

# Cisco MDS 9000 Family Pluggable Transceivers

## Product Overview

The Cisco® Small Form-Factor Pluggable (SFP), Enhanced Small Form-Factor Pluggable (SFP+), and X2 devices for use on the Cisco MDS 9000 Family of products 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, SFP+, and X2 transceivers are available for use in conjunction with the Cisco MDS 9000 Family products as outlined in Table 1.

**Table 1.** Cisco MDS 9000 Family Switching Modules and Fabric Switch Transceiver Support

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-X9016	Yes				Yes		
DS-X9032	Yes				Yes		
DS-X9032-SSM	Yes				Yes		
DS-X9112		Yes <sup>2</sup>					
DS-X9124		Yes <sup>2</sup>					
DS-X9148		Yes <sup>2</sup>					
DS-X9248-48K9		Yes <sup>2</sup>	Yes <sup>2</sup>				
DS-X9224-96K9		Yes <sup>2</sup>	Yes <sup>2</sup>				
DS-X9248-96K9		Yes <sup>2</sup>	Yes <sup>2</sup>				
DS-X9232-256K9		Yes <sup>2, 10</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9248-256K9		Yes <sup>2, 10</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9302-14K9	Yes				Yes	Yes	
DS-X9304-18K9		Yes <sup>2</sup>			Yes <sup>1</sup>	Yes <sup>D</sup>	
DS-X9304-SMIP					Yes	Yes	
DS-X9308-SMIP					Yes	Yes	
DS-X9316-SSNK9					Yes <sup>F</sup>	Yes <sup>F</sup>	
DS-X9704							Yes <sup>2</sup>
DS-C9216A-K9	Yes				Yes		
DS-C9216i-K9	Yes				Yes	Yes	
DS-C9222i-K9		Yes <sup>2</sup>			Yes <sup>1</sup>	Yes <sup>D</sup>	
DS-C9120-K9	Yes				Yes		
DS-C9124-K9		Yes <sup>2</sup>					
DS-C9134-K9		Yes <sup>2</sup>					Yes <sup>2, 5</sup>
DS-C9140-K9	Yes				Yes		
DS-C9148-K9		Yes <sup>2, 7</sup>	Yes <sup>2, 11</sup>				
DS-C9020-20K9		Yes					

Switching Module and Fabric Switch	DS-X2-FC10G-CX4=C	DS-X2-E10G-SR=A	DS-CWDM-xxxx=	DS-CWDM4Gx xxx=A	DWDM-SFP-xxxx=A	ONS-SC-4G-xx.x= G	SFP-10G-XX	SFP-H10GB-xCUM	DWDM-X2-xx.xx=E
DS-X9016			Yes		Yes				
DS-X9032			Yes		Yes				
DS-X9032-SSM			Yes		Yes				
DS-X9112			Yes	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9124			Yes	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9148			Yes	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9248-48K9			Yes	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9224-96K9			Yes	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9232-256K9									
DS-X9248-256K9									
DS-X9248-96K9			Yes	Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>			
DS-X9302-14K9			Yes <sup>6</sup>		Yes				
DS-X9304-18K9			Yes <sup>6</sup>	Yes <sup>2</sup>	Yes <sup>2,6</sup>	Yes <sup>2</sup>			
DS-X9304-SMIP			Yes						
DS-X9308-SMIP			Yes						
DS-X9316-SSNK9			Yes <sup>F</sup>		Yes <sup>F</sup>				
DS-X9704	Yes <sup>2</sup>	Yes <sup>2</sup>							Yes <sup>2</sup>
DS-X9708-K9							Yes <sup>8</sup>	Yes <sup>9</sup>	
DS-C9216A-K9			Yes		Yes				
DS-C9216i-K9			Yes <sup>6</sup>		Yes				
DS-C9222i-K9			Yes <sup>6</sup>	Yes <sup>2</sup>	Yes <sup>2,6</sup>	Yes <sup>2</sup>			
DS-C9120-K9			Yes		Yes				
DS-C9124-K9			Yes <sup>3</sup>	Yes <sup>2,4</sup>		Yes <sup>2</sup>			
DS-C9134-K9	Yes <sup>2</sup>	Yes <sup>2,F</sup>	Yes <sup>3</sup>	Yes <sup>4</sup>					Yes <sup>2,F</sup>
DS-C9140-K9			Yes		Yes				
DS-C9148-K9				Yes <sup>2</sup>		Yes <sup>2</sup>			
DS-C9020-20K9									

