Cisco ONS Pluggable Optics Series Modules for the Carrier Packet Transport (CPT) Platform

This document provides technical descriptions, applications, and compatibility information for the Small Form-Factor Pluggable (SFP) and 10-Gigabit Small Form-Factor Pluggable (XFP and SFP+) optics modules used in the Cisco® Carrier Packet Transport product family.

Summary

Cisco offers a comprehensive range of pluggable optical modules for the Cisco ONS Family of multiservice platforms. The wide variety of modules gives you flexible and cost-effective options for all types of client interfaces. Cisco offers a range of gigabit interface converters (GBICs) for Gigabit Ethernet use, a wide variety of SFP modules, and has recently introduced XFP modules. These small, modular optical interface transceivers offer a convenient and cost-effective solution for a variety of applications in the data center, campus, metropolitan-area access and ring network, storage area network, and long-haul network.

Technical Overview

SFP Module

A SFP transceiver module (Figure 1) is a bidirectional device with a transmitter and receiver in the same physical package. The module interfaces to the network through a connector interface on the electrical ports and through an LC termination connector on the optical ports. Electrical interfaces and dimensions are defined in the SFF-8472 industry-standard multisource agreement (MSA).

Figure 1.   SFP Transceiver Modules for the Cisco ONS Family

A schematic of the SFP transceiver module functional block diagram is illustrated in Figure 2. It contains three parts: the transmitter, receiver, and Electrically Erasable Programmable Read-Only Memory (EEPROM) storage chip. This block diagram is intended for information purposes only and does not illustrate design requirements.

Figure 2. SFP Module Block Diagram
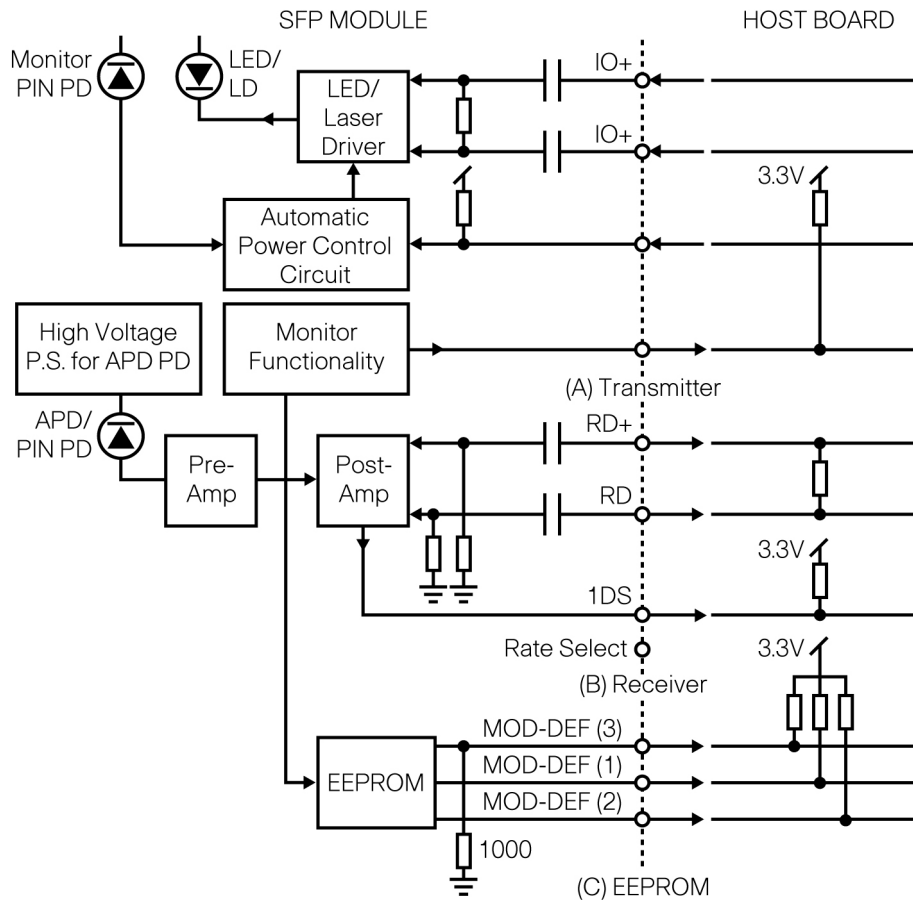
- Transmitter: In the transmit direction, the SFP transceiver module receives the electrical signal and transmits this data in an optical signal by using a laser driver that controls the laser diode. The optical output power is held constant by an automatic power control circuit.

- Receiver: In the receive direction, the SFP transceiver module receives a nonreturn to zero (NRZ) optical signal and converts it to an electrical equivalent. The receive portion of the module will use some kind of amplifier to control the converted electrical signal.

- EEPROM: This type of SFP transceiver is identified by the standard two-wire serial interface used in EEPROM with an I2C interface (with serial ID functions) that is part of the GBIC specifications and the SFF-8472 MSA. In addition, EEPROM offers an enhanced monitoring interface for optical transceivers as described in SFF-8472, which allows real-time access to the device to support monitoring of received optical power, laser bias current, laser optical output power, etc.

XFP Module

The XFP transceiver module (Figure 3) is a bidirectional device with a transmitter and receiver in the same physical package. The XFP module contains a 30-pin surface mount connector on the electrical interface and a duplex LC connector on the optical interface.

Figure 3.   XFP Transceiver Module for the Cisco ONS Family

Figure 4 shows an XFP transceiver module functional block diagram. It contains two parts: the transmitter and the receiver.

