

Optical modules DR4 and SR4



Overview

400G Optical Modules Explained: SR4 Vs. DR4 Vs. FR4 Vs. LR4 Key differences between SR4, DR4, FR4, and LR4 400G optical modules. Expert advice from Asterfus.

Key Takeaways

SR4 modules are short-reach, multimode solutions for intra-data center links, while DR4 modules are single-mode, medium-reach solutions for inter-data center connections up to 500 meters.

Overview

SR4 (Short Reach, 4 lanes) is designed for short distances, typically within a single rack or between racks in a data center. It uses multimode fiber (MMF), commonly OM3 or OM4, and transmits data over four parallel optical channels, each at 100Gbps, achieving a total of 400Gbps using PAM4 modulation. The typical reach is 30 meters on OM3 and 50 meters on OM4, with some OM5 deployments extending up to 150 meters. SR4 modules use MPO-12 APC connectors and are optimized for high-density, cost-effective deployments with low power consumption (around 4-5W per module) ().

DR4 (Datacenter Reach, 4 lanes) is intended for medium-short distances, up to 500 meters, using single-mode fiber (SMF, OS2). Like SR4, it uses four optical channels at 100Gbps each with PAM4 modulation, but it employs DFB lasers instead of VCSELs. DR4 is suitable for inter-rack or inter-room connections within a data center, bridging dense fabrics to aggregation or spine switches. It also uses MPO-12 APC connectors for parallel single-mode transmission ().

Key Differences	Feature	SR4	DR4	Fiber Type	Multimode (OM3/OM4/OM5)	Single-mode (OS2)
Maximum Distance		30–50 m (OM3/OM4), up to 150 m (OM5)	500 m	Laser		
Type	VCSEL	DFB	Connector	MPO-12 APC	MPO-12 APC	Typical Use
	Intra-rack or intra-data center	Inter-rack or inter-room within data center	Power Consumption	4–5 W	Slightly higher than SR4	Cost
	Lower	Higher due to single-mode optics	Applications			

- SR4: Ideal for short, high-density connections inside racks or between adjacent racks, where cost and low power are priorities. Common in AI clusters, high-performance computing, and dense data center fabrics ().

- DR4: Suitable for longer intra-data center links, such as connecting aggregation switches or spine layers, where single-mode fiber is preferred for future-proofing and longer reach ().

Deployment Considerations

- Fiber Compatibility: SR4 requires multimode fiber; DR4 requires single-mode fiber. Using the wrong fiber type can limit reach or cause signal degradation.
- Connector Type: Both use MPO-12 APC for 400G parallel optics. Ensure patch panels and cabling support this standard.
- Power and Thermal Design: SR4 modules have lower power consumption, which is important when populating high-density switches.
- Cost vs Reach: SR4 is cheaper but limited in distance; DR4 costs more but supports longer links without re-cabling. In summary, choose SR4 for short, cost-sensitive, high-density intra-data center links, and DR4 for longer intra-data center or inter-room connections where single-mode fiber is available and future scalability is needed ().

Article Content

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However, after calculating the cabling impact—four times the fiber links, four times the optical modules, and four times

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Each of the 8 optical channels from an SR8 module are carried on separate fibers, resulting in a total of 16 fibers (8 Tx and 8 Rx).

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