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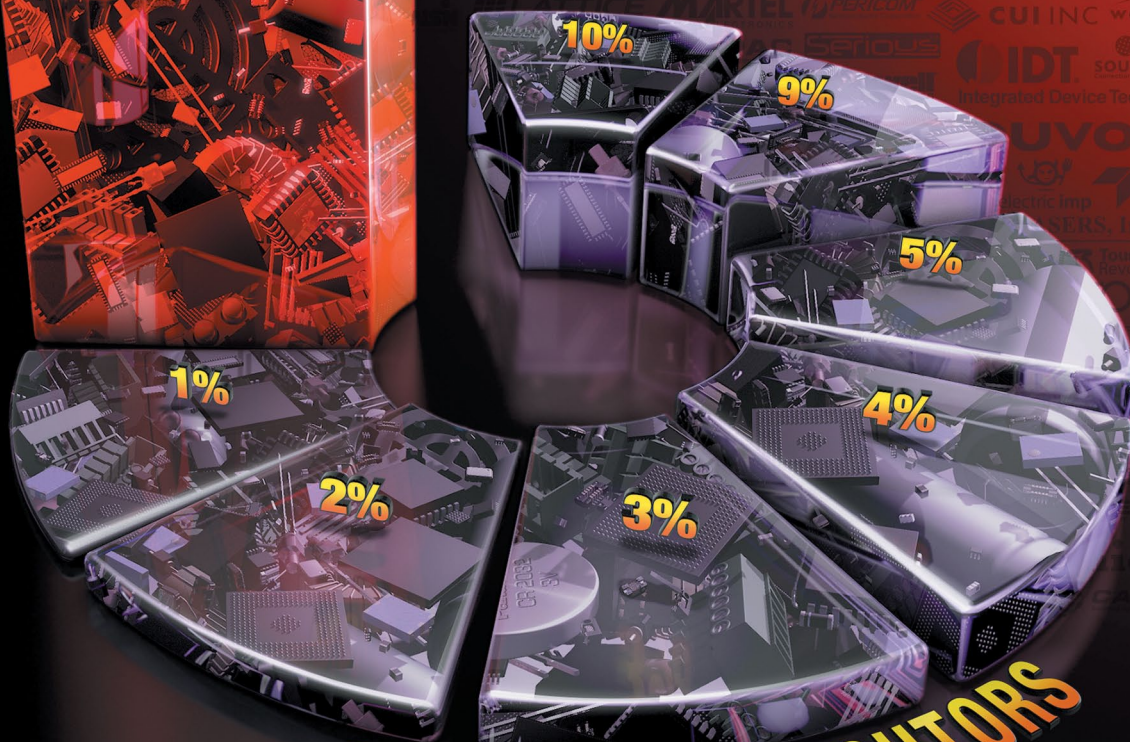
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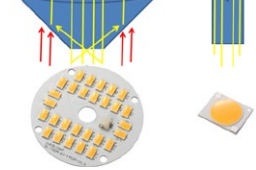

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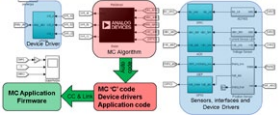
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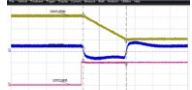
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Should Abu Dhabi build a MEMS fab?

By Peter Clarke

THE ABU DHABI PLAN to work with the chip company it owns, Globalfoundries, to build a wafer fab in the emirate, appears to have been on hold for a couple of years. But there are signs emerging that the plan could be revived with a change of focus to MEMS.

Some of you may remember that along with the creation of foundry chipmaker Globalfoundries in 2009 and 2010 by an investment vehicle of the Abu Dhabi government came a plan to set a wafer fab down there in the emirate.

Early in 2011 the plan was to break ground in 2012 for an \$8 billion Abu Dhabi wafer fab with chip production starting in 2015. However, after Ajit Manocha took over as CEO of Globalfoundries in October 2011 the plan went on to the back burner. This is despite sustained efforts to build up academic, semiconductor research and training efforts in the emirate.

But perhaps the Abu Dhabi government and Advanced Technology Investment Company (ATIC) – the investment vehicle that owns Globalfoundries – could dust off the plan and update it by inserting MEMS (micro-electromechanical systems) ahead of wafer fab.

The benefits are numerous, not least that the market for MEMS components is growing faster than the overall market for semiconductor ICs.

The next obvious benefit is that it would provide a much lower cost of entry into chip manufacturing for the United Arab Emirates. About \$500 million would allow the creation of a purpose-built 200-mm going on 300-mm wafer fab that could be the best in the world for the production of MEMS.

This would also allow Globalfoundries to focus its big spending – of the order of \$10 billion – in upstate New York where it must now be considering whether its next fab will be for the production of ICs on 450mm diameter wafers.

A third factor is somewhat double-edged and might be a source of contention.

Timing and location

The good news is that Globalfoundries already makes MEMS and so would be a good partner to carry such an Abu Dhabi plan forward. The bad news is that Globalfoundries makes MEMS in Singapore and that city-state might be lobbying to keep MEMS expansion there.

There is also the issue that by tradition MEMS production has moved into amortized facilities as IC production has moved out. To purpose-build a MEMS factory in Abu Dhabi would be ground-breaking on multiple fronts.

However there are signs that Singapore and Abu Dhabi are attempting to finesse this. It was announced in November that Singapore and Abu Dhabi research institutes and government economic agencies have agreed to establish a “twin-lab” to research MEMS aided by their commercial protégé Globalfoundries. However, this is R&D transfer to Abu Dhabi’s Masdar research institute, not full-blown manufacturing.



“Does a new-build MEMS fab make sense for Globalfoundries in a sector where the fabless-foundry business model is not yet fully established?”

The most significant cause of contention would be the possibility that Abu Dhabi and Globalfoundries have a different sense of urgency about this; one born of the difference between political and commercial interests.

The idea of building a shell for a MEMS foundry in 2014 for production in 2016 might make sense for the Abu Dhabi government and bureaucrats.

This would not be too far behind the original plan. The question is: does a new-build MEMS fab make sense for Globalfoundries in a sector where the fabless-foundry business model is not yet fully established?

I asked ATIC about plans they might have for a MEMS wafer fab and the response was: “We are committed to establishing a manufacturing and technology presence in Abu Dhabi, but have not established a concrete timeline or announced specific details about the facility.” There was no acknowledgement of my

MEMS reference.

I also asked at Globalfoundries. The response: “We are still committed to establishing a manufacturing and technology presence in Abu Dhabi, but we have not established a concrete timeline or announced specific details about the facility.”

Given the volatility in the world economy and the decline in global semiconductor demand due to economic conditions, we are reviewing our expansion plans to ensure they are fully aligned with customer needs.”

The first sentence shows unanimity. The second sentence shows a different emphasis.

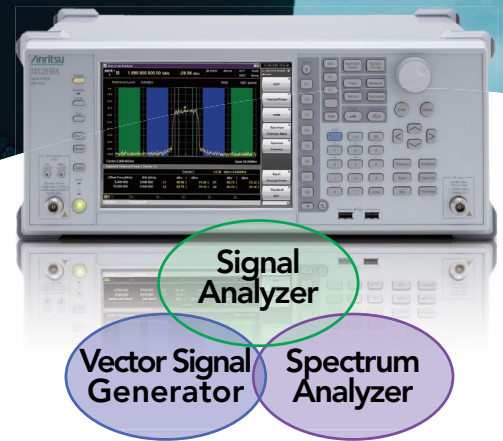
But, of course, Abu Dhabi sovereign wealth funds have deep pockets and ATIC is not obliged to pursue a MEMS wafer fab with Globalfoundries exclusively or at all. STMicroelectronics might make a suitable partner or a consortium might make sense.

However, this would also beg the question: “If a purpose-built MEMS foundry would make sense for Abu Dhabi why can’t the continent of Europe choose to afford to do something similar within Europe?”

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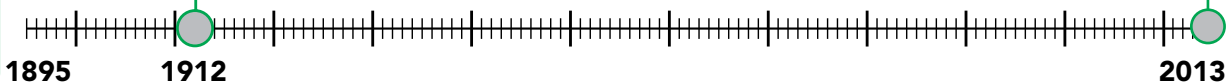
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Extendible processors go head to head backed by EDA giants

By Nick Flaherty

CADENCE DESIGN SYSTEMS' Tensilica and Synopsys ARC are going head to head in the market for embedded processors in system on chip designs. These devices can have as many as 30 controller cores outside the main CPU, handling data movement and signal processing with higher clock rates and higher memory bandwidth.

"There's been a very substantial shift in the market to people that want a lot more programmability in their data operations," said Chris Rowen, founder of Tensilica and now Fellow at cadence Design Systems following the acquisition in May 2013. "Down on the factory floor where the real work gets done there's an increasing shift to a smarter data plane to more programmable engines that are adapting more often under software control so you can choose your algorithms after the design of the chip. The data rates and energy budgets keep that out of the reach of the execution CPUs."

"Process technologies are so dense the small premium to make a programmable block is negligible, but it means people want to design it once and tape it out and not have to get back to it if they change the algorithm," he said. "These kinds of processors come much closer to reconciling the gap."

The latest Tensilica Xtensa LX5 is the tenth generation of the extendible architecture, but the first new core since the acquisition. "The acquisition was an important step forward in technology for extensible processors," said Rowen, "and a big validation of everything that we are working for as it reinforces that this is one of the key technologies."

The move has gone well, he says. "The whole team came across and Tensilica maintains its identity under the IP group of Cadence run by Martin Lund," he said. "We do a major release every 18 to 24 months so [the definition of] this processor goes back a couple of years and is pushing on data plane processing and efficiency. It brings leadership in the IP space especially in the need for better data plane processors and Tensilica is engaging with customers early in the design cycle and in product definition as a result."

The LX5 core is configurable over a wide range of pre-verified options including 10 different DSP choices that can also be extended with custom application-specific instructions, execution units, register files, and I/O. The pipeline of the processor is selectable with 5- and 7-stage versions, as well as an extended DSP pipeline up to 11 stages.

A lot of work has been done on the memory structures, says Rowen, with 'virtually unlimited' I/O bandwidth with multiple, wide, designer-defined FIFO, GPIO and lookup interfaces as well as dual load/stores up to 512-bit wide with data cache support and multi-bank RAM support.

"We have DRAM improvements in the data cache perfor-

mance particularly to reduce the latency for cache misses and improving the cache pre-fetch," he said. "We have also done some innovation in the banking memory to provide much higher bandwidth. In order to sustain the bandwidth you often need multiple banks for example 512-bit wide and you need to have two ports ready for these wide memories and a DMA channel so you have may have three 512-bit operations per cycle."

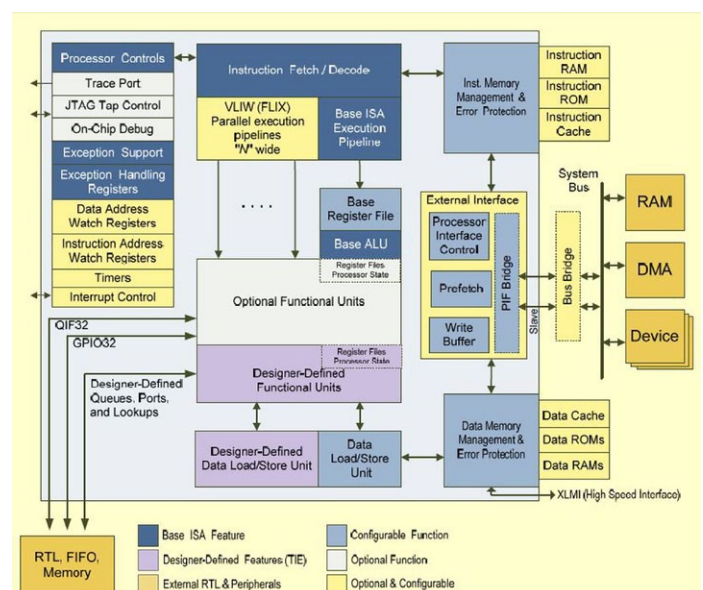
"We have also introduced more independent arbitration for banks, coalescing the reads so if it requires locations in the same bank it does a single read and gives the bits back from a single memory width, which makes the effective memory bandwidth higher," he said.

One new element is a semantic engine. "The vector processor operates on certain elements of a data word," said Rowen "In the past you needed to read the whole word and even if you updated one bit you had to re-write the whole word, so we have added this feature to enable and disable individual bit writes. That's part of the semantics engine. We have an operation that computes which bits you write and don't write so you can combine two operations for the same latency and the same power."

There has also been focus on fitting the processor into the rest of the chip, adding support for ARM's CoreSight debug interface. "One of the things we really work on hard was improving the debug and software integration,"



Chris Rowen, founder of Tensilica and now Fellow at cadence Design Systems.



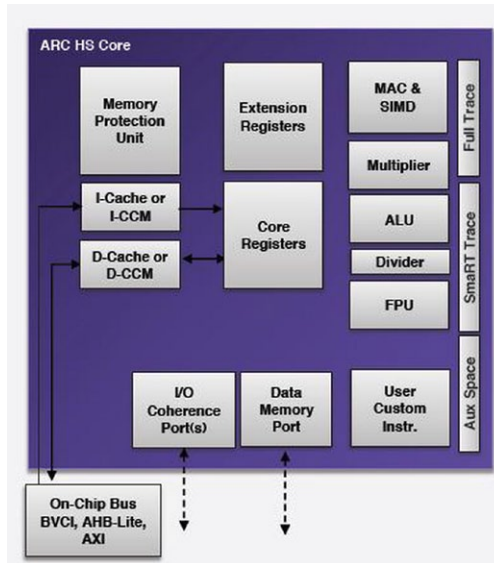
The LX5 core is configurable over a wide range of pre-verified options including 10 different DSP choices.

said Rowen. "It has a CoreSight compatible interface for performance monitoring so that fits nicely with the memory." This adds multi-core on-chip debug with break-in/break-out and works closely with Tensilica's Eclipse-based tool chain that is automatically generated for each core.

Synopsys has also enhanced its 32-bit ARC extendible embedded processor architecture to target the high memory bandwidth applications such as storage and digital TV and also added support for ARM infrastructure.

The ARC HS34 and HS36 processors are the highest performance ARC processor cores to date, handling 1.9 DMIPS/MHz at speeds up to 2.2 GHz. In a typical 28nm process the cores consume as little as 0.025mW/MHz in an area as small as 0.15mm².

The family uses the ARCV2 instruction-set architecture (ISA) coupled with a new ten stage pipeline that supports out of order instruction retirement, minimizing idle processor cycles and maximizing instruction throughput. Sophisticated branch prediction and a late stage ALU improve the efficiency of instruction processing and



Synopsys' 32-bit ARC HS extendible embedded processor architecture.

allow a deterministic response for real time performance says Mike Thompson, senior product marketing manager for ARC Processors and Subsystems.

SoC peripherals can be directly accessed by the CPU in a single cycle using native ARM AMBA AXI and AHB standard interfaces that are configurable for 32-bit or 64-bit transactions to optimize system throughput.

To speed the execution of math functions, the HS cores give designers the option to implement a hardware integer divider, instructions for 64-bit multiply, multiply-accumulate (MAC), vector addition and vector subtraction, and a configurable IEEE 754-compliant floating point unit (single or double precision or both).

The ARCV2-based cores provide an 18 percent improvement in code density compared to previous generation

ARC cores, reducing memory requirements and support close coupled memory as well as instruction and data cache (HS36 only), with new 64-bit load-double/store-double and unaligned memory access capabilities that accelerate data transfers.

Emergency steer assistant avoids collisions

By Christoph Hammerschmidt

If in road traffic suddenly an obstacle appears in front of the vehicle, drivers have to react within fractions of a second. In many cases, the natural response time of human drivers is too long and a collision renders unavoidable. The European interactive project (Accidence avoidance by active intervention for Intelligent Vehicles) now has developed an assistant system aiming at avoiding or at least mitigating such collisions.

The German Centre for Aviation and Astronautics (DLR) has tested an Emergency Steer Assistant developed within the scope of the interactive project. The system supports the driver in the case of an imminent crash by automatic steering motions. "If in urban traffic suddenly the door of a parking vehicle is opened or if on the highway a slower vehicle suddenly merges in front of you, such an emergency steer assistant can help to avoid a collision", says Prof. Karsten Lemmer from the DLR Institute of Traffic Systems Technology. In three simulator studies and a real-world trial with the FASCar test vehicle, the researchers investigated the interplay between drivers and the steering assistant.

The test drives have been conducted with the FASCar at a speed of 50 kmph (31 mph) on a straight test track. Abruptly, a cable pulled a large net across the road in a way that drivers had no chance to avoid a collision by merely braking. In this test situation the emergency steer assistant was able to perform a dodging manoeuvre at cyberspeed and managed to

avoid the collision. In addition, the behaviour of the assistant at higher speeds has been investigated at DLR's dynamic driving simulator. The test persons had to react to obstacles such as



cars that suddenly merged into the driver's track - a dangerous situation that frequently occurs on motorways. Multiple early warning concepts including acoustic or optical signals as well as assistant system parameters such as the intensity of the steering movement were tested.

The trials showed that such an assistant can help reducing the number of accidents with suddenly appearing obstacles. If a collision could not be avoided, its consequences could at

least be mitigated. The acceptance of the assistant among the test persons was good. Many drivers did not even realise that the system actively intervened or said afterwards they believed that they acted by themselves with a dodging manoeuvre to the obstacle.

Within the interactive project, the DLR collaborates with 30 partners such as BMW, Ford and Volkswagen in developing driver assistant systems for critical situations. Along with Volvo Technology Corp, the Centro Ricerche Fiat and Allround Team GmbH, DLR compiled significant findings for design and dimensioning of such collision avoidance systems. Currently the industry partners are working to implement such an assistant system for serial vehicles. A schedule for market introduction however has not yet been submitted.

How green is your code?

By Julien Happich

MID-NOVEMBER, French technology cluster Images & Réseaux was holding a one-day presentation of start-up companies at Rennes' École Supérieure de Commerce campus, under the banner "Loading the Future". The cluster's main fields of research include digital connectivity, image and data processing, digital infrastructures and software.

One project that particularly caught my attention was about so called software eco-conception and delivering the tools for coding energy-efficient software.

A Managing Partner for three-year old startup Kaliterre, Thierry Leboucq presented the Code Vert project (Green Code in French) as a way to extend energy-efficient coding practises beyond embedded software, to help reduce power consumption across billions of visited web pages.

Started in February 2012, the project came to light from a fairly simple observation: for consumers and equipment vendors, the power consumption of computers and internet-connected mobile devices is often considered from a hardware point of view, as if the software running on client devices and web servers had nothing to do with their final energy bill. Today, European consumers can make energy-conscious choices when buying white-goods or home appliances, among other things by reading the compulsory EU Energy Label applied to those.

Since it is mostly the software developed by publishers and integrators that is responsible for excessive power consumption but also for consumer electronics hardware obsolescence (when the hardware can't run fast enough to cope with inefficient or too heavy code), why not assess its efficiency and label it too.

Kaliterre is also an active contributor to the Green Lab Center, an association of companies and research centres dedicated to exploring new green coding practices and promoting software eco-conception at a national and international level. The Green Lab Center is conceived as a virtual environment with space for developers to experiment with green code and code optimization tools.

"With the Green Lab Center, we want to create the first observation platform for measuring the impact of internet usage patterns on power consumption" explained Leboucq who is also project leader for the Green Lab Center, "this could be by providing the tools to rank a website's energy efficiency versus the average of other assessed websites".



On most websites, between 10 and 20% of the energy consumed while browsing the pages is due to advertising alone, he noted. Then with a rigorous review of coding practices, between 30 and 40% of energy can be saved altogether between the server side and the client side of a website.

"In the future, we could envisage to give green-code labels to internet service providers or content providers running efficient code on their servers, or even to app developers and individual websites" Leboucq continued.

The idea behind this is also to raise internet users' awareness about their energy consumption on the net, with scores showing up directly into their browser's toolbar.

The Green Lab Center could also be well positioned to collect data on the power consumption of mobile applications, helping developers code in a more environmentally friendly manner.

In a recent study on mobile apps, Purdue University and Microsoft Research have shown that on free apps, about 75% of the energy consumption is dedicated to advertising-related software execution (for geolocation

and user-data manipulation to serve the right adverts). Such "free" apps are not your battery's best friend.

An interesting application derived from the Green Lab Center is the GREENISCORE, aimed at smartphones and tablets running Android. GREENISCORE is conceived as a fun application to increase the autonomy of smartphones and tablets. The app provides users with a performance score based on the actual use of their device, offering personalized advice to reduce energy consumption and increase battery life.

Using this application, Leboucq has seen his smartphone's battery autonomy increase drastically from one day to three days per charge. In the long run, that also translates to a lower energy bill. Users can also share their score online at www.greeniscore.com, the site displays additional statistics on the use and actual autonomy of smartphones (better than the manufacturer's fact sheet).

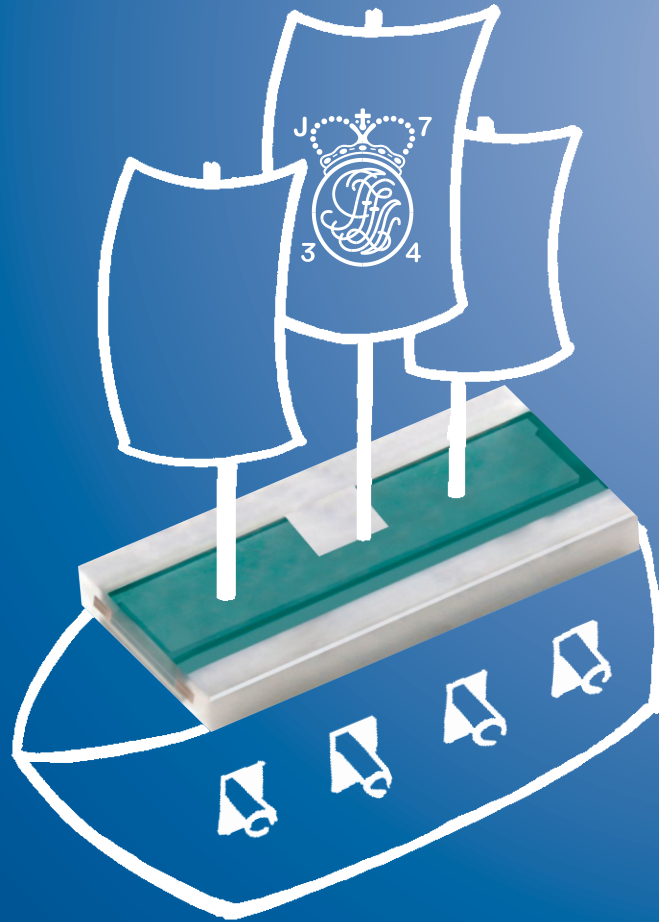
For better coding practices, Kaliterre - www.kaliterre.fr - has just come up with a new tool, Greenspector, capable of identifying "dirty" coding patterns that unnecessarily consume power, while offering equivalent coding solutions that maintain the software's quality of service, transparently.

The tool browses through thousands of lines of code to highlight consuming objects and report green code violations, it allows programmers to view key metrics of their software before offering alternatives. To do so, Greenspector digs into a robust repository of 250 green rules whose impact on power consumption has been measured and validated in several programming languages.

The tool can inspect java, java Android, css, html, JavaScript and PHP code. Developers can then score various programming solutions and correct the code on the fly.

Kaliterre also sees a business opportunity in offering consultancy services or offering access to a cloud-based tool for developers to use as SaaS, uploading their source code for inspection and optimization.

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Janusz Bryzek: the trillion-sensor man

By Peter Clarke

FRESH FROM CHAIRING the Trillion Sensor Summit held at Stanford University, Palo Alto, Calif. Janusz Bryzek, vice president of MEMS and sensing solutions at Fairchild Semiconductor, agreed to be interviewed by EE Times Europe.

Bryzek, who received his MSc and PhD degrees from Warsaw Technical University, is a well-known serial entrepreneur in the field of MEMS having co-founded SenSym, IC Sensors and NovaSensors in the 1980s. He founded Jyve Inc in March 2009 but it has never got out of stealth mode. Jyve was reportedly working on inertial MEMS technology prior to being acquired by Fairchild Semiconductor Inc. in November 2010.

Fairchild is not commercially involved in MEMS at present but its employment of Bryzek has led to speculation that the company is about to make a big-splash entry into the market. However, Fairchild has a long history of involvement in the MEMS sector, Bryzek pointed out. His company, NovaSensor, was financed by Schlumberger, which also owned Fairchild Semiconductor at the time.

Bryzek told EE Times Europe he is unable to discuss in detail Fairchild's re-entry into the MEMS business in 2014 but that the reason for Fairchild's interest in the market is straightforward: MEMS is a market that is growing much faster than conventional semiconductors and a market that is unlikely to stop growing any time soon. "MEMS is growth at around 15 percent per year – maybe 13 percent maybe 17 percent – while the overall semiconductor market is growing at 3 or 4 percent," he said.

This is the same motivation that led Bryzek to call into being and chair the Trillion Sensors Summit. "We wanted to try and foresee what sensor applications are going to push the sensor market from a few billion units per year to a trillion sensors per year within the next 10 years." Bryzek said that with that sort of growth MEMS could become 30 percent of the total global semiconductor market. That would make it worth in excess of \$100 billion per year compared to a value of about \$11 billion in 2012.

Abundance

Bryzek said that during his work towards the TSensors Summit he had been influenced by the book *Abundance* authored by Peter Diamandis and Steven Kotler. This book looks at exponentially advancing technologies and their markets and extrapolates that it will be possible to meet the basic needs of every man, woman, and child on the planet - see www.abundancethe-book.com. Networked sensors, or sensor swarms, are part of that vision.

The extreme growth rates that would be needed to take MEMS sensors towards the trillion count are quite possible, Bry-



Janusz Bryzek, vice president of MEMS and sensor solutions at Fairchild and chair of the Trillion Sensors Summit.

zek argues. He makes the point that the market researchers in 2007 missed how the market for MEMS in mobile equipment would achieve a compound annual growth rate of 222 percent over the next five years and go from 10 million units to 3.5 billion units.

Bryzek said that while the growth of MEMS in mobile phone would continue – with the addition of new sensor types – other markets were set to join in the explosion. He referenced the Internet of Things, digital health and context-based computing as likely areas. "While 70 percent of those trillions of sensors will be solving problems for us, at least 30 percent will be making life more fun," he argued.

Funding

But to get from where the world stands today to that visionary future will require financial investment and a return on that investment in the nearer term. This is another part of the motivation for the formation of the TSensors Summit: to help spell out the financial opportunities, Bryzek said.

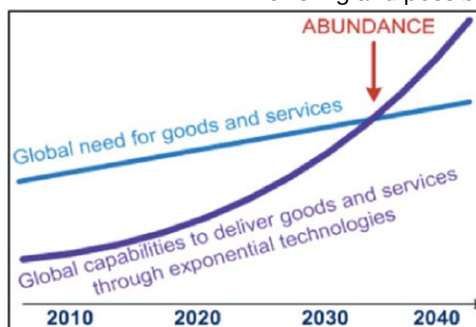
However, Bryzek believes the funding will come. Many sectors already see automated sensor networks as the solution to current problems. In health, current methods with an emphasis on cure rather than prevention are expensive and not sustainable as populations in more advanced nations continue to age. Medical insurance companies need little persuading to become involved in trials of personal and at-home diagnostic systems and their extension to personal therapeutics.

Similarly improved efficiencies in energy use, and energy generation are likely to pay for the creation and deployment of sensor network monitor systems, said Bryzek. "For example, some estimate about 30 percent of office building HVAC energy cost reduction when smart HVAC systems are installed, a very short ROI."

And the market opportunity is not just in the hardware of existing and possible future MEMS technologies. Some of

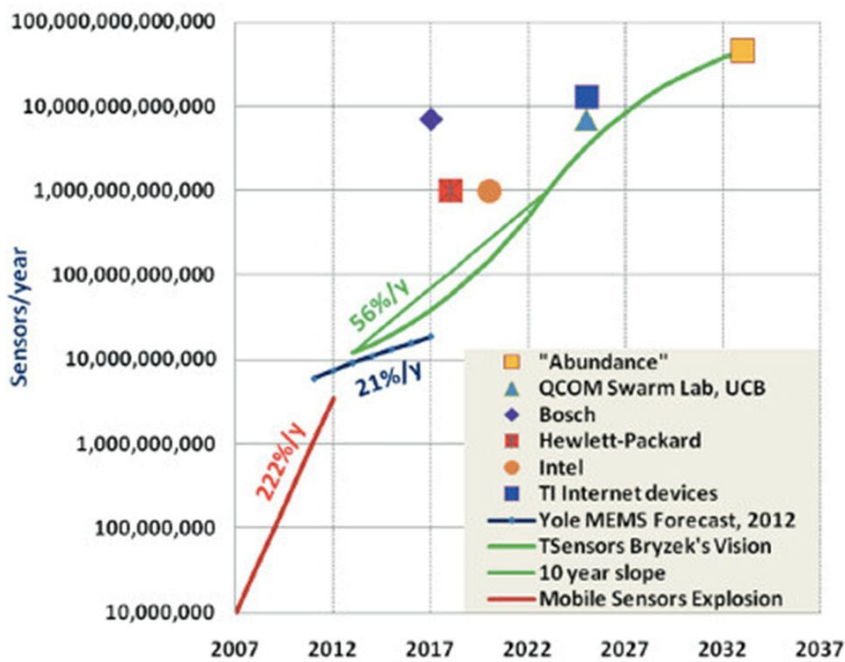
the strongest areas of development in MEMS are in things like sensor fusion and data fusion. Bryzek gave an example of sensor fusion with the use of pressure, gyroscope, accelerometer sensors working with satellite position finding in mobile phones. The ability to use results from multiple relatively inaccurate sensors to cross calibrate each other can result in highly precise and useful information. "Software is a much needed component."

