

EDITORIAL



Energy harvesters finally challenging battery-powered WSN solutions

Today, energy conservation is one of our biggest challenges. One promising solution is energy harvesters, which offer clean, perpetual powering of small systems. In fact, it appears that the energy harvesting industry is currently undergoing a new cycle of market expansion. Since 2008 the industry has grown significantly, thanks to the construction business.

Yole Développement believes energy harvesters will be the dominant application for the next five years, equipping 25% of all wireless modules by 2020. Energy harvesters will impact industries that use wireless sensors based on vibrational or thermal actuation by driving costs down due to less power consumption. As for buildings, wireless sensors that utilize energy harvesters will be used to monitor industrial processes for better maintenance.

On the flip side, we believe that other applications such as automotive and transportation will remain unchanged, and that these applications are unlikely to be a significant part of the energy harvesting business before 2017. The TPMS application is no longer the killer app for energy harvesters; manufacturers have shown less interest over the last few years, and the prospects for TPMS are now uncertain. On the technical side, we believe thermal energy will be the fastest growth opportunity for energy harvesting, eventually representing one quarter of all energy harvester units. Other mechanical energy sources will grow at the second-fastest rate, followed by solar.

In this landscape, MEMS could offer low-cost integrated devices, specifically for automotive. However, cost is still a challenge.

Yole Développement has just released its "Emerging Energy Harvesting Devices" report. Inside, you'll find a complete analysis of the dynamics surrounding this promising technology.

Dr. Éric Mounier
Editor-in-chief

MEMS

MEMS microphone with high signal-to-noise ratio

TDK presents the new EPCOS C914 MEMS microphone. It offers a particularly high signal-to-noise ratio (SNR) of 65 dB(A) in the frequency range from 20 Hz to 20 kHz. It is thus particularly suitable for demanding audio applications in smartphones.

Its high SNR improves the audio quality considerably when the signal source is distant from the microphone, such as in video recordings or hands-free talking.

Thanks to the innovative design of the C914, the distortion is no more than one percent even at a sound volume of 128 dB. In contrast to this, an improvement of the signal-to-noise ratio of conventional microphones as a rule leads to a strong rise of the nonlinear distortion at high acoustic pressures...



EPCOS C914 MEMS microphone (Courtesy of EPCOS)

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IMAGE SENSORS & OPTO

Tessera Technologies announces third quarter 2012 results

Tessera Technologies announced its results for the third quarter ended Sept. 30, 2012. Total revenue for the third quarter of 2012 was \$72.7 million.

Generally accepted accounting principles (GAAP) net loss for the third quarter of 2012 was \$1.1 million, or \$0.02 per basic share.

Turning to our DigitalOptics segment, in the third quarter we made further progress towards our goal of shipping our MEMS autofocus technology in the fourth quarter. We also began construction of our optical component manufacturing site in Taiwan and

began converting our production facility in Zhuhai, China to enable the manufacture of our next-generation MEMS camera modules, which we anticipate shipping in the first half of 2013," stated Robert A. Young, chief executive officer and president, Tessera Technologies...

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POWER ELECTRONICS

Fujitsu Semiconductor will start production of GaN power devices in 2013

Fujitsu Semiconductor achieves high output power of 2.5kW in power supply units for servers.

Fujitsu Semiconductor announced that it successfully achieved high output power of 2.5kW in server power supply units equipped with GaN power devices built on a silicon substrate.

Fujitsu Semiconductor aims to start volume production of the GaN power devices in the second half of 2013...

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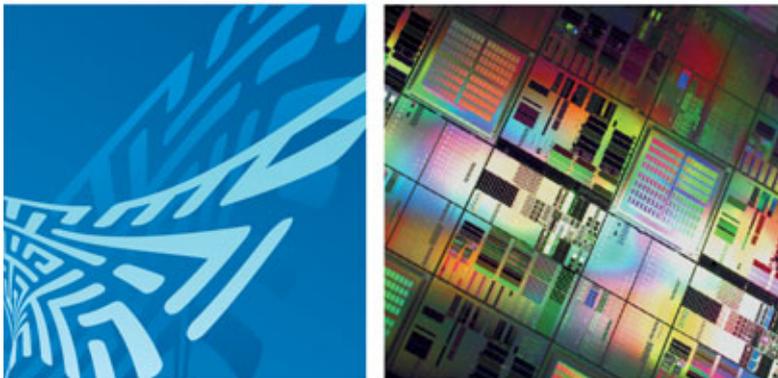
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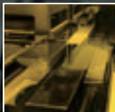
Go to www.i-micronews.com to read the latest news:

- **MEMS**
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INSIDE ...

Dainippon Screen's direct imaging system for advanced packaging

Dainippon Screen is branching out from the front-end of the semiconductor industry into the 3D packaging & MEMS arenas with its direct imaging tool for wafer bumping and pillar formation operations.

Dainippon Screen, a.k.a. "SCREEN", is well known for its semiconductor manufacturing equipment. Founded in 1943 and headquartered in Kyoto, Japan, the company has evolved over the years to become the top supplier of front-end wafer cleaning equipment, as well a leading supplier in lithography equipment, media precision printing equipment, and flat panel display manufacturing equipment.

Making a move into new territory, the semiconductor back-end, Dainippon Screen's latest product is targeted at 3D packaging and through-silicon vias (TSVs)—particularly for wafer bumping and pillar formation operations. The MEMS industry should also find it appealing for wafer bumping applications. "We recognized that the latest progress in back-end manufacturing, such as 3D packaging and TSVs, required improved manufacturing technologies—especially to boost the current levels of manufacturing flexibility and efficiency," says Rolf Schmidt, sales manager, Frontier accounts, at Dainippon Screen. So Dainippon Screen decided to create a new back-end tool, a direct imaging system for advanced packaging—suitable for both 200mm and 300mm operations. "This is the first and only direct-imaging exposure system at the wafer-level for advanced packaging," Schmidt says.

A key feature of the lithography tool, called DW-3000, is that it eliminates the need for a photomask or reticle, which have traditionally been used for patterning, to enable patterning with greater speed and flexibility.

How did they eliminate the need for a photomask? At the heart of the tool is a proprietary optical system. "DW-3000's optical system is equipped with a twin drafting head that combines Dainippon Screen's grating light valve (GLV) device with high-power YAG lasers," explains Schmidt. "The GLV is the device that equips 8,000 laser beam channels, 'extremely fine ribbons,' above the base of a semiconductor chip to reflect light. By moving these ribbons up and down, it allows multiple light channels to be switched on and off independently."

Rolf Schmidt, Sales Manager Frontier Account, Dainippon Screen



Rolf is responsible for market introduction and sales of Frontier tools in EU/US/SEA. Prior to this position he was Key Account Manager and in charge of New Business Development.



Dainippon Screen's DW-3000, a direct imaging system for advanced packaging, is designed for 3D packaging, bump, and pillar formation applications (Courtesy of Dainippon Screen)

Essentially, the tool relies on 355nm-wavelength laser beams and a projection lens to write the pattern-data directly onto the wafer, and provides a resolution of 3.0µm, with 1.0 µm overlay accuracy, Schmidt explains. And synchronization with a high-speed stage results in fast, high-precision imaging. With its high-speed stage, the DW-3000 can achieve throughputs of 65 wafers per hour for 300mm wafers.

Since the industry is increasingly shifting to TSVs to achieve high integration of semiconductor devices with 3D packaging technologies, the DW-3000's low numerical aperture drafting head was specifically designed to provide advantages in TSV and bump formation processes, as well as sufficient focal depth for thick resists—resulting in extremely uniform patterning. If you ever need to modify or adjust a pattern, it can now be easily accomplished through a simple "mouse click"—rather than having to order a new photomask and wait weeks for it to arrive.

Yet another attribute of the tool is that it's designed to handle the huge issue of warped wafers and nonlinear distortion that frequently occur during thinning and attachment to the supporting substrate. How? By enabling wafer-to-wafer alignment with up to 400 alignment marks.

Besides patterning and alignment, the tool can scan distorted wafers and identify the locations of all alignment marks, then create new exposure data—aligning the software-based original exposure data with the true locations of the alignment marks.

"The ability to obtain high-yield and high-reliability

device performance, exceptional resolution, and overlay accuracy are essential," says Schmidt. "The DW-3000 is equipped with a global and local alignment capability that controls imaging data and enables correction for each individual wafer. This is critical for yield improvements with warped or distorted wafers."

"The DW-3000 also is capable of producing high aspect ratio and straight profiles for TSVs, even near the resolution limit," points out Schmidt. "And it produces perfect copper pillars on thick photoresist." In terms of production, the DW-3000 is equipped with plenty of options designed for advanced packaging. For example, it has the ability to image the main pattern and also put a unique identification number on each die at the same time, which greatly enhances device traceability. And a bridge tool allows you to choose to work with either 200 or 300mm wafers. There's even a way to mark defective chips.

Whether you're working on prototype development or running a small-lot multi-variation business or even dealing with rush or mass production, the tool's exposure system will enable you to ship advanced packages at high yield to your customers, Schmidt notes.

"Dainippon Screen is continuing to focus on further boosting productivity to meet the rapidly evolving needs of semiconductor manufacturing," says Schmidt.

