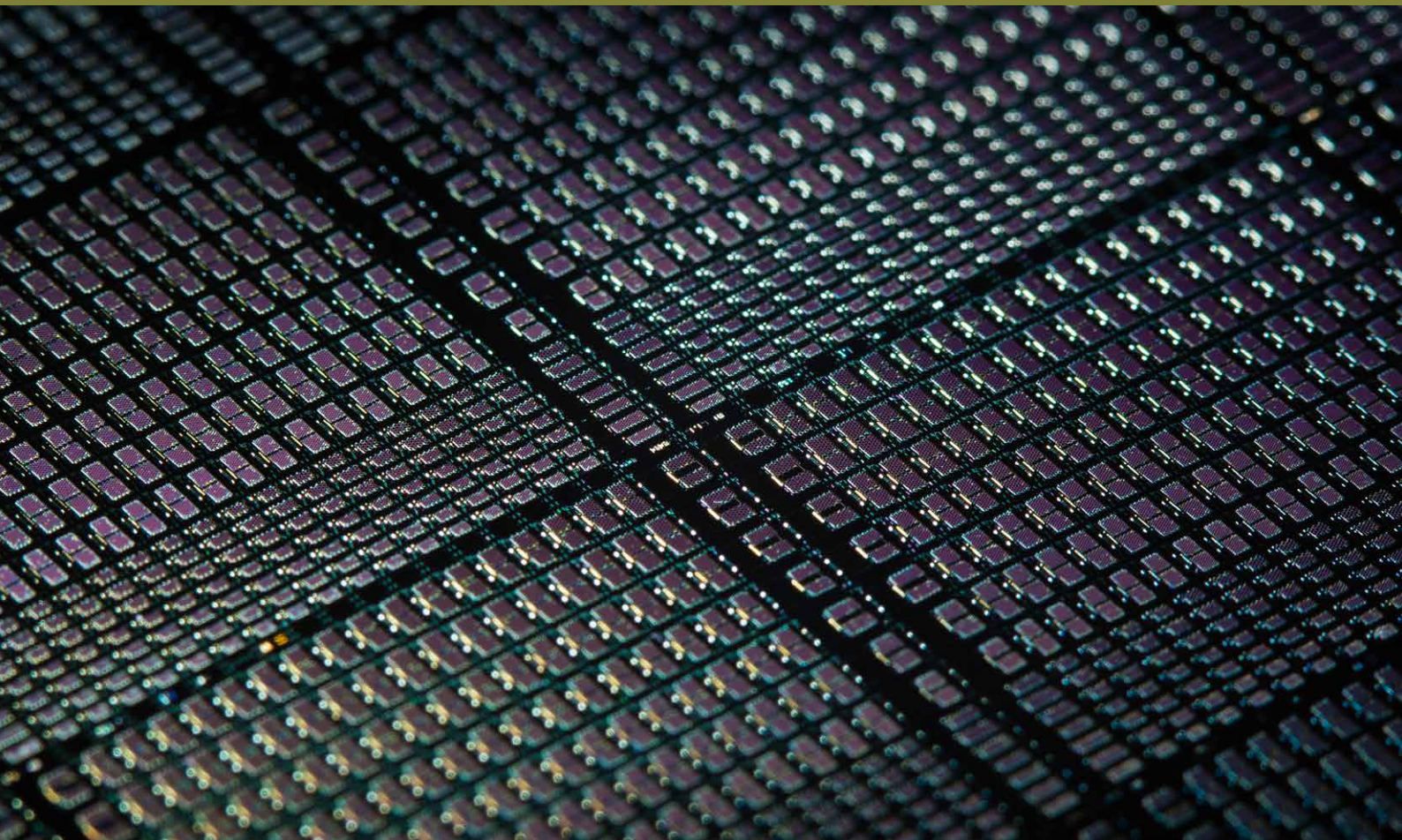


MEMS REPORT

3 / 2016



CONTENTS

- Prof. Dr. Hubert Lakner Receives Fraunhofer Medal
- ECSEL »IoSense« Project for New Sensor Technologies and Competitive Production Methods
- Universal Adapter for RFID Components: ROAD Server
- 10 Years of Successful Cooperation Between HiperScan and Fraunhofer IPMS
- CAN FD Controller IP Core Excels Through 3. Plug Fest Testing
- Multi-Spectral Camera With a Single Lens

