

Function of Single-Fiber Bidirectional Optical Modules

Article Overview

Single-fiber bidirectional (BiDi) optical modules enable simultaneous data transmission and reception over a single optical fiber using different wavelengths, reducing fiber usage and simplifying network deployment.

What is a BiDi Optical Module?

A Bidirectional (BiDi) optical module is a compact transceiver that allows full-duplex communication over a single fiber strand, unlike traditional modules that require two fibers--one for transmitting (TX) and one for receiving (RX) data . By using Wavelength Division Multiplexing (WDM), BiDi modules assign different wavelengths to upstream and downstream signals, enabling simultaneous bidirectional transmission without interference .

How BiDi Modules Work

- o **Transmission Side:** The module emits light at a specific wavelength (e.g., 1310 nm) for sending data. A WDM filter ensures only this wavelength passes in the transmit direction .
- o **Reception Side:** Incoming light at a different wavelength (e.g., 1490 nm or 1550 nm) is directed to the receiver while blocking the transmit wavelength, allowing simultaneous reception .
- o **WDM Coupler:** This key component multiplexes the two wavelengths onto a single fiber and demultiplexes them at the receiving end, ensuring interference-free bidirectional communication .

Advantages of Single-Fiber BiDi Modules

- o **Fiber Conservation:** Reduces fiber usage by 50% compared to dual-fiber solutions .
- o **Cost Efficiency:** Lowers deployment costs and simplifies cabling infrastructure .
- o **Full-Duplex Communication:** Supports simultaneous sending and receiving of data without performance loss .
- o **Flexibility:** Compatible with various data rates, including 1G (SFP BIDI), 10G (SFP+ BIDI), and 100G (QSFP28 BiDi) modules .

Applications

BiDi modules are widely used in environments where fiber resources are limited or expensive, such as:

- o Telecommunications networks
- o Data centers and data center interconnects (DCI)
- o Enterprise campus networks
- o Metropolitan area networks (MANs) They are particularly valuable for upgrading existing fiber

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infrastructure without laying additional fibers, supporting distances from 10 km to 80 km depending on the module type .

Common Form Factors

- o SFP (Small Form-factor Pluggable): Typically used for 1G and 10G Ethernet applications .
- o SFP+: Enhanced version for higher-speed 10G links .
- o QSFP28 BiDi: Supports 100G high-speed interconnects over a single fiber, ideal for modern data center deployments .

Summary

Single-fiber BiDi optical modules leverage WDM technology to transmit and receive data simultaneously over a single fiber, offering cost-effective, fiber-efficient, and high-performance solutions for modern networking. They simplify network expansion, reduce infrastructure costs, and are suitable for a wide range of applications from enterprise networks to high-speed data center interconnects .

Learn what a BiDi SFP module is, how it works, key types, benefits, and when to use BiDi optics in fiber networks.

Things You Should Know About BiDi SFP Modules For the past few years, SFP transceiver modules have received

Enter the 10G BiDi (bidirectional) SFP+ module --an elegant solution that enables full-duplex communication over a

Single-fiber bidirectional (BiDi) refers to the simultaneous transmission and reception of optical signals in two directions over 1 optical

Unlike traditional optical modules that use separate fibers for transmitting and receiving data, BiDi modules

I. "Dual-channel" transmission and reception, without interference. Bidirectional over Single Fiber (BiDi) means

Bidi single fiber bidirectional optical module can be installed in switches, optical fiber

Bidirectional single-fiber (BiDi) transmission technology is a core technology in the field of optical communication that

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Different center wavelengths are used for the two directions. This mode saves half of the fiber resources compared to the single-fiber

A BiDi SFP module is a type of optical transceiver designed for bidirectional communication over a single optical fiber, most

Deploying or upgrading network infrastructure often hits a bottleneck: limited fiber strands. Running new fiber is

A single fiber optical transceiver, known as Bidi transceiver, allows bidirectional communication over a single optical

BiDi transceivers have become synonymous with reliable and high-performance networks, enabling bidirectional fiber

Bi-Directional (BiDi) Transceiver is a compact optical transceiver module that uses WDM (wavelength division

Discover BIDI SFP optical transceivers, the single-fiber bidirectional modules that optimize fiber usage. Learn how they

Working principle of BiDi single fiber bidirectional optical module As shown in the figure below, a general optical

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