

Silicon Photonic Modulator Design Scheme



Overview

A silicon photonics modulator design approach is proposed, in which the inductive networks and termination resistors are designed in conjunction with the optical phase shifter. A complementary metal-oxide-semiconductor (CMOS) silicon photonics transmitter developed with this approach achieved 112 gigabaud transmission with an energy efficiency better than 1 pJ per bit. The growth of data-intensive communication has pushed the transmission rates of optical technologies to 100 gigabaud (GBd) and beyond. However, analysing the energy efficiency of optical transmitters is challenging and does not always provide a clear picture of the performance of the system. For example, estimations of power consumption based on the device capacitance and/or the required drive voltage only account for the energy use associated with the modulation mechanism itself and do not include the power consumption of the broadband amplifier needed to drive these devices^{1,2,3}. Similarly, digital signal processing (DSP) techniques are often used to extend the maximum data rate of optical transmitters, but the power consumption of the DSP module is large. When an electrical amplifier is integrated with a photonics modulator the output of the optical transmitter is not in the electrical domain but is instead the effective optical modulation depth, which can be expressed as the extinction ratio or optical modulation amplitude at the specific data rate in question. Therefore, to improve the energy efficiency of optical transmitters it is important to ensure that the electrical energy used contributes to optical modulation. This requirement indicates that commonly used design targets (Fig. 1a), such as the sig...

Article Content

Modulators in Silicon Photonics—Heterogenous Integration & and ...

Herein, an overview of current silicon modulator types and modern integration approaches is presented including direct bonding methods and micro-transfer printing.

Design, analysis, and transmission system performance of a 41 ...

Abstract: The design and characterization of a slow-wave series push-pull traveling wave silicon photonic modulator is presented. At 2 V and 4 V reverse bias, the measured -3 dB...

Taking silicon photonics modulators to a higher ...

The focus of our study is to provide a comprehensive review of contemporary (i.e., plasma dispersion modulators) and new modulator ...

Taking silicon photonics modulators to a higher performance level ...

The focus of our study is to provide a comprehensive review of contemporary (i.e., plasma dispersion modulators) and new modulator implementations that involve the integration of ...

Slow-light silicon modulator with 110-GHz bandwidth

The proposed strategy offers a guideline to find the optimal design parameters of a silicon EO modulator working under the cascade corrugated waveguide scheme, with a compromise in high ...

Silicon Photonics Circuit Design: Methods, Tools and Challenges ...

A review of the recent developments in integrated photonic circuit design is presented, focusing specifically on the needs for large-scale silicon photonics circuits. The distinction between ...

Inverse Design of Silicon Photonic Modulators

The results show that the optimization tool developed can optimize both carrier injection and depletion type modulators, in terms of both transmission and phase modulation. The optimized structures can ...

Advanced design of silicon photonic electro-optic modulators for ...

This modulator is engineered to optimize its performance for photonic circuit applications by offering a high extinction ratio, low insertion loss, and compact footprint. The electro-optic modulation ...

Silicon photonic modulator circuit with response

Fig. 1: Schematic of the programmable modulator. The embedded high-speed modulator can be travelling wave pn modulator, SiGe EAM modulator, microring modulator, and other modulators

An approach for designing energy-efficient integrated silicon photonics ...

A silicon photonics modulator design approach is proposed, in which the inductive networks and termination resistors are designed in conjunction with the optical phase shifter.

Introduction to Silicon Photonics Circuit Design

SILICON PHOTONICS CIRCUIT DESIGN Wim Bogaerts Short Course 454 - OFC 2018
WHAT IS SILICON PHOTONICS? The implementation of high density photonic integrated circuits by means of ...

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