Figure 4.   XFP Module Block Diagram
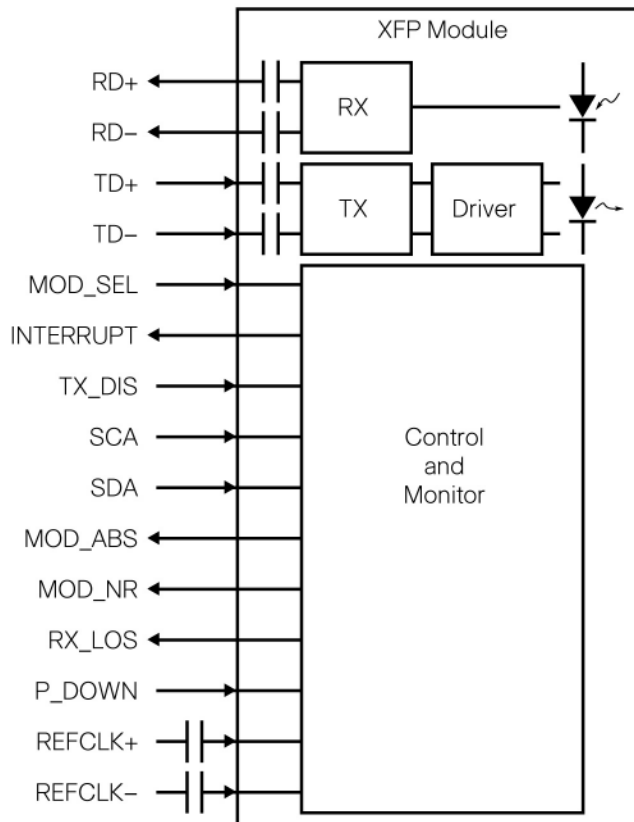
- Transmitter :In the transmit direction, the transceiver module receives a 10-Gbps electrical data signal and transmits the data as an optical signal through an electrical to optical converter. The optical output power is held constant by an automatic power control circuit. The transmitter also contains a Clock Data Recovery (CDR) circuit. The function of this circuit is to attenuate and reshape any jitter received on the electrical interface.

- Receiver: In the receive direction, the transceiver module receives a 10-Gbps optical signal and converts it to an electrical equivalent. The receiver contains a CDR circuit.

SFP+ Module

The SFP+ transceiver (Figure 5) is an evolution of the SFP optic developed for 1-Gbps Ethernet and 1-Gbps, 2-Gbps and 4-Gbps Fibre Channel. It extends the data rate up to 11.10 Gbps while meeting low power and low electromagnetic interference (EMI) requirements for datacom and storage applications.

Similar to SFP, the SFP+ module is a bidirectional device with a transmitter and receiver in the same physical package. It has a 20-pin connector on the electrical interface and a duplex LC connector on the optical interface.

Figure 5. SFP+ Transceiver Module for the Cisco ONS Family

Figure 6 shows an SFP+ transceiver module functional block diagram. It contains two parts: the transmitter and the receiver.

A possible SFP+ module functional block diagram is shown in. It contains three parts: a (A) Transmitter, (B) Receiver, and (C) I2C Management interface. This architecture does not exclude other possible implementations that can be compliant to the SFP+ specs (such as CDR-based designs).

Figure 6. SFP+ Module Block Diagram
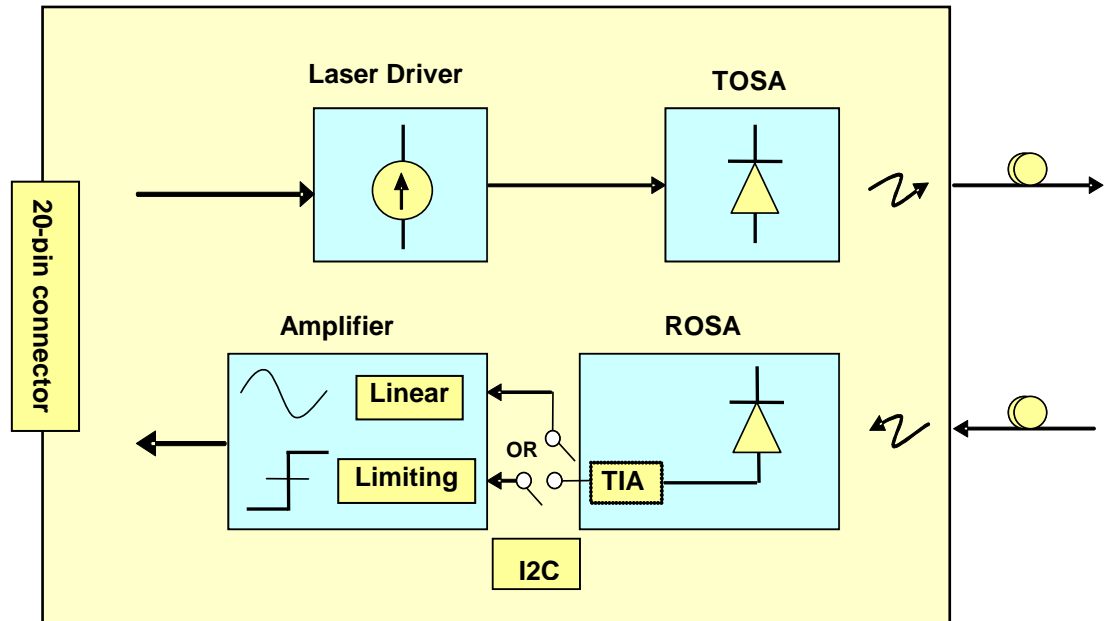
The block diagram shows two different SFP+ module implementations, one based on linear and one based on limiting receiver

(A) Transmitter

In the transmit direction, the SFP+ transceiver module receives a 8.5- to 10.3125-Gbps electrical signal (signaling rate) from the host board Asic/SerDes and converts the data to an optical signal through the laser driver that controls the laser diode in the Transmitter Optical Sub-Assembly (TOSA).

