Optical Module Device Packaging Categories



Overview

The article introduces to photonic packaging: functions, optical and electrical interfaces, package types, design, testing, reliability, cost and standardization.

Key Takeaways

Optical modules are packaged in various standardized form factors and methods, including GBIC, SFP, XFP, QSFP, and hermetic or non-hermetic designs, each optimized for performance, density, and application environment. Standard Form Factor PackagesGBIC (Gigabit Interface Converter): One of the earliest hot-swappable optical module packages, widely used in the 1990s. It supports SC interfaces and allows flexible interchangeability but is relatively large in size.

SF

P (Small Form-factor Pluggable): A compact, hot-pluggable module that replaced GBIC due to its smaller size, allowing higher port density.

SF

P supports up to 4 Gbps and is widely used in modern networks. SFP+ and SFP28: SFP+ supports 10 Gbps, maintaining the same physical size as SFP but with reduced power consumption. SFP28 supports 25 Gbps, serving as a cost-effective transition for high-speed applications.

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CSF

P (Compact SFP): A multi-channel variant of SFP, reducing the form factor to 1/2 or 1/4 while maintaining interface compatibility, increasing port density and throughput.

XFP and CF

P Series: XFP is a 10G module with a larger footprint than SFP+, while CFP modules support 40G and 100G transmission, designed for high-speed, long-distance applications.

QSF

P, QSFP+, QSFP28, microQSFP: Quad Small Form-factor Pluggable modules integrate four channels in a single package. QSFP28 supports 100G transmission, and microQSFP is a miniaturized version supporting 25G and 50G per channel, optimized for high-density data centers.

Packaging Methods

Hermetic Packaging: Provides airtight sealing to protect optical chips from moisture and environmental stress. Common hermetic types include: TO-CAN: Laser mounted on a small heat sink, sealed with a metal cap and window. Suitable for telecom applications with moderate power and distance requirements.

Butterfly: Larger heat sink with optional temperature control (TEC), used for high-power or multi-channel modules.

BO

X: A multi-channel variant of butterfly packaging, integrating multiple lasers in a single package for high reliability and temperature control.

Non-

Hermetic Packaging: Cost-effective approach where the optical chip is directly attached to the circuit board and sealed with epoxy or adhesives. Examples include Chip-on-Board (COB) packaging, which reduces auxiliary components, increases integration, and is suitable for controlled environments like data centers.

Key Considerations

Performance vs. Cost: Hermetic packages offer higher reliability and environmental tolerance but are more expensive. Non-hermetic packages reduce cost and size but are better suited for indoor, controlled environments.

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Thermal Management: High-speed or multi-channel modules require careful heat dissipation, often influencing the choice of packaging method. Port Density: Smaller form factors like SFP, SFP+, and microQSFP allow more ports per panel, critical for data center applications. In summary, optical module packaging types are defined by both form factor standards and chip-level packaging methods, balancing size, speed, power, reliability, and cost to meet the requirements of telecom networks and data centers.

Article Content

Optical Module Package Types Overview

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

Photonic Packaging – optical interfaces, package types, TO-can ...

The article introduces to photonic packaging: functions, optical and electrical interfaces, package types, design, testing, reliability, cost and standardization.

Optical Transceiver: Packaging Methods & Optical Chip Types

It includes a detailed analysis of various terms, technologies, and categories in the optical module industry, as well as a brief overview of industry trends.

Optical Transceiver: Packaging Methods & Optical Chip Types

Analyzes the requirements of optical transceivers and discusses packaging methods and optical chip types to understand their design and manufacturing process.

Optical device packaging technology: COB,BOX and coaxial

Common optical device packaging methods include COB (chip-on-board packaging), BOX and coaxial packaging. Today, we will discuss the differences between them to help you better

Advanced optical packaging – how much do you know

Optical transceiver modules can be classified into three levels: optical chip, optical device, and optical module. They are used in telecom and data communication applications and can be

What are the types of optical module packaging?

There are many types of optical module packaging, such as 1*9, SFF, GBIC, X2, XENPAK, XFP, etc., which are not commonly seen now. The following mainly introduces the common SFP series and

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Optical Module Packaging: From Bulky Designs to SFP, QSFP, and

From the large GBIC in 1995 to today''s nano-scale QSFP-DD and co-packaged optics (CPO), how has packaging technology advanced? This guide explains the evolution of optical module packaging in

What is an Optical Module?

Explore the world of optical modules, essential components in optical fiber communication. Learn about the different types of optical modules, their functions, packaging, and key technical concepts like

COB vs. BOX vs. Coaxial: Key Differences in Optical Device Packaging

In the field of optical communication, the packaging of optical devices plays a crucial role in the performance and application of optical modules. Common optical device packaging methods

Module/packaging technologies for optical components: current and ...

The basic design methodology and criteria required for packaging of optical components are reviewed, and the state-of-art of different types of the packaging technologies of laser modules and receiver

Packaging Technologies for Optical Components: Integrated Module ...

The demands for high-speed data transmission and the needs for an integrated optical module comprising more functional optical devices, and electronics devices, are increasing. The reasons for

Optical module packaging form and size standards -

Optical modules are an important part of optical communication systems and are used to transmit and receive optical signals. The packaging form and size standards of optical modules have

Classification and Types of Optical Modules

The types of optical modules are mainly distinguished by their parameters and characteristics. Current classification methods include: transmission distance, rate/protocol,

Optical Module Classification and Common After-Sales FAQs

Explore the classification of optical modules based on transmission rate, package type, mode, central wavelength, and color. Learn about common causes of optical module failure and

Opto-Electronic Packaging

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In passage 7 an overview of existing fiber connectors is shown. Afterwards, different optical module types for active and passive opto-electronic devices are described in details. Finally,

Understanding COB, BOX, and TO-CAN Packaging for Optical Devices

COB, BOX, and TO-CAN packaging impact optical devices by balancing size, cost, and reliability. Learn how COB excels in compact, high-speed applications.

Optical Module Packaging: From Bulky Designs to SFP, QSFP, and

Optical transceiver packaging is the “genetic code” defining their performance, cost, and use cases. From the large GBIC in 1995 to today''s nano-scale QSFP-DD and co-packaged optics (CPO), how

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