- A: Supported on switches running Cisco MDS 9000 SAN-OS Software Release 3.1(3) or later.  
B: DS-X2-FC10G-ER supported on switches running Cisco MDS 9000 SAN-OS Software Release 3.1(3) or later.  
C: Supported on switches running Cisco MDS 9000 SAN-OS Software Release 3.2(1) or later.  
D: Supported on switches running Cisco MDS 9000 SAN-OS Software Release 3.3(1) or later.  
E: Supported on switches running Cisco MDS 9000 NX-OS Software Release 4.1(1) or later.  
F: Supported on switches running Cisco MDS 9000 NX-OS Software Release 4.2(1) or later.  
G: Supported on switches running Cisco MDS 9000 NX-OS Software Release 5.0 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 and -LR is supported.  
9: Passive Copper -CU1M, -CU3M, -CU5M and Active Copper -ACU7M, -ACU10M TwinAx cables are supported.  
10: DS-SFP-4GFC-MR is not supported.  
11: Maximum distance with DS-SFP-FC8G-ER is limited to 31 km.

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

## Cisco 2-Gbps Fibre Channel SFPs

The Cisco 2-Gbps Fibre Channel SFPs (Figure 1) are designed to provide cost-effective Fibre Channel connectivity for the Cisco MDS 9000 Fibre Channel switching modules. Two types of Cisco 2-Gbps Fibre Channel SFP 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 product offers 1/2-Gbps autosensing Fibre Channel connectivity.

**Figure 1.** Cisco 2-Gbps Fibre Channel SFPs



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual LC connector

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	1.0625	300 m (984 ft)
			62.5	2.125	150 m (492 ft)
			50.0 (Optical Multimode 2 [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 mi)

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

### Dimensions

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

## Environmental Conditions and Power Requirements

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

**Table 3.** Optical Parameters

SFP	Average Transmit Power (decibels per milliwatt [dBm])		Average Receive Power (dBm)		Fiber Loss Budget (decibels [dB])
	Max	Min	Max	Min	
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	
	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 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 SFPs

The Cisco 4-Gbps Fibre Channel SFPs (Figure 2) are designed to provide cost-effective Fibre Channel connectivity for the 1/2/4-Gbps ports on the Cisco MDS 9000 Family platform. Three types of Cisco 4-Gbps Fibre Channel SFP 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 product offers 1/2/4-Gbps autosensing Fibre Channel connectivity.

**Figure 2.** Cisco 4-Gbps Fibre Channel SFPs



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual LC connector

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	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)
			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 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 SFPs listed (MMF and SMF) is 6.5 feet (2 meters).

### Dimensions

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

## Environmental Conditions and Power Requirements

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

**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	-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	
	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 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+

The Cisco 8-Gbps Fibre Channel SFP+ (Figure 3) is designed to provide Fibre Channel connectivity for the 2/4/8-Gbps ports on the Cisco MDS 9000 Family platform. Three types of Cisco 8-Gbps Fibre Channel SFP+ 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 product offers 2/4/8-Gbps autosensing Fibre Channel connectivity.

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



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual LC connector

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	2.125	150 m (492 ft)
			62.5	4.250	70 m (230 ft)
			62.5	8.500	21 m (69 ft)
			50.0 (OM2)	2.125	300 m (984 ft)
			50.0 (OM2)	4.250	150 m (492 ft)
			50.0 (OM2)	8.500	50 m (164 ft)
			50.0 (OM3)	2.125	500 m (1640 ft)
			50.0 (OM3)	4.250	380 m (1246 ft)
			50.0 (OM3)	8.500	150 m (492 ft)
			50.0 (OM4)	2.125	520 m (1706 ft)
			50.0 (OM4)	4.250	400 m (1312 ft)
			50.0 (OM4)	8.500	190 m (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)

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
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+ listed (MMF and SMF) is 6.5 feet (2 meters).

