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Cisco SFP Modules for Gigabit Ethernet Applications

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Cost-effective Small Form-Factor Pluggable (SFP) transceivers for Gigabit Ethernet applications

Product overview

The industry-standard Cisco Small Form-Factor Pluggable (SFP) Gigabit Interface Converter (Figure 1) links your switches and routers to the network. The hot-swappable input/output device plugs into a Gigabit Ethernet port or slot. Optical and copper models can be used on a wide variety of Cisco products and intermixed in combinations of 1000BASE-T, 1000BASE-SX, 1000BASE-LX/LH, 1000BASE-EX, 1000BASE-ZX, or 1000BASE-BX10-D/U on a port-by-port basis.

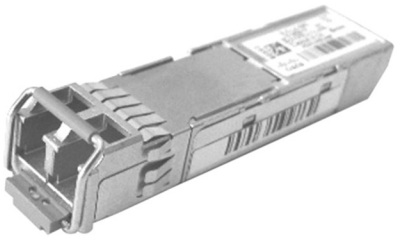


Figure 1.
Cisco Optical Gigabit Ethernet SFP

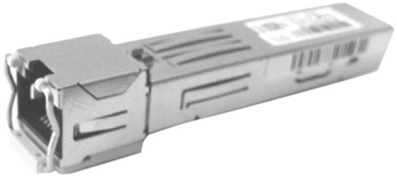


Figure 2.
Cisco 1000BASE-T Copper SFP



Figure 3.
Cisco 2-Channel 1000BASE-BX Optical SFP

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Features and benefits

- Hot swappable to maximize uptime and simplify serviceability
- Flexibility of media and interface choice on a port-by-port basis, so you can “pay as you populate”
- Robust design for enhanced reliability
- Supports Digital Optical Monitoring (DOM) capability

1000BASE-T SFP for copper networks

The 1000BASE-T SFP operates on standard Category 5 unshielded twisted-pair copper cabling of link lengths up to 100 m (328 ft). Cisco 1000BASE-T SFP modules support 10/100/1000 auto negotiation and Auto MDI/MDIX.

1000BASE-SX SFP for multimode fiber only

The 1000BASE-SX SFP, compatible with the IEEE 802.3z 1000BASE-SX standard, operates on legacy 50 µm multimode fiber links up to 550 m and on 62.5 µm Fiber Distributed Data Interface (FDDI)-grade multimode fibers up to 220 m. It can support up to 1km over laser-optimized 50 µm multimode fiber cable.

1000BASE-LX/LH SFP for both multimode and single-mode fibers

The 1000BASE-LX/LH SFP, compatible with the IEEE 802.3z 1000BASE-LX standard, operates on standard single-mode fiber-optic link spans of up to 10 km and up to 550 m on any multimode fibers. When used over legacy multimode fiber type, the transmitter should be coupled through a mode conditioning patch cable. For details on this implementation, refer to https://www.cisco.com/en/US/prod/collateral/modules/ps5455/product_bulletin_c25-530836.html.

1000BASE-EX SFP for long-reach single-mode fibers

The 1000BASE-EX SFP operates on standard single-mode fiber-optic link spans of up to 40 km in length. A 5-dB inline optical attenuator should be inserted between the fiber-optic cable and the receiving port on the SFP at each end of the link for back-to-back connectivity.

1000BASE-ZX SFP for long-reach single-mode fibers

The 1000BASE-ZX SFP operates on standard single-mode fiber-optic link spans of up to approximately 70 km in length. The SFP provides an optical link budget of 21 dB, but the precise link span length depends on multiple factors such as fiber quality, number of splices, and connectors.

When shorter distances of Single-Mode Fiber (SMF) are used, it might be necessary to insert an inline optical attenuator in the link to avoid overloading the receiver. A 10-dB inline optical attenuator should be inserted between the fiber-optic cable plant and the receiving port on the SFP at each end of the link whenever the fiber-optic cable span loss is less than 8 dB.

