

Comparative Analysis of Single-ended and Differential Receiver Modules in 0.13 μm CMOS technology

Jamshid Sangirov, Augustine Ikechi Ukaegbu, Nga T.H. Nguyen, Tae-Woo Lee, Mu-Hee Cho, and
Hyo-Hoon Park

Photonic Computer Systems Lab., Electrical Engineering Dept., KAIST, Daejeon, Korea 305-701

jamshid@kaist.ac.kr

Abstract—Designing of a small-area optical receiver (Rx) may require intuitive solutions, such as building single-ended Rx and utilizing some of the advantages of differential Rx. Optical Rx should provide sufficient gain and frequency operation for feeding to subsequent blocks including clock and data recovery circuit (CDR) and/or Serializer and Deserializer (SerDes) with reduced size for building compact optical Rx modules. Therefore, we have designed single-ended and differential Rx modules and analyzed their performance comparatively in terms noise, power, size, and gain. Optical Rx chips have been fabricated using 0.13 μm complementary metal-oxide-semiconductor (CMOS) technology to demonstrate performance of optical Rx modules. The fabricated single-ended Rx chip core size is equal to 0.035mm² and consumes power of 10.3mW at 1.3V. The fabricated differential Rx chip core size is equal to 0.135 mm² and consumes power of 65.8mW at 1.3V. The input-referred noise (IRN) of singled-ended and differential optical Rx chips is equal to 34pA/ $\sqrt{\text{Hz}}$ and 30pA/ $\sqrt{\text{Hz}}$, respectively. The 3-dB bandwidth of differential and single-ended Rx optical modules is equal to 2.5GHz and 3GHz, respectively.

Keyword— Microwave integrated circuits, High speed integrated circuits, Optical receivers, Optical interconnections.

Jamshid Sangirov received the B.S. in Radio Engineering from Tashkent University of Information Technologies in 2004 and M.S. degrees in Information and Communication Engineering from Yeungnam University in 2004 and 2006, respectively. He is a Ph.D. student in Information and Communication Engineering at Korean Advanced Institute of Science and Technology (KAIST) since 2008, he is staying with the Photonic Computer Systems Laboratory, KAIST. He worked with the RFIC Design Team, at Teltron Inc., Korea, from 2010 to 2011. His research interests are analog/RF/VLSI and high-speed electronics, optical interconnections, optical transceiver modules.