8 Pluggable Modules for Interfaces

- 8.1 Important Notes About Using Optical Modules Certified for Huawei Switches
- 8.2 Understanding Optical Modules
- 8.3 Understanding Copper Modules
- 8.4 FE SFP/eSFP Optical Modules
- 8.5 GE eSFP Optical Modules
- 8.6 GE-CWDM eSFP Optical Modules
- 8.7 GE-DWDM eSFP Optical Modules
- 8.8 GE SFP Copper Modules
- 8.9 SFP Stack Optical Modules
- 8.10 GPON Optical Modules

8.1 Important Notes About Using Optical Modules Certified for Huawei Switches

8.1.1 How to Identify Huawei-Certified Switch Optical Modules

NOTICE

- A switch must use optical or copper modules that have been certified for use on Huawei switches. Non-certified optical or copper modules cannot ensure transmission reliability and may affect service stability. Huawei is not liable for any problem caused by the use of non-certified optical or copper modules and will not fix such problems.
- The methods provided here are only for reference. To confirm whether optical modules you are using have been certified for use on Huawei switches, contact Huawei technical support.

10GE or Lower Speed Optical Modules

Huawei started certification on 10GE or lower speed optical modules for switch products on July 1, 2013.

To determine whether optical modules delivered for Huawei switches before July 1, 2013 are certified ones, contact Huawei technical support.

If your optical modules are delivered after July 1, 2013, use either of the following methods to determine whether they have been certified by Huawei.

Method 1: Check for "HUAWEI" on the label

If an optical module has been certified by Huawei, its label contains "HUAWEI", as shown in **Figure 8-1**.

Figure 8-1 "HUAWEI" on the label of a Huawei-certified switch optical module



Method 2: Run the display transceiver command

An optical module has received Huawei switch certification if it meets the following conditions:

- In the **display elabel** command output, the **Manufactured** field displays a date later than 2013-07-01.
- In the **display version** command output, the displayed version is V200R001C00 or later.
- In the display transceiver command output, the Vendor Name field displays HUAWEI.

NOTE

The SFP-FE-SX-MM1310 (part number: 02315233) is a Huawei-certified 100M optical module. However, the **Vendor Name** field displays the original manufacturer name, instead of **HUAWEI**.

For copper modules, the **Vendor Name** field also displays the original manufacturer name, instead of **HUAWEI**.

40GE and 100GE Optical Modules

Huawei started certification on 40GE and 100GE optical modules for switch products on January 1, 2016.

To determine whether optical modules delivered for Huawei switches before January 1, 2016 are certified ones, contact Huawei technical support.

If your optical modules are delivered after January 1, 2016, use either of the following methods to determine whether they have been certified by Huawei.

Method 1: Check for "HUAWEI" on the label

If an optical module has been certified by Huawei, its label contains "HUAWEI", as shown in **Figure 8-1**.

Method 2: Run the display transceiver command

A 40GE or 100GE optical module has received Huawei switch certification if it meets the following conditions:

- In the **display elabel** command output, the **Manufactured** field displays a date later than 2016-01-01.
- In the **display version** command output, the displayed version is V200R008 or later.
- In the display transceiver command output, the Vendor Name field displays HUAWEI.

For the optical modules connected to high-speed cables or AOC cables, the **Vendor Name** field displays the original manufacturer name, instead of **HUAWEI**. For the methods of checking whether such an optical module has been certified by Huawei, contact technical support personnel.

8.1.2 Risks of Using Non-Huawei-Certified Switch Optical Modules

During certification of optical modules for Huawei switches, Huawei completes comprehensive functionality verification to ensure quality of optical modules. The verified items include optical module plug/unplug, transmit optical power, receive optical power, signal transmission quality, data reading, error tolerance, compatibility, electromagnetic compatibility (EMC), and environmental parameters.

