

## Ultra-Low-Power Wireless Technology of the MEDICS Partner Zarlink Semiconductor Used in Swallowable Camera Capsule

MEDICS, the European Competence Centre for Biomedical Microdevices, specialises in the application areas of telemedicine, active implants, medical ASICs and biomedical sensors. MEDICS' know-how is based on the close collaboration between the applied R&D organisations Fraunhofer IBMT & CSEM, newcomer i2m-design and the global player Zarlink Semiconductor. This unique combination of expertise enables MEDICS to support customers in the improvement of existing devices, as well as in the development of completely new and innovative types of applications. For example, MEDICS partner Zarlink Semiconductor recently announced that they have developed a new ultra low-power technology used by Given Imaging in the world's only swallowable camera capsule for wireless endoscopy. Where traditional endoscopy requires a hospital stay, in comparison the patient simply swallows Given Imaging's M2A camera capsule, then continues with their normal daily activities over the course of an 8- to 12-hour examination.

Published medical articles conclude that camera capsule endoscopy has a higher diagnostic yield than traditional, invasive methods in diagnosing patients with disorders of the small intestine, including Crohn's Disease and small bowel cancer. Zarlink's European Medical Design Centre in Järfälla, Sweden, develops high-performance analogue and mixed-signal integrated circuits (ICs) for in-vivo and audiology products, such as cardiac pacemakers, defibrillators, surge protection devices and hearing aids. Today, Zarlink's skills are being put to new uses. The combination of ultra low-power, audio processing and wireless design know-how opens the door for a wide range of novel communication tools and advanced health-monitoring applications. Zarlink offers radio frequency (RF) transceivers optimised for short-range performance (up to 10 m) with the lowest number of external components and which consume the lowest power.

The development of fully integrated medical devices and emerging communication applications relies on the same core skills provided by Zarlink's Ultra-Low-Power Communications group:

- System architecture knowledge optimised for low-power applications
- Analogue circuit design that takes advantage of every available nanoamp
- Sub-threshold complementary metal oxide semiconductor (CMOS) circuit design techniques enabling complete system-on-chip solutions
- Layout experience gained from years of ultra-low-power development
- Careful use of clocks trees/grids, domains, gating and buffering.

Given Imaging's M2A capsule endoscope is the world's first swallowable camera capsule used for diagnoses of the gastrointestinal tract. The M2A capsule consists of a microchip camera, light-emitting diodes that act as flash, an antenna, two 1.5 V silver oxide batteries and Zarlink's RF transmitter chip. The RF transmitter chip is manufactured in 0.35µm CMOS technology, requires a voltage of 2.6 to 3.2 V and transmits on a 403, 432 or 434 MHz carrier. This allows a data rate of 2,700 kbit/s over a distance of 1 m while having a power consumption of 5.2 mW.

The disposable camera capsule is easily swallowed by the patient and travels naturally through the gastrointestinal tract while transmitting two high-definition, full-colour images per second to a belt receiver worn by the patient. Over the entire procedure, the RF transmitter relays more than 60,000 images from the camera capsule to the receiver. Images are downloaded to a workstation and a video of the camera's

journey is produced that potentially reveals pathologies and diseases of the previously unobservable small intestine.

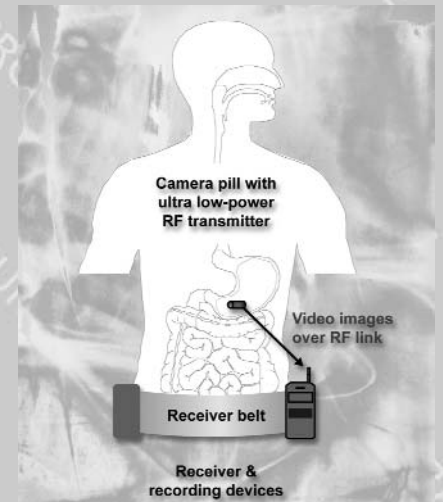


Figure 1: Going where no camera has gone before, Given Imaging's M2A camera capsule includes imager and RF chips that can operate over an 8- to 12-hour examination.



Figure 2: Zarlink's breakthrough ultra-low-power wireless technology is used by Given Imaging in the world's only swallowable camera capsule, measuring just 26 mm x 11 mm. Zarlink's transmitter chip relays camera images as it passes through a patient's gastrointestinal tract.

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## Fully Integrated Home Blood Glucose Monitor Incorporating Microfluidics

Self-monitoring of blood glucose is a cumbersome procedure that includes many steps and leaves potentially hazardous waste. It is a painful and inconvenient procedure hindering good monitoring compliance, which has been demonstrated to improve the long-term care of diabetic patients. Recent commercial trends have involved minimising the number of steps in the testing process and reducing the blood sample volume required. However, to date no commer-

cially available device features a truly one-step procedure. In order to make such a device a reality, the following needed to be achieved:

- Provision of very low-pain lancing while reliably obtaining blood
- Integration of many sensors into a suitable cartridge
- Incorporation of suitable microfluidic structures

LICOM partner, Cranfield Biotechnology Centre (Silsoe, UK), has worked with Pelikan Technologies Inc. (Palo Alto, USA) to develop a novel blood sampling and measurement platform that integrates and automates the various steps involved to make glucose testing a seamless one-step procedure. This not only improves ease-of-use and convenience but also significantly reduces the pain of lancing. The first commercial glucose monitor to be based on this technology platform will feature a disposable disk, which will allow 50 glucose tests to be

carried out with "smart" one-step, one-button operation. Users will not have to handle or dispose of individual test strips or lancets.

