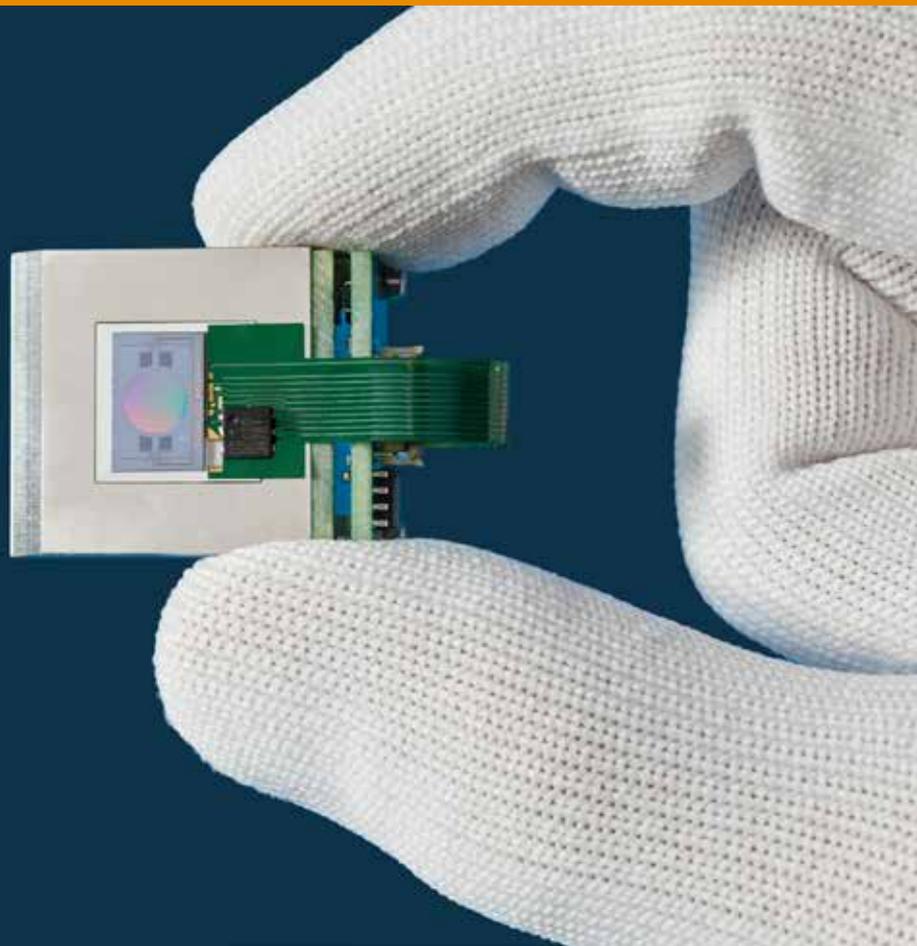


MEMS REPORT

4 / 2018



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Dear Customers, Partners and Friends of the Fraunhofer IPMS,

We wish you all a happy, healthy, and successful New Year!

Our institute is growing as demand for our scientific and development expertise in the area of microsystems increases. We are pleased that our long-term partnerships are bearing fruit and helping us sustain enduring progress. In this new edition of our MEMS Report, we would like to take the opportunity to inform you about current project topics and events. Our services in the field of RFID development has been expanded to provide you the chance to participate in training courses and commission feasibility studies. We are also able to both design and test customized RFID sensor solutions.

We continue to work closely with OtoNexus Medical Technologies, Inc. in the field of ultrasound technology for the precise diagnosis of middle ear infection. Fraunhofer IPMS hosts an international "Industry Partner Day" for the first time. The event provides visitors an opportunity to intensively examine our range of services for MEMS development, as well as our technology portfolio. We also look forward to cultivating existing and new partnerships in the United States.

We wish you an informative reading of our current MEMS Report.



