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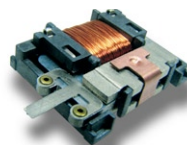
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Is digital signage ready for the perfect media storm?

By Philip Ling

While it would be difficult to have missed the increase in digital signage installations now apparent in public areas, some may say the wave has yet to reach the mainland.

However, in parallel to its relatively gentle ebbing and flowing, other elements have been emerging that may now combine to swell the impact of digital signage, turning it in to a force to be reckoned with.

Primarily, the technology behind digital signage has and, for now, remains, single-board computers or industrial PCs; not necessarily the most cost effective way to deliver a multimedia experience and despite the cost of display technology continuing to fall, the infrastructure and value chain for a digital signage installation remains too high for perhaps a real commercial breakthrough, particularly in the retail sector. Add to that the challenge of end-users creating and delivering the necessary media content, then it's little wonder that, in the main, the market is currently limited to those that have or can afford the resources needed to support digital signage.

However, that may be changing. While the majority of SBCs and industrial PCs are based on the x86 architecture and corresponding chipsets, new platforms are emerging that make use of more 'application specific' media processors, such as Texas Instruments' OMAP family, which integrates an ARM Cortex-A8 with its own TMS320C6x class DSP, a POWER VR graphics accelerator and a NEON co-processor. When coupled with the right software, this highly capable SoC is capable of providing all the functionality needed to create a convincing media player.

According to David Dalzell, Managing Director of UK-based ONELAN Digital Signage, a company which recently reported its sixth consecutive year of growth in digital signage, the market comprises two main sectors; foyer (or electronic notice board) and retail (now widely known as Digital-out-of-the-home, or DOOH). While

ONELAN is predominantly known for its presence in the foyer sector, Dalzell believes it is now time for the company to re-enter the retail market. The retail market is much more cost-competitive but at the same time needs less flexible players, which may well suit the RISC-based processors mentioned above.

Here, the focus is less on features and more on network management and functional support for advertising revenue, such as proof-of-play. Another important element in this scenario, and one that illustrates the maturation of the market, is the need for a content management system that is 'digital signage-centric', in that it combines A/V management to suit the digital signage market (such as location based content, time of day, sales promotions) along with the features necessary to support an advertising based revenue stream. ONELAN is currently developing its own CMS for this purpose.

But the hardware/software platform is only part of the story. In conjunction with their development another trend is sweeping across all high-tech vertical markets; cloud computing, enabled by what has become known as SaaS (software as a service). Together, these elements may provide the commercial boost digital signage needs to go 'mainstream'.

The popularity of social media networks is now feeding into the digital signage industry, as it becomes easier to create content streamed from other sources, via the cloud. Today it is almost inconceivable for a company of any size not to have a YouTube channel, which is essentially a free streaming service for marketing material. Having gone to the cost and expense of creating a video for a social network or your own website, the next logical step may be to port that



ScreenScape; a video media network for companies targeting the same customers

to a digital signage platform to maximise exposure.

ScreenScape, a Canadian company, has recently been identified by market analysts IDC Canada as one of 10 Digital Media companies. It describes itself as 'the first of its kind' and that could very well be an understatement. ScreenScape is a community-based digital signage network; sort of like a YouTube for corporate marketing. Users are able to share their content within groups, thereby giving them greater exposure.

Groups may be geographically relevant, for instance people living in the same town, or they may be subject-specific, such as a group of complementary retailers focused on, for instance, sporting goods and activities. The concept is simple; if you have captured a market with your digital signage installation you could 'sell' space on that to others, while at the same time you could 'buy' space on someone else's digital signage installation targeting the same customer as you.

Digital-out-of-the-home, or DOOH, aims even higher; to make content available on a range of platforms, such as mobile phones, tablets, and other media players. This may require the wholesale adoption of the W3C standard SMIL, or Synchronised Multimedia Integration Language, which is the standard behind MMS and interactive DVDs. Future content management systems - ONELAN's including - are expected to be SMIL-compliant to help facilitate this. ■

Multi-functional on-top technologies enable silicon-based detectors and actuators

By Christoph Hammerschmidt

**MEMS
TECHNOLOGIES**

FOR ELECTRONICS ENGINEERS, 'silicon' is mostly synonymous with integrated circuit. Transistors, diodes, FETs of all kind are silicon-based devices, and electronics today is generally perceived as the technology related to design and application of integrated circuits. But silicon can be more. In today's electronics, micro electro-mechanical systems (MEMS) are ubiquitous devices, they are used in pressure sensors, gyros, inertial sensors, SAW filters, and many more applications. Since MEMS are manufactured much the same ways as ICs, combining a MEMS sensor and the related signal processing circuitry seems an obvious step. However, the large variety of requirements for these different applications tends to foil the designer's

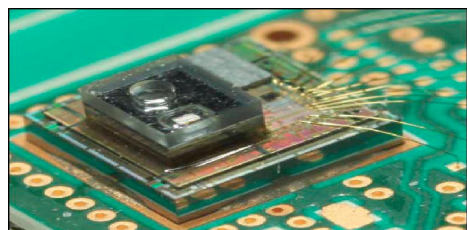


Fig. 1: The integration of heterogeneous functional units on silicon offers interesting perspectives, but it also contains technological challenges. That is Fraunhofer EMFT's research focus.

simplistic intentions; not every MEMS can be produced in one process step with the related electronics. Nevertheless, there are options to integrate both worlds, perhaps not at wafer level but at a level that is very close. Multi-functional On-Top Technologies or MOTT is the current set of technologies that can be used to put a MEMS on top of an IC. A good application example for MOTT is MEMS microphones. Combining a MEMS microphone and an ASIC as pre-amplifier, filter and digitizer enabled companies such as Epcos to significantly shrink the MEMS component and thus produce the microphone system at much lower costs. MEMS, however, are not the only devices that call for this kind of integration. The range

of MOTT options includes RF components, radiation detectors, passive components and microfluidics to be planted on top of conventional silicon integrated circuits. These combinations open new perspectives for

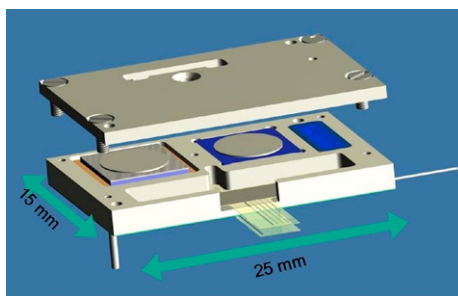


Fig. 2: Micro dispensers, embracing control electronics and micro pumps, can be implemented as all-silicon-systems (image from Fraunhofer EMFT)

wafer-level integrated products. The Fraunhofer entity for modular solid-state technologies (Fraunhofer EMFT) in Munich focuses on MOTT technology. The scientists have a pilot production line for MEMS and CMOS at their disposal, along with the related backend technologies and a process cluster for micro and nano structuring. MOTT can also be used to add specific functionality to standard silicon chips, be it based on piezo, fluidics, optics or chemistry. Micro dispensing systems for medical applications are a future-prone field of applications, explained researcher Sebastian Kibler. Electronically controlled micro pumps and micro valves can be used in pharmaceutical and medical environments as well as in chemical laboratories. Integrated at micro level, dispensing systems can be implemented as implantable systems. Semiconductor companies see a broad range of options to employ MOTT technologies in their products. At a recent industry meeting, a number of companies and research activities demonstrated examples of new MOTT-enables applications. LFoundry, for example demonstrated a high-Q inductance on top of pre-processed silicon wafers. Infineon showed a tire pressure monitoring system in

a three-level array. The system consisted of a MEMS pressure sensor on top of a transceiver circuit which in turn was located on top of a microcontroller ASIC. The entire system would be significantly smaller and cheaper than existing systems.

As another example, Siemens combined a positron emission tomograph (PET) and an MRI scanner into one machine which can concurrently visualize the morphology and metabolism of a given human organism. "We had to make use of silicon-based X-ray detectors", explained Thomas Scheiter, leader of Siemens' Global Technology Field Micro-

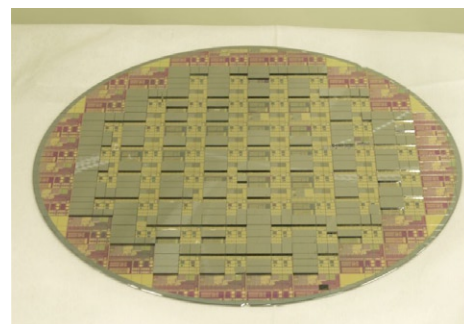


Fig. 3: A silicon wafer with added silicon functionality on top (image from Fraunhofer EMFT).

systems. Conventional photomultipliers can't operate in the strong magnetic fields required by the MRI scanner. With the type of silicon-based X-ray detectors however, the designers ran into another problem: in order to achieve the extremely low noise required, an ultra-low-noise JFET transistor developed for this particular applications had to be placed very close to the sensor.

This was only possible by means of MOTT technologies, said Reinhard Fojit, managing director of Siemens partner Ketek GmbH who designed the related devices. "MOTT was much better suited to solve this challenge than classical semiconductor production methods. With MOTT technology, you have much less process steps and a more flexible approach, resulting in a higher degree of process reliability". ■

Dual ARM Cortex-A9 MPCore drives Xilinx' 28nm FPGA extensible mesh

By Julien Happich

SUPPORTING A PROCESSOR-CENTRIC

approach, Xilinx revealed its plans for a new family of devices that will tightly integrate a permanent and fully autonomous dual ARM Cortex-A9 MPCore processing system with a fabric of programmable logic, all in one single 28nm chip.

Dubbed the Zynq-7000 Extensible Processing Platform (EPP), the new family comprises four devices all featuring the same dual ARM processing system with NEON and double precision floating point engines, fully integrated and hardwired with L1 (32KB) and L2 (512KB) caches, memory controllers, and commonly used peripherals, but they differ by the amount of programmable logic, block RAM and I/Os that makes the system extensible. The chips will be aimed at high-end embedded applications targeting markets such as video surveillance, automotive driver assistance, factory automation, and many others.

The Z-7010 tops up the processing system with about 430K ASIC gates (30k logic cells) and 240KB of RAM, whereas at the top of the line, the Z-7040 would add 3.5M ASIC gates (235k logic cells) together with 1,860KB of RAM. The devices' programmable logic is based on Xilinx's newest 7 series FPGA architecture to ensure 100% compatibility with respect to IP, tools and performance across all devices within the 28nm generation. The smallest Zynq-7000 devices, the Zynq-7010 and Zynq-7020, are based on the Artix-7 family which is optimized for low-cost and low power. The larger Zynq-7030 and Zynq-7040 devices are based on the Kintex-7 family and includes between four and twelve 10.3 Gbps transceiver channels and a PCI Express Gen2 block for high-speed off-chip connectivity. All four devices also include a new dual 12bit 1MSps ADC block.

"It is very different from your typical FPGA configured with processor IP and other bits. In fact, this approach overcomes the throughput limitations of many two-chip solutions where designers would normally try to associate an ASIC or an ASSP with an FPGA" commented Stéphane Monboisset, senior manager, processing platforms market-

ing at Xilinx. "You have about 3000 interconnects between the processing system and the FPGA fabric, enabling 100Gbit/s of interface between the different elements of the chip. With this level of throughput, while the ARM cores run control operations, reconfigurable blocks from the FPGA elements could perform signal processing directly on L1 or L2 cache data within control loops" added Monboisset.

Another big distinction from regular add-on FPGA devices is that the processing system boots at power-up and can run a variety of operating systems independent of the programmable logic. Only then, the programmable logic is configured based on the user's requirements. This enables software programmers to look at the device the same way they would consider a standard, fully featured ARM processor-based SoC, using integrated development tools where the FPGA parts are fully transparent elements, like extensions specified by the hardware designer.

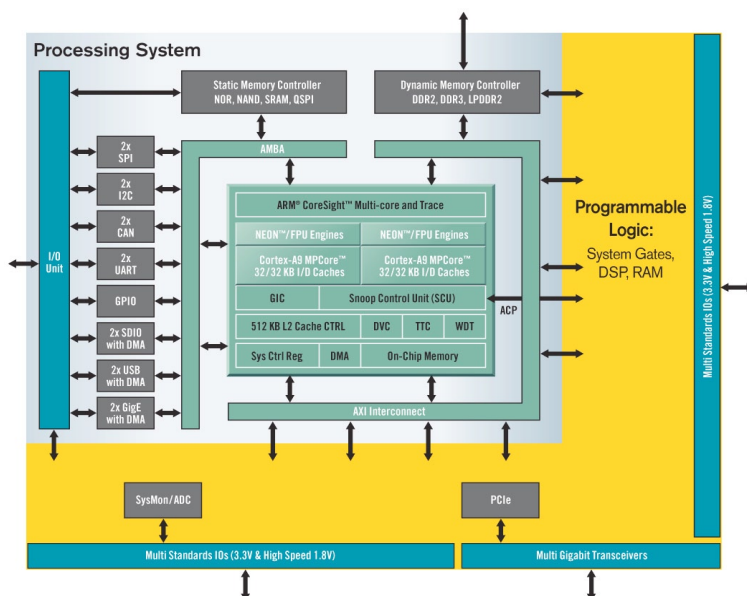
Application developers can take advantage of the programmable logic's massive parallel processing to handle large amounts of data across a wide range of signal processing applications, as well as extend the features of the processing system by implementing additional peripherals. High-bandwidth AMBA4 Advanced Extensible Interface (AXI4) interconnect between the processing system and the programmable logic enables multi-gigabit data transfers at very low power, thereby eliminating common performance bottlenecks for control, data, I/O, and memory.

Software

developers can leverage the Eclipse environment, Xilinx Platform Studio Software Development Kit (SDK), ARM Development Studio 5 (DS-5) and ARM RealView Development Suite (RVDS), or compilers, debuggers, and applications from leading vendors within the ARM Connected Community and Xilinx Alliance Program ecosystems, such as Lauterbach, Wind River, PetaLogix, The MathWorks, Mentor Graphics, Micrium, and MontaVista.

In parallel, the Zynq-7000 family's programmable fabric can be tailored to maximize system level performance and application specific requirements, using Xilinx's ISE Design Suite. Following Xilinx's acquisition of high level synthesis provider AutoESL Design Technologies, further tool enhancements are underway to provide C, C++ and SystemC synthesis optimized for the Zynq-7000 device architecture.

First silicon devices are scheduled for the second half of 2011 with general engineering samples available in the first half of 2012. But customers can start evaluating the Zynq-7000 family by joining Xilinx' Early Access program. The company developed an emulation platform based on its own FPGAs to run early prototypes. The Zynq-7000 family is expected to have an entry point of below \$15 in high volumes. ■





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Biomedical signal processor targets wearable biomedical sensor systems

By Julien Happich

IMEC, HOLST CENTRE AND NXP presented a versatile ultra-low power biomedical signal processor, CoolBio, meeting the requirements of future wearable biomedical sensor systems. The biomedical signal processor consumes only 13pJ/cycle when running a complex ECG (electrocardiogram) algorithm at 1MHz and 0.4V operating voltage. This C-programmable chip is voltage and performance scalable supporting a frequency range of 1MHz up to 100MHz with an operating voltage from 0.4 to 1.2V.

Intelligent body area networks (BANs) consisting of wireless sensors nodes which continuously monitor vital body parameters such as heart, muscle and brain activity promise to be a solution for more comfortable, cost- and time-efficient healthcare

systems. They allow people to be monitored and followed up at home, doing their daily life activities.

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

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

Imec, Holst Centre and NXP started from the commercially available low power Cool-Flux DSP baseband core from NXP to design

an ultra-low power flexible processor solution for body area networks applications. The architecture and circuitry were adapted to operate at near-threshold voltage (0.4V) at low operating frequencies. Extreme separation into multiple voltage power, clock and memory domains were implemented to guarantee high energy efficiency from standby to 100 MHz performance.

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

Body network spars with Bluetooth

By Rick Merritt

AN EMERGING BODY AREA NETWORK

(BAN) technology is gearing up to compete with Bluetooth Low Energy across a broad range of medical and consumer applications. The competition comes as medical devices are increasingly adopting a growing set of wireless network technologies including Wi-Fi and Zigbee.

Backers of the IEEE 802.15.6 effort say the standard could be completed this year and products based on it could ship in 2012. The specification promises a range of implementations roughly on par with Bluetooth bandwidth and range but at much lower power consumption and less interference.

The 802.15.6 group is resolving about 100 technical comments on the second draft of its proposed standard. Companies including Broadcom, Texas Instruments and Toumaz Technology are interested in developing chips for the spec.

There's no shortage of wireless options for health care systems. Wi-Fi and Zigbee proponents also have big initiatives in medical. The Continua Health Alliance and the

Wi-Fi Alliance announced an agreement to work together to promote Wi-Fi in medical and fitness electronics and to conduct joint technical reviews to ensure interoperability. The Wi-Fi group is exploring whether it needs certification standards unique to medical and fitness products.

Continua, which sets standards for connected medical devices, has already adopted multiple wireless technologies including Bluetooth. As for the 802.15.6 effort, Samsung's mobile phone group has proposed one of three physical layers for the draft standard, targeting links between handsets. It uses an electric field similar to near-field communications to establish connections at 21 or 32 MHz that transmit from 164 Kbits/second to 1.3 Mbits/s of data up to three meters.

A separate narrowband PHY for 802.15.6 proposed by the MedWin Alliance, which includes GE, Philips, TI and Toumaz, targets mainly medical apps running anywhere from 100 Kbits/s to 1 Mbit/s. The PHY is geared for peak power consumption of less

than three milliamps, said Anuj Batra, a senior member of TI's technical staff, speaking at the ISSCC event.

The narrowband approach embraces slices of spectrum ranging from the 400 MHz MICS band to GE's 2.4 GHz proposal. It supports as many as 64 BANs co-existing in a 36 square foot space, using constant symbol rates and differential PSK modulation to maximize data rates and simplify radio designs.

Japan's National Institute of Information and Communications Technology sponsored work on a version of the 802.15.6 spec using ultrawideband technology. It will enable data rates of about 2 Mbits/s over three meters using 7.25 to 10 GHz UWB links, said Huan-Bang Li, a senior researcher in NICT's medical group.

Once the standard is set, the MedWin Alliance is expected to work out a certification process. Despite its broad backing, the technology will be at least a year behind Bluetooth Low Energy which adopted its standard in July. ■



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Liquid metal key to simpler creation of electrodes for microfluidic devices

By Julien Happich

RESEARCHERS FROM North Carolina State University have developed a faster, easier way to create microelectrodes, for use in microfluidic devices, by using liquid metal. Microfluidic devices manipulate small amounts of fluid and have a wide variety of applications, from testing minute blood samples to performing advanced chemical research.

“By making it easier to incorporate electrodes into microfluidic devices, we hope to facilitate research and development into new technologies that utilize those devices, such as biomedical tools,” says Dr. Michael Dickey, an assistant professor of chemical and biomolecular engineering at NC State and co-author of a paper describing the research.

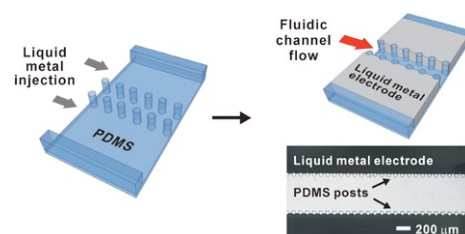
Traditionally, microfluidic devices have incorporated solid metal electrodes that serve as sensors, pumps, antennas or other functions. However, these solid electrodes

can be problematic, because they need to be physically aligned to a channel that runs through the device.

The channel serves as the entry point for whatever fluid the device is designed to manipulate. Aligning the electrodes is tricky because the electrodes are only tens to hundreds of microns in diameter, as is the channel itself. It is difficult to manipulate objects of that size.

The NC State team has addressed the problem by designing microfluidic devices that incorporate three channels, with the central channel separated from the other two by a series of closely set posts.

The researchers inject the two outer channels with a liquid metal alloy composed of gallium and indium. The alloy fills the outer channels completely, but forms an oxidized “skin” that spans the space between the posts – leaving the central channel free to receive other fluids. “This approach allows



you to create perfectly aligned electrodes in a single step,” Dickey says. “The channels are built into the device, so the electrodes are inherently aligned – we get the metal to go exactly where we want it. This means creating these devices is easier and faster.”

In addition, this approach allows for the creation of electrodes in useful configurations that were previously difficult or impossible to achieve. This can be done by changing the shape of the channels that will be injected with the liquid metal. These configurations would create more uniform electric fields, for use in manipulating fluids and particles. ■

Phosphorescence boosts solid-state lighting

By R. Colin Johnson

SWITCHING TO PURELY organic phosphorescent emitters could drastically cut the cost of solid-state lighting panels, according to a team of researchers at the University of Michigan.

The group claims to have found the first example of a purely organic, and therefore ultracheap, compound that can compete with metal-doped emitters in terms of brightness and color tuning capability.

Unlike traditional fluorescence technology, phosphorescent material does not immediately reemit the radiation it absorbs, but rather continues to glow for up to several hours after the original excitation.

The property previously had only been seen in compounds doped with metals called organometallics. The new, metal-free organic compounds developed at the university,

however, appear white in visible light but radiate blue, green, yellow and orange after absorbing ultraviolet light.

“This is the first example of an organic that can compete with an organometallic in terms of brightness and color tuning capability,” said University of Michigan professor Jinsang Kim.

The novel compounds, called aromatic carbonyls, form strong bonds with halogens in the crystal that allow molecules to be tightly packed, suppressing vibration and heat losses during recombination.

That leads to strong yet tunable phosphorescence. Color is determined by the precise chemical formula. Quantum yields were



about 55 percent. Research associate Kangwon Lee discovered the unique properties of aromatic carbonyls, which were developed further by fellow researcher Onas Bolton. The National Science Foundation and the National Research Foundation of Korea provided funding. ■

Inertial sensor market to grow 20.3% annually to reach \$2.56B in 2015

By Julien Happich

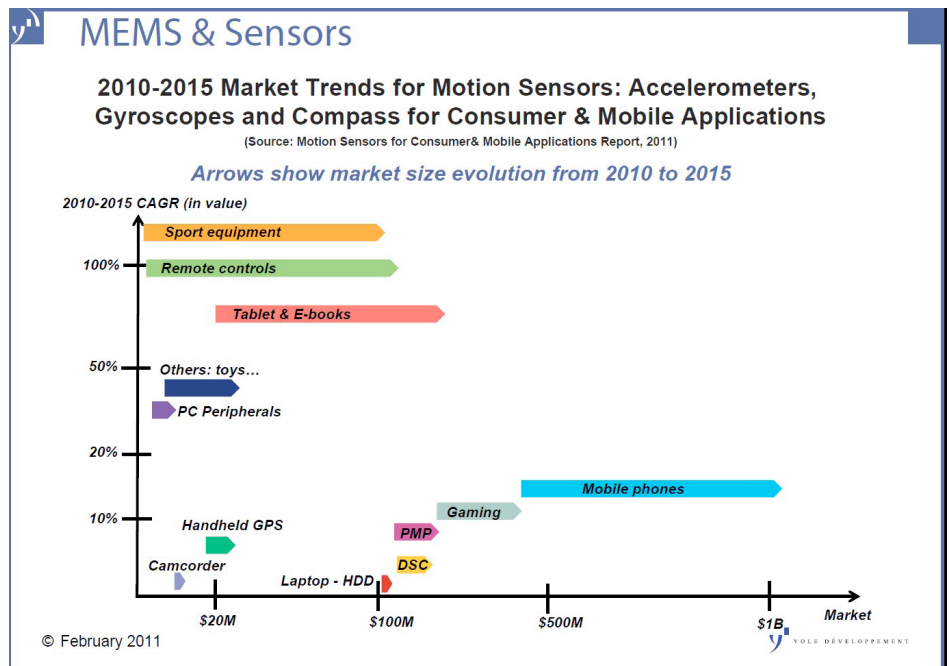
THE INERTIAL SENSOR MARKET for consumer electronics is growing very quickly due to the fast adoption of accelerometers, gyroscopes and magnetometers in mobile phones, tablets, game stations and laptops. According to Laurent Robin, analyst for the MEMS & Sensors market at Yole Développement, 20.3% annual growth is expected from \$847M in 2009 to reach \$2.56B in 2015.

