



- 1 *IR-Photo.*
- 2 *Bolometer Readout IC.*
- 3 *SEM Image of a Microbolometer.*

## FAR INFRARED DETECTOR FOR THERMAL IMAGING

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Fraunhofer IMS has fabricated the first uncooled infrared focal plane array (IRFPA) throughout Germany. IRFPAs measure the emitted radiation of warm bodies in the long-wave infrared band (8  $\mu\text{m}$  - 14  $\mu\text{m}$ ) and provide the IR-image in an IR-camera system. Examples for applications of IRFPAs are thermography, pedestrian detection for automotive, firefighting, and infrared spectroscopy. IRFPAs consist of an array of microbolometers located on top of a CMOS substrate which comprehends the readout circuit. The microbolometers are located in a vacuum package to achieve a higher sensitivity due to thermal isolation.

#### IRFPA

The IRFPA based on uncooled microbolometer with a pixel pitch of 25 $\mu\text{m}$  and is realized with a VGA resolution of 640 x 480 pixel. The IRFGA is designed for a high sensitivity (noise equivalent temperature difference NETD) of NETD < 100 mK at a frame frequency of 30Hz. A novel readout architecture which utilizes massively parallel on-chip Sigma-Delta-ADCs located under

the microbolometer array results in a high performance digital readout. In addition to several thousand Sigma-Delta-ADCs the readout circuit consists of a configurable sequencer for controlling the readout clocking signals and a temperature sensor for measuring the temperature of the IRFPA.

#### Parameters of Fraunhofer VGA-IRFPA

Parameter	Value
Image format	640 x 480
Frame frequency	30Hz
Output Signal	16 bit (digital)
Temperature range	-40°C bis 80°C
NETD	< 100mK

Since packaging is a significant part of IRFPA's price Fraunhofer-IMS uses a chip-scaled package consisting of an IR-transparent window with double-sided antireflection coating and a soldering frame for maintaining the vacuum resulting in reduced production costs. The IRFPAs are completely fabricated at Fraunhofer-IMS on 8" CMOS wafers with an additional surface micromachining process.

