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OPINION

4 Fair Comment: What a mess!
50 Last Word: Safe and secure at any speed?

NEWS & TECHNOLOGY

6 Acquisitions shake up telecoms chip landscape
Two major acquisitions are set to change the landscape of networking and telecom chip development.

7 Agilent Technologies to spin-off Keysight Technologies by early November 2014

8 E-cigarettes: just more e-waste or an opportunity to educate consumers?
No tar, no pollution: this is an easy marketing shortcut taken by most e-cigarette vendors keen to publicize their products as a healthy alternative to traditional combustion cigarettes.

9 E-waste to jump one-third to 65.4 million tonnes annually by 2017, says STEP report
By 2017, all of that year's end-of-life refrigerators, TVs, mobile phones, computers, monitors, e-toys and other products with a battery or electrical cord worldwide could fill a line of 40-ton trucks end-to-end on a highway straddling three quarters of the Equator.

10 IEC presses for a single charger specification for notebook computers

11 Rensselaer Polytechnic Institute launches Light and Health Alliance

12 Bosch Sensortec grows in mobile and beyond, says CEO
Robert Bosch GmbH has successfully ridden the wave of automotive demand for micro-electromechanical systems (MEMS) components since 1988. And then in 2005 it formed Bosch Sensortec as a wholly-owned subsidiary to offer MEMS for consumer applications.

14 Design-free RF-based wireless charging redefines user experience

15 IR sensor startup preps smartphone bid

16 Betting on GaN-on-GaN for efficient white light
“How efficient is white light?” asked Dr Harald Pier, team leader for EMEA technical solutions at Philips Lumileds, during a round table on white LEDs held at Forum LED Europe in Paris.

18 Continental to showcase first concepts jointly developed with IBM

19 Carmakers test C2X under winter conditions in Finland

20 Amazing race toward autonomous car design

21 Ford rolls research platform for automated driving

26 Innovative back EMF based stall detection simplifies stepper-motor drive designs

DESIGN & PRODUCTS

SPECIAL FOCUSES:

- ANALOG & MIXED SIGNAL

21 Designing compact medical ultrasound systems
Over the past decade, medical ultrasound imaging equipment has experienced a revolution.

24 Detecting and selecting the right power supplies for portable electronics
The boom in portable electronics has made it commonplace to find devices capable of powering from multiple sources.

- PASSIVE COMPONENTS

32 Silicon capacitors: a new solution for decoupling applications

34 Understanding the distortion mechanism of high-K MLCCs

READER OFFER

46 To offer you a good start in 2014, Renesas Electronics Europe is giving away four RX62N RSK demonstrations kits worth 325 Euros each, for EETimes Europe's readers to win

49 DISTRIBUTION CORNER

51 WHITEPAPERS
What a mess!

By Peter Clarke

THE CLOSURE OF LFoundry Rousset, ordered by the Commercial Court in Paris, puts an end – probably permanently – to chip manufacturing in Aix-en-Provence; a blow to France, to Europe and to 613 engineering workers that were employed there.

We even have the parent company, LFoundry in Germany, reportedly under a criminal investigation in Paris for the alleged misappropriation of funds from LFoundry in France during dealings prior to this unhappy state of affairs.

The fighting and dissent that have now broken out within Europe are all so different to the expansive, co-operative, pan-European days that created the Rousset fab in 1985.

Clearly one of Rousset's problems is that it runs 200mm wafers – when much manufacturing has moved on to larger, more economic 300mm wafers – and it has relatively mature manufacturing processes in place – although not disastrously so for mixed-signal IC manufacturing. It has a manufacturing capacity of about 25,000 wafer starts per month, and it is – or was – a repository of skills that could have been useful to wealth creation in Europe in the decades to come.

And yet only two years ago Rousset was being positioned as a beacon of hope within LFoundry.

LFoundry GmbH was founded in 2008 by the management buy-out of a Renesas wafer fab in Landshut, Germany. The purchase came with legacy orders from the vendor but LFoundry put the German manufacturing site out into a separate entity called Landshut Silicon Foundry GmbH, which was declared insolvent in 2011. And this was because no sales were found to replace those legacy orders from Renesas.

Meanwhile in 2010 LFoundry had acquired the Rousset fab from Atmel Corp. together with legacy orders. But again LFoundry has failed to replace those legacy orders to a significant degree. It is reported that Atmel has contributed to Rousset's downfall by cutting back orders after three years. But it is any foundry's job to make its chip manufacturing attractive so that customers are lining up, not turning away.

And so Rousset is the second LFoundry wafer fab that has had to close due to being unable to make sales after legacy chip orders have gone away. And even as Rousset closes LFoundry is in the process of bringing up its third fab, a former Texas Instruments and then Micron Technology wafer fab in Avezzano, Italy. It is as if LFoundry is using legacy fabs as stepping-stones to make its way across Europe – from Germany to France to Italy. On present form the Avezzano wafer fab has three years before its demise.

The more cynical amongst us might see a broader and more general pattern at multiple management buyouts across Europe whereby inward investors are relieved of their responsibilities to long-serving employees by transferring ownership to a new company for the last couple of years of a factory's life.

Standing back it can be seen that Europe has been managing – or mismanaging depending on your point of view – its exit from the semiconductor industry for some time. And in the particular case of LFoundry there seems to have been a decided lack of ability to create new business.

And yet it need not be so. There are other companies that have made a good job of taking on legacy manufacturing and creating new business. There's X-Fab Silicon Foundries AG in Germany and Tower Semiconductor in Israel. Both are expansive and global in their ambitions. Tower has successfully taken on a Micron wafer fab in Nishiwaki, Japan, and has struck a deal with Panasonic Corp. to take control of three of the Japanese company's wafer fabs including 300-mm capable fabs.

It is all quite different to 1985 when Rousset was the manufacturing site for a new company, European Silicon Structures (ES2). ES2 was funded by European industrial giants of the time, that were users of ICs and just getting into custom IC design. They included Philips Electronics, British Aerospace; Olivetti; Sweden's Saab France's Bull, Switzerland's Asea Brown Boveri and Societe Generale de Belgique.

The whole point of the company was to apply Silicon Valley business methods learned from inward investors in chip making, such as Motorola and National Semiconductor and let a European company apply them, grab European market share and eventually take global market share. One wrinkle in the business plan that would eventually prove ES2's undoing was a decision to use direct-write e-beam manufacturing in an attempt to create low volume chips while saving on mask costs.

The plan was technically feasible and differentiating, but it put ES2 outside the mainstream of chip manufacturing and in a niche between FPGAs and the semi-custom and full-custom offerings of LSI Logic Corp., VLSI Technology Inc. and
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Acquisitions shake up telecoms chip landscape

By Nick Flaherty

Two major acquisitions are set to change the landscape of networking and telecom chip development.

Intel has acquired the wireless baseband division of Mindspeed, including its UK picochip operation, while Avago Technologies has acquired network processor developer LSI.

Intel sees the acquisition of the wireless infrastructure division of Mindspeed as one of the final building blocks in its telecoms strategy. The deal ended up being part of the $272m sale of Mindspeed to M/A Com and brings the products, people and IP, much of which comes from the acquisition of UK femtocell chip developer picoChip, into the storage and communications group of Intel. While Intel has been penetrating the basestation controller and cloud server market with its x86 devices, Mindspeed is built around the ARM architecture, and the picoChip products also integrate ARM cores. However the software skills in the radio access network (RAN) is a key part of the acquisition, says Rose Schooler, VP and general manager of the group.

Similarly the $6.6bn acquisition of LSI by Avago creates a highly diversified semiconductor market leader with approximately $5 billion in annual revenues by adding enterprise storage to Avago’s existing wired infrastructure, wireless and industrial businesses. The company says it will be strongly positioned to capitalize on the growing opportunities created by the rapid increases in data center IP and mobile data traffic as a result of the deal.

“This highly complementary and compelling acquisition positions Avago as a leader in the enterprise storage market and expands our offerings and capabilities in wired infrastructure, particularly system-level expertise,” said Hock Tan, President and Chief Executive Officer of Avago. “This combination will increase the Company’s scale and diversify our revenue and customer base. In addition to these powerful strategic benefits, as we integrate LSI onto the Avago platform, we expect to drive LSI’s operating margins toward Avago’s current levels, creating significant additional value for stockholders.”

“This transaction provides immediate value to our stockholders, and offers new growth opportunities for our employees to develop a wider range of leading-edge solutions for customers,” said Abhi Talwalkar, President and Chief Executive Officer of LSI. “Our leadership positions in enterprise storage and networking, in combination with Avago, create greater scale to further drive innovations into the datacenter.”

LSI has always had a strong presence in Europe, dating back to its fabs as ASIC foundry LSI Logic. It had recently anticipated achieving cost savings of $200m a year and is funding the deal with $1bn from its own cash, a $4.6 billion term loan from a group of banks and a $1 billion investment from Silver Lake Partners.

Agilent Technologies to spin-off Keysight Technologies by early November 2014

By Julien Happich

Agilent Technologies has revealed the name of the electronic measurement company it expects to spin off in early November 2014 as Keysight Technologies.

The new company’s tagline, “unlocking measurement insights for 75 years,” commemorates the 1939 birth of the original Hewlett-Packard Company, from which Keysight originated.

Keysight will concentrate solely on the electronic measurement industry, focusing on its test and measurement customers. The business, currently a part of Agilent, is the world leader in test and measurement, holding the No. 1 position in its industry segments of wireless data ecosystem; aerospace and defense; and industrial, computers and semiconductors. The new company will include the entire portfolio of Agilent electronic measurement products and the largest sales and support team in the test and measurement industry.

Due to become a standalone company in early November 2014, Keysight will be headquartered in Santa Rosa, Calif., and have approximately 9,500 employees in 30 countries.
E-cigarettes: just more e-waste or an opportunity to educate consumers?

By Julien Happich

NO TAR, NO POLLUTION: this is an easy marketing short-cut taken by most e-cigarette vendors keen to publicize their products as a healthy alternative to traditional combustion cigarettes.

Now as its name infers, the e-cigarette operates on a battery (lithium ion) that powers a pressure sensor to detect inhalation from the user, and a heater that vaporizes the liquid flavour and nicotine mixture when a drag is detected.

On most models a LED gives a fancy visual feedback (more elaborate models even boast an LCD display to indicate the number of vapour puffs taken, the daily intake of nicotine, then smartphone Apps help users manage their consumption).

All these components driven by a microcontroller form the electronic part of the e-cigarette, and this won’t just end-up in smoke. Now, each e-cigarette brings its little contribution to the global pile of electronic waste which according to StEP’s figures (Solving the E-Waste Problem Initiative), could jump 33% by 2017 to 65.4 million tonnes annually.

Of course, e-cigarettes only represent a small percentage of this e-waste (the bulk being made up of discarded TVs, computer monitors, mobile phones of all sorts...), yet, like any other such electronic appliances, it contains hazardous substances that if not recycled, could end up leaking into landfills, eventually contaminating soil and water.

In Europe, the debates are raging about the actual health benefits (for the smokers and their associated clusters of passive smokers) and the EU’s recent “tobacco products directive” to become effective in 2016 will include electronic cigarettes, now considered as a “tobacco related product”.

Officially, it is to do with the level of nicotine in the refillable cartridges and the imitation of tobacco taste, but then the tobacco industry, the e-cigarette manufacturers and the pharmaceutical industry are all lobbying to have a say and maintain their exclusive right to sell this toxic product.

E-cigarette vendors claim these products are just harmless consumer electronic devices that should not be regulated. Tobacco companies fear the new competition and want to maintain their legal monopoly and exclusive distribution channels (French courts recently ruled in favour of a tobacconist who claimed the nearby shop selling e-cigarettes was unfair competition since e-cigarettes should be considered as tobacco products), and pharmaceutical companies want to put e-cigarettes in the same lot as nicotine patches (which they would prefer to sell instead since they manufacture those).

Other health concerns shared by various medical bodies around the world include the fact that a number of known carcinogens and toxins have been identified in e-cigarette vapour from mainstream vendors, as well as metal nanoparticles (coming from the solder). As a striking statement, Michael Bloomberg signed a law on his last day as the mayor of New York, expanding the city’s ban on indoor smoking to include electronic cigarettes.

Some e-cigarettes are rechargeable (with a rechargeable battery and refillable cartridges for the flavoured vapour), others are sold as disposable, which is pretty worrying, considering the bad habit that most smokers have to throw traditional cigarette butts just anywhere (these nicotine and tar-filled butts end up into the environment, washed from the gutters into rivers, lakes and the ocean, eventually poisoning the entire food chain).

Now you could argue for ever on the actual health benefits for smokers and passive smokers, but there is a true opportunity to raise e-waste awareness through all existing e-cigarette distribution channels, regardless of who wins the rights to intoxicate us.

Except for the mandatory electronic waste disposal symbol that is applied on the back of the packaging, few manufacturers really want to educate their customers with regard to how they should dispose of their electronic butts. Maybe the sheer volume of e-cigarettes being sold (and consequently the incremental e-waste issue, will force governments to educate electronic consumers a bit more while expanding their e-recycling strategies with more collection points put into place.

This would naturally benefit all other “disposable” battery-operated gadgets that often only integrate electronics for the sake of featuring a blinking LED or making funny sounds, and which unlike bulkier electronic appliances, are too often disposed-off improperly. The circuits for actually recycling e-waste still lack transparency, another story altogether, far beyond the collection points which only represent the first step in an opaque process.
E-waste to jump one-third to 65.4 million tonnes annually by 2017, says StEP report

By Julien Happich

BY 2017, all of that year’s end-of-life refrigerators, TVs, mobile phones, computers, monitors, e-toys and other products with a battery or electrical cord worldwide could fill a line of 40-ton trucks end-to-end on a highway straddling three quarters of the Equator.

The forecast based on data compiled by “Solving the E-Waste Problem (StEP) Initiative” represents a global jump of 33% in just five years. While most of these used e-products are destined for disposal, gradually improving efforts in some regions are diverting some of it to recycling and reuse.

The escalating global e-waste problem is graphically portrayed in a first-of-its-kind StEP E-Waste World Map available online. The interactive map resource, presenting comparable annual data from 184 countries, shows the estimated amount of electrical and electronic equipment (EEE - anything with a battery or a cord) put on the market and how much resulting e-waste is eventually generated (i.e. comes out of use or post-use storage destined for collection by a recycling company or disposal).

The map shows, for example, that almost 48.9 million metric tons of used electrical and electronic products was produced last year - an average of 7 kg for each of the world’s 7 billion people. And the flood of e-waste is growing.

Based on current trends, StEP experts predict that, by 2017, the total annual volume will be 33 per cent higher at 65.4 million tons, the weight equivalent of almost 200 Empire State Buildings or 11 Great Pyramids of Giza.

“Although there is ample information about the negative environmental and health impacts of primitive e-waste recycling methods, the lack of comprehensive data has made it hard to grasp the full magnitude of the problem,” says Ruediger Kuehr of United Nations University and Executive Secretary of the StEP Initiative, “We believe that this constantly updated, map-linked database showing e-waste volume by country together with legal texts will help lead to better awareness and policy making at the public and private levels.”

Digging into the waste pile

The StEP e-waste world map database shows that in 2012 China and the United States topped the world’s totals in market volume of EEE and e-waste. China put the highest volume of EEE on the market in 2012 – 11.1 million tons, followed by the US at 10 million tons. Those positions were reversed when it came to the total volume of e-waste generated per year, there being more products put on the market in the past in the US which are now likely to be retired. Here the US had the world’s highest figure of 9.4 million tons and China generated the second highest e-waste total of 7.3 million tons. However, the world’s two biggest economies were far apart when it came to the amount of annually e-waste per person.

Here the US was highest among major countries (and seventh overall) with each American responsible for an average 29.8 kg of hi-tech trash. That was almost six times higher than China’s per capita figure of 5.4 kg. Information covering e-waste rules, regulations, policies and guidance is also available via the StEP e-waste map. This is obtained substantially from StEP member Compliance & Risks’ knowledge management platform, C2P, and highlights the huge variety of requirements and lack of consistency in tackling the e-waste issue throughout the world.

A report released in tandem with the map was developed by the Massachusetts Institute of Technology (MIT) Materials Systems Laboratory and the US National Center for Electronics Recycling (NCER), and funded by the US Environmental Protection Agency in support of the US government’s National Strategy for Electronics Stewardship.

The detailed analysis of the United States’ generation, collection and export of some types of used electronics shows that about 258.2 million used, whole unit computers, monitors, TVs and mobile phones were generated in 2010. The study, “Quantitative Characterization of Domestic and Transboundary Flows of Used Electronics”, found mobile phones constitute the biggest component in units – with an estimated 120 million collected – while TVs and computer monitors made up a major proportion of the total weight. Despite growing interest and concern surrounding transboundary movements of used electronics around the world, there is a dearth of data on their movements.

Although a multitude of different data sources exist, coherent sets of information on used electronics leaving households and their movement are lacking because of inherent challenges in obtaining such information, both the StEP e-waste world map and the MIT/NCER study are addressing.

These challenges include limited mechanisms for data collection, undifferentiated trade codes, lack of consistent definitions for categorizing and labelling used electronics as well as their components, minimal regulatory oversight, and limited agreement on the definitions of end uses (i.e., reuse vs. recycling and shipments for repair vs. recycling).

Two-thirds of the used units (56 percent of total weight) were collected for reuse or recycling and 8.5 per cent of the collected units (3.1 percent of total weight) were exported as whole units. This export figure, based on trade data, likely represents the low end of the range as not all whole units may be shipped using appropriate trade codes.
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IEC presses for a single charger specification for notebook computers

By Graham Prophet

Aiming to “significantly reduce e-waste”, the IEC international standards and conformity assessment body for all fields of electrotechnology, has announced what it terms the “first globally relevant Technical Specification” for a single external charger for a wide range of notebook computers and laptops. The detailed IEC Technical Specification 62700: DC Power supply for notebook computer, will be available in early 2014.

Each year billions of external chargers are shipped globally. Power supplies for notebooks weigh typically around 300 but sometimes up to 600 grams. They are generally not usable from one computer to the next. Sometimes they get lost or break, leading to the discarding of computers that may still work perfectly well. It is estimated that the total e-waste related to all kinds of chargers of ICT devices (Information and Communication) exceeds half a million tons each year; basically the equivalent of 500,000 cars.

This new IEC Technical Specification covers critical aspects of external chargers for notebook computers, their connector and plug, as well as safety, interoperability, performance and environmental considerations. The new IEC Technical Specification opens the way to a significant and very real reduction of e-waste related to power supplies and will allow consumers to use a single external charger with a wide range of notebook computers. This will also make it much easier for external chargers to be reused or replaced when needed.

IEC General Secretary and CEO Frans Vreeswijk said, “The IEC international Standards for the universal charger for mobile phones has been widely adopted by the mobile phone industry and is already starting to help reduce e-waste. A single power supply covering a wide range of notebook computers is the next step in lowering e-waste and its impact on our planet.”

The IEC Technical Specification 62700: DC Power supply for notebook computer, comprises the input of experts from many countries around the world and has been accepted by the National Committees participating in IEC TC (Technical Committee) 100: Audio, video and multimedia systems and equipment.

Even though some organisations are discussing and examining the merits of a universal power adapter covering numerous ICT (Information and Communication Technology) devices, due to the technical realities, this is likely still a long way from being achievable. Therefore, rather than chasing a dream that remains out of reach today, IEC says that it has leveraged its global technical expertise to bring concrete solutions to the market place. Vreeswijk commented, “The IEC is all about bringing concrete, feasible solutions to the market place. We welcome input from many sides to make our work as broadly relevant as possible. The result are state-of-the-art tools that allow policy makers to initiate achievable and effective energy-efficiency and waste-management programmes.”

Rensselaer Polytechnic Institute launches Light and Health Alliance

By Paul Buckley

The Lighting Research Centre (LRC) at Rensselaer Polytechnic Institute has launched the Light and Health Alliance which is a collaborative initiative to bridge the science of light and health to practical applications.

The Alliance, which is led by Dr. Mariana Figueiro, LRC Light and Health Program director and associate professor at Rensselaer, is aiming to provide objective information based on basic and applied research.

“We will also hold seminars and present at conferences to educate key audiences and advance attention to light and health.”

The Light and Health Alliance is a collaboration among manufacturers, government organizations and NGOs, codes and standards bodies, along with architects, specifiers, medical facility managers and physicians, working to enable the broad adoption of lighting for human health by producing factual information based on basic and applied research and by visualizing future applications. Acuity Brands, Ketra, OSRAM SYLVANIA, and Philips are current members.
Tower buys three wafer fabs for $8 million

By Peter Clarke

AS EXPECTED FOUNDRY Tower Semiconductor Ltd. (Migdal Haemek, Israel) has struck a deal with Panasonic Corp. to take control of three of the Japanese company’s wafer fabs. However, the deal may have implications for Tower’s existing wafer fab in Japan, at Nishiwaki.

The two companies are forming a joint venture in which Tower, which trades as TowerJazz, will hold 51 percent and Panasonic has pledged to purchase chips from the JV in volume for five years.