Dear Customers, Partners and Friends
of Fraunhofer IPMS,

Today, cooperations are often required to meet the demands of our industrial customers as well as the objectives of publicly-funded research and development projects. Therefore, institutes of the Fraunhofer-Gesellschaft working in these fields established the Microelectronics Alliance 20 years ago. Now, thanks to joint strategy processes, the industry can access solutions of which singular institutions are not capable. Recently launched performance centers contribute to a stronger network of institutions and even closer forms of cooperation are currently being considered. Fraunhofer IPMS participation in projects under the ECSEL common technology initiative also serves the goal of building strategic alliances especially with leading industry partners.

In this edition of the MEMS Report, we will present a closer look at the recently launched »IoSense« project coordinated by Infineon Technologies Dresden. In addition to IoSense, we are also a partner in the new ECSEL project »PRIME« with our CNT business unit working alongside Globalfoundries on the basic principles of 22nm FDSOI technology.

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



Prof. Dr. Harald Schenk

Prof. Dr. Hubert Lakner

PROF. DR. HUBERT LAKNER RECEIVES FRAUNHOFER MEDAL

Prof. Dr. Reimund Neugebauer, President of the Fraunhofer-Gesellschaft, honors Prof. Dr. Hubert Lakner, Chairman of the Fraunhofer Microelectronics Alliance and Director of the Fraunhofer IPMS, with the Fraunhofer Medal for his outstanding dedication to microelectronics.

In recognition of the 20th anniversary of the Fraunhofer Microelectronics Alliance, Prof. Dr. Hubert Lakner was awarded the Fraunhofer Medal on May 23, 2016 in Berlin. In his opening remarks, Prof. Dr. Neugebauer emphasized the importance of the Microelectronics Alliance within the Fraunhofer-Gesellschaft and presented excellent research examples.



Prof. Neugebauer presents Prof. Lakner with the Fraunhofer Medal.

Prof. Dr. Lakner has led the Fraunhofer Institute for Photonic Microsystems IPMS since its spin-off from the Fraunhofer Institute for Microelectronic Circuits and Systems IMS in 2003. In 2011, he succeeded Prof. Dr. Heinz Gerhäuser, the former Director of the Fraunhofer ISS, as Chairman of the Fraunhofer Microelectronics Alliance. As a member of the Fraunhofer Board, Prof. Lakner has been instrumental in numerous evaluations, restructurings and appointment committees of member institutions. In addition, Prof. Lakner has served in diverse capacities to strategically position Fraunhofer microelectronic activities. Among other responsibilities, Prof. Lakner sits on the supervisory board of AENEAS (a European association for nano-electronics), is a member of the Electronic Leaders Group ELG (an association made up of leading European semiconductor and research executives) and is the Speaker of the advisory board of Silicon Saxony.

ECSEL »IOSENSE« PROJECT FOR NEW SENSOR TECHNOLOGIES AND COMPETITIVE PRODUCTION METHODS



Within the »IoSense« framework, Fraunhofer IPMS develops e.g. pressure sensors in surface micromechanics.

Because of the expanding network and the Internet of Things (IoT), the need for sensor systems will grow significantly in the coming years. Sensors are also increasingly found in smartphones or lifestyle products. New sensor technologies and competitive production methods are in demand. The cost-efficient manufacturing of such sensor systems is therefore an especially essential requirement. Large quantities of sensors are needed for the success of the IoT. Only then can the equipment and systems gather and process the properties of the physical world. Infineon Technologies in Dresden has therefore initiated »IoSense« (Internet of Sensors), one of the most important European sensors and sensor systems pilot projects. Launched in 2016, the project is comprised of a strong consortium of 33 partners from six countries including the Fraunhofer IPMS.