Non-Huawei-certified switch optical modules may cause the following problems:

- Non-standard structure and size cause failures to install optical modules on adjacent optical interfaces.
 - Structures or sizes of some non-Huawei-certified optical modules do not comply with the Multi-Source Agreement (MSA). When such an optical module is installed on an optical interface, the size of this optical module hinders optical module installation on adjacent optical interfaces.
- Data bus defects cause suspension of a switch's data bus.
 - Some non-Huawei-certified optical modules have defects in data bus designs. Using such an optical module on a switch causes suspension of the connected data bus on the switch. As a result, data on the suspended bus cannot be read.
- Improper edge connector size damages electronic devices of optical interfaces.
 - If a non-Huawei-certified switch optical module with improper edge connector size is used on an optical interface, electronic devices of the optical interface will be damaged by short circuits.
- Unnormalized temperature monitoring causes incorrect alarms.
 - The temperature monitoring systems of some non-Huawei-certified switch optical modules do not comply with industry standards and report temperature values higher than the real temperature. When such optical modules are used on a switch, the system will report incorrect temperature alarms.
- Improper register settings cause errors or failures in reading parameters or diagnostic information.
 - Some non-Huawei-certified switch optical modules have improper register values on page A0, which can cause errors or failures when the system attempts to read parameters or diagnostic information from a data bus.
- Some non-Huawei-certified switch optical modules are not designed in compliance with EMC standards and have low anti-interference capability. Additionally, they bring electromagnetic interference to nearby devices.

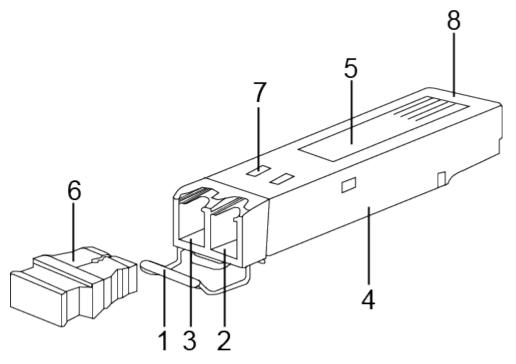
• The operating temperature ranges of non-Huawei-certified switch optical modules cannot meet service requirements. When they are used under relatively high temperature, the optical power decreases, resulting in service interruption.

8.2 Understanding Optical Modules

8.2.1 What Is an Optical Module

On an optical network, a sender needs to convert electrical signals into optical signals before sending them to a receiver, and the receiver needs to convert received optical signals into electrical signals. An optical module is a component that completes electrical/optical conversion on an optical network. **Figure 8-2** shows the structure of an optical module.

Figure 8-2 Structure of an optical module (using an SFP/eSFP optical module as an example)



1. Handle	2. Receiver	3. Transmitter
4. Shell	5. Label	6. Dust plug
7. Spring	8. Connector	-

Figure 8-3 shows an SFP/eSFP optical module.

Figure 8-3 SFP/eSFP optical module



Figure 8-4 shows the appearance of an SFP+ optical module.

Figure 8-4 Appearance of an SFP+ optical module



Figure 8-5 and Figure 8-6 show the appearance of a QSFP+ optical module.

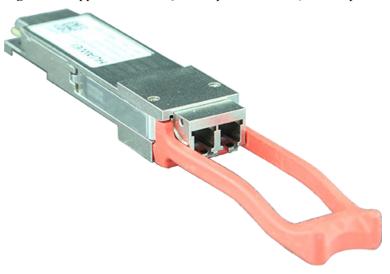
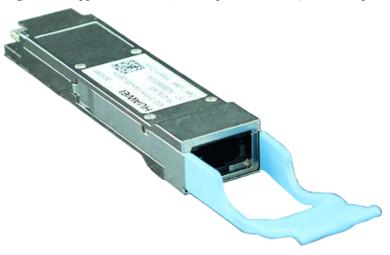


Figure 8-5 Appearance of a QSFP+ optical module (for LC optical fibers)

Figure 8-6 Appearance of a QSFP+ optical module (for MPO optical fibers)



NOTICE

The side with an L-shaped notch close to the connector is the top of a QSFP+ optical module, as shown in **Figure 8-5**. When connecting a QSFP+ optical module to a port, keep the top side upward. Do not insert the QSFP+ optical module upside down.

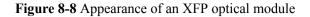
Currently, there is no formal standard for 40G Ethernet. Therefore, a device may not display complete diagnostic information about 40GE optical modules. This is an acceptable fact in the telecommunications industry and does not affect functions of 40GE optical modules.

Figure 8-7 shows the appearance of a CSFP optical module.



Figure 8-7 Appearance of a CSFP optical module

Figure 8-8 shows the appearance of an XFP module.





The SFP+ and XFP optical modules are 10GE hot-pluggable optical modules. Compared with the SFP+ optical modules, the XFP optical modules have a larger caliber.

Figure 8-9 and Figure 8-10 show CFP optical modules for different optical fibers.

