering information.

Table 9. Cisco Fibre Channel SFP Ordering Information

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

Cisco 8-Gbps Fibre Channel SFP+ Modules

Cisco 8-Gbps Fibre Channel SFP+ modules (Figure 3) provide Fibre Channel connectivity for the 2/4/8-Gbps ports on the MDS 9000 Family platform. Three types are available: the Cisco Fibre Channel Shortwave SFP+ (part number DS-SFP-FC8G-SW), the Cisco Fibre Channel Longwave SFP+ (part number DS-SFP-FC8G-LW), and the Cisco Fibre Channel Extended Reach SFP+ (part number DS-SFP-FC8G-ER). Each offers 2/4/8-Gbps autosensing Fibre Channel connectivity.

Figure 3. Cisco 8-Gbps Fibre Channel SFP+ Modules

Technical Specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 10 summarizes the cabling specifications.

Table 10. Cisco 8-Gbps Fibre Channel SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
DS-SFP-FC8G-SW	850	MMF	62.5 62.5	2.125 4.250	150m (492 ft) 70m (230 ft)

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
			62.5	8.500	21m (69 ft)
			50.0 (OM2)	2.125	300m (984 ft)
			50.0 (OM2)	4.250	150m (492 ft)
			50.0 (OM2)	8.500	50m (164 ft)
			50.0 (OM3)	2.125	500m (1640 ft)
			50.0 (OM3)	4.250	380m (1246 ft)
			50.0 (OM3)	8.500	150m (492 ft)
			50.0 (OM4)	2.125	520m (1706 ft)
			50.0 (OM4)	4.250	400m (1312 ft)
			50.0 (OM4)	8.500	190m (623 ft)
DS-SFP-FC8G-LW	1310	SMF	9.0	2.125	10 km (6.2 mi)
			9.0	4.250	10 km (6.2 mi)
			9.0	8.500	10 km (6.2 mi)
DS-SFP-FC8G-ER	1550	SMF	9.0	2.125	40 km (24.85 mi)
			9.0	4.250	40 km (24.85 mi)
			9.0	8.500	40 km (24.85 mi)

Note: The minimum cable distance for all SFP+ modules listed (MMF and SMF) is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 8.5 x 13.55 x 56.5 mm.

Environmental Conditions and Power Requirements

Table 11 presents the optical parameters, and Table 12 presents temperature ranges.

Table 11. Optical Parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)		
	Maximum	Minimum	Maximum	Minimum	(62.5 microns)	(50.0 microns [OM2])	(50.0 microns [OM3])
DS-SFP-FC8G-SW	-1.3	-10 (2 Gbps) -9 (4 Gbps) -8.2 (8 Gbps)	0	-	2.10 (2 Gbps) 1.78 (4 Gbps) 1.58 (8 Gbps)	2.62 (2 Gbps) 2.06 (4 Gbps) 1.68 (8 Gbps)	3.31 (2 Gbps) 2.88 (4 Gbps) 2.04 (8 Gbps)
DS-SFP-FC8 G-LW	-3 (2 Gbps) -1 (4 Gbps) 0.5 (8 Gbps)	-11.7 (2 Gbps) -8.4 (4 Gbps) -8.4 (8 Gbps)	-3 (2 Gbps) -1 (4 Gbps) 0.5 (8 Gbps)	-	-7.8 (2 Gbps) 7.8 (4 Gbps) 6.4 (8 Gbps)		
DS-SFP-FC8G-ER	4	-4.7	-1	-	10.9		

Table 12. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC8G-SW	40°C	0°C	85°C	-40°C
DS-SFP-FC8G-LW	40°C	0°C	85°C	-40°C
DS-SFP-FC8G-ER	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance*

- Compliant with Fibre Channel FC-PI 800-SM-LC-L, FC-PI 800-M5-SN-S, FC-PI 800-M5E-SN-I, and FC-PI 800-M6-SN-S 8.5 GBd specifications
- Compliant with Fibre Channel FC-PI 400-SM-LC-L, FC-PI 400-M5-SN-I, FC-PI 400-M5E-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, FC-PI 200-M5E-SN-I, and 200-M6-SN-I 2.125 GBd specifications
- Laser Class I 21CFR1040

* Applicable only to DS-SFP-FC8G-SW and DS-SFP-FC8G-LW.

Ordering Information

Table 13 provides ordering information.

Table 13. Cisco Fibre Channel SFP+ Ordering Information

Part Number	Description
DS-SFP-FC8G-SW	2/4/8-Gbps Fibre Channel-Shortwave, SFP+, LC
DS-SFP-FC8G-SW=	2/4/8-Gbps Fibre Channel-Shortwave, SFP+, LC, Spare
DS-SFP-8G-SW-4=	2/4/8-Gbps Fibre Channel-Shortwave, SFP+, LC, 4 pack, Spare
DS-SFP-FC8G-LW	2/4/8-Gbps Fibre Channel-Longwave, SFP+, LC
DS-SFP-FC8G-LW=	2/4/8-Gbps Fibre Channel-Longwave, SFP+, LC, Spare
DS-SFP-FC8G-ER	2/4/8-Gbps Fibre Channel Extended Reach SFP+, LC (40 km Reach)
DS-SFP-FC8G-ER=	2/4/8-Gbps Fibre Channel Extended Reach SFP+, LC, Spare (40 km Reach)

Cisco 10-Gbps Fibre Channel SFP+ Modules

Cisco 10-Gbps Fibre Channel SFP+ modules (Figure 4) provide Fibre Channel connectivity for the 10-Gbps Fibre Channel ports on the MDS 9000 Family platform. Two types are available: the Cisco Fibre Channel Shortwave SFP+ (part number DS-SFP-FC10G-SW) and the Cisco Fibre Channel Longwave SFP+ (part number DS-SFP-FC10G-LW).

Figure 4. Cisco 10-Gbps Fibre Channel SFP+ Modules

Technical Specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 14 summarizes the cabling specifications.

Table 14. Cisco 10-Gbps Fibre Channel SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
DS-SFP-FC10G-SW	850	MMF	62.5 (OM1) 50 (OM2) 50 (OM3)	10.518 10.518 10.518	33m (104 ft) 82m (269 ft) 300m (984 ft)
DS-SFP-FC10G-LW	1310	SMF	9.0	10.518	10 km (6.2 mi)

Note: The minimum cable distance for all SFP+ modules listed (MMF and SMF) is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 8.5 x 13.55 x 56.5 mm.