An additional factor that is likely to help MEMS sensor growth is increasing maturity in manufacturing. "For many years the MEMS industry struggled with



So called exponential technologies could improve global delivery of goods and services and take the world into an era of abundance. Source: TSensors Summit.

Trillion Sensor Visions



Differences of opinion. Market research firms don't yet see the explosive growth forecast by Bryzek and others. Source: TSensors Summit.

one device, one process, one package, one test system. Then Analog Devices followed by STMicroelectronics started moving towards process platforms that could build multiple products. Now InvenSense is a fabless MEMS company that is opening its standard processes to others and has had several multiproject wafer runs," said Bryzek.

With foundries such as Taiwan Semiconductor Manufacturing Co. Ltd. and Globalfoundries Inc. entering into MEMS manufacturing there is the potential for the fabless-foundry business model to develop along similar lines to those followed in conventional ICs, albeit with multiple manufacturing platforms, rather than a single dominant CMOS offering.

However at the same time Bryzek thinks that novel materials and manufacturing methods will also be significant in the future of MEMS. "This could involve 3D-printing of semiconductor sensors and packages. It may be possible to print VLSI sensor arrays, batteries and energy scavengers using roll-to-roll manufacturing."

There is no doubt a trillion sensors per year would be enough volume to persuade companies to build dedicated facilities rather than just repurpose older 200-mm wafer fabs.

Bryzek estimates that one trillion sensors in silicon would require 130 million 200mm diameter ASIC wafers and 260 million 200mm MEMS wafer. If they were constructed using 3D printing methods using a 12mm by 25mm strip one trillion sensors would require 300 million square meters of substrates.

So what could prevent Bryzek's vision of an abundant MEMS-enabled future?

"Energy is a challenge. To power trillions of sensors requires energy and per unit it will have to be reduced

from today's levels. It will need to be derived from light, vibration, thermal energy scavengers. Particularly we need to reduce the energy to power radios by a factor of 100 to allow them to be powered by scavenging," he said.

But radio communication is also likely to be a challenge. "There is not enough bandwidth to support a trillion discrete radios. The wireless center at University of California Berkely is working on next-generation wireless technology but many technologies will resist quick development." And then there is the data processing that a trillion sensors implies.

However, overall Bryzek feels the biggest challenges may come from legal and moral issues and public resistance to what could be massive social change but a change that may be required to provide the necessities of life to all on this planet. Bryzek said there would clearly be privacy issues where sensor swarms could detect brainwaves and other cues to extract information about a subject's mood.

Sensor roadmap

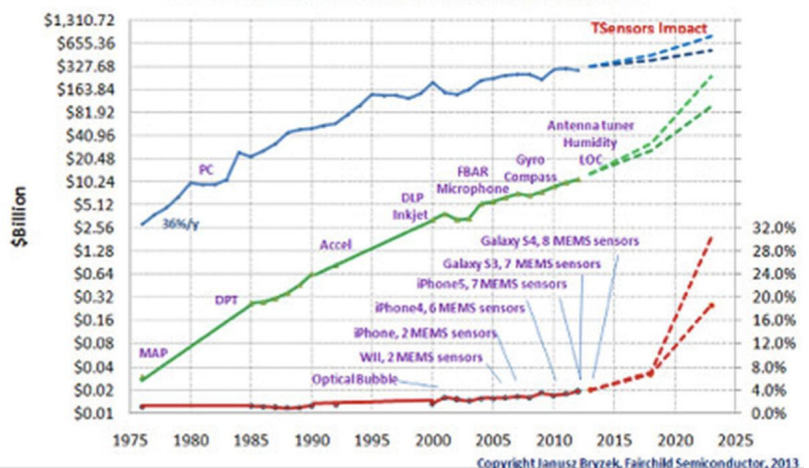
Bryzek states that one purpose of the Trillion Sensor Summit was to develop a roadmap for MEMS and sensor development to try and guide cooperation and development.

"I invited visionary speakers to attend. The next step is for us to create working groups to identify technology platforms that support multiple applications and to work out what needs to be done to ease the path to volume commercialization. We will then publish that as a book to stimulate development and funding."

Each working group will have a chair person and several contributors responsible for contributing their chapter for the book. Bryzek said he hopes to see the first revision of the TSensors Roadmap before the next US TSensors Summit in October 2014. A one-day TSensors summit is scheduled to take place on February 21, 2014, in Tokyo Japan, with events to follow in China in August, in Germany in September and in the US in October of 2014.

Global SEMI and MEMS (Component) Markets

Blue: SEMI, Green: MEMS, Red: MEMS/SEMI (right axis)



Bryzek's long-term view shows how the MEMS market is growing faster than the general semiconductor market. Source: Janusz Bryzek.

Mobile smart card payment terminals tap into emerging markets

By Julien Happich

AT THIS YEAR'S CARTES SECURE CONNEXIONS event held near Paris, the main message to anyone holding a smartphone was a loud "Buy! Buy! Buy, impulsively if need be", especially if you were to visit the smart shopping area. The underlying message delivered by a vast majority of the exhibitors was of course their capability to secure data and payment transactions on the spot, and mobile payment terminals were definitely the new kid on the block.

All established POS vendors had a mobile merchant version on display, often a mock-up device still under development or ready for commercialization sometime next year. But what's so special about MPOS (mobile point-of-sale) when NFC-based mobile phone applications have already been demonstrated for direct smartphone-to-smartphone secure payment transactions?

Well, the argument here is that there are many more banking card holders than NFC-enabled smartphone owners, especially in emerging countries where smartphones are still a luxury item. Even in Europe, if using NFC may well catch up for certain applications like transport, the use of smartphones in place of contactless smart cards is not widespread. Then only a fraction of NFC-enabled smartphone owners are fully aware of their phone's new capability, and they would still have to queue for the cashier to swipe their phone onto a contactless pad. What's more, in Europe at least, NFC-based transactions would be limited to fairly small amounts. Unrestricted credit card transactions for chip cards are only authorized through PIN entry devices (PED) that comply with the current Payment Card Industry's (PCI) Data Security Standard (DSS). The PCI PED standard imposes particular security requirements for the keyboard, the chips and architecture being used and the display of the PED, which justifies the emergence of PED-enabled MPOS solutions.

Until everyone on earth becomes well acquainted with their smartphones, and before smart cards disappear themselves, there will be a growing market for secure card readers that can accept any type of banking cards (magnetic stripe or chip-and-pin) and connect directly to a merchant's smartphone, forming a completely mobile point-of-sale system, without requiring a costly cashier infrastructure.

This is precisely where the Italian startup Jusp (short for JUS t Pay) aims to play. Founded two years ago, the company has developed the Jusp card reader, a unit that can connect via a mini jack audio lead to any smart device and accepts all major chip-and-pin credit cards.



Launched at Cartes, the world's smallest credit card reader from Jusp.

Measuring about 5cm per side, the square device is what the company claims to be the world's smallest mobile POS system and the most compatible because it doesn't rely on Bluetooth to communicate with the smartphone.

The company has also designed adaptors for Jusp to fit various smartphones and tablets brands, enabling merchants to choose their communication platform.

What's more, at only €39.00 Jusp is very competitively priced, less than half the price of other MPOS solutions, the company claims.

It is also an order of magnitude cheaper than traditional behind-the-desk POS systems where activation costs and monthly fees add up to the merchant's business expenses.

Part of its business model, Jusp will take a 2.50% commission on each transaction, again claimed to be the lowest in Europe. Emerging countries where small mobile merchants abound are the key growth markets for such MPOS solutions, but the company also says the tiny portable unit could be used by sales-assistants to capture impulse-buying customers before they change their mind or before they give-up queuing.

mPowa, a direct competitor in this new market, was show-

casing a Bluetooth-connected MPOS in a neat 62.5x62.5x16mm case, ready to be commercialized in January next year. The device which also accepts swipe and chip & pin credit cards took the company two years to develop. When asked why traditional POS vendors would not be first to come up with this solution, the answer from a marketing spokesperson was a sharp "Total lack of foresight!", maybe the truth is more about maintaining high profit margins on cashier-based POS solutions while avoiding self-cannibalizing their own market with low-cost mobile solutions.

A European distributor for POS and payment solutions, German company PCP (Products for Card Payments) launched its own prod-



A poster illustrating the benefits of mPowa's white-label MPOS solution.

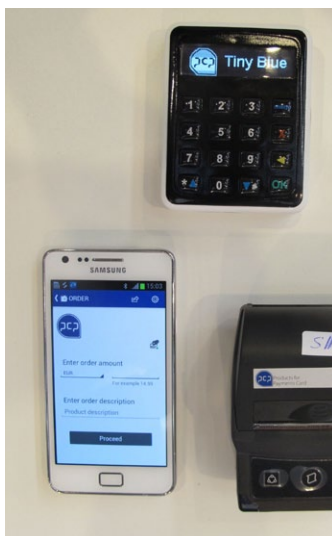
uct at the show, dubbed Tiny Blue, a MPOS unit measuring 88x68x22mm and featuring all the right security certifications (PCI-PTS/SRED, EMV L1, L2). The company sees potential growth both in new markets created by mobile merchants, and in traditional POS circuits as a lower cost and more mobile replacement solution.

Just to follow the trends, some more established vendors like the Korean POS manufacturer Bítel for example, also displayed mock up solutions, still in the design stage.

With its iCM unit measuring 116x68x14mm, well-known POS manufacturer Ingenico is also keeping a close eye on this market. Indeed during the show, a designer from Ingenico took a keen interest at Jusp's offering, acknowledging that their solution must have been tricky to design in such a compact form (less than a third the size of Ingenico's implementation).

While it is assumed that these new MPOS solutions could rely on off-the-shelf certified secure chips already commonly used in the smart-card industry (most would not disclose what was inside), Ezetap Mobile Solutions' CTO and Co-Founder Bhaktha Keshavachar (from Bangalore, India) was keen to exhibit his mobile POS unit on Maxim Integrated's booth. With the 78x45x10mm certified Ezetap unit, Keshavachar is ready to go to market, first in India, with plans to expand globally.

Although Maxim Integrated had not officially announced it, for such compact designs, the company has taped out a trimmed-down version of its DeepCover Secure Microcontroller, USIP Professional IC, dubbed USIP-L for Lite. Offering the same level of security around a 32-bit RISC core (MIPS32 4KSd), but fewer peripherals (none for printers), the USIP-L chip comes in a 8x8mm package instead of the regular 15x15mm offering. For 2014 the company plans to keep the package size but integrate more functionalities.



Tiny Blue, a MPOS unit by German company PCP (Products for Card Payments).

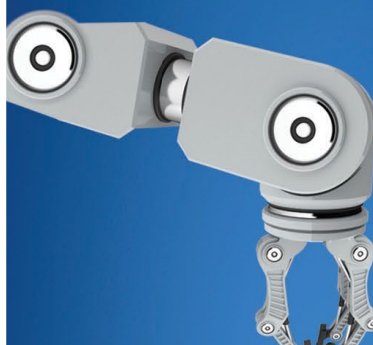


Built around Maxim Integrated's USIP-L (the small black chip), the Ezetap MPOS unit connects to smartphones either through their audio-jack, USB or Bluetooth.



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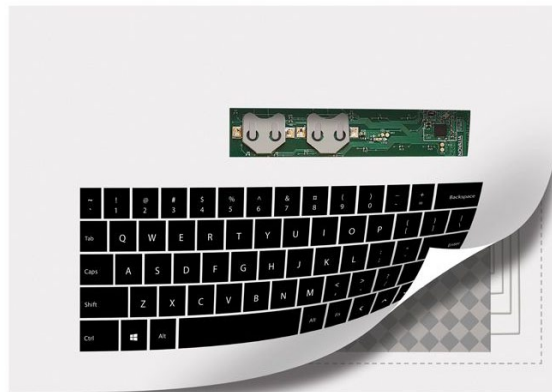
Touch-interactive posters use conductive ink and Bluetooth to run smartphone apps

By Julien Happich

CAMBRIDGE STARTUP NOVALIA has demonstrated printed conductive ink on paper to implement circuit tracks and touch-patterns connected to a wafer-thin Bluetooth low energy chip embedded into cardboard. Together, these components allow new mass-market applications such as interactive posters and books or personalized greetings cards that can connect to a smartphone wirelessly and run entertainment or control apps.

Using the nRF51822 system-on-chip from Nordic Semiconductor and any Bluetooth v4.0 enabled smartphone or gadget, the printed posters require very little manual assembly or wiring. Novalia has demonstrated a Bluetooth-connected printed keyboard, 10 times thinner than any other similar device on the market, which can be printed at 100 meters-per-minute on a standard print press.

The fully-functioning QWERTY keyboard is printed with conductive ink on a regular sheet of A4-sized photo paper that weighs just 30g (not including batteries). A 120x25mm control module with two CR2016 watch batteries and electronics housing, only 2mm deep, is embedded into the supporting cardboard, while the actual keyboard area could be as thin as 50-microns. The QWERTY keyboard keys are printed on regular paper layered upon a 20x8, X-Y touch matrix substrate printed



on the photo paper that can be re-configured in software to represent any language or indeed other user or developer-assigned functionality. The Nordic Semiconductor nRF51822's on-board 32-bit ARM Cortex M0 based processor manages the capacitive touch side of the application, while the SoC's ultra-low power performance supports a battery life of up to 18-months (9-months for a single CR2032).

A simpler version of this keyboard has already been developed by Novalia. Called 'Switchboard', it comprises eight capacitive touch buttons printed onto a piece of A5-sized printed paper mounted on foam card that can be configured to control (or be controlled by) apps running on any

Bluetooth v4.0 enabled iOS device.

The company has also demonstrated a drum poster comprising a printed image of a drum kit that allows users to play the drums either standalone or wirelessly through a Bluetooth v4.0 enabled iPhone or iPad by simply touching the individual drum or cymbal pictured.

Developers Kits are available from Novalia which is actively inviting and partnering with interested companies to begin developing ground-breaking applications based on its patented technology.

Wearable textile battery can be recharged by lightweight solar cells

By Paul Buckley

A RESEARCH TEAM AT the Korea Advanced Institute of Science and Technology has developed a technology for textile-based foldable batteries which are rechargeable using energy recharged via integration with lightweight solar cells.

Key to the researchers' approach was a polyester yarn coated with nickel and polyurethane to form the battery's current collector, binder and separators. The performance of the batteries is said to be comparable with that of conventional foil-based cells, even under severe folding/unfolding conditions.

The research group of professors Jang-Wook Choi & Jung-Yong Lee from the Graduate School of EEWS and Taek-Soo Kim from the Department of Mechanical Engineering at KAIST which developed the technology is now looking to make the

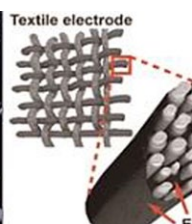
batteries softer and more wearable.

Trial versions of flexible and wearable electronics are being developed and introduced in the market such as Galaxy Gear, Apple's i-Watch, and Google Glass.

The new technology is expected to be applied to the development of wearable computers as well as winter outdoor clothing since it is flexible and light. The research group expects that the new technology can be applied to current battery production lines without

additional investment.

Professor Choi said: "It can be used as a core-source technology in the rechargeable battery industry in the future. Various wearable mobile electronic products can be developed through cooperation and collaboration within the industry."

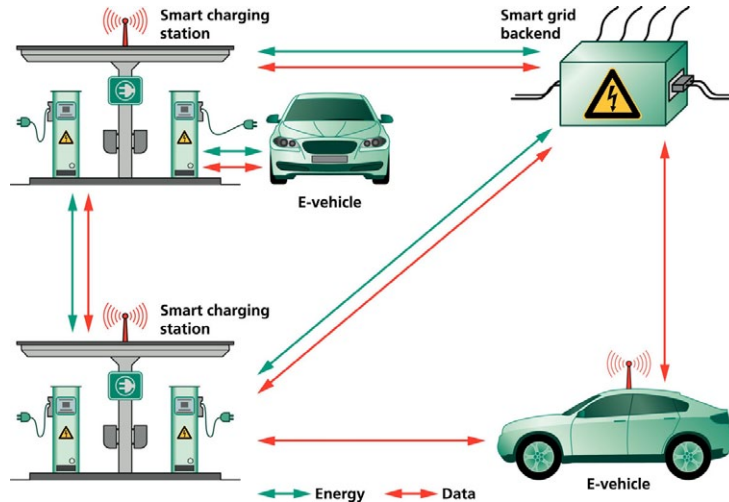


Interface fits e-vehicles into the smart grid

By Christoph Hammerschmidt

TO CONNECT ELECTRIC VEHICLES to the power grid seamlessly, researchers from Fraunhofer ESK have specified and implemented the required communication interface. The aim is to create a system in which electric vehicles use and temporarily store energy. The charging station serves as an active node that communicates with the vehicle and an energy management system in the smart grid. The research activity is part of the EU-sponsored SMARTV2G project (smart vehicle-to-grid interface).

Researchers are creating a consistent, manufacture-independent specification for the E-vehicle-to-charging station communication through ISO/IEC15118. This standard defines a comprehensive exchange of information that is essential for the "smart" charging process. Communication between the charging station and the smart grid will be based on an enhancement of the IEC 61850 global standard.



With the development of this interface, Fraunhofer ESK researchers provide a significant contribution to the further development of the IEC61850-90-8 specification, which to date has been available in draft form. By combining the two standards, the charging station is transformed into a node that integrates the electric vehicle charging process into the smart grid.

A demonstrator developed by the Fraunhofer researchers simulates the entire information chain, from the vehicle to the energy management system of a control centre. During this simulation a variety of information such as battery status, charging progress, charging mode, authentication data and price and payment information are exchanged among the participants.

The SMARTV2G (smart vehicle-to-grid interface) project is funded through the European Union's Seventh Framework Program (FP7).

Soft IP targets situational awareness radar sensors for driver-assist applications

By Julien Happich

ENSILICA HAS LAUNCHED a Constant False Alarm Rate (CFAR) soft IP core for use in situational awareness radar sensors for automotive driver-assist applications.

The hardware accelerated CFAR IP is matched to EnSilica's pipelined FFT IP core and, operating on continuous data at one bin per clock cycle, the combination of cores delivers a substantially reduced data set for analysis by the processor.

The development of the CFAR IP also followed the guidelines necessary for integration with devices adhering to the ISO 26262 functional safety standard for road vehicles.

Situational radar sensors can be used in a wide variety of driver-assist applications such as advanced electronic stability control systems, pre-crash impact mitigation, blind spot and lane departure detection, and self-parking. 1D and 2D-CFAR is used in these applications to identify relevant objects or targets from the background clutter

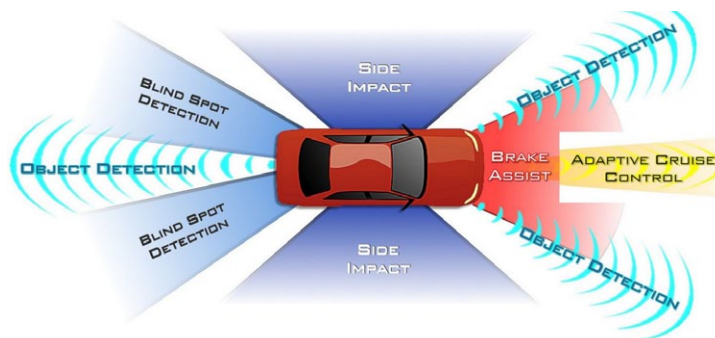
of a radar image and tag them for further processing.

As driver-assist applications grow in complexity, the challenge is processing all the available data while recognising that a very large percentage of the field of view does not contain relevant objects. The EnSilica CFAR IP coupled with a 2K point

FFT can calculate and search over 200,000 Fourier Transforms per second, reducing the radar image to a manageable number of possible objects that are critical to the driver safety.

The highly configurable EnSilica CFAR IP implements all the popular compute intensive algorithms, including GOSCA, GOSGO,

GOSSO, CA, GOCA and GOSA, that would normally be applied in software and which involve real-time data transform, sorting and selection. The soft IP can be targeted for implementation in either FPGA or ASIC technologies to address a wide range of market segments.



X-Fab ready for global growth, says CEO

By Peter Clarke

X-FAB SILICON FOUNDRIES AG (ERFURT, Germany) is doing well according to co-CEO Rudi De Winter, but as a private company it is not obliged to be very forthcoming with its numbers. The company is coming towards the end of a transition to 200-mm wafer production and sees scope for expansion in its current fabs and in particular at X-Fab Sarawak, its wafer fab in Malaysia.

X-Fab, best known as a European foundry focused on analogue, mixed-signal and specialty processes, emerged from VEB Mikroelektronik in Erfurt, East Germany in 1992 soon after the re-unification of the country. The company acquired a few amortized, older wafer fabs and deployed a foundry service business model at a time when it was relatively new and mainly being applied to digital CMOS production.

The company, now majority owned by Xtrion NV a holding company based in Tesselro, Belgium, is focused on analogue and mixed-signal processes and with much of its work in the industrial and automotive sectors the company was not as susceptible to the global economic malaise of 2008 and 2009 as some other companies.

"We're doing well. We've grown through acquisition. Our latest one was 1st Silicon in Malaysia. That was fully loaded when we acquired it but we had to find new business," De Winter said. The acquisition took place in 2006 and part of the transition was to qualify the fab for the production of automotive ICs with multiple customers. "The fab runs 200-mm wafers down to 130-nm. It's the next generation from what we have in Erfurt," De Winter said.

De Winter said that in 2013 the Malaysia fab is at breakeven and that from now on he expects their production to grow profitably. "Manufacturing capacity there is about 20,000 wafer starts per month. We can further increase that to 30,000 wafers per month with additional equipment," said De Winter. "We installed 0.35-micron HV CMOS applicable to automotive applications with 100V and a lot of different modules. We also have 0.18-micron installed there."

Indeed overall X-Fab's highest shipping node is 0.35-micron with mixed-signal capability, De Winter said. "The 0.35-micron is still the most popular although 0.18-micron is on a par with it in terms of enquiries."

X-Fab does have a more recent manufacturing acquisition than its fab in Malaysia. In November 2012 X-Fab increased its shareholding in MEMS Foundry Itzehoe GmbH to 51 percent and renamed the company X-Fab MEMS Foundry Itzehoe. "Ah yes, but Itzehoe is MEMS only. The processes are varied so it is very hard to talk about wafer starts per month." But Itzehoe runs 200-mm wafers as standard something that is unusual in the MEMS sector and which gives X-Fab an economic advantage.



Rudi De Winter: co-CEO of X-Fab Silicon Foundries

The majority of X-Fab's five wafer fabs are on 200-mm. Erfurt runs a mix of 6-inch and 200-mm wafers and Dresden will have converted to 200-mm wafers only by mid-2014, said De Winter. The exception is X-Fab's facility in Lubbock, Texas, which runs specialty processes on 6-inch wafers. "In fact, we announced a deal with Cymbet so we are making batteries on silicon there," he said.

But increasingly some of the digital giants of the foundry sector – TSMC, UMC, Globalfoundries – are also offering 'more-than-Moore' processes using their own older wafer fabs. How

does X-Fab cope with that level of competition?

"If you look across the total foundry landscape there are many processes but they are not all offered in all market sectors," he said. X-Fab is not playing in the pure digital sector nor does it require the very high volume orders that are normal for the larger foundries. "When it comes to more-than-Moore when you look at the levels of integration for non-volatile memory, for high voltage, across a broad temperature range, I believe we are un-matched," said De Winter. "We also put a lot of emphasis on design support, we invest a lot in models, in PDKs [physical design kits] to give customers the best chance of success. Our NVM IP is developed in house, which is important for the automotive market."

De Winter said that in the automotive sector multi-party supply chains are not favoured by customers that must control and attest to the rigor of design and manufacturing for safety.

Emphasizing the support to design teams that X-Fab can provide De Winter added: "In MEMS we also have IP blocks and offer pressure and inertial sensor platforms."

X-Fab's sales by major industry sector breakdowns as: automotive 46 percent, industrial 15 percent and communications and consumer about 33 percent. The high automotive tally is largely due to the work done for automotive component company Melexis NV, a sister company that is also controlled by Xtrion. "Melexis is around a third of our business," said De Winter.

Does X-Fab's acquisition of 1st Silicon as the next domino in its chain of globalization indicate that as it grows it is choosing to, or being forced to, de-emphasize Europe? "We are glad to have our fab in Asia. It is well received by our Asian customers," De Winter responded.



X-Fab's Malaysian operation in Kuching.

But European Commissioner Neelie Kroes with her call to create an Airbus of Chips and her 10/100/20 strategic plan wants €10 billion of European tax-payers' money to leverage €100 billion of industry investment to enable Europe to double manufacturing as percentage of the global total to 20 percent by 2020. Surely that represents a regional opportunity for X-Fab?

"I am glad such statements are made, but 20 percent is a very aggressive number. The European Commission wants to stimulate the semiconductor equipment industry for 450mm diameter wafers. That's not something for us. They also want to stimulate 'more-Moore' [leading edge] which is for STMicroelectronics and Globalfoundries. More-than-Moore is somewhere we could participate and we want to contribute and also to grow. We are working in MEMS in Europe for example. But it is not yet clear how this strategy will benefit us."

De Winter is also sceptical about plans for setting down large fabs for More-than-Moore operations such as MEMS. "If you look at the MEMS market in mobile the volumes are big but the margins are small. There are a lot of smaller MEMS opportunities in market niches. In those sectors it is often engineering and research that makes the difference rather than just manufacturing capacity. And, in fact, Europe is well placed in that regard."

X-Fab will therefore continue with the strategy of acquiring shells and converting them. "We will be acquiring one day. We get offers of fabs to buy every day but there is nothing very serious at the moment. At present we are consolidating in our current facilities. It might be something to think about in three years' time."

And what about an IPO for the privately-held parent Xtrion NV or X-Fab to fund expansion? De Winter indicated that this was unlikely on the grounds that if the business model is working why try to fix it.

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Future OLEDs and solar cells to come straight from the printer

By Paul Buckley

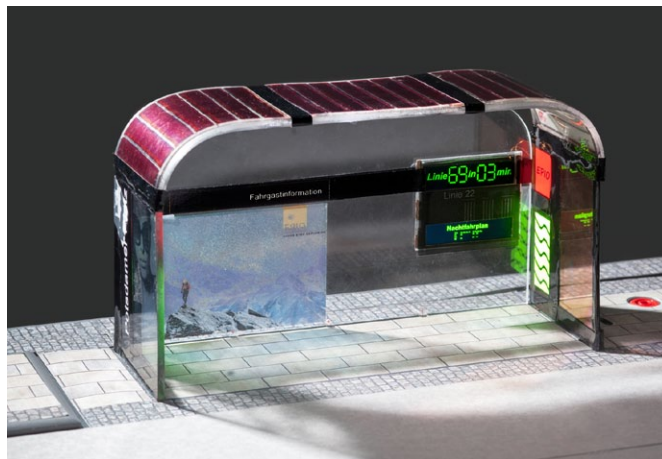
SCIENTISTS AT THE FRAUNHOFER Institute for Applied Polymer Research IAP in Potsdam-Golm have been working together with mechanical engineering company MBRAUN to develop a production facility capable of creating OLEDs as well as organic solar cells on an industrial scale.

The innovation makes it now possible to print OLEDs and solar cells from solutions containing luminescent organic molecules and absorptive molecules respectively, which makes printing them onto a carrier film straightforward. Usually, printing them involves vaporizing small molecules in a high vacuum, making it an expensive process.

Scientists had previously only ever used various printing technologies to design components on a laboratory scale. They can now produce larger sample series – and this is advantageous for the applications that feature large illuminated surfaces and information systems that require tailored solutions produced in relatively small numbers.

“We’re now able to produce organic components under close-to-real-life manufacturing conditions with relative ease. Now for the first time it will be possible to translate new ideas

into commercial products,” explained Dr. Armin Wedel, head of division at the Fraunhofer Institute for Applied Polymer Research IAP.



At the heart of the pilot plant is a robot that controls different printers that basically act like an inkjet printing system. OLEDs are applied to the carrier material one layer at a time using a variety of starting materials. This produces a homogenous surface that creates a perfect lighting layer. “We’re able to service up-scale niche markets by offering tailored solutions, as we can apply the organic electronic system to customers’ specifications, just like in digital printing,” explained Wedel.

“The main hurdle, as far as I’m concerned, is the high level of investment required to set up manufacturing,” said Wedel. This is why, at least where lighting is concerned, he expected OLEDs to complement rather than replace conventional lighting devices. Wedel’s view of where OLED production technology could head is less modest: “My vision is that the day will come when all we need do is switch ink cartridges in our printers in order to print out our own lighting devices.”

Amazon bets on GPS-driven drones to deliver goods to your door-step

By Julien Happich

ON THE CBS SHOW 60 MINUTES, Amazon CEO Jeff Bezos has discussed the company’s plans to use drones to deliver customer packages within 30 minutes after ordering online. This would apply to customers within a 15km perimeter of one of Amazon’s warehouses, under a premium service agreement dubbed Amazon Prime Air.

The octocopters would pick up a yellow box containing the customer’s order, and use GPS coordinates to fly directly to the customer’s address, dropping the box in front of the house. The drones are being tested and Bezos sees this delivery scheme become a reality within a few years. He said that one of the most difficult challenges would be to convince the Federal Aviation Administration’s (FAA) that these drones do not impact air safety negatively. Today, small drones are not permitted to fly in U.S. airspace without special permission, then there are also concerns about privacy issues, especially with camera-



equipped drones. Another argument in favour of these drones, from Amazon’s perspective, would be the low cost of delivery for small packages (about 85% of Amazon’s deliveries).

Going physical

By Nick Flaherty

Does a distributor that pioneered sales over the Web need a physical presence? In the last year, Digi-Key has expanded in Europe, adding a new office in Munich and moving into China with an office in Shanghai.