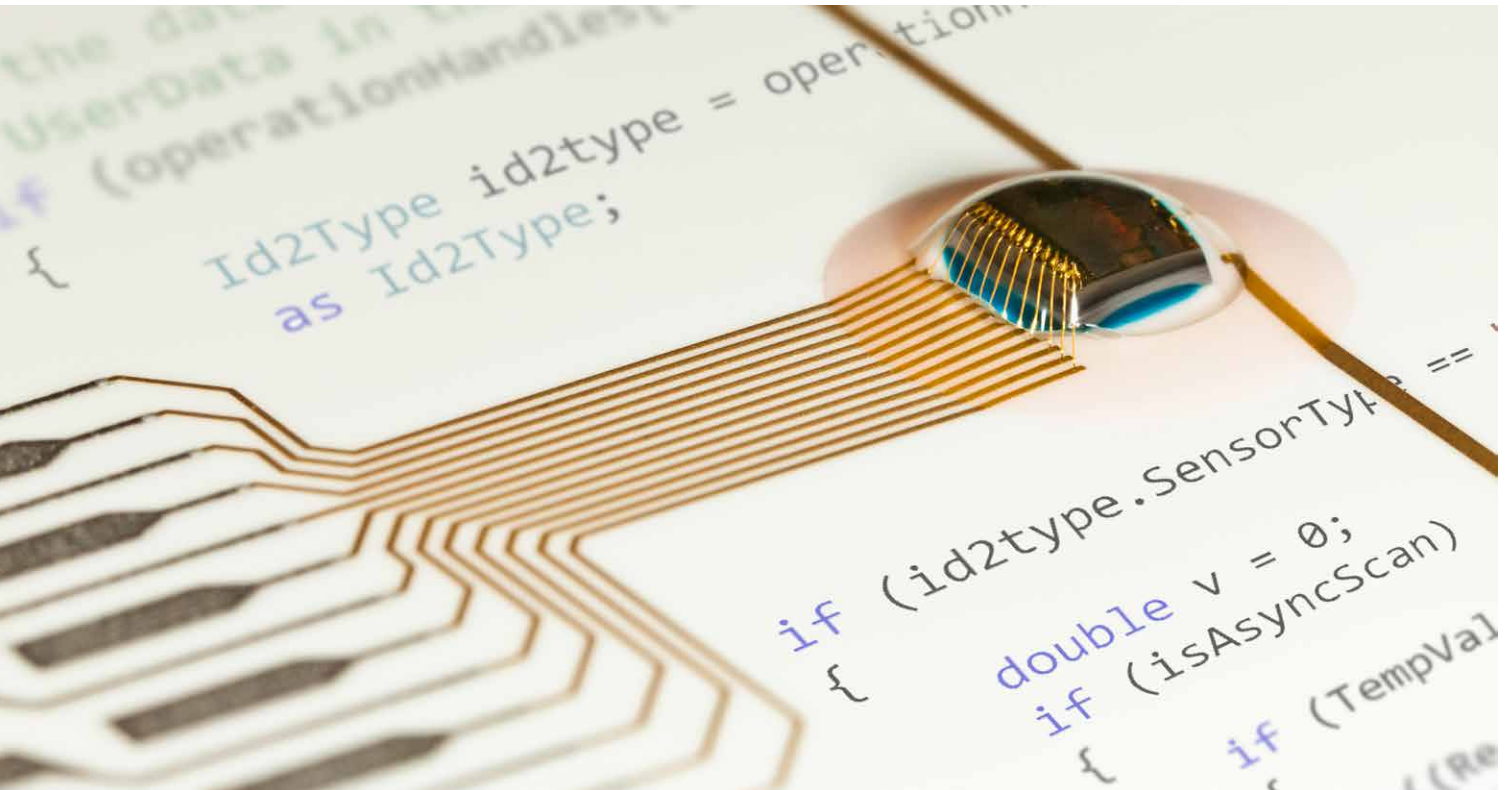
IoSense is part of ECSEL, the European program for microelectronics designed to strengthen Germany and Europe for the manufacture of flexible, application-oriented and cost-efficient sensors and sensor systems. The project focuses on building pilot lines with complementary competences, from the development of

new sensor technologies and competitive methods of high-volume production to the creation of new application examples.

