

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

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

| Switching Module and Fabric Switch | DS-X2-FC10G-CX4=C | DS-X2-E10G-SR=A | DS-CWDM-xxxx= | DS-CWDM4Gxx xx=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 ² | Yes ² | Yes ² | | | |
| DS-X9124 | | | Yes | Yes ² | Yes ² | Yes ² | | | |
| DS-X9148 | | | Yes | Yes ² | Yes ² | Yes ² | | | |
| DS-X9248-48K9 | | | Yes | Yes ² | Yes ² | Yes ² | | | |
| DS-X9224-96K9 | | | Yes | Yes ² | Yes ² | Yes ² | | | |
| DS-X9232-256K9 | | | | Yes ^{2, 13} | | Yes ² | | | |
| DS-X9248-256K9 | | | | Yes ^{2, 13} | | Yes ² | | | |
| DS-X9248-96K9 | | | Yes | Yes ² | Yes ² | Yes ² | | | |
| DS-X9302-14K9 | | | Yes ⁶ | | Yes | | | | |
| DS-X9304-18K9 | | | Yes ⁶ | Yes ² | Yes ^{2, 6} | Yes ² | | | |
| DS-X9304-SMIP | | | Yes | | | | | | |
| DS-X9308-SMIP | | | Yes | | | | | | |
| DS-X9316-SSNK9 | | | Yes ^F | | Yes ^F | | | | |
| DS-X9704 | Yes ² | Yes ² | | | | | | | Yes ² |
| DS-X9708-K9 | | | | | | | Yes ^{8, 12} | Yes ⁹ | |
| DS-C9216A-K9 | | | Yes | | Yes | | | | |
| DS-C9216i-K9 | | | Yes ⁶ | | Yes | | | | |
| DS-C9222i-K9 | | | Yes ⁶ | Yes ² | Yes ^{2, 6} | Yes ² | | | |
| DS-C9120-K9 | | | Yes | | Yes | | | | |
| DS-C9124-K9 | | | Yes ³ | Yes ^{2, 4} | | Yes ² | | | |
| DS-C9134-K9 | Yes ² | Yes ^{2, F} | Yes ³ | Yes ⁴ | | | | | Yes ^{2, F} |
| DS-C9140-K9 | | | Yes | | Yes | | | | |
| DS-C9148-K9 | | | | Yes ² | | Yes ² | | | |
| DS-C9020-20K9 | | | | | | | | | |
| DS-X9448-768K9 | | | | | | | Yes ⁸ | | |
| DS-C9250I-K9 | | | | | | | Yes ⁸ | | |

- 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 6.2.1 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, -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.
- 12: Maximum distance with SFP-10G-ER is limited to 20 km.
- 13: Maximum distance for CWDM optics will be 25 km to account for dB loss in CWDM multiplexer/demultiplexer.

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 | 300m (984 ft) |
| | | | 62.5 | 2.125 | 150m (492 ft) |
| | | | 50.0 (Optical Multimode 2 [OM2]) | 1.0625 | 500m (1640 ft) |
| | | | 50.0 (OM2) | 2.125 | 300m (984 ft) |
| DS-SFP-FC-2G-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 (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 | 300m (984 ft) |
| | | | 62.5 | 2.125 | 150m (492 ft) |
| | | | 62.5 | 4.250 | 70m (230 ft) |
| | | | 50.0 (OM2) | 1.0625 | 500m (1640 ft) |
| | | | 50.0 (OM2) | 2.125 | 300m (984 ft) |
| | | | 50.0 (OM2) | 4.250 | 150m (492 ft) |
| | | | 50.0 (OM3) | 1.0625 | 860m (2821 ft) |
| | | | 50.0 (OM3) | 2.125 | 500m (1640 ft) |
| | | | 50.0 (OM3) | 4.250 | 380m (1246 ft) |
| DS-SFP-FC4G-MR | 1310 | SMF | 9.0 | 1.0625 | 4 km (2.4 mi) |
| | | | 9.0 | 2.125 | 4 km (2.4 mi) |
| | | | 9.0 | 4.250 | 4 km (2.4 mi) |
| DS-SFP-FC4G-LW | 1310 | SMF | 9.0 | 1.0625 | 10 km (6.2 mi) |
| | | | 9.0 | 2.125 | 10 km (6.2 mi) |
| | | | 9.0 | 4.250 | 10 km (6.2 mi) |

Note: The minimum cable distance for all 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) |
| 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) | 0 | - | 2.10 (2 Gbps) | 2.62 (2 Gbps) | 3.31 (2 Gbps) |
| | | -9 (4 Gbps) | | | 1.78 (4 Gbps) | 2.06 (4 Gbps) | 2.88 (4 Gbps) |
| | | -8.2 (8 Gbps) | | | 1.58 (8 Gbps) | 1.68 (8 Gbps) | 2.04 (8 Gbps) |
| DS-SFP-FC8 G-LW | -3 (2 Gbps) -1 (4 Gbps) 0.5 (8 Gbps) | -11.7 (2 Gbps) | -3 (2 Gbps) | - | -7.8 (2 Gbps) | | |
| | | -8.4 (4 Gbps) | -1 (4 Gbps) | | 7.8 (4 Gbps) | | |
| | | -8.4 (8 Gbps) | 0.5 (8 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 |
|-----------------|---|
| 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 (40km Reach) |

| | |
|------------------------|--|
| DS-SFP-FC8G-ER= | 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 | |
| | | | | | |

| 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 |

Cisco 10-Gbps Ethernet SFP+

The Cisco 10-Gbps Ethernet SFP+ (Figure 5) is designed to provide 10-Gbps Ethernet connectivity for the Cisco MDS 9500 10-Gbps 8-Port FCoE Module and MDS 9250i.

