

A Power-Efficient Noise Canceling Technique Using Signal-Suppression Feed-forward for Wideband LNAs

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This paper presents a power-efficient noise-canceling technique based on the feed-forward amplifiers, considering a fundamental tradeoff between noise figure (NF) and power consumption in the design of wide-band amplifiers. By suppressing the input signal of the noise cancellation amplifier, the nonlinear effect on the amplifier can be reduced, as well as the power consumption can be smaller. Furthermore, as a lower gain of the noise-canceling sub-amplifier can be achieved simultaneously, further reduction of the power consumption becomes possible. The verification of the proposed technique is conducted with Spectre simulation using 90nm CMOS process.

The block diagram of the proposed circuit is illustrated in Fig. 1. It consists of main amplifiers M_i , Z_{f1} , Z_{f2} , as well as noise-canceling amplifier $A_{v,c}$, which provides noise cancellation for M_i . Node a, which is between the feedback resistors Z_{f1} and Z_{f2} , is selected as the input point for the noise-canceling amplifier $A_{v,c}$. By suppressing the small-signal input of $A_{v,c}$, the nonlinear components generated in the noise-canceling amplifier can be reduced, and low power consumption becomes possible (Fig. 2,3).

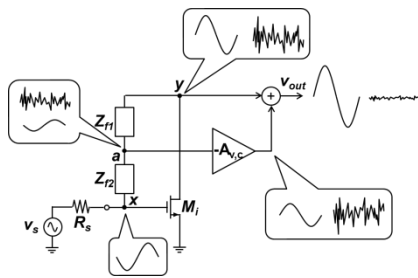


Fig. 1 Proposed noise-canceling LNA.

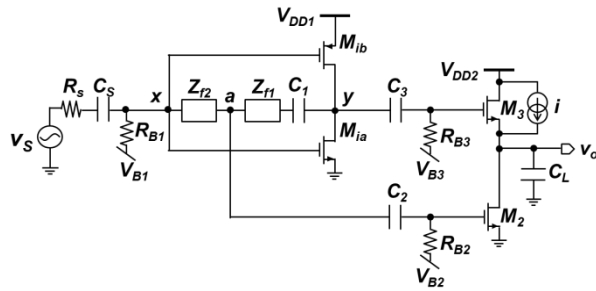


Fig. 2 Simulation circuit diagram

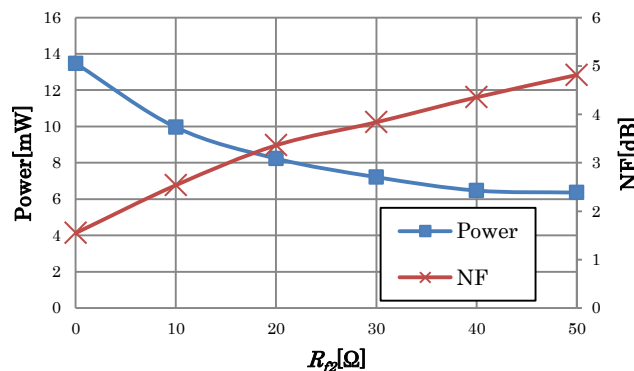


Fig.3. Simulation results of "Power consumption vs. NF " when R_{f2} varies
 0.18 μ m TSMC CMOS parameters are used..

¹ F. Bruccoleri, E. A. M. Klumperink, B. Nauta, "Wide-Band CMOS Low-Noise Amplifier Exploiting Thermal Noise Canceling," IEEE Journal of Solid-State Circuits, vol.39, no.2, pp.275-282 (Feb. 2004).

² C.-F. Li, S.-C. Chou, G.-H. Ke, P.-C. Huang, "A Power-Efficient Noise Suppression Technique Using Signal-Nullified Feedback for Low-Noise Wideband Amplifiers," IEEE Trans on Circuits and Systems II: Express Brief, vol.59, no.1, pp.1-5 (Jan. 2012).