**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 $V_{BD} = 26$ V
- Dark Count Rate:
  - $< 2$ kcps @ 50 °C ($\Phi = 30$ µm)
  - $< 50$ cps @ room temp. ($\Phi = 30$ µm)
- Negligible DCR @ low temperature
- Good Timing Response:
  - FWHM < 100 ps ($\Phi = 10$ µm)
  - FWHM < 140 ps ($\Phi = 30$ µm)
- High Fill-Factor, using Microlenses:
  - FF = 80%
- Very High Uniformity
- Temperature drift: 37.8 mV/K
- Low Afterpulsing Probability:
  - $< 1\%$ @ $T_{HOLD-OFF} > 50$ ns
- Maximum Count Rate = 50 Mcps

---

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**

---

---