#### Dimensions

- Dimensions (H x W x D): 8.5 x 13.55 x 56.5 mm

#### Environmental Conditions and Power Requirements

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

**Table 11.** Optical Parameters

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)		
	Max	Min	Max	Min	(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-FC8G-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	-14.1	-	10.9		

**Table 12.** Operating and Storage Temperature Ranges

SFP+	Operating		Storage	
	Max	Min	Max	Min
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
<b>DS-SFP-FC8G-SW</b>	2/4/8-Gbps Fibre Channel-Shortwave, SFP+, LC
<b>DS-SFP-FC8G-SW=</b>	2/4/8-Gbps Fibre Channel-Shortwave, SFP+, LC, Spare
<b>DS-SFP-8G-SW-4=</b>	2/4/8-Gbps Fibre Channel-Shortwave, SFP+, LC, 4 pack, Spare
<b>DS-SFP-FC8G-LW</b>	2/4/8-Gbps Fibre Channel-Longwave, SFP+, LC
<b>DS-SFP-FC8G-LW=</b>	2/4/8-Gbps Fibre Channel-Longwave, SFP+, LC, Spare
<b>DS-SFP-FC8G-ER</b>	2/4/8-Gbps Fibre Channel Extended Reach SFP+, LC (40km Reach)
<b>DS-SFP-FC8G-ER=</b>	2/4/8-Gbps Fibre Channel Extended Reach SFP+, LC, Spare (40km Reach)

## Cisco 10-Gbps Fibre Channel SFP+

The Cisco 10-Gbps Fibre Channel SFP+ (Figure 4) is designed to provide Fibre Channel connectivity for the 10-Gbps Fibre Channel ports on the Cisco MDS 9000 Family platform. Two types of Cisco 10-Gbps Fibre Channel SFP+ 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+



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual LC connector

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)	10.518	33m (104 ft)
			50 (OM2)	10.518	82m (269 ft)
			50 (OM3)	10.518	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+ listed (MMF and SMF) is 6.5 feet (2 meters).

### Dimensions

- Dimensions (H x W x D): 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)
	Max	Min	Max	Min	
DS-SFP-FC10G-SW	-1.3	-7.3	-1.0	-9.9	7.3
DS-SFP-FC10G-LW	+0.5	-8.2	-1.0	-9.9	7.4

**Table 16.** Operating and Storage Temperature Ranges

SFP+	Operating		Storage	
	Max	Min	Max	Min
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

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## Cisco 10-Gbps Ethernet (FCoE) SFP+

The Cisco 10-Gbps Ethernet SFP+ (Figure 4) is designed to provide 10-Gbps Ethernet connectivity for the Cisco MDS 9500 10-Gbps 8-Port FCoE Module.

**Figure 5.** Cisco 10GBASE SFP+ Modules



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual LC/PC connector

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	160	26m
			62.5	200	33m
			50.0	400	66m
			50.0	500	82m
			50.0	2000	300m
SFP-10G-LR	1310	SMF	50	-	10 km
SFP-H10GB-CU1M	-	Twinax cable, passive, 30AWG cable assembly	-	-	1m
SFP-H10GB-CU3M	-	Twinax cable, passive, 30AWG cable assembly	-	-	3m
SFP-H10GB-CU5M	-	Twinax cable, passive, 24AWG cable assembly	-	-	5m
SFP-H10GB-ACU7M	-	Twinax cable, active, 24AWG cable assembly	-	-	7m
SFP-H10GB-ACU10M	-	Twinax cable, active, 24AWG cable assembly	-	-	10m

† Minimum cabling distance for -SR, -LRM, -LR 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 used must be compliant with the standards specified in the standards section.

### Dimensions

- Dimensions (H x W x D): 8.5 x 13.55 x 56.5 mm

### Environmental Conditions and Power Requirements

Operating temperature range:

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

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

**Table 19.** Optical Parameters

SFP+	Type	Average Transmit Power (dBm)		Average Receive Power (dBm)		Transmit and Receive Wavelength
		Max	Min	Max	Min	
SFP-10G-SR	10GBASE-SR 850 nm MMF	-1.2**	-7.3	-1.0	-9.9	840 to 860
SFP-10G-LR	10GBASE-LR 1310 nm SMF	+0.5	-8.2	.05	-14.4	1260 to 1355

\* Transmitter and receiver power is in 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	1
SFP-10G-LR	1
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)
- 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
- Cable jacket of SFP+ copper modules is UL #E116441 Compliant
- All length SFP+ copper cables are ELV and RoHS Compliant

### Warranty

- Standard warranty: 90 days
- Extended warranty (optional): Cisco SFP+ modules can be covered in a Cisco SMARTnet<sup>®</sup> 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
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 Tri-Rate Multiprotocol SFPs

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

There are two types of Cisco Tri-Rate Multiprotocol SFP (Figure 4): 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 product offers autosensing 1/2-Gbps Fibre Channel connectivity and 1-Gbps Ethernet connectivity.

