

10 Gigabit Optical Module Transmission Distance Standard



AI Overview

10G optical modules have standardized transmission distances ranging from 300 meters to 80 kilometers, depending on module type, wavelength, and fiber type.

Common 10G SFP+ Module Types and Distances

- 10GBASE-SR (Short Reach):** Designed for multimode fiber (MMF), typically OM3 or OM4, with a maximum reach of up to 300 meters. Ideal for data center and high-density applications where short distances are sufficient.
- 10GBASE-LRM (Long Reach Multimode):** Supports up to 220 meters over standard multimode fiber (OM1/OM2/FDDI-grade) and requires a mode conditioning patch cord for older fiber types.
- 10GBASE-LR (Long Reach):** Operates over single-mode fiber (SMF) at 1310 nm, with a maximum distance of 10 km, suitable for campus networks or metro-area connections.
- 10GBASE-ER (Extended Reach):** Uses SMF at 1550 nm and supports distances up to 40 km, designed for metro-scale or inter-building links where signal attenuation and reliability are critical.
- 10G BiDi (Bidirectional):** Transmits 10 Gb/s over a single strand of SMF using wavelength-division multiplexing (WDM), effectively halving fiber usage. Distances vary depending on the module, typically up to 10 km.

Wavelength and Fiber Considerations

- 850 nm:** Common for SR modules over MMF.
- 1310 nm:** Used for LR modules over SMF.
- 1550 nm:** Used for ER modules over SMF for extended distances.

Summary Table

Module Type	Fiber Type	Wavelength	Max Distance
10GBASE-SR	MMF (OM3/OM4)	850 nm	300 m
10GBASE-LRM	MMF (OM1/OM2/FDDI)	1310 nm	220 m
10GBASE-LR	SMF	1310 nm	10 km
10GBASE-ER	SMF	1550 nm	40 km
10G BiDi	SMF (single strand)	1270/1330 nm	~10 km

Practical Deployment Notes

- Short-reach modules (SR/LRM) are cost-effective for intra-data center connections.
- Long-reach modules (LR/ER) are preferred for campus or metro-area networks where fiber runs exceed 1...

Article Content

10GBASE-ER SFP Module Explained: Distance, Specs & Use Cases

Learn what a 10GBASE-ER SFP module is, how it works, key specifications, transmission distance, and when to use it in enterprise networks

10 Gbit/s SFP+ Optical Modules

10 Gbit/s SFP+ optical modules apply to 10 GE optical ports. The wavelength can be 850 nm, 1310 nm, or 1550 nm, and the transmission distance ranges from 0.5 km (0.31 mi) to 80 km (49.71 mi).

10 Gigabit Ethernet

10 Gigabit Ethernet Router with two dozen 10 Gigabit Ethernet ports and three types of physical-layer module 10 Gigabit Ethernet (10GE, 10GbE, or 10 GigE) is a group of computer networking

Optical Fiber and 10 Gigabit Ethernet

Introduction As 10 Gigabit Ethernet (10GbE) is introduced into networks the physical limitations and properties of optical fiber introduce new challenges for a network designer. Due to the increased data

Cisco 10GBASE SFP+ Modules Data Sheet

It has the SFP+ form factor and an RJ-45 interface so that CAT5e/CAT6A/CAT7 cables can be used to connect to end points with embedded 10GBASE-T ports. They are suitable for distances

10 Gigabit Ethernet Fiber Design Considerations

This paper has introduced some basic fiber related concepts and outlined some of the key points to understand and consider when designing a 10 Gigabit Ethernet network.

Cisco 40GBASE QSFP Modules Data Sheet

The Cisco® 40GBASE QSFP (Quad Small Form-Factor Pluggable) portfolio offers customers a wide variety of high-density and low-power 40 Gigabit Ethernet connectivity options for

10G SR vs LR vs ER vs ZR - Optical Transceiver

When deploying a 10G network, choosing the right optical transceiver is critical. The main difference between SR, LR, ER, and ZR modules lies in

What Is 10GBASE-LR? SMF 1310nm 10km SFP+ Explained

10GBASE-LR is a 10-gigabit Ethernet optical standard that operates at 1310 nm over single-mode fiber (SMF), supporting link distances of up to 10 km. It is typically implemented using SFP+ transceivers