Figure 8-9 CFP 100GE optical module (for LC optical fibers)



Figure 8-10 CFP 100GE optical module (for MPO optical fibers)



Figure 8-11 and Figure 8-12 show the appearance of a QSFP28 optical module.

Figure 8-11 Appearance of a QSFP28 optical module (for MPO optical fibers)





Figure 8-12 Appearance of a QSFP28 optical module (for LC optical fibers)

8.2.2 Types of Optical Modules

Optical modules are available in various types to meet diversified requirements.

Classified by transmission rates

Depending on transmission rates, optical modules are classified into 100GE, 40GE, 10GE, FE, and GE optical modules.

Classified by encapsulation types

The higher transmission rate an optical module provides, the more complex structure it has. Optical modules are encapsulated in different modes to provide different structures. Huawei switches support optical modules of the following encapsulation types: CFP, QSFP+, QSFP28, XFP, SFP, eSFP, and SFP+. All optical modules are hot swappable.

- SFP: small form-factor pluggable. SFP optical modules support LC fiber connectors.
- eSFP: enhanced small form-factor pluggable. An eSFP module is an SFP module that supports monitoring of voltage, temperature, bias current, transmit optical power, and receive optical power. Therefore, eSFP is also called SFP sometimes.
- SFP+: small form-factor pluggable plus, SFP with a higher rate. SFP+ optical modules are more sensitive to electromagnetic interference (EMI) because they have a higher rate. To reduce EMI, SFP+ optical modules have more springs than SFP optical modules and the cages for SFP+ modules on a card are tighter.
- XFP: 10 Gigabit small form-factor pluggable. X is the Roman numeral 10, meaning that all XFP optical modules provide a 10 Gbit/s transmission rate. XFP optical modules support LC fiber connectors. They are wider and longer than SFP+ optical modules.
- QSFP+: quad small form-factor pluggable. QSFP+ optical modules support MPO fiber connectors and are larger than SFP+ optical modules.

- CFP: centum form-factor pluggable. The dimensions of a CFP optical module are 144.75 mm x 82 mm x 13.6 mm (L x W x H). CFP is a new optical module standard that can be used in data communication and telecommunications fields.
- QSFP28: with the same interface size as a QSFP+ module. A QSFP28 interface can use a 100GE QSFP28 optical module or a 40GE QSFP+ optical module.

Classified by physical layer standards

Different physical layer standards are defined to allow data transmission in different modes. Therefore, different types of optical modules are produced to comply with these standards. For details, see **Standards compliance** of the specific optical module.

Classified by modes

Optical fibers are classified into single-mode and multimode fibers. Therefore, optical modules are also classified into single-mode and multimode modules to support different optical fibers.

- Single-mode optical modules are used with single-mode fibers. Single-mode fibers support a wide band and large transmission capacity, and are used for long-distance transmission
- Multimode optical modules are used with multimode fibers. Multimode fibers have lower transmission performance than single-mode fibers because of modal dispersion, but their costs are also lower. They are used for small-capacity, shortdistance transmission.

Wavelength division multiplexing modules differ from other optical modules in center wavelengths. A common optical module has a center wavelength of 850 nm, 1310 nm, or 1550 nm, whereas a wavelength division multiplexing module transmits lights with different center wavelengths. Wavelength division multiplexing modules are classified into two types: coarse wavelength division multiplexing (CWDM) and dense wavelength division multiplexing (DWDM). Within the same band, DWDM modules are available in more types and use wavelength resources more efficiently than CWDM modules. DWDM and CWDM modules allow lights with different center wavelengths to be transmitted on one fiber without interfering each other. Therefore, a passive multiplexer can be used to combine the lights into one channel, which is then split into multiple channels by a demultiplexer on the remote end. This reduces the optical fibers required. DWDM and CWDM modules are used for long-distance transmission.

The transmit power of a long-distance optical module is often larger than its overload power. Therefore, when using such optical modules, select optical fibers of an appropriate length to ensure that the actual receive power is smaller than the overload power. If the optical fibers connected to a long-distance optical module are too short, use an optical attenuator to reduce the receive power on the remote optical module. Otherwise, the remote optical module may be burnt. Generally, an optical attenuator is required if an optical module supporting a transmission distance longer than 10 km is used together with short optical fibers.

8.2.3 Parameter Description

Transmit optical power Output optical power of an optical module when it is working properly. When two optical modules are connected, the transmit optical power of one end must be within the range of receive optical power on the other end.