In consideration of its acquisition of 51 percent in the JV Tower is issuing $8 million in shares and Panasonic will become a minority shareholder in Tower Semiconductor Ltd. As well as the fabs and the tools the joint venture will get $40 million in cash to be invested by Panasonic and work in progress and inventories manufactured at the fabs before the closing date.

Panasonic is acting as part of efforts to exit the semiconductor industry, stem losses and reduce its workforce.

While most of the 2,500 jobs associated with the Panasonic fabs will transfer to the joint venture Tower said that after the acquisition it will rationalize its Japanese business. This may include consolidations between its Nishiwaki fab and those of the joint venture. The company said it is therefore evaluating possibilities for the Nishiwaki facility.

Under the terms of the deal Panasonic will transfer to the joint venture its semiconductor manufacturing processes and manufacturing equipment for 200- and 300mm diameter wafers at its Hokuriku factories in Uozu, Tonami and Arai. The deal will add $400 million of annual revenue to Tower’s books and 800,000 wafers of annual capacity (200mm diameter equivalent). TowerJazz had full-year sales in 2012 of $639 million.

The deal will also extend Towers’ manufacturing process capability. One of the wafer fabs produces analog circuits on 300mm diameter wafers and Tower will also receive 65nm CMOS image sensor process and additional 45nm digital technology. The deal is expected to close by April 2014. The high-definition front-side illuminated CMOS image sensor process is suited to high performance sensors used in high-end digital single lens reflex cameras. A high-voltage SOI process will extend Tower’s bipolar-CMOS-DMOS process from 80V up to 190V enabling Tower’s entry into some display driver and medical markets.

Tower said that, following the acquisition of the three Panasonic wafer fabs, it will rationalize its Japanese business. This may include consolidations between its Nishiwaki fab and those of the joint venture. The company said it is therefore evaluating possibilities for the Nishiwaki facility.

“This partnership brings together two leaders - Panasonic, an acknowledged analog components and systems leader, and TowerJazz, a recognized analog foundry leader - to create a company that will serve and grow the analog foundry space as no existing single foundry company can,” said Russell Ellwanger, CEO of Tower Semiconductor, in a statement.

Silicon supersaturated with gold atoms through laser doping yields broadband infrared response

By Julien Happich

RESEARCHERS AT MIT have published results on doping silicon with gold to improve its response to broadband infrared light. Normally, Silicon lets most infrared light pass right through because its bandgap requires an energy level greater than that carried by photons of infrared light.

Various treatments of silicon can mitigate this behaviour, usually by creating a waveguide with structural defects or doping it with certain other elements, but these methods have significant negative effects on silicon’s electrical performance, only work at very low temperatures, or only make silicon responsive to a very narrow band of infrared wavelengths.

The new system works at room temperature and provides a broad infrared response. It incorporates atoms of gold into the surface of silicon’s crystal structure in a way that maintains the material’s original structure.

The researchers implanted gold into the top hundred nanometers of silicon and then used a laser to melt the surface for a few nanoseconds.

The silicon atoms recrystallize into a near-perfect lattice, into a layer of layer of silicon supersaturated with gold atoms (what the paper says is that the final material contains about 1 percent gold, over 100 times greater than silicon’s solubility limit).

At the very high concentrations achieved by laser doping, the researchers noted that gold could have a net positive optoelectronic impact under infrared light. These results could find applications in infrared imaging systems.
Bosch Sensortec grows in mobile and beyond, says CEO

By Peter Clarke

ROBERT BOSCH GMBH has successfully ridden the wave of automotive demand for micro-electromechanical systems (MEMS) components since 1988. And then in 2005 it formed Bosch Sensortec as a wholly-owned subsidiary to offer MEMS for consumer applications. It was near perfect timing. Smartphones were starting to emerge and the iPhone was launched by Apple in June 2007 – would go on to drive a rapid increase in the market for MEMS.

EE Times Europe caught up with Bosch Sensortec CEO Stefan Finkbeiner has he prepared for the Consumer Electronics Show coming up in Las Vegas January 6 to 10, 2014.

In June 2013 IHS-iSuppli ranked ST and Bosch as joint leaders in the supply of MEMS in 2012 with $793 million of annual sales each. So how well is Bosch Sensortec doing in the mobile platform? Or are the margins becoming so thin that STMicroelectronics is welcome to the market?

“Bosch is a pioneer in MEMS in automotive and we leverage that. Bosch Sensortec is 100 percent focused on consumer and every other smartphone has a Bosch Sensortec MEMS in it,” was FinkBeiner’s response. “The biggest markets are for accelerometers, gyroscopes, magnetometers, pressure sensors where we are very successful.

“In accelerometers for consumer [electronics] we are the market leaders and when combined with a magnetic sensor it produces Bosch Sensortec’s successful eCompass line of products for dead reckoning calculations. In gyroscopes ST remains the leader,” said Finkbeiner.

But as price points for smartphones move down and volumes increase the pressure on margins increases for MEMS vendors. Does there come a point where Bosch Sensortec should focus on adjacent markets with less competition?

Finkbeiner doesn’t see it like that. “We want to be the technology and innovation leader. We can produce an accelerometer with a footprint of 1.2mm by 1.5mm and we are integrating to produce IMUs [inertial measurement units] that combine accelerometers, gyro and pressure sensors. That way we can get a benefit for us and for the customer by using less material and reducing foot print.

So what technologies, applications and industry sectors are next?

There are different things such as humidity sensors that can be useful in terms of judging the context the phone is in. If you hold a phone to your ear the humidity goes up quickly so such a sensor could be used to automatically switch the phone on, Finkbeiner explained. Accelerometers can be tuned for use as step counters and so on. And humidity allied to pressure and temperature measurements could be used to make local weather reports – useful for the owner of the cell phone but also potentially part of a crowdsourced weather reporting system, said Finkbeiner. And then there are microfluidics for a wide range of medical and fitness applications.

Finkbeiner said that equipment that connects to smartphones – small units that link to the smartphone to present information or to gain access to the Internet – is the next big and most obvious market. Beyond that there is the more general world of autonomous machines with sensors and actuators that will make up the Internet of Things.

Even as we were speaking parent Robert Bosch GmbH was preparing the launch of Bosch Connected Devices And Solutions GmbH to engage in this market, which the company sees as the third application wave for MEMS in networked homes, in transportation and traffic management and for logistics.

However, Bosch CDS will be a “platform” company that puts MEMS sensors together with microcontrollers, energy sources, RF ICs and software to produce system-in-package or system-level products. Bosch CDS is likely to be a major sales opportunity for Bosch Sensortec.

“Bio-medical is different to fitness and consumer electronics. It requires long trial periods and country approvals. Bosch Sensortec is not a medical company,” said Finkbeiner but he added that Robert Bosch GmbH is large and if the company chose to it could make a subsidiary focused on that market.

Exceptional sales growth requires additional manufacturing capacity. Bosch Sensortec is essentially a fabless subsidiary that makes use of a 200-mm MEMS fab at Reutlingen, Germany belonging to the automotive operations of the parent company. The fab was formally opened in March 2010 and is being gradually fitted out with equipment through 2016. It is located alongside the previous generation 6-inch wafer fab.

“We leverage the Bosch supply chain. We use external suppliers of the ASIC and packaging. We are allowed to go to external suppliers. But the automotive market makes for a very stable load on the fab and then the consumer electronics is additional,” said Finkbeiner.

Finkbeiner also revealed that Bosch Sensortec, following the lead of its automotive sibling uses contractors in southeast Asia for the delicate and vital business of wirebonding and packaging its multi-die MEMS.

But the consumer electronics portion is growing fast so could Bosch Sensortec be forced to use an external foundry even for the MEMS die. “It’s not expected for the next two or three years but perhaps it will be,” said Finkbeiner.

Packaged and opened up MEMS-based sensors.
years," said Finkbeiner, by which time, of course, Robert Bosch may have invested in manufacturing again. Finkbeiner qualified his position saying: “It could happen if there was a special product that needed a special process,” he said.

Given the commanding position of Bosch Sensortec and STMicroelectronics NV as joint market leaders in MEMS is there scope for the companies to become involved in the “Airbus of chips” initiative that is being promoted as vital to Europe’s interests by Neelie Kroes, vice president of the European Commission and Commissioner for the Digital Agenda?

“I would not expect so. It appears to be focused on 450-mm diameter wafers, which is not a Bosch issue, and on digital CMOS which is not a central activity.”

With Bosch manufacturing on 200-mm diameter wafers a move into 300mm manufacturing would be next on the MEMS agenda. Will it be coming any time soon either at Bosch or elsewhere? Finkbeiner indicates it’s not imminent at Bosch. “On 8-inch wafers you can get 20,000 to 30,000 MEMS die per wafer. It only takes a few wafers to get to millions of die.” Finkbeiner said that although demand is going up MEMS makers are finding ways to reduce the size of die.

But eventually with the automotive and consumer MEMS markets growing and moves into the Internet of Things (IoT) additional manufacturing capacity will be needed; either from the IDMs such as Bosch and ST or established digital CMOS foundries such as TSMC or Globalfoundries.

Indeed one possibility being mooted is that Abu Dhabi switch an earlier plan to build a CMOS wafer fab there to MEMS manufacturing.

Finkbeiner does not dismiss it but is sceptical. “To set up the MEMS, ASIC and packaging requires a lot of money and a lot of learning. Unlike CMOS, MEMS is not one process and lot of products. The process often needs to be adapted. It makes it difficult. To build a new fab and get the money back would take a long time.”

So how does Finkbeiner see demand for 2014. “It’s frightening. We more than doubled manufacturing capacity from 2012 to 2013 and we will likely need to install more capacity in 2014.”
Design-free RF-based wireless charging redefines user experience

By Julien Happich

ALTHOUGH IT WAS ESTABLISHED in July 2010, funded by private investors, Israeli startup Humavox has been operating pretty much under the radar until now, busy filing patents and working on the first prototypes of its RF-based charging technology.

When interviewed by EE Times Europe, Omri Lachman, co-founder and CEO of Humavox put the emphasis on natural user experience, noting that all existing inductive or magnetic coupling wireless charging mats or surfaces (when the electronics is directly embedded into furniture) require the end-user to place their devices “correctly”, which can be a bit tricky or frustrating if the device does not charge properly. More conventional chargers require wires and connectors to be plugged into the power outlets and the devices.

By using well-tuned RF power transmission within a confined environment (i.e. a box of any shape able to receive the devices to be charged), Humavox sees many natural opportunities for end-users to recharge their wearable devices, especially as the number of these devices increases and they become smaller.

Lachman didn’t want to give away too much about his newly launched Eterna technology platform, consisting of a Nest station (essentially a confined volume with at least one integrated antenna, that acts as the power station for the smart electronics devices it receives and ThunderLink, the company’s wireless charging IP to be integrated into the smart devices (at PCB-level or as a full ASIC).

“To make the charging experience more natural, without asking users to learn yet another procedure, we could implement the Nest charging enclosure in many convenient storage places, such as a cabinet drawer at home, a glove-compartment in a car, a hotel-safe, a seat receptacle in airplanes”, explained Lachman. “Recharging your devices could be as simple as dropping them into a box.”

“Essentially, you could refer to the Nest station as a Faraday cage enclosing an RF cavity resonator”, said Lachman when pressed for more technical details. “The RF frequency we use depends on the size of the Nest, it can range from 1MHz for the large volumes to between 2.4 and 5.6GHz for smaller implementations” he added. With its ThunderLink circuitry, the company is able to precisely tune the RF frequency in the cavity to create narrow hot spots and focus the RF power onto the receiving antennas of the devices to be recharged. The RF signal picked up by the antennas is then rectified to the appropriate DC currents for charging each of the devices’ batteries. The Nest allows multiple devices to charge simultaneously, while constantly monitoring and adjusting the charging process for ultimate compliance with the device’s power requirements.

By confining the charging procedure to a box, Humavox claims to achieve a wireless power transfer efficiency of 90%, from the enclosure to the device to be recharged. The company also stays clear of regulations on transmitted RF power in free space, with no limitations on power output, so the Nest could charge anything from tiny hearing aids to smart watches, wearable fitness or health monitoring devices or even more power hungry mobile phones and tablets.

The key benefit again is that the devices can be stored in any order and orientation into the Nest, which itself could take any shape. The Nest station was intentionally crafted to be a design-free solution, hence it has no predefined industrial design. To illustrate this, Lachman mentioned an interesting automotive application, where difficult to access sensors had to be powered remotely, in the car engine. Humavox was able to use the engine block as the Nest station and tune the transmitted RF power to precisely address the sensor’s need, in the 200 to 400MHz range.

The company is not planning to sell chips, but will license its technology as IP for others to integrate, alongside other charging technologies. It is already working with OEMs and expects Eterna-enabled products to reach market by 2015.
IR sensor startup preps smartphone bid

By Peter Clarke

PYREOS LTD. (EDINBURGH, SCOTLAND), a developer of infrared sensors that spun out of Siemens in 2007, has raised $4 million to help it pitch for design wins in smartphones and tablet computers. The round was led by Robert Bosch Venture Capital GmbH, Seraphom Capital, Siemens Technology Accelerator and the Scottish Investment Bank.

The company reckons its low-power IR technology when applied to gesture and proximity detection consumes about one-thousandth that of competing technologies. Pyreos’ passive infrared sensor technology is already in use in industrial gas and flame markets and for handheld spectroscopy in the dairy, winery and lubricant industries.

The Pyreos combined gesture and proximity sensor uses microwatts of power which allows designers of portable consumer electronics to create “always on” and “wake up on motion” gesture recognition equipment. Pyreos plans to launch two products; one that recognizes proximity and gestures at 20cm range and another that performs the same combined function at one meter.

Pyreos makes use of sputtered thin films of lead zirconate titanate (PZT) laid down in a crystalline orientation (111) that provides a spontaneous permanent polarization and a Curie point above 500 degrees C. The IR sensors are manufactured on a silicon membrane MEMS device as uncooled IR sensors and sensor arrays. The peak wavelength absorption is tunable so the sensors can operate from terahertz through infra-red, visible and even ultraviolet.

The applications are similarly varied. Besides consumers electronics they range from spectroscopic materials analysis, through oil, gas and flame sensing, medical applications such as diabetes monitoring and breath analysis for early illness detection.

Claus Schmidt, managing director of Robert Bosch Venture Capital GmbH commented: “The design breakthrough they have achieved in reducing power consumption and hence eliminating the long-standing, industry barrier of the battery drainage issue means the potential in mobile and handheld applications across consumer and industrial markets globally, is explosive. The investment will fund growth in the team to extend their established, international customer base further.”

Br/N-based dopants open up the band-gap in graphene nanoplatelets for the design of FETs

By Julien Happich

RESEARCHERS AT THE Ulsan National Institute of Science and Technology (UNIST in Korea) unveiled a method for the mass production of boron/nitrogen co-doped graphene nanoplatelets, which led to the fabrication of a graphene-based field-effect transistor (FET).

Led by Prof. Jong-Beom Baek, the research team uses a simple solvothermal reaction of BBr3/CCl4/N2 in the presence of potassium to mass produce boron/nitrogen co-doped graphene nanoplatelets (BCN-graphene).

Since the discovery of graphene, various methods of making graphene-based field effect transistors (FETs) have been exploited, including doping graphene tailoring graphene-like a nanoribbon, and using boron nitride as a support. Among the methods of controlling the band-gap of graphene, doping methods show the most promise in terms of industrial scale feasibility.

Although world leading researchers have tried to add boron into graphitic framework to open its band-gap for semiconductor applications, there has not been any notable success yet. Since the atomic size of boron (85 pm) is larger than that of carbon (77 pm), it is difficult to accommodate boron into the graphitic network structure.

The new synthetic protocol has revealed that boron/nitrogen co-doping is only feasible when carbon tetrachloride (CCl4) is treated with boron tribromide (BBr3) and nitrogen (N2) gas.

In order to help boron-doping into graphene structure, the research team used nitrogen (70 pm), which is a bit smaller than carbon and boron. The idea was very simple, but the result was surprising. Pairing two nitrogen atoms and two boron atoms can compensate for the atomic size mismatch. Thus, boron and nitrogen pairs can be easily introduced into the graphitic network. The resultant BCN-graphene generates a band-gap for FETs.

A schematic representation for the formation of BCN-graphene via solvothermal reaction between carbon tetrachloride (CCl4) boron tribromide (BBr3) and nitrogen (N2) in the presence of potassium (K).
"HOW EFFICIENT IS WHITE LIGHT?" asked Dr Harald Pier, team leader for EMEA technical solutions at Philips Lumileds, during a round table on white LEDs held at Forum LED Europe in Paris.

The luminous efficacy of radiation (LER) in lumens per watt is defined as the ratio of the photometrical flux (luminous flux of visible light) and the radiometrical flux of the light source (radiant power of the total emitted spectrum).

The LER indicates how much of the light output we humans perceive (as white light or its visible components) versus the total energy put into emitting the light. Pier gave some examples of light sources, a tungsten light bulb typically delivers 15lm/W, while the sun spectrum including the non-visible bands is only 93lm/W, but the LER of the sun spectrum truncated to its 400-700nm visible bands is at 251lm/W for natural white light at a 5800K colour temperature.

Now, according to Pier, a combination of two or more individual spectral lines should yield optimum efficacy. Nowadays, most “white LEDs” are in fact Blue LEDs covered with a mixture of phosphors. The blue light (of higher energy) pumps or excites the phosphors that re-emit light at different set spectrum bands, depending on their chemistry.

"The LER depends very much of the spectrum bands being used and is relatively independent from the drive current or the temperature" explained Pier, taking as an example the Luxeon M white LED, a 5700K device capable of delivering 316lm/W. Another device put forward as being the state of the art was Philips Lumiled’s Luxeon Altolon core, combining four dies into a single 3.5x3.76 chip package and exhibiting a luminance of 75Mcd/m², a flux of 1000lm and a LER of over 200lm/W. This is to compare with halogen lamps with a 30Mcd/m² luminance, high intensity discharge (HID) lamps at 60Mcd/m² and the sun 1600Mcd/m². The colour rendering index (CRI) achieved by this product is considered very good at 93.

GaN-on-GaN
Today, about 95 percent of GaN LEDs are manufactured on sapphire wafers but the scope of using cheaper and more widely available Si wafers to scale up the production of GaN-on-Si devices is an attractive one.

While a recent forecast from market analysis firm IHS Inc expects GaN-on-Silicon LEDs to increase their market share from 1% today to 40 percent by 2020 (mostly taking market share from both sapphire and silicon carbide wafers), Californian startup company Soraa is betting on GaN-on-GaN for high efficiency white LEDs.

Looking at system efficiency, Soraa’s Principal Scientist Aurélien David started with LED efficiency metrics to highlight the inherent limitations of conventional LEDs. Since overall system efficiency results from the combination of internal quantum efficiency (IQE), extraction efficiency (Cex) and package efficiency (PE), one should look at improving all three.

"Growing GaN or InGaN on foreign substrates such as sapphire, SiC or silicon yields epitaxial defects, dislocations which are all detrimental to the internal quantum efficiency (IQE)” noted David, adding that efficiency droop is also a fundamental physical limitation of power LEDs on foreign substrates.

Running at high efficiency requires a low current density (under 100A.cm⁻²), which translates into larger devices. Then, not all white lights are equal, he explained the audience, partly because of the chosen phosphor mix, missing out on some of the red bands, but also because using a blue LED to pump these phosphors means the overall light output will typically lack the violet and the cyan bands.

"Even being efficient and cheap, Cathode Fluorescent Lamps (CFLs) failed to convince consumers because of their poor light quality", David remarked before coming up with GaN-on-GaN LEDs as the ultimate solution.

First because growing GaN LEDs on a bulk GaN substrate yields a higher crystal quality (with a dislocation density up to 1000x lower compared to GaN on foreign substrates) which reduces epitaxial constraints and translates into a higher IQE and less droop.

The manufacturing process is also much simpler than for GaN on foreign substrates, skipping the carrier and lift-off steps typically required. Growing devices on bulk GaN also gives Soraa access to all crystal planes for the design of volumetric

Comparing crystal growth quality: GaN-on-GaN versus GaN-on-foreign substrates, as seen by Soraa.
chips. According to Soraa’s physical models, at around 90%, the extraction efficiency of specially “roughened surface” volumetric chips is well beyond the thin-film limit currently in the range of 82 to 84%.

What’s more, the devices exhibit excellent power density uniformity, with no current crowding even when driven at ten times the current density of traditional LEDs. This means that GaN-on-GaN LED dies about 15 to 25 times smaller than typical power LED dies can be driven at high power and yet retain a high external quantum efficiency. Soraa stress-tested its LEDs for several thousands of hours at junction temperatures up to 140°C without noticeable performance shifts. Using the TM-21 convention, the company predicts a lifetime of over 30,000 hours for its products under standard conditions.

Using proprietary Si-based wafer level packaging, Soraa packed up to 36 dies under a mix of red, green and blue phosphors to produce high brightness compact LEDs.

