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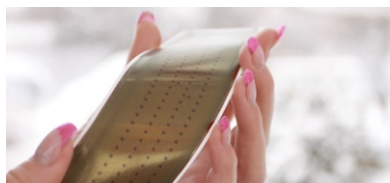
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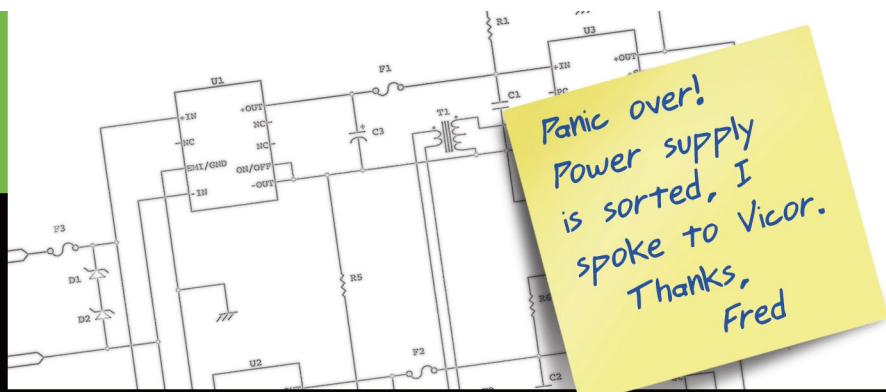
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Energy savings sneak up on home automation

By Julien Happich

A FEW WEEKS AGO, the EnOcean Alliance celebrated with fanfare its 200th member company, NanoSense, designer of air quality control sensors. NanoSense's products use EnOcean and KNX technologies to regulate and optimize air quality inside buildings. The EnOcean alliance - www.enocean-alliance.org - was created just over three years ago, and according to keynote speaker Emmanuel François, marketing director for Western Europe, over 750 interoperable products are supported collectively by the alliance members, deployed in over 200,000 buildings worldwide that use energy harvesting wireless technology to feed data back to building automation systems.

The sensors "harvest and store" tiny amounts of energy from motion, light or temperature differences, they then use it to wirelessly control lighting, heating and air conditioning systems. According to François' figures, about 20 to 30% of recurring savings can be achieved in new building installations, and up to 80 percent savings can be achieved in retrofit scenarios where maintenance, cabling requirements and installation time are considerably reduced. The French legislation on thermal efficiency will only accelerate the deployment of stringent home automation solutions, remarked François, with the RT 2012 (Réglementation Thermique 2012) specifying that all new buildings in France must have an average energy footprint below 50kWh/m²/year by the end of 2012, compared to 150kWh/m²/year today. The ultimate goal on the roadmap to 2020 is to make all new buildings energy self-sufficient, reducing their average energy consumption per square meter to 0. The residential market is only starting to adopt such energy-saving measures with about 400 new houses being equipped every year. Nowadays, many sensors (temperature, CO₂, light, presence detection) run on replaceable batteries, though François is confident that sooner or later, European legislation will exclude battery-operated devices altogether from all new buildings, calling for more autonomous solutions.

Achieving these high efficiency goals means that more sensors and energy monitoring devices should be deployed, together with active switches and easy-to-use monitoring tools. Educated and responsible end-users will have their part to play, or rather will be entan-

gled in an invisible maze of sensor very akin to an energy-conscious surveillance network.

In the so-called "smart buildings", switches mounted inside window and door frames can send a short telegram to notify the air conditioning system that heating or cooling is no longer required whilst the windows remain open. Presence (often infrared) and movement detectors together with light sensors act as relays to switch the light on or to set a camera



"Intelligence should come from the system installers to avoid the KGB effect"

in action when someone enters a room, and turn it off when the room is empty again. Since every switch and every sensor bears a unique 32-bit identifier, an entire building can easily be mapped. The actuation data can then be recorded and synchronized with energy consumption data from smart-metered appliances, helping identify usage patterns and improve energy efficiency through education (i.e recommendations to staff or occupants).