Receive optical power

Average input optical power that the receiver of an optical module can receive within a range of bit error rate (BER = 10^{-12}). The upper limit of this parameter is the overload optical power and the lower limit is the maximum receiver sensitivity. When two optical modules are connected, the receive optical power on one end determines the range of transmit optical power on the other end.

Maximum receiver sensitivity

Minimum average input optical power that the receiver of an optical module can receive within a range of bit error rate (BER = 10^{-12}). When two optical modules are connected, the maximum receiver sensitivity on one end determines the minimum value of transmit optical power on the other end.

Overload optical power

Maximum average input optical power that the receiver of an optical module can receive within a range of bit error rate (BER = 10^{-12}). When two optical modules are connected, the overload optical power on one end determines the maximum transmit optical power on the other end.

Extinction ratio

Minimum ratio of the average optical power with signals transmitted against the average optical power without signals transmitted in complete modulation mode. The extinction ratio indicates the capability of an optical module to identify signal 0 and signal 1. This parameter is a quality indicator for optical modules. Optical modules with a large extinction ratio may not have good quality. Qualified optical modules should have an extinction ratio complying with IEEE 802.3.

Fiber mode

Mode of optical fibers defined based on core diameters and features of optical fibers. Optical fibers are classified into single-mode and multimode fibers. Generally, multimode fibers have large core diameters and severe dispersion, so they transmit optical signals over short distances. Single-mode fibers have low dispersion and can transmit optical signals over long distances.

Modal bandwidth

Bandwidth measured at a point with transmit power several dB lower than that of the point with the peak center wavelength. Modal bandwidth reflects spectrum characteristics of multimode fibers. The higher modal bandwidth a multimode fiber has, the longer transmission distance the fiber supports.

Fiber diameter

Diameter of the core of a fiber. According to international standards for optical fibers, the diameter of a multimode fiber is 62.5 um or 50 um, and the diameter of a single-mode fiber is 9 um. Select optical fibers with diameters supported by the optical modules.

Fiber class

Optical signals with different wavelengths have their best working windows in different optical fibers. To help efficiently adjust wavelengths or dispersion features of optical fibers and change their refractive indexes, the following fiber classes are defined: multimode fiber (G.651), common single-mode fiber (G.652), shifted dispersion fiber (G.653), and non-zero shifted dispersion fiber (G.655). G.651 and G. 652 are commonly used fiber classes. Optical fibers of higher classes support longer transmission distances. When selecting optical fibers for optical modules, determine the classes of fibers based on the required transmission distances.

Connector type Type of the interface on an optical module to accommodate a fiber. Commonly used

connector types are LC (applicable to all the SFP, SFP+, and XFP modules), SC, and MPO (applicable to 150~m QSFP+ and CXP modules). Select optical fibers with

connectors supported by the optical modules.

Transmission distance Maximum distance over which optical signals can transmit. Optical signals sent from

different types of sources can transmit over different distances due to negative effects of optical fibers, such as dispersion and attenuation. When connecting optical interfaces, select optical modules and fibers based on the maximum signal

transmission distance.

Interface rate Maximum rate of electrical signals that an optical component can transmit without bit

errors. The interface rates defined in Ethernet standards include 125 Mbit/s, 1.25 Gbit/s, 10.3125 Gbit/s, and 41.25 Gbit/s. When connecting optical interfaces, select

optical modules and fibers based on the maximum signal transmission rate.

Center wavelength Wavelength measured at the midpoint of the half-amplitude line in the transmit

spectrum. Two connected optical modules must have the same center wavelength.

MSA Multi-Source Agreement, a non-profit organization jointly established by optical

module manufacturers. This agreement defines the structure and dimensions of optical transceivers by referring to Optical Internetworking Forum (OIF) and International

Telecommunication Union (ITU) standards.

8.2.4 How to View Optical Module Parameters

Viewing the Hardware Description

If you know the model or type of an optical module, you can view the section "Pluggable Modules for Interfaces" in the *Hardware Description* to look up parameters of the optical module, including the center wavelength, transmission distance, fiber types supported, receive optical power, and transmit optical power.

Using a Command

If an optical module is installed in a running switch, you can run the **display transceiver** command to view parameters of the optical module, including the center wavelength, transmission distance, fiber types supported, receive optical power, and transmit optical power.