10 Gigabit Ethernet (10GbE) Standards: The Definitive Guide

Final Words This guide is for you if you are ready to go “all in” with 10GbE Ethernet standards. **What Is 10 Gigabit Ethernet (10GbE)?** 10 Gigabit Ethernet, often known as 10GbE, is a

Ethernet

Fiber optic variants of Ethernet (that commonly use SFP modules) are also very popular in larger networks, offering high performance, better electrical isolation and longer distance (tens of kilometers)

SFP+, XFP, QSFP+, DAC Twinax Cable 10Gtek Transceivers Co., Ltd

DAC Twinax Cable Maker. CE, FCC, RoHS, ISO9001 Certified. Professional Manufacturer focusing on SFP+ Cables, QSFP+ Cables, MiniSAS Cables, QSFP Cables, XFP Cables, CX4 Infiniband Cables

Juniper 800G Optical Transceivers and Cables Guide

800 Gigabit (800G) transceivers are optical modules capable of handling data rates of 800 Gbps. With a transmission rate of up to 800 Gbps, 800G transceivers offer double the capacity

SFP-10G-SR vs LRM vs LR: Which 10G Module Should

Compare SFP-10G-SR, LRM, and LR modules by distance, fiber type, and cost to find the right fit for your 10G network deployment.

10 Gigabit Ethernet

10 Gigabit Ethernet (10GE, 10GbE, or 10 GigE) is a group of computer networking technologies for transmitting Ethernet frames at a rate of 10 gigabits per second. It was first defined by the IEEE

Standards for 10Gb Ethernet: A Comprehensive Overview

In the ever-evolving landscape of networking technologies, the demand for higher data transfer speeds and increased bandwidth has led to the development of 10 Gigabit Ethernet (10GbE)

SFP Distance Explained: Real-World Range, Limits, and Optics

Understand SFP distance, fiber optic range, and real-world limits of SR/LR modules. Learn how wavelength, fiber type, and optics affect performance.

Ethernet Media Standards and Distances

Reference chart for common ethernet media types. Most of the distances listed are average. Quality fiber and quality vendor optics can typically perform better. This chart is not an

Cisco Nexus 5600 Platform 10-Gbps Switches Data Sheet

This data sheet describes the benefits, specifications, and ordering information for the Cisco Nexus 5600 Platform 10-Gbps Switches.

What is the longest transmission distance of a 10G

There is a variation of ranges, Technically ZR modules are the longest and can transmit data over single-mode fiber for distances up to 80

10 Gigabit Ethernet Fiber Design Considerations

The 10 Gigabit Ethernet operating distances provided in the tables below are limited by the channel insertion loss, the cable bandwidth for multimode fiber, and the optical transceiver characteristics

10GBASE-ER SFP Module Explained: Distance, Specs & Use Cases

A standard 10GBASE-ER SFP module supports transmission distances of up to 40km over single-mode fiber. Actual reach depends on fiber quality, connector loss, and overall optical budget.

10GBASE-ER Application Overview

10GBASE-ER supports extra-long wavelength serial transmission over duplex (2-fiber) single-mode optical fiber cabling. The application's equivalent symbol rate is 10.3125 GBd per lane and the

Optical Fiber and 10 Gigabit Ethernet

The current IEEE 802.3 standard for 10 Gigabit Ethernet cites ISO/IEC standard 11801 for optical fiber specification compliance, which in turn refers to IEC 60793-2 for detailed optical fiber parameter

What is 10 gigabit ethernet standard?

This guide will explain 10 gigabit ethernet computer standard and detail the kinds of interfaces, optical fiber, and port types involved.

Multimode Fiber and 10GE

Multimode Fiber and 10 Gigabit Ethernet The IEEE 802.3ae 10 Gigabit Ethernet specification includes a serial interface referred to as 10GBASE-S (the S stands for short wavelength) that is designed for

KD — High-Speed Optical Connectivity Semiconductors

KD designs semiconductor ICs for multi-gigabit optical networking over fiber optics. Solutions for automotive, industrial, and consumer connectivity.

10G Optical Modules: Short-Range vs. Long-Range

Understand short-range and long-range 10G optical modules in terms of distance, budget, energy use, and scalability to make the right choice.

Contact Us

For more information, pricing, or custom solutions, please contact us:

Website: <https://dknconsulting.co.za>

Email: info@dknconsulting.co.za

Phone: +31 6 2948 7351

Address: Herengracht 123, 1015 BT Amsterdam, Netherlands

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