

## Simultaneous transmit receive optical transceiver module



### Overview

An optical telecom transceiver is a device that combines an optical transmitter and receiver in a single module.

### Key Takeaways

Simultaneous transmit/receive optical transceivers enable bidirectional data communication over a single fiber or fiber pair using different wavelengths, improving fiber efficiency and reducing infrastructure costs.

Simultaneous transmit/receive optical transceivers, also known as bidirectional (BiDi) or transmit-receive modules, allow data to be sent and received at the same time over the same optical medium. This is achieved using wavelength division multiplexing (WDM), where one wavelength is dedicated to transmission (TX) and another to reception (RX) on the same fiber, or over a fiber pair in multimode systems. These modules are widely used in fiber-constrained environments, data centers, metro networks, and long-haul optical networks.

#### Key Types

- **BiDi SFP Modules:** Designed for single-mode fiber, BiDi SFPs transmit and receive simultaneously over a single strand using two distinct wavelengths. They are available in multiple speeds, including 155M, 1G, and 10G, making them suitable for both legacy and modern Ethernet networks. BiDi SFPs must be deployed in matched pairs with complementary wavelengths.

- **SR-BIDI Modules:** Short-range multimode transceivers (e.g., 40G QSFP+ and 100G QSFP28) enable bidirectional communication over existing duplex multimode fiber (OM3/OM4). They use integrated WDM filters to separate incoming and outgoing signals, allowing simultaneous transmission and reception without interference .
- **Transmit-Receive Optical Subassemblies (TROSAs):** High-performance modules for coherent optical networks, TROSA integrates electrical-to-optical and optical-to-electrical conversion in a single assembly. They include photonic integrated circuits (PICs), RF drivers, and transimpedance amplifiers, supporting high-speed metro, regional, and long-haul networks with low power consumption and high reliability .
- **High-Bandwidth OSFP Modules:** Modules like the MJ-OSFP1.6TB-DR8 provide bidirectional conversion for AI data center applications, supporting single-mode fiber spans up to 500 meters and extremely high aggregate throughput (1.6 Tb/s) using multiple PAM4 channels .

#### Technical Principles

- **Wavelength Division Multiplexing (WDM):** Each module uses separate wavelengths for TX and RX. Incoming and outgoing signals are separated by WDM filters inside the transceiver, ensuring simultaneous bidirectional communication without interference .
- **Integration and Packaging:** Advanced modules like TROSA integrate photonic and electronic components in a hermetic package, including drivers, transimpedance amplifiers, and thermoelectric cooling, enabling compact, high-density deployment .

#### Applications

- **Data Centers:** BiDi and SR-BIDI modules reduce fiber count, simplify cabling, and allow high-speed upgrades without replacing existing fiber infrastructure .
- **Metro and Long-Haul Networks:** TROSA and coherent transceivers provide high OSNR, low out-of-band noise, and compatibility with cascaded ROADMs for reliable long-distance transmission .
- **Broadcast and Video Transport:** Modules like the SFC-6901 support flexible SFP configurations for SDI and ASI signals, enabling optical failover and efficient fiber usage .

#### Benefits

- Reduced fiber infrastructure and deployment costs
- Simultaneous bidirectional communication
- Compatibility with existing fiber networks
- High-density, high-bandwidth support for modern applications
- Enhanced reliability and simplified network planning Simultaneous transmit/receive optical transceivers are essential for modern optical networks, offering efficient fiber utilization, high-speed data transmission, and flexible deployment options across data center, metro, and long-haul environments .

## Article Content

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Optical module

An optical module is a typically hot-pluggable optical transceiver used in high-bandwidth data communications applications. Optical

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