“A year has made a lot of difference and it’s the beginning of a process,” said Mark Larson, founder and chief executive of Digi-Key. “We started in Israel 14 months ago because we wanted to make sure we were comfortable with how we could resource it ourselves and be self-contained. Moving into Europe was the next logical move because there’s a lot of individual activity that aligns with our production model.”

“In the last four to five years in the US we have rolled out our higher mix, lower volume business and this is the entry for the UK and Europe and we now have 25 people in Germany,” he said. “The fact is there are a lot of good people that are available from franchised distributors but the people that we took on were still employed. We gained a lot of really sharp sales guys that were enlightened – that the mode of the traditional distributor doesn’t have a lot of potential for growth.”

The physical offices are there to support the centralised web business which stocks nearly 1m products in a central warehouse in Minnesota with worldwide delivery. Digi-Key now has over 500,000 customers making \$3.4m orders a year with an average of four items per order from 13 million line items.

“Most of our customers still choose to use the Web but to have a couple of guys handling sales in the UK really helps,” he said. “At this point we are not stocking in Europe. It’s just a matter of a few months that we have had a physical presence in Europe but it gives our customers additional comfort. You have a real live person, but just as important is the way it’s viewed by suppliers who are rapidly becoming supportive.”

“We are now opening in Shanghai and that’s a big deal for us because we can finally deal in the local currency” he said. “We have done great business in China but it’s all in US and Hong Kong dollars.” The breadth of customers has been vital to supporting the industry through the downturn and is a key element



Mark Larson, founder and chief executive of Digi-Key.

of the Digi-Key business model, says Larson.

He points to the different investment models for distributors – because the company is privately held it can stock a broader range.

This helps when

products go into allocation and customers are looking everywhere for their parts. “A strong inventory is integral to the Digi-Key model and it is differentiated by being aggregated across the worldwide demand,” he said. “With the Digi-Key model, our 500,000 customers give us more latitude to stock more parts. It’s a circular business – as Digi-Key has the broadest engineering base we can justify the widest product line”

“The growth in 2010 was because of allocation,” he said, “and mid-sized companies were the biggest losers. I think that we have been able to hold onto that business by giving them access to a broader inventory.” The same thing is starting to happen again, he says. “There is some spot allocation [at the moment] and I feel we are seeing a strengthening in the market,” he said.

“The year is strengthening as we go on,” he said. “The first half of 2013 saw a 6% growth compared to 1% for the larger distributors and if we take out the Raspberry Pi they are actually down.”

One of the things that have made a difference this year has been the rise of the Raspberry Pi. Larson says he has no plans to stock the product, but has other boards. “We are seeing a lot of activity on the TI beagle boards and there a lot of boards out there,” he said

The breadth of products and customers also gives Digi-Key a tremendous database of transactions that can be mined for information and trends from its 3.4m orders a year. However the data isn’t quite making sense. “With what we are doing right now the associations are so strange it’s just not relevant,” he said. “But I don’t think there’s any disbenefits if you are using all the data anonymously.”

IMEC uses CCD-in-CMOS for image sensor

By Peter Clarke

BELGIAN NANOELECTRONICS

research centre IMEC has developed an embedded CCD-in-CMOS time-delay integration (TDI) image sensor linear array for space applications. A TDI imager synchronizes linear motion of the scene with multiple samplings of the same object to obtain an increased signal-to-noise ratio. The image sensor is based on IMEC’s proprietary embedded charge-coupled device (CCD) technology and it was developed by IMEC for the French Space Agency, CNES, which plans to utilize the technology for space-based earth observation.

The sensor combines a light sensitive CCD-based TDI pixel array with CMOS readout electronics. The CCD pixel structure

delivers low-noise TDI performance in the charge domain, while CMOS technology enables low-power, on-chip integration of fast and complex circuitry readouts. The CMOS technology enables on-chip readout electronics, such as clock drivers and analogue-to-digital converters (ADCs), operating at higher speeds and lower power consumption not possible with traditional CCD technology. The prototypes were fabricated using a 130nm CMOS manufacturing process with an additional CCD process module at IMEC’s 200-mm wafer fab. A charge transfer efficiency of 99.9987 percent has been measured ensuring almost lossless transport of charges in the TDI array, and guaranteeing high image quality.

Chip-on-board LEDs for directional high power applications

By Dr. Christopher Keusch

IN ORDER MAINTAIN a pleasant and uniform light environment, directional and decorative lighting applications need a light source which has to meet several key criteria. It should be compact, have a high efficiency with sufficient light output, a high colour rendering index (CRI), a high colour uniformity and colour consistency and a long service life. The light source should also be easy to implement into the application at an acceptable price for the user or the consumer.

A lot of different types of LEDs are available for lamp and lighting manufacturers. For a long time, standard discrete components such as high power LEDs or, alternatively, more cost effective PLCC package LEDs in the small and medium power range played the dominant role. Meanwhile, however, chip-on-board LEDs successfully serve the requirements of this application segment and specifically address design and performance issues. Typical applications mainly include downlights, spot-lights and retrofits such as MR16, GU10 and PAR lamps as well as decorative lamps such as candle lights.

Setup of Chip-on-Board LEDs

Conventional SMD LEDs mostly consist of a single or maximum two LED chips. Chip-on-board LEDs, however, are based on a multi-chip assembly with many individual low power LED chips connected in series and in parallel. Mechanically, the COB can be mounted directly on the lamp heat sink, eliminating the SMT processes required by traditional discrete components on an MCPCB. This provides more direct thermal dissipation, higher efficacy, and ease of assembly.

LED Type	Electrical Power	Typ. Luminous Flux	CCT	Forward Voltage	Forward Current	Min. CRI	Aperture	Dimensions
COB LED	15W	1650lm	3000K	27.0~33.0V	500mA	80	16.0-16.9mm	20x24mm
	10W	1110lm		16.0~20.0V	550mA	80	10.0-10.9mm	12x15mm
	7W	730lm		11.0~14.0V	550mA	80	9.0-9.9mm	12x15mm
	4W	350lm		8.0~11.0V	550mA	80	5.0-5.9mm	12x15mm
High Power LED	1W	80lm		2.8~3.5V	350mA	80	∅ 3.0mm Lense	3.5x3.5mm
Mid Power LED	0.5W	50lm		2.8~3.5V	150mA	80	5.0x2.5mm	5.6x3.0mm

Table 1: Typical specifications of COBs versus high-power and mid-power LEDs.

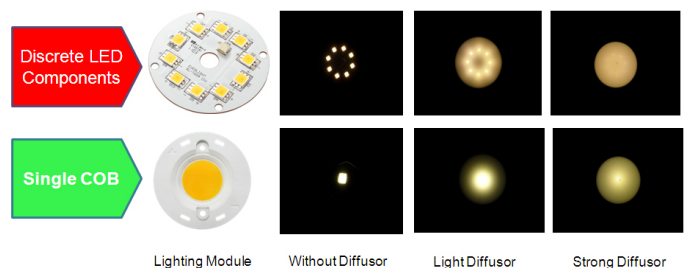


Fig. 2: Optical properties.

Typical specifications

Table 1 shows typical specifications of COBs within the power range from 4W to 15W vs. established High Power LEDs at 1W and Mid Power LEDs at 0.5W. COBs in particular are characterized by much higher luminous fluxes, higher electrical parameters as well as by their larger emission surfaces (apertures) and dimensions.

Discrete components mounted onto a common MCPCB cannot provide a homogeneous emission, but show optical hot spots such as the ring pattern shown in figure 2. Performance can be improved by use of diffusers but considerable light power losses have to be taken into account. COBs in contrast provide a singular light spot ensuring homogeneous intensity distribution without any optical hotspots. Hence they allow for a much simpler optical design.

Furthermore, discrete LEDs mounted onto an MCPCB (LED ensembles) cannot be coupled into small optics apertures due to the larger resulting emission surface. Thus, a part of the radiation is shaded by the aperture and is lost for the application – see figure 3. COBs, however, are ideal for combination with secondary optics providing matched optics aperture.

Thermal properties

Standard LEDs with a PLCC package have a relatively high

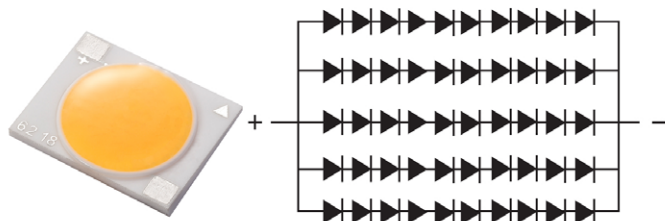


Fig. 1: 15W COB including internal electrical configuration.

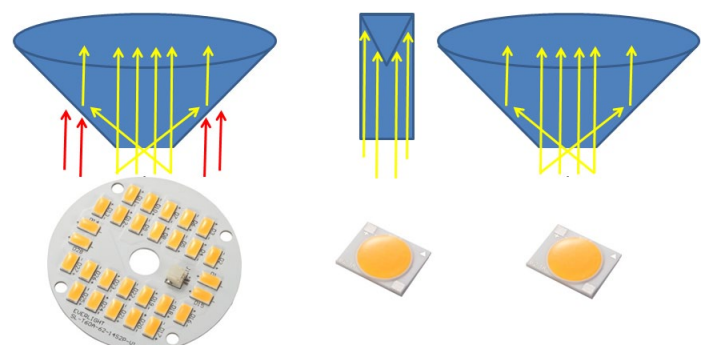


Fig. 3: 10W COB which is comparable to PCB

Dr. Christopher Keusch is Senior Technical Sales Manager EMEA at Everlight Electronics - www.everlight.com - He can be reached at christopher.keusch@everlight-eu.de

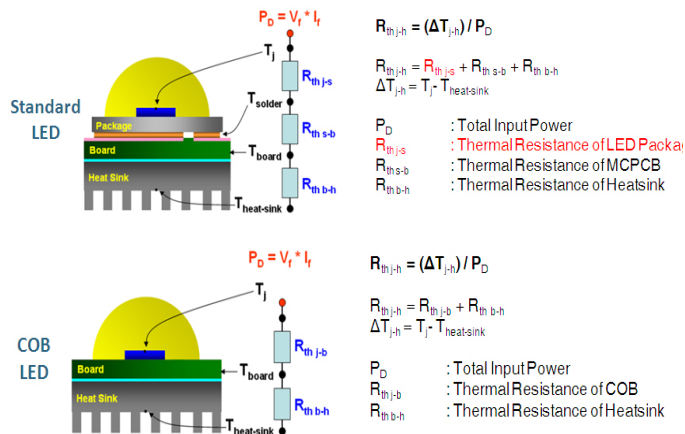


Fig. 4: Comparing the thermal properties of standard LEDs (top) and COB LEDs (bottom).

thermal resistance in the range of 20 to 200K/W. Even High Power LEDs on ceramic substrate still provide 6-12K/W. The thermal resistance of COBs is less than 2K/W. Here, the multi-chip ensemble is directly mounted onto the substrate without any interface, eliminating in particular the high total thermal resistance of PLCC packages – see figure 4.

Thus, the total thermal resistance of the ensemble is reduced considerably. This results in a lower chip temperature T_j , which ensures a longer product life of a COB LED.

COBs are specifically applied in applications which require a singular LED light source. Thus, the COB focus is on directional applications like spotlights, downlights, retrofits and partly on decorative applications. For omnidirectional lamp applications like A60 bulbs in particular, the advantage of beam uniformity is not relevant because here more cost-efficient multi chip ensembles based on mid-power or high-power LEDs are usually applied along with a diffuser which creates a homogeneously diffused light output of the bulb. In a typical setup of a spotlight for directed applications, the COB is installed in a compatible Zhaga Book 3 holder, which ensures not only the mechanical clamp but also the electrical connection.

The backside of the COB is thermally coupled to a heat sink heat via a thermally conductive adhesive or foil. The heat sink is responsible for proper heat dissipation. The emitted luminous flux of the COB is focused by a reflector whose aperture is adapted to the diameter of the COB – see figure 5.

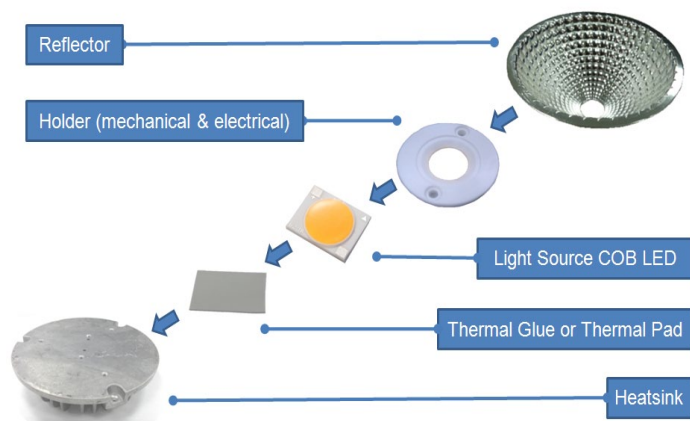


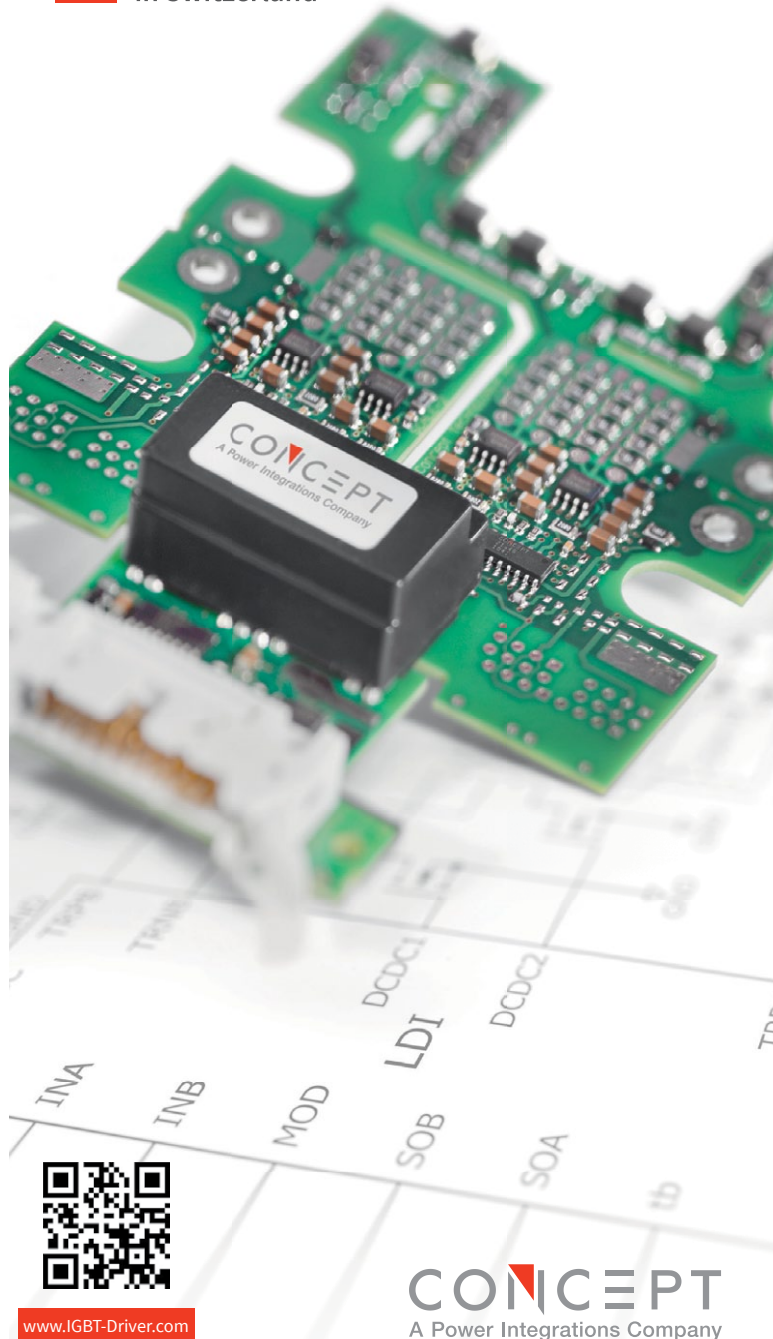
Fig. 5: Setup of a COB based spotlight.

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Thermally conductive nano-ceramics simplify LED lighting assemblies

By Steve Curtis

MANUFACTURING A HIGH-PERFORMANCE thermal substrate is a balancing act: it involves applying a dielectric layer to a metal base plate to gain sufficient electrical isolation for the circuit's tracks and pads, while providing the least possible resistance to the passage of heat from components to the base plate. Too thick a dielectric layer, and the heat cannot escape fast enough; too thin, and the system is at risk of forming a short circuit between the tracks and the base plate.

Spurred by growing demand for high-density power electronics systems and LED lighting equipment, however, the thermal substrate industry has been developing new materials and production processes that dramatically shift the balance between dielectric strength and thermal performance. The latest nano-ceramic materials are now posing a challenge to existing metal-backed PCB (MBPCB) technologies by providing a better combination of high performance and competitive cost.

Epoxy: a poor thermal interface

There are two contributors to the thermal impedance of a substrate: the impedance of the layers of the substrate; and the impedance at the interface between the layers. So in an MBPCB, the thermal impedance of the metal back or base plate is not the problem: the problem is the dielectric layer, and the interfaces between the circuit layer, the dielectric layer and the base plate.

In the most widely used kind of thermal substrate, insulated metal substrate, the dielectric layer is a filled epoxy (epoxy mixed with ceramic particles) sandwiched between the base plate and the copper circuit layer. Filled epoxy, which has relatively poor thermal properties, supports a minimum thickness of some 30µm, and its glued interface to the base plate suffers from high thermal impedance.

While an epoxy dielectric layer is applied thermo-mechanically to the base plate, nano-ceramic material can be grown directly on it. Alumina (aluminium oxide) for instance, a crystalline ceramic material which is both electrically isolating and thermally conducting, may be grown on an aluminium base plate. The purpose of nano-ceramic technology is to create a ceramic coating with properties peculiarly well suited to high-temperature electronics applications. Tiny crystals between 20nm and 40nm in size are packed densely together, providing an excellent electrically isolating layer which also provides an impermeable barrier to the materials used in circuit board formation.

The process for growing the nano-ceramic layer allows for precise control of the thickness of the dielectric. This means that it can be tuned to the needs of the application: the minimum 10µm layer is sufficient for low-voltage applications such as LED lighting, offering a breakdown voltage of 500V. A 25µm

layer provides a 1,500V rating. Higher voltages may be obtained by applying a thicker layer of nano-ceramic material.

The junctions between crystals also have a remarkable ability to absorb the expansion and contraction of the base plate due to extreme changes in temperature, a property that has been proven in motor sport and aerospace applications.

The resulting nano-ceramic material has obvious advantages over conventional insulated metal substrate. The dielectric layer is atomically bonded to the base plate, providing for an excellent thermal interface. What's more, an adhesive layer no more than 5µm thick is sufficient to bond the copper circuit layer to the dielectric – see figure 1, drastically reducing the thermal impedance compared to the much thicker layer of epoxy in conventional products.

With the copper circuit layer bonded to the alumina nano-ceramic layer, the resulting 'biscuit' is ready for circuit formation and assembly in exactly the same way as a conventional MBPCB. With a thermal conductivity of 7.2W/mK, the dielectric layer conducts heat twice as well as even the best epoxy-based metal substrate.

Nano-ceramic might be a promising material, then, but is it suitable for mass production and for use in electronics systems? In Nanotherm, a new patented process commercialised by Cambridge Nanotherm, an alumina layer grows on the surface of an aluminium base plate when it is suspended in a bath of electrolyte and subjected to complex electrical pulses. The great advantage of this process is that it is highly controllable, so that the thickness of the dielectric can be chosen at the level of single microns, while at the same time it uses as its main material aluminium, which is both abundant and cheap.

At first glance, this process might seem similar to other ways of growing ceramic on metal, such as anodising, plasma electrolytic oxidation or micro-arc oxidation. In practice, however, none of these methods creates a dense enough layer to provide the electrical isolation values that the electronics industry requires.

Nanotherm, by contrast, produces a material proven in demanding applications, and can be scaled up for high-volume

Processing

1. Nano-Ceramic coated Aluminium sheet
2. Laminated Cu foil using thin adhesive onto ceramic coating
3. Process through PCB fabrication plant to create a circuit

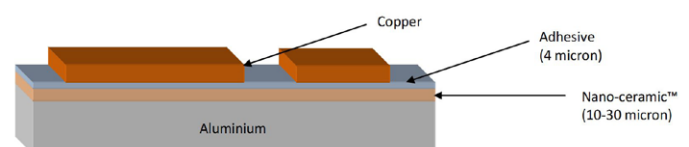


Fig. 1: Lay-up of a nano-ceramic MBPCB.

Steve Curtis is Chief Engineering Officer at Cambridge Nanotherm - www.camnano.com

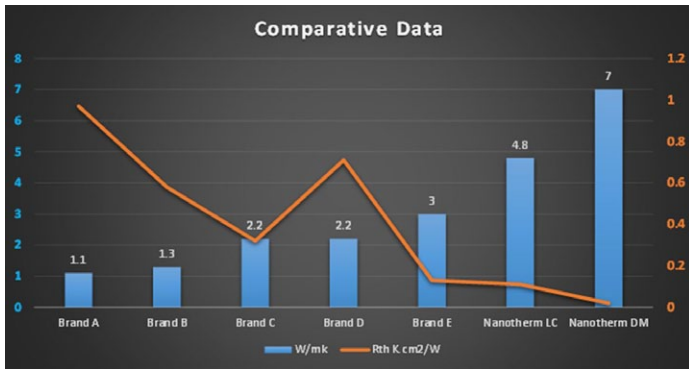


Fig. 2: conventional MBPCB materials cannot match the thermal performance of the Nanothem substrates.

circuit board production. And because the base material is aluminium, its cost is competitive. This means it may be used as a more thermally efficient replacement for conventional MBPCBs.

Testing the performance of LEDs with a variety of substrate types shows how dramatic the difference in performance can be at the device level when the performance of the substrate is improved. Figure 2 shows a comparison of the thermal conductivity of Nanothem LC (Laminated Copper) alongside a selection of commonly used thermal substrates.

By improving the flow of waste heat from the LED through the substrate to a heat sink, Nanothem reduces the heat at the LED's junction temperature - see figure 3. For instance, a popular Cree XP-E LED driven at 1.5A operates around 20°C cooler when mounted on Nanothem than when mounted on a common 2W/mK insulated metal substrate.

Nanothem, then, can offer improved thermal performance over conventional MBPCBs. It may also be used as a reduced-cost replacement for high-performance aluminium nitride (AlN) ceramic tiles. Today, metallised AlN ceramics are the gold standard of thermal substrates, offering thermal impedance as much as a factor of 10 lower than typical insulated metal substrates. But the extremely high cost of AlN tiles has restricted their use to the most demanding applications.

Here, however, Nanothem technologies can provide an alternative. In the Nanothem LC material described above, the thin adhesive layer between the dielectric and the copper circuit layer makes for a slight thermal bottleneck. This can be almost eliminated in higher-performance versions of Nanothem. Nanothem PS (for 'Printed Silver') uses conventional thick-film

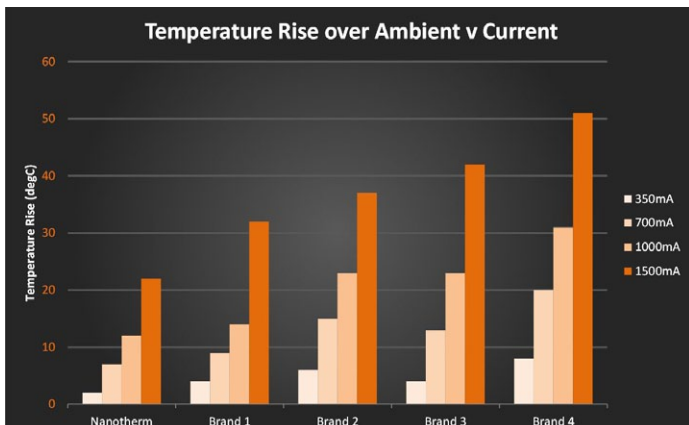


Fig. 3: a Cree LED runs substantially cooler when mounted on a Nanothem MBPCB than when on commonly used conventional MBPCBs.

processes to form a silver circuit layer directly on the alumina dielectric. Because it uses standard equipment and processes, this material is relatively cheap to manufacture, but its electrical isolation rating limits it to low-voltage applications.

Nanothem DM (for 'Direct Metallisation') uses semiconductor fabrication processes to form a thin Titanium and Copper seed layer on the nano-ceramic. The circuit layer can then be formed on the copper using common PCB photo-lithographic and plating techniques.

AlN ceramic tiles are expensive because they require an exotic base material; Nanothem PS and Nanothem DM, by contrast, have the same nano-ceramic-on-aluminium composite structure as Nanothem LC. Applications for Nanothem DM, such as heavy-duty power supplies, are able to benefit from comparable performance to AlN ceramic tiles, sometimes at as little as half the cost.

New uses for isolated aluminium

As the above description shows, new nano-ceramic techniques for coating aluminium with an electrically isolating crystal alumina layer offer an improved combination of low cost and low thermal impedance, ideal for high-temperature electronics systems.

The technology is not limited, however, to flat aluminium boards: any aluminium extrusion may be coated. Today, this supports, for instance, Chip-on-Heat-Sink (CoHS) substrates, in which a pre-formed circuit layer is bonded to an aluminium/alumina composite heat sink, with no intervening circuit board or Thermal Interface Material (TIM). Further uses for electrically isolated aluminium are already being found, for instance in brick power supply designs, and the ingenuity of electronics design engineers will no doubt find more.

Now, Nanothem is giving system designers a means to lower device operating temperatures, extend device lifetimes and increase efficiency and output across a range of demanding high-temperature applications, at a cost competitive with conventional thermal substrates. Nano-ceramic technology appears to represent the future for the thermal substrate industry, exposing the weaknesses of epoxy-based products and giving manufacturers for which the cost of AlN tiles is too high a means to enjoy hugely improved thermal performance.

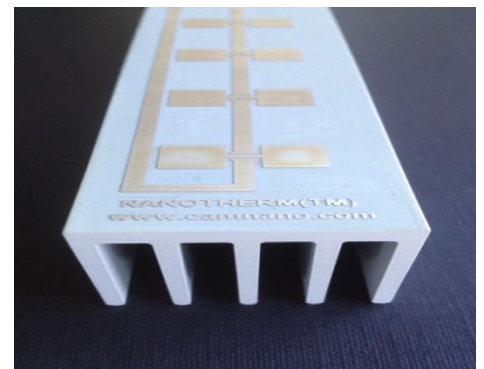


Fig. 4: Examples of extruded aluminium heat sinks with screen printed circuit with Ag thick film paste, directly on top of a 30um thin nanoceramic layer.

LED Driver with integrated spread spectrum reduces EMI without adding flicker

By Keith Szolusha

AUTOMOTIVE LED DRIVERS should be compact, efficient and support flicker-free PWM dimming. They should not produce significant conducted EMI at and around the AM radio band. Unfortunately, low EMI is not in the nature of high power switch mode power supplies. The constant switching frequency produces a significant EMI signature at a number of frequencies, including the power supply's fundamental operating frequency and its harmonics. Odds are good that something will fall into the AM band.

One way to minimize EMI peaks is to allow the switch mode power supply (SMPS) operating frequency to cover a range of values, namely spread spectrum switching. The desired effect of spread spectrum switching is to push down the EMI peaks that would occur at the SMPS fundamental operating frequency and harmonics, spreading the EMI energy over a range of frequencies instead.

LED driver SPMSs have an additional requirement: the frequency spreading should also be synchronized with the PWM dimming (brightness control) frequency to ensure that there is no resulting LED flicker.

To this end, the LT3795 generates its own spread spectrum ramp signal and aligns it with the lower frequency PWM dimming input with a patent pending technique. This eliminates the chance that the spread spectrum frequency could combine with the PWM signal to produce visible flicker in the LEDs, even at the highest PWM dimming ratio.

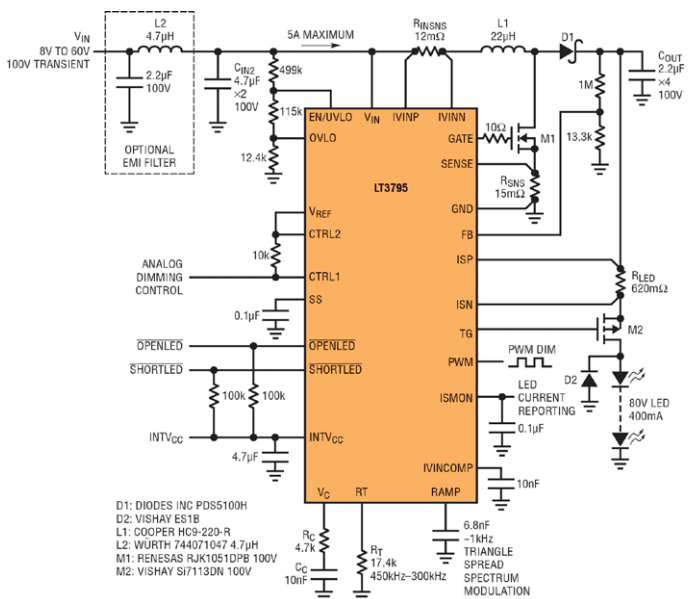


Fig. 1: 80V, 400mA automotive LED driver with internal spread spectrum for low EMI.

Keith Szolusha is Applications Engineering Section Lead for Power Products at Linear Technology – www.linear.com

High power LED driver

The LT3795 is a high power LED driver that uses the same high performance PWM dimming scheme as the LT3756/LT3796 family, but with the additional feature of the internal spread spectrum ramp for reduced EMI. It is a 4.5V-to-110V input to 0V-to-110V output single-switch controller IC that can be configured as a boost, SEPIC, buck-boost mode or buck mode LED driver. It features a 100kHz to 1MHz switching frequency range, open LED protection, short-circuit protection, and can also be operated as a constant voltage regulator with current limit or as a constant current SLA battery or supercapacitor charger.