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100/1000BASE-LX SFP for long-reach single-mode fibers

The dual-rate 100M/1G 10Km SFP is interoperable with the IEEE 100BASE-LX and 1000BASE-LX/LH standards.

The GLC-GE-DR-LX SFP also supports Digital Optical Monitoring (DOM) functions according to the industry-standard SFF-8472 Multisource Agreement (MSA). This feature gives the end user the ability to monitor real-time parameters of the SFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage.

SFP Operation at 100M

The GLC-GE-DR-LX SFP can interoperate with other 100M SFPs/interfaces as long as those are based on 100BASE-LX10 standard. A 5dB attenuator is needed on the path of dual-rate SFP Tx and 100BASE-LX10 interface Rx. No attenuator is needed on the other fiber strand.

SFP Operation at 1G

The GLC-GE-DR-LX SFP can interoperate with other 1G SFPs/interfaces as long as those are based on 1000BASE-LX/LH standard. No attenuator is needed in any fiber strand.

1000BASE-BX10-D and 1000BASE-BX10-U SFP for single-fiber bidirectional applications

The 1000BASE-BX-D and 1000BASE-BX-U SFPs, compatible with the IEEE 802.3ah 1000BASE-BX10-D and 1000BASE-BX10-U standards, operate on a single strand of standard SMF.

A 1000BASE-BX10-D device is always connected to a 1000BASE-BX10-U device with a single strand of standard SMF with an operating transmission range up to 10 km. The communication over a single strand of fiber is achieved by separating the transmission wavelength of the two devices as depicted in Figure 2: 1000BASE-BX10-D transmits a 1490-nm channel and receives a 1310-nm signal, whereas 1000BASE-BX10-U transmits at a 1310-nm wavelength and receives a 1490-nm signal. As shown, the presence of a Wavelength-Division Multiplexing (WDM) splitter integrated into the SFP to split the 1310-nm and 1490-nm light paths.

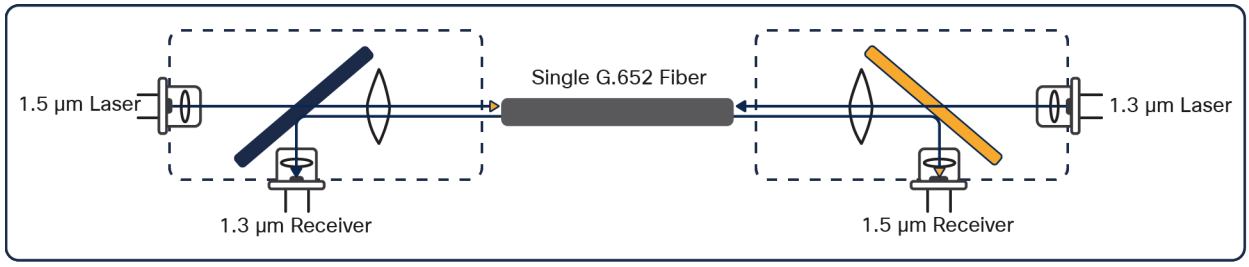


Figure 4.
Bidirectional transmission of a single strand of SMF

The GLC-BX-D and GLC-BX-U SFPs also support Digital Optical Monitoring (DOM) functions according to the industry-standard SFF-8472 Multisource Agreement (MSA). This feature gives the end user the ability to monitor real-time parameters of the SFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage.

The GLC-BX-D-I and GLC-BX-U-I are the Industrial temperature rated (IND) counterparts of GLC-BX-D and GLC-BX-U SFPS. This allows link operation in harsh environmental conditions where the module case temperature can be in the range -40° C to 85° C.

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2-Channel 1000BASE-BX10-D for single-fiber bidirectional applications

The 2-channel 1000BASE-BX-D SFP module, also known as Compact SFP, integrates two IEEE 802.3ah 1000BASE-BX10-D interfaces in one SFP module. The GLC-2BX-D or GLC-2BX-D-I is always connected to two 1000BASE-BX10-U interfaces over two single strands of standard SMF with an operating transmission range up to 10km.