When asked if Soraa could be cost competitive despite its reliance on expensive GaN substrates, David replied with a resounding yes! “The substrate is expensive, but we can drive the LEDs from 15 to 25 times harder, so we get much more light output while using much less substrate”. “The first generation of LED technology (on foreign substrates) is maturing slowly, but GaN-on-GaN LEDs offer a breakthrough in output power per wafer, and we are only at the beginning” he added.

Then back on the white light quality issue, David only had praise for the new devices, with a measured CRI of 95. Because Soraa’s chips emit violet light to pump a proprietary mix of phosphors, the company is able to generate cyan light, as opposed to the cyan gap of common blue-pumped LEDs.

“For instance, you will find that for a 3000K 24 degree lamp, Philips’ state of the art MR16 lamp outputs just about 2000 cd of CBCP at 10 watts (40watt equivalent, CRI80) while a Soraa product with a CRI of 95 can deliver a CBCP of 2750 cd (11.5watts, 65watt equivalent)” David noted in complementary email exchange.
Continental to showcase first concepts jointly developed with IBM

By Christoph Hammerschmidt

AT THE FORTHCOMING CONSUMER Electronics Show (CES) in Las Vegas, automotive tier one Continental plans to demonstrate the first results of its strategic collaboration with IBM. Examples are a ‘connected electronic horizon’ for the vehicles as well as natural voice processing.

The electronic horizon is a platform aiming at enabling and improving a foresighted driving style - not so much for the human driver but for the electronic control systems. Using digitized precision road maps, the system knows the further course beyond the driver’s visual horizon and offers these informations to the vehicle’s relevant control systems. This enables, for instance, to gear down and / or decelerate in due time before a vehicles reaches a slope and adapt the speed to the respective situation.

In its current state, the electronic horizon utilizes static map data with topographical information, enabling the most efficient driving strategy and thus reducing fuel consumption. In contrast, the connected electronic horizon optimizes the map data by means of crowdsourcing techniques - other vehicles, traveling nearby, contribute their ‘knowledge’ of topographic and traffic situation and thus enable a more detailed situation assessment.

The enhanced utilization of multiple vehicle sensors will make the electronic horizon a central function in future vehicles, believes Continental. Eventually, this approach will enable the vehicles to “look around the corner” and anticipate road conditions. This technology is also regarded as another precursor of automated driving.

Beyond the electronic horizon, Continental and IBM plan to collaborate on the field of controlling vehicle functions through human voice. By merging the expertise of both partners, the duo plans to devise a cloud-based voice control solution which will be more intelligent and adaptive in comparison to today’s available solutions. Towards this end, Continental will provide its expertise in vehicle voice processing interfaces while IBM contributes its interactive dialog and content-finding techniques. By merging these ingredients, the partners intend to create an interactive, highly personalised solution based on artificial intelligence. In this solution, the dialog between the vehicle and its passengers will be unique for each user, its interaction patterns and usage history.

Within the scope of their collaboration, ‘Big Blue’ IBM and Continental are developing software, technical services for vehicles and a back-end platform which will form the cornerstone of intelligent transport systems. Such scalable cloud platform services will enable automotive OEMs to offer a broad range of new vehicle-based services aiming at better utilizing the time enroute for the drivers, said Helmut Matschi, General Manager of Continental’s Interiors Division.

Carmakers test C2X under winter conditions in Finland

By Christoph Hammerschmidt

IF SAFETY-CRITICAL TECHNOLOGIES such as car-to-x communications eventually will be used in series vehicles and everyday transport, they have to be reliable and must not fail if weather conditions are less than excellent - and the messaging system itself must be pragmatic and useful. For this reason, several carmakers jointly test C2X under winter conditions in Finland.

The DRIVE C2X project, currently conducted in the city of Tampere, includes large-scale testing of automated data communications among vehicles and between roadside infrastructure systems and vehicles under slippery and demanding weather conditions. Participants are carmakers Volvo, Mercedes-Benz and Opel as well as the VTT Technical Research Centre of Finland. VTT is responsible for the test site and participates in project steering, data management and impact analysis.

First-stage field trials were completed at the Tampere test site past May. The current second stage tests a system whereby the drivers receive information on slippery road surfaces and traffic signs over a 22 kilometre stretch of road. Measuring points along the road transmit warnings of slippery stretches and traffic signs such as right of way or speed limits. These warning messages are displayed at the vehicle’s dashboard about 400 to 500 metres in advance. 30 drivers generate enough data material to gain statistical relevance. While the data will be analysed only in spring 2014, preliminary results seem to indicate that the tested systems have a positive effect on overall road safety, explained VTT scientist Harri Koskinen.
Amazing race toward autonomous car design

By Junko Yoshida

CHIP COMPANIES ARE FINDING 2014 a critical year to drive their technology into semi-autonomous car platforms - currently in development by a number of different carmakers. Such platforms, says a Freescale Semiconductor executive, will ultimately become the basis for each car OEM's own, branded, self-driving cars.

Major car OEMs including General Motors, Nissan, and Toyota are all racing to develop their own, unique semi-autonomous architectures. While describing it as a “friendly race,” Davide Santo, Freescale’s ADAS (Advanced Driver Assistance System) microcontroller product line manager, said the competition intensified when Nissan this summer announced that its first cars using the autonomous car platform will arrive in 2020. Germany’s Daimler AG similarly announced plans to start selling a self-driving car by 2020.

Self-driving cars are no longer just about Google cars. Carmakers aren’t pontificating or debating the pros and cons of self-driving cars, either. Daimler is already using self-driving as a way to differentiate from other luxury cars, as it competes with its German rival BMW.

Just as much as car OEMs are under pressure to come up with their own autonomous car platforms, automotive chip suppliers such as Freescale, Infineon Technologies, and NXP Semiconductors are similarly feeling the heat.

The second half of 2014 is a sort of consensus deadline for leading car OEMs to make final decisions on architecture and technologies for semi-autonomous car platforms. By then, Freescale says, it will be working closely with OEMs, contributing its ideas and making proposals, hopeful for design wins for key technologies on the platform.

Carmakers are all “working toward” autonomous cars, agrees Drue Freeman, senior vice president for global automotive sales and marketing at NXP. “They are preparing roadmaps for self-driving cars.”

But for now, the most visible competition among OEMs is the rollout of different sensor, camera, and radar technologies to enable ADAS.

While different technologies help create a variety of ADAS features, ADAS, in essence, consists of two principles, explained Freescale’s Santo. First, you create a grid around a car and keep the car running within a lane. Second, you communicate where the car is, relative to other cars and the road infrastructure.

Although it’s easier to think of self-driving cars as essentially built on a combination of different ADAS features, such a view may be an oversimplification.

Hans Adlkofer, head of the system group at the automotive division at Infineon, explained that a variety of ADAS technologies, integrated in a vehicle, need to be able to run seamlessly on a single unit of underlying software adopted by each car company’s platform.

In other words, ADAS features can’t exist totally independent of the semi-autonomous car platform where they will be deployed.

Truth about autonomous cars

Nobody believes that self-driving cars will be easy to develop. In fact, technology aside, the uncertainty of consumer behaviour is a major concern among car OEMs. Car companies are responsible for developing a solid solution that can guarantee driver and passenger safety in semi-autonomous/self-driving cars.

In the 1949 Geneva Convention treaty, one section stipulates that every car must have a live driver behind the wheel. But with so many driving features getting automated in semi-autonomous cars, OEMs today know very little about whether human drivers will continue to pay attention to the road, or start doing something else while leaving the driving to the car.

Carmakers designing a semi-autonomous car platform need to pay attention to “drivers’ fatigue and attention levels, while checking their driving styles,” said Freescale’s Santo.

‘Flight’ simulator for autonomous cars?

In the next few years, car OEMs will be “collecting, evaluating, and analyzing a lot of data on drivers’ behaviour in semi-autonomous cars,” Santo explained. Some OEMs and tier ones are even running semi-autonomous car simulators, similar to flight simulators, said Santo, to see what happens to car and driver when complex situations arise on the road. Carmakers need to figure out a threshold level as to when the car should return control to the driver.

In designing a semi-autonomous (or ADAS) platform, OEMs are trying to figure out interactions among different ADAS features within a system, especially to prevent any single point of failure. They’re emphasizing built-in redundancies wherever appropriate, says Santo.

One could compare drivers in autonomous cars to pilots flying an aircraft on autopilot, but “cars can be much more dangerous than airplanes,” said Santo. First, there are more unexpected hazards on the road. But more important, rank-and-file drivers are not professional pilots.

Because the vast majority of drivers are amateur operators, the development of self-driving cars at car OEMs and tier ones is driven by a team of experts from multiple disciplines ranging from psychology to fuel economy, Santo added.

Junko Yoshida is Chief International Correspondent at EE Times
Ford rolls research platform for automated driving

By Christoph Hammerschmidt

IN COLLABORATION WITH the University of Michigan and insurance company State Farm, carmaker Ford has developed a research vehicle capable of highly automated driving. The move is in line with Ford’s ‘Blueprint for Mobility’ project that provides for series vehicles with autonomous functions by 2025. The platform is based on the Ford model Fusion Hybrid; it aims at developing and perfecting advanced sensor technologies and driver assistant systems.

The concept for the Ford research vehicle is based in part on the company’s ‘Driver-in-Control’ series of analysis, realized in Ford’s VIRTTEX driving simulator. This simulator enables developers to find out how humans and automated technologies can be conflated to create a holistic driving experience. Thus, the new research platform does not only serve for resolving technological problems but also to investigate societal and legal solutions associated to automated driving.

Ford chose the Fusion Hybrid as test platform because this model is equipped with a broad range of driver assistant systems, including blind spot assistant, parking assistant active city stop and adaptive cruise control with front collision warning system. All these systems are regarded as building blocks for automated driving. In addition, the research platform is equipped with an infrared LIDAR sensor system that is said to scan the road ahead 2.5 million times per second. The instrument has a range of 60 m (about 200 ft) and generates a 3D map of the vehicle’s surroundings.

Currently, Ford’s development works focus on further improving existing driver assistant systems, with particular emphasis on functions that alert drivers in the case of traffic stalls and hazards ahead. In the medium term, Ford plans to enable inter-vehicle communications, for instance to ‘synchronise’ vehicles and thus improve the overall traffic flow. On the long run, cars will navigate and park completely autonomously. According to Ford’s vision, the vehicles will communicate among themselves and with their environment and integrate themselves autonomously into the traffic.

Nanosheets alleviate lattice matching restrictions of epitaxial crystalline thin film growth

By Julien Happich

EPITAXIAL GROWTH HAS become increasingly important for growing crystalline thin films with tailored electronic, optical and magnetic properties for technological applications. However the approach is limited by the high structural similarities required between an underlying substrate and a growing crystal layer on top of it.

Takayoshi Sasaki and colleagues at the International Center for Materials Nanoarchitectonics (MANA) and the University of Tokyo in Japan have demonstrated that using two-dimensional materials, the versatility of epitaxial growth techniques can be extended.

In 1984 Komo proposed that certain layered materials such as mica or graphite can be easily cleaved to produce surfaces with no dangling bonds that would alleviate the lattice matching requirements for epitaxial growth. Interactions between atoms on these cleaved materials would be more prominent compared with growth on single crystalline substrates since the interlayer van der Waals interactions are weak. However the variety of suitable cleaved surfaces is limited and handling them can be difficult.

With the increasing attention on two-dimensional materials over recent years Takayoshi Sasaki and colleagues decided to look into molecularly thin two-dimensional crystals as possible seed layers to alleviate lattice matching requirements in a manner similar to Komo’s van der Waals epitaxy.

They deposited nanosheets of either Ca$_2$Nb$_3$O$_{10}$$^-$, Ti$_{0.87}$O$_{2.52}$$^-$, or MoO$_2$$^-$ as highly organised layers onto amorphous glass. On these different surfaces they grew different orientations of SrTiO$_3$, an important perovskite for various technological applications. The approach demonstrated the ability to grow different orientations of SrTiO$_3$ with a high level of precision.

The researchers suggest that in the future, it would be of great interest to achieve more sophisticated control of growth geometry using nanosheets with a complex structure. They add, “Such advanced design, hardly realized with present technology, will pave a new way for further development of crystal engineering.”
Designing compact medical ultrasound systems

By John Scampini

OVERTHEPASTDECADE, medical ultrasound imaging equipment has experienced a revolution. Advances in integrated electronics have allowed equipment manufacturers to significantly improve the portability and the affordability of this powerful medical tool. What once weighed hundreds of pounds and required a cart for mobility, is now the size of a portable laptop computer. Needless to say, the impact for the medical community and the patient has been profound. In developed countries ultrasound is now utilized at the patient’s point of care, which reduces costs and improves outcomes. In developing countries ultrasound imaging is now available to a much larger segment of their large rural populations. The impact of these new, more portable low-cost systems on healthcare worldwide is significant and well received. The future of the technology promises even more advances.

The road to developing these compact imaging solutions has not been easy. There have been, and will continue to be, significant design challenges as manufacturers strive to make these systems more portable, less expensive, and higher in performance. This article will highlight some of the more significant design challenges faced by designers of this equipment.

Designers of compact ultrasound systems must fit the large number of ultrasound transceivers required to produce a high-quality image into the available small space. This is no simple task. Current state-of-the-art systems commonly possess 128 or more of these transceivers.

A typical ultrasound transceiver block diagram is shown in figure 1. To produce an ultrasound image, the transceiver’s high-voltage transmitters generate properly timed high-voltage pulses to excite the ultrasound transducer elements and generate a focused acoustic transmission. Acoustic energy from this transmission is reflected by impedance discontinuities in the patient’s body, received by the same elements, and routed back to the receive portion of the transceiver.

The receiver consists of a transmit/receive switch (TR switch), low-noise amplifier (LNA), variable gain amplifier (VGA), anti-alias filter (AAF), and analog-to-digital converted (ADC). Each transducer element is connected to an LNA through a TR switch which protects the LNA input from the high-voltage transmit signal. The LNA itself provides an initial fixed gain to optimize the receiver’s noise performance. The VGA is used to compensate for the attenuation of the ultrasound signals in the body over time which reduces the dynamic range requirements for the subsequent ADC. The AAF in the receive chain keeps any high-frequency noise beyond the normal maximum imaging frequencies from being mapped into the receive band by the ADC. The amplified and digitized signals are delayed and summed in the ultrasound system’s digital beamformer to generate a focused receive beamformed signal. The resulting digital signal is used to generate 2D images as well as pulsed-mode Doppler information.

The receiver also has a separate continuous wave Doppler (CWD) receiver/beamformer path after the LNA. In CWD mode, the receiver’s dynamic range requirements are very demanding and beyond the range of the VGA/ADC signal path. CWD beamforming can be achieved by mixing the received signals with properly phased LOs and summing the resulting baseband signals. As a result, the CWD receiver block is comprised of high-dynamic-range analog I/Q mixers and programmable LO generators.

As one can see, there is significant functionality in a typical transceiver and getting 128 or more of these into something the size of a PC is a design challenge. Analog IC manufacturers have responded to this challenge with more highly integrated...
solutions. Thus, it is now common to find octal receivers including the LNA, VGA, AAF, and ADC in packages as small as 10x10mm. High-voltage pulsers are also now available in 4- and 8-channel single-package configurations as small as 10x10mm. These advances are significant and have played a key role in enabling the current generation of portable systems. Moving forward, however, there are more integration opportunities.

The MAX2082 octal transceiver – see figure 2 – is an example of the latest advance in highly integrated ultrasound solutions. It includes the full receiver, TR switch, coupling capacitors, and the three level high-voltage pulsers in a single 10x23mm package. This single transceiver saves considerable space, reduces design time, and lowers overall system cost.

The space savings from such a highly integrated transceiver can be dramatic. The integrated TR switch alone represents significant savings. Consider a typical discrete TR switch used in most existing ultrasound systems – see figure 3. There are nine discrete components in this TR switch implementation. In a 128-channel system this represents over 1000 discrete parts for the TR switch function alone!

Figure 4 shows a PCB layout using the MAX2082 for a 128-transceiver channel configuration. The space required is less than 10 square inches, which is less than half the space required for current solutions that use individual octal receiver ICs. octal pulser ICs. and discrete TR switches.

Transceiver power management

Power is also a major concern in these highly integrated designs. Many of these ultrasound systems are portable and must run from a battery for an hour or more between charges. Heat management is also problematic as the component density is very high and the PCBs can be very close together, leaving little room for airflow. The ultrasound transceivers represent a significant portion of the overall system power budget and, therefore, warrant significant design attention.

Over the past 10 years ultrasound receiver power has been cut in half. It is now common to find IC receive solutions including the LNA, VGA, AAF, and ADC that burn less than 150mW per channel. These new-generation receivers also have more flexible power-control features allowing users to trade off power for performance as well as utilize low-power, fast wake-up “nap” modes to conserve power when systems are in non-imaging modes.

There are still more opportunities for future improvement. The TR switch itself, for example, can burn in excess of 80mW per channel, because significant bias current is required to lower the on-impedance of the diodes to meet necessary noise performance. This is almost as much power as the rest of the receiver! Newer proprietary integrated TR switch designs in products like the MAX2082 transceiver mentioned above achieve better noise performance than these discrete designs for less than 15mW per channel.

Balancing noise with miniaturization

High levels of integration and low power are obvious design challenges for portable ultrasound systems. Not so obvious are some of the performance issues associated with the miniaturization of this equipment.

Minimizing in-band noise

Ultrasound systems are extremely sensitive to both radiated and conducted in-band noise and interference in the 2MHz to 15MHz range. The input sensitivity of a single channel can be as low as 1nV/rtHz. In typical 128-channel systems, an unwanted signal applied to all inputs can have a processing gain of up to 21dB, depending on channel-to-channel beamforming delay. As a result, an in-band noise signal applied to all inputs as small as 0.09nV/rtHz can be visible and appear as an artifact in the image. These artifacts occur so commonly that they are universally called “flash light” artifacts; they resemble a beam of light in the center of a phased array image where the system has the highest processing gain to a common input signal. Signals this small can easily come from a variety of radiated or conducted interference sources in the system.

Ultrasound system designers go to great lengths to physically separate and shield noisy digital circuitry from sensitive analog circuitry, and to control ground loops. Unfortunately, portable ultrasound system designers do not have the luxury of physically separating this circuitry, and shielding can be problematic given the limited space and heat density of most PCBs. As a result, it is extremely common that in-band noise problems occur in these designs, especially when they are so physically close to noisy single-board PCs commonly used to perform many of the computational and display tasks. Consequently, it is particularly important that proper attention to grounding and shielding be made early in the design process. Trying to modify these highly integrated designs later in the prototype evaluation phase can be extremely difficult and time-consuming.

Minimizing audio noise

In many cases, low-frequency audio noise can also be a problem and, in fact, is often more difficult to solve. In ultrasound systems blood flow is detected by measuring the small Doppler frequency shift of the reflected transmit signal. Any low-frequency modulation of the transmit signal or the received signal from stationary objects will produce noise sidebands which
can obscure Doppler signals of interest, as shown in figure 5 or produce unwanted “tones” in the Doppler spectrums. In pulsed Doppler applications the ratio of the transmit signal power to the noise at 1kHz offset needs to be less than 140dBc/Hz. For CWD, the requirement is even more demanding at 155dBc/Hz or greater.

There are many sources of this low-frequency noise, but the largest and most common is low-frequency power-supply noise which can cause a host of Doppler problems. It can introduce jitter in sensitive digital transmit and receive clocks which can, in turn, limit the receiver’s dynamic range or produce unwanted Doppler tones. It can also create low-frequency noise on VGA gain control signals that can modulate large received signals from stationary tissue and obliterate weak adjacent Doppler signals.

Power-supply noise in the audio spectrum can only be effectively reduced by active regulation of the supplies. Traditionally, in larger cart-based systems, power-inefficient linear regulators were distributed liberally throughout the system to effectively control this source of noise. In more portable systems this type of solution is quite often not acceptable.

As a result, designers must utilize distributed switching regulators to improve efficiency. Unfortunately, this type of regulation can introduce significant RF in-band conducted and radiated switching noise that is difficult to control, even with proper bypassing. Spectral Doppler is particularly sensitive to this type of noise as the discrete switching frequencies can cause tones in the Doppler spectral displays, a common artifact in these systems.

One way to ensure that this type of noise is not visible is to ensure that the switching-regulator frequency is synchronized to the master clock of the system. In this way, switching noise can be more easily managed out of the Doppler bands of interest, and a high level of efficiency can be achieved. Considerable attention must be given to the use of switching regulation in these designs to keep power low and avoid difficult-to-solve Doppler artifacts.

Where do we go from here? Design engineers agree that designing portable ultrasound systems presents significant challenges. Limited space, managing power within shrinking space constraints, and the demand for higher and higher levels of performance are presenting new and quite significant problems to overcome. Designers need to judiciously use analog IC solutions that are already highly integrated, are low power, and meet the required levels of performance. They must also anticipate and then perform the necessary detailed system-level design work to avoid the common noise-related problems inherent in these highly compact designs.

