How to configure the electrical interface of an SFP optical module



Overview

SFP Module Pinout: Electrical Interface and I2C Standards GuideMaster the SFP module pinout with our complete 20-pin diagram and electrical interface guide.

Key Takeaways

The SFP optical module electrical interface connects the host device's high-speed electrical signals to the module's transmitter and receiver, enabling conversion to optical signals for fiber transmission. Overview of the Electrical InterfaceAn SFP (Small Form-factor Pluggable) module is a hot-pluggable transceiver that converts electrical signals from a network device into optical signals for fiber, or vice versa for incoming signals. The electrical interface is standardized under Multi-Source Agreements (MSAs), ensuring interoperability across vendors.

This interface defines the pinout, voltage levels, and signal types that connect the module to the host device, typically a switch, router, or server NIC.

Functional Blocks

Transmitter (TX): Receives electrical signals from the host via the SFP electrical interface and drives a laser diode (VCSEL or DFB) to generate optical pulses. Receiver (RX): Converts incoming optical signals into electrical signals compatible with the host PHY. Host Interface: The module connects to the host through a defined pinout, which carries differential high-speed signals (typically LVPECL or CML for SFP/SFP+/SFP28), power supply pins, ground, and control signals such as TX_DISABLE, MOD_ABS, and SCL/SDA for I²C-based Digital Diagnostics Monitoring (DDM/DOM),.

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Electrical Specifications by Module TypeSFP (1G): Supports 1 Gbit/s data rates; electrical interface uses CML or LVPECL differential pairs for TX and RX. SFP+ (10G): Supports 10 Gbit/s; requires higher-speed differential signaling and stricter impedance control. SFP28 (25G): Supports 25 Gbit/s; electrical interface is optimized for 25 Gbit/s CML signaling, with careful attention to signal integrity and host PHY compatibility.

Management and Diagnostics

Modern SF

P modules include Digital Diagnostics Monitoring (DDM), which communicates over an I^2C interface. This allows the host to read module parameters such as temperature, supply voltage, and optical TX/RX power. The electrical interface supports these control and monitoring signals alongside the high-speed data lanes.

Key Considerations

Compatibility: Even if a module physically fits into an SFP cage, it will only operate correctly if the host PHY and firmware support the module's electrical interface and data rate.

Hot-

Pluggability: The electrical interface is designed to allow insertion and removal without powering down the host device, with proper grounding and signal isolation to prevent damage. Copper vs. Optical: Copper SFP modules integrate PHY and magnetics to convert electrical signals to Ethernet over twisted pair, while optical SFPs rely on the electrical interface to drive the optical transmitter and receive signals from the photodiode.

In summary, the SFP electrical interface is a standardized, high-speed differential connection that ensures reliable signal conversion between the host device and the optical or copper medium, supporting modularity, hot-pluggability, and diagnostic monitoring across multiple data rates and module types.

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Frequently Asked Questions

Cisco SFP and SFP+ Transceiver Module Installation Notes

This installation note provides the installation instructions for the Cisco small form-factor pluggable (SFP) and SFP+ transceiver modules. These t...

Installing SFP and SFP+ Transceiver Modules

SFP transceiver modules can have three types of latching devices to secure an SFP transceiver module in a port socket: •Figure 4 shows an SFP trans...

Removing SFP and SFP+ Transceiver Modules

If you are removing an SFP or SFP+ transceiver module, follow these steps: Step 1 Attach an ESD-preventive wrist strap to your wrist and to the ESD...

Obtaining Documentation and Submitting A Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What's New in Cisco...

Article Content

SFP Module Pinout: Electrical Interface and I2C Standards Guide

Master the SFP module pinout with our complete 20-pin diagram and electrical interface guide. Learn I2C EEPROM flashing, PCB hardware design, and troubleshooting.

Cisco SFP and SFP+ Transceiver Module Installation Notes

Learn more about how Cisco is using Inclusive Language. This installation note provides the installation instructions for the Cisco small form-factor pluggable (SFP) and SFP+ transceiver

How to Install an SFP Module: Step-by-Step Guide

Learn how to install an SFP module correctly with step-by-step instructions, safety tips, hot-swap rules, and troubleshooting for reliable network links.

SFP Cage Connector Pinout and Specifications Guide

The SFP electrical interface uses a 20-pin edge-card connector defined by INF-8074i (1G) and backward-compatible SFF-8431 (10G SFP+). The pinout is identical across SFP, SFP+,

Why SFP Module Pinouts Matter More Than You Think

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Understanding SFP module pinouts is more than a technical exercise; it is the basis for reliable network performance. This comprehensive article will detail pin definitions, connector types,

TI Optical Module 10G SFP+ Total Solution

This application note provides the schematics, PC-board layout, Gerber files, bill of materials (BOM), firmware, and a graphical user interface (GUI); not only for the module but also for the evaluation board.

How to Use SFP Connectors in Your PCB Layout | Altium

SFP connectors are used to route data into fiber optic transceiver modules, which are normally found in high-speed networking equipment. Today, however, I''ve had multiple design

Operation, Maintenance & Calibration of SFP Transceivers

Learn how to operate, maintain, and calibrate GAO Tek''s SFP Transceivers with detailed instructions for optimal performance and reliability.

How to Install or Remove SFP, SFP+, QSFP, and XFP Modules

To connect an optical cable to an SFP module, use the appropriate patch cord (e.g., LC-LC, SC-LC, etc.). The patch cord must match the fibre type – single-mode or multi-mode. Once

SFPTOTAL™

Software and hardware solution for coding SFP, SFP+, XFP, QSFP+, GBIC, SFP28 and QSFP-DD transceivers. Improving compatibility with brand switches.

Cisco Optical Transceiver Handling Guide

Overview The QSFP-DD, QSFP, and SFP transceiver modules are hot-swappable and connect the electrical circuitry of the system with an optical external network. The following figure shows the

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HMS Networks

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Pluggable Optical Modules: Transceivers for the Cisco ONS Family

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Cisco offers a comprehensive range of pluggable optical modules for the Cisco ONS family of multiservice platforms. The wide variety of modules gives you flexible and cost-effective

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QSFP-DD Optical Module Signal Flow and Management

How does a QSFP-DD optical module actually work? This animation shows a simplified end-to-end signal flow inside a QSFP-DD transceiver. The host sends high-speed electrical data through eight ...

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Pluggable Optical Modules: QSFP-DD or OSFP Both variants support all the technical

How to Install and Remove Optical Modules Safely

How to Remove an SFP Module (Step-by-Step) Prepare: Ideally, gracefully shut down the interface in the device''s OS if management access is available (shutdown command in Cisco IOS/NX

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