GLC-2BX-D or GLC-2BX-D-I is designed to connect to any standard-based Customer Premises Equipment (CPE) in FTTx links (Figure 3).

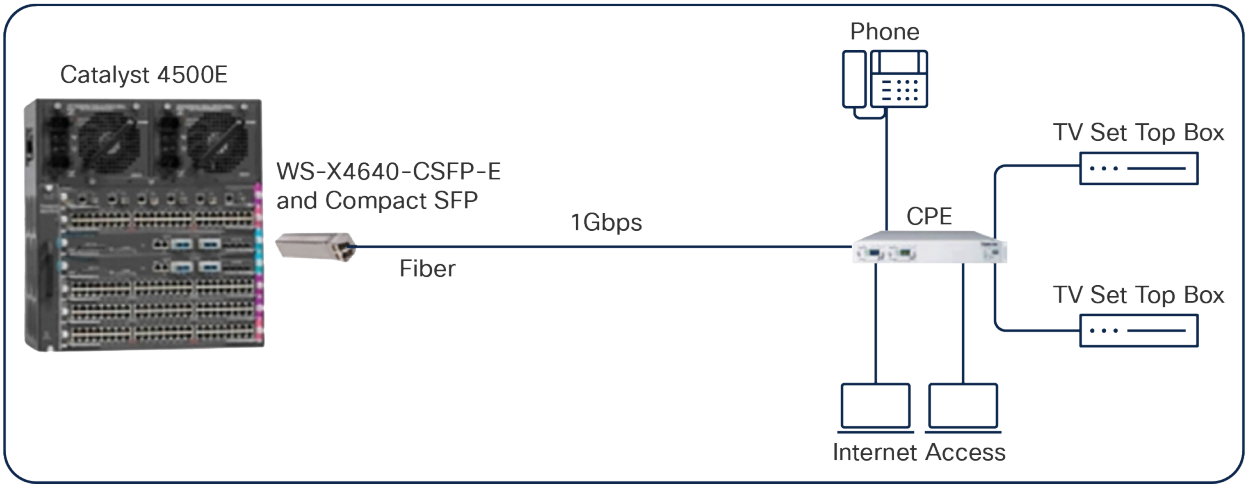


Figure 5.
Compact SFP deployment with Cisco Catalyst 4500

1000BASE-BX40-D and 1000BASE-BX40-U for single-fiber bidirectional applications

The Cisco GLC-BX40-D-I, GLC-BX40-DA-I, and GLC-BX40-U-I SFPs operate on a single strand of standard SMF.

A GLC-BX40-D-I or GLC-BX40-DA-I device connects to a GLC-BX40-U-I device with a single strand of standard SMF with an operating transmission range up to 40 km.

The communication over a single strand of fiber is achieved by separating the transmission wavelength of the two devices. The GLC-BX40-D-I, GLC-BX40-DA-I, and GLC-BX40-U-I SFPs also support Digital Optical Monitoring (DOM) functions according to the industry-standard SFF-8472 Multisource Agreement (MSA). This feature gives the end user the ability to monitor real-time parameters of the SFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage.

1000BASE-BX80-D and 1000BASE-BX80-U for single-fiber bidirectional applications

The Cisco GLC-BX80-D-I and GLC-BX80-U-I SFPs operate on a single strand of standard SMF.

A GLC-BX80-D-I device is always connected to a GLC-BX80-U-I device with a single strand of standard SMF with an operating transmission range up to 80 km.

The communication over a single strand of fiber is achieved by separating the transmission wavelength of the two devices. The GLC-BX80-D-I and GLC-BX80-U-I SFPs also support Digital Optical Monitoring (DOM) functions according to the industry-standard SFF-8472 Multisource Agreement (MSA). This feature gives the end user the ability to monitor real-time parameters of the SFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage.