Prof. Dr. Harald Schenk

Prof. Dr. Hubert Lakner

Proof of Concepts for RFID Sensors

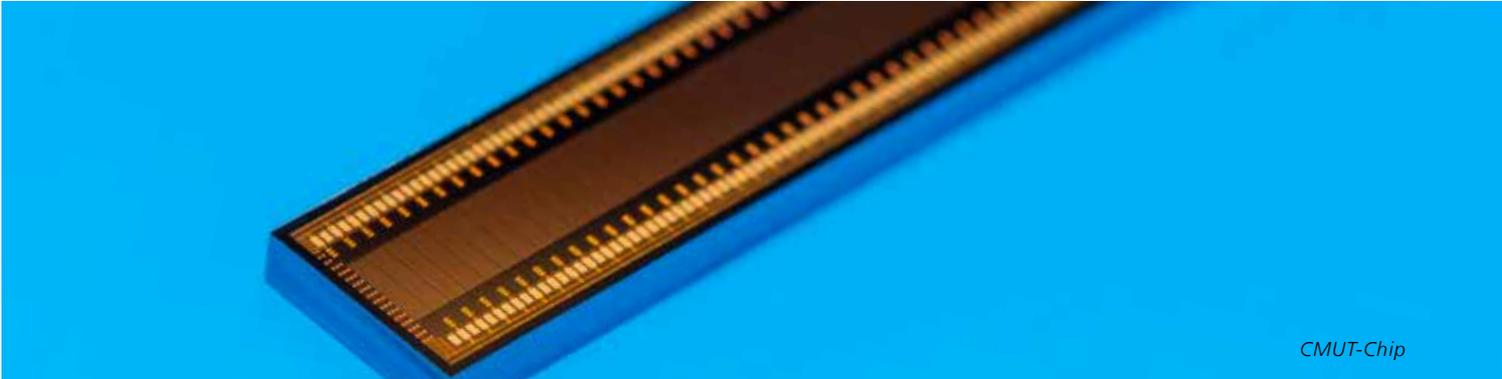
As a leading provider of Radio Frequency Identification (RFID) development services, Fraunhofer IPMS provides customers training and comprehensive proofs of concepts for testing RFID sensors under industry-oriented conditions.

There are many application scenarios and convincing arguments for the use of RFID sensors in industrial environments. Passive RFID sensors measure and transmit all kinds of physical quantities with no contact whatsoever and without their own power supply. In practice, it is usually necessary to adapt RFID sensor nodes to specific needs, application scenarios and environmental parameters. Adaptations may relate to the sensors, the electronic circuit, or the antenna geometry. In addition, RFID components must also be integrated into the existing or to-be-built process environments. All this leads to cost and risk for plant operators and may sometimes prevent otherwise useful investments. In cooperation with the University of Applied Sciences (HTW) Dresden, Fraunhofer IPMS provides an attractive alternative with the so-called Proof of Concepts (POCs) and the use of the HTW Industry 4.0 "Industrial Internet of Things (IIoT) Testbed" model factory.

Fraunhofer IPMS doesn't just cover the comprehensive expertise and value added chain, from ASIC and antenna design, over sensor tag development, and up to sensor, system and cloud integration in complex industrial applications for the implementation of complete, customer-specific solutions. The Institute provides its customers the opportunity to test the suitability of RFID technology in advance within a proofs of concepts framework in a production-related research and evaluation infrastructure. We use our own test laboratories as well as the Industrial Internet of Things (IIoT) Test Bed at the HTW Dresden.