Even after a first installation, switches can be re-arranged within a room without re-wiring, they will remain wirelessly paired with their respective appliances or lighting. This makes it easy to reconfigure office-space. Further tuning is enabled through dedicated software. At the conference, French company Lifedomus demonstrated Lifedomus i.o, an intuitive design studio for home automation aimed at end-users (apartment or house owners). The multi-protocols software is compatible with Windows, Linux, Mac OS, iPhone and Android. The tool lets users configure the lighting and various appliance interactions throughout their home, setting up morning or evening routines, defining custom lighting

scenarios or whatever other creative home automation. Real time feedback through the graphical interface provides an instant grasp of their energy consumption for a given scenario, and in the future, utility providers may want to entice users to behave differently. Via this software, all the settings and actuators can be controlled remotely from virtually any internet-connected device. This is similar to many other existing home automation solutions like iControl, Control4, or Google's recently announced Android@Home Framework, a middleware layer sitting on top of the newest Android OS.

Rich citizens from emerging countries are very fond of such control capabilities, noted Laurent Tavel, director of IP infrastructures at the C2S Bouygues group. In Asia, the super-riches allow as much privacy intrusion as technology can offer, for the sake of their safety. Tavel is supervising the IP convergence in the 40-storeys, 185m high M&C Tower project in Saigon, Vietnam. The "building 2.0" connected tower will be fully automated and under heavy surveillance, with individual control only handed over to privately owned areas.

In Europe, exacerbated home automation could fail to be widely accepted if solely based on technical machine-to-machine solutions. The suspicious human beings that we are could feel uneasy when trapped into what could rapidly be perceived as a hostile environment. This is what Seven Line Control founder, Yves Waltzer, describes as the "KGB effect", when over reactive building automation brings sudden changes of lighting or when invisible triggers annoyingly open the wrong doors. "I like to qualify such buildings as "connected", or "communicating", but certainly not smart. The intelligence should come from the people who configure them and it is important to inform professional users of home automation technologies how to best configure such systems so as to offer increased comfort from an end-user's perspective" Waltzer says. The Rhenergy working group has been set up in France to study end-users' behaviour and interaction with such automated environments, in order to establish the best energy-saving routines while educating the end-users to sensible usage patterns. When the two converge into the right comfort zone, privacy will be the first to take another hit. ■

Car electronics build bridges to the IT world

EXECUTIVE
INTERVIEW

By Christoph Hammerschmidt

IN THE WORLD of automotive electronics, new usage models call for closer ties between car and IT. The integration of cars into IT applications, in turn, affects the technologies deployed in the vehicles. EE Times Europe discussed the perspectives of car connectivity with Kurt Sievers, Senior Vice President and General Manager of NXP Semiconductors' automotive business unit.

EE Times Europe: Mr. Sievers, what do you regard currently as the most interesting trends in automotive electronics?

Sievers: One of the most interesting transformations we observe currently is the transformation of the immobilizer. Hitherto, this was a security-driven function, but in the meantime it assumes a very significant role in comfort electronics - think about "passive keyless go" functions, these start/stop buttons. In the future, we believe that NFC will be combined with immobilizer functions. We are about to integrate NFC into the keys. This will enable the keys to talk to mobile phones. This way, you can transfer data from the key to the phone and implement applications like a car finder.

EE Times Europe: What does this mean?

Sievers: You park your vehicle somewhere,



Fig. 1: No car should be an island. Kurt Sievers sees cars becoming part of an embracing IT infrastructure.

pull off the key. In this instance, the key reads out your navigation system's GPS data. Then you go shopping - or you take the plane and fly away. When you come back, you have to remember the exact location where you parked your car. This is a very common problem. With a car finder, you simply hold your key near your mobile handset; the key then transfers the car's position data, and your smartphone shows you the way to your car. This feature will go into production in 2012. However, the car finder is just an application example. The car key increasingly becomes a carrier for additional functionalities.

EE Times Europe: Such as personalizing driver-specific functions like seat position?

Sievers: Yes, but also OEM processes. Car diagnostic functions could be integrated. For example, the key could download all of your car's diagnostic data as you remove it. This is possible because the immobilizer is connected to the CAN bus. Thus, the key could store all relevant data to pass along to a technician at a service workshop. The mechanic would just need to hold the key against his reader and establishes an NFC connection to read out the data.