The MEMS accelerometer market will be strategic because many applications are expected to rely on 3-axis accelerometer + 3-axis gyroscope in a single package within 2015. There is thus a strong synergy between accelerometer and gyroscope technologies and players. The gyroscope market is really thriving thanks to the successful introduction of 3-axis devices by ST Micro and InvenSense. While adoption in handsets is only starting to surge, (with iPhone since June 2010 and now with Android smartphones) the gaming market is quickly growing and additional markets are emerging like tablets or remote controls.

Compasses are also gaining strong market traction. 2010 was an incredible year for digital compass in handsets, but the market will find growth outside of the mobile phone area as well: on gaming, on DSC for advanced geo-tagging. It will be particularly interesting to monitor strategies of newcomers to compete against AKM who is way ahead in the market, notes Robin. Competition is gaining in intensity as the motion sensing market becomes increasingly attractive. More than 50 companies are targeting this business including large players and small companies. But in the consumer market only a few companies are really making money out of this business, while the others are struggling to make a decent profit.

Several levels of competition are shaping the market

Competition among companies trying to offer a complete product family (accelerometers, gyroscopes and magnetometers), either internally or with partners (ST is partnering with Honeywell for example on electronic compass).



Competition among devices: accelerometer, gyroscopes and electronic compass can provide functions, either alone or in combination with each other. So companies have to propose the best sensor or sensor combination for a dedicated function.

Competing business models: fabless companies (InvenSense for example) are competing against integrated device manufacturers (ST, Kionix, Panasonic, Epson Toyocom, Freescale). Optimization of the production cost is one of the biggest key success factors. It is thus necessary for all players to work hard in order to really get the costs lower and produce on 8 inch wafer lines at a reasonable yield.

Hardware competing against software: companies such as Movea start to impact the traditional supply chain model by bringing a novel expertise in software and sensor fusion.

Technology competition: companies are proposing discrete devices (a 3-axis accelerometer, a 3-axis gyroscope, etc...) or sensor combination (acceleration sensor plus gyroscope, gyroscope plus electronic compass...) either in a system-in-package or on a single die, along with a transition from a sensor of

fer to a solution offer (with sensor fusion).

Which company, business model, device... will win?

It is both a booming and fragmented market so multiple companies can have an important part of the business. Cost-effective production infrastructure is clearly important but as the market will be moving from device to functions, the software and "function delivery" part of the business will be more and more significant.

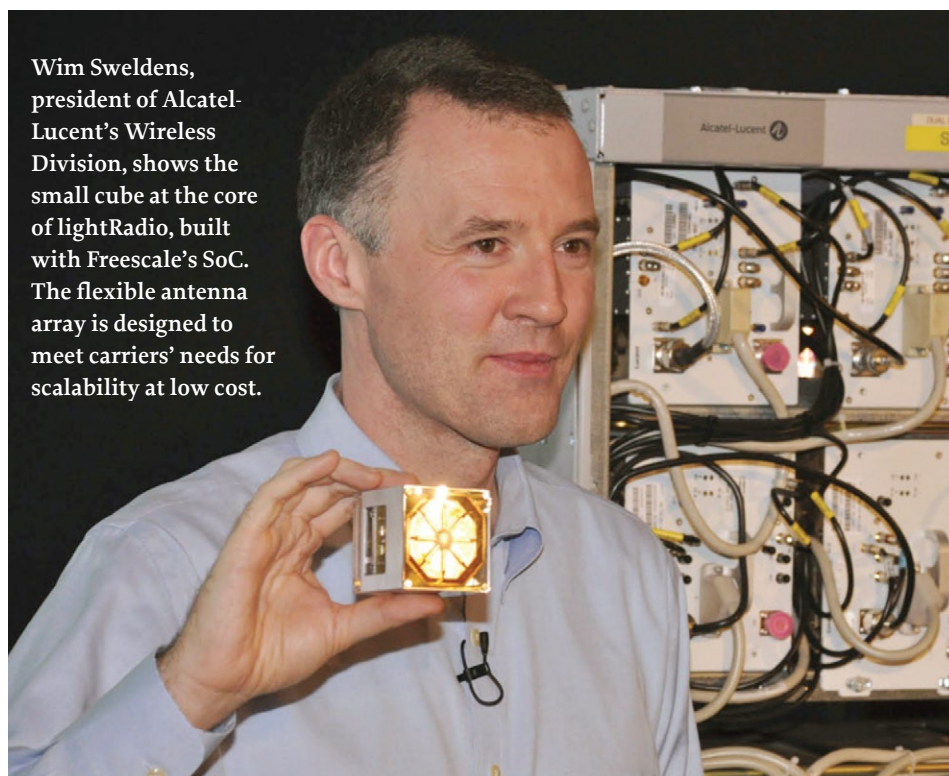
This area is exciting and still far from being mature. "We expect considerable evolutions in the next years as illustrated by the strong demand for more precise and long-term navigation solutions, including indoor pedestrian navigation", explains Robin.

In parallel to the current race to develop ultra-low cost versions of motions sensors, few start-ups are working on revolutionary motion sensing technologies by using different sensing principle or different way of combining motion sensors, with compatibility to a low cost production infrastructure.

The Motion Sensors for Consumer & Mobile Applications Report is available from Yole Développement at www.yole.fr

Freescall,TI square off on basestation SoCs

By Junko Yoshida



Wim Sweldens, president of Alcatel-Lucent's Wireless Division, shows the small cube at the core of lightRadio, built with Freescale's SoC. The flexible antenna array is designed to meet carriers' needs for scalability at low cost.

IN RESPONSE TO network operators' diverging demands for small to large cells, Freescale Semiconductor and Texas Instruments unveiled their respective visions for basestations-on-a-chip at this month's Mobile World Congress in Barcelona. Freescale is rolling out a scalable, multimode wireless basestation processor family dubbed QorIQ Qonverge. The products, designed to scale from small femtocells and picocells to large metrocells and macrocells, share a common architecture consisting of Freescale's proven multicore communication processor, multicore DSP and baseband accelerators.

The semiconductor company's baseband system-on-chip has a role in the lightRadio technology recently announced by Alcatel-Lucent. LightRadio is intended to help create wireless carrier basestations that are said to be "barely bigger than a golf ball."

"Our new baseband SoC is in it," Lisa Su, senior vice president and general manager of Freescale's networking and multimedia group, said of lightRadio. Hewlett-Packard

also worked with Alcatel-Lucent on the technology.

TI, for its part, is fielding a multimode wireless basestation chip, the TM-S320TCI668, that it said delivers "double the LTE performance of any existing 40-nanometer SoC."

The company has also added hardware accelerators to the recently announced TCI6616 basestation SoC. Both the 6618 and 6616 leverage TI's new TSM320C66x digital signal processor, which features floating- and fixedpoint math in every core.

Scalability fits all

Facing exponentially increasing data traffic, network operators are scrambling to find new solutions to boost their networks. As Freescale's Su bluntly put it, "Most operators can't keep up with data traffic today." Operators want network solutions that are "multimode" and "future proof," she said.

The transition to Long Term Evolution, now in trials, could help. But LTE is still at an early stage, said Su. If operators are still

building out a 3G network, they want the equipment "to be 4G capable," she said.

In explaining the wireless network architecture's current state of flux, Su added, "Femtocells, deemed an 'interesting solution' six months ago, are now a part of the solution many operators are looking at." Network operators want a network architecture "optimized for cost, performance and capacity," she said.

Many in the industry agree that there is no one-size-fits-all answer to the wireless network architecture of tomorrow. "Everyone is designing their own vision of network architecture right now," observed Brian Glinsman, general manager of TI's communications infrastructure business. "Solutions proposed by equipment vendors are colored by their top five customers."

That trend, in turn, influences semiconductor suppliers' basestation SoCs.

"Any operator who says they know what client devices will demand in flavors of 802.11, WiMAX, LTE, various flavors of 4G ... is lying, overly optimistic or both," said Rick Doherty, co-founder and director of The Envisioneering Group. "The only sane survival method is to build cell systems with agile software radio support until 4G 'stratifies' into clear winners ... again, driven by the consumer, business and institutional device mix and demand."

TI's strategy is squarely focused on "spectral efficiency." The new hardware acceleration solution integrated in the TCI6618 is responsible for handling the high numbers of bits flowing through basestations, while freeing the programmable-DSP-core processing power to execute customer differentiation chores such as scheduling and multiple-input/multiple-output (MIMO) antenna processing. TI claims the new TCI6618 enables spectral efficiency gains of up to 40 percent.

By making the TCI6618 pin- and software-compatible with the TCI6616, TI offers customers flexibility in designing multimode basestations supporting all 2G, 3G and 4G standards, according to the company.

The TCI6618 basestation SoC does not come with a RISC processor, which would be needed for network processing. The company said it would not detail a basestation SoC complete with a cluster of ARM cores until mid-2011.

As an interim step, in collaboration with Azcom Technology, TI will field a 3G/4G small-cell basestation platform in the second quarter.

The platform comprises the TCI6616 SoC for PHY and Layer 2 processing, C6A8167 Integra DSP+ARM processor for Layer 3 processing, GC5330 transmit/receive processor for digital radio front-end processing and NaviLink 6.0 GPS for clock synchronization.

"We are offering such a platform now so that developers can start writing code," said TI's Glinsman.

Freescale, by contrast, plans to offer a family of basestation processors integrated with its proven network processor.

Well-established CPU, DSP

Freescale's QorIQ Qonverge processors integrate multiple Power Architecture cores, StarCore DSPs with Maple packet processing acceleration engines and interconnect fabric.

Noting that there will always be waste in a system using discrete components, Su said the efficiency of the QorIQ Qonverge processor is largely attributable to its multicore fabric.

"We spent a lot of time developing it," she added. "The key strength of Freescale is that it has both well-established CPU and DSP technology," said Joseph Byrne, a senior analyst at The Linley Group. "Nobody else is in the same position."

Byrne added that "Freescale's embedded-processor business has been stronger than its DSP business, which creates a particularly good opportunity for the company."

He explained, "Freescale is well placed to lure OEMs that have been using TI DSPs with Freescale embedded processors, eliminating TI from these designs."

TI, of course, will try to do the reverse, but the company is not a well established supplier of embedded processors, Byrne said.

In fairness, the timing of the two competitors' rollouts of complete base-station SoCs might not differ all that much. Both are aiming for the second half of 2011.

But analysts believe Freescale may have an edge. "We think Freescale's existing and new customers will get to the market faster because Freescale offers more tools and endorsed, trusted third-party solutions [such as performance monitoring] than TI," said The Envisioneering Group's Doherty. "Time-to-market and the flexibility to change designs as the market demands—more so on the enterprise cell than the femtocell—are crucial."

Freescale sees fundamental changes happening in basestation design and deployment. Su described the expected proliferation of tiny basestations enabled by Alcatel-Lucent's light-Radio technology as akin to cloud computing.

"Instead of racks of servers, we now see a network of desktops connected to the cloud," she said. Similarly, by combining Alcatel-Lucent's antenna and RF communications with Freescale's digital baseband unit, "you will soon see a network of small basestations that are the size of a Rubik's Cube" enabling cellular networks.

The Linley Group's Byrne agreed. "The big-picture is that mobile broadband requires a dense network of basestations, but the carrier's capital expenditure is limited. Thus, some kind of solution that provides density economically is required," he said.

In his view, lightRadio looks to be the kind of architecture that can do the trick. ■

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Stretchable solar cells could power electronic 'super skin'

By Julien Happich

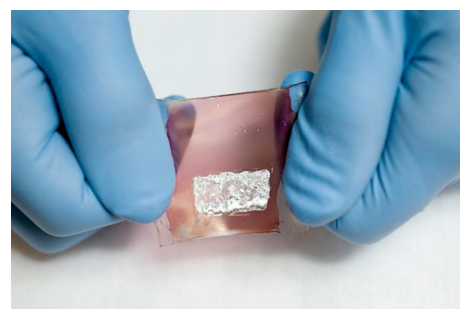
"SUPER SKIN" is what Stanford researcher Zhenan Bao wants to create. The researcher has already developed a flexible sensor that is so sensitive to pressure it can feel a fly touch down. Now she's working to add the ability to detect chemicals and sense various kinds of biological molecules. She's also making the skin self-powering, using polymer solar cells to generate electricity. And the new solar cells are not just flexible, but stretchable, they can be stretched up to 30 percent beyond their original length and snap back without any damage or loss of power.

"With artificial skin, we can basically incorporate any function we desire," says Bao, a professor of chemical engineering. "That is why I call our skin 'super skin.' It is much more than what we think of as normal skin." The foundation for the artificial skin is a flexible organic transistor, made with flexible polymers and carbon-based materials. To allow touch sensing, the transistor contains a thin, highly elastic rubber layer, molded into a grid of tiny inverted pyramids.

When pressed, this layer changes thickness, which changes the current flow through the transistor. The sensors have from several hundred thousand to 25 million pyramids per square centimeter, corresponding to the desired level of sensitivity.

To sense a particular biological molecule, the surface of the transistor has to be coated with another molecule to which the first one will bind when it comes into contact. The coating layer only needs to be a nanometre or two thick. "Depending on what kind of material we put on the sensors and how we modify the semiconducting material in the transistor, we can adjust the sensors to sense chemicals or biological material," comments Bao.

Regardless of what the sensors are detecting, they have to transmit electronic signals to get their data to the processing centre, whether it is a human brain or a computer. Having the sensors run on the sun's energy makes generating the needed power simpler than using batteries or hooking up to the electrical grid, allowing the sensors to be



The foundation for the artificial skin is a flexible organic transistor, made with flexible polymers and carbon-based materials.

Photos by L.A. Cicero.

lighter and more mobile. Having solar cells that are stretchable opens up other applications. The cells have a wavy microstructure that extends like an accordion when stretched.

A liquid metal electrode conforms to the wavy surface of the device in both its relaxed and stretched states. The solar cells continue to generate electricity while they are stretched out, producing a continuous flow of electricity for data transmission from the sensors. ■

MIPS makes virtual processor models available to licensees

By Philip Ling

IMPERAS, which through the Open Virtual Platforms (OVPTM) initiative has become the de facto source for instruction accurate processor modeling and simulation, has announced that MIPS Technologies has licensed an OEM version of the OVPSim simulator to provide a fast, instruction accurate simulation product to its licensees.

The models for the MIPS processor cores support the full software view of the processor cores, including both the MIPS32 and microMIPS instruction sets as well as extensions to the instruction sets such as for floating point, DSP and multi-threading capabilities.

The functionality of these models, developed by Imperas, is verified by MIPS Technologies as part of the MIPS-Verified program, which Imperas has participated in since 2008. MIPS licensees will have access to the full range of OVP technology, enabling them to build peripheral models and full virtual platforms with OVP, and to integrate the models into SystemC/TLM-2.0 environments. All OVP processor models are instruction accurate, and very fast, focused on enabling embedded software developers, especially those building hardware-dependent software such as firmware and bare metal applications, to have a development

environment available early to accelerate the software development cycle.

OVP models of the complete families of the MIPS32 and microMIPS processors, both single and multi-core are currently available for download from www.OVPworld.org.

Virtual platforms utilizing these OVP processor models can be created with the OVP peripheral and platform models, or the processor models can be integrated into SystemC/TLM-2.0 based virtual platforms using the TLM-2.0 interface available with all OVP models. The models also work with the Imperas advanced tools for multicore software verification, analysis and debug. ■

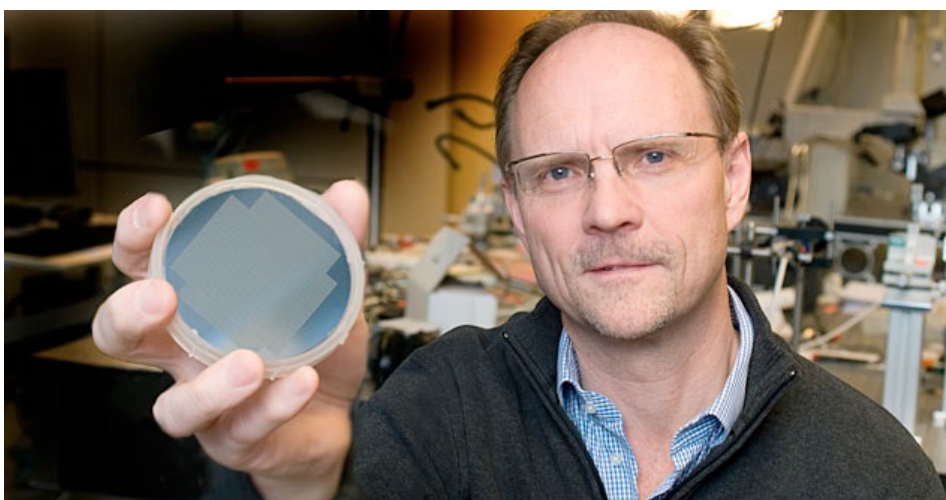
Surface emitting laser demonstrated to deliver error-free data at 40 Gbit/s

By Julien Happich

RESEARCHERS AT CHALMERS have shown that a surface-emitting laser, a cheaper and more energy-efficient type of laser for fiber optics than conventional lasers, can deliver error-free data at a record speed of 40 Gbit/s. The break-through could lead to faster Internet traffic, computers and mobile phones. Today's commercial lasers can send up to 10Gb of data per second through optical fibers. This applies to both conventional lasers and to surface emitting lasers. Researchers at Chalmers University of Technology have managed to increase the speed of the surface emitting laser four times, and see potential for further capacity increase.

Unlike a conventional laser the light from a surface-emitting laser is emitted from the surface of the laser chip (not from the edge), like in an LED. The gain is the ability to not only fabricate, but also test, the lasers on the wafer (a 75 mm wide substrate of semiconductor material of industrial type) before it is cut into individual chips for assembly. The lasers work directly where they sit on the wafer. Conventional lasers work only after partition. The ability to test up to 100 000 lasers on a wafer reduces the cost of production to one tenth compared with conventional lasers.

The laser volume is smaller. It requires less power without losing speed. The energy and power consumption is a tenth of what a



"Each wafer contains Up to 100 000 lasers chips. The surface emitting lasers can both be fabricated and tested before we cut the wafer into chips," says Anders Larsson, Professor in Optoelectronics at Chalmers University of Technology.

conventional laser requires at 40 Gbit/s only a few hundred fJ/bit. If professor Anders Larsson, who has developed the high-speed laser together with his research group in optoelectronics, succeed in their development he expects that the power consumption of a complete optical link will be no more than 100 fJ/bit.

The next step for the Chalmers researchers is to modify the design and refine the ways to control the laser, to increase speed and reduce power consumption even further. "We strive to meet market demands ten years from now," says Anders Larsson, who

estimates that we by 2020 will need energy-efficient cables that can handle 100 Gbit/s per channel.

The research is performed at the Chalmers research center FORCE. It is funded by Swedish Foundation for Strategic Research, SSF, and by the EU through the project VISIT. Participating companies in the European project are IQE Europe (UK), VI Systems (Germany) and Intel (Ireland). Informal partners in the project are Tyco Electronics and Ericsson (both Sweden). The findings are published in Electronics Letters from IEEE Explore. ■

Fiber optics boosted by crystalline core

By R. Colin Johnson

RESEARCHERS AT PENNSYLVANIA State University last week demonstrated what they said are the world's first optical fibers to harbor a compound semiconductor core.

The Penn State researchers, led by professor John Badding, demonstrated fiber optic cables with zinc-selenide cores, which they claim have a wider wavelength range and superior photonic qualities to the amorphous core fibers in use today.

"The key advantage is that these fibers operate over a wide wavelength range, specifically into the long IR and, just as importantly, that one can exploit the materials properties of crystalline compound semiconductors," said Badding. According to the professor, using optical fibers with a compound semiconductor core enabled them to perform many of the same amplification and waveguide functions that today are being demonstrated

on optical chips, but were impossible for traditional optical fibers with amorphous cores. "Crystalline compound semiconductors can host transition-metal gain media, which amorphous semiconductors cannot," said Badding. "The fiber cores can also be made smoother and more symmetric than competing planar compound semiconductor waveguides, potentially giving them superior wave-guiding properties." ■

Startup rolls complementary litho

By Mark LaPedus

MULTIBEAM'S COMPLEMENTARY E-BEAM

Lithography (CEBL) tool is a multi-column, maskless lithography system designed for patterning the most critical layers in a design, contact holes, vias and line cutting, at the 16nm node and beyond. Throughput is said to be five wafers an hour, more than twice the speed of today's single-beam e-beam tools.

David Lam, venture capitalist and chairman of Multibeam, said CEBL will not replace today's optical lithography. But rather CEBL "complements" or works in tandem with today's 193nm immersion tools, Lam told EE Times. Multibeam is looking for partnerships to enable CEBL, he added. (Lam is also noted for being the founder of Lam Research Corp. He is no longer associated with Lam Research.) The company, along with Tela Innovations, submitted a paper for the SPIE Advanced Lithography conference, entitled "E-beam Litho to Complement Optical Lithography for 1-D GDR." 1-D GDR, or one-dimensional gridded design rule, is based on Tela's 1-D layout optimization technology. The combination of CEBL and 1-D gridded design rule technology could provide a powerful one-two punch to enable next-generation IC designs at 22nm and beyond, he said.

Today's optical lithography could hit the wall, prompting the need for another next-generation lithography (NGL) solution. Direct-write or maskless, EUV and nanoimprint are among the next possible waves in lithography.

For years, the industry has used direct-write e-beam technology to pattern lines directly on a wafer. Today's direct-write tools make use of a single-beam technology. E-beams are also used in mainstream photomask production. Direct-write promises to give chip makers some relief from the soaring costs of photomasks.

Direct-write prints tiny features on a wafer, but it is slow in terms of throughput, thereby relegating the technology to niche applications like compound semiconductors. For the most part, direct-write is too slow and expensive for mainstream IC production.

In the last decade, a number of companies began working on next-generation e-beam technology, dubbed maskless lithography or ML2. IMS, KLA-Tencor, Mapper, Multibeam and others are separately working on tools that use multiple beams in a single machine. In theory, ML2 is supposed to overcome the throughput issues associated with single-beam direct-write.

Formed in 2001, Multibeam emerged from stealth mode in 2005. At about that time, the company obtained approximately \$2 million in funding from the National Institute of Standards and Technology (NIST). The startup also disclosed that it was developing a maskless, 50-KeV tool that use an array of 10 electron beams.

At the time, Multibeam was among several vendors racing to develop a tool in NGL. In NGL, there are several technologies aimed to replace today's optical lithography, such as extreme ultraviolet (EUV), maskless and nanoimprint.

Then, in 2009, Multibeam entered into a joint development program with Japan's Tokyo Electron Ltd. (TEL) for an undisclosed project. But in more recent times, Multibeam has narrowed its focus. Instead of replacing optical lithography, Multibeam's new strategy is to work in tandem with 193nm immersion, or perhaps another technology in mainstream fabs. "We are not an NGL," Lam said. "We will not replace optical in high-volume manufacturing anytime soon."

To beam or not to beam

Multibeam, according to Lam, is looking to address only "5 percent of the pattern density" in the challenging and critical layers in chips. Multibeam is somewhat taking a page from Intel Corp, which has been pushing a "complementary" lithography strategy. The chip giant hopes to push 193nm immersion to 11nm. Then, at 11nm, Intel is pushing its concept of a "complementary" or mix-and-match strategy, in which 193nm immersion could work hand-in-hand with EUV or maskless lithography to enable advanced chip designs. It's unclear which technology, EUV or maskless,

will get the nod at Intel. EUV is still lagging in terms of power sources, resists, metrology and defect-free masks. Maskless is still underfunded and the tools are behind.

Still in the R&D phase, Multibeam believes it has the right formula. Instead of the original 50-KeV approach, Multibeam's tool is a 10- to 15-KeV system. The company's CEBL tool makes use of multiple-column arrays. A typical system could have 100 columns for 300-mm production. Each column has its own electron source or beam. The company is in the testing phase for its fourth-generation column. Every column array is identical and they can work independently or in parallel. The range of current is 15 to 26 nanoAmps per column.

"E-beam litho systems on the market today are either single-column or a few columns, all derived from the scanning electron microscope (SEM). In contrast, Multibeam's innovative approach eliminates the magnetic field: the e-beam column is all-electrostatic," according to Multibeam.

