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Take it to heart

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Consumers to get ECG body monitors

Low power ECG body monitors can become consumer items connected to your mobile phone with low power radio and sensor technologies, writes **Richard Wilson**

Within a few years we could all be wearing wireless heart-rate monitors that transfer data to be stored on our mobile phones.

Analog Devices and Texas Instruments can offer the low power electrocardiogram (ECG) front-end devices which would make consumer-priced, battery-powered heart-rate and blood pressure monitors possible. They have now been joined by Plessey Semiconductor with its first 'electric potential' ECG sensor IC. Imec and Holst Centre have gone one step further and integrated its low power ECG chip with a Bluetooth Low Energy radio.

The aim of all these suppliers is to tap into the potential market for personal body health monitors, and for that a low-power radio link seems necessary. Imec said the low-power design means that when transmitting heart rate data, for example, the system will consume 280µA at 2.1V, running continuously for one month on a 200mAh Li-Po battery.

When transmitting accelerometer data (at 32Hz) on top of the heart rate, the power consumption remains below 1mA in continuous operation, giving about a week of autonomy.

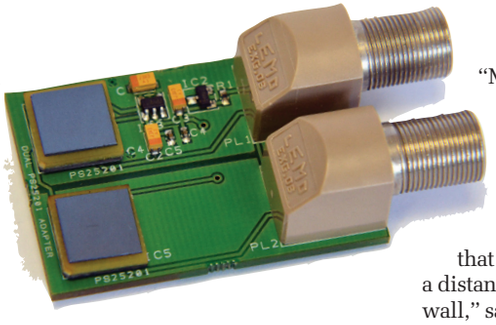
The big prize is the mobile phone market. It is expected that Bluetooth Low Energy (Bluetooth 4.0) will be integrated as standard in smartphones from next year, which could open the way for new healthcare monitoring applications.

At the heart of the Imec patch is an ECG system-on-chip (SoC), a mixed signal Asic. Next to monitoring 1- to 3-lead ECG, the ECG SoC also monitors the contact impedance, providing real-time information on the electrode contact quality. This can be used to evaluate the quality of the ECG measurement and to filter motion artifacts. The SoC has been designed to run algorithms for motion artifact reduction (based on adaptive filtering or principal component analysis) and beat-to-beat heart rate computation (based on discrete or continuous wavelet transforms).

It has additional computation power to run application-specific algorithms such as epileptic seizure detection, energy expenditure estimation or arrhythmia monitoring. The built-in 12-bit ADC is capable of adaptive sampling – sampling QRS waves at high frequency, and the other waves at a lower frequency – achieving a compression ratio of up to five. The monitor is part of the Human++ program being carried out at Imec and Holst Centre addressing healthcare technology.

Plessey Semiconductors is sampling its Electric Potential Integrated Circuit (EPIC) sensors targeting ECG applications. "The first EPIC products are designed for ECG applications for health and patient monitoring as well as fitness and wellness applications," said Derek Rye, Plessey's marketing manager.

The EPIC sensor measures changes



in an electric field in a similar way to a magnetometer detecting changes in a magnetic field. The technology works at normal room temperatures and functions as an ultra-high, input impedance sensor that acts as a highly stable, extremely sensitive, contactless digital voltmeter to measure tiny changes in the electric field, down to milliVolts.

"The next release products, available later in this quarter, will be optimised for movement sensing where applications range from security to automotive, to safety through to gesture recognition applications," said Rye. "We are working on end applications where the potential volumes are in millions per month. This is all very exciting for the company."

A feature of the EPIC sensors are that they are dry contact so that no gels or similar fluids are required to make contact. The sensors can be cleaned between uses – unlike conventional ECG sensors that have to be disposed of after every use at a cost of $2 a set. The supplier also claims that fewer sensors are required to monitor the body while the patient lies down.

"Most places on Earth have a vertical electric field of about 100 Volts per metre. The human body is mostly water and this interacts with the electric field. EPIC technology is so sensitive that it can detect these changes at a distance and even through a solid wall," said the supplier. The sensor is being offered in two package formats. The PS25101 is supplied in the same custom engineered, metal or plastic disc style, probe assembly that was used for the first prototype sensors and demonstration systems. This comes complete with a connecting lead and DIN plug termination.

Analog Devices has ECG front-end chips, which incorporate pacemaker pulse detection and respiration measurement. The ADAS1000 is intended for the design of a five-electrode ECG system. It uses a DC-coupled channel implementation that offers simplified input switching and reduced power. It will operate five ECG electrode measurements from as low as 19mW.

Texas Instruments also has ECG front ends, designed to be sufficiently low power for portable patient monitoring and consumer medical applications. The eight-channel, 24-bit ADS1298 has a specified power efficiency of 1 mW/channel.

www.analog.com
www.imec.be
www.plesseysemi.com
www.ti.com