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CISCO
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Cisco MDS 9000 Series Pluggable Transceivers

Contents

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 Series 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 Cisco MDS 9000 Series products as shown in Table 1.

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

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-SFP-FC32G-XX	DS-SFP-FC64G-XX
DS-X9232-256K9		Yes[2,10]	Yes[2]	Yes[2]						
DS-X9248-256K9		Yes[2,10]	Yes[2]	Yes[2]						
DS-X9304-18K9		Yes[2]			Yes[1]	Yes[D]				
DS-X9316-SSNK9					Yes[F]	Yes[F,15]				
DS-X9704							Yes[2]			
DS-C9220I-K9*			Yes[2,19]					Yes[2,19]	Yes[2]	
DS-C9222i-K9		Yes[2]			Yes[1]	Yes[D]				
DS-C9124-K9		Yes[2]								
DS-C9148-K9		Yes[2,7]	Yes[2,11]							
DS-X9448-768K9			Yes[2,14]	Yes[2]				Yes[2]		
DS-C9250I-K9			Yes[2,14]		Yes[17]	Yes[17]		Yes[2]		
DS-C9396S-K9			Yes[2,14]	Yes[2]				Yes[2]		
DS-C9148S-K9			Yes[2,14]					Yes[2]		
DS-X9334-K9			Yes[2,14]	Yes	Yes	Yes		Yes[2]		
DS-X9648-1536K9			Yes[2,19]					Yes[2]	Yes[2]	
DS-X9748-3072K9								Yes[2]	Yes[2]	Yes[2]
DS-C9132T-K9			Yes[2,19]					Yes[2,19]	Yes[2]	
DS-C9148T-K9			Yes[2,19]					Yes[2,19]	Yes[2]	
DS-C9396T-K9			Yes[2,19]					Yes[2,19]	Yes[2]	
DS-C9124V-K9								Yes[2]	Yes[2]	Yes[2]
DS-C9148V-K9								Yes[2]	Yes[2]	Yes[2]

Table 2. Cisco SFP, SFP+, QSFP and X2 Transceivers Available for Use with the Cisco MDS 9000 Series

Switching Module and Fabric Switch	DS-X2-FC10G-CX4=C	DS-X2-E10G-SR=A	DS-CWDM-xxxx=	DS-CWDM4 Gxxxx=A	DS-CWDM8 Gxxxx=	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-CSR4[20], QSFP-40G-LR4[20], QSFP-40G-LR4-S[20], QSFP-40/100G-SRBD[20], QSFP-40G-SR4[20], QSFP-40G-SR-BD[20]
DS-X9232-256K9				Yes[2,13]			Yes[2]	Yes[8,12]				
DS-X9248-256K9				Yes[2,13]			Yes[2]	Yes[8,12]				
DS-X9304-18K9			Yes[6]	Yes[2,13]		Yes[2,6]	Yes[2]					
DS-X9316-SSNK9			Yes[F]			Yes[F]						
DS-X9704	Yes[2]	Yes[2]								Yes[2]		
DS-X9708-K9								Yes[8,12]	Yes[9]			
DS-C9220I-K9*	Yes[14,18]	Yes[14,18]										Yes[21]
DS-C9222i-K9*			Yes[6]	Yes[2,13]		Yes[2,6]	Yes[2]					
DS-C9124-K9			Yes[3]	Yes[2,4]			Yes[2]					
DS-C9148-K9				Yes[2,13]	Yes[2,13,H]		Yes[2]					
DS-X9448-768K9					Yes[2,13,H]			Yes[8]				
DS-C9250I-K9					Yes[2,13,H,14]			Yes[8]	Yes[9]		Yes[2,16]	
DS-X9848-480K9								Yes[8,12]	Yes[9]		Yes[2]	
DS-C9396S-K9					Yes[2,13,14]			Yes[8]				
DS-C9148S-K9					Yes[2,13,14]							
DS-X9824-					Yes[2, 13,14]							Yes

Switching Module and Fabric Switch	DS-X2-FC10G-CX4=C	DS-X2-E10G-SR=A	DS-CWDM-xxxx=	DS-CWDM4 Gxxxx=A	DS-CWDM8 Gxxxx=	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-CSR4[20], QSFP-40G-LR4[20], QSFP-40G-LR4-S[20], QSFP-40/100G-SRBD[20], QSFP-40G-SR4[20], QSFP-40G-SR-BD[20]
960K9												
DS-X9334-K9					Yes[2,13,14]			Yes	Yes		Yes	Yes[21]
DS-X9648-1536K9					Yes[2,13,14]							
DS-C9132T-K9					Yes[2,13,14]							
DS-C9148T-K9					Yes[2,13,14]							
DS-C9396T-K9					Yes[2,13,14]							