8.2.5 Rules for Optical Module Interoperation

Interoperation Rules

Optical modules with the same standards can interoperate with each other. The standards define the rate, wavelength, and transmission distance of optical modules, but not their encapsulation modes (two interoperated optical modules can have different encapsulation modes).

If you need to achieve interoperability between optical modules with different standards, contact technical support personnel.

When Huawei switches are connected to other products such as routers, comply with the preceding optical module interoperation rules.

Standards Description

The following describes the standards, using 1000BASE-LX10 as an example:

- 1000 indicates the rate (1000 Mbit/s, in this case). Other rates include 10 Mbit/s, 100 Mbit/s, 10 Gbit/s, 40 Gbit/s, and 100 Gbit/s.
- BASE indicates baseband transmission.
- L represents a center wavelength of the laser. Currently, the following center wavelengths are available: S (short wavelength: 850 nm), L (long wavelength: 1310 nm), E (extra long wavelength: 1550 nm), and B (single-fiber bidirectional long wavelength).
- X represents the encoding format. The encoding formats include T (twisted pair), X (8B/10B), R (64B/66B), and W (WIS).
- 10 indicates the number of channels. Currently, the value can be 4 or 10. If there is no number, the value is 1.

NOTE

This example provides the definitions in IEEE standards, which are not applicable to all optical modules, for example, non-standard optical modules.

The following organizations or agreements define standards related to optical modules:

- IEEE 802.3, which defines MAC and PHY standards
- Small Form Factor (SFF) committee or Multi-Source Agreements (MSAs), which define optical module hardware, software, and structure standards

Interoperability of 40GE and 100GE Optical Modules

Huawei S series switches support the following types of 40GE and 100GE optical modules:

- 40GE QSFP+ optical modules
- 40GE CFP optical modules
- 100GE CFP optical modules
- 100GE QSFP28 optical modules

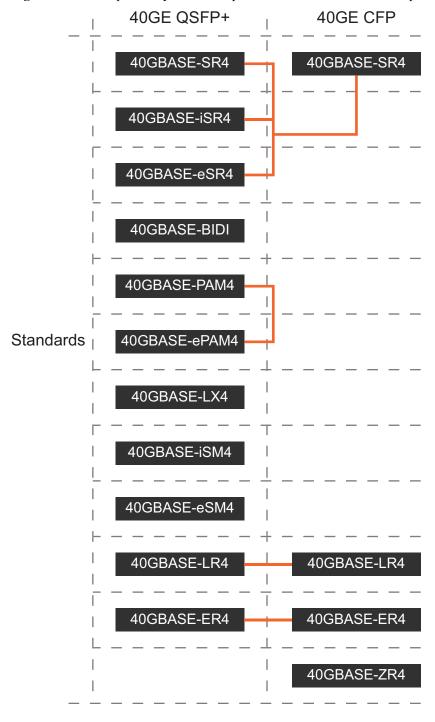


Figure 8-13 Interoperability of 40GE optical modules in different encapsulation modes

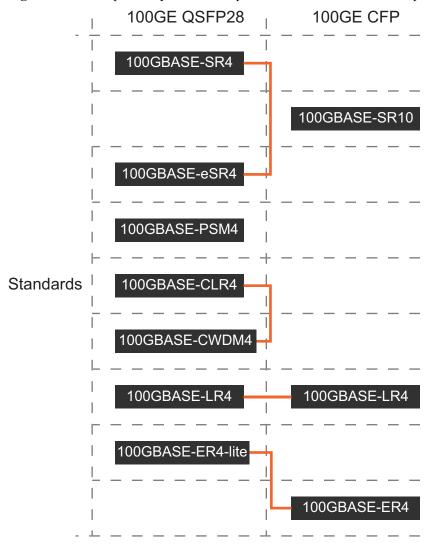


Figure 8-14 Interoperability of 100GE optical modules in different encapsulation modes

Optical modules complying with the standards connected in the preceding figures can interoperate with each other.

iSR4 and eSR4 are non-standard formats derived from SR4, and support interoperation with SR4.

A 40GBASE-PAM4 optical module can interoperate with a 40GBASE-ePAM4 optical module.

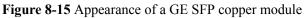
A 100GBASE-CLR4 optical module can interoperate with a 100GBASE-CWDM4 optical module.

A 100GBASE-ER4-lite optical module can interoperate with a 100GBASE-ER4 optical module, at a maximum distance of 30 km.

