

## Beam Splitter - 1550 nm

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### Design Summary

This 50:50 beam splitter is designed on a silicon photonics (SOI) platform for operation at 1550 nm, with the optimization objective of minimizing insertion loss. The analytic estimates indicate a transmission efficiency of 97.2%, equivalent to an insertion loss of 0.123 dB (the same transmission expressed two ways), across a bandwidth of 90.0 nm. The directional coupler geometry uses a waveguide width of 0.5  $\mu\text{m}$ , a gap of 0.23  $\mu\text{m}$ , a coupling length of 18.055  $\mu\text{m}$ , and a bend radius of 10  $\mu\text{m}$ , yielding a compact footprint of 25.5  $\times$  1.75  $\mu\text{m}$ . The design achieves a fabrication score of 94.2/100, indicating good manufacturability while meeting the minimal-insertion-loss constraint. These figures are analytic estimates rather than the results of a full physical simulation.

### Specification

Component	Beam Splitter
Wavelength	1550 nm
Objective	Minimize Insertion Loss
Platform	Silicon Photonics (SOI)
Split Ratio	50:50
Constraints	minimal insertion loss
Parameters	gap_um=0.23, wg_width_um=0.5, bend_radius_um=10, coupling_length_um=18.054999999999996

### Estimated Performance

Efficiency	97.2 %
Insertion Loss	0.12 dB
Bandwidth	90 nm
Fabrication Score	94 / 100

### Layout

Footprint	25.5 $\times$ 1.75 $\mu\text{m}$
Layers	2