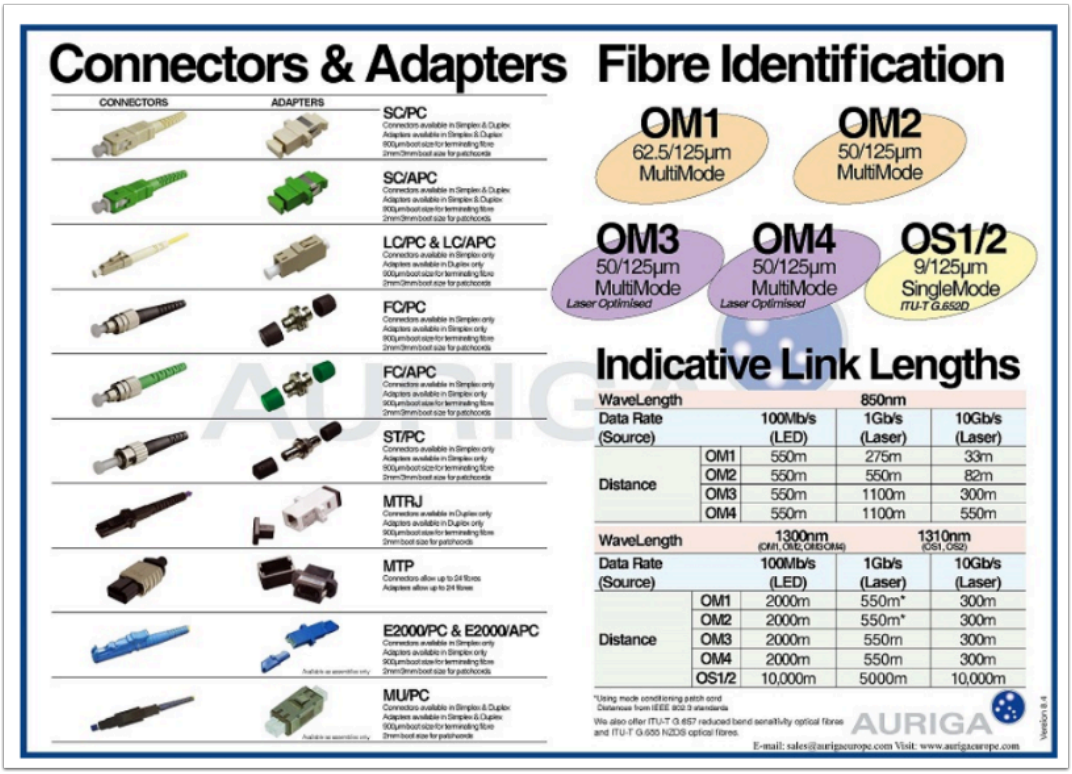
REFERENCE INFORMATION

Table of Contents

Networking Reference

1G and 10G Optic Specs



Helpful information on Fiber connector types:
https://www.fluxlight.com/fiber-optic-connector-guide/

10G SFP+ port cabling specifications

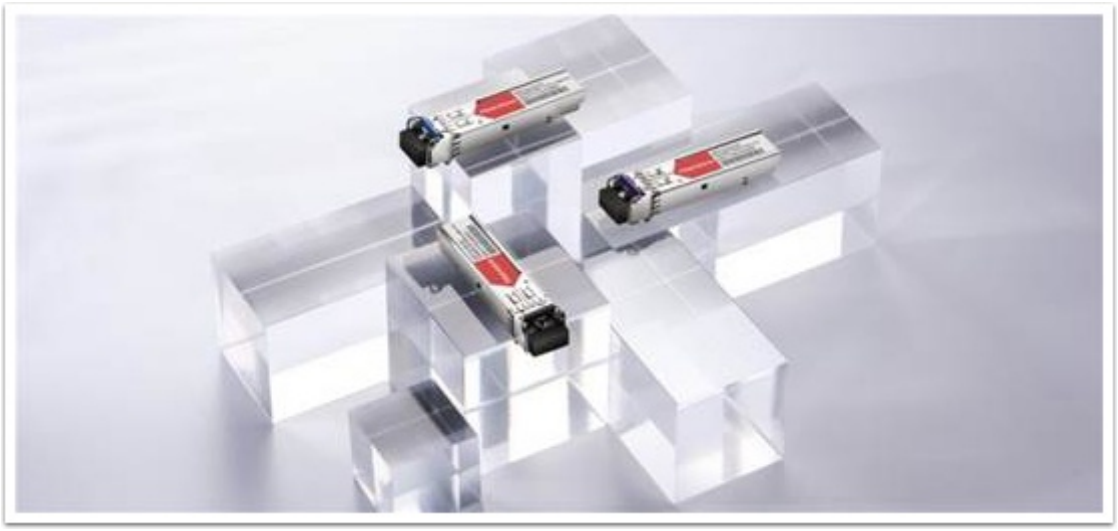
Cisco SFP+	Waveleng th (nm)	Cable Type	Core Size (Microns)	Modal Bandwidth * *** (MHz km)	Cable * Distance
10G-a SR-S 10G-SR 10GSR-X	850	MMF	62.5 62.5 50.0 50.0 50.0 50.0	160 (FDDI) 200 (OM1) 400 500 (OM2) 2000 (OM3) 4700 (OM4)	26m 33m 66m 82m 300m 400m
10G-LRM	1310	MMF SMF	62.5 50.0 50.0 G.652	500 400 500 -	220m 100m 220m 300m
10GLR-Sa 10G-LR 10GLR-X	1310	SMF	G.652	-	10km

Table 1. 1G SFP Port Cabling Specifications

Product	Wavelen gth (nm)	Fiber Type	Core Size (µm)	Modal Bandwidth * *** (MHz Km)	Operating Distance (m)
1000BAS E-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)
1000BAS E-LX/LH	1310	MMF *	62.5	500	550 (1,804 ft)
			50	400	550 (1,804 ft)
			50	500	550 (1,804 ft)
		SMF	** -	-	10,000 (32,821 ft)

FS.COM Cisco SFP+ Primer and Comparison

Cisco 10G SFP+ modules are mainstream 10G optical modules, Cisco SFP-10G-SR in particular, according to the sales volume in 2017. As a basis component for upgrading higher network, SFP+ module is still a playing predominant role in fiber optic network. This article would provide a comprehensively introduction to Cisco 10G SFP+.



Cisco 10G SFP+ Overview

Cisco 10G SFP+ modules are optical devices intended for 10 Gigabit Ethernet deployments in diverse networking environments. They offer customers a wide variety of 10 Gigabit Ethernet connectivity options for data center, enterprise wiring closet, and service provider transport applications. With digital optical monitoring capability, Cisco 10gb sfp+ transceiver module provides a high performance on short- and longhaul transmission. Different Cisco 10Gb SFP+ modules are designed for various usages. The detailed specification of every Cisco 10 gig SFP transceiver is shown in below table.

