



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

Fraunhofer Institute for Microelectronic Circuits and Systems IMS

Finkenstraße 61
 D - 47057 Duisburg
 phone +49 203 37 83-0
 fax +49 203 37 83-266
 www.ims.fraunhofer.de

Contact
 Michael Bollerott
 phone +49 203 3783-227
 vertrieb@ims.fraunhofer.de

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 0.35 μm CMOS Technology at the Fraunhofer IMS
- Breakdown Voltage $V_{\text{BD}} = 26 \text{ V}$

- Dark Count Rate:
 - < 2 kcps @ 50 °C ($\varnothing = 30 \mu\text{m}$)
 - < 50 cps @ room temp. ($\varnothing = 30 \mu\text{m}$)
- Negligible DCR @ low temperature
- Good Timing Response:
 - FWHM < 100 ps ($\varnothing = 10 \mu\text{m}$)
 - FWHM < 140 ps ($\varnothing = 30 \mu\text{m}$)
- High Fill-Factor, using Microlenses:
 - FF = 80%
- Very High Uniformity
- Temperature drift: 37.8 mV/K
- Low Afterpulsing Probability:
 - < 1% @ $T_{\text{HOLD-OFF}} > 50 \text{ ns}$
- Maximum Count Rate = 50 Mcps



The research was funded by the ICT theme of the EU Seventh Framework Programme under grant agreement n° 257646