Multibeam believes the technology is ripe to help propel designs based on 1-D GDRs. For years, chip makers have made use of two-dimensional layouts in IC designs. But the problem is that there are many challenges to scale 2-D layouts beyond 45nm.

As a result, IBM, Intel, TSMC and others have proposed 1-D GDR schemes. Intel, for example, makes use of unidirectional, gridded layouts at 45nm. In 1-D GDR at 45 and 32nm, chip makers can make do with 193nm immersion lithography.

That could change at 20nm. A 193nm immersion scanner can handle the traditional steps. To handle the line-cut scheme, chip makers are looking at EUV, maskless and even 193nm immersion.

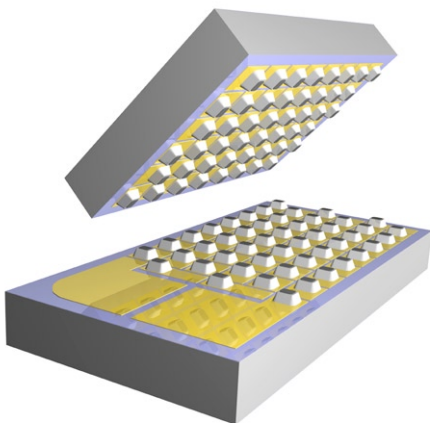
Multibeam believes that CEBL makes the most sense for line cut applications. "Of the three, the most viable and cost-effective solution is (CEBL), if it is used to pattern critical layers, in a mix-and-match mode" with 193nm immersion, Lam said in a recent paper. "This is the only path to high-volume manufacturing." ■

The potential of energy harvesting means there's nothing to lose

By Philip Ling

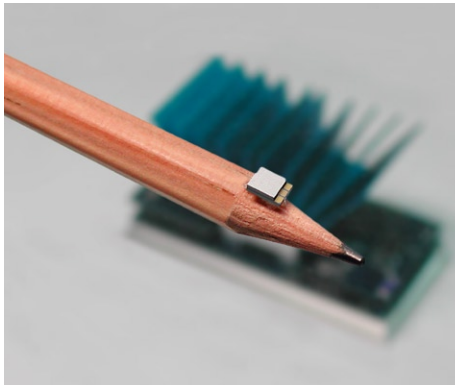
ENERGY HARVESTING IS rapidly maturing to become an important sector in the electronics industry, having risen over the past five years to take its place as a competent technology enabling an expanding market. While the pioneering companies behind the technology have faced many challenges in that time, the market now faces one of its biggest obstacles; convincing system integrators that it is a viable alternative to battery packs.

According to some leading companies in the field, the technology has proved it delivers the levels of energy needed for its target applications, in a reliable, sustainable way. The number of installations using harvested energy grows daily, and many forms of energy harvesting now exist; from thermopiles to vibration, solar to RF. As they all deliver relatively modest amounts of energy, they also share a common application area, which today is predominantly providing power for wireless sensor nodes, used for monitoring industrial/automation equipment and machinery.



Micropelt's Thermoelectric Generator (TEG) uses MEMS technology to sandwich n-type and p-type substrates to harness Seebeck's Law.

But even with significant demand now coming from end-users in this field, it seems system integrators are yet to be fully convinced of harvested energy's credentials. This is due in part to the fragmentation that currently exists amongst competing suppli-



Micropelt's TEG device shown on a pen, can be directly mounted on a heatsink to maximise the temperature gradient across its faces.

ers as, while standards exist for batteries, the same isn't yet true for harvested energy. This places another hurdle in the way of their being specified, but one that is comparatively easier to overcome than the laws of physics.

Because they increasingly target the same class of applications as batteries; typically those that need limited power often sourced from replaceable, removable, rechargeable or renewable cells, this breakdown in the supply chain threatens to impede the future progress of energy harvesting.

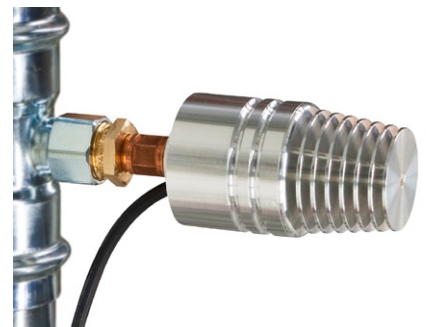
However, recent efforts backed by the ISA (Instrumentation, Systems and Automation Society) have created a working group that intends to develop standards for the interchangeability of power modules for wireless sensor nodes (WSNs), which will cover the electrical and mechanical characteristics of power modules whether they be batteries, fuel cells or energy harvesters.

With a focus on wireless sensors as used within an industrial setting, requiring average power of around 1mW, the ISA100.18 working group will also take in to account the needs of wireless systems such as those covered by ISA100.11A, as well as commercially dominant protocols including WirelessHART and ZigBee. But high on the deliverables will be a standard for power module interchangeability, that will ensure that any (compliant) application will be able to use batteries, fuel cells or energy harvesters indiscriminately. This, it is hoped, will promote the use of energy harvesting mod-

ules within new installations by promoting interchangeability. The first draft detailing a standard connector has recently been published for comment.

A number of companies have now commercialised their energy harvesting technologies and are already seeing success. Typically the underlying technology employs a well-known and well understood electromechanical or chemical effect. For example at least two companies are currently producing harvesters that exploit Seebeck's Law to create a current flowing between two substrates; one n-type, one p-type. Current flow between the substrates is caused by a thermal differential. The effect itself has been known for many years and is synonymous with the Peltier Effect, which is the reverse effect used to create a heat pump.

All that is needed to generate energy is a relative temperature difference between the two sides of the substrate 'sandwich', a significant advantage of this effect is that the n- and p-type pairs can be 'stacked' side by side and wired in series to create greater potential differences.



The symbiotic nature of energy harvesting in wireless sensor nodes enables many use-cases, like this thermostatic radiator valve.

Micropelt, which started as a project by Infineon but is now VC funded, employs the effect to create both Peltier coolers and thermoelectric generators (TEGs). It uses MEMS technology to create micro-TEGs which are capable of producing power in the 10mW range, and is currently commissioning its first volume production line in Halle/Saale, Germany, which will eventually produce 10



The Perpetuum free-standing harvester combines electromagnetic vibration energy harvesting technology with a selectable suite of energy charge, storage and management options.

million parts per year.

According to Micropelt's Vice President of Business Development, Burkhard Habbe, the biggest challenge the company now sees is supporting its target markets and customers through to volume deployment, but that market acceptance will require the energy harvesting industry to further prove its maturity by developing and adopting standards, while educating and supporting system integrators: "Cross-disciplinary consulting and design houses are very desirable and we work on establishing those in our efforts to speed market development."

Another company favouring the thermoelectric generator solution is Perpetua, which produces a flexible thermoelectric film. Jerry Wiant, Vice President of Marketing at Perpetua, believes that education is the company's biggest short-term challenge, but feels energy harvesting is destined to be accepted on a wide scale: "The widely published reports of the pending explosive growth in wireless sensor network deployments is already intensifying the demand for energy harvesting solutions," explained Wiant. "It is becoming clear that battery-changing labour costs and environmental concerns of disposing of batteries are going to be the primary drivers for widespread harvesting adoption."

With technology already shipping in production quantities, Perpetuum, a spin-off from the UK's University of Southampton but now also a VC-backed company, has developed its solution around a different principal; electromagnetic induction. Using the same basic techniques seen in countless electric motors - albeit in reverse - the

company's technology also targets wireless sensing in industrial automation. Predominantly the technology harnesses vibration created by the machines being monitored, making the wireless sensing node symbiotic with its power source. For this reason there is little need for storing excess power, but Perpetuum's President, Roy Freeland, who is also the co-chair of the ISA100.18 Power Sources Working Group, does believe that better power management and its storage will be critical to the future success of energy harvesting.

One of the objectives of the Working Group is to address power management, which could include defining the average power output that any particular method of energy harvesting must produce.

This is perhaps more relevant for energy harvested using vibration because, as Freeland explained, the energy produced is dependent on the efficiency of the converter which is, in turn, dependent on the method used to harness the energy. This requires a 'tuned' solution which is optimal at the reso-



Thinergy's solid-state flexible and rechargeable thin-film cells are only 0.17mm thick.

nant frequency of the vibration source. For machinery running AC induction motors, for example, this may be 100Hz, but for an energy harvester attached to a locomotive, the frequency may be significantly different and prone to change. Perpetuum's technology differentiator is the way it dynamical adjusts to these changes, to maximise the energy harvested.

While low-power, autonomous wireless sensing is clearly the main application for harvested energy today, it is commonly felt that the amount of energy available from existing solutions isn't impeding its use in others: "We're beyond the stage where power is that important, we've shown it can be done and the fundamental breakthroughs were made years ago," explained Freeland. Micropelt's Habbe agreed: "This is not a true

bottleneck, even though there is demand for higher power levels. Higher power levels are usually just a matter of cost, as they can be achieved by combining multiple basic harvester elements, but this premium will go down as volumes grow."

Here, again, the need for better energy storage was raised, by Habbe: "Here is indeed a gap to fill. A 'pure' wireless monitoring sensor simply runs off a capacitor or a perfectly rechargeable small thin film battery, because there is no need for monitoring during the non-operational times of its host. However, if continuous access to, or heartbeat from the sensor is critical, there needs to be a bulk energy storage with considerable capacity, able to sustain operation over multiple weeks without the supply of harvested energy."

It seems that if wireless sensing is to become ubiquitous, creating and transmitting an unprecedented amount of data continuously, the issue of energy storage is the next challenge faced. Several companies already target harvesting applications with energy storage solutions, such as Cymbet and Infinite Power Solutions, both of which produce energy storage solutions for applications powered by harvested energy.

Roy Freeland pointed out that wireless sensing isn't always about networking, although it has become synonymous with, say, ZigBee, where mesh networking is the default topology. Wireless sensing nodes will be less dependent on mesh networks, but better energy storage solutions could enable a greater level of networking, which inherently demands more power.

Freeland also sees applications that are less dependent on wireless connectivity; closed control loops that simply need harvested energy to power a microcontroller that must wake occasionally for maintenance, but agrees that energy harvesting will drive ubiquitous computing. To reach the level of ubiquitous sensing that many feel is on the roadmap, energy harvesting coupled with improved energy storage will be fundamental, as Micropelt's Burkhard Habbe, explained: "Energy harvesting will become pervasive as more autonomous systems need power independent of batteries. In fact, to many of those, energy harvesting will be the key enabler, because it is simply impossible to constantly maintain billions of 'smart dust' devices in structures, buildings, machines, production assets, cattle, pets and, lastly, humans." ■

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Actuation-powered wireless switch eases remote controls

By Frank Schmidt

ENERGY HARVESTING TECHNOLOGY has only become commercially available in the last few years and is enabling entirely new, energy-saving applications in building and industrial automation. The first requirement for designing self-powered wireless products was the ability to scavenge energy from the surrounding environment. Energy harvesting has been around for centuries: after all, windmills, tide mills and water turbines have been extracting raw energy from the environment to generate power since ancient times. The second requirement was to use this energy for efficient communication between different devices. Again, likely solutions have been assumed for some time, with low power radio systems such as Bluetooth or Wi-Fi.

Bringing these two needs together was the challenge that researchers in Siemens laboratories took up in the late 1990s, when they turned their attention to scavenging tiny amounts of energy to power wireless systems. It was apparent from the start that existing technologies were not efficient enough to make them work reliably. What was needed was to bring three key elements together: effective energy converters, sophisticated electronics and software.

Having successfully identified the opportunity and potential solutions, in 2001 a new company - EnOcean - was established out of Siemens in order to exploit the new technology. EnOcean's wireless technology harvests the required power from the energy resources in the surroundings: motion, light or differences in temperature. The amount of energy obtained in this way is enough to transmit a wireless signal and turn on a light, for instance. These radio telegrams, just one millisecond in duration, use an optimum data rate of 125 kilobits per second. To eliminate transmission errors, each telegram is typically repeated twice in the space of 30 milliseconds. Furthermore, data packets are

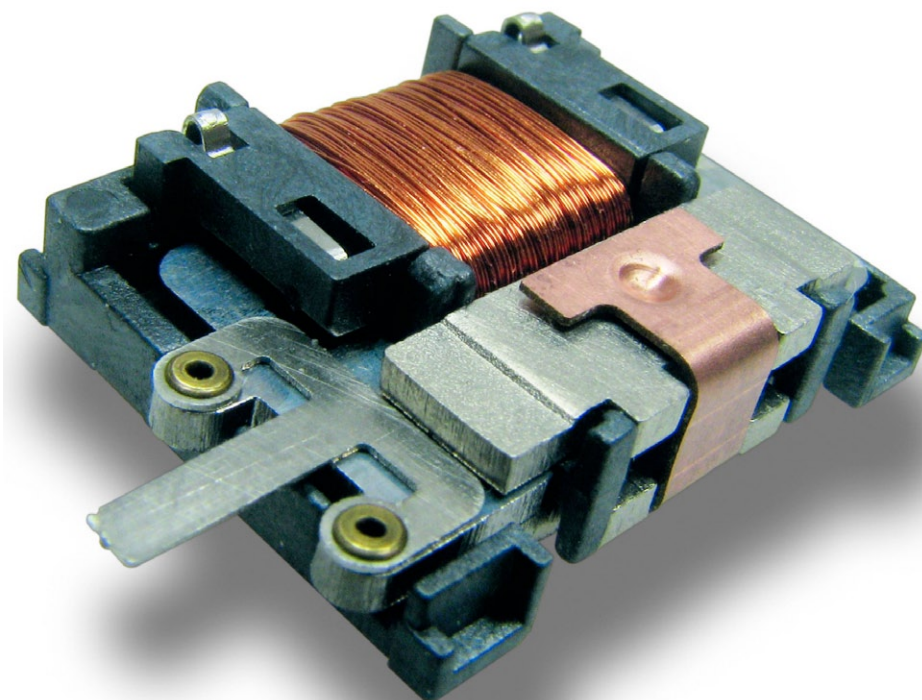


Fig. 1: The ECO 200 bare switch module, a design that measures only 15x20x5mm

transmitted at random intervals, so the probability of collision is extremely small. Using the 868 MHz and 315 MHz frequency bands, this technology can be used just about anywhere in the world.

Wireless transmission distances can reach approximately 300m in the open and up to 30m inside buildings. A refinement with new self-powered wireless modules is their individually attributed 32-bit identification number, which provides over 4 billion unique IDs, to exclude any possibility of overlap with other wireless devices. Power conversion and radio transmission are complemented by sophisticated electronics and, most importantly, by intelligent software stacks that make it simple and straightforward to integrate the technology across a large variety of user applications.

In 2003, EnOcean commercialised its first generation of energy harvesting radio sensors based on piezoelectric powered modules. The second generation in 2007, which consolidated energy transducers, electronics and software, added the option of a new, more efficient means of mechanical power conversion – this time using miniature magnetic coils instead of piezoelectric devices. In the next few months EnOcean is going to market with its third generation of mechanical converters (ECO 200), with further improvements in the efficiency of energy conversion, in noise emission and fully automated manufacturing. Here the magnetic flux permeating a coil is abruptly reversed as soon as a spring mechanism reaches a snap-over point and causes iron parts to move.

Frank Schmidt is CTO and co-founder of EnOcean GmbH - www.enocean.com



Fig. 2: The handheld self-powered wireless switch produced by SEMD.

Self-powered switch applications

This third generation of mechanical converters, which can only be used in combination with EnOcean radio system, allows a quick and simple implementation of individual switch solutions in very different segments. For example, the ECO 200 converter – see figure 1 – could be connected solderfree to the PTM 330 wireless transmitter module from EnOcean for use in remote control keys, or as wireless transmitters for access cards, window and door sensors.

Building automation is the sector that recognised the benefits of energy harvesting the earliest, enabling a lower total cost of ownership through energy savings and reduced operating costs. Essential to the success of building automation projects, installation time should be minimised and overall system costs can be significantly reduced owing to device placement flexibility. Another key area for energy harvesting technology is industrial automation, because high availability and reliability in production are essential factors for the success of a business.

German company SEMD sets the example as an early adopter of the 15x20x5mm ECO 200 mechanical energy generator. The company recently developed a wireless handheld switch that combines the ECO 200 of which a single actuation produces about 150 µJ, with the PTM 330 radio module. The unit can be used as a remote door and gate control, garage opener, lights control or nurse call – see figure 2.

The company also implemented the new energy converter in its high volume application for cable harness testing in automotive industry. Instead of conventional cabled

switches, testing uses energy-autonomous wireless switches incorporating the ECO 200. Simply pressing the switch unit generates enough energy to detect whether the single components are properly attached to a cable harness. A further advantage is that the classic cabling on the rear or under side of the mounting board is substantially reduced. In a conventional cable harness manufacturing setup hundreds of components have to

be checked per board. This needs an electrical connection between each inspection station and the test system that has to be documented or updated when there are changes. The use of wireless sensors makes the test units not only more flexible but also more transparent, the individual test components can be exchanged fast and simply without modifying the overall supporting device or halting the manufacturing system. ■

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Platform design for testing vibration to electrical power generators

By Felipe jerez

RECENTLY, the use of sensor networks has expanded into all sorts of applications to collect ambient or industrial data such as temperature, humidity, acceleration, pressure and any other relevant process information. In addition to the use of a radio frequency system to communicate their data logs to a central unit for various control operations, these sensor nodes are often placed in areas that are difficult to access and where maintenance such as battery replacement would be costly.

Thanks to a new breed of microcontrollers that rely on partial circuitry activation or watchdogs to achieve power consumptions of only a few microamperes, battery size can be reduced or their operational life can be extended for a given size. What makes their low-power consumption interesting is that very often, these low-power sensing devices can be placed on infrastructures (such as bridges), machinery (such as elevators, motors, automotive parts) or even worn by humans (patients, sportmen) where they'll be able to collect vibrational energy.

The mechanical energy created by the natural movement or transmitted vibrations can then be converted into electrical energy. Often, this will translate into enough energy to power the sensor nodes or at least help increase their batteries life if those are used as the primary power supply.

Energy scavenging devices relying on vibrational energy can use permanent magnets together with windings to obtain the energy generation. They are what we call vibration to electrical power generators (VEPGs). Premo group is developing micro VEPGs in order to replace batteries in sensor network applications as well as in low-power consumption microcontrollers including for applications such as TPMS in automotive or body-wearable heart beat monitoring systems. These micro VEPGs are able to generate between 2mW and 6mW (enough to replace small batteries type 2016 or 2032). Electromotive force generated by a VEPG.

According to the laws of electromagnetism, a varying magnetic flux across a wire loop will induce an electromotive force in the wire. The magnetic flux variation can be caused either by changing the flux density across the loop or by moving the loop in relation to the magnetic flux.

Hence a movement or a vibration in a loop crossed by a magnetic flux will induce a voltage across the loop's terminals that is directly proportional to the cross area of the loop, the relative movement and speed of variation of the flux linked to this movement. The induced voltage is also proportional to the number of wire turns if we use a coil.

A permanent magnet normally generates a symmetrical field and the electromotive force generated is fully dependent on the axial (Bz) and radial (Br) components of the magnetic flux density but does not depend on the tangential component (BF). Because the induced voltage is proportional to the axial field as much as the radial field, the relative speed of the coil versus the permanent magnet, its cross section and the number of turns will all determine the power generation.

In collaboration with research teams at the Universities of Malaga, Spain (Department of electronic Technology) and Barcelona (CEIB Group of the UPC), Premo group is working on the development of a complete tool for the design of VEPGs systems. The tool is to include a complete system to catch movement and vibration information, together with SW applications to process the data, and VEPG simulation tools using finite elements for the manufacture of advanced prototypes. A functional test system - figure 1 - has also been developed to reproduce the various vibrating environments in which



Fig. 1: Motor setup able to reproduce various vibrating environments. The VEPG device under test (blurred) is mounted at the tip of a moving cam.

the microgenerator would normally operate. In order to extract energy from a vibrating system or a moving object, it is helpful to determine the parameters of this movement or vibration. The basic parameters that we require for the design of a VEPG include the frequency and amplitude of the movement. In a real application such as a VEPG designed to operate a body-wearable system that monitors the vital parameters of a marathon runner, we would need to power the pulse and temperature sensors together with the display. Together with the University of Malaga, Premo has developed a new system that allows on one hand to extract movement data by means of a series of sensors and on the other hand to run a high-level application that will make the right decisions in-situ in order to maximize the energy generation from the interpreted data. Figure 2 shows various graphs produced by this application in which we can appreciate



Fig. 2: The coloured graphs show the energy-generation capacity of different sensor system locations on a cyclist's body.

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the energy-generation capacity of a cyclist provided with a system of wearable sensors mounted on different body locations (wrist, chest, ankles) at different riding speeds. The sensors help evaluate the capacity to generate energy and can correlate this to the heart beat. With the generated data, we are able to make the calculations for an early prototype that will be simulated prior to its construction using the simulation tools – figure 3.

We can then make any necessary adjustments in the design and optimize the VEPG before prototyping. The prototypes are built in cooperation with the CEIB group at the Polytechnical University of Catalonia. Once the prototype has been built, we can use our functional test system to reproduce the vibrations of the device's normal operating environment in which the real movement parameters are applied to the device. All the parameters can be changed in amplitude and frequency and the generated levels of voltage can be tested in-situ and transferred to the system to be powered according to the assigned functionalities.

As a design project, we were able to manufacture a device able to power the sensors of a typical heartrate monitor as often used by sportsmen to monitor their level of activity. These wearable systems are normally fed by type 2032 batteries that provide the 2mW of power needed to measure and transmit the data to a watch-like display. The VEPG device we implemented was able to generate this level of power by uniquely relying on the own sportsman's movements. The prototypes were developed using Premo's core technology, ultrafine wire products manufacturing capability, which is perfectly suited to the miniaturization of microgenerators. The small VEPG devices are wound with 5000 to 10000 turns of 20 to 60 microns wire. They generate from 2 to 10mW of power depending on the vibration conditions and can easily replace batteries such as type 2016, 2032. Other types of applications such as tyre pressure monitoring sensors in transport applications are also good candidates for VEPG devices.

The use of energy-harvesting sensors is particularly interesting in the implementation of networks that can remotely be accessible from control units without hardly any maintenance. Such networks could also contribute to the Internet of the things, enabling remote infrastructure monitoring through dedicated web pages. ■

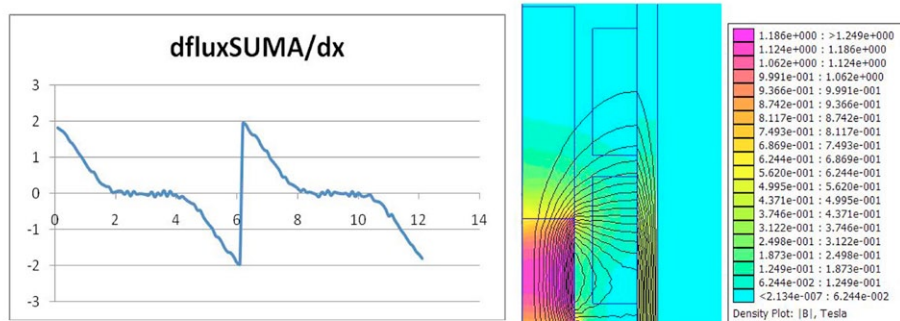


Fig. 3: Simulation data obtained from a virtual prototype.

Can new uses for phaser data measurements prevent blackouts?

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Multiplying energy sources to power demanding smartphones

By Roald Neuquelman

IN THE RECENT YEARS the semiconductor industry has made amazing progresses in delivering higher performance at lower power consumption. However, the gap between the energy need and availability not only persists, but is continuously widening.

For example, while a user was typically able to use his fully charged phone for an entire week a couple of years ago, it's now often the case that after a single day of smartphone usage the battery is flat. Inadequate battery life is one of the biggest sources of frustration for today's smartphone owners.