Cisco SFP+	Wavelength (nm)	Interface	Cable Type	Core Size (Microns)	Cable Distance
Cisco SFP-10G-T-S	/	RJ-45	Cat6a/cat7	/	100m*
Cisco SFP-10G-SR-S	850	Dual LC/PC	MMF	62.5(OM1)	26m
Cisco SFP-10G-SR	850	Dual LC/PC		62.5(OM1)	33m
Cisco SFP-10G-SR-X	850	Dual LC/PC		50(OM2)	66m
				50(OM2)	82m

				50(OM3)	300m
				50(OM4)	400m
Cisco SFP-10G-LRM	1310	Dual LC/PC	SMF	G.652(OS2)	300m
			MMF	62.5(OM1)	100m
				50(OM2)	220m
				50(OM3)	220m
Cisco SFP-10G-LR-S	1310	Dual LC/PC	SMF	G.652(OS2)	10km
Cisco SFP-10G-LR					
Cisco SFP-10G-LR-X					
Cisco SFP-10G-ER-S	1550	Dual LC/PC	SMF	G.652(OS2)	40km
Cisco SFP-10G-ER					
Cisco SFP-10G-ZR-S	1550	Dual LC/PC	SMF	G.652(OS2)	80km
Cisco SFP-10G-ZR					
Cisco FET-10G	850	Dual LC/PC	MMF	50(OM2)	25m
				50(OM3)	100m
				50(OM4)	100m
Cisco SFP-10G-BXD-I	1330	Dual LC/PC	SMF	G.652(OS2)	10km
Cisco SFP-10G-BXU-I	1270	Dual LC/PC	SMF	G.652(OS2)	10km
Cisco SFP-10G-BX40D-I	1330	Dual LC/PC	SMF	G.652(OS2)	40km
Cisco SFP-10G-BX40U-I	1270	Dual LC/PC	SMF	G.652(OS2)	40km

CWDM-SFP-10G	1470-1610	Dual LC/PC	SMF	G.652(OS2)	80km
DWDM-SFP+10G	1561.41-1560.61	Dual LC/PC	SMF		80km

*30 meters via 10Gbps, 50 meters via 5Gbps and 2.5Gbps, 100 meters via 1000Mbps.

How to Choose Cisco 10G SFP+ for Ideal Distance?

The selection of the optimum transmission distance of Cisco 10G SFP+ module matters. The following section would divide the transmission distance of Cisco 10 gig SFP into three parts, Cisco 10GBASE-T, Cisco 10G multimode SFP+, and Cisco singlemode SFP+ 10G transceiver modules.

Cisco 10GBASE-T SFP+ Transceiver: ?30m

The Cisco 10GBASE-T SFP+ is a hot-swappable input/output device which allows a 10 Gigabit Ethernet port to link. It interfaces with RJ-45 connector, so you can use cat6a or cat7 network cable to connect. The transmission distance varies under different transmission speed. Under 10Gbp/s, the maximum transmission distance is 30m. It can arrive up to 50m for 5Gbps and 2.5Gbps. The transmission distance can be up to 100m under 1000Mbps.

Cisco 10G Multimode SFP+ Transceiver:

100m~400m

The Cisco SFP-10G-SR module uses 2000 MHz*km multimode fiber (OM3) to transmit data, and the transmission distance of this Cisco 10G multimode SFP+ can be up to 300m. About other information about Cisco SFP-10G-SR, you can learn more in the SFP-10G-SR datasheet. The Cisco 10GBASE-LRM module supports link lengths of 220m on standard Fiber Distributed Data Interface (FDDI) grade Multimode Fiber

(MMF). The maximum transmission distance can be 300m on standard singlemode fiber (SMF, G.652).

Cisco SFP-10G-SR-X, however, can achieve transmission distance of 400m on multimode fiber.

Cisco Singlemode SFP+ 10G Transceiver:

10km~80km

For very long span 10GbE deployment, e.g. connectivity between two buildings, mostly beyond 10km, Cisco singlemode SFP+ modules are the preferred option defined by IEEE. Cisco 10GBASE-LR module supports link lengths of 10 km on standard singlemode fiber (SMF, G.652). Cisco 10GBASE-ER SFP+ supports up to 40 km on SMF. And Cisco 10GBASE-ZR module achieves up to 80 kilometers on standard SMF(G.652). For detailed information about Cisco 10GBASE-LR-S, SFP-10G-LR-X, Cisco SFP-10G-ER-S, SFP-10G-ZRS, you can check the above table.

FAQ About Cisco 10G SFP+

Q: What do -S and -X signify, as in SFP-10G-SRS and SFP-10G-SR-X?

A: -S in SFP-10G-SR-S means S-class, the S-class is different from Non-class in temperature range, networking environment and cost. -X in SFP-10G-SR-X signifies the extended ability for temperature. The module could be operated under wider temperature variation, from -40? to 85? (-40? to 365?).

Q: Can we use SFP+ optical module in SFP slots?

A: The answer is NO. As a rule of thumb, the SFP optical module can be operated in the SFP+ slot, but the SFP+ optical module can't run in the SFP slot. When you insert a SFP+ module on a SFP port, the speed of this port is 1G instead of 10G.

Q: Can Cisco SFP+ transceivers be used in other brands equipment?

A: No, Cisco SFP+ transceivers are not encouraged to use in other brands equipment because the codes from different vendors might be unmatched. However, some optical switches from certain vendors can be matched with any other brands devices.

Q: What is the difference between SFP-10G-LR and SFP-10G-LRM?

A: The Cisco 10GBASE-LRM module supports link lengths of 220m on multimode fiber and 300m on singlemode fiber, while Cisco 10GBASE-LR supports 10km on standard singlemode fiber. The price of Cisco SFP-10G-LR is a little bit higher than Cisco SFP-10G-LRM.

Q: Can 10GBASE-T down-support 10/100/1000Mbps?

A: In most cases, 10GBASE-T SFP+ can auto-negotiate to 10/100/1000Mbps data rate, but it might vary according to different vendors. A 10GBASE-T transceiver from HPE, MikroTik, FS.COM can down-support 10/100/1000Mbps. Cisco 10gbase-t SFP+ can operate at 10, 100, or 1000 Mbps on some Cisco devices.

Q: Can I use Cisco compatible SFP+ modules in any Cisco switch w/ SFP+ port?

A: Theoretically, Cisco compatible SFP+ modules cannot be used in any Cisco switches as different Cisco switches have distinct requirement for codes and hardware. For example, Cisco SFP/SFP+ is not certified to work with Cisco Meraki products. For Cisco 10G transceiver module compatible switches, you can refer to Cisco 10-Gigabit Ethernet transceiver modules compatibility matrix and Cisco 10-Gigabit Ethernet transceiver modules datasheet.

