

Selection Guide for New Data Center Interconnect-Grade Optical Modulators



AI Overview

Choosing the right optical modulator for DCI depends on modulation format, material technology, reach, power efficiency, and integration capability.

Key Considerations

- 1. Modulation Format and Baudrate** High-speed DCI links require modulators capable of supporting high symbol rates. Silicon photonics (SiP) modulators, including Mach-Zehnder (MZM) and microring resonator modulators (MRM), have demonstrated up to 128 Gbaud on-off keying and multi-channel 224 Gbps links, making them suitable for short-reach, high-capacity intra-datacenter links. Indium phosphide (InP) modulators, including externally modulated lasers (EML) and directly modulated lasers (DML), can achieve very high symbol rates for longer-reach DCI without optical amplification.
- 2. Material Technology**
 - Silicon Photonics (SiP):** Offers low energy consumption, small footprint, CMOS compatibility, and scalability with dense wavelength-division multiplexing (DWDM). Ideal for short-reach intra-datacenter links with ultra-low power per bit.
 - Indium Phosphide (InP):** Provides high-speed modulation and longer reach, suitable for metro and regional DCI links. InP modulators can be integrated monolithically with lasers for compact, high-performance solutions.
 - Other Technologies:** Thin-film lithium niobate (TF LN), plasmonic, and electro-optic materials are emerging for ultra-high-speed applications beyond 400 Gb/s per lane.
- 3. Detection Method**
 - Direct Detection (IM/DD):** Best for short-reach, cost-sensitive, and power-efficient links. Suitable for intra-datacenter and metro DCI where simplicity and low latency are priorities.
 - Coherent Detection:** Preferred for longer distances, high-capacity, and scalable networks. Offers higher spectral efficiency and better tolerance to dispersion, but with higher power and cost.
- 4. Power Consumption and Energy Efficiency** Energy per bit is critical in DCI. SiP modulators typically consume 1...

Article Content

Transceiver Modules for Data Center Interconnect

Learn how and where to implement Cisco Optics solutions to gain the reach you need for connecting data centers across your metro areas and beyond.

The Evolution of Optical Modules: 400G → 800G → 1.6T - A Strategic ...

Discover the evolution from 400G to 800G and 1.6T optical modules. Learn key technologies, CPO vs pluggable, and upgrade strategies for future-ready data centers.

Optical Interconnect Technology Analysis: LPO, NPO, CPO

Exploring optical interconnects for AI data centers: LPO for low-power, short-distance links, NPO for high-density, near-package connections, and CPO for ultra-high-bandwidth co

Co Packaged Optics (CPO) - Scaling with Light for the Next Wave of ...

We first discuss Host and Optical Engine packaging and explain TSMC COUPE in detail and why it is emerging as the

1 Optical Interconnect Technologies for Datacenter Networks

In recent years, investments by cloud companies in mega data centers and associated network infrastructure has created a very active and dynamic segment in the optical components and

800G Data Center Interconnect Guide: DAC, AEC, AOC

DAC · ACC · AEC · AOC · Optical Transceivers — the complete engineer's framework for choosing the right interconnect for every link in your AI

Intra-Datacenter Interconnects With a Serialized Silicon Optical ...

Powerful warehouse-scale datacenters form the fabric of cloud computing. Efficient computing requires intra-datacenter interconnects with large capacity, low energy consumption, and

800G Client Optics in the Data Center

When hyperscale data center operators start deploying a new generation of client optics, they immediately require massive volumes of optical modules to build out switching fabric and router

Data Center Interconnect Basics - MapYourTech

Data center interconnect technology has evolved dramatically over the past decade, progressing from simple 10 Gigabit connections to

Optical Interconnects for Data Centers

Optical interconnects offer low latency due to the high speed of light transmission. This is particularly important in data centers where latency can significantly impact overall system

800G Data Center Interconnect Selection Guide

We published the complete 800G Data Center Interconnect Selection Guide on our blog — here's the decision framework in one visual.

Silicon-organic Hybrid Electro-optic Modulators for Next

Currently, mainstream data centers still rely heavily on copper interconnects. But as the industry inevitably shifts toward optical interconnect architectures, we will

Challenges in silicon photonics modulators for data center interconnect ...

For data center interconnect (DCI) applications, this mean that modulators should offer high bandwidth and low optical loss.

Charting the Path Toward 1.6T and 3.2T Optical Module Solutions

These advancements not only enhance current data transmission capabilities, but also pave the way for future breakthroughs in optical interconnects, ensuring that the infrastructure of data centers evolves

Key Differences, Applications, and Selection Guide for Optimal 100G ...

Learn how 100G direct-detection (IM/DD) and coherent optical solutions compare for metro DCI, and select the best option for your network needs.

Top Optical Transceiver Modules for Data Center Applications

Introduction: Why Optical Modules Are Critical to Data Center Infrastructure In today's cloud-first, AI-driven, and 5G-enabled landscape, optical transceiver modules play a pivotal role in

Optical Switching Data Center Networks: Understanding Techniques

This paper first summarizes the topologies and traffic characteristics in data centers and analyzes the reasons and importance of moving to optical switching. Recent techniques related to the optical

Photonic Integrated Circuits: Research Advances and

Silicon photonics, serving as a cornerstone technology in modern information technology, demonstrates significant application potential in critical

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Challenges in silicon photonics modulators for data center interconnect ...

The exponential demand for bandwidth in data centers is on high alert with the increase in data traffic. In this scenario, the design of optical modulators is crucial for the continuous evolution of

Challenges in silicon photonics modulators for data center interconnect ...

For data center interconnect (DCI) applications, this mean that modulators should offer high bandwidth and low optical loss. In addition, devices must operate with low power consumption and be

The Evolution of Optical Modules: Powering the Future

Data centers, the beating hearts of this digital revolution, are tasked with processing and moving massive volumes of data at unprecedented speeds.

How optical interconnect and optical processing are

Although optics has been used in data centers for decades, it is now reaching further and further into the beating heart of the data center - the

Silicon modulator design using a system-oriented methodology for high ...

Short-reach fiber-optic communication technologies are a promising solution to fulfill the growing demand for data center traffic. Among these technologies, power-efficient and high-speed

High-Speed Optical Modulators for Intra-Data Center Links: Unlocking ...

So far, several optical device candidates have been reported to achieve 400 Gb/s per lane and beyond, and their practical implementation is becoming a reality. In this panel session, we

400G, 800G and 1.6T Interconnect Selection Guide

Data center networking guide for selecting 400G, 800G, and 1.6T interconnects. Compare DAC, ACC, AEC, AOC, and optical transceivers by distance, density, power ...

A comprehensive survey on optical modulation techniques for

Abstract Advancements in photonics across telecommunications, sensing, and data processing have elevated optical modulation to a pivotal position for high-speed, efficient signal

Co Packaged Optics (CPO) – Scaling with Light for the

Co-Packaged Optics (CPO) has long promised to transform datacenter connectivity, but it has taken a long time for the technology to come to market,

Fiber optics for data centers: the state of the art in 2025

Blog Fiber optics for data centers: the state of the art in 2025 The datacom optical component market will grow over 60% to exceed \$16 billion in revenue during 2025, driven primarily

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