

Principle of Single-Fiber Bidirectional Optical Modules



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

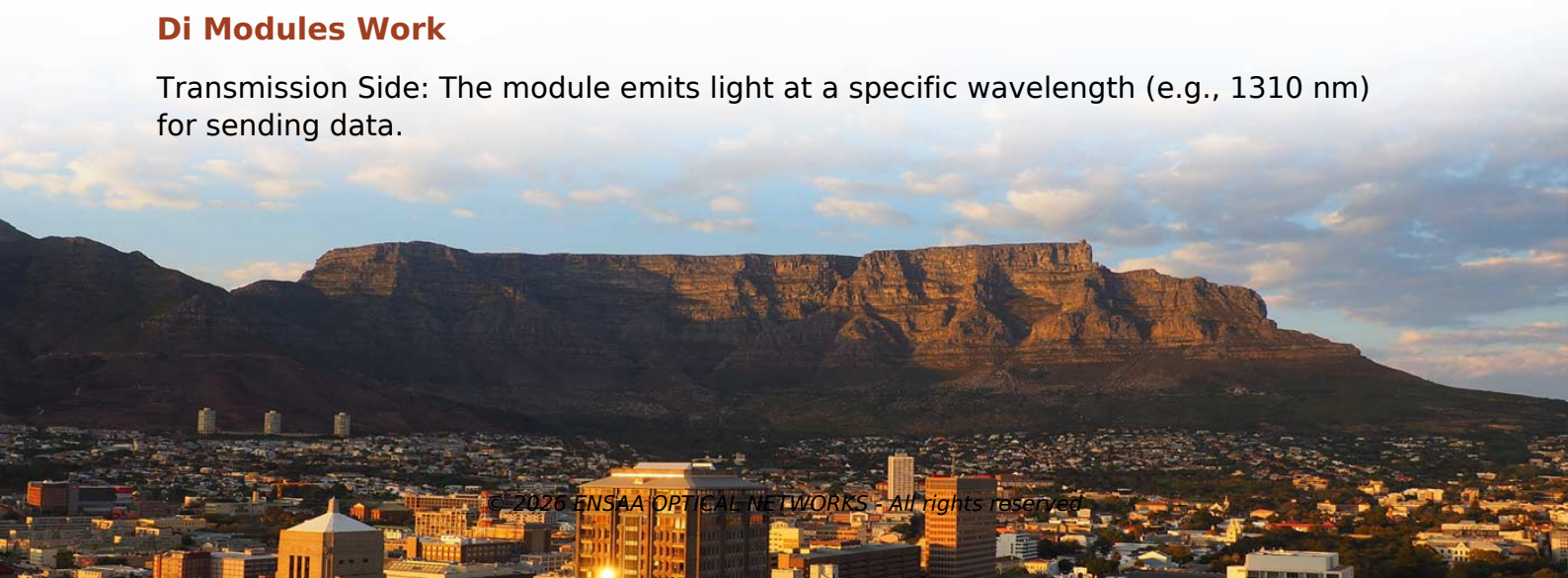
Single-fiber bidirectional (BiDi) optical modules enable simultaneous data transmission and reception over a single optical fiber using different wavelengths, reducing fiber usage and simplifying network deployment. What is a BiDi Optical Module? A Bidirectional (BiDi) optical module is a compact transceiver 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 Bi

Di Modules Work

Transmission Side: The module emits light at a specific wavelength (e.g., 1310 nm) for sending data.



A WD

M filter ensures only this wavelength passes in the transmit direction. 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.

WD

M 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 Bi

Di Modules Fiber Conservation: Reduces fiber usage by 50% compared to dual-fiber solutions. Cost Efficiency: Lowers deployment costs and simplifies cabling infrastructure.

Full-

Duplex Communication: Supports simultaneous sending and receiving of data without performance loss. 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: Telecommunications networks Data centers and data center interconnects (DCI) Enterprise campus networks Metropolitan area networks (MANs) They are particularly valuable for upgrading existing fiber infrastructure without laying additional fibers, supporting distances from 10 km to 80 km depending on the module type.

Common Form Factors SFP (Small Form-factor Pluggable): Typically used for 1G and 10G Ethernet applications. SFP+: Enhanced version for higher-speed 10G links. 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.

Article Content

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

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...

How Do Optical Modules Achieve Single-fiber Bidirectional

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

BiDi SFP: The Complete Guide to Bidirectional SFP Transceivers and ...

BiDi SFP (Bidirectional Small Form-Factor Pluggable) transceivers have emerged as a powerful solution, enabling full-duplex communication over a single optical fiber. By using

BiDi Optical Modules: Unlocking Single-Fiber Bidirectional Connectivity

Bidirectional (BiDi) optical modules utilize wavelength division multiplexing/wavelength selective coupling (WDM) technology to provide simultaneous transmit and receive capability over a

The Essential Guide to BiDi Transceivers: Everything You Need to Know

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

Introduction to BIDI Optical Module.

BIDI optical modules are an efficient solution for single-fiber bidirectional communication, leveraging WDM technology to optimize fiber usage. By understanding their working principles and

The Complete Guide to BiDi Transceiver

Unlike traditional optical modules that use separate fibers for transmitting and receiving data, BiDi modules accomplish this bidirectional data transfer on a single fiber, optimizing space

Single Strand Mastery: BiDi SFP Architecture

Explore the BiDi SFP working principle and wavelength mapping. Our architect-level guide covers WDM duplexers, DFB lasers, and TCO strategies to double your fiber capacity.

Understanding BiDi SFP Optical Transceiver Modules

Visually, a BiDi module has only one port and uses only one optical fiber for connection. The working principle of a BiDi optical module is that it uses a filter (filtering out unwanted center

Transceiver CBO SFP-10G-BX-D 10G SFP+ | AiO.lv

Short description CBO SFP-10G-BX-D is a fiber-optic SFP+ transceiver supporting 10 Gbps bidirectional transmission over a single fiber. Designed for data center and carrier networks, it enables duplex

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.

Explanation of Optical Module Parameters

Considering that some newcomers to optical modules may not understand the letters on the optical module or the specific meanings of the parameters on the optical module, the following is

Recommendation ITU-T G.9806 (2020) Cor. 2 (08/2024) Higher-speed ...

This document is a comprehensive update to the ITU-T G.9806 recommendation, focusing on higher speed bidirectional point-to-point (HS-PtP) Ethernet-based optical access systems. It outlines

Cisco 10GBASE SFP+ Modules Data Sheet

Product overview The Cisco® 10GBASE SFP+ modules (Figure 1) give you a wide variety of 10 Gigabit Ethernet connectivity options for data center, enterprise wiring closet, and service provider transport

SFP+ transceiver CBO SFP-10G-BX-D | AiO.lv

Short description CBO SFP-10G-BX-D is an SFP+ fiber optic transceiver module for 10 Gigabit Ethernet. Designed for single-fiber bidirectional links, it supports high-speed data transmission in network

OPTICAL TRANSCEIVER MODULE

Abstract: An optical transceiving module is provided, including a housing, a circuit board, a bidirectional optical interface, a circulator assembly, an optical transmission assembly, a wavelength division

155M-2.5G CSFP BiDi

GIGALIGHT's CSFP series optical transceiver modules include two single-fiber bidirectional channels, each supporting data rates from 155Mbps to 2.5Gbps.

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

