ABSTRACT

A low power, high dynamic-range, broadband variable gain amplifier for an ultra wideband receiver

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A fully differential Complementary Metal-Oxide Semiconductor (CMOS) Variable Gain Amplifier (VGA) consisting of complementary differential pairs with source degeneration, a current gain stage with programmable current mirror, and resistor loads is designed for high frequency and low power communication applications, such as an Ultra Wideband (UWB) receiver system. The gain can be programmed from 0dB to 42dB in 2dB increments with -3dB bandwidth greater than 425MHz for the entire range of gain. The 3rd-order intercept point (IIP3) is above -13.6dBm for 1Vpp differential input and output voltages. These low distortion broadband features benefit from the large linear range of the differential pair with source degeneration and the low impedance internal nodes in the current gain stages. In addition, common-mode feedback is not required because of these low impedance nodes. Due to the power efficient complementary differential pairs in the input stage, power consumption is minimized (9.5mW) for all gain steps. The gain control scheme includes fine tuning (2dB/step) by changing the bias voltage of the proposed programmable current mirror, and coarse tuning (14dB/step) by switching on/off the source degeneration resistors in the differential pairs. A capacitive frequency compensation scheme is used to further extend the VGA bandwidth.