FS.COM Cisco 10G SFP+ Solution

In recent years, using non-OEM optical transceivers in fiber optic network is a new trend. More and more MSOs and service providers prefer to utilize third-party pluggable optics as they are assured to be fully compatible with the original brand hardware. Moreover, third-party optics have absolute advantage on price. The follow table shows the large price gap between Cisco 10G SFP+ modules and FS.COM 3-rd party optics.

Module	Cisco	FS.COM
SFP-10G-SR	$995	$16
SFP-10G-LR	$3,995	$34

SFP-10G-ER	$10,000	$149
SFP-10G-LRM	$995	$34
SFP-10GB-LR	$3,995	$34
SFP-10G-ZR	$16,000	$299
SFP-10GB-LRM	$995	$34

In addition to the huge price discrepancy between OEM and third-party Cisco 10G SFP+ modules, the branded optical transceivers seem to have fairly short warranty periods. At FS.COM, we offer lifetime warranty and limited warranty for different products varying on the materials, workmanship, usage rate, and the availability of the spare parts for each product. FS.COM truly understands the value of compatibility and interoperability to each optics. FS.COM third-party optics must run through programming and an extensive series of platform diagnostic tests to prove its performance and compatibility. In addition, our Cisco compatible modules can be customized according to customers' individual needs—connector, wavelength, transmission distance and temperature.

Conclusion

Definitely, 40G and 100G optical transceivers are increasingly becoming popular. However, SFP+ module is still a dominant choice for optical networking connections. Because its reduced pricing and stable technology.

Related article: Use Direct Attach Cable Assemblies for Data Center Interconnection

Tags: CIsco 10G SFP+, optical module, transceiver module

Cisco 10gig Primer

Source: Devon Murphy with Network Hardware Resale

In our continued effort to be helpful to those who rely on us for their Cisco hardware needs, we wanted to send you a reference guide for Cisco's growing line of 10gb modules. We hope this is useful to you.

Over the years of 10 gigabit Ethernet's existence, there have been numerous different form factors and optics types introduced. The oldest, XENPAKS, remain very popular as the install base is large, while the newest SFP+ offer a much smaller form factor and the ability to offer 1G/10G combo ports on hardware for the first time. Like the move from GBIC to SFP the move from Xenpak to SFP+ seems inevitable, but currently there are four standard modules / form-factors available. This is a guide to these module types and optical standards currently available.

Module Types

XENPAK – the original 10GbE pluggable optics. Presents SC connectors

X2 – the successor to the XENPAK. Presents SC connectors

XFP – the first of the small form factor 10GbE optics. Presents LC connectors

SFP+ - a 10GbE optics using the same physical form factor as a gigabit SFP. Because of this, many of the small SFP+ based 10GbE switches use 1G/10G ports, giving an added degree of flexibility. Presents LC connectors.

Within these form factors are many different types of optical and electrical specifications; the only requirement is that the optics type match. It is perfectly acceptable to connect an X2 to an SFP, or a XENPAK to an SFP+, or any other combination.

Optical Standards

Electrical/Copper

10GBase-CX4

CX4 modules use Infiniband 4X cabling, and have a maximum distance of 15 meters. CX4 is an early copper standard, and due to the physical size of the connector, is not available in SFP+ form, or in XFP form from Cisco (Force10, though, offers a CX4 XFP). CX4 was designed as a drop-in replacement for legacy Infiniband switching hardware – the existing Infiniband cable plant can be reused in a CX4 based network.

10GBase-CX1/10GBase-CU

10GBase-CX1 is the SFP+ copper standard. The standard has a maximum distance of 10 meters, though Cisco currently only offers lengths up to 5m. This is actually a cable with SFP+ ends, not a module with a separate cable.

Notice that the cable is permanently integrated into the SFP+ ends. Because of this, both devices must present SFP+ ports. While the cables are somewhat inconvenient to work with due to the integration, CX1 modules are used due to a very low cost ($150-$200 per cable), extremely low power consumption (0.25W per cable), and a negligible latency penalty.

10GBase-T

Cisco offers 10GBase-T options in the form of pluggable optics (the X2-10GB-T) for the 6708, 6908, and

6716 line cards for the 6500, as well as fixed interface options in the 4900M, Cat6500, and Nexus 2000/5000 switches . Maximum distance, using Cat6a cable, is 100 meters. Use of older Cat6 cable reduces the maximum distance to 55 meters. The main drawback to early 10GBase-T is the very high power consumption per port, around 6W per port for most devices. Current 10Gbase-T switches have reduced this power consumption enough to allow for high-density deployments, as seen in the Nexus 5596T recently announced by Cisco. Because it retains the incredibly simple cabling of other –T standards, now that power concerns are being addressed, 10GBase-T options are available from all the major switch vendors as of summer 2012.

Multimode Fiber

10GBase-SR

10GBase-SR is the original multimode optics specification, and is still by far the most commonly used. As it uses a single, low cost solid state laser assembly, it is also the least expensive of the optical modules available for a 10GbE platform. However, 10GBase-SR is very sensitive to fiber type. Below is a list of cable specs and maximum distance with SR optics.

Core Size (microns)	Modal Bandwidth (MHz*km)	Max Distance	Notes
62.5	160	26m	This is standard multimode fiber.
62.5	200	33m	
50	400	66m	

50	500	82m	
50	2000	300m	Also known as OM3 or 10GbEoptimized fiber

Because of this, it is highly recommended that any new deployment of multimode fiber be done with OM3 fiber. This will ensure an easier transition to 10GbE for future needs.

10GBase-LX4

To overcome the distance limitations of SR optics, the 10GBase-LX4 standard was developed. LX4 uses 4 lasers, each operating at a different wavelength, at a 2.5Gbps data rate. This results in a range of 240-300 meters, depending on cable grade. However, due to the complex laser assembly, it is not possible to get LX4 optics in XFP or SFP+ versions. With the ready availability of OM3 fiber and newer standards that provide long reach over multimode with a single laser, LX4 is rapidly becoming obsolete.

10GBase-LRM

The replacement to LX4, 10GBase-LRM will reach up to 220m over standard multimode fiber, but without the complexity of the LX4 optics. Instead, a single laser operating at 1310nm is used. This allows LRM optics to be packaged in XFP and SFP+ form factors.

Singlemode Fiber

10GBase-LR

10GBase-LR can reach up to 10km over singlemode fiber. There is no minimum distance for LR, either, so it is suitable for short connections over singlemode fiber as well.

10GBase-ER

10GBase-ER can reach up to 40km over singlemode fiber. Due to the laser power, attenuation is required for links less than 20km long.

10GBase-ZR

ZR optics can reach up to 80km over singlemode fiber. Due to the very high transmit power, significant attenuation is needed for shorter links. Use of ZR optics should be preceded with an optical power test of the fiber span in question to ensure a problem-free deployment. Interestingly, 10GBase-ZR is actually not an IEEE standard, though most vendors offer a ZR option.