8.3 Understanding Copper Modules

Copper modules are also called RJ45 modules. Unlike optical modules, copper modules do not perform electrical-optical conversion. When two optical interfaces have copper modules installed, the interfaces can be connected using a copper cable. Currently, Huawei offers only GE copper modules with RJ45 interfaces. GE copper modules work with Category 5 network cables, comply with 1000BASE-T (IEEE 802.3ab), and support a maximum transmission distance of 100 m.

Figure 8-15 shows a GE SFP copper module.





8.4 FE SFP/eSFP Optical Modules

8.4.1 SFP-FE-SX-MM1310

Table 8-1 Technical specifications

Item	Description
Transceiver form factor	SFP
Transmission speed	FE
Center wavelength (nm)	1310
Standards compliance	100BASE-FX
Connector type	LC
Applicable cable and maximum transmission distance	Multimode fiber (50 μm or 62.5 μm diameter): 2 km
Transmit power (dBm)	-19.0 to -14.0
Maximum receiver sensitivity (dBm)	-30.0
Overload power (dBm)	-14.0
Extinction ratio (dB)	10

Item	Description
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315233

8.4.2 eSFP-FE-LX-SM1310

Table 8-2 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	FE
Center wavelength (nm)	1310
Standards compliance	Non-standard
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 15 km
Transmit power (dBm)	-15.0 to -8.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-8.0
Extinction ratio (dB)	8.2
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315205

8.4.3 S-SFP-FE-LH40-SM1310

 Table 8-3 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	FE
Center wavelength (nm)	1310

Item	Description
Standards compliance	Non-standard
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 40 km
Transmit power (dBm)	-5.0 to 0
Maximum receiver sensitivity (dBm)	-37.0
Overload power (dBm)	-10.0
Extinction ratio (dB)	10.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02317344

8.4.4 S-SFP-FE-LH80-SM1550

 Table 8-4 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	FE
Center wavelength (nm)	1550
Standards compliance	Non-standard
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	-5.0 to 0
Maximum receiver sensitivity (dBm)	-37.0
Overload power (dBm)	-10.0
Extinction ratio (dB)	10.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02317345

8.4.5 SFP-FE-LX-SM1310-BIDI (Single-Fiber-Bidirectional Module)

Table 8-5 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	FE
Center wavelength (nm)	Rx: 1550/Tx: 1310
Standards compliance	100BASE-BX
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 15 km
Transmit power (dBm)	-15.0 to -8.0
Maximum receiver sensitivity (dBm)	-32.0
Overload power (dBm)	-8.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315203

NOTE

BIDI optical modules must be used in pairs. For example, SFP-FE-LX-SM1310-BIDI must be used with SFP-FE-LX-SM1550-BIDI.

8.4.6 SFP-FE-LX-SM1550-BIDI (Single-Fiber-Bidirectional Module)

Table 8-6 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	FE
Center wavelength (nm)	Rx: 1310/Tx: 1550
Standards compliance	100BASE-BX

Item	Description
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 15 km
Transmit power (dBm)	-15.0 to -8.0
Maximum receiver sensitivity (dBm)	-32.0
Overload power (dBm)	-8.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315202

BIDI optical modules must be used in pairs. For example, SFP-FE-LX-SM1550-BIDI must be used with SFP-FE-LX-SM1310-BIDI.

8.5 GE eSFP Optical Modules

8.5.1 eSFP-GE-SX-MM850

Table 8-7 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	850
Standards compliance	1000BASE-SX
Connector type	LC

Item	Description
Applicable cable and maximum transmission	 Multimode fiber (with modal bandwidth of 160 MHz*km and diameter of 62.5 μm): 0.22 km
distance	Multimode fiber (OM1): 0.275 km
	 Multimode fiber (with modal bandwidth of 400 MHz*km and diameter of 50 μm): 0.5 km
	Multimode fiber (OM2): 0.55 km
	Multimode fiber (OM3): 1 km
Transmit power (dBm)	-9.5 to -2.5
Maximum receiver sensitivity (dBm)	-17.0
Overload power (dBm)	0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315204

8.5.2 SFP-GE-LX-SM1310

 Table 8-8 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1310
Standards compliance	1000BASE-LX10/LH
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 10 km
Transmit power (dBm)	-9.0 to -3.0
Maximum receiver sensitivity (dBm)	-20.0
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)

