Optical modules with different transmission rates



Overview

The ultimate goal for all-optical connectivity with an ultra-high F5G bandwidth is to increase transmission rates.

Key Takeaways

Optical modules are available in a wide range of transmission rates, from 100 Mbps to 400 Gbps and beyond, each designed for specific network applications and distances.Overview of Transmission Rates

Optical modules are classified by their data rates, which determine network throughput and application suitability:

• 100 Mbps: Legacy systems, rarely used in modern networks .

• 1 Gbps (Gigabit Ethernet): Standard enterprise networks, supported by SFP modules .

• 10 Gbps: Common in data centers and high-performance networks, typically using SFP+ or XFP modules .

• 25/40/100 Gbps: High-throughput applications in modern data centers, supported by SFP28, QSFP+, and QSFP28 modules .

• 200/400 Gbps and above: Ultra-high-speed networking, often using OSFP or QSFP-DD modules .

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• Specialized rates: 1.6T, 800GE, 400GE, 100GE, 40GE, 25GE, 10GE, GE, and FE modules exist for specific high-capacity or legacy applications .

Common Form Factors

Optical modules come in various form factors, which influence compatibility, size, and channel capacity:

• SFP (Small Form-factor Pluggable): Supports 1G and some 10G applications, LC fiber connectors .

• SFP+: Enhanced SFP for 10G, more sensitive to EMI, tighter fitting cages .

• SFP28: Same size as SFP+, supports 25G and 10G .

• QSFP+ (Quad SFP): Four-channel module, supports 40G, MPO fiber connectors .

• QSFP28: Supports 100G, widely used in high-capacity data centers .

• OSFP (Octal SFP): Supports 400G, designed for ultra-high-speed environments .

• Other types: CFP, CFP2, CFP4, CXP, XFP, eSFP, and QSFP-DD for specialized high-speed or long-distance applications .

Transmission Distance and Fiber Type

The distance capability depends on the module type and fiber:

• Short-Range (SR): Up to 300 meters over multimode fiber (MMF), often 850 nm wavelength .

• Long-Range (LR): Up to 10 km over single-mode fiber (SMF), typically 1310 nm wavelength .

• Extended Range (ER): Beyond 10 km, often 1550 nm wavelength for high-performance applications . Modules may also use CWDM/DWDM for wavelength division multiplexing, enabling multiple signals over a single fiber for longer distances and higher capacity .

Key Considerations

When selecting an optical module, consider:

• Data rate: Match the module to network speed requirements.

• Form factor: Ensure compatibility with switches or routers.

• Distance and fiber type: Choose SR, LR, or ER modules based on deployment.

• Connector type: LC for single-mode/multimode, MPO/MTP for high-density applications.

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• Power consumption and optical loss: Ensure alignment with network power budget and signal quality . By understanding these factors, network designers can select optical modules that optimize performance, scalability, and cost-efficiency.

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Explore the ultimate guide to optical modules. Learn types, functions, performance metrics & how to choose the right

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An optical fiber patching cabinet. The yellow cables are single-mode fibers; the orange and blue cables are multi-mode fibers:

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