Figure 1 shows a 92% high efficiency 80V, 400mA, 300kHz-450kHz automotive LED head-lamp driver with spread spectrum

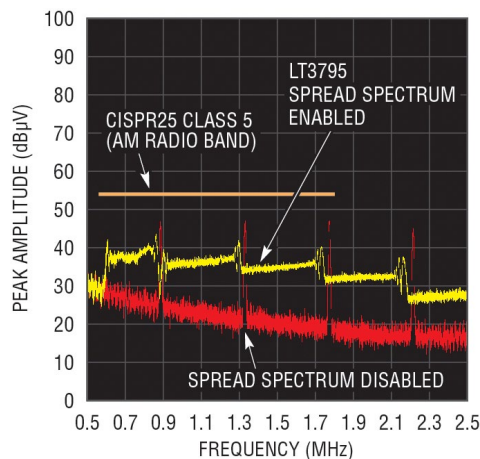


Fig. 2: Conducted peak EMI around the AM band is reduced by 3dBµV-6dBµV when the LT3795's spread spectrum frequency modulation is used. The CISPR25 Class 5 AM-band limit is provided for reference.

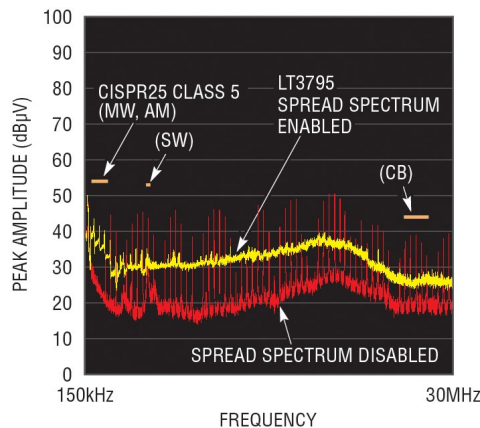


Fig. 3: Spectrum analyzer scan of the LT3795 150kHz-30MHz peak conducted EMI.

frequency modulation and short-circuit protection.

Internal spread spectrum

Unlike other high power LED drivers, the LT3795 generates its own spread spectrum ramp to produce 30% switching frequency modulation below the programmed switching frequency. This lowers its conducted EMI peaks, reducing the need for costly and bulky EMI input filter capacitors and inductors.

Using an external, or separate, spread spectrum clock to produce the switching frequency in an LED driver can produce visible flicker during PWM dimming since the spread spectrum frequency pattern is not synchronized with the PWM period. For this reason, in many high end LED driver applications, implementing spread spectrum is not trivial. Without spread spectrum, designers must rely upon bulky EMI filters, gate

resistors that slow down switching edges (but reduce efficiency) and snubbers on the switch and catch diode.

Figure 2 shows a comparison of the conducted EMI measurements of the LT3795 LED driver around the AM band when spread spectrum is enabled and disabled. Normal (non-spread spectrum) operation yields high energy peaks at the switching frequency and its harmonics. These peaks can prevent the design from passing stringent EMI requirements in EMI sensitive applications such as automobiles. For reference, the CISPR 25 class 5 automotive conducted EMI limits are shown in figure 2. Figure 3 shows the effect of spread spectrum over a wider frequency band.

Since there is no limit between 300kHz and 580kHz, that is an excellent place for the fundamental frequency to be placed. In this application it is placed at 450kHz and spread down to 300kHz. Spread spectrum can be disabled by simply grounding the RAMP pin.

The 6.8nF capacitor at the RAMP pin sets the spread spectrum frequency modulation rate to a 1kHz triangle, that is, the LT3795's operating frequency sweeps from 300kHz to 450kHz and back every millisecond. The addition of the triangular 1kHz spread spectrum signal has a negligible effect on LED ripple current, as shown in figure 4.

The modulation frequency of 1kHz is chosen because it is low enough to be within the LT3795's bandwidth, yet high enough to significantly attenuate AM-band conducted EMI peaks. Further reducing the modulation frequency degrades peak attenuation in the AM band, where it may be most important for classification. The choice of spread spectrum modulation frequency does not appear to affect EMI peak attenuation at higher frequencies. Nothing above 100Hz is perceived by the human eye.

Flicker-free PWM dimming

It is possible to reduce EMI with a spread spectrum source that is not synchronized with the PWM signal, but the beat of the switching frequency and PWM signal can produce visible flicker in the LED. The spread spectrum ramp generated inside the LT3795 synchronizes it-self with the PWM period when PWM dimming is used. This provides repeatable, flicker-free PWM dimming, even at high dimming ratios of 1000:1.

Figure 5 compares the PWM dimming current waveforms of two spread spectrum solutions: one with the LT3795's patent-pending spread-spectrum-to-PWM synchronization technique, and one without. Both captures are produced with infinite persist, showing an overlay of a number of cycles of a 1% PWM dimming wave-

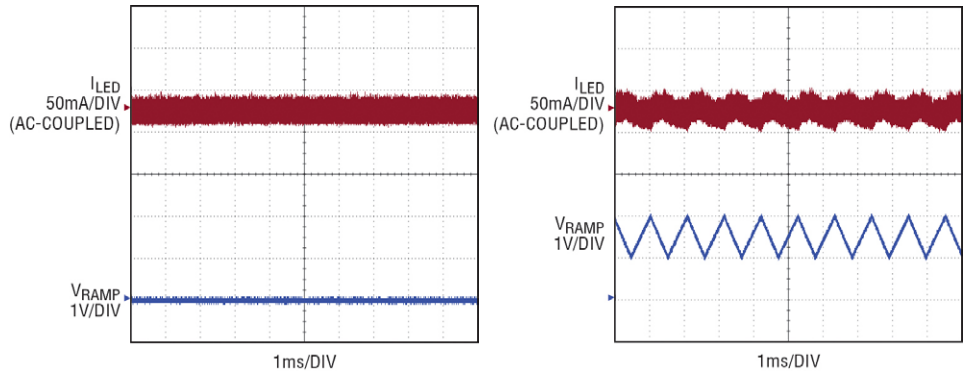


Fig. 4: Spread spectrum as implemented in the LT3795 has no discernable effect on LED brightness. The 1kHz spread spectrum sweep set in figure 1 has a negligible effect on LED ripple current (b) when compared to no spread spectrum (a) and is much too high a frequency to be detected by the human eye as flicker.

form. Figure 5a shows the result of LT3795's spread spectrum operation on the PWM LED current. The waveform is consistent cycle-to-cycle, which results in flicker-free operation. Figure 5b shows the results of a comparable, non-LT3795, spread spectrum solution. The cycle-to-cycle variation in on-time shape produces variation in average LED current, which can be seen as LED flicker at high dimming ratios.

Note that spread spectrum driver ICs without the LT3795's patented technique might produce a clean spread spectrum EMI reduction result but the flicker may still be present. One has to observe the LEDs or the LED current waveform to understand if flicker is present. In the case of the LT3795, both the conducted EMI scan and the scope shot of LED current are good.

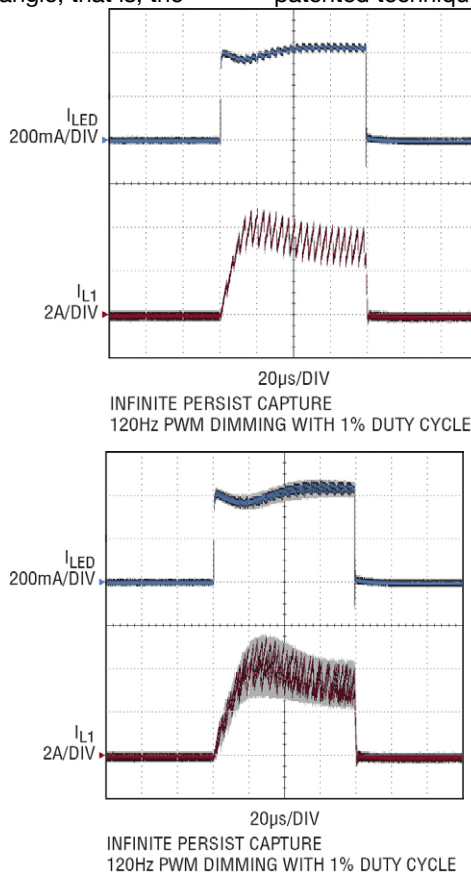


Fig. 5: Comparison of two spread spectrum LED driver solutions and the effect on PWM dimming. In (a), the patent-pending spread spectrum technique of the LT3795 produces consistent cycle-to-cycle LED PWM on-time shape. The waveforms in (b) show a comparable, non-LT3795, spread spectrum LED driver result.

Short-circuit proof boost

The LT3795 boost LED driver shown in figure 1 is short-circuit proof. The high side PMOS disconnect is not only used for PWM dimming, but also for short-circuit protection when the LED+ terminal is shorted to ground. Unique internal circuitry monitors when the output current is too high and the LED+ voltage is too low, turns off the disconnect PMOS and reports a short LED fault. Similarly, if the LED string is removed or opened, the IC limits its maximum output voltage and reports an open LED fault.

Multi topology solution

The LT3795 can be used to drive LEDs in a boost setup as shown here, or it can be used in buck mode, buck-boost mode, SEPIC and flyback topologies when the relationship of the LED string voltage and input voltage ranges requires it. All topologies feature the same spread spectrum and short-circuit protection.

The LT3795 can even be configured as a constant boost or SEPIC voltage regulator with spread spectrum frequency modulation.

New generation controls offer huge benefits for indoor lighting

By Dr Andy Davies

Technological advances in monitoring and control solutions for indoor lighting offer designers, engineers and managers an array of benefits from significant reductions in a building's energy consumption, and the associated cut in CO2 emissions, to unrivalled dynamic control of all lighting output. Innovative lighting systems are inherently flexible and offer completely customisable solutions for every client.

There is huge potential to make significant savings on energy costs by taking control of indoor lighting. Of all the controllable lighting sold in Europe today 75% is currently not being controlled by anything more sophisticated than an on/off switch. As lighting accounts directly for 50% of the electricity consumed in Europe's office buildings, control of this expenditure would be hugely beneficial to those organisations wishing not only to cut energy costs but also boost their green credentials.

Traditional lights are extremely energy inefficient or lack controllability. For instance, incandescent light bulbs convert less than 5% of the energy they use into visible light and the remaining energy is converted into heat; an unwanted output and unnecessary expense in offices that then have to rely on air-conditioning to regulate the temperature.

Incandescent lights also have much shorter life spans than many of the alternatives. With an average life span of around 1,000 hours, the maintenance and replacement costs of these light sources has to be taken into consideration when compared with compact fluorescent lights, which have an expected life span of up to 10,000 hours and LED lamps that offer up to 100,000 hours.

Fluorescent lights will convert about 22% of power input into visible light and produce less heat but they require a ballast and their life span is greatly reduced when switched on and off regularly. They also do not have a dimming capacity. Fluorescent lights may be more energy efficient than incandescent lights but, again, they lack controllability.

LEDs address both these issues by offering an energy efficient option that is easy to control. However it is only with the recent developments in monitoring and control systems for indoor lighting that the full potential of LEDs can now be realised. This new generation of lighting controls has been instrumental in overcoming a number of challenges faced by the earlier generation controls.

Early generation lighting controls, such as DALI and Analogue 1-10V, may be effective in reducing energy consumption but are particularly difficult to commission. Specialist engineers, who can command daily fees of between £600 and £1,000, are required to configure an early generation control system. As this task can take several days this cost alone makes these systems financially unattractive.

In new builds configuration of these early generation systems

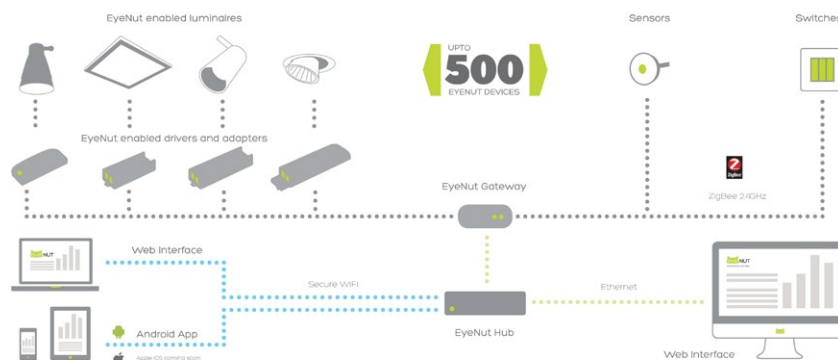


Fig. 1: Harvard Engineering's EyeNut LED-lighting control infrastructure.

may be carried out in vacant sites before the exact occupancy patterns are known. Based on these assumptions it is highly unlikely that the best energy saving strategies will have been programmed into the system. To optimise the full energy efficiency potential, reconfiguration is often required, however this expense is even more difficult to justify as these controls have no means to monitor their own performance and so their true effectiveness is impossible to ascertain.

The new generation of indoor lighting systems which have been recently launched into the market offer control and monitoring capabilities that overcome these challenges and help to optimise the full potential of energy efficient lighting units, such as LEDs – see figure 1.

These new solutions can be incorporated into a new build at the design stage or easily retrofitted into existing sites as part of a refurbishment scheme and through wireless networked controls the new intelligent lighting solutions eliminate the need for expensive rewiring of existing buildings and the inevitable disruption to normal business operations. The ability to retrofit these new wireless systems into existing sites is a significant advantage, especially taking into consideration the fact that of all the buildings that are expected to be here in 2050 80% have already been built.

One of the most time-consuming tasks associated with commissioning existing lighting control systems, namely the recognition and addressing of individual lights within a scheme, is overcome by new generation solutions that use RFID functionality. Each luminaire can be scanned into the system by using the RFID scanner, or an App on a tablet or smartphone. The intuitive, user-friendly Graphic User Interface (GUI) then has the ability to map each light within the system; it is this innovative technology that allows for the unrivalled control and flexibility of the latest lighting solutions.

Control systems that use the open protocol ZigBee mesh network can be operated remotely through the internet via smartphones or computers. This open protocol also offers robust protection against communication breakdown between two devices on the same network, an issue that had previously caused nervousness with earlier wireless technology. Further network security features can include the adoption of remote server hosting, an option often available through the provider of the control system.

Dr Andy Davies is business development manager for indoor controls at Harvard Engineering - www.harvardeng.com



Solutions from AC to Point of Load

Our Latest Products

Picor Cool-Power Isolated ZVS DC-DC Converters

Simple to Use

- Complete Isolated DC-DC converter with zero-voltage switching module
- Three input voltage ranges for communication, industrial, rugged/M-Grade applications
- Communication converters have max peak input voltage of 100 V / 100 ms (non-operating)
- 2,250 V input to output isolation

High Density



- 50 W / 60 w output power (dependent upon converter model)
- Surface mount 22mm x 16.5mm x 6.7mm high-density package
- 900 kHz switching frequency, minimizes input filtering and reduces output capacitance

Rich Feature Set

- On/Off Control, positive logic ENABLE
- Wide trim range +10/-20% Trim
- Temperature monitor™ & Over-temperature Protection (OTP)
- Input UVLO & OVLO and output OVP
- Over current protection with auto restart
- Adjustable soft-start
- Output voltage sensing without opto coupler use for higher reliability



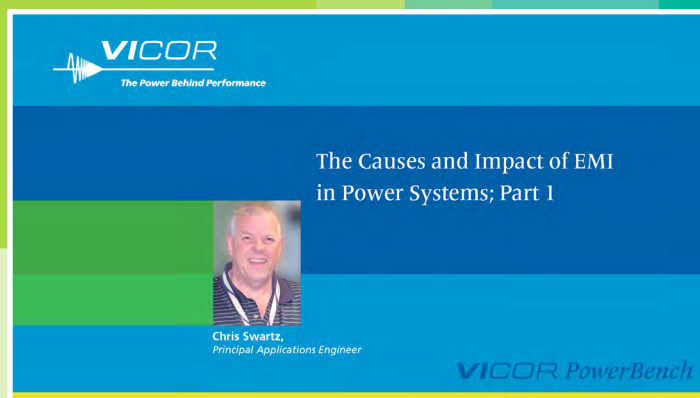
Resources


-  Blog Post: The technology behind the Cool-Power ZVS DC-DC Converters
-  Video: An Introduction to Vicor's Cool-Power ZVS DC-DC Converters

Cool-Power	Input	Output Set	Output Range	I _{OUT} Max
Communications (-40°C to 125°C)				
PI3101-00-HVIZ	36 – 75 V _{in}	3.3 V	3.0 to 3.6 V	18 A
PI3105-00-HVIZ		12 V	9.6 to 13.2 V	5 A
PI3110-01-HVIZ	41 – 57 V _{in}	18 V	16.2 to 19.8 V	3.3 A
Industrial (-40°C to 125°C)				
PI3109-01-HVIZ	18 – 36 V _{in}	5 V	4.0 to 5.5 V	10 A
PI3106-01-HVIZ		12 V	9.6 to 13.2 V	4.2 A
M-Grade (-55°C to 125°C)				
PI3109-00-HVMZ	16 – 50 V _{in}	5 V	4.0 to 5.5 V	10 A
PI3106-00-HVMZ		12 V	9.6 to 13.2 V	4.2 A
PI3111-00-HVMZ		15 V	12 to 16.5 V	3.3 A

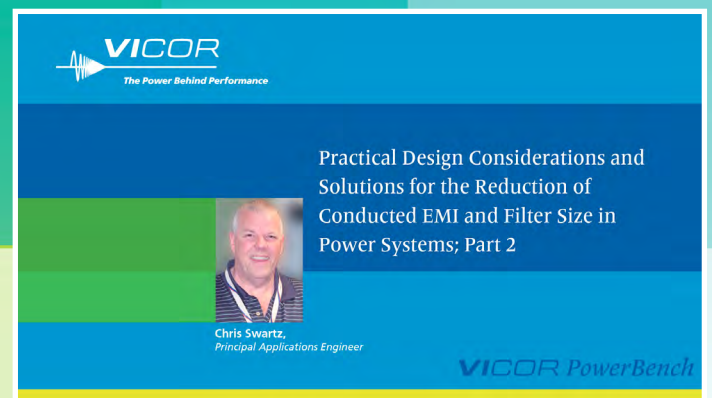
Two-Part Web Seminar Series About EMI


Watch Part 1



-  The Causes and Impact of EMI in Power Systems

Watch Part 2



-  Practical Design Considerations and Solutions for the Reduction of Conducted EMI and Filter Size in Power Systems

VI Brick AC Front End

Overview

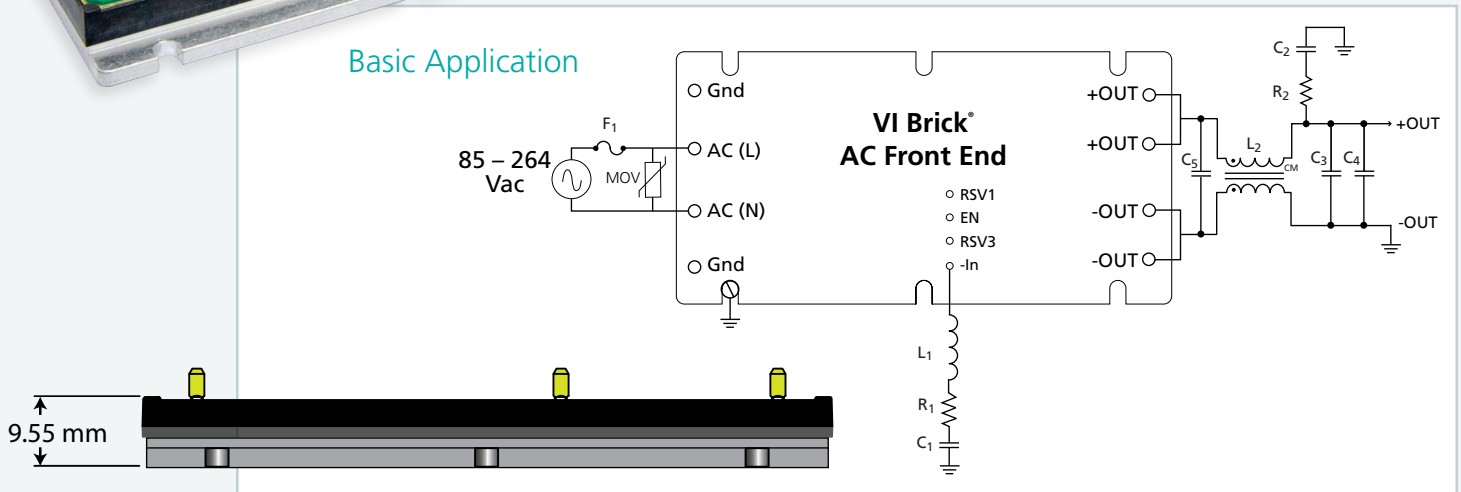
- Universal Input: 85 – 264 Vac
- Output: 48 Vdc - isolated, regulated (SELV)
- Power: 330 W - over entire input voltage range
- Isolated AC-DC converter with active Power Factor Correction (PFC)
- Integrated rectification, filtering and transient protection
- Peak efficiency: >92%
- EN55022, Class B EMI conducted emissions with a few components
- EN61000-3-2 harmonic limits
- -55 to 100°C baseplate operation

Features

- Low profile, 9.55 mm height above board
- Small footprint, size of a business card
- Flanged aluminum package for secure mounting and thermal management
- Consistent high efficiency across the worldwide mains (flat efficiency curve)
- Reduced power loss and cooling requirements
- Module includes PFC, regulation, isolated 48 V output (SELV), filtering, rectification, transient protection, agency approvals, simplified thermal management
- Simple design, requires few external components
- Module power density, 121 W/in³
- Complete solution including hold-up capacitors, 54 W/in³



Basic Application



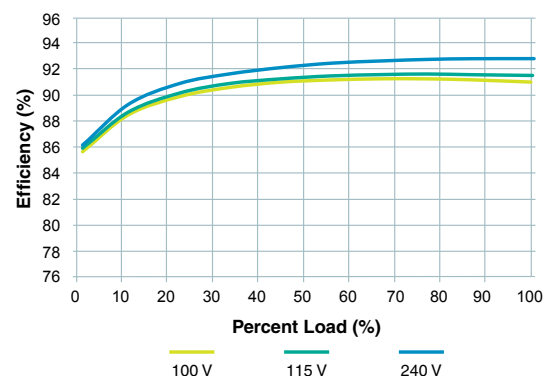
Resources

- [▶ An Introduction to the Vicor AC Front End Module](#)
- [▶ Webinar: Designing High Performance AC-DC Power Systems Using a Power Component Approach](#)
- [▶ AC Front End Product Information](#)

Part Number	Input Voltage	Output Voltage	Output Power	Operating Temperature
FE175D480C033FP-00	85 – 264 Vac	48 Vdc	330 W	-20 to 100°C
FE175D480T033FP-00	85 – 264 Vac	48 Vdc	330 W	-40 to 100°C
FE175D480M033FP-00	85 – 264 Vac	48 Vdc	330 W	-55 to 100°C

Replace the “-00” suffix in the part number with “-CB” to order an evaluation board.

Consistent High Efficiency Over Line, Load, Temperature



Picor Cool-Power ZVS Buck Regulators

Wide Operating Range

- Wide V_{IN} (8 – 36 V) and wide V_{OUT} (1 – 16 V)
- 12 V-optimized performance with PI34xx Series
- 40°C to 125°C operating range

Simple to Use; Fast Development Time

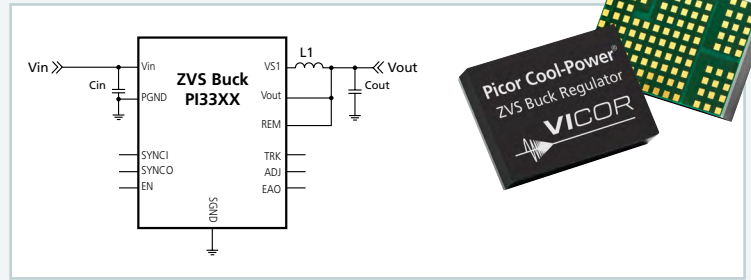
- Internal compensation - few external components
- No additional design or additional settings required

High Efficiency

- Up to 98% peak efficiency (19 V_{IN} to 15 V_{OUT})
- PI34xx Series optimized for 12 V_{IN} with even higher efficiency
- Light and full load high-efficiency performance

Flexible and Rich Feature Set

- Paralleling and single wire current sharing
- Frequency synchronization
- User adjustable soft-start & tracking
- Power-up into pre-biased load
- Optional I²C functionality & programmability



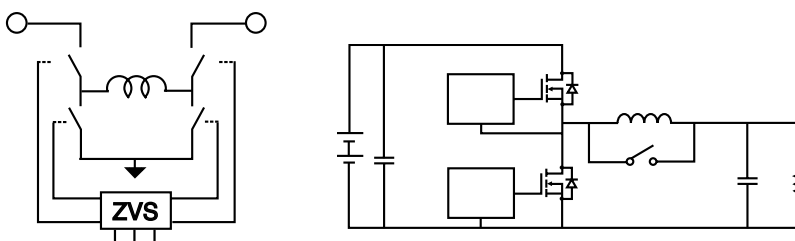
Cool-Power Model Number	Output Range		I_{OUT} Max
	Set	Trim Range	
PI3311-00-LGIZ	1.0 V	1.0 V to 1.4 V	10 A
PI3318-00-LGIZ	1.8 V	1.4 V to 2.0 V	10 A
PI3312-00-LGIZ	2.5 V	2.0 V to 3.1 V	10 A
PI3301-00-LGIZ	3.3 V	2.3 V to 4.1 V	10 A
PI3302-00-LGIZ	5.0 V	3.3 V to 6.5 V	10 A
PI3303-00-LGIZ	12 V	6.5 V to 13.0 V	8 A
PI3305-00-LGIZ	15 V	10.0 V to 16.0 V	8 A
Higher Current Versions			
PI3311-01-LGIZ	1.0 V	1.0 V to 1.4 V	15 A
PI3318-01-LGIZ	1.8 V	1.4 V to 2.0 V	15 A
PI3312-01-LGIZ	2.5 V	2.0 V to 3.1 V	15 A
PI3301-01-LGIZ	3.3 V	2.3 V to 4.1 V	15 A
I²C Functionality and Programmability			
PI3311-20-LGIZ	1.0 V	1.0 V to 1.4 V	10 A
PI3318-20-LGIZ	1.8 V	1.4 V to 2.0 V	10 A
PI3312-20-LGIZ	2.5 V	2.0 V to 3.1 V	10 A
PI3301-20-LGIZ	3.3 V	2.3 V to 4.1 V	10 A
PI3302-20-LGIZ	5.0 V	3.3 V to 6.5 V	10 A
PI3303-20-LGIZ	12 V	6.5 V to 13.0 V	8 A
PI3305-20-LGIZ	15 V	10.0 V to 16.0 V	8 A
PI3311-21-LGIZ	1.0 V	1.0 V to 1.4 V	15 A
PI3318-21-LGIZ	1.8 V	1.4 V to 2.0 V	15 A
PI3312-21-LGIZ	2.5 V	2.0 V to 3.1 V	15 A
PI3301-21-LGIZ	3.3 V	2.3 V to 4.1 V	15 A
12 V Optimized Option			
PI3420-00-LGIZ	1.0 V	1.0 V to 1.4 V	15 A
PI3421-00-LGIZ	1.8 V	1.4 V to 2.0 V	15 A
PI3422-00-LGIZ	2.5 V	2.0 V to 3.1 V	15 A
PI3423-00-LGIZ	3.3 V	2.3 V to 4.1 V	15 A
PI3424-00-LGIZ	5.0 V	3.3 V to 6.5 V	15 A

8 – 36 Vin
8 – 18 Vin

Resources

- Video: Interview with ECE Europe about ZVS Regulators
- Webinar: ZVS Point-of-Load Regulation – Enabling High Performance On-Board Power Solutions
- Webinar: Design Considerations For High Performance On-Board Power Design
- Cool-Power ZVS Buck Regulators Product Information

I²C is a trademark of NXP Semiconductors



- Reduces Q1 turn-on losses
- Reduces gate drive losses
- Reduces body diode conduction

Benefits of Zero-Voltage-Switching Topology

VI Chip PRM Module

Simple to Use

- Point-of-load, Buck-Boost regulation
- Factorized Power Architecture
- Minimal external components

High Density

- Up to 1,700 W/in³, with 500 W in 1.1in² package

Wide Vin Optimized for 48 Vout

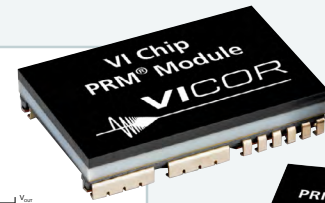
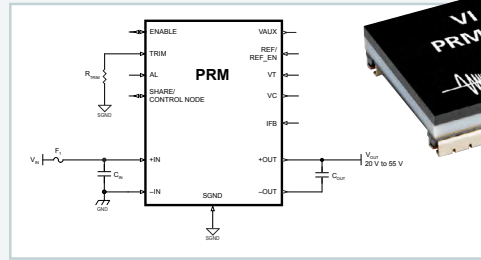
- 24 Vin, 18 – 36 Vin range
- 36 Vin, 18 – 60 Vin range
- 45 Vin, 38 – 55 Vin range
- 48 Vin, 36 – 75 Vin range

High Efficiency

- Full chip 500 W: 97.8%
- Half chip 250 W: 96.7%

Flexible

- Regulation: Remote sense, local loop, adaptive loop
- Parallel capabilities



PRM Modules Model Number	Input Voltage Nom. (V)	Input Voltage Range (V)	Output Voltage Voltage Range (V)	Output Power Max.	Output Current Max.	Package Size
P024F048T12AL	24 V	18 – 36 V	26 – 55 V	120 W	2.5 A	Full
P036F048T12AL	36 V	18 – 60 V	26 – 55 V	120 W	2.5 A	Full
P045F048T17AL	45 V	38 – 55 V	26 – 55 V	170 W	3.5 A	Full
P045F048T32AL	45 V	38 – 55 V	26 – 55 V	320 W	6.67 A	Full
P048F048T12AL	48 V	36 – 75 V	26 – 55 V	120 W	2.5 A	Full
P048F048T24AL	48 V	36 – 75 V	26 – 55 V	240 W	5.0 A	Full
PRM48BH480T200A00	48 V	38 – 55 V	5 – 55 V	200 W	4.17 A	Half
PRM48BF480T400A00	48 V	38 – 55 V	5 – 55 V	400 W	8.33 A	Full
✘ PRM48AH480T200A00	48 V	36 – 75 V	20 – 55 V	200 W	4.17 A	Half
✘ PRM48AF480T400A00	48 V	36 – 75 V	20 – 55 V	400 W	8.33 A	Full
✘ PRM48BH480T250A00	48 V	38 – 55 V	20 – 55 V	250 W	5.21 A	Half
✘ PRM48BF480T500A00	48 V	38 – 55 V	20 – 55 V	500 W	10.42 A	Full

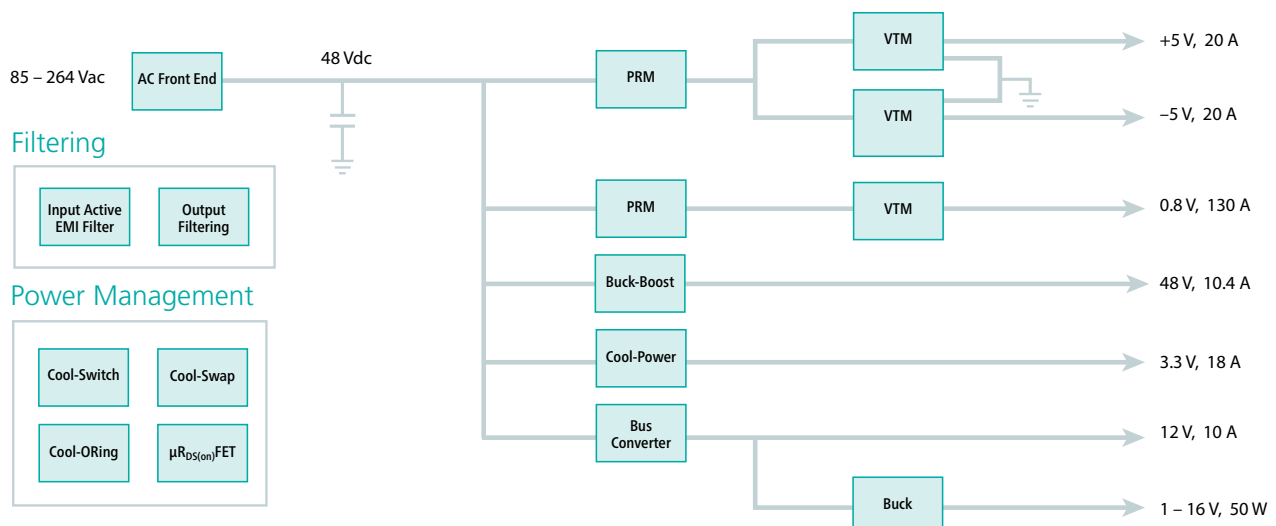


These PRM modules can be further configured to meet your exact needs.

