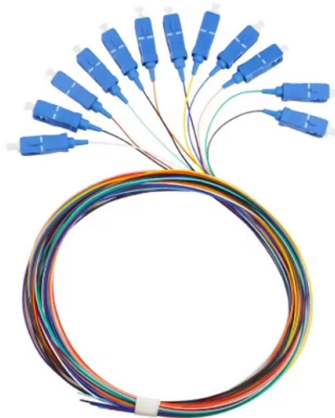


Single-mode 100G optical module



Overview

The single-lambda 100G optical specifications were first standardized by the 100G Lambda MSA (multisource agreement).

Key Takeaways

100G single-mode single-lambda optical modules use a single wavelength to achieve 100Gbps transmission, simplifying design and reducing cost while supporting distances from 500m to 40km.

Single-lambda 100G optical modules transmit 100Gbps over a single wavelength using PAM4 modulation, unlike traditional 100G modules that use four 25G channels with WDM or parallel transmission. This reduces the number of optical components, lowers power consumption, and increases port density, making them ideal for high-density data centers and enterprise networks (FS, 2026) .

Key Types and Specifications

Single-mode 100G single-lambda modules include:

- 100G QSFP28 DR: Supports up to 500m over single-mode fiber (SMF) at 1310nm, ideal for leaf-spine data center interconnects. Uses DSP-based gearbox to convert 4x25Gbps NRZ signals to 1x50Gbaud PAM4. Max power ~4W (FS, 2026) .
- 100G QSFP28 FR / FR CWDM: Short-reach modules for 2–10km connections over SMF, using 1310nm EML laser and PIN receiver. Max power ~4–4.5W.

- 100G QSFP28 LR / LR CWDM / LR BIDI: Designed for 10–20km links, suitable for core and aggregation networks. Compliant with IEEE 802.3cd 100GBASE-LR1 and QSFP28 MSA standards.
- 100G QSFP28 ER Lite / ER BIDI: Long-distance modules supporting 25–40km over SMF at 1310nm, with digital diagnostics via I2C interface.
- 100G DWDM QSFP28 ZR: For ultra-long-haul applications, typically exceeding 40km, using dense wavelength division multiplexing (DWDM) (FS, 2026) .

Advantages of Single-Lambda Modules

- Simplified optical design: Reduces internal optical components from four to one, lowering complexity and cost.
- Lower power consumption: Single-lambda modules consume less energy compared to traditional 100G modules.
- High density: Supports more ports per switch or router, enabling scalable network expansion.
- Future-proof: Compatible with 400G upgrades, allowing incremental network modernization without replacing all infrastructure (FS, 2026) .

Applications

- Data center interconnects: Leaf-spine architecture, server-to-switch connections.
- Enterprise core and distribution networks: High-speed backbone links.
- Service provider networks: Metro and regional transport networks requiring 10–40km reach.
- Fiber-to-the-server deployments: High-density, short- to medium-range connections.

Summary

100G single-mode single-lambda optical modules provide efficient, cost-effective, and scalable 100Gbps connectivity over single-mode fiber. By using a single wavelength and PAM4 modulation, they reduce component count, power consumption, and complexity while supporting a wide range of distances from 500m to 40km, making them suitable for modern data centers, enterprise, and service provider networks (FS, 2026) .

Article Content

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