REVERSE COSTING

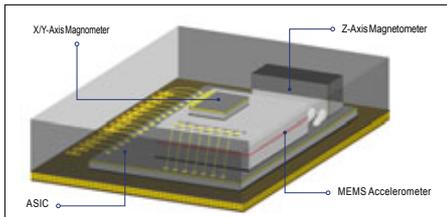
STMicroelectronics' LSM303D: 6-axis electronic compass

Following Bosch Sensortec and their BMC050 (see our article in Micronews#133), STMicroelectronics just released a 3x3mm e-Compass module integrating motion and magnetic sensing.

Targeted for consumer applications (Tilt-compensated compass, Map rotation, Position detection, etc.), the LSM303D provides accurate output across full-scale ranges up to ±16g (linear acceleration) and ±12 Gauss (magnetic field).

Technology analysis

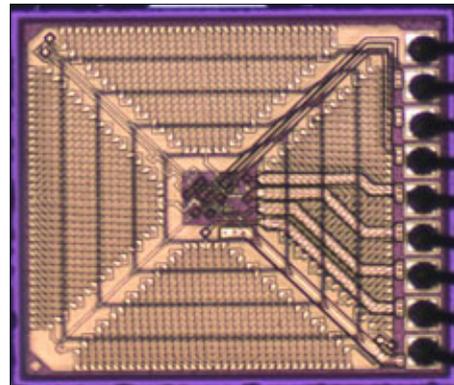
The LSM303D is a system-in-package featuring a 3-axis magnetometer and a 3-axis accelerometer.



LSM303D structure
(Courtesy of System Plus Consulting)



MEMS accelerometer cross-section
(Courtesy of System Plus Consulting)



X/Y-axis magnetometer
(Courtesy of System Plus Consulting)

The 3-Axis accelerometer uses ST's TSV process to remove the area reserved for I/O pads, generating an area savings of almost 20%.

Resulting from the partnership of ST and Honeywell, the magnetometer uses anisotropic magneto-resistive (AMR) technology. Two AMR dies are necessary to realize X/Y-Axis detection and Z-Axis detection.

Cost results

STMicroelectronics manufactures the 3-Axis accelerometer and the ASIC dies on 8-inch wafers in France and Italy. The magnetometer dies are supplied by Honeywell and manufactured on 6-inch wafers in the U.S. By focusing on die size reduction and the integration of only one ASIC to control the sensors, ST has managed to create a very cost-effective device.

The complete reverse costing report, combining technological analysis of the device and a detailed manufacturing cost, is currently available.

www.systemplus.fr

Recent reverse costing reports

- Bosch-Sensortec BMC050: e-compass
- InvenSense MPU-9150: MEMS 9-Axis IMU
- TI DLP: nHD Pico projector
- SETi UVTOP270: UV LED
- Mitsubishi CM450DY-24S: 1200V IGBT Power Module

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MEMS microphone with high signal-to-noise ratio

From page 1

Besides its outstanding performance features, the microphone has a footprint of only 3.35 x 2.5 mm² and an insertion height of 1 mm. At a supply voltage of between 1.64 and 3.6 V DC, its current consumption is only 300 µA. The output impedance of this RoHS-compatible component is 200 Ω. The main applications of the microphones are smartphones and consumer electronics devices. And the main features and benefits are

- Signal-to-noise ratio of 65 dB(A)
- Low distortion even at sound volumes of 128 dB
- Compact footprint of 3.35 x 2.5 mm² and an insertion height of 1 mm

www.epcos.com

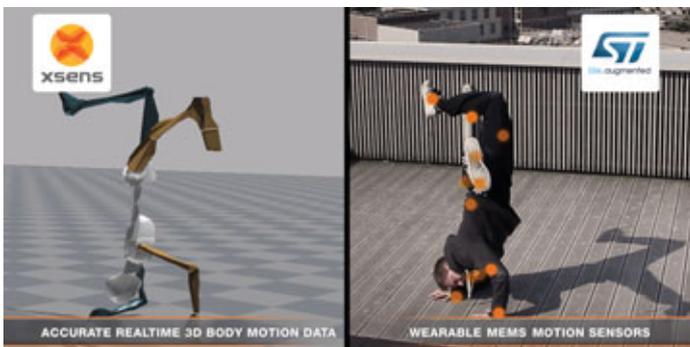
Xsens partners with STMicroelectronics to demonstrate wearable wireless 3D body motion tracking

Xsens and STMicroelectronics demonstrated the world's first wearable wireless 3D body motion tracking system based on consumer-grade MEMS combo sensors at Electronica 2012 in Munich, Germany.

Xsens built the demonstrator by combining Xsens' patented sensor-fusion algorithms and wireless protocols with STMicroelectronics' iNEMO-M1, the 9-axis "Smart System" combining iNEMO MEMS motion combo sensors and the STM32 microprocessor from ST. The demonstrator leverages ST's industry-leading motion-MEMS technology to showcase Xsens' strategy to leverage IP originally developed for the professional market (B2B) in movement science and the movie industry. Having supplied the motion-capture technology for Hollywood productions such as Alice in Wonderland, Iron man 2 and X-Men, Xsens is now reaching out to partners in consumer electronics to help create unique next-generation user experiences and solutions for 3D body motion tracking. "After our tremendous success in adding better realism and functionality to gaming systems, smartphones and tablets through Motion MEMS, it's time to inspire and lead new emerging applications," said Benedetto Vigna, Executive Vice President and General Manager, Analog, MEMS and Sensors Group, STMicroelectronics. "Xsens' unique 3D body motion tracking technology will help our customers innovate and deliver new solutions to their customers in sports, fitness, healthcare and gaming. We are at the dawn of a new era for Motion MEMS and we want to extend our leadership." "Wearable wireless 3D body motion tracking will enable the next wave of innovation in cloud-connected wearable sports, fitness, healthcare and gaming sensor accessories for smartphones. "Real-time 3D body motion data enables the development of apps that can recognize and classify complex motions such as sports techniques by digitizing your exact movements for immediate feedback and live sharing of the performance. With over a decade of experience in developing value added applications based on MEMS motion sensors, we are uniquely positioned to enable our partners to take the lead in this new era for Motion MEMS," adds Per Slycke, CTO and founder, Xsens.

www.xsens.com

www.st.com



(Courtesy of STMicroelectronics and Xsens)

MEMS and FOG
technologies
to fuel market
growth ?

Gyroscopes
and IMUs
for Defense,
Aerospace
& Industrial

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Freescale introduces new Xtrinsic Sensor for smart meter tamper protection

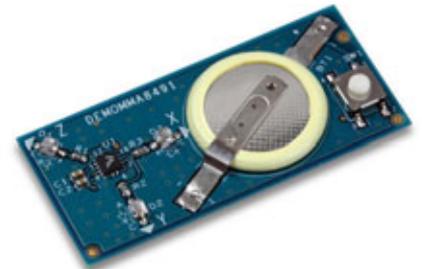
Energy-efficient 3-axis accelerometer delivers advanced motion detection accuracy and low noise for smart metering and industrial applications.

Freescale Semiconductor introduced a new accelerometer featuring ultra-low power consumption and a simple plug-and-play approach to tilt threshold detection for use in physical tamper protection for smart meter applications. Freescale's Xtrinsic MMA8491Q energy-efficient accelerometer expands the portfolio to industrial markets requiring wide pin pitch, visually inspectable leads and long product life cycles. "Smart meters are proliferating with the emergence of the connected home and smart grid, and protection from physical tampering is a critical requirement," said Seyed Paransun, vice president and general manager of Freescale's Sensor & Actuator Solutions Division. "Freescale is addressing this need with a simple to use, cost-effective and extremely low-power 3-axis accelerometer with specific embedded functionality." Designed for applications requiring reduced complexity and advanced system integration, the Xtrinsic MMA8491Q accelerometer for tilt threshold sensing plays an integral role in Freescale's system-level smart meter reference designs that detect physical tampering. Movement of the meter is detected through the change in tilt angle and communicated to the utility

company as a tampering event. The Xtrinsic MMA8491Q accelerometer was designed to be very flexible and useful for a wide variety of applications beyond smart metering in which orientation needs to be accurately measured – motion detection in gaming consoles and home appliances, for example. The accelerometer also is ideal for tracking asset handling in business and industrial settings and can be employed in eHealth and portable health monitoring systems. The Xtrinsic MMA8491Q accelerometer for tilt sensing features X-, Y- and Z-axis tilt threshold detect outputs and operates with reduced power capabilities that intelligently determine when a device should operate in a low-power mode or shut off, helping prolong battery life.

Additional features include:

- Dedicated enable pin: "On" for trigger one shot measurements; "Off" for shutdown mode and ultra-low current consumption at 10 nA
- Preconfigured tilt threshold detection triggers for simple plug-and-play integration
- 3-axis logic outputs (above/below threshold) provide tilt indicators



Xtrinsic MMA8491Q (Courtesy of Freescale)

- Low current consumption at 400 nA per Hz
- Programmable tilt threshold limits
- I2C functionality with +/- 8 g dynamic range for traditional accelerometer data capture
- 3 x 3 x 1.05 mm QFN package with solder visual inspectable pins at 0.65 mm pitch
- Wide range voltage supply functionality at 1.95 V to 3.6 V

The Xtrinsic MMA8491Q accelerometer is in production now for a suggested resale price starting at \$1.03 (USD) in 10,000-piece quantities.

www.freescale.com

Digital barometric pressure sensor BMP280 from Bosch Sensortec sets market reference

Based on the huge success of the predecessor in the mobile phone market, Bosch Sensortec releases the new BMP280 digital barometric pressure sensor with improved performance and the industry's smallest footprint. The BMP280 provides the absolute pressure value along with temperature measurements.

