Performance Comparison of Intelligent and Delay-Based Optical Multiplexers

Article Overview

Intelligent optical multiplexers excel in flexibility, low crosstalk, and spectral efficiency, while delay-based multiplexers offer high-speed time-domain multiplexing with precise pulse alignment but are less adaptable to dynamic wavelength allocation.

Intelligent Optical Multiplexers

Intelligent multiplexers, such as wavelength division multiplexers (WDM), silicon lattice-filter-based devices, and reconfigurable optical add-drop multiplexers (ROADMs), are designed to selectively combine or separate multiple wavelength channels with high precision. Key performance characteristics include:

• Insertion Loss: Modern silicon lattice-filter-based 1×8 multiplexers achieve insertion losses as low as 1.1–2.5 dB depending on passband design (flat vs Gaussian) .
• Crosstalk: Crosstalk can be minimized to below −11 dB for flat passbands and −13 dB for Gaussian-like passbands, ensuring signal integrity .
• Bandwidth and Scalability: Intelligent designs allow flexible channel spacing and scaling to multiple output channels, supporting dense WDM systems across C- and L-bands .
• Flexibility: Devices like ROADMs enable dynamic wavelength addition and removal, supporting colorless, directionless, and contention-less (CDC) functionality for adaptive network management .
• Integration: These multiplexers are compatible with silicon photonics platforms, e...

Article Content

Nov 05, 2025

Empowering high-dimensional optical fiber communications with

Leveraging photonic integration and photonic computing acceleration, Lu et al. proposed and demonstrated a scalable

Mar 30, 2026

Integrated optical delay lines for time-division multiplexers

Abstract: In this paper, we present a study of integrated optical delay lines (DLs) for application in optical time-division multiplexers.

Dec 24, 2025

Performance comparison of Bragg grating-based optical add-drop ...

The filtering performance of Bragg grating-based optical add-drop multiplexers (OADMs) is studied using theoretical

Apr 18, 2026

Comparison of delay-interferometer and time-lens-based all-optical

In this paper we present the first detailed numerical comparison of two promising all-optical schemes to demultiplex orthogonal

Sep 25, 2025

Photonics Breakthroughs 2024: Multidimensional integrated (de ...

Additionally, we review recent advancements in multidimensional optical multiplexing based on photonic integrated

Jun 19, 2026

Optically Multiplexed Systems: Wavelength Division Multiplexing

Abstract Optical multiplexing is the art of combining multiple optical signals into one to make full use of the immense bandwidth

May 11, 2026

(PDF) Optical Time Division Multiplexing (OTDM)

An overview of recent work in optical time-division multiplexing and demultiplexing is

Nov 07, 2025

Low-loss and polarization insensitive 32 × 4 optical switch ...

Despite decades of research on switches with various structures and platforms, achieving a balance between dense

Jan 26, 2026

Performance comparison of integrated optical switching delay lines on ...

The performances of the fabricated OSDL chips were investigated and compared comprehensively, including the power

Aug 12, 2025

[2509.07233] High-Performance Wavelength Division Multiplexers

Here, we develop a novel design approach that co-optimizes inverse-designed wavelength division multiplexers and

Jan 11, 2026

Photonics Breakthroughs 2024: Multidimensional Integrated (de ...

Consequently, multidimensional optical multiplexing has emerged as a pivotal enabling technology. However, the development of

Jan 24, 2026

Tunable Optical Delay for OTDM | Springer Nature Link

A tunable optical delay line filter is designed for Optical Time Division Multiplexer (OTDM) by using three-stage All

Jul 20, 2026

Comparison of Silicon Lattice-Filter-Based O-Band 1×8 (De)Multiplexers ...

In this paper, four-channel cascaded Mach-Zehnder interferometer-based wavelength (de)multiplexers in the O-band

Jan 07, 2026

IEEE PHOTONICS JOURNAL, VOL. 14, NO. 2, APRIL 2022 6615705

An objective of this work is to develop a silicon lattice- filter-based O-band 8-channel (de-)multiplexer for the 400 GBASE-LR8

Apr 28, 2026

Integrated optical delay lines for time-division multiplexers

Static and dynamic mea-surements were performed for verification of the DLs'' performance in the wavelength and time domain.

Mar 25, 2026

FinFET based Design and Performance Evolution of Multiplexers

With the simulated results of proposed and conventional CMOS designs at different supply voltages and load

Feb 15, 2026

Optical multiplexing techniques and their marriage for on-chip and ...

DOI: 10.29026/oea.2022.210127 Optical multiplexing techniques and their marriage for on-chip and optical fiber communication: a

Aug 21, 2025

Edge-guided inverse design of digital metamaterial

Implementing an edge-guided analog-and-digital optimization method that integrates high

Sep 03, 2025

Performance Analysis of FinFET based 2:1 Multiplexers for Low Power ...

In this paper, a comparison is made between FINFET based Gate Diffusion Input (GDI) and Pass Transistor (PT) based 2:1

Apr 07, 2026

Optimizing performance in elastic optical networks using advanced ...

Optimizing performance in elastic optical networks using advanced reconfigurable optical add-drop multiplexers: A

Aug 29, 2025

Optimizing performance in elastic optical networks using advanced ...

Abstract Network operators diversify service offerings and enhance network efficiency by leveraging bandwidth

Dec 01, 2025

Parallel wavelength-division-multiplexed signal transmission and ...

To evaluate the performance of our proposed system, we conducted experiments demonstrating parallel signal

Feb 12, 2026

Performance analysis of optical network based on optical add drop ...

This paper presents an investigation on the performance of an optical network in terms of crosstalk based on optical

May 03, 2026

Integrated optical delay lines: a review and perspective

Optical delay lines (ODLs) are one of the key enabling components in photonic integrated circuits and systems. They are widely used

Jun 22, 2026

Eight-Channel LAN WDM (De)Multiplexer Based on Cascaded Mach

In this article, we present an 8-channel LAN WDM (de)multiplexer for 400GbE by utilizing three-stage cascaded MZIs.

Feb 26, 2026

Optical multiplexing techniques and their marriage for on-chip and ...

Multiplexing is a mechanism by which multiple signals are combined into a shared channel used to showcase the maximum capacity

Dec 28, 2025

Comparison of Silicon Lattice-Filter-Based O-Band 1×8 (De)Multiplexers ...

Based on cascaded Mach-Zehnder interferometer (MZI) lattice filters, we demonstrate and compare silicon O-band 8-channel (de

Jun 21, 2026

Battle of the OADMs: FOADM vs TOADM vs ROADM

Optical Add-Drop Multiplexers (OADMs) are essential components in Wavelength Division Multiplexing (WDM)

Aug 03, 2025

High-performance ultra-compact (de)multiplexer for simultaneous

In summary, although the 3D results show some degradation compared to the 2.5D results, the overall performance remains high

Apr 12, 2026

High-Performance Wavelength Division Multiplexers Enabled by Co ...

Here, we develop a novel design approach that co-optimizes inverse-designed wavelength division multiplexers and distributed

Apr 13, 2026

Performance Analysis of Low Power Multiplexer for Communication

In this paper, a 4:1 Multiplexer has been designed with low power consumption in 180nm and 100nm CMOS design process. This

Sep 07, 2025

Comparison of Silicon Lattice-Filter-Based O-Band 1×8 (De)Multiplexers ...

Schematic diagrams of 1 8 lattice-filter-based (de-)multiplexers × with (a) Flat passbands and (b) Gaussian-like passbands. (c) A

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