10GBase-LW

10GBase-LW optics use the same laser, and have the same specifications as the 10GBase-LR optics. However, the LW optics present SONET/SDH physical signaling, allowing LW-equipped devices to interface directly with an existing OC192 transport infrastructure. LW optics are only available in XENPAK and X2 form factors. XFP-based cards move this functionality from the transceiver to the card itself, so make sure that if this functionality is needed, that the card itself has this support. The primary example is the as in the SPA-1X10GE-L-V2 vs. the SPA-1X10GE-LW-V2.

10G over DWDM

With 10GbE, it is possible to get optics modules that output at DWDM wavelengths, allowing for much simpler DWDM deployments, and with these optics no additional transponder hardware is required. A select few 10GbE cards even offer fixed, tunable DWDM interfaces for maximum flexibility.

As one of the most confusing aspects of choosing and deploying 10Gig fiber switches, I hope this information helps. If you have any questions, please do not hesitate to ask. Also, keep in mind that NHR has the largest standing inventory of Cisco labeled and NHR labeled optics in the world. Our NHR optics have been through the most rigorous testing and QA process to ensure maximum reliability and compatibility within all Cisco platforms. They are available at discounts starting at 70% off list.

Cisco 10G Fiber Standards and Specs

A broad range of industry-compliant SFP+ modules for 10 Gigabit Ethernet deployments in diverse networking environments

Product overview

The Cisco 10GBASE SFP+ modules (Figure 1) give you a wide variety of 10 Gigabit Ethernet connectivity options for data center, enterprise wiring closet, and service provider transport applications. **Figure 1.** Cisco 10GBASE SFP+ modules

Features and benefits

Cisco SFP+ modules offer the following features and benefits.

Industry’s smallest 10G form factor for greatest density per chassis

Hot-swappable input/output device that plugs into an Ethernet SFP+ port of a Cisco switch (no need to power down if installing or replacing)

Supports “pay-as-you-populate” model for investment protection and ease of technology migration

Digital optical monitoring capability for strong diagnostic capabilities

Optical interoperability with 10GBASE XENPAK, 10GBASE X2, and 10GBASE XFP interfaces on the same link

Cisco quality Identification (ID) feature enables a Cisco platform to identify whether the module is certified and tested by Cisco

Cisco SFP-10G-SR-S module (S-Class)

- The Cisco 10GBASE-SR module supports a link length of 26 meters on standard Fiber Distributed Data
- Interface (FDDI)-grade Multimode Fiber (MMF). Using 2000 MHz km MMF (OM3), up to 300-meter link
- lengths are possible. Using 4700 MHz km MMF (OM4), up to 400 meter link lengths are possible. SFP-10GSR-S does not support FCoE.

Cisco SFP-10G-SR module

- The Cisco 10GBASE-SR Module supports a link length of 26m on standard Fiber Distributed Data Interface
- (FDDI)-grade Multimode Fiber (MMF). Using 2000MHz km MMF (OM3), up to 300m link lengths are
- possible. Using 4700MHz km MMF (OM4), up to 400m link lengths are possible.

Cisco SFP-10G-SR-X module

- The Cisco SFP-10G-SR-X is a multirate 10GBASE-SR, 10GBASE-SW and OTU2/OTU2e module for extended operating temperature range. It supports a link length of 26m on standard Fiber Distributed Data
- Interface (FDDI)-grade Multimode Fiber (MMF). Using 2000MHz km MMF (OM3), up to 300m link lengths
- are possible. Using 4700MHz km MMF (OM4), up to 400m link lengths are possible.
- Except for version 1, which supports only 10GBASE-SR.

Cisco SFP-10G-LRM module

The Cisco 10GBASE-LRM Module supports link lengths of 220m on standard Fiber Distributed Data

Interface (FDDI) grade Multimode Fiber (MMF). To make sure that specifications are met over FDDI-grade, OM1 and OM2 fibers, the transmitter should be coupled through a mode conditioning patch cord. No mode conditioning patch cord is required for applications over OM3 or OM4. For additional information on mode conditioning patch cord requirements please see: https://www.cisco.com/en/US/prod/collateral/modules/ps5455/product_bulletin_c25-530836.html.

The Cisco 10GBASE-LRM Module also supports link lengths of 300m on standard Single-Mode Fiber (SMF, G.652).

Cisco SFP-10G-LR-S module (S-Class)

The Cisco 10GBASE-LR module supports a link length of 10 kilometers on standard Single-Mode Fiber (SMF) (G.652). SFP-10G-LR-S does not support FCoE.

Cisco SFP-10G-LR module

The Cisco 10GBASE-LR Module supports a link length of 10 kilometers on standard Single-Mode Fiber (SMF, G.652).

Cisco SFP-10G-LR-X module

The Cisco SFP-10G-LR-X is a multirate 10GBASE-LR, 10GBASE-LW, and OTU2/OTU2e module for extended operating temperature range. It supports a link length of 10 kilometers on standard Single-Mode Fiber (SMF, G.652).

Cisco SFP-10G-ER-S module (S-Class)

The Cisco 10GBASE-ER module supports a link length of up to 40 kilometers on SMF (G.652). SFP-10GER-S does not support FCoE.

Cisco SFP-10G-ER module

The Cisco 10GBASE-ER Module supports a link length of up to 40 kilometers on standard Single-Mode Fiber (SMF, G.652).

Cisco SFP-10G-ZR-S module (S-Class)

The Cisco 10GBASE-ZR module supports link lengths of up to about 80 kilometers on standard SMF (G.652). This interface is not specified as part of the 10 Gigabit Ethernet standards and is, instead, built according to Cisco specifications. SFP-10G-ZR-S does not support FCoE.

Cisco SFP-10G-ZR module

The Cisco SFP-10G-ZR is a multirate 10GBASE-ZR, 10GBASE-ZW, and OTU2/OTU2e module. It supports link lengths of up to about 80 kilometers on standard Single-Mode Fiber (SMF, G.652). This interface is not specified as part of the 10 Gigabit Ethernet standard and is instead built according to Cisco specifications.

Cisco FET-10G module

The Cisco FET-10G Fabric Extender Transceiver supports link lengths up to 100m on laser-optimized OM3 or OM4 multimode fiber. It is supported on fabric links from a Nexus 2000 to a Cisco parent switch only.

Note this product is not orderable individually. For more information refer to Nexus 2000 datasheet: https://www.cisco.com/en/US/prod/collateral/switches/ps9441/ps10110/data_sheet_c78507093.html.

