Optical module for GPU



Overview

Silicon Photonics Networking for Agentic AI | NVIDIANVIDIA co-packaged optics with silicon photonics deliver 5x power efficiency and 10x resiliency, enabli.

Key Takeaways

Optical modules such as SFP, QSFP, CWDM, and co-packaged optics enable high-speed, low-latency, and long-distance connectivity for GPU clusters and AI systems. Types of Optical ModulesSFP (Small Form-factor Pluggable): Compact modules supporting 1G–10G links, suitable for smaller GPU clusters or edge nodes.

QSF

P (Quad Small Form-factor Pluggable): Supports 40G–400G, commonly used in large-scale HPC and AI clusters for high-bandwidth interconnects. QSFP-DD / OSFP (Double Density / Octal Small Form-factor Pluggable): Advanced modules providing 400G, 800G, and 1. 6T links, often deployed in NVIDIA GPU supercomputers to meet multi-terabit-per-second bandwidth requirements.

CWD

M (Coarse Wavelength Division Multiplexing): Extends network reach over long distances with multiple wavelength channels, ideal for distributed GPU data centers.

Co-

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Packaged Optics (CPO) and Silicon Photonics: Emerging technologies integrating optical engines directly with GPU or motherboard packages, enabling extremely high transfer rates (up to 12. 8 Tb/s) with reduced power consumption and latency. Functions and BenefitsHigh-Speed Data Transmission: Optical modules provide 10G–1.

6T connectivity, ensuring rapid data movement between GPU nodes with minimal latency.

Long-

Distance Communication: CWDM and advanced photonics modules allow inter-rack and inter-datacenter links over several kilometers without signal degradation. High Bandwidth for Parallel Processing: QSFP and QSFP-DD modules aggregate bandwidth, enabling multiple GPUs to exchange data simultaneously without congestion. Reliability and Low Latency: Designed for low error rates and stable signal transmission, critical for AI inference and HPC simulations.

Deployment Considerations

Number of Modules per GPU: Each NVIDIA GPU node may require multiple optical links to achieve optimal throughput. Small clusters (8–16 GPUs) may use 16–32 modules, while hyperscale AI clusters with hundreds or thousands of GPUs can require tens of thousands of modules, including redundancy for reliability. Form Factor and Compatibility: Modules are available in SFP, QSFP, QSFP-DD, and OSFP form factors, compatible with mainstream networking equipment in data centers.

Emerging Technologies: LPO (Low-Power Optics) and NPO (Near-Packaged Optics) reduce power consumption and latency by integrating analog transmission paths and shortening electrical connections between GPU and optical engine.

Summary

Optical modules are essential for modern GPU clusters, enabling high-speed, high-bandwidth, and long-distance communication. From traditional SFP and QSFP modules to advanced co-packaged optics and silicon photonics, these technologies ensure GPUs can operate at full computational capacity, supporting AI training, HPC workloads, and large-scale data center deployments efficiently and reliably.

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Article Content

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Its core concept is to place the optical engine and xPU chip (such as a GPU, NPU, or switching chip) side-by-side on the same high-performance PCB or organic substrate, directly

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Pluggable optical modules have reached mass deployment and are considered a mature technology. 800 G modules became widely available in 2025, and 1.6 T modules began volume shipments in

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⚠ LPO (Linear Pluggable Optics): The AI Fabric Power Game-Changer LPO eliminates the DSP retimer chip inside the optical module, reducing power consumption by ~50% compared to

How Industry Collaboration Fosters NVIDIA Co

NVIDIA is developing a co-packaged optics (CPO) platform that integrates optical and electrical components to improve data-center connectivity,

OSFP Transceivers: High-Density Optical Connectivity from 400G to

As hyperscale data centers shift toward AI-optimized fabrics and ultra-high-bandwidth switching platforms, the OSFP (Octal Small Form-Factor Pluggable) form factor has become central

NVIDIA AI Networking & Data Center Hardware | GPUs

Leading supplier of NVIDIA AI infrastructure including H200/B200 GPUs,Spectrum SN9700 switches,ConnectX InfiniBand NICs,DDR5 server memory & SSDs&optical transceiver modules

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400G vs 800G Optical Modules: Differences, Use Cases, and

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Compare optical modules for data centers and AI clusters. Learn key differences in standards, power, cabling, and use cases.

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