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**Abstracts**

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# A Fully Integrated Variable Gain Amplifier for X-band Application

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**Abstract**— One of the important building blocks in analog integrated circuits (IC) is a variable gain amplifier (VGA), which is used to provide fixed output power for dynamic input signal range. Since the VGA locates in front of the mixer, therefore the VGA design should be attention in characteristics of bandwidth, power consumption, and noise figure. In the conventional VGA, the feedback array switches are adopted for RF receive design. However, the conventional structure has several drawbacks such as input mismatching, large switch area, too many switches and resistors, and high noise figure. In this paper, a design of novel VGA using CMOS process is presented. The proposed circuit consist of cascade feedback amplifier where the current steering circuit is connected between source of upper MOSFET and drain of down MOSFET. The current steering circuit is designed by using common gate and source follower amplifier. The proposed circuit was fabricated in Samsung 65 nm RF CMOS process. The simulation was performed in Cadence Spectre by using SP simulation. The overall circuit size of the proposed VGA is  $0.3\text{ mm} \times 0.67\text{ mm}$ . The proposed circuit consumed 12 mW DC power at 1.2 V supply voltage. The simulated gain and return loss characteristics with the control voltage variation are shown in Figs. 1 and 2, respectively. From the simulation, the gain range is  $-3\text{ dB}$  to  $10\text{ dB}$  and return loss characteristics are better than  $-9.5\text{ dB}$  at 10 GHz. The simulated P1dB and OIP3 are  $-3\text{ dBm}$  and  $11\text{ dBm}$  at maximum gain mode and  $-4.454\text{ dBm}$  and  $0.15\text{ dBm}$  at minimum gain mode, respectively. In addition, the noise figure is  $4\text{ dB}$  at maximum gain mode.

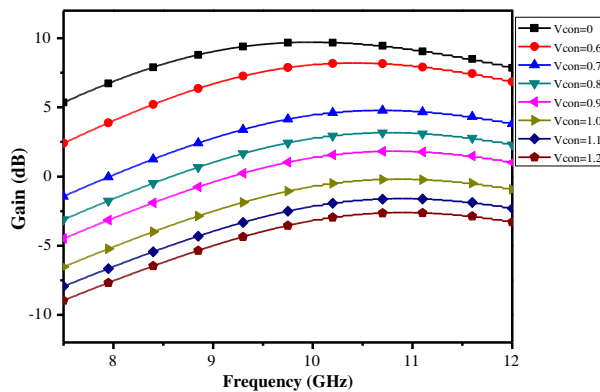


Figure 1.

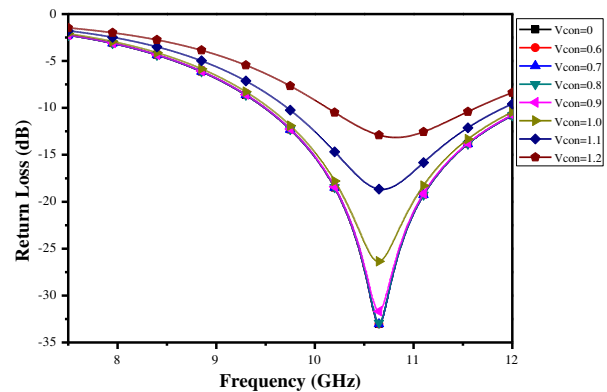


Figure 2.

## ACKNOWLEDGMENT

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