One way to address this dilemma is to design bigger or denser batteries for the phones, impacting cost or weight or both, but this is not enough to effectively close the energy gap. A smarter way is to multiply the sources of available energy and recharge the battery continuously. This means charging the phone as fast as possible when it is plugged into a wall or a USB charger, and supplementing this with charging the phone "on the go" or anytime while using the device. This is the approach ST-Ericsson has taken with the recently announced PowerHUB product family, which combines conventional charging technologies and new energy sources for unprecedented flexibility and scalability. At Mobile World Congress 2011 in Barcelona, ST-Ericsson demonstrated an innovative three-way solution to power the cellular phone system and charge the Li-Ion battery: 3Amps fast charger, solar harvesting and Near Field Communication (NFC) harvesting.

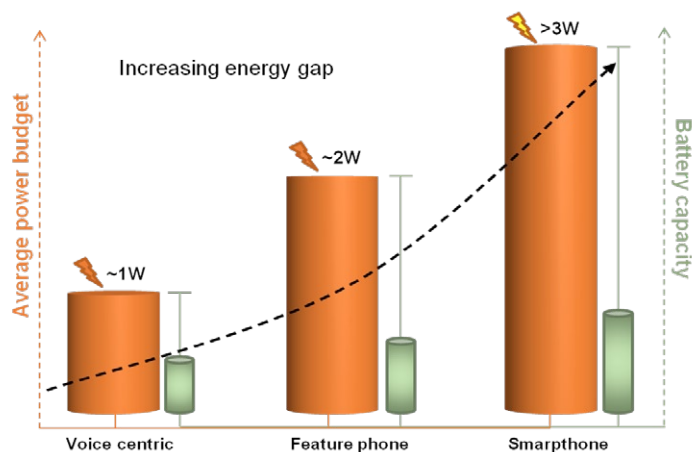
To start with, ST-Ericsson focused on improving conventional charging methods. The newly introduced PM2300 is a 3Amps charger which reduces up to 50% the charging time of tablets and smartphones using large single cell or parallel Li-Ion batteries. With conventional charging, instead of 5-6 hours now only 2-3 hours are needed to

charge for example a 6.5Ah battery. New battery technologies allow to charge during a short period with high current and thus charging up to 80-90% in only 45 minutes for a 1500mAh battery. But another very important aspect is that

some intensive use cases of mobile devices, such as tablets for example, could consume almost all the 1.5Amps provided by a normal charger, which means the battery is not even charging when you are connected to the wall outlet. In other words, even while being plugged, the battery is being drained because the intense use of the modem, gaming and graphics capabilities will consume more energy than the charger can provide. With the PM2300 supporting up to 3A of charging, the battery will always charge while in use and your mobile device will be fully powered.

Charging with high current represents two main challenges: power dissipation which heats the phone up, and the size of the external components required for charging. PM2300 introduces an innovative structure with a dual charging path enabling better power efficiency (around 500mW less power dissipation compared to a single path structure) with the use of conventional small external components. PM2300 has been selected by several manufacturers whose products will be on the market by the end of 2011. PM2300 samples are available in a wafer chip scale package featuring a total PCB footprint of 55mm².^{1,3}

Today, end users want to have a common charging plate that is compatible with all of their mobile devices either at home or in public places. To that end, the Wireless Power Consortium (WPC), of which ST-Ericsson is a member, has established the WPC international standard. This standard is based on the energy transfer from a transmitter, a so-called charging plate to a receiver, the



portable device, with a maximum power of 4 to 4.5W being delivered to the battery. WPC charging uses coils coupled in a resonant inductive way. The standard allows multiple devices to be charged at the same time. It uses a closed loop and a specific protocol to control the power provided to each device up to its end of charge. The charging plate is connected to the wall outlet and provides energy only when a receiver is detected, otherwise the plate does not consume any significant energy. ST-Ericsson will sample WPC charger ICs for mobile applications this year.

Additionally, ST-Ericsson is also looking at alternative energy sources, such as power harvesting to solve battery life issue of future devices. Solar energy is one alternative source that was demonstrated at Mobile World Congress 2011. Today's solar cells, at a typical smartphone size, can harvest up to 600mW of solar energy, enabling longer music playback time, while charging the phone battery at the same time. Future flexible or transparent photovoltaic (PV) cells technologies will offer an even better end user experience with solar energy harvesting. This year, ST-Ericsson will sample PowerHUB solutions combining solar charging as well as other energy charging solutions.

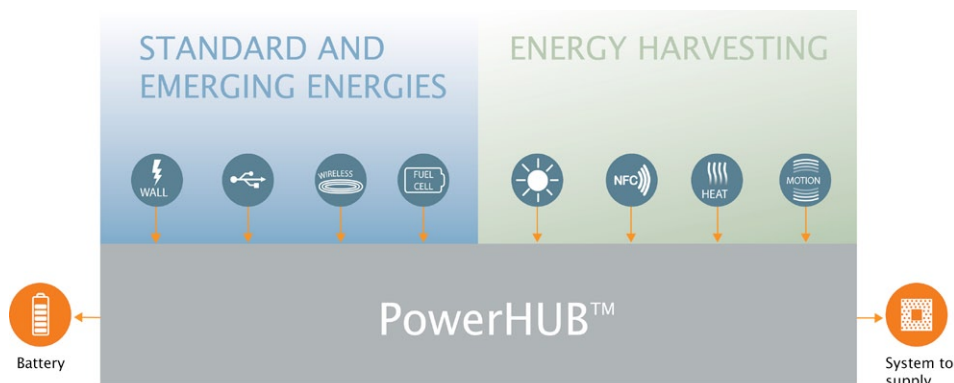
Other wireless communication protocols also offer an opportunity for energy harvesting. With a standard NFC coil for example, harvesting energy from any NFC access point can deliver another 150mW to the phone system. This energy may be a solution in the future for some NFC applications even

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SPECIAL FOCUS:
ENERGY HARVESTING

when the mobile phone battery is flat. It is important to understand that energy harvesting is unpredictable, contrary to a USB or wireless charger. The distribution part of the energy management system must be built in order to harvest energy where and when it is present, with the best possible efficiency. It also needs to mix with the conventional energy sources whenever it is possible. ST-Ericsson is committed to make these energy sources available to the end user, with more solutions from the PowerHUB family being introduced in the coming years that include thermal, motion, fuel cell and other energy combinations.

The possible sources of energy and charg-



ing options for mobile devices are about to grow significantly and the PowerHUB family should drive the introduction of new energy sources while maintaining hardware

and software compatibility over the entire product range. This opens the door to an intelligent, scalable and flexible energy management for future portable devices. ■

Self-adaptive MEMS vibration energy harvester targets low frequencies

By Ghislain Despesse

CEA-LETI RESEARCHERS are developing an innovative energy-harvesting technology that collects vibrations from the environment and converts them into electricity to power a variety of sensors.

A unique aspect of Leti's energy-harvesting microsystem is its ability to use vibrations of varying frequency and amplitude. Although it is easier to convert stable, high-frequency vibrations (over 1 kHz) into electrical energy than low frequency unstable ones, Leti has chosen to focus on harvesting low-frequency vibrations with varying frequencies and amplitudes. The reason for this choice is that many of the vibrations in natural and man-made environments are relatively low frequency (under 120 Hz), and often depend on energy sources of varying activity levels such as engine vibrations, vehicle speed, wind level, etc.

The output power of a vibration-driven energy harvester is directly proportional to the vibration amplitude and frequency of the energy source and to the size (seismic

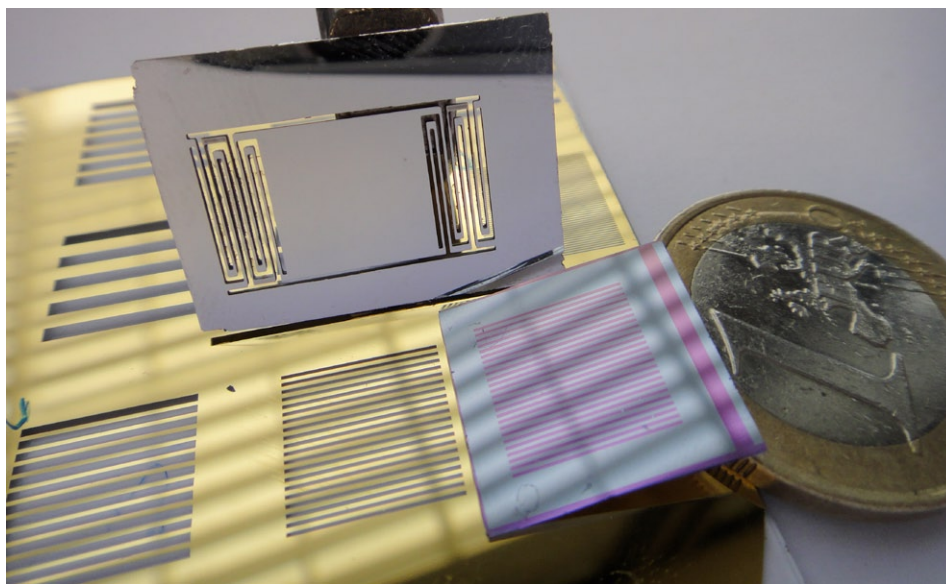


Fig. 1: All three elements shown separately - The SiO₂-based electret (purple slice) is to be mounted or patterned directly onto the MEMS seismic mass (shown standing). The whole assembly is then mounted a few micrometers away from the electrode glass plate (shown at the bottom with several electrode patterns) to form the vibration energy harvester.

mass weight) of the harvester. Output power is inversely proportional to the harvester's frequency bandwidth. Consequently, it is much harder to efficiently harvest power from low-frequency sources with a large frequency band response and with a very small system size than from a stabilized high frequency vibration source.

Seeking better harvesters

With those challenges in mind, Leti (Laboratory for Electronic and Information Technologies of the French Atomic and Alternative Energies Commission) set out to find a better way to maximize the output power of energy harvesters. The laboratory developed an electrostatic micro-electromechanical system (MEMS) structure capable

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of efficiently converting both low- and high-amplitude vibrations into electrical energy, thanks to a unique patterned electrode structure – see figure 1.

This patented electrostatic structure translates the input vibration into multiple capacitance variations, which are used to convert the input vibration energy into electrical energy. When a constant charge is placed in the variable capacitor, the voltage varies in inverse proportion to the capacitance variation (capacitor voltage = charge/capacitance) and the associated energy varies in proportion to this voltage:

$$\text{Energy} = 1/2 \text{ Charge} * \text{Voltage}.$$

In other words, a capacitance variation induces an energy variation, and that energy variation is used to supply the output load.

This type of structure differs from a piezoelectric structure in that the energy level converted per cycle by the electrostatic structure can be adjusted by adjusting the charge value and is not linked to a specific material property. If no charges are placed on the structure, no electrostatic forces will be applied to the structure. The structure is then free to move and no mechanical work is converted into electrical energy. However, if a large charge is placed on the structure, a large electrostatic force appears in the structure, preventing it from moving. As a result, the capacitance value remains constant and no electrical energy is delivered.

To maximize the output power, an optimum charge value is required that matches the mechanical impedance of the vibration source and the converter input.

New electret material

To maintain an optimal electric charge in the electrostatic structure, Leti developed an electret material able to keep its charge over many years, even when built into very small electrodes less than 20^3m . The electret in that case is a silicon oxide-based dielectric material compatible with microelectronic manufacturing processes and is able to permanently store an electric charge, or polarization.

This polarized material behaves very much like a permanent magnet in close proximity to a coil. When an electret changes of position relative to two electrodes, it induces a new charge distribution on the electrodes. If an electrical load is connected between these electrodes then the electret movement will generate electrical energy. Because the structure is electrostatic,

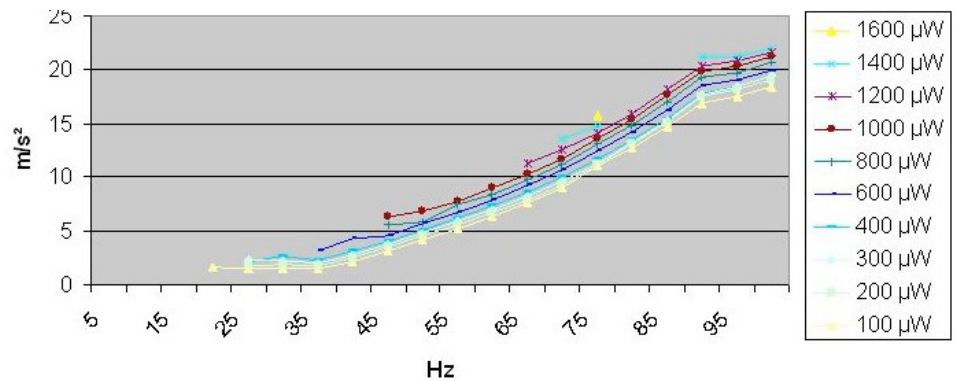


Fig. 2: Different constant output power curves at 3V, measured in function of the input vibration amplitude and frequency for a 100 g seismic mass.

there are no resistive losses, unlike in small electromagnetic systems with low operating frequencies where the losses generated by the coil grow drastically as the size and frequency decrease.

At vibrations of less than 0.2 grams at 50 Hz, Leti's system was able to output 3V, reaching an output power of about 10 microwatts per gram of seismic mass. The resulting mechanical-to-electrical conversion efficiency was an impressive 60 percent. Thus, the main limitation is no longer the converter, but the available mechanical input energy. The largest piece of the system, which represents 80 percent of the system's total mass, is not the mechanical-to-electric converter but the seismic mass component required to provide more mechanical energy to the converter.

Increasing the frequency range

To further increase the energy harvester's vibration amplitude and frequency range, Leti has developed a patented mechanical non-linear spring, which limits the relative displacement of the seismic mass without dissipating energy and helps keep the relative displacement fairly constant over a wide range of frequencies.

To make the most of resonant effects over a wide frequency band, Leti is also working on two solutions that would allow the electrostatic structure to resonate at any frequency. The first one consists of electrically modifying a mechanical parameter of the structure to adjust its resonant frequency so that it can follow the main vibration frequency, for example when harvesting energy in a car, a train or an airplane whose engine is speeding up or slowing down. A piezoelectric effect is used to electrically modify the resonant frequency of the energy harvester.

Experiments suggest that with such a solution, the system's resonant frequency

can be tuned over a range representing up to 30 percent of its main resonant frequency. The feedback loop that automatically tunes the system's resonant frequency to the vibration source's frequency is expected to draw less than 5µW.

The second patented solution consists in amplifying a random vibration by synchronizing a mechanical rebound with the vibration source acceleration. This allows the energy harvester system to absorb the maximum possible input vibration energy and translate it into electrical energy. To achieve this, the seismic mass displacement direction is changed when the vibration source reaches its peak speed by making a short elastic rebound (which lasts a short time compared to the vibration source period).

This mechanical rebound induces a speed increase in the seismic mass of about twice the vibration source's maximum speed at each rebound. The speed increase at each rebound induces a kinetic energy increase of the seismic mass.

Finally, one part of the kinetic energy increase is proportional to the square of the vibration source speed, while the other part is proportional to the input speed times the previous speed. Hence, the higher the previous speed is, the higher is the kinetic energy increase.

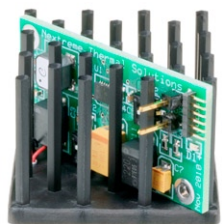
This energy amplification process enables this system to reach high mechanical energy levels from the vibration source at each rebound, which are then converted into electrical energy when the amplification level is sufficiently high.

The second solution was tested using piezoelectric actuators to create the rebound, and a relative average displacement gain six times greater than that of a simple resonant system was obtained, over more than one octave. ■

Thermoelectric module

generates 3.3, 4.1 or 5.0Vdc outputs

The Thermobility WPG-1 wireless power generator from Nextreme Thermal Solutions converts heat into electricity for low-power wireless applications. When paired with wireless transmitters, the Thermobility solution can provide electric power for decades



of maintenance-free operation. The first in a series of wireless power generators, the Thermobility WPG-1 provides a constant voltage output of 3.3, 4.1 or 5.0 Vdc to electrical loads of 15k Ω or higher. The WPG-1 is about the size of a golf ball and consists of a pin-fin heat sink, a custom circuit board, Nextreme's eTEG HV56 thermoelectric power generator module and a metal attachment plate that is applied to the desired heat source. The device incorporates a Linear Technologies LTC3108 ultralow voltage step-up converter and power manager chip to provide up to 1mW of electrical power at temperature differentials as low as 15-20K relative to ambient. Larger temperature differences can generate significantly more power. For simple bench-top testing, the WPG-1 can be placed directly on a laboratory grade hotplate with temperature control.

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Android mobile phone

recharges via its own photovoltaic cells

At Mobile World Congress, Umeox launched the Apollo, a solar-powered Android phone. The Chinese manufacturer showcased two different models: one for the US (MTK6573) with support for 850/1900Mhz bands and one (the MTK6516) that will work in Europe and much of Asia.



The mobile phone features a 3.2 inch 320x480 display, 1GB of internal storage, it has a microSD card slot and comes with FM radio, Bluetooth 2.1 with A2DP, a 3 megapixel rear camera and a 3.5mm audio jack. The back of the unit is fully wrapped by sleek photovoltaic cells. The company estimates that charging up for daily usage should only require about 2.5 hours of sunlight, bringing it back to 100% after it has been fully emptied would require 17 hours.

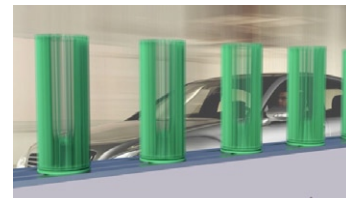
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Vertical wind turbine

harnesses transport-generated turbulences

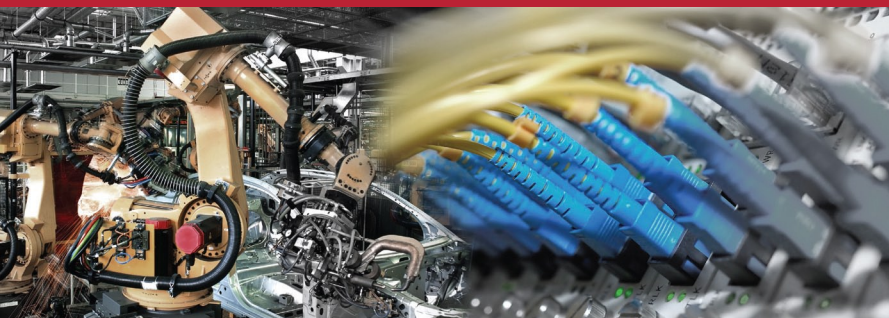
Industrial designer Luis Castanheira Santos described on his blog a new wind turbine concept for urban environments, taking advantage of the traffic-generated air turbulences. The aim of the Voltair concept is to use wind energy as it could be generated by the movement of transportation vehicles such as automobiles, motorcycles, trains, etc. The motion-generated wind could be harnessed by vertical axis turbines mounted along the axes of motorways, on top of New Jersey barriers that divide the directions of traffic lanes. The energy produced will be used to supply the infrastructure to support different transport routes and associated equipment, making them self-sustaining. The Voltair modular product should be flexible, installed at strategic locations, such as suburban transport, railways or motorways. The turbines can be applied to sections of road with light or infrastructures that require electricity and that support these transportation routes such as petrol stations, toll roads or service areas.



Luis Castanheira Santos

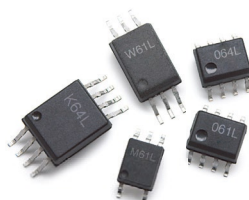
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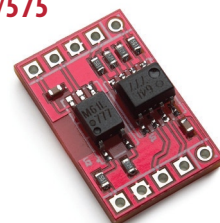
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March 2011 Electronic Engineer



Tracing mixed-tool flows graphically

By Rosemary Francis

HOW MANY TIMES have you got a “file not found” error about a file that you know is there? When integrating new tools or using someone else’s flow it can be frustrating, not to mention time consuming, to have to read through the code or litter the code with a bunch of print statements. We’ve all done it and we’ve never had a good time.

But there could be a satisfying way forward. Recently launched software Breeze provides a new solution, giving development teams the kind of connected overview that the software industry has been enjoying for over decade.

By working with members of the University of Cambridge, the team at Ellexus has developed a new way of analysing and debugging scripted systems. The goal of the Breeze development team was to provide 21st-century software engineering and debugging technology with the spontaneity and precise control that you only get with a fully-featured Linux commandline and scripting interface.

Breeze is based on the Eclipse platform but functions as a stand-alone application. Eclipse was originally designed as a Java development platform, but has since been extended to support C, C++ and a variety of other languages through its plug-in architecture. Eclipse is the obvious choice for software developers, but its dependency on projects means that it lacks the spontaneity needed in the scripting environment. There now exist plug-ins for almost every language you can think of, but they are unregulated so vary in quality. Each plug-in can only handle a single language so they tend to focus their features on the syntax of the language rather than the semantics of the dynamic system.

If you want to write a large project in a single language then Eclipse or one of its competitors would be an obvious choice. Breeze comes in where the system is constantly changing or comprises many tools from different vendors, and users need to

share code quickly and easily in the most appropriate language for the job.

Taking breakpoints a step further

The combined editor and file-navigator interface of Breeze should be familiar to everyone, but the command-line gives an added dimension of flexibility and control. For this reason Breeze does not require the lengthy project set-up that is integral to other development tools. The tool acts as a dashboard that understands how build infrastructure comprises many tools and many scripts in multiple languages. The tracing and breakpoint debugging system gives direct access to the system as it runs so that engineers can develop code more quickly and share infrastructure more easily.

Using breakpoints as a facility for interactively debugging programs is already well understood. The user selects a location, runs the program and the debugger halts when it hits that point. The user can then decide whether to step through, run to the next breakpoint or suspend execution. However, breakpoints could previously only be set in compiled programs with hardware support or in scripted programs with language-specific support. Language-specific debuggers are available for interpreted or scripted programs, but none that can cope with the mixed hierarchies common in EDA design flows. Specifically, tools with built-in Tcl interpreters can be difficult to debug in a mixed-language hierarchy as the design tools each have their own selection of debugging facilities.

With this gap in the market in mind, Breeze takes the use of breakpoints a step further, as the software automatically generates a graph of execution showing the dependencies within a system. It detects breakpoints at the operating system level

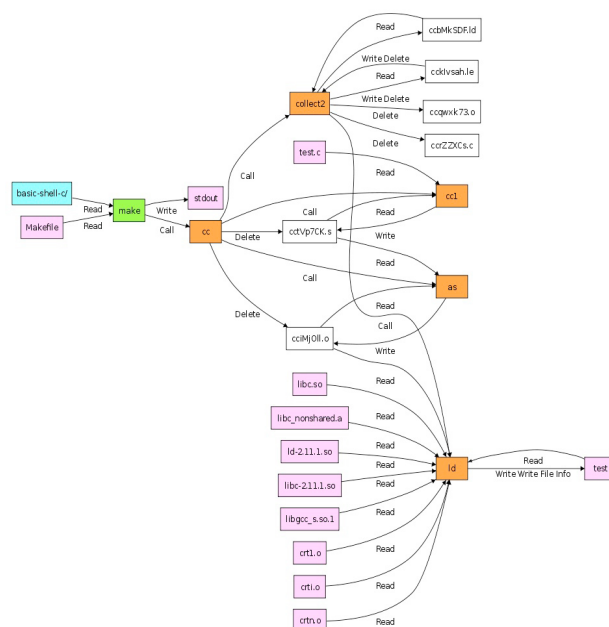


Fig. 1: a quick C compilation job shown in terms of relationships between the files and the programs.

so it can support each of the languages, interpreters and tools automatically. The tool uses the tracing mechanism to detect and intercept GNU C library calls between the applications and the operating system. This means that the tracing and breakpoint facilities do not have to rely on vendor-specific information.

By doing this, Breeze solves the problem of managing scripted flows that control many tools in different languages. From the editor within Breeze, developers can set breakpoints throughout the system and view the execution of the build in real time in the form of an interactive graph. Developers can even use the infrastructure to set breakpoints in in-house tools and languages.

It is this innovation that has really been the breakthrough in designing a product that can support any tool and build-chain. Without this technology, the task of supporting each language and tool individually made such a product prohibitively complex to design.