<input type="checkbox"/>	V	Min: <input type="text"/>	Max: <input type="text"/>
Undervoltage Lockout Hysteresis	<input type="checkbox"/> %	Min: <input type="text"/>	Max: <input type="text"/>
	<input type="checkbox"/> V	Min: <input type="text"/>	Max: <input type="text"/>
Overvoltage Lockout	<input type="checkbox"/> %	Min: <input type="text"/>	Max: <input type="text"/>
	<input type="checkbox"/> V	Min: <input type="text"/>	Max: <input type="text"/>
Overvoltage Lockout Hysteresis	<input type="checkbox"/> %	Min: <input type="text"/>	Max: <input type="text"/>
	<input type="checkbox"/> V	Min: <input type="text"/>	Max: <input type="text"/>
Output Voltage			

Resources

- Video: Overview of Vicor's VI Chip PRM Module
- PRM Product Information
- Configure a PRM for your application's requirements



Solutions from AC to Point of Load

Introducing... The Growing ChiP Lineup

"Converters housed in Package" Technology

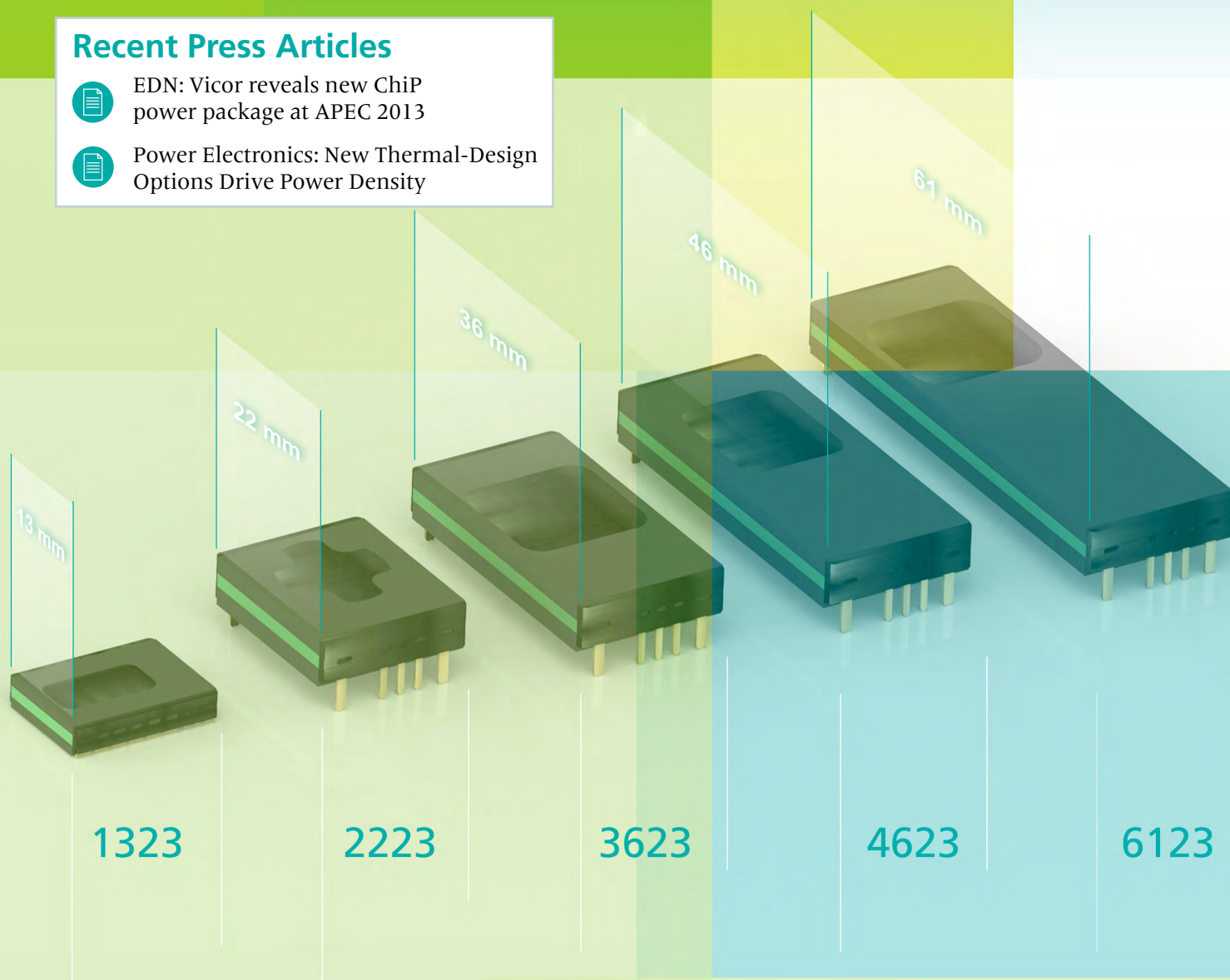
Recent Press Articles



EDN: Vicor reveals new ChiP power package at APEC 2013



Power Electronics: New Thermal-Design Options Drive Power Density



Resources



2013 APEC Plenary Session
Patrizio Vinciarelli, CEO, Vicor Corporation



Stephen Oliver
Vice President, VI Chip Product Line



Vicor's CEO discusses ChiP technology at APEC



An introduction to ChiP technology

Online Design Tools

Online Simulator

- Simulate electrical and thermal behavior
- User defines line and load conditions, input and output impedance and filters
- Simulations include start-up, steady state, shutdown, Vin step and load step, as well as thermal.
- Electrical and thermal performance showed in charts and tables







- Determine trim resistors for fixed and variable output voltage trimming
- Calculate required bus capacitance for VI-ARM, FARM, and ENMod modules
- Thermal calculator for heat sink selection

Filter Design

- Select attenuation and frequency
- Choose from five different topologies
- Supports regulated and unregulated converters

Design Calculators

Resources

-  Video: Using Vicor's online simulator
-  Online simulator: VI Brick IBCs
-  Online simulator: BCMs
-  Online simulator: PRMs
-  Filter design tool
-  Design calculators



Watch Video

Visit NEW Website ▶

Navigate >
Select >
Architect >
Configure >
Simulate >

Configure Your Product

PowerBench™ online design center

- Design your own DC-DC converters to meet your application's requirements
- Or use hundreds of predefined designs
- Online registration allows designs to be saved

VI Chip® PRM® Module

- Point-of-Load Buck-Boost regulation with remote sense
- Full Chip (up to 500 W in 1.1 in²)
- Half Chip (up to 250 W in 0.57 in²)

Other DC-DC Converters

- Maxi, Mini, Micro Series: Full (160–600 W), Half (100–300 W), Quarter (50–150 W)
- VI-200 / VI-J00 Series: Full brick (50–200 W), Half brick (25–100 W)
- ComPAC, VIPAC Arrays and chassis-mount MegaMods




AC-DC Converters

- VIPAC - Autoranging input with filtering, multiple output, cold plate chassis,
- FlatPAC - Multiple output and autorange input with heat sink or conduction-cooled models

Complete power systems

- Westcor custom AC-DC
- High power density, small size, high efficiency
- Fan-cooled, slide-in assemblies

Resources

-  PowerBench online design center
-  Design calculators
-  Webinar: Modeling, Simulation, and Selection Techniques in Power Design

VI Chip PRM Module Configurator

User Defined Module

Specify a User Defined PRM Module All PRM Modules

Designer's Reference (This text is for reference in M)

Input Voltage

Voltage Range Platform

1. Wide (36-75 V) Narrow (38-55V)

	Selection Range
Vin Low Line	<input type="text"/> V
Vin Nominal	<input type="text"/> V
Vin High Line	<input type="text"/> V
Undervoltage Lockout	<input type="text"/> %
Undervoltage Lockout Hysteresis	<input type="text"/> %

Enabling Our Customers' Competitive Advantage

At Vicor, we enable customers to efficiently convert and manage power from the wall plug to point of load.

We master the entire power chain with the most comprehensive portfolio of high efficiency, high-density, power distribution architectures addressing a broad range performance-critical applications.

Vicor's holistic approach gives power system architects the flexibility to choose from modular, plug-and-play components ranging from bricks to semiconductor-centric solutions.

By integrating our world-class manufacturing and applications development, we can quickly customize our power components to meet your unique power system needs.

Focus Performance-Centric Markets /Applications

Communications

- > 400 VDC Power Distribution
- > Datacom
- > Netcom
- > Telecom Infrastructure

Computing

- > Data Centers
- > High Performance Computing
- > Network Servers

Industrial

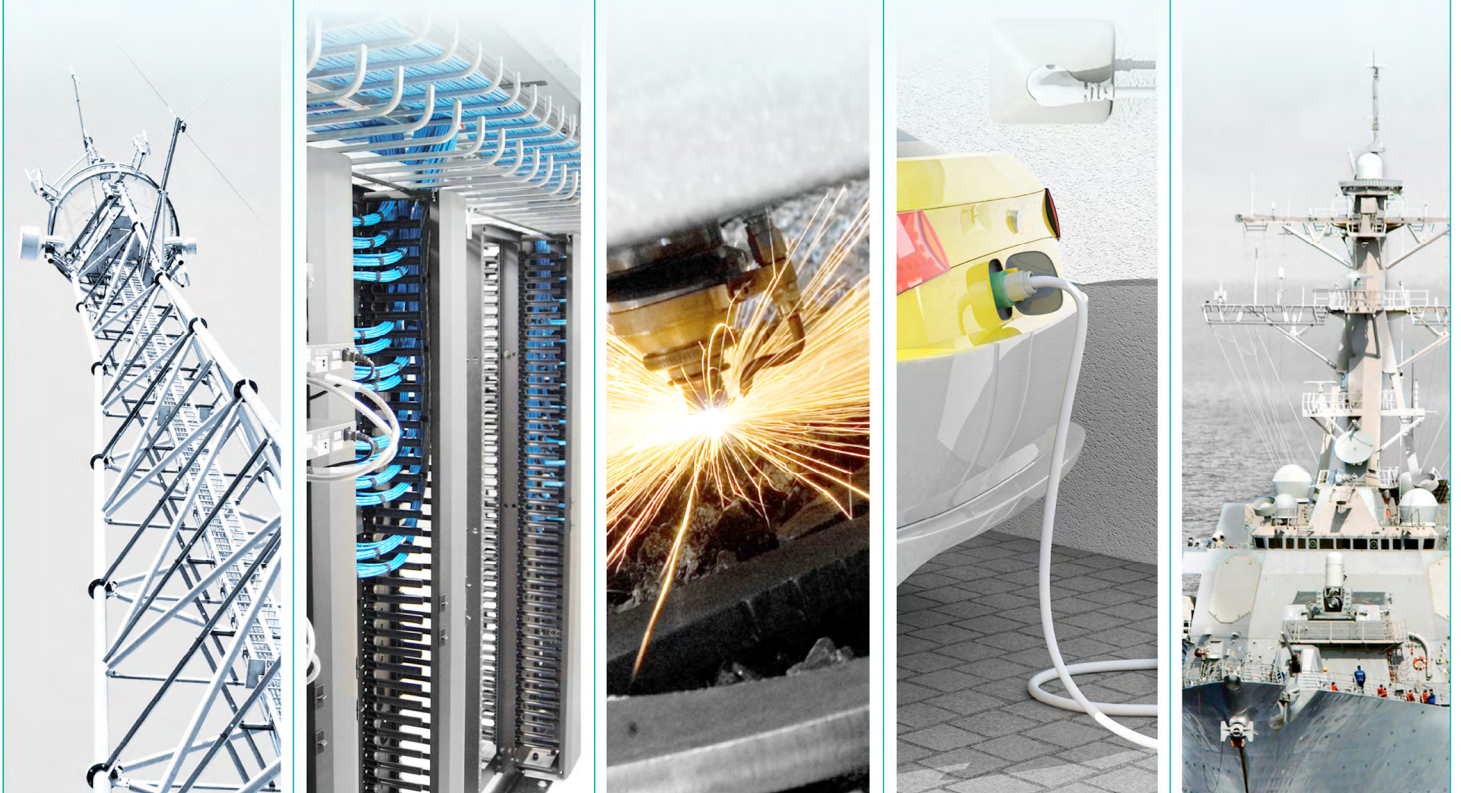
- > ATE
- > Lighting
- > Process Control
- > Transportation

Automotive

- > Electric Vehicles
- > Hybrid Vehicles

Defense/Aerospace

- > Aircraft Test Equipment
- > Ground Vehicles
- > Radar
- > Telemetry
- > Unmanned Vehicles



Developments in wireless technology have opened up a number of additional opportunities. It offers unrivalled flexibility and controllability to building managers who can monitor and control light output throughout a building from a single remote hub. This level of dynamic control can be extended from this single remote hub to multiple sites or multiple buildings allowing managers to oversee light intensity and energy consumption throughout all the properties under their jurisdiction and then giving them the tools to control it.



Fig. 2: The EyeNut wireless monitoring and control system interface from Harvard Engineering.

The wireless technology also allows engineers to monitor the energy consumption of each individual luminaire, or groups of luminaires, their light intensity and potential lamp failure to ensure that the most efficient maintenance schedule can be implemented whilst reducing engineer on-site time. These cost benefits are additional to the savings made automatically through reductions in energy usage.

As buildings become increasingly multi-functional the requirements from occupants become more varied. Seldom does a building now house a single occupant; instead retail, residential, manufacturing and offices reside on the same site creating challenges to building managers aiming to optimise energy efficiency strategies whilst at the same time meeting all the users' needs 24-hours a day.

Lighting will not be required at full intensity at all times in all areas but determining the best lighting option has not always been an easy task, especially as people do not follow set patterns. Retail outlets are open longer and people work flexible hours. To meet these changing requirements lighting systems have to be intelligent, adaptable and customisable. Even within buildings different areas often need different lighting, for example the lighting required on the shop floor in a supermarket will be significantly different to that in the stockroom.

By using the detailed monitoring and analysis capabilities now available through the latest lighting systems building managers have at their fingertips the data to implement a whole suite of energy saving strategies to optimise efficiency – see figure 2. This data can be gathered automatically at regular intervals to give a broad overview of the whole system. Lighting can then be tailored to meet the specific requirements of each area, activity and time of day. The new generation solutions are able to use the energy consumption data gathered to create a map of the whole complex allowing managers to not only instantly alter the lighting in each area to suit the activity taking place but also to generate and implement longer term energy saving strategies.

Intelligent solutions can use a number of energy efficiency strategies, often simultaneously, to reduce energy consumption. Photocell sensors can measure the amount of daylight in any given location and adjust the intensity of the electric lights to ensure optimum efficiency and light output. Occupants will be unaffected by these daylight harvesting operations as small reductions are undetectable by the human eye. Nevertheless these reductions will deliver significant savings over time. Lights may be dimmed without impacting on human activity. Managers can see the dim status of all lights on the system from the remote hub and have the ability to return all lights to their full intensity at the push of a button when required. Further energy saving strategies include time scheduling, load shedding and scene setting.

Intelligent new generation monitoring and control lighting systems allow for the delivery of a completely user-customisable dynamic lighting solution that will save money on energy and maintenance whilst at the same time reducing carbon emissions. Managers can implement a co-ordinated lighting strategy across their entire property portfolio, however complex or diverse, from a single building to multiple sites.

Seizing control of indoor lighting is one simple way in which a business can save money, energy and reduce their carbon footprint. These benefits can be achieved without having any impact on business operations. With the installation of such a system managers have complete control over the whole lighting output, whether this is in retail, residential, manufacturing, office-based settings or a combination in a mixed-use development. Flexibility and adaptability combine with comprehensive monitoring and control capabilities to ensure a completely user-customisable indoor lighting system that delivers on every level.

Electromechanics for LEDs

- various LED heatsinks
- versatile thermal conductive materials
- LED connectors for LED-line module and PCB
- special solutions and versions for your special application



For more details please
 check our website:
www.fischerelektronik.de

Fischer Elektronik GmbH & Co. KG

Nottebohmstraße 28
 D-58511 Lüdenscheid
 Phone +49 (0) 23 51 43 5-0
 Fax +49 (0) 23 51 4 57 54
 E-mail info@fischerelektronik.de
www.facebook.com/fischerelektronik



Zhaga Consortium publishes interface specification for LED light engines

Two more interface specifications for LED light engines have been published by the Zhaga Consortium which is an international organization that is enabling the interchangeability of LED light sources made by different manufacturers. Book 7 covers a variety of rectangular and linear LED modules with separate electronic control gear that are intended primarily for use in in do or lighting applications. Book 8 describes a drum-shaped LED light engine (LLE) with integrated electronic control gear, used primarily for downlighting applications. Book 7 modules are typically mounted directly into a luminaire by means of screws, while Book 8 light engines can be inserted into a suitable socket inside the luminaire.

Luminaires built using interchangeable, Zhaga-based LED light sources enable manufacturers to switch from one supplier to another without changing the design of the luminaire. This can increase competition among suppliers, alleviate the risks of having a single source, and allow luminaire makers to take full

advantage of light-engine performance enhancements. Books 7 and 8 join Books 1, 2 and 3, which are already available for public use. The other approved Books are expected to be published shortly, and new specifications are in development. Zhaga interface specifications are made public as soon as each specification is stable and the certification procedure is fully established.

Zhaga member companies have already received certification for a range of products that were designed according to either Book 7 or Book 8, including LED modules and holders. Zhaga interface specification Book 7 defines the interfaces of a variety of LLEs comprised of non-socketable LED modules with separate electronic control gear.

Such LLEs are intended primarily for use in indoor lighting applications. Book 7 covers several rectangular LED modules with different dimensions.

Zhaga Consortium

www.zhagastandard.org/specifications

Programmable LED driver ICs enable digital dimming, wireless control and sensor control

Dialog Semiconductor has released the smarteXite platform based on fully configurable logic, a LED driver technology designed to directly and easily support wireless connectivity, light sensor control and allowing easy integration into lighting control systems. The first device from the smarteXite family, the iW6401, supports multiple dimming interfaces, including digital dimming via a simple main on/off switch, the new Ledotron digital dimming protocol and toggle-switch based dimming. All dimming-curves can be memory-configured to enable a



highly optimised end-user lighting experience. The integrated digital loadline transmission (DLT) receiver in the iW6401 sup-

ports the Ledotron IEC 62756-1 dimming protocol, making it the world's first single-chip plug-and-play Ledotron solution. Using a standard I2C digital interface, the iW6401 can serve as a frontend for wireless communication modules like low-energy Bluetooth, Wi-Fi or ZigBee. Additionally, intelligent sensor devices enabling colour- or proximity-sensing can be directly connected.

When such a peripheral device is used, the integrated power management unit in the iW6401 provides a stable power source, reducing the external component count and cost. The iW6401 programmable AC/DC retrofit LED lamp driver IC allows engineers to design and configure the bulb design via software with an optimised bill of material.

SmarteXite supports final stage digital calibration on the production line where the bulb manufacturers can reconfigure the illumination calibration settings like brightness and colour via the A/C mains terminals.

Dialog Semiconductor

www.dialog-semiconductor.com

Remote phosphor LED lighting module delivers 203 lumens per Watt

Intematix Corporation, a leading manufacturer of phosphor solutions and Philips Lumileds, a leading LED supplier, today announced a remote phosphor-based LED lighting module with 203 lumens per watt efficacy. The module is claimed to represent the highest level of efficacy among LED-based light sources commercially available for production in the market. "This result is a significant step along our innovation roadmap for phosphor solutions," said Yi-Qun Li Chief Technology Officer at Intematix. "Remote phosphor architectures lower cost, increase efficacy and improve light quality in many of the consumer, commercial, industrial and outdoor area lighting applications commonly deploying LED technology today." The LED lighting module uses a commercially available, 26 mm diameter dome shaped remote phosphor developed by Intematix that converts blue light to on-the-black-body-line 6000K daylight spectrum and 70CRI with conversion efficacy of 267 lumens per radiant watt. The design is applicable for round and linear mod-

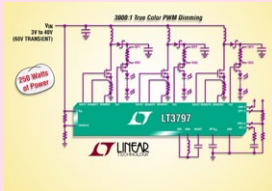
ule configurations and is offered in color temperatures ranging from 2700K to 6000K with CRI values from 70 up to 98. The groundbreaking lighting module uses Philips Lumileds LUXEON T/TX family of royal blue LEDs, achieving industry leading wall plug efficiencies of 76%. "We're very proud of this landmark performance of 203 lm/W as this was achieved using our latest commercially available LED technology and Intematix's remote phosphor," said Jy Bhardwaj, Senior Vice President of R&D at Philips Lumileds. "This marquee performance simplifies a wide variety of thermally constrained applications such as 100 W A19 bulbs and high lumen candle lamps, and enables downlights with the highest efficacy in the industry." Remote phosphor solutions are notable for delivering high quality, uniform light and omni-directional light distribution to applications like replacement lamps, high bay industrial illumination and linear applications like commercial lighting. By increasing efficacy, remote phosphor reduces material and operating costs.

Intematix

www.intematix.com

High-current LED driver controller handles 250W

LT3797 is a triple output DC/DC controller designed to drive three independent channels of LEDs. Its fixed



frequency, current-mode architecture delivers constant, accurately

regulated LED current over a wide range of supply and output voltages. Its 2.5V to 40V input voltage range with transient tolerance up to 60V makes it suitable for automotive applications as well as a wide range of industrial applications. Each of the LT3797's channels can drive a wide range of LED power in either step-up, step-down or SEPIC topologies. In a boost configuration, it powers three channels of up to 90V of LEDs with LED currents in excess of 1A, delivering over 250W of power from a nominal 12V input with efficiencies as high as 93%. Each of the three channels is operated by an independent "True Color" PWM signal, enabling each channel to be dimmed to ratios as high as 3000:1. Each channel has open-LED and short-circuit protection in boost mode, providing high safety and reliability designs required in automotive applications. A frequency-adjust pin enables the user to program the frequency between 100 kHz and 1 MHz. The thermally-enhanced 7x8 mm QFN package provides a compact solution footprint for 20W to 250W LED applications.

Linear Technology
www.linear.com

Intelligent programmable LED driver packs 150-W

Efore's Italian-based ROAL Electronics acquisition has launched a higher power Intelligent LED driver series which combines smart technology, space and energy savings, and user-managed flexibility into a compact 150 W package.

The Ozone 150W series single channel constant current LED drivers are designed for directly powering LEDs in high power indoor and outdoor lighting fixtures such as street, tunnel, flood, parking lot, industrial and high baylight-

ing. Ozone integrates many intelligent functions, such as adjustable dimming, soft start and constant light feature, plus complimentary software and user friendly programming tools that may be used to set all of the driver's features. A dedicated case accessory enables the unit to be used in remote gear applications.

First samples will be ready in December 2013 for OEM customers. The family will be released to distribution beginning in Q2/2014.

Efore
www.efore.com

Wide-area portable LED light focuses on Class 1, Division 2 applications

Molex has introduced the Woodhead Wide-Area Portable LED Light for Class 1, Division 2 locations including petrochemical and refinery environments. Designed to operate safely in hazardous conditions, the Wide-Area Portable LED light delivers industry leading 5270-lumen output lasting 50,000 hours, provides instant-on capability and is reliable even in extreme temperatures of -40 to +40°C. Used for task lighting in maintenance and repair operations, the Wide-Area Portable LED light features a rugged cast-aluminium enclosure with a rubber lens-gasket assembly to ensure superior strength and durability, including resistance to shock, vibration, impact and intrusion of dust and water. It includes four 20 W LED arrays with Molex array holders that can be easily serviced and contain no mercury, eliminating costly lamp disposals. The colour temperature of 5100K and CRI of 87 helps reduce fatigue and allows for better colour differentiation than alternate light sources. Additionally, a removable diffuser under the lens cuts the harshness of LED light for improved visibility. The Wide-Area Portable LED Light is third-party certified to CSA Class I, Division 2, Groups B, C and D requirements with a T4A temperature rating and NEMA Type 3 enclosure rating for wet locations. Because of its hazardous duty rating, the lamp can be used for scaffold and area lighting in petrochemical, refinery, utility and gas processing plants. The light features a versatile mounting system and a variety of electrical cable options, including Brad power cordsets for Zone 2 environments, providing a flexible set up and stability while in use.



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Model-based design of advanced motor control systems

By Anders Frederiksen

LEVERAGING ADVANCED PROCESSOR functionality to facilitate ease of design has been discussed throughout recent decades. Nowadays even greater design flexibility allows engineers to use standard Model-Based design with MATLAB and Simulink can be used to optimize motor control systems functionality and to minimize overall design time. It also enables design engineers to reuse simulation models to ensure the correct functionality and desired performance of a system in its end market application.

Model-Based Design (MBD) has been a discussion topic for decades but has only in recent years evolved into a complete design flow - from model creation to complete implementation. In the 1970s analogue computing platforms were available for simulation but control hardware implementation was done at the transistor level. Simulation tools advances through to the 2000s saw the introduction of graphical control schematic entry tools and control design tools that vastly simplified the task of complex control design and evaluation. However, the control system designer still developed the hardware control algorithm by writing C code to mirror the simulated design. Now at the start of this decade, complete MBD allows a common control design for both simulation and hardware implementation platforms enabling complex control algorithms to be rapidly deployed on hardware platforms.

MBD is a process that uses a system model as an executable specification throughout development. This simulation-based approach gives you a better understanding of design alternatives and trade-offs than traditional hardware prototype-based design methodologies, enabling you to optimize your design to meet predefined performance criteria. Rather than using complex structures and extensive software code, designers can define models with advanced functional characteristics using continuous-time and discrete-time building blocks. Existing C code can be integrated with standard control library blocks to maximize design efficiency. These models, used with simulation tools, can lead to rapid prototyping, software testing

and hardware-in-the-loop (HIL) simulation. Simulation enables specification discrepancies and modelling errors to be found immediately, rather than later in the design cycle. Automatic code generation eliminates the manual steps in implementation the same algorithm to run on the hardware platform. This simplifies the design process, minimizes errors in hardware design implementation and reduces the overall time-to-market.

There are multiple steps within MBD that allow optimization of individual tasks in the overall design. These tasks can be completed by different design engineers or design teams, and then combined to form the overall design and complete system – see figure 1. With this approach, a higher level of abstraction of the individual tasks can be applied, resulting in an overall design flow optimized for the given end application. All-in-all MBD allows a designer to expand from more classical design schemes and move directly from model creation to simulation, code generation, and HIL test, in a controlled fashion that allows incremental changes in system behaviour without a complete redesign of the system.

