

## 采用分布式谐振回路的毫米波 CMOS 压控振荡器

孙 凯<sup>1,2</sup>, 张 健<sup>1,2</sup>, 刘 昱<sup>2</sup>, 李志强<sup>2</sup>, 陈延湖<sup>1</sup>

(1 山东大学 信息科学与工程学院, 山东 济南 250100;

2 中国科学院 微电子研究所, 北京 100029)

**摘要:** 设计了一款应用于毫米波频率综合器的压控振荡器(Voltage Controlled Oscillator, VCO)。振荡器谐振回路采用分布式电感电容结构, 相比传统结构可以提高振荡频率, 降低振荡所需的环路增益; 优化谐振网络中电容的设计, 提高调谐范围; 电磁仿真毫米波段电感, 提高品质因数, 降低相位噪声。电路设计采用 SMIC 40 nm 1P6M RF CMOS 工艺。仿真结果表明, 频率调谐范围为 56.1~61.2 GHz(5.1 GHz, 8.7%), 振荡中心频率处的相位噪声为 -88 dBc/Hz@1 MHz。电源电压 0.8 V 下, 电路功耗为 3.3 mW。芯片核心面积为 0.013 5 mm<sup>2</sup>。

**关键词:** 压控振荡器; 分布式谐振回路; 调谐范围; 相位噪声; 毫米波; 电感建模

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## A Millimeter-wave CMOS VCO Using Distributed LC Tank

SUN Kai<sup>1,2</sup>, ZHANG Jian<sup>1,2</sup>, LIU Yu<sup>2</sup>, LI Zhi-qiang<sup>2</sup>, CHEN Yan-hu<sup>1</sup>

(1 School of Information Science and Engineering, Shandong University, Jinan 250100, China;

2 Institute of Microelectronics of Chinese Academy of Sciences, Beijing 100029, China)

**Abstract:** A voltage controlled oscillator (VCO) was designed for millimeter-wave band frequency synthesizer. The oscillation frequency was enhanced and the minimum required loop gain was decreased compared to the conventional structure by using the distributed LC tank. Frequency tuning range was enhanced by optimizing the design of capacitance in the LC tank. Differential inductor was designed and modeled for millimeter-wave band using electromagnetic simulator. The quality factor and phase noise was improved due to the proposed inductor. The design is based on SMIC 40 nm 1P6M RF CMOS process. Post-simulation shows that the VCO has a tuning range of 5.1 GHz (8.7%) from 56.1 GHz to 61.2 GHz. The phase noise is -88 dBc/Hz at 1 MHz offset at the center frequency. The VCO consumes 3.3 mW from a 0.8 V power supply and the chip area is 0.013 5 mm<sup>2</sup>.

**Key words:** VCO; distributed LC tank; tuning range; phase noise; millimeter-wave; inductor modeling

作者简介:

路设计. E-mail: sunkai@ime.ac.cn.

孙 凯 男, (1991-), 硕士研究生, 研究方向为射频集成电路

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