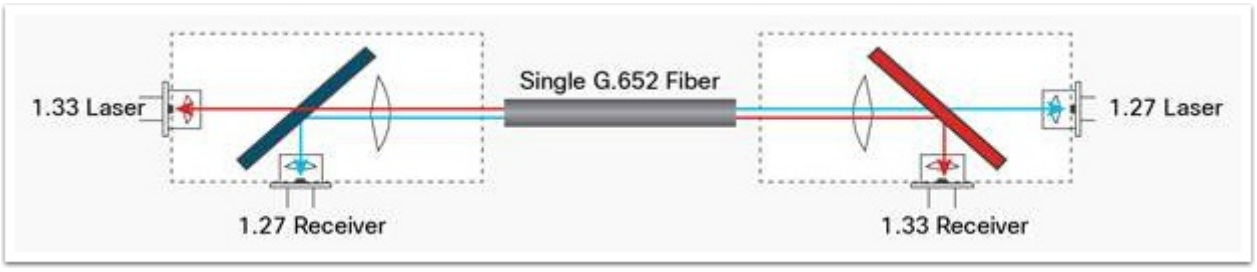
Cisco SFP-10G-BXD-I and SFP-10G-BXU-I for 10Km (single-fiber bidirectional applications)

The Cisco SFP-10G-BXD-I and SFP-10G-BXU-I SFPs operate on a single strand of standard SMF.

A SFP-10G-BXD-I device is always connected to a SFP-10G-BXU-I 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. SFP-10G-BXD-I transmits a 1330-nm channel and receives a 1270-nm signal, whereas SFP-10G-BXU-I transmits at a 1270-nm wavelength and receives a 1330-nm signal. Note in Figure 2 the presence of a Wavelength-Division Multiplexing (WDM) splitter integrated into the SFP to split the 1270-nm and 1330-nm light paths.

Figure 2. Bidirectional transmission of a single strand of SMF



The SFP-10G-BXD-I and SFP-10G-BXU-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.

Cisco SFP-10G-BX40D-I and SFP-10G-BX40U-I (for 40Km single-fiber bidirectional applications)

The Cisco SFP-10G-BX40D-I and SFP-10G-BX40U-I SFPs operate on a single strand of standard SMF.

A SFP-10G-BX40D-I device is always connected to a SFP-10G-BX40U-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. SFP-10G-BX40D-I transmits a 1330-nm channel and receives a 1270-nm signal. The SFP10G-BX40U-I transmits at a 1270-nm wavelength and receives a 1330-nm signal.

The SFP-10G-BX40D-I and SFP-10G-BX40U-I SFPs 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.

Cisco SFP+ Twinax copper cables

Cisco SFP+ Copper Twinax (Figure 3) direct-attach cables are suitable for very short distances and offer a cost-effective way to connect within racks and across adjacent racks. Cisco offers passive Twinax cables in lengths of 1, 1.5, 2, 2.5, 3 and 5 meters, and active Twinax cables in lengths of 7 and 10 meters.

Figure 3. Cisco direct-attach twinax copper cable assembly with SFP+ connectors

Cisco SFP+ Active optical cables

Cisco SFP+ Active Optical Cables (Figure 4) are direct-attach fiber assemblies with SFP+ connectors. They are suitable for very short distances and offer a cost-effective way to connect within racks and across adjacent racks. Cisco offers Active Optical Cables in lengths of 1, 2, 3, 5, 7, and 10 meters. **Figure 4.** Cisco direct-attach active optical cables with SFP+ connectors

Platform support

* Cisco SFP+ modules are supported on a wide range of Cisco switches and routers :

7600 Series Router ASR 901 ASR 903 ASR 1000 Series Router ASR 9000 Series Router ASR 9000v Series Router Catalyst 2350 and 2360 Series Switches Catalyst 2960-S, 2960-X, and 2960-XR Series Switches Catalyst 3100 Blade Switches Catalyst 3560, 3560-E, and 3560-X Series Switches Catalyst 3750, 3750-E, and 3750-X Series Switches Catalyst 3850 Series Switches	Catalyst 4500 and 4500-X Series Switches CRS Router MDS 9000 ME 4500 ME 4900NCS 6000 Series Router Nexus 2000, 3000, and 4000 Series Switches Nexus 9000 and 9500 (modular) Series Switches RF Gateway Series SCE 8000 Shared Port Adapter (SPA) Unified Computing System (UCS) Switches

* Not all devices listed support every module. For details about which modules run in which devices and other compatibility information, refer to the document “Cisco 10 Gigabit Ethernet Transceiver Modules Compatibility

Matrix”: https://www.cisco.com/en/US/docs/interfaces_modules/transceiver_modules/compatibility/matrix/O L_6974.html.

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.

Connectors: Dual LC/PC connector (-SR, -LRM, -LR, -ER, -ZR and FET-10G).

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.

Product specifications

Table 1 provides cabling specifications for the Cisco SFP+ modules.

Table 1. SFP+ port cabling specifications

Cisco SFP+	Wavel ength (nm)	Cable Type		Modal Bandwidth * *** (MHz km)	Cable Dista * nce
Cisco SFP-a 10G-SR-S Cisco SFP-10G-SR Cisco SFP-10G-SR-X	850	MMF	62.5 62.5 50.0 50.0 50.0 50.0	160 (FDDI) 200 (OM1) 400 500 (OM2) 2000 (OM3) 4700 (OM4)	26m 33m 66m 82m 300m 400m
Cisco SFP-10G-LRM	1310	MMF SMF	62.5 50.0 50.0 G.652	500 400 500 -	220m 100m 220m 300m
Cisco SFP-10G-LR-Sa Cisco SFP-10G-LR Cisco SFP-10G-LR-X	1310	SMF	G.652	-	10km
Cisco SFP-10G-ER-	1550	SMF	G.652	-	* 40km

****a S Cisco SFP- **** 10G-ER					*
Cisco SFP- 10G-ZR- *****a S Cisco SFP- ***** 10G-ZR	1550	SMF	G.652	-	80km
Cisco FET- 10G	850	MMF	50.0 50.0 50.0	500 (OM2) 2000 (OM3) 4700 (OM4)	25m 100m 100m
Cisco SFP- 10G-BXD-I	1330	SMF	G.652	-	10km

Cisco SFP+	Wavel ength (nm)	Cable Type		Modal Bandwidth (MHz km)	Cable Dista nce
Cisco SFP- 10G-BXU-I	1270	SMF	G.652	-	10km
Cisco SFP- 10G-BX40D- ****** I	1330	SMF	G.652	-	40km
Cisco SFP- 10G-BX40U- ****** I	1270	SMF	G.652	-	40km
Cisco SFP- H10GB- CU1M	-	Twinax cable, passive, 30AWG cable assembly	-	-	1m
Cisco SFPH10GB- CU1- 5M	-	Twinax cable, passive, 30AWG cable assembly	-	-	1.5m
Cisco	-	Twinax cable, passive,	-	-	2m

