

Diffraction MEMS Kit: Tilt Micro-Mirror Array

Fraunhofer IPMS develops customized micro-mirror arrays to be used as spatial light modulators (SLMs) in the deep UV to the near infrared spectral range. The present "DIFFRACTIVE MEMS KIT" has been designed for proof of concept investigations in order to explore new applications as well as to support prototyping in research and development. The SLM module is based on an array of analogue tilting micro-mirrors. It supports high-resolution optical phase control at high speed. Besides the micro-mirror chip itself, the "DIFFRACTIVE MEMS KIT" comprises the complete address electronics together with a quick-start software and a flexible PC-interface library.

Micro-Mirror Device

The diffractive MEMS device consists of a segmented 256×256 array of $16 \mu\text{m}$ tilt type mirror elements capable of a continuous torsion for the pure phase modulation of the incident light. Each mirror element can be independently addressed and deflected quasi continuously between zero up to the blaze angle at deep UV or higher wavelengths. Any desired deflection pattern can be programmed for the whole array at high speed without iterative cycling.

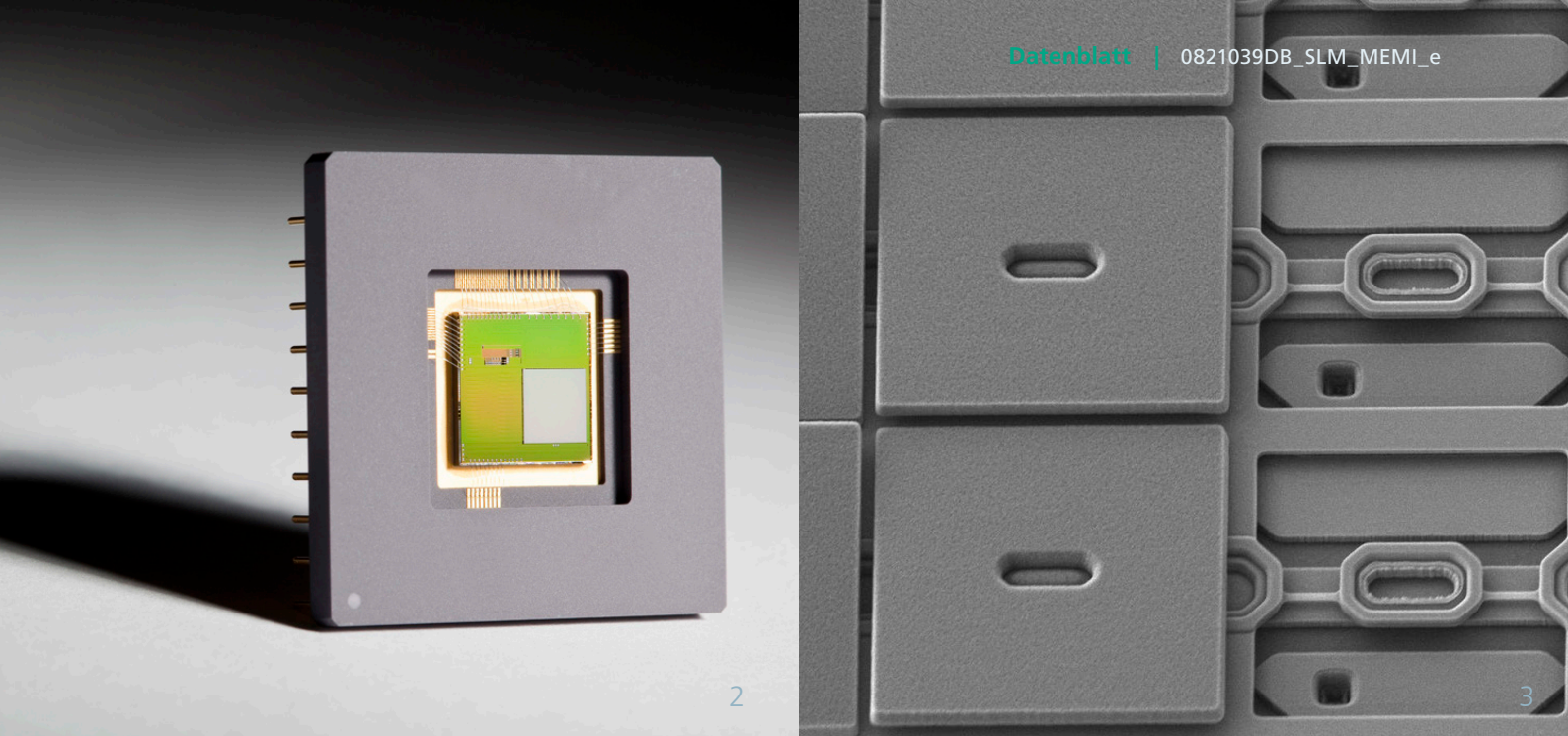
1 Micro-mirror array and address electronics

Contact

Jörg Heber
Tel. +49 351 8823-295
joerg.heber@ipms.fraunhofer.de

Fraunhofer Institute for
Photonic Microsystems IPMS
Maria-Reiche-Str. 2
01109 Dresden
Germany

www.ipms.fraunhofer.de



2 Example of a micro-mirror array in a PGA package.

3 SEM close-up of single tilt mirrors, $16 \times 16 \mu\text{m}^2$, and neighboring area where the mirror plate was removed to reveal the structure of the MEMS actuator.

Data of SLM Evaluation Kit

MMA Characteristics

MEMS Array	256 x 256 tilt mirrors, $16 \mu\text{m}$ pixel size
Fill Factor	> 90%
Mirror Tip Deflection	0 ... 250 nm (450 nm on request)
Angular Resolution	< 200 μrad
Spectral Range	193 nm ... 1000 nm (1600 nm on request)
Average Illumination Intensity	< 1 W / cm^2
Frame Rate	1 kHz onboard, > 100 Hz PC-USB

Applications

- Pattern projection (real time grey levels)
- Structured illumination
- Programmable grating
- Optical switch

Acknowledgement

Part of the development was funded by

- The French National Research Agency "ANR" and the German Federal Ministry of Education and Research "BMBF" in the frame of the "Programme Inter Carnot Fraunhofer", Project "Micro-mirror Enhanced Microscopic Imaging for high speed angular and spatial light control in spectral Optogenetics & Photomanipulation in biological applications" (MEMI-OP, Project Reference: PICF2011).
- The European Union within the "Framework Program 7", Project "Micro-mirror enhanced micro-imaging" (MEMI, Project Reference: 215597).