Item	Description
Part number	02315200

8.5.3 S-SFP-GE-LH40-SM1310

Table 8-9 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	1310
Standards compliance	1000BASE-EX (non-standard)
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 40 km
Transmit power (dBm)	-5.0 to 0
Maximum receiver sensitivity (dBm)	-23
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02317346

8.5.4 S-SFP-GE-LH40-SM1550

 Table 8-10 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	1550
Standards compliance	Non-standard

Item	Description
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 40 km
Transmit power (dBm)	-5.0 to 0
Maximum receiver sensitivity (dBm)	-22
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02317347

8.5.5 S-SFP-GE-LH80-SM1550

 Table 8-11 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	1550
Standards compliance	1000BASE-ZX
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	-2.0 to +5.0
Maximum receiver sensitivity (dBm)	-23
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02317348

8.5.6 eSFP-GE-ZX100-SM1550

Table 8-12 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1550
Standards compliance	1000BASE-ZX
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 100 km
Transmit power (dBm)	0 to 5
Maximum receiver sensitivity (dBm)	-30.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	9.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315206

8.5.7 SFP-GE-LX-SM1310-BIDI (Single-Fiber-Bidirectional Module)

Table 8-13 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1490/Tx: 1310
Standards compliance	1000BASE-BX10
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 10 km

Item	Description
Transmit power (dBm)	-9.0 to -3.0
Maximum receiver sensitivity (dBm)	-19.5
Overload power (dBm)	-3.0
Extinction ratio (dB)	6
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315285

\square NOTE

Single-fiber bidirectional (BIDI) optical modules must be used in pairs. For example, SFP-GE-LX-SM1310-BIDI must be used with SFP-GE-LX-SM1490-BIDI.

8.5.8 SFP-GE-LX-SM1490-BIDI (Single-Fiber-Bidirectional Module)

Table 8-14 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1310/Tx: 1490
Standards compliance	1000BASE-BX10
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 10 km
Transmit power (dBm)	-9.0 to -3.0
Maximum receiver sensitivity (dBm)	-19.5
Overload power (dBm)	-3.0
Extinction ratio (dB)	6
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02315286

Single-fiber bidirectional (BIDI) optical modules must be used in pairs. For example, SFP-GE-LX-SM1490-BIDI must be used with SFP-GE-LX-SM1310-BIDI.

8.5.9 LE2MGSC40DE0 (Single-Fiber-Bidirectional Module)

Table 8-15 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1490/Tx: 1310
Standards compliance	1000BASE-BX
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 40 km
Transmit power (dBm)	-2.0 to +3.0
Maximum receiver sensitivity (dBm)	-23
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310KVV

NOTE

Single-fiber bidirectional (BIDI) optical modules must be used in pairs. For example, LE2MGSC40DE0 must be used with LE2MGSC40ED0.

8.5.10 LE2MGSC40ED0 (Single-Fiber-Bidirectional Module)

Table 8-16 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1310/Tx: 1490

Item	Description
Standards compliance	1000BASE-BX
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 40 km
Transmit power (dBm)	-2.0 to +3.0
Maximum receiver sensitivity (dBm)	-23
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310KVU

\square NOTE

Single-fiber bidirectional (BIDI) optical modules must be used in pairs. For example, LE2MGSC40ED0 must be used with LE2MGSC40DE0.

8.5.11 SFP-GE-ZBXD1 (Single-Fiber-Bidirectional Module)

Table 8-17 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1490/Tx: 1570
Standards compliance	Non-standard
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	-2.0 to +4.0
Maximum receiver sensitivity (dBm)	-26
Overload power (dBm)	-3.0
Extinction ratio (dB)	9

Item	Description
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02311DDB

This module can only be used on a switch running V200R008C00 or a later version. A switch running an earlier version may fail to obtain information about this module.

Single-fiber bidirectional (BIDI) optical modules must be used in pairs. For example, SFP-GE-ZBXD1 must be used with SFP-GE-ZBXU1.

8.5.12 SFP-GE-ZBXU1 (Single-Fiber-Bidirectional Module)

Table 8-18 Technical specifications

Item	Description
Transceiver type	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1570/Tx: 1490
Standards compliance	Non-standard
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	-2.0 to +4.0
Maximum receiver sensitivity (dBm)	-26
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02311DDC

NOTE

This module can only be used on a switch running V200R008C00 or a later version. A switch running an earlier version may fail to obtain information about this module.

