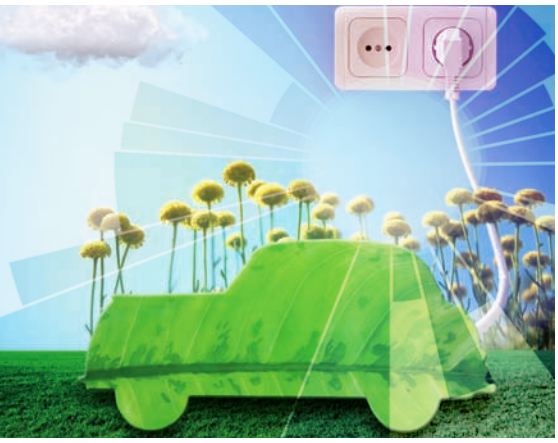
Project profile

LAST POWER

Large area silicon-carbide substrates and heteroepitaxial gallium nitride for power device applications



Power microelectronics represents an important segment of the semiconductor industry worldwide and is generally characterised by devices with low revenue but high strategic importance.
The aim of the ENIAC JU project LAST POWER project is to make the European Union independent from other sources in the design and production of highly-efficient systems for applications controlling electrical power. The project focuses on the development of high-power technologies and devices for both the forthcoming era of pure electrical mobility and a variety of industries which make use of electrical drivers.

Sub Programme

- Equipment and Materials for Nanoelectronics

Power devices are found everywhere from telecommunications to automotive, consumer electronics to household appliances and industrial applications to home automation. The microelectronics sector has been conservative regarding the environmental impact of chip-power consumption. Devices have been designed and improved on the basis of cost versus performance. Consequently, power density and conversion efficiency have been the main focus, with the innovative effort on the integration of more functionality.
Two trends are changing this:

1. The growing use of electronics in homes and offices – in appliances, computers, peripherals, televisions, wireless, etc. – and in industry, with servers, communications, computers, peripherals, electric motors, etc., has reversed the illumination/electronics ratio and most energy is now consumed by electronic devices; and
2. The total consumption and unit cost of energy has increased substantially with respect to the average income per EU citizen. Furthermore, the need to reduce the environmental impact has become essential by extending the previous considerations to transport and mobility with electric vehicles.

As a result, power saving and conversion efficiency of electronic devices will become even more important, while energy classification will be the product reference in the market – even for semiconductor devices. At the same time, legal restrictions on energy use will become ever more severe.

Perfect timing

The ENIAC JU project LAST POWER is therefore focusing on power-efficient microelectronics processes and devices making use of new materials and advanced technologies.
The best technology candidates for high-efficiency power conversion on medium- and high-voltage devices are based on wide bandgap materi-

als such as silicon carbide (SiC) and gallium nitride (GaN). These technologies benefit from higher speed, greater current capability, higher breakdown voltages and greater thermal capacity by comparison with silicon-based devices. The main highlight, with the industrial development of efficient SiC and GaN power devices, is on the availability of large diameter wafers of high material quality and relatively dedicated equipment. This will increase the yield and throughput with consequent cost reductions and wide market acceptance of the new devices.

LAST POWER's principal objective is to develop cost-effective, reliable integration of advanced SiC and GaN semiconductors in power microelectronics by introducing a high quality compound material on large diameter wafers and dedicated European equipment. This will ensure European independence with respect to US and Asian substrate manufacturing.

Wafer size is key

The ENIAC JU project will develop European technology in equipment, processing and characterisation as well as some of the possible applications. The expertise will be developed by taking advantage of the presence of advanced research centres, universities experienced in SiC and GaN technologies, large world-leading companies and many SMEs from seven EU countries.

The target wafer size of 150mm will establish the EU at the cutting edge of the state of the art. GaN heteroepitaxy will be developed on 150mm silicon wafers. This material is targeted for high-performance power devices – switches and amplifiers – but the industry involved in producing the material will also take advantage of other substantial markets such as solid-state lighting where SiC wafers could be in demand in the near future.

Innovative power devices developed using the enhanced material will be oriented towards energy-consumption reduction in such areas as consumer air conditioning and household electrical appliances, and transport with hybrid and electrical vehicles. In this field, the processing technologies for switching devices – MOSFET and normally-off JFET – will be developed and demonstrators will be manufactured. Devices working at temperatures over 150°C will be developed and will include a number of innovative packages.

Global opportunities

One of the main challenges for Europe is to compete successfully in emerging global markets and to create the wealth necessary to ensure a permanent high standard of living for all its citizens. To meet this challenge the EU needs to develop world-class capabilities based on appropriate research infrastructures in key enabling technologies.

LASTPOWER will contribute to new strategies in equipment and material for nanoelectronics by increasing co-ordination of R&D to reinforce industrial exploitation while maintaining scientific excellence and developing power electronics knowledge, materials, and equipment as well as product independence.

Equipment and Materials for Nanoelectronics

Partners:

- Acreo
- Aristotle University of Thessaloniki
- CNR-Institute for Microelectronics and Microsystems (IMM)
- Consorzio Catania Ricerche
- CSIC-Centro Nacional de Microelectronica (CNM)
- ETC Epitaxial Technology Center
- Foundation for Research & Technology-Hellas (FORTH)
- Institute of High Pressure Physics Unipress
- LPE
- NOVASiC
- SenSiC
- SEPS Technologies
- SiCrystal
- STMicroelectronics Italy
- University of Calabria

Project co-ordinator:

- Maria Grazia Podesta, STMicroelectronics Italy

Key project dates:

- Start: April 2010
- Finish: October 2013

Countries involved:

- France
- Germany
- Greece
- Italy
- Poland
- Spain
- Sweden

Total budget:

- €16.3 million

The ENIAC Joint Undertaking, set up in February 2008, co-ordinates European nanoelectronics research activities through competitive calls for proposals. It takes public-private partnerships to the next level, bringing together the ENIAC member states, the European Commission and AENEAS, the association of R&D actors in this field, to foster growth and reinforce sustainable European competitiveness.

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