The benefits of these new more portable systems are more than worth any design risks. We have already seen the positive impact that these systems have had on healthcare worldwide. There is no reason to believe that this trend will not continue—as long as more highly integrated analog IC solutions become available to the equipment designers of these highly compact medical systems.
Detecting and selecting the right power supplies for portable electronics

By Pinkesh Sachdev

THE BOOM IN PORTABLE electronics has made it commonplace to find devices capable of powering from multiple sources. For example, an industrial handheld instrument or portable medical diagnostic equipment runs mostly on battery, but when plugged into a wall adapter or USB port draws power from that port, both for charging the battery and powering the system. On the other end of the mobility spectrum, big high-availability servers have chassis that take in at least two power supplies to maintain operation through the failure of any one of them. Storage servers employ super-capacitor backups to facilitate a clean error-free shutdown when main power turns off, while some servers have a high-current main and a low-current auxiliary supply. All of these systems face the non-trivial task of dynamically selecting one among the various available supplies to power the system load.

Pitfalls of supply multiplexing

While the task of selecting the appropriate supply for the given circumstance sounds easy, an improper implementation can cause system malfunction and damaged supplies. Switching between supplies operating in parallel runs the risk of pushing current back in to a supply when a higher voltage is imposed at its output. Some supplies malfunction when energy is pumped back into them, disrupting their control loops to cause an overvoltage at their input terminals, potentially blowing up capacitors and other devices. The other risk during switchover is that all supplies may disconnect from the output for too long, drooping the output voltage to reset or corrupt system operation. A third issue occurs when supply voltages are close together. Some comparator-based control methods enter an oscillation mode, switching continuously between supplies. Thus, the need for careful switching around of supplies is required.

Identical supplies

Let’s start with the simplest scenario – a system powered by two identical supplies. Here, identical implies an equal nominal voltage with variation over the supply tolerance range, usually a few percent. This occurs in high reliability servers, which are equipped with two or more redundant supplies to achieve continuous operation through any supply failure. In such a system, a simple method is to select the supply with the highest voltage to power the system. Two diodes with the supply at their anodes and cathodes connected together, a so-called diode-OR, implements this highest voltage function - see figure 1. This works properly with just one supply plugged in. With both supplies present, the one with the highest voltage has its diode forward biased with the other diode reverse biased.

In a modern server populated by multiple cards, power levels easily reach over a kilowatt, causing a 12V DC supply to source currents in the 50A to 100A range. Employing plain old diodes, even of the lower-drop Schottky kind, to diode-OR two such 12V supplies is a daunting if not impossible thermal management task as the diodes drop 1V at high currents, dissipating 50W at 50A. An ideal diode with a much lower drop is needed. As with so many other circuit problems, MOSFETs once again come to the rescue. MOSFETs with a sensing circuit around them are made to behave like an ideal diode, turning on with a very low drop in the forward bias condition (input greater than output) and turning off when reverse biased (input below output). A 10x reduction in the voltage drop brings the power dissipation of the ideal diode to a manageable 5W. This is easily accomplished by a single or paralleled N-channel MOSFETs with an RDS(ON) of 2mΩ. Such a circuit is shown in figure 2 with the associated I-V curves. Linear Technology’s LTC4352 controls an N-channel MOSFET to implement an ideal diode function. Two of these circuits connected in parallel form an ideal diode-OR for redundant supply systems.

A linear servo of the MOSFET voltage drop ensures smooth supply switchover without oscillations, while 0.5µs fast turn-on and turn-off minimizes output droop and reverse currents.

Ideal diodes possess capabilities that a passive diode only dreams of. The LTC4352 enables the ideal diode only when the input is within a valid range set by undervoltage (UV) and overvoltage (OV) thresholds. STATUS# pin signals the downstream circuitry about the on or off condition of the MOSFET. FAULT# indicates whether the MOSFET is off for a UV/OV condition or has excessive drop across it due to a resistive or open MOSFET, the latter warning of an impending failure before it occurs.

Let’s share the load

A diode-OR is a winner-take-all system in that the supply with the highest voltage sources the entire load current. Supply lifetime is extended when both supplies source the load equally.
halving their thermal stress and exponentially raising power system reliability. However, many load sharing schemes that adjust the supply are beset with oscillating loops. The complications arise from the load sharing control loop interacting with the supply dynamics. The ideal diode concept provides the solution here. By adjusting the ideal diode voltage drop to compensate for the supply voltage difference, the output voltage of the two ideal diodes is equalized. Using sense resistors from these two equal points to the common load ensures an equal or ratiometric flow of current from the two supplies. The LTC4370 diode-OR current balancing controller implements this method of current sharing between two supplies - see figure 3. It compensates for supply voltage differences up to 600mV, translating to a ±2.5% tolerance on two 12V supplies or ±6% on two 5V supplies.

Non-identical supplies
The diode-OR and load sharing methods are well-suited when the two supplies are identical as in the server example. It does not apply to battery-powered systems, where the input comes either from the battery, a wall adapter, or a 5V USB source, i.e., sources with very different nominal voltages. In some instances super-capacitor backups are also involved. A more general-purpose solution is needed instead of one that relies on the simple metric of supply voltage. This solution is called a prioritizer. It is based on the reality that a battery-powered system has its supplies ranked by preference.

Typically, the wall adapter is at the top of this list, i.e., the system draws power from the wall adapter whenever it is present. Each supply needs to have a defined valid voltage range (to detect presence) and a priority. If a supply is present, it is considered for powering the system based on its priority. The LTC4417 prioritizer connects only one of three input supplies to the output based on their valid voltage windows and priorities – see figure 4. Careful switching never connects two supplies together, connecting a supply to the output only when the output is below the input voltage. This minimizes or eliminates any reverse current flow back in to the supply. Also, it implements controlled fast switching to limit output droop and inrush current.

Conclusion
Depending on the kind of supplies housed in the system, the appropriate solution for supply multiplexing requires selection first. The choices are a diode-OR (with or without load sharing) and a prioritizer. Irrespective of the method, selecting the correct supply to power the load needs careful design to not bring down the entire system. Reverse currents back in to the supply and the output voltage droop need to be minimized without triggering back-and-forth oscillatory switching between supplies. The solutions described here take care of these pitfalls in a simple and elegant manner.

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Innovative back EMF based stall detection simplifies stepper-motor drive designs

By Don Jacques

STEPPER MOTORS PROVIDE significantly more flexibility and control than traditional continuously rotating electric motors, and are widely used in a variety of industrial, consumer, and automotive applications. Many applications require reliable detection of when a mechanical end point is reached without using an external sensor, which can be achieved using motor stall detection. This article describes an innovative method of stepper-motor stall detection and its application.

A general definition for a stepper motor is an electromechanical machine that moves a rotor shaft in small precise increments without feedback to govern motor speed. Stepper motors offer several advantages. They exhibit good speed stability when the load fluctuates, because the stepper can maintain constant torque. They have good startup characteristics, with maximum torque at zero speed. Stepper motors also have wide dynamic ranges and can accelerate faster than servo motors.

Owing to the narrowness of the step angle, stepper motors have small mechanical transient responses, which makes position and speed control possible without a complicated control loop. As a result, the cost of drive solutions for stepper motors is very affordable.

Certain disadvantages occur with steppers, although advancements in electronics have helped to minimise their effects. For example, open-loop operation fails to provide information about absolute position, or whether the motor is responding to input commands. In addition, resonance can cause vibration if motor speed or winding current is not controlled properly, and motors can lose step if the speed is too high.

Requirement for stall detection

In practical systems, a means of stall detection is required to detect when the rotor is stationary: something that can be caused by any of several conditions. Rotation of the electrical field generated by the driver may lose synchronicity with the mechanical rotation of the stator, or the mechanical load may exceed the design limits of the motor. Any obstruction of the load path, including a fixed mechanical stop, can also cause the motor to stop rotating, but in these instances, without information on absolute position, the motor will attempt to drive through the obstruction in order to ensure that the load reaches the end point. This can cause wear, audible noise, heating, and mechanical failures. In addition, driving a stepper into a fixed stop by design inherently reduces the efficiency of the system, which is critical in battery-operated applications.

To moderate these negative effects, an electronic integrated stall detection function can be used to ensure the load has reached its desired position, or to notify the user if the load is obstructed. When absolute positioning is not required, electronic stall detection can often replace a costly slip-clutch or optical encoder to provide stall detection.

How stall detection works

Electronic stall detection works by measuring the effect of back EMF on the number of PWM cycles. When a motor is stopped or is moving slowly there is little back EMF to impede the current in the phase windings. This allows the current to rise quickly to the limit and causes the PWM current to activate. However, when a motor is rotating at normal operating speeds, the back
EMF generated by the fields of the magnetic poles passing over the phase windings acts against the supply voltage and reduces the rise time of the phase current, causing the PWM current control to take longer to activate. Assuming a constant step rate, this results in fewer PWM cycles for each step of the motor.

This effect can be seen in figure 1. Two phases of the winding current are shown, and are offset so each step is shown overlaid. Phase B is delayed by 90 electrical degrees. This allows direct comparison of the winding current. When phase B current is rising, the motor is still running normally and back EMF acts to limit the current rise time. The stall is applied at time $t = -4 \text{ ms}$. A visual comparison shows that phase A current rises slightly faster, causing the control IC to apply more PWM cycles to control the current. These additional cycles provide the count difference necessary to detect a stall condition. The stall is detected at time $t = 0$.

Method for determining a stall
Each motor winding phase has a PWM counter that accumulates the number of current limit events at each full step, from zero to full current. The allowable difference in counts is programmed into the IC’s onboard diagnostic register. A stall is detected when the count falls below the programmed value. There are a few conditions required for electronic stall detection to work properly. Before the stall, the motor must have been stepping fast enough for the back EMF to reduce the phase current slew rate. In addition, the motor cannot be in full-step mode; the phase current scheme must conform to 0% and 100% currents at steps 0, 16, 32 and 48; and both phases must have the same profile.

Stall detection scenarios
There are many factors which can contribute to a stall, so it is important to use an advanced IC that properly evaluates stall signals such as those shown in figure 3. In the following examples, two alternative scenarios are presented, and the performance of the IC detection method is demonstrated:

Hard (locked) stall scenario: A spinning rotor was stopped approximately 2ms before the stall detect signal indicated a fault by going low. Note how the phase current maintains its shape even though the number of PWM cycles has increased – see figure 2.

Soft (partial) stall scenario:

Moortec improves on-chip thermal sensors
Moortec Semiconductor has announced improvements to its range of on-chip temperature sensors for advanced CMOS technologies. With an uncalibrated accuracy of +/-3C and a calibrated accuracy of +/-1C, across the temperature range of -40C to +125C, the range also offers a resolution of 0.06C. The enhanced accuracy temperature sensor range is available on TSMC28LP and TSMC28HPM technology nodes. By licensing and deploying this sensor IP IC designers will be able to monitor temperature on different regions of processors and SoC chips to higher accuracy. This is now a fundamental method by which the use of IP blocks within complex chip designs at the leading edge is now controlled. Better management of IC heating issues on advanced-node ICs allows for higher gate and power densities than would otherwise be possible. The sensor IP can be used within performance optimization schemes such as Dynamic Voltage and Frequency Scaling (DVFS), thermal monitoring to create alarm conditions and also device security against hacking.

Moortec Semiconductor
www.moortec.com

Magnetic sensor measures down to 0.1% of Earth’s field
PNI Sensor has introduced a geomagnetic sensor that can measure fields at 0.1 percent the intensity of the Earth’s magnetic field and claimed to be 20 times more sensitive than some competitive technologies including Hall Effect sensors. The RM3100 measures signals that less than 10nT and is suitable for applications that require absolute heading or orientation data, including augmented reality and location tracking. The component includes three magneto-inductive sensor coils together with an ASIC for drive and to interpret the data. The RM3100 delivers improvements in gain, resolution and power consumption over previous PNI products with the added flexibility of both SPI and I2C digital interfaces. PNI’s proprietary technology provides more than 23 times better resolution and 27 times less noise than commonly used Hall Effect magnetic sensors.

PNI Sensor Corp.
www.pnicorp.com
Latching digital Hall-effect sensor IC has built-in pull-up resistors

Honeywell Sensing and Control's latest latching Hall-effect sensor ICs, the SS360PT and SS460P feature built-in pull-up resistors and provide reliable switching points with a high magnetic sensitivity of 30 Gauss typical, at 25°C, and 56 Gauss maximum over the full -40 to 125°C temperature range. This allows the use of smaller magnets or a wider air gap. These sensor ICs do not use chopper stabilization on the Hall element, providing a cleaner output signal and a faster latch response time when compared to competing chopper-stabilized, high sensitivity Hall-effect bipolar latching sensor ICs. Latching magnetics make these sensors well-suited for accurate speed sensing and RPM (revolutions per minute) measurement. The sub-miniature, SOT-23 surface mount package (SS360PT) allows for compact design with automated component placement. The small, led, flat TO-92-style package (SS460P) allows for a compact PC board layout design. The devices operate from 3 Vdc to 24 Vdc, with built-in reverse voltage capability to further protect the sensor and the circuits.

Honeywell
www.honeywell.com

Backlight panel LED driver ICs include voltage step-up controller

Ams has posted detail of a series of high precision LED controllers with PWM input for driving external bipolar transistors in LED backlight panels, also optimised for 2D and 3D operation in TV applications. AS3834/3834B are 4 channel devices with integrated step-up controller to provide the necessary output voltage for the LED string supply. The SMPS feedback control optimises the power efficiency by adjusting the LED string supply voltage. Output current is up to 270mA per channel and built-in safety features include under-voltage and thermal shutdown as well as open and short LED detection. The AS3833 is a 6 channel LED controller with a similar specification, delivering output current up to 250mA per channel.

Ams
www.ams.com

LDO adds features for monitoring, protection & cable drop compensation

Linear Technology’s LT3086 is an addition to the LDO+ family, with features previously unavailable in linear regulators. The 40V, 2.1A low dropout linear regulator (LDO) includes current monitoring with externally settable current limit and temperature monitoring with external control of thermal limit temperature. The device includes a programmable power good status flag, cable drop compensation and easy paralleling. The current reference in the LT3086x LDO family provides regulation, independent of output voltage. The LT3086 features a 1.4V to 40V input voltage range. A single resistor programs output voltage from 0.4V to 32V with ±2% output voltage tolerance over line, load and temperature. The trimmed, precision 50 µA current reference is ±1% accurate, providing ±2% output voltage tolerance over load, temperature and noise (40 µVRMS) remain independent of output voltage due to the device’s unity-gain voltage follower architecture. Internal circuitry allows paralleling of multiple LT3086s for higher load current and heat spreading without needing external ballast resistors. Programmable cable drop compensation cancels regulation errors caused by line drops to the load. Output current and temperature monitoring, in addition to a power-good flag with programmable threshold, provide system monitoring and diagnostic/debug capability. Internal fault circuitry includes thermal limit and current limit with foldback. Thermal limit and current limit are externally programmable. The device’s reverse battery and reverse current protection add robustness to the end design. The LT3086 is offered in a variety of thermally enhanced surface mount packages, including a low profile (0.75 mm) 16-lead 4x5mm DFN, a 16-lead thermally enhanced TSSOP and a 7-lead DD-Pak; all dissipate 2W in surface mount applications with no heat sink. The LT3086 is also available in a 7-lead TO-220 power package for vertical mounting.

Linear Technology
www.linear.com/product/LT3086

LED driver is optimized for dimmable off-line LED bulb/tube applications

Supertex has introduced a constant frequency (67kHz), constant duty cycle LED driver optimized for dimmable off-line LED bulb/tube applications, providing high power factor correction (PFC). The PS30 is intended to drive a single switch, single inductor power converter (flyback for isolated version and buck-boost for non-isolated version) directly from AC line, 110 V or 220 V, for power levels up to 20 W. PS30DB1 demo board provides a 6.3 W design solution, achieving 93% PFC and greater than 81% efficiency with ±4% current accuracy. The device can be modified for other power levels up to 20 W. PS30 offers smooth dimming to extinction for a wide variety of dimmer types such as leading edge dimmers, trailing edge dimmers, and dimmers with microprocessor controls. The device implements a PFC LED driver solution, operating from a 10V shunt regulator derived from the power supply snubber, and provides for a simple design by eliminating feedback components and the optocoupler typical in isolated solutions. The device minimizes line induced brightness variation, and protects against open circuit failure with over voltage protection. Two novel features, covered by filed patents, enhance the performance and value of PS30. The device is designed to implement a simpler, lower cost open loop solution. The potential limitation of open loop design is that the output choke tolerance normally results in variation in output current amplitude across product builds in production. PS30 includes proprietary control techniques that largely mitigate this output current variation.

Supertex
www.supertex.com
Digital PWM controller for high-current, non-isolated DC-DC power supplies

Micrel has introduced a true-digital PWM controller for high-current, non-isolated DC-DC power supplies in computing and telecom applications. Designed to work with an external industry standard DrMOS as well as Micrel’s proprietary IntelliMOS solution, the MIC21000 can be used as a flexible building block for +12 V or +5 V step-down, high current-point-of-load power supplies. The MIC21000 meets designers’ challenges by integrating a digital control loop, optimized for maximum flexibility and stability, as well as for load transient and steady state performance. The MIC21000’s ultra-fast transient response reduces the output capacitance. The non-linear control feature improves transient response by a factor of two versus competing analog solutions. Highly-reliable fuse-based, on-board nonvolatile memory (OTP NVM) and I²C/PMBUS interface enable user configuration and communication with a supervisory controller for monitoring and fault management. This allows for rapid power subsystem development and debugging which, in turn, accelerates time to market. The I²C/PMBUS interface allows for real time monitoring of input voltage, output voltage/current and internal/external temperature. The MIC21000 can operate from a single bias supply voltage of 5 V or 3.3 V. A full suite of power management features eliminates the need for complicated and expensive sequencing and monitoring of the IC.

Micrel
www.micrel.com

Reversible DC motor driver saves space and boosts power efficiency

Diodes Incorporated has introduced a single-chip IC for driving single-coil reversible DC fans and motors. A highly integrated device, in a choice of SO8 and thermally enhanced SO8 exposed pad packages, the ZXBM5210 reduces component count and circuit footprints in medium voltage, low-power applications in consumer, domestic appliance, industrial and office equipment. The driver’s integrated high-performance H-bridge output stage can deliver currents as high as 700 mA continuous, 1.2 A peak and has been designed to meet stringent low noise requirements by minimizing both audible switching noise and electromagnetic interference. Its generous supply range of 3 V to 18 V means the device will support a wide variety of single phase 5 V, 9 V, 12 V and 15 V DC motors. Typical operating current is a low 0.85 mA. Achieving highly linear speed control, the ZXBM5210 has four modes of operation: forward, reverse, brake and standby, which are selected via the device’s FWD and REV input pins. Motor speed is regulated by modifying the duty ratio of PWM signals applied to the two inputs or by adjusting the DC input voltage to the VREF input pin. The PWM oscillator is integrated within the device and no external timing capacitor is required. The ZXBM5210’s standby mode consumes a typical current of 32µA. To prevent damage to either the motor coil or driver IC, the ZXMB5210 incorporates under-voltage lockout, overvoltage, over-current and thermal shutdown protection functions.

Diodes Incorporated
www.diodes.com

Dual Hall sensor detects rotation direction and speed

Infineon has developed a vertical dual-Hall sensor for detecting rotation direction and speed. Delivered in a TSOP-6, the TLE4966V is the first dual-Hall device with its integrated Hall plates oriented vertically instead of horizontally on the chip surface, making it sensitive to magnetic fields with in-plane direction. This 90-degree orientation change provides flexibility to fit designs into space-constrained areas. Its design flexibility and low current consumption make the TLE4966V suited for energy-sensitive electronic automotive systems such as trunk lifts, power window lifts, sun roofs and seat adjustment. In non-automotive applications, the sensor can also be utilized for escalators, motorized window blinds and shades. The sensor is an extension of Infineon’s TLE4966 family frequently used in window lifter and other index counting applications. This product family is designed to detect the rotation direction and rotation speed of a magnetic pole wheel. The vertically integrated Hall plates in the new TLE4966V enable sensing of in-plane, instead of perpendicular, magnetic fields. Changing sensing orientation by 90 degrees allows system engineers to design new and previously unattainable mechanical concepts, in particular for space-restricted applications such as power window lifts and electronic trunk lifts. Detecting the direction and speed of rotation of a magnetic pole wheel requires two separate Hall plates. Due to the distance between the two plates, they detect slightly different signals at any time. This is termed the phase difference. During a rotation direction change, the phase difference changes polarity. The TLE4966V detects this change and delivers a corresponding signal. The rotation speed of a magnetic pole wheel can directly be calculated with the second sensor output signal. This signal is triggered by each polarity change of the magnetic field. The two integrated vertical Hall plates on a single silicon die within the TLE4966V feature the same behaviour for temperature and lifetime stress, with no sensitivity deviation over lifetime. Furthermore, the TLE4966V has two signal outputs: one signal for the magnet rotation direction, the other signal for the pole wheel rotation speed.