In figure 2 the different design phases and the scale of individual steps in the flow are visualized. These steps together describe the “standard” flow of MBD. From a motor control design perspective they are:

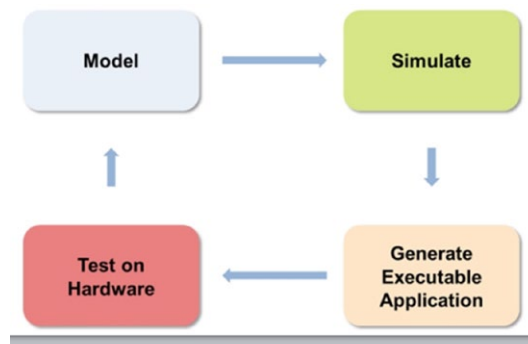


Fig. 1: Model-based design flow.

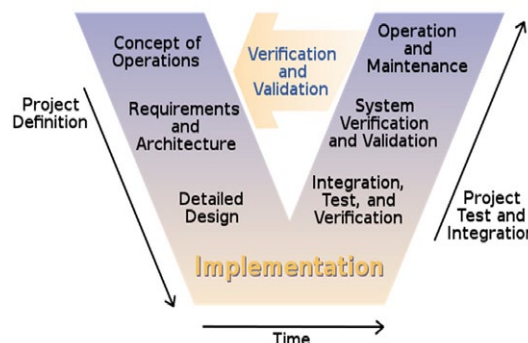


Fig. 2: Concept of a model-based design implementation.

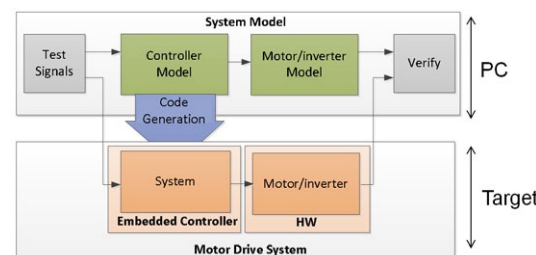
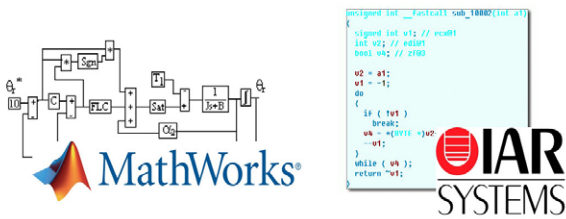


Fig. 3: Model-based design setup.

- Concept of operations
- Overall functionality of the motor system
- Plant modelling / Architecture
- Development of models of motor, load, power electronics, signal conditioning, etc.
- Controller modelling and requirements
- Encoder-based field oriented control of 3-phase PM motor
- Analysis and synthesis – Detailed design
- Models created above are used to identify dynamic characteristics of the plant model

- Tuning and configuration of the system
- Validation and test
- Off-line simulation and/or real-time simulation
- Investigation of time response of the dynamic system
- Deployment to embedded target – Full operation
- Automatic code generation
- Test and verification
- Updating controller model

Anders Norlin Frederiksen is Segment Marketing Manager for Motor and Power Control at Analog Devices – www.analog.com – He can be reached at anders.frederiksen@analog.com



Strength	<ul style="list-style-type: none"> - Solving differential equation - Time domain modeling - Visualization 	<ul style="list-style-type: none"> - Register setup and control - Managing System resources - Time scheduling
Weakness	<ul style="list-style-type: none"> - Target specific setup - Managing system resources - Time scheduling 	<ul style="list-style-type: none"> - Real time control systems - Debugging and test - Visualization

Fig. 4: MathWorks & IAR system strength.

Together this forms a multi-step approach for aligning the overall design and allows individual control steps to be analysed independently. Once the hardware and software specification has been completed, the complete system architecture can be setup for deployment of both specific algorithm and functionality of the overall system - see figure 3. Simulation of controller and plant models can be evaluated. Off-line development of algorithms without access to hardware can be architected and fine-tuned to meet overall system performance requirements. Initial code generation, either with existing code "reuse" or code generated by a code generation tool, can be deployed to the embedded controller to compare the system simulation on a

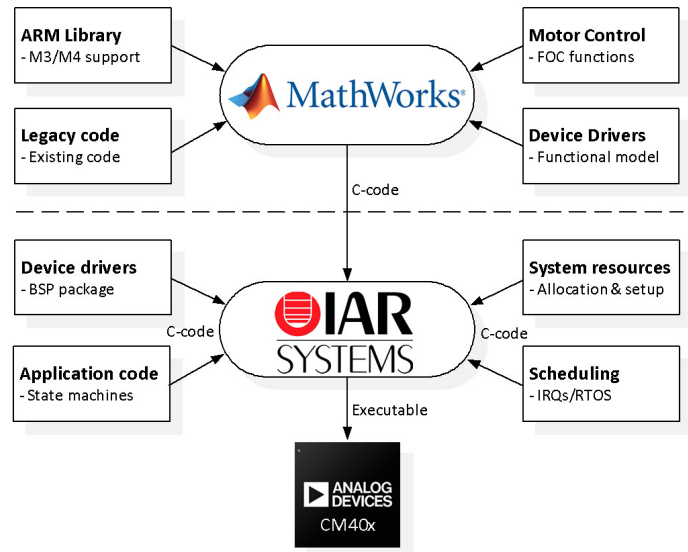


Fig. 5: Deployment environment.

PC with the actual implementation data on a hardware target. A designer must consider the complexity of the model when defining a correctly balanced structure for MBD. However, once a balanced concept is realized, it is possible to quickly change independent models within the design and achieve more accurate results from the entire drive system.

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The experimental setup used as background for this paper is based on an ARM CortexTM-M4 mixed-signal control processor from Analog Devices used with combined tools from IAR and MathWorks, to achieve complete implementation of the MBD platform. Each of the steps discussed above has a direct link to the available tools and to the overall implementation. As can be seen in figure 4, each tool-chain offers a range of value. In MBD, the designer must choose how to balance the use of these tool-chains with the overall value creation of the independent MBD platform.

For the target platform a real-time development environment is now in place to model, simulate, evaluate, deploy and optimize overall system performance and capability. This is all based on MBD and the balanced selection of system parameters, resulting in best-in-class flexibility where specific optimization is needed. In this way a scalable model of a system has been realized which facilitates use and reuse of code, either based on existing legacy code or functions, or complete new building blocks based on standard C or graphical functionality (Simulink/MATLAB models aligned with the complete simulation and deployment phase as shown in figure 5).

Not only from the software perspective is it possible to change the overall setup, but once the right device drivers for a system are developed, a designer can change system resources, hardware elements and overall applications software for the end-application or system. Also, by being able to control the real-time aspects of the overall system timing, optimization of system scheduling is possible directly through this environment.

Taking a deeper look at the classic sketch of a drive system as in figure 6, one can now visualize the capability of this architecture. It is possible to optimize each of the elements in the "Drive" and focus effort on what element is most critical to the end system. This means that, for example, if protection functionality and scale is of key importance, then the focus can be placed on the mechanical system in combination with the electrical control and power system. A mix of simulated results and real-time data can be used for monitoring system behaviour, and together forms a "Live" optimization. On the other hand, if noise disturbances decrease the overall efficiency level of the system, measurements of these can be used in scalable filters and observers which minimize the hardware's noise issues to give an optimal state. Once all factors have been modelled and gathered, the final step in the deployment phase can begin and a complete implementation phase on the target system is a reality.

Through the MBD design flow, and via MathWorks and IAR, the implementation of an overall model and the compilation of code are now possible. Each of the stages or elements in the model of the "Drive System" is now represented by a MATLAB

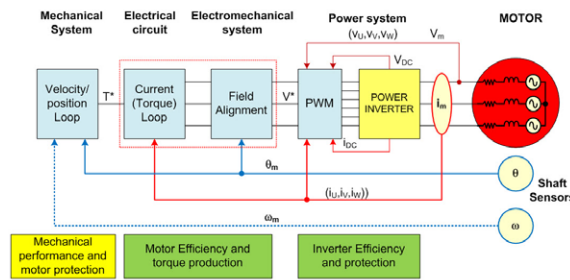


Fig. 6: Sketch of a "Drive System".

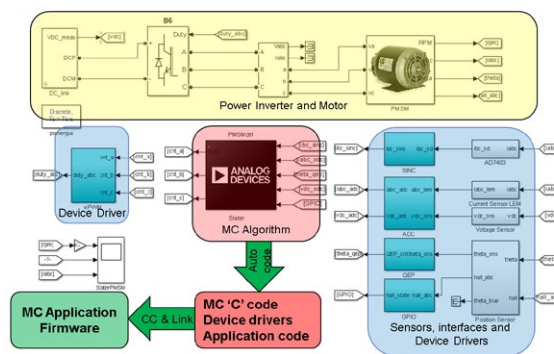


Fig. 7: Implementation and compilation.

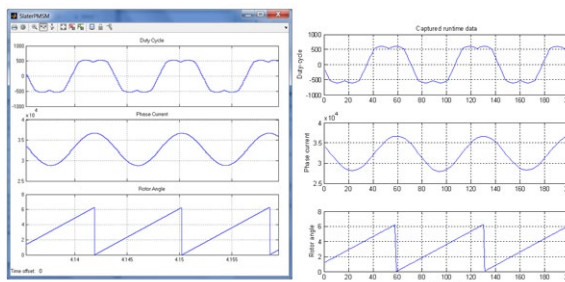


Fig. 8: Simulation and run-time data from a MBD build system (processor data vs. simulation).

and Simulink model which is scaled at the right level for optimal design criteria. Each of the elements in the model is based on standard tool-boxes and block sets from MathWorks and can be reused across any element in a particular design – see figure 7. These elements also represent the different domains of the drive system and can be fine-tuned fully to minimize the Model vs. Deployment error.

Through real-time deployment methods and compilation in this mixed environment, it is also possible to combine existing C code written by hand with ARM Cortex M4 optimized C code generated by Embedded Coder, the production code generation tool for MATLAB and Simulink. This entire process allows users to reuse existing knowledge of motor control design at the right level. At this point the IAR Embedded Work Bench can take the generated code and compile the complete project for ARM Cortex M4, which closes the MBD implementation phase for this system.

Since its inception, MBD has been questioned on its capability and functionality relative to traditional system development and on its efficient use of overall system resources. This is where strong efforts from component suppliers, simulation- and deployment-vendors, and tools compiler providers have "merged" and results today

are comparable to traditional deployment methods. Of course, any code development written for a real-time system can be created in an inefficient way, depending on the implementation method used.

With MBD, profiling, cross-optimization options and strong advantages in safety-critical system development can be combined, so that code development overheads are minimized and highest performance results are achieved. MathWorks offers tool qualification for use of Embedded Coder with IEC 61508, ISO 26262, and related functional safety standards.

This mix of capability is much more difficult to achieve in a standard design flow. In the example above a standard FOC model is implemented on Analog Devices ADSP-CM40x series. In this model, position and current loop feedback are executing in 15us, supporting real-time profiling of both the current scheme and debug facility. It also allows tracking functionality of the overall FOC scheme.

Both MBD simulation results and real-time data can now be evaluated and compared with ideal system functionality in relation to the target specification, as shown in figure 8. This ultimately enables a designer to constantly improve system efficiency, functionality and performance, and to evaluate how a given element or component in the signal chain is performing against specification.

Performance monitoring solution helps provide intelligent control of high power systems

By Paul Buckley

A PERFORMANCE MONITORING solution designed to enable companies to monitor high power IGBT module systems in locomotive, wind turbine, High Voltage DC and industrial drive applications was unveiled this month by UK-based power conversion start-up Amantys. Paul Buckley of EE Times Europe talks to Erwin Wolf the new CEO of Amantys and Richard Ord the marketing director for Amantys, about what the future holds for the innovative Cambridge-based power conversion specialist.

Amantys is a privately-funded power products company which is looking to change the way power is converted in medium and high voltage applications. The company is targeting a market worth \$3 billion per year which is estimated to be growing by 10% annually.

EE Times Europe: What is your new role at Amantys and what experience are you bringing to a start-up company that is looking to grow its business?

Erwin Wolf: I have been the CEO of Amantys since the 1st of October 2013. However, I have been a non-executive director

of Amantys for two years so I am aware at a higher level of what is going on at the company. I have two areas I have specialized in during my long career. One of those is LED technologies and the other area has involved power semiconductors and I always switch from one to the other having had several CEO or general manager roles in companies like Osram, Siemens and Infineon. Before I joined Amantys I was CEO of Azzuro Semiconductors doing gallium nitride on silicon (GaN-on-Si) substrates for power semiconductors as well as LEDs.

EE Times Europe: Can you provide some background on Amantys?

Erwin Wolf: Amantys was started in 2010 in Cambridge in the UK and currently has 30 employees but we have recently set up a new technical office in Shanghai, China in order to support our customers there. We have three distributors in China.

We have raised about \$20 million to date and three major investors. One is Moonray Investors, part of Fidelity International. We also have ARM as an investor and Avago Technolo-

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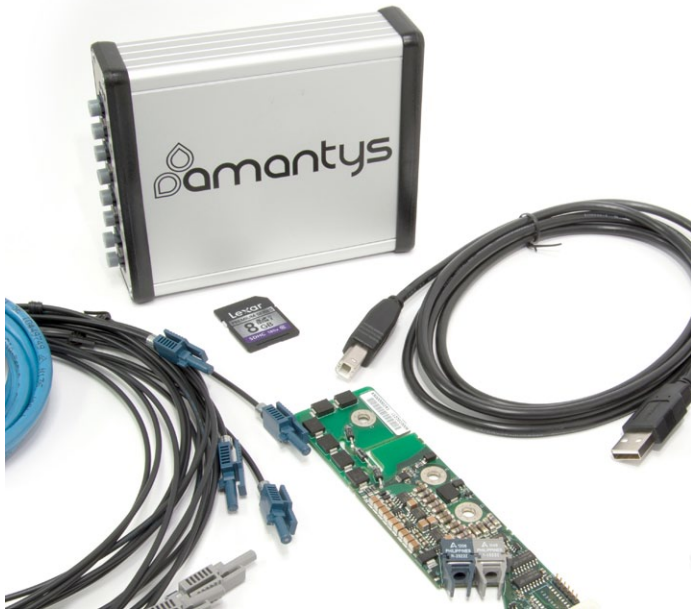
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The Power Insight Adapter monitors and reports about IGBT performances.

gies joined us on the 1st of October 2103 with a five million dollar investment. Why Avago? Well Avago is a pretty natural partner and with the company's plastic optical fibre technology they are in the same business as we are. We use plastic optical fibre links and on the control card they are present as well. The plastic optical fibre link is Avago's domain so they are talking to the same customers as we do and if they adopt our algorithm we both can add value to the same customers we talk to. So it was a very natural arrangement which was then sealed with an investment.

EE Times Europe: Where do you see Amantys fit into the power sector?

Erwin Wolf: Our differentiating position can be summed as 'Intelligent control of power'. We supply the customer with our algorithm to enable them, with our knowhow, to not only drive the IGBT but also control it. That means we can do real-time condition monitoring of the IGBT module. We can monitor how the power module is behaving. How are the voltages? How is the temperature? We can then feed this information back to the control card so that it can decide what to do with the data. Either switch off or reduce power or schedule preventive maintenance and such like.

We are also providing a forensic analysis capability so if something critical really happens then there is data available about what happened to the voltage and what happened to the temperature which helps to find a reason or cause for the fault. Everything is field upgradable so that helps the customer improve their system availability and reduce energy costs through high efficiency. It also helps reduce maintenance costs.

Richard Ord: In traditional IGBT gate drivers there are typically only three states - on, off or fault. What we are doing is building a dashboard for high power electronics. We can pose all manner of questions such as:

- How many times has this IGBT been used?
- How many switching cycles has it made?
- Is it starting to suffer?
- Is the temperature starting to rise?
- What are the conditions that are changing around it that may

mean this specific IGBT needs some planned maintenance?

Can you switch the load to some of the other IGBTs?

We are getting that 'under the bonnet' visibility right in the core of the power electronics that has been the challenge. What we have done is put sensors right at the core of the system, digitized it and then we control what signals are passed out using an ARM microcontroller over the fiber optic link. By doing that we are getting more reliable signals with less noise or interference and getting some real information back about how their systems are actually going. In this way people can learn how their systems are operating, modify the mission profile to make it more available and more efficient. Those are the areas Amantys is working on and why we have come into the market.

EE Times Europe: What application areas are you targeting?

Erwin Wolf: The new Power Insight Adapter is a fully engineered solution to add Insight data monitoring and observability to an IGBT module-based power assembly. We have developed the Adapter to offer the capacity to support existing power systems in locomotive traction, wind turbine, High Voltage DC and industrial drive applications with a performance monitoring solution.

EE Times Europe: How does the new Power Insight Adapter solution fit into your plans?

Richard Ord: With the Adapter we have created a product that allows people to start straight away using the Amantys Power Insight software platform. The Adapter basically sits across an existing fibre optic link from the gate drive to the central control host system. Signals pass through the Adapter so there is no change to the gate drive operation that is still controlled by the host system but the different Power Insight parameters such as the number of switching cycles, different voltage measurements, temperature changes can be observed and reported independently to a laptop or industrial PC that can compute all the information. We already store some data on the



Amantys' new CEO, Erwin Wolf.

gate drive which can be a rolling snapshot in time of events and signals or it could be a longer sampled set of indicators.

There is some storage in the control card and there is further storage in the Adaptor with a SD card. So when you get a failure event you can look back at some recent history and examine what happened in the run up to the fault. In this way you can start to learn how the system is operating and build a profile of recent events before a failure.

With the Adapter we can also change the mission profile of the gate drive. We can reset the speed of switching. We can make it faster for greater efficiency or possibly slower to avoid voltage overshoot. We can tune it in real time.

In commissioning environments Power Insight Adapter gives you a huge bonus in terms of the time saved to observe and fix different problems. If you have a failure in commissioning, say, in a High Voltage DC application you tend to need spanners as well as a ladder and you have to disassemble everything. With the Adapter you can simply look at it through a laptop and see that the electronics have tripped because a specific IGBT is running hotter than the others. Now you can realize that all that needs doing is to shift the load sharing to balance it out. Now you can do that without the half a day of disassembly by just looking at the application from a laptop.

The Adapter allows an Amantys-enabled gate drive to talk to the outside world. The device hooks onto the unit without changing the host system. The time to install a Power Insight Adapter is very short and it allows people to evaluate the gate drives, evaluate the module as well as develop and commission the system.

With the Adapter you can feed data out over the Internet or over your USB and you can also use it to set your alarms, thresholds and triggers.

EE Times Europe: Is there a development kit for the Adaptor?

Richard Ord: We are offering a development kit which uses a GUI interface that allows engineers to talk to four different gate drives through the fibre optic links. With the GUI you can click on an individual gate drive. You can set your PWM frequencies, you can set the duty cycle and the offset for individual gate drives and you can then watch what is happening. So you will be able to, say, look at the temperature on an individual gate drive. You will be able to see when the temperature begins to spike.

You can also observe an individual gate drive when you want to look at it in more detail and you will be able to see if there has been a short circuit event or under voltage. The unit will tell you the time stamp of the last event. You will be able to see the temperature start to rise if there is a problem. You can also use the GUI to set thresholds. So you can instruct it to tell you when it goes below -30°C or above $+55^{\circ}\text{C}$.

You can actually configure the IGBT module and the mission profile you drive it with from outside the cold plate assembly.

It might be that a particular industrial motor is used on a ship in the Tropics for a winch where it has a relatively constant load when it is switched on and off but that same industrial drive design might then be used in a steel mill where the load has a totally different profile. Using the Adaptor you can actually 'tune' the switching of the individual motor according to its application or according to its environment and that 'tuning' can be done 'in situ' at the installation.

We are talking about condition monitoring in an area that has not traditionally had it.

Erwin Wolf: I think the Adaptor is really going to give a system level advantage. It is not so much of an advantage for the



Marketing director at Amantys, Richard Ord.

module makers but it offers a major advantage for the system makers or somebody who wants to know how their offshore turbines are doing. Or how their trains are doing or a HVDC is doing. You can get the feedback and be able to act before it is too late. The Adaptor enables you to do preventative maintenance or switch an IGBT off before it blows up and the whole system trips. This is also only the first version of the Power Insight which was developed. We have a lot of ideas as to how to refine it.

EE Times Europe: What does the immediate future hold for Amantys?

Erwin Wolf: We started in Europe and the majority of our design-in projects in Europe are most advanced in the UK, France, Germany and Portugal.

We have development activities with about ten to 15 OEMs - some of those are standard products others are featuring Power Insight.

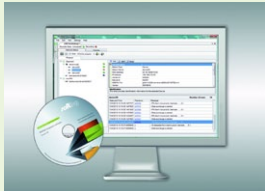
With some of them we will be very shortly going into serial production and a continuous revenue generating relationship which for a start-up is the first validation of the technology. We see a wide range of potential applications for our technology but we need to maintain our focus on immediate objectives and not go off-the road and become distracted.

The major aims in the short term are to prepare ourselves for serial production to be ready from the quality management point of view and the supply chain management point of view. We need to get ISO 9001 certified - essentially all the unspectacular groundwork needs to be done to be ready for serial manufacturing and generating a continuous revenue stream.

Then we can go on to enlarge the application areas in the medium term. In the short term the first stage applications are wind power and renewables, locomotive and transportation, industrial motors, power grid and HVDC. The second stage will look at lower voltages for electric vehicles and hybrid vehicles (HEV) and the UPS sector.

Diagnostic software monitors PROFINET networks

The PROFINET Diagnostics Suite from Softing offers extensive features to support the analysis of the network status as well as for early error detection and correction. The software



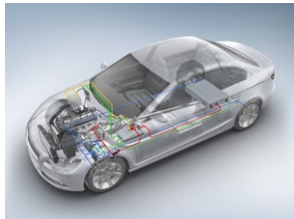
includes several methods for viewing and analysing the network communication, and supports passive, active, and offline monitoring principles. The Identification & Maintenance (I & M) information supports the maintenance personal

in identifying and replacing malfunctioning devices. Last but not least, the software maintains a list of communication events. Each event is hyperlinked to the according data frame for quick reference.

Softing Industrial Automation
industrial.softing.com

Backward-compatible, high-bandwidth CAN bus version

As an intermediate step on the transition to the high-performance CAN bus version with flexible data rate (CAN-FD), Swedish technology company Kvaser AB has presented a new



CAN version, dubbed CAN-EF (Enhanced Format). The beauty of CAN-EF: Unlike CAN-FD, it offers higher bandwidth without giving up backward compatibility. As automotive software applications require more bandwidth for data communications among ECUs inside

the car, a new, speedier version of the venerable CAN bus is currently under development by CAN inventor Bosch GmbH. This version, CAN FD, will provide a highly efficient method of increasing CAN data throughput, by increasing the number of bytes in each CAN frame (from 8 to 64 bytes), whilst making the CAN frames shorter. However, this technology is not compatible with existing CAN controllers; systems and modules have to be re-designed. At the 14th International CAN Conference in Paris, Kvaser pressed ahead by introducing CAN-EF. This version achieves higher data rate communication than CAN by packing the extra bits into the CAN-frames in such way that they can be received by legacy CAN controllers, ensuring backwards compatibility with existing CAN infrastructure. According to Kvaser president Lars-Berno Fredriksson, CAN-EF could facilitate the industry's move to CAN-FD. Since the development and standardization of CAN-FD is expected quite a while - currently the flexible data rate CAN is in the process of being integrated within ISO 11898-1 - CAN-EF could give CAN users quicker and simpler access to greater data rates in the meantime. The performance of CAN-EF would be within the range of 50-90% of CAN-FD in similar circumstances. CAN-EF works by hiding the high-speed data from the legacy CAN modules, allowing CAN-EF modules to be installed into any system to communicate at a higher bit-rate without interfering with any connected CAN module in use today. In truck applications where J1939 is employed at 250 kBit/s, CAN-EF would facilitate an increase in data throughput, without altering the basic bit rate.

Kvaser AB
www.can-cia.org

Brushless DC tachometer monitors industrial motor speed

ServoTek Products' TachSyn Series of brushless DC tachometer/commutator may be used as either a brushless DC tachometer or brushless DC motor commutator for monitoring the rotational speed of brushless



industrial DC motors. The unit offers an economical solution to many velocity-loop problems, whether brushless or standard servo. The robust design of the ServoTek Products TachSyn transducer consists of a primary magnetic sensing device, in which output windings, field winding, and a permanent magnet are all co-located within the stator itself, maximizing reliability. The transducers are available in several unique models to commutate 4-, 6-, or 8-pole brushless DC motors. Any sized TachSyn tachometer may be specified in applications where a simple DC tachometer signal is the only requirement. Pancake-shaped TachSyn transducers are easily mounted, cantilever-style, to the back of a motor or other device, with synchro-type adjustment for phasing. Each TachSyn transducer requires one CT-4 Series circuit board (or a customer-supplied equivalent), as well as a connecting cable with double-barreled shield to complete signal conditioning. The CT-4 circuit board provides AC field excitation for the transducer and conditioning for its output signals, which include a linear low-ripple DC tachometer voltage, and either a Hall-equivalent or sine-wave commutation signal.

ServoTek Products
www.servotek.com

Compact single channel gate driver focuses on applications up to 1200-V

Infineon Technologies's 1EDI EiceDRIVER compact single channel gate driver support applications with isolation voltages of up to 1200 V. The galvanically isolated driver components are based on the Coreless Transformer Technology developed by Infineon, which enables output currents of up to 6 A on separate output pins. The basic system includes UVLO (under voltage lockout) for IGBTs and MOSFETs as well as an active shutdown in the event that the driver is not connected to the power supply. The 1EDI drivers are supplied in a compact DSO-8 housing and can be used at ambient temperatures of up to 125°C.

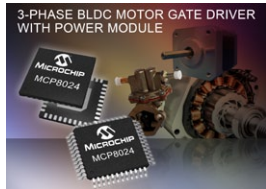
The 1EDI driver ICs are offered in eight variants that can be operated at up to voltages of 1200 volts and are designed for use in applications with either IGBTs or MOSFETs. The new EiceDRIVER components claim to be the first driver ICs to achieve a value of 100 kV/μs for the CMTI (common mode transient immunity). Both the MOSFET as well as one IGBT driver supply 6 A of output current. The MOSFET driver is optimized for use with power semiconductors that are based on CoolMOS technology.

Owing to lower induction loss, the EiceDRIVER enables an additional gain in efficiency of 0.5 percent with the latest generation CoolMOS C7. Further IGBT only variants with 4, 2 and 0.5 A are in preparation. The five variants have a separate output for charging and discharging the gate.

Infineon Technologies AG
www.infineon.com

Microchip adds complete 3-phase BLDC motor drive capability

A three-phase BLDC motor gate driver with power module provides all the power, sensing and protection functions needed to implement a robust, highly-efficient solution; it integrates



voltage regulators, current-sensing amplifiers and over-current protection. Increased flexibility comes with configurable driver dead-time management, driver blanking-time control, and Over-Current Limit (OCL) for external MOSFETs; the device is suitable

for harsh conditions such as industrial & automotive under-hood applications, Microchip says. The MCP8024 includes functions that power dsPIC Digital Signal Controllers (DSCs) and PIC microcontrollers (MCUs) with capabilities to drive six N-channel MOSFETs. It operates across a voltage range of 6V to 28V and can withstand transient voltage up to 48V. The device provides high-integration analogue functions, such as three current-sensing operational amplifiers; an over-current comparator; MOSFET drivers and a bidirectional communication interface for a complete motor system design. An adjustable step-down DC-to-DC converter powers a broad range of microcontrollers. In addition, the wide operating temperature range, from -40°C to +150°C (H-temp), allows the MCP8024 to be used in harsh environments such as automotive under-hood applications. The MCP8024 is in thermally-enhanced 40-pin QFN 5 x 5 mm and 48-pin TQFP 7x7mm packages.

Microchip

www.microchip.com

Servo motor controller supports sensorless operation of BLDC motors

The ESCON Module 50/4 EC-S from maxon motor is a miniaturized OEM plug-in module for sensorless BLDC applications. With a claimed efficiency of 97%, the compact 4-quadrant PWM servo motor



controller is suitable for permanent-magnet activated sensorless BLDC motors (brushless DC motors, so-called EC motors) without Hall sensors up to approximately 200 Watts. The plug-in module's drift-free and extremely dynamic speed behaviour enables speeds up to 120'000 rpm and provides extensive functionality with free configurable digital and analogue inputs/outputs. It matches maxon's motor range to suit even highest-demand applications and dynamic drive solutions and can be operated in speed controller (closed loop) and speed controller (open loop). The servo controller is controlled by an analogue set value. It can be specified by means of analogue voltage, by external or internal potentiometer, by defined value, or by means of a PWM signal with variable duty cycle. The ESCON Module 50/4 EC-S features protective circuitry against overcurrent, excess temperature, undervoltage and overvoltage, voltage transients and short-circuits in the motor cable. It also is equipped with protected digital inputs and outputs and adjustable current limitation to protect motor and load.

maxon motor AG

www.maxonmotor.com

Rugged ECU targets construction and agricultural machines

TTControl's HY-TTC 500 electronic control units feature freely programmable controllers with a high performance dual-core ARM Cortex-R4 lockstep processor, they are designed for



use in demanding safety-critical mobile applications and protected by a compact, automotive-style housing suited for harsh environments. The controllers fulfill safety requirements up to SIL 2 (IEC 61508) / PL d (ISO 13849)

and can be programmed either in C or in CODESYS. The safety certified CODESYS Safety SIL 2 speeds up application validation significantly. The majority of run-time tests that is needed to achieve the diagnostic coverage required for SIL 2 / PL d is performed in hardware by the dual-core lockstep CPU and its safety companion. Therefore almost the full processor power is available for the application. The available memory protection mechanisms allows to execute safety and non-safety software on the same ECU without interference. The time-consuming validation of non-safe software is therefore no longer necessary. Safe data communication is achieved by the standardized CANopen Safety protocol. In case of safety-relevant failure outputs can be shut-off in 3 groups allowing limp-home functionality. The extensive I/O set with various configuration options makes the HY-TTC 500 controllers suitable for a wide range of high-end applications.