Switching Module and Fabric Switch	DS-8G-ZR-XXXX	DS-16G-ER-XXXX
DS-X9448-768K9	Yes[14,18]	Yes[14,18]
DS-C9250I-K9	Yes[14,18]	Yes[14,18]
DS-C9396S-K9	Yes[14,18]	Yes[14,18]
DS-C9148S-K9	Yes[14,18]	Yes[14,18]
DS-X9334-K9	Yes[14,18]	Yes[14,18]
DS-X9648-1536K9	Yes[14,18]	Yes[14,18]
DS-C9132T-K9	Yes[14,18]	Yes[14,18]
DS-C9148T-K9	Yes[14,18]	Yes[14,18]
DS-C9396T-K9	Yes[14,18]	Yes[14,18]

[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.

[H] Supported on switches running Cisco 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] Refer to Configuration Limits for Optics Modules.

[15] Ethernet autonegotiation is not supported.

[16] Supported only for Fibre Channel over Ethernet (FCoE) ports prior to Cisco MDS 9000 NX-OS Release 6.2(15).

[17] Supported on NX-OS Release 6.2(13) and later.

[18] Refer to Third Party Modules for ordering, support and technical information.

[19] 2G speeds not supported on 32G module. Only 4G speeds and 8G speeds supported when 8G SFPs are used. Only SW and LW supported on 32G module. Supported in NX-OS 8.x version and higher.

[20] Refer to Cisco 40GBASE QSFP Datasheet for detailed specifications.

[21] Supported on NX-OS Release 8.5(1) and later.

[*] DS-C9220i-K9 supports the following Ethernet optics.

Table 3.   Cisco Ethernet Transceivers

Speed	Optics PID	Fiber
1G	GLC-SX-MMD	MMF LC
	GLC-LH-SMD	SMF LC
10G	SFP-10G-SR	MMF LC
	SFP-10G-LR/ SFP-10G-LR-S	SMF LC
40G	QSFP-40G-CSR4	MPO12
	QSFP-40G-SR-BD	MMF LC
	QSFP-40G-LR4	SMF LC
	QSFP-40G-LR4-S	SMF LC
	QSFP-40/100G-SRBD	MMF LC
	QSFP-40G-SR4	MPO12

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 Cisco MDS 9000 Series 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 4 summarizes the cabling specifications.

Table 4.   Cisco 2-Gbps Fibre Channel SFP Cabling Specifications

SFP	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC-2G-SW	850	MMF	62.5 (OM1)	1.0625	984 ft (300m)
			62.5 (OM1)	2.125	492 ft (150m)
			50.0 (OM2)	1.0625	1640 ft (500m)
			50.0 (OM2)	2.125	984 ft (300m)
DS-SFP-FC-2G-LW	1310	SMF	9.0	1.0625 / 2.125	6.2 mi (10 km)

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

Note: SMF must be ISO/IEC OS2 compliant.

Dimensions

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

Environmental conditions and Power requirements

Table 5 presents the optical parameters, and Table 6 presents temperature ranges.

Table 5.   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 (OM1) 2.62 (OM2)
DS-SFP-FC-2G-LW	–3	–11.7	–3	–	7.8

Table 6.   Operating and storage temperature ranges

SFP	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC-2G-SW	70° C	0° C	85° C	-40° C
DS-SFP-FC-2G-LW	70° 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 with 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 7 provides ordering information.

Table 7.   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 Cisco MDS 9000 Series 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 8 summarizes the cabling specifications.

Table 8.   Cisco 4-Gbps Fibre Channel SFP Cabling Specifications

SFP	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC4G-SW	850	MMF	62.5 (OM1)	1.0625	984 ft (300m)
			62.5 (OM1)	2.125	492 ft (150m)
			62.5 (OM1)	4.250	230 ft (70m)
			50.0 (OM2)	1.0625	1640 ft (500m)
			50.0 (OM2)	2.125	984 ft (300m)
			50.0 (OM2)	4.250	492 ft (150m)
			50.0 (OM3)	1.0625	2821 ft (860m)
			50.0 (OM3)	2.125	1640 ft (500m)
			50.0 (OM3)	4.250	1246 ft (380m)

SFP	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS–SFP–FC4G–MR	1310	SMF	9.0	1.0625 / 2.125 / 4.250	2.4 mi (4 km)
DS–SFP–FC4G–LW	1310	SMF	9.0	1.0625 / 2.125 / 4.250	6.2 mi (10 km)

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

Note: SMF must be ISO/IEC OS2 compliant.

