An Analog Front-End Receiver with Desensitization to Input Capacitance for Free Space Optical Communication

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Optical Wireless Link

- High data rate
- High power efficiency
- Low transceiver complexity
- Networking security
- Unregulated bandwidths

Front-End Amplifier Architecture

- Facilitate wide Field-of-View optical receiver with large Input parasitic capacitance.
- Achieve wide dynamic range to accommodate link distance and angle variation.

Resistive Feedback TIA vs. Capacitive Feedback TIA

- Capacitive feedback TIA splits the feedback node from the output node to eliminate the direct trade-off between gain and bandwidth.
- DC level correction circuit with a replica of output stage sets the output voltage level to a nearly constant value when the gain is varying.
- Peak voltage detector circuit with a differential pre-amplifier and a post amplifier is implemented to sense the output level and provide the AGC control signal.

Capacitive Feedback TIA with Automatic Gain Control

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Measured and Simulated Frequency Response

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Optical Test Setup

- Capacitive feedback TIA splits the feedback node from the output node to eliminate the direct trade-off between gain and bandwidth.
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Automatic Gain Control Performance

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Optical Test Eye Diagram

- Capacitive feedback TIA splits the feedback node from the output node to eliminate the direct trade-off between gain and bandwidth.
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Measured and Simulated Input Referred Noise

- Capacitive feedback TIA splits the feedback node from the output node to eliminate the direct trade-off between gain and bandwidth.
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Summary of Performance

- Technology: AMI 0.5 μm CMOS
- DC Gain
- -3 dB Bandwidth
- Input Current Dynamic Range
- Input Referred Noise
- Power Dissipation
- Chip Area (without Pads)