Single-mode optical module SFP parameters



Overview

Confused by SFP vs SFP+? Read the definitive 2026 guide on SFP modules. We explain Single Mode vs Multimode, DDM diagnostics, and how to choose the right transceiver for Cisco, Juniper, and more.

Key Takeaways

Single-mode SFP modules transmit optical signals over long distances using a 9µm core fiber, with key parameters including wavelength, distance, optical power, and Digital Optical Monitoring (DOM) metrics. Core CharacteristicsSingle-mode SFPs are designed for long-distance fiber communication using a 9µm glass core, which allows light to travel in a single mode, minimizing modal dispersion and signal loss. They are typically used in enterprise backbones, data centers, and telecom networks where distances range from 10 km to over 80 km depending on the module type.

Wavelength and Standards

Common wavelengths: 1310 nm (LR modules), 1550 nm (ER/ZR modules), and CWDM/DWDM variants for dense wavelength division multiplexing. Standard codes: LR (Long Range): ~10 km, 1310 nm, blue latchER (Extended Range): ~40 km, 1310/1550 nm, red latchZR (Zeal Range): 80 km+, 1550 nm, green/white latch Transmission Speed and CompatibilitySingle-mode SFPs support a range of speeds from 1G to 25G and are compatible with Gigabit Ethernet, 10G, and 25G networks. They use LC connectors and are hot-swappable, allowing flexible deployment in SFP ports on switches, routers, and other network devices.

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Optical Power and Link Budget

Transmit power (P_transmit) and receiver sensitivity (P_sensitivity) define the link budget, typically 6–9 dB for 10G-LR modules. High-power single-mode optics can exceed 30 dB loss tolerance, but care must be taken to avoid exceeding the receiver's maximum input power (Pmax), which can damage the photodetector. Digital Optical Monitoring (DOM)Modern single-mode SFPs support DOM (SFF-8472), providing real-time monitoring of: Optical output power (TX)Optical input power (RX)TemperatureSupply voltageLaser bias current Monitoring these parameters helps detect early signs of module degradation, such as increasing bias current or sudden RX power spikes, which may indicate a failing laser or voltage regulator.

Environmental and Industrial ConsiderationsIndustrial-grade SFPs can operate in temperature ranges from -40°C to 85°C, making them suitable for harsh environments. Factors like vibration, interference, and temperature tolerance are critical for reliable long-distance deployments.

Deployment Recommendations

Always match the SFP module to the fiber type (single-mode vs. multimode) and connector type (usually LC) to ensure proper operation. Verify wavelength and distance requirements to avoid link failures. Use attenuators for high-power modules on short links to prevent receiver burnout.

Monitor DO

M metrics regularly to maintain network stability and preempt failures.

Single-mode SF

P modules are essential for high-availability, long-distance optical networks, providing scalable bandwidth, low attenuation, and precise monitoring for enterprise and carrier-grade deployments.

Article Content

The Ultimate Guide to SFP Modules (2026): Types, Speeds

Confused by SFP vs SFP+? Read the definitive 2026 guide on SFP modules. We explain Single Mode vs Multimode, DDM diagnostics, and how to choose the right transceiver for Cisco, Juniper, and more.

Single-mode vs Multimode SFP 2026: Fiber Types and distances

A guide to single-mode vs multimode SFP modules. Covers fiber types, wavelengths, distances, BiDi, CWDM/DWDM, SMF vs MMF selection, and application scenarios.

Cisco SFP Modules for Gigabit Ethernet Applications Data Sheet

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This data sheet describes the benefits, specifications, and ordering information for the Cisco SFP Modules for Gigabit Ethernet Applications.

How to Choose SFP Module for Compatibility, Speed, and Distance

Learn how to choose the right SFP module based on compatibility, speed, fiber type, wavelength, and distance. Practical guide for engineers and IT buyers.

SFP module specification and selection guide (EN)

SFP modules comply with the MSA Multi-Source Agreement standard. They are Class 1 laser and comply with the international standards - 21 CFR 1040.10/11. 100FX works at 125 Mbps over the

What Is an SFP Optical Module? Guide | PHILISUN

Understand the core function, compare data rates (1G to 25G), learn critical compatibility rules, and follow our 5-step checklist for selecting the perfect SFP optical module for your network build.

Single-Mode vs Multimode SFP Identification: 2026 Protocol

Confused about whether your SFP is single-mode or multimode? Learn the differences, visual cues, wavelength ranges, and compatibility to avoid mismatched fiber connections and costly

Single Mode vs Multimode SFP: Data Center Selection Guide

By using Single mode SFP for everything from the leaf-spine to the core, you create a unified physical layer. This simplifies sparing, reduces the variety of patch cords needed, and

How to Tell if My SFP is Single-Mode or Multimode?

Discover how to identify if your SFP (Small Form-factor Pluggable) module is single-mode or multimode. Look for SM or MM labels, check color coding, and consult manufacturer specs

Single-mode vs Multimode SFP: What''s the Difference?

Discover the differences between single-mode and multimode SFP transceivers. Learn which one suits your network needs for optimal performance and connectivity.

Unlocking the Potential of Fiber SFP Modules: A

The main difference among the SFP modules is their classification according to data rate, transmission distance, and optical fiber type: single mode

Small Form-factor Pluggable

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Small Form-factor Pluggable Small Form-factor Pluggable connected to a pair of fiber-optic cables Small Form-factor Pluggable (SFP) is a compact, hot-pluggable network interface module format used for

SFP-10G-ER Explained: Powering 40km 10Gbps Optical Links

SFP-10G-ER is a 10G SFP+ transceiver for up to 40km over single-mode fiber, featuring 1550nm wavelength, LC connector, and real-time monitoring.

SFP Module: What''s It and How to Choose It?

This blog will explore the function of SFP modules, SFP module types, applications and how to choose suitable SFP modules.

What is SFP Module and How to Choose it□

SFP modules are versatile enough to operate with both copper Ethernet cables and optical fiber cables. On the optical fiber side of things, SFP modules come in single-mode and

Single Mode SFP vs Multimode SFP: Deciphering the

Single-mode SFP modules are designed for long-distance transmission, typically exceeding 10 kilometers. Such modules use a thin fiber

Selecting the Right SFP Module for Single-Mode and Multimode Fiber

Learn how to select the right SFP module for single-mode and multimode fiber by understanding wavelength, distance, compatibility, and industrial network requirements.

Single Mode vs Multimode SFP Modules: Which One to

Single Mode vs Multimode SFP Modules: Compare fiber types, wavelengths, cost, and transmission distance to select the right optical

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