EE Times Europe: But the cars do communicate their status already online - by means of mobile radio. Internet-based services such as "Connected Drive" enable repair workshops to proactively recommend a service appointment.

Sievers: This depends on the respective use case. Automotive OEMs tell us that they prefer to keep control of these things. Certainly, there are car buyers who want this degree of internet orientation. It boils down to the question "Do we still need our own

car, after all?" Instead of a car key, you could use a mobile phone just as well. From the perspective of physics, it would be the same thing. But we see a strong interest from the OEMs to adhere to the key since it is a branding symbol.

EE Times Europe: The short product life cycle of mobile phones is not overly compatible with car design cycles. Thus, a smartphone as the carrier for automotive applications perhaps creates challenges to car designers.

Sievers: Indeed. The OEMs are struggling to master this challenge. But there are more usage models for mobile phones in connection with cars: look at these new car sharing models. You book the car over the internet with your smartphone and download your ticket. Then the smartphone leads you to the place where the vehicle is parked. You hold your smartphone against the NFC reader installed behind the windscreen. In the meantime, the car has been notified that you are currently authorized to use this car. You identify yourself by means of the NFC data exchange, and the car opens the door and allows you to use it.

Several car rental companies have similar schemes in place with the new European electronic driver's license assuming the same function. This is basically the same technology.

The point is that the attitude of the younger generation towards owning a car and mobility in general is changing. People are ready to share cars. The challenge is that you always have to know where the car is and who pays for what. This challenge can only be solved by means of such technologies.

EE Times Europe: Besides the changing mobility behaviour, do you see further shifts in automotive electronics?

Sievers: Several application fields which had been separated until now are about to merge,



The “Car Finder” leads forgetful users to the place where they parked their vehicle: One example of applications based on Near Field Communications (NFC)

for instance car connectivity. There are applications designed with CO₂ reduction in mind but now it turns out they generate synergies with respect to connectivity infrastructure. For instance, weight reduction. If you deploy smart networks in cars you could reduce the weight of the cable loom, after all, this is the second heaviest part in the car after the motor. One can also reduce CO₂ emissions by guiding drivers through dense traffic and avoiding traffic congestions.

EE Times Europe: You mentioned intelligent networking. It has been remarkably silent about the FlexRay data bus in the past months.

Sievers: FlexRay is about to take off now. We

see the first commitments from American OEMs now. And after JASPAR has finalized their standard version, Japan is now committed. Similar to AUTOSAR, the Japanese industry has its own, slightly different version. All in all, the FlexRay pickup curve is steeper than it was the case during the introduction of the CAN bus.

EE Times Europe: The discussion about Ethernet as in-car networking technology has been resumed recently, albeit not for the same applications as FlexRay.

Sievers: FlexRay will replace the CAN bus, at least in high-end applications. Ethernet clearly is positioned for applications with even higher bandwidth requirements. It is known that BMW uses Ethernet for its in-car diagnosis infrastructure, but there is a higher potential: camera-based driver assist applications, for instance. Ethernet could even serve as a backbone, connecting several domains. We have info-

tainment, body, power train, all of them using their own protocols and bus systems. Currently, it looks like Ethernet will be the technology of choice to interconnect these domains.

EE Times Europe: But wouldn't this require automotive-specific Ethernet versions?

Sievers: The goal is to eliminate the distinction between automotive and commercial Ethernet. Clearly, the products have to meet automotive quality standards, but the protocol should be identical to industry standard Ethernet. The idea behind is to create an open industry solution in order to generate scale effects and innovation effects across the industry.

Indeed, for many years in the automotive sector, engineers tried to create their own optimized solutions, but now the idea prevails to align the technologies. This way, the automotive industry could better participate in innovation cycles.

EE Times Europe: There are automotive-specific issues such as security. A car needs to be inherently more secure than the standard IP stack can offer.