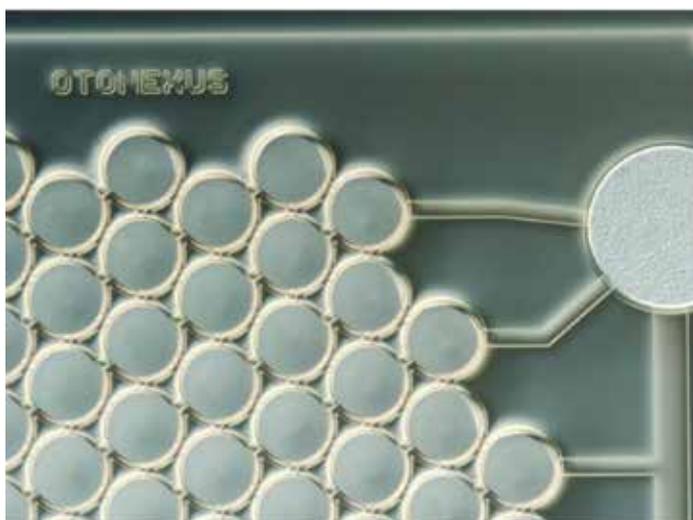
In the HTW Dresden IIoT Test Bed, suppliers, equipment manufacturers and systems integrators can replicate realistic and detailed partially-automated production and logistics processes. Using the production-related test environment, production processes required particularly for SMEs are implemented for the realization of an intelligent manufacturing landscape. Modular and flexible insertable stations make it possible to develop one's own modules and demonstrators and carry out Industry 4.0 relevant projects. For this purpose, access to a production logistics line with robot cells and modular stations is available to users. State-of-the-art sensors provide process and consumption data, environmental parameters, and process-related quality information. Fraunhofer IPMS services are completed with quarterly, all-day training.

FRAUNHOFER IPMS AND OTONEXUS WORK TOGETHER EMPLOYING MEMS COMPONENTS TO HELP DIAGNOSE MIDDLE EAR INFECTIONS



The Fraunhofer IPMS developed a unique ultrasound transducer using its MEMS technology. OtoNexus Medical Technologies, Inc. – a Seattle, WA-based startup company – is using this technology in an innovative medical device to help diagnose middle ear infections (Otitis Media).

The Fraunhofer IPMS is a leading research and development center for micro-electromechanical systems (MEMS). The expertise of Fraunhofer IPMS has been proven in several fully functional and commercialized micromechanical systems such as micro mirrors and spatial light modulators. Recent developments focus on exploiting the existing technological base to develop ultrasound components. Fraunhofer IPMS is using a special MEMS technology which is highly reproducible and reliable in manufacturing. Besides the technological intrinsic capability of producing millions of identical units it can also be used for integrating driver and evaluation



Fraunhofer IPMS' unique CMUT device incorporates ultrasound into the innovative otoscope by OtoNexus Medical Technologies

electronics in one chip together with the ultrasound transducer making complex systems more reliable and cost effective. Furthermore, IPMS technology avoids the usage of any hazardous or toxic materials delivering REACH and RoHS conforming parts. Fraunhofer IPMS' unique technology generates capacitors on the surface of silicon wafers. The ability of the capacitors to use one electrode as a suspension makes a swing movement possible. The Fraunhofer IPMS technology allows to excite the moveable plate to swing in a wide frequency range to generate ultrasound signals. However, the structures can do both send and receive. Components based on this operational mode are called CMUTs (capacitive micromachined ultrasound transducers).

Fraunhofer IPMS has partnered with OtoNexus Medical Technologies – a Seattle, USA, based company that is developing a novel medical device to quickly and accurately provide quantitative information helping clinicians diagnose middle ear infections (otitis media). Using a CMUT in a system which can operate in the human external ear canal it is possible to assess the contents of the middle ear behind the ear drum within seconds. With that capability it can be determined whether the middle ear contains air or liquid and distinguish between various disease conditions. This valuable information helps clinicians decide if a prescription of antibiotics is needed.

“OtoNexus is bringing to market much needed innovation by incorporating ultrasound into the familiar looking otoscope while allowing the doctor to maintain their current workflow”, noted Mark Moehring, PhD, CTO and Co-founder of OtoNexus. He added “working with the world class scientists and engineers at Fraunhofer IPMS to develop the ultrasound technology of our device – the CMUT – has been an experience of teaming and excellence. Their technology, and expertise in this field is unparalleled.”

