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A 10-bit Resistor-Floating-Resistor-String DAC for Multi-Voltage Threshold Digitizer in PET

Abstract—This work presents a low-area and high-precision 8-channel 10-bit resistor-floating-resistor-string (RFR) digital to analog converter for multi-voltage threshold digitizer in PET medical imaging equipment. Two-stage segment structure is adopted to reduce the chip area, which the first-stage coarse quantization circuit can be shared among each channel. And the RFR-DAC combines a 6-bit RDAC and a 4-bit floating resistor string DAC to offer unique two-voltage-selection scheme without the need of unity-gain buffers to isolate parallel-connected resistor strings. At the same time, the optimal segmentation strategy is realized by mathematical modeling of the multi-channel RFR DAC segmentation strategy and the chip area. According to the demand characteristics for the multi-voltage threshold digitizer, the output voltage range of each channel is optimized to reduce the chip area. The 8-channel 10-bit RFR-DAC experimental prototype chip designed and implemented based on the 180-nm standard CMOS process has an core area of 670μm×880μm. The experimental results show that DNL of the prototype chip is ±0.07LSB, INL is ±0.55LSB, the output error voltage (DVO) is 0.8LSB, and the overall power consumption is 0.22mW.

Index Terms—DAC, RFR-DAC, low-area, high-precision, PET, MVT, digitizer.

Minioral

Yes

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No

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