



ROBERT BOSCH GMBH AND BOSCH SEMICONDUCTOR MANUFACTURING DRESDEN GMBH

Planning, construction and upgrading of semiconductor production facilities for innovative technologies and products

The Bosch Group is an international technology and service company with around 400,000 employees worldwide. Its business activities are divided into four divisions: **Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology.** Bosch manufactures semiconductors for around 50 years and is a globally active chip manufacturer for mobility applications. **Bosch's current semiconductor portfolio primarily comprises microelectromechanical systems (MEMS), circuits (ASICs) for vehicle control units and power semiconductors.** The company's MEMS sensors, which are used, for example, to measure pressure or acceleration, can also be found in many smartphones and are also installed in fitness wristbands, flying drones, game consoles and smart home applications.

Challenges

Automotive applications such as driver assistance systems or the highly automated driving requires high-performance chips that always function faultlessly

even under extreme environmental conditions such as large temperature ranges, mechanical stresses such as vibrations and high humidity. In addition to the high demands on functionality and reliability, these components must also be designed to always be smaller and more energy-efficient. Microelectronic components are also indispensable for electric drives. Here, new materials, robust technologies and innovative circuit designs are required to reliably switch and distribute high electrical currents and voltages in the vehicle with minimal power loss. These are then to be transferred to series production in the required quality.

Objective

Robert Bosch GmbH will be working with considerable research and for developing a new generation of energy-efficient and high-performance microchips with a focus on the development and industrialisation of application-specific integrated circuits (ASICs). An example of this is a microchip for the intelligent power

management of sensors such as radar, video and LiDAR (Light Detection and Ranging), or for the high-precision control of laser sources and optical detectors in a LiDAR sensor. Such sensors are used for object recognition and classification, as well as for speed and distance measurement, and represent an important key technology for autonomous driving. In order to achieve climate-friendly mobility, Bosch is investigating new semiconductor materials and is developing a new technology based on silicon carbide, which is more stable than silicon and particularly suitable for switching high voltages and currents: it reduces waste heat and increases the range of electric vehicles. Bosch is also developing a new thin-wafer technology for low-voltage power semiconductors. This enables energy-efficient and reliable power components for new hybrid applications (e.g. mild hybrid vehicles) and is to be further developed in line with the requirements for series production. In the spirit of the integrated European project, close cooperation with



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Reutlingen, Dresden



other partners is taking place. For example, a technology licensed from Infineon for the production of low-voltage power semiconductors serves as the basis for its own further development.

Approaches

In the course of the project, the facilities for production lines for silicon semiconductors, thin-wafer technologies and silicon carbide are being set up or converted and evaluated on the basis of initial prototypes. For this purpose, a new semiconductor fabric is being built in Dresden, in which chips will be produced on a 300-millimetre silicon wafer. Compared to the established production with smaller 150- and 200-millimetre wafers, higher economies of scale can be achieved with the 300-millimetre technology. In order to be able to easily transfer plant processes once they have been developed to other production lines, standardised production processes are to be established as far as possible. The plant in Dresden will be fully 5G-networked and highly automated: This will enable process flows to be optimised with the help of artificial intelligence and digital twins. It is planned, to start pilot production in Dresden as early as the end of 2021 after an initial start-up phase. A large number of process systems have to be developed and optimised for this new semiconductor technology. To realise the pilot line, it is necessary to expand the existing production infrastructure and further develop the corresponding processes and integration concepts. In a next step, the start of market-oriented series production can be prepared, probably from mid-2021.

Perspectives

By transferring the development results into series production, Europe can consolidate and even expand its leading position as a supplier to the automotive industry. At the same time, the shift towards e-mobility will be supported by these new technologies and cost-saving manufacturing processes, and the applications of driver assistance systems will be expanded. This project from the technology field of power semiconductors is strongly interwoven with the second Bosch project, which is assigned to the IPCEI technology field of „intelligent sensors“. With the development of high-performance, energy-saving and cost-effective semiconductor solutions, the two Bosch projects contribute to advancing the key technology of microelectronics and nanoelectronics as a common European goal and address the societal challenge of digitalisation. The solutions developed here for the automotive sector can also be transferred to other sectors, such as the consumer sector.

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