

Domestic Optical Module Technology



Overview

Nvidia's official announcement, CPO mass production, and a. The rise of CPO technology has a structural differentiation effect on domestic optical modul.

Key Takeaways

Domestic optical module technology focuses on locally developed high-speed chips and system-level integration to achieve supply chain independence, high performance, and cost-effective solutions for AI, 5G, and data center applications. Overview of Domestic Optical Modules

Domestic optical modules are plug-and-play interconnect solutions that integrate electrical chips (DSP, driver ICs, TIAs), optical device chips (lasers, photodetectors), and silicon photonics (SiPh) components into standardized form factors such as SFP, QSFP, QSFP-DD, OSFP, and CFP . These modules support high-speed data transmission at 100G, 400G, 800G, and emerging 1.6T rates, with optimized power efficiency, thermal management, and real-time monitoring through DDM/DOM ICs .

Core Chip Development

Electrical Chips

Electrical chips act as the “brain” of optical modules, controlling signal processing and data transmission. Domestic development focuses on DSP, driver, and TIA ICs, which are critical for 800G and higher speeds. While China has made progress, high-end DSP chips are still largely dominated by international suppliers like Broadcom and Marvell .

Optical Device Chips

China has strong capabilities in laser and photodetector production, including 25G/50G DFB and EML lasers, with self-sufficiency rates exceeding 50% for 25G+ lasers. These chips are essential for high-speed optical links and form a competitive advantage in domestic production .

Silicon Photonics (SiPh)

SiPh integration is a strategic focus for future localization, enabling chip-scale integration of modulators, detectors, and drivers. Domestic SiPh development has reached 400G/800G verification stages, though the ecosystem is still maturing .

MCU Chips

MCUs in optical modules serve as management controllers, handling temperature, voltage, laser bias, optical power monitoring, and firmware management. Domestic MCU manufacturers like GigaDevice and Nations Technologies have developed specialized MCUs for 800G/1.6T modules, supporting complex interfaces (I2C, MDIO, SPI, I3C) and dual-bank firmware for AI data center operations .

Advantages of Domestic Optical Modules

- **Supply Chain Independence:** Reduces reliance on imported components, ensuring stable access for hyperscale data centers .
- **Cost Efficiency:** Domestic production lowers procurement costs and enables competitive pricing .
- **Technological Sovereignty:** Supports local innovation in high-speed optical transmission, modulation, and co-packaged optics (CPO) integration .
- **Reliability and Monitoring:** Enterprise-grade standards with integrated diagnostics for temperature, voltage, and optical power .

Challenges

- **High-Speed Performance:** Achieving multi-channel 400G/800G and 1.6T transmission with low error rates requires precise design and manufacturing .
- **Process Technology:** Advanced fabrication for SiPh, EML, and TFLN demands highly precise wafer-level processes .
- **Supply Chain Maturity:** Certain materials and specialized IC components still rely on imports .
- **Global Standards Compliance:** Domestic modules must meet IEEE, ITU-T, and OIF standards for interoperability .

Future Trends

- **Higher Data Rates:** Development of 1.6T and 3.2T modules with advanced modulation schemes like PAM4 and QAM .
- **Co-Packaged Optics (CPO):** Placing optical chips closer to switch ASICs to reduce latency and power consumption .

- Full Silicon Photonics Integration: Chip-scale integration for compact, high-performance modules .
- System-Level Localization: Moving from component substitution to chip + system co-innovation, driven by AI computing and 5G network expansion . Domestic optical module technology is rapidly evolving, with China transitioning from a manufacturing leader to a core chip innovator, aiming for full localization and global competitiveness in high-speed optical communication.

Article Content

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Domestic optical module chips have become a cornerstone of national optical communication strategy. They cover

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Overall, domestic optical module chips are poised to play a strategic role in China's high-speed optical communication

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Its analog integrated circuit chip shipments consistently rank among the top three in China, serving leading domestic

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Several domestic frontrunners have successfully penetrated the supply chains of top-tier global optical module makers

10 companies in the optical transceiver industry chain 2024

The rapid development of AIGC has promoted the demand for 800G optical modules, and the entire industrial chain

Understanding Optics Module Trends and Growth Dynamics

The region also hosts a significant portion of the world's hyperscale data center build-out and manufacturing capabilities for optical

Which publicly traded companies manufacture optical chips for optical ...

Optical-chip companies used in optical modules typically refer to publicly traded firms that design, manufacture, or

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Source Photonics is one of the world's leading optical communications suppliers, with operations spanning optical

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Top 10 Optical Module Brand & Manufacturers

Zhongji Innolight Co., Ltd. (SZ: 300308) is a professional high-speed optical module solution provider and a technology-innovative

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Chinese providers of optical modules are not just domestic players but primary suppliers to Western tech giants.

From optical modules to chips -

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