

# Versatile ultra-low power biomedical signal processor

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Flexible ultra-low power biomedical signal processor designed by imec, Holst Centre and NXP.

At today's International Solid-State Circuit Conference (ISSCC2011), imec, Holst Centre and NXP present a versatile ultra-low power biomedical signal processor, CoolBio, meeting the requirements of future wearable biomedical sensor systems. The biomedical signal processor consumes only 13pJ/cycle when running a complex ECG (electrocardiogram) algorithm at 1MHz and 0.4V operating voltage. This C-programmable chip is voltage and performance scalable supporting a frequency range of 1MHz up to 100MHz with an operating voltage from 0.4 to 1.2V.

Intelligent body area networks (BANs) consisting of wireless sensors nodes which continuously monitor vital body parameters such as heart,

muscle and brain activity promise to be a solution for more comfortable, cost- and time-efficient healthcare systems. They allow people to be monitored and followed up at home, doing their daily life activities.

A major challenge in developing such BANs is to bring overall power consumption down to a level where the system can be powered by energy harvesting or a microbattery that runs for months.

The CoolBio allows drastic power reduction of the wireless BAN sensor nodes. Processing and compressing data locally on the BAN node limits power hungry transmission of data over the wireless link, while adding motion artifact reduction and smart diagnosis at the same time.

Imec, Holst Centre and [NXP](#) started from the commercially available low power CoolFlux DSP baseband core from NXP (see [www.coolflux.com](http://www.coolflux.com)) to design an ultra-low power flexible processor solution for body area networks applications. The architecture and circuitry were adapted to operate at near-threshold voltage (0.4V) at low operating frequencies. Extreme separation into multiple voltage power, clock and memory domains were implemented to guarantee high energy efficiency from standby to 100 MHz performance. The result means reduced power consumption at low operating frequency, while maintaining high performance possibilities for multi-channel biomedical signal processing.

“We designed the CoolBio based on the concept: “If there’s nothing to be done, then don’t waste energy!” With this key research focus on low power circuit techniques, we succeeded in designing with our industrial partner NXP a biomedical processor suitable for future biomedical products offering an optimized balance between performance and power consumption;” said Harmke De Groot, program director imec the Netherlands at Holst Centre.

“Ultra low power dissipation is a critical requirement for ubiquitous deployment of Personal Health solutions. NXP continues to push the envelope on all critical functions required in wearable healthcare solutions. CoolBio complements our comprehensive ultra low power portfolio with which we enable solutions improving people’s quality of life;” said Bart De Loore, VP New Business at NXP.

Medical device companies, Semiconductor manufacturers or fabless design houses who aim to evaluate the CoolBio or to develop their own bioprocessor can build on imec’s expertise by joining imec’s research program on ultra-low power processing for body area networks, part of the HUMAN++ program.

Provided by NXP

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