PROJECT PROFILE

2T205: Deep sub-micron smart-power technologies (SPOT-2)

TECHNOLOGY PLATFORM FOR PROCESS OPTIONS

Partners:

Atmel
AMI Semiconductor
AUDI
CNRS LAAS
Infineon
NXP Semiconductors
Robert Bosch
Siemens VDO
SOITEC
TU Vienna
X-FAB Silicon Foundries

Project leader:

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Key project dates:

Start: April 2007
End: March 2010

Countries involved:

Austria
Belgium
France
Germany
The Netherlands

The MEDEA+2T205 SPOT project aims to develop innovative and cost-effective smart-power safety applications for European car manufacturers and global markets. Smart-power technologies combine digital logic functions in CMOS with higher voltage drivers in DMOS. Chips combining high voltage handling with greater integration of digital functions make it possible to increase speed and enhance automotive safety systems. The new solution will ensure high reliability and robustness at elevated temperatures and higher voltages. At the same time, results will support fast growing demands for power over Ethernet and voice over Internet. All these applications require highly integrated smart-power devices.

Deep submicron smart-power technologies focus on integration of different semiconductor components – for example microcontrollers, memory, power drivers and sensors – on a single system-on-chip (SoC) device. The alternative multi-chip or system-in-a-package (SiP) approach with separate dies for every function poses additional quality risks – such as multiple wire bonding – and complexity in testing parts compared with the SoC approach.

Deep submicron smart-power technologies on SoC devices have already been widely adopted for automotive products for two main reasons:

1. The strong demand to ensure high quality to meet the need for zero defects; and
2. The pressure on cost in several application fields such as antilock braking systems/electronic stability programmes (ABS/ESP) and engine management.

Deep submicron smart-power technologies are also needed to make possible a series of future consumer products. Leading customers worldwide are already demanding a new generation of power technology for high volume applications. Products could include: display drivers for liquid crystal (LCD) and plasma displays; power management for high efficiency power conversion; and developing applications such as power over Ethernet (PoE) and voice over Internet (VoIP).

Most promising solution

All these require management of high voltages and/or high currents in combination with sophisticated control logic, and often in harsh environmental conditions – such as high temperatures for cars or complex electrostatic discharge environments during assembly and over the lifetime. Demands vary according to application.

The main targets for developing deep submicron smart-power technology to address these markets successfully are to improve the robustness, performance and cost of future highly integrated SoC components. It will require the development of specific failure-mechanism-analysis and acceleration techniques as well as reliability and quality requirements for safety-critical devices.

This will also require the capability to interface directly with the outside world, controlling a variety of actuators from displays to stepping motors. Common applications are in: cars – especially body

and engine control; industrial processes – particularly robotics; and domestic consumer equipment – with the increasing penetration of information technologies in home appliances.

New bipolar CMOS/DMOS (BCDMOS) technologies with the integration of smart power in core digital CMOS technology appear to be the most promising solution to address these markets successfully.

Developing new standard

The MEDEA+ 2T205 SPOT-2 project is intended to boost deep submicron smart-power technologies. Success will provide a major boost for this technology and strengthen European chipmakers with the result of becoming a de-facto industrial standard. Advanced smart-power processing technologies will enable a new class of products, combining high performance computation and high power management capabilities.

SPOT-2 is setting out to develop and compare new generations of smart-power technologies. Co-operation will favour the exchange of technology data between partners that include major European chipmakers, their materials suppliers and foundry-tool manufacturers.

Several approaches are being explored and developed, aiming at benefits for the target applications of the industrial partners. The two main technologies of deep submicron BCDMOS, one based on bulk silicon and the other on silicon-on-insulator (SOI) substrate materials, will be compared. The challenges involve increasing voltages while shrinking geometries to 180 and 130 nm from current production technologies at 0.35 μm. The state-of-the-art in this field involves bulk or SOI BCDMOS high voltage drivers, with breakdown voltage of typically 60 to 80 V.

The smart-power roadmap is driven by the CMOS part to get more and more intelligence on the same silicon die. For this reason, the smart-power More than Moore roadmap is around three technology generations behind the CMOS More Moore roadmap.

Strong competitive position

Road accidents are amongst the top causes of death and injury in the EU. Research shows technology developed in SPOT-2 will enhance automotive system performance, reduce system cost and improve time to market for new safety applications.

Production of semiconductor components with thousands of process parameters and hundreds of process steps will never be 100% error free. Even the largest chip-testing programmes cannot guarantee absolutely secure operation within the harsh automotive environment over the total life cycle of a car. Embedded diagnostics, redundant architectures and an enormous amount of fault tolerance are necessary to guarantee car-driver security and system reliability in safety applications. For the first time, deep-submicron smart-power technology will offer such ingredients, providing a large amount of logic circuitry operating at high speed.

A successful outcome of this project will secure a strong competitive position in the European automotive, Internet communications and industrial sectors. It will enable project partners to be world leaders in both technologies, with additional knowledge of the advantages and disadvantages based on benchmark results, even under different application-specific requirements.

Immediate applications

This MEDEA+ project will have immediate application in the product portfolios of the industrial partners. Additionally, new demonstrator platforms will be available for industrial evaluation of next-generation cell concepts and process options developed by the research partners.

The capability of SoCs integrating several complex functions will bring a competitive cost advantage to the automotive electronic equipment manufacturer. It will also lead to creation of high level jobs required to keep Europe as the driving force in the worldwide automotive industry. And, on the materials side, Europe will be in position to exploit new SOI material evolutions, increasing market share in silicon-like substrates for power applications.

New technology will be offered to all design centres with powerful support, design kits and intellectual property (IP) block libraries. With the new combined complex and high voltage technology, new solutions are possible. Moreover, the technology can be used by many small and medium-sized enterprises (SMEs) and will support the development of the smart-power electronics, smart sensors and actuators required worldwide.

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MEDEA+ Σ!2365 is the industry-driven pan-European programme for advanced co-operative R&D in microelectronics to ensure Europe's technological and industrial competitiveness in this sector on a worldwide basis.

MEDEA+ focuses on enabling technologies for the Information Society and aims to make Europe a leader in system innovation on silicon.