Breeze in action

Breeze comes with an example of a quick C compilation job, as shown in figure 1. The graph of the build shows the relationships between the files and programs in the

build. A user can zoom in on the graph so that larger operations can be examined in detail and switch between graphs for run comparisons. Files can be opened in the editor with a double click, making it easy to edit dependent scripts in parallel. Using this functionality, teams can be sure of a good understanding of the scripts. The graph forms a detailed summary of the system so teams can maintain up-to-date documentation by saving the graphs and sharing design flows more easily.

Breeze breakpoints are showcased in figure 2, which provides a screenshot of the debugger in action. The example system is a makefile that calls scripts in Shell, Perl, Python and Tcl. The tool is waiting at a breakpoint in the shell script. The process list shows all the active processes and you can step through each process as each hits a breakpoint. Although we have used these as an example, the technology sits at the operating system level so we can support any design tool and any language – even languages developed in house with custom interpreters.

The software uses graph filters to restrict the graph to files in the user space and to make it easier to navigate. This way, developers can check the dependencies of their source files in isolation from the rest of the system. They can step through the code and verify the system structurally as if it were a single program written in a single language. By making the components of the system unambiguous you can be absolutely certain during sign-off that due diligence has been paid.

On top of this, reading reports is much easier using Breeze. When the logfile from the graph is opened, a user knows that he or she is looking at the latest output; it is simply not possible to accidentally read the

data from a previous run. The logfile editor automatically detects errors and warnings so that a user can click through the document skipping straight to the important information.

Working with other design tools

Many tools such as Azuro's PowerCentric and Altera's Quartus come with a GUI that provides a lot of development features such as custom error filtering and graphical flow wizards and analysis tools. Breeze is not designed to compete with such tools, it works with them. You can run the graphical tools from the Breeze tracing infrastructure to check your flow inside the tool. It is this functionality that also appeals to tool designers. Figure 3 shows the execution and reporting infrastructure of a Quartus compilation run.

Several design tools are out there to help integrate vendor-specific best practices with run management in specific areas. For example, Lynx from Synopsis has been designed to incorporate third-party tools. For new design teams these tools can be of great benefit when setting up a new flow and getting to grips with the tool chain. Breeze would come in at the set-up stage when the third-party scripts need to be integrated and checked and when the design files and libraries for a project need to be merged into the flow. Developers might even want to check the recommended flows that come with the tool to make sure that they are linking against the correct databases and binaries.

Larger organisations glean less benefit from dedicated flow-management tools because in general they have a lot of in-house tools and internally developed flows. For those companies, the advantages of Breeze come in maintaining and updating their IP. The areas that would most benefit from using Breeze are in flow development or

tool integration where you need to get the infrastructure right and you need to work with a variety of tools.

This can be in digital physical implementation as well as digital and analogue tool management and test.

Graph 41: ./compile.sh

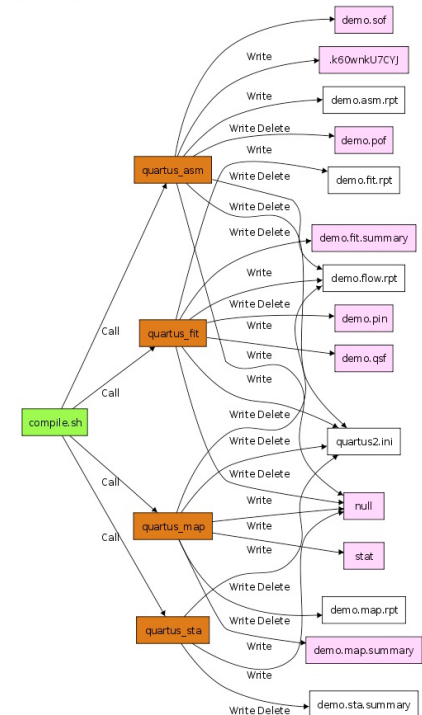


Fig. 3: The execution and reporting infrastructure of a Quartus compilation run.

Real cost benefits

A typical design team can spend upwards of \$100,000 per engineer each year. This figure can be much higher for digital synthesis and P&R engineers. But much of the value for money is lost through costly procedures. It may take a few hours for the engineer to get to know a new flow if they have to mentally map the flow by reading the code. Similarly, a typing error on the last line of a script can waste a whole night's runs. As well as saving time during the day, enabling developers to check their infrastructure before setting off a long run overnight can save \$500 or more for each mistake prevented.

Early feedback from trials in the EDA industry has indicated that Breeze is a little way from being a ubiquitous script development tool, it certainly is great for a variety of common problems. It may never become a tool that will be used during every hour of development, but it is already shaping up to be a valuable asset that can be picked up when problems occur or when a new flow is being introduced or restructured. Trials have indicated a range of uses such as understanding customer infrastructure as well as documentation and even sign-off quality assurance. The use cases are clear; there are few development teams out there that don't have to maintain scripted flows and test harnesses. What the team at Ellexus has provided is a way to make life a little easier and a lot more fun. ■

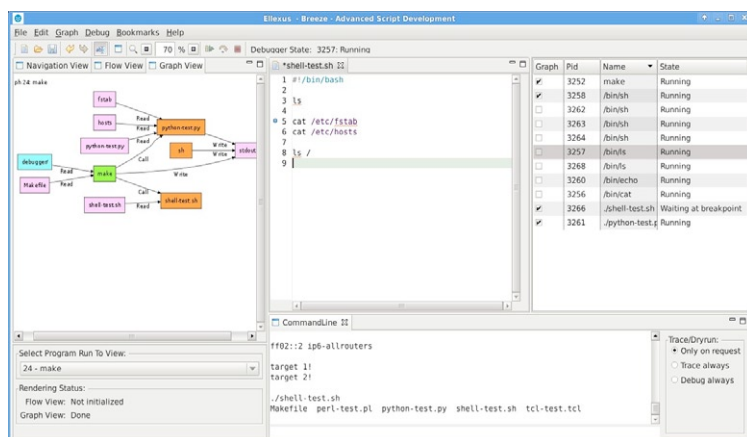


Fig. 2: The debugger in action showing the breakpoints.

Simulation takes the guess out of LED lighting junction temperature

By Norbert Engelberts

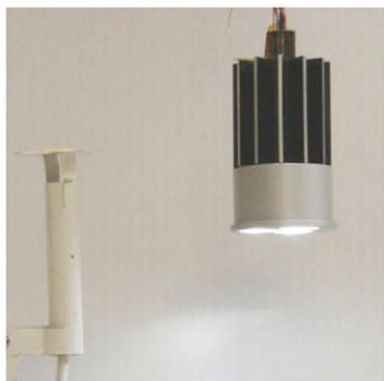
ELECTRONICS DESIGN ENGINEERS face complex trade-offs when they design small high-power-consuming lighting devices like LEDs. The market wants smaller, brighter and more reliable lighting devices. But those features cost more. Can designing the new generation of LEDs using simulation reduce their cost and improve their performance? Unlike traditional lighting solutions, LEDs have a maximum junction temperature of around 100°C whilst other lighting solutions are at around two thousand degrees Celsius. This means that for LED lighting, there needs to be an effective heat transfer path to the ambient air; a thermal design challenge to say the least. A better heat transfer path is normally proportional to the cost of the product. The heat sink performance can be greatly decreased by adding a fan, but that adds noise and an extra reliability concern to the product. The challenge is to provide a cooling solution which is just as cost effective whilst satisfying the LED thermal requirements. When designing LED cooling solutions, the size of the cooling solution can be directly related to the cost. A bigger heat sink means more weight and more material that has to be paid for. Optimization of a heat sink allows for the best possible performance for a

Norbert Engelberts is director of advanced thermal solutions, ATS Europe at www.qats-europe.com

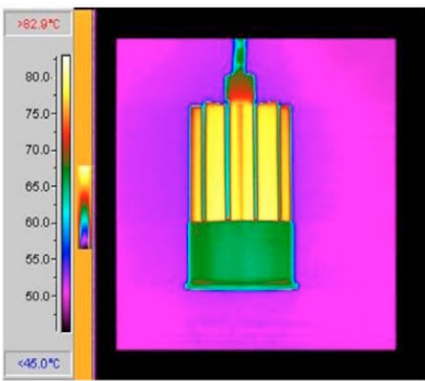
Parameter	Unit	Analytical	Experimental	6SigmaET
Ambient	°C	20	20	20
Heat sink base	°C	76	71	66
Board	°C	81	78	74
LED junction	°C	110	107	103
Comparison	°C	2.80%	Datum	-3.70%

given material cost. Natural convection heat sinks also have the benefit being more reliable than a fan cooled solution without the extra cost of the fan. Could simulation tools be used to accurately predict the junction temperatures of LEDs and reduced hot spots while minimizing the size of the overall lighting product? We looked at a lighting system consisting of three Philips Luxeon K2 cold white LEDs with 1A of forward current and 9.6 W of total power dissipation. The system had a required life time of 60,000 hours, with a maximum junction temperature limit of 124 °C at 20°C ambient and a maximum junction temperature limit of 150 at 40 °C ambient. ATS Europe used Future Facilities’ 6SigmaET simulation software to model the thermal performance of the lamp alongside analytical calculations and the eventual experimental measurements. Different configurations of printed circuit boards (PCB) were evaluated using the software. The configurations

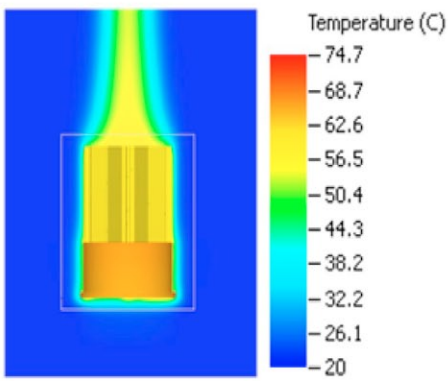
included FR4 and metal core board configurations. The models predicted that temperature drop across the PCB using the FR4 board configurations would be severe and preclude the use of a natural convection heat sink. After an optimized metal core board configuration was simulated, the heat sink size was determined by analytical methods and performance was confirmed with the software. The heat sink was eventually selected from ATS’ standard LED heat sink catalogue. The heat sink design was optimized for a natural convection environment and coated with a highly efficient surface finish. 6SigmaET has the modelling capabilities necessary to accurately predict heat transfer and resulting temperature distribution throughout the LED down lighter assembly for a variety of design configurations. In the lighting system configuration we had opted for, 6SigmaET was able to predict temperatures within 4% of the experimental values. ■



LED thermal test configuration



Measured temperatures



Simulation results from 6SigmaET

Defect analysis software for IC photomask inspection systems

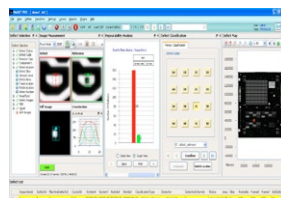
SoftJin Technologies released its latest version of NxDAT, a defect analysis software that is widely used by mask shops and wafer foundries for the analysis of defects as identified by IC photomask inspection systems. With its open architecture, NxDAT can be easily extended for analysis of defects identified by a variety of inspection instruments including IC / FPD mask inspection systems, wafer inspection systems and metrology systems. NxDAT includes a host of features for navigation, visualization, sophisticated image measurement, cross-section analysis and repeatability analysis for accurate analysis and classification of defects. The enhanced version of NxDAT is optimized for better performance in terms of both speed and memory. Several new analysis options in the defect image analysis and defect-to-CAD database correlation

area provide the user with more insight into nature of defect.

Usability improvement features such as customizable GUI layout, batch mode support, property based file opening and user-defined filters provide greater flexibility and efficiency to users. SoftJin provides a generic reader/writer plug-in interface through which various defect file formats can be easily supported. The new version of NxDAT supports SEMI's P41-0304E mask defect data specification standard. It can load and stack multiple inspections in different formats. A direct interface is provided with Hotscope layout and mask data viewer, enabling the tool users to navigate through the defect data and at the same time visualize the corresponding region of CAD data in Hotscope.

SoftJin Technologies

www.softjin.com



Design productivity boost with Ascent Lint's 10 times faster performance

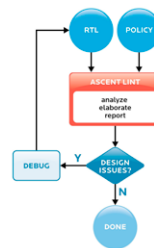
Real Intent announced the immediate availability of Ascent Lint Version 1.4, which the company claims to be the industry's fastest and most accurate solution for performing syntax and semantic lint checks for complex SoC designs. Ascent Lint 1.4 features a new capability to generate incremental reports, which compare violation differences between runs.

Incremental reporting saves designers significant time by directing attention to new violations since the last check. Other productivity features include an enhanced capability to waive violations from the command line, design source files or graphical user interface, as well as scope-based lint analysis

and reporting, which allows designers to focus on specific portions of the overall design. Comprehensiveness is improved in version 1.4 with new rules for arithmetic data path checking, dubious logic modeling and RTL (Register Transfer level) coding policy. In addition, a new rule set has been added to analyze the integrity of netlists. The company claims that the tool consistently outperforms the competition in runtime by more than 10x.

Real Intent

www.realintent.com



Deep source code analysis tool for complex C/C++ systems

GrammaTech and Lattix announced the availability of an integration between their respective tools, GrammaTech CodeSonar and Lattix LDM. The new CodeSonar integration with Lattix provides precise and accurate architecture analysis to enable teams to review, refactor and maintain the architecture of complex C/C++ software systems. The Lattix CodeSonar integration loads the data from CodeSonar's deep source code analysis to enable users to analyze the relationships between the contents of the C/C++ files. This capability to explore dependencies between functions, variables, class methods, fields and macros significantly improves impact analysis and support for refactoring initiatives. Users can conduct impact

analysis on defects identified by CodeSonar, using impact tags and reports to ascertain those parts of the architecture which could be affected directly or indirectly by changes in the code to fix the defects. The integration is said to address the need for a more complete and scalable solution for complex C/C++ systems, enabling users to better understand and improve the architecture, eliminating bad dependencies, expediting refactoring efforts and reducing defects.

GrammaTech and Lattix

www.grammatech.com - www.lattix.com



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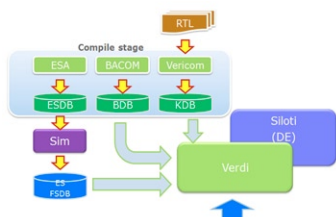
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Reusable behavior analysis database *eliminates redundant SoC design analysis cycles*

SpringSoft launched the Siloti visibility automation system, offering a streamlined flow for SoC verification and debug. The latest software release incorporates a new reusable behavior analysis database to eliminate redundant analysis cycles, which speeds up design preparation time by at least 10X over previous releases during debug operations with the company's Verdi automated debug system. Siloti records the minimal (essential) signal data needed from logic simulation to achieve full visibility into the functional behavior of complex IC and SoC designs. This process minimizes simulation overhead and provides data that can then be used with the Verdi system for more efficient debug and analysis.



The new Siloti release further enhances the visibility automation and debug flow by enabling engineers to choose the behavior analysis mode that best fits verification requirements (Verdi full signal dump or Siloti essential signal dump), transparently switch between modes, and store/reuse analysis results. The new Siloti flow is based on a unified essential signal database that can be shared by multiple simulation runs and works in conjunction with the open architecture of SpringSoft's design knowledge and fast signal databases (KDB and FSOB, respectively).

SpringSoft

www.springsoft.com

Magillem Design Services and CEA *join forces on unified hw/sw design platform*

Magillem, a provider of platform solutions, announced the signing of a multi-year collaboration agreement with CEA, the French alternative energies and atomic energy commission. The project will focus on development of unified hardware/software design tools for complex systems-on-chip (SOC) to reduce design-iteration steps and improve the verification path. To shorten time-to-market, designers integrate more and more software to add functionality and flexibility. Current development methods for embedded systems decouple the design of application software from the design of its execution platform. This results in intractable verification of the entire system, along with sub-optimal hardware/software partitions, and

discontinuities in the design flow. It also makes specifications revision difficult and directly impacts time-to-market. Magillem brings its know-how in design methods and tools as well as innovative solutions for complex SOC design and reuse. Leti and LIST, institutes of CEA, will bring their expertise on SOC design to help Magillem extend its design technology offer. The goal is to ease hardware-and-software integration and enable global validation of SOC. The joint-development work will take place at the CRI PILSI, the Integration Research Center of the International Software and Smart Systems Cluster, in Gîères, France.

Magillem

www.magillem.com

CST Studio Suite version 2011 *for real world EMC analysis*

Studio Suite version 2011's general purpose electromagnetic solvers, in the time and frequency domains, can provide sensitivity information for an arbitrary number of parameters in just one simulation run. The newly implemented trust region framework in CST Studio Suite 2011 can employ the sensitivity information to cut down optimization time dramatically. Yield analysis for complex three dimensional models is now available at virtually no additional computational cost, says the manufacturer.

High performance computing options are now also available for the frequency domain and the integral equation solver.

The CST MWS TLM solver (CST Microstripes) and CST Cable Studio (CST CS) support "real world" EMC analysis including coupled simulations which enable large system analysis and installed performance studies. In pre-processing, the definition of compact equivalent aperture models and

cable harnesses will be performed in CST's familiar design environment. Coupling between the electromagnetic field and cable solvers is further enhanced to enable direct transient simulation of susceptibility problems in systems containing complex cable bundles, including shielded twisted pair circuits. Based on one single simulation model, the simulation task concept facilitates optimization, considering electromagnetic, thermal and mechanical designs. The temperature calculated from the electromagnetic losses can be used to change the material parameters automatically for a consecutive



electromagnetic field simulation. CST MPhysics Studio now also features a thermal solver on tetrahedral grids. The tool suite integrates well into the Cadence RF-SiP design flow.

CST

www.cst.com

High speed inter-chip (HSIC) PHY IP *enables significant power and area savings*

Evatronix SA, provider of USB-IF certified solutions for Super-Speed USB 3.0 and USB 2.0 IP, has announced a High Speed Inter-Chip (HSIC) compatible PHY IP for significant power and area savings in USB 2.0 chip-to-chip connections. Implementation of the HSIC technology enables setting up a direct connection on a PCB board between a USB Host chip and other on-board USB devices. The HSIC standard features much less power consumption by eliminating the requirements to support long external USB cables while remaining USB protocol compliant and

thus USB software compatible. Through the implementation of a 240MHz DDR interface the HSIC standard provides full support for the 480Mbps data transfer of the USB protocol. It eliminates the 3.3 and 5V signalling, enabling significant silicon area and power savings in comparison to standard cable USB 2.0 PHYs. The Evatronix USBHSIC-PHY logic macro is available now on the LFoundry 150nm process and can be ported to any technology node from 65 to 180nm.

Evatronix SA

www.evatronix-ip.com

MEMS sensors: When GPS is not enough

By Bob Scannell

TYPICALLY ASSOCIATED WITH cars, aircraft and ships, precision navigation has become widely used within the industrial and medical segments for applications ranging from factory machinery and surgical robots to first responder tracking.

There are many existing approaches to derive location, direction and movement as they relate to pointing, steering and guiding equipment. In fact, it has become common for many applications to rely on GPS. But when it comes to navigating indoors and addressing more complex and environmentally challenging scenarios, GPS alone is insufficient.

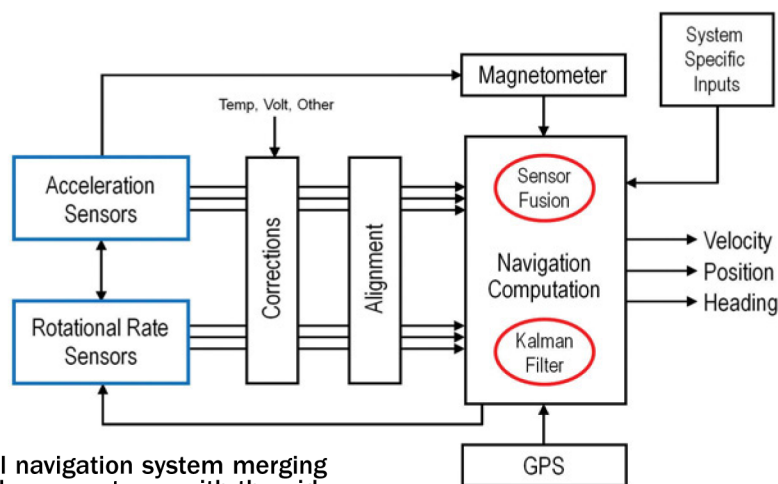
For such applications, you can deploy various sensor types to improve a system's ability to determine actual from anomalous motion. The ability of a given sensor to address a particular navigation problem isn't dependent only on the performance level of the sensor, but also on the unique dynamics of the application.

As with any complex design problem, the starting point is to understand the end application objectives and limitations. From there, rank the critical performance parameters to arrive at a rough understanding of the required sensors; then optimize the design through careful sensor conditioning, integration and processing.

The navigation problem

Let's begin with an analogy: Say you're at work and want a cup of coffee, so you head for the break room. If you've been to the break room before, you likely have a route in mind, but along the way you will rely on various senses—optical, audio, balance and perhaps even touch—to help get you there. Your own "personal processor" combines the inputs from the various "sensors" and applies some embedded pattern recognition. If

Bob Scannell is a business development manager for Analog Devices Inc.'s Inertial MEMS products. He holds a BSEE from the University of California, Los Angeles and an MS in computer engineering from the University of Southern California.



Inertial navigation system merging multiple sensor types with the aid of Kalman filtering.

it's been a rough day, you may need to obtain external input (get directions). Throughout this process, your personal sensors must be individually precise but must also work well together to filter out and reject misleading information, such as the smell of coffee from your neighbor's cubicle.

In other words, to reach the break room, you employ the same techniques used by designers of navigation systems for vehicles, surgical instruments and robotic machinery.

The industrial corollary to this example consists of various sensing techniques, none of which singlehandedly addresses the requirements of most applications. GPS is prone to errors due to obstacles that block satellite reception. Another common navigational aid, the magnetometer, requires clear access to the Earth's magnetic field; there are many field interferences within industrial environments that make a magnetometer's reliability intermittent at best. Optical sensors are subject to line-of-sight obstructions, while inertial sensors are generally free of these interferences but have some limitations of their own. For example, they lack an absolute reference (where is north?).

Sensor selection

Except for the simplest of problems, most solutions rely on multiple sensor types to deliver the required accuracy and performance under all conditions. Inertial sensors, such

as microelectromechanical systems (MEMS)-based accelerometers and gyros, can potentially fully compensate for the shortcomings of other sensor types because they are free from many of the same interferences and do not require external infrastructure—no satellite, no magnetic field, no camera, just inertia.

With a 20-year track-record in the automotive industry, MEMS inertial sensors are highly reliable and commercially attractive, as has been demonstrated by their successful application in mobile phones and video games, for which the sensors' low power consumption, size and cost are favorable factors. There is a large variation in available performance levels, however, and devices suitable for gaming are not capable of addressing high-performance navigation problems. Precision industrial and medical navigation, for example, typically require performance levels an order of magnitude higher than is available from MEMS sensors used in consumer devices.

In most cases, a device's motion is relatively complex (more than one axis), which drives the need for full inertial measurement units (IMUs), which may integrate up to six degrees of freedom of inertial movement (three linear and three rotational).

For example, Analog Devices Inc.'s ADIS16334 iSensor IMU is amenable to many industrial instruments and vehicles.

In many cases, you can integrate four or more additional degrees of freedom, including three axes of magnetic sensing and one axis of pressure (altitude) sensing.

An inertial measurement unit outputs highly stable linear and rotational sensor values that must compensate for the following influences:

- temperature and voltage drift;
- bias, sensitivity, and non-linearity;
- vibration; and
- x,y,z axis misalignment.

Depending on their quality, inertial sensors encompass varying degrees of drift. Designers can occasionally correct for this by employing GPS or a magnetometer.

A central challenge in navigation, beyond good sensor design, is determining which sensors to rely on and when. Inertial MEMS accelerometers and gyros have proved that they are a good complement to help designers craft a fully functioning sensing system.

Machine guidance

In an indoor industrial or medical setting where the GPS signal is denied and where machinery and electronics introduce magnetic interference, designers must establish less traditional approaches to machine

guidance. Many emerging applications, such as surgical tool navigation, also require significantly higher levels of precision than, say, automobile navigation. In all of these cases, inertial sensors are an option for providing the dead-reckoning guidance required to maintain accuracy during line-of-sight blockage or other interference sources detrimental to noninertial sensors.