Dimensions

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

Environmental conditions and Power requirements

Table 9 presents the optical parameters, and Table 10 presents temperature ranges.

Table 9. 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 (OM1) 2.06 (OM2) 2.88 (OM3)
DS–SFP–FC4G–MR	–3	–11.2	–1	–	4.8
DS–SFP–FC4G–LW	–3	–8.4	–1	–	7.8

Table 10. Operating and storage temperature ranges

SFP	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
DS–SFP–FC4G–SW	70°C	0°C	85°C	–40°C
DS–SFP–FC4G–MR	70°C	0°C	85°C	–40°C
DS–SFP–FC4G–LW	70°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 with 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 11 provides ordering information.

Table 11. 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 Cisco MDS 9000 Series 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 12 summarizes the cabling specifications.

Table 12.   Cisco 8-Gbps Fibre Channel SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC8G-SW	850	MMF	62.5 (OM1)	2.125	492 ft (150m)
			62.5 (OM1)	4.250	230 ft (70m)
			62.5 (OM1)	8.500	69 ft (21m)
			50.0 (OM2)	2.125	984 ft (300m)
			50.0 (OM2)	4.250	492 ft (150m)
			50.0 (OM2)	8.500	164 ft (50m)
			50.0 (OM3)	2.125	1640 ft (500m)
			50.0 (OM3)	4.250	1246 ft (380m)
			50.0 (OM3)	8.500	492 ft (150m)
			50.0 (OM4)	2.125	1706 ft (520m)
			50.0 (OM4)	4.250	1312 ft (400m)
			50.0 (OM4)	8.500	623 ft (190m)
			50.0 (OM5)	8.500	623 ft (190m)

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC8G-LW	1310	SMF	9.0	2.125 / 4.250 / 8.500	6.2 mi (10 km)
DS-SFP-FC8G-ER	1550	SMF	9.0	2.125 / 4.250 / 8.500	24.85 mi (40 km)

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

Note: SMF must be ISO/IEC OS2 compliant.

Dimensions

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

Environmental Conditions and Power Requirements

Table 13 presents the optical parameters, and Table 14 presents temperature ranges.

Table 13. Optical parameters

SFP	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)		
	Maximum	**Minimum**	**Maximum**	**Minimum**	**OM1**	**OM2**	**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 14. Operating and storage temperature ranges

SFP	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC8G-SW	70°C	0°C	85°C	–40°C
DS-SFP-FC8G-LW	70°C	0°C	85°C	–40°C
DS-SFP-FC8G-ER	70°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 15 provides ordering information.

Table 15. 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 Cisco MDS 9000 Series 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 16 summarizes the cabling specifications.

Table 16.   Cisco 10-Gbps Fibre Channel SFP+ Cabling Specifications

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

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

Note: SMF must be ISO/IEC OS2 compliant.

Dimensions

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

Environmental Conditions and Power Requirements

Table 17 presents the optical parameters, and Table 18 presents the temperature ranges.

Table 17. 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 (OM3)
DS-SFP-FC10G-LW	0.5	–8.2	0.5	–14.4	6.2

Table 18. Operating and storage temperature ranges

SFP	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC10G-SW	70° C	0° C	85° C	–40° C
DS-SFP-FC10G-LW	70° C	0° C	85° C	–40° C

Regulatory and Standards Compliance

Laser Class I 21CFR1040

Ordering Information

Table 19 provides ordering information.

Table 19. 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 Cisco MDS 9250i Multiservice Fabric Switch.

Figure 5.
Cisco 10GBASE SFP+ Modules

Technical specifications

Connectors and Cabling

The connectors are dual LC/PC connectors.

Table 20 summarizes the cabling specifications.

Table 20.   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	50.0	500 (OM2)	82m
			50.0	2000 (OM3)	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.

Note: SMF must be ISO/IEC OS2 compliant

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 21 presents the optical parameters, and Table 22 presents maximum power consumption.

