

What is an optical module circuit



AI Overview

An optical module circuit converts electrical signals into optical signals and vice versa, using TOSA, ROSA, driver circuits, amplifiers, and control systems to ensure high-speed, reliable data transmission. Core Components of an Optical Module

1. Transmitter Optical Sub-Assembly (TOSA) The TOSA is responsible for converting electrical signals into optical signals. It typically includes a laser diode (LD) or light-emitting diode (LED), an optical interface, a monitoring photodiode, and a driver circuit. Laser diodes are preferred for high-speed applications due to their coherent light output, narrow spectral linewidth, and high coupling efficiency, while LEDs are used for low-speed, short-distance links because of their cost-effectiveness and long lifespan. The TOSA often integrates an Automatic Power Control (APC) circuit to maintain consistent optical output power.

2. Laser Driver Circuit The laser driver amplifies and modulates the incoming electrical signal to drive the laser diode. It ensures the optical signal accurately represents the input data at the required bit rate, which can range from hundreds of Mbps to tens of Gbps depending on the module type. The driver also manages extinction ratio, which defines the contrast between logical "1" and "0" in the optical signal.

3. Receiving Optical Sub-Assembly (ROSA) The ROSA converts incoming optical signals back into electrical signals. It contains a photodetector (PIN diode or avalanche photodiode, APD), a Trans-impedance Amplifier (TIA), and a post-amplifier. APDs provide higher sensitivity by amplifying the photocurrent through avalanche multiplication, improving receiver performance by 6-10 dB compared to PIN diodes. The TIA converts the weak photocurrent into a voltage signal, which is then digitized by the post-amplifier for further processing.

4. Limiting Amplifier and Signal Processing After the TIA, the limiting amplifier ensures the output signal has a consistent amplitude, reducing noise and preparing it for digital processing. This stage is critical for maintaining signal integrity.

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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

Contact Us

For more information, pricing, or custom solutions, please contact us:

Website: <https://adikor.eu>

Email: info@adikor.eu

Phone: +33 6 48 37 92 15

Address: 12 Rue de la Paix, 75002 Paris, France

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