The accompanying figure depicts a generic inertial navigation system (INS) for navigating anything from a surgeon's tool to a vehicle or an aircraft. The INS model incorporates a Kalman filter. First used on the Apollo moon missions, these filters are pervasive today in phased-locked loops within mobile communications to provide a mechanism for merging multiple good but imperfect sensors and thereby obtaining the best estimate of location, direction and overall motion dynamics.

When applied to surgical applications, the INS could be used as a navigational aid for aligning artificial joints, such as knees or hips, according to a patient's unique physical characteristics. Besides enabling better alignment (for improved comfort) and faster, less invasive surgery, use of the right sensors can help counter hand tremor and fatigue.

Purely mechanical alignment has been supplemented by optical alignment in recent years, but just as there are GPS signal blockages that can impede vehicle navigation, there are potential line-of-sight blockages in the operating room that limit optical sensor accuracy. An inertial-guided surgical alignment tool can supplement (or even replace) optical guidance, with no line-of-sight issues, and also offer potential advantages in size, cost and automation.

Though there is consistency across applications in the basics of solving a navigational problem, the end-system specifics must be well understood. Those considerations will ultimately guide the selection of appropriate sensor types, which in turn affects overall end-system performance.

Thus, in parallel with the strong push for small, low-power and multiaxis inertial sensors for consumer applications, some sensor developers are equally focused on turning out compact, high-accuracy and low-power high-performance sensors.

These environmentally robust sensor developments are driving a surge in the adoption of MEMS inertial sensors within the industrial, instrumentation and medical markets. ■

Achieving high currents on PCBs with fine-pitch SMD components

By Peter Mauer

IN SWITCHED-MODE power supply systems or other circuits used in power electronics, the demand for control circuitry to use fine-pitch SMD components is ever increasing. At the same time, however, high currents of more than 100A will be present across the printed circuit board. Product developers face the challenge of finding a suitable yet financially viable solution.

In power electronic systems, the PCBs used often involve challenging technical requirements that force product developers to come up with particularly creative solutions to meet these requirements. Engineering compromises in key areas have to be made, since the sensitive control circuits normally

have to use standard inexpensive SMD components. This calls for fine-pitch structures for the wiring and land pattern for the components, microcontroller and FPGAs. Fine-pitch SMD structures are now easily achieved by the majority of PCB manufacturers for copper thicknesses in the signal layers up to 35µm – see figure 1. By way of contrast, to achieve the high currents needed for a MiniSKiiP module, i.e. to achieve 120 Amps in 35µm technology, either extremely wide wiring or copper surfaces would be needed to keep heat build-up at bay.

For such thicknesses, it would be virtually impossible for product designers to comply with clearance specifications if the PCB is to be small in size and, for cost reasons, the number of layers is to be kept to a minimum. The use of standard 35µm



Fig. 1: Normal 35µm stackup design

technology can therefore be ruled out here; instead, new solutions are required. Possible compromises might be to use thick copper or wirelaid technology.

Thick copper stackup design

To achieve a satisfactory width for the individual high-current tracks, the stackup design has to be altered while the cross-sectional area of the conductor remains unaltered. If, instead of 35µm-thick copper, the layer thickness for the outer and inner layers is increased to 70µm and 105µm, respectively, suitable conductor widths can be achieved – see figure 2. Unfortunately, it is not possible

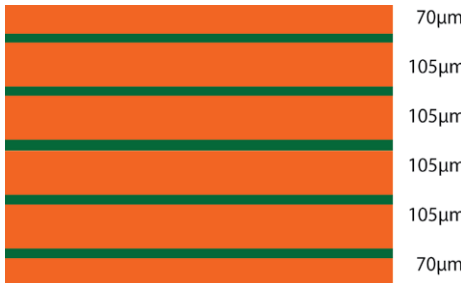


Fig. 2: PCB layout with 70 and 105µm thick copper

to achieve fine pitches (clearances) on the 70µm-thick outer layers at a reasonable cost. Here, the ratio of circuit board conductor width to height would result in behaviour in production that is difficult to predict. An additional 35µm layer pair would resolve this problem technically; unfortunately, however, this would negatively impact the production costs. Alternatively, in place of SMD components, traditional components with no fine-pitch clearances could be used and 70µm-thick copper used for the outer layers. This would normally result in a larger PCB. Another problem here is that some components are only available in fine-pitch technology, meaning that circuit redesign would be necessary.

Wirelaid technology as a compromise

A new technology available from a number of manufacturers such as Jumatech, Häusermann or others is wirelaid technology. Here, a wire with a rounded or rectangular cross-sectional area is integrated into the stackup design directly beneath the outer layer. In our circuit shown on figure 3, ribbon wiring with a 0.5mm-high and 4mm-wide cross-section is used. In a micro-welding process, the copper wire is welded (or bonded) on the outer layer to form a positive-locking connection. The given outer FR4 dielectric layer is slightly thicker than usual and contains more resin, meaning that the wire is pressed into the FR4 layer. Using Allegro or OrCAD PCB Editor, a layer for the copper wire was defined directly below the top layer that describes the wire routing – see figure 4. In the first internal signal layer, a Route Keep Out was defined below the wire. During the pressing process, the wire cannot form a short circuit with the signal wire on the internal layers. In the Cadence PCB Tool, the only settings to be made are those for the stackup design; plus, wirelaid technology can

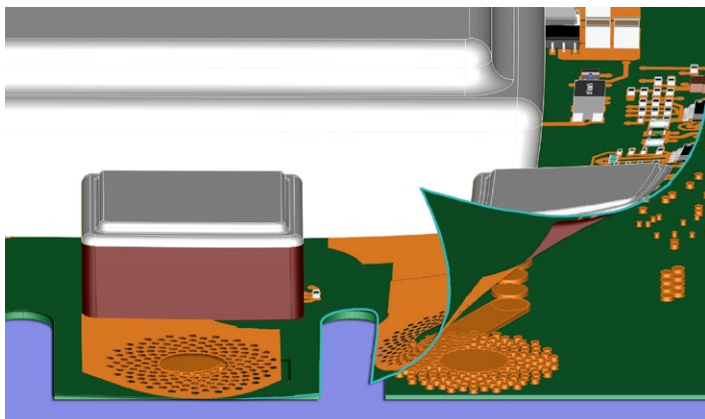


Fig. 3: Wirelaid technology whereby a wire with a rounded or rectangular cross-sectional area is integrated into the stackup design directly beneath the outer layer.

Layout Cross Section

	Subclass Name	Type	Material	Thickness (MM)	Conductivity (mho/cm)	Dielectric Constant	Loss Tangent	Negative Artwork	Shield	Width (MM)
1		SURFACE	AIR			1	0			
2	TOP	CONDUCTOR	COPPER	0.035	595900	1	0	<input type="checkbox"/>		0.30
3	L1 PROFIL	CONDUCTOR	COPPER	0.5	100000	4.7	0.019	<input type="checkbox"/>		0.30
4		DIELECTRIC	FR-4, TG150	0.3	0	4.7	0.019			
5	L2	CONDUCTOR	COPPER	0.035	595900	1	0	<input type="checkbox"/>		0.30
6		DIELECTRIC	FR-4, TG150	0.3	0	4.5	0.035			
7	L3	CONDUCTOR	COPPER	0.035	595900	4.5	0.035	<input type="checkbox"/>		0.30
8		DIELECTRIC	FR-4, TG150	0.3	0	4.7	0.019			
9	L4 PROFIL	CONDUCTOR	COPPER	0.5	100000	4.7	0.019	<input type="checkbox"/>		0.30
10	BOTTOM	CONDUCTOR	COPPER	0.035	595900	1	0	<input type="checkbox"/>		0.30
11		SURFACE	AIR			1	0			

Total Thickness: 2.04 MM Layer Type: ALL Material: ALL Field to Set: Thickness Value to Set: Update Fields

OK Apply Cancel Refresh Materials Help

☐ Show Single Impedance
☐ Show Df Impedance

Fig. 4: A 35µm layout in wirelaid technology, shown in Allegro PCB Editor

even be applied in the smallest scalable PCB design stage in OrCAD PCB design software.

Unlike the first solution using thick-film copper, the use of wirelaid technology does not impact the costs negatively. The additional costs for the wire are balanced out, for example by the savings made for the reduction in layer pairs and the use of standard copper thicknesses. An additional cost benefit is the reduced PCB dimensions as opposed to the dimensions achieved using thick copper technology.

To calculate the heatsink requirements, the PCB manufacturer using wirelaid technology has translated its experience into mathematical formulae. The calculation results were very close to the actual

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readings obtained in test measurements and a temperature difference of 20K was found compared to thick copper technology. A further advantage of wirelaid technology is that the surfaces are very planar and do not differ from standard PCBs built with 35µm technology.

PCB's in wirelaid technology can conduct very high currents. This property is one of the core requirements for the use of PCB-based modules such as MiniSKiiP or SEMITOP (power modules produced by

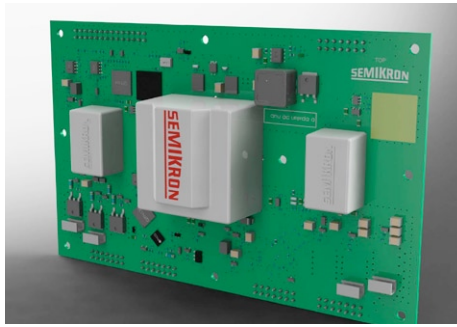


Fig. 5: PCB 3D simulation using CAD data exported from Allegro & Nextra

Semikron, where, for example, +DC, -DC and AC load connections are routed through the PCB). This technology uses far less space than conventional thick-copper PCBs. Since circular and ribbon wires take up far less space on the PCB than special power layers, the number of layers can often be reduced. This technology can easily be designed with all of the individual design stages of the scaleable cadence PCB Design solution from OrCAD and Allegro. ■

Touchless gesturing brings innovation

By Ahsan Javed

HUMAN-MACHINE interaction has evolved significantly over the past decade through enhancements in user interfaces and smart design. Many of these changes have focused around touchscreen interfaces with high-precision, low-power capacitive touchscreens at the forefront particularly in the handset market. Now, through advancements in human interface (HI) technology and design, infrared proximity sensors are poised to usher in the next user interface innovations centered on touchless gesturing.

Traditionally, infrared proximity sensing systems have incorporated legacy photo-detectors and photo-interrupters, which trigger based on motion or interruption respectively. These proximity sensing solutions are used extensively in automatic doors and lavatory dispensing systems, but the applications have been limited due to the sensor size, power and configurability. More advanced active proximity sensors offer exciting features and promise enhancements to consumer electronics and industrial products. Next-generation infrared sensor offerings, such as the Silicon Labs Si114x product family, are not only smaller and lower power than previous offerings, but also have the ability to drive multiple infrared light emitting diodes (LEDs), thereby enabling advanced gesture inputs in multiple dimensions.

Single-LED driver proximity sensors have been used in touchscreen handsets for many years and represent the highest-volume

proximity sensor market, but their use has not been without issues. For example, although proximity sensors are used to deactivate handset touchscreens during calls to eliminate errant touches by the cheek, a quick web search reveals that many end-users are unhappy with proximity sensor performance in their handsets. Accidentally muting calls, initiating conference calls and hanging up on callers are frequent mishaps caused by erroneous proximity sensor operation.

Why does a seemingly simple proximity-sensing system malfunction so frequently? The answer lies in the sensor design and configurability as well as the mechanical guidelines that accompany them. Many infrared proximity sensors are just that: dumb sensors that output raw data based on the signals received. The sensors do not have any onboard smarts to aid in distinguishing system noise from an actual signal, and they have trouble operating in environments with high ambient infrared content such as full sunlight or rooms lit by incandescent light bulbs for example. Furthermore, with industrial design taking an increasingly important role in the appeal of modern electronic systems, these proximity sensors are ill-suited to operate behind very dark overlays that limit the amount of visible and infrared light reaching the sensor.

The latest generation of proximity sensors, such as Silicon Labs' Si114x family, addresses the shortcomings associated with poor proximity sensor operation. For example, the advanced architecture of the Si114x sensors, Figure 1, features multiple high-sensitivity photodiodes coupled with

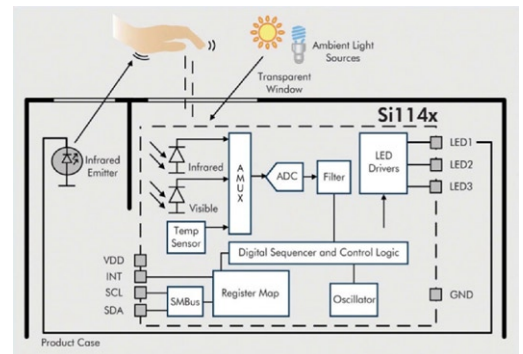


Figure 1: The Si114x proximity sensor enables multi-dimensional touchless gesture interfaces.

a high-precision analog-to-digital converter (ADC). This enables measurements with the infrared LED "on" for a fraction of the time (25.6 microseconds) of other, less advanced sensor offerings. This short LED on-time enables the sensor to determine and compensate for ambient infrared levels in the environment and to better distinguish them from the actual proximity measurement.

Faster measurements also have the benefit of reducing overall system power. The infrared LED is the biggest contributor to a proximity system's power

budget. Minimizing the time that the LED needs to remain on reduces the overall system power consumption. With 15 dynamically adjustable LED drive settings, the LED drive strength can be adjusted based on the ambient infrared conditions, thereby saving power and leading to a more energy-efficient design.

The LED no longer must be set at a power-hungry maximum setting. Highly sensitive photodiodes also enable the sensor to operate behind very dark glass so that the electronics can remain hidden to the human eye, resulting in cleaner, sleeker industrial designs.

Triple the LEDs, triple the innovation

While single-LED proximity systems are driving today's market, the future is geared toward multi-LED proximity sensor systems enabling unique innovations in user interfaces. Two-LED infrared systems enable slide and select gestures for use in applications such as page turning in e-books, volume selection in home audio equipment or scrolling in tablet PCs. Three-LED proximity systems can be used for 3-D positional calculation and multi-axis gesturing. These three-LED systems can be used for touchless UI navigation such as icon or photo selection, zooming-in and out in mapping applications, or even game controls.

Other, more exciting applications for two- and three-LED proximity systems are limited only by the designer's imagination. Just as capacitive touchscreens ushered in a new era of user interfaces, touchless gesturing technology will similarly change how end users interact with electronics products.

Touchless benefits: health, safety and convenience

A valid challenge to touchless interfaces is why they should be implemented at all. Why do away with tactile buttons and touchscreens if they work? Infrared systems are not going to replace existing systems, but instead they are going to augment the user experience. Increased integration and miniaturization are changing the way customers use electronics products. No longer are "computers" relegated to use in the home study or on an office desk. These days people travel everywhere with their smart handsets, personal media players, e-books and tablet PCs.

Coffee shops, restaurants, gyms, bus stops, plane terminals and even lavatories are fair usage environments for this new generation of embedded electronics. In such diverse operating environments, users' hands are sometimes occupied, dirty, sweaty or covered in food—all conditions not conducive to touchscreen operation. If a customer is reading an e-book at the gym while on a treadmill and wants to turn a page, it would be a much easier to swipe across the device with a touchless gesture to turn the page rather than physically contacting a touchscreen or hunting down a small button.

Being able to control a device without having to look at it has additional benefits. For example, a touchless interface can allow an automobile driver to safely start/end a call or adjust volume with the touchless swipe of a hand without having to navigate through a complicated instrument cluster to find control buttons. Not all devices have or need complex graphical displays with touchscreens either, and for such devices a touchless interface can provide an innovative and differentiated approach for operation.

Multi-LED proximity systems can be used to change the operation of a system based on a user's proximity to the system. A display for a set-top box or HVAC control panel, for example, can remain dark until the system detects a user within a certain distance, thereby saving power. A TV also can be turned on or off with a gesture-based input. Small-scale video advertising billboards within public spaces can change the context of their messages based on whether someone is near or far away and then use touchless gesture inputs to interact with the potential customer; this is a far more sanitary way to display an advertisement publicly than using a touchscreen. Such "environment aware" electronics can enable smarter end-products that are simultaneously more energy-efficient.

Combining multi-LED proximity sensors with host MCUs opens the door to flexible user interfaces using both capacitive touch and infrared touchless technologies. Host touch-sense MCUs provide

the computational power necessary to interpret the output of the infrared sensors and help to tune the timing and sensitivity of touchless gestures.

The MCUs also can assist with runtime configuration of the sensors to optimize operation for low power consumption based on ambient light levels. Figure 2 is an example of a touchless application incorporating a proximity sensor combined with a capacitive touch-sense MCU.

With the advent of more sophisticated proximity-sensor ICs that support two- and three-LED implementations, embedded developers will dream up new applications for touchless gesturing interfaces that will help make electronic products easier, safer, more sanitary and more enjoyable to use. The day will soon come when even the most commonplace home appliance, handheld device, computing platform and industrial interface can be activated and controlled with the wave of a hand. ■

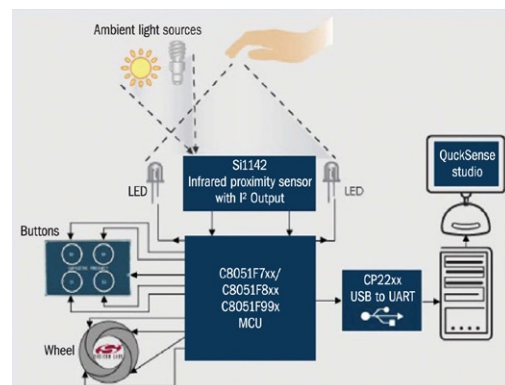


Figure 2: Touchless interface application based on proximity sensor and touch-sense MCU.

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Stereo analog subsystem

with Class G headphone amp

National Semiconductor has unveiled what the company claims is the industry's first stereo analog subsystem with integrated Class G headphone amplifier and automatic level control (ALC) for

smartphones and feature phones. The PowerWise LM49251's Class G headphone amp dynamically reduces the

supply voltage to lower power consumption and extend audio (MP3, movies, etc.) playback time. The loudspeaker's ALC provides designers with several options to control audio distortion levels and prevent speaker damage. National's LM49251 stereo analogue subsystem combines a 1.4W Class D speaker amplifier, 20mW Class G headphone amplifier and ALC

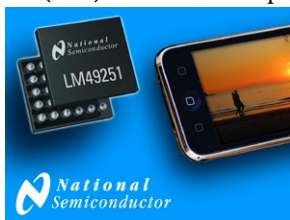
in an ultra-small 2.55x3.02mm package. The LM49251 offers the lowest power consumption in its class, consuming less than 7mA of quiescent current at 3.3V for the loudspeaker and headphone.

The LM49251's ALC feature provides designers with a programmable output power limiter for speaker protection and clip level select.

Offered in a 30-bump micro SMD package, the LM49251 provides enhanced Emission Suppression (E2S) and a Class D amplifier featuring a patented, ultra-low EMI pulse-width modulation (PWM) architecture that significantly reduces RF emissions while preserving audio quality.

National Semiconductor

www.national.com



Power and audio SoC

also integrates a touch-screen controller

Maxim Integrated Products has developed a range of integrated Power System-on-Chip (Power SoC) devices that combine power management with mixed-signal functions such as digital audio, a high-speed interface, and a touch-screen controller on a single chip. It targets the thinner and smaller form factors found in smartphones, tablets, and e-readers. Often, larger batteries are needed because of the use of more power hungry processors, displays, and wireless ICs. These requirements are driving the design of much smaller PCBs to enable the desired form factor for these mobile devices. It is to meet this demand, Maxim says, that it has brought together many technologies from across the company and integrated them into the Power SoC products. The company claims that by incorporating highly

efficient power-management functions, audio codec, touch-screen controller, microcontroller, additional memory, and system clocks into one chip, it can reduce board space by 40%, as well as extend battery life and lower system cost. Maxim's mobile Power SoC solutions target smartphone or tablet designers who want to minimize the overall component count and increase design flexibility and speed, regardless of which baseband controller or applications processor is used. Additionally, these Power SoC products are claimed to reduce power consumption, PCB size and BOM cost, thus enabling lighter and thinner mobile devices that greatly enhance the user's experience.

Maxim Integrated Products

www.maxim-ic.com

Power management development kits

generate clean positive and negative rails

Texas Instruments has introduced two power management development kits, which help designers generate the cleanest possible positive and negative voltage rails to power today's analog circuits. The new TPS54060 and TPS7A30/49 development kits remove switching noise and increase the performance of data converters, operational amplifiers, clocks and other signal chain devices.

Designers can enhance their system's power performance by connecting the new TPS54060EVM-590 and TP-

S7A30-49EVM-567 evaluation modules for a complete low-noise reference design. TI's new 60-V TPS54060 SWIFT switcher in an inverting buck-boost configuration generates a highly accurate, highly balanced positive and negative output voltage up to 18 V.

The switcher's positive and negative voltage outputs are post-regulated with TI's TPS7A30 and TPS7A49 low-noise high-PSRR LDOs.

Texas Instruments

www.ti.com

High-speed 14- and 16-bit ADCs

cut power consumption by two-thirds

Intersil has announced its newest family of analogue-to-digital converters (ADCs); pin-compatible 12-, 14- and 16-bit ADCs with sample rates from 130 to 500 megasamples per second (MSPS). The first device to be introduced is the ISLA214P50, a 14-bit, 500MSPS ADC that consumes 63% less power while sampling at a rate 25% higher than any other 14-bit ADC.

The ISLA214P50 was designed using Intersil's proprietary FemtoCharge technology and operates from a 1.8V power supply. The new converter's ultra-high sample rate and resolution improve sensitivity and accuracy, while the decrease in power consumption allows simplified thermal and power system design.

At a sample rate of 500MSPS, the ISLA214P50 features a signal-to-noise ratio (SNR) of 72.7dBFS with spurious free dynamic range (SFDR) of 84dBc for f_{IN} = 30MHz (-1dBFS).

The ISLA214P50 was recently selected by Spectrum Signal Processing By Vecima, a leading provider of high-performance, software-reconfigurable signal

processing platforms, for use in their RF-4902 Wideband Frequency-Agile RF Transceiver. Because the ISLA214P50 consumes only 835mW of power, it can be used in systems that cannot tolerate the bulky heat sinks and fans that are needed to cool competitive devices. A serial peripheral interface (SPI) port provides access to the ADC's extensive feature set, such as power-management functions, output test pattern generation and output code format selection.

Digital output data is presented in selectable LVDS or CMOS modes. The ISLA214P50 uses two time-interleaved 250MSPS ADCs to achieve the resulting 500MSPS sampling rate. Similarly, all dual channel devices are pin-compatible. All devices will be available in space-efficient 10x10mm, 72-pin QFN packages. For area-constrained PCBs, a subset will be offered in a 7x7mm, 48-pin QFN package, reducing footprint by an additional 51%.

Intersil Corporation

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Novel touchscreen controller

operates seamlessly with noisy battery chargers

Cypress Semiconductor, has unveiled a new feature for the company's TrueTouch touchscreen controllers that enables touchscreens in handsets, cameras, GPS systems and other mobile systems to function seamlessly while connected to noisy chargers. Low-cost, third-party and after-market battery chargers emit large levels of common-mode noise that adversely affects touchscreen performance, often resulting in inaccurate touch readings or phantom touches. Cypress's new Charger Armor feature allows TrueTouch touchscreens to operate normally in the presence of AC noise. The new feature, which is available in Cypress's CY8C-TMA3XX TrueTouch family, solves a common problem that mobile device manufacturers are struggling to overcome. Low cost chargers lack critical noise



suppression components, and can generate tens of volts (peak to peak) across the frequency spectrum of 1 Hz to 1 MHz. The voltage spikes can go directly into the touch panel during the presence of touch, impacting touch performance. As such, many of the mobile phone vendors have worked together to create EN 62684 and EN 301489, standards which regulate the noise spectrum for battery chargers. While Cypress's TrueTouch technology alone can suppress noise at the levels of these standards, Charger Armor allows Cypress to go beyond the standards to deliver truly revolutionary charger noise immunity to the market, enabling mobile devices to operate with the lowest-cost chargers.

