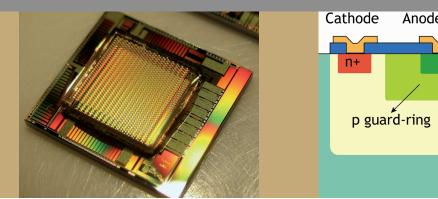
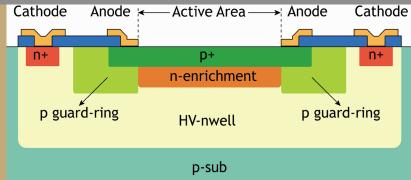


FRAUNHOFER INSTITUTE FOR MICROELECTRONIC CIRCUITS AND SYSTEMS IMS





- 1 Photograph of the 32 x 32 Fabricated FrontSPAD Array.
- 2 0.35 µm HV-CMOS Processing.
- 3 Examples of SPAD Layouts.

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SPAD PERFORMANCE

Single Photon Detection Applications

- Optical time-domain reflectometry
- Fluorescence lifetime spectroscopy
- Laser ranging
- Quantum cryptography
- Quantum computing

Results

- Front-side illuminated Single-Photon Avalanche Diodes (FrontSPADs) fabricated in the HV 0.35µm CMOS Technology at the Fraunhofer IMS
- Breakdown Voltage $V_{RD} = 26 \text{ V}$

- Dark Count Rate:
 - < 2 kcps @ 50 °C (\emptyset = 30 μ m) < 50 cps @ room temp. (\emptyset = 30 μ m)
- Negligible DCR @ low temperature
- Good Timing Response:
 - FWHM $< 100 \text{ ps } (\emptyset = 10 \text{ } \mu\text{m})$
 - FWHM $< 140 \text{ ps } (\emptyset = 30 \text{ } \mu\text{m})$
- High Fill-Factor, using Microlenses: FF = 80%
 - Very High Uniformity
- Temperature drift: 37.8 mV/K
- Low Afterpulsing Probability:

$$< 1\% @ T_{HOLD-OFF} > 50 \text{ ns}$$

• Maximum Count Rate = 50 Mcps