TTControl

www.ttcontrol.com

'Pocket' CompactPCI system offers flexible modularity in a compact size

Kontron has launched a control cabinet computer in its 3U CompactPCI Value Line series using Intel's Celeron 807UE processor. The intelligent system offers customers a compact sized industrial computer with all the flexibility of a modular 3U CompactPCI server.

OEMs and system integrators can use the entire ecosystem of 3U CompactPCI and define their dedicated wall mount system within minutes, reducing design and system integration effort to a minimum. By downgrading system functionality from a server to a box sized CompactPCI platform, the intelligent modular system has also been cost-optimized - a perfect fit for price-sensitive applications such as machine and factory control, programmable logic controllers, and inspection systems. The advantage of using the CP-POCKET over conventional box PC sized designs is by including versatile expansion options enabled by rugged CompactPCI peripheral boards. Accessible from the front without the need to remove the enclosure, the boards are easily swapped in a matter of seconds. An actively cooled system can operate in ambient temperatures from 0°C to 50°C. The CP-POCKET integrates the 3U CompactPCI CP3003-V controller that uses the Intel Celeron 807UE processor with 1.0 GHz and the Intel QM77 Platform Controller Hub. A smart cache of 1 MB and up to 4 GB of DDR3 SDRAM memory with as much as 1333 MHz guarantee high data throughput.



Kontron

www.kontron.com

Power over Ethernet for automotive use at no additional system cost

By Mike Jones

THE DESIRE FOR SAFER vehicles has led to an influx of advanced driver assistance systems (ADAS) being added to cars' feature set. Today, rear view parking sensors and cameras are already commonplace.

Moving forward, increasingly sophisticated sensor-based collision avoidance will provide lane departure, signpost, traffic light and pedestrian recognition. Standard Ethernet is proving to be an attractive solution for ADAS applications as this technology provides high bandwidth data transportation via a low cost, unshielded twisted pair cable. The adoption of standards-based solutions is well understood; multiple suppliers servicing markets, resulting in economies-of-scale to provide the lowest cost of ownership. However, typically overlooked are the holistic benefits of using standard Ethernet from the many complementary IEEE standards for example, power over Ethernet (PoE). Interestingly, the automotive market can significantly profit more than most when deploying standard Ethernet coupled with PoE.

Adding multiple camera sensors around the vehicle inevitably increases the wiring content, an undesirable consequence for car manufacturers. Remotely located vehicle sensors unsurprisingly also require power to be delivered along with the data wiring. The result is an additional pair of wires routed per sensor to remotely power each device. IEEE 802.3af (standard) and IEEE 802.3at (increased power) specify a means to distribute power over the same wiring as the data. By adopting such techniques, remote sensor devices utilising standard Ethernet interface can eliminate the need for an additional power cable. Furthermore, not only is the wiring reduced but also automotive applications can specifically benefit by optimizing standard PoE to provide all the benefits of this robust technology without any additional system costs.

To understand how this is possible, one should first examine the basic principles of IEEE802.3af/at PoE operation, shown in figure 1.

The PoE architecture consists of two elements; the first is the power, which is supplied by the power sourcing equipment

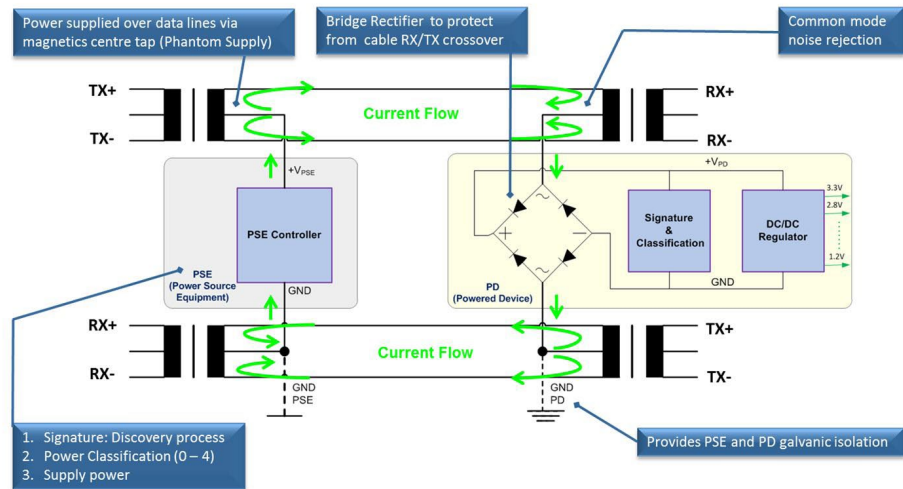


Fig. 1: IEEE802.3af/at Power over Ethernet phantom supply method.

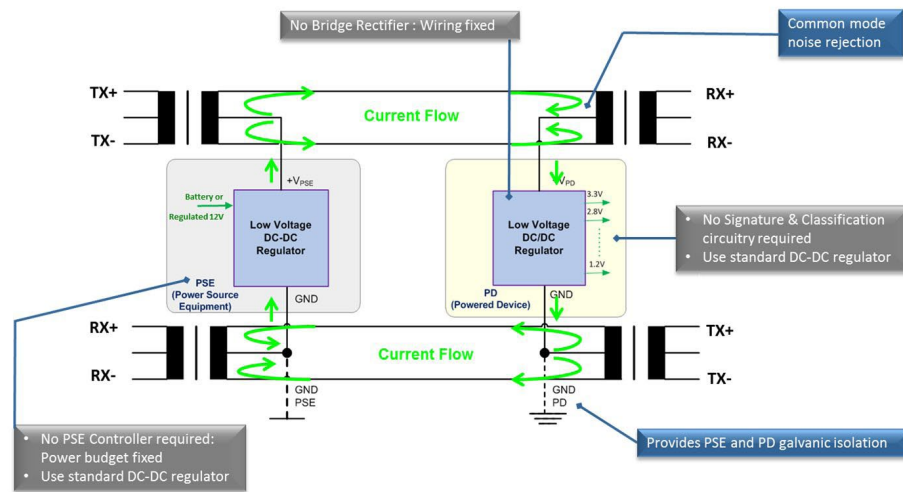


Fig. 2: Optimized automotive 100Base-TX PoE using 'phantom supply' methodology.

(PSE) and accepted by the power device (PD). A dedicated PSE controller must firstly detect and classify a PD before sourcing any power in a 3-phase process:

Discovery – PSE checks if it is connected to a valid, compliant PD device.

Classification – PSE checks the power required by the PD

Operational – If #1 and #2 are valid and PSE can provide sufficient power it will enable VPSE voltage (between 44V to 57V).

The PoE voltage VPSE is applied to the centre tap of the standard 100BASE-TX Ethernet transformer; a technique known as 'phantom supply'. Current will then flow down both wires to the PD side Ethernet transformer centre tap. Each winding carries half the current with opposite polarity so the total DC current through the transformer is actually zero. This 'phantom supply' method provides a key benefit of common mode noise rejection at the PD side transformer and is only applicable to 100BASE-TX Ethernet interfaces. Any noise from the PSE or

Mike Jones is Marketing Director for LAN Solutions at Micrel Inc. – www.micrel.com

Performance	
Proven method	• IEEE 802.3at/af phantom supply method
Common-mode noise rejection	• Superior data signal quality / reduced filtering • Eases cable routing constraints
Isolated PSE / PD grounds	• Eliminates potential ground loops (noise, interference etc.) • Eases cable routing constraints
Cost	
Optimized for Automotive 'PoE for FREE'	• Existing cables • Existing magnetics • Existing standard power management
Lower PSE Voltage (7V-12V)	• Low voltage regulators = lower cost
2-wires per PSE supply line	• Thinner cable (material & cost reduction)

Table 1: Benefits of optimized 100Base-TX PoE for automotive.

picked up along the twisted-pair cable routing is coupled as common mode noise to the differential Ethernet signal and, hence is removed. At the PD side, a bridge rectifier is required to enable rectification and act as polarity insensitive in case the RX and TX wiring pairs are accidentally swapped.

A ground return path to the PSE is provided via the centre tap of the other transformer, providing a second key benefit; galvanic isolation of the PD and PSE grounds. Such isolation is critical to prevent radiating ground loops occurring when there are differences in the ground potentials of each side – something that is likely to be significant in a vehicle. Again, such a benefit is unique to 100BASE-TX Ethernet implementation.


Optimization for automotive use

It is interesting to discover the optimization offered when applying such IEEE PoE methods for use in automotive applications, as shown in figure 2.

The significant difference lies in the elimination of the traditional PSE controller. For automotive applications the discovery and classification phases are redundant as the PD side is always known and fixed. A good example is the interface between a head unit and rear view camera module. The relatively expensive PSE controller can be replaced by simply using a low cost DC-DC regulator. The regulator will be able to provide shut down protection in fault cases of current over load. By using a more suitable lower PoE voltage VPSE for automotive, for example 12V compared to the 48V specified in IEEE802.3af/ at, a lower cost / lower voltage DC-DC regulator can be utilized at the PD side. Power ratings of 6W or more per port are still achievable when operating from 12V PoE. In cases when additional power may be required, a higher PoE voltage can be utilized (or increased current rated magnetics).

At the PD side, the common bridge rectifier can also be eliminated as the automotive wiring will also be fixed. Despite optimization and ultimately cost reduction, standard Ethernet PoE for automotive applications still has additional benefits to gain from the 'phantom supply' method. Notably, common mode noise rejection at the PD and PD / PSE ground isolation, as highlighted in table 1.

When one closely examines the optimization demonstrated in figure 2, it is apparent that all the key benefits of IEEE PoE are realized without any additional cost; no additional wiring, existing standard Ethernet magnetics and existing standard power management. Hence, the automotive market has a quite unique value proposition in the notion of: 'PoE for Free!'




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Power supply implications of envelope tracking

By Robert Kollman

RF POWER SYSTEM EFFICIENCY is becoming increasingly important in low-power systems when it comes to wringing out the last minute of operation from a battery, and in high-power base stations where electric bills can be substantial. One obvious way to improve the situation is to emit only the needed RF power. This is relatively easy to do, as the amplifiers operate as AB amplifiers, and the drive signals can be backed off when lower output power is desired.

This can be taken a step further by reducing the supply voltage to the amplifiers when lower output power is desired. Figure 1 illustrates this; it presents amplifier efficiency as a function of output power for two different supply voltages. Lowering the supply voltage improves efficiency but limits how much power the amplifier can deliver.

Speed of response can be an issue in these types of systems, as the bandwidth of switching power supplies is usually limited to the tens of kilohertz, and the modulation requirements can be in the multiple megahertz range. There have been combinations of linear regulators and switching power supplies developed, such as the LM3290 and LM3291. These devices feature linear regulators with 50+ MHz control loop bandwidths coupled with a high-performance switching regulator.

The switching regulator provides enough headroom to the low dropout regulator (LDO) for envelope tracking while keeping the power loss low. There also have been efforts to improve control loop speeds by pushing the power supply switching well past 1 MHz with advanced switching devices such as GaN.

In addition to a fast control loop, an envelope-tracking power supply needs to source and sink current. That is, the power supply needs to take charge off the output capacitor to quickly reduce the output voltage, rather than letting the load discharge it. Otherwise, there can be a significant energy loss due to the discharge.

Current sinking has several significant implications on the power supply architecture. The power supply must process energy in both directions. The excess output capacitor charge has to go somewhere, and control, current sense, and current limit need to work in both source and sink operation.

One way to efficiently remove charge from the output capacitors is with a synchronous topology. Synchronous topologies replace output diodes in a power supply with semiconductor switches that enable current flow in both directions. The obvious solution is a synchronous buck regulator. This topology has been used for years in DDR memory applications with source and sink requirements. However, synchronous isolated topologies are just as appropriate, as there is nothing inherently limiting reverse current flow. Flybacks, forwards, and phase-shifted bridges all have been operated successfully with reverse energy flow.

The next issue is where does the excess capacitor energy go? With synchronous topologies, it goes back to the power supply input, where it can be dissipated by other power sup-

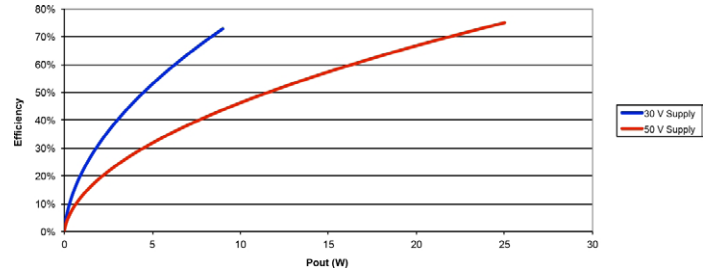


Fig. 1: Lower supply voltage improves efficiency but limits output power.

plies or be stored on input filter capacitors. If there are no other power supply loads, it is prudent to consider what the input voltage may surge with this energy. Also, you should consider possible interactions between this voltage perturbation and other equipment connected to the input.

The final issue with these types of supplies is that the traditional current measurement techniques are unidirectional. This means that, with a reverse current, you can lose your current sense ramp in current-mode control, which greatly impacts the loop. It also means that you have no current limit in the reverse direction. Couple this with a very wide bandwidth loop, and there is an overcurrent possibility when taking charge off the output capacitor.

An example of an envelope-tracking power supply is the PMP5726. It is a phase-shifted bridge with synchronous rectifiers to enable bidirectional current. It is operated with voltage-mode control and uses a full-wave rectified current sense transformer for over-current protection in both directions.

Figure 2 shows the converter performance taking current off the output capacitor. A 20-kHz control bandwidth ramps the current negative in less than 50 μ s and linearly discharges the output capacitor from 30 to 20 volts in 500 μ s.

To summarize, envelope tracking requires a high-bandwidth power supply with the ability to source and sink current. The bidirectional current flow complicates the design, as it must comprehend synchronous rectification and energy storage, as well as reversal of current sense voltages. Envelope tracking puts no real limit on topologies as long as they are synchronous.

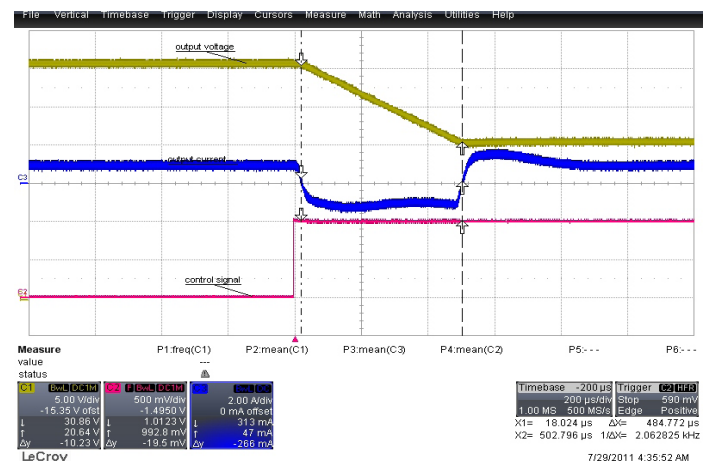


Fig. 2: Current reverses to discharge output capacitor.

Robert Kollman is Senior Applications Manager at Texas Instruments – www.ti.com

Pre-qualified lithium-ion batteries target medical device design applications

UK-based battery specialist, Accutronics, has launched a new range of pre-qualified and pre-tested batteries. The customisable 14.4V VR420 batteries use lithium-ion technology to deliver high volumetric and gravimetric energy density so that equipment runs for longer yet weighs less. The unit includes a SMBus (System Management Bus), SBS (Smart Battery System) compliant impedance tracking fuel gauge that allows the battery to



communicate pertinent battery data between itself, a smart host and a smart charger. When configured in a product, the host equipment is able to easily request dynamic information from the battery such as runtime to empty, cycle count and discharge current as well as static information such as serial number, manufacturer name and part number. The data allows the customers device to better manage its own power which can increase device runtimes and reduce the number of premature device shutdowns. Additionally, a five bar LED display on the battery case allows the user to easily determine the state of charge in simple 20% increments. The VR420 includes its own active and passive protection devices which prevent it from being over-charged, over-discharged or overloaded in an abuse condition. Holding safety certification to IEC62133 and UL2054, the VR420 is easily designed into new devices with minimal time and cost. Designed for rugged work environments the VR420 features a black flame retardant plastic housing which includes a polarised rail feature down either side so the VR420 can be slid into a host device with minimal effort. Transportation of the VR420 is simplified as the product has a stored energy of less than 100 Watt-Hours and it has been independently certified to the Manual of Tests and Criteria (ST/SG/AC.10/11/Rev5) section 38.3. The VR420 is available in two versions; VR420A and VR420B, supplying 6.2 Ah and 4.4 Ah respectively. The 'A' version provides highest capacity, whilst the 'B' option is optimized for higher discharge applications.

Accutronics
www.accutronics.co.uk

Battery pack provides constant power to LED arrays during a loss of AC power

IOTA has introduced the ILB-CP Constant Power LED Emergency Battery Pack Series which is a family of integral emergency battery packs that deliver constant power to the LED array during a loss of normal AC power. Unlike most LED battery packs, ILB-CP's constant power design maintains the output wattage to the system even while system battery current decreases, meaning no degradation in emergency illumination during the required 90-minute duration. ILB-CP models feature 18-48V and are available for 5, 7 and 10 watt LED designs. In addition to the constant power output, the ILB-CP Series offers a selection of available mounting configurations for accommodating the requirements of different LED fixture types. The ILB-CP Series are UL Recognized Components and are covered under IOTA's 5-year warranty.

IOTA Engineering
www.iotaengineering.com

40 or 60W LED power supplies have switch-selectable output current levels

Sunpower has introduced a series of flexible constant current output LED power supplies to meet today's demand for intelligent LED lighting control. Rated at 40W or 60W, their output current levels can be set by a built-in DIP switch. The LCM-40 and LCM-60 models have a dual dimming function, accepting either 0 – 10 Vdc or a PWM signal as their dimming control input. The LCM-40DA and LCM-60DA digital control versions feature a built-in DALI interface as well as a push dimming function. Both models are ideal for meeting the performance and flexibility demands of today's intelligent digital dimming applications. These LCM models feature a 180 to 295 Vac input and built-in two stage active PFC function, with a power factor exceeding 0.9 for loads over 35%. The series' harmonic current limitations comply with EN61000-3-2 Class C above a 35% load. Their Line-Neutral surge immunity of 2 kV complies with EN61000-4-5 heavy industry level and meets related lighting standards. Modern high performance circuit topology ensures that these products operate at up to 91.5% efficiency, allowing free air convection cooling in ambient temperatures from -30°C to +60°C. A 12V 50mA auxiliary output is however available if a fan is required. All models accept inputs from external NTC resistor temperature sensors, allowing temperature compensation of the output current. The series also features synchronised dimming with up to 9 slaves.



Sunpower Technology
www.sunpower-uk.com

Lighter AC-DC power supplies deliver performance improvements

TDK Corporation has introduced the TDK-Lambda HWS-A series of AC-DC power supplies, which comprises five models rated from 15-150W to meet a wide range of customer requirements. The HWS-A series is an upgrade of the HWS series which was originally introduced in 2005, typical industrial applications include equipment used for factory automation, process control, LED display and signage, test and measurement, broadcast and communications. The HWS-A is completely form, fit and function compatible with the HWS series to enable easy upgrade, with the added bonus that it is up to 12% lighter in weight. The new series also achieves up to a three percent improvement in efficiency at full load (up to 91% efficiency), and up to a four percent improvement at low loads. Power consumption at no load is also lower, thereby contributing to a reduction in environmental impact. Operating from a universal input of 85-265 Vac (47-63 Hz), the 50, 100 and 150 W HWS-A models include active power factor correction and all models are EN61000-3-2 compliant. HWS-A meets SEMI F47 requirements at high line input. Each of the 15, 30, 50, 100 and 150W models is available with nominal outputs of 3.3, 5, 12, 15, 24 and 48 Vdc. The operating temperature range is from -10 to +50°C at full load.



TDK-Lambda
www.uk.tdk-lambda.com

800-W and 1500-W PSUs provide constant current output down to near zero volts

XP Power has introduced the HDS series of 800W and 1500W programmable AC-DC power supplies with a typical efficiency of up to 93%. The single output low profile supplies measure 249.0x127.0x40.9mm for the 800 Watt models and 280x127x63.5mm for the 1500 Watt range and fit into an industry standard 1U or 2U profile. Two front mounted variable speed fans, included in the above dimensions, help conserve energy and keep noise to a minimum. The power density of these compact units is greater than 10 Watts per cubic inch. Both the output voltage and output current are programmable from 0% through to 105% of stated nominal through a serial RS232 interface, I2C interface, a 0 to +5 VDC input or via an external potential divider. By programming the output current a true constant current output is achieved down to almost zero volts, this being better than the industry norm which is typically only down to 20-40%. The HDS series comprises seven models covering the popular nominal outputs from +12 to +60 VDC. The output voltage for both series can also be manually adjusted +/- 5% by a trim function in order to make up for line losses. Both ranges also provide a user selectable standby output of 5 VDC / 0.5 Amp or 9 VDC / 0.3 Amp when the AC input is present.



XP Power

www.xppower.com

IEC-certified X-capacitor discharge IC saves time, cuts design complexity and reduces cost

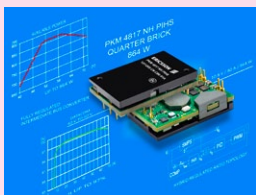
Power Integrations' CAPZero automatic X-capacitor discharge IC is now certified to meet IEC CTL DSH 1080, the new mandatory addition to the Certification Body (CB) scheme of the IEC60950 and IEC60065 standards governing X-capacitor discharge safety regulations. CAPZero ICs are simple, SO-8-packaged, two-terminal devices that require only the addition of discharge resistors to automatically implement the X-capacitor discharge function. New power supplies must comply immediately with the IEC CTL DSH 1080 requirement, which ensures that a power supply's X-capacitor safety-discharge function remains operational over the life of the product. CB-certified X-capacitor discharge devices such as CAPZero pass a stringent safety-testing protocol including a lengthy period of high-temperature and high-humidity testing and high voltage line-surge testing. Power supplies using a certified X-capacitor discharge device are deemed automatically compliant. Power supplies not utilizing a CB-certified device, including those using discrete components or other non-certified ICs, must pass the same environmental tests as well as line-surge testing with all protection devices such as varistors and bulk capacitors removed. Any redesign would result in a need for re-certification of the power supply.

Power Integrations

www.powerint.com

864W quarter-brick DC/DC module for datacom supplies

Ericsson has introduced a hybrid regulated ratio DC/DC converter that handles 864W: the PKM-NH platform quarter-brick module delivers high power density of 35.6W/cm³, with



a flat-curve, high-efficiency of up to 97%. The second product in the high-power PKM-NH format, the PKM4817NH-PIHS is optimised for datacom board applications that have a 52-58V system bus distribution and require high-power

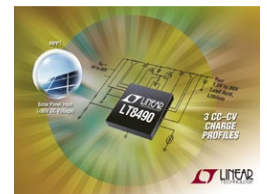
regulated quarter-brick-format intermediate bus converters. The PKM-NH follows the PKM4717NH, which has high-power handling capability of 750W. To meet the challenge of packing this level of power into a fully regulated quarter-brick format DC/DC converter, Ericsson has deployed its proprietary topology known as Hybrid Regulated Ratio (HRR). The topology combines two power-control methods – voltage-regulation and ratio-regulation – resulting in high performance across the input voltage ranges between 40V to 60V, which are commonly used in datacom systems. The PKM4817NH-PIHS module delivers an output voltage from 8.6V to 10.8V at a maximum output current of 80A across an input voltage range of 40V to 60V, within the operational system voltage between 36V and 60V. PKM4817NH has a typical efficiency of 97% at 50% load and offers flat-curve characteristics from 20A to 60A.

Ericsson

www.ericsson.com

80-V battery charging controller actively finds true maximum power point in solar panels

Linear Technology Corporation has released a synchronous buck-boost battery charging controller for lead acid and Lithium batteries which features automatic maximum power point tracking (MPPT) and temperature compensation. The LT8490 operates from input voltages above, below or equal to the regulated battery float voltage. The LT8490's full-featured battery charger offers many selectable constant-current constant-voltage (CC-CV) charging profiles, making it suitable for charging a variety of Lithium or lead acid chemistry types, including sealed lead acid, gel cells and flooded cells. All charge termination algorithms are provided onboard, eliminating the need for software or firmware and thus reducing design cycle time. The LT8490 operates over a wide 6 V to 80 V input voltage range and can produce a 1.3 V to 80 V battery float voltage output using a single inductor with 4-switch synchronous rectification. The device is capable of charging currents as high as 10 A depending on the choice of external FETs. The LT8490's MPPT circuit enables a sweep of the full operating range of a solar panel, finding the true maximum power point, even in the presence of local maxima points caused by partial shading of the panel. Once the true maximum power point is found, the LT8490 will operate at that point while using a dithering technique to quickly track changes in the local maximum power point. With this methodology, the LT8490 fully utilizes the power generated by a solar panel even in non ideal operating environments.

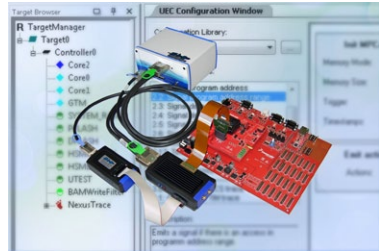


Linear Technology

www.linear.com

Universal emulation configurator defines trace and measurement tasks

The Universal Emulation Configurator (UEC) from PLS Programmierbare Logik & Systeme is now also available for the emulation devices MPC57xx from Freescale and SPC57x from



STMicroelectronics. The MPC57xx and SPC57x emulation devices are pin-compatible to their respective production chips, but include additional emulation memory, extensive trigger and filter logic as well as connections for a

serial high-speed interface based on the Aurora protocol. The Universal Emulation Configurator (UEC) is based on a three-stage programming model which allows developers to configure the additional emulation memory's hundreds of registers.

PLS Programmierbare Logik & Systeme

www.pls-mc.com

Configurable enclosure for custom PCBs available in 21 different case sizes

The Schroff Interscale M case platform from Pentair comes in metal for applications ranging from fanless fieldbus enclosures, single-board computers or ARM modules, to mobile



medical systems, PC-based point-of-sale systems, or peripheral control units for industrial applications. The new platform concept is available with three options: an off-the-shelf case, a modified case or a customized case. All three

are based on the same core component to keep costs under control, even for the customized version. The enclosure is available in 1, 2 or 3 U heights and various widths and depths.

Pentair Equipment Protection

www.pentairequipmentprotection.com

WPC-compliant receiving coil enables wireless charging 7-V portable electronic devices

Distributor Rutronik is offering Vishay's IWAS-4832EC-50 WPC-compliant wireless charging receiving coil which provides high efficiency greater than 75% for the wireless charging of 7 V



portable electronics. The powdered-iron-based device features durable high permeability shielding. For higher voltage wireless power base stations and receivers, the high-saturation powdered iron of the IWAS-4832EC-50 is not affected by permanent locating magnets,

and the device blocks charging flux from sensitive components or batteries. The IWAS-4832EC-50 has magnetic saturation of 50% of inductance at 4000 gauss. The RoHS-compliant device features inductance of 16.2 μH at 200 kHz with a $\pm 5\%$ inductance tolerance, DCR of 366 mOhm at +25°C, and Q of 30 min. at 200 kHz. The coil comes with a lead length of 50 mm and tinned length of 10 mm.

Rutronik

www.rutronik.com

V-LOCK

IEC Connectors with integrated cord retaining mechanism



- Prevents unintended disconnection
- Ease of use and no additional parts required
- Suitable for safe power supply in mobile equipment

schurter.com/connectors

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ELECTRONIC COMPONENTS

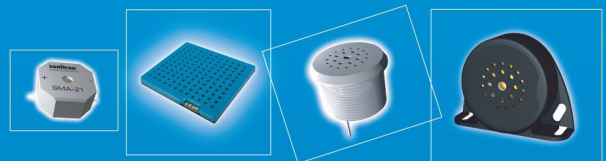
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Piezo audio components



Buzzers Transducers Alarms
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www.sonitron.be

H.264 video streamer/recorder boards operate standalone

Advanced Micro Peripherals' StreamCorder-SD4 and StreamCorder-HD boards are standalone, intelligent streaming and recording solutions that accept video inputs for real time



H.264 compression, local storage and streaming over 100/1000 MBit Ethernet. The StreamCorder-SD4 has four NTSC/PAL/RS-170 inputs, while the StreamCorder-HD's input is a single HD-SDI channel at up to 1080p30. Both StreamCorder

products are suitable for demanding applications within military, communications, transportation, mining and energy industries. The StreamCorder-HD supports extraction of KLV (MSB 0605.3 compliant) data and stereo audio embedded within the HD-SDI source. Both data and audio can be synchronized and streamed with the compressed video. The StreamCorder-SD4 features a dedicated hardware compression engine which can record all four video channels at full size and full frame-rate. A flexible streaming engine then streams each channel direct from the on-board Ethernet port. It can also capture audio from all four video inputs for streaming within the Ethernet output. Both boards can also save compressed data directly to an on-board SD card or external USB storage. Both boards are designed for mobile, UAS and Vetrionix applications, and both have optional on-board features including Controller Area Network (CAN), 3-Axis Accelerometer, High Sensitivity GPS Receiver, Altimeter and 3-Axis Digital Magnetometer (e-compass). These can integrate with other vehicle systems, and their outputs can be used as metadata embedded within the video and streamed to clients or saved locally for later analysis. With their own built-in standalone intelligence, the StreamCorders do not require a host CPU, or any driver or OS software.