**Figure 6.** Cisco Tri-Rate Multiprotocol SFPs



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual LC connector

Table 22 summarizes the cabling specifications.

**Table 22.** 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	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-FCGE-LW	1310	SMF	9.0	1.0625	10 km (6.2 mi)
			9.0	2.125	10 km (6.2 mi)

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

### Dimensions

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

### Environmental Conditions and Power Requirements

Table 23 presents the optical parameters, and Table 24 presents the temperature ranges.

**Table 23.** 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) and -9.5 (GE)	0	-17 (GE)	<ul style="list-style-type: none"> <li>• 2.1 (FC: 62.5 microns) and 2.62 (FC: 50.0 microns [OM2])</li> <li>• 2.38 (GE: 62.5 microns) and 3.37 (GE: 50.0 microns [OM2])</li> </ul>
DS-SFP-FCGE-LW	-3	-11.0	-3	-19 (GE)	<ul style="list-style-type: none"> <li>• 7.8 (FC)</li> <li>• 4.57 (GE)</li> </ul>

**Note:** The 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.

**Table 24.** 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

## 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, 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

## Warranty

- Standard warranty: One year

## Ordering Information

Table 25 provides ordering information.

**Table 25.** 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
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 SFPs

To enable 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 (Figure 5) provides cost-effective connectivity for data center applications. The Cisco Copper Gigabit Ethernet SFP (part number DS-SFP-GE-T) allows a user to use standard Category-5 unshielded twisted pair (UTP) cabling for Ethernet connectivity.

**Figure 7.** Cisco Copper Gigabit Ethernet SFP



## Technical Specifications

### Connectors and Cabling

- Connectors: RJ-45 connector

Table 26 summarizes the cabling specifications.

**Table 26.** Cisco Copper Gigabit Ethernet SFP Cabling Specifications

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



## Dimensions

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

## Environmental Conditions and Power Requirements

Table 27 presents the temperature ranges.

**Table 27.** Operating and Storage Temperature Ranges

SFP	Operating		Storage	
	Max	Min	Max	Min
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

- Standard warranty: One year

## Ordering Information

Table 28 provides ordering information.

**Table 28.** 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 are designed to provide high-performance Fibre Channel connectivity for the 10-Gbps Fibre Channel ports on the Cisco 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 300 m; 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 6). There is also a 10-Gbps Fibre Channel X2 transceiver for transmission on copper cable (up to 15 m; part number DS-X2-FC10G-CX4) (Figure 7). Each product offers 10-Gbps Fibre Channel connectivity.

**Figure 8.** Cisco 10-Gbps Fibre Channel X2 Transceiver (Part Numbers DS-X2-FC10G-SR, DS-X2-FC10G-LR, and DS-X2-FC10G-ER)



**Figure 9.** Cisco 10-Gbps Fibre Channel CX4 X2 Transceiver (Part Number DS-X2-FC10G-CX4)



## Technical Specifications

### Connectors and Cabling

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

Table 29 summarizes the cabling specifications.

**Table 29.** 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	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 mi)
DS-X2-FC10G-ER	1550	SMF	9.0	10.51875	40 km (24.8 mi)
DS-X2-FC10G-CX4	-	Copper	-	10.51875	15 m (49.2 ft)

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

### Dimensions

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

### Environmental Conditions and Power Requirements

Table 30 presents the optical parameters, and Table 31 presents the temperature ranges.

**Table 30.** 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 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 31.** 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

### 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 32 provides ordering information.

**Table 32.** 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 10-Gbps Ethernet X2 Transceivers

The Cisco Ethernet X2 Transceiver Short Reach (up to 300 m; part number DS-X2-E10G-SR) enables high-performance Fibre Channel connectivity for the Cisco MDS 9000 family 10-Gbps Fibre Channel switching module to an existing Ethernet Dense Wavelength-Division Multiplexing (DWDM) transponder (Figure 8). The data format transmitted by the Ethernet X2 transceiver (DS-X2-E10G-SR) onto the fiber is identical to that transmitted by the Fibre Channel 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 Cisco MDS 9000 family 10-Gbps Fibre Channel switching module will automatically detect DS-X2-E10G-SR; no software configuration is required.