Sievers: The security problem won't be solved at the protocol level but through a cryptography controller, or by deploying gateways and firewalls. I am not aware of any efforts to harden the IP protocol with respect to automotive use. I don't think it would make sense. Ethernet will be part of automotive solutions, and it will comply with industry standards as far as possible. Preferred applications are camera-based assistant systems and diagnostics. My personal opinion is that it will also be deployed in infotainment systems, but this view might be subject to discussions.

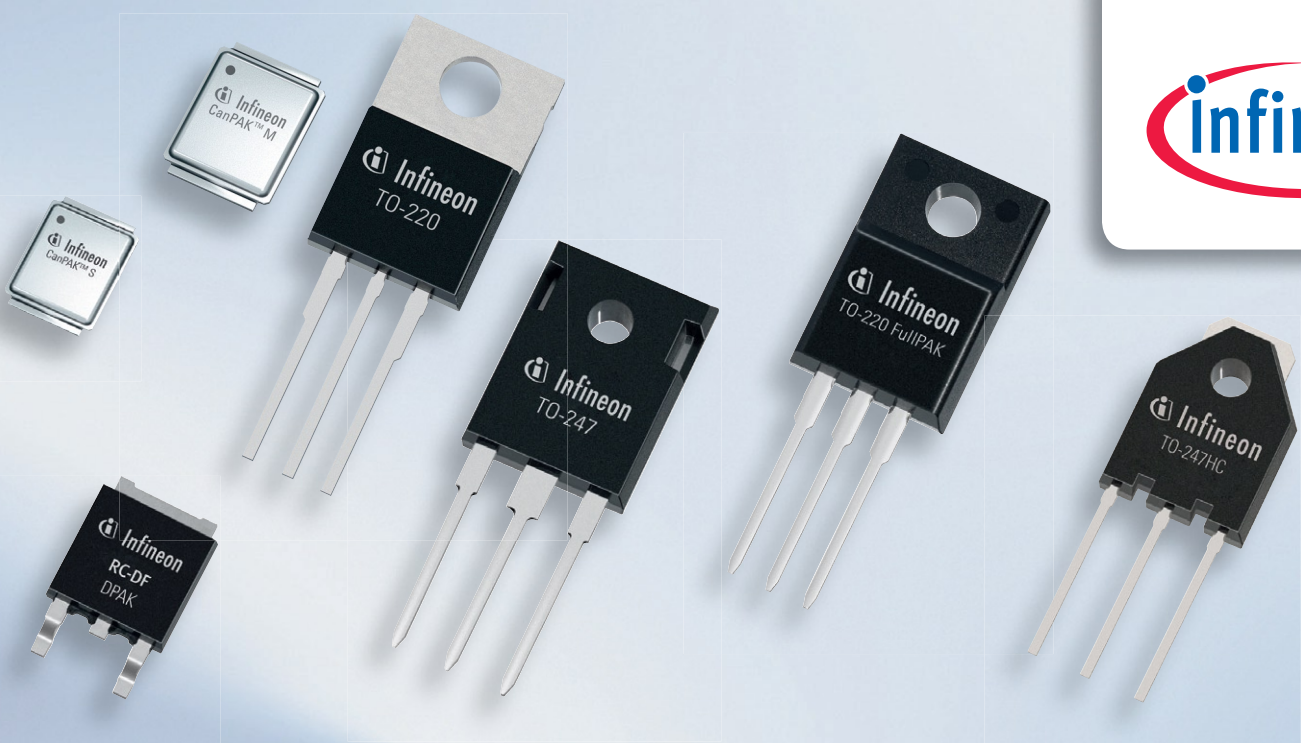
EE Times Europe: Currently the car industry is about to roll out the latest MOST version, MOST150.

Sievers: I know, but there are enough advocates of a more open solution. Not all of the OEMs are happy with the current status. The car will increasingly be integrated into an IT context.

Against this background it can only make sense to bring standards established in the IT over to vehicles to that they can be connected to the IT world. This is undeniable. ■



The car of the future communicates with other cars. Trials (here in Eindhoven, The Netherlands) demonstrate the volume maturity of the technology.