Infineon
www.infineon.com

Wide-dynamic-range, high-accuracy RF power detectors

Analog Devices has added two RF power detectors with wide dynamic range and high levels of accuracy and temperature stability. ADL5903 is a solution for a variety of high frequency systems requiring accurate measurement of signal power independent of waveform characteristics. The ADL5506 RF detector is a complete subsystem for the measurement of RF signals in a wide range of wireless terminal devices. Both detectors come in small packages with low-power operation.

Analog Devices
www.analog.com
Android App automates Bluetooth and analogue audio testing for smartphones
Audio Precision has released an Android app for testing smartphone audio quality. Serving as an interface between the Android device and one of Audio Precision’s APx audio analyzers, the app allows fast, automated profiling of new phones and tablets. It will be useful to network carriers, repair and refurbishment centres and other people who need to evaluate the audio performance of different models and manufacturers against a common standard. The Android app has four key features. It routes the audio through various analogue signal paths not normally allowed by stock Android OS (for example, making a closed-loop test from analyzer to analogue line-in to device’s speaker and back to analyzer). It uses the device’s record feature, then transfer the resulting file to an APx audio analyzer over USB for analysis. The app also tests Bluetooth signal paths, including the playback of stimulus waveforms over Bluetooth Handsfree Profile (HFP) without initiating a phone call over the network. It automates the entire process with the APx desktop application and back to analyzer). It uses the device’s record feature, then transfer the resulting file to an APx audio analyzer over USB for analysis. The app also tests Bluetooth signal paths, including the playback of stimulus waveforms over Bluetooth Handsfree Profile (HFP) without initiating a phone call over the network. It automates the entire process with the APx desktop application to control the device over USB, allowing audio test sequences to run through all available signal paths with no user interaction required. The ability to route analogue audio through arbitrary inputs and outputs in loopback mode makes testing much faster than record and playback and enables real-time electro-acoustic measurements. In addition, the default media player is bypassed, so there is no risk of user settings, EQ or resampling interfering with measurements. The ability to open a SCO and send signals over Bluetooth HFP directly from the phone takes the mobile network’s audio performance out of the equation. The stock Android OS does not allow files to be streamed over HFP. The AP app overrides this behaviour, allowing direct evaluation of the Bluetooth connection quality independent of the mobile network (the weakest link in the signal chain). The AP Smartphone App for Android supports sine, continuous sweep and multitone signals for music playback signal paths. For voice band, AP recommends using PESQ or POLQA MOS (mean opinion score) perceptual audio measurements, which are fully supported by the AP smartphone app and are incorporated in the accompanying APx project files and test waveforms.

Audio Precision
http://ap.com

MEMS design software gets 64-bit upgrade
Version 4.0 of the MEMS+ design software from Coventor is a full 64-bit implementation that adds the ability to export Verilog-A models. The 64-bit resolution allows more accurate modeling of MEMS sensors and actuators and the software is designed to operate in parallel with Matlab and Virtuoso design software from Mathworks and Cadence Design Systems Inc., respectively. The extension to 64-bits has been accompanied by an option to tune the software between accuracy and speed.

Reduced-order models can be exported in Verilog-A format, for use by IC designers. These exported models simulate 100X faster than fully non-linear MEMS+ models and are compatible with all commercial analog/mixed-signal circuit simulators that support the industry-standard Verilog-A hardware description language. Within Coventor’s range of software MEMS+ 4.0 sits alongside CoventorWare and SEMulator3D. The combination provides support for the design of accelerometers, gyroscopes, microphones and many other types of MEMS.

“We were able to create a Verilog-A ROM [reduced order model] of a complex gyro design in just a few minutes, allowing our ASIC team to work in parallel with the MEMS team on further design iterations,” said Tero Sillanpaa, ASIC design manager at Murata Electronics Oy, in a statement issued by Coventor. “Harmonic simulations in Cadence showed that the model maintained the expected modal frequencies and was stable. Moreover, transient startup simulations were very fast, on the order of 25 seconds CPU time for one seconds real time, before front-end electronic components including RC parasitics were added.”

Coventor
www.coventor.com

Sensor signal-conditioning IC optimized for die stacking
Analog and mixed-signal semiconductor supplier Zentrum Mikroelektronik Dresden AG (Dresden, Germany) is offering a 16-bit sensor signal conditioning IC with an integrated 18-bit DSP for linearization and calibration functions. The ZSSC3027 chip is intended for application in calibrated resistive sensor modules in high-resolution industrial, consumer and medical application, the company said. The 16-bit precision analog-to-digital conversion includes features for battery-driven devices, including 930-microampere typical overall current consumption and a 20-nanoamp current typical in sleep mode. The voltage range is 1.7 to 3.6 volts. The ZSSC3027 can be used to provide digital compensation of signal offset, sensitivity, temperature and non-linearity, via an internal correction algorithm with coefficients stored on-chip in a multiple-time programmable non-volatile memory. Programming is via the ZSSC3027’s serial interface using PC-controlled calibration software provided in the chip’s evaluation kit. “The ZSSC3027 is designed for stacked die assembly together with a dedicated MEMS sensor element to provide the lowest form factor for MEMS-based sensors on the market. A typical application is barometric pressure sensors for mobile devices,” said Michael Georgi, Product Marketing Manager at ZMDI. The chip offers an accuracy of ±0.10 percent of full-scale output and operates over a temperature range of -40°C to 85°C. It is available as a die for wafer bonding. Die, samples and wafers are available from ZMDI. In component form and in 10,000 piece quantities the ZSSC3027 is priced at €0.70 per unit or US$0.95 per unit.

Zentrum Mikroelektronik Dresden AG
www.zmd.com
10.1×7.4×3.2mm real-time clock module only draws 130nA typical

With typical current consumption of just 130nA, Seiko Epson’s RX6110SA real-time clock (RTC) module enables the reduction of hazardous substances by allowing electronic device makers to replace batteries with supercapacitors. With a 0.33F supercapacitor, the RX6110SA can operate for 16 weeks. According to the manufacturer, the RX6110SA achieves an operating current that is half that of leading competitors by employing special low-power circuit design techniques and Epson’s unique low-leakage IC process technology. Compared to microcontroller implementations, Epson’s RX6110SA can operate eight times longer. The RX6110SA also includes a diode-less power-supply switching circuit which allows it to operate and charge from power supplies ranging from 5 V down to as low as 1.1V. In addition to keeping time, real-time clocks are used to log power-loss events and save system state when power is lost. Epson’s RX6110SA offers a rich feature set to support these needs, including a 32.768 kHz output, alarms and timers, and RAM. The RX6110SA supports both SPI-bus and I2C-bus interfaces.

Epson
www.global.epson.com

Smart activity tracker integrates ultra-low power MEMS accelerometer

Analog Devices, Inc., has introduced the ultra-low power ADXL362 MEMS accelerometer which is integrated into the Pulse activity tracker developed by Withings, a company that creates smart products and apps to help people take care of their health and well-being. The Pulse activity tracker is a pocket-sized tool designed to help users to achieve their personal health and fitness goals. The tracker offers a range of monitoring features, from tracking the number of steps and the distance traveled, to calculating the number of calories burned, measuring heart rate and detecting the quality of sleep. Withings needed technology that offered a high performance solution combined with ultra-low power consumption for a longer battery life and enhanced user autonomy. As the industry’s lowest power MEMS accelerometer, the Analog Devices ADXL362 MEMS accelerometer was a good choice. The 3-axis, ADXL362 MEMS digital accelerometer consumes less than 2 µA at a 100-Hz output data rate and 270 nA when in slower sampling wake-up mode, consuming up to an order of magnitude lower power than competing MEMS accelerometers. The MEMS accelerometer includes an activity detection function that distinguishes between different kinds of motion and prevents the sensor from turning the system on unnecessarily and using additional battery life.

Analog Devices
www.analog.com

RF power LDMOS transistors support the 700 MHz to 2700 MHz band with a single device

Freescale Semiconductor has introduced two Airfast RF power devices that cover all major cellular infrastructure bands and deliver industry-leading gain in a compact package. The AFT27S006N delivers 6 W of peak power and is the next-generation follow-on to the popular MW6S004N product. Freescale is also adding a higher power device to this family, called the AFT27S010N, which delivers 10 W of peak power. Both devices feature outstanding frequency range (700 MHz to 2700 MHz) and single-stage gain (20 dB to 24 dB), together with an ultra-small footprint package (PLD-1.5W) making them ideally suited for macro base station MIMO applications rated up to 40 W average power. Many competitive solutions require customers to deploy multiple RF devices to support this range, but the AFT27S006N and AFT27S010 support this cellular band range with a single power amplifier. The Airfast technology platform allows Freescale to improve performance in frequency, range and gain while addressing a host of other customer needs such as ease-of-use and flexibility. The broad frequency range of these new transistors means they can also be used as universal driver devices for a wide array of additional RF applications.

Freescale Semiconductor
www.freescale.com

Clock ICs offer sub-200fs of phase jitter for PCIe clock applications

Micrel's PL6020xxx and PL6070xxx clock generators, along with the SY7557xL clock distribution family, provide sub-200fs phase jitter for the PCI-Express (PCIe) reference clock signals and output-to-output skew of 50ps. Spread Spectrum Technology (SST) in the PL6070xxx is also supported for EMI reduction. The clock synthesizers accept a fundamental crystal or reference input of 25MHz and produce output frequencies ranging from 25MHz to 200MHz with 100MHz phase noise performance of -135 dBc at 10kHz offset. In addition, the PCIe clock synthesizers support 2.5V and 3.3V power supply operation offering design flexibility with reduced power dissipation. The SY75576L and SY75578L clock buffers with 4 and 8 outputs, respectively, provide high performance solutions for new and existing PCIe system designs. The chips offer ultra-low additive phase jitter of sub-150fs with sub-50ps output-to-output skew for stringent PCI Express based server, storage, and networking applications. All devices are production released with industrial temperature range of 40°C to +85°C .The ICs have RoHS, and PFOS compliant packaging. The devices are offered in 6-pin SOT (1 output), 16-pin 3x3mm QFN (2 outputs), 24-pin 4x4mm QFN (4 outputs), or 44-pin 7x7mm QFN (8 outputs) package options.

Micrel
www.micrel.com
Silicon capacitors: a new solution for decoupling applications

By Laëtitia Omnès

As consumers are eager to get the most cutting-edge products, manufacturers have to adapt their technologies and continue to drive innovations to offer the most advanced electronic equipment. Two key features must often be considered for electronic devices: size and performance. In order to anticipate the demand for more miniaturization and signal integrity over a wide range of frequencies in the decoupling applications, IPDiA adds to its silicon passive component library some ultra low ESR/ESL structures, in low profile form factor. These new silicon capacitors enable to drastically decrease the overall impedance and offer the best solution for decoupling performances up to 10 GHz frequency range.

In the case of embedded applications and System in Package modules, not only must the size of the device be optimized in x and y axes, the thickness is also highly important. IPDiA provides a full range of silicon capacitors, including some with ultra-low profile - down to 30 µm - developed and offered for decoupling applications with space constraints.

In terms of performance for decoupling applications, the main feature that needs to be improved is the signal integrity of the integrated circuit. On top of the low profile feature, these applications are very demanding in signal integrity and decoupling capacitors are considered to be one of the best solutions in terms of efficiency and cost to reduce the voltage fluctuation. However, decoupling capacitors are not perfect and their performance depends not only on the capacitance but also on the Equivalent Series Resistance (ESR) and on the Equivalent Series Inductance (ESL). The total ESR is the sum of the resistance of the dielectric material (frequency dependent) and the resistance of the conductive parts (constant value). For a long time, ESR was the main parameter to be considered. But as the race for higher-speed applications gathers pace, capacitors with low impedance at highfrequencies are needed. This trend leads manufacturers and designers to take into account the ESL parameter. This further complicates the work of designers, who need to consider the constraints imposed by these parameters. The IPDiA R&D team has addressed this issue with its high density capacitors.

Ultra low profile silicon capacitors

The manufacture of IPDiA passive components is based on the PICS (Passive Integration Connecting Substrate) developed in IPDiA’s own R&D center. This technology takes advantage of the thickness of silicon to integrate hundreds of passive components such as high-Q inductors, resistors, MIM capacitors and trench MOS capacitors in one single die. This technology has already proved its efficiency in terms of area saving. The 3D trench depth of the silicon capacitor drives the results obtained in terms of thickness and capacitance density. Table 1 shows the die thickness obtained and the corresponding capacitor density, figure 1 shows a 100 µm die embedded in a PCB.

On top of the low profile specification, these 3D silicon capacitors, already in mass production, offer a capacitance density up to 250 nF/mm² with a breakdown voltage (VBD) of 11V minimum.

Their “Intrinsic lifetime” 10.1% is over 10 years at 3.6V, 100°C (60% C.I.) even for corner batches.

The devices have low leakage (typically < 5 nA/µF and down to < 0.2 nA/µF at 3.2V/25°C), and a high capacitance stability with respect to temperature (70 ppm/°C over the -55°C/+200°C range) or voltage (<0.1%/V).

ESR/ESL contribution

To cope with the increased demand for more sensitive devices and faster transition in the IC, power integrity must be guaranteed and therefore impedance minimized while maintaining the availability of a wide range of capacitance values. The output ripple voltage is directly related to ESR values. As input/output voltages of modern DC/DC converters are getting lower and lower, this input/output ripple due to ESR is an increasingly important parameter that has become challenging to solve with standard MLCCs. In the past decades, all capacitor parameters were measured at a standard of 1MHz, as DCDC converters were operating at 10MHz. But in today’s high frequency world where the trend in DC/DC converters is to operate in ranges of tens of MHz, this is far from sufficient. Ideal values for a good high frequency capacitor for a given capacitance could run in the order of about
50 mΩ at 200 MHz, 110 mΩ at 900 MHz and 140 mΩ at 2 GHz. To reach a global impedance of 140 mΩ at 2 GHz, as this frequency is way above the SRF, several MLCCs must be added in parallel. Designers, however, need to find a capacitor with very low impedance over a broad frequency range.

IPDiA R&D’s team of experts has addressed this issue and has set up a new PICS capacitor quasi fractal design, so called ‘Mosaic’ that provides a way to reduce the ESR/ESL of the global structure – see figure 2. The approach consists in increasing the contact density with the electrode to obtain a less resistive backend (metallic) grid. Optimization is carried out to minimize the grid ESR and ESL while the individual Mosaic cells are massively parallelized to control the global ESR/ESL.

When comparing this new generation of silicon capacitors with X7R and COG 100 nF capacitors – see figure 3 – we can see that no inductive transition is observed up to 10 GHz for the PICS capacitor and that it acts as a low-impedance element over a wide range of frequencies while X7R and COG capacitors act as low-impedance elements over a limited range of frequencies. IPDiA PICS capacitor provides the best result in terms of low impedance for frequencies higher than 20 MHz compared with COG and 35 MHz compared with X7R.

Comparing capacitance density, we observed that whilst offering 100 times more capacitance density (2000 nF/mm³ vs 20 nF/mm³), IPDiA 3D Silicon capacitors also offer better ESR characteristics (20 mΩ versus 100 mΩ when compared with Type I capacitors). For Type II, IPDiA offers unique capacitance stability performance with an ultra-low profile of 80 µm and 20 mΩ of ESL when X7R and X5R capacitors offer a standard thickness of 300 µm at the same level of ESL, with lower stability performance. Improving decoupling performance has usually been based on the idea of reducing the ESL. Low ESR MLCCs have been widely used for this purpose. However, nowadays, in new DC/DC converters operating at much higher frequencies, a very low impedance device is required. A standard capacitor can in fact only be used up to the SRF. Above the SRF, the user essentially has a “DC blocking inductor”. In order to extend the usable frequency range in such applications, IPDiA is offering ultra-low ESL structures, in a low profile form factor, which drastically decrease the overall impedance above the SRF and offer the best solution for decoupling performances in the 35 MHz to 10 GHz frequency range.

### Table 1: Die thickness and the corresponding capacitor density.

<table>
<thead>
<tr>
<th>Process Node</th>
<th>Capacitor Density</th>
<th>Minimum die thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICS1</td>
<td>25 nF/mm²</td>
<td>30 µm</td>
</tr>
<tr>
<td>PICS2</td>
<td>80 nF/mm²</td>
<td>50 µm</td>
</tr>
<tr>
<td>PICS3</td>
<td>250 nF/mm²</td>
<td>80 µm</td>
</tr>
</tbody>
</table>

### Fig. 3: Impedance magnitude for 100 nF capacitor element. Comparison of PICS, COG and X7R.
Understanding the distortion mechanism of high-K MLCCs

By John Caldwell

THE UNDERLYING MECHANISM causing distortion when using High-K ceramic capacitors in a system’s signal path is the voltage coefficient of capacitance (VCC) of the capacitor.

The term VCC is used to describe the change in the value of a capacitor with respect to the magnitude of the applied voltage. Power supply designers are well aware of this behaviour as it can directly affect the output ripple or stability of their system, but VCC is often ignored in small-signal circuitry. In order to understand why the capacitance varies with applied voltage and how the VCC varies with other capacitor parameters, it is necessary to first look at a capacitor’s basic structure.

Figure 1 shows a simple capacitor consisting of two plate electrodes of area A, separated a distance d by a dielectric (green). The capacitance of this structure is given by equation 1:

\[ C = \frac{\varepsilon_0 \varepsilon_r A}{d} \]

where \( \varepsilon_0 \) and \( \varepsilon_r \) are the permittivity of free space and relative permittivity of the dielectric, respectively. The magnitude of the electric field applied to the dielectric is a function of the applied voltage and the separation distance between the two plates.

\[ E = \frac{V}{d} \]

The voltage coefficient of many capacitors arises from the electrostatic force on the dielectric when a voltage is applied to the capacitor.

\[ F = \frac{\varepsilon_0 \varepsilon_r A V^2}{2d^2} \]

Because the dielectric material cannot be infinitely stiff, it is compressed by this force, reducing the separation distance d and increasing the capacitance. Multilayer ceramic capacitors, on the other hand, exhibit an additional negative voltage coefficient that arises from other properties of the dielectric.

Ceramic capacitors owe their small size, high capacitance, and low cost to the use of barium titanate in the dielectric, which provides an extremely high relative permittivity. Unfortunately, this material’s relative permittivity varies depending upon the intensity of the applied electric field – see figure 2. As the applied electric field is increased, the relative permittivity of the barium titanate is reduced, showing a 55% reduction over the tested range. Therefore, increasing the voltage applied to a ceramic capacitor reduces the relative permittivity of the barium titanate in the dielectric material, causing a decrease in capacitance.

The electric field intensities in figure 2 may seem unlikely to occur in small signal circuits. However, in the pursuit of higher volumetric efficiencies, capacitor manufacturers are able to produce ceramic capacitors with dielectric thicknesses below 5 microns, creating surprisingly high electric field intensities. Using equation 2, we can see that applying 1V to a capacitor with a 5 μm dielectric thickness results in an electric field intensity of 200,000 V/m!

Understanding this property of barium titanate allows us to infer some rules for the voltage coefficient of ceramic capacitors. First, the voltage coefficient is worst (greatest change with applied voltage) in ceramic capacitors with the highest barium titanate content. Table 1 displays the barium titanate content of selected ceramic dielectric types.

Second, the voltage coefficient gets worse for smaller packages because the change in the relative permittivity is dependent upon the intensity of the applied electric field. As the capacitor’s package size is decreased, the area of the electrode plates is reduced. Therefore, the thickness of the dielectric must be reduced to maintain a certain capacitance.

Voltage coefficient effects

Although we’ve identified the mechanism for voltage coefficient of capacitance, it may not be immediately clear how this voltage coefficient causes distortion. Consider that because the value of a ceramic capacitor is, in reality, a function of the applied voltage, the equation for current through that capacitor must be modified. As shown in the equation below, the constant C for capacitance is replaced with a function C, which depends on the applied voltage V.

\[ i = C(V) \frac{dV}{dt} \]

We can extract the function C(V) from typical voltage coef-
In the previous example, a 50 Vpk sine wave was chosen such that the distortion of the current waveform would be visibly noticeable. However, these effects begin at much lower voltages.

**Simulating with non-ideal capacitors**

The effect on the current waveform may seem miniscule, but the degree to which it degrades the total harmonic distortion of a circuit can be surprising. In order to prove this, a SPICE model for a polynomial non-linear capacitor (polycap) was modified to incorporate the cubic equation for voltage coefficient, C(V). This model approximates a nonlinear capacitor using a controlled current source whose output current is defined by the polynomial equation for C(V), as well as the derivative of the applied voltage with respect to time, dV/dt. The time derivative is determined by applying a copy of the applied voltage across a known capacitance CREF, and measuring the resulting current.

The model accepts four parameters: C0, C1, C2, and C3. These can be positive or negative and define the capacitor’s voltage coefficient equation.

