Cost Proportion of Optical Module Servers



Overview

With the rapid evolution toward 400G, 800G, and 1.6T optical modules, the cost structure is continuously changing.

Key Takeaways

Optical modules typically account for a significant but declining share of high-speed server networking costs, with electrical chips and packaging increasingly dominating in 400G–1. 6T modules.

Cost Breakdown of Optical Modules

In modern high-speed optical modules (400G, 800G, 1. 6T), the total cost is generally divided among three main components: optical devices, electrical chips (DSPs), and packaging/manufacturing. Historically, early-generation modules (100G–200G) had a high proportion of costs in optical devices due to complex manufacturing and low yields.

However, in current 400G and 800G modules, the optical device share has declined, while electrical chips, particularly DSPs, have become the main cost driver. Packaging costs remain significant and are steadily increasing in complexity, though their percentage of total cost is relatively stable.

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Typical Cost Proportions

Optical devices: In 400G–800G modules, optical components may account for roughly 30–40% of module cost, depending on reach and complexity (e.g., OSFP-FR4 modules with longer reach are more expensive due to optics),. Electrical chips (DSPs): These can represent 40–50% or more of the total cost in 800G and above modules, especially in coherent or high-performance modules. Packaging and assembly: Typically 20–30%, reflecting the increasing complexity of high-speed module integration.

For lower-speed or simpler modules (e.g., 100G–400G QSFP-DD), optical devices can still dominate costs, but as speeds increase, the shift toward a “chip + system + packaging co-driven” cost model becomes evident.

Implications for Server Networking Costs

In large-scale AI or hyperscale data centers, optical modules are a non-negligible portion of server networking costs, particularly for high-bandwidth interconnects. For example, 800G OSFP-DR8 modules can cost $1,100–$1,400 per unit at volume, while simpler 400G QSFP-DD modules cost $600–$800. The choice of module type, vendor, and volume discounts can significantly affect the proportion of total server networking expenditure allocated to optics.

Coherent modules, used for longer-reach or high-capacity links, have higher unit costs but can reduce overall TCO by minimizing additional line-system hardware.

Summary

Optical modules remain a key cost component in server networking, but their relative share is decreasing in ultra-high-speed modules. Electrical chips and packaging are increasingly dominant, especially in 800G–1. 6T modules.

Module type, reach, and vendor pricing strongly influence the proportion of server costs attributable to optics. For budgeting and TCO planning, data center operators should consider both unit cost and operational efficiency, as higher-cost modules may reduce downstream infrastructure expenses. This evolving cost structure highlights the importance of strategic procurement and technology selection in modern high-performance server networks.

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How To Choose Optical Modules For Servers

Those who are familiar with servers know this, and those who are not will learn from this article: unlike switches, servers are not equipped with ports for plugging in optical modules directly.

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Optical Module: A Comprehensive Analysis from Source

In conclusion, the choice of modulation method needs to take into account multiple factors, including transmission requirements, optical chip

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Understanding Optics Module Trends and Growth Dynamics

The Optics Module market is expanding rapidly, driven by data center proliferation and 5G deployment. Analyze the 12% CAGR to $42 billion by 2033 with our market insights.

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