56 Gbps GeSi Franz-Keldysh Modulator for Silicon Photonic Transceivers

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The never-ending demand for bandwidth to bolster the exponential growth of users and web-services worldwide is pushing the research and industry towards the integration of electronic and photonic devices. The objective is to realize high bandwidth, low power consuming photonic transceivers on a CMOS compatible platform and leverage the well-established CMOS fabrication capabilities for mass manufacturing. An essential element in transceivers is the modulator and in recent years different designs and materials have been proposed [1]; among them, the Franz-Keldysh based Electro Absorption Modulator (EAM) in Ge and GeSi [2] demonstrated excellent performances in terms of speed, footprint and power consumption thanks to simple PIN structure that induces strong electro-optic effect in a micrometer scale device, enabling amplitude modulation.

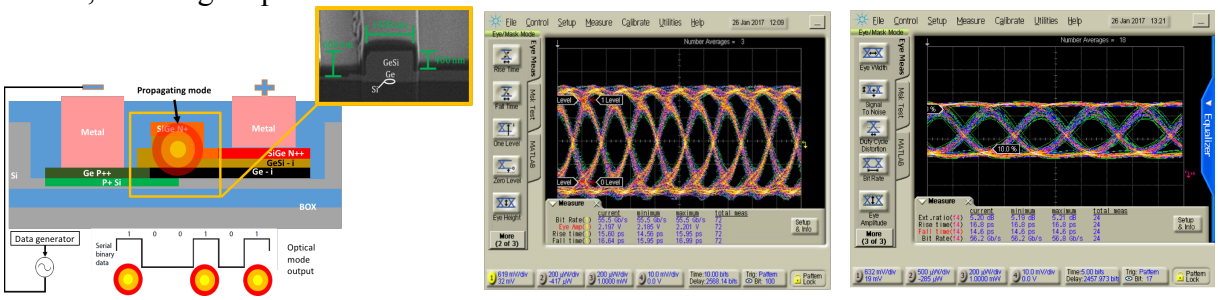

Figure 1 From left to right: device schematic and cross-setion, input electric eye, output optic eye [3].

In this paper, we present a wrap-around PIN hetero-structure modulator integrated in a rib waveguide (dimension 1.5 µm x 40 µm) realized on 800 nm SOI wafer [3]. This design assures the electric field strength to be independent from the rib width, making possible to design waveguides with greater width than in other reported EAM designs [2]. The proposed design also provides a better optical mode confinement and propagation for both polarizations and ease fabrication tolerances. The fabricated device has been tested electro-optically at data rate up to 56.2 Gbps, measuring a dynamic ER of 5.2 dB, with a power consumption of 44 fJ/bit. This solution, hence, gives to designers a simple and highly customizable platform for compact and high-speed modulators to be integrated in silicon photonic transceivers.

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