Within IoSense, Fraunhofer IPMS works as a so-called low volume R&D line providing CMOS wafers from Infineon Technologies Dresden with micromechanical sensor elements. The semiconductor lines of Infineon and Fraunhofer IPMS are virtually linked and the technological and logistical interfaces are defined. This will be demonstrated by the integration of a surface micromachining pressure sensor on the Infineon CMOS technology. Tasks of development include the technological adaptation of integration processes as well as the electronic readout of the sensor elements. This cooperation enables faster developments and a simpler and quicker transfer of development results on an industrial pilot line.

Managed at Infineon Technologies Dresden GmbH, the IoSense project will run for a three-year period at a cost of 65 million Euro. The EU is supporting the project with approximately 14.7 million Euro as part of its ECSEL program. The State of Saxony and the BMBF are together providing around 5.2 million Euro.

UNIVERSAL ADAPTER FOR RFID COMPONENTS: ROAD SERVER



The Fraunhofer IPMS has developed a middleware that makes it possible to combine RFID components like readers, identification transponders or sensor transponders regardless of manufacturer, interface and selected frequency range and for those components to be controlled via a generic interface. This makes it much easier for system integrators, plant manufacturers or RFID hardware vendors to integrate RFID technology into intelligent production environments.

RFID technology is increasingly being used in modern production environments to autonomously control logistics or production processes or to perform maintenance-free measurements in hard to reach places or on moving parts and to provide wireless transfer with no internal source of energy. However, users usually face considerable implementation time and costs when integrating new RFID components in existing or yet to be established process environments. Because readers as well as identification and sensor-transponders differ considerably in some cases according to manufacturer, frequency band used, protocol and interface, they can not be readily combined with each other. Fraunhofer IPMS has developed a middleware, the so-called »ROAD server«, to change this. This is the first middleware of this type to implement the OPC-UA (Unified Architecture Open Platform Communication) AutoID-

companion specification, a standard for manufacturer-independent communication in automation technology, which enables universal interoperability of industrial bus systems and protocols.

The ROAD server works like an universal adapter. It ensures that any readers and tags for various LF, HF, UHF and NFC frequency ranges are integrated via a standard interface in process systems and are able to communicate with each other. This is especially interesting for users who want to record various parameters such as temperature, humidity, light or pressure with sensor transponders.

Development was especially focused on the convenient incorporation of modern sensor-transponders. Designed for MS Windows platforms, the middleware recognizes the reader and transponder type and autonomously chooses a suitable controller, which allows the user to access the transponder as well as ID, memory and measured values readouts over a standard interface. Therefore, users must no longer deal with the detailed control of readers, tags and sensors at electronic and protocol levels.

Fraunhofer IPMS offers complete, customer-specific solutions and services relevant to RFID middleware and RFID sensors for reader and equipment manufacturers as well as system integrators.

10 YEARS OF SUCCESSFUL COOPERATION BETWEEN HIPERSCAN AND FRAUNHOFER IPMS

Founded on May 24, 2006 as a Fraunhofer startup, HiperScan celebrates its 10th anniversary this year. Today, HiperScan is a successful company providing high-quality technologies and applications for the analysis of materials in the near infrared range.

HiperScan has grown strongly over the last decade, thanks in part to the excellent cooperation with Fraunhofer IPMS. The company had already completed their first compact near infrared spectrometer SGS1900 prototype based on scanning-grating technology. Designed to verify the identity of raw materials used in the pharmacy, the HiperScan »Apo-Ident« analysis system was successfully placed on the market in the following year. Apo-Ident is currently being used in both German and international pharmacies. Over 1.500 pharmacies are already using the Apo-Ident NIR analysis system and the introduction of yet another spectrometer is imminent. Development of this new product allows numerous industries to perform both qualitative and quantitative analysis.

