

RIVO MULTITRADE OPTICAL SYSTEMS

Functions of each component in a 400g optical module



Overview

A 400G transceiver uses multiple lanes of optical signals and advanced modulation techniques to achieve higher capacities.

Key Takeaways

A 400G optical module is composed of optical transmit and receive chips, electrical signal processing chips (including DSPs), and control/management chips, all integrated to enable high-speed optical data transmission.

The optical chips are responsible for converting electrical signals into optical signals and vice versa. Key elements include:

- **Laser sources:** Generate stable optical signals for transmission, often using technologies like EML (Electro-absorption Modulated Laser) for long-reach applications due to high speed and low chromatic dispersion impact .
- **Modulators:** Encode electrical signals into optical signals, supporting advanced formats such as PAM4 to improve spectral efficiency .
- **Optical receivers:** Convert incoming optical signals back into electrical signals, ensuring high sensitivity and low noise performance .

Electrical Signal Processing Components

The electrical chips handle signal processing and drive the optical components:

- DSP (Digital Signal Processor): Acts as the “signal brain,” performing modulation, demodulation, error correction, and compensation for fiber impairments like chromatic and polarization mode dispersion .
 - Driver chips: Power the optical transmitters, ensuring proper modulation and signal integrity.
 - TIA (Transimpedance Amplifier): Amplifies the weak electrical signals from the optical receiver for further processing .
- Control and Management Components

The control chips manage system-level functions:

- MCU (Microcontroller Unit): Oversees timing synchronization, monitoring, and module management, ensuring stable operation of the 400G system .
- Supporting Technologies

Modern 400G modules often integrate silicon photonics (SiPh) to replace discrete optical components, enabling compact, highly integrated designs with improved performance and reduced power consumption . Multi-channel parallel architectures are commonly used, allowing multiple 100G lanes to operate simultaneously to achieve the full 400G throughput .

Summary

In essence, a 400G optical module is a highly integrated system combining optical, electrical, and control components. The optical chips handle signal conversion, the DSP and driver chips manage high-speed signal processing, and control chips ensure proper module operation. Together, these components enable reliable, high-capacity data transmission for modern data centers, AI clusters, and long-haul optical networks .

Article Content

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In this blog, we'll explore the core structure of an optical transceiver, explaining the function of each part and how they

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The primary function of 400G optical transceivers is to increase data throughput and maximize bandwidth and port

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