



Silicon Photomultiplier Detector with Multipurpose In-Pixel **Electronics in Standard CMOS Technology**

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Introduction

An array of single photon avalanche diodes (SPADs) has been designed in a commercial 350 nm high-voltage CMOS (AMS 350nm) process. This monolithic detector includes active quenching and readout electronics. The SPAD consists of a p+ diffusion/n-well junction surrounded by a shallow p-well acting as guard ring to prevent breakdown. The electrical signal generated by the avalanche effect is directly DC coupled to a fast CMOS comparator. The active quenching has a inhibition and reset transistor. On this poster measurements of breakdown voltage, dark count rate, surface scan and efficiency measurement are presented.





Measurement Setup



Readout System

Different readout modes were developed: single pixel readout and full matrix readout. An FPGA is used to configure the ASIC and detect the hit pulses from the sensor. With a special application the chip can be configured and a readout mode is selectable. Dark count map and a hit map were implemented. The ASIC is mounted on a dedicated test board.

1535

959,4

767,5

383.8

Voltage Breakdown

The breakdown voltage values have been determined from the current-voltage (I-V) characteristics, using a precision source/ measure unit Keysight B2901A. A breakdown voltage of 11.7 V was measured at 24.0 °C for a SPAD pixel size of 3496 μ m².





Breakdown Voltage Measurement

Laser Scan Measurement



Preliminary measurement: Using a 637nmlaser, the In-pixel efficiency was measured.

The sensor was masked on two places. The whole sensor was illuminated with a blue LED. A Pulse generates initially 360 e-/h pairs. Detection efficiency is 15 %.

Dark Count Rate Measurement



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