Optical Module Photoelectric Conversion



Overview

WO2025225623A1 A photoelectric conversion module according to the present disclosure comprises a substrate, an optical waveguide, a photoelectric conversio.

Key Takeaways

Optical modules achieve photoelectric conversion by using optoelectronic components to transform electrical signals into optical signals and vice versa, with efficiency enhanced through material, structural, and circuit optimizations.

Working Principle

An optical module functions as a photoelectric converter at the physical layer of the OSI model, enabling data transmission over optical fibers. It consists of optical transmitters, optical receivers, functional circuits, and optical interfaces. During transmission, an electrical signal enters the module and is processed by a driver circuit, which modulates a semiconductor laser diode (LD) or light-emitting diode (LED) to emit optical signals at the corresponding bit rate.

These optical signals travel through the fiber and are received by a photodetector diode, which converts the light back into an electrical signal. The signal is then amplified by a preamplifier before outputting at the original data rate.

Key Components

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Transmitter Assembly (TOSA): Contains the laser or LED and driver circuits to generate modulated optical signals. Receiver Assembly (ROSA): Includes a photodetector (PIN or APD) and a limiting amplifier to convert optical signals back to electrical form. Photodetectors: Detect incoming light and generate a proportional electrical current, which is then converted to voltage using a transimpedance amplifier (TIA) for high gain and low noise.

Functional Circuits: Manage signal modulation, amplification, and error correction to maintain signal integrity.

Methods to Improve Photoelectric Conversion Efficiency

Optical Design Optimization: Precise alignment and waveguide design reduce light scattering and maximize the amount of light reaching the photodetector. Electronic Structure Optimization: Circuit design improvements enhance electron transmission speed and stability, improving conversion performance. Material Selection: High-quality semiconductor materials with higher quantum efficiency and lower noise improve light absorption and conversion.

Device Structure Optimization: Structural designs, such as varying the width of the photoelectric conversion layer, prevent saturation and maintain responsiveness under high optical power. Integration and Adaptive Control: Higher integration reduces signal loss and interference, while intelligent algorithms adjust operating parameters to maintain efficiency under varying conditions. Thermal Management: Effective heat dissipation ensures stable module temperature, which is critical for consistent photoelectric conversion.

Summary

Optical modules achieve photoelectric conversion through a combination of optoelectronic devices, precise circuit design, and material and structural optimizations. By converting electrical signals to optical signals for transmission and back to electrical signals for reception, these modules enable high-speed, reliable communication in fiber-optic networks. Efficiency improvements in design, materials, and adaptive control further enhance performance, making modern optical modules highly effective for data centers, telecom networks, and high-speed communication systems.

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Article Content

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A photoelectric conversion module according to the present disclosure comprises a substrate, an optical waveguide, a photoelectric conversion element, and a support member.

WO/2025/204956 PHOTOELECTRIC CONVERSION MODULE

WO2025204956 - PHOTOELECTRIC CONVERSION MODULE. The present invention provides a photoelectric conversion module that is advantageous in terms of reducing optical signal loss.

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Photoelectric conversion optical transceiver module

The main function of the optical transceiver module is photoelectric conversion, realizing optical power control, modulation, transmission, signal detection, etc.

Fundamentals of an Optical Module

As an important part of fiber-optic communication, an optical module is a photoelectric converter which converts electrical signals into optical signals and vice versa. An optical module works at the physical

Learn About Optical Transceiver Modules in One Minute

An optical transceiver module is a photoelectric conversion accessory and one of the key devices in the field of optical communication transmission. It is composed of optoelectronic devices,

A co-packaged photoelectric converter module

In this paper, we introduced an ultra-compact photoelectric converter array module fabricated with hybrid-integration microassembly process, the practical test results showed a good optical coupling

Understanding the Working Principle of Photoelectric Sensor

Learn the working principle of photoelectric sensor conversion modules for industrial automation. This guide covers signal flow, key parameters, noise mitigation, calibration, and advanced IO-Link

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PHOTOELECTRIC CONVERSION MODULE, ELECTRONIC

To increase the output of this photoelectric conversion element, a module structure may be used where a plurality of photoelectric conversion elements are produced on the same substrate and are coupled

Optical module – A comprehensive exploration

The optical module is composed of optoelectronic devices, functional circuits, and optical interfaces. It mainly performs photoelectric and electro-optical conversion, that is, the transmitting

Optical Module Performance: Key Power and Sensitivity Metrics

In modern optical communication systems, optical modules serve as the core photoelectric conversion components whose performance metrics directly impact the efficiency and

Optical Module Working Principle | SFP Transceiver Technical Guide ...

Understanding the working principle of optical modules—especially SFP transceivers—is critical for network engineers, data center operators, and telecom professionals tasked with building

HTF DWDM equipment,OTN Solution,QSFP28 OSFP

HTFuture offers industry-leading fiber optic products and WDM system solutions with global recognition for excellence and innovation.

Optical Ethernet apparatus capable of reset control

In one general aspect, there is provided an optical Ethernet apparatus comprising: an optical receiver configured to perform photoelectric conversion on packet data received through an optical

Optical module for ultrahigh-speed communication

Abstract: The present invention relates to a TO can-type optical module for ultrahigh-speed communication including a laser diode chip of ultrahigh-speed communication of at least 5 Gbps

What Is an Optical Module and Its FAQs (V200)

As an important part of fiber-optic communication, an optical module is a photoelectric converter which converts electrical signals into optical signals and vice versa.

Product Expansion and Prospect of Huarui High Photonics

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Transceiver (Optical Module) is the core photoelectric conversion device of fiber-optic communication systems, known as the "photoelectric interpreter" of the network world and the "super

What is the 400G Optical Module?

The 400G optical module is also called the 400G optical transceiver module, which is mainly used for photoelectric conversion. The electrical signal

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