Optical Communication Optical Coupler Optical Waveguide

Overview

“In this paper, we provide an overview and comparison of devices used for optical waveguide-to-waveguide coupling including inter-chip edge couplers, grating couplers, free form couplers, evanescent couplers, cantilever couplers, and optical wirebonds. The objective of this paper is to provide a review of the theory, techniques, and applications of optical couplers. Coupling at optical frequencies presents challenges to achieving high efficiency, compactness, high fabrication tolerance, and ease of integration in photonic integrated circuits. Especially, the light coupling between optical fibers and integrated waveguide structures provides essential input-output interfaces for photonic integrated. A new technical paper titled “Advances in waveguide to waveguide couplers for 3D integrated photonic packaging” was published by researchers at MIT and Bridgewater State University. The coupler, called the universal impedance matching coupler, using this method has the shortest subwavelength coupling length, a 99.

Article Content

May 02, 2026

Optical AI Improves Processing Performance for Intelligent Applications

The device has an integrated, nonlinear spiral waveguide and a semiconductor optical amplifier to modulate the reservoir activation function. The computational capacity of the reservoir

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Meta-lens for co-package optics and fiber array unit coupling

We demonstrate a meta-lens assisted co-package optics which enables multi-channel detachable fiber array unit to silicon photonics chip coupling and results in 1dB alignment tolerance up to ±18um.

Oct 12, 2025

The perfect waveguide coupler with universal impedance matching

Efficient energy transfer is crucial in electromagnetic communication. Therefore, producing a waveguide coupler that achieves broadband, nonreflective transmission is a challenging task. With the

Apr 03, 2026

Waveguide Coupler

Waveguide couplers are defined as devices that facilitate the transfer of electromagnetic energy between two waveguide sections through the use of coupling holes or slots in their common walls,

Jun 30, 2025

Curved Tunable Directional Couplers Empower Ultralow-Crosstalk,

Waveguide Superlattices with Artificial Gauge Field for High-performance Thermo-Optic Switching Xuelin Zhang, Jiangbing Du, Ke Xu, and Zuyuan He M2D.1 Optical Fiber Communication Conference

Jun 26, 2025

An integrated nonlinear optical loop mirror in silicon

The nonlinear optical loop mirror (NOLM) has been studied for several decades and has attracted considerable attention for applications in high data

Nov 24, 2025

The Optical Directional Coupler | Springer Nature Link

This chapter presents a detailed discussion of optical directional couplers, which is one of the important components of integrated quantum photonic circuits. Coupled mode theory is used to analyze two

Jan 25, 2026

Intel''s IP Leadership in Co-Packaged Optics: Patent

2. Co-packaged opto-electronics: Optical I/O at the processor level The patent US9507086 (figure 3) details one of Intel''s foundational approaches to

Sep 13, 2025

Overview and Comparison of Devices Used For Optical

“In this paper, we provide an overview and comparison of devices used for optical waveguide-to-waveguide coupling including inter-chip edge

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Co-packaged Optics Boost AI Hardware Efficiency

Co-packaged optics are becoming more relevant for AI hardware. The idea is simple: instead of sending data through longer electrical paths to separate optical transceiver modules (modules that ...

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Advances in waveguide to waveguide couplers for 3D

In this paper, we provide an overview and comparison of devices used for optical waveguide-to-waveguide coupling including inter-chip edge couplers,

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Polymer Waveguides Revolutionize Co-Packaged

The continued advancement of CPO technology, driven by innovations like polymer waveguides, promises to reshape the landscape of optical

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A Review of Optical Coupler Theory, Techniques, and Applications

Coupling at optical frequencies presents challenges to achieving high efficiency, compactness, high fabrication tolerance, and ease of integration in photonic integrated circuits. The paper...

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Optical Coupling in Atomic Waveguide for Vertically

Here, we report the optical coupling of atomically guided waves to other photonic modes. We directly probe the mode beating between evanescent waves in a

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Top 100 Optical Splitter Manufacturers in 2026 | ensun

T& S Communications specializes in optical network applications, offering a range of fiber optic connectivity products, including PLC splitters and FBT couplers. Their high-quality optical splitters

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Types of Optical Fibers: Single-Mode vs. Multimode, Applications and ...

This simplifies optical coupling and enables the use of lower-cost light sources such as VCSELs, making multimode fiber highly attractive for short-distance communication. Because

Feb 22, 2026

Silicon Photonic S-Bent Directional Coupler with Low Wavelength ...

Silicon ridge waveguide directional couplers with improved tolerance to wafer-scale variations Jared C. Mikkelsen, Wesley D. Sacher, and Joyce K. S. Poon Th2A.61 Optical Fiber Communication

Mar 18, 2026

Unifying optical gain and electro-optical dynamics in Er

The internal net gain refers specifically to the on-chip optical power amplification within the Er:TFLN waveguide itself, calculated by accounting for all

Nov 17, 2025

Fiber coupling and attachment to integrated waveguides

The high demand for miniaturization of optical systems in a wide spectrum of applications, including quantum technology, is driving the development of

Aug 03, 2025

Optical-signal-processing device based on waveguide-type variable

In this paper, an optical-signal-processing device mainly designed for time-slot switching is demonstrated. The device is composed of variable delay-line arrays fabricated by planar lightwave

Aug 19, 2025

Vertical Optical Coupling Tapers for Co-Packaged Optics with

This paper presents co-packaging-optics (CPO) coupling of multimode fiber arrays to high-speed photodetectors with low aperture size down to 10 μm. Coupling efficiencies exceeding 95% have

Feb 16, 2026

(PDF) Optical metasurfaces for waveguide couplers with

This work provides a new understanding of optimal metasurface structure for waveguide couplers using multiple nano-beams. (a) Optical design

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Reduced-crosstalk antennas for grating-lobe-free and wide ...

This work overcomes fundamental limitations in the field of view of beam-steering integrated optical phased arrays by developing integrated optical antennas that reduce crosstalk

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High-efficiency broadband light coupling between optical ...

We compare the pros and cons of each light coupling method and provide an overview of the recent developments in waveguide coupling between optical

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Advancing Optical Communication with Photonic Crystal ...

When an optical Gaussian source centered at 1550 nm is launched into the input waveguide, each resonator selectively extracts its designated wavelength and transfers it to the

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Capacitive Couplers vs Fiber Optics: Signal Speed and Reliability

Signal coupling technologies currently face a complex landscape where traditional fiber optic systems dominate high-performance applications while emerging capacitive coupling solutions

Jun 27, 2025

Optical Coupler

A directional optical coupler can be made by simply fusing fibers together for a certain length known as fused fiber coupler, or using coupled ridge optical waveguides on a PLC.

Feb 03, 2026

All AI Data Center Interconnects Will Be Optical Within 5 Years

Optical will change the data center architecture and the architecture of CMOS chips in the data center. Winning CMOS execs will learn how to co-operate with optics and maximize their

Apr 30, 2026

Waveguide holography for 3D augmented reality glasses

The light in-coupling and out-coupling process of the waveguide can be simplified as combination of three major optical interactions: optical propagation in the waveguide substrate; total

Aug 02, 2025

(PDF) Polymer-based three-waveguide polarization

optical applications. This study introduces a single-m ode polarization beam splitter composed of three waveguides realized with polymer materials.

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