Cypress Semiconductor

www.cypress.com/go/TrueTouch

Power-efficient RF transceivers

for standalone femto basestations

Maxim Integrated Products is now sampling the MAX2550-MAX2552, a family of multi-band transceivers specifically designed for a new range of dongle, module, and standalone femto basestations. These highly integrated transceivers have multiple low-noise-amplifier (LNA) inputs to monitor WCDMA and GSM macro-network signals. To minimize pin count, they also utilize Maxim's high-dynamic-range MAX-PHY serial interface. Based on architecture that has proven performance in deployments worldwide, this interface is claimed to improve time-to-market for next-genera-

tion designs. The transceivers consume greater than 25% less power than current solutions. Small size and low power allow customers to design ultra-small femtocells and dongles that easily plug into residential gateways and access points. A reference design kit that provides a complete evaluation platform with all necessary software will be available for rapid application development. Due to unusually high demand for the MAX2550-MAX2552, samples, data sheets, and applications support will be available by request only.

Maxim Integrated Products

www.maxim-ic.com

Atmel optimizes QTouch

for application-specific devices

Designed for implementing button, slider and wheel (BSW) functionality on application-specific devices, the AT42QT1070 and AT42QT2120 from Atmel require no firmware development, offer a reduced bill of materials and lower power consumption. In addition, the AT42QT2120 device offers a proximity range of up to 8 inches to enable unique new capabilities including 3-D gestures. This family of touch controllers includes a touch sensing architecture that eliminates the need for any external components and uses only one I/O pin for each sensing channel. This architecture also supports a new capacitive sensing method with a faster scan time, lower current consumption and less

sensitivity to power supply fluctuations than previous generation devices. The company says the devices add greater value and differentiation for customers' end products, with features that provide a lower barrier of entry for integrating touch user interfaces. These ready-to-use touch sensing controllers support up to 12 sensor channels, 1.8V-5.5V operating voltage range and an I2C-compatible communications interface. In addition, this family includes Adjacent Key Suppression (AKS) support, self-calibration, auto-drift compensation, noise filtering, and a selectable sleep interval.

Atmel

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Yukyung marshals small army of chip vendors for Windows tablet

By Allan Yogasingam

THE HISTORY OF THE TABLET PC began in the late 1980s with the introduction of computer screens that were guided by pens. Back then, the prevailing thought was that the so-called slate PCs would usher in the age of the keyboardless computer.

Nearly 20 years later, many still considered tablet PCs a market after thought. Even with the introduction of improved touchscreen technology, tablets were a niche product that appealed primarily to gadget geeks.

That all changed, of course, on Jan. 27, 2010, the day Apple CEO Steve Jobs introduced the iPad. Apple's device would not only reverse the tablet platform's fortunes, but it would change the course of the electronics industry.

An instant success with consumers—with its 10-inch touchscreen and ability to let users read e-books, browse the Web, watch movies and play games—the thin, all-in-one device set the standard against which not only all tablets but all mobile products would be measured.

The initial success of the iPad forced competitors to enter this “new” market. Most competing offerings launched with little of the fanfare that accompanied Apple's tablet, and few (so far) have achieved anything close to the iPad's success.

Competitors quickly learned it would require innovation to make gains in this burgeoning industry. Samsung established itself as a true competitor to Apple by introducing the Galaxy Tab, which incorporated Google's Android OS and a number of features not found in the iPad.

By the end of 2010, tablet vendors had sold nearly 20 million units worldwide. Many analysts believe total shipments will nearly triple this year. The battle for this new market will lead to numerous technical advancements, as manufacturers seek to outdo one another and thereby draw con-

sumers' attention.

January's Consumer Electronics Show demonstrated that the primary trend for this year will be the continued exponential growth of the tablet industry. Companies that revealed new tablets at the show included Cisco, Motorola and Research in Motion. Meanwhile, expect Apple and Samsung to field variations on their existing lines in 2011.

The tablet market isn't contained to the usual suspects of consumer electronics manufacturers. As with any leading edge product, opportunity exists for all sorts of players to enter the field.

Consider, South Korea's Yukyung Technologies, whose Viliv X70 EX 3G is a good example of a tablet that preceded the iPad.

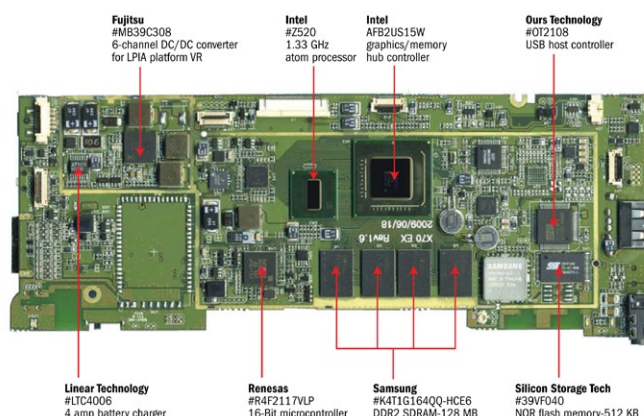
The component reveal

The Viliv X70 EX 3G is a mobile Internet device and ultramobile personal computer that features a 7-inch WSVGA (1,024 x 600) touch-sensitive display from manufacturer Chunghwa. Compared with the more-typical capacitive touchscreens of competing devices, the X70's resistive technology limits capabilities and is difficult to operate.

The hardware supports 720p high definition video and includes a global positioning system receiver, a single-chip solution for Wi-Fi and Bluetooth, and an integrated High Speed Packet Access (HSPA) cellular-data module for 3G broadband. Video conferencing is made possible through voice-over-IP and the unit's integrated microphone and Webcam.

The X70 is one of the first tablets we've analyzed to use a 32-Gbyte solidstate drive, built by SanDisk. Most of the tablets on the market integrate more cost-effective flash for storage.

Opening up the Viliv reveals a very com-



pact design. Yukyung mounts the SSD and the HSPA module on the main board, where a majority of the other internal devices are contained.

The Viliv is very much a “globally designed” tablet; its complement of more than 90 IC packages was sourced from more than 40 suppliers.

The main brain of the X70 is its 1.33GHz Atom Z520 processor in combination with an Intel AF82US15W graphics and memory controller hub. Samsung provides the tablet's system memory: 1 Gbyte of K4T1G164QQ DDR2 SDRAM.

GSM/W-CDMA cellular wireless connectivity is provided by a combined transceiver, the RTR6085, from Qualcomm, which also earned a design win with the selection of its MSM6290 analog and digital baseband processor by Yukyung. Four Avago Technologies power amplifiers (ACPM-7381, ACPM-7331, ACPM-7311 and ACPM-7371) are used for the X70's W-CDMA bands. On the GSM side, the manufacturer lever-ages a TriQuint Semiconductor quadband power amplifier, the TOM7M5012.

Finally, Samsung delivers the 1.3-megapixel CMOS image sensor, the S5K5AAF, used for the X70's Webcam. Though introduced quietly before Apple thrust the tablet computer into the spotlight, the X70 stands unique among competitors because of Yukyung's choice of Windows rather than the Android, iOS (in Apple's case) or webOS (HP) platforms. That software decision might appeal to those who require a

Allan Yogasingam

(ayogasingam@ubmtechinsights.com)

is technical marketing analyst for UBM TechInsights.



tablet more closely resembling a “true PC” in operation.

As Asus, Motorola, RIM and host of other companies jump into the tablet game, they’ll closely examine design decisions by industry pioneers such as Yokyung, assessing the impact of those decisions on the marketplace and the industry. With a market as young as tablets, innovation is the key to maintaining predicted exponential growth.

Teardowns, in the meantime, will remain a great map for identifying the direction of the industry. ■

INSIDE THE VERIZON IPHONE

The Verizon version of the Apple iPhone 4 uses a multimode Qualcomm processor, opening the door to a future “global” iPhone, according to a teardown analysis.

The Verizon handset uses a Qualcomm MDM6600 capable of handling GSM, CDMA, GPRS/Edge and HSPA+ networks, said analysts at UBM TechInsights, a division of EE Times publisher United Business Media.

“There was obviously no surprise that there was a Qualcomm baseband, but I must admit I was surprised that it was an MDM device as opposed to a QSC [Qualcomm single chip],” said Steve Bitton, the UBM TechInsights product manager who conducted the teardown. “The A4 handles the processing load, so minimal cellular requirements need to be met. Perhaps an MDM device is more in line with what Apple wants to do with the iPhone 5. For the iPhone 5, I would predict an MDM device, but not necessarily the MDM6600.” The MDM6600 puts a baseband and transceiver in

a single package, according to the teardown. Unlike some single-chip Qualcomm devices, it does not include a power management die; thus Apple also adopted the Qualcomm PM8028. UBM TechInsights has reported other sightings of the latter Qualcomm chip in several teardowns.

“Apple is potentially setting themselves up for their next iteration of the iPhone to be a fully global phone,” said Allan Yogasingam, a technical marketing manager with UBM TechInsights. “This will help them save time and money in research and development. And it bodes well for Qualcomm in the future, as they may have helped pave the way for a future design win.”

In an earlier report, UBM Tech-Insights had estimated the Verizon phone would shave \$25 off the bill-of-materials cost of the iPhone 4.

Most of the other chips in the Verizon phone are similar to those in other Apple handsets. A list of the chips can be found at <http://www.eetimes.com/4212938>.

- Rick Merritt

Link Manager.

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JTAG/boundary scan controller

operates through a USB 2.0 interface

The PicoTAP from Goepel electronic is what the company describes as the world's smallest JTAG/boundary scan controller with single TAP interface. The matchbox sized solution has been designed for simple boundary scan test and programming tasks and for cost-critical applications throughout the entire product life cycle. If users want to upgrade their Boundary Scan applications at a later point in time, programs generated with PicoTAP are cross compatible to all controllers from the manufacturer, such



as the Scanbooster series or the Scanflex platform. The low cost JTAG/Boundary Scan Controller is controlled by a USB 2.0 interface and doesn't require any additional voltage supply, making its use very efficient. PicoTAP provides a preconfigured plug-in TAP (Test Access Port), and therefore can be directly plugged to the assembly without any cable adapters. The unit also features a 5V auxiliary supply voltage switchable at the TAP interface.

Goepel electronic

www.goepel.com

Double-width AdvancedMC module

with Intel Core i7 mobile processor

The Kontron AdvancedMC processor module AM5020 incorporates the high-performance Intel Core i7 processor with an integrated memory controller, PCI Express Gen2 I/O and Intel HD graphics. Coupled with the highly integrated Intel QM 57 platform controller hub (PCH), it has a high

performance density packed into a small footprint. With its MicroTCA.1 face-plate design for robust system



integration, it is capable of withstanding demanding mechanical environmental conditions. With support for PICMG AMC.1/.2/.3 sub-specifications, the Kontron AM5020 ensures a comprehensive set of interconnecting capabilities. Eight PCI Express lanes to the backplane configurable as 2 x PCIe x4 or 8 x PCIe x1, guarantee high throughput for I/O-intensive applications.

Four GbE interfaces, two on the front panel and two on the backplane in accordance with AMC.2, provide comprehensive networking capabilities. The Kontron AdvancedMC processor module AM5020 provides an extensive range of mass storage support with six SATA-II channels. Users can choose between an on-board 2.5 SATA drive and/or up to 32 GB of SATA flash memory, which is securely

fastened to the PCB. In addition, four SATA channels are routed to the AMC connector (AMC Port 2, 3, 12, and 13), enabling applications with a high amount of storage capacity and RAID. The board has full hot-swap capabilities for monitoring, controlling and replacement.

Kontron

www.kontron.com

Universal FPGA module

with Gigabit Ethernet interface and PCIe endpoint

Enclustra's cost optimized Mars MX2 FPGA module is equipped with a Gigabit Ethernet interface, two 3.125 Gbps multi-gigabit transceivers and a PCIe endpoint.

The compact module is well suited for application specific I/O



attachments to PCI Express capable IPCs like COM Express or Qseven. A reference design of a SoPC system including a 32-bit Microblaze soft-core processor for use with Xilinx Platform Studio is available free of charge. Windows, Linux, MATLAB, LabView, Visual Basic, C#, C/C++ drivers and a suitable PCIe DMA firmware are under development. At the heart of the Mars MX2 is a Xilinx Spartan-6 LXT FPGA containing 43,661 logic

elements, 116 block RAMs and 58 DSP slices. The module boasts 128 MB of DDR2 SDRAM, 16 MB of Flash, a real-time-clock as well as 108 user I/Os and runs off a

single 3.3 V power supply. The virtually pin-compatible Mars MX1 with two Fast Ethernet interfaces remains

available. The SO-DIMM form factor (68x30mm) enables space saving hardware designs and a simple integration of the module into the final product. The company claims that with this modular approach, an application-specific carrier board can usually be implemented on four layers and with a minimum number of components.

Enclustra

www.enclustra.com

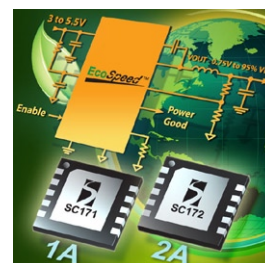
1A and 2A buck regulators

offer ultra-fast transient response up to 1MHz

Semtech has launched the SC171 and SC172 buck regulators, which are 1 A and 2 A output current devices that have been added to the company's

EcoSpeed DC-DC converter platform which includes a broad selection of output current capabilities ranging from 1 A to 30 A. The EcoSpeed converters help designers meet emerging green power

adaptive on-time (AOT) architecture to achieve what the company claims is best-in-class performance for today's demanding green power requirements by ef-



ficiently managing both standby and full current demands in networking and office automation equipment, set-top boxes, portable products, power supply modules and other embedded products, including dynamic point-of-load (POL) applications.

Like all EcoSpeed regulators, the SC171 and SC172 incorporate Semtech's advanced, patented

compensation components and enables the use of ceramic input and output capacitors. Both the SC171 and SC172 are programmable from 200 kHz to 1 MHz, enabling designers to optimize their power supply to maximize either the conversion efficiency or the solution size.

Semtech

www.semtech.com/info

Rugged, high current spring pins

rated at 1,000,000 cycles, take 9A

Mill-Max now offers a series of rugged spring pins capable of carrying 9 amps continuous current at a low 10° C temperature rise. The Mill-Max 0850, 0851, 0852 and 0853 spring pins are the perfect solution for rugged applications and for use in

circuits operating at currents above signal level. The 085X series is characterized by a greater mass and surface area which provides a lower resistance electrical path than miniature spring pins. Because they are designed and built with the same precision of our miniature spring pins they exhibit excellent signal integrity in shock and vibration environments. These large scale spring pins feature a gold plated stainless

steel spring, .050" diameter solid plunger and thick wall construction to withstand the rigors of demanding applications. Designed for through-hole mounting, each pin has a large diameter post and flange providing for a perpendicular and secure P.C.B. attachment.

The 085X series provides a generous .045" mid-stroke and .090" maximum stroke allowing for use in applications where stack up tolerances are great. Applications include board stacking, docking stations, cable assemblies, quick connects and anywhere there is a blind mate situation. The pins are rated at 1,000,000 cycles minimum.

Mill-Max

www.mill-max.com



Special Y-ConRJ45 EMI protection

withstands vibrations and shock up to 50g

The market-tested Y-ConRJ45 series from Yamaichi Electronics, used in a variety of industrial applications, has been further developed specifically to provide the best possible EMI protection. The resulting new products, Y-ConCover-10-E and Y-ConCover-40-E, meet this requirement to an astounding degree. In industrial applications such as engine connectors, there is vibration that can lead to temporary breaks in the EMC connection. The background is that most of the systems on the market offer EMI protection only through the cable shield and the connected plug. This means that a permanent, reliable EMC connection with the jack is not ensured. Yamaichi has therefore devel-

oped special contact springs for the plug area of the Y-ConCover-10-E and Y-ConCover-40-E that ensure a reliable connection between the plug and the jack. The contact spring offers reliable EMI protection and ensures that applications remain protected without interruption even for vibrations and shock of up to 50 g. The

Y-ConCover-40-E, consisting of a metal housing developed for the harshest industrial requirements, represented a particular challenge. For full EMI protection to be provided for the metal housing, Yamaichi used a special washer that is integrated into the housing.

Yamaichi Electronics

www.yamaichi.eu



Mixed-signal and digital oscilloscopes

26 new models in Agilent's portfolio

Agilent Technologies expanded its mixed-signal and digital-storage oscilloscope portfolio with 26 new models that comprise its next-generation InfiniiVision 2000 and 3000 X-Series. The Agilent InfiniiVision 2000 X-Series offers bandwidths from 70 MHz to 200

MHz and according to the manufacturer, boasts the fastest waveform update rate in its class for superior viewing of signal detail and capture of infrequent events. The Agilent InfiniiVision 3000 X-Series scopes step up performance while aggressively holding prices in line, offering bandwidths from 100 MHz to 500 MHz and industry-leading waveform update rates of 1,000,000 waveforms per second.

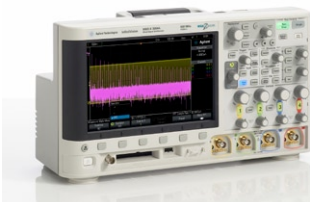
Options include a 16-channel MSO, an integrated function generator, and hardware-accelerated serial protocol decode. The heart of the InfiniiVision

X-Series scopes is an Agilent-designed custom 90-nm CMOS ASIC with 6M gates and embedded memory. This MegaZoom

IVsingle-chip architecture enables the industry's fastest waveform update rates and responsive deep memory along with integrated logic analyzer, function generator, and protocol analyzer functionality so engineers and educators have highly advanced scope performance at economical prices.

Agilent Technologies

www.agilent.com



USB power controllers

with over-current protection

Intersil's ISL6185/6 USB devices provide port power for products based on the USB 2.0 and 3.0 interface standards, offering designers several current limit level options, all with an accuracy 3x better than competitive solutions according to the manufac-

turer. In addition, the ISL6185/6 come in industry standard packages for easy, drop-in replacement as well as a new, smaller package for saving even more board space. The ISL6185 independently controls two power channels and features a pair of 71 milliohm P-channel power switches. Providing added design flexibility, each power channel is capable of protecting multiple USB ports. The ISL6185 provides continuous current at

0.6, 1.1, 1.5 and 1.8A levels.

Its high current limit capability supports USB 3.0 as well as USB 2.0. In addition, both devices feature automatic restart/retry after

an over-current or transient event, ensuring continued operation without requiring additional monitoring. No user or system

intervention is required to reset the devices, with automatic recovery when the load fault is cleared. The ISL6186 USB power controller provides single channel over-current (OC) fault protection totaling up to 3.6A, allowing a single device to protect multiple USB ports. The device supports continuous current options for 1.5, 3, and 3.6A.

Intersil

www.intersil.com



Rugged automotive connectors

suit the infotainment and car body electronics

With its GT23F board-to-board connector series, Hirose Electric aims at automotive applications in particular in the infotainment and body domain.

The GT23F is a board-to-board connector system suited for SMT processing. For the start, the product will be available with 50 pins; products with 30, 40 or 60 contacts will follow. The connector features a "floating" area in x, y and z axis of 1 mm. Thus, the product enables manufacturers to connect two PCBs slightly

shifted. In addition, it facilitates the installation at the production line.

The offset between the two halves of the connectors are evened out by means of the specific contact and package design. Other features include temperature range from -40 to +105 degrees Celsius, current carrying capacity of 0.5 A and voltage of up to 50 V.

Hirose Electric

www.hiroseeurope.com

High voltage battery stack monitor

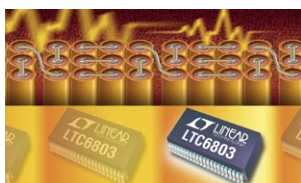
enhances HEV/EV battery management systems

Linear Technology has introduced a second generation high voltage battery monitor for hybrid/electric vehicle (HEVs), electric vehicles (EVs) and other high voltage, high

performance battery systems. The LTC6803 is a complete battery measuring IC that includes

a 12-bit ADC, a precision voltage reference, a high voltage input multiplexer and a serial interface.

Each LTC6803 can measure up to 12 individual battery cells in series. The device's proprietary design enables multiple LTC6803s to be stacked in series without optocouplers or isolators, permitting precision voltage monitoring of every cell in long strings of series-connected batteries. The maximum total measurement error of the LTC6803 is guaranteed to be less than 0.25% from -40 to 125°C. It offers an extended cell measurement range from -300 mV to 5 V, enabling the LTC6803 to monitor a wide range of battery chemistries, as well as supercapacitors. Each cell is monitored for undervoltage and overvoltage conditions, and an



associated MOSFET is available to discharge overcharged cells. Added functionality is provided by an onboard 5V regulator, temperature sensor, GPIO lines

and thermistor inputs. For long-term battery pack storage, the current consumed by the integrated BMS can potentially unbalance

the cells. The LTC6803 addresses this concern with a standby mode that draws less than 12 µA. Furthermore, the power input of the LTC6803 is isolated from the stack, allowing the LTC6803 to draw current from an independent source. When powering from this input, the current draw on the pack is reduced to less than 1 µA. The device is fully specified for operation from -40 to 125°C. It has been engineered for ISO 26262 (ASIL) compliant systems and a full set of self-tests ensure that there are no latent fault conditions. The LTC6803 is designed to withstand up to 75 V, providing more than 20% of overvoltage margin for a full string of 12 cells.

Linear Technology

www.linear.com/6803

Colour image sensor pipeline IC

for low-cost camera systems

ChipWrights released a new colour pipeline solution for cameras using non-System-on-Chip (SoC) sensors based on ChipWrights' CW5631 SoC. The solution requires a CW5631 SoC and a DDR2 DRAM; it can be employed in tandem with a second CW5631 SoC, which can be used as a



system processor or as a stand-alone image sensor pipeline in existing camera designs. The chip has 16-bit streaming input and output ports, which can be configured for BT.601 or BT.656 operation. The image pipeline is implemented in software that runs on ChipWrights' proprietary DSP and can be as complex or simple as required. The pipeline inputs raw sensor data in Bayer format and outputs the image as YUV422i.

ChipWrights will release the colour pipeline's source code to qualified customers. The baseline release includes bad pixel interpolation, auto-white

balance and auto-exposure calculation, black level clip, lens shading correction, update statistics, bayer interpolation, colour transform to sRGB, white clamp, gamma LUT, convert to YUV422i and an

image enhancement library. The CW5631 SoC offers the flexibility and computational power to implement a wide variety of options including programmable timing generators for Horizontal and Vertical Sync timing and an I2C Master to configure and control the image sensor. In a typical application the device consumes about 350 mW.

ChipWrights

www.chipwrights.com

Fast assembly SMT coin cell holder

for BR1225 and CR1225 batteries

Harwin has expanded its range of EZ BoardWare products with the introduction of a single piece surface mountable coin cell holder which ensures coin cells are securely retained in place while cutting assembly time. EZ Coin Cell Holders can accommodate 12.5mm diam-



eter x 2.5mm thick BR1225 and CR1225 coin cells and are available in Tape and Reel packaging making them ideally suited to automatic placement systems. Low profile EZ Coin Cell Holders provide a cost effective solution to the problem of battery mounting. Coin cells are securely held in place, yet they can be quickly

and easily removed when they run down.

Manufactured in phosphor bronze and tin plated, the clips employ a twin beam contact

system, resulting in a mechanically strong product. Comments Product Manager, Paul Gillam: "EZ Coin Cell Holders enable companies

to reduce manufacturing costs while achieving a very secure solution. The product will suit most markets, with typical applications including on-board power supplies to drive memory circuits.

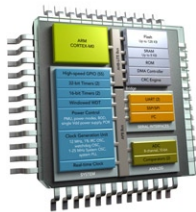
Harwin

www.harwin.com

32-bit ARM industrial MCUs

support energy-efficient controls and appliances

NXP's LPC1200 Industrial Control Series feature the ARM Cortex-M0 processor which extends NXP's 32-bit ARM microcontroller continuum and targets a wide range of industrial application. The new device also expands NXP's Cortex-M0 microcontroller offering with a



wide range of Flash memory sizes. LPC1200 customers can now choose the exact Flash memory size they need, ranging from 32 KB to 128 KB in increments of 8 KB. The LPC1200 product platform is specifically designed with flexibility and customization in mind, making it particularly suitable for a wide variety of energy-efficient system and power management require-

ments. For example, in advanced washing machines, the LPC1200 can control the motor systems, handle the user interface, monitor system power consumption, and manage off-board communications in a simple, integrated and energy-efficient solution. Its high current GPIO can directly control TRIACs without the need for external transistors, further

reducing footprint and costs. Maximizing flexibility, efficiency and robustness The NXP LPC1200 offers over 50 flash and SRAM memory combinations, giving designers maximum flexibility to optimize the features and product cost within the same footprint.