Figure 5. Cisco 10GBASE SFP+ Modules



SFP+ Copper (Twinax) cable

SFP+ OPTIC

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 | 9 | - | 10 km |
| SFP-10G-ER | 1550 | SMF | 9 | - | 40 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, -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 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 |
| SFP-10G-ER | 10GBASE-ER 1550 nm SMF | 4 | -4.7 | -1.0 | -15.8 | 1530 to 1565 |

* 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-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, 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
- 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[®] Service support contract for the Cisco switch or router chassis

Ordering Information

Table 21 provides ordering information.

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

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

Cisco 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 6): 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 | 300m (984 ft) |
| | | | 62.5 | 2.125 | 150m (492 ft) |
| | | | 50.0 (OM2) | 1.0625 | 500m (1640 ft) |
| | | | 50.0 (OM2) | 2.125 | 300m (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"> 2.1 (FC: 62.5 microns) and 2.62 (FC: 50.0 microns [OM2]) 2.38 (GE: 62.5 microns) and 3.37 (GE: 50.0 microns [OM2]) |
| DS-SFP-FCGE-LW | -3 | -11.0 | -3 | -19 (GE) | <ul style="list-style-type: none"> 7.8 (FC) 4.57 (GE) |

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 7) 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 | 100m (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 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 8). 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 9). 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 50.0 (OM3) | 10.51875 10.51875 | 33m (108 ft) 300m (984 ft) |
| DS-X2-FC10G-LR | 1310 | SMF | 9.0 | 10.51875 | 10 km (6.2 mi) |
| DS-X2-FC10G-ER | 1550 | SMF | 9.0 | 10.51875 | 40 km (24.8 mi) |
| DS-X2-FC10G-CX4 | - | Copper | - | 10.51875 | 15m (49.2 ft) |

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

Dimensions

- 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 16-Gbps Fibre Channel SFP+ Transceivers

The Cisco 16-Gbps Fibre Channel SFP+ transceivers (Figure 10) is designed to provide Fibre Channel connectivity for the 4/8/16-Gbps ports on the Cisco MDS 9000 Family platform. Two types of Cisco 16-Gbps Fibre Channel SFP+ transceiver are available: the Cisco Fibre Channel Shortwave SFP+ (part number DS-SFP-FC16G-SW) and the Cisco Fibre Channel Longwave SFP+ (part number DS-SFP-FC16G-LW). Each product offers 4/8/16-Gbps autosensing Fibre Channel connectivity.

Figure 10. Cisco 16-Gbps Fibre Channel SFP+ Transceivers



Technical Specifications

Connectors and Cabling

- Connectors: Dual LC connector

Table 33 summarizes the cabling specifications.

Table 33. Cisco 16-Gbps Fibre Channel SFP+ Cabling Specifications

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

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

Dimensions

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

Environmental Conditions and Power Requirements

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

Table 34. Optical Parameters

| SFP+ | Average Transmit Power (dBm) | | Average Receive Power (dBm) | | Fiber Loss Budget (dB) | | |
|-----------------|------------------------------|-------|-----------------------------|--------------------|--|--|--|
| | Max | Min | Max | Min | (62.5 microns [OM1]) | (50.0 microns [OM2]) | (50.0 microns [OM3]) |
| DS-SFP-FC16G-SW | -1.3 | -7, 8 | 0 | -10.3 [†] | 2.08 (4 Gbps) 1.68 (8 Gbps) 1.63 (16 Gbps) | 2.08 (4 Gbps) 1.68 (8 Gbps) 1.63 (16 Gbps) | 2.88 (4 Gbps) 1.04 (8 Gbps) 1.86 (16 Gbps) |
| DS-SFP-FC16G-LW | 2.0 | -5.0 | 2.0 | -10.0 [†] | 7.8 (4 Gbps) 6.4 (8 Gbps) 6.4 (16 Gbps) | | |

Table 35. Operating and Storage Temperature Ranges

| SFP+ | Operating | | Storage | |
|-----------------|-----------|-----|---------|-------|
| | Max | Min | Max | Min |
| DS-SFP-FC16G-SW | 40°C | 0°C | 85°C | -40°C |
| DS-SFP-FC16G-LW | 40°C | 0°C | 85°C | -40°C |