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1000BASE-X modules for 10G ports

1000BASE-SX SFP for multimode fiber only

The SFP-1G-SX module operates in 10G, 10/25G dual rate and 10/25/50G tri-rate ports of Cisco switches and routers but provides 1G connectivity. The SFP-1G-SX interoperates with 1000BASE-SX modules.

The SFP-1G-SX module will only operate in 10G capable ports and will not operate in 1G only ports.

1000BASE-LX/LH SFP for single mode fiber and multimode fiber

THE SFP-1G-LH module operates in 10G, 10/25G dual rate and 10/25/50G tri-rate ports of Cisco switches and routers but provides 1G connectivity. The SFP-1G-LH interoperates with 1000BASE-LX/LH modules.

The SFP-1G-LH module will only operate in 10G capable ports and will not operate in 1G only ports.

1000BASE-T module for 10G ports

1000BASE-T/100BASE-T/10BASE-T module provides up to 100m of 1000/100M connectivity over Cat 5e or better, and up to 100m of 10M connectivity over Cat 3 or better unshielded twisted pair cabling.

The SFP-1G-T-X module operates in 10G, 10/25G dual rate and 10/25/50G tri-rate ports of Cisco switches and routers but provides 1G connectivity.

The SFP-1G-T-X module will only operate in 10G capable ports and will not operate in 1G only ports.

Platform support

The Cisco 1-Gbps SFPs are supported across a variety of Cisco networking equipment*. For more details, refer to the document SFP Compatibility Matrix at: https://www.cisco.com/en/US/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6981.pdf

Table 1. Cisco Platforms

Cisco Platforms	
• ASA5500 Series Appliances • ASR 901 and 903 Series Routers • ASR 1000, 9000, and 9000v Series Routers • Catalyst Express 500 and Express 520 • Catalyst 2350 and 2360 Series • Catalyst 2900, 2940, 2950, 2960, 2960-Plus, 2960-C, 2960-S, 2960-SF, 2960-X Series • Catalyst 2970 and 2975 Series • Catalyst 3000 and 3100 Blade Switches • Catalyst 3500XL Series • Catalyst 3550, 3560, 3560-C, 3560-E, 3560-X Series • Catalyst 3750-E Series, 3750 Metro, 3750-X Series • Catalyst 3850 Series • Catalyst 4500 and 4500-X Series • Catalyst 4900 Series • Catalyst 6000 Series • Catalyst 6800 Series • Cisco 1941 Series Router	• Cisco uBR7200 Series • Cisco 7200, 7300, 7500, and 7600 Series Routers • Cisco 10000 and uBR 10000 Series Routers • Cisco 10700 Series Internet Router • Cisco 12000 Series Router • Cisco 2000 Connected Grid Router Series • Cisco 2500 Connected Grid Switch Series • Cisco IE2000 and IE2000U Series • Cisco IE3010 Series • Cisco MDS 9000 • Cisco ME 2400 • Cisco ME 2600X • Cisco ME 3400 • Cisco ME 3600X and ME 3800X • Cisco ME 4600 and ME 4900 Series • Cisco ME 6500 Series • Cisco MWR 2941 Mobile Wireless Router • CRS Router Series

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Cisco Platforms	
• Cisco 2600, 2800, 2900 Series Router • Cisco 3200, 3600, 3700 Series Router • Cisco 4400 Series Router • Cisco 5700 Series Wireless LAN Controller • Cisco 6400 Universal Access Router	• CSS 11500 Series • Cisco RF Gateway Series • NAM 2200 Series Appliances • Nexus 2000, 3000, 4000, 5000, 7000, 9000, 9300, 9500 (modular) Series

* Additional platforms may continually be added; please check the compatibility matrix for the latest information and for the Cisco compatible operating system for each platform.

