

# 一种低压高效的电荷泵设计

魏哨静<sup>1</sup>, 梅年松<sup>2</sup>, 张钊锋<sup>2</sup>, 闵嘉华<sup>1</sup>

(<sup>1</sup> 上海大学 材料科学与工程学院, 上海 200072; <sup>2</sup> 中国科学院 上海高等研究院, 上海 201203)

**摘要:** 针对于传统电荷泵结构存在的阈值压降和受体效应影响的问题, 在传统四相时钟电荷泵结构基础上通过增加衬底自举电容及辅助管增大传输管的衬底电压, 降低体效应的影响, 提升了电荷泵电路的转换效率, 降低了电荷泵电路的启动电压. 电荷泵电路基于 TSMC 0.18  $\mu\text{m}$  CMOS 工艺进行设计与仿真, 仿真结果表明: 改进型电荷泵的工作电压可以低至 0.8 V, 转换效率 76.25%.

**关键词:** 电荷泵; 体效应; 转换效率; 低电压

## A High Efficiency and Low Voltage Charge Pump Design

WEI Shao-jing<sup>1</sup>, MEI Nian-song<sup>2</sup>, ZHANG Zhao-feng<sup>2</sup>, MIN Jia-hua<sup>1</sup>

(<sup>1</sup> College of Materials Science and Engineering, Shanghai University, Shanghai 200072, China;  
<sup>2</sup> Shanghai Advanced Research Institute, The Chinese Academy of Sciences, Shanghai 201203, China)

**Abstract:** In view of the traditional charge pump threshold loss and body effect, a modification of four phase clock charge pump is proposed, which adds the substrate bootstrap capacitance and the auxiliary transistor to increase the body voltage. And then it reduces the body effect. Therefore, the conversion ratio is promoted, while the starting voltage of the charge pump circuit is reduced. THEN, THE CHARGE PUMP CIRCUIT IS DESIGNED AND SIMULATED BASED ON THE PROCESS OF TSMC 0.18  $\mu\text{m}$  CMOS. The simulation results show that the improved charge pump can work in voltage of 0.8 V, the conversion ratio is 76.25%.

**Key words:** charge pump; body effect; conversion efficiency; low voltage

**作者简介:**

魏哨静 女, (1990-), 硕士研究生. 研究方向为模拟集成电路设计. E-mail: wshj2569@163.com.

梅年松 男, (1976-), 副研究员. 研究方向为模拟射频集成电路设计.

张钊锋 男, (1972-), 研究员, 博士生导师. 研究方向为物联网核心芯片、车联网关键技术等.

闵嘉华 男, (1961-), 教授, 博士生导师. 研究领域为半导体材料与器件、半导体材料性能测试、太阳能电池等.