Regulatory and Standards Compliance

- Compliant with Fibre Channel FC-PI 1600-SM-LC-L, FC-PI 1600-M5-SN-S, FC-PI 1600-M5E-SN-I, FC-PI 1600-M5F-SN-I, and FC-PI 1600-M6-SN-S 14.025-GBd specifications
- Compliant with Fibre Channel FC-PI 800-SM-LC-L, FC-PI 800-M5-SN-S, FC-PI 800-M5E-SN-I, and FC-PI 800-M6-SN-S 8.5-GBd specifications
- Compliant with Fibre Channel FC-PI 400-SM-LC-L, FC-PI 400-M5-SN-I, FC-PI 400-M5E-SN-I, and FC-PI 400-M6-SN-I 4.25-GBd specifications
- Compliant with Fibre Channel FC-PI 200-SM-LC-L, FC-PI 200-M5-SN-I, FC-PI 200-M5E-SN-I, and 200-M6-SN-I 2.125-GBd specifications
- Laser Class I 21CFR1040

[†] Applicable only to DS-SFP-FC16G-SW and DS-SFP-FC16G-LW

[†] Average receiver power (minimum) is based on 4.5-dB extinction ratio

[†] Optical parameters listed here are above is for 14.025-Gbd application

Ordering Information

Table 36 provides ordering information.

Table 36. 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 |
| DS-SFP-FC16G-LW | 16 Gbps Fibre Channel LW SFP+, LC |
| DS-SFP-FC16G-LW= | 16 Gbps Fibre Channel LW SFP+, LC |

Cisco 10-Gbps Ethernet X2 Transceivers

The Cisco Ethernet X2 Transceiver Short Reach (up to 300m; part number DS-X2-E10G-SR) enables high-performance Fibre Channel connectivity for the Cisco MDS 9000 family 10-Gbps Fibre Channel switching module to an existing Ethernet Dense Wavelength-Division Multiplexing (DWDM) transponder (Figure 11). 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 11. Cisco 10-Gbps Ethernet X2 Transceiver



Technical Specifications

Connectors and Cabling

- Connectors: Dual SC connector

Table 37 summarizes the cabling specifications.

Table 37. 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 | 33m (108 ft) |
| | | | 50.0 (OM3) | 10.3125 | 300m (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 38 presents the optical parameters, and Table 39 presents the temperature ranges.

Table 38. 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 39. 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 40 provides ordering information.

Table 40. 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 12). 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.

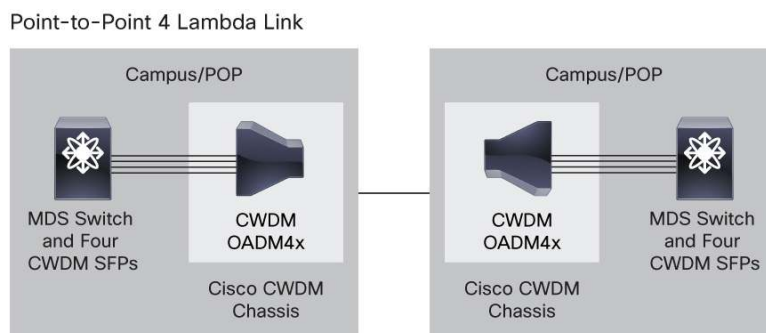
Figure 12. Cisco CWDM Extended Distance SFP Solution



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 13 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 13. Point-to-Point Architecture (Dual-Fiber 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 41 presents the optical parameters, and Table 42 presents the temperature ranges.

Table 41. 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 ⁻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 |

| Parameter | Symbol | Minimum | Typical | Maximum | Units | Notes and Conditions |
|--|-----------|---------|---------|---------|-------|----------------------|
| 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 42. 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 43 provides ordering information.

Table 43. 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 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 44 presents the optical parameters, and Table 45 presents the temperature ranges.

Table 44. 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 ⁻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 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 45. 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 46 provides ordering information.

Table 46. 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 47 and 48 provide comparisons of the OADM types.

Table 47. 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 48. 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 49 provides ordering information.

Table 49. 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 for details.

Ordering Information

Table 50 provides ordering information.

Table 50. 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 51. Table 52 identifies the rest of the 4-Gbps DWDM SFP modules.

Table 51. 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 52. 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.

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.

Ordering Information

Table 53 provides ordering information.

Table 53. Cisco 10-Gbps Ethernet DWDM X2 Transceiver Ordering Information

| Part Number | Description | ITU Channel |
|----------------|---|-------------|
| DWDM-X2-60.61= | 10GBASE-DWDM 1560.61 nm X2 (100-GHz ITU grid) | 21 |
| DWDM-X2-59.79= | 10GBASE-DWDM 1559.79 nm X2 (100-GHz ITU grid) | 22 |
| DWDM-X2-58.98= | 10GBASE-DWDM 1558.98 nm X2 (100-GHz ITU grid) | 23 |
| DWDM-X2-58.17= | 10GBASE-DWDM 1558.17 nm X2 (100-GHz ITU grid) | 24 |
| DWDM-X2-56.55= | 10GBASE-DWDM 1556.55 nm X2 (100-GHz ITU grid) | 26 |
| DWDM-X2-55.75= | 10GBASE-DWDM 1555.75 nm X2 (100-GHz ITU grid) | 27 |

| Part Number | Description | ITU Channel |
|----------------|---|-------------|
| 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.cisco.com/go/storage>.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

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