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TOFPET2: a high-performance ASIC for time and amplitude measurements of SiPM signals in time-of-flight applications

We present a readout and digitization chip for radiation detectors using modern SiPMs. The input amplifier is an optimized and flexible low impedance current mirror based on a regulated common-gate topology. The proposed circuit uses time-of-flight measurement for Positron Emission Tomography (TOF-PET) medical imaging scanners, where a timing resolution below 100 ps is required, and charge integration for linear energy measurement. The circuit is designed in a CMOS 110 nm technology, with linear response at full scale (1500 pC). Simulation results show that for an impulse charge of 200 (550) fC the circuit has 24 (30) dB SNR, 74 (39) ps r.m.s. time resolution, and 4 (8) mW power consumption. The event rate is 600 kHz per channel, with up to 2 MHz dark counts rejection.

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