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PCI Express poised for 2x upgrade

By Rick Merritt

THE PCI SPECIAL INTEREST GROUP has determined it can squeeze out of copper links at least one more high speed version of PCI Express before a likely transition to optical interconnects. PCIe Gen 4 is expected to deliver at least 16 GT/s when it debuts in products in about four years. "The initial report we got yesterday is a PCI Express 4.0 is feasible - we have to work out the details, but it is feasible," said Al Yanes, president of the PCI SIG, speaking in a press briefing at the group's annual developers conference.

A exploratory group including members from AMD, Hewlett-Packard, IBM and Intel are conducting simulations using chip, channel, packet and socket data. They have determined throughput of at least 16 GT/s is possible and are expected to deliver a final report before the end of the year.

"We think we can eke out one more turn of the crank out of copper, so we are not looking at optics yet," said Ramin Neshanti, chairman of the PCI SIG's serial communications working chair.

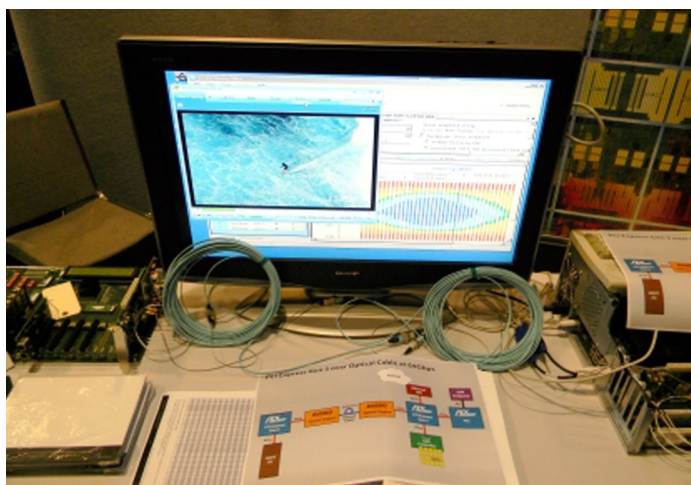
It took the PCI SIG about four years to hammer out its 8 GT/s PCIe Gen 3 spec which required new signal encoding and equalization schemes. The Gen 4 spec should take a similar period, but this time the focus will be less on silicon and more on the board-level channels through which signals pass, Neshanti said.

Specifically, Gen 4 will probably be limited to distances of about eight to 12 inches compared to 20 inches for Gen 3. Engineers wanting longer reaches will need to use repeaters, a potential growth area for PCIe silicon.

The Gen 4 boards may need to use new materials, via designs and backwards-compatible connectors designed for improved signal integrity to reduce impedance discontinuities.

"We think we have achieved about as much as we can scaling silicon," said Neshanti who also serves as an I/O standards manager at Intel.

That's a big shift for the PCIe community which has not previously required major changes of board makers. Typically the PCI SIG has thrown its hardest problems to chip makers such as AMD, Intel, NEC and others to ease problems for its less techni-



cally sophisticated supply chain among high volume PC board and system makers.

Nevertheless, some significant silicon shifts are ahead. Transceivers for Gen 3 were the first to use techniques to massage signals, adopting single-tap decision feedback equalization (DFE). Gen 4 transceivers will need to use multi-tap DFE. How many taps they will need is not yet clear.

"There also will be heavy investments needed from test equipment vendors to do some very creative probing solutions either on chip or somehow as an add-in," said Neshanti. Agilent, LeCroy and Tektronix are among the testers involved in the work, "but we don't know which will step up first," he said.

Work has so far focused on electric and analogue aspects of the physical-layer design for PCIe Gen 4. Over time, exploration will start

on logical-layer and protocol improvements in areas such as latency reduction, forward error correction, deeper pipelining and error reporting and control.

At the end of the day, costs are expected to increase with the new generation, especially for applications that need to maintain today's longer distances. But the group aims to keep additional costs to a minimum.

"PCI Express lives and breathes because of its ubiquity and that comes based on its low cost," said Neshanti. The need for speed is clear. Graphics and network switches are among the most bandwidth-hungry applications driving Gen 4. Designers of dual-port 40 Gbit/s Ethernet and single-port 100G Ethernet boards want Gen 4 to avoid the costs of supporting the pins they otherwise need for 16 lanes of PCIe Gen 3.