SFPH10GB-CU2M		30AWG cable assembly			
Cisco SFPH10GB-CU2-5M	-	Twinax cable, passive, 30AWG cable assembly	-	-	2.5m
Cisco SFP-H10GBCU3M	-	Twinax cable, passive, 30AWG cable assembly	-	-	3m
Cisco SFP-H10GB-CU5M	-	Twinax cable, passive, 24AWG or 26AWG cable assembly	-	-	5m
Cisco SFP-H10GB-ACU7M	-	Twinax cable, active, 30 AWG cable assembly	-	-	7m
Cisco SFP-H10GBACU10M	-	Twinax cable, active, 28 AWG cable assembly	-	-	10m
Cisco SFP-10G-AOC1M	-	Active Optical Cable assembly	-	-	1m
Cisco SFP+	Wavelength (nm)	Cable Type		Modal Bandwidth (MHz km)	Cable Distance
Cisco SFP-10G-AOC2M	-	Active Optical Cable assembly	-	-	2m
Cisco SFP-10G-AOC3M	-	Active Optical Cable assembly	-	-	3m
Cisco SFP-10G-AOC5M	-	Active Optical Cable assembly	-	-	5m
Cisco SFP-10G-AOC7M	-	Active Optical Cable assembly	-	-	7m
Cisco SFP-10G-AOC10M	-	Active Optical Cable assembly	-	-	10m

* Minimum cabling distance for -SR, -LRM, -LR, -ER modules is 2m, according to the IEEE 802.3ae.

** Links longer than 30km are considered engineered links as per IEEE 802.3ae.

*** Specified at transmission wavelength.

**** Requires 5 dB 1550nm fixed loss attenuator for 20km. Attenuator is available as a spare. The part number is 15216 ATT LC 5=.

***** Requires 15dB attenuator if Link Distance 5km.

Requires 10dB attenuator if Link Distance is between 5km and 25km.

Requires 5dB attenuator if Link Distance is between 25km and 45km.

****** Requires 15dB attenuator if Link Distance 5km.

Requires 10dB attenuator if Link Distance is between 5km and 15km.

Requires 5dB attenuator if Link Distance is between 15km and 25km.

Attenuator is available as a spare. The part numbers:

5dB - 15216 ATT LC 5=

10dB - 15216 ATT LC 10= ? 15dB - 15216 ATT LC 15=a

- No FCoE support.

Table 2 lists the main optical characteristics for the Cisco SFP+ modules.

Table 2. Optical transmit and receive specifications

Product	Type	Transmit Power * (dBm)		Receive Power * (dBm)		Transmit and Receive Wavelength (nm)
		Maximum	Minimum	Maximum	Minimum	
Cisco SFP10G-SR-S Cisco SFP10G-SR	10GBASE-SR 850nm MMF	1.2 **	7.3	1.0	-9.9	840 to 860
Cisco SFP10G-SR-X	10GBASE-SR, 10GBASE-SW and OTU2e 850nm MMF	1.2 **	7.3	1.0	-9.9	840 to 860

Cisco SFP-10G-LRM	10GBASE-LRM 1310nm MMF and SMF	0.5	6.5	0.5	-8.4 (in average) and -*** 6.4 (in OMA)	1260 to 1355
Cisco SFP10G-LR-S Cisco SFP10G-LR	10GBASE-LR 1310nm SMF	0.5	8.2	0.5	-14.4	1260 to 1355
Cisco SFP10G-LR-X	10GBASE-LR, 10GBASE-LW and OTU2e 1310nm SMF	0.5	8.2	0.5	-14.4	1260 to 1355

Product	Type	Transmit Power (dBm)		Receive Power (dBm)		Transmit and Receive Wavelength (nm)
		Maximum	Minimum	Maximum	Minimum	
Cisco SFP10G-ER-S Cisco SFP10G-ER	10GBASE-ER 1550nm SMF	4.0	4.7	-1	-15.8	1530 to 1565
Cisco SFP10G-ZR-S Cisco SFP10G-ZR	10GBASE-ZR 1550nm SMF	4.0	0	-7	-24	1530 to 1565
Cisco FET-10G	FET-10G 850nm MMF	1.3	-8	-1	-9.9	840 to 860
Cisco SFP-10GBXD-I	10G-SFP Bidirectional for 10km	0.5	8.2	0.5	-14.4	1320 to 1340 (Tx) 1260 to 1280 (Rx)
Cisco SFP-	10G-SFP Bidirectional for 10km	0.5	8.2	0.5	-14.4	1260 to 1280 (Tx)

10GBXU-I						1320 to 1340 (Rx)
Cisco SFP-10GBX40D-I	10G-SFP Bidirectional for 40km	4.5	2.7	-9	-21.2	1320 to 1340 (Tx) 1260 to 1280 (Rx)
Product	Type	Transmit Power (dBm)		Receive Power (dBm)		Transmit and Receive Wavelength (nm)
		Maximum	Minimum	Maximum	Minimum	
Cisco SFP-10GBX40U-I	10G-SFP Bidirectional for 40km	4.5	2.7	-9	-21.2	1260 to 1280 (Tx) 1320 to 1340 (Rx)

* Transmitter and receiver power is in average, unless specified.

** The launch power shall be the lesser of the class 1 safety limit or the maximum receive power. Class 1 laser requirements are defined by IEC 60825-1: 2001.

*** Both average and OMA specifications must be met simultaneously.

Table 3 details optical specifications for the Cisco SFP-10G-ZR modules.

Table 3. SFP-10G-ZR optical parameters

Parameter	Symbol	Minimum		Maximum	Units	Notes and Conditions
Transmitter						
Transmitter wavelength		1530		1565	nm	

Side-mode suppression ratio	SMSR	30			dB	
Transmitter extinction ratio		9			dB	
Parameter	Symbol	Minimum		Maximum	Units	Notes and Conditions
Transmitter optical output power	Pout	0		4.0	dBm	Average power coupled into single-mode fiber
Receiver						
Receiver optical input wavelength		1260		1565	nm	Receiver Sensitivity specified over 15301565nm only, with 3dB degradation permitted from 1260-1530nm
Receiver damage threshold		+5			dBm	
Receiver Overload		-7			dBm	
Receiver performance at 10GE LAN and 10GE WAN rates, non-FEC application						
Receiver sensitivity		-24			dBm	At BER=1E-12 with PRBS31 and 10GE frame
Chromatic Dispersion Penalty@ 1600 ps/nm				3	dB	
Receiver performance at OTU2/OTU2e rates, FEC application						
Receiver sensitivity		-2			dB	At Pre-FEC BER=1E-5 for GFEC and PreFEC BER=7E-4 for EFEC with PRBS31 and OTU2 frame

		7			m	
Chromatic Dispersion Penalty@ 1300 ps/nm				3	d B	

Note: Parameters are specified over temperature and at end of life unless otherwise noted. When shorter distances of single-mode fiber are used (40km), an inline optical attenuator must be used to avoid overloading and damaging the receiver.

Table 4 describes the bail latch color code for each type of optical SFP+ module.