<table>
<thead>
<tr>
<th>Dielectric Type</th>
<th>Barium Titanate Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0G</td>
<td>10% to 50%</td>
</tr>
<tr>
<td>X7R</td>
<td>90% to 98%</td>
</tr>
<tr>
<td>ZSU</td>
<td>80 to 94%</td>
</tr>
<tr>
<td>ZSV</td>
<td>80 to 94%</td>
</tr>
</tbody>
</table>

Table 1: Barium titanate content of selected ceramic capacitor dielectric types [4]
Because the cubic equation for $C(V)$ extracted in figure 3 is only defined for voltages greater than zero, the absolute value function must be incorporated to accurately model the capacitance value for both positive and negative voltages. This approach was found to be much more accurate than attempting to fit a polynomial over the entire range of possible voltages (both positive and negative). A Sallen-Key 1 kHz lowpass filter was simulated using polynomial nonlinear capacitor models for 10 nF and 22 nF, 50V X7R capacitors. Figure 7 shows the simulation schematic incorporating X7R capacitors $C_{X1}$ and $C_{X2}$.

TINA was used to perform a Fourier Spectrum analysis of the output of the filter for a 500 Hz, 1 Vrms input signal. A 65536-sample FFT was performed on an 80 ms sample of the output signal to produce the spectrum. In order to avoid the use of windowing, the time steps of the simulation were constrained and the input signal was chosen to be a coherent frequency.

Any harmonics in the output spectrum are the result of the capacitors' voltage coefficient because the distortion characteristic of the operational amplifier (op amp) is not modelled below the full power bandwidth limitation.

Figure 8 shows the simulated output spectrum of the circuit when using the modeled X7R capacitors (blue) compared to idealized capacitors (red). The simulation shows a large number of predominantly odd order harmonics are produced when using X7R capacitors in the filter circuit, which agrees with the results from the first article.

As expected, the simulation using ideal capacitors shows only a spur at the fundamental frequency. The amplitude of the harmonics in the simulation, on average, is 10 dB lower than that measured in the actual circuit (using capacitors with more pronounced voltage coefficients than those chosen for the simulation model).

**Conclusion**

In ceramic capacitors, the relative permittivity of the dielectric is changed by the intensity of the applied electric field, giving rise to a substantial voltage coefficient. This effect is worst in high-K dielectric types and smaller package sizes. As a result, the value of the capacitor is changing instantaneously due to the applied signal, causing distortion in the current waveform.

We demonstrated this by producing a SPICE model for a capacitor that replicates the voltage coefficient of a typical 50V X7R capacitor. The X7R capacitor models produced a large number of harmonics when used to simulate a Sallen-Key lowpass filter. In wide dynamic range applications where a substantial voltage may appear across a capacitor, it is best to select C0G, polypropylene film, or silvered mica capacitors to avoid excess distortion.
Additive photolithographic process yields micro flex circuits with 5µm feature resolution
Using additive photolithographic processes, Metrigraphics is able to manufacture Extreme Resolution Micro Flex (ERMF) ultra-miniature passive circuits and structures with traces and spaces as small as 5µm. The circuits can also be delivered in complex, high-resolution shapes and patterns for medical sensor applications, including various in body and fluid sensors. The micro circuits are produced with very thin layers of sputtered metal or thicker plated metal such as gold or copper. The company reports that its processes can achieve traces as narrow as 3µm for some designs. Metrigraphics offers both single and multilayer ERMF circuits. Multilayer circuits include additional conductive layers that are independently stacked, aligned and interconnected. Plated conductive vias connect the different layers as required. Via sizes can be down to 25µm diameter.
Metrigraphics
www.metrigraphicsllc.com

SMD power inductors come with the highest reliability rating currently available
API Delevan now offers three SMD power inductors with the highest reliability rating available after achieving a “T” Level reliability rating. The MILP1812, MIL4922 and MIL8532 meet all Military QPL requirements, and the ruggedized moulded and leaded construction is proven against MIL-STD-202 mechanical vibration, moisture resistance, and DWV testing. All “T” Level inductors are thermally shocked for 25 cycles, burned-in for 96 hours, and x-ray inspected before customer delivery. High-saturation ferrite core materials and thick AWG size wire offer these inductors higher operating power along with maximum operating efficiency, resulting in a cooler running product.
API Delevan
www.delevan.com

TDK further shrinks common-mode choke for CAN and FlexRay
For deployment in both CAN and FlexRay data bus environments, TDK has developed the ACT1210 series of common-mode chokes. Measuring only 3.2x2.5x2.4mm, the chokes are the world’s smallest, claims TDK, taking 45% less PCB space than that of existing components. Rated for a wide operating temperature range from -55 to +150°C, the ACT1210 series offers high heat resistance and reliability, making it suitable for use under severe conditions such as those encountered in the engine compartment of a vehicle. The ACT1210 common-mode chokes employ an improved ferrite and is based on the joint technology competence of TDK and EPCOS in the area of EMC. Thanks to the structural design of the new series, the components are manufactured using a high-precision autowinding process.
TDK
www.tdk.com

Automotive-qualified passives
Murata has extended its automotive qualified MLCC offering with addition of AEC-Q200 and ISO7637-2 parts. Added to Murata’s AEC-Q200 qualified multi layer ceramic capacitors (MLCC) aimed at automotive applications are the RCE and RHE series radial leaded MLCCs that fully conform to the automotive environmental stress test requirement AEC-Q200 and conducted surge pulse immunity specification ISO7637-2. The RCE series comprises capacitors in the range 1 pF to 22 µF and working voltage from 25 to 1 kV. Operating temperature range is up to 125°C. With an operating temperature up to 150°C the RHE series devices are available with 50 to 100 VDC working voltage and capacitance values from 100 pF to 10 µF. The RHE series is guaranteed to operate in temperatures up to 170°C for 100 hours when a temperature mission profile is agreed with Murata in advance.
Murata Europe
www.murata.eu

High directivity couplers for WiFi bands
AVX has introduced a series of integrated thin film (ITF), high directivity, directional couplers for WiFi bands. Available in 0302, 0402, & 0603 sizes, the LGA couplers offer excellent high frequency performance across WiFi bands, 2,400-5,950 MHz Using Land Grid Array (LGA) packaging, the 0302, 0402, and 0603 sizes all provide identical electrical performance; the 3W couplers exhibit high directivity (20 dB), low parasitics, improved heat dissipation, and self-alignment during reflow. The couplers are rated for -40°C to +85°C and feature RoHS-compliant, 100% tin terminations that are compatible with automatic soldering technologies, including: reflow, wave soldering, vapor phase, and manual. Finished parts are 100% tested for electrical parameters.
AVX
www.avx.com

2W-rated chip resistor from 0.1 Ohms up to 1M0hm with low self-heating
The RHC2512 from Stackpole is a high power 2W-rated 2512 size chip resistor claimed to have a much lower heat rise compared to other high power chip resistors currently available. Stackpole uses a unique set of materials, part design, and manufacturing processes to lower the self-heating of the part by at least 30 degrees C. The RHC2512 is available in values from 0.1 Ohms up to 1M Ohm in 1% and 5% tolerances and TCR of 100 ppm. The RHC Series can be used in a wide range of applications, including professional, commercial, and industrial power systems; control systems; and industrial and commercial automation.
Stackpole Electronics
www.seielect.com
Snap-in power aluminium capacitors offer high ripple current to 2.80A over full lifetime

Vishay Intertechnology, Inc. has extended the company’s 159 PUL-Si series of snap-in power aluminum capacitors to a high rated voltage of 500 V at +105 °C. Designed for solar PV inverters, industrial motor controls, and power supplies, the enhanced devices feature a long useful life, high ripple current to 2.80 A and +105 °C, and max. ESR down to 150 mΩ at 100 Hz. Featuring a cylindrical aluminum case with a pressure relief valve, insulated with a blue sleeve, the new Vishay BCcomponents snap-in capacitors released today are available in a variety of case sizes ranging from 22 x 25 mm to 35 x 60 mm. At 500 V, the devices feature a maximum operating temperature to +105 °C and useful life of >3,000 hours. As polarized aluminum electrolytic capacitors with a non-solid electrolyte, the 159 PUL-Si series devices are ideally suited for smoothing, filtering, and energy storage in pulsed power applications. The capacitors are also available in a keyed polarity snap-in version.

Vishay Intertechnology
www.vishay.com

Automotive ESD protectors in 0402 and 0603 packages

The ChipGuard ESD protectors from Bourns are designed specifically to guard sensitive automotive electronics from the threat of electrostatic discharge (ESD) and are qualified to meet up to IEC 61000-4-2 Level 4 standards. Designated the CGA-MLC Series, these ESD protectors are extremely fast bidirectional devices have low capacitance, minimal insertion loss and low leakage over a wide temperature range. The devices are available in ultra-small, industry standard 0402 and 0603 packages which make them suitable for a large range of automotive applications including antenna circuits, camera links, sensors, touchscreen interfaces, GPS systems, USB 3.0 devices and high-speed communication buses. The chips are designed to withstand multi-strike ESD threats, are RoHS compliant and are fully AEC-Q200 qualified and supported.

Bourns
www.bourns.com

Cloud-based tool helps board designers select best DC/DC power module

GE’s Critical Power business has launched the company’s cloud-based Power Module Wizard, providing board designers with an intuitive tool to help them easily select the optimal DC/DC modules for their power board. The Power Module Wizard helps board designers select the right power module on the first try, improving design productivity, reducing risks and virtually eliminating the need to rework their designs. The Power Module Wizard uses desired or required specifications set forth by a board designer to generate a list of possible DC/DC modules that would be acceptable for their current board design. Board designers can enter a variety of basic search parameters - such as available input voltage, desired output voltage and current, maximum ambient temperature, minimum airflow and maximum allowable height - to help narrow the module selection. Once a list is compiled, modules are ranked by weighted user-selected preferences such as cost, density or efficiency. If preferred, the designer has the option to skip this stage and review the schematic generated from just the first level of requirements laid out. The Power Module Wizard helps to eliminate the need for multiple test and configuration tools such as GE’s Tunable Loop Tool, Stability Tool, Point of Load (POL) Programming Tool, Power Module Selector Tool and Power System Designer by incorporating technology from each to provide a complete set of board design capabilities in a single, easy-to-use solution. In addition, the solution’s system design tool provides board designers with a variety of module combinations that specifically match the voltage needs of the application being designed.

GE’s Critical Power business
www.gecriticalpower.com

Reversible debugger adds support for ARM and Android

Undo Software has launched version 4.0 of its reversible debugger for Linux, adding support for ARM processors and Android Native application code. UndoDB allows Linux software developers to record their program’s execution, and then “wind the tape” back and forth in real-time to get a clear picture of their program’s execution, significantly reducing the cost of bugs to software vendors. The v4 release follows the announcement made in September that ARM has integrated UndoDB into their flagship software development studio, ARM DS-5 Professional Edition. From embedded to mobile and servers, Linux and its variants are becoming increasingly important across many of ARM’s market segments, and as devices and systems become more capable, so the software becomes ever more important and complex. UndoDB is used daily on some of the world’s most complex software, from scientific computing at NASA and Lawrence Livermore National Labs, to enterprise custom- ers including some of the world’s largest banks and the world’s largest design automation vendors.

With v4, developers working on ARM processors and Android Native can now use Undo’s reversible debugger and benefit from significant productivity gains. UndoDB v4 enables ARM and Android Native software developers to use the power of reversible debugging on complex, real-world code, as well as providing performance improvements and new features for Linux users.

It supports the ARMv5, ARMv6 and ARMv7 architectures, including Thumb technology and VFP as well as Android on ARM and x86 for native application debug. There is also support for remote debugging to give developers the ability to debug an executable running a remote target using undodb-server instead of gdbserver. Undo has made significant performance improvements when executing writeable code and when debugging very large programs, and improved the compatibility with graphical front-ends including Eclipse and emacs.

Undo Software
www.undo-software.com
Triaxial, piezoresistive shock accelerometer comes in 20,000 g and 60,000 g ranges

Meggitt Sensing Systems has introduced the Endevco model 7284 series, a family of lightly damped, high-g, triaxial, piezoresistive shock accelerometers designed for weapons testing, high-g data recorders and other extreme-g applications. These very rugged sensors, available in 20,000 g and 60,000 g ranges, offer superior survivability and low power consumption. The Endevco model 7284 series is the triaxial version of the company’s popular single-axis 7280A series. It shares the same footprint, bolt pattern and highly survivable sensing system, while making high-g shock measurements across three mutually perpendicular axes. And, with a frequency response extending down to dc (steady state), the model 7284 can measure long duration transient shocks. The robust design of the model 7284 incorporates three sensors mounted in a triaxial arrangement within a single housing. Each axis features a unique piezoresistive MEMS sensor with light gas damping to attenuate resonant amplitudes and prevent breakage in overload conditions. Because units are only lightly damped, they still accurately respond to fast rise times and short duration shock motion. Simple screw-mount installation with factory controlled and tested cross-axis performance makes the model 7284 much easier and more cost effective to install than three single-axis units.

Meggitt Sensing Systems
www.meggitt.com

OCXOs operate at up to +90°C for demanding applications

Precision Devices has released the high temperature VN01 and VN03 series of Oven Controlled Crystal Oscillators (OCXO), operating at up to +90°C for applications like satellite communications and a variety of military systems where extremely high temperature operating environments are the norm. In many cases, using these devices can reduce the cooling requirements of a system, hence also reducing the power required for the overall system. Measuring 36.20x27.18x16.81mm, the devices feature a low phase noise, performance in high vibration environments. They are built with double-hermetically sealed quartz crystals and can be made available in custom frequencies from 10.000 to 50.000MHz.

Precision Devices
www.pdixtal.com

Power supply IC protects automotive antenna amplifiers

Modern cars are equipped with up to six active antennae for data communication, mobile telephony and similar tasks. Chipmaker Elmos AG has devised a power supply IC which not only provides the right voltage for the amplifiers integrated in these antennae but also offers multiple protection functions. The E522.40 is a compact dual antenna power supply chip which at the same time protects the RF amplifier circuitry against electrostatic discharge (ESD) and overheating as well as against short circuit to ground or battery voltage level. The device can be utilized in antenna applications with supply voltages between 4.5V and 25V. Utilizing external voltage dividers, two independent output voltages can be programmed to a value between 3.3V to VBAT. Despite its small size, the chip offers extensive diagnosis functions. The I²C interface and an 8-bit ADC enable designers to implement real-time monitoring of output voltages and currents. Over and under voltage thresholds can be programmed separately for each output; if needed, they also can be deactivated. An additional analog sensor input can be used in connection with a programmable digital output to monitor a third phantom supply circuit.

Elmos
www.elmos.com
AC-DC power supply achieves 92 percent efficiency at 50 percent full load

Murata has introduced the Murata Power Solutions D1U86G series of 86 mm wide, 460 Watt front end power supplies which can achieve a high minimum conversion efficiency of 92 percent at 50 percent full load. With 1U form factor, the units measure 86.0 x 196.9 x 39.9 mm, ideal for length-limited applications and mid-plane design architectures. The unit’s high efficiency lowers the host system cooling requirements and also contributes to power savings in customer applications. The D1U86G series comprises two models, both providing a +12 VDC 460 Watt output with either ‘back to front’ or ‘front to back’ direction of airflow. The power factor corrected D1U86G series accommodates the universal AC input range from 90 to 264 VAC. Forced air cooling is provided by an internal variable speed fan. The series features a 0 to 50 degrees C operating temperature range, without any derating due to line input or temperature. The D1U86G series features hot-swapping and hot plug capability and droop current sharing for up to 8 supplies to be connected together. Safety features include output overvoltage, output overcurrent, and self-resetting overtemperature protection. PMBus management and I²C interface with status indicators and boot loading are also available. An LED on the front panel indicates the operational status of the power supply.

Murata Europe
www.murata.eu

High-power projectors provide a system output of up to 1700 lumen

Osram Opto Semiconductors has launched two high-power versions of the Osram Ostar Projection for projectors with a brightness of up to 1700 lumen. Thanks to their optimized product design they offer high luminous flux from the available chip surface. Between 1000 and 8300 lumen can be produced depending on the color and the LED version. An anti-reflex coated glass cover instead of the usual lens, together with external optics, ensures that the light is very well bundled. The two new light emitting diodes offer so much luminous flux that they can be used in office projectors with brightness levels of up to 1700 lumen. At the heart of the product is a 2 mm² LED high-current chip based on state-of-the-art thin-film and UX:3 technologies. The two LED versions contain two (P1W) or four chips (P2W) with a total luminous area of 4 mm² and 8 mm² respectively. In LED projectors three LEDs in the colors red, green and blue serve as the light source. The LEDs are pulsed one after the other (color sequential mode), making the color filter wheel used in classic lamp projectors superfluous. The high output of the new LEDs comes from the latest chip technologies and Osram C² conversion technology for a particularly efficient green. The P2W version emits light pulses with brightnesses of 1000, 2500 and 8300 lumen for Blue, Red and Green. These high brightness levels require current pulses of up to 32 amps (8 amps per chip) and optimized product design to efficiently remove the resulting heat.

Osram Opto Semiconductors
www.osram-os.com

Small form factor rugged PC based on 4th generation Haswell Core processor

ADL Embedded Solutions is to start shipping its latest small form factor PC for rugged environments in January. The ADLQM87PC PCIe/104 SBC is based on the 4th generation Haswell Core processor, built on Intel's 22nm tri-gate process technology. This will enable ADL Embedded Solutions to continue its focus on small form-factor embedded computing after the release last year of a PCIe/104 second generation Intel Core i7 ADLQM67PC platform. The ADLQM87PC builds on the ADLQM67PC to include new features like USB 3.0, TPM v1.2, and an onboard minicard socket for miniPCie and mSATA modules. This will enable all manner of applications including WiFi and onboard bootable mSATA flash modules. Additional features include support for next generation digital video interfaces including Display Port, DVI-D, HDMI, and embedded-DP, as well as a full-complement of I/O including SATA 6Gb/s, 2xGLAN, 8xUSB2.0, 2xUSB3.0, and a downstacking Type 1 PCIe/104 bus for peripherals.

ADL Embedded Solutions
www.adl-europe.com

LED family handles drive currents to 70mA

The Optoelectronics group of Vishay Intertechnology, Inc. has released a family of LEDs in a PLCC-2 package that can handle higher drive currents and produce improved luminous intensity. The new VLM.334.. series LEDs, an advanced modification of Vishay’s VLM.31.. series LEDs, can incorporate larger chips and are thus capable of withstanding drive currents up to 70 mA. The AEC-Q101-qualified VLM.334.. LEDs are offered in super red, red, amber, and yellow to serve a wide range of applications, including traffic signals and signs, interior and exterior lighting, automotive dashboard illumination, indicators and controls for audio and video equipment, LCD switches and symbols, illuminated advertising, and many other uses. Utilizing the latest advanced AlInGaP technology, the VLM.334.. series devices claim to provide exceptional brightness with a typical luminous intensity of 3760 mcd and maximum luminous intensity of 6052 at 70 mA while delivering improved thermal performance compared to previous-generation LEDs. At 300 K/W, junction-to-ambient thermal resistance is 25% lower than the former VLM.333 product. VLM.334.. series LEDs are available in 8 mm tape. RoHS-compliant, halogen-free, and Vishay Green, the devices are compatible with IR-reflow soldering processes and preconditioned according to JEDEC Level 2a.

Vishay Intertechnology
www.vishay.com
Cell balancing IC recovers energy and provides charge flow monitoring

Making up to 96% of the energy in a battery pack usable, LT8584 is a monolithic flyback DC/DC converter that can handle 2.5A average currents, and is designed to actively balance high voltage stacks of batteries, as found in electric and hybrid vehicles. LT8584 offers high efficiency active balancing, which redistributes the charge from the stronger cells (higher voltage) to charge the weaker cells during discharge. This enables the weaker cells to continue to supply the load, extracting 96% of the entire stack capacity where passive balancing usually extracts, according to Linear Technology, approximately 80%. Passive energy balancing protects against damage to cells by over-charge or deep discharge, but offers no improved run-time as it dissipates the added energy of the higher capacity batteries to match the lowest one. The device includes an integrated 6A/50V power switch, enabling an average discharge current of 2.5A while offering a simple and compact application circuit. Its isolated balancing design can return charge to the top of the battery stack or to any combination of cells in the stack.

Linear Technology
www.linear.com

4-wavelength integrated 100Gbps EML-TOSA

Mitsubishi Electric has developed a laser diode-transmitter optical subassembly (TOSA) that enables 100Gbps optical transmission in one fibre using four-channel wavelength-division multiplexing. The unit helps downsize 100Gbps communication facilities and expand high-speed 100Gbps optical transmission networks. Compliant with IEEE 100GBASE-LR4, the FU-401REA TOSA features four electro-absorption modulators with laser diode (EML) and an optical multiplexer integrated in one compact package measuring only 8.8×26.5×5.6mm, a 75% reduction in footprint compared to the existing FU-412REA model, claims the manufacturer. The new EML chip can operate at up to 15 degrees Celsius higher than the company’s previous model and cooling power is reduced by 50% to help lower the operating power of optical-transceiver modules. The unit achieves a maximum transmission distance of 10km, with an output power ranging from -2 to +2dBm.