Environmental Conditions and Power Requirements

Table 15 presents the optical parameters, and Table 16 presents the temperature ranges.

Table 15. Optical Parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)
	Maximum	Minimum	Maximum	Minimum	
DS-SFP-FC10G-SW	-1.2	-7.3	-1.0	-9.9	2.6 (50.0 microns [OM3])
DS-SFP-FC10G-LW	0.5	-8.2	0.5	-14.4	6.2

Table 16. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC10G-SW	40°C	0°C	85°C	-40°C
DS-SFP-FC10G-LW	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

Laser Class I 21CFR1040

Ordering Information

Table 17 provides ordering information.

Table 17. Cisco Fibre Channel SFP+ Ordering Information

Part Number	Description
DS-SFP-FC10G-SW	10-Gbps Fibre Channel-Shortwave, SFP+, LC
DS-SFP-FC10G-SW=	10-Gbps Fibre Channel-Shortwave, SFP+, LC, Spare
DS-SFP-FC10G-LW	10-Gbps Fibre Channel-Longwave, SFP+, LC
DS-SFP-FC10G-LW=	10-Gbps Fibre Channel-Longwave, SFP+, LC, Spare

Cisco 10-Gbps Ethernet SFP+ Modules

Cisco 10-Gbps Ethernet SFP+ modules (Figure 5) provide 10-Gbps Ethernet connectivity for the Cisco MDS 9500 10-Gbps 8-Port FCoE Module and MDS 9250i Multiservice Fabric Switch.

Figure 5. Cisco 10GBASE SFP+ Modules

Technical Specifications

Connectors and Cabling

The connectors are dual LC/PC connectors.

Table 18 summarizes the cabling specifications.

Table 18. Cisco 10-Gbps Ethernet SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Cable Type	Core Size (microns)	Modal Bandwidth (MHz km)**	Cable Distance*
SFP-10G-SR	850	MMF	62.5 62.5 50.0 50.0 50.0	160 200 400 500 2000	26m 33m 66m 82m 300m
SFP-10G-LR	1310	SMF	9	-	10 km
SFP-10G-ER	1550	SMF	9	-	40 km
SFP-H10GB-CU1M	-	Twinax cable, passive, 30 AWG cable assembly		-	1m
SFP-H10GB-CU3M	-	Twinax cable, passive, 30 AWG cable assembly	-	-	3m
SFP-H10GB-CU5M	-	Twinax cable, passive, 24 AWG cable assembly	-	-	5m
SFP-H10GB-ACU7M	-	Twinax cable, active, 24 AWG cable assembly	-	-	7m
SFP-H10GB-ACU10M	-	Twinax cable, active, 24 AWG cable assembly	-	-	10m

* Minimum cabling distance for -SR, -LRM, -LR, and -ER modules is 2m according to the IEEE 802.3ae.

** Specified at transmission wavelength.

Note: Only connections with patch cords with PC or UPC connectors are supported. Patch cords with APC connectors are not supported. All cables and cable assemblies must comply with the standards specified in the Standards section.

Dimensions

The dimensions (H x W x D) are 8.5 x 13.55 x 56.5 mm.

Environmental Conditions and Power Requirements

The operating temperature range is:

- Commercial temperature range: 32 to 158°F (0 to 70°C)
- Storage temperature range: -40 to 185°F (–40 to 85°C)

Table 19 presents the optical parameters, and Table 20 presents maximum power consumption.

Table 19. Optical Parameters

SFP+	Type	Average Transmit Power (dBm)*		Average Receive Power (dBm)		Transmit and Receive Wavelength
		Maximum	Minimum	Maximum	Minimum	
SFP-10G-SR **DS-SFP-10GE-SR**	10GBASE-SR 850 nm MMF	-1.2**	-7.3	-1.0	-9.9	840 to 860
SFP-10G-LR **DS-SFP-10GE-LR**	10GBASE-LR 1310 nm SMF	0.5	-8.2	.05	-14.4	1260 to 1355
SFP-10G-ER	10GBASE-ER 1550 nm SMF	4	-4.7	-1.0	-15.8	1530 to 1565

* Transmitter and receiver power is an average, unless specified.

** The launch power shall be the lesser of the class 1 safety limit or the maximum receive power. Class 1 laser requirements are defined by IEC 60825-1: 2001.

Table 20. SFP+ Modules Maximum Power Consumption

Product	Power Consumption (W)
SFP-10G-SR **DS-SFP-10GE-SR**	1
SFP-10G-LR **DS-SFP-10GE-LR**	1
SFP-10G-ER	1.2
SFP-H10GB-CU1M	1
SFP-H10GB-CU3M	1
SFP-H10GB-CU5M	1
SFP-H10GB-ACU7M	1
SFP-H10GB-ACU10M	1

Regulatory and Standards Compliance

Standards

- GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable
- GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors
- IEEE 802.3ae (-SR, -LRM, LR, and ER)
- SFP+ MSA SFF-8431 (Optical Modules and Passive Twinax Cables)
- SFP+ MSA SFF-8461 (Active Twinax Cables)

Safety

- Laser Class 1 21CFR-1040 LN 50 7/2001
- Laser Class 1 IEC60825-1
- The cable jacket of SFP+ copper modules is UL E116441 compliant.
- All lengths of SFP+ copper cables are ELV and RoHS compliant.

Warranty

- Standard warranty: The standard warranty is 90 days.
- Extended warranty (optional): Cisco SFP+ modules can be covered in a Cisco SMARTnet™ Service support contract for the Cisco switch or router chassis.

Ordering Information

Table 21 provides ordering information.

Table 21. Cisco Fibre Channel Over Ethernet SFP+ Ordering Information

Part Number	Description
Cisco 10GBASE-SR SFP+ Module for MMF	SFP-10G-SR
Cisco 10GBASE-LR SFP+ Module for SMF	SFP-10G-LR
Cisco 10GBASE-ER SFP+ Module for SMF	SFP-10G-ER
10GBASE-CU SFP+ Cable 1 Meter, passive	SFP-H10GB-CU1M
10GBASE-CU SFP+ Cable 3 Meter, passive	SFP-H10GB-CU3M
10GBASE-CU SFP+ Cable 5 Meter, passive	SFP-H10GB-CU5M
10GBASE-CU SFP+ Cable 7 Meter, active	SFP-H10GB-ACU7M
10GBASE-CU SFP+ Cable 10 Meter, active	SFP-H10GB-ACU10M

Cisco 40GBASE QSFP SFP+ Modules

The Cisco 40GBASE Quad SFP (QSFP) portfolio offers customers a wide variety of high-density and low-power-consumption 40 Gigabit Ethernet connectivity options for data center, high-performance computing networks, enterprise core and distribution layers, and service provider applications.

