

Structure of SFP optical module



Overview

An SFP module is a small form factor pluggable optical transceiver that fits into the SFP port of the networking switch or other device.

Key Takeaways

An SFP optical module consists of a compact, hot-pluggable assembly with a transmitter (TOSA), receiver (ROSA), control circuitry, and interface pins for electrical and optical signal conversion.

Core Components



1. Transmitter Optical Sub-Assembly (TOSA) The TOSA converts electrical signals from the host device into optical signals for fiber transmission. It typically contains a laser diode (LD) or, in lower-speed applications, an LED. Laser diodes provide coherent light with narrow spectral linewidth and high directionality, enabling efficient fiber coupling and long-distance transmission, while LEDs are used for short-distance, low-speed links due to lower coupling efficiency and broader spectral output . 2. Receiver Optical Sub-Assembly (ROSA) The ROSA detects incoming optical signals and converts them back into electrical signals. It usually contains a photodiode, which may be a PIN or avalanche photodiode (APD) for higher sensitivity. High-speed modules often include a limiting amplifier to maintain signal integrity across varying data rates . 3. Control and Interface Circuitry SFP modules include a central controller that manages the laser driver, receiver amplifier, and communication with the host via an I²C interface. This allows Digital Diagnostics Monitoring (DDM), providing real-time telemetry such as temperature, supply voltage, and transmit/receive optical power . 4. Electrical Connector (Gold Finger Pins) The module connects to the host device through a gold finger interface, with pins of varying lengths to ensure proper power-up sequencing. Longest pins are for signal ground, followed by power supply pins, and shortest for data signals. This design ensures safe hot-plug operation and reliable electrical contact .

Functional Overview

- Transmitter (TX): Converts electrical input into optical pulses using TOSA.
- Receiver (RX): Converts incoming optical signals into electrical output using ROSA.
- Monitoring: DDM/DOM provides diagnostic data to the host for proactive maintenance.
- Hot-Pluggable Interface: Allows insertion and removal without powering down the host device, supporting modular deployment and high port density .

Variants and Evolution

SFP modules have evolved to support higher data rates:

- SFP: 1 Gbps
- SFP+: 10 Gbps
- SFP28: 25 Gbps While the mechanical form factor remains largely consistent, higher-speed modules require more advanced optical components and precise control circuitry to maintain signal integrity . In summary, the SFP optical module is a modular, standardized transceiver that integrates TOSA, ROSA, control electronics, and a hot-pluggable interface to convert signals between electrical and optical domains, enabling flexible, high-speed network connectivity.

Article Content

SFP Optical Modules by Structure and Classification

SFP optical modules convert electrical and optical signals, with details on module structure, optical interfaces, fiber

The Key External Components of Optical Modules

In this blog, we'll explore the core structure of an optical transceiver, explaining the function of each part and how they

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

What is an SFP? SFP (Small Form-factor Pluggable) is a compact, hot-pluggable network interface module used to connect network

What is the SFP Module? 2024 Best SFP Transceiver Guide

An SFP module is a small form factor pluggable optical transceiver that fits into the SFP port of the networking switch or other device.

What Is an SFP Module? □Comprehensive Guide Including Fiber

Conclusion The hot-swappable feature and wide compatibility of SFP optical modules have injected strong impetus into the large

Brief Introduction To The Data Structure Of SFP Optical Modules

As a universal photoelectric conversion module, the SFP optical module has uniform specifications for its structure,

What Is an SFP Module? Types, Uses & Compatibility (2025)

Learn what an SFP module is, how SFP transceivers work, common types (SX/LX/SFP+), single-mode vs multimode, and how to

Understanding Pluggable Optical Modules

An eSFP optical module is an SFP optical module that supports monitoring of voltage, temperature, bias current, transmit optical

TI Optical Module 10G SFP+ Total Solution

ABSTRACT TI 10G optical module SFP+ total solution is a complete demonstrated-working optical transceiver solution targeted for

Optical module design resources | TI

Integrated circuits and reference designs help you create a smaller and faster optical module design used in high-bandwidth data

Everything You Need to Know About Optical Modules

Pluggable optical modules can be divided into small form-factor pluggable (SFP) modules and quad small form-factor

The road to SFP+: Examining module and system architectures

SFP+ is the latest pluggable optical module form factor for use in 10-Gbit/sec Ethernet and 8.5-Gbit/sec Fibre Channel systems. The

The Three Structures of SFP+ Fiber Optic Modules | Sopto

The three structures of SFP+ optical modules are: limiting structure, linear structure and synchronous structure. The

What is an SFP Module and How Does it Power Your Network?

What is an SFP Module An SFP (Small Form-factor Pluggable) module is a compact, hot-pluggable optical transceiver

Optical Module Working Principle

1. Internal Structure of SFP Optical Module As can be seen in Figure 1, the main part of the optical module is

Fiber transceiver and the what is sfp fiber module

Things you should know about optical transceiver The word “optical fiber transceiver” is a unified name for a small photoelectric

The Internal Components and Structure of The Optical Transceiver

The optical module is a very important component in an optical communication system. This article will introduce you

Small Form-factor Pluggable

Small Form-factor Pluggable (SFP) is a compact, hot-pluggable network interface module format used for both telecommunication

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