Project result

Cluster for Application and Technology Research in Europe on NanoElectronics

CT206 | All-in platforms for cost-effective design and production of CMOS 32/28nm technology [UTTERMOST]

The UTTERMOST project brought together an alliance of European industrial businesses to offer total design, development and production platforms for CMOS 32nm and 28nm technologies. In doing so, UTTERMOST is providing ample opportunities for European companies to respond to an explosion in new portable devices with amazing technological capabilities and bandwidth-intensive multimedia applications. Crucially, this project will strengthen the competitiveness of European industry by providing complete solutions for low-power communications-centred, multi-core architectures.

UTTERMOST was built on earlier research done at the International Semiconductor Development Alliance (ISDA) and in the FP7 project PULLNANO. The latter demonstrated the feasibility of an SRAM 6T cell deploying 32nm design rules and e-beam lithography, and using FinFet transistor architecture (FinFet is a non-planar, multi-gate transistor built ether on bulk or on SOI substrate) and extreme ultraviolet at the IMEC research centre. In fact, all this prior research can be seen as the preparation phase in creating a new European CMOS technology node. The second phase – the UTTERMOST project – is largely the development phase leading to production and industrialisation.

All-inclusive approach

UTTERMOST represented a joint effort by major players in the European semiconductor ecosystem (operating around three leading semiconductor companies), working at the leading edge of technology. They collectively generated advanced-process modules and validated – at two European manufacturing facilities, deploying four product demonstrators designed by three application providers – a design platform for reliable CMOS 32/28 nm digital memory technologies based on 300 mm wafers.

In short, technology enablement was achieved through:

- Test-mask development for process validation;
- Extended library design and modelling;
- Design methodology enhancement and portability/scaling of libraries;
- Assessment of the integration choices in four major demonstrators.

UTTERMOST's key achievements and deliverables were:

- A technology node with two low-power (LP) design platforms and design enablement for 32nm and 28nm;
- Four complex demonstrators which validated the LP design platforms;
- A site for prototyping and industrialising a 28nm bulk LP CMOS using HK/MG gate (high permittivity gate dielectric with metallic gate electrodes) first, followed by innovative back-end-of-line (BEOL) – the second part of IC fabrication – for up to 10 metal levels. A second source-plant was also qualified.

Experience and expertise gained from the 28nm LP technology was crucial in the subsequent development of 28nm FDSOI technology and conversion methodology (from 28nm LP to 28nm FDSOI including the porting of the 28 LP libraries). In addition, the yield ramp of 28nm LP resulted in a much faster time-to-manufacture for 28nm FDSOI technology.

Qualification (industrial maturity) of the 28nm LP technology was achieved and the 32nm and 28nm technologies reached all their targets in terms of device performance and integration density, as well as, reliability. And design platforms met their dynamic and static power and speed targets.

Notably, complete design enablement of the 32/28nm technology node required individual validations for the 32nm version, and subsequently for the 28nm one. And the development effort did not stop at platform level. In fact, the work required to develop marketable products was significantly

Partners:

Cameca
CEA-INAC
CEA-LETI
CNRS-LTM
CNRS/CEMES
Dolphin Integration
Fraunhofer Institutes
GLOBALFOUNDRIES
IBS
INPG/IMEP
Intel Mobile Communications (formerly a division of Infineon Technologies)
SERMA Technologies
ST-Ericsson
STMicroelectronics
Thales Communications
University of Stuttgart

Project leader:

Gilles Thomas
STMicroelectronics

Key project dates:

Start: January 2010
End: May 2013

Countries involved:

France
Germany

PROJECT CONTRIBUTES TO

Communication	✓
Automotive and transport	
Health and aging society	
Safety and security	
Energy efficiency	✓
Digital lifestyle	✓
Design technology	✓
Sensors and actuators	
Process development	✓
Manufacturing science	✓
More than Moore	
More Moore	✓
Technology node	✓

higher than to develop the technology platform. That is why it was imperative to deploy product demonstrators.

Impressive European industrial and institutional support

Worldwide, the digital CMOS manufacturing industry is being streamlined, with increasingly fewer actors involved in digital CMOS. Crucially, UTTERMOST offered Europe a rare opportunity to put together such a large consortium for the purpose of industrialising a mainstream, leading-edge 'More Moore' technology.

The project consortium comprised 19 French and German partners which included major chipmakers, equipment manufacturers and research institutes. Project goals could only be met because of Europe's strong industrial and institutional bed of knowledge, experience and expertise in modelling, simulation and powerful physical and electrical characterisation tools to fully understand such sophisticated, state-of-the art technologies.

A position of strength

UTTERMOST is expected to strengthen the competitiveness of European industry by providing complete solutions for low-power communications-centred multi-core architectures. It will also contribute to new business development and boost Europe's position for innovative applications, particularly in communications components and chipsets using 32nm CMOS computing and storage power.

With project details widely available through some 168 publications, conference papers and one doctoral thesis, research organisations and academic teams will gain intellectual property and process module knowledge on industrial lines, enabling them to extend their influence and draw interest from industrial partners.

UTTERMOST's success also strengthens the position of equipment suppliers and enable them to innovate (eleven patents were filed) and expand further their product portfolio for silicon industry applications. This project will also provide ample opportunities for European companies to continue participating in the most advanced high-speed interfaces for new product creation. Such products will power portable devices that will define a wireless century characterised by pervasive broadband wireless communications and networking. This transformation is being driven by an explosion in bandwidth-intensive multimedia applications, as well as by the expanded technological capabilities of personal communications systems, air interface technology, IP networking and new architectures, such as mesh networking.

CATRENE (Σ! 4140), the EUREKA **C**luster for **A**pplication and **T**echnology **R**esearch in **E**urope on **N**ano**E**lectronics, will bring about technological leadership for a competitive European information and communications technology industry.

CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.

CATRENE Office
9 Avenue René Coty - F-75014 Paris - France
T. +33 1 40 64 45 60
E. catrene@catrene.org
www.catrene.org