To receive a clean electrical 1-Gbps signal for optical transmission, the preemphasis from host ASIC provides the precompensation and wave-shaping of the transmit waveform. This effectively eliminates the need for equalizers or retimers in the SFP+ module, thus saving power and cost to the SFP+ module.

(B) Receiver

In the receive direction, the transceiver module receives a 8.5/10.3125 Gbps optical signal through a photodiode mounted together with a trans-impedance preamplifier(TIA), and converts it to an electrical equivalent. Depending on the SFP+ architecture, either a limiting or a linear electrical interface will be implemented on the module.

For a limiting interface, the host ASIC Receive Equalizer compensates the printed circuit board (PCB) trace impairment between the module and the ASIC.

For a linear interface, the host Electronic Dispersion Compensation (EDC) provides the adaptive signal processing that is capable of compensating for impairments due to optical fiber, connector, electro-optics and PCB trace effects.

It is worth noting that cost tradeoffs favor the limiting interface, but the linear interface provides better performance.

(C) I2C Management Interface

The third functional capability of the SFP+ module is the 2-wire serial, I2C, interface. I2C is used for serial ID, digital diagnostics and module control functions. The enhanced digital diagnostics monitoring interface allows real-time access to the device, allowing monitoring of received optical power, laser bias current, laser optical output power, etc.

Pluggable Modules: List and Description

Cisco ONS Family modules have well-defined product IDs, making it easy for you to order the appropriate module.

The product ID is structured as follows: ONS-"AB"-"CCC"-"DD":.

- **A** = S for SFP, G for GBIC, and X for XFP
- **B** = C for commercial temperature (0 to 70℃), E for extended temperature (–10 to 85℃), and I for indus trial temperature (–40 to 85℃)
- **CCC** = Supported bit-rate or signal type: 155 Mbps for OC-12/STM-1 signal or 2 GF for a tri-rate Gigabit Ethernet, Fibre Channel, and 2G Fibre Channel signal support
- **DD** = Supported reach: S1 for short-reach/intra-office 1310 nm interface or SX for Ethernet

There are still some older product IDs for the Cisco ONS 15454 platform, but those IDs will migrate toward the newer ID scheme for the Cisco ONS Family.

Data SFP Modules

Cisco offers a wide range of different data SFP modules capable of transmitting Gigabit Ethernet, Fibre Channel, IBM Fiber Connection (FICON), and Enterprise Systems Connection (ESCON) signal format. Table 1 provides details.

Table 1. Data SFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-SI-100-LX10=	SFP – 100 Mbps Long Reach – 1310 nm – SM – LC, ITEMP	10-2294-01	100BASE LX IEEE-802.3	–40 to +85
ONS-SI-100-FX=	SFP – 100 Mbps Short Reach – 1310 nm – MM – LC, ITEMP	10-2350-01	100BASE FX IEEE-802.3	–40 to +85
ONS-SE-GE-BXU=	SFP – 1000BASE-BX U – GE Bidirectional Upstream – Ext Temp		100BASE BX-U IEEE-802.3	–10 to +85
ONS-SE-GE-BXD=	SFP – 1000BASE BX D – GE Bidirectional Downstream Ext Temp		1000BASE BX-D IEEE-802.3	–10 to +85
ONS-SI-GE-SX=	SFP – 1000BASE-SX Gigabit Ethernet, 850 nm, MM, I-TEMP	10-2295-01	1000BASE SX IEEE-802.3	–40 to +85
ONS-SC-GE-LX=	1000BASE LX SFP – 1310 nm – LC – C Temp	10-2298-01	1000BASE LX IEEE-802.3	0 to +70
ONS-SI-GE-LX=	SFP – 1000BASE-LX Gigabit Ethernet, 1310 nm, SM, I-TEMP	10-2300-01	1000BASE SX IEEE-802.3	–40 to +85
ONS-SI-GE-ZX=	SFP – 1000BASE-ZX Gigabit Ethernet, 1550 nm, SM, I-Temp	10-2296-01	1000BASE ZX IEEE-802.3	–40 to +85
ONS-SE-GE-ZX=	SFP – 1000BASE-ZX Gigabit Ethernet, 1550, SM, Ext-Temp	10-2354-01	1000BASE ZX IEEE-802.3	–10 to +85

Electrical SFP Modules

Cisco also offers electrical SFP modules for the Universal Terminal Support (UTS) platform. See Table 2 for reference.

Table 2. Electrical SFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-SE-ZE-EL=	SFP – 10/100/1000 Ethernet BASE-T Multirate Copper RJ-45	10-2351-01	IEEE-802.3	–10 to +85

CWDM SFP Modules

Cisco offers a wide range of coarse wavelength-division multiplexing (CWDM) ITU-T compliant SFP modules. Table 3 lists the details.