Product specifications

Cabling and connectors

Connectors include the following:

- Dual LC/PC connector (1000BASE-SX, 1000BASE-LX/LH, 1000BASE-EX and 1000BASE-ZX)
- Single LC/PC connector (1000BASE-BX-D and 1000BASE-BX-U)
- RJ-45 connector (1000BASE-T)

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.

Table 2 provides cabling specifications for the SFPs that you install in the Gigabit Ethernet port. Note that all SFP ports have LC-type connectors, and the minimum cable distance for all SFPs listed (multimode and single-mode fiber) is 6.5 feet (2 m).

Table 2. SFP Port cabling specifications

Product	Wavelength (nm)	Fiber Type	Core Size (µm)	Modal Bandwidth (MHz* Km) ***	Operating Distance (m)
1000BASE-SX	850	MMF	62.5	160 (FDDI-grade)	220 (722 ft)
			62.5	200 (OM1)	275 (902 ft)
			50	400 (400/400)	500 (1,640 ft)
			50	500 (OM2)	550 (1,804 ft)
			50	2000 (OM3)	1000 (3281 ft)
			50	4700 (OM4)	1000 (3281 ft)
			50	4700 (OM5)	1000 (3281 ft)
1000BASE-LX/LH	1310	MMF*	62.5	500	550 (1,804 ft)
			50	400	550 (1,804 ft)
			50	500	550 (1,804 ft)

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Product	Wavelength (nm)	Fiber Type	Core Size (µm)	Modal Bandwidth (MHz* Km) ***	Operating Distance (m)
		SMF	-**	-	10,000 (32,821 ft)
1000BASE-EX	1310	SMF	-**	-	40,000 (131,234 ft)
1000BASE-ZX	1550	SMF	-	-	Approximately 70 km depending on link loss
GLC-GE-DR-LX	1310	SMF	-**	-	10,000 (32,821 ft)
1000BASE-BX-U	1310	SMF	-**	-	10,000 (32,821 ft)
1000BASE-BX-D	1490	SMF	-**	-	10,000 (32,821 ft)
GLC-BX40-D-I	1550	SMF	-**	-	40,000 (131,234 ft)
GLC-BX40-DA-I	1490	SMF	-**	-	40,000 (131,234 ft)
GLC-BX40-U-I	1310	SMF	-**	-	40,000 (131,234 ft)
GLC-BX80-D-I	1570	SMF	-**	-	80,000 (262,467 ft)
GLC-BX80-U-I	1490	SMF	-**	-	80,000 (262,467 ft)

* A mode-conditioning patch cord, as specified by the IEEE standard, is required regardless of the span length. Note how the mode conditioning patch cord for 62.5-µm fibers has a different specification from the mode-conditioning patch cord for 50-µm fibers.

** ITU-T G.652 SMF as specified by the IEEE 802.3z standard.

*** Specified at transmission wavelength.

Optical specifications

Table 3 specifies the optical parameters for the SFPs. Both receiver power and channel insertion loss specifications must be met for guaranteed operation.

Table 3. Main optical parameters

Product	Transmit Power Range (dBm)	Receive Power Range (dBm)	Maximum Channel insertion loss in dB (by fiber type)*	Transmit and Receive Wavelength Range (nm)
1000BASE-SX	-3 to -9.5	0 to -17	2.4 (FDDI-grade) 2.6 (OM1) 3.4 (400/400) 3.6 (OM2) 5 (OM3) 5 (OM4) 5 (OM5)	770 to 860
1000BASE-LX/LH	-3 to -9.5	-3 to -20	2.4 (any MMF) 6 (G.652 SMF)	1270 to 1355
1000BASE-EX	+3 to -1	+1 to -22	18 (G.652 SMF)	1290 to 1335

