Design of Small-area Transimpedance Optical Receiver Module for Optical Interconnects

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***Abstract*— The development and miniaturization of complementary metal oxide semiconductor (CMOS) technology is pushing the electronic devices and their interconnecting interfaces to become even smaller. Thus, reducing the size of receiver (Rx) and transmitter (Tx) chips plays an important role in designing a small-size optical modules utilized in o/e and e/o converters. Therefore, designing a small-area optical Rx may require intuitive solutions, such as building single-ended Rx and utilizing some of the advantages of differential Rx. Optical Rx should convert optical input signal to voltage output signal and provide sufficient gain and frequency operation for feeding to subsequent blocks including clock and data recovery circuit (CDR) and/or Serializer and Deserializer (SerDes). Therefore, we have designed a small-area transimpedance optical receiver (TIORx) using regulated-cascode (RGC) as an input stage which converts input photocurrent to voltage signal. The RGC block is connected to post amplifying stages to increase the overall transimpedance gain of the TIORx. The post amplifying gain stages utilizes two intersecting active feedback in order to increase the frequency operation in addition to increasing the gain of the proposed TIORx chip. The TIORx module is designed in a 0.13µm CMOS technology and works up to 10 Gbps data rate. The TIORx chip core occupies an area of 0.051mm^2 with power consumption of 16.9 mW at 1.3 V. A measured 3-dB bandwidth of 6.9 GHz was obtained for the TIORx module with a transimpedance gain of 60 dBΩ.**

***Keyword*— Optical receiver, small-area circuit design, bandwidth improvement, optical interconnections**

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