Optical modules are the most expensive



Overview

Seven of the global top 10 optical module suppliers in 2024 were Chinese companies (including Source Photonics, acquired by Chinese capital).

Key Takeaways

The most expensive optical modules are 400G coherent ZR+ transceivers, which can exceed $130,000 per unit.

Overview of High-

Cost Optical Modules

The highest-priced optical modules are typically coherent long-haul transceivers used for Data Center Interconnects (DCI) and ultra-long-distance fiber links. For example, a 400G QSFP-DD coherent ZR+ module from an OEM can cost over $130,000, while short-reach 400G SR8 modules for in-rack connections are priced under $2,000 from third-party vendors, illustrating a price spread of roughly 100: 1 depending on technology and reach.

Factors Driving Cost

Transmission Distance and Technology: Modules designed for long-haul or ultra-long-haul transmission, such as LR4, ZR, and ZR+ optics, require coherent detection, high-precision lasers, and advanced DSP chips, which significantly increase cost.

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M vs Third-Party: OEM-branded modules from Cisco, Juniper, or Arista often carry a premium due to certification, support, and vendor lock-in, whereas third-party compatible modules are much cheaper but may lack full vendor guarantees. Optical Components: Single-mode optics, extended reach, and specialized lasers (EML or DFB) are more expensive than multimode or short-reach modules. Performance Requirements: Modules with higher optical power, tighter tolerances, and advanced coding (e.g., PAM4, FEC) command higher prices.

Price Comparison by Module Type10G SFP+: $10–$300+, with LR/ER modules at the higher end. 25G SFP28: Typically lower than 10G due to market competition, but high-end LR/ER modules remain costly. 100G QSFP28: OEM modules can reach several thousand dollars, especially for long-reach or DWDM variants.

400G QSFP-DD: SR8 modules $1,400–$1,800; LR4 modules over $10,000; ZR+ modules exceeding $130,000. 800G QSFP-DD: Emerging high-speed modules are expected to be similarly expensive, particularly for coherent long-haul applications.

Conclusion

The most expensive optical modules are coherent 400G ZR+ transceivers, primarily due to their long-haul capabilities, advanced optical and digital signal processing technologies, and OEM branding. These modules are critical for high-capacity, long-distance data center interconnects, and their cost reflects the complexity and precision required for reliable ultra-high-speed transmission.

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