Today, the barometric pressure sensor is an inherent part of high-end smart phones. With its footprint of 2.5 x 2.0 mm² and a height of 0.95 mm in an 8-pin metal-lid LGA package the sensor offers highest design flexibility. This way, it can easily be implemented into multifunctional sports wrist watches. Furthermore, the power consumption has been reduced by a factor of 4. Its low current consumption of now only 2.7 μ A and its wide measurement range from 300 to 1100 hPa make the BMP280 ideally suited for all battery driven outdoor applications. The BMP280 offers a significant improvement of the absolute accuracy. Nevertheless, it shares with its predecessor BMP180 its very high relative accuracy of ± 0.12 hPa, which is equivalent to only ± 1 m difference in altitude. This is beneficial for all applications where the pressure sensor is used to complementarily support the GPS system in order to obtain more precise and faster position determination. The sensor noise has been reduced by a factor of 2.3. The offset temperature coefficient of the new device amounts to only 1.5 Pa/K, translating to an altitude stability over temperature of 12.6 cm/K and the resolution of the pressure measurement could be melted down to 0.18 Pa (1,5 cm). The BMP280's low TCO and its high resolution will become noticeable in applications requiring the user's precise altitude. E.g. location based services on handheld devices require the vertical position of a user within a building



BMP280 from Bosch Sensortec (Courtesy of Bosch Sensortec)

even if the device temperature changes by several degrees Celsius. Thus, for its accurate pressure reading, the BMP280 is ideally suited for floor tracking in in-door navigation applications. The sensor is equipped with both I2C and SPI communication interfaces. Three power modes and separately configurable oversampling rates for pressure and

temperature measurements empower designers to freely adapt the BMP280 to the use-case. The optional integrated IIR filter eliminates short-term measurement variations caused by environmental influences. Proven settings are available for specific use-cases such as weather logging or indoor navigation.

www.bosch-press.com

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MEDTECH: MICROFLUIDICS & BIOMEMS

Fluigent and Micronit Microfluidics have entered into a co-promotion agreement, enabling to promote each other's products.

Fluigent has already integrated Micronit chips and chip holder in its demonstration package at customer sites and conferences.

Micronit has set-up a Fluigent fluid handling system at its site, for chip characterization and for demonstration purposes. The Parties aim at leveraging on each other technical expertise and market experience, to offer products that can be easily integrated into any microfluidics experiments for R&D laboratories and industrial applications. Micha

Mulder, Managing Director of Micronit is excited about the products of Fluigent: "The Fluigent system works perfectly with our microfluidic chips. It's really a plug and play system and is capable of very precise manipulation of liquids in microchannels because it makes use of pressurized reservoirs. We also got positive feedback from customers that use the Fluigent

system with our chips and holder." François Leblanc, CEO of Fluigent is glad to join marketing and promotion activities with Micronit, "We are excited to announce this collaboration with Micronit, a major independent player in microfluidic chip design and manufacturing."

www.fluigent.com
www.micronit.com

Japan's Fuji in talks to buy Given Imaging for \$750M

Given Imaging's talks for a sale are apparently most advanced with Japan's Fujinon, a unit of Fujifilm Holdings.

Market sources say that a deal is under discussion at a company value of \$750 million for Given Imaging, a 34% premium on its \$561 million market cap.

Given Imaging's share price rose a further 5.8% by mid-afternoon on the TASE to NIS 73.85, continuing

its rise since announcing last Thursday (18/10/2012) that it was in talks for a merger or sale of the company.

Elron Electronic Industries a subsidiary of Nochi Dankner's IDB Holding Corp. unit Discount Investment Corporation, owns 22% of Given Imaging, and

Discount Investment owns 15.26%. Given Imaging has received several queries about an acquisition.

To read the complete article, please visit *Globes website*.

www.globes.co.il

RainDance Technologies and Integrated DNA Technologies to develop reagents and consumables for digital PCR

Collaboration will provide best-in-class solutions for RainDance's RainDrop Digital PCR System.

RainDance Technologies, the Digital Biology™ Company, and Integrated DNA Technologies (IDT) announced a collaboration focused on consumables specifically tailored to perform the fast-growing application of digital PCR. Under the terms of the agreement, the companies will work together on the development of reagents compatible with the RainDrop™ Digital PCR System. Financial terms of the agreement were not disclosed. The RainDrop Digital PCR System is a breakthrough research platform that is transforming the performance of molecular assays by enabling digital answers across a number of important applications including low-frequency tumor allele detection, gene expression, copy number variation, and SNP measurement. Built using RainDance's proven RainStorm™ picodroplet technology, the RainDrop System generates up to 10

million picoliter-sized droplets per sample. Since each droplet encapsulates no more than a single molecule, researchers can quickly determine the absolute number of droplets containing specific target DNA and compare that to the number of droplets with background, wild-type DNA. "We have achieved a new gold standard in sensitivity, quantitation and multiplexing through enhancements in every aspect of system and reagent refinement," said Rena McClory, Ph.D., Marketing Director for Digital PCR at RainDance Technologies. "We are pleased to be working with market leaders such as IDT on the development and broad availability of best-in-class reagents in support of our new RainDrop Digital PCR System." IDT is a leader in manufacturing and developing custom oligonucleotide products for use in the research and diagnostic life science markets.

This includes design and synthesis of dual-labeled probes for gene expression and genotyping as part of the PrimeTime® qPCR product family. Founded by Dr. Joseph Walder in 1987, IDT's development has been guided by an uncompromising approach to quality, a belief in the value of good service, and a determination to minimize consumer costs.

"We are pleased to be working with RainDance in supporting scientists who are seeking to apply the powerful attributes of digital PCR to their research projects," said Stephen Gunstream, Sr Vice President of Marketing and Strategy at IDT. "Digital PCR is redefining the science of directly quantifying and amplifying nucleic acids and will open the doors to an exciting era of new discoveries."

www.RainDanceTech.com

Cellectricon and Fluxion settle microfluidic cellular analysis IP dispute

Cellectricon and Fluxion Biosciences announced they have settled a legal dispute dating back to 2009 in which Fluxion was accused of patent infringement.

Under the terms of the settlement, the firms will cross-license patents related to microfluidic cellular analysis. Cellectricon and Fluxion said they will ask the US District Court for the Northern District of California to dismiss all claims that Cellectricon brought against Fluxion involving US Patent Nos. 7,390,650; 7,470,518; and 7,563,614. "Resolution of this lawsuit allows us to focus on providing innovative and enabling products and discovery services for drug discovery and life science

research globally," Cellectricon CEO David Burns said in a statement. Jeff Jensen, CEO of Fluxion, added, "We believe it is a win-win for both companies, and will benefit our customers as we can now focus all of our attention on developing and providing solutions that continue to deliver maximum benefit to them." When Cellectricon sued Fluxion, it alleged infringement of four patents — the three covered by today's settlement announcement, as well as US Patent No. 5,376,252, a patent held by Gyros but

licensed to Cellectricon. The firms settled the dispute over the '252 patent late last year.

The patents covered microfluidic technology used in Cellectricon's ion channel drug screening solution, the Dynaflo HT System. Cellectricon had claimed Fluxion's IonFlux automated patch clamp system infringed the patents, as GenomeWeb Daily News' sister publication BioArray News previously reported.

www.genomeweb.com

COMPOUND SEMICONDUCTORS

Development of GaN wafers nearly doubling green LED luminous efficiency

NGK Insulators has announced the development of high-quality GaN wafers that significantly reduce defects and roughly double the luminous efficiency of green LEDs over previous models.

NGK achieved this breakthrough by using a crystal growth technology that it has improved through a proprietary approach.

The GaN wafers developed by NGK feature low defect density across the entire 2-inch diameter of the wafer surface and have a colorless transparency. NGK achieved this through proprietary improvements to liquid phase epitaxial technology for single crystal growth. In joint research carried out with Nagoya University, green LED chips formed on the NGK GaN wafers showed a 60% internal quantum efficiency

(injection current density of approximately 200 amperes per square centimeter). This figure is roughly double that of the green LED chips currently on the market.

In previous LED chips using sapphire wafers as substrates, defects of light emission layer were common, especially for green LEDs. These defects prevented a large operation current, which in turn prevented the LEDs from achieving sufficient brightness. This issue can be addressed by the use of the low-defect GaN wafers produced by NGK as substrates that enable dramatically improved light

emission layer quality. The reduction in current loss that results allows for a large current, making high brightness green LED elements a reality. When these elements are used to make up green LED light sources, the result is an improvement in brightness of more than 20 times compared to previous models. Light sources can also be made more compact thanks to the simplified heat dissipation structure made possible by less heat generated from current loss. This control of heat-related degradation also enables longer product life.

www.ngk.co.jp

Cree releases new-generation 50-V GaN HEMT technology to significantly reduce cellular-network energy needs

Cree introduces a range of new 50-V GaN HEMT devices enabling a significant reduction in the energy needed to power cellular networks.

The world's cellular network is estimated to consume more than 100 TWh of electricity per year (approximate value of \$12 billion US Dollars) and 50–80 percent of the networks' power is consumed by the systems' power amplifiers and feed infrastructure. Leveraging this new, innovative Cree® technology, radio base-station power amplifiers have demonstrated performance improvements of more than 20 percent over incumbent technology at 2.6 GHz operating under the latest 4G LTE signals. This increased power amplifier efficiency could save an

estimated 10 TWh per year, the equivalent power output of two nuclear power plants. While operational cost savings from increased efficiency can be significant, additional substantial savings are also possible in the acquisition cost of the system. A higher-efficiency power amplifier can help OEMs save capital equipment costs through simplified cooling, and the higher-voltage GaN components can lower the cost of AC-to-DC and DC-to-DC converters. Overall, the impact on the total bill of materials can be as much as 10 percent, leading to significantly lower system costs.

