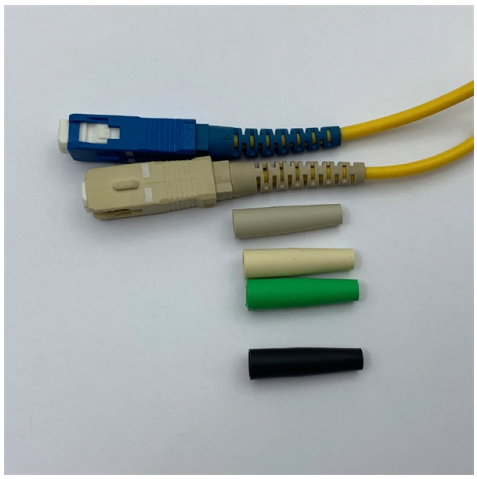
Cost of each component in the optical module



Overview

Cost of optical module electronic chips | WeylandFor traditional 10G and 25G optical modules, the structure is relatively simple, and electronic chips typi.

Key Takeaways

The cost of optical module components is primarily driven by active optical components, electronic chips, manufacturing, R&D, and integration, with each category contributing significantly to the total module price.

Active Optical Components

Active optical components include lasers, modulators, photodetectors, and transimpedance amplifiers (TIAs). These are essential for converting electrical signals into optical signals and are often sourced from specialized suppliers. High-speed, tunable, or coherent technologies increase costs substantially.

Active components typically account for 30–40% of the total chip cost, with lasers and modulators representing the largest share due to their complexity and precision requirements.

Electronic Chips

Electronic chips form the core processing system of optical modules. Key chips include: DSP (Digital Signal Processing) chips: Handle modulation, error correction, and high-speed data processing, especially in 400G and 800G modules.

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Driver I

Cs: Drive the laser for stable optical output.

TI

A chips: Convert weak photodetector currents into usable voltage signals.

MC

Us: Monitor module status and manage system functions. For lower-speed modules (10G–25G), electronic chips account for 10–20% of total cost, while in high-speed modules (400G–800G), DSP and advanced chips become a dominant cost factor.

Manufacturing and Fabrication

Manufacturing involves wafer fabrication, assembly, packaging, and testing. High-precision semiconductor processes in cleanrooms, along with optical alignment and environmental stress testing, contribute 25–35% of total chip cost. Yield losses and complexity in high-speed modules further increase expenses.

R&

D and EngineeringResearch and development, including hiring skilled engineers in photonics, lens technology, and signal processing, can account for 20–30% of total chip cost, particularly for high-end 400G and 800G modules. Continuous innovation in speed, power efficiency, and reliability drives these costs.

Integration and Module-

Level Costs

Once chips are fabricated, they are integrated into optical modules, which adds costs for thermal management, fiber coupling, packaging, and module-level testing. Passive components like lenses, mirrors, waveguides, and optical connectors, while smaller in cost, are critical for signal integrity.

Example Pricing

For high-speed 800G modules, volume pricing ranges approximately as follows: 800G OSFP-DR8: $1,100–$1,400 per module800G QSFP-DD-DR8: $1,000–$1,300 per module800G OSFP-FR4 (longer reach): $1,500–$1,900 per module800G LPO (no DSP): $700–$900 per module Factors affecting price include vendor tier, volume discounts, technology maturity, supply constraints, and customization requirements.

Summary

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The total cost of an optical module is a combination of: Active optical components (largest share)Electronic chips (DSP, TIA, driver ICs, MCU)Manufacturing and assemblyR&D and engineeringIntegration and passive components High-speed modules (400G–800G) have significantly higher costs due to advanced DSP chips, coherent optics, and complex fabrication processes, while lower-speed modules are dominated by optical and packaging costs.

Article Content

Cost of optical module electronic chips | Weyland

For traditional 10G and 25G optical modules, the structure is relatively simple, and electronic chips typically account for 10%–20% of total cost, while optical components and packaging

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Understanding the cost structure of optical module chips is essential for developers, investors, and network operators, as it heavily impacts pricing, profitability, and supply chain decisions.

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Internal Structure of Optical Modules

The internal design of an optical module aims to ensure efficient and stable electro-optical conversion while addressing factors like heat dissipation, protection, and cost.

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Optical Components

Detailed unit shipment forecasts for each Datacom and Telecom optical module category. No market share for detailed unit shipments is provided; unit shipment data from

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QSFP-DD price guide with 400G/800G module costs, OEM vs third-party comparison, volume discounts, and 3-year TCO analysis for data center buyers.

800G AEC, 800G OSFP to 800G QSFP-DD Active Electrical Cable,

The electrical interface of the module is compliant with the 800GAUI-8 interface as defined by IEEE 802.3ck, and compliant with OSFP MSA and QSFP-DD MSA.

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An optical module serves as the backbone of modern fiber-optic communication. Its appearance often resembles a compact rectangular device, designed to fit seamlessly into

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

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