Table 21.   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 22. SFP+ Modules Maximum Power Consumption

Product	Power Consumption (watts)
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 jackets of SFP+ copper modules are 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 23 provides ordering information.

Table 23.   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 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 Cisco 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 24 summarizes the cabling specifications.

Table 24. Cisco 40GBASE Ethernet QSFP Cabling Specifications

SFP+	Wavelength (nanometers)	Cable Type	Core Size (microns)	Modal Bandwidth (MHz per km)	Cable Distance[*]
QSFP-40G-SR4	850	MMF	50.0	500 (OM2)	30m
			50.0	2000 (OM3)	100m
			50.0	4700 (OM4)	150m[*]
			50.0	4700 (OM5)	150m[*]
QSFP-40G-CSR4	832	MMF	50.0	500 (OM2)	30m
			50.0	2000 (OM3)	100m
			50.0	4700 (OM4)	150m[*]
			50.0	4700 (OM5)	150m[*]
QSFP-40G-SR-BD	832-918	MMF	50.0	500 (OM2)	82m
			50.0	2000 (OM3)	100m
			50.0	4700 (OM4)	150m
			50.0	4700 (OM5)	150m

[*] 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 25 presents the optical parameters, and Table 26 presents the maximum power consumption.

Table 25. 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
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 26. SFP+ Modules maximum power consumption

Product	Power Consumption (watts)
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 jackets of QSFP copper modules are 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 27 provides ordering information.

Table 27. 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 speeds, enabling the use of one type of SFP module for all ports on the Cisco MDS 9000 Series platform.

Two types of 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 Gigabit Ethernet connectivity.

Figure 7.
Cisco Tri-Rate Multiprotocol SFP Modules

Technical specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 28 summarizes the cabling specifications.

Table 28.   Cisco Tri-Rate Multiprotocol SFP Cabling Specifications

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

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

Note: SMF must be ISO/IEC OS2 compliant

Dimensions

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

Environmental Conditions and Power Requirements

Table 29 presents the optical parameters, and Table 30 presents temperature ranges.

Table 29.   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 30. Operating and storage temperature ranges

SFP	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
DS-SFP-FCGE-SW	70°C	0°C	85°C	–40°C
DS-SFP-FCGE-LW	70°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 with 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 31 provides ordering information.

Table 31. 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 SFP Modules

For even more cabling flexibility, the Cisco MDS 9000 Series offers Cisco Copper Gigabit Ethernet SFP modules. Based on the 1000BASE-T standard, Copper Gigabit Ethernet SFP modules (Figure 8) provide cost-effective connectivity for data center applications. 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 32 summarizes the cabling specifications.

Table 32.   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 33 presents the temperature ranges.

Table 33.   Operating and storage temperature ranges

SFP	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
DS-SFP-GE-T	70° 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 34 provides ordering information.

Table 34. 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 Cisco MDS 9000 Series 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 35 summarizes the cabling specifications.

Table 35. X2 Port Cabling Specifications

X2	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-X2-FC10G-SR	850	MMF	62.5 (OM1)	10.51875	108 ft (33m)
			50.0 (OM3)	10.51875	984 ft (300m)
DS-X2-FC10G-LR	1310	SMF	9.0	10.51875	6.2 mi (10 km)
DS-X2-FC10G-ER	1550	SMF	9.0	10.51875	24.8 mi (40 km)
DS-X2-FC10G-CX4	-	Copper	-	10.51875	49.2 ft (15m)

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

Note: SMF must be ISO/IEC OS2 compliant

Dimensions

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

Environmental Conditions and Power Requirements

Table 36 presents the optical parameters, and Table 37 presents the temperature ranges.

Table 36. 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 (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 37. Operating and storage temperature ranges

X2	Operating		Storage	
	Maximum	**Minimum**	**Maximum**	**Minimum**
DS-X2-FC10G-SR	70°C	0°C	85°C	-40°C
DS-X2-FC10G-LR	70°C	0°C	85°C	-40°C
DS-X2-FC10G-ER	70°C	0°C	85°C	-40°C
DS-X2-FC10G-CX4	70°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 38 provides ordering information.

Table 38. 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 Cisco MDS 9000 Series 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 39 summarizes the cabling specifications.

