

The role of CPO optical modules



Overview

The Rise of Co-Packaged Optics: A Deep Dive into CPO Optical This article provides a comprehensive overview of CPO optical modules, exploring their technol.

Key Takeaways

A CPO optical module integrates optical and electronic components directly with switch or processor silicon to increase data throughput, reduce latency, and improve power efficiency in data centers. **Core Purpose**

A CPO (Co-Packaged Optics) optical module is designed to combine optical engines (lasers, modulators, photodetectors) with electronic components like ASICs or GPUs on the same substrate or interposer. This integration drastically shortens the electrical signal path from centimeters to millimeters, which reduces signal loss, improves signal integrity, and lowers latency compared to traditional pluggable optical transceivers that connect via long PCB traces or copper cables .

Key Benefits

- **Higher Bandwidth:** By placing optics close to the switching silicon, CPO modules support higher data rates and enable dense interconnects, which is critical for AI, cloud, and HPC workloads .
- **Lower Power Consumption:** Shorter electrical paths reduce the need for high-power drivers, repeaters, and retimers, cutting energy usage by up to 50% per link .
- **Reduced Latency:** Millimeter-scale interconnects minimize signal propagation delays, improving overall system responsiveness .

- Scalability: CPO modules allow data centers to handle growing data volumes efficiently, supporting future expansion without major redesigns .

How It Differs from Traditional Optical Modules

Unlike conventional pluggable transceivers, which are discrete and hot-swappable, CPO modules are tightly integrated assemblies. They are not designed to be removed or replaced individually but are co-located with the ASIC or processor to optimize performance. This co-packaging approach also leverages silicon photonics, advanced 2.5D/3D packaging, and high-density interposers to achieve compact, high-performance optical interconnects .

Applications

CPO optical modules are primarily used in data centers, cloud computing, AI accelerators, and high-performance computing systems, where high-speed, energy-efficient, and low-latency data transfer is essential . They are particularly valuable in environments where traditional copper-based interconnects are reaching their physical and electrical limits. In summary, the purpose of a CPO optical module is to enable faster, more efficient, and scalable data transfer by integrating optics directly with electronic processing chips, addressing the limitations of traditional optical interconnects while supporting next-generation computing demands .

Article Content

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"Standing in the Light: Understanding the Optical Module and CPO Industry Chain"
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1.3. Introduction The CPO JDF plans to release three documents focused on different elements of Co-Packaged Optics (CPO): the

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This helps reduce reliance on traditional pluggable optical modules, which are becoming less practical at scale due to their size and

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This technology has evolved from traditional board-edge optical modules to smaller and more integrated solutions.

Comprehensive Overview of CPO (Co-Packaged Optics)

OSFP modules, currently common for 800Gbps optical modules, are distinct from the CPO standard, which defines a

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