



GLOBALFOUNDRIES DRESDEN MODULE ONE LIMITED LIABILITY COMPANY & CO. KG

# Further development and industrialisation of the innovative FDSOI technology

**Globalfoundries is a semiconductor producer that manufactures microchips for customers who do not have their own production facilities. The functions of the microchips are geared to the customers' wishes so that they can easily integrate them into their end products such as computers, smart phones or tablets. The microchips are produced on silicon wafers in clean rooms in over 1000 process steps. The smallest structures on a chip are only 22 nanometres in size.**

## Challenges

Electronics are a component of many products in everyday life and their importance will continue to grow with the coming Internet of Things (IoT) markets. The increasing number of electronic devices alone means that power consumption is rising - and with it energy consumption, Globalfoundries is working in its „WIN-FDSOI“ subproject on a new generation of microchips, which is more powerful and at the same time much more energy

efficient than previous generations. The new technology is therefore a possible solution for energy management that will ultimately help the entire world population to operate electronic devices with due regard for power consumption.

## Objective

Globalfoundries' goal in the technology field „Energy Efficient Chips“ is the further development and industrialisation of the innovative FDSOI technology (Fully-Depleted Silicon-on-Insulator) in industrial semiconductor manufacturing. FDSOI transistors are more energy efficient than conventional transistors by suppressing leakage currents on the wafer. The 22FDX technology developed by Globalfoundries is particularly distinguished by the fact that it enables the development of chips with excellent performance and minimal power consumption at low cost. By integrating further functionalities, such as the implementation of high-frequency power, the technology can also be used for

radar or mobile radio. With this project, Globalfoundries wants to demonstrate the high technology 22FDX and make it available for SMEs and start-ups. The successful introduction places high demands on the design support software, the full modelling of the technology (so-called process design kits - PDK) and the development and implementation of functional circuit blocks (IP), which are ultimately made available to customers for their own product developments. Particularly in the area of the Internet of Things and Industry 4.0, there are many small and medium-sized companies that need to resort to PDKs, design automation and also functional IP in order to realise their circuits as cost-effectively as possible. These innovative micro- and nanoelectronic components can then be used, for example, in automotive engineering, aerospace, medical technology or the energy sector. The careful development of the new 22FDX modules as part of this project is the fundamental basis for the



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technology's later suitability for production. The technology will only be successful on the market if the performance parameters of the modules meet customer expectations: maximum energy efficiency with the best performance and reliability at optimal costs.

### Approaches

New design methods (PDK) must be developed for the 22FDX ecosystem, which are then made available to chip development customers. Elementary basic components and complex IP must be defined and worked out, which contain the chip design of many products. The technology is to be expanded for additional fields of application, such as smart cards, to include an on-chip memory option. With the 22FDX technology, the chip cards can achieve higher computing power, which significantly improves the security properties.

In addition, new transistor architectures are being developed that can be used specifically for the high-frequency range: They improve digital functions and offer higher capacities for analogue applications. With optimised design, space-saving integrative applications can be developed that have outstanding high-frequency properties.

In addition, innovative packaging solutions, i.e. new types of enclosures for the chips, are being developed in the project. Many new applications will require a cost-efficient solution for packaging, while others will need a so-called hybrid solution, where different types of chips are combined in a special housing. This heterogeneous integration provides the necessary flexibility to combine different building blocks from the respective optimised manufacturing processes.

### Perspectives

To ensure the dissemination of the results, Globalfoundries already cooperates with more than 70 partners for diverse 22FDX application areas and works with new subcontractors. These include SMEs, start-ups, universities (TU Dresden and TU Bergakademie Freiberg) and the Fraunhofer-Gesellschaft (IIS). The cooperations include the creation of first prototypes for specific applications, which then define the starting points for product development. This creates a great transfer of knowledge. With the development of high-performance, energy-saving and cost-effective semiconductor solutions, the Globalfoundries project contributes to advancing the key technology of micro- and nanoelectronics as a common European goal. The solutions developed address a wide range of applications in the fields of industrial automation (Industry 4.0), automotive, energy transition, logistics, medical technology and security.

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