A micro scanning mirror with diffraction grating developed at Fraunhofer IPMS is at the center of the HiperScan scanning-grating

spectrometer. Consisting of silicon chips with movable parts (MEMS), these mirrors have excellent mechanical and optical properties and don't wear out.

In addition to joint appearances at trade shows, HiperScan and Fraunhofer IPMS have worked together on various research projects. The SGS 1900 scanning-grating spectrometer resulted from a successful, long-standing research cooperation involving Carinthian Tech Research AG (CTR), Fraunhofer IPMS and HiperScan GmbH. The partners were distinguished with the 2013 »Science2Business Award«.

Furthermore, HiperScan had already won the 2011 Industry Prize in the optical technology category for »Apo-Ident«. The »Technology Fast 50 Award« followed in 2015, recognizing HiperScan as one of the fastest growing technology companies. Fraunhofer IPMS will continue to work with HiperScan in the future in the areas of high-tech development and the development of next-generation equipment in terms of the miniaturization of spectrometers.

CAN FD CONTROLLER IP CORE EXCELS THROUGH 3. PLUG FEST TESTING

The CAN FD Controller core developed by Fraunhofer IPMS and available through semiconductor intellectual property provider CAST, Inc. successfully underwent its third Plug Fest testing experience in Nuremberg.

These Plug Fests are sponsored by the CAN in Automation (CiA) trade group to approximate real-world conditions that go well beyond typical lab testing procedures. Representatives from numerous firms all connect their standards-based devices and see how they perform, individually and with all the other devices. This month's Plug Fest was the most rigorous yet, with twenty participating CAN FD suppliers, thirty-three device nodes, and very challenging network topologies and timing scenarios presented by automakers Daimler AG and Volkswagen AG. It also featured CAN FD running in an actual automobile for the first time, a modified Passat provided by Volkswagen.

Fraunhofer engineers evaluated the CAN FD controller core running on CAST's CAN FD Reference Design, implemented on

Altera's DEO Nano Development Kit board and using transceivers from multiple suppliers. After two days of rigorous testing, Dr. Ralf Hildebrandt of the Fraunhofer Institute for Photonic Microsystems IPMS gave this succinct report: »Protocol behavior of our node was excellent. No problems.« This marks the third successful Plug Fest for the CAN-CTRL IP Core, making it, the company believes, one of the most production-ready CAN FD controller cores available.

This high-performance, fully-featured controller supports all versions of the CAN FD standard and is available as a register-transfer level (RTL) soft core for ASICs or optimized netlist for FPGAs. Moreover, the company believes it is the only CAN FD controller IP core to have been proven to work well with all popular physical CAN FD transceivers, including those from Denso Automotive, Infineon Technologies, NXP Semiconductors, and On Semiconductor.

The CAN-CTRL CAN 2.0 & CAN FD Bus Controller IP Core is available now.

MULTI-SPECTRAL CAMERA WITH A SINGLE LENS



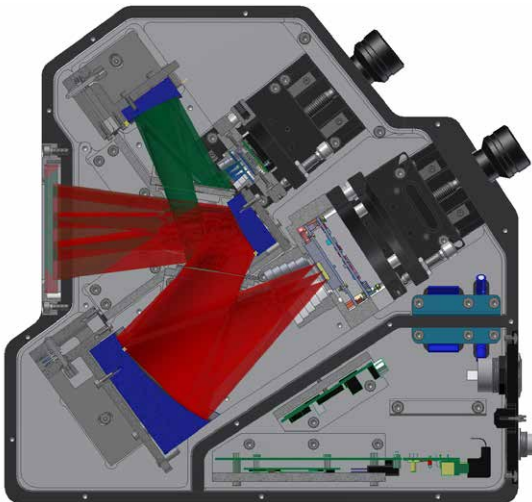
Researchers at the Fraunhofer IPMS have developed a high-resolution camera which produces congruent images for two spectral ranges using multiple detectors through a single lens. In contrast to already existing multi-spectral imaging systems, this technology provides for low-cost constructions and significantly easier post-production of imaging data.