Three types of 40GBASE QSFP modules are supported for MDS 40-Gbps line cards (Figure 6).

Figure 6. Cisco 40GBASE SFP+ Modules

Technical Specifications

Connectors and Cabling

QSFP-40G-SR4 and QSFP-40G-CSR4 are MPO-12 connectors, and QSFP-40G-SR-BD is an LC connector.

Table 22 summarizes the cabling specifications.

Table 22. Cisco 40GBASE Ethernet SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Cable Type	Core Size (microns)	Modal Bandwidth (MHz km)*	Cable Distance*
QSFP-40G-SR4	850	MMF	50.0 50.0 50.0	500 (OM2) 2000 (OM3) 4700 (OM4)	30m 100m 150m*
QSFP-40G-CSR4	832	MMF	50.0 50.0 50.0	500 (OM2) 2000 (OM3) 4700 (OM4)	30m 100m 150m*
QSFP-40G-SR-BD	832-918	MMF	50.0 50.0 50.0	500 (OM2) 2000 (OM3) 4700 (OM4)	82m 300m 400m

* Minimum cabling distance is 0.5 meters for -SR4 and -CSR4 modules according to the IEEE 802.3 standard.

Dimensions

The maximum outer dimensions for the QSFP modules are (H x W x D) 13.5 x 18.4 x 72.4 mm.

Cisco QSFP connector modules typically weigh 100 grams or less.

Environmental Conditions and Power Requirements

The operating temperature range is as follows:

- Commercial temperature range: 32 to 158°F (0 to 70°C).
- Exception: QSFP BiDi (QSFP-40G-SR-BD): 50 to 158°F (10 to 70°C)
- Storage temperature range: -40 to 185°F (-40 to 85°C)

Table 23 presents the optical parameters, and Table 24 presents the maximum power consumption.

Table 23. Optical Parameters

SFP+	Type	Average Transmit Power (dBm)*		Average Receive Power (dBm)		Transmit and Receive Wavelength
		Maximum	Minimum	Maximum	Minimum	
QSFP-40G-SR4	40GBASE-SR4, 4 lanes, 850-nm MMF	-1, per lane*	-7.6, per lane	2.4, per lane	-9.5, per lane	840 to 860

SFP+	Type	Average Transmit Power (dBm)*		Average Receive Power (dBm)		Transmit and Receive Wavelength
QSFP-40G-CSR4	40GBASE-CSR4, 4 lanes, 850-nm MMF	0, per lane	-7.3, per lane	0, per lane	-9.9, per lane	840 to 860
QSFP-40G-SR-BD	40GBASE-SR-BiDi, duplex MMF	+5, per lane	-4, per lane	+5, per lane	-6, per lane	832 to 918

* Transmitter and receiver power is an average unless specified otherwise.

Table 24. SFP+ Modules Maximum Power Consumption

Product	Power Consumption (W)
QSFP-40G-SR4	1.5
QSFP-40G-CSR4	1.5
QSFP-40G-SR-BD	3.5

Regulatory and Standards Compliance

Standards

- GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable
- GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors
- IEEE 802.3ae (-CSR4)
- QSFP+ MSA SFF-8436
- SFP+ MSA SFF-8431 and -8461
- RoHS 6

Safety

- The cable jacket of QSFP copper modules is UL E116441 compliant.
- QSFP copper cables are ELV compliant.

Warranty

- Standard warranty: The standard warranty is 90 days.
- Extended warranty (optional): Cisco SFP+ modules can be covered in a Cisco SMARTnet Service support contract for the Cisco switch or router chassis.

Ordering Information

Table 25 provides ordering information.

Table 25. Cisco FCoE SFP+ Ordering Information

Part Number	Description
Cisco 40GBASE-SR4 QSFP Module for MMF	QSFP-40G-SR4
Cisco 40GBASE-CSR4 QSFP Module for MMF	QSFP-40G-CSR4
Cisco 40GBASE-SR Bi-Directional QSFP Module for Duplex MMF	QSFP-40G-SR-BD

Cisco Tri-Rate Multiprotocol SFP Modules

To ease management and sparing concerns, we offer SFP modules for use in both Fibre Channel and Gigabit Ethernet ports. The Cisco Tri-Rate Multiprotocol SFP modules can run at 1/2-Gbps Fibre Channel and 1 Gigabit Ethernet, enabling the use of one type of SFP module for all ports on the MDS 9000 Family platform.

Two types of Cisco Tri-Rate Multiprotocol SFP modules are available (Figure 7): the Cisco Tri-Rate Multiprotocol Shortwave SFP (part number DS-SFP-FCGE-SW) and the Cisco Tri-Rate Multiprotocol Longwave SFP (part number DS-SFP-FCGE-LW). Each offers autosensing 1/2-Gbps Fibre Channel connectivity and 1-Gbps Ethernet connectivity.

Figure 7. Cisco Tri-Rate Multiprotocol SFP Modules

Technical Specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 26 summarizes the cabling specifications.

Table 26. Cisco Tri-Rate Multiprotocol SFP Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
DS-SFP-FCGE-SW	850	MMF	62.5 62.5 50.0 (OM2) 50.0 (OM2)	1.0625 2.125 1.0625 2.125	300m (984 ft) 150m (492 ft) 500m (1640 ft) 300m (984 ft)
DS-SFP-FCGE-LW	1310	SMF	9.0 9.0	1.0625 2.125	10 km (6.2 mi) 10 km (6.2 mi)

Note: The minimum cable distance for all SFP modules listed (MMF and SMF) is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 8.5 x 13.75 x 55.2 mm.

Environmental Conditions and Power Requirements

Table 27 presents the optical parameters, and Table 28 presents temperature ranges.

