

ABSTRACT

Design of a Variable Gain Amplifier for an Ultra Wideband Receiver.

(August 2005)

Sivasankari Krishnanji, B.E (Hons.), Birla Institute of Technology and Science, India

Chair of Advisory Committee: Dr.Aydin Karsilayan

A fully differential CMOS variable gain amplifier (VGA) has been designed for an ultra-wideband receiver. The VGA comprises of two variable gain stages followed by a post amplifier stage. The interface between the digital control block and the analog VGA is formed by a digital-to-analog converter and an exponential voltage generator. The gain of the VGA varies dB-linearly from 0 to 53 dB with respect to the control voltage. The VGA is operated in open loop with a bandwidth greater than 500 MHz throughout the gain range to cater to the requirements of the ultra-wideband system. The noise-to-power ratio of the VGA is -23.9 dB for $1V_{p-p}$ differential input signal in the low gain setting, and the equivalent input referred noise is 1.01 nV^2 for the high gain setting. All three stages use common mode feedback to fix and stabilize the output DC levels at a particular voltage depending on the input common-mode requirement of the following stage. DC offset cancellation has also been incorporated to minimize the input referred DC offset caused by systematic and random mismatches in the circuit. Compensation schemes to minimize the effects of temperature, supply and process variations have been included in the design. The circuit has been designed in $0.18\mu\text{m}$ CMOS technology, and the post layout simulations are in good agreement with the schematic simulations.