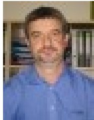
MEMS



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Biography

Uwe Schwarz obtained a degree in Physics at the University in Leipzig in 1988. He joined X-FAB in 1992, where he worked first as a development and process engineer on photolithographic processing and was also involved in some of the CMOS technology development programs of the company. Since 1997 he is working on the field of MEMS process development.

3D Structuring Techniques as Enablers for New MEMS-based Devices

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Abstract

This year, we celebrated the 50th anniversary of Moore's Law. Over the past decades, the development of the semiconductor industry has been driven by miniaturization of standard devices. In parallel, the demand for sensor devices undergoes a dramatic change - not only in terms of volume and average selling price, but also with respect to requirements of further miniaturization. As an example, in a few years, a package height for pressure sensors in the order of one millimeter will not be accepted anymore by most of mobile device providers. The discussion on the choice "system in package" or "system on chip" is not only driven by production costs anymore. Furthermore - in some cases, the miniaturization of micro mechanic devices is the door opener for CMOS integration by also reducing production cost of the system: New versions of MEMS resonators in the 10MHz to 100MHz range are smaller than a single bond pad - an integration might save chip area. On the other hand, new sensors for ambient radiation and chemical analyses will capture new markets.
In this contribution, a discussion on the link of structuring techniques to system design is provided. Taking three practical examples, the consequences of technological concepts and the choice of sensing techniques are presented. It underlines the need of continuous concept reviews even of mature device and product groups such as pressure sensors, acceleration sensors or ambient light sensor systems.

Biography

Thoralf Kautzsch coordinates pre-development and innovation activities in the field of sensor and MEMS solutions at Infineon Technologies Dresden. In 2003 he received his PhD from the Technical University of Berlin. Since 2003 he has been with Infineon Technologies Dresden, his activities covered embedded flash integration, development of power devices and investigation of new sensor concepts.
His current interests include MEMS-based sensors, optoelectronic devices and sensing systems based on infrared spectral analysis.

A Cu based TSV technology for MEMS accelerometers

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Abstract

3D integration represents a decisive technology for realizing miniaturized, heterogeneous smart systems. In contrast to microelectronic devices, specific constraints have to be considered for MEMS with fragile structures. Hereby, the wafer thickness is usually higher (~200-400 µm) due to the MEMS fragility and for reasons of avoiding thin wafer technologies. This requires through-silicon vias (TSVs) with large dimensions and high aspect ratios. In this presentation a Cu-TSV technology and its application to MEMS accelerometers based on high aspect ratio microstructures will be described.

In the presented TSV technology approach the TSVs are fabricated after the device fabrication as so called Via Last technology. One distinctive feature hereby is an incomplete TSV Cu-filling, which avoids long processing and complex process control, while minimizing the thermomechanical stress between Cu and Si and related adverse effects in the device. However, the incomplete filling also includes various challenges regarding process integration. A method based on pattern plating using spin-on negative resist will be described where the TSVs are metalized at the same time as the redistribution layer. This eliminates the need for additional planarization and patterning steps. As demonstrator a 2-axis MEMS accelerometer based on the so called AIM (air gap insulated microstructures) technology has been built up with TSVs. Cross sectional analysis as well as functional tests will be shown in order to validate the feasibility of the presented Cu based TSV technology.

Biography

Stefan E. Schulz is head of the Department Back-end of Line and Deputy Director at the Fraunhofer Institute for Electronic Nano Systems (Fraunhofer ENAS), Chemnitz, Germany. His main research fields are on-chip interconnects, 3D integration, and Carbon Nanotube (CNT) based devices.

S. E. Schulz received his doctoral degree in electrical engineering from Technische Universität Chemnitz in 1996. Before entering the newly founded Fraunhofer ENAS in 2008 as head of Dept. BEOL, he held several positions as researcher and research group leader at Technische Universität Chemnitz, Center for Microtechnologies and Fraunhofer IZM.

S. E. Schulz was appointed as Honorary Professor for "Nanoelectronics Technologies" at the Technische Universität Chemnitz in 2008. In 2013 he became Spokesman of the Fraunhofer Cluster 3D Integration.

S. E. Schulz authored and co-authored more than 150 publications in journals, books and conference proceedings, held 11 invited speeches at international congresses and symposia, and is inventor of 3 granted patents and 4 published patent applications.

Agile value chain for medium volumes custom MEMS manufacturing, packaging and integration.

V. Gaff
Business Unit Manager
Tronics Microsystems Sa, Grenoble, France

Abstract

MEMS technologies are enabling a wide range of new sensor and/or actuator functions of (inertial sensors, micro-mechanics, optical and RF microsystems, BioMEMS, etc..). At the heart of product innovation, those technologies are driving the future of growing markets like industrial instrumentation, aeronautics & security, medical and pharmaceutical devices.

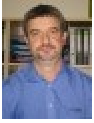
The functions created are very diverse and call for wide range of manufacturing, packaging and integration technologies that are neither well mastered by customers not available at a single sub-contractor manufacturing location when needed. To address these new product integration challenges tight relationships between solution providers and customers need to be established. An agile and sustainable model must be implemented so that the hurdles of cost, performance and integration can be lowered.

Specialized in the manufacturing of highly differentiated, high-value add, custom MEMS products for medium volume applications, Tronics has set-up agile manufacturing strategies to address those diverse requirements. With a mix of in-house capabilities and an ecosystem of solutions providers, Tronics manages supply chain to deliver OEMs functions they can easily integrate into their systems.

Biography

Vincent Gaff is Manager of the Business Unit "Microsystems Solutions" at Tronics Microsystems. He manages the custom MEMS development and foundry services for the company. Vincent Gaff joined Tronics Microsystems in 2000 as marketing and sales engineer. He led the marketing and business development activity of the company from 2005 to 2011 and then took charge of the main business unit of the company. He was previously project manager at CEA-Leti from 1998 to 2000.

The Importance of Through Silicon Vias for Next Generation CMOS and MEMS Processes



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Abstract
Integration is becoming more and more popular and necessary for advanced microelectronic and MEMS devices. Through Silicon Vias (TSV) are important elements of 3D stacking and packaging methods as they carry the electrical current from one side to the other side of the wafer. The presentation will provide an overview of solutions on how to implement TSVs for CMOS and MEMS wafers.

Biography
Uwe Schwarz obtained a degree in Physics at the University in Leipzig in 1988. He joined X-FAB in 1992, where he worked first as a development and process engineer on photolithographic processing and was also involved in some of the CMOS technology development programs of the company. Since 1997 he is working on the field of MEMS process development.