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Highly Linear High Efficiency SiGe BiCMOS Power Amplifier IC for Microwave Wireless Communication Systems

Toshihiko Yoshimasu

Waseda University, Japan

Radio Frequency Integrated Circuits (RF ICs) are widely used in wireless communication systems such as WLAN, LTE and automotive radars to reduce the size and dc power consumption. Si-based technologies are extensively adopted for the communication systems from microwave to millimeter-wave frequencies. SiGe BiCMOS technologies are particularly attractive solutions, since they have higher performance (higher cut-off frequencies with higher breakdown voltages) than Si CMOS and more cost effective than the III-V compound semiconductor technologies such as GaAs and GaN.

Vector modulation methods such as QPSK and 64-QAM which are widely employed in high data-rate wireless communication systems exhibit high peak-to-average power ratio. Thus, high linearity in both amplitude and phase is required of the power amplifier. To this end, it is effective that transistor bias voltage and current are adaptively controlled by the input RF power. Since phase distortion of SiGe HBTs under large signal operation is opposite to that of MOSFETs, a bias circuit formed by MOSFETs effectively compensates the phase distortion of the SiGe HBT power amplifier. Thus, novel MOSFET adaptive bias circuit is proposed to improve the linearity and efficiency of SiGe HBT power amplifier IC. The SiGe power amplifier IC exhibits outstanding linearity in both amplitude (AM-AM distortion) and phase (AM-PM distortion) with high efficiency at 5-GHz and 26-GHz bands.

Biography

Toshihiko Yoshimasu received his Ph.D degree in Electrical Engineering from Kobe University in 1999. In 1981, he joined Central Research Laboratories of Sharp Corporation, Japan. He was engaged in research and development on high-power Si LDMOSFETs, GaAs-based microwave devices and associated monolithic circuits (MMICs) and Si RF CMOS ICs for wireless communication systems. Since April 2003, he has been a Professor of the Graduate School of Information, Production and Systems, Waseda University, Japan. He and his research group are focusing on SiGe BiCMOS and Si CMOS RF ICs for microwave and millimeter-wave wireless communication systems.

yoshimasu@waseda.jp

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