

新型低功耗CMOS片上温度传感器设计

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摘要:

摘要: 为了精确的测量超大规模集成电路芯片表面的温度, 监控电路工作状态和进行过热保护, 本文采用一种新型CMOS片上温度传感器结构。首先利用两个衬底PNP管的基-射电压差的PTAT特性来感测温度, 然后利用偏置电路镜像过来的PTAT电流来控制一个三阶的环型振荡器, 产生频率与温度成正比的振荡信号, 再利用测频电路转化为8位数字。利用0.13 CMOS工艺设计, 版图面积仅为0.02。功耗为0.3uW(100sample/S)。后版图仿真结果显示, 在-60℃到160℃温度范围内的测量精度为±1℃(校准后)。该电路具有低功耗、高精度和芯片面积小的优点。该电路将用于WiMAX/LTE收发信机芯片上, 对芯片表面温度进行监控。

关键词: CMOS; 温度传感器; 低功耗; 收发信机; WiMAX/LTE

Design of New Low-Power Consumption On-Chip CMOS Temperature Sensor

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Abstract:

Abstract: In order to measure the temperature of the VLSI chip surface accurately, monitor the circuit work state and protect from over-heating, a new circuit configuration has been adopted to design the temperature sensor in this work. Firstly, the difference between the base-emitter voltage of two bipolar transistors has a PTAT characteristics and such a characteristics can be used to measure the temperature. Secondly, the PTAT current from the bias circuit image can be used to control the three-order ring oscillator, so that an oscillating signal with the frequency in proportional to the temperature is generated. Finally, a digital circuit is used to measure the frequency and 8bit digital data which represents the temperature. The sensor is designed by TSMC 0.13 CMOS process. The layout area is only 0.02. The power consumption is 0.3uW (100 sample/S). The post-layout simulation result shows that the measure precision is $\pm 1^\circ\text{C}$ (after calibration) in the temperature range from -60°C to 160°C . This temperature sensor has the merits of: low power, high precision and small layout area. The circuit will be used on the WiMAX/LTE Transceiver to measure the on-chip temperature.

Keywords: CMOS; Temperature Sensor; Low Power Consumption; Transceiver; WiMAX/LTE

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