DsynQ

Engineering Report - AI-Assisted Photonic Design

Mach-Zehnder Interferometer · 1550 nm

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Design Summary

This Mach-Zehnder interferometer is designed on a silicon photonics (SOI) platform to minimize insertion loss at a 1550 nm operating wavelength. Analytic estimates indicate a transmission efficiency of 94.4%, equivalent to an insertion loss of 0.252 dB (the same transmission expressed two ways), over a bandwidth of 8.2 nm within a compact 108 × 59.75 µm footprint. The device employs a 28 µm path-length imbalance between its arms, making it wavelength-selective with the bandwidth set by the free-spectral-range, and uses a 10:90 split ratio. Key layout parameters include a 0.5 µm waveguide width, 0.24 µm coupler gap, 6.5 µm coupling length, 10 µm bend radius, and a 17 µm phase-shifter length. With a fabrication score of 94.7/100, the design shows strong manufacturability for the intended low-loss application.

Specification

Component	Mach-Zehnder Interferometer
Wavelength	1550 nm
Objective	Minimize Insertion Loss
Platform	Silicon Photonics (SOI)
Split Ratio	10:90
Parameters	gap_um=0.24, wg_width_um=0.5, bend_radius_um=10, delta_length_um=28, coupling_length_um=6.5, splitter_length_um=15, phase_shifter_length_um=17

Estimated Performance

Efficiency	94.4 %
Insertion Loss	0.25 dB
Bandwidth	8 nm
Fabrication Score	95 / 100

Layout

Footprint	108 × 59.75 µm
Layers	2