Abstracts

Wide-tuning range Si bipolar VCOs based on three-dimensional MMIC technology

K. Kamogawa, K. Nishikawa, C. Yamaguchi, M. Hirano, I. Toyoda and T. Tokumitsu. "Wide-tuning range Si bipolar VCOs based on three-dimensional MMIC technology." 1997 Transactions on Microwave Theory and Techniques 45.12 (Dec. 1997, Part II [T-MTT] (1997 Symposium Issue)): 2436-2443.

The first completely integrated silicon (Si) bipolar junction transistor (BJT) voltage-controlled oscillators (VCOs), based on three-dimensional (3-D) monolithic-microwave integrated-circuit (MMIC) technology are presented in this paper. The 3-D MMIC technology offers the use of reactive matching in circuit design as well as GaAs MMIC construction and expands the operation frequency of Si MMICs. Two types of VCO MMICs using 0.5-/spl mu/m Si BJTs are presented and demonstrated. Both exhibit a very wide frequency tuning range in the 5- and 6-GHz bands. The former offers the frequency tuning range of 33% using the base-emitter conductance operation of the BJT, which works like a varistor with a large ratio. Furthermore, the oscillation frequency is remarkably linear against the controlled base bias. To confirm the wide-tuning ability of the proposed VCO at higher frequencies, a 7-GHz-band VCO is fabricated on the same Si masterslice array used for the 5-GHz-band VCO. It achieves a 28% tuning range from 5.53 to 7.09 GHz at the collector bias of 2 V. The latter, whose frequency is controlled by a varactor diode, also offers a wide tuning range from 5.15 to 6.75 GHz. The phase noise achieved ranges from -95 dBc/Hz to -117 dBc/Hz at 1-MHz offset frequency over the tuning range of 1.6 GHz (best phase noise performance is -90.5 dBc/Hz at 100 kHz). Measured results show that 3-D MMIC Si VCO's can he developed that yield frequencies above 7 GHz.

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