



TDK-MICRONAS GMBH

Investing in the future of the manufacturing industry: Waferlab, assembly, connection technology and final test

TDK-Micronas GmbH develops, produces and distributes semiconductor components for sensor systems and motor control systems for automotive applications. These electronic components communicate, measure and control various functions, such as angle, position, speed and current to make modern vehicles safer. TDK-Micronas is part of the TDK Group and a global company that specialises in manufacturing magnetic field sensors (Hall-effect sensors). TDK-Micronas uses semiconductor technology (CMOS) to manufacture integrated electronic circuits and components for signal conditioning, evaluation, power management and network interfaces.

Challenges

Hall sensors are very versatile, intelligent magnetic field sensors for position detection. For example, they are being used in the Internet of Things (IoT), in the automotive sector, in information and communication technology as well as in medical technology. Hall sensors are based on the so-called Hall effect: this

effect occurs when a current-carrying conductor is in a stationary magnetic field. Consequently, electric voltage is generated – referred to as Hall voltage – that occurs in vertical direction to the current flow and the magnetic field. This allows non contact and wear –free measurement of the position of machine parts and products. The Hall effect is also used in the automotive sector, for example when it comes to monitoring belt and door locks. The above mentioned industries face ever increasing demands on the reliability of such position detection systems. To meet the high performance and quality requirements, numerous new inspection and monitoring systems need to be developed, to analyse and monitor quality already at the stage of production.

Objective

TDK-Micronas will dedicate considerable research and development efforts to developing novel key technologies for reliable and efficient magnetic field sensors. The aim is to increase the quality

of the products through new processes and innovative quality monitoring, while improving performance by integrating new functionalities. New design strategies are being developed for the existing product portfolio. In addition, TDK Micronas is working on new assembly and joining technologies to reduce the mechanical stresses with the help of specific encapsulation technologies. Another focus of the project is to test and ensure the high reliability requirements of the automotive sector. Especially in the context of automotive electronics, it is not only cost efficiency that matters: product performance and quality are decisive factors in order to remain competitive. The systems can only be used for autonomous driving if they are absolutely reliable.



Project coordinator

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01/17 – 12/21

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Location

Freiburg im Breisgau



Approaches

A well known source of error in the reliability of Hall sensors are mechanical stresses caused, for example, by temperature changes or high humidity. To reduce the mechanical stresses in the sensor, TDK-Micronas is investigating and developing decoupling structures and components that are incorporated into the silicon chip and the package. This significantly increases the service life as changing environmental conditions no longer result in any functional limitations of the sensor. Furthermore, we aim to develop new technological processes for the integrated Hall elements to increase the performance of the Hall sensors. Moreover, existing products can be converted accordingly and thus greatly improve their quality. Another development field is the integration of two different magnetic field sensor technologies: TDK-Micronas intends to combine magnetoresistive and Hall sensor technology in one product and thus develop a hybrid technology magnetic field sensor. As such, it has a significantly increased signal dynamic which is expected to result in higher measuring accuracy. This creates possibilities for new applications in automated production processes or autonomous driving.

Perspectives

To ensure the dissemination of the results, cooperations with universities and research institutions will be fostered in the form of scientific papers and articles. The training of young scientists is promoted within the framework of subcontracts and by providing opportunities for doctoral, bachelor's and master's theses. TDK-Micronas also participates in numerous symposia and conferences with scientific presentations and posters to ensure knowledge transfer. In addition, the company aims to cooperate with

new subcontractors who have not been business partners before. TDK-Micronas' sensor solutions are required for industrial applications, such as robot control systems or automation systems for manufacturing production facilities. Hall sensors can also be used in household electronics, heating and air-conditioning technology, and medical technology. Due to the fact that TDK-Micronas is changing the wafer diameter from 150 mm to 200 mm, the overall competitiveness of production can be increased. With larger wafer diameters, more sensors per wafer are produced with the same number of production steps. This will allow TDK-Micronas to counterbalance the decline in production capacity and to ensure a constant level in the long term. At the same time, the development of the „More-than-Moore“ technology for wafer sizes of 200 mm in Germany helps to strengthen Europe's competitiveness. This has a direct impact on securing high-quality jobs.

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