Advanced Micro Peripherals

www.amp-usa.com

RFID magnetometer tag enables instant magnetic field measurements

The Magneto from Farsens S.L. is a battery free RFID sensor tag capable of transmitting a unique identifier and the associated magnetic field measurement data to a commercial



EPC C1G2 reader without the need of a battery on the sensor tag. The device features a LIS3MDL magnetometer from ST Microelectronics

with a measurement range from ± 4 gauss to ± 16 gauss. The tag comes in a variety of antenna designs and sizes to adapt the performance to the required application in the 860-960 MHz band. The reading distance for the battery free magnetometer tag is around 1.5 meters and it can be embedded in a wide variety of materials such as plastics or concrete. The tags can be easily retrofitted to piping systems (rust monitoring), industrial process automation (actions based on magnetic field changes) or used as smart dust devices. Evaluation kits are available.

Farsens S.L.

www.farsens.com

Coherent polymer fibre supports high resolution remote imaging

OMC has released a coherent polymer fibre which bundles thousands of individual polymer fibre cores arranged coherently at each end such that the image incident on one fibre face is visible on the other face. The high tensile strength coherent polymer fibre offers over 7000 individual pixels bundled in 2.0mm or 2.5mm cable diameters. The cores are protected by a robust outer protection layer. The fibre offers a lower cost solution to remote imaging in applications where the extremely small diameters of coherent glass fibre (such as those used to image inside blood vessels) are not required. The resolution is very high, making the fibre suitable not only for high resolution imaging, but also high precision sensing, remote vision, passive surveillance, and imaging in inaccessible areas.



OMC

www.omc-uk.com

Infrared cameras feature autofocus, wireless connectivity for quick measurement

Infrared cameras can identify overheated motors bearings or, in general machine parts. Their use simplifies the work of service personnel and maximizes their productivity. Fluke has introduced three new cameras which further maximize this productivity: Their LaserSharp Auto Focus allows them to pinpoint where the camera should focus for precisely focused images. The rugged Fluke Ti200, Ti300 and Ti400 will soon be able to connect to the Fluke CNX Wireless system, allowing them to be used as a main unit to view live measurements from up to five wireless modules (e.g. AC current or voltage



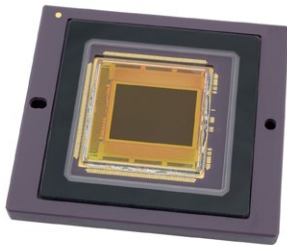
modules) on its screen, and integrate the data into the infrared image. This functionality will be provided by a firmware update. The infrared cameras feature wireless connectivity to easily transfer images from the cameras directly to PCs, an Apple iPad or iPhone which can then be imported into Fluke SmartView software, a suite of analysis and reporting tools for optimizing and analysing infrared images and producing professional reports. The cameras integrate wirelessly with the new Fluke SmartView Mobile app for iPhone and iPad. Like the desktop version, the SmartView Mobile app allows users to transfer images wirelessly for additional image optimisation and analysis and to create professional reports, but now they can share information without returning to the office to create and send reports to clients or management. With the SmartView Mobile app, users can get approval for additional work needed or next steps immediately, increasing efficiency and profitability. And unlike many other apps, SmartView Mobile is optimised for both the iPhone and iPad, maximising the productivity no matter which device is used. With IR-Fusion technology, images can be viewed from full infrared to blended views to a full visible image, to document problem areas of the devices tested.

Fluke

www.fluke.co.uk

6 megapixel CMOS image sensor targets machine vision with up to 160fps

Delivered in a one-inch optical format, the 6 megapixel (2832x2128) KAC-06040 image sensor from Truesense Imaging provides 10-bit full resolution output at up to 160 fps. The device includes a flexible read-out architecture that supports

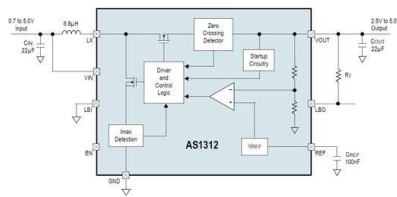


programmable, multiple regions of interest, enabling full speed, interspersed video streams for simultaneous monitoring of both full field of view and multiple localized zones. The KAC-06040 is available in monochrome and Bayer colour configurations, and is sampling today with production planned for Q1, 2014.

Truesense
www.truesenseimaging.com

DC/DC boost converter has 1-µA quiescent current

The AS1312 from ams is an ultra-low-IQ hysteretic step-up DC-DC converter that achieves an efficiency of up to 94% and is designed to operate from a +0.7V to +5.0V supply, with an output voltage fixed in 50 mV steps from +2.5V to 5.0V. Peak output current is 200mA; it features a shutdown mode,



where it draws less than 100 nA and in which the battery is not connected to the output. If the input voltage exceeds the output voltage the device is in a feedthrough mode and the input is directly connected to the output voltage. In light load operation, the device enters a sleep mode when most of the internal operating blocks are

turned off in order to save power. This mode is active approximately 50 µsec after a current pulse provided that the output is in regulation. The AS1312 also offers an adjustable low-battery detection. If the battery voltage decreases below a threshold defined by two external resistors, the LBO output is pulled to logic low: LBO functions as a power-OK indication when LBI is connected to GND. The AS1312 is available in a 8-pin (2x2mm) TDFN and a 0.4 mm pitch 8-pin WL-CSP package.

ams
www.ams.com

Load-switch IC offers on-resistance of 18.4 milliohms

This device from Toshiba is an ultra-low-voltage switch in a correspondingly small package, intended for use as power management switch ICs in smartphones, tablets, laptops and other mobile equipment. The TCK20xG load switch series claims



the industry's lowest ON resistance of 18.4 mΩ at an input voltage of only 0.75V, the minimum input voltage; output current handling is up to 2 A. The typical standby and quiescent currents in the range of 1 µA and 20 µA together with the minimum ON resistance ensure switch IC operation with minimal power consumption and loss. There are three models in the series - the TCK206G, TCK207G and TCK208G - offering different output discharge and control

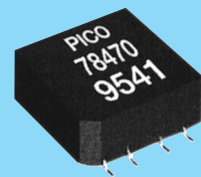
pin configurations. The TCK207G and TCK208G feature an integrated output discharge function, with "active high" and "active low" control pin, respectively, whereas the TCK206G omits the discharge function offering a pull down (active high) control pin. All three versions have additional integrated features such as a reverse current blocking circuit and a control circuit with inrush current limitation.

Toshiba Electronics Europe
www.toshiba-components.com

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 Germany**

ELBV/Electronische Bauelemente Vertrieb
 E-mail: info@elbv.de
 Phone: 0049 89 4602852
 Fax: 0049 89 46205442

England

Ginsbury Electronics Ltd.
 E-mail: rbennett@ginsbury.co.uk
 Phone: 0044 1634 298900
 Fax: 0044 1634 290904



Compact Coriolis flow meter addresses plant engineering

The Sitrans FC410 is the currently smallest and lightest Coriolis flow meter at the market, claims vendor Siemens. At the same time, the sensor offers a high accuracy of 0.1%. With dimensions of just 265 x 280 x 90 mm and a weight of only 4.6 kg in its most compact version, the FC410 is ideal for mechanical and plant engineering as well as for frame-mounted equipment.



Its combination of compact size, high precision, IP67 protection and versatility makes it ideal for

deployment in compact high-performance equipment. The new Mini Flow Link (MFL) concept enabled Siemens to integrate the functionality of the measuring transducer in the sensor case. The digital MFL allows significantly more compact designs without added complexity. Thus, the FC410 can be positioned flexibly within very small space without compromising reliability and accuracy. The MFL works at a speed of 10 scans per millisecond and provides besides flow data also data on mass, volume, density and temperature of the respective medium. The proprietary CompactCurve design ensures high reliability thanks to a stable zero point, low pressure loss and high resilience against process noise and oscillations. The Sitrans FC410 is designed for working pressures of up to 100 bar and temperatures between -50°C and +200°C.

Sitrans
www.siemens.com

Wireless data logger reports on five different measurables remotely

At only 57x35x17mm, the MSR145WD universal data logger from MSR Electronics GmbH can accurately report on temperature, relative humidity, air pressure, 3-axis-acceleration and light, and communicate the measured values at programmable intervals to any Bluetooth-enabled device. With its 10m range, the BLE wireless radio link (Bluetooth 4.0 Smart) is particularly advantageous



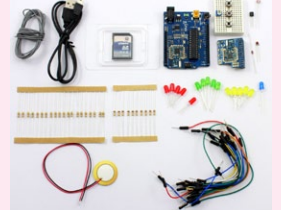
for applications that require monitoring of measured data from locations that are difficult to access, such as machine rotations or climate data in a display cabinet. A smartphone app allows users to recall the current and last recorded values at any time, to receive alarm messages via the MSR SmartCloud and, if required, to share data from multiple MSR145WD data loggers with a team any time. Although the unit has enough memory capacity to store over one million measured values, the MSR SmartCloud facilitates the storage of measured data on a server via the Internet, allowing the user to view, print or download the measured values of their data loggers to a PC for a detailed analysis. The MSR SmartCloud can also notify the user of incoming alarms via text messages and e-mail. For a compact representation of data and graphic charts, the MSR145WD is equipped with a 96x64 pixels colour OLED display.

MSR Electronics GmbH
www.msr.ch

MSR Electronics GmbH
www.msr.ch

To win: 12 Raspberry Pi 'Wireless Inventors Kits'

Internet of Things (IoT) manufacturer Ciseco has launched the Raspberry Pi 'Wireless Inventors Kit' (RasWIK), featuring 88 pieces to provide everything a Pi owner needs to follow a series of step-by-step projects or to create their own wireless devices, without the need for configuration or even writing code. RasWIK has been designed to be highly accessible, demystifying the dark art of wireless and enabling anyone with basic computing skills



to begin building wireless devices with a Raspberry Pi. You can create anything from a simple traffic light, to a battery monitor, or even a temperature gauge that sends data to the Xively IoT cloud so billions can access the data. RasWIK components are plug-in and play, removing the need for any soldering. The kit includes a wireless module for the Pi, an SD card with starter software and a fully-configured pre-installed Pi operating system, a wireless Arduino-compatible development board and additional electronic components, including LEDs, a sounder and connectors. Ciseco's radio technology and the Lightweight Local Application Protocol (LLAP) makes communicating with remote devices as easy as sending a text message or tweet.

Ciseco
<http://shop.ciseco.co.uk/>

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

Multi-radio module ready-to-embed in demanding IoT applications

The OWL355 radio module announced by connectBlue is a completely ready-to-embed package for demanding industrial, medical and Internet of Things (IoT) applications, offering multi-radio capability across Classic Bluetooth v2.1+EDR, Bluetooth low energy v4.0 and Wireless LAN (WLAN) 802.11 a, b, g, n with full dual-band support for the 2.4GHz and 5GHz radio bands. The OWL355 meets a higher quality level regarding both IPC class and AQL standards. Since the OWL355 has pre-calibrated radio parameters and MAC address stored on-board in EEPROM, no trimming or tuning is needed during the customer end-product manufacturing. Together with the open source Linux host driver the module minimizes the work needed to implement wireless technology in a device as it will provide hardware, modular radio type approval, EMC certification, Bluetooth qualification, wide range of certified antennas and offers extremely long life cycle. Other popular features for demanding industrial and medical wireless applications include solder castellations for visual inspection, an extended operating temperature range from -40 to +85°C, WLAN SDIO or SPI host interface and Bluetooth UART host interface.



connectBlue
www.connectblue.com

ESD protection diodes provides 200W surge capability in SMF package

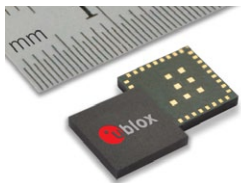
Vishay Intertechnology has unveiled a series of surface-mount ESD protection diodes in the low-profile SMF package. For portable electronics, SMFxxA series devices provide high surge capability of 200 W at 10/1000 μ s. With their low 1 mm profile, 'Low-Noise' technology, and fast response times, the devices released are ideal for line transient voltage protection in space-constrained electronics, such as laptops, notebooks, tablets, external hard drives, and more. The SMFxxA series consists of 32 devices with working voltages from 5 V to 58 V. The devices offer a peak pulse current from 2.1 A to 21.7 A, excellent clamping capability from 9.2 V to 95 V, low incremental surge resistance, and operating temperatures from -55°C to +150°C. The protection diodes provide ESD capability of \pm 30 kV (air and contact discharge) in accordance with IEC 61000-4-2, support high-temperature soldering to 260°C / 10 s at their terminals, and meet the MSL Level 1 standard per J-STD-020. The devices are RoHS-compliant, halogen-free, and Vishay Automotive Grade.



Vishay Intertechnology
www.vishay.com

Standalone GNSS module measures 7x7x1.1mm

Delivered in a 7x7x1.1mm LGA module, the u-blox EVA-7M integrates all the necessary components, including crystal and passives to support US GPS, Russian GLONASS, Japanese QZSS and all SBAS augmentation systems. It only requires an antenna for instant global positioning capability. The module has a sensitivity of -160 dBm when tracking GPS satellites (-158 dBm with GLONASS satellites), a fast acquisition time, and draws only 16.5mA at 3V thanks to an innovative high-efficiency power converter. The EVA-7M is a standalone GNSS receiver which provides a position without the need for host integration or extra RF components. It is optimized for keeping eBOM and system costs to an absolute minimum. A UART, USB, SPI and I²C interface provide flexible connections to a host processor. EVA-7M can also communicate directly with u-blox' SARA 2G, LISA 3G and TOBY LTE cellular modules to support advanced tracking and location-aware applications.



u-blox
www.u-blox.com

Micro SD card turns mobile and embedded systems into secure devices

With its PS 100u Series, Swissbit AG adds dedicated security products to its flash memory product line. By using the secure PS 100u Micro SD as root of trust, this storage solution which features an embedded secure element enables solution



providers to turn mobile and embedded systems into secure devices. The Standard Edition PS-100u SE fits best into authentication and PKI use cases. The Voice Edition PS-100u VE provides Elliptic Curve Cryptography. The big computation and security advantage combined with small certificate sizes make the PS-100u VE card suitable for online key- and certificate exchange. In terminals the contactless card PS-100u

CL could be connected with an external antenna and communicate via ISO 14443 contactless protocol with all NFC smart phones. The PS-100u Series is equipped with a CC EAL 5+ smart card chip with a CC EAL 5+ certified Java Card OS of the latest standard. The list of supported platforms comprises of Windows 7/8/Vista/XP, Android and BlackBerry, which can be flexibly extended upon request. The available storage densities are 4GB and 8GB in speed class 10.

Swissbit
www.swissbit.com

PICO

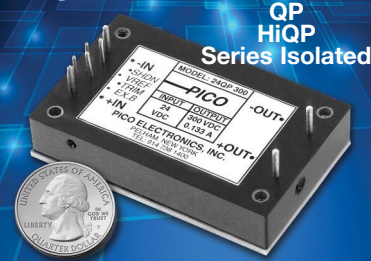
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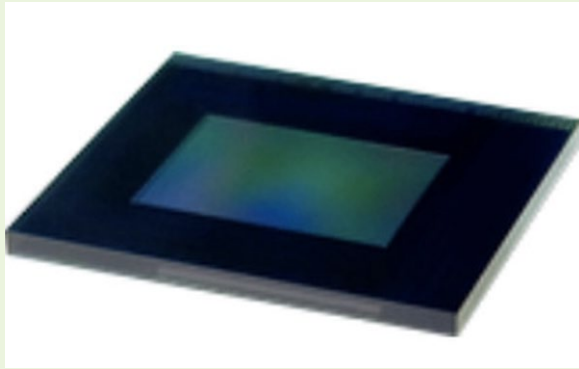
ELBV/Electronische Bauelemente Vertrieb
 E-mail: info@elbv.de
 Phone: 0049 89 4602852
 Fax: 0049 89 460205442

England

Ginsbury Electronics Ltd.
 E-mail: rbennett@ginsbury.co.uk
 Phone: 0044 1634 298900
 Fax: 0044 1634 290904

Toshiba ships 1080p image sensor

Toshiba is now shipping the T4K71 1080p CMOS image sensor for use in cell phones, smartphones, tablet computers and notebook computers. The image sensor uses back-side illumination and has a



1.12-micron pixel size and supports a frame rate of 60fps at 1080 progressive scan resolution, allowing use in front cameras for mobile devices for video chat. The sensor integrates a color noise reduction circuit to achieve a signal-to-noise ratio equal to Toshiba's equivalent products fabricated with 1.4-micron pixel process. The unit has a 16:9 aspect ratio in a 1-inch optical format and output is 8- and 10bit RAW.

Toshiba Corp.

www.semicon.toshiba.co.jp

Miniature coupled power inductors support flyback and SEPIC applications

Coilcraft has released a compact PFD3215 Series coupled chip power inductors that provide high efficiency and claim excellent current handling in a rug-



ged, low-cost part. The dual-wound PFD3215 features a 1:1 turns ratio and is designed for use in a variety of circuits including flyback, multi-output buck and SEPIC. The versatile inductors can also be used as two single inductors connected in series or parallel, as a wideband transformer or as a common mode choke. Measuring 3.2x2.3x1.5mm, the devices are useful when board space is limited and a low profile is desired. Typical applications include tablets and other battery-operated mobile devices requiring precise voltage regulation, efficient charging, and maximum operating time. The PFD3215 comes in eight inductance values from 0.39 uH to 10 uH and current ratings to 2.4 Amps.

Coilcraft

www.coilcraft.com

Break-out cable designed for 40GBase-LR4 / ER4 transceivers

Cube Optics is releasing the first Break-Out cable suited for 40GBase-LR4 and ER4 transceivers. Data centre operators are now able to split 40G switch ports or router ports to 4 separate 10G connections. Until today this was done with standard break-out cables for Multi-mode 40GBase transceivers, resulting in a limited reach of only 300 meter. CUBO's 40GBase-LR4/ER4 Break-Out cable with its integrated 40G CWDM multiplexer inside extends this reach to 10 or 40km for single mode transceivers.

The switches allow the configuration of each 40G switch port to act as four individual 10G ports. However, although the switch port is configured as if it was virtually four pieces of 10G ports, it physically remains one port. This port is typically in accordance with the QSFP+ standard, for which only 40GBase-SR/LR/ER optics exist. For multimode versions, the transceiver already features 4 duplex fibre in/outputs, so only a cable or connector adaption is required. Single mode versions are based on four different wavelengths streams which are multiplexed, respectively de-multiplexed, into one fibre output / input. Therefore the break out cable cannot simply adapt to different connectors but also must feature the matching optical multiplexer inside the cable to be able to mux and demux the four lambdas from one duplex transceiver port to 4 fibre pairs.

Cube Optics AG

www.cubeoptics.com



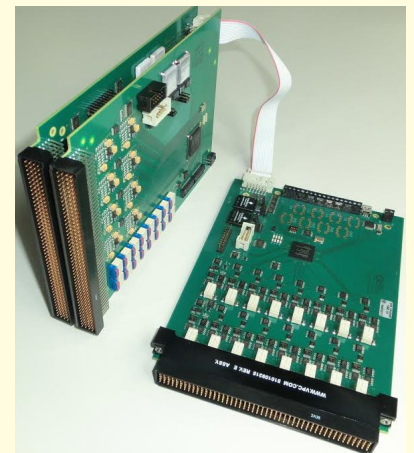
Gang test module kit supports parallel test and programming for up to 32 different assemblies

Goepel electronic has extended its Scanflex Boundary Scan hardware product range with the SFX Gang Test Module Kit, a new solution for parallel test and programming of up to 32 different assemblies with an integrated Mass Interconnect Interface from Virginia Panel. The kit consists of three interconnected module types – a TAP transceiver, a multipurpose parallel I/O unit, and a power management unit. It offers a complete solution for parallel applications based on Embedded System Access (ESA) technologies providing throughput increase by factors of 16 or 32. As only one system controller is required, efficiency increases and investment costs are reduced. The module kit, particularly developed for gang applications, can be flexibly adjusted to various environments and

different test and programming applications such as Flash programming, MCU programming or dynamic tests per Processor Emulation.

GÖPEL electronic GmbH

www.goepel.com



Mantracourt expands instrumentation distribution across Europe

Mantracourt has appointed several new overseas technical partners in order to advance the sales and support of its range of wired, wireless, digital and analogue instrumentation products across Europe. The new technical partners for Europe include Elkome in Finland, Ascell in Spain, Wallace in France, Geotrade in Switzerland, Teknik Destek Grubu in Turkey and Sensors AS in Norway, helping the company fulfil its plan to expand its sales operation. Based in the UK, the company designs and manufactures electronics for measurement technologies. Mantracourt has also become a player in the field of remote data logging software, it has recently announced the latest version of its T24LOG100 software, a data-logging package that can handle up to 100 channels of wireless instrumentation data simultaneously.

Mantracourt
www.mantracourt.com



element14 launches Gertduino plug-in board for the Raspberry Pi

element14 has released the Gertduino expansion board for the Raspberry Pi computer, an Arduino-Uno like board that was created by Gert van Loo, the inventor of the Gertboard.

Gertduino is Arduino compatible and plugs directly onto the Raspberry Pi. It features dual Atmel Atmega MCUs, -328 and -48, both of which can be programmed from the Raspberry Pi using the Arduino GUI or the GCC Atmel compiler. Gertduino is feature rich and includes a Real Time Clock (RTC), IRDA interface, RS232 level converter and a battery back-up power supply for the Atmega-48.

element14
www.element14.com



RS Components stocks flat-packed 19" wall-mounted cabinets

RS Components is stocking CamdenBoss' CamRack QX series 19" wall-mounted cabinets. Designed to house rack mount equipment for cabling, telecommunications, IT, industrial and home installations, the CamRack QX cabinets are supplied flat-packed, which eases access to the installation site while reducing logistics costs and providing greater protection during transit. Fast and efficient ¼-turn lock fixings allow users to assemble the

cabinets without the aid of tools in just three minutes. CamRack QX cabinets are available in five models, each offering a selection of five standard corner colours (red, blue, orange, white and black). A further five colours – yellow, green, purple, lilac and grey – are available on request. The five models are 6U, 9U, 12U, 15U, and 18U, all in a standard 19" width (580mm).

RS Components
www.rs-components.com



Richardson RFPD to support antenna booster from Fractus

Richardson RFPD announced immediate availability and full design support of the mXTEND antenna booster from Fractus, S.A., a compact device measuring 5.0x5.0x5.0mm and specifically designed to provide multiband performance in mobile and other wireless devices. This omnidirectional antenna enables worldwide coverage by allowing operation in the communication standards GSM850, GSM900, GSM1800/DCS, GSM1900/PCS, UMTS, LTE2100, LTE2300 and LTE2500. The mXTEND can be standardized across multiple devices and platforms, with no customization required. Several evaluation boards are available.

Richardson RFPD
www.richardsonrfpd.com



Rutronik distributes new family of µATX high availability industrial mainboards from Fujitsu

The Fujitsu D3231-S marks the start of a new family of high reliability industrial microATX (µATX) mainboards and is now available at distributor Rutronik. The µATX with its Intel Q87 Express chipset supports the latest Intel Core processors i7/i5/i3 with LGA1150 up to 95W and dual-channel DDR3 1600/1333 SDRAM memory up to 32GB. The mainboard as of now. The D3231-S is designed for 24/7 continuous operation in an extended temperature range of 0° up to 60°C. Long-lived components and rugged tin coating of the circuit board make the D3231-S particularly robust and resistant. Its EMI compatibility and burst resistance live up to industrial standards. Thanks to this, the board ensures fail-safe operation of critical applications in the medical field as well as in harsh industrial manufacturing environments.

Rutronik
www.rutronik.com



Avnet Abacus clinches award for sustained sales growth of Kingbright LED range

Distributor Avnet Abacus has received the 'Platinum' award for outstanding sales growth and support from Kingbright, the Taiwan-headquartered manufacturer of light emitting diodes (LEDs) and related products. For the fourth year running, sales through Avnet Abacus have resulted in the biggest revenue growth in Europe for the Kingbright range compared to other distribution channels for these products, with annual sales doubling over this period. Avnet Abacus is Kingbright's largest and most successful pan-European distributor, stocking an extensive selection of SMD LEDs, through-hole LED, LED displays and other LED related products from the manufacturer for a broad array of industrial applications.

Avnet Abacus
www.avnet-abacus.eu



PUBLISHER

André Rousselot
+32 27400053
andre.rousselot@eetimes.be

EDITOR-IN-CHIEF

Julien Happich
+33 169819476
julien.happich@eetimes.be

EDITORS

Nick Flaherty
+44 7710236368
nick.flaherty@eetimes.be

Christoph Hammerschmidt
+49 8944450209
chammerschmidt@gmx.net

Peter Clarke
+44 776 786 55 93
peter.clarke@eetimes.be

Paul Buckley
+44 1962866460
paul@activewords.co.uk

Jean-Pierre Joosting
+44 7800548133
jean-pierre.joosting@eetimes.be

CIRCULATION & FINANCE

Luc Desimpel
luc.desimpel@eetimes.be

ADVERTISING PRODUCTION & REPRINTS

Lydia Gijsegom
lydia.gijsegom@eetimes.be

ART MANAGER

Jean-Paul Speliers

ACCOUNTING

Ricardo Pinto Ferreira

REGIONAL ADVERTISING REPRESENTATIVES

Contact information at:
<http://www.electronics-eetimes.com/en/about/sales-contacts.html>

EUROPEAN BUSINESS PRESS SA

7 Avenue Reine Astrid
1310 La Hulpe
Tel: +32 (0)2 740 00 50
Fax: +32 (0)2 740 00 59

www.electronics-eetimes.com
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LAST WORD

HLS is dead, long live HLS? Time for a revolution

By Matthieu Wipliez

IF YOU PAY ATTENTION, you will find that there is something a bit amusing regarding the marketing of High-Level Synthesis (HLS) solutions for C/C++/SystemC. For years, each time an EDA company created a new HLS tool, it claimed that it was better than the ones before, that HLS was finally “ready for prime time”, that it now had “unique quality of result”, or was bringing at last a “10-fold improvement in productivity”. Of course there is often little actual evidence to substantiate these claims. How could there be? After all, you can replace a king by another one as much as you want, it will not make monarchy any better an idea.

Now, let us make one thing clear: HLS vendors are correct in saying that the complexity of chips is increasing dramatically. Moore’s law is still going strong and is expected to continue to do so for almost ten years (and as always who knows what will happen in ten years?). This means that while designing whole chips at RTL entirely by hand from scratch is still possible, it is no longer profitable to do it, as it will require far too much manpower. Semiconductor companies did not switch to HLS though, they have instead turned to using IP (Intellectual Property) cores in a “divide and conquer” manner so they do not have to design huge amounts of new silicon over and over.

That worked fine until the complexity of IP started to increase too much: there are always more protocols or standards to support, and there is a very real limit to the number of engineers that can work in parallel on a hardware design, after which the critical path from specification to silicon cannot be reduced further if you keep using RTL. So we must infer that semiconductor companies will have to turn to HLS.

But what HLS? First we have HLS of C/C++ code. What is the benefit of using C or C++ languages? That software engineers can describe hardware? Granted, they may

well be able to describe hardware at the so-called algorithmic level of description with ‘for’ loops and arrays, but this is only good for regular DSP algorithms (filters, FFT, etc.). Of course, high performance often require them to annotate their code with very hardware-related directives. How does that benefit anybody? And what about any other design but DSP? What is the other benefit of using C or C++? That hardware designers can use pointers to exchange data between entities?

Another very popular trend is HLS of SystemC code. It does solve a few problems compared to starting from C/C++. SystemC includes the notions of entities, ports, channels, etc. It still shares the problems inherent to the algorithmic level of description: for instance, compiler optimizations can make it very difficult to predict the scheduling of an untimed description, which does not help interacting with a cycle-accurate implementation; changes at the source level can also result in dramatic changes in the generated design, making ECO troublesome.

The advantage of SystemC is that it allows the description of lower-level and/or more control-oriented algorithms, in other words if the algorithmic level of description does not give useful performance (which is very probable when dealing with anything other than DSP), or is not appropriate (e.g. when implementing communication protocols) one can resort to RTL coding in SystemC. In addition to being about as natural as string manipulation in Verilog, we can wonder how “high-level” this really is. And again, this is without taking the steep learning curve of the C++-based (seriously, C++ again?) language/framework.

The truth is that High-Level Synthesis of C/C++/SystemC is not, and by its very nature, can never be satisfying outside of the DSP world. If you are willing to use something other than C/C++/SystemC there are some interesting HLS tools out there, but many are limited by the complexity of the language they use. Truth is that as hardware designers, we need, and deserve, more.



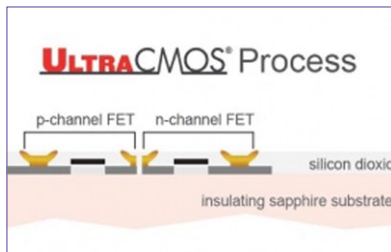
“We’re tired of the HLS monarchy: it is time for a revolution in hardware design”

Matthieu Wipliez is CTO at Synflow - www.synflow.com - he can be reached at matthieu.wipliez@synflow.com

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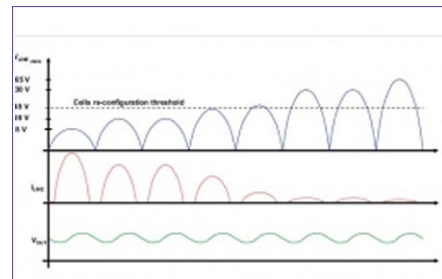


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