Table 3. CWDM SFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-SE-2G-1470=	SFP – OC-48/STM-16/GE, CWDM, 1470 nm Ext Temp	10-2461-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1490=	SFP – OC-48/STM-16/GE, CWDM, 1490 nm Ext Temp	10-2462-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1510=	SFP – OC-48/STM-16/GE, CWDM, 1510 nm Ext Temp	10-2463-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1530=	SFP – OC-48/STM-16/GE, CWDM, 1530 nm Ext Temp	10-2464-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1550=	SFP – OC-48/STM-16/GE, CWDM, 1550 nm Ext Temp	10-2465-01	ITU-T G.694.2	0 to +85

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-SE-2G-1570=	SFP – OC-48/STM-16/GE, CWDM, 1570 nm Ext Temp	10-2466-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1590=	SFP – OC-48/STM-16/GE, CWDM, 1590 nm Ext Temp	10-2467-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1610=	SFP – OC-48/STM-16/GE, CWDM, 1610 nm Ext Temp	10-2468-01	ITU-T G.694.2	0 to +85

XFP List and Description

Grey XFP Modules

Cisco offers a wide range of Grey XFP modules for the UTS Platform. Table 4 lists the details.

Table 4.   GREY XFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-XC-10G-S1=	XFP – OC-192/STM-64/10GE – 1310 SR – SM LC	10-2012-03	ITU G694 I-64.1 GR253 SR-1 10GE BASE LR 1200-SM-LL-L IB-1x-DDR-LX	0 to +70
ONS-XC-10G-I2=	XFP – OC-192/STM-64/10GE – 1550 IR2 – SM LC	10-2193-02	ITU G694 S-64.2b GR253 IR-2 10GE BASE-ER	0 to +70
ONS-XC-10G-L2=	XFP – OC-192/STM-64 – 1550 LR2 – SM LC	10-2194-02	ITU G959.1 P1L1-2D2 GR253 LR-2 10GE BASE-ZR	0 to +70
ONS-XC-10G-SR-MM=	XFP – Ultra Short Reach MM –10GE BASE SR	10-2420-01	1200-MX-SN-I / 10GE BASE-SR	0 to +70

DWDM XFP Modules

Cisco offers a complete set of DWDM XFP modules. Table 5 lists the details.

Table 5.   DWDM XFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-XC-10G-C=	10G Multirate Full C Band Tunable DWDM XFP, 50 GHz, LC	10-2480-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP30.3=	10G MR, XFP,Edge Performance 1530.33, 100 GHz, LC	10-2577-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP31.1=	10G MR, XFP,Edge Performance 1531.12, 100 GHz, LC	10-2579-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP31.9=	10G MR, XFP,Edge Performance 1531.90, 100 GHz, LC	10-2580-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP32.6=	10G MR, XFP,Edge Performance 1532.68, 100 GHz, LC	10-2581-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP33.4=	10G MR, XFP,Edge Performance 1533.47, 100 GHz, LC	10-2582-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP34.2=	10G MR, XFP,Edge Performance 1534.25, 100 GHz, LC	10-2578-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP35.0=	10G MR, XFP,Edge Performance 1535.04, 100 GHz, LC	10-2611-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP35.8=	10G MR, XFP,Edge Performance 1535.82, 100 GHz, LC	10-2604-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP36.6=	10G MR, XFP,Edge Performance 1536.61, 100 GHz, LC	10-2615-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP37.4=	10G MR, XFP,Edge Performance 1537.40, 100 GHz, LC	10-2608-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP38.1=	10G MR, XFP,Edge Performance 1538.19, 100 GHz, LC	10-2610-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP38.9=	10G MR, XFP,Edge Performance 1538.98, 100 GHz, LC	10-2612-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP39.7=	10G MR, XFP,Edge Performance 1539.77, 100 GHz, LC	10-2609-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP40.5=	10G MR, XFP,Edge Performance 1540.56, 100 GHz, LC	10-2607-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP41.3=	10G MR, XFP,Edge Performance 1541.35, 100 GHz, LC	10-2606-01	ITU G694, GR2918	0 to +70

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-XC-10G-EP42.1=	10G MR, XFP,Edge Performance 1542.14, 100 GHz, LC	10-2605-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP42.9=	10G MR, XFP,Edge Performance 1542.94, 100 GHz, LC	10-2603-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP43.7=	10G MR, XFP,Edge Performance 1543.73, 100 GHz, LC	10-2590-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP44.5=	10G MR, XFP,Edge Performance 1544.53, 100 GHz, LC	10-2602-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP45.3=	10G MR, XFP,Edge Performance 1545.32, 100 GHz, LC	10-2601-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP46.1=	10G MR, XFP,Edge Performance 1546.12, 100 GHz, LC	10-2589-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP46.9=	10G MR, XFP,Edge Performance 1546.92, 100 GHz, LC	10-2588-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP47.7=	10G MR, XFP,Edge Performance 1547.72, 100 GHz, LC	10-2600-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP48.5=	10G MR, XFP,Edge Performance 1548.51, 100 GHz, LC	10-2599-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP49.3=	10G MR, XFP,Edge Performance 1549.32, 100 GHz, LC	10-2587-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP50.1=	10G MR, XFP,Edge Performance 1550.12, 100 GHz, LC	10-2598-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP50.9=	10G MR, XFP,Edge Performance 1550.92, 100 GHz, LC	10-2597-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP51.7=	10G MR, XFP,Edge Performance 1551.72, 100 GHz, LC	10-2596-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP52.5=	10G MR, XFP,Edge Performance 1552.52, 100 GHz, LC	10-2614-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP53.3=	10G MR, XFP,Edge Performance 1553.33, 100 GHz, LC	10-2595-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP54.1=	10G MR, XFP,Edge Performance 1554.13, 100 GHz, LC	10-2586-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP54.9=	10G MR, XFP,Edge Performance 1554.94, 100 GHz, LC	10-2585-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP55.7=	10G MR, XFP,Edge Performance 1555.75, 100 GHz, LC	10-2594-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP56.5=	10G MR, XFP,Edge Performance 1556.55, 100 GHz, LC	10-2613-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP57.3=	10G MR, XFP,Edge Performance 1557.36, 100 GHz, LC	10-2584-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP58.1=	10G MR, XFP,Edge Performance 1558.17, 100 GHz, LC	10-2583-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP58.9=	10G MR, XFP,Edge Performance 1558.98, 100 GHz, LC	10-2593-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP59.7=	10G MR, XFP,Edge Performance 1559.79, 100 GHz, LC	10-2576-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP60.6=	10G MR, XFP,Edge Performance 1560.61, 100 GHz, LC	10-2592-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP61.4=	10G MR, XFP,Edge Performance 1561.43, 100 GHz, LC	10-2591-01	ITU G694, GR2918	0 to +70