Mitsubishi Electric
www.MitsubishiElectric.com

USB-driven dual-port vector network analyser covers the 400 to 4000MHz range

The VNA-0440 vector network analyser from MegiQ is a bi-directional two-port unit allowing detailed impedance measurements of antennas, circuits and components. With its 400 to 4000MHz measuring range, the instrument covers the most popular communication bands for GSM-LTE, GPS, ISM, Wifi, Dect and more. A version with an extra generator output allows the characterization of 3-port devices, like splitters and hybrids. It features an internal, programmable bias generator with bias-Tee’s allowing full automatic parametric measurements of amplifier and varactor or PIN circuits. An UFL kit allows users to measure circuits on micro-PCBs, like baluns, antennas, amplifiers. Other kits are available such as WFL, SMA, balanced, including calibration tools. The ‘RF Sandbox’ provides new users with a series of experiments, so they can be up and running within 10 minutes. PC software provides intuitive control, extensive graphing, data export and reporting. Measurements and set-ups can be stored in sessions for easy ‘Retrace-and-Compare’. The handy ‘Click-and-Match’ calculates and simulates matching circuits.

MegiQ
www.megiq.com
**Raspberry Pi universal demo kit aids TFT panel selection**

Kyocera Display Europe’s Universal Demo Kit (VIP Kit) can be used to quickly and easily operate all current Kyocera TFT display modules: the converter included in the VIP Kit adapts HDMI graphics data from a Raspberry Pi so that they can be viewed on a Kyocera display panel. Users don’t have to worry about resolution or data format. Texts, photos, images, videos — everything is displayed in real time and at a high resolution. So users can check straight away if the correct display has been selected for the intended application or whether the viewing angles are sufficient. This will benefit designers and developers in industrial automation, medical technology, and not least in the automotive industry. The Kyocera VIP Kit consists of the desired size of display from the Kyocera product range, a universal HDMI-to-LVDS converter and the appropriate cables and power packs. The converter is designed to be connected directly to the Raspberry, but if required, can also be connected to any HDMI port so that content can be viewed on the corresponding Kyocera display. The kit is available as a plug-and-play version, enabling you to quickly and easily upload your own images and view them with the application. It can be used anywhere for presentations without the need for an additional display. In addition, graphics can be easily altered and optimised on the display. The Kyocera VIP Kit has a single channel 24-bit HDMI-LVDS converter with a 15-MHz to 85-MHz pixel clock. Other features include VGA (640 x 480) to Full HD (1920 x 1080) resolution and users can select between Hsync, Vsync or Clock polarity. The power pack supplied provides the required voltage of 12V/1.5 A; and the control unit for the backlight with up to a maximum of 600 mA is integrated.

**Kyocera**

www.kyocera.eu

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**Family of optic modules provide cost effective lighting with mid-power LEDs**

LEDIL has unveiled new family of optic modules for Philips Fortimo Led Line 3R compliant 3-row mid-power modules. The Florence family offers three optical versions. Florence symmetrical beam Z60(60deg) and Z90(90deg) applications provide a uniform and low glare light distribution in advanced low bay environments with 90% efficiency. For low-bay applications the modules provide more light directed to the application area and also offers better area uniformity and better horizontal illuminance. The modules are also suitable for store lighting, office lighting as well as high bay lighting. The Florence asymmetrical beam ZT25 application is designed for retail environments where items are illuminated on shelves on both sides of the aisle. ZT25 provides a uniform double sided asymmetric beam with a twenty degree tilt optimized to illuminate products on the shelves.

**LEDIL**

www.ledil.com

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**More CAN channels and analog I/Os for prototyping system**

Automotive development tool vendor dSpace GmbH now offers a new I/O board for its MicroAutoBox II prototyping system. The board features six CAN channels as well as 32 ADC and 8 DAC I/Os, offering additional flexibility to connect sensors and actuators which makes it particularly suited for combustion engine and vehicle dynamics controls. The CAN interfaces can be configured through tools like Simulink or dSpace Blocksets RTI (Real-time interface) CAN and RTI CAN MultiMessage, enabling fast and efficient CAN network topology configuration. Anticipating future developments, the CAN interface hardware is prepared to accommodate Partial Networking configurations which makes it possible to selectively switch of specific CAN nodes for energy efficiency reasons. Software support for Partial Networking will be offered in a future release, the vendor said. The MicroAutoBox II with the new DS1513 I/O board will be available in 1Q2014. The board can be combined with a freely programmable FPGA and with the MicroAutoBox PC.

**dSpace GmbH**

www.dspace.de

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**Micron collaborates with Broadcom to improve DRAM timing and speed of operation**

Micron Technology is joining forces with Broadcom Corporation to develop what is claimed to be the industry’s first solution designed for customers challenged by an intrinsic DDR3 timing parameter called tFAW, or four activate window. tFAW refers to a DDR3 timing parameter that restricts data throughput in server, storage and networking applications and can compromise bandwidth by 15 to 35 percent. With every new DRAM generation, the access granularity is becoming double, causing some timing parameters like tRDD and tFAW to restrict data throughput. This creates challenges for high-performance applications because no more than four bank activate commands can be issued in any given tFAW period. The Micron solution validated by Broadcom reduces the tFAW value from 35ns to 30ns for a 2KB page size, DDR3-2133, improving operations per second by 18 percent. This performance increase is especially critical for complex packet processing functions, such as highly scalable IPv4 and IPv6 lookups used in service provider networking applications. The four activate window solution enables Broadcom’s BCM88030 200 Gb/s NPU to achieve extremely scalable L2, IPv4 and IPv6 lookup capacities at wire speed performance using Micron’s DDR3 memory. Micron’s 2Gb and 4Gb DDR3 with the reduced tFAW timing specification are available in volume production now.

**Micron Technology**

www.micron.com
Snap-Lock LED driver cartridge offers quick-change serviceability

Journée Lighting has expanded its intellectual property portfolio with the introduction of the patented Snap-Lock LED Driver Cartridge and Field-Replaceable Linear LED Modules. Invented by Clayton Alexander, CEO of Journée Lighting and creator of the Lotus, the industry’s first high-brightness LED track light, the new modules claim breakthrough solutions, enabling the creation of sustainable and serviceable LED light fixtures. LEDs offer a number of advantages over incandescent, fluorescent, and high intensity discharge bulbs, however their installation makes it hard to replace the LEDs without extensive removal of the entire lighting unit. Journée’s Linear LED Module can be easily detached from its heat sink with no tools, as well as provide for effective dissipation of the heat generated by the LED light module. With the linear LED module, the heat sink and socket are a permanent part of the fixture, and the linear LED module is quick and easy to install. It offers multiple beam angle options and is available in multiple lengths. The linear light bulb pops in and out of the socket and can be used for various high-brightness linear lighting applications. Designed to replace dual T5 HO lamp applications, Journée Lighting’s new linear LED modules can deliver over 2,000 lumens per foot.

Journée Lighting
www.journeelighting.com

SMD True sinewave clock oscillator delivers -170 dBc/Hz of noise floor at 1MHz offset

The CCSS-945 crystal oscillator from Crystek Crystals Corporation provides -170 dBc/Hz of noise floor at 1MHz offset. The close-in phase noise performance is -105 dBc/Hz typical at 10Hz offset. This high-performance clock oscillator is available in the industry standard 9x14mm SMD package and is engineered to MIL-STD-883 and MIL-STD-202 specifications. The CCSS-945 generates frequencies between 10 MHz and 125 MHz, with output level of +5 dBm minimum into 50 Ohms and harmonics lower than -25dBc. The CCSS-945 consumes 30mA maximum at 5.0 volts and has no sub-harmonics. The device is suitable for applications requiring ultra-low noise performance similar to more expensive OCXO crystal oscillators. Extended temperature operating range of -40°C to +85°C and other custom specifications are also available.

Crystek Corporation
www.crystek.com

Schroff plug-in kits come with IET or XL handle for high insertion and extraction forces

Pentair has expanded its portfolio of complete kits for Schroff plug-in units to include kits with the so-called IET handle or an XL handle for very high insertion and extraction forces. The kits consist of a front panel, one or two handles (top and/or bottom) and fixing and shielding elements. The design of the plug-in units with the IET handle makes them particularly well-suited for telecommunications applications, where large numbers of cables must be run and thus only limited space is available between the cabinet door and plug-in unit. This handle is suitable for insertion and extraction forces of up to 700 N per pair. Complete kits with IET handles are available as 3U/4 HP, 3U/8 HP and 3U/12 HP, also as 6U/4 HP, 6U/8 HP and 6U/12 HP with U front panel and textile gasketing. Plug-in units with IET handle are suitable for coding and can be used in all VME64x, VPX, VXS and CompactPCI applications. The kits with the XL handle are suitable for insertion and extraction forces of up to 1500 N per pair and are available in sizes 6U/4HP, 6U/8 HP and 6 HE/12 HP.

Schroff
www.schroff.co.uk

Follow-us on
Flash MCU with LED/LCD driver directly drives display panels for small household appliances
Holtek Semiconductor Inc. has introduced a Flash MCU with LCD/LED Driver which includes fully integrated LCD and LED driver circuits that can directly drive display panels and eliminate the need for large number of external components. The HT69F240 is suitable for small household appliance panel applications. The device includes 4K Words of Flash Program Memory, 256 bytes of RAM Data Memory, 64 bytes of Data EEPROM Memory and an 8-level stack. With regard to peripheral functions, the device includes multifunctional Timer Modules, external interrupts, I²C and UART interfaces, internal and external high accuracy oscillators etc. In addition to operating independently, the device can use its communication interfaces to work together with other master devices as part of an overall system. With this wide range of integrated and versatile functions, users have at hand a highly functional device with which to easily develop their small household appliance products. Holtek supports the HT69F240 with the company’s comprehensive hardware and software development tools. The hardware development tool is known as the e-Link which works together with an OCDS structured evaluation MCU, providing users with an actual device with which full emulation and debug can be implemented. The software development tool is known as the HT-IDE3000, which includes features such as real time emulation, full memory and register access, hardware breakpoints complete with logical setups, trace analysis etc. The range of development tools ensure that designers have all the resources at hand to provide for rapid and efficient design and debug of their microcontroller based new product applications.
Holtek Semiconductor

PC Cards with integrated NVRAM for extended temperature
Hilscher has enhanced its CIFX PC-Card family by special types with integrated NVRAM for secure data storage. Especially designed for compact IPC or HMI terminals those cards are available in “Low Profile PCI express” and “Mini PCI Express” format. In addition to Fieldbus or Real-Time Ethernet communication the user can freely access a 128kByte non-volatile memory. Thus in case of a voltage loss his key data will remain available. The cards are also available for extended temperature, same as for the complete CIFX family. Due to loadable firmware and software licenses the same hardware can alternatively be used as Master or Slave. For Real-Time Ethernet 11 different protocol variants can be used on the same PC-card. All protocols use the same application interface and data exchange will be done via Dual-Port-Memory or DMA. A complete software package is always included in the scope of delivery.
Hilscher Gesellschaft für Systemautomation
www.hilscher.com

Dual 12-A PoL modules offers 30 percent reduction in board space
GE’s Critical Power business has introduced the company’s uDXS1212 non-isolated point of load (PoL) DC-DC board-mounted power module which claims to offer an industry-leading 30 percent reduction in board space over previous and competing solutions. The new DLynx Series power modules include GE’s PMBUS interface for digital configuration, communication and control, as well as adaptive voltage scaling for power reduction. The features provide exceptional power density in a single, flexible module. The new uDXS1212 power module offers original equipment manufacturers (OEMs) a high-density solution by utilizing two 12-amp parts in a single module instead of two individual modules. This greatly reduces the amount of board space required for installation of the module. In addition, the module provides exceptional current de-rating over temperature, which enables the device to achieve full load (up to 85 degrees Celsius) without external airflow for most application voltages. The uDXS1212’s industry-standard PMBus interface and space-saving Tunable Loop technology deliver leading current density for a broad range of applications including data communications, telecommunications, storage, industrial, medical and military infrastructure equipment. The uDXS1212 POL modules have a broad input range of 4.5 V to 14.4 V and a precisely regulated output voltage from 0.51 VDC to 5.5 VDC. The PMBUS digital interface supports a wide range of commands including on/off, trim, margin, power good, rise time adjustment and input under voltage lockout. Digital interface also offers output voltage, current and temperature measurement capabilities. The module supports 12 A at 1.2 V up to 80 degrees Celsius without airflow and is interleaved 180 degrees out-of-phase to reduce input ripple when both outputs are operating.
GE’s Critical Power
www.dlynx.com

Robot automates NFC testing
NFC Forum standards harmonize quite a few related specifications to form a universal NFC ecosystem, thus enabling interoperability. An NFC Forum compliant device has to support all different NFC technologies with a large number of possible parameter sets. This becomes especially apparent when testing the RF performance at physical level. Although only about 30 test cases have been specified for the RF interface, the variety of parameters and antenna positions sums up to about 3,500 individual test executions. Running this vast number of test cases manually is a time-consuming effort. Even worse, it is also tedious and error prone. Comprion’s new NFC Robot extends the company’s UT³ Platform to a comprehensive and automated solution for RF analogue testing. The 6-axis robot allows for the testing of NFC devices regardless of their size or shape. This also enables testing not only mobile devices but also other consumer electronic goods such as TV sets for instance. An additional benefit is the possibility to emulate natural movements like the swipe of a hand to and away from the reader.
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www.comprion.com

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Comprion
www.comprion.com
**Cross-platform application development framework works on all leading platforms**

Digia has launched version Qt 5.2 of its cross-platform application development framework. By adding support for Android and iOS to its extensive range of desktop, mobile and embedded operating system platforms and enhancing its core performance and functionality, Qt 5.2 is claimed to be the only cross-platform development framework for UI and non-UI creation to enable intuitive platform-independent software applications no matter the target device or screen size. Under the Qt Enterprise offering, Qt 5.2 opens the door to increased mobility of enterprise applications, supporting enterprise-ready multi-screen applications that users can experience from desktop to smartphone to automobile to TV. In addition to Android and iOS support, Qt 5.2 also introduces Qt Cloud Services, developed to address the cloud computing needs of enterprises and developers, with data storage and user management. The Qt Cloud Services allow users to develop, test, deploy and manage applications with one Qt. Qt 5.2 also includes a new JavaScript engine and Scene Graph renderer that further improve the functionality and performance of Qt Quick QML. New modules for Positioning, Bluetooth and NFC have also been introduced, as well as a bundled-in Qt Creator 3.0, the Qt integrated development environment (IDE). The new application development framework supports 15 leading operating systems.

**Digia Qt**

[http://qt.digia.com](http://qt.digia.com)

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**Qi compliant wireless power receiver IC reduces heat generation by 30 percent**

Toshiba Electronics Europe (TEE) has launched a wireless power receiver IC that complies with Qi Standard Low Power Specifications version 1.1. The TC7761WBG will be used in wireless power supply applications, such as smartphones and mobile accessories. ICs used in mobile applications including smartphones, are required to generate heat at low level, to prevent overheating. The TC7761WBG is fabricated with a combined CMOS-DMOS wafer process that cuts heat generation to 70% that of an equivalent product while achieving 95% power conversion efficiency. The IC’s built-in protocol authentication circuit, includes a foreign object detection (FOD) function, eliminates the need for an external microcontroller and contributes to simplified system designs. TC7761WBG has been Qi certified for an output power of 3.5 W, and can handle a maximum output power of 5 W. Shipments of mass produced chips are now available to buy.

**Toshiba**

[www.toshiba-components.com](http://www.toshiba-components.com)

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**Micronas takes ARM 32-bit core to brushless DC motor controls**

Sensor system manufacturer Micronas has licensed the Cortex-M3 32-bit RISC processor from ARM Ltd. for its next generation of brushless DC motor control solutions in a single IC. These ARM-based motor controllers will complement Micronas’ existing line of 8051-based devices and enable solutions that require more intelligence. The Cortex-M3 processor with its deterministic 3-stage pipeline provides an ideal blend of high performance and instruction efficiency the company’s experts find - in particular due to the use of the Thumb-2 instruction set, hardware divider, and single-cycle multiplier. The processor is also equipped with essential microcontroller features, such as low latency interrupt handling, integrated sleep modes, debug and trace capabilities, as well as best-in-class software development tool chain. The company’s embedded controllers for use in automotive and industrial applications are single chip, high-voltage controllers with flexible peripherals and direct motor driving capabilities. The various integrated digital and analog components include comparators, diagnosis and protection functions, programmable gain amplifier, A/D converter, communication interfaces, direct 12 V operation regulators, as well as power bridges. These features make the system lighter in weight and save important space within the application which enables a compact and cost-effective motor system design. These embedded controllers further support various commutation schemes and can either be operated in a sensor-less or sensored mode in conjunction with the company’s HAL 2xy and HAL 5xy switch or 2D rotational encoder families. Typical applications for smart actuator system solutions include DC motor drives, fans and pumps.

**Micronas**

[www.micronas.com](http://www.micronas.com)

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**25mm THIN Mini-ITX with Core processor targets space-limited embedded application**

Advantech has developed an industrial-grade THIN Mini-ITX motherboard, AIMB-230, supporting the latest dual core Intel Core i5-4300U and Intel Core Celeron 2980U processors with BGA1168 socket. The AIMB-230 is a low profile Mini-ITX design of only 25mm in height with a wide variety of I/O functions to fulfill an assortment of space-limited applications. AIMB-230 can be applied in the many embedded applications such as nursing carts, slim panel PC, slim signage box, vending machines, small POS systems and portable media devices. The AIMB-230 incorporates the 22nm Intel Core i processor architecture, which supports a dual-core single-chip processor (MCP) with best-in-class energy saving within a 15W TDP. Only 25mm in height, AIMB-230 offers a variety of I/O connections. It also integrates a 3D GT3/GT2 graphics chipset which provides high-quality, high-resolution three-screen output (DP / HDMI, DP + +, LVDS / eDP), coupled with HD Audio codec support and supports up to 16GB of DDR3L 1600MHz low power memory. The AIMB-230 comes embedded with iManager, an intelligent self-management firmware agent, which gives applications smart self-control, resource management, and auto-protection features to enhance security and system reliability, and simplify integration and configuration.

**Advantech**

[www.advantech.eu](http://www.advantech.eu)
46 Electronic Engineering Times Europe January 2014

QuickLogic offers sensor hub for mobile devices

Former FPGA vendor QuickLogic has developed a sensor hub IC that provides multi-axis context awareness at approximately 1 percent of a mobile phone’s system power budget. This allows sensors to be always-on and to be ready to sense when a phone has been picked up and to be switched on automatically, the company said. The ArcticLink 3 S1 integrates a combination of hard logic and reprogrammable fabric. The Sensor Manager block communicates with multi-axis sensors such as accelerometers, magnetometers, gyroscopes, ambient light sensors, and pressure sensors, sampling and buffering multiple seconds of the sensor data. It is a microwcoded state machine and features an I2C controller. The Flexible Fusion Engine (FFE) is intended to filter and interpret sensor data before sending information up the line to the host application processor. The FFE is a microwcoded finite state machine plus microcontroller ALU for processing sensor data. When coupled with the FreeMotion software from Sensor Platforms this allows the delivery of such functions as: change detector, pedometer and background magnetometer diversity. As well as the sensor hub IC QuickLogic provides a software tool for developers to define, simulate and map their algorithms to the FFE.

QuickLogic Corp.
www.quicklogic.com

Colour light measurement sensor targets process automation

EMX Industries has introduced the LEX-1000 colour light measurement sensor, designed to provide fast, high-resolution comparative measurements of the colour characteristics of a variety of light sources and illuminated objects. The introduction of colour light sensing technologies within industrial automation environments allows personnel to conduct real-time verifications of colour accuracy, quality and consistency for manufactured light sources and illuminated products, with increased throughput and improved sorting and production efficiencies. In contrast to traditional optical colour sensors that measure the light reflected from a target, the LEX-1000 proprietary optics focus the light emitted by the product onto a sensitive RGB photodiode, where it is then read and analysed for its respective red, green and blue (RGB) composition. The RGB reading is then automatically compared to pre-programmed parameters. If readings of all three colours fall within these parameters, the LEX-1000 sensor issues a discrete signal to indicate a colour proper match. Supplied PC-based ColorMax Windows application software provides comprehensive sensor configuration capabilities, file management and real-time analysis and evaluation, displaying the measured values as bar graphs (for absolute values) or pie-charts (for relative value). The sensor is supplied with the software, mounting hardware, interface cables, 12–30 VDC power supply, and an I/O board with status indicators. The LEX-1000 works with a variety of user-supplied light sources and provides four unique programmable colour recognition channels; three 0–5 V analogue outputs for red, green and blue (RGB); four discrete outputs; and USB or RS-232C serial data output. Tolerance is programmable from 0.5% to 50%, high-speed sampling frequency is 20 kHz, and the recommended operating distance is from 50mm to 600mm, depending upon source intensity. The sensor offers a fast response time, programmable averaging for 1 to 64 readings, a teach function for RGB values from 1%–100%, and external triggering. Operator lockout prevents unauthorized changes. Additional features include reverse polarity and overcurrent protection, an operating temperature range of -10° to +55°C, and an IP67-rated M30 316 stainless steel housing with a 12-pin IP67-rated connector and glass lens/window for enhanced survivability within demanding environments.