**Figure 10.** Cisco 10-Gbps Ethernet X2 Transceiver



## Technical Specifications

### Connectors and Cabling

- Connectors: Dual SC connector

Table 33 summarizes the cabling specifications.

**Table 33.** 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	10.3125	33 m (108 ft)
			50.0 (OM3)	10.3125	300 m (984 ft)

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

### Dimensions

- Dimensions (H x W x D): 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
	Max	Min	Max	Min	
DS-X2-E10G-SR	-1.2	-7.3	-1.0	-9.9	2.6 (50.0 microns [OM3])

**Table 35.** Operating and Storage Temperature Ranges

X2	Operating		Storage	
	Max	Min	Max	Min
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 36 provides ordering information.

**Table 36.** 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 Cisco MDS 9000 family offers cost-effective multiprotocol extended distance connectivity that optimizes the use of a customer's existing optical infrastructure through the Cisco Coarse Wavelength-Division Multiplexing (CWDM) SFP solution (Figure 11). 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 of up to two Cisco CWDM OADMs. The Cisco CWDM OADMs are passive and require no power or configuration.

**Figure 11.** Cisco CWDM Extended Distance SFP Solution

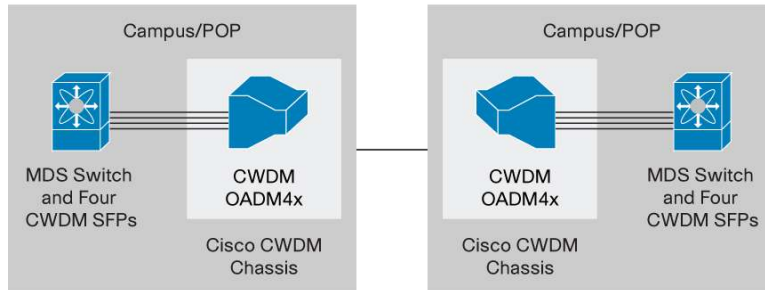


The Cisco CWDM SFP solution enables the transport of up to eight channels over one pair of single-mode fiber strands, enabling enterprises to increase the bandwidth of an existing optical infrastructure without adding new fiber strands. The solution can be used in parallel with other Cisco SFP devices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

Figure 12 shows a common point-to-point deployment scenario for the Cisco MDS 9000 family using the Cisco CWDM SFP solution. Two endpoints are directly connected through a fiber link. The Cisco 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 12.** Point-to-Point Architecture (Dual-Fiber Link)

Point-to-Point 4 Lambda Link



## Cisco 1/2-Gbps CWDM SFPs

### 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 x 13.75 x 55.2 mm

#### Environmental Conditions and Power Requirements

Table 37 presents the optical parameters, and Table 38 presents the temperature ranges.

**Table 37.** Optical Parameters for Cisco 1/2-Gbps CWDM SFPs

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 <sup>-12</sup> 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 <sup>-12</sup> 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 38.** Operating and Storage Temperature Ranges

Operating		Storage	
Max	Min	Max	Min
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 39 provides ordering information.

**Table 39.** Cisco 1/2-Gbps CWDM SFP Ordering Information

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

**Cisco 4-Gbps CWDM SFPs****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 x 13.27 x 56.64 mm

## Environmental Conditions and Power Requirements

Table 40 presents the optical parameters, and Table 41 presents the temperature ranges.

**Table 40.** Optical Parameters for Cisco 4-Gbps CWDM SFPs

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 <sup>-12</sup> 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 40 km (24.8 mi).
- 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 Cisco 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 41.** Operating and Storage Temperature Ranges

Operating		Storage	
Max	Min	Max	Min
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 42 provides ordering information.

**Table 42.** 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
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 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 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.

The Cisco 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 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 43 and 44 provide comparisons of the OADM types.

**Table 43.** 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 44.** 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 Cisco 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 Cisco CWDM chassis. The Cisco CWDM chassis is one-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

- Standard warranty: One year

## Ordering Information

Table 45 provides ordering information.