CWDM XFP Modules

Cisco offers a complete set of CWDM XFP modules. Table 6 lists the details.

Table 6. CWDM XFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (℃)
ONS-XC-10G-1470=	OC192/10GE/OTU2, CWDM, 1470mn, XFP C-Temp, 40km range	10-2548-01	ITU G694.2	0 to +70
ONS-XC-10G-1490=	OC192/10GE/OTU2, CWDM, 1490mn, XFP C-Temp, 40km range	10-2551-01	ITU G694.2	0 to +70
ONS-XC-10G-1510=	OC192/10GE/OTU2, CWDM, 1510mn, XFP C-Temp, 40km range	10-2552-01	ITU G694.2	0 to +70
ONS-XC-10G-1530=	OC192/10GE/OTU2, CWDM, 1530nm, XFP C-Temp, 40km range	10-2553-01	ITU G694.2	0 to +70
ONS-XC-10G-1550=	OC192/10GE/OTU2, CWDM, 1550nm, XFP C-Temp, 40km range	10-2554-01	ITU G694.2	0 to +70
ONS-XC-10G-1570=	OC192/10GE/OTU2, CWDM, 1570nm, XFP C-Temp, 40km range	10-2555-01	ITU G694.2	0 to +70
ONS-XC-10G-1590=	OC192/10GE/OTU2, CWDM, 1590nm, XFP C-Temp, 40km range	10-2556-01	ITU G694.2	0 to +70
ONS-XC-10G-1610=	OC192/10GE/OTU2, CWDM, 1610nm, XFP C-Temp, 40km range	10-2557-01	ITU G694.2	0 to +70

SFP+ Modules

Cisco offers a complete set of SFP+ modules for the CPT platform. Table 7 and 8 list the details.

Table 7. Grey SFP+ Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SC+-10G-SR=	SFP+ SR - Commercial Temp	10-2620-01	10GE BASE SR	0 to +70
ONS-SC+-10G-ER=	SFP+ ER - Commercial Temp	10-2619-01	10GE BASE-ER	0 to +70
ONS-SC+-10G-LR=	SFP+ LR - Commercial Temp	10-2618-01	10GE BASE-LR	0 to +70

Table 8. Active Cable

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SC+-10G-CU1=	10GBASE-CU SFP+ Cable 1 Meter	37-1188-01	10GE	0 to +70
ONS-SC+-10G-CU3=	10GBASE-CU SFP+ Cable 3 Meter	37-1197-01	10GE	0 to +70
ONS-SC+-10G-CU5=	10GBASE-CU SFP+ Cable 5 Meter	37-1198-01	10GE	0 to +70
ONS-SC+-10G-CU7=	10GBASE-CU SFP+ Cable 7 Meter	37-1196-01	10GE	0 to +70

SFP Technical Details

SONET/SDH SFP Modules

The Cisco SFP modules are compatible with SONET/SDH standards, and support the digital diagnostic functions specified in the SFF-8742 MSA.

Data SFP Modules

The Data SFP modules for the Cisco ONS Family are compatible with the IEEE 802.3 and support the digital diagnostic functions specified in the SFF-8742 MSA.

Table 9. Ethernet Pluggable Modules: Optical Specifications

Product ID	Operating Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Power Range (dBm)	Maximum Dispersion (ps/nm)	Maximum Target Distance
ONS-SI-GE-SX=	770–860	–9.5 to 0	–17 to 0[1]	—	0.5 to 500m (50/125 μm fiber) 0.5 to 300m (62.5/125 μm fiber)
ONS-SI-GE-LX=	1270–1355	–9.5 to –3	–19 to –3[2]	—	10km
ONS-SI-GE-ZX=	1500–1580	0 to +5	–23 to –3	1200–1600[3]	80km
ONS-SE-100-BX10U=	1260–1360 (TX) 1480–1580 (RX)	–14 to –8	–28.2 to –7	—	10 km
ONS-SE-100-BX10D=	1480–1580 (TX) 1260–1360 (RX)	–14 to –8	–28.2 to –7	—	10 km

1: Minimum Stressed Sensitivity (10^{-12}): -12.5(62.5um) and -13.5(50um) dBm

2: Minimum Stressed Sensitivity (10^{-12}): -14.4 dBm

3: The indicated dispersion range corresponds to the approximate worst-case dispersion for 80 km G.652/G.654 fiber over the wavelength range 1500–1580 nm.