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Product	Transmit Power Range (dBm)	Receive Power Range (dBm)	Maximum Channel insertion loss in dB (by fiber type)*	Transmit and Receive Wavelength Range (nm)
1000BASE-ZX	+5 to 0	-3 to -23	21 (any SMF)	1500 to 1580
GLC-GE-DR-LX	-9.5 to -3	-25 to -3	6 (G.652 SMF)	1260 to 1360
1000BASE-BX10-D	-3 to -9	-3 to -19.5	5.5 (G.652 SMF)	1480 to 1500 (Transmit) 1260 to 1360 (Receive)
1000BASE-BX10-U	-3 to -9	-3 to -19.5	6 (G.652 SMF)	1260 to 1360 (Transmit) 1480 to 1500 (Receive)
GLC-BX40-D-I	-5 to +3	-25 to +3	19 (G.652 SMF)	1540 to 1560 (Transmit) 1260 to 1360 (Receive)
GLC-BX40-DA-I	-5 to +3	-25 to +3	19 (G.652 SMF)	1480 to 1500 (Transmit) 1260 to 1360 (Receive)
GLC-BX40-U-I	-5 to +3	-25 to +3	19 (G.652 SMF)	1260 to 1360 (Transmit) 1480 to 1600 (Receive)
GLC-BX80-D-I	-2 to +3	-27 to +3	23 (G.652 SMF)	1560 to 1580 (Transmit) 1470 to 1510 (Receive)
GLC-BX80-U-I	-2 to +3	-27 to +3	23 (G.652 SMF)	1480 to 1500 (Transmit) 1550 to 1620 (Receive)

* Maximum channel insertion loss is defined for maximum distance guaranteed as specified in Table 1 and by fiber type. When links are deployed over shorter distances, additional channel insertion loss may be allowed.

Dimensions

Dimensions (H x W x D): 8.5 x 13.4 x 56.5 mm. Cisco SFPs typically weigh 75 grams or less.

Environmental conditions and power requirements

Operating temperature range:

- Commercial temperature range (COM): 0 to 70° C (32 to 158° F)
- Extended temperature range (EXT): -5° C to 85° C (23 to 185° F)
- Industrial temperature range (IND): -40 to 85° C (-40 to 185° F)
- Storage temperature range: -40 to 85° C (-40 to 185° F)

Cisco SFP modules typically consume up to 1W per SFP port., The Compact SFP (GLC-2BX-D) consumes up to 1.5W. The SFP-1G-LH, SFP-1G-SX and SFP-1G-T-X consume up to 2W.

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Table 4 lists temperature range and DOM support information for the SFPs.

Table 4. Temperature range and DOM support

Product Number	Temperature Range	DOM
GLC-T	COM	n/a
GLC-TE	EXT	n/a
GLC-T-RGD	IND	n/a
SFP-GE-T	EXT	n/a
GLC-SX-MMD	EXT	Yes
GLC-SX-MM-RGD	IND	Yes
GLC-LH-SMD	EXT	Yes
GLC-LX-SM-RGD	IND	Yes
GLC-EX-SMD	EXT	Yes
GLC-ZX-SMD	EXT	Yes
GLC-ZX-SM-RGD	IND	Yes
GLC-GE-DR-LX	EXT	Yes
GLC-BX-U	COM	Yes
GLC-BX-D	COM	Yes
GLC-BX-U-I	IND	Yes
GLC-BX-D-I	IND	Yes
GLC-2BX-D	COM	Yes
GLC-2BX-D-I	IND	Yes
GLC-BX40-D-I	IND	Yes
GLC-BX40-DA-I	IND	Yes
GLC-BX40-U-I	IND	Yes
GLC-BX80-D-I	IND	Yes
GLC-BX80-U-I	IND	Yes
SFP-1G-LH	COM	Yes
SFP-1G-SX	COM	Yes
SFP-1G-T-X	EXT	n/a

