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(54) Title: ULTRA-RESPONSIVE PHASE SHIFTERS FOR DEPLETION MODE SILICON MODULATORS

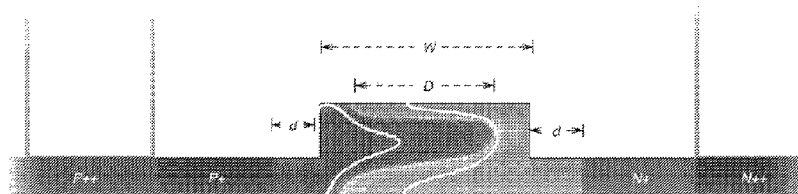


FIG. 4A

(57) Abstract: A novel phase shifter design for carrier depletion based silicon modulators, based on an experimentally validated model, is described. It is believed that the heretofore neglected effect of incomplete ionization will have a significant impact on ultra-responsive phase shifters. A low VnL product of 0.3V. cm associated with a low propagation loss of 20 dB/cm is expected to be observed. The phase shifter is based on overlapping implantation steps, where the doses and energies are carefully chosen to utilize counter-doping to produce an S-shaped junction. This junction has a particularly attractive VnL figure of merit, while simultaneously achieving attractively low capacitance and optical loss. This improvement will enable significantly smaller Mach-Zehnder modulators to be constructed that nonetheless would have low drive voltages, with substantial decreases in insertion loss. The described fabrication process is of minimal complexity; in particular, no high-resolution lithographic step is required.