**Table 45.** Cisco Dual Fiber 4-Channel OADM, Dual Fiber 8-Channel Multiplexer/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 ONS 100-GHz product family
- Fixed-wavelength SFP, with 32 SFP models

**Note:** Up to eight 2-Gbps DWDM SFPs are supported in a single Cisco MDS 9000 family switching module.

Refer to [http://www.cisco.com/en/US/prod/collateral/modules/ps5455/ps6576/product\\_data\\_sheet\\_0900aecd80582763.html](http://www.cisco.com/en/US/prod/collateral/modules/ps5455/ps6576/product_data_sheet_0900aecd80582763.html) for details.

## Ordering Information

Table 46 provides ordering information.

**Table 46.** 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
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 4G DWDM optics in the Cisco MDS 9000 platform dramatically reduces capital and operational expenses for an FC over DWDM network, avoiding the need of 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

Based upon customer usage, Cisco has identified and selected particular high-usage 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 39. Table 40 identifies the rest of the 4-Gbps DWDM SFP modules.

**Table 47.** Cisco 4-Gbps DWDM SFP Transceiver Ordering Information - Commonly Used Wavelengths

PID	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
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 48.** Cisco 4-Gbps DWDM SFP Transceiver Ordering Information - Other Wavelengths

PID	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

PID	Description
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 SAN Switches, visit

[http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/brochure\\_c02-452560.html](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 Cisco MDS 9000 family 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 Cisco 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

A detailed data sheet is 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](http://www.cisco.com/en/US/products/hw/modules/ps5455/products_data_sheets_list.html).

## Ordering Information

Table 49 provides ordering information.

**Table 49.** 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

Part Number	Description	ITU Channel
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
DWDM-X2-50.92=	10GBASE-DWDM 1550.92 nm X2 (100-GHz ITU grid)	33
DWDM-X2-50.12=	10GBASE-DWDM 1550.12 nm X2 (100-GHz ITU grid)	34
DWDM-X2-48.51=	10GBASE-DWDM 1548.51 nm X2 (100-GHz ITU grid)	36
DWDM-X2-47.72=	10GBASE-DWDM 1547.72 nm X2 (100-GHz ITU grid)	37
DWDM-X2-46.92=	10GBASE-DWDM 1546.92 nm X2 (100-GHz ITU grid)	38
DWDM-X2-46.12=	10GBASE-DWDM 1546.12 nm X2 (100-GHz ITU grid)	39
DWDM-X2-44.53=	10GBASE-DWDM 1544.53 nm X2 (100-GHz ITU grid)	41
DWDM-X2-43.73=	10GBASE-DWDM 1543.73 nm X2 (100-GHz ITU grid)	42
DWDM-X2-42.94=	10GBASE-DWDM 1542.94 nm X2 (100-GHz ITU grid)	43
DWDM-X2-42.14=	10GBASE-DWDM 1542.14 nm X2 (100-GHz ITU grid)	44
DWDM-X2-40.56=	10GBASE-DWDM 1540.56 nm X2 (100-GHz ITU grid)	46
DWDM-X2-39.77=	10GBASE-DWDM 1539.77 nm X2 (100-GHz ITU grid)	47
DWDM-X2-38.98=	10GBASE-DWDM 1538.98 nm X2 (100-GHz ITU grid)	48
DWDM-X2-38.19=	10GBASE-DWDM 1538.19 nm X2 (100-GHz ITU grid)	49
DWDM-X2-36.61=	10GBASE-DWDM 1536.61 nm X2 (100-GHz ITU grid)	51
DWDM-X2-35.82=	10GBASE-DWDM 1535.82 nm X2 (100-GHz ITU grid)	52
DWDM-X2-35.04=	10GBASE-DWDM 1535.04 nm X2 (100-GHz ITU grid)	53
DWDM-X2-34.25=	10GBASE-DWDM 1534.25 nm X2 (100-GHz ITU grid)	54
DWDM-X2-32.68=	10GBASE-DWDM 1532.68 nm X2 (100-GHz ITU grid)	56
DWDM-X2-31.90=	10GBASE-DWDM 1531.90 nm X2 (100-GHz ITU grid)	57
DWDM-X2-31.12=	10GBASE-DWDM 1531.12 nm X2 (100-GHz ITU grid)	58
DWDM-X2-30.33=	10GBASE-DWDM 1530.33 nm X2 (100-GHz ITU grid)	59

## For More Information

For more information about the Cisco MDS 9000 Series Multilayer SAN Switches, visit

<http://www.en/US/products/hw/ps4159/ps4358/index.html>.



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