Table 4. SFP+ optical modules color code

Product	Bail Latch Color
Cisco SFP-10G-SR-S Cisco SFP-10G-SR Cisco SFP-10G-SR-X	Beige
Cisco SFP-10G-LRM	Orange
Cisco SFP-10G-LR-S Cisco SFP-10G-LR Cisco SFP-10G-LR-X	Blue
Cisco SFP-10G-ER-S Cisco SFP-10G-ER	Red
Cisco SFP-10G-ZR-S Cisco SFP-10G-ZR	Green
Cisco FET-10G	Brown
Cisco SFP-10G-BXD-I Cisco SFP-10G-BXU-I	Blue
Cisco SFP-10G-BX40D-I Cisco SFP-10G-BX40U-I	Red
Cisco SFP-H10GB-CU1M	Beige
Cisco SFP-H10GB-CU1-5M	Black
Cisco SFP-H10GB-CU2M	Brown
Cisco SFP-H10GB-CU2-5M	Yellow

Cisco SFP-H10GB-CU3M	Orange
Cisco SFP-H10GB-CU5M	Gray
Cisco SFP-H10GB-ACU7M	Blue
Cisco SFP-H10GB-ACU10M	Red
Cisco SFP-10G-AOC1M	Beige
Product	Bail Latch Color
Cisco SFP-10G-AOC2M	Brown
Cisco SFP-10G-AOC3M	Orange
Cisco SFP-10G-AOC5M	Gray
Cisco SFP-10G-AOC7M	Blue
Cisco SFP-10G-AOC10M	Red

Table 5 provides the maximum power consumption and operating temperature range ratings per Cisco SFP+ module.

Table 5. SFP+ modules maximum power consumption

Product	Power Consumption (W)	Operating Temperature Range
Cisco SFP-10G-SR-S Cisco SFP-10G-SR	1	COM
Cisco SFP-10G-SR-X	1	EXT
Cisco SFP-10G-LRM	1	COM
Cisco SFP-10G-LR-S Cisco SFP-10G-LR	1	COM
Cisco SFP-10G-LR-X	1	EXT
Cisco SFP-10G-ER-S Cisco SFP-10G-ER	1.5	COM
Cisco SFP-10G-ZR-S Cisco SFP-10G-ZR	1.5	COM
Cisco FET-10G	1	COM

Cisco SFP-10G-BXD-I Cisco SFP-10G-BXU-I	1	IND
Cisco SFP-10G-BX40D-I Cisco SFP-10G-BX40U-I	1.2	IND
Cisco SFP-H10GB-CU1M	1	COM
Cisco SFP-H10GB-CU1-5M	1	COM
Product	Power Consumption (W)	Operating Temperature Range
Cisco SFP-H10GB-CU2M	1	COM
Cisco SFP-H10GB-CU2-5M	1	COM
Cisco SFP-H10GB-CU3M	1	COM
Cisco SFP-H10GB-CU5M	1	COM
Cisco SFP-H10GB-ACU7M	1	COM
Cisco SFP-H10GB-ACU10M	1	COM
Cisco SFP-10G-AOC1M	1	COM
Cisco SFP-10G-AOC2M	1	COM
Cisco SFP-10G-AOC3M	1	COM
Cisco SFP-10G-AOC5M	1	COM
Cisco SFP-10G-AOC7M	1	COM
Cisco SFP-10G-AOC10M	1	COM

Dimensions

Dimensions (H x W x D): 8.5 x 13.4 x 56.5mm. Cisco SFP+ connectors 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 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)

Warranty

Standard warranty: 1 year

®

Extended warranty (optional): Cisco SFP+ modules can be covered in a Cisco SMARTnet Service support contract for the Cisco switch or router chassis

Ordering information

Table 6 provides the ordering information for Cisco SFP+ modules and related cables.

Table 6. Ordering information

Description	Product Number
Cisco 10GBASE-SR SFP+ Module for MMF S-Class	SFP-10G-SR-S
Cisco 10GBASE-SR SFP+ Module for MMF	SFP-10G-SR
Cisco multirate 10GBASE-SR, 10GBASE-SW and OTU2e SFP+ Module for MMF, extended temperature range	SFP-10G-SR-X
Cisco 10GBASE-LRM SFP+ Module for MMF and SMF	SFP-10G-LRM
Cisco 10GBASE-LR SFP+ Module for SMF S-Class	SFP-10G-LR-S
Cisco 10GBASE-LR SFP+ Module for SMF	SFP-10G-LR
Cisco multirate 10GBASE-LR, 10GBASE-LW and OTU2e SFP+ Module for SMF, extended temperature range	SFP-10G-LR-X
Cisco 10GBASE-ER SFP+ Module for SMF S-Class	SFP-10G-ER-S
Cisco 10GBASE-ER SFP+ Module for SMF	SFP-10G-ER
Cisco 10GBASE-ZR SFP+ Module for SMF S-Class	SFP-10G-ZR-S

Cisco multirate 10GBASE-ZR, 10GBASE-ZW and OTU2e SFP+ Module for SMF	SFP-10G-ZR
Cisco 10GBASE-BX10-D Bidirectional for 10km	SFP-10G-BXD-I
Cisco 10GBASE-BX10-U Bidirectional for 10km	SFP-10G-BXU-I
Cisco 10GBASE-BX40-D Bidirectional for 40km	SFP-10G-BX40D-I
Cisco 10GBASE-BX40-U Bidirectional for 40km	SFP-10G-BX40U-I
10GBASE-CU SFP+ Cable 1 Meter, passive	SFP-H10GB-CU1M
10GBASE-CU SFP+ Cable 1.5 Meter, passive	SFP-H10GB-CU1-5M
10GBASE-CU SFP+ Cable 2 Meter, Passive	SFP-H10GB-CU2M
10GBASE-CU SFP+ Cable 2.5 Meter, Passive	SFP-H10GB-CU2-5M
Description	Product Number
10GBASE-CU SFP+ Cable 3 Meter, passive	SFP-H10GB-CU3M
10GBASE-CU SFP+ Cable 5 Meter, passive	SFP-H10GB-CU5M
10GBASE-CU SFP+ Cable 7 Meter, active	SFP-H10GB-ACU7M
10GBASE-CU SFP+ Cable 10 Meter, active	SFP-H10GB-

	ACU10M
10GBASE-AOC SFP+ Cable 1 Meter	SFP-10G-AOC1M
10GBASE-AOC SFP+ Cable 2 Meter	SFP-10G-AOC2M
10GBASE-AOC SFP+ Cable 3 Meter	SFP-10G-AOC3M
10GBASE-AOC SFP+ Cable 5 Meter	SFP-10G-AOC5M
10GBASE-AOC SFP+ Cable 7 Meter	SFP-10G-AOC7M
10GBASE-AOC SFP+ Cable 10 Meter	SFP-10G-AOC10M

Regulatory and standards compliance Standards:

GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable

GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies

GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors

IEEE 802.3: 10-Gigabit Ethernet

ITU-T G.709: Interfaces for the Optical Transport Network

ITU-T G.975: GFEC

ITU-T G.975.1: EFEC

SFP+ MSA SFF-8431 (Optical Modules, Active Optical Cables, and Passive Twinax cables) ? SFP+ MSA SFF-8461 (Active Twinax cables) **Safety:**

Laser Class 1 21CFR-1040 LN#50 7/2001

Laser Class 1 IEC60825-1

Cable jacket of SFP+ copper modules is UL #E116441 Compliant

All length SFP+ copper cables are ELV and RoHS Compliant

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Next steps

Learn more about Cisco 10GBASE SFP+ fiber modules or 10GBase SFP+ copper modules (twinax cable) by contacting your sales representative or visiting https://www.cisco.com/en/US/products/ps6574/index.html.