Cree's 50-V GaN HEMT transistors operating at 100-W or 200-W output powers are now released for both the 1.8 – 2.2 GHz and 2.5 – 2.7 GHz frequency bands. The devices are internally matched for optimum performance, enabling wide instantaneous bandwidths. Cree 50-V GaN HEMT transistors are ideal for use in high-efficiency Doherty power amplifiers where power gains higher than 18 dB at 2.14 GHz and 16 dB at 2.6 GHz can be achieved respectively.

www.cree.com

DARPA GaN contracts go head to head

This work in Near Junction Thermal Transport (NJTT) is expected to set the stage for substantial MMIC performance enhancements including reduced size, weight, and power consumption.

To reach its current state of success and industry acclaim, gallium-nitride (GaN) technology had to overcome a number of performance challenges. Now, the technology may reach new heights, thanks to extended performance. Some GaN research and development efforts are currently underway with backing from the Defense Advanced Research Projects Agency (DARPA). TriQuint Semiconductor, Inc. has received a \$2.7-million contract from DARPA to triple the power-handling performance of GaN devices and circuits. In a similar move, DARPA has given RFMD a \$2.1-million contract to enhance the thermal efficiency of GaN circuits.

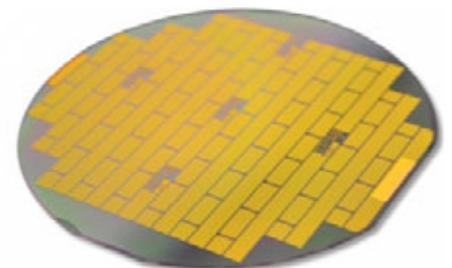
For TriQuint, this effort will build on both the firm's GaN-on-silicon-carbide (SiC) technology and RF integrated circuits (RF ICs). By combining its GaN-on-SiC process technology with diamond substrates and new thermal-handling processes, TriQuint seeks to significantly reduce heat build-up. In doing so, it hopes to enable GaN devices that can generate more power.

Among TriQuint's partners in this program are the University of Bristol and diamond-substrate specialist Group4 Labs. In addition, Lockheed Martin will evaluate the results of the program for its projected impact on future defense systems.

For its part, RFMD hopes to improve both power density and power-handling capability by combining thermally enhanced diamond substrates with its GaN-on-SiC technology. RFMD's partners in the program include the Georgia Institute of Technology, Stanford University, Group4 Labs, and Boeing. Boeing plans to evaluate the resulting technology to assess its projected impact on future defense systems.

According to DARPA, varied NJTT approaches may be implemented to reduce the near-junction thermal barrier. These include the use of high-thermal-conductivity diamond substrates, which will replace lower-conductivity materials like SiC, Si, and sapphire. In addition, low-conductivity epitaxial and transition

layers at the interface of the GaN active layers and the substrate can be removed by etching or other techniques. DARPA also points to the introduction of liquid cooling in the near-junction region as well as the use of metrology and modeling—both to address the challenges of measurement verification at this scale and quantify the thermal and electrical performance of the GaN devices.



GaN wafer from TriQuint (Courtesy of TriQuint)

mwrf.com

COMPOUND SEMICONDUCTORS

Bluglass achieves reduction of impurities in its GaN films

Australian clean technology innovator, BluGlass has announced that it is now able to produce GaN with industry acceptable impurity levels using its breakthrough low temperature Remote Plasma Chemical Vapour Deposition (RPCVD) technology.

BluGlass' RPCVD grown GaN layers are now demonstrating reduced levels of key impurities (carbon, hydrogen and oxygen) on par with the industry standard process, Metal Organic Chemical Vapor Deposition (MOCVD) for its GaN layers.

The impurity levels were measured by Evans Analytical Group (EAG), a widely recognised independent, global materials characterisation

company, using Secondary Ion Mass Spectrometry (SIMS). EAG has confirmed that BluGlass has demonstrated carbon, oxygen and hydrogen impurities at levels less than 1×10^{17} atoms per cm^3 . This is a significant step forward that BluGlass believes will help enable the demonstration of industry equivalent electrical properties in RPCVD grown films to reach its proof of concept milestone.

Following this achievement BluGlass will now seek to optimise the p-GaN layer in order to show the advantages of RPCVD to customers, including improved LED device efficiency over the current industry standard MOCVD produced devices.

www.bluglass.com.au

RFMD releases family of linear GaN power transistors

RF Micro Devices has production released two highly linear GaN RF unmatched power transistors (UPTs)—RFHA3942 (35W) and RFHA3944 (65W)—that deliver superior linear performance versus competing GaN transistors.

The release of the RFHA3942 and RFHA3944 follows the previous release of the RF393X series of UPTs targeting continuous wave (CW) and pulsed peak power applications. This new series of linear GaN discrete amplifiers is optimized for broadband applications requiring linear back-off operation or reduced spurious performance. RFMD plans to further its technology leadership position with future releases of 10W and 95W linear GaN devices over the next 12 months, significantly expanding the GaN UPT options available to RFMD's customers.

RFMD's highly linear GaN UPTs target new and existing communication architectures requiring improved broadband linear performance in support of high peak-to-average modulation waveforms. The RFHA3942 and RFHA3944 are tunable over a broad frequency range (DC to 4GHz) and provide CW peak power of 35W and 65W respectively. They also offer high gain of 15dB and high peak efficiency of > 55%. Using an IS95 9.8dB PAR signal tuned to 2.1GHz, the RFHA3942 achieves -43dBc adjacent channel power (ACP) at 34dBm POUT and the RFHA3944 achieves

-54dBc ACP at 37dBm POUT. Additionally, the RFHA3942 and RFHA3944 offer high terminal impedance at the input and output of the package, enabling wideband gain and power performance advantages in a single amplifier. The RFHA3942 and RFHA3944 are packaged in a flanged ceramic two-leaded package that leverages RFMD's advanced heat-sink and power-dissipation technologies to deliver excellent thermal stability and conductivity.

ir.rfmd.com

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Toshiba and Epistar have concluded a patent license agreement

Epistar has announced that Toshiba has granted a patent license regarding certain AlGaInP LED technologies and sold certain AlGaInP LED patents to Epistar. As part of the agreements, Epistar also licensed certain AlGaInP LED patents to Toshiba. The agreements recognize the value of Toshiba's AlGaInP LED patent portfolio, and are expected to bring benefits for Epistar's product development and enhance its patent portfolio further within the field of AlGaInP LED technologies. The exact terms of the license will not be disclosed under the confidential obligations.

www.epistar.com.tw

Commencement of mass production of large sapphire substrates

Sumitomo Metal Mining has established a production line for large sapphire substrates at its fully-owned subsidiary Okuchi Electronics and has commenced mass production.

Since the start of this year, SMM has moved forward with the installation of new large crystal growth furnaces and an increase in the number of substrate processing lines at Okuchi Electronics. These operations are now complete and mass production of 6-inch-diameter large sapphire substrates has begun. The production of 6-inch sapphire substrates necessitates technology for the growth of large crystals, and SMM has developed its own original techniques for growing large, single sapphire crystals based on the crystal growth technology it has developed over many years. SMM has established technologies that allow the rapid growth of large single sapphire crystals with a diameter of 30cm and a weight of 80kg, and has instituted a world-class mass production system for large substrates. Furthermore, growth techniques for very large single sapphire crystals with a weight of 130kg that allow a further increase in productivity for large substrates have also been developed, with mass production due to start in FY2013.

www.smm.co.jp

CSA Group acquires Orb Optronix to provide state-of-the-art testing and certification services to LED and lighting manufacturers globally

The acquisition of Orb Optronix provides CSA Group with state-of-the-art, LED and lighting metrology testing capabilities; accelerating and enhancing the CSA Group's Solid State Lighting testing capabilities globally. CSA Group has an established presence in the United States with a 30,000 square-foot testing facility in Atlanta, Georgia providing testing and certification of LED and lighting products to more than 75 different standards as well as required third-party ENERGY STAR[®], LED Lighting Facts[®], and Designlights Consortium testing. The organization also provides energy efficiency verification (EEV) services in Cleveland, Ohio and Toronto, Canada. To service lighting manufacturing clients based in China, CSA Group's Hong Kong, Guangzhou and Shanghai labs provide LED lighting testing and certification services as well as EEV services.

Orb Optronix provides a wide range of LED test and measurement services in its Kirkland laboratory. It specializes in the characterization, measurement and testing of discrete LEDs, LED array, LED light engines, LED replacement lamps, and LED luminaires including IES LM-80-08 LED lumen maintenance testing, IES LM-79-08 Luminaire testing, and Flat Panel Display testing to VESA standards. The company services the LED, optics, electronic display, machine vision, medical, military, and Solid State Lighting markets. Its clients range from major LED manufacturing companies to early-stage lighting projects which require next-generation solid state lighting design solutions.

www.csagroup.org

TSMC SSL announced strategic relationship with Cnlight

TSMC Solid State Lighting (TSMC SSL) announced that it has entered into a strategic relationship to supply LED emitter packages and LED lighting solutions to Cnlight.

