

Article Overview

Linear Pluggable Optics (LPO) are high-efficiency optical transceivers that remove the DSP from the module, shifting signal processing to the host to reduce power, cost, and latency.

Overview of LPO Technology

Linear Pluggable Optics (LPO) are a type of optical transceiver designed for high-speed, short-reach connections in modern data centers, AI clusters, and GPU fabrics. Unlike traditional DSP-based modules, LPO modules eliminate the digital signal processor (DSP) and clock data recovery (CDR) chips inside the module. Instead, they use high-linearity analog components such as drivers, lasers, photodiodes, and transimpedance amplifiers (TIAs), while the host ASIC or NIC handles digital signal processing tasks like equalization and error correction ().

Key Advantages

- o Lower Power Consumption: Removing the DSP significantly reduces module power usage. For example, in 400G modules, DSPs can consume around 4W, nearly 50% of total module power ().
- o Reduced Latency: Shifting signal processing to the host reduces delays, which is critical for AI/ML training and high-performance computing.
- o Cost Efficiency: LPO modules are less expensive because they eliminate costly DSP chips, which can account for 20-40% of module cost ().
- o Pluggable Form Factor: LPO retains hot-swappable, pluggable design, allowing easy maintenance and interoperability ().

Applications

LPO modules are particularly suited for:

- o Hyperscale Data Centers: Leaf-spine networks benefit from higher port density and lower operational costs.
- o AI/ML Clusters: Reduced latency improves synchronization during distributed training.
- o Data Center Interconnect (DCI): 200G, 400G, and emerging 800G LPO modules support high-speed interconnects for AI computing and cloud infrastructure ().

Limitations

- o Shorter Transmission Distances: Without DSP-based equalization, LPO modules have higher bit error rates (BER) over long or unpredictable links ().
- o Platform Compatibility: LPO modules require host devices capable of handling digital signal processing, so

interoperability depends on the specific switch or NIC implementation ().

o Standardization: While LPO is based on open standards (LPO MSA), industry adoption is still evolving, and careful qualification is needed for multi-vendor deployments ().

Role of ODMs

Original Design Manufacturers (ODMs) like Guangzhou Ruidong Technology (Fiberwdm) produce LPO-based optical modules for 200G, 400G, and 800G applications. ODMs focus on integrating LPO technology into modules that meet AI computing, DCI, and high-density data center requirements, providing scalable, low-power, and cost-effective solutions ().

Summary

LPO represents a power-efficient, low-latency evolution of pluggable optical modules, ideal for modern high-speed data center environments. By offloading DSP functions to the host, LPO modules reduce energy consumption and cost while maintaining pluggable flexibility. They are particularly advantageous in AI clusters, hyperscale data centers, and short-reach high-density interconnects, though careful platform compatibility and link distance considerations are essential.

Linear Drive Pluggable Optics refers to the use of direct-drive linear technology in fiber

Source: Macom, OFC 2023 To reduce power consumption and cost while meeting the demands of high-speed, high

Pluggables, Power, and Geopolitics: Mapping the 800G and 1.6T Optical Transceiver Battle How AI Demand Is

The Optical Active Device Market is expected to grow from USD 7.80 Billion in 2025 to USD 13.41 Billion by 2032, at a CAGR of

The Linear-drive Pluggable Optics (LPO) transceiver with linear-drive technology has advantages in power

LPO Optical Module Market Overview: The LPO Optical Module Market Size was valued at 2,510 USD Million in 2024. The LPO

In H1 2025, the share of optical active devices in its revenue rose 8 percentage points year-on-year to 63.78%, mainly

One of the most groundbreaking network innovations driving transformations of data centers

Exploring optical interconnects for AI data centers: LPO for low-power, short-distance links, NPO for high-density,

LPO is short for Linear Pluggable Optics (or Linear-drive Pluggable Optics), it is a potential technology to satisfy the low power

Active Optical Components are used to manipulate light through a variety of electrical methods, including adaptive reflection, variable

Half-Retimed Linear Optics creates an easier composite channel, allowing greater margin and robustness Shorter electrical

Linear pluggable optics (LPO) is garnering more attention as a way to quickly and efficiently

The Figure below presents LightCounting's forecast for sales of optical transceivers, LPO and CPO for scale-out and

Learn about LPO vs LRO vs NPO vs CPO optics. Understand their architectures, DSP design, deployment

What is LPO LPO, the full name of the English called Linear-drive Pluggable Optics. As you can tell from the name, it

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