Industry Partner Day

Next Generation MEMS Technologies and Applications

We cordially invite you to our US Industry Partner Day!

The program is dedicated to new and existing strategic partners from the semiconductor and electronics industry, especially start-ups, investors and SME's looking for a leading MEMS development & fabrication partner.

During the event, Fraunhofer IPMS will present its technology expertise in the fields of microsystems development and manufacturing. In short lectures, external partners as well as our leading scientists will speak about mutual projects, current developments and latest trends. We are looking forward to your active participation, shaping future MEMS developments and applications.

SPEAKER

*Prof. Butrus Khuri-Yakub
(Stanford University, Head of Research Group Ultrasonics)*

His current research interests include medical ultrasound imaging and therapy, ultrasound neuro-stimulation, chemical/biological sensors, gas flow and energy flow sensing, micromachined ultrasonic transducers, and ultrasonic fluid ejectors. He has authored over 600 publications and has been principal inventor or co-inventor of 97 US and international issued patents.

*Dr. Jörg Schieferdecker
(Heimann Sensor, CEO & Owner)*

Heimann Sensor is technology leader in infrared sensors for contactless temperature measurement and gas detection. Mr. Schieferdecker is an entrepreneur with a PhD in microelectronics and infrared physics. Heimann Sensor is a long-term development partner of Fraunhofer IPMS.

*Danny Kreindler
(Otonexus Medical Technologies, VP Product Development)*

He is an engineering, product, and technical marketing manager with over 20 years of experience in the imaging and medical device industry e.g. for airborne imaging systems, high-speed print/scan controllers, and various ultrasound-based medical devices, as well as managing medical business units, and running technical marketing for various medical technology start-ups.

*Alex Walsh
(Envision Diagnostics, President & CEO)*

Ophthalmologist and engineer embarking on venture to develop a handheld, self-operated binocular device capable of performing a complete eye examination. He is also specialized in mechanical and product design as well as software engineering.

February 8, 2019

SEMI Global Headquarters
California, Milpitas, CA 95035, USA



PROGRAM

- 09:00 am *Registration & Reception*
- 09:20 am **Carmelo Sansone**
Welcome & Opening
Director of MEMS & Sensors Industry Group at SEMI
- 09:30 am **Prof. Dr. Harald Schenk**
„MEMS Engineering for Innovative Applications“
Director - Fraunhofer IPMS
- 09:50 am **Prof. Butrus Pierre T. Khuri-Yakub**
„The Evolution of Ultrasonic Transducers“
Professor - Stanford University
- 10:10 am *Coffee Break, Networking*

Fraunhofer IPMS Foundry Services

- 10:45 am **Dr. Matthias Schulze**
„Fraunhofer IPMS 200 mm - MEMS Shop“
Head of Engineering - Fraunhofer IPMS
- 11:05 am **Dr. Jörg Schieferdecker**
„High Resolution Thermal Infrared Arrays in MEMS Technology“
CEO - Heimann Sensors

Ultrasound MEMS Technologies

- 11:30 am **Dr. Sandro Koch**
„MEMS Ultrasound - From Technology to Application“
Head of CMUT Group - Fraunhofer IPMS
- 11:50 am **Danny Kreindler**
„Medical Applications for Capacitive Micromachined Ultrasonic Transducers“
Vice President OtoNexus Medical Technologies
- 12:10 pm *Lunch Break, Networking*

Optical MEMS Technologies

- 1:15 pm **Alex Walsh & Dr. Jan Grahmann**
„Eye Examination using MEMS Scanning Mirrors“
Envision Diagnostics & Fraunhofer IPMS
- 1:45 pm *Coffee Break, Networking*
- 2:30 pm *End*



FREE ONLINE REGISTRATION:
www.ipms.fraunhofer.de

TIME-SENSITIVE NETWORKING (TSN) IP CORE MAKING DEVICES FIT FOR REAL-TIME ETHERNET



Time-Sensitive Networking (TSN) is a set of standards allowing for the timed and prioritized transmission of real-time critical messages over standard Ethernet hardware. With the TSN IP Core, developers at Fraunhofer IPMS provide equipment manufacturers and operators the opportunity to make their devices fit for new TSN standards.

