

Optical Modules and New Infrastructure



Overview

AI infrastructure accelerates the shift to scalable optical systems. CPO and soldered optical integration were another major focus. The OCI MSA promoted.

Key Takeaways

Optical modules are evolving rapidly with silicon photonics, co-packaged optics, and high-speed 400G-1.6T solutions driving AI, 5G, and data center infrastructure upgrades.

Key Technological Trends

Silicon Photonics (SiPh) is emerging as a leading technology due to its high integration, cost-effectiveness, and compatibility with CMOS manufacturing processes.

Si

Ph enables precise integration of optical components, reducing costs and improving performance, particularly in short-range and coherent optical applications. Challenges remain in yield rates and optical losses, but SiPh is expected to dominate as data centers upgrade to 400G and beyond.

Co-

Packaged Optics (CPO) integrates optical engines directly with switch ASICs on the same board, reducing signal attenuation, power consumption, and cost while increasing bandwidth density. Although still in early development, CPO is poised to become critical as transmission rates approach 1.6T, especially in AI and hyperscale data centers.

Linear Pluggable Optics (LPO) and Half-Retimed Linear Optics (LRO) focus on power efficiency and signal stability.

LP

O eliminates traditional DSP and CDR chips, reducing power consumption from over 13W to under 4W for 800G modules, making it ideal for short-range data center interconnects.

LR

O serves as a transitional technology, balancing performance and power efficiency while maintaining interoperability. Coherent Optical Transmission is increasingly used for long-distance and high-capacity data center interconnects (DCI), offering superior signal-to-noise ratios. Coherent modules, such as 400G QSFP-DD ZR and ZR+, are expanding from backbone networks into metro and edge networks.

Market and Infrastructure Drivers

The optical module market is projected to grow rapidly, with global demand exceeding USD 23 billion in 2025 and expected to grow by approximately 25% in 2026. Growth is driven by AI infrastructure, cloud computing, 5G deployment, and high-bandwidth data center interconnects. Leading companies like Huawei, Cisco, and Juniper are investing heavily in R&D to innovate optical modules and system-level solutions.

A

I and Hyperscale Data Centers are reshaping optical module requirements. High-speed interconnects, low latency, and high-density packaging are critical for GPU clusters and AI workloads. Technologies like 1.

6T optics, 400G-per-lane, and 3. 2T platforms are moving toward commercialization, emphasizing reliability, manufacturability, and serviceability.

Future Outlook

Transmission Speeds: The industry is transitioning from 400G/800G to 1. 6T and beyond, with silicon photonics and CPO enabling higher integration and efficiency.
Network Architecture: Optical networks are evolving to support ultra-broadband, low-latency, and high-capacity connectivity for AI, 3D display, and immersive applications.

Access networks are moving beyond 50G PON to meet differentiated service requirements with deterministic latency and jitter.

System-

Level Integration: The focus is shifting from individual transceivers to complete optical connectivity solutions, integrating lasers, modulators, and fiber interfaces for modular, scalable, and serviceable architectures. In summary, the development of optical modules in new infrastructure is characterized by high-speed, energy-efficient, and highly integrated solutions, driven by AI, 5G, and data center demands. Silicon photonics, co-packaged optics, and coherent technologies are central to this evolution, while market growth and system-level integration are shaping the next generation of optical networks.

Article Content

AI infrastructure accelerates the shift to scalable optical systems ...

CPO and soldered optical integration were another major focus. The OCI MSA promoted optics over copper for AI scale-up networks, aiming to reduce power consumption by eliminating high

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,

Standing in the Light: A Comprehensive Guide to the Optical Module

In conclusion, optical interconnects are fundamental to AI infrastructure. The competitive landscape sees US firms leading in architecture and high-end chips, TSMC in advanced packaging,

Optical Communication Industry Trends 2026: AI, 800G/1.6T Optical ...

Explore optical communication industry trends in 2026, driven by AI infrastructure, 800G and 1.6T optical modules, silicon photonics, and next-generation data center connectivity solutions.

From optical modules to chips: China's tech supply chains sustain ...

With the global push for AI computing power unleashing an unprecedented wave of infrastructure buildout, China-made optical modules that shuttle data and the chips that process it

Optical Networking: The Next Mega Trend in AI Infrastructure

Networking unlocks computing capability for single AI chips, connecting multiple chips (working together), enabling seamless data exchange and low latency, and driving AI to the next level.

CPO Technology Nvidia: Death of Optical Modules and the Future of

Nvidia has started mass production of Spectrum-X CPO switches, which leads to the destruction of the traditional optical modules market. The reasons and consequences of the transition

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

Building the AI Optical Layer: Connectivity, Standards, and the Future ...

The integration of optical solutions across multiple layers—from connectors to silicon photonics—underscores a shift towards optical infrastructure as a core component of future AI data

Tower Semiconductor Teams with NVIDIA to Advance AI

“NVIDIA is collaborating with Tower Semiconductor to advance the ecosystem, enabling more efficient AI infrastructure through next-generation silicon photonics and accelerating AI

NVIDIA Optical Interconnect 2026, \$500M Ayar Labs Round

Optical Interconnect Projects, NVIDIA \$4 B Investment, and 1.6 T Module Adoption
The industry has shifted from identifying the optical interconnect bottleneck before 2025 to pursuing aggressive, large

NVIDIA Announces Strategic Partnership With

NVIDIA today announced multiyear strategic agreements with Lumentum Holdings Inc. (NASDAQ: LITE) to accelerate innovation in advanced

Overview of 400G Optical Modules

With the advent of 400G, optical communication is entering a new era, moving from single-carrier modulation in low-end modules to polarization

Silicon photonics and co-packaged optics at the heart of

While linear-drive pluggable modules remain competitive, CPO is expected to offer unmatched customization and scalability, with large-scale

Lumentum

Lumentum Holdings Inc. (“Lumentum”), a global leader in photonic solutions, today announced its showcase of technology and product demonstrations designed to meet the

Co-Packaged Optics (CPO) Market Trends 2026: AI Data Center Optical ...

Explore the future of co-packaged optics (CPO) in AI data centers. Learn how silicon photonics, optical I/O, and high-speed optical interconnect technologies are shaping next-generation

Is Your Network Ready for 800G? Key Fiber Optic Trends Shaping

Discover the top fiber optic trends shaping network infrastructure in 2026, including 800G optical transceivers, AI-driven networking, high-density fiber cabling, DWDM evolution, and power

Google's Ironwood TPU and Apollo OCS to Drive 800G Optical Module

Google's Ironwood TPU and Apollo OCS to Drive 800G Optical Module Share Over 60% by 2026 Google's new Ironwood TPU utilizes a 3D Torus network and Apollo optical circuit switch,

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