CWDM and DWDM SFP Modules

Cisco offers a full set of CWDM SFP modules and DWDM SFP modules for GE applications. Table 10, Table 10, and Table 12 list the optical parameters.

Table 10.   CWDM SFP Modules: Optical Specifications

Product ID	Receiver Wavelength Range (nm)	Spectral Width (nm)	Transmit Power Range (dBm)	Receiver Power Range (dBm)
ONS-SE-2G-xxxx=	1460-1620	1	-1 to +4	-28 to -9 (BER 10-12)

Note: "xxxx" ranges from 1470 to 1610.

Table 11.   DWDM SFP Module: Optical Specifications

Product ID	Receiver Wavelength Range (nm)	Transmitter Stability (pm)	Spectral Width (pm)	Transmit Power Range (dBm)
ONS-SC-2G-xx.x=	1260–1620[11]	–100 to +100 (100 GHz spacing)	200	0 to +4

Note: "xx.x" ranges from 30.3 to 60.6.

1: Receiver sensitivity specified over 1528–1561 nm only, with 2dB degradation permitted outside of this range.

Table 12.   DWDM SFP Modules: Optical Performance

Optical Performance					
Power-Limited Performances					
		2G DWDM SFP		**4G DWDM SFP**	
Input power range	dBm	–9 to –28	At BER=10e-12 with SONET framed PRBS23 at OSNR of 21dB, 0.1nm BW	–9 to –22	At BER=10e-12 with SONET framed PRBS23 at OSNR of 26dB, 0.1nm RBW
Dispersion tolerance	ps/nm	–800 to +2400	Power Penalty=3dB, OSNR=21dB at 0.1nmBW (Noise Penalty=0dB)	–800 to +1600	–9 to –20 dBm with OSNR=26dB at 0.1nm RBW (Noise Penalty=0dB)
Noise-Limited Performances					
Input power range	dBm	–9 to –22	At BER=10e-12 with SONET framed PRBS23 at OSNR of 16dB at 0.1nm bandwidth	–9 to –18	At BER=10e-12 with SONET framed PRBS23 at OSNR of 22dB at 0.1nm bandwidth
Dispersion tolerance	ps/nm	–800 to +2400	Noise Penalty=3dB, OSNR=19dB at 0.1nmBW (Power Penalty=0dB)	–800 to +1600	–9 to –18 dBm with OSNR=25dB at 0.1nmBW (Power Penalty=0dB)

Grey XFP Modules

Cisco offers a full set of Grey XFP modules for 10-Gbps applications. Table 13 lists the optical parameters.

Table 13.   Grey XFP Modules: Optical Specifications

Product ID	Transmitter Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Wavelength Range (nm)	CD Robustness (ps)	Receiver Power Range (dBm)
ONS-XC-10G-S1=	1260–1335	–6 to –1 [1] –8.2 to +0.5 [2]	1260–1565	6.6	–11 to –1 [1] –14.4 to +0.5 [2,3]
ONS-XC-10G-I2=	1530–1565	–1 to +2	1260–1565	800	–14 to +2
ONS-XC-10G-L2=	1530–1565	0 to +4	1260–1565	1600	–24 to –7
ONS-XC-10G-SR-MM=	840–860	–7.3 to –1	840–860	–	–9.9 to –1

1: SONET/SDH application

2: 10GE/10G Fibre Channel application

3: Stressed receiver sensitivity (maximum) in OMA is -10.3 dBm

DWDM XFP Modules

Cisco offers a full set of DWDM XFP modules for 10-Gbps applications. Table 14, table 15 and Table 16 list optical parameters

Table 14. DWDM XFP Modules: Optical Specifications

Product ID	Receiver Wavelength Range (nm)	Transmitter Stability (pm)	Spectral Width (pm)	Transmit Power Range (dBm)
ONS-XC-10G-EPxx.x=	1260–1607[11]	−100 to +100 (100 GHz spacing)	200	−1 to +3
ONS-XC-10G-C=	1260–1607[11]	−25 to +25 (50 GHz spacing)	200	0 to +3

Note: "xx.x" ranges from 30.3 to 61.4.

Table 15. Fixed Wavelength DWDM XFP Modules: Optical Performance

Optical Performance			
Short Wavelength Performances			
Input power range	dBm	−7 to −20	At BER=10e-12 (at 1310 nm ± 20nm) applicable at 9.9G, 10.3G only
Long Wavelength Performances C Band NO-FEC Applications Power-Limited			
Input power range	dBm	−7 to −23	At BER=10e-12 applicable at 9.9G, 10.3G only 23dB OSNR (0.5nm RBW)
Input power range	dBm	−7 to −20	At BER=10e-12 (−500 to +1100 ps/nm) applicable at 9.9G, 10.3G only – 23dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band NO-FEC Applications Noise-Limited			
Input power range	dBm	−7 to −18	At BER=10e-12 applicable at 9.9G, 10.3G only 17dB OSNR (0.5nm RBW)
Input power range	dBm	−7 to −18	At BER=10e-12 (−500 to +1100 ps/nm) applicable at 9.9G, 10.3G only – 20dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band FEC Applications Noise-Limited			
Input power range	dBm	−7 to −18	At BER PREFEC <10e-5 applicable at 10.7G, 11.1G only -- 11dB OSNR (0.5nm RBW)
Input power range	dBm	−7 to −18	At BER PREFEC <10e-5 (-500 to +1100 ps/nm) applicable at 10.7G, 11.1G only – 12dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Power-Limited			
Input power range	dBm	−7 to −27	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 23dB OSNR
Input power range	dBm	−7 to −24	At BER PREFEC <7*10e-4 (−500 to +1100 ps/nm) applicable at 10.7G, 11.1G only – 23dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Noise-Limited			
Input power range	dBm	−7 to −18	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 8dB OSNR (0.5nm RBW)
Input power range	dBm	−7 to −18	At BER PREFEC <7*10e-4 (−500 to +1100 ps/nm) applicable at 10.7G, 11.1G only – 9dB OSNR (0.5nm RBW)