Table 39. Cisco 16-Gbps Fibre Channel SFP+ Cabling specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC16G-SW	850	MMF	62.5 (OM1)	14.025	49 ft (15m)
			50.0 (OM2)	14.025	115 ft (35m)
			50.0 (OM3)	14.025	328 ft (100m)
			50.0 (OM4/OM5)	14.025	410 ft (125m)
			62.5 (OM1)	8.5	69 ft (21m)
			50.0 (OM2)	8.5	164 ft (50m)
			50.0 (OM3)	8.5	492 ft (150m)
			50.0 (OM4/OM5)	8.5	623 ft (190m)
			62.5 (OM1)	4.25	230 ft (70m)
			50.0 (OM2)	4.25	492 ft (150m)
			50.0 (OM3)	4.25	1247 ft (380m)
			50.0 (OM4/OM5)	4.25	1312 ft (400m)
DS-SFP-FC16G-LW	1310	SMF	9.0	14.025 / 8.5 / 4.25	6.2 mi (10 km)

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC16GELW	1310	SMF	9.0	14.025 / 8.5 / 4.25	15.5 mi (25 km)

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

Note: SMF must be ISO/IEC OS2 compliant

Dimensions

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

Environmental conditions and Power requirements

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

Table 40. Optical parameters

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)			
	Maximum	Minimum	Maximum	Minimum	OM1	OM2	OM3	OM4/OM5
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)	2.04 (8 Gbps) 1.95 (16 Gbps) 1.86 (32 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 41. Operating and storage temperature ranges

SFP+	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC16G-SW	70° C	0° C	85° C	−40° C
DS-SFP-FC16G-LW	70° C	0° C	85° C	−40° C
DS-SFP-FC16GELW	70° 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 42 provides ordering information.

Table 42.   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 32-Gbps Fibre Channel SFP+ Transceivers

The Cisco 32-Gbps Fibre Channel SFP+ Transceivers (Figure 12) provide Fibre Channel connectivity for 8/16/32-Gbps ports on the Cisco MDS 9000 Series platform. Two types are available: the Cisco Fibre Channel Shortwave SFP+ (part number DS-SFP-FC32G-SW) and the Cisco Fibre Channel Longwave SFP+ (part number DS-SFP-FC32G-LW). Each offers 8/16/32-Gbps autosensing Fibre Channel connectivity.

Figure 12.
Cisco 32-Gbps Fibre Channel SFP+ Transceivers

Technical specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 43 summarizes the cabling specifications.

Table 43. Cisco 32-Gbps Fibre Channel SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC32G-SW	850	MMF	50.0 (OM2)	28.05	65 ft (20m)
			50.0 (OM3)	28.05	230 ft (70m)
			50.0 (OM4/OM5)	28.05	328 ft (100m)
			50.0 (OM2)	14.025	115 ft (35m)
			50.0 (OM3)	14.025	328 ft (100m)
			50.0 (OM4/OM5)	14.025	410 ft (125m)
			50.0 (OM2)	8.5	164 ft (50m)
			50.0 (OM3)	8.5	492 ft (150m)
			50.0 (OM4/OM5)	8.5	623 ft (190m)
DS-SFP-FC32G-LW	1310	SMF	9.0	28.05 / 14.025 / 8.5	6.2 mi (10 km)
DS-SFP-FC32G-ELW	1310	SMF	G.652	28.05 / 14.025 / 8.5	15.5mi (25 km)

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

Note: SMF must be ISO/IEC OS2 compliant

Dimensions

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

Environmental conditions and Power requirements

Table 44 presents the optical parameters, and Table 45 presents temperature ranges.

Table 44. Optical parameters

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)			
	Maximum	Minimum	Maximum	Minimum	OM2	OM3	OM4	OM5
DS-SFP-FC32G-SW	2.0	−6.2	2.0	−8.2	1.68 (8 Gbps)	2.04 (8 Gbps)	2.04 (8 Gbps)	2.04 (8 Gbps)
					1.63 (16 Gbps)	1.86 (16 Gbps)	1.95 (16 Gbps)	1.95 (16 Gbps)
					2.02 (32 Gbps)	1.86 (32 Gbps)	1.86 (32 Gbps)	1.86 (32 Gbps)

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)
DS-SFP-FC32G-LW	2.0	−5.0	2.0	−11.4	6.4 (8 Gbps) 6.4 (16 Gbps) 6.4 (32 Gbps)
DS-SFP-FC32G-ELW	7	30	−15.8	4.5	20

Table 45. Operating and storage temperature ranges

SFP+	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC32G-SW	70°C	0°C	85°C	−40°C
DS-SFP-FC32G-LW	70°C	0°C	85°C	−40°C
DS-SFP-FC32G-ELW	70°C	0°C	85°C	−40°C