Table 27. Optical Parameters

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dBm)
	Maximum	Minimum	Maximum	Minimum	
DS-SFP-FCGE-SW	-1.2	-10.0 (Fibre Channel) and -9.5 (Gigabit Ethernet)	0	-17 (Gigabit Ethernet)	• 2.1 (Fibre Channel: 62.5 microns) and 2.62 (Fibre Channel: 50.0 microns [OM2]) • 2.38 (Gigabit Ethernet: 62.5 microns) and 3.37 (Gigabit Ethernet: 50.0 microns [OM2])
DS-SFP-FCGE-LW	-3	-11.0	-3	-19 (Gigabit Ethernet)	• 7.8 (Fibre Channel) • 4.57 (Gigabit Ethernet)

Note: The fiber loss budget is derived by taking the difference between the minimum average transmit power and the minimum average receive power and subtracting the link penalties. Use the specified fiber loss budget to calculate the maximum link distance.

Table 28. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FCGE-SW	40°C	0°C	85°C	-40°C
DS-SFP-FCGE-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 FC-PI 200-M6-SN-I 2.125 GBd; and IEEE 802.3 Gigabit Ethernet (1.25 GBd) 1000BASE-SX specifications
- Compliant with the Fibre Channel FC-PI 100-SM-LC-L, FC-PI 100-M5-SN-I, FC-PI 100-M6-SN-I, 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

Warranty

The standard warranty is one year.

Ordering Information

Table 29 provides ordering information.

Table 29. Cisco Tri-Rate Multiprotocol SFP Ordering Information

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

Part Number	Description
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

Cisco Copper Gigabit Ethernet SFP Modules

For even more cabling flexibility, the MDS 9000 Family offers copper Gigabit Ethernet SFP modules. Based on the 1000BASE-T standard, Cisco Copper Gigabit Ethernet SFP modules (Figure 8) provide cost-effective connectivity for data center applications. Cisco Copper Gigabit Ethernet SFP modules (part number DS-SFP-GE-T) allow the use of standard Category 5 unshielded twisted pair (UTP) cabling for Ethernet connectivity.

Figure 8. Cisco Copper Gigabit Ethernet SFP Modules

Technical Specifications

Connectors and Cabling

The connectors are RJ-45 connectors.

Table 30 summarizes the cabling specifications.

Table 30. Cisco Copper Gigabit Ethernet SFP Cabling Specifications

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

Dimensions

The dimensions (H x W x D) are 13.75 x 13.75 x 67.8 mm.

Environmental Conditions and Power Requirements

Table 31 presents the temperature ranges.

Table 31. Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
DS-SFP-GE-T	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

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

Warranty

The standard warranty is one year.

Ordering Information

Table 32 provides ordering information.

Table 32. Cisco Copper Gigabit Ethernet SFP Ordering Information

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

Cisco 10-Gbps Fibre Channel X2 Transceivers

The Cisco Fibre Channel X2 Transceivers provide high-performance Fibre Channel connectivity for the 10-Gbps Fibre Channel ports on the MDS 9000 Family platform. There are three types of Cisco 10-Gbps Fibre Channel X2 Transceivers for transmission on optical cables: Cisco Short Reach (up to 300m; part number DS-X2-FC10G-SR), Cisco Long Reach (up to 10 km; part number DS-X2-FC10G-LR), and Cisco Extended Reach (up to 40 km; part number DS-X2-FC10G-ER) (Figure 9). There is also a 10-Gbps Fibre Channel X2 transceiver for transmission on copper cable (up to 15m; part number DS-X2-FC10G-CX4) (Figure 10). Each offers 10-Gbps Fibre Channel connectivity.

Figure 9. Cisco 10-Gbps Fibre Channel X2 Transceiver (Part Numbers DS-X2-FC10G-SR, DS-X2-FC10G-LR, and DS-X2-FC10G-ER)

Figure 10. Cisco 10-Gbps Fibre Channel CX4 X2 Transceiver (Part Number DS-X2-FC10G-CX4)

Technical Specifications

Connectors and Cabling

- Dual SC connector (DS-X2-FC10G-SR, DS-X2-FC10G-LR, and DS-X2-FC10G-ER)
- CX4 connector (DS-X2-FC10G-CX4)

Table 33 summarizes the cabling specifications.

Table 33. X2 Port Cabling Specifications

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

Note: The minimum cable distance for all listed transceivers (MMF and SMF) except CX4 is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 19.2 x 41.8 x 90.8 mm.

Environmental Conditions and Power Requirements

Table 34 presents the optical parameters, and Table 35 presents the temperature ranges.

Table 34. Optical Parameters

X2	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dBm)
	Maximum	**Minimum**	**Maximum**	**Minimum**	
DS-X2-FC10G-SR	-1.2	-7.3	-1.0	-9.9	2.6 (50.0 microns [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 this table.

Table 35. Operating and Storage Temperature Ranges

X2	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
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

Regulatory and Standards Compliance

- Compliant with Fibre Channel 10GFC 1200-M6-SN-I, 10GFC 1200-M5-SN-I, 10GFC 1200-M5E-SN-I, and 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

Ordering Information

Table 36 provides ordering information.

Table 36. Cisco 10-Gbps Fibre Channel X2 Transceiver Ordering Information

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
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

Cisco 16-Gbps Fibre Channel SFP+ Transceivers

The Cisco 16-Gbps Fibre Channel SFP+ Transceivers (Figure 11) provide Fibre Channel connectivity for 4/8/16-Gbps ports on the MDS 9000 Family platform. Three types are available: the Cisco Fibre Channel Shortwave SFP+ (part number DS-SFP-FC16G-SW), the Cisco Fibre Channel Longwave SFP+ (part number DS-SFP-FC16G-LW), and the Cisco Fibre Channel Extended Longwave SFP+ (part number DS-SFP-FC16GELW). Each offers 4/8/16-Gbps autosensing Fibre Channel connectivity.

Figure 11. Cisco 16-Gbps Fibre Channel SFP+ Transceivers

Technical Specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 37 summarizes the cabling specifications.

Table 37. Cisco 16-Gbps Fibre Channel SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
DS-SFP-FC16G-SW	850	MMF	62.5 50.0 50.0 50.0 62.5 50.0 50.0 50.0 62.5 50.0 50.0 50.0	14.025 14.025 14.025 14.025 8.5 8.5 8.5 8.5 4.25 4.25 4.25 4.25	15m (49 ft) (OM1) 35m (115 ft) (OM2) 100m (328 ft) (OM3) 125m (410 ft) (OM4) 21m (69 ft) (OM1) 50m (164 ft) (OM2) 150m (492 ft) (OM3) 190m (623 ft) (OM4) 70m (230 ft) (OM1) 150m (492 ft) (OM2) 380m (1247 ft) (OM3) 400m (1312 ft) (OM4)
DS-SFP-FC16G-LW	1310	SMF	9.0 9.0 9.0	14.025 8.5 4.25	10 km (6.2 mi) 10 km (6.2 mi) 10 km (6.2 mi)
DS-SFP-FC16GELW	1310	SMF	9.0 9.0 9.0	14.025 8.5 4.25	10 km (6.2 mi) 10 km (6.2 mi) 10 km (6.2 mi)

Note: The minimum cable distance for all SFP+ devices listed (MMF and SMF) is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 8.5 x 13.55 x 56.5 mm.