Under this agreement, TSMC SSL will be able to leverage its advanced LED technology with Cnlight's brand, channels, as well as luminaire R&D and production to expand the presence of both companies in China and the global LED lighting market.

TSMC SSL is a wholly-owned subsidiary of Taiwan Semiconductor Manufacturing. Inheriting TSMC's expertise in semiconductor manufacturing and rigorous quality control processes, TSMC SSL has announced several types of LED emitters that feature extraordinarily high performance brightness, efficacy, and light quality.

Cnlight, one of the most respected lighting brands and lighting product manufacturers in China, is committed to the development of reliable and advanced lighting products and owns nearly 200 domestic and overseas patents. Through this strategic relationship, Cnlight will incorporate TSMC SSL's LED emitters into its products while TSMC provides Cnlight with full support to develop future innovative lighting products. In addition to general lighting, TSMC SSL and Cnlight will evaluate opportunities to cooperate in R&D for plant and automotive lighting.

The agreement with Cnlight is TSMC SSL's first official customer collaboration and marks the company's first into the China lighting market. Going forward, the company will focus on building technically innovative LED products and processes as well as building firm partnership with clients to expand LED lighting markets for both sides.

www.tsmcssl.com



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Tessera Technologies announces third quarter 2012 results

From page 1

Third quarter 2012

Total revenue for the third quarter of 2012 was \$72.7 million, compared to \$59.3 million of total revenue in the third quarter of the prior year. Intellectual Property segment revenue for the third quarter of 2012 was \$57.9 million, compared to \$50.3 million in the third quarter of the prior year, which included a nonrecurring \$1.0 million license fee. The year-over-year increase was due primarily to the payment from Amkor Technology, Inc. related to the International Court of Arbitration of the International Chamber of Commerce interim award, offset in part by declining royalty income from Micron Technology, Inc. and Powertech Technology Inc.

DigitalOptics segment revenue for the third quarter of 2012 was \$14.8 million, compared to \$9.0 million in the third quarter of the prior year. The increase was due primarily to camera module product sales from the Company's recently acquired manufacturing facility in Zhuhai, China.

GAAP net loss for the third quarter of 2012 was \$1.1 million, or \$0.02 per basic share, which included

non-cash charges of \$6.2 million for amortization of acquired intangibles and \$4.0 million for stock-based compensation.

Non-GAAP net income for the third quarter of 2012 was \$6.5 million or \$0.12 per diluted share. Non-GAAP net income is defined as income and operating expenses adjusted for acquired intangibles amortization, charges for acquired in-process research and development, stock-based compensation expense, impairment charges on long-lived assets and goodwill, and related tax effects.

Nine-month period ended Sept. 30, 2012

Total revenue was \$180.8 million; Intellectual Property segment revenue was \$149.9 million and DigitalOptics segment revenue was \$30.9 million.

GAAP net loss for the nine-month period was \$9.6 million, or \$0.19 per diluted share. Non-GAAP net income for the nine-month period was \$14.5 million, or \$0.27 per diluted share.

Balance sheet

Cash, cash equivalents and investments were \$465.9 million at Sept. 30, 2012, a decrease of \$8.9 million from June 30, 2012. In the third quarter of 2012, net cash provided by operations was \$2.3 million. The Company purchased \$6.3 million of property and equipment and \$1.2 million of intellectual property in the third quarter of 2012. On Sept. 13, 2012, \$5.2 million was paid to stockholders of record as of Aug. 23, 2012, for the quarterly \$0.10 per share of common stock cash dividend.

Quarterly cash dividend

On Oct. 31, 2012, the board of directors declared a cash dividend of \$0.10 per share of common stock for the fourth quarter, payable on Dec. 13, 2012, for stockholders of record at the close of business on Nov. 22, 2012.

www.tessera.com

KIT, University of Louvain & Humboldt University have developed a novel etch method produces 3D microstructures in silicon for photonic crystals

Promising new methods for optical processing for telecoms.

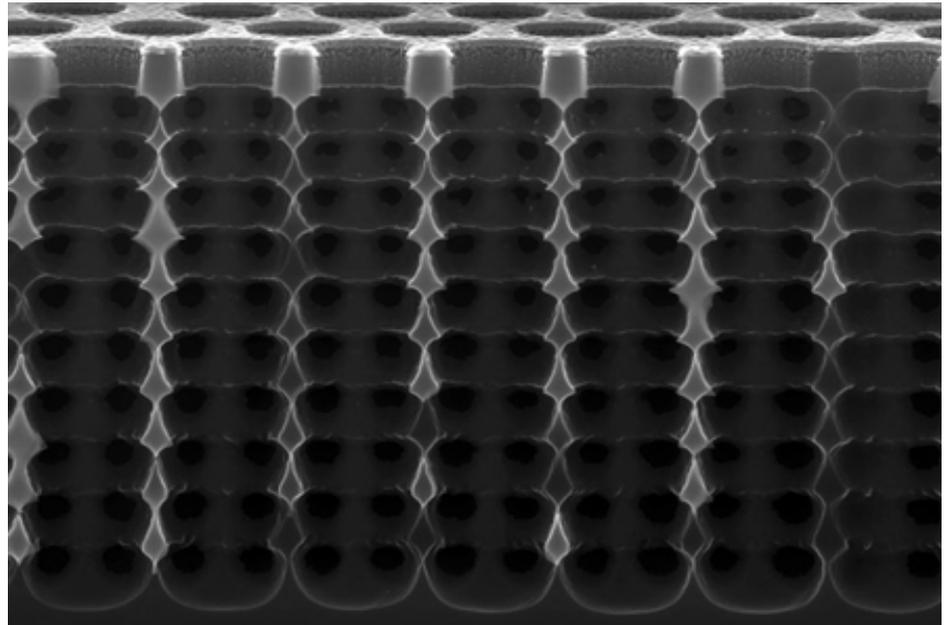
In modern, high-speed telecommunications, light carries digital information over hundreds or thousands of kilometers within seconds. Switching, modulating and multiplexing devices based on adapted optical materials control the light signals.

Now researchers from Karlsruhe Institute of Technology, Germany, the Université Catholique de Louvain, Belgium, and Humboldt University, Berlin, Germany, have developed a novel method to produce photonic crystals to manipulate such optical signals. Their optical properties are adjusted by structures of micrometer size. The method is rapid, cheap, and simple and partly uses the self-organization principle. The work has been published in the journal *Advanced Functional Materials*.

To read the complete article, please visit Optics.org website.

optics.org

SPRIE produces micrometer structures that refract light (Courtesy of KIT)



Laser vendors stay cautiously optimistic

Longbow research finds industrial demand staying positive and fiber lasers gaining market share in the third quarter of 2012.

The regular quarterly survey of industrial lasers and optics vendors undertaken by Longbow Research found that the mood remained modestly positive, even though the number of US vendors reporting an actual year-on-year increase in demand fell from 63 percent in Q2 2012 to 50 % in Q3.

The number of respondents experiencing a fall in demand rose from 11 % to 19 % for the same periods.

Summarizing the results of the survey, Mark Douglass of Longbow indicated that demand within the automotive sector remained strong for all varieties of laser system, from low- to high-power. Continued investment in

agricultural equipment was likewise supporting that sector, although flatter growth in 2013 seems likely.

To read the complete article, please visit Optics.org website.

optics.org

EVENT REVIEW

Invest in Photonics hosts session for European tech firms targeting € 72.2 million in funding

18 innovative companies selected for leading-edge applications in fast-growth cleantech, healthcare and consumer goods markets

At this year's Invest in Photonics, taking place December 12th – 13th, 18 innovative start-ups active in healthcare, cleantech and consumer goods from around Europe have been selected to present their projects in a 10-minute elevator pitch to a panel of international investors.

The selected companies are a pan-European group of firms from Belgium, The Netherlands, Switzerland, the UK and 11 companies from around France. An international panel of photonics industry experts and venture capitalists made the selection based on the following criteria:

- Technology uniqueness
- Business model credibility
- Clearly defined 'go to market' strategy
- Market size/growth
- Management experience/scalability
- International development

Together, the companies will target a total of € 72.2M in funding. They are: Ovizio Imaging Systems (BE), Actlight (CH), Medimaps (CH), EUPhoenix BC Mach8 Lasers (NL), Smart Photonics (NL) and Holixica (UK), plus one unnamed firm. They include French companies: Argolight, Aurea Technology, Blue Industry and Science, Fibercryst, Image Guided Therapy, Lasar, μQUANS, Nethis, Prestodiag, Sunna Design, and Vence Innovation.

Be a part of the future !



"The only European investment conference focused exclusively on photonics VC investments. Invest in Photonics is an event where early stage companies can find the latest market information, and the newest technological developments, which together, creates a unique opportunity to network with investors and potential partners. Invest in Photonics is the place where investors are presented with the most innovative, credible and profitable business opportunities." says Giorgia Anania, VP Photonics21, Chairman Invest in Photonics 2012.

"I am pleased to say that, responding to big demand, this third edition of the conference will be significantly expanded, with significantly more participating companies, world-class speakers from end-user industries, and a special new focus on particular markets, where we have added sessions exclusively focusing on Cleantech and Life Sciences markets. It's the unique opportunity in Europe to spot the new opportunities and to network with key players in this market", he adds.

New! Asian Conference on December 13

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About Invest in Photonics[®]

Invest in Photonics is the only European event which offers big investment opportunities in photonics, and where attendees get high value market information. The top three fast-growth markets: cleantech, healthcare and consumer products, head this year's investor conference. The emerging Asian market will also be a focus of this year's event.