Regulatory and Standards compliance

- Compliant with Fibre Channel (FC-PI-6) 3200-SM-LC-L (OS2), 3200-M5-SN-S (OM2), 3200-M5E-SN-I (OM3), 3200-M5F-SN-I (OM4) 28.05-GBd specifications.
- Compliant with Fibre Channel (FC-PI-5) 1600-SM-LC-L (OS2), 1600-M6-SN-S (OM1), 1600-M5-SN-S (OM2), 1600-M5E-SN-I (OM3), 1600-M5F-SN-I (OM4) 14.025-GBd specifications.
- Compliant with Fibre Channel (FC-PI-4) 800-SM-LC-L (OS2), 800-M6-SN-S (OM1), 800-M5-SN-S (OM2), 800-M5E-SN-I (OM3), 800-M5F-SN-I (OM4) 8.5-GBd specifications.
- Laser Class I 21CFR1040.

Ordering information

Table 46 provides ordering information.

Table 46. Cisco Fibre Channel SFP+ ordering information

Part Number	Description
DS-SFP-FC32G-SW	32 Gbps Fibre Channel SW SFP+, LC
DS-SFP-FC32G-SW=	32 Gbps Fibre Channel SW SFP+, LC, spare
DS-SFP-FC32G-LW	32 Gbps Fibre Channel LW SFP+, LC
DS-SFP-FC32G-LW=	32 Gbps Fibre Channel LW SFP+, LC, spare
DS-SFP-FC32G-ELW	32 Gbps Fibre Channel ELW SFP+, LC
DS-SFP-FC32G-ELW=	32 Gbps Fibre Channel ELW SFP+, LC, spare

Cisco 64-Gbps Fibre Channel SFP+ Transceivers

The Cisco 64-Gbps Fibre Channel SFP+ Transceivers (Figure 13) provide Fibre Channel connectivity for 16/32/64-Gbps ports on the Cisco MDS 9000 Series platform. The following types are available:

- Cisco Fibre Channel Shortwave SFP+ (part number DS-SFP-FC64G-SW.

Offers 16/32/64-Gbps autosensing Fibre Channel connectivity.

Figure 13.
Cisco 64-Gbps Fibre Channel SFP+ Transceivers

Technical specifications

Connectors and Cabling

The connectors are dual LC connectors.

Table 47 summarizes the cabling specifications.

Table 47.   Cisco 64-Gbps Fibre Channel SFP+ Cabling Specifications

SFP+	Wavelength (nanometers)	Fiber Type	Core Size (microns)	Speed (Gbps)	Cable Distance
DS-SFP-FC64G-SW	850	MMF	50.0 (OM3)	57.8	230 ft (70m)
			50.0 (OM4/OM5)	57.8	328 ft (100m)
			50.0 (OM2)	28.05	66 ft (20m)
			50.0 (OM3)	28.05	230 ft (70m)
			50.0 (OM4/OM5)	28.05	328 ft (100m)
			50.0 (OM2)	14.025	115 ft (35m)
			50.0 (OM3)	14.025	328 ft (100m)
			50.0 (OM4/OM5)	14.025	410 ft (125m)

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

Note: SMF must be ISO/IEC OS2 compliant.

Dimensions

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

Environmental conditions and Power requirements

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

Table 48.   Optical parameters

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber Loss Budget (dB)			
	Maximum	Minimum	Maximum	Minimum	OM2	OM3	OM4	OM5
DS-SFP-FC64G-SW	4	–7.5	4	–7	1.63 (16 Gbps) 1.57 (32 Gbps) NA (64 Gbps)	1.86 (16 Gbps) 1.75 (32 Gbps) 1.75 (64 Gbps)	1.95 (16 Gbps) 1.86 (32 Gbps) 1.86 (64 Gbps)	1.95 (16 Gbps) 1.86 (32 Gbps) 1.86 (64 Gbps)

Table 49.   Operating and storage temperature ranges

SFP+	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-SFP-FC64G-SW	70° C	0° C	85° C	–40° C

Regulatory and Standards compliance

- Compliant with Fibre Channel (FC-PI-7) 64GFC-SW (OM3, OM4 and OM5) 57.8 Gbps specification.
- Compliant with Fibre Channel (FC-PI-6) 3200-SM-LC-L (OS2), 3200-M5-SN-S (OM2), 3200-M5E-SN-I (OM3), 3200-M5F-SN-I (OM4) 28.05-GBd specifications.
- Compliant with Fibre Channel (FC-PI-5) 1600-M6-SN-S (OM1), 1600-M5-SN-S (OM2), 1600-M5E-SN-I (OM3), 1600-M5F-SN-I (OM4) 14.025-GBd specifications.
- Laser Class I 21CFR1040.