This fully integrated approach means that the user no longer has to see the blood drop in order to be able to transfer it to the glucose strip, a feature that will allow such a device to use blood volumes significantly lower than those offered by the best systems today. This makes possible multiple tests on the same blood sample, which results in improved precision and / or an expanded test menu. The development of high-density sensor arrays suitable for low-volume fully integrated applications will also become a possibility.

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## Foundry Services - the Way to Fabless Production

More than 15 years of experience in microstructure foundry service - this is the competence HL-Planartechnik offers its customers. A modern 4" and 6"-wafer facility provides deposition of various materials like Ni, NiFe, NiCr, Pt, Au, Pd, Ti, BiSb, TiW, CrSi and others on request and lithography in up to 3 µm with dry or wet etching processes. A quality certificate for ISO/TS 16949 confirms the intention of HL-Planartechnik to satisfy its customers.

It was possible to realize more than 60 projects within the Europractice

foundry service. The deposition and lithography of Pt or Au microstructures used as electrodes for chemical or biosensors are examples of basic foundry service tasks. Silicon dry or wet etching technologies to produce V-grooves, cavities or SiON membranes gave engineers the chance to create their own microsystems used for fluidic components, optical fibre switches or mass airflow sensors.

Ordering special designs for magneto-resistive sensors in multi-project wafers enables developers to find

their optimal product design for angle, position or even current sensors. Using foundry services gives customers the opportunity to develop and produce Microsystems without risk of investment in high-technology machinery.

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## LICOM's first Microfluidic Symposium

The 1st Microfluidic Symposium, organised by LICOM at the Hanover Fair on 22 April, was attended by 50 participants and was widely regarded as a great success. Overall, 15 internationally renowned experts from academia and industry presented the state of the art in research, engineering and commercialisation of mi-

crofluidic technologies in all kinds of industries. The feedback from the audience was very positive and encouraging. The event was considered to be an excellent platform for experts as well as newcomers for stimulating discussions, gathering the latest information and for networking activities. For further information, LI-

COM is offering a download service at [www.licom.net/symposium](http://www.licom.net/symposium).

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## Eurotraining - Microsystems Technologies

With the success of microelectronics, many technologies have been available for mass-producing systems with micro (and now nano) feature size. Micro Systems Technology (MST) has been created in order to exploit this mass-production capability towards design devices capable of processing also non-electrical signals. The micro- & nanosystems are emerging technologies with an increasing importance for the European industry. As a logical consequence, education in these technologies is the key towards success.

The competences needed for the design and study of MST are actually not provided by any established course of study, and there is the need to gather the best knowledge already present to create a basis for efficient training of professionals in this field. There is a big need for not only standard training but above all for specific university education in MST, covering the complete technology and the technologies associated to it.

In the near future training in MST will strongly improve through the new IP projects and the Network of

Excellence that will be established under the 6th framework, as dissemination of knowledge through training is mandatory in these projects. The next objective is to create an educational structure of all these courses in order to become an expert in MST. EuroTraining started one important asset in order to pursue this goal.

EuroTraining launched the non-commercial training service addressing academic members and experts in Microsystems. The aim of the initiative is to provide easy access to training material by combining expertise and competences through the sharing of educational resources. A special section - a training bank - has been created to become part of the renowned EuroTraining Course Directory, in order to host the MST educational material; access is restricted to authorised members of the service only. The purpose of the service is to create a high-quality collection of MST training material including the mathematics, chemistry and mechanics of Microsystems technologies as well as exercises and laboratory facilities.

At the moment, the Microsystems University Service hosts more than 60 courses divided between lectures and assignments. EuroTraining is looking to encourage European universities, academic organisations and experts involved in Microsystems research and education to collaborate in order to make this initiative a success. If you have Microsystems course material and are willing to share this information, please do contact us.

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## EUROPRACTICE Winning Projects VC Start-up Funding Forum

November 04, 2004, Institute of Physics, London / UK

Are you looking for an investment opportunity from £500k - £3m in a MNT (Micro & Nanotechnology) start-up company?

The Europractice VC Start-up Funding Forum will provide you with the opportunity to assess the 10 winning projects of the competition to find the most promising MNT (Micro & Nanotechnology) start-ups in Europe. The winners have been provided with support by the EU to bring their ideas to the marketplace and are from the UK, France, Germany and Belgium.

The projects include:

- Micro Scanner component for image projection
- A device for monitoring UV sunlight exposure
- Peak flow meter for the accurate diagnosis of asthma
- Non-invasive monitoring of blood

glucose

- Fabrication of printing stencils for electronics manufacturing
- Provision of MEMS reliability, testing, analysis and process optimisation
- Microarrays for genotyping and pharmaceutical development
- Pen-sized portable print scanner
- Pressure sensors for medical catheters and automotive applications
- Pumping of fluids in microscopic channels for biotechnology

If you would like to attend please book early to avoid disappointment, you can register by emailing [julie@tfti-ltd.co.uk](mailto:julie@tfti-ltd.co.uk). There is no charge for this event as it is being sponsored by Europractice however numbers may have to be restricted. More information on: [www.europractice.com](http://www.europractice.com)

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