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Ordering information

To place an order, refer to Table 5 and visit the Cisco Ordering Home Page

Table 5. Ordering information

Product Description	Product Number
1000BASE-T standard	GLC-T
1000BASE-T standard	GLC-TE
1000BASE-T standard	GLC-T-RGD
1000BASE-T NEBS 3 ESD	SFP-GE-T
1000BASE-SX short wavelength; with DOM	GLC-SX-MMD
1000BASE-SX short wavelength; rugged	GLC-SX-MM-RGD
1000BASE-LX/LH long-wavelength; with DOM	GLC-LH-SMD
1000BASE-LX/LH long wavelength; rugged	GLC-LX-SM-RGD
1000BASE-EX long-wavelength; with DOM	GLC-EX-SMD
1000BASE-ZX extended distance; with DOM	GLC-ZX-SMD
1000BASE-ZX extended distance; rugged	GLC-ZX-SM-RGD
100/1000BASE-LX long-wavelength; with DOM	GLC-GE-DR-LX
1000BASE-BX10-D downstream bidirectional single fiber; with DOM	GLC-BX-D
1000BASE-BX10-U upstream bidirectional single fiber; with DOM	GLC-BX-U
1000BASE-BX10-D downstream bidirectional single fiber, (IND) rated, with DOM	GLC-BX-D-I
1000BASE-BX10-U upstream bidirectional single fiber, (IND) rated, with DOM	GLC-BX-U-I
2-channel 1000BASE-BX10-D downstream bidirectional single fiber; with DOM	GLC-2BX-D
2-channel 1000BASE-BX10-D downstream bidirectional single fiber; with DOM	GLC-2BX-D-I
1000BASE-BX40-D for 40km Single-Fiber Bidirectional Applications; with DOM	GLC-BX40-D-I
1000BASE-BX40-D (Alternative) for 40km Single-Fiber Bidirectional Applications; with DOM	GLC-BX40-DA-I
1000BASE-BX40-U for 40km Single-Fiber Bidirectional Applications; with DOM	GLC-BX40-U-I
1000BASE-BX80-D for 80km Single-Fiber Bidirectional Applications; with DOM	GLC-BX80-D-I
1000BASE-BX80-U for 80km Single-Fiber Bidirectional Applications; with DOM	GLC-BX80-U-I

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Product Description	Product Number
1000BASE-LX/LH long wavelength module for 10GE ports	SFP-1G-LH
1000BASE-SX short wavelength module for 10GE ports	SFP-1G-SX
1000BASE-T standard module for 10GE ports	SFP-1G-T-X

Warranty

- Standard warranty: 5 years
- Expedited replacement available via a Cisco SMARTnet® Service support contract

Cisco environmental sustainability

Information about Cisco's environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the "Environment Sustainability" section of Cisco's Corporate Social Responsibility (CSR) Report.

Reference links to information about key environmental sustainability topics (mentioned in the "Environment Sustainability" section of the CSR Report) are provided in the following table:

Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

Cisco makes the packaging data available for informational purposes only. It may not reflect the most current legal developments, and Cisco does not represent, warrant, or guarantee that it is complete, accurate, or up to date. This information is subject to change without notice.

Regulatory and standards compliance

Safety:

- Laser Class I 21CFR1040 LN#50 7/2001
- Laser Class I IEC 60825-1

Standards:

- IEEE 802.3z
- IEEE 802.3ah
- 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
- IEC 60603-7:2000: Generic Requirements for RJ-45 connectors

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Next steps

Learn more about the Cisco SFP Ethernet Converter Modules by contacting your sales representative or visiting https://www.cisco.com/site/us/en/products/networking/optics-transceiver-modules/index.html.

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Document history

New or revised topic	Described in	Date
Updated diagram in Figure 4, and revised Standards section.	On page 5 and page 13	December 06th, 2022
Added new transceivers SFP-1G-LH and SFP-1G-SX	On page 4	January 10th, 2022
Added power consumption for SFP-1G-LH and SFP-1G-SX	On page 10	February 9th, 2023
Added new transceiver SFP-1G-T-X	Table 4 and 5	November 8, 2024

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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