Environmental Conditions and Power Requirements

Table 38 presents the optical parameters, and Table 39 presents temperature ranges.

Table 38. Optical Parameters

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)		
	Maximum	**Minimum**	**Maximum**	**Minimum**	**(62.5 microns [OM1])**	**(50.0 microns [OM2])**	**(50.0 microns [OM3])**
DS-SFP-FC16G-SW	-1.3	-7,8	0	-10.3*	2.08 (4 Gbps) 1.68 (8 Gbps) 1.63 (16 Gbps)	2.08 (4 Gbps) 1.68 (8 Gbps) 1.63 (16 Gbps)	2.88 (4 Gbps) 2.04 (8 Gbps) 1.86 (16 Gbps)
DS-SFP-FC16G-LW	2.0	-5.0	2.0	-12.0*	7.8 (4 Gbps) 6.4 (8 Gbps) 6.4 (16 Gbps)		
DS-SFP-FC16GELW	5.0	-2.0	2.0	-14.0	10 (16 Gbps)		

Table 39. Operating and Storage Temperature Ranges

SFP+	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
DS-SFP-FC16G-SW	40°C	0°C	85°C	-40°C
DS-SFP-FC16G-LW	40°C	0°C	85°C	-40°C
DS-SFP-FC16GELW	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

- Compliant with Fibre Channel FC-PI 1600-SM-LC-L, FC-PI 1600-M5-SN-S, FC-PI 1600-M5E-SN-I, FC-PI 1600-M5F-SN-I, and FC-PI 1600-M6-SN-S 14.025-GBd specifications
- Compliant with Fibre Channel FC-PI 800-SM-LC-L, FC-PI 800-M5-SN-S, FC-PI 800-M5E-SN-I, and FC-PI 800-M6-SN-S 8.5-GBd specifications
- Compliant with Fibre Channel FC-PI 400-SM-LC-L, FC-PI 400-M5-SN-I, FC-PI 400-M5E-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, FC-PI 200-M5E-SN-I, and 200-M6-SN-I 2.125-GBd specifications
- Laser Class I 21CFR1040

* Applicable only to DS-SFP-FC16G-SW and DS-SFP-FC16G-LW.
* Average receiver power (minimum) is based on a 4.5-dB extinction ratio.
* Optical parameters listed here are for 14.025-GBd applications.

Ordering Information

Table 40 provides ordering information.

Table 40. Cisco Fibre Channel SFP+ Ordering Information

Part Number	Description
DS-SFP-FC16G-SW	16 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC16G-SW=	16 Gbps Fibre Channel SW SFP+, LC, spare
DS-SFP-FC16G-LW	16 Gbps Fibre Channel LW SFP+, LC
DS-SFP-FC16G-LW=	16 Gbps Fibre Channel LW SFP+, LC, spare
DS-SFP-FC16GELW	16 Gbps Fibre Channel ELW SFP+, LC
DS-SFP-FC16GELW=	16 Gbps Fibre Channel ELW SFP+, LC, spare

Cisco 10-Gbps Ethernet X2 Transceivers

The Cisco Ethernet X2 Transceiver short reach module (up to 300m; part number DS-X2-E10G-SR) enables high-performance Fibre Channel connectivity for the MDS 9000 Family 10-Gbps Fibre Channel switching module to an existing Ethernet Dense Wavelength-Division Multiplexing (DWDM) transponder (Figure 12). The data format transmitted is identical to that transmitted by the Fibre Channel transceiver (DS-X2-FC10G-SR), except the Fibre Channel packets are clocked at the 10 Gigabit Ethernet rate to carry Fibre Channel packets over a 10-Gbps Ethernet DWDM infrastructure. The MDS 9000 Family 10-Gbps Fibre Channel switching module automatically detects DS-X2-E10G-SR; no software configuration is required.

Figure 12. Cisco 10-Gbps Ethernet X2 Transceiver

Technical Specifications

Connectors and Cabling

The connectors are dual SC connectors.

Table 41 summarizes the cabling specifications.

Table 41. Cisco 10-Gbps Ethernet X2 Transceiver Cabling Specifications

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

Note: The minimum cable distance for all transceivers listed (MMF and SMF) is 6.5 feet (2 meters).

Dimensions

The dimensions (H x W x D) are 19.2 x 41.8 x 90.8 mm.

Environmental Conditions and Power Requirements

Table 42 presents the optical parameters, and Table 43 presents temperature ranges.

Table 42. Optical Parameters

X2	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget
	Maximum	Minimum	Maximum	Minimum	
DS-X2-E10G-SR	-1.2	-7.3	-1.0	-9.9	2.6 (50.0 microns [OM3])

Table 43. Operating and Storage Temperature Ranges

X2	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-X2-E10G-SR	40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

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

Ordering Information

Table 44 provides ordering information.

Table 44. Cisco 10-Gbps Ethernet X2 Transceiver Ordering Information

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

Cisco Coarse Wavelength-Division Multiplexing Extended Distance SFP Solution

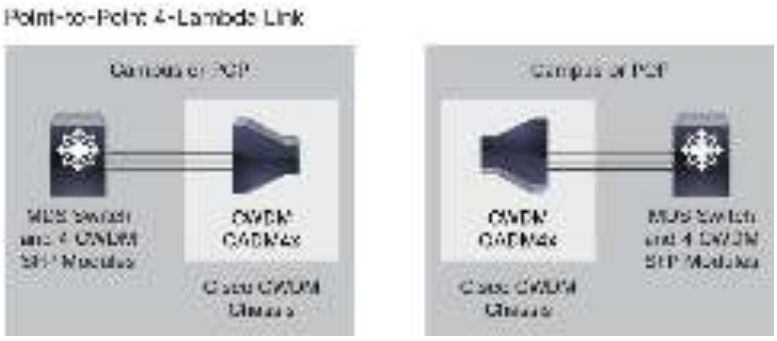
The MDS 9000 Family offers cost-effective multiprotocol extended distance connectivity to optimize to existing optical infrastructure through the Cisco CWDM SFP solution (Figure 13). The solution has two main components: a set of eight wavelength-specific SFP modules and a set of CWDM optical add-drop modules (OADMs). A Cisco CWDM chassis enables rack-mounting of up to two CWDM OADMs. The CWDM OADMs are passive and require no power or configuration.

