

Article Overview

Optical coupler performance depends on parameters like coupling efficiency, insertion loss, polarization-dependent loss, directivity, and current-transfer ratio, which must be optimized for the intended application.

Fiber-Optic Coupler Parameters

1. **Coupling Ratio:** The ratio of optical power from each output port to the total output power. For a 50:50 coupler, each output receives half the input power. This is wavelength-dependent and should be measured across the operating spectrum to ensure uniformity . 2. **Excess Loss:** Defined as the ratio of total input power to total output power, expressed in dB. Lower excess loss indicates higher efficiency . 3. **Polarization-Dependent Loss (PDL):** The variation in transmission due to polarization states. It is calculated as the difference between maximum and minimum transmitted power across all polarization states . 4. **Directivity:** The fraction of input light lost in the internally terminated fiber end. High directivity minimizes back reflections and improves signal integrity . 5. **Uniformity:** Variation of insertion loss over the spectral range. It ensures consistent performance across the operating wavelength band . **Optimization:** Parameters like fiber position, grating pitch, duty cycle, and tilt angle are critical in grating couplers. Tools like particle swarm optimization or 2D/3D simulations can maximize coupling efficiency .

Phototransistor Optocoupler Parameters

1. **Current-Transfer Ratio (CTR):** The ratio of the phototransistor collector current (I_C) to the LED drive current (I_F). CTR determines the efficiency of optical-to-electrical conversion and is sensitive to temperature and DC bias . 2. **Output Parasitic Capacitance:** Limits the operating frequency and switching speed. Lower capacitance allows higher-speed operation . 3. **Switching Speed:** Defined by rise and fall times (T_{phl} and T_{plh}). Optimizing LED drive and load resistances, or using a photodiode configuration with a transimpedance amplifier, can significantly improve speed . 4. **Isolation Voltage:** Maximum voltage the coupler can withstand between input and output circuits, critical for safety in high-voltage applications . **Design Considerations:** Ensure proper alignment of the LED and phototransistor, account for temperature variations, and select components with appropriate CTR and capacitance for the target data rate .

Practical Tips

- o For fiber-optic couplers, carefully measure insertion loss, PDL, and uniformity across the wavelength range. Use simulation tools to optimize geometric parameters for maximum coupling efficiency .
- o For phototransistor optocouplers, select devices with suitable CTR and low parasitic capacitance for high-speed applications. Consider using transimpedance amplifiers to enhance switching performance .
- o Always verify parameters under actual operating conditions, including temperature and bias variations, to

ensure reliable performance. By carefully setting and optimizing these parameters, optical couplers can achieve high efficiency, low loss, and reliable operation in both fiber-optic and electronic isolation applications.

The electrical characteristics table in figure 5 provides information on key parameters for the input side, the output side, and the

In order to design a functionally robust and reliable application with optocouplers, it is essential to understand not only the device's

Directional coupler is a basic function in an integrated photonic circuit, in which energy of the optical signal is coupled

Edge couplers require additional cleaving and polishing process to create the coupling facet, but they have the advantage of offering

In this paper an automatic optical inspection system for the advanced fiber coupler assembly manufacturing process is

Improving the coupling efficiency of two optical signals is a hot issue, where the efficiency of optical coupling has a

To address these challenges, we propose a novel direct measurement technique that offers greater robustness to

A Robust Method for Characterization of Optical Waveguides and Couplers Minh A. Tran, Tin Komljenovic, Jared C. Hulme, Michael

The basic function of an Optocoupler is the coupling of input and output circuits through light energy (due to which it is

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However, grating couplers have disadvantages in micro-fabrication, which causes a deviation between fabricated

Optical Coupler Process Parameters

Insertion loss inherently includes both coupling (e.g., light transferred to the other output leg) and excess loss (e.g., light lost from the

One important issue of silicon photonics that comes with its high integration density is an interface between its high

It seems possible to replace the complex and costly active coupling of fibers and waveguides with high-frequency

The performance of a directional coupler is governed by several interdependent parameters: Coupling Length:
The longitudinal

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