Single-fiber bidirectional optical module technology



Overview

Bidirectional over Single Fiber (BiDi) means that data transmission and reception can be completed simultaneously within a single optical fiber, unlike ordinary optical fibers which...

Key Takeaways

Single-fiber bidirectional (BiDi) optical modules enable simultaneous transmit and receive over a single fiber using two different wavelengths, effectively doubling fiber efficiency and reducing network costs. Overview and Working PrincipleSingle-fiber bidirectional optical modules, commonly called BiDi transceivers, use Wavelength Division Multiplexing (WDM) technology to achieve full-duplex communication over a single fiber strand. Each module transmits data at one wavelength while receiving data at a different wavelength.

For example, one end may transmit at 1310 nm and receive at 1550 nm, while the opposite end transmits at 1550 nm and receives at 1310 nm. This setup allows a single fiber to carry traffic in both directions simultaneously, similar to a two-lane road for optical signals. Inside the module, a BOSA (Bi-Directional Optical Sub-Assembly) integrates a transmitter (TOSA) and receiver (ROSA) with an optical filter to separate the wavelengths, preventing crosstalk and maintaining signal integrity.

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The modules must be deployed in matched pairs to ensure proper wavelength alignment and successful communication. Types and ApplicationsBiDi modules are available in various speeds and form factors: 155M BiDi SFP for legacy SONET/SDH networks1G BiDi SFP for Gigabit Ethernet10G BiDi SFP+ for high-bandwidth enterprise and metro networks These modules are widely used in fiber-constrained environments, such as campus networks, metro rings, and data center interconnects, where reducing fiber usage is critical. By using BiDi modules, network operators can save up to 50% of fiber resources, lower installation and maintenance costs, and simplify cabling management.

Advantages

Fiber Efficiency: Only one fiber is needed for bidirectional communication, reducing the need for additional fiber deployment. Cost Reduction: Fewer fibers mean lower infrastructure and leasing costs. Simplified Installation: Reduced cabling complexity and fewer physical connections speed up deployment.

Scalability: Supports network upgrades and expansions without major fiber additions.

Considerations

Optical Isolation: Proper filtering is required to prevent interference between transmit and receive wavelengths. Pairing Requirement: BiDi modules must be used in matched pairs with complementary wavelengths. Design Complexity: Single-fiber bidirectional systems require careful planning for wavelength separation and network management.

In summary, single-fiber bidirectional optical modules are a cost-effective and efficient solution for modern fiber networks, enabling full-duplex communication over a single fiber while reducing infrastructure costs and simplifying network management.

Article Content

BiDi Optical Modules: Unlocking Single-Fiber

Comprehensive guide on BiDi Optical modules, detailing single-fiber bidirectional connectivity, deployment tips, troubleshooting, and multi-speed

How do optical modules achieve single-fiber bidirectional transmission ...

This comprehensive guide explains how WDM couplers combine and separate different wavelengths (1310nm/1550nm,1270nm/1330nm,850nm/900nm) to achieve bidirectional transmission

The Complete Guide to BiDi Transceiver

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

How Do Optical Modules Achieve Single-Fiber Bidirectional ...

Bidirectional over Single Fiber (BiDi) means that data transmission and reception can be completed simultaneously within a single optical fiber, unlike ordinary optical fibers which...

BiDi Transceiver: Utilizing WDM Technology for Dual-Direction Data ...

BiDi transceiver, a compact optical transceiver with WDM (wavelength division multiplexing) technology and SFP multi-source protocol (MSA) compliance, allows fast data

How do optical modules achieve single-fiber bidirectional

It achieves bidirectional signal transmission over a single fiber through wavelength splitting and single-fiber multiplexing, adaptable to various speeds such as gigabit and 10-gigabit

Bidirectional SFP Selection Guide for Single-Fiber Links

This guide explains how bidirectional SFP technology works and outlines the key specifications to consider when selecting modules for single-fiber links. It also covers common BiDi SFP types,

BiDi SFP Module: A Complete Guide for Fiber Networks

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

What is BiDi Transceiver: A Beginner''s Guide

BiDi transceiver, or Bidirectional or simplex optical transceiver, is an optical module that uses Wavelength Division Multiplexing (WDM) technology to

BIDI Transceiver Technology And Applications

EXECUTIVE SUMMARYBidirectional (BIDI) optical transceiver technology represents a paradigm shift in fiber optic network infrastructure, enabling full-duplex communication ...

The Most Comprehensive Guide Of Optical Modules

Explore the ultimate guide to optical modules. Learn types, functions, performance metrics & how to choose the right module for your fiber network.

Meaning of Optical Module Pull Tap Colors

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BIDI SFP Single-fiber Bidirectional Optical Module Pull Tap Color The characteristic of a single-fiber bidirectional optical module is that it can realize signal transmission in two directions

Datasheet Archive: FRENCH SINGLE-FIBER BIDIRECTIONAL OPTICAL MODULE ...

View results and find french single-fiber bidirectional optical module datasheets and circuit and application notes in pdf format.

Ubiquiti 1 Gbps Bidirectional Single-Mode Optical Module

Ubiquiti 1 Gbps Bidirectional Single-Mode Optical Module The 1 Gbps Bidirectional Single-mode Optical Module is a simplex transceiver that delivers up to 1.25 Gbps speed over distances up to 3

Ubiquiti 10 Gbps Bidirectional Single-Mode Optical Module

Single-mode, simplex, fiber transceiver module. The 10 Gbps Bidirectional Single-mode Optical Module is a simplex transceiver that delivers up to 10 Gbps speed over distances up to 10 kilometers.

100G Optical Module: How to Choose Between SR4, DR4, FR4, LR4,

Transmission Technology: The module is designed for bidirectional data transmission over a single multimode fiber strand. It uses two optical lanes, each capable of 50Gbps, to transmit

Is Your Network Ready for 800G? Key Fiber Optic Trends Shaping

BiDi Optical Transceivers BiDi technology enables bidirectional communication over a single fiber strand, helping organizations maximize existing fiber resources. These technologies

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

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

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