Whether in security systems monitoring airports, tunnels or train stations, automotive driver assistance systems, remote sensing and environmental analysis, industrial metrology or medical technologies, wideband spectrum imaging is preferred or even required in many areas of application. In addition to the visible spectral range, the infrared spectral range with wavelengths above a few microns is particularly interesting. It offers further image information not provided in the visible range, but which is extremely useful in many applications such as building services engineering, field monitoring and quality control of electronics production.

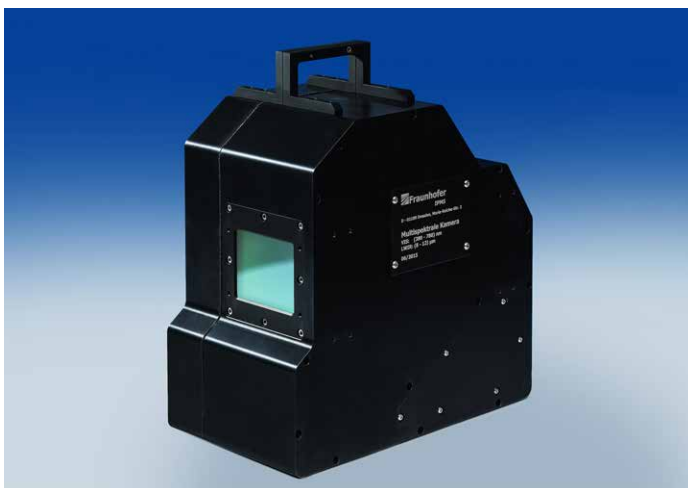
Systems currently available on the market use optics, materials and components individually adapted for various spectral ranges. Because conventional glasses are not transparent in the infrared spectral range, lenses are often made of expensive semiconductor materials. In addition, images captured using multiple cameras from different directions are always subject to a parallax. This results in complicated post-processing, requiring precise classification of image data provided by the different cameras.

These disadvantages can be overcome with a multi-spectral camera which produces congruent, parallax-free images using multiple detectors through a single lens. Using mirrors instead of lenses for the optical system not only provides the opportunity to replace commonly available camera systems, but also offers the chance for the creation of new applications for which weight and space are critical.

Seizing the opportunity, Fraunhofer IPMS has developed a fully reflective, multi-spectral camera that uses two image sensors behind a common lens. The lens is designed as a special tilted mirror system which, because of its construction, avoids the chromatic aberrations or central obscuration effects occurring in current systems. Individual mirror surfaces are designed in a partially aspheric manner to correct geometric aberrations and are provided with suitable coatings to ensure high reflectivity over a wide spectral range. Due to the parallax-free simultaneous image capturing in different spectral ranges through a single lens resulting from this approach, both the previous need for a second lens as well as subsequent elaborate post-processing of image data have been eliminated. The choice of the spectral range of the reflective optics is then limited only by the detectors available.



Embodiment of the multi-spectral camera with the optical path of the mirror objective.



A first prototype of the multi-spectral camera was presented to the professional public for the first time at the Optatec 2016.

UPCOMING EVENTS

ECOC

Düsseldorf, Germany September 19 - 21, 2016
 CCD Congress Center Düsseldorf, Booth 327

FachPack

Nuremberg, Germany September 27 - 29, 2016
 Nuremberg Exhibition Center, Hall 4, Booth 4-327

SEMICON Europa

Grenoble, France October 25 - 27, 2016
 Alpexpo, Booth 662

VISION

Stuttgart, Germany November 8 - 10, 2016
 Stuttgart Exhibition Center, Booth 1H75

Electronica

Munich, Germany November 8 - 11, 2016
 Munich Exhibition Center, Hall A4, Booth 113

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

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