EMX Industries
www.emxinc.com

To win: four RX62N evaluation platforms

To offer you a good start in 2014, Renesas Electronics Europe is giving away four demonstrations kits worth 325 Euros each, for EETimes Europe’s readers to win. Designed as an evaluation and demonstration tool for the company’s RX62N microcontrollers, the RX62N RSK (part number R0K5562N0S000BE) provides users with a powerful debug and demonstration platform targeted at common applications. The board will also be a useful platform for evaluating the Renesas suite of development tools for coding and debugging, using the High-performance Embedded Workshop (HEW) IDE as well as programming the device using the on-board SEGGER J-Link debugger. The kit includes a CPU Board, a detachable LCD display module, a detachable AD adjustment shaft, the E1 Emulator, a connection cable (USB Cable, User Interface Cable), and a multi-region 12V power supply. The package is complete with a quick start guide and a CD-ROM including the user manual, tutorials, the HEW IDE, a C/C++ compiler package for the RX family (evaluation version) and an E1/E20 emulator debugger.

Check the reader offer online at www.electronics-eetimes.com
800 MIPS dual-core floating point MCUs have low latency for real time control

Texas Instruments has launched a new family of dual core 32-bit microcontrollers for real time applications. The C2000 Delfino 32-bit F2837xD microcontrollers have dual-core C28x processors, multiple embedded nuclei and dual real-time control accelerators, also known as control law accelerators (CLAs), from 800 MIPS of low latency floating-point performance. Designers can also reduce complexity by consolidating multiple embedded processors into a single MCU for applications requiring real-time signal analysis, such as high-end servo drives, solar central inverters, industrial uninterruptible power supplies (UPS) and more. Customers can precisely control and monitor multiple feedback inputs simultaneously with the Delfino F2837xD MCU using powerful analog peripherals integrated on-chip. By providing four independent 16-bit analog-to-digital converters (ADCs), the F2837xD MCU is able to precisely and efficiently manage multiple analog signals, which enables overall system throughput for solutions such as the monitoring of three-phase motors. Designers can also safely shut down their motors with the integrated windowed comparators, which provide critical power stage protection, while the sigma delta demodulators allow direct interface to isolated converters providing noise immunity for the MCU. The Delfino F2837xD MCUs are the first devices in a series of innovative C2000 MCUs that will be pin- and software-compatible and provide varying performance ranges capable of addressing different performance requirements in a product line.

The microcontrollers eliminate the need for multiple embedded processors with 800 MIPS combined performance from dual C28x cores and dual CLAs and off-load main CPUs (C28x cores) from demanding control loop analysis with two real-time control accelerators, or control law accelerators (CLAs), creating additional bandwidth, allowing the main processor to focus on system diagnostics or applications management. Texas Instruments

www.ti.com

Infrared (850 nm) LED chip offers high photoelectric efficiency

EPISTAR LAB has developed an infrared (850 nm) LED chip which has achieved a wall plug efficiency of 75% with an operating current of 40 mA and greater than 70% at 350 mA. The SFPN42 is a 1x1mm² chip offering power that exceeds 1W and has reached 1027mW with the operating current of 1A which provides the LED chip with energy saving and eco friendly benefits. The infrared products are targeted at the security monitor, smart touch panel and wireless communication systems.

EPISTAR LAB

www.epistar.com

Wireless MCUs draw only 18mA when transmitting at +10 dBm, 50nA in standby

Silicon Labs has expanded its family of 8-bit Si10xx wireless microcontrollers (MCUs) with two new options optimized for both cost-sensitive and performance-intensive designs. By combining the company’s energy-efficient 8051 MCU technology with its sub-GHz EZRadio and EZRadioPRO transceivers in a 5x6mm QFN single-chip solution, the Si106x and Si108x wireless MCUs support worldwide frequency bands from 142 to 1050MHz with low-power sleep and active modes for extended battery life. The devices feature a priority crossbar decoder that gives designers complete control over a variety of functions including a 10-bit analogue-to-digital converter, dual comparators, four 16-bit timers as well as UART, SPI and I²C serial interfaces. This flexible crossbar configurability eliminates the trade-offs that often must be made with small packages. The EZRadioPRO transceiver offers a higher sensitivity of -126 dBm and a higher output power of +20dBm for long-range applications. Its 60 dB adjacent channel selectivity with 12.5 kHz channel spacing ensures robust operation in harsh RF conditions. The EZRadioPRO transceiver offers frequency coverage in all major bands up to 1050 MHz and supports data rates from 100 bps to 1 Mbps. The devices are available with flash memory scaling from 8 to 64kB, and 768 bytes to 4kB of RAM.

Silicon Labs

www.silabs.com

AC/DC medical power supply saves energy

Mean Well has introduced a 600 W AC/DC medical enclosed type power supply in response to the high wattage requirement of reliable medical power supplies. The MSP-600 series comply with international medical safety regulations (MOOP level) and feature with low leakage current (</-300 μA at 264 VAC), hence, they provide power solutions for non-patient contact medical applications. Thes units also possesses no load power consumption under 0.8 W, five years warranty, and EMI Class B level compliance so they can be used in all kinds of ‘green mode’ medical equipments or electric devices and fulfill the energy-saving requirements for end systems. The unit takes an universal 85 to 264 VAC input and provides 3.3V to 48V output voltage options and possesses up to 89% of high efficiency. It can be forced air cooling by built-in DC fan for full load operation at -40°C to +50°C ambient temperature, and even up to +70°C by suitable derating. Other standard functions include protections for short circuit, overload, over voltage, and over temperature, 300 VAC input surge immunity for 5 seconds, remote ON/OFF control, remote sense, fan ON/OFF control, and DC OK signal output. In addition, to meet the requirement of higher wattage application, the models of MSP-600-24/36/48 equipped with parallel function and can be operated up to four units in parallel. MSP-600 series comply with global medical certificates per UL/ CUL/ CB/ CE that ensure users’ safety.

MEAN WELL

www.meanwell.com
LED-backlit 27” monitor delivers 2560x1440 pixels of resolution

Display specialist AOC has released a LED-backlit 27” (68.6 cm) Super PLS monitor featuring a WQHD (Wide Quad High Definition) resolution of 2560x1440 pixels for demanding home users and professionals. With nearly twice as many pixels as conventional Full HD models, the display has a response time of only 5ms. Super PLS (Plane-to-Line Switching) is a display technology with especially high brightness and wide viewing angles. The q2770Pqu’s top-notch panel thus delivers stunning colour stability from viewing angles of up to 178° (both vertical and horizontal) and a luminosity of up to 300 cd/m² for use in environments with bright ambient light. The PLS model receives signals via VGA, DVI-D and HDMI sockets and in addition features a DisplayPort. The unit comes with speakers and a USB hub integrated in its bezel. Pen drives, digital cameras, hard drives and countless more USB gadgets can be connected via four sockets (two conforming to the USB standards 2.0 and 3.0 each). The monitor stand offers full ergonomic flexibility, including 130 mm height adjustment as well as tilt, swivel and pivot (portrait mode 90° rotation) functions, allowing working comfortably on large tables, documents or photos editing.

AOC International (Europe) B.V.
www.aoc-europe.com

7/16 DIN coaxial connectors support high power communications applications

L-com has released a full line of 50 Ohm 7/16 DIN coaxial products for use in high power wireless communication systems such as cellular network antenna systems. The robust coax products are designed for the harshest environments. L-com’s 7/16 DIN product line includes connectors for 400 and 600 series low loss cable, within series and interseries adapters, caps, 400-series and 600-series cable assemblies and 1/4 wave coaxial lightning protectors. Competitively priced, the new products are in stock and available for shipment. The cable can be customized upon request.

L-com
www.l-com.com

Regulated DC-DC converter provides 3-kVDC isolation for industrial automation applications

Murata has introduced the Murata Power Solutions MEF1 series of 1 Watt regulated DC-DC converters suitable for use in industrial, automation and instrumentation applications. The tightly regulated single output converters, rated to better than 1% of nominal output voltage, are packaged in a fully encapsulated single-in-line through-hole format occupying less than 1.17 cm squared footprint. The MEF1 converters are available with either 1 kVDC or 3 kVDC input to output isolation, the latter model having an enhanced immunity to voltage transients. Output voltage options are 3.3 or 5.0 VDC, with input voltages covering the popular nominal inputs from 3.3 to 24 VDC. Compared to previously available models, the MEF1 offers a 13% improvement in energy efficiency. Both the 3.3 VDC input and 3.3 VDC output options can operate over the full industrial temperature range of -40 to +85 degrees C without derating. Certification to the internationally recognized safety standard UL60950 is pending.

Murata Europe
www.murata.eu

ARM powered Kinetis miniature MCUs come in 1.9x2mm WL-CSP

Freescale Semiconductor is extending its Kinetis portfolio of microcontrollers to include Kinetis miniature (mini) MCUs, shrinking the devices into 1.9x2mm wafer-level chip-scale packages (WL-CSP) while maintaining the scalability and feature rich IP available across its entire Kinetis portfolio. The company’s Kinetis KL02 is included in this category. Leveraging WL-CSP packaging, Kinetis mini MCUs allow designers to dramatically reduce the size of their boards and products. Alternatively, space-constrained applications that previously couldn’t incorporate an MCU now can be upgraded to become smart applications, adding a new tier of devices to the Internet of Things (IoT) ecosystem. Kinetis mini MCUs span multiple cores and several families and offer a broad range of performance and memory options, starting with the ultra-low-power Kinetis L series MCUs at just 32 KB Flash and scaling up to the high-performance Kinetis K series MCUs with up to 1 MB Flash.

Freescale Semiconductor
www.freescale.com/KinetisMinis

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Freescale Semiconductor
www.freescale.com/KinetisMinis

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Freescale Semiconductor
www.freescale.com/KinetisMinis
Richardson RFPD offers 1 W power amplifier from Wavelex

Richardson RFPD has announced immediate availability and full design support capabilities for a new 1 W, wide-band, N-connectorized power amplifier from Wavelex. The WPA0006N offers wide frequency band operation, from 20 MHz to 600 MHz, with 50 Ohm impedance, and features 30 dBm P1dB, and 17 dB gain. It is versatile for a range of applications, including VHF, UHF, RF bench test, and fixed wireless communications. Gain flatness is +0.2 and typical VSWR is 1.5:1. The PA is packaged with precision machine housings in Wavelex’s IP-2 packaging. Wavelex products are 100% production-tested on all minimum and maximum electrical specifications.

Richardson RFPD
www.richardsonrfpd.com

Digi-Key adds quick-start wireless solutions from Bluegiga Technologies

Distributor Digi-Key has announced a global distribution agreement with wireless product maker Bluegiga Technologies. The company manufactures highly integrated wireless modules employing the latest wireless technologies, including Wi-Fi, Bluetooth, and Bluetooth Low Energy. Founded in 2000, Finland-based Bluegiga provides, easy-to-use, short-range wireless connectivity solutions to OEMs, device manufacturers, and system integrators. The company is known for its Bluetooth solutions, and its module firmware provides a simple interface for configuration of the device for specific design implementation. According to Mark Zack, Digi-Key vice president, global semiconductor product, “Bluegiga’s embedded solutions offer our customers a seamless interface through which to implement wireless functionality into their design.” Bluegiga’s products are used in a wide range of industries, including construction, utilities, healthcare, law enforcement, retail and transportation, among others.

Digi-Key
www.digikey.com

Avnet extends lifecycle support across EMEA

Avnet Services, the dedicated services business of Avnet Technology Solutions, and part of Avnet, has opened a new, state-of-the-art, EMEA lifecycle solutions facility in Tiel, the Netherlands. There, the company expects to carry out over 250,000 repairs annually and will cater to reverse logistics, support and depot repair for major original equipment manufacturers (OEMs) across EMEA. This expansion, coupled with additional new capabilities, enables customers and partners in the region to reduce costs and minimise risk in all stages of lifecycle management. Avnet Services’ enhanced lifecycle portfolio provides a broad range of solutions, including reengineering, redesign and reverse engineering for end-of-life (EOL) and existing products. Additionally, Avnet Services provides EOL component sourcing, lifetime inventory of EOL components, continued manufacturing of legacy products, and OEM and third-party component warranty management. Partners, customers and resellers can work with Avnet Services in the region to better manage every aspect of the equipment lifecycle, from financing to installation, repair, and eventually disposal.

Avnet
www.avnet.com

Touch-screen display expansion capes target BeagleBone

Premier Farnell has launched its first range of LCD expansion capes, named BB View, designed for use with the BeagleBone family of development boards. The BB View range of LCD expansion capes are available in two sizes; 4.3” and 7” displays, with a resistive touch-screen and provide full access to the BeagleBone GPIOs. The capes do not require any external power supply and for quick and easy set-up they are supplied with Linux QT demo for display and touch functionalities. Features include 24-bit TFT LCD modules, a 7”(800 x 480) or 4.3”(480x272) 4-wire resistive touch-screen, full GPIO expansion via two 46-pin connectors, five user switches, and two user-defined LEDs.

Premier Farnell
www.element14.com

FTDI Embedded Video Engine (EVE) available in distribution

For engineers who need to quickly implement a sophisticated user interface with minimum investment of time and effort, Mouser Electronics is now stocking FTDI’s FT800 Embedded Video Engine (EVE) integrated circuit. The FTDI FT800 Embedded Video Engine (EVE) is a high quality graphics chip with 3-in-1 functionality for graphical user interface (GUI) development. The FT800 combines display, audio, and touch operations into a single chip, providing an optimised solution that reduces power, board area, and bill of material (BOM) costs; a complete solution to create interactive displays. Targeting intelligent QVGA and WVQGA TFT display panels, EVE’s object-oriented approach renders display images in a line-by-line manner with resolution of 1/16th of a pixel, eliminating the expense of traditional frame buffer memory. The FT800 interfaces to the system microcontroller by a low bandwidth serial interface, allowing for lower cost MCUs to be used in the design. The controller supports 4-wire resistive touch sensing with built-in intelligent touch detection and an embedded audio processor that allows MIDI-like sounds, combined with pulse code modulation (PCM) for audio playback. Mouser is also stocking complementary development boards for use with the FT800, including the credit-card sized VM800C board series that comes in 3.5, 4.3, or 5-in. LCD display with a 4-wire resistive touch screen. The VM800B series is similar and is designed for easy mounting inside a bezel. Both have a USB micro-B port which can also power the board.

Mouser
www.mouser.com/new/ftdi/ftdi-TFT800EVE/
Safe and secure at any speed?

By Robert Dewar

FOUR TECHNOLOGY TRENDS have come together to make the challenge of building safe cars more and more difficult.

Embedded processors are now so inexpensive that software is taking over functions such as braking, which were once achieved solely by mechanical means.

We expect cars to do more and more on their own. GPS systems, adaptive cruise control, lane following, and automatic parallel parking are features found on many high-end cars today.

We are moving towards more sophisticated power systems, including fully electric cars and hybrid engines that require more elaborate control systems.

We have to worry about security as well as safety. Any system where a bug can cause loss of life can potentially be hacked to deliberately cause such an accident.

As a result of these trends, modern cars contain an extraordinary amount of on-board software. Published figures suggest for example that the Chevy Volt has more lines of embedded code than the advanced Boeing 787 “Dreamliner”. And like the software on an airplane, automotive systems are safety critical: an error can directly cause serious accidents. Unfortunately, news of software-related problems don’t create hazardous conditions. In the case of avionics, DO-178B calls for unexpected transmission shifts. Of course automobile manufacturers are starting to emerge; for example the recall of the 2013 Buick LaCrosse and Cadillac SRX because of unexpected transmission shifts. Course automobile manufacturers are hardly eager to publicize such things, so there may be many more issues that we don’t know about.

So what should be done? First, we should not be too pessimistic. The experience from other safety-critical domains, such as avionics systems, is rather impressive: no one has died as a result of a software error. Systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate that our systems are secure.

“How do we go about developing software that we can trust to not create hazardous conditions?”

“safety culture” ethic that has characterized the aviation industry since its inception. Analogously, you might presume that automotive software is subject to satisfying the requirements of a comparable rigorous standard. Well if you presume that, you will be disappointed. Automotive software is developed by the manufacturers or their suppliers, and, somewhat surprisingly, no meaningful external standards are imposed to certify the resulting systems. The software is regarded as strictly proprietary, and no external party can examine it closely to understand what it is doing. This may seem a bit shocking, but it’s not so easy to impose such external standards.

So how do we go about developing safe software – i.e., software that we can trust to not create hazardous conditions? In the case of avionics, DO-178B calls for a well-defined set of verification activities, with a focus on testing, to make sure the software satisfies its requirements. But is rigorous testing enough? Not when it comes to security. I recently saw a rather frightening demonstration where a CD was inserted into the CD player of a current production car. It played beautiful music, but as a side effect totally disabled the steering wheel. Now that Wifi and Bluetooth connections provide additional entry points to the software of a car, we need to be able to demonstrate that automotive systems are immune to this kind of hacking.

Testing can never convince us that systems are secure; we can’t try every possible attack that anyone will think up in the future. Instead, we have to demonstrate with confidence that the software contains no vulnerabilities that could be exploited to create a safety hazard. This can only be achieved by the use of formal methods, which allow us to prove, with mathematical rigor, important properties of a program. The ability to prove individual properties is achievable today, partly because of better software and proof technologies, and partly because of the enormous computing power available for running automated proof systems. Programming languages play an important role here.

Robert Dewar is President of AdaCore – www.adacore.com
A leading reference resource for electronics engineers, EE Times Europe’s White Paper library includes over 600 white papers, application notes, technical articles, books and case studies that can be downloaded free of charge. The latest featured papers are available below.

4-20 mA, Loop Powered, Thermocouple System Using ARM

The circuit note describes a complete loop powered thermocouple temperature measurement system. The PWM function of a precision analog microcontroller controls the 4 mA-to-20 mA output current. This circuit provides a low cost solution to temperature monitoring because most of the circuit functionality is integrated into the ADuCM360 (or ADuCM361) precision analog microcontroller.


Managing Electrical Complexity with a Platform Level Approach and Systems Engineering

In this competitive and challenging environment, thought-leaders are recommending a shift to systems engineering. Using a systems engineering approach could help OEMs maintain product quality, reduce costs, manage change, and achieve time to market. This paper talks about applying systems engineering principles using the Capital tool suite to address these issues.


Using Next Generation Power Firmware to Simplify Energy Star Compliant Designs

Exar’s PowerXR programmable power management system provides a cost effectice and easy to change solution for ENERGY STAR rated products both in the USA and worldwide. The ability to configure the power system via an easy to use GUI allows ENERGY STAR compliance to be quickly achieved for idle and standby modes. Even as late as 2007, different countries have had different views as to how to address the need for driving manufacturers to design more power efficient products. In order to promote trade a common set of specifications, procedures and labeling have been created by many countries so that consumers can readily identify the efficiency of various products.


UltraCMOS Semiconductor Technology Platforms: A Rapid Advancement of Process & Manufacturing

For more than 20 years, Silicon-on-Sapphire (SOS) technology—an advanced form of Silicon-on-Insulator (SOI) processing—has been used in semiconductor manufacturing. Recently, SOS in the form of UltraCMOS technology has been designed into high-volume applications that have made it the technology of choice for several demanding RF applications. For more than 20 years, Silicon-on-Sapphire (SOS) technology—an advanced form of Silicon-on-Insulator (SOI) processing—has been used in semiconductor manufacturing. Recently, SOS in the form of UltraCMOS technology has been designed into high-volume applications that have made it the technology of choice for several demanding RF applications.


Mixed Signal Design and Verification for complex SoCs

This paper describes the design & verification methodology used on a recent large mixed signal System on a Chip (SoCs) which contained radio frequency (RF), analog, mixed-signal and digital blocks on one chip. We combine a top-down functional approach, based on early system-level modelling, with a bottom-up performance approach based on transistor level simulations, in an agile development methodology.


An Introduction to Rigid-Flex PCB Design Best Practices

Designers increasingly face project requirements for densely populated PCBs including pressures to reduce manufacturing times and costs. To meet these requirements, design teams have increasingly turned to 3D rigid-flex circuits to meet their project’s performance and production requirements. Designing for rigid flex presents a number of challenges to electronic and mechanical design teams. This Altium whitepaper lays out some of the golden rules for successful rigid-flex PCB design.

650V TRENCHSTOP™5
A Technology to Match Tomorrow’s High Efficiency Demands

The TRENCHSTOP™5 IGBT technology from Infineon redefines the “Best-in-Class IGBT” by providing unmatched performance in terms of efficiency. When high efficiency, lower system costs and increased reliability are demanded, TRENCHSTOP™5 is the only option. The devices deliver a dramatic reduction in switching and conduction losses whilst also offering a 650V blocking voltage.

Key features and benefits
- New benchmark in terms of Best-in-Class efficiency
- Lowest ever switching losses
- $V_{CE(sat)}$ more than 10% lower than previous generation
- Temperature stable $V_f$ value of free-wheeling Rapid diode
- 2.5 factor lower $Q_g$ compared to HighSpeed 3

www.infineon.com/trenchstop5