

# Supercomputing and Optical Modules



## Overview

These compact devices are the indispensable workhorses converting electrical signals into light pulses and back, enabling the unprecedented data transfer speeds and low latency that define contemporary supercomputing. Without them, exascale computing and complex AI training would be impossible. The implementation of semiconductor architectures with embedded optical interconnect (I/O) technologies is gaining traction this year. The shift from copper to optical technologies will bring more bandwidth with reduced power needs. This blog digs into how embedded semiconductor solutions—think On-Board Optics (OBO), Near-Packaged Optics (NPO), and Co-Packaged Optics. Supercomputing chips are designed for massively parallel computation, supporting: Floating-point computation, tensor calculations, matrix multiplication, and AI-specific workloads. High computational throughput: trillions of operations per second (TOPS or FLOPS) for AI and scientific computing.



## Article Content

Get on the Optical Bus

Within five years, we hope to connect microprocessors and memory chips right to the optochip, producing the optical analogue to the electrical

Optical Interconnect Technology Analysis: LPO, NPO, CPO

With supercomputing and intelligent computing clusters rapidly moving towards the "supernode" era, interconnect technology is becoming a key

High-Speed Optical Modules for AI and Supercomputing

Discover Shenzhen HTFuture's AI optical modules driving advancements in AI, quantum computing, and big data with efficient solutions.

The Application of Optical Modules in AI Technology

Optical modules boost AI technology by enabling high-speed data transfer, reducing latency, and improving energy efficiency in modern AI systems.

Optics and supercomputing | IEEE Journals & Magazine | IEEE Xplore

Storage, interconnection, and processing are discussed. Various types of optical disks and page-oriented holographic memories are considered. It is shown that optical storage is advancing rapidly

Embedded Optical Modules Expected to Grow 50% CAGR by 2033

Embedded optical modules aren't just a tech upgrade—they're a push toward making AI supercomputing more accessible. High-speed optical connections are crucial for advanced AI

Superconducting optoelectronic networks for neuromorphic supercomputing

Superconducting optoelectronic networks are a promising route to large-scale neuromorphic computing. Using light for communication at the single-photon level overcomes fan-out

Networking chips and modules for AI data centers:

The opportunity for optical connections reaches beyond the AI data center. That's because there isn't enough power. In September, Marvell,

Integrated Photonics | Transitioning to End-to-End

Integrated Photonics | Transitioning to End-to-End Optical I/O Since 2004, Intel Labs has pioneered silicon photonics research from architecture design to

The Application of Optical Modules in High-Performance

Optical modules deliver high bandwidth, low latency, and scalable connectivity for high-performance computing, enabling efficient data center

Quantum Computing Optical Modules | Speed, Precision

Explore the role of optical modules in quantum computing, their impact on speed and precision, challenges, and the future of technological

Optical interconnection networks for high-performance systems

Large-scale high-performance computing (HPC) systems in the form of supercomputers and warehouse-scale data centers permeate nearly every corner of modern life from applications in scientific

Seng Tiong Ho Photonics in Supercomputers: Pushing

How Seng Tiong Ho's Work Advances Photonic Interconnects One of the most promising applications of photonics in supercomputing lies in the

LNCS 7715

Preface OCS, the International Workshop on Optical SuperComputing, is a forum for research presentations on all facets of optical computing for solving hard computation tasks. Optical

TPU v4: An Optically Reconfigurable Supercomputer for

TPU v4 is the fifth Google domain specific architecture (DSA) and its third supercomputer for such ML models. Optical circuit switches (OCSes)

Optical Modules and Networks for AI-Era Data Centers

We review recent advances in optical modules and networks for AI-era data centers (DCs), covering intra-DC optical pluggable transceivers, DC interconnections, optical cross-connect based flexible

Optical interconnection networks for high-performance systems

Figure 18.8 (A) Optical interface for pluggable optics, for onboard optics, for copackaged optics and on-chip optics. (B) Schematic of a 2.5D multichip module cointegrating electronics and photonics via an

Embedded Optical Transmission Tech, Arrival of CPO Set to Deliver

The implementation of semiconductor architectures with embedded optical interconnect (I/O) technologies is gaining traction this year. The shift from copper to optical technologies will bring more

The Evolution of Optical Modules: Powering the Future

Enter optical modules, which leverage the power of light to transmit data efficiently over long distances, driving the next generation of technological

## Application and Deployment of Optical Modules in Intelligent ...

This article systematically explains how optical modules build an efficient and stable interconnection system for intelligent computing centers, covering core application scenarios,...

## Embedded Optical Transmission Tech, Arrival of CPO Set to Deliver

Shipments of embedded optical modules are set to grow at a CAGR of 50% through 2033. Of the various types of I/O solutions — OBO, NPO and CPO — the latter will bring the biggest generational

## OCP: Photonics in Supercomputer Systems for HPC & AI

Among the highlights, network architecture based on Optical Circuit Switching (OCS) was discussed, along with optical module vendors

## LPO vs NPO vs CPO: The Evolution of Optical Interconnects in AI

Today, 800G optical transceivers are widely deployed in modern AI data centers to support high-performance GPU networking. As AI clusters continue to scale, the industry is moving

## High-performance computing chips and optical modules

In the era of AI, high-performance computing (HPC), and big data, supercomputing chips (GPUs, TPUs, AI accelerators) have become the core engines for computation. At the same time,

## Optical supercomputing: introduction to special issue

Optical computers use photons rather than electrons to represent and modify information. Computer architectures that are based on optics offer several interesting features: Current

## Harnessing optical advantages in computing: a review of

Through a multidimensional exploration, this article provides a comprehensive understanding of the opportunities and challenges in harnessing

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