Table 16. Full C Band Tuneable Wavelength DWDM XFP Modules: Optical Performance

Optical Performance			
Short Wavelength Performances			
Input power range	dBm	−7 to −20	At BER=10e-12 (at 1310 nm ± 20nm) applicable at 9.9G, 10.3G only
Long Wavelength Performances C Band NO-FEC Applications Power-Limited			
Input power range	dBm	−7 to −24	At BER=10e-12 applicable at 9.9G, 10.3G only 23dB OSNR (0.5nm RBW)
Input power range	dBm	−7 to −22	At BER=10e-12 (−500 to +1600 ps/nm) applicable at 9.9G, 10.3G only – 23 dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band NO-FEC Applications Noise-Limited			
Input power range	dBm	−7 to −22	At BER=10e-12 applicable at 9.9G, 10.3G and 10.5 only 19dB OSNR (0.5nm RBW)
Input power range	dBm	−7 to −20	At BER=10e-12 (−500 to +1600 ps/nm) applicable at 9.9G, 10.3G and 10.5G only – 19dB OSNR (0.5nm RBW)

Optical Performance			
Long Wavelength Performances C Band FEC Applications Noise-Limited			
Input power range	dBm	–7 to –18	At BER PREFEC <10e-5 applicable at 10.7G, 11.1G only – 8.5dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –18	At BER PREFEC <10e-5 (–400 to +1000 ps/nm) applicable at 10.7G, 11.1G only – 10dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Power-Limited			
Input power range	dBm	–7 to –27	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 19dB OSNR
Input power range	dBm	–7 to –26	At BER PREFEC <7*10e-4 (–400 to +1300 ps/nm) applicable at 10.7G, 11.1G and 11.3G only – 19dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Noise-Limited			
Input power range	dBm	–7 to –20	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 5dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –20	At BER PREFEC <7*10e-4 (–400 ps/nm) applicable at 10.7G, 11.1G and 11.3G only – 7.5dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –20	At BER PREFEC <7*10e-4 +1300 ps/nm) applicable at 10.7G, 11.1G and 11.3G only – 7dB OSNR (0.5nm RBW)

CWDM XFP Modules

Cisco offers a full set of CWDM XFP modules for 10-Gbps applications. Table 14 lists optical parameters.

Table 17.   CWDM XFP Modules: Optical Specifications

Product ID	Wavelength Range Rx (nm)	Sensitivity Rx (dBm)	Stability Tx (nm)	Dispersion Tolerance (ps/nm)	Tx Power Range (dBm)	Supported Bit Rate	Target Distance
ONS-XC-10G-xxxx=	1450-1620	–14	+/– 6.5	0 to +800	+3 to +7	OC-192 STM-64 10GE OTU2 OTU2e (up to 11.1Gbps) 10G FC	40km (OTU2 and 10GE) 10km (OC-192/STM-064)

Note: "xxxx" ranges from 1470 to 1610.

Electrical SFP Modules

Cisco offers multiple options for copper SFP modules. Table 18 lists the main characteristics.

Table 18.   Electrical SFP Module Specifications

Product ID	Bit Rate	Connector	Typical Distance
ONS-SE-ZE-EL=	10/100/1000 Mbps	RJ-45	100m

SFP+ Modules

Cisco offers multiple options for SFP+ modules. Table 18 and Table 20 list the main characteristics.

Table 19.   SFP+ modules

Product ID	Transmitter Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Wavelength Range (nm)	Optical Reach	Receiver Power Range (dBm)
ONS-SC+-10G-SR=	840-860	–7.3 to –1.3	840-860	26 m (FDDI-Grade / 62.5 micron) 33 m (OM1 /62.5 micron) 66 m (50.0 micron) 82 m (OM2 / 50.0 micron) 300 m (OM3 / 50.0 micron)	–11.1 (in OMA) to –1
ONS-SC+-10G-LR=	1260–1355	–8.2 to +0.5	1260–1355	10km	–12.6 (in OMA) to 0.5

Product ID	Transmitter Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Wavelength Range (nm)	Optical Reach	Receiver Power Range (dBm)
ONS-SC+-10G-ER=	1530–1565	–4.7 to +4	1530–1565	40km	–14.1 (in OMA) to -1

Table 20. Active Cables

Product ID	Interface standard compliance	Cable Length	Connector
ONS-SC+-10G-CU1=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	1m	SFP+ MSA
ONS-SC+-10G-CU3=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	3m	SFP+ MSA
ONS-SC+-10G-CU5=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	5m	SFP+ MSA
ONS-SC+-10G-CU7=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	7m	SFP+ MSA

