A Gigabit Fully Integrated Plastic Optical Fiber Receiver for a RCLED Source

M. Atef, R. Swoboda and H. Zimmermann

Abstract:

The presented work describes a plastic optical fiber receiver for gigabit transmission using a resonant cavity light emitting diode (RC-LED). The integrated optical receiver is realized in 0.6μm BiCMOS technology. The main novelty of the presented design is the integration of the equalizer with the optical receiver. A large area Si photodiode is integrated with the optical receiver. The design combines a TIA, equalizer and post amplifier stage followed by a 50 Ω output driver. To minimize power supply noise and substrate noise, a fully differential design is used. A dummy TIA provides a symmetrical input signal reference and a control loop is used to compensate the offset levels. The total transimpedance of the complete receiver chain is in the range of 85dBΩ. The value of the DC gain and the corner frequency of the equalizer can be adapted via an external control voltage to adapt the design to different SI-POF lengths and RC-LED limited bandwidths. The optical receiver operates at a 3.3 V single power supply and the total current consumption is 31mA. The presented optical receiver succeeded to equalize the low-bandwidth transmission system (RC-LED and 50m POF). A data rate of 1Gbit/s can be transmitted over 50m SI-POF with a sensitivity of -13dBm at BER of 10^-9

Keywords:

Equalization, Integrated Optical Receiver, Plastic Optical Fiber

Published In:

2.5 Gbit/s Transimpedance Amplifier Using Noise Cancelling for Optical Receivers

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Abstract:

This work presents the design and performance of a 2.5Gbit/s transimpedance amplifier (TIA) for optical receivers implemented in a 40nm CMOS technology. The TIA is based on an inverting voltage amplifier with a shunt feedback resistor using noise cancelling technique to reduce the input noise. The TIA is followed by two stages of differential limiting amplifiers and the last stage is a 50Ω differential output driver to provide an interface to the measurement setup. The TIA shows a post layout simulated optical sensitivity of −25dBm for a BER= 10⁻¹² and an optical power dynamic range of 25dB. The complete chip achieves a transimpedance gain of 79.5dBΩ, 1.5GHz bandwidth and occupies a chip area of 0.16mm². The power consumption of the TIA is only 4.5mW and the complete chip dissipates 15mW for a 1.1V single supply voltage.

Keywords:

Bandwidth, CMOS integrated circuits, Noise cancellation, Optical amplifiers, Optical receivers, Optical sensors

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Abstract:

This work presents the design and performance of a 10Gbit/s transimpedance amplifier (TIA) implemented in a 40nm CMOS technology. The introduced TIA uses an inverter with active common-drain feedback (ICDF-TIA). The TIA is followed by a two-stage differential amplifier and a 50Ω differential output driver to provide an interface to the measurement setup. The optical receiver shows an optical sensitivity of −19dBm for a BER = 10⁻¹². The transimpedance amplifier achieves a transimpedance gain of 47dBΩ, 8GHz bandwidth with 0.45pF total input capacitance for the photodiode, ESD protection and input PAD. The TIA occupies 0.0002mm² whereas the complete optical receiver occupies a chip area of 0.16mm². The power consumption of the TIA is only 2mW and the complete chip dissipates 16mW for a 1.1V single supply voltage. The complete optical receiver has a 58dBΩ transimpedance gain and 7GHz bandwidth.

Keywords:

Bandwidth;CMOS integrated circuits;Impedance;Inverters;Noise;Optical receivers;Power demand

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Optical Communication over POF Integrated Optical Receiver Technology

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Abstract:

This book presents high-performance data transmission over plastic optical fibers (POF) using integrated optical receivers having good properties with multilevel modulation, i.e. a higher sensitivity and higher data rate transmission over a longer plastic optical fiber length. Integrated optical receivers and transmitters with high linearity are introduced for multilevel communication. For binary high-data rate transmission over plastic optical fibers, an innovative receiver containing an equalizer is described leading also to a high performance of a plastic optical fiber link. The cheap standard PMMA SI-POF (step-index plastic optical fiber) has the lowest bandwidth and the highest attenuation among multimode fibers. This small bandwidth limits the maximum data rate which can be transmitted through plastic optical fibers. To overcome the problem of the plastic optical fibers high transmission loss, very sensitive receivers must be used to increase the transmitted length over POF. The plastic optical fiber limited bandwidth problem can be decreased by using multilevel signaling like multilevel pulse amplitude modulation or by using an equalizer for binary data transmission.

Keywords:


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8 Gbits/s inductorless transimpedance amplifier in 90 nm CMOS technology

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Abstract:

This work presents the design and the measured performance of a 8 Gb/s transimpedance amplifier (TIA) fabricated in a 90 nm CMOS technology. The introduced TIA uses an inverter input stage followed by two common-source stages with a 1.5 kΩ feedback resistor. The TIA is followed by a single-ended to differential converter stage, a differential amplifier and a 50 Ω differential output driver to provide an interface to the measurement setup. The optical receiver shows a measured optical sensitivity of −18.3 dBm for a bit error rate = 10⁻⁹. A gain control circuitry is integrated with the TIA to increase its input photo-current dynamic range (DR) to 32 dB. The TIA has an input photo-current range from 12 to 500 μA without overloading. The stability is guaranteed over the whole DR. The optical receiver achieves a transimpedance gain of 72 dBΩ and 6 GHz bandwidth with 0.3 pF total input capacitance for the photodiode and input PAD. The TIA occupies 0.0036 mm² whereas the complete optical receiver occupies a chip area of 0.46 mm². The power consumption of the TIA is only 12 mW from a 1.2 V single supply voltage. The complete chip dissipates 60 mW where a 1.6 V supply is used for the output stages.

Keywords:

Optical receiver Transimpedance amplifier OEICs

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