400g optical module model



Overview

Discover key factors driving the rapid adoption of 400G optical transceivers, including AI, 5G, coherent optics, and market trends shaping next-gen network infrastructure.

Key Takeaways

400G optical modules come in multiple types and form factors, including VR4, SR4, SR4. 2, SR8, DR4, FR4, LR4, LR8, ER4, ZR4, and form factors like QSFP-DD, OSFP, CFP8, and QSFP112, each optimized for specific distances, fiber types, and data center applications. Transmission Reach CategoriesVR4 (Very Short Range): Designed for 0–100 meters over multimode fiber (MMF), ideal for intra-rack or top-of-rack connections in data centers.

SR4 / SR4. 2 (Short Range): Supports up to 300 meters (SR4) or 150 meters (SR4. 2) on MMF, using parallel transmission with 4 or 8 channels via PAM4 modulation.

SR4. 2 doubles capacity using wavelength division multiplexing. SR8: Uses 8 channels for high-density, short-distance links within data centers.

DR4 (Distance Range): Reaches up to 500 meters on single-mode fiber (SMF), suitable for inter-rack or inter-data center connections. FR4 (Long Range): Extends up to 2 kilometers on SMF, often using CWDM to multiplex 4 wavelengths over a single fiber pair. LR4 / LR8 (Long Reach): Supports up to 10 kilometers on SMF, designed for wide-area or extended-distance links.

LR8 uses 8 channels for higher density. ER4 (Extended Reach): Typically up to 30 kilometers, for metro or enterprise backbone links. ZR4 (Ultra-Long Reach): Can reach 80–120 kilometers, suitable for inter-data center or metro networks with high optical loss.

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Form FactorsQSFP-DD (Quad Small Form Factor – Double Density): Backward-compatible with QSFP/QSFP28, supports 8 lanes for 400G.

OSF

P (Octal Small Formfactor Pluggable): New interface, not backward-compatible, optimized for high-density deployments. CFP8: Scales older CFP4 standard with 8 channels, used in high-capacity backbone links. QSFP112: Supports 400G with 4 or 8 channels, often used for VR4 or SR4.

2 modules. CWDM8 / CDFP / COBO: Specialized form factors for multiplexing or on-board optics, with varying degrees of field service flexibility.

Key Technical Features

Modulation: Most 400G modules use PAM4 (4-level pulse amplitude modulation) to double data rate per channel. Fiber Type: MMF for short-range (VR4, SR4, SR4. 2, SR8), SMF for longer distances (DR4, FR4, LR4, LR8, ER4, ZR4),.

Channels: Modules may use 4, 8, or more parallel channels, each carrying 50–100G, to achieve 400G total bandwidth. Applications: Short-range modules are ideal for intra-rack or leaf-to-spine connections, while long-range modules serve inter-data center, metro, or enterprise backbone links.

Summary

Choosing the right 400G optical module depends on distance, fiber type, density, and application scenario. Short-range modules (VR4, SR4, SR4. 2, SR8) are optimized for high-density, low-latency intra-data center links, while DR4, FR4, LR4/LR8, ER4, and ZR4 cater to longer distances, metro, and inter-data center connectivity.

Form factors like QSFP-DD, OSFP, and CFP8 determine compatibility and deployment flexibility, making it essential to match module type with network architecture and future scalability requirements.

Article Content

Introduction to 400G Optical Modules · KAD

A clear, engineer-friendly overview of 400G optical modules, including standards, packaging formats, functions, and market outlook for next-generation

How 400G Optical Modules Are Shaping Next-Gen Networks

Discover key factors driving the rapid adoption of 400G optical transceivers, including AI, 5G, coherent optics, and market trends shaping next-gen network infrastructure.

400G Optical Modules 2026 Guide: DR4 vs. FR4 vs.

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Our CCIE/HCIE team shares lab-tested benchmarks for DR4, FR4, and LR8, focusing on power efficiency, latency, and AI cluster scalability.

Cisco 400G QSFP-DD High-Power (Bright) Optical

Learn how Cisco 400G QSFP-DD High-Power (Bright) Optical module''s small size and low power make it an optimal choice for a wide range of

400G Optical Modules Explained: SR4 Vs. DR4 Vs. FR4 Vs. LR4

Today, we have provided a definitive overview of the transmission standards for 400G optical modules. We are confident that this article will assist you in selecting the optimal standard.

Overview of 400G Optical Modules

What is a 400G Optical Module? A 400G optical module is primarily used for optical-electrical conversion. The electrical signal is converted into an

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Arista''s 400G-VSR4 modules will optically interop over 50m MMF with third-party QSFP112 or OSFP-RHS modules that are compliant to the IEEE 400GBASE-SR4 or 400GBASE-VR4 optical standards.

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Compare QSFP-DD, QSFP28, and OSFP form factors. Learn about compatibility, power constraints, migration TCO, and data center selection

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Key differences between SR4, DR4, FR4, and LR4 400G optical modules. Expert advice from Asterfusion engineers to optimize your data center network.

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100G/400G Optical Transceiver

EXECUTIVE SUMMARYThis document serves as the definitive technical reference and product datasheet for the next-generation 100G/400G Optical Transceiver family. Designed to address the

400G vs 800G Optical Modules: Differences, Use Cases, and

Compare optical modules for data centers and AI clusters. Learn key differences in standards, power, cabling, and use cases.

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