It is a unique networking event for industry leaders in photonics, investors and photonics companies seeking financing. This is the third biennial event, which has helped raise € 37M to date. Previous events took place in 2008 and 2010.

Early stage companies seeking seed funding, development and later stage financing can successfully network with qualified international panels of investors and potential partners to further business projects. The program will kick-off on Wednesday, December 12 at 1:30pm (CET). Global-leading companies, such as Zeiss, Philips and Samsung Ventures, will lead discussions on the key role of photonics in future applications, share their market experiences, as well as their perspectives and vision.

The event is accompanied by a wine tasting at the Château Smith Haut Laffitte, followed by a gala dinner, which will provide further networking opportunities.

You can find any further information on the event website:
www.invest-in-photonics.com

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PHOTOVOLTAICS

GT Advanced Technologies targets ultra-thin silicon wafers by acquiring Twin Creeks Technologies

GT Advanced Technologies announced it has acquired certain capital assets and intellectual property of Twin Creeks Technologies, a privately owned company that has developed an ion implanter technology that enables the production of lower cost thin substrates with minimal material (kerf) loss.

Although the use of this approach for silicon solar cells is not expected at short term (see Yole's report for more details), such wafers may find future application in power electronics.

The assets were purchased from Twin Creeks' lenders in a private sale for approximately \$10 million and royalties that will be based on future sales.

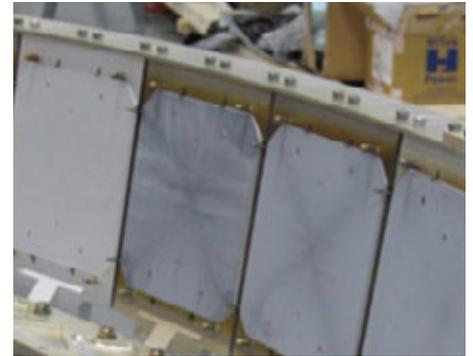
GT expects that Twin Creeks' unique Hyperion™ ion implanter technology will have broad application in the production of engineered substrates for power semiconductors and thin wafers for solar applications. In addition, GT expects to pursue the development of thin sapphire laminates for use in applications such as cover and touch screen devices. The Hyperion ion

implanter has the potential to minimize, or in some cases eliminate, the need for wafering saws, which would significantly lower the cost of production.

The assets acquired by GT relate primarily to the Hyperion ion implanter as well as Twin Creeks' portfolio of approximately 30 granted US patents and over 70 pending US and international patent applications. GT's ion implanter engineering team will be based in Danvers, MA.

GT expects to start the commercialization of this technology in late 2014.

www.gtat.com



Twin Creeks Technologies' developed Hyperion™ Ion Implanter Technology for production of ultra-thin wafers.

Total introduces Awango by Total, solar solutions to improve access to energy

Total plans to sell one million solar lamps by 2015.

To enable off-grid, low-income communities to meet some of their most basic everyday needs, Total has introduced Awango by Total, a line of innovative, reliable solar lighting and phone charging solutions.

Energy is an essential driver of social and economic development. Total is committed to fostering the emergence of innovative technological and marketing solutions to develop a more efficient, reliable and affordable lineup that is also economically viable enough to be sustainable and widely adopted.

For more than a year, all of the components in the Awango by Total line have been tested by customers in four pilot countries — Cameroon, Indonesia, Kenya and the Republic of the Congo — with 125,000 lamps

and solar kits sold. Deployment is now being stepped up, with rollout proceeding through 2013 in eight more countries: Burkina Faso, Cambodia, Ethiopia, Haiti, Myanmar, Nigeria, Senegal and Uganda.

Awango by Total, a reliable, affordable energy service combining:

- Equipment selected for its robustness and ease of use: partnerships with three suppliers — d.Light Design, Greenlight Planet and Sundaya — enable the program to offer a full line of lighting and phone charging products, ranging from portable solar lamps to modular kits.
- Affordable price points and financially responsible solutions, such as leasing in the Republic of the Congo and cooperatives in Indonesia.

• A one-to two-year warranty for all products, and customer service.

• Distribution networks adapted to local conditions. To cover the last mile to the communities concerned, the solutions are being marketed through Total's service station networks, newly created young reseller networks, agricultural cooperatives, etc.

• The strategically related competencies of Total and German development cooperation agency GIZ. Total and GIZ are working in partnership in four key areas: measuring the program's social impact, educating communities about renewable energies, training the sales force and developing local recycling systems. The results of this cooperation will be shared and published.

www.total.com

According to the IEA, solar is the fastest growing renewable technology

Renewables are set to become the world's second largest source of power generation by 2015 with solar the fastest growing renewable technology, according to the International Energy

Agency (IEA). The IEA's World Energy Outlook 2012 report goes on to say that renewables will account for one third of the total global electricity output by 2035. Driving the uptake of renewables will be falling

technology costs, rising fossil fuel prices and carbon pricing.

www.worldenergyoutlook.org

Semprius to supply high-concentration photovoltaic (HCPV) modules for department of defense

200 kW HCPV system composed of 2,400 Semprius modules will be installed at Edwards Air Force Base in 2013.

Semprius will be supplying its state-of-the-art technology in support of Pratt & Whitney Rocketdyne's (PWR's) \$2.3 million award from the Environmental Security Technology Certification Program (ESTCP) office of the U.S. Department of Defense (DoD). The project is designed to demonstrate the high-performance and cost-effectiveness of HCPV technology for use at DoD installations as well as in other commercial and utility scale applications.

As part of the project, PWR will install a 200 kilowatt solar system at Edwards Air Force Base in California. The system will be comprised of 2,400 Semprius modules mounted on dual-axis trackers and will produce over 400,000 kWh of electricity annually, enough to power approximately 40 homes. Semprius' manufacturing facility, located in Henderson, North Carolina, uses a proprietary process to deliver the world's highest efficiency solar

modules. At 33.9 percent, Semprius' modules are the first to convert over one-third of the sun's energy into electricity. In addition, Semprius modules perform better than conventional modules under high temperature conditions, and in locations like the US Southwest, Semprius-based systems can deliver up to 30 percent more energy than equivalent PV systems.

www.semprius.com

ADVANCED PACKAGING

2.5D silicon interposer with stacked FPGA and Wide I/O memory revealed by Huawei and Altera

Huawei and Altera will package an FPGA and a Wide I/O memory on a 2.5-D silicon interposer to bust through memory bandwidth limits in communications systems. The technology presents thorny challenges but could become critical in networking, said a senior scientist

for Huawei. The new device, in the works only about three months, will significantly reduce board space while increasing performance. "2.5D silicon interposers seem to be the best fit for networking companies—in fact, they are mission critical," said Anwar A. Mohammed, a senior staff scientist for

packaging working in Huawei's U.S. R&D center here.

To read the complete article, please visit [EETimes website](http://EETimes.com).

www.eetimes.com

NANIUM extends WLP offer by including 12" fan-in volume production

NANIUM announced that it has extended its offering to include fan-in WLP volume production on 300mm wafers.

NANIUM earlier this year licensed Flip Chip International's (FCI) Spheron[®] Plated Cu Redistribution technology to provide solutions for 300mm wafer-level chip scale packaging (WLCSP) using fan-in WLP processes. After completing line setup and qualification for that technology, the company added the capability to manufacture fan-in WLP products, which extends its service portfolio using the latest technology on 300mm wafers. "The conventional fan-in variant of WLP on the silicon wafer, where all IOs are located on the die, offers a cost-effective solution for the

required package size, IO count and performance of many IC products," said Armando Tavares, president of NANIUM's executive board. "By leveraging our proven WLP processes and know-how, NANIUM is now extending its service offer to cover the full range of wafer-level packaging requests of our customers, fan-in and fan-out." Wafer-level chip scale packaging (fan-in WLCSP) enables low-cost manufacturing of small die sizes, with low I/O density, and high performance. The technology includes repassivation, redistribution (RDL), under-bump metallization (UBM), bumping, test, laser marking, singulation,

automatic inspection (AOI) and pick and pack in tape and reel.

This technology complements NANIUM's existing fan-out WLP offer, which is more directed to high-pin /high-performance products, SiPs and 3D integration. NANIUM recently passed the production milestone of 200 million components using embedded wafer-level ball grid array (eWLB), a fan-out WLP technology.

www.nanium.com



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www.semi.org/european3DTSVsummit



STATS ChipPAC to expand flip chip and 3DIC capacities in South Korea

STATS ChipPAC announced plans to expand its semiconductor assembly and test operation in South Korea. The Company has signed a non-binding memorandum of understanding to invest in a new integrated facility in the Incheon Free Economic Zone, an international business district located in the Incheon metropolitan area that is adjacent to Seoul, South Korea.

The integrated facility will include approximately 95,000 square meters (1 million square feet) of land with options for future expansion. The integrated facility will be used for manufacturing, research and development, and administration. Construction is scheduled to begin in the third quarter of 2013 and the new facility is expected to be operational in the second half of 2015. STATS ChipPAC intends to integrate its existing facilities in South Korea into the new, larger facility to achieve a more efficient, cost effective manufacturing flow and provide flexibility for future expansion.

