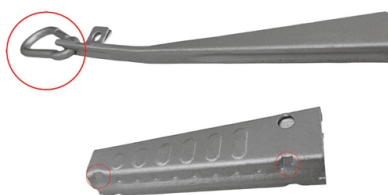


Model of optical modules in the IDC server room



Overview

Data Center Optical Transceivers: From 1G to 800G GuideMaster optical transceivers from 1G to 800G architecture, QSFP/OSFP form factors, silicon photonics.

Key Takeaways

IDC server rooms typically use high-speed optical modules such as QSFP-DD, OSFP, and SFP112, supporting 100G to 800G speeds, with emerging 1.6T modules for advanced data center interconnects. Common Optical Module Models and Form Factors

- QSFP-DD (Quad Small Form-Factor Pluggable Double Density): Supports 400G and 800G speeds, widely used for GPU clusters and high-speed switch interconnects in intelligent computing centers .
- OSFP (Octal Small Form-Factor Pluggable): Compatible with 400G/800G and future 1.6T speeds, often deployed in high-performance servers and multi-GPU nodes .
- SFP112: Smaller form factor supporting 100G-400G, suitable for short- to medium-range interconnects within racks or between adjacent racks .
- QSFP28: Supports 25G-100G, commonly used for legacy or lower-speed links .

Deployment Scenarios

- GPU Clusters: For example, NVIDIA DGX H100 servers use 400G OSFP DR4/VR4 modules to connect to 800G OSFP 2DR4/2VR4 switch ports, enabling real-time multi-GPU data interaction .

- **Cross-Data Center Interconnects:** Single-mode optical modules with distances of 100m, 500m, 2km, or 10km are used for long-distance switch interconnections, supporting distributed training and synchronization .
- **Storage Networks:** InfiniBand or RoCE protocols rely on optical modules like QSFP56 HDR for 200Gbps transmission, ensuring high-speed storage-to-compute connectivity .

Advanced Technologies

- **Liquid-Cooled Optical Modules:** Gigalight and similar vendors offer silicon photonics liquid-cooled modules with QSFP-DD, OSFP, and SFP112 compatibility, supporting 400G-800G and future 1.6T speeds. These modules reduce power consumption by up to 30% and improve thermal management in high-density server rooms .
- **Co-Packaged Optics (CPO):** Integrates optics with switch ASICs to reduce latency and power consumption, enabling ultra-high-speed interconnects for next-generation 51.2T switches .
- **Linear Drive / Direct Optical Drive:** Reduces module power by eliminating secondary PHYs and DSPs, improving latency and efficiency in hyperscale data centers .

Summary

IDC server rooms rely on a combination of QSFP-DD, OSFP, SFP112, and QSFP28 modules to meet varying speed and distance requirements. High-performance clusters and multi-GPU servers increasingly use 400G-800G modules, while emerging 1.6T co-packaged or liquid-cooled modules are being adopted for ultra-dense, low-latency, and energy-efficient deployments. These optical modules are critical for supporting east-west traffic, high-speed storage access, and distributed AI/ML workloads in modern data centers .

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What optical modules are usually equipped on network servers?

SFP+ is a high-speed optical module used for 10Gbps network connections. It is an upgraded version of the SFP module, providing

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