

Data Center Optical Modules



Overview

Learn how and where to implement Cisco Optics solutions to gain the reach you need for connecting data centers across your metro areas and beyond.

Key Takeaways

Data centers use optical modules to enable high-speed, reliable, and scalable data transmission between servers, switches, and storage systems.

What Optical Modules Are

Optical modules, also known as optical transceivers, are compact, hot-pluggable devices that convert electrical signals from network equipment into optical signals for transmission over fiber optic cables, and vice versa. They consist of a transmitter, a receiver, and supporting electronics that facilitate this conversion, allowing data to travel long distances with minimal loss and latency.

Why Data Centers Use Optical Modules

Data centers rely on optical modules for several key reasons: **High-Speed Connectivity:** Optical modules support speeds ranging from 10G to 400G and beyond, enabling fast data transfer between servers, switches, and storage devices. **Extended Reach:** Unlike copper cables, optical modules can transmit data over longer distances without significant signal degradation, which is essential for cross-rack and inter-pod connections. **Energy Efficiency:** Modern optical modules are designed to deliver high data rates per watt, reducing power consumption and heat generation in large-scale data centers.



Scalability and Flexibility: Small form factors like QSFP-DD, OSFP, and SFP+ allow data centers to host multiple ports in a single rack unit, supporting modular growth and easy upgrades. **Reliability:** Optical modules maintain signal integrity and low latency, which is critical for AI workloads, cloud computing, and real-time applications.

Types of Optical Modules

Optical modules come in various types to meet different networking needs: SFP/SFP+ (1G–10G): Common for short-distance connections and top-of-rack switches. SFP28 (25G): Supports higher-speed server connectivity. QSFP+/QSFP28 (40G–100G): Used for aggregation and core layers.

QSFP-DD/OSFP (200G–400G): Designed for high-density, high-bandwidth applications, including AI and cloud workloads.

DWDM and Bi

Di Modules: Enable long-distance and wavelength-division multiplexing for specialized applications.

Emerging Developments

Companies like Kyocera are developing pluggable optoelectronic modules supporting PCIe 6.0, which convert electrical signals from CPUs and GPUs into optical signals, enhancing high-speed communication and power efficiency in data centers. Similarly, NVIDIA Mellanox modules address bandwidth challenges in leaf-spine architectures, supporting 25Gbps per lane over multimode fiber for cross-aisle connections.

Conclusion

Optical modules are essential for modern data centers, providing high-speed, reliable, and energy-efficient connectivity. They enable scalable network architectures, support AI and cloud workloads, and allow for flexible upgrades without overhauling the entire infrastructure. By selecting the appropriate module type and form factor, data centers can optimize performance, reduce latency, and maintain robust network operations.

Article Content

DCI Optical Modules | Delivering high bandwidth over

The Marvell data center interconnect portfolio includes COLORZ®, COLORZ® 400 and COLORZ® 800 modules in multiple form factors to connect regional data

Transceiver Modules for Data Center Interconnect

Learn how and where to implement Cisco Optics solutions to gain the reach you need for connecting data centers across your metro areas and beyond.

Products

The solution simplifies transport between data centers by replacing stand-alone optical transponders with the Cisco ® portfolio of standardized coherent pluggable modules, which can be

Optical Interconnect Technology Analysis: LPO, NPO,

Exploring optical interconnects for AI data centers: LPO for low-power, short-distance links, NPO for high-density, near-package connections,

XPO: Redefining Pluggable Optics for AI Networking

This section outlines the five critical requirements that define the next generation of data center optics and examines why existing standards—originally developed for traditional cloud computing

Optical Modules in General-Purpose Computing Scenarios

Huawei offers a comprehensive portfolio of pluggable StarryLink optical modules for data center networks, with various models providing flexible plug-and-play solutions tailored to diverse interface

AI Data Center Optical Transceiver Module Market 2025-2030

The AI data center optical transceiver market has entered a historic growth phase, driven by the exponential expansion of AI computing clusters and the accelerated migration from traditional copper

Top Optical Transceiver Modules for Data Center Applications

Explore the best optical transceiver modules for modern data centers, including SFP+, QSFP28, QSFP-DD, and OSFP. Learn how to select the right module for speed, distance, and

All AI Data Center Interconnects Will Be Optical Within

All AI Data Center Interconnects Will Be Optical Within 5 Years InP and SiPho join CMOS as critical technologies. Lasers, CPO and OCS will be

Next-Gen Optical Modules: A Technical Comparison of CPO, NPO,

Compare CPO, NPO, and XPO optical modules for 800G/1.6T data centers. Evaluate power efficiency, integration, and OCS synergy for your network architecture.

Optical Module MCUs Become Critical as AI Data Centers Drive

MCU chips for optical modules emerge as a critical semiconductor segment as AI data center buildout drives 800G/1.6T demand, with domestic players GigaDevice and Nations

Tower Semiconductor Teams with NVIDIA to Advance AI

Tower Semiconductor's SiPho platform is optimized for high-speed optical interconnects, making Tower an ideal foundry for market-leading companies across AI infrastructure, data center

Matrix Optical Modules: Boost AI Data Centers

Together, combined with automated optical fiber management systems, they create highly adaptable matrix optical modules in ai data centers. Instrumentation: Ensuring Reliability In

Applications of Optical Module PCBs in AI Data Centers

Optical modules serve as core components in high-speed optical communication links within AI data centers. Inside an optical module, the PCB serves as the electrical platform for

NVIDIA Mellanox MMAIB00-B150D Data Center Optical Transceiver

Discover the details of NVIDIA Mellanox MMAIB00-B150D Data Center Optical Transceiver in Practice at Hong Kong Starsurge Group Co., Limited, a leading supplier in China for

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Explore DCI Modules Marvell offers a portfolio of DCI modules designed to efficiently transmit data over regional fiber networks. Using Marvell coherent DSP

800G Optical Module Reliability Engineering | AI Data

Learn reliability engineering best practices for 800G optical modules including failure analysis, quality control, accelerated testing, and predictive

The Evolution of Optical Modules: 400G → 800G → 1.6T – A Strategic ...

Discover the evolution from 400G to 800G and 1.6T optical modules. Learn key technologies, CPO vs pluggable, and upgrade strategies for future-ready data centers.

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