NXP Semiconductors

www.nxp.com

250-Watt power supplies

conduction-cooled for outdoor applications

Emerson Network Power has released a fully-enclosed 250 W fanless ac-dc power supply series featuring a 12 Vdc output and a wide operating temperature range of minus 40 to 85 degrees Celsius. Suitable for demanding sealed box and outdoor applications, the LCC250 embedded power supply series includes conduction-cooled models providing full useable power at elevated temperatures, offering a very cost-effective alternative to conventional power supplies. The Emerson Network Power LCC250 power supplies are housed in a robust fully-sealed enclosure offering IP64 protection against the ingress of dust and water. LCC250 power supplies are fully approved to the international EN60601-1 safety standard for medical electrical equipment. The units have a compact form factor, enabling them to be accommodated easily in end users'

equipment. There is a choice of mounting types; conduction-cooling and convection-cooling. All models measure 178x101x28mm. The convection-cooled versions feature an integral low profile heatsink which raises their overall height to 38mm. Both imperial and metric mounting holes are provided as standard, and the use of 150mm cables for the ac input, dc output and control connections further simplify installation. Unlike many power supplies on the market, which typically require output derating above approximately 55 degrees Celsius, Emerson LCC250 supplies fed from a nominal 115 Vac input are capable of maintaining their full 250 W load capacity up to their maximum baseplate temperature of 85 degrees Celsius.

Emerson Network Power

www.powerconversion.com

WiLink front-end RF module

operates in the 2.4 to 2.5GHz ISM band

Manufacturers designing around the WiLink 6.0 and WiLink 7.0 platforms from Texas Instruments can integrate RFMD's RF3482 to gain reliable, flexible WiFi connectivity. Volume shipments of the RF3482 have begun, and RFMD estimates shipments will increase in support of key cellular and consumer device manufacturers. RFMD's RF3482 is a high-performance, single-chip integrated front end module (FEM) for WiFi applications in the 2.4GHz to 2.5GHz ISM band. The RF3482 FEM greatly reduces customers' time-to-market and bill-of-material (BOM) cost by delivering a highly integrated single placement solution. In addition to satisfying smartphone manufacturers' requirements for aggressive size

reductions in 802.11b/g/n front end solutions, the RF3482 delivers high linear output power and greatly reduces the number of components outside the core connectivity chipset.

TI's WiLink 6.0 and WiLink 7.0 platforms are powerful multi-radio solutions able to support a wide range of connectivity requirements for various end equipments. RFMD's RF3482 is manufactured using the Company's E/D-mode pHEMT fabrication process and is available in a small 3x3x0.45mm 16-pin QFN package. The RF3482 is fully RF-tested, meeting or exceeding the stringent RF front end requirements of 802.11b/g/n systems.

Texas Instruments

www.rfmd.com

High-current buck regulators

deliver 97% efficiency for FPGAs and ASICs

National Semiconductor has introduced a pair of high-current, synchronous buck regulators which the company claims delivers the industry's highest efficiency at 97 percent. The LM21212-1 and LM21215 feature integrated high-side and low-side FETs, which simplify design and reduce solution size. The LM21212-1

92 percent efficiency when regulating a 1.2 V output from a 5 V input. The buck regulators come in a 4.4x6.5x0.9mm package. The LM21212-1 is capable of delivering up to 12 A of continuous output current with a switching

frequency that can be synchronized to an external oscillator between 300 kHz and 1.5 MHz. The



features an output current up to 12A with synchronizable switching frequency and the LM21215 provides a resistor-programmable current limit, allowing up to 15A of continuous output current, offering the industry's best power density. Both products provide peak efficiency greater than 97 percent from a 5 V input to 3.3 V output, and greater than

LM21215 features a fixed 500 kHz switching frequency and is capable of delivering up to 15 A. The regulators are optimized to work over an input voltage range of 2.95 V to 5.5 V and produce an output voltage down to 0.6 V with superior efficiency.

National Semiconductor

www.national.com

'Size 8' slotless brushless DC motors *are autoclavable for medical use*

The Pittman "Size 8" high-performance slot-less brushless DC motors proposed by Ametek Technical & Industrial Products have been introduced in auto-

clavable versions to power medical instruments, dental drills, and other small medical devices.

These motors deliver high-speed capabilities, an extended 1000+ autoclave cycle count, and high efficiency with low temperature rise to suit handheld operation. Their patented "Parallex" winding geometry uniquely enables the motors to develop more power using less energy. The compact motors are offered in two standard lengths, 53mm and 74mm with diameters of 20mm. They can run at speeds up to



19,400 RPM under varying loads, depending on the model, and can achieve continuous torque ratings approaching 4.0 oz-in. Standard features include

precision shielded and replaceable ABEC ball bearings, high-energy rare earth magnets for enhanced performance, robust construction with stainless steel housings for durability and corrosion-resistance, balanced 4-pole rotors for smooth and quiet operation, 3-phase stator, and Hall sensors. These autoclavable motors can be customized with gearboxes, optical encoders, and drives, among other options, to tailor motor to application.

Pittman

www.ametektechnicalproducts.com

SMT board stacking connector *with 0.8mm floating mechanism*

Honda Connectors has introduced a 0.8mm pitch, 20 position SMT board stacking connector range that provides a generous 0.8mm mating misalignment

both laterally and longitudinally. This novel floating mechanism, providing a full 0.8mm movement

on a contact pitch of the same dimension is unmatched in the marketplace. A special 'S'-shaped section in each contact strip provides the necessary flexibility, and with a reaction force of less than 0.098N per contact in both lateral and longitudinal directions the floating mechanism is also highly compliant. Despite the small size of the QZAC-A connector series, each contact has a current capacity



of 0.3A dc, a voltage rating of 120V ac and a withstand voltage of 250Vac for one minute. The contact resistance is 90mΩ and the insulation resistance is

1,000MΩ at 250V dc. The QZAC-A series stacking connector is available with a stack height of 15mm and footprints of 9x18mm (20-pin). The 9x42mm (80-pin) and 9x58mm (120-pin) versions will be available soon. The plug connector comprises four parts: contacts, inner and outer housings and a hold-down. In addition, for automatic pick-and-place, the plug connector can be fitted with a vacuum cap. The receptacle comprises three parts: contacts, housing and a hold-down.

Honda Connectors

www.hondaconnectors.co.uk

Low loss RF combiner *for high speed PXI measurements*

The Aeroflex 3065A RF combiner addresses the need of RF test system engineers working in cellular handset or RFIC and component manufacturing when making measurements of RF transceivers. The RF combiner module is used in conjunction with signal generator and RF digitizer modules from the Aeroflex 3000 PXI range to enable development of high performance, low cost modular test systems for testing RF transceivers and components.

In addition to providing summed signal outputs, the two-input combiner module supports various combinations of input and output switched path configurations, to enable testing of single- and multi-port RF devices without the need to alter connections.

Operating over the frequency

range 250 MHz to 6 GHz, the 3065A provides a combined low loss connection for a RF signal generator and

RF digitizer to a mobile phone antenna, while offering high isolation between input ports and accepting input of power levels of up to +33dBm for TDMA burst signals or +30dBm for continuous CW. To support the 3065A a new version of Aeroflex's PXI Studio application software V1.11 is also available to download free of charge from

Aeroflex

www.aeroflex.com



2GB and 4GB DDR3 SODIMMs *with heat spreader for coated industrial use*

Swissbit announced a variations of its industrial family of DDR3 SODIMMs. In order to increase the heat dissipation and to avoid thermal hot spots on the memory modules in systems with difficult cooling, Swissbit can add an aluminum heat spreader to

the existing portfolio of DDR3 SODIMMs. The dual sided heat spreader is attached with a thermally conductive tape and increases the heat dissipating area, thus reducing the critical high case temperatures which otherwise might lead to failing bits. The target applications for these DDR3 modules are COM or SBC boards or specialized notebooks for operation under high ambient temperature. By keeping the maximum thick-

ness below 5 mm and the height below 31.5mm these SODIMMs still fit into the standard socket and the regular keepout area for the memory modules. The

SODIMMs are available in industrial temperature grade of -40°C to +95°C (TCASE), allowing for further flexibility in operating environment where cooling resources may be

limited. For systems operating in aggressive environmental conditions Swissbit offers additional conformal coating. In this case a thin, but impenetrable film of Polyurethane covers the PCB and the DRAM components and protects the PCB traces and lead connections against corrosion, leaving the gold contact fingers of the edge connector uncovered.

Swissbit

www.swissbit.com



Data acquisition and control software suite

for Windows 7 64- and 32-bit, Vista and XP

Windmill Software launched a new data acquisition and control software suite for Windows 7 64- and 32-bit, Vista and XP. Windmill 7 software lets users read and control up to ten devices over RS232, RS422, RS485 and Modbus. The software comprises ready-to-run applications to chart and log data, control analogue and digital outputs, monitor the com port and send data directly to Excel. The new software is offered at an

introductory price of £50, a 65% discount on older versions of the software. Windmill works with instruments communicating with ASCII or binary messages. With a flexible approach to extracting data values, it is suitable for collecting readings from the majority of serial instruments.

Windmill Software

www.windmill.co.uk

Synchronous rectification controller

compatible to flyback and forward topologies

Fairchild Semiconductor has developed the FAN6204 synchronous rectification controller to meet increased power efficiency demands and regulatory standards for desktop PCs, All-in-One (AIO) PCs and notebook adaptors. Designers need secondary-side synchronous rectification (SR) controllers that can increase power efficiency while integrating more functions. Using a proprietary, linear prediction timing-control technique, not limited to the

RDS(ON) of the SR MOSFET, the FAN6204 is suitable for fixed frequency or quasi-resonant (QR) flyback converters and discontinuous or continuous conduction mode (DCM and CCM) operation. It has an ultra-low V_{DD} operating voltage (5V to 28.5V), V_{DD} pin over-voltage protection (OVP) and a 12 V gate drive clamp.

Fairchild Semiconductor

www.fairchildsemi.com

Universal debug engine version 3.0

extended test and debug capabilities for the Cortex-M4 core

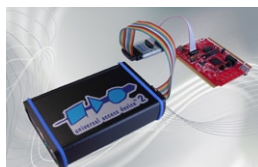
PLS Programmierbare Logik & Systeme presents an optimized test and debug tool specifically for Freescale's ARM Cortex-M4 based 32-bit Kinetis microcontroller family. The Universal Debug Engine (UDE) 3.0 supports the extended debug and test capabilities of the Cortex-M4 cores, without any limitations of any kind. For example, new technologies such as Serial Wire Viewer (SWV), Instrumentation Trace Macrocell (ITM) and Data Watchpoint

and Trace (DWT) allow an observation of systems while the application is running.

This is achieved entirely without or only very little change of the timing behavior.

PLS

www.pls-mc.com



Laptop security microchip

enables remote tracking of portable devices

Xelltec released a new security microchip which the company says will enable users to remotely track and protect their laptops and handheld devices. The microchip is unique in that it provides the user with multiple options if their mobile device is lost or stolen. The microchip can wipe out data, or it can physically destroy the mobile device so that it is completely inoperable. And if the user needs the data that is on the mobile device, then the data can be copied remotely from the device

to a server, before the data is destroyed. When the backup process is finished, a new process can be initiated inside the main boards which generates a high frequency voltage that zaps all of the hardware parts of device and destroys the device, so neither the device parts are usable any more. The microchip can also be used to physically locate a stolen or lost device.

Xelltec

www.xelltec.com

PICO

Surface Mount
(and Plug In)
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Inductors

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Pulse Transformers

10 Nanoseconds to 100 Microseconds. ET Rating to 150 Volt Microsecond, Manufactured and tested to MIL-PRF-21038.

Multiplex Data Bus Pulse Transformers

Plug-In units meet the requirements of QPL-MIL-PRF 21038/27. Surface units are electrical equivalents of QPL-MIL-PRF 21038/27.

DC-DC Converter Transformers

Input voltages of 5V, 12V, 24V And 48V. Standard Output Voltages to 300V (Special voltages can be supplied). Can be used as self saturating or linear switching applications. All units manufactured and tested to MIL-PRF-27.

400Hz/800Hz Power Transformers

0.4 Watts to 150 Watts. Secondary Voltages 5V to 300V. Units manufactured to MIL-PRF-27 Grade 5, Class S (Class V, 155°C available).

FREE PICO Catalog
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Ultra-compact LED drivers

IP67 rated module delivers up to 92W

Excelsys Technologies launched the LDV series of ultra compact LED drivers, capable of delivering up to 92W of output power in a very compact package size with a section of just 28x40mm.

These waterproof IP67, Class 2 LED drivers offer efficiencies of over 90% and are well suited for space critical applications including commercial refrigeration, retail and office lighting as well as environmentally harsh outdoor and urban lighting. The first two products in this new family are the LDV075-024SN, offering a 24V/3.125A output and LDV100-024SN rated at 24V/3.830A. Additional output voltage and current models are set to follow soon extending the range from 60 to 200W

output power. Standard features include a universal input over the range 90-264VAC, constant output voltage, typical efficiency of 91%, IP67 rated LED Class 2 device to UL 1310, typical power



factor of 0.95, over current, over voltage, short circuit and over temperature protection. All Excelsys LDV products carry a 5 year warranty.

Excelsys Technologies

www.excelsys.com

Smart meter chipset

boosts performance and hardware scalability

STMicroelectronics has unveiled a new set of metering chips that it claims offer the industry's most accurate and cost-effective solution for next-generation



smart meters. The company's STPMCI and STPMS1/S2 create a cost-effective chipset for modular smart meters, supporting 50-60Hz IEC and ANSI standards for up to 0.2-class AC Watt meters. The STPMCI metrology IC, which has five input channels, accepts measurements from three phases with the option of using the fourth channel for tamper detection or temperature sensing, and the fifth channel to accept magnetic field information from a Hall sensor.

The device can be configured and calibrated for any international distribution standard. The STPMS1 and STPMS2 are dual-channel delta-sigma modulators that convert analogue current and voltage values from each phase and transmit digital data to the STPMCI. They can be placed very close to the current sensor to avoid long analogue tracks and high-

noise capture. In addition, the reduced number of connections and the discrete implementation leads to the potential use of three shunt resistors via low-cost isolation on digital data paths, instead of using significantly more expensive isolated sensors. The STPMS1 has a first-order modulator, while the STPMS2 has a second-order modulator delivering enhanced accuracy.

STMicroelectronics

www.st.com

Win a ThreadX/PrismX

reference design kit for the STM3210E processor platform



This month, Express Logic is giving away a complete ThreadX/PrismX reference design kit for the STM3210E processor together with a development license, worth \$5,000. The complete GUI software development solution was specifically designed for resource-constrained devices such as STMicroelectronics Cortex-M3-based STM32. PrismX represents a ThreadX RTOS-integrated port of Blue Water Embedded's Prism



technology that is marketed and supported by Express Logic. It comprises the PrismX Runtime Framework, a full-featured GUI toolkit, PrismX Micro, a GUI toolkit for monochrome to 8-bit color-depth targets, and

PrismX Insight, a desktop GUI design and resource editing tool. Integrated to take advantage of STM32's limited onboard RAM, PrismX executes without a traditional graphics frame buffer. To work around this, all drawing operations cause immediate

updates to external GRAM memory of the LCD. PrismX Insight offers a large range of data out-

put formats such as C++ source code, XML screen description files, and binary resource files, enabling developers to tailor output to the requirements and capabilities of target systems.

Express Logic

Check the reader offer online at www.electronics-eetimes.com
www.expresslogic.com

DC filter reduces solar inverter noise

for rated currents from 25 to 1500A

Schurter has unveiled the company's new standard DC filter series FMER SOL which has been developed for use on the DC side of the inverter in photovoltaic systems and other DC systems. Modern solar inverters, that use MPP (maximum power point) trackers, generate disturbances into both the grid's AC power line, as well as the DC side of the solar module. An AC filter is normally



used on the grid's AC power line, but the noise generated on the DC side tends to be overlooked. EMC standards EN 61000-6-3 and EN 55014-1, however, also put limits on the noise generated from lines not connected to the grid, such as for example the line to the solar panels. Meeting these limits can be achieved by

using a DC filter on the DC side of the inverter. Large solar inverters installed in electrical installations will generally require a cooling system. Components which provide high temperature resistance simplify the system

and reduce the energy needed to cool. The FMER SOL filters are designed for rated currents from 25 to 1500A at 55°C ambient temperature, and voltages

up to 1200VDC. cURus approval, up to 75°C ambient temperature, is expected for 1st quarter 2011. The FMER SOL DC filters are designed with screw clamps for types up to 150A and copper bars for types upwards of 250A.

Schurter

www.schurter.ch

Provertha D-sub connectors

available from cable assemblies provider Quadrant Connections

Quadrant Connections, the Hertfordshire-based manufacturer of coaxial and multicore cable assemblies and electronic component distributor, is now a stocking distributor for Provertha, a German manufacturer of D-sub connectors, hoods and associated accessories. Provertha's 'quick-lock' D-sub hoods are fitted with an innovative push-pull locking mechanism that provides fast and secure locking with simple, one-handed, blind-mating assembly even in places that are difficult to access. The hood snaps in automatically with an audible click.



The Provertha range of plastic, metallised-plastic and die-cast hoods are available in two different lengths of 42 and 56mm and provide full 360° EMC/RFI shielding and high levels of vibration-proof strain relief. They are suitable for all standard D-sub connector sizes. The 'quick-lock' system offers a complete cable fixing solution with use of either a crimp flange or internal or external clamps and has full automotive approval.

Quadrant Connections

www.quadrantconnections.com

Closing the gap between MCU and x86

with nanoRISC modules clocked at up to 833MHz

MSC has unveiled an ARM-based module concept that targets cost-sensitive embedded applications. The first member of the new product family is a nanoRISC module, based on the Samsung Cortex-A8 S5PC100 processor.

Due to their pin compatibility and the usability of various CPUs - the current range is from ARM9 derivatives clocked at 400 MHz up to 1 GHz Cortex-A8 cores - the new nanoRISC modules offer a high degree of scalability. Furthermore, the modules, which measure only 50x70 mm, feature a low power consumption of typically under 3W. Interfaces such as Ethernet, USB, CAN, UART, I2C, SPI, GPIO, Camera, Audio, ADC, Touch and Display are directly available to developers via a 230-pin MXM connector. Depending on the CPU used and use of the integrated 2D/3D graphics engine and corresponding codex, the graphics performance achieves video resolutions of up to 1080p. The first module offers up to 667/833 MHz clock frequency, maximum 512 MB DDR2 SDRAM, up to 4GB NAND flash memory (NAND, eMMC and SD/MMC), audio and touch support, real time clock, system monitoring, watchdog and many other features. The 2D/3D graphics engine integrated on the S5PC100 supports video resolutions up to 720p. The evaluation board, which is made available from MSC together with the na-



noRISC module, enables developers to access all input and output pins of the module via standard connectors. In combination with different modules, the baseboard can also be used as a starter kit for the development of own hardware on the basis of the respective Samsung processor, which is also available from MSC. Linux and WINCE are offered as board support packages. Thanks to the use of NAND flash memories, DDR2-SDRAMs and the wide range of interfaces integrated on the module that additionally minimize the cost of the baseboard, the nanoRISC modules are also said to be suitable for cost-sensitive projects with large volumes. In the lower performance range, the nanoRISC modules are primarily used in applications where a change from microcontroller to microprocessor is necessary due to increased demands

in the area of visualization and operation as well as of communication with Ethernet or USB. In the higher performance range, the nanoRISC modules with Cortex-A8 CPU and clock frequencies up to 1 GHz particularly attract a great deal of interest when looking for more compact, lower power and, ultimately, more cost-effective solutions compared to established technologies.

MSC

www.msc-ge.com

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Does application security pay?

By Craig LeGrande and Amir Hartman

THE LAST DECADE has seen a dramatic shift in the way companies manage information security and protect vital data. In the past, businesses confronted the threat of cyber-attacks and data breaches primarily by building firewalls and other “perimeter defences” around their networks, but the threat has continued to evolve, and more criminals are hacking into applications that are running on a plethora of new devices and environments, including cloud, mobile, and social media.

As a result, the focus of threat protection is moving from securing the infrastructure to securing the software applications that businesses write and deploy. The shift has created a market for a new generation of products and services - known as software security assurance (SSA) solutions - that help companies uncover vulnerabilities in their code, effectively fix these defects, and produce software that is impervious to security threats. In an effort to quantify the business value of SSA, Fortify Software commissioned Mainstay Partners to conduct in-depth interviews of 17 global customers, organisations that have implemented SSA, and representing a cross-section of industries. The study found that companies are realising substantial benefits from SSA right out of the box, saving as much as \$2.4M per year from a range of efficiency and productivity improvements, including faster, less-costly code scanning and vulnerability remediation and streamlined compliance and penetration testing. Exponential increases in benefits, however, are being achieved by companies that deploy SSA in more comprehensive and innovative ways. These advanced deployments include embedding software security controls and best practices throughout the development lifecycle, extending SSA programs into critical customer-facing product areas, and leveraging SSA to seize unique value-generating opportunities. For these strategic companies,

the benefits of software security solutions can add up to as much as \$37M per year. In our interconnected world,

software is everywhere, not just in data centres or on desktop computers, but in mobile phones and all kinds of wireless devices and consumer products. Software resides on the Web and in the cloud, where businesses rely on software-as-a-service solutions (SaaS) for mission-critical business functions. Application security protects the software that is running in all these environments and devices, and the business improvements of SSA are seen as extending to wherever applications are deployed. Faster vulnerability remediation Across the board, companies adopting SSA solutions report significant efficiency improvements in finding and remediating software security flaws. By introducing automated SSA technology and best practices, organisations reduced average remediation from 1 to 2 weeks to 1 to 2 hours. Organisations saved an estimated \$44K annually in remediation costs per application. For the average organisation, these cost savings are estimated conservatively to amount to \$3M per year.

Companies are also facing tighter government and industry regulations for application security, particularly in new software standards in the financial services and health-care industries. By configuring the SSA solution to address specific compliance mandates, for example, organisations quickly identified and ranked vulnerabilities according to severity. The solution also generates a report that documents these activities, creating an audit trail for regulators. The average organisation adopting SSA saw its fees paid to compliance auditors fall by 89% - or about \$15K annually. The average organisation achieved a 50% reduction in penetration testing efforts, translating into annual savings of more than \$250K. Avoid



“Companies using SSA solutions save as much as \$2.4M per year”

data breaches The threat of a major data breach can keep CISOs awake at night, and most are aware of the history of high-profile security failures that have damaged company reputations and resulted in millions of dollars in legal

and PR fees, remediation expenses, lost revenue, and customer churn. The average cost of a data breach is about \$3.8M, or \$204 per compromised record. Companies can save an estimated \$380K per year by adopting SSA solutions to avoid major data breaches.

Businesses that fail to comply with industry standards for software security can face substantial penalties. In the payment card industry, for example, penalties can range from \$5K to \$25K per month. Moreover, when lost sales, customer churn, and remediation expenses are also factored in, the full cost of PCI non-compliance can be substantially more. By ensuring compliance through systematic application security testing, companies can conservatively avoid approximately \$100K in penalties annually. Pay-for-performance benefits In an innovative use of software security technology, companies that outsource software development to partners are leveraging solutions to drive cost-effective “pay for performance” programs. Companies using SSA to screen and adjust the price of outsourced code can capture fee savings of about \$100K annually while improving the overall quality of code delivered by development partners.

For companies that sell e-commerce and other commercial software, discovering security flaws late in the development life cycle can delay new product introductions (NPI) by weeks or months, putting revenue and market share at risk and adding millions of dollars in development costs. What’s more, companies can extend the value of their software security solution by deploying it in strategic ways, i.e. using it to perform software security audits of acquisition targets that own core products critically dependent on software. ■

Craig LeGrande and Amir Hartman are co-founder and managing partners of Mainstay Partners - <http://mainstaypartners.net>

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