# Different Packaging Types of Optical Modules

Article Overview

Optical modules come in various packaging types, including SFP, SFP+, XFP, QSFP, QSFP28, QSFP-DD, GBIC, and co-packaged optics (CPO), each designed for specific speed, density, and application requirements.

First-Generation Packaging (1995-2000)

o 1x9 Package: Early modules with welding design, speeds <=1 Gbps, typically using SC interfaces. These were large and incompatible with modern equipment, now obsolete .
o GBIC (Gigabit Interface Converter): Hot-swappable, 20-pin modules supporting 1 Gbps, widely used in data centers and metro networks. Large size limited port density, accommodating only about eight modules per switch .

Second-Generation Packaging (2000-2018)

o SFP (Small Form-Factor Pluggable): Compact, pluggable modules supporting Gigabit Ethernet, SONET, and Fiber Channel, with speeds up to 4.25 Gbps. Replaced GBIC due to smaller size and higher port density .
o SFP+: Enhanced SFP supporting 10 Gbps, widely used in 10 Gigabit Ethernet. Compatible with LC interfaces and smaller than XENPAK/XFP modules .
o XFP: Hot-swappable 10G modules, protocol-independent, supporting 850nm, 1310nm, or 1550nm wavelengths. Often used alongside SFP+ in 10G networks .
o SFP28: Same size as SFP+, supports 25 Gbps per channel, enabling efficient upgrades from 10G to 25G and 100G networks .

Third-Generation Packaging (2018-Present)

o QSFP (Quad Small Form-Factor Pluggable): Four-channel modules, typically 10G per channel, total 40G. Compact and high-density for modern data centers .
o QSFP+: Enhanced QSFP for 40G networks, widely adopted in high-speed data centers .
o QSFP28: Four 25G channels, total 100G, same size as QSFP+, enabling direct 25G->100G upgrades .
o QSFP-DD (Double Density): Eight-channel modules supporting 200G/400G, same width as QSFP28, designed for ultra-high-density applications .
o Co-Packaged Optics (CPO): Integrates optical modules with switch ASICs for extremely high-speed applications (400G-800G), reducing power consumption and improving density .

Summary

Optical module packaging has evolved from large, low-density GBICs to compact, high-speed

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SFP/SFP+/QSFP modules, and now to ultra-dense QSFP-DD and CPO solutions. Each generation addresses compatibility, port density, speed, and power efficiency, supporting the growing demands of data centers, 5G networks, AI computing, and cloud infrastructure .

Speaking of optical modules, many people who have used optical modules must be very

Explore the working principles, structures, and performance metrics of optical modules, essential components of

The chapter categorizes optical packages into two types: coaxial type package, which is generally uncooled, and

An optical module is a typically hot-pluggable optical transceiver used in high-bandwidth data communications applications. Optical

In the 5G era, the demand for high-bandwidth computing, transmission, and storage has led to the development of

Optical modules are classified by package type, rate, laser type, center wavelength, mode, connector type, modulation

What Is an Optical Module and Its FAQs (V200) Describes what an optical module is and FAQs, including the fundamentals,

The 400G QSFP-DD optical module has become one of the most popular optical modules for the next generation of data center

Packaging is much more complex for photonics than for electronic integrated circuits (ICs). The chapter categorizes optical packages

Many partners do not know much about the packaging types of optical modules,so in this article,ETU-LINK introduces

Explore the classification of optical modules based on transmission rate, package type, mode, central wavelength, and

Common optical device packaging methods include COB (chip-on-board packaging), BOX and coaxial packaging.

# Different Packaging Types of Optical Modules

Various standard and emerging package types are described, from simple TO-cans and high-performance butterfly packages to

An optical module serves as the backbone of modern fiber-optic communication. Its appearance often resembles a

From the large GBIC in 1995 to today"s nano-scale QSFP-DD and co-packaged optics (CPO), how has packaging technology

There are many types of optical modules, and there are several standard ways to categorize them, such as according

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