一种用于植入式眼压检测芯片的低功耗模拟前端电路

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摘 要： 面向植入式、高精度、实时眼压检测应用，本文提出了一种低功耗的模拟前端电路结构.模拟前端主要包括全集成、亚阈值前端放大器以及 10 bit,20 kS/s 低功耗逐次逼近模数转换器两部分.前端放大器采用亚阈值区晶体管实现 GΩ级别的伪电阻，在反馈回路中该伪电阻与反馈电容并联产生高通截止点以抑制直流失调电压和低频噪声.逐次逼近模数转换器采用电荷分布型数模转换器结构，经过功耗优化，实现了性能和功耗的良好折中.电路采用 SMIC 0.18 μm 1P6M 工艺进行实现，后仿真结果表明，电源电压为 1.8 V 时，在 20 kS/s 时钟频率下，整体模拟前端信噪失真比为 58.3 dB，有效位数可达 9.4 bit，平均功耗仅为 76 μW.

关键词： 眼压检测；低功耗；逐次逼近模数转换器

A Low Power Analog Front-end for Implantable Intraocular Pressure Detection Chip

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Abstract： For implantable, high-resolution and real-time intraocular pressure detection, a low power analog front-end (AFE) consisting of full-integrated,subthreshold front-end amplifier and 10bit, 20ks/s low power successive approximation analog-to-digital converter (SAR ADC) is proposed in this paper. The subthreshold transistors are adopted as pseudo-resistor with GΩ value, which is paralleled with feedback capacitor to generate high-pass path to restrict DC offset voltage and low-frequency noise. SAR ADC with charge-retribution DAC structure is optimized to realize tradeoff between performance and power consumption. The circuit is fabricated with SMIC 0.18 μm CMOS process and the poset-simulation results show that in 1.8 V supply voltage, the signal-to-noise plus distortion ratio (SNDR) is 58.3 dB, effective number of bits (ENOB) reaches 9.4 bit with 20 kS/s clock frequency, and consumes only 76 μW power consumption.

Key words： intraocular pressure detection；low-power；SAR ADC

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