For S-Class SFP+ 10 Gigabit Modules, refer to the link below: https://www.cisco.com/c/en/us/products/interfaces-modules/transceiver-modules/datasheetlisting.html.

10G Fiber LRM Standards

10G speeds are beginning to gain steam in Enterprise networks. The rising standard for running 10G speeds over Multimode fiber is the LRM module standard. This is the best balance of distance and compatibility with current multimode optical fiber that can run at 10G speeds. Here is a good primer on LRM fiber specs and how it should be used:

http://www.cisco.com/c/en/us/products/collateral/interfaces-modules/transceiver-modules/prod_white_paper0900aecd806b8bcb.html

Further information on how to test Multimode fiber for LRM 10G speed compatibility see attached white paper.

Netmasks, CIDR sizes and Inverse Masks

Cisco Netmasks, CIDR sizes and Inverse Masks

Netmask	Inverse	/CIDR	Usable	Size
0.0.0.0	255.255.255.255	/0	4,294,967,294	The Internet
128.0.0.0	127.255.255.255	/1	2,147,483,646	128 Class 'A's
192.0.0.0	63.255.255.255	/2	1,073,741,822	64 Class 'A's
224.0.0.0	31.255.255.255	/3	536,870,910	32 Class 'A's
240.0.0.0	15.255.255.255	/4	268,435,454	16 Class 'A's
248.0.0.0	7.255.255.255	/5	134,217,726	8 Class 'A's
252.0.0.0	3.255.255.255	/6	67,108,862	4 Class 'A's
254.0.0.0	1.255.255.255	/7	33,554,430	2 Class 'A's
255.0.0.0	0.255.255.255	/8	16,777,214	1 Class 'A'
255.128.0.0	0.127.255.255	/9	8,388,606	128 Class 'B's
255.192.0.0	0.63.255.255	/10	4,194,302	64 Class 'B's
255.224.0.0	0.31.255.255	/11	2,097,150	32 Class 'B's
255.240.0.0	0.15.255.255	/12	1,048,574	16 Class 'B's
255.248.0.0	0.7.255.255	/13	524,286	8 Class 'B's
255.252.0.0	0.3.255.255	/14	262,142	4 Class 'B's
255.254.0.0	0.1.255.255	/15	131,070	2 Class 'B's
255.255.0.0	0.0.255.255	/16	65,534	1 Class 'B'
255.255.128.0	0.0.127.255	/17	32,766	128 Class 'C's
255.255.192.0	0.0.63.255	/18	16,382	64 Class 'C's
255.255.224.0	0.0.31.255	/19	8,190	32 Class 'C's
255.255.240.0	0.0.15.255	/20	4,094	16 Class 'C's
255.255.248.0	0.0.7.255	/21	2,046	8 Class 'C's

255.255.252.0	0.0.3.255	/22	1,022	4 Class 'C's
255.255.254.0	0.0.1.255	/23	510	2 Class 'C's
255.255.255.0	0.0.0.255	/24	254	1 Class 'C'
255.255.255.128	0.0.0.127	/25	126	128 Hosts
255.255.255.192	0.0.0.63	/26	62	64 Hosts
255.255.255.224	0.0.0.31	/27	30	32 Hosts
255.255.255.240	0.0.0.15	/28	14	16 Hosts
255.255.255.248	0.0.0.7	/29	6	8 Hosts
255.255.255.252	0.0.0.3	/30	2	4 Hosts
255.255.255.254	0.0.0.1	/31	0	2 Hosts
255.255.255.255	0.0.0.0	/32	1	1 Host

Netmask	Inverse	/CIDR	Usable	Size
0.0.0.0	255.255.255.255	/0	4,294,967,294	The Internet
128.0.0.0	127.255.255.255	/1	2,147,483,646	128 Class 'A's
192.0.0.0	63.255.255.255	/2	1,073,741,822	64 Class 'A's
224.0.0.0	31.255.255.255	/3	536,870,910	32 Class 'A's
240.0.0.0	15.255.255.255	/4	268,435,454	16 Class 'A's
248.0.0.0	7.255.255.255	/5	134,217,726	8 Class 'A's
252.0.0.0	3.255.255.255	/6	67,108,862	4 Class 'A's
254.0.0.0	1.255.255.255	/7	33,554,430	2 Class 'A's
255.0.0.0	0.255.255.255	/8	16,777,214	1 Class 'A'
255.128.0.0	0.127.255.255	/9	8,388,606	128 Class 'B's
255.192.0.0	0.63.255.255	/10	4,194,302	64 Class 'B's
255.224.0.0	0.31.255.255	/11	2,097,150	32 Class 'B's
255.240.0.0	0.15.255.255	/12	1,048,574	16 Class 'B's
255.248.0.0	0.7.255.255	/13	524,286	8 Class 'B's
255.252.0.0	0.3.255.255	/14	262,142	4 Class 'B's
255.254.0.0	0.1.255.255	/15	131,070	2 Class 'B's
255.255.0.0	0.0.255.255	/16	65,534	1 Class 'B'
255.255.128.0	0.0.127.255	/17	32,766	128 Class 'C's
255.255.192.0	0.0.63.255	/18	16,382	64 Class 'C's
255.255.224.0	0.0.31.255	/19	8,190	32 Class 'C's
255.255.240.0	0.0.15.255	/20	4,094	16 Class 'C's
255.255.248.0	0.0.7.255	/21	2,046	8 Class 'C's
255.255.252.0	0.0.3.255	/22	1,022	4 Class 'C's
255.255.254.0	0.0.1.255	/23	510	2 Class 'C's
255.255.255.0	0.0.0.255	/24	254	1 Class 'C'
255.255.255.128	0.0.0.127	/25	126	128 Hosts
255.255.255.192	0.0.0.63	/26	62	64 Hosts
255.255.255.224	0.0.0.31	/27	30	32 Hosts
255.255.255.240	0.0.0.15	/28	14	16 Hosts
255.255.255.248	0.0.0.7	/29	6	8 Hosts
255.255.255.252	0.0.0.3	/30	2	4 Hosts
255.255.255.254	0.0.0.1	/31	0	2 Hosts
255.255.255.255	0.0.0.0	/32	1	1 Host