Figure 13. Cisco CWDM Extended Distance SFP Solution

The CWDM SFP solution enables the transport of up to eight channels over one pair of single-mode fiber strands, enabling 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 14 shows a common point-to-point deployment scenario for the MDS 9000 Family using the CWDM SFP solution. Two endpoints are directly connected through a fiber link. The CWDM SFP solution enables customers to add or drop up to eight channels onto a pair of single-mode fiber strands. As a result, the need for additional fiber is reduced. Redundant point-to-point links can be implemented by adding or dropping redundant channels onto a second pair of single-mode fiber strands.

Figure 14. Point-to-Point Architecture (Dual-Fiber Link)



Cisco 1/2-Gbps CWDM SFP Modules

Technical Specifications for Cisco 1/2-Gbps CWDM SFP Modules

Connectors and Cabling

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

Dimensions

The dimensions (H x W x D) are 8.5 x 13.75 x 55.2 mm.

Environmental Conditions and Power Requirements

Table 45 presents the optical parameters, and Table 46 presents the temperature ranges.

Table 45. Optical Parameters for Cisco 1/2-Gbps CWDM SFP Modules

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and Conditions
Transmitter center wavelength	Lambda_c	(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 PRBS 2-7-1)	Pin	-28.0	-	-7.0	dBm	At 2.12 Gbps, 140°F (60°C) case temperature
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 mi)	-	-	-	3	dB	At 2.12 Gbps
Dispersion penalty at 100 km (62.1 mi)	-	-	-	2	dB	At 1.25 Gbps

Note:

- Parameters are specified over temperature and at end of life unless otherwise noted.
- When shorter distances of single-mode fiber are used, you may need to insert an inline optical attenuator in the link to avoid overloading the receiver.

Table 46. Operating and Storage Temperature Ranges

Operating		Storage	
Maximum	**Minimum**	**Maximum**	**Minimum**
40°C	0°C	85°C	-40°C

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 47 provides ordering information.

Table 47. Cisco 1/2-Gbps CWDM SFP Ordering 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

Cisco 4-Gbps CWDM SFP Modules

Technical Specifications for Cisco 4-Gbps CWDM SFP Modules

Connectors and Cabling

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

Dimensions

The dimensions (H x W x D) are 8.46 x 13.27 x 56.64 mm.

Environmental Conditions and Power Requirements

Table 48 presents the optical parameters, and Table 49 presents the temperature ranges.

Table 48. Optical Parameters for Cisco 4-Gbps CWDM SFP Modules

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and 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 mi)	-	-	-	3	dB	-

Note:

- In typical point-to-point deployments, all wavelengths have a minimum reach of 24.8 miles (40 km).
- Parameters are specified over temperature and at end of life unless otherwise noted.
- When shorter distances of single-mode fiber are used, you may need to insert an inline optical attenuator in the link to avoid overloading the receiver.
- Up to 24 Cisco 4-Gbps CWDM SFP Transceivers are supported in a single MDS 9000 Family switching module.
- When interoperating a Cisco 4-Gbps CWDM SFP Transceiver with a Cisco 1/2-Gbps CWDM SFP Transceiver, you must manually configure the port speeds on the Cisco 4-Gbps CWDM SFP Transceiver to 1 or 2 Gbps.

Table 49. Operating and Storage Temperature Ranges

Operating		Storage	
Maximum	**Minimum**	**Maximum**	**Minimum**
40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

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

Ordering Information

Table 50 provides ordering information.

Table 50. Cisco 4-Gbps CWDM SFP Ordering 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

Part Number	Description	Color
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

Cisco 8-Gbps CWDM SFP Modules

Technical Specifications for Cisco 8-Gbps CWDM SFP Modules

Connectors and Cabling

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

Dimensions

The dimensions (H x W x D) are 8.5 x 13.55 x 56.5 mm.

Environmental Conditions and Power Requirements

Table 51 presents the optical parameters, and Table 52 presents the temperature ranges.

Table 51. Optical Parameters for Cisco 8-Gbps CWDM SFP Modules

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and Conditions
Transmitter center wavelength	Lambda_c	(x - 65)	x	(x + 6.5)	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	-	4.0	dBm	Average power coupled into single-mode fiber
Receiver optical input power (BER <10-12 with PRBS 2-23-1)	Pin		-	-24	dBm	140°F (60°C) case temperature
Receiver optical input wavelength	Lambda_in	1450	-	1620	nm	-
Transmitter extinction ratio	OMI	9	-	-	dB	-
Dispersion penalty at 25 km (15.5 mi)	-	-	-	3	dB	-

Note:

- The link budget is -24 dBm.
- The minimum receiver overload is -7 dBm.
- The Cisco Enhanced Wavelength Division Multiplexing product line is also supported for CWDM optics: http://www.cisco.com/c/en/us/products/collateral/interfaces-modules/transceiver-modules/product_data_sheet0900aecd806a1c36.html.
- In typical point-to-point deployments, all wavelengths have a minimum reach of 24.8 miles (40 km).
- Parameters are specified over temperature and at end of life unless otherwise noted.

- When shorter distances of single-mode fiber are used, you may need to insert an inline optical attenuator in the link to avoid overloading the receiver.
- Up to 24 Cisco 8-Gbps CWDM SFP Transceivers are supported in a single Cisco MDS 9700 Series Multilayer Director switching module. The Cisco MDS 9250i and 9148 Multilayer Fabric Switches support 10 ports.
- When interoperating a Cisco 8-Gbps CWDM SFP Transceiver with a Cisco 4-Gbps CWDM SFP Transceiver, you must manually configure the port speeds.

