1310 Optical Receiver Principle



Overview

Everything You Need to Know About 1310nm Optical 1310nm optical module offers reliable, cost-effective data transmission for metro, campus, and enterprise.

Key Takeaways

A 1310nm optical receiver converts incoming light signals into electrical signals using a photodiode, typically a Schottky diode, followed by low-noise amplification for signal processing.

Basic Operating Principle

A 1310nm optical receiver is designed to detect light in the O-band (1260–1360 nm), commonly used in single-mode fiber networks for medium-distance communication due to low dispersion and attenuation. The core principle involves photoelectric conversion, where incoming photons are absorbed by a photodiode, generating a small photocurrent proportional to the optical power.

Key Components

Photodiode (Schottky Photodiode)Schottky photodiodes are metal–semiconductor junctions that can detect photons with energies below the silicon bandgap, such as 1310nm. When light hits the silicide layer, hot carriers are excited, producing a photocurrent. These diodes are often integrated in bulk CMOS technology, allowing compact, high-speed receiver designs.



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Transimpedance Amplifier (TIA)The photocurrent generated by the photodiode is very small, so a low-noise TIA converts it into a usable voltage signal. Techniques like positive capacitive feedback or critical damping design are used to optimize noise performance and maintain signal integrity. Signal Processing Front-EndAfter amplification, the electrical signal is further processed to restore the digital data.

Equalization may be applied to compensate for channel losses and improve the signal-to-noise ratio (SNR). Performance ConsiderationsSingle-Mode Fiber (SMF) is typically used to minimize modal dispersion and allow high data rates over distances up to 10 km. Responsivity of the photodiode is modest, so careful design of the front-end electronics is crucial to maintain high-speed performance.

Noise optimization is essential, as low photocurrents are susceptible to thermal and shot noise, which can degrade signal quality.

Summary

In essence, a 1310nm optical receiver works by absorbing light in a photodiode, converting it to a photocurrent, amplifying the signal with a low-noise transimpedance amplifier, and processing it to recover the transmitted data. This principle enables reliable, high-speed communication in metropolitan and campus fiber networks, balancing performance, cost, and distance.

Article Content

Everything You Need to Know About 1310nm Optical

1310nm optical module offers reliable, cost-effective data transmission for metro, campus, and enterprise networks. Compare performance, reach, and

1310nm Single Mode Fiber Optical Transceivers Explained

A 1310nm single mode optical transceiver works by converting electrical data signals into optical signals at the 1310nm wavelength, transmitting them through single-mode fiber, and then converting them

Understanding 1310nm Fiber: A Comprehensive Guide

What is the principle behind 1310nm wavelength transmission? Due to its beneficial optical attributes, the 1310nm wavelength transmission principle in

Fiber Optic Wavelengths Explained: 850 vs 1310 vs 1550 nm

In fiber optics, the choice of wavelength is a fundamental design decision: it determines how far your signal can travel, how much it attenuates, and how many channels you can multiplex.

1310/1550 nm Optical Receivers With Schottky Photodiode in Bulk

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Abstract: This article presents optical receivers in bulk CMOS technology with integrated Schottky photodiodes (PDs). These PDs can detect photons with an energy below the silicon bandgap, such

Monolithic 1310nm 1Gb/s Optical Receiver with Schottky Photodiode

We present a fully integrated optical receiver in a standard 40nm CMOS process, suitable for 1310nm communication. The receiver consists of a Schottky photodiode and an analog front-end.

Fundamental mode transmission around 1310-nm over OM1

In this paper, we conduct a study to understand the MCSMF mode field diameter and connector offset tolerance requirements for OM1 fiber, which affect the transmission performance of

Semiconductor optical amplifier (SOA)

The expansive bandwidth and high saturated power capabilities of the Semiconductor Optical Amplifier (SOA) ensure its critical role across a diverse

Chapter 17 Optical Communication in CMOS—Bringing New

This paper discusses the design of 1310/1550nm optical receivers with integrated Schottky photodiode in bulk CMOS, from device characterization/modeling to experimental measurements.

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