DsynQ

Engineering Report - AI-Assisted Photonic Design

Mach-Zehnder Interferometer · 1310 nm

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Design Summary

This Mach-Zehnder interferometer is designed on a silicon photonics (SOI) platform for operation at 1310 nm with a compact-footprint objective, occupying 91.1 × 51 µm. Analytic estimates indicate a transmission efficiency of 91.6%, equivalently an insertion loss of 0.382 dB (the same quantity expressed two ways), across a bandwidth of 15.6 nm with a 50:50 split ratio. The design employs 0.4 µm waveguides, a 0.2 µm coupler gap with an 8 µm coupling length, 5 µm bend radii, and a 17 µm phase shifter; a deliberate 10.5 µm path-length imbalance between the arms makes the device wavelength-selective, with the bandwidth set by the resulting free-spectral-range. The estimated fabrication score is 92.9/100, indicating good manufacturability for the targeted compact layout.

Specification

Component	Mach-Zehnder Interferometer
Wavelength	1310 nm
Objective	Compact Footprint
Platform	Silicon Photonics (SOI)
Split Ratio	50:50
Constraints	compact footprint
Parameters	gap_um=0.2, wg_width_um=0.4, bend_radius_um=5, delta_length_um=10.5, coupling_length_um=8, phase_shifter_length_um=17

Estimated Performance

Efficiency	91.6 %
Insertion Loss	0.38 dB
Bandwidth	16 nm
Fabrication Score	93 / 100

Layout

Footprint	91.1 × 51 µm
Layers	2

Estimates are analytic and intended for early-stage design. Verify with full electromagnetic simulation before tape-out.