Table 52. Operating and Storage Temperature Ranges

Operating		Storage	
Maximum	**Minimum**	**Maximum**	**Minimum**
40°C	0°C	85°C	-40°C

Regulatory and Standards Compliance

- Compatible with Fibre Channel Draft Physical Interface Specification (FC-PI -4 8.00)
- Laser Class: Optical output not to exceed the Class 1 maximum permissible exposure limits under any conditions of operation (including open transmitter bore, open fiber, and reasonable single-fault conditions) as stated in EN 60825-2 (reference 15) and CDRH 1040.10 regulations 21 CFR, chapter I and subchapter J (reference 6)

Ordering Information

Table 53 provides ordering information.

Table 53. Cisco 8-Gbps CWDM SFP Ordering Information

Part Number	Description	Color
DS-CWDM8G1470=	1470 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Gray
DS-CWDM8G1490=	1490 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Violet
DS-CWDM8G1510=	1510 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Blue
DS-CWDM8G1530=	1530 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Green
DS-CWDM8G1550=	1550 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Yellow
DS-CWDM8G1570=	1570 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Orange
DS-CWDM8G1590=	1590 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Red
DS-CWDM8G1610=	1610 nm CWDM 2/4/8-Gbps Fibre Channel SFP+	Brown

Cisco CWDM OADMs

Technical Specifications for Cisco CWDM OADMs

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

The MDS 9000 Family offers two CWDM OADMs and a multiplexer and demultiplexer:

- Cisco Dual Fiber 4-Channel OADMs (part numbers DS-CWDMOADM4A= and DS-CWDMOADM4B=): This device allows you to add and drop four channels (with different wavelengths) onto 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 to 1550, 1570, 1590, and 1610 nm for DS-CWDMOADM4B=.
- Cisco Dual Fiber 8-Channel Multiplexer/Demultiplexer (DS-CWDM-MUX8A=): This device allows you to multiplex and demultiplex eight separate channels onto 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.

Tables 54 and 55 provide comparisons of the OADM types.

Table 54. OADM Type Comparison

Product Number	Type	Architecture Options
DS-CWDMOADM4x=	OADM	Ring and point to point
DS-CWDM-MUX8A=	Multiplexer/demultiplexer	Ring and point to point

Table 55. 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	-		23

Connectors and Cabling

- DS-CWDMOADM4x=: Dual LC connector
- DS-CWDM-MUX8A=: Dual LC connector

Environmental Conditions and Power Requirements

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

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

Dimensions and Weight

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

Regulatory and Standards Compliance

Network Equipment Building Standards (NEBS) Level 3

Warranty

The standard warranty is one year.

Ordering Information

Table 56 provides ordering information.

Table 56. Cisco Dual Fiber 4-Channel OADM, Dual Fiber 8-Channel Multiplexer and Demultiplexer, and 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

Cisco Dense Wavelength-Division Multiplexing Extended-Distance Solution

2-Gbps DWDM SFP Transceiver

The Cisco DWDM SFP modules enable enterprises and service providers to provide scalable, easy-to-deploy DWDM Fibre Channel services in their networks.

The main features of the Cisco DWDM SFP include:

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

Note: Up to eight 2-Gbps DWDM SFP modules are supported in a single MDS 9000 Family switching module. Refer to http://www.cisco.com/en/US/prod/collateral/modules/ps5455/ps6576/product_data_sheet0900aecd80582763.html for details.

Ordering Information

Table 57 provides ordering information.

Table 57. Cisco 2-Gbps DWDM SFP Transceiver Ordering Information

Part Number	Description
DWDM-SFP-6061=	Cisco 1560.61 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5979=	Cisco 1559.79 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5898=	Cisco 1558.98 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5817=	Cisco 1558.17 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5655=	Cisco 1556.55 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5575=	Cisco 1555.75 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5494=	Cisco 1554.94 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5413=	Cisco 1554.13 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5252=	Cisco 1552.52 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5172=	Cisco 1551.72 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5092=	Cisco 1550.92 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-5012=	Cisco 1550.12 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4851=	Cisco 1548.51 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4772=	Cisco 1547.72 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare

Part Number	Description
DWDM-SFP-4692=	Cisco 1546.92 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4612=	Cisco 1546.12 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4453=	Cisco 1544.53 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4373=	Cisco 1543.73 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4294=	Cisco 1542.94 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4214=	Cisco 1542.14 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-4056=	Cisco 1540.56 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3977=	Cisco 1539.77 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3898=	Cisco 1538.98 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3819=	Cisco 1538.19 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3661=	Cisco 1536.61 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3582=	Cisco 1535.82 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3504=	Cisco 1535.04 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3425=	Cisco 1534.25 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3268=	Cisco 1532.68 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3190=	Cisco 1531.90 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3112=	Cisco 1531.12 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare
DWDM-SFP-3033=	Cisco 1530.33 NM DWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, Spare

4-Gbps DWDM SFP Transceiver

The Cisco 4-Gbps DWDM SFP modules enable enterprises and service providers to provide scalable, easy-to-deploy DWDM Fibre Channel services in their networks. Direct integration of 4-Gbps DWDM optics in the MDS 9000 Family platform dramatically reduces capital costs and operating expenses for a Fibre Channel-over-DWDM network, avoiding the need for DWDM transponders and muxponders.

The main features of the Cisco 4-Gbps DWDM SFP include:

- Support for International Telecommunication Union (ITU) 100-GHz wavelength grid
- Match for wavelength plan of Cisco ONS 100-GHz product family
- Fixed-wavelength SFP, with 40 SFP models

Ordering Information

Using customer use data, Cisco has identified and selected particular high-use wavelengths and will maintain shorter lead times on these items. The short lead-time 4-Gbps DWDM SFP modules are from 1546.1 to 1560.6 with a 4-skip-1 approach. These part numbers are identified in Table 58. Table 59 identifies the rest of the 4-Gbps DWDM SFP modules.