Already a reality in many companies, intelligent Industry 4.0 automation systems connect increasingly more sensors, machines, and control units with each other. These systems must not only handle ever larger amounts of data, but especially in case of control systems and sensors/actuators, must transmit data with precise timing – often in real time. Many manufacturers of industrial devices, therefore, are currently in the process of making their devices TSN-capable. Because Ethernet network technology typically found throughout industrial automation is not designed for difficult real-time transmission due to latencies and non-deterministic delays in overload situations, Fraunhofer IPMS provides companies support with a so-called IP Core.

Dr. Frank Deicke, Head of the Fraunhofer IPMS Research Group, states, »Our TSN IP Core helps producers and operators of manufacturing and process automation equipment who aim to extend their network devices to meet Time-Sensitive Networking (TSN) standards.« He explains, »Ethernet TSN is advantageous in that it allows data packets with real-time requirements to be prioritized ahead of less time-critical messages, and time-controlled and deterministically transmitted over standard Ethernet hardware throughout widely ramified networks. Vendor-specific real-time field buses that require specialized hardware support, that are not compliant with IEEE 802.1 and 802.3 standards, and that often interfere with each other are therefore unnecessary.«

The Fraunhofer IPMS TSN IP CORE includes hardware modules for time synchronization (IEEE 802.1AS) and data stream management (Traffic Shaping) according to IEEE 802.1 Qav and 802.1Qbv standards as well as a dedicated Ethernet MAC for low latency. Available as a synthesizable source code or a netlist, the IP Core uses standard AMBA® or Avalon® interfaces to facilitate integration with your own circuits and FPGA solutions.

MEMS TECHNOLOGIES DRESDEN

Fraunhofer IPMS customers benefit from both our extensive experience in R&D and fabrication as well as our expertise in diverse fields of application. Scanning mirrors and spatial light modulators are examples of technologies developed at Fraunhofer IPMS which have prompted our successful cooperation with industry partners and we have manufactured pressure sensors for the automotive industry and photo diodes in our clean room for years. Due to strong and trusted relationships within our network of excellent partners in the semiconductor / MEMS ecosystem, Fraunhofer IPMS is uniquely positioned to offer clients products and services well beyond our intrinsic capabilities.



Added Value

- Comprehensive competencies in surface and bulk micromachining
- One-stop-shop for your specific requirements along the entire value chain
- State-of-the-art clean room facility capable of low- to mid-volume pilot production
- Intensive engineering support for manufacturing processes in 24-hour / 5-day operations

Research and Development Across Several Locations

Fraunhofer IPMS is part of the Research Fab Microelectronics Germany (FMD). This cooperation of 13 research institutes (11 Fraunhofer and 2 Leibniz institutes) connects all processes and infrastructure available to serve major areas of technology that are essential to the research, development and (pilot) fabrication of micro- and nanosystems – whether it is for information gathering and processing, telecommunications, or power electronics.

UPCOMING EVENTS

SPIE Photonics West

San Francisco, USA February 2 - 7, 2019
Moscone Center, Booth 4238

MEMS Industry Partner Day USA

Milpitas, USA February 8, 2019
SEMI Global Headquarters

LogiMAT

Stuttgart, Germany February 19 - 21, 2019
Tracking & Trace Theatre, Hall 4, Booth F05

Embedded World

Nuremberg, Germany February 26 - 28, 2019
Nuremberg Convention Center, Booth 3-123

OFC

San Diego, USA March 5 - 7, 2019
San Diego Convention Center, Booth 828

www.ipms.fraunhofer.de/en/events.html

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