"STATS ChipPAC Korea is an important strategic manufacturing operation with an illustrious history of delivering the most advanced packaging and test technologies with proven manufacturing capabilities that extend back over 27 years to when the factory was first established. We are very confident that our expansion in South Korea will increase our overall competitiveness in advanced flip chip, advanced wirebonding and three dimensional (3D) packaging

technologies where we have established a strong leadership position in the industry," said Tan Lay Koon, President and Chief Executive Officer, STATS ChipPAC. "The expansion and integration of our operations in South Korea align with our ongoing growth over the last several years in advanced technologies for the electronics mobility and convergence markets."

STATS ChipPAC Korea's sizeable flip chip technology portfolio ranges from large single die fcBGA packages with passive components used for graphics, CPU and ASIC devices to smaller fcBGA packages including single die, multi-die and stacked configurations that combine wire bond and flip chip technology within a single package. In terms of 3D technology, STATS ChipPAC Korea provides advanced Package-on-Package (PoP), Package-in-Package (PiP) and System-in-Package (SiP) technologies that integrate one or more integrated circuits or passives into a single solution for mobile, digital consumer and data storage applications.

"We are proud of the leadership position we have in advanced packaging technologies and the extensive manufacturing experience we have demonstrated over the years. We are excited to begin a new phase of expansion in South Korea with the opportunity to increase the level of manufacturing efficiency, capabilities and overall capacity for our customers," said Sang-Jin Maeng, Managing Director, STATS ChipPAC Korea. "We believe our strategic partnership with Incheon International Airport Corporation (IIAC) will facilitate our future growth in South Korea due to the exceptional business infrastructure in Yeongjongdo and close proximity to Incheon International Airport for accessibility and efficient supply chain logistics."

www.statschippac.com

Events



IMAPS France 8th Advanced Technology Workshop on Micropackaging and Thermal Management

La Rochelle, France - February 6-7, 2013

•The **8th edition workshop will feature 24 conference papers and a tabletop exhibition** The program is available on the IMAPS website. Registration and payment may be completed online.

For further information on IMAPS France events, please refer to the website <http://france.imapseurope.org>

Or contact Florence VIRETON at +33(0) 1 39 67 17 73 or by e-mail: imaps.france@imapsfrance.org.

IMAPS France, on behalf of IMAPS Europe, will host the 2013 edition of the biannual European Microelectronics Packaging Conference (EMPC) on Sept 9-12 in Grenoble, France. This is the major European packaging event in 2013 - **Mark your calendars!** Further information is available on the conference website.

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NANOTECHNOLOGY

Scientists reveal new insights on nano 3D printing

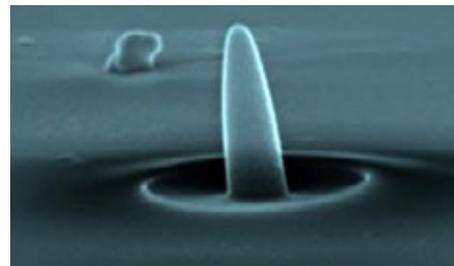
Scientists at the University of Technology Sydney have unveiled new physics behind the nanofabrication technique known as electron beam induced deposition or EBID.

A team of physicists funded by FEI Company and the Australian Research Council have unveiled new physics behind the nanofabrication technique known as electron beam induced deposition (EBID), essentially 3D printing at the molecular level. The UTS team has reported new insights into the behaviour of molecules at surfaces to achieve extraordinary improvements in speed and the quality of materials fabricated using the EBID technique. Using the UTS FEI laboratory and an advanced research grade electron microscope

the scientists have been able to explain the nature of chemical reactions on hot, solid surfaces and to "write" highly pure nanostructures.

The UTS experiments have led to the discovery that the EBID technique performs optimally under conditions previously dismissed as ineffective, due to gaps in prior understanding of the basic science behind EBID.

www.uts.edu.au



*A nanostructure fabricated using EBID
(Courtesy of University of Technology Sydney)*

Enhanced light output power of GaN LEDs with graphene film as a transparent conducting electrode

Researchers in Korea have developed gold-doped graphene as a transparent and current-spreading electrode (TCSE) for UV LEDs.

Researchers from the Chonbuk National University and Sungkyungkyun University reported the enhanced light output power of GaN-based light-emitting diode (LED) by using graphene film as a transparent conducting electrode. Monolayer graphene was synthesized on copper foil

by using chemical vapor deposition method and directly transferred onto the GaN-LED as a top electrode. Compared to the conventional LEDs using indium tin oxide (ITO) layer for an electrode material, the light output power of LED with graphene electrode was improved by 25%. This was attributed excellent

graphene characteristics of high electrical conductivity, high optical transmittance of nearly 97% over a wide range of infrared, visible, and ultraviolet region and large area uniformity with fewer defects.

www.chonbuk.ac.kr

Single graphene stripes as electrodes for nanoelectronics

The transport of electrons and thus electrical current is not only of central importance in modern society, but also for scientists in fundamental research where it is of interest for biological processes and for potential applications for future molecular electronics (with single molecules as devices).

A research team at the Fritz Haber Institute Berlin (in collaboration with theoreticians from Toulouse and Singapore) could measure for the first time the electrical current through single molecules at different electrode voltages, thus characterizing various charge transport regimes. Graphene stripes were chosen, due to their interesting electronic properties, and assembled directly on the

surface by in-situ polymerization. The central challenge for such measurements is to measure the current through an object at the atomic scale with macroscopic electrodes, ensuring for a well-defined arrangement. In this work, a scanning tunneling microscope was used to pick up single graphene ribbons from a surface, thus realizing the desired geometry. In this way, the decay of the electric current

with the molecular length, the key property for charge transport efficiency, can be measured in real time. It is shown that the conductance properties of a single molecule can be correlated with its electronic states. Comparison with calculation reveals that the conductance depends on the precise atomic structure and bending of the molecule in the junction.

www.fhi-berlin.mpg.de

Fabrication on patterned silicon carbide produces bandgap for graphene-based electronics

By fabricating graphene structures atop nanometer-scale "steps" etched into silicon carbide, researchers have for the first time created a substantial electronic bandgap in the material suitable for room-temperature electronics.

Researchers have measured a bandgap of approximately 0.5 electron-volts in 1.4-nanometer bent sections of graphene nanoribbons. Researchers don't yet understand why graphene nanoribbons become semiconducting as they bend to enter tiny steps – about 20 nanometers deep – that are cut into the silicon carbide wafers. But the researchers believe that strain induced as the carbon lattice bends, along with the confinement of electrons, may be factors creating the bandgap. The nanoribbons are composed of two layers of graphene. Production of the semiconducting graphene structures begins with the use of e-beams to cut "trenches" into silicon carbide

wafers, which are normally polished to create a flat surface for the growth of epitaxial graphene. Using a high-temperature furnace, tens of thousands of graphene ribbons are then grown across the steps, using photolithography. During the growth, the sharp edges of trenches become smoother as the material attempts to regain its flat surface. The growth time must therefore be carefully controlled to prevent the narrow silicon carbide features from melting too much. The new technique permits not only the creation of a bandgap in the material, but potentially also the fabrication of entire integrated circuits from graphene without the need for interfaces that introduce resistance. On either side of

the semiconducting section of the graphene, the nanoribbons retain their metallic properties. By growing the graphene down one edge of the trench and then up the other side, the researchers could in theory produce two connected Schottky barriers – a fundamental component of semiconductor devices. Conrad and his colleagues are now working to fabricate transistors based on their discovery.

To read the complete article, please visit Georgia Tech website.

www.gatech.edu

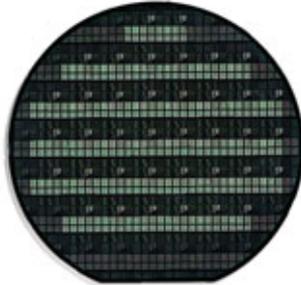
POWER ELECTRONICS

Fujitsu Semiconductor will start production of GaN power devices in 2013

From page 1

These devices will enable Fujitsu Semiconductor to propose their use in a wide variety of value-enhancing power supply applications, significantly contributing to the realization of a low-carbon society. Fujitsu Semiconductor is aiming to achieve approximately 10 billion yen in sales of GaN power devices in fiscal 2015.

Compared to conventional silicon-based power devices, GaN-based power devices feature characteristics such as lower on-resistance and the ability to perform high-frequency operations. These characteristics are expected to contribute to improvements in the conversion efficiency of power supply units and make them more compact. Fujitsu Semiconductor is aiming to commercialize GaN power devices on a silicon substrate, which, with increases in the diameters of silicon wafers, enables low-cost production. In addition, Fujitsu Semiconductor has provided specific power supply-related partners with sample GaN power devices since 2011 and has worked on optimizing them for use in power supply units. Recently, in a collaborative effort together with Fujitsu Laboratories Limited, Fujitsu Semiconductor has been engaging in technical development initiatives, such as developing a process technology for growing high quality GaN crystals on a silicon substrate, developing device technologies, such as optimizing the design of electrodes to control the rise of on-resistance during switching, and devising a circuit layout for power supply units that can support the high-speed switching of GaN-based devices. These results have enabled Fujitsu Semiconductor, in a test circuit using a GaN power device, to succeed in achieving conversion efficiency that exceeds the performance of conventional silicon devices. Fujitsu Semiconductor also prototyped a power supply unit for servers equipped with a GaN power device for the power factor correction circuit and successfully achieved output power of 2.5kW.



