

What types of 400G optical modules are available



Overview

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

Key Takeaways

400G optical modules come in multiple form factors and transmission standards, including QSFP-DD, OSFP, CFP8, and coherent modules like ZR/ZR+, with short-range to ultra-long-range capabilities.

- **QSFP-DD** (Quad Small Form-factor Pluggable Double Density): Supports 8 lanes for 400G, backward-compatible with QSFP28/QSFP+ modules, widely used in data center switches for high-density deployments .
- **OSFP** (Octal Small Form-factor Pluggable): Slightly larger than QSFP-DD, offers better heat dissipation, used in AI clusters and some early 400G switches .
- **CFP8**: Scales older CFP4 modules with 8 channels, suitable for high-capacity transport but less common in modern data centers .
- **CWDM8, CDFP, COBO**: Specialized or early 400G form factors; COBO mounts optics directly on PCB but lacks hot-swap capability .

Transmission Standards

400G modules are categorized by distance and fiber type:



- VR4 (Very Short Range): 0–100 meters over multimode fiber, ideal for intra-rack connections .
 - SR4 / SR4.2 (Short Range): Up to 300 meters (SR4) or 150 meters (SR4.2) on multimode fiber, using 4 or 8 channels with PAM4 modulation .
 - DR4 (Datacenter Reach): Up to 500 meters over single-mode fiber, suitable for inter-row or inter-hall connections .
 - FR4 (Long Range): Up to 2 km over single-mode fiber, for longer intra-data center or metro links .
 - LR4 / LR8 (Long Range): Up to 10 km over single-mode fiber, for wide-area or extended-distance links .
 - ER4 (Extended Range): Up to 40 km on single-mode fiber, for high-capacity metro or regional networks .
 - ZR / ZR+ (Zero-Dispersion Range): 80–120 km over single-mode fiber, coherent modules for ultra-long-distance data center interconnects and long-haul networks .
- Key Features
- Modulation: PAM4 is commonly used to double the bit rate per lane.
 - Fiber Type: Multimode fiber (MMF) for short-range, single-mode fiber (SMF) for long-range and coherent modules.
 - Applications: From intra-data center links (VR4, SR4) to metro and long-haul transport (LR4, ER4, ZR/ZR+).
 - Power and Efficiency: Modern 400G modules are energy-efficient, typically consuming a few watts, and support integrated digital diagnostics for monitoring temperature, voltage, and optical power . 400G optical modules provide flexibility across data centers, metro networks, and long-haul transport, enabling high-bandwidth, low-latency, and scalable network deployments while supporting the evolution toward 800G networks .

Article Content

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The 400G optical module is a hot topic in the industry, and its development prospects are vast. In the future, 400G

400G Optical Transceiver Module Types

The 400G optical transceiver refers to an optical module product with a transmission rate of up to 400Gbps, which is

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On the optical side, lane counts and wavelengths vary by variant (SR8, DR4, FR4, LR4), which is why reach and fibre

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Cisco 400G QSFP-DD High-Power (Bright) Optical module's small size and low power make it an optimal choice for a wide range of

400G, 800G, and Terabit Pluggable Optics:

Full range of 400G / 800G pluggable modules Copper cables Multimode Fiber – 100m Single Mode Fiber inside DC – 500m & 2km

Overview of 400G Optical Modules

The primary role of 400G optical modules is to increase data throughput, maximizing bandwidth and port density in

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