Access provider – Holst Centre / imec

Select access type – Micro-Power Management

Micro-Power Management - Access description

A toolbox that includes near threshold computing and other methods for power consumption reduction by an order of magnitude to render an energy harvesting solution for long term system operability more likely. Methods to implement minimum power point tracking to improve harvester performance.

Technical offering

- Low voltage (near-threshold) standard cell libraries, including ultra-low voltage level shifter
- Recharacterization flow for existing technology cell libraries for specified PVT corners (NLDM, CCS, ECSM)
- Standard-cell memories operating at low voltage (down-to 0.3V)
- On-chip performance monitors
- Know-how and experience to identify critical timing paths for PVT corners

Main equipment

- High quality and accurate technology cell characterization flow
- Expertise in low power, low voltage standard cell and memory design
- Accurate power tracking tools by means of on- and off-chip power and performance monitors.
- (Power) simulation techniques for technology cells and memories.

Typical applications

Autonomous wireless sensor nodes – for home sensing, health, and automation – usually must as efficient as possible to assure (very) long operation times. By means of accurate real-time on-chip power tracking at an fine granularity an optimal/efficient power profile given the state of the application can be continuously selected: Low voltage (near threshold) / low frequencies during data collection phases, and high(er) voltage / high(er) frequencies during data processing phases.

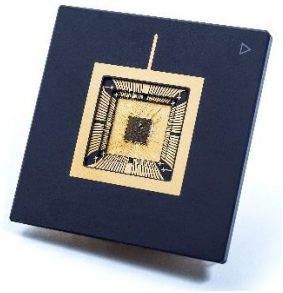
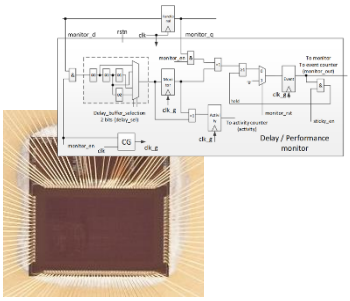
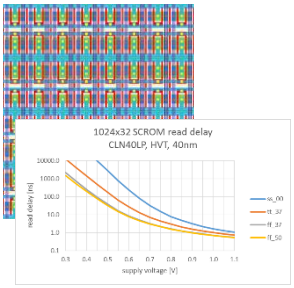
The ASIC used in these kind of systems is optimized for operating at ultra-low up to regular voltage by means of using technology libraries characterized in a broad range of PVTs.

Case study

An SME or research team developing a (multi-)sensor application requiring a power efficient and reliable chip / system solution to collect and process the data. EnABLES can provide chip and system (design) solutions to support the application development. EnABLES provides the development, analysis, simulation, characterization means to assure an efficient solution.

Responsible

Ir. Jan Stuyt

		
MUSEIC v3	**ULPSRP**	**Mask-programmable ROM**
Keys specifications		
• **MUSEIC measures heartrate (ECG), respiration (BIOZ) and motion** • **High performance, ultra-low power, miniaturized** • **DVFS for a large voltage range and frequency** • **During development re-characterized libraries used and low-power standard-cell memories.**	• **Low power processor** • **On-chip 'canary' performance monitor to perform real-time voltage and frequency scaling depending on required performance**	• **Mask programmable (VIA1)** • **Technology independent** • **Low voltage (≥0.3V)** • **Metal layers 1 ... 4** • **Uses Verilog $readmemh data** • **Silicon proven (40nm)**

Low-power technologies include a highly efficient multi sensor hub, known as Museic, which can handle an increasing number of bio-medical as well as off the shelf sensors. It has built in power point tracking and power management that enables our cardiac and activity monitoring device which weighs only 10 grams and consumes <1 μW.

Imec-NL also has a large toolbox including near threshold computing to reduce overall system power consumption by almost an order of magnitude.

Finally, Imec-NL is active in the development of next generation batteries and specific expertise in the characterization of battery performance towards implementations where duty cycling creates highly time-dependent energy consumption profiles.

Efficient power conversion techniques particularly at low voltages and power levels are needed by the user community, coupled with accurate device and system level models. To convert efficiently very low levels of input power from typical ambient energies (as low as a few μW), it is essential to understand the best possible trade-off between intrinsic consumption of MPM circuits and conversion efficiency.

Electronic interfaces based on recent commercial discrete components can provide a cost-effective solution with very low intrinsic consumptions (< 1 μA) but must implement simplified less efficient control schemes. To exploit sub-μW unprecedented applications of self-powered systems for IoT application, custom CMOS ICs provide advanced embedded micro-scale circuit optimizations with low intrinsic consumption.[23] Ambient energy sources can be very low and sporadic so provisioning for both homogeneous and heterogeneous sources must be made.[24] Moreover, a deep understanding of the EH transducers is necessary to design appropriate power management circuits.

Low power digital design and Maximum Power Point tracking toolboxes for IoT building blocks Offering (MPM) Simulation tools & libraries Testbeds & system optimisation tools.
A toolbox that includes near threshold computing and other methods for power consumption reduction by an order of magnitude to render an energy harvesting solution for long term system operability more likely. Methods to implement maximum power point tracking to improve harvester performance.