Single-fiber bidirectional (BIDI) optical modules must be used in pairs. For example, SFP-GE-ZBXU1 must be used with SFP-GE-ZBXD1.

8.5.13 SFP-GE-BXU1-SC (Single-Fiber-Bidirectional Module)

Table 8-19 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	Rx: 1310/Tx: 1490
Standards compliance	Non-standard
Connector type	SC
Applicable cable and maximum transmission distance	Single-mode fiber: 10 km
Transmit power (dBm)	-9.0 to -3.0
Maximum receiver sensitivity (dBm)	-19.5
Overload power (dBm)	-3.0
Extinction ratio (dB)	9
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310TQH

8.6 GE-CWDM eSFP Optical Modules

8.6.1 CWDM-SFPGE-1471

Table 8-20 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1471
Standards compliance	GE-CWDM
Connector type	LC

Item	Description
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310LPN

8.6.2 CWDM-SFPGE-1491

 Table 8-21 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1491
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310LPK

8.6.3 CWDM-SFPGE-1511

 Table 8-22 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1511
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310LPH

8.6.4 CWDM-SFPGE-1531

 Table 8-23 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1531
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0

Item	Description
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310LPL

8.6.5 CWDM-SFPGE-1551

Table 8-24 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1551
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02312AXN

8.6.6 CWDM-SFPGE-1571

 Table 8-25 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1571
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02312AXM

8.6.7 CWDM-SFPGE-1591

Table 8-26 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1591
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0

Item	Description
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02312AXK

8.6.8 CWDM-SFPGE-1611

 Table 8-27 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1611
Standards compliance	GE-CWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 80 km
Transmit power (dBm)	0 to 5.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-9.0
Extinction ratio (dB)	8.5
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310LPJ

8.7 GE-DWDM eSFP Optical Modules

8.7.1 DWDM-SFPGE-1560-61

Table 8-28 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed	GE
Center wavelength (nm)	1560.61
Standards compliance	GE-DWDM
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 120 km
Transmit power (dBm)	0 to 4.0
Maximum receiver sensitivity (dBm)	-28.0
Overload power (dBm)	-8.0
Extinction ratio (dB)	8.2
Operating temperature	0°C to 70°C (32°F to 158°F)
Part number	02310LLE

8.8 GE SFP Copper Modules

8.8.1 SFP-1000BaseT

Table 8-29 Technical specifications

Item	Description
Transceiver form factor	SFP
Transmission speed	The transmission speed varies depending on the port where the copper transceiver module is used.
Standards compliance	1000BASE-T
Connector type	RJ45
Surge protection	Common mode: ±1 kV
Applicable cable and maximum transmission distance	Ethernet cable: 0.1 km

Item	Description
Part number	02314171

8.9 SFP Stack Optical Modules

8.9.1 SFP-6GE-LR

Table 8-30 Technical specifications

Item	Description
Transceiver form factor	SFP+
Transmission speed	6GE
Center wavelength (nm)	1310
Standards compliance	6GBASE-LR (non-standard)
Connector type	LC
Applicable cable and maximum transmission distance	Single-mode fiber: 2 km
Transmit power (dBm)	-8.4 to +0.5
Maximum receiver sensitivity (dBm)	-13.8
Overload power (dBm)	0.5
Extinction ratio (dB)	3.5
Operating temperature	-40°C to +85°C (-40°F to +185°F)
Part number	02310SRD

8.10 GPON Optical Modules

8.10.1 H87MMA5671A2

 Table 8-31 Technical specifications

Item	Description
Transceiver form factor	eSFP
Transmission speed (Gbit/s)	Rx: 2.488/Tx: 1.244 NOTE In practice, the maximum upstream service bandwidth is 1.1 Gbit/s and downlink service bandwidth is 2.3 Gbit/s.
Center wavelength (nm)	Rx: 1490/Tx: 1310
Standards compliance	GPON CLASS B+
Connector type	SC
Applicable cable and maximum transmission distance	Single-mode fiber: 20 km
Transmit power (dBm)	0.5 to 5.0
Maximum receiver sensitivity (dBm)	-27
Overload power (dBm)	-8.0
Extinction ratio (dB)	10
Operating temperature	-40°C to +85°C (-40°F to +185°F)
Part number	03031QHU

Ensure that the optical power is not overloaded. Otherwise, the optical module may be burnt. This module can only be used on a switch running V200R012C00 or a later version.