Compatibility Matrix

Table 21indicates which SFP modules are available on different CPT boards

Table 21. Cisco ONS and CPT Compatibility Matrix

Product ID	Cisco UTS Boards		
	CPT-50-44GE	CPT-PTM-10Gx4	CPT-PTF256-10Gx4=
ONS-SI-100-LX10=	X		
ONS-SI-100-FX=	X		
ONS-SE-GE-BXU=	X		
ONS-SE-GE-BXD=	X		
ONS-SI-GE-SX=	X		
ONS-SI-GE-LX=	X		
ONS-SI-GE-ZX=	X		
ONS-SE-ZE-EL=	X		
ONS-SE-2G-xxxx[1]	X		
ONS-SC+-10G-SR=	X	X	X
ONS-SC+-10G-LR=	X	X	X
ONS-SC+-10G-ER=	X	X	X
ONS-SC+-10G-CU1=[4]	X	X	X
ONS-SC+-10G-CU3=[4]	X	X	X
ONS-SC+-10G-CU5=[4]	X	X	X
ONS-SC+-10G-CU7=[4]	X	X	X
ONS-XC-10G-S1=		X	X
ONS-XC-10G-I2=		X	X
ONS-XC-10G-L2=		X	X
ONS-XC-10G-xxxx[1]		X	X
ONS-XC-10G-EPxx.x=[3]		X	X
ONS-XC-10G-C=		X	X

1: For CWDM SFP and XFP modules, "xxxx" ranges from 1470 to 1610

2: For DWDM SFP modules, "xx.x" ranges from 30.3 to 60.6, wavelength 28.7, 33.4, 41.3, 49.3, 57.3 requires Release 8.5

3: For DWDM XFP modules, "xx.x" ranges from 30.3 to 61.4

4: Copper cable shall be maintained within same line of racks

SFP Physical Details

Tables 22 through 26 list reliability data, power consumption, and cable type to be used for each pluggable module.

Table 22.   Data SFP Modules

Product ID	MTBF in Hours	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SI-100-LX10=	9,970,080	1W	LC-LC
ONS-SI-100-FX=	9,970,080	1W	LC-LC
ONS-SI-GE-SX=	7,919,921	1W	LC-LC
ONS-SI-GE-LX=	9,970,080	1W	LC-LC
ONS-SI-GE-ZX=		1W	LC-LC
ONS-SE-GE-BXU=	6,250,000	1W	LC-LC
ONS-SE-GE-BXD=	6,250,000	1W	LC-LC

Table 23.   Electrical SFP Modules

Product ID	MTBF in Hours	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SE-ZE-EL=	4,068,349	1	RJ-45 STP CAT5e and CAT6

Table 24.   Grey XFP Modules

Product ID	MTBF in Hours	Maximum Power Consumption (W)	Supported Cable Connection
ONS-XC-10G-S1=	3,039,506	2.5	LC-LC
ONS-XC-10G-I2=	3,279,693	3	LC-LC
ONS-XC-10G-L2=	2,711,429	3	LC-LC
ONS-XC-10G-SR-MM=	1,974,000	1.5	LC-LC

DWDM Pluggable Modules

Table 25.   xWDM SFP Modules

Product ID	MTBF	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SC-2G-xx.x=	5,346,554	1	LC-LC
ONS-SC-Z3-xxxx=	2,070,393	1.1	LC-LC
ONS-XC-10G-EPxx.x=	2,711,000	3.5	LC-LC
ONS-XC-10G-C=	1,000,000	3.5	LC-LC
ONS-XC-10G-xxxx=	2,711,000	3.5	LC-LC

SFP+ Pluggable Modules

Table 26.   SFP+ Modules Physical Data

Product ID	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SC+-10G-SR=	1	LC-LC
ONS-SC+-10G-LR=	1	LC-LC
ONS-SC+-10G-ER=	1.1	LC-LC
ONS-SC+-10G-CU1=	1	N/A
ONS-SC+-10G-CU3=	1	N/A
ONS-SC+-10G-CU5=	1	N/A
ONS-SC+-10G-CU7=	1	N/A

Ordering Information

You can order all the available pluggable interfaces from Cisco.com. Please check the Pricing Tool for further information: www.cisco.com/cgi-bin/front.x/pricing?Request=ShowCurrentPriceSrch.

Please select ONS Pluggable Optics Series as the Product Family.

Third-Party Equipment

The use of third-party equipment in place of Cisco ONS SFP products is not recommended, for the following reasons.

- Cisco can guarantee service-level agreements (SLAs) only on parts that have undergone the Cisco test plan and validation process. Without comprehensive testing and validation, SFP products may display anomalous behavior that can impact host-board performance.
- Cisco SFP modules reserve specific EEPROM fields to store inventory data such as Product ID, Part Number, Serial Number, and CLEI CODE that are specific to Cisco SFP modules and are required for SLAs.
- The Cisco Technical Assistance Center (TAC) and Cisco Customer Advocacy can only support Cisco modules and boards for the Cisco ONS Family products.

Lead Time

Please check the Lead-Time Tool to identify standard lead-time for various Cisco ONS Family products: http://www.cisco.com/cgi-bin/front.x/leadtimes.cgi

A different approach is used for DWDM SFP/XFP modules. Based upon customer usage, Cisco has identified and selected particular high-usage wavelengths, and will maintain shorter lead times on these items.

Short lead-time DWDM SFP or XFP modules are those from 1546.1 to 1560.6, with a 4 skip 1 approach.

Unforecasted pluggable optics on different lambdas could require 16 weeks of delivery time.