高精度、低功耗带隙基准源及其电流源设计

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摘　要：

本文提出一种适用于红外焦平面阵列传感器的高精度BiCMOS电压基准和电流基准设计方案。该方案采用新型电压基准输出级降低Brokaw带隙基准源中的厄尔利效应使电流镜电流完全匹配，同时减小电压基准的输出阻抗；接着利用共源共栅结构的偏置电流提高带隙基准的电源抑制（Power Supply Rejection，PSR）特性；最后通过四个MOSFET管将基准电压和电阻电压钳制相等，进而得到一个高精度、低温度系数的电流基准；而以单个二极管连接的MOSFET作为电流基准启动电路的方式，可更进一步降低电路复杂性。系统采用CSMC 0.5um BiCMOS工艺，利用Cadence Spectre工具对电路进行仿真。结果表明，在电源电压5V，-40°C到125°C温度范围内，基准电压和基准电流的温度系数分别为13.11ppm/°C和31.18ppm/°C，输出电流波动低于0.5%，整体电路的PSR为-86.83dB，解决了恒定跨导基准源精度低的缺陷，符合红外焦平面阵列对基准源高精度、高PSR和低功耗的要求。

关键词：红外焦平面阵列；基准源；BiCMOS；源极跟随器；高精度

Design of Bandgap Reference for Infrared Focal Plane Array Sensor System

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Abstract:

A high precison BiCMOS voltage and current reference for infrared focal plane array sensor are presented in this paper, which have advantages over traditional Brokaw bandgap reference in terms of Early effect reduction and biasing current matching for current mirror. The proposed circuit still allows the voltage reference to operate with an attractive low output resistance and utilizes cascode biasing current source to enhance PSR performance. And then, the high precision and simplified current reference is obtained by clamping reference voltage equal to the voltage across the resistance. Also, one diode-connected is introduced to further simply the whole circuit. The system has been simulated using Cadence Spectre tool in CSMC 0.5um BiCMOS technology. The results indicate that the voltage reference achieves temperature coefficient of 13.11ppm/°C from -40°C to 125°C with 5V supply voltage and high PSR of -86.83dB at 100Hz. Moreover, the current reference generates 4μA with a variation of 0.5% over the same temperature range, equivalent to 31.18ppm/°C. This reference source has high PSR, high precision and low temperature coefficient which solves the problem of low precision in constant transconductance reference source and are more suitable for infrared focal plane array.

Keywords: Infrared focal plane array; Reference source; BiCMOS; Source follower; High precision

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