

Article Overview

Linear pluggable optical (LPO) QSFP modules offer low-latency, high-bandwidth connectivity with reduced power consumption, but require careful host SerDes integration and channel loss management.

Overview of LPO QSFP Modules

Linear Pluggable Optical (LPO) QSFP modules, such as QSFP-DD LPO, are designed to deliver high-speed PCIe Gen 5.0 or Ethernet connectivity over optical links with low latency and reduced power consumption compared to DSP-based optics . Unlike traditional DSP-based transceivers, LPO modules do not include signal regeneration or digital signal processing within the module itself. This linear approach shifts the responsibility for signal integrity to the host ASIC SerDes, which must handle both electrical and optical link performance .

Key Technical Considerations

1. Host SerDes Requirements:

- o The host SerDes must manage the entire analog link, including electrical trace loss, E/O and O/E conversion, and optical fiber transmission .
- o High linearity is critical to maintain signal fidelity across the link.
- o Ensure your system supports the required FEC (Forward Error Correction), such as RS (544) for PAM4 signaling, to maintain error-free transmission .

2. Power and Latency:

- o LPO modules reduce module power consumption by approximately 40%, lowering typical module power from ~14W to under 8W .
- o This reduction is particularly beneficial in AI/ML workloads or high-density NIC and switch deployments.
- o Latency is also lower compared to DSP-based optics, which can improve performance in latency-sensitive applications.

3. Interoperability and Channel Loss:

- o LPO modules require careful channel loss budgeting; the host system must accommodate variations in insertion loss across ports .
- o Interoperability between LPO and DSP-based modules is possible, but LPO modules are optimized for linear transmission and may not fully leverage DSP demarcation points (TP2/TP3 interfaces) defined for DSP optics .

4. Applications:

- o Two FIR (Finite Impulse Response) settings are typically sufficient to compensate for channel variations.
- o Ideal for rack-to-rack interconnects, server disaggregation, and AI/ML clusters where low latency and power efficiency are critical .
- o Suitable for QSFP-DD, OSFP, OSFP-RHS, and QSFP112 form factors.



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Practical Support Tips

- o Verify host compatibility: Confirm that your switch or NIC supports the required SerDes performance and FEC.
- o Monitor thermal headroom: LPO modules generate less heat, but ensure adequate cooling for high-density deployments.
- o Plan for analog link management: Since LPO modules lack DSP, maintain strict control over trace quality, fiber loss, and connector performance.
- o Test interoperability: If mixing LPO and DSP-based modules, validate link performance under expected insertion loss conditions. By following these guidelines, LPO QSFP modules can provide high-performance, low-power optical connectivity while maintaining reliability and scalability in modern data center environments .

Description QSFP-DD LPO TRANSCEIVER DESIGNED FOR PCIE® GEN 5.0 DATA RATES
Amphenol"s QSFP-DD

Optical transceivers, optical DSPs (oDSPs), and switch ASICs are the core components of

Learn more about the Cisco QSFP-DD Open Line System (QDD OLS), a pluggable optical

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

See Amphenol"s experts demonstrate the QSFP-DD Linear Pluggable Optics at OFC 2025!

We are there now." As designs continue to evolve, current optical interconnects choices are now between traditional

Amphenol"s QSFP-DD Linear Pluggable Optical (LPO) Transceiver delivers low-latency,

Non-retimed Linear Drive Pluggable Optics (LPO) was the hottest topic at OFC 2023 and it continued to draw a crowd at the most

Linear Drive optics can offer data center providers various benefits, namely reducing power by eliminating DSP functions from optics.

QSFP+ optics and Cables Opticonnect offers a range of QSFP+ (Quad Small Form-factor Pluggable Plus) products such as



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Learn how linear pluggable optics (LPOs) reduce power use, cost and latency by eliminating the DSP and enabling efficient AI, ML

The definitive guide to SFP, QSFP, and QSFP-DD standards for 2025. Compare 400G/800G optics, understand

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

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

Eoptolink Technology Inc., Ltd. (SZSE: 300502) used OFC 2023 to launch 800G linear-drive pluggable optical

By leveraging linear pluggable optical (LPO) technology, these modules minimize on-module digital signal

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