Ordering information

Table 50 provides ordering information.

Table 50.   Cisco Fibre Channel SFP+ ordering information

Part Number	Description
DS-SFP-FC64G-SW=	64G FC Shortwave Optics

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 Cisco MDS 9000 Series 10-Gbps Fibre Channel switching module to an existing Ethernet Dense Wavelength-Division Multiplexing (DWDM) transponder (Figure 13). 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 Cisco MDS 9000 Series 10-Gbps Fibre Channel switching module automatically detects DS-X2-E10G-SR; no software configuration is required.

Figure 14.
Cisco 10-Gbps Ethernet X2 Transceiver

Technical specifications

Connectors and Cabling

The connectors are dual SC connectors.

Table 51 summarizes the cabling specifications.

Table 51.   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	108 ft (33m)
			50.0 (OM3)	10.3125	984 ft (300m)

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 52 presents the optical parameters, and Table 53 presents temperature ranges.

Table 52. 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 53. Operating and storage temperature ranges

X2	Operating		Storage	
	Maximum	Minimum	Maximum	Minimum
DS-X2-E10G-SR	70°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 54 provides ordering information.

Table 54. 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 Series offers cost-effective multiprotocol extended distance connectivity to optimize to existing optical infrastructure through the Cisco CWDM SFP solution (Figure 15). 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 15.
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 16 shows a common point-to-point deployment scenario for the Cisco MDS 9000 Series 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.
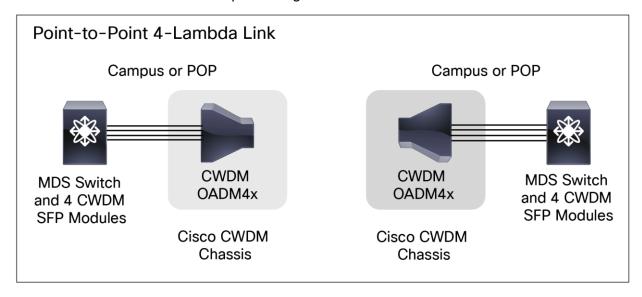

Figure 16.
Point-to-Point Architecture (Dual-Fiber Link)

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 55 presents the optical parameters, and Table 56 presents the temperature ranges.

Table 55. 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 56. Operating and storage temperature ranges

Operating		Storage	
Maximum	**Minimum**	**Maximum**	**Minimum**
70° 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 57 provides ordering information.

Table 57. 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 58 presents the optical parameters, and Table 59 presents the temperature ranges.

Table 58. 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 Cisco MDS 9000 Series 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 59.   Operating and storage temperature ranges

Operating		Storage	
Maximum	**Minimum**	**Maximum**	**Minimum**
70° 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 60 provides ordering information.

Table 60.   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 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 61 presents the optical parameters, and Table 62 presents the temperature ranges.

Table 61. 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	-	–1	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 –1 dBm.

- The Cisco Enhanced Wavelength Division Multiplexing product line is also supported for CWDM optics: https://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. Refer to the Table 66 for maximum ports supported with 8G CWDM transceivers on all Cisco MDS switches.

- 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 62.   Operating and storage temperature ranges

Operating		Storage	
Maximum	**Minimum**	**Maximum**	**Minimum**
70° 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 63 provides ordering information.

Table 63.   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 Cisco MDS 9000 Series 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 64 and 65 provide comparisons of the OADM types.

Table 64. 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 65. 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 to 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 66 provides ordering information.

Table 66.   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 products.
- Fixed-wavelength SFP, with 32 SFP models.

Note: Up to eight 2-Gbps DWDM SFP modules are supported in a single Cisco MDS 9000 Series switching module. Refer to https://www.cisco.com/en/US/prod/collateral/modules/ps5455/ps6576/product_data_sheet0900aecd805 82763.html for details.

Ordering information

Table 67 provides ordering information.

Table 67. 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

Part Number	Description
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 Cisco MDS 9000 Series 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 products.

