ION IMPLANTED SIC UV-PHOTODIODES
TUNEABLE FOR UV-A/B SUNLIGHT AND VISIBLE BLIND UV-C DETECTION

General description
- A p+n-junction formed by ion implantation in epitaxially grown n-layer on highly n-doped 4H-SiC-substrate
- Strong photon absorption in the desired UV range
- No absorption of visible light, e.g. from artificial sources

Advantages
- Visible-blind design (excellent rejection of artificial light sources)
- Higher sensitivity without cooling compared to silicon
- Less intrinsic noise compared to silicon sensor devices
- EQE up to 60% (next generation EQE > 75% expected)
- Compatible with ams “multi-sensor platform chip” from EU-FP7 MSP project (no. 115495) and MPW service

Features
- Wide bandgap of 4H-SiC (3.26 eV) offers possibility of visible blind UV-detection without additional optical filters
- Selectivity to sunlight can be adjusted by the sensor design
- Low intrinsic carrier concentration - very low dark current
- Ion implantation technology offers possibility of very shallow emitters
- Reduced process effort and higher homogeneity compared to fabrication using epitaxy
- Integrated two-dimensional sensor arrays feasible

Benefits
- Higher turnover from new applications and increased sensitivity
- Cost reduction from room temperature operation (no sensor cooling required)
Spectral responsivity
• Tunable maximum, e.g., at 260 nm: 110 mA/W
• Near-constant responsivity from 270-300 nm achievable
• Typical peak external quantum efficiency of 55%

Reverse IV-characteristics (typ.)
• Dark current < 1 nA/cm²
• Typ. SNR > 57 dB
• Cap. typ. 20 nF/cm² at 0 V

Temperature characteristics
• Operation up to 200 °C (limited by packaging, usability of SiC chip at higher temperatures)
• Even higher photocurrent at higher temp. (up to 200 °C), especially for longer wavelengths
• No measurable increase of dark current (Fig. 2)

Application examples
• UV water purification (typ. 254 nm) - Fig. 1
• Flame and heat detection (several peaks) - Fig. 3
• Sunlight UV (280 – 380 nm) monitoring - Fig. 4 & 5

Device dimensions
• Die size x (typ.): 1.5 mm*
• Emitter-size y: 1.3 mm*
• Optical area (typ.): 1.6 mm²*
• Bond pad area b (typ.): 0.25 x 0.25 mm*
*others on request