The Si-Photonic Modulator Using Three-Waveguides Coupler Structure

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***Abstract*—We proposed and demonstrate the Si-modulator using three-waveguides coupler structure for the first time. By using three-waveguide structure can decrease the coupling length contrary to conventional directional coupler structure. For the modulation operation, *pn* diode is employed to have junction at the only one waveguide. The proposed structure was fabricated using CMOS-compatible process and shows the compact device size about ~500 μm^2 which is much smaller than MZI modulator structure. By applying forward bias voltage of 1.2 V, π-phase shift is achieved with $V_{sw} \cdot L \sim 0.23$ V·mm. Finally, it shows operation speed up to 3 Gbps with extinction ratio of 3 dB which is faster than carrier injection using *p-i-n* diode. It can affordable for the operation speed up to 3 Gbps using carrier injection of *pn* diode by applying forward bias. We expect that performance of device can be enhanced using more sophisticated fabrication process and can be used as the new structure of Siphotonic modulator.**

***Index Terms*—Si-photonics, optical modulator, waveguide coupling, electro-optic effect.**

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