Table 58. Cisco 4-Gbps DWDM SFP Transceiver Ordering Information: Commonly Used Wavelengths

Part Number	Description
ONS-SC-4G-50.1=	SFP - 4G FC 1550.12, 100 GHz, LC
ONS-SC-4G-50.9=	SFP - 4G FC 1550.92, 100 GHz, LC
ONS-SC-4G-51.7=	SFP - 4G FC 1551.72, 100 GHz, LC
ONS-SC-4G-52.5=	SFP - 4G FC 1552.52, 100 GHz, LC

Part Number	Description
ONS-SC-4G-54.1=	SFP - 4G FC 1554.13, 100 GHz, LC
ONS-SC-4G-54.9=	SFP - 4G FC 1554.94, 100 GHz, LC
ONS-SC-4G-55.7=	SFP - 4G FC 1555.75, 100 GHz, LC
ONS-SC-4G-56.5=	SFP - 4G FC 1556.55, 100 GHz, LC
ONS-SC-4G-58.1=	SFP - 4G FC 1558.17, 100 GHz, LC
ONS-SC-4G-58.9=	SFP - 4G FC 1558.98, 100 GHz, LC
ONS-SC-4G-59.7=	SFP - 4G FC 1559.79, 100 GHz, LC
ONS-SC-4G-60.6=	SFP - 4G FC 1560.61, 100 GHz, LC

Table 59. Cisco 4-Gbps DWDM SFP Transceiver Ordering Information: Other Wavelengths

Part Number	Description
ONS-SC-4G-30.3=	SFP - 4G FC 1530.33, 100 GHz, LC
ONS-SC-4G-31.1=	SFP - 4G FC 1531.12, 100 GHz, LC
ONS-SC-4G-31.9=	SFP - 4G FC 1531.90, 100 GHz, LC
ONS-SC-4G-32.6=	SFP - 4G FC 1532.68, 100 GHz, LC
ONS-SC-4G-33.4=	SFP - 4G FC 1533.47, 100 GHz, LC
ONS-SC-4G-34.2=	SFP - 4G FC 1534.25, 100 GHz, LC
ONS-SC-4G-35.0=	SFP - 4G FC 1535.04, 100 GHz, LC
ONS-SC-4G-35.8=	SFP - 4G FC 1535.82, 100 GHz, LC
ONS-SC-4G-36.6=	SFP - 4G FC 1536.61, 100 GHz, LC
ONS-SC-4G-37.4=	SFP - 4G FC 1537.40, 100 GHz, LC
ONS-SC-4G-38.1=	SFP - 4G FC 1538.19, 100 GHz, LC
ONS-SC-4G-38.9=	SFP - 4G FC 1538.98, 100 GHz, LC
ONS-SC-4G-39.7=	SFP - 4G FC 1539.77, 100 GHz, LC
ONS-SC-4G-40.5=	SFP - 4G FC 1540.56, 100 GHz, LC
ONS-SC-4G-41.3=	SFP - 4G FC 1541.35, 100 GHz, LC
ONS-SC-4G-42.1=	SFP - 4G FC 1542.14, 100 GHz, LC
ONS-SC-4G-42.9=	SFP - 4G FC 1542.94, 100 GHz, LC
ONS-SC-4G-43.7=	SFP - 4G FC 1543.73, 100 GHz, LC
ONS-SC-4G-44.5=	SFP - 4G FC 1544.53, 100 GHz, LC
ONS-SC-4G-45.3=	SFP - 4G FC 1545.32, 100 GHz, LC
ONS-SC-4G-46.1=	SFP - 4G FC 1546.12, 100 GHz, LC
ONS-SC-4G-46.9=	SFP - 4G FC 1546.92, 100 GHz, LC
ONS-SC-4G-47.7=	SFP - 4G FC 1547.72, 100 GHz, LC
ONS-SC-4G-48.5=	SFP - 4G FC 1548.51, 100 GHz, LC
ONS-SC-4G-49.3=	SFP - 4G FC 1549.32, 100 GHz, LC
ONS-SC-4G-53.3=	SFP - 4G FC 1553.33, 100 GHz, LC
ONS-SC-4G-57.3=	SFP - 4G FC 1557.36, 100 GHz, LC
ONS-SC-4G-61.4=	SFP - 4G FC 1561.43, 100 GHz, LC

For More Information

For more information about the Cisco MDS 9000 Series Multilayer Switches, visit http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/brochure_c02-452560.html.

Cisco 10-Gbps Ethernet DWDM X2 Transceiver

The Cisco 10-Gbps Ethernet DWDM X2 Transceiver pluggable module (part number DWDM-X2-xx.xx=) enables high-performance Fibre Channel connectivity for the MDS 9000 10-Gbps Fibre Channel switching module to an existing Ethernet DWDM infrastructure. The data format transmitted by the Ethernet DWDM X2 transceiver (DWDM-X2-xx.xx=) onto the fiber is identical to that transmitted by the Fibre Channel X2 transceiver (DS-X2-FC10G-SR), except that the Fibre Channel packets are clocked at the 10 Gigabit Ethernet rate, which allows Fibre Channel packets to be carried over an existing 10-Gbps Ethernet DWDM infrastructure. The MDS 9000 10-Gbps Fibre Channel switching module will automatically detect DWDM-X2-xx.xx=; no software configuration is required.

The main features of the Cisco 10-Gbps Ethernet DWDM X2 Transceiver include:

- Support for 32 nontunable ITU 100-GHz wavelengths compatible with the Cisco ONS DWDM channel plan
- Support for digital optical monitoring capability

Detailed data sheets are available at http://www.cisco.com/en/US/products/ps6576/index.html and http://www.cisco.com/en/US/products/hw/modules/ps5455/products_data_sheets_list.html.

Ordering Information

Table 60 provides ordering information.

Table 60. Cisco 10-Gbps Ethernet DWDM X2 Transceiver Ordering Information

Part Number	Description	ITU Channel
DWDM-X2-60.61=	10GBASE-DWDM 1560.61 nm X2 (100-GHz ITU grid)	21
DWDM-X2-59.79=	10GBASE-DWDM 1559.79 nm X2 (100-GHz ITU grid)	22
DWDM-X2-58.98=	10GBASE-DWDM 1558.98 nm X2 (100-GHz ITU grid)	23
DWDM-X2-58.17=	10GBASE-DWDM 1558.17 nm X2 (100-GHz ITU grid)	24
DWDM-X2-56.55=	10GBASE-DWDM 1556.55 nm X2 (100-GHz ITU grid)	26
DWDM-X2-55.75=	10GBASE-DWDM 1555.75 nm X2 (100-GHz ITU grid)	27
DWDM-X2-54.94=	10GBASE-DWDM 1554.94 nm X2 (100-GHz ITU grid)	28
DWDM-X2-54.13=	10GBASE-DWDM 1554.13 nm X2 (100-GHz ITU grid)	29
DWDM-X2-52.52=	10GBASE-DWDM 1552.52 nm X2 (100-GHz ITU grid)	31
DWDM-X2-51.72=	10GBASE-DWDM 1551.72 nm X2 (100-GHz ITU grid)	32
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Cisco 10GBASE WDM SFP+ Modules

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Printed in USA C78-332774-30 02/16