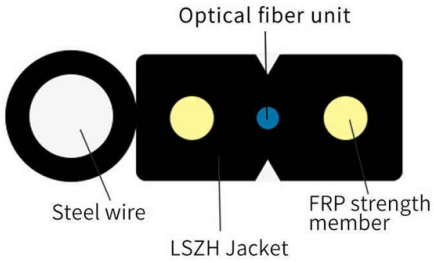
# Wavelength requirements at both ends of a single-fiber optical module




## Overview

Single fiber QSFP28 modules (commonly called BiDi transceivers) enable full-duplex 100G communication over a single optical strand.

## Key Takeaways

Each end of a single-fiber optical module must use complementary wavelengths: one wavelength for transmitting (Tx) and a different, paired wavelength for receiving (Rx) to enable bidirectional communication over a single fiber.

### Wavelength Pairing in Single-

Fiber ModulesSingle-fiber optical modules, often called BiDi (bidirectional) transceivers, transmit and receive data over a single optical fiber using Wavelength Division Multiplexing (WDM). This requires that: Tx wavelength: The module transmits data at a specific wavelength (e.g., 1271 nm)Rx wavelength: The module receives data at a complementary wavelength (e.g., 1331 nm)Complementary pairing: The opposite end of the fiber must have the Tx and Rx wavelengths reversed (e.g., 1331 nm Tx / 1271 nm Rx) to ensure proper bidirectional communication. Inside the module, a WDM coupler separates and combines the two wavelengths, allowing a single LC or optical interface to carry both directions simultaneously.

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Fiber Type and Wavelength ConsiderationsSingle-mode fiber (SMF) is typically used for long-distance links and supports bidirectional transmission with WDM. Multimode fiber (MMF) is generally limited to shorter distances and uses specific wavelengths (e.g., 850 nm or 1300 nm) for compatibility. The chosen wavelength affects attenuation, dispersion, and link budget, so selecting the correct wavelength pair is critical to avoid signal loss or instability.

### Practical Deployment Tips

Verify module compatibility: Ensure both ends of the link use modules designed for the same wavelength pair. Label fibers and transceivers: Clearly mark Tx/Rx wavelengths to prevent misconnection during maintenance. Check link budget: Account for fiber loss, connectors, and splices to ensure receiver sensitivity meets margin requirements.

Vendor interoperability: Confirm that switches or routers support the specific BiDi module and wavelength combination.

### Summary

For a single-fiber optical module, bidirectional communication is achieved by assigning distinct, complementary wavelengths for Tx and Rx at each end. Proper wavelength pairing, fiber type selection, and link planning are essential to ensure reliable operation and maximize fiber utilization. This approach effectively doubles the capacity of a single fiber while reducing cabling complexity and cost.

## Article Content

Recommendation ITU-T G.652 (08/2024)

This document outlines the specifications for a single-mode optical fiber and cable designed for use around the 1310 nm zero-dispersion wavelength, suitable for both the 1310 nm and 1550 nm regions,

100G QSFP28 Single Fiber (BiDi) Modules: Technology, Benefits ...

Single fiber QSFP28 modules (commonly called BiDi transceivers) enable full-duplex 100G communication over a single optical strand. They do this by using Wavelength Division

BiDi SFP Module: A Complete Guide for Fiber Networks

At a technical level, a BiDi SFP module achieves this by using two different wavelengths—one for transmission (TX) and one for reception (RX) —on the same fiber, based on WDM principles.

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

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By using Wavelength Division Multiplexing (WDM), BiDi SFP modules transmit and receive data on two different wavelengths, cutting fiber usage in half without sacrificing performance.

Fiber Optic Wavelengths Explained: 850 vs 1310 vs 1550 nm

In this article, we will explore what wavelengths are used in fiber, why those wavelengths are chosen, what lesser-known wavelength regimes exist (and sometimes surprise engineers), and

BiDi Optical Modules: Unlocking Single-Fiber Bidirectional Connectivity

Paired BiDi modules multiplex and demultiplex the two wavelengths onto a single fiber, allowing for simultaneous bidirectional data flow effectively. This practical design reduces cabling

SFP Selection Simplified | Westermo

First, an SFP is required at both ends of the connection. For instance, if you are connecting two switches, you will need two corresponding SFPs. The next crucial question is: which SFP should you

Single-mode Fibers – launching light, monomode fiber, cut-off

Typically, a fiber has single-mode characteristics only over a limited wavelength range with a width of a few hundred nanometers. The limit towards smaller wavelengths is given by the single-mode cut-off

Wavelength-division multiplexing

This technique enables bidirectional communications over a single strand of fiber (also called wavelength-division duplexing) as well as multiplication of capacity.

SFP Wavelength Guide: 850nm vs. 1310nm vs. 1550nm

BiDi (Bidirectional) SFP modules transmit and receive signals on a single fiber using two different wavelengths. Common pairs include 1310 nm TX / 1550 nm RX and 1550 nm TX / 1310 nm

10 Gigabit Ethernet

There are two basic types of optical fiber used for 10 Gigabit Ethernet: single-mode (SMF) and multi-mode (MMF). In SMF light follows a single path through the

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Welcome to Channel Dive | Channel Dive

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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.

PDF document

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Fiber Optic Cable Types – Multimode and Single Mode

Fiber Optic Cable Types – Multimode and Single Mode Application Fiber Optic connectors and cables are present in nearly every communications

What Is A Single-Fiber BiDi Transceiver?--ETU-LINK

Common wavelength of BIDI optical module SFP BIDI:TX1310nm/RX1550nm; TX1550nm/RX1310nm;TX1490nm/RX1550nm; TX1550nm/RX1490nm;TX1310nm/Rx1490nm;

Fiber Optics Part 2: Single-Mode Fiber vs. Multi-Mode

Written by Priya Maratukulam, Product Manager, Transceiver Modules Group, Cisco In our previous post we described the phenomenon of

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