Power devices built on 6-inch Si wafer
(Courtesy of Fujitsu)

jp.fujitsu.com

Cree announce its new Silicon-Carbide, high-frequency power module

The new high frequency module, rated at 100-A current handling and 1200-V blocking, allows higher efficiency, compact and lighter weight systems that can result in lower total system costs compared to conventional silicon-based technologies.

Cree continues to showcase the superior performance and reliability of its silicon-carbide (SiC) power technology with the introduction of the first commercially available all-SiC Cree® power module. The new high frequency module, rated at 100-A current handling and 1200-V blocking, allows higher efficiency, compact and lighter weight systems that can result in lower total system costs compared to conventional silicon-based technologies.

The module includes SiC MOSFETs and SiC Schottky diodes in a 50-mm half-bridge configuration rated to 150°C maximum junction temperature. The SiC components enable the module to be operated at exceptionally high switching frequencies that can reduce the size, weight and cost of the power conversion system. The new power module has demonstrated up to 100 kHz switching frequency. Target applications include high power converters, industrial motor drives, solar inverters and uninterruptible power supplies.

www.cree.com

Fairchild Semiconductor's SiC solution is available for sample

SiC bipolar junction transistors offer lowest total power losses at high operation temperatures.

By introducing SiC-based offerings into its product mix, Fairchild reinforces its product leadership in innovative, high-performance power transistor technology.

Fairchild's SiC capabilities include: Optimized, semi-standard, and customized technical solutions that take advantage of its large portfolio of semiconductor devices and module packaging technologies.

Advanced technologies that simplify engineering challenges with functional integration and design support resources that minimize components while reducing engineering time. Meeting the needs of device manufacturers and chipset suppliers by integrating leading device technologies into smaller advanced packages that offer size, cost and power advantages. By leveraging exceptionally efficient transistors, Fairchild's SiC BJTs enable higher switching frequencies due to lower conduction and switching losses (ranging from 30-50 percent) that provide up to 40 percent higher output power in the same system form factor. Enabling the use of smaller inductors, capacitors and heat sinks, these robust BJTs can lower overall system costs up to 20 percent. Fairchild, as part of a complete silicon carbide solution, also has developed "plug-n-play" discrete driver boards (a 15A and 50A version) that, when used in conjunction with Fairchild's advanced SiC BJTs, not only provide increased switching speeds for reduced switching losses and better reliability, but also allow designers to easily implement SiC technology into their applications. Application notes and reference designs are also available from Fairchild and are intended to reduce design time and shorten time-to-market.

www.fairchildsemi.com



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POWER ELECTRONICS

Infinion releases new generation thin wafer IGBT with 650V TRENCHSTOP™ 5**It features significantly lower conduction and switching losses compared to currently leading solutions.**

Infinion Technologies releases the next generation of thin wafer IGBT by introducing TRENCHSTOP™ 5. It features significantly lower conduction and switching losses compared to currently leading solutions. With this major breakthrough, Infineon sets a new benchmark in IGBT performance to continue holding a leading position in markets requiring constantly increasing efficiency.

With an increased breakthrough voltage of 650V the new technology provides a higher safety margin for designs. Target topologies are boost PFC (AC/DC) stage and high voltage DC/DC topologies commonly found in applications such as Photovoltaic Inverters, Uninterruptible Power Supplies (UPS) and Inverterised Welding Machines.

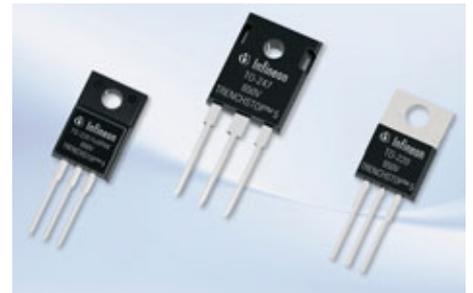
The TRENCHSTOP™ 5 provides the basis for two product families. The HighSpeed 5 (H5) is a soft high speed IGBT designed for ease of use and the plug and play replacement of existing IGBTs, since it requires minimum design-in effort. The HighSpeed 5 FAST (F5) is the most efficient IGBT ever seen; for example, more than 98 percent system efficiency has been observed in application measurements on a photovoltaic inverter using a "H4 bridge" topology.

"TRENCHSTOP™ 5 is a quantum leap in IGBT performance, providing dramatic system efficiency improvement and higher breakthrough voltage for increased reliability. This will lead to reduced system costs of the overall platform. For customers demanding all these features in one solution, TRENCHSTOP™ 5 is the only option," says Roland Stele, Marketing Director IGBT Power Discretets at Infineon Technologies.

The new TRENCHSTOP™ 5 delivers major benefits to a wide range of target applications. Compared to the current Best-in-Class HighSpeed (H3) family from Infineon, conduction losses have been reduced by more than 10 percent, whilst total switching losses have been reduced by more than 60 percent. This massive increase in efficiency allows for either lower junction temperatures during operation, which ensures higher lifetime reliability, or higher power density designs. For example, application tests have shown TRENCHSTOP™ 5 in a TO-220 package to have 15 percent lower case temperature than a H3 in a TO-247 package.

Other significant improvements include a mild positive temperature coefficient of the saturation voltage ($V_{ce(sat)}$) and turn-off switching losses (E_{off}), which

ensure that performance is not penalized during high temperature operation and paralleling is straightforward. The 2.5 times lower gate charge (Q_g) compared to H3 results in an IGBT that is easier to drive at lower costs. Furthermore, TRENCHSTOP™ 5 features a temperature stable forward voltage drop (V_F) of the fast recovery free-wheeling diode and reverse recovery time (T_{rr}) of less than 50ns. Low output capacitance (C_{oss} and E_{oss}) provide outstanding light-load efficiency, which is perfect for designs that predominately operate below 40 percent of maximum rating.



650V TRENCHSTOP™ 5 group (Courtesy of Infineon)

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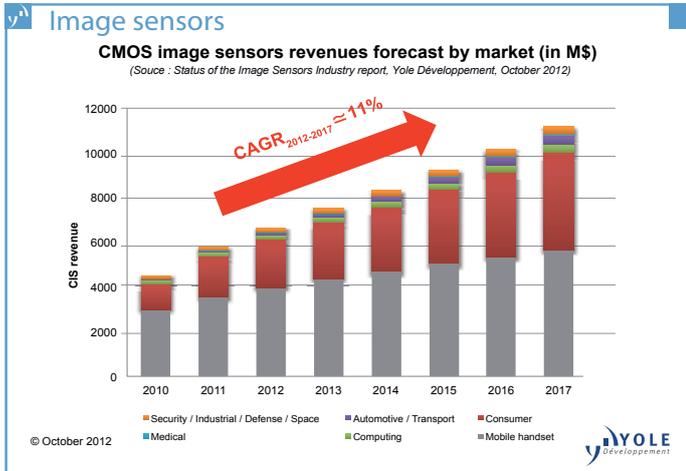
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Status of the CMOS Image Sensors Industry

New technologies & application opportunities promise a bright future to the CMOS image sensors industry.



Our new market analysis will provide you with market data on key CIS market metrics & dynamics (CMOS Image Sensors unit shipments, revenue and wafer production by application, market share, application focus on key areas of growth...). The report also features key technical insights about future technology trends & challenges from a manufacturing standpoint and a special focus on BSI. We will supply you with an in-depth understanding of the CIS value chain, infrastructure & players: CIS players (IDMs, foundries, design houses) and how are they related and the key suppliers to watch...

Released in October 2012

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"From \$458M in 2011 to \$1.57B by 2017, the 3-axis consumer gyroscope market becomes the hottest segment of all MEMS sensors", announces Yole Développement

3-Axis Consumer Gyroscopes is a market & technology report from Yole Développement (Released in Nov. 2012).

... Changes can happen quickly in the inertial MEMS industry! 3-axis MEMS gyroscopes did not exist in 2009, but it is now a very large market. Indeed 3-axis gyroscopes and gyro-based combos in consumer applications were a \$458M market in 2011. Since continuous growth is expected, everyone agrees that this is the hottest segment of all MEMS sensors and the market is expected to reach \$1.57B by 2017!...

Sources: *ElectronicsWeekly.com - SemiconductorPackagingNews - SiliconSemiconductor.net - EETimes - Product Design & Development - Pradeep's blog - NextGen Log ...*

"Energy harvesters challenge batteries into wireless sensors", say Yole Développement's experts

Emerging Energy Harvesting Devices is a market & technology report from Yole Développement (Released in Nov. 2012).

... "The industrial market will be the second key area for energy harvesters, again with applications in wireless sensors that are used to monitor machines and processes", announces Antoine Bonnabel, Technology & Market Analyst, MEMS Devices & Technologies at Yole Développement. Energy harvesters increase the autonomy of the battery and thus the measurement data rates which are today limited with batteries. Maintenance free is also a great argument for EH in those applications where accessibility is sometimes critical (oil & gas industry for instance) ...

Sources: *EFYTimes - EETimes - Silobreaker - ElectronicSpecifier/AlternativeEnergy - SemiconductorPackagingNews - Mojim.com - MachineBuilding - Product Design & Development ...*

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on www.yole.fr

About Yole Développement

Beginning in 1998 with Yole Développement, we have grown to become a group of companies providing market research, technology analysis, strategy consulting, media in addition to finance services. With a solid focus on emerging applications using silicon and/or micro manufacturing, Yole Développement group has expanded to include more than 50 associates worldwide covering MEMS, MedTech, Advanced Packaging, Compound Semiconductors, Power Electronics, LED, Optoelectronics and Photovoltaic. The group supports companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to develop their business.

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