- 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 68. Table 69 identifies the rest of the 4-Gbps DWDM SFP modules.

Table 68. 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
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

Part Number	Description
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 69.   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

Part Number	Description
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

Third Party Optical Modules

Cisco MDS products do not support third party optics with the exception of whats documented in this guide.

Smartoptics branded optics modules

Current generation of 32G and 16G Cisco MDS switches is now qualified to work with third party SFP modules from Smartoptics, a leading OEM of SFP modules. These long reach optics allow Cisco MDS customers a unique, seamless and self-configure option of connecting their existing and new Cisco MDS 16G switches over long distances transporting Fibre channel natively on dark fiber. Refer to Table 1-10 of the Cisco MDS and Nexus interoperability matrix for a current list of qualified variants. For information on order-ability, support and detailed technical specifications visit https://www.smartoptics.com/products/cisco-collection. Table 70 presents the configuration limits on these optical modules.

Table 70. Configuration Limits for optics modules

Switching Module and Fabric Switch	DS-SFP-FC8G-ER	DS-CWDM8Gxxxx	Smartoptics DS-8G-ZR-XXXX	Smartoptics DS-16G-ER-XXXX	Smartoptics DS-32G-IR-XXXX
DS-X9448-768K9	Max 32 out of 48 Ports	Max 32 out of 48 Ports	Max 32 out of 48 Ports	Max 32 out of 48 Ports	Not Applicable
DS-C9250I-K9	Odd ports only	Odd Ports only	Odd Ports only	Odd Ports only	Not Applicable
DS-C9396S-K9	Odd ports only	Odd Ports only	Odd Ports only	Odd Ports only	Not Applicable
DS-C9148S-K9	Ports 1 – 12	Ports 1 – 12	Ports 1 – 12	Ports 1 – 12	Not Applicable
DS-X9334-K9	Max 16 out of 24 Ports	Max 16 out of 24 Ports	Max 16 out of 24 Ports	Max 16 out of 24 Ports	Not Applicable

Switching Module and Fabric Switch	DS-SFP-FC8G-ER	DS-CWDM8Gxxxx	Smartoptics DS-8G-ZR-XXXX	Smartoptics DS-16G-ER-XXXX	Smartoptics DS-32G-IR-XXXX
DS-X9648-1536K9	Max 32 out of 48 Ports	Max 32 out of 48 Ports	Max 32 out of 48 Ports	Max 32 out of 48 Ports	Not Applicable
DS-C9132T-K9	Odd ports only	Odd Ports only	Odd Ports only	Odd Ports only	Not Applicable
DS-C9148T-K9	All Ports	All Ports	All Ports	All Ports	Not Applicable
DS-C9396T-K9	All Ports	All Ports	All Ports	All Ports	Not Applicable
DS-C9220I-K9	All Ports	All Ports	All Ports	All Ports	All Ports
DS-X9848-3072K9	All Ports	All Ports	All Ports	All Ports	All Ports
DS-C9124V-K9	All Ports	All Ports	All Ports	All Ports	All Ports
DS-C9148V-K9	All Ports	All Ports	All Ports	All Ports	All Ports

Cisco 10-Gbps Ethernet DWDM X2 Transceiver

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

Cisco 10GBASE DWDM SFP+ Modules

The Cisco 10GBASE Dense Wavelength-Division Multiplexing SFP+ Module offer the following features and benefits:

- Supports 10-Gigabit data rates from 9.9G to 11.1G (LAN, WAN, and OTU2/OTU2e) to accommodate different long distance Fibre channel applications.
- Smallest SFP+ module footprint in the industry.
- Hot-swappable input/output device plugs into an Ethernet SFP+ port of a Cisco switch or router to link the port with the network.
- Digital optical monitoring capability for enhanced diagnostics and troubleshooting.
- DWDM fixed module supports 40 non-tunable ITU 100-GHz wavelengths.
- DWDM tunable module supports 96 tunable ITU 50-GHz wavelengths.
- Supports the Cisco quality identification (ID) feature, which enables a Cisco switch or router to identify whether or not the module is an SFP+ module certified and tested by Cisco.

For the Cisco 10GBASE DWDM data sheet and ordering information,
Visit https://www.cisco.com/c/en/us/products/collateral/interfaces-modules/dwdm-transceiver-modules/data_sheet_c78-711186.html.

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For more information

For more information about the Cisco MDS 9000 Series Multilayer Switches,
Visit https://www.cisco.com/go/san.

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