"Adapter vendors like to be around eight-lane implementations for cost reasons," said Yanes. Meanwhile, engineers are making process getting 8 GT/s PCIe 3.0 products out the door. At least 14 companies with building block cores, software or testers have announced Gen 3 support.

To date about 23 adapter cards and 19 systems from top PC makers have participated in the PCI SIG's Gen 3 plugfests. "Their products are in prototype phase and haven't achieved full debug interoperability, so they are not ready to announce them," said Yanes. The PCI SIG hopes to publish by early next year a list of products that have passed interop tests. The group plans at least three more plugfests in Silicon Valley and Taiwan this year.

"PCI Express Gen 3 is more sophisticated in its electrical design than past PCI SIG standards, so we are giving members more feedback on how they are doing" with their first products, said Neshanti. ■

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Multicore is mandatory, claims Freescale CEO

By Philip Ling

OPENING THE FREESCALE TECHNOLOGY

Forum 2011, in San Antonio, Texas, CEO and Chairman, Rich Beyer stated in his keynote address that the PC model isn't going to work as we enter the era of 'connected intelligence', adding that multicore is going to be mandatory. It fits with the industry-wide acceptance that greater performance can no longer come at the cost of more power.

Beyer's comments supported the official announcement of Freescale's latest QorIQ family, the PowerPC based Advanced Multiprocessing series (AMP), adding that in the future, multicore solutions will not only be mandatory but will also have to scale with the application in order to maintain the power/performance balance. This resonates with the company's decision to develop the ARM Cortex-based i.MX series which spans single, dual and now quad Cortex-A9 based processors.

In five years Beyer expects tablets to outship PCs and believes they will be optimised for content consumption. However, he also defended the company's decision to leave the baseband market and stated that through strategic partnerships Freescale can be a major supplier to the tablet and mobile device market. Beyer believes the industry is now looking for a new breed of mobile processors, which will need to be OS-compatible, scalable and lower power than those available today. This was punctuated by the first public demonstration of working silicon for the iMX 6 Series application processor; a quad-core ARM device. Freescale continues to support both the ARM and PowerPC architectures and, according to Senior VP and General Manager of the Networking and Multimedia Group, Lisa Su, hasn't ruled out taking a MIPS license in the future. This reflects the company's strategy to create devices that are less general purpose and more application specific, by assessing the best solution for developing embedded processors that address specific market requirements.

However, Su stated that the company is unlikely to use the Cortex-A15 core in its communication processors, while it was confirmed that the multimedia group will be bringing an -A15 based product to market in the near future.

Is the Cortex-M4 in need of a 'killer app'?

It's been about a year since Freescale led the industry with the first implementation of the first Cortex-M4 in its Kinetis family, but its competitors have been slow to respond. Moreover, the deployment of M3 based devices has increased and often they are integrated alongside peripherals or even other cores that target specific application areas where, it could be suggested, the M4 might offer a better solution.

Dr Reza Kazerounian, Senior Vice President and General Manager, Microcontroller Solutions Group, described the strategy behind the Kinetis family and why there is still demand for other solutions where, perhaps, the M4 could be applied.



"DSC for us is a very optimised product for a very specific set of applications".

"We wanted Kinetis to be very clearly identifiable, the reason it's Cortex-M4 is because for industrial and multimarket applications it is the most suitable core available through ARM; it addresses many of the applications areas we are interested in participating in."

A key part of the Kinetis strategy is about mixed signal integration: "It has a very powerful core engine as well as its DSP capability. When you participate in that type of market it is all about integration; analogue, digital and I/O, and it's about scalability." This is reflected in the 200+ products now in the Kinetis family and despite the lack of direct competition for Kinetis, Dr Kazerounian believes others will appear. He stated: "I am sure that the current



In five years Beyer expects tablets to outship PCs

suppliers of M3 will follow suite and will quickly try to do an M4, without a doubt."

However, other ARM licensees seem to be hesitant in developing yet another Cortex family, when there seems to be so much more mileage available with M3 based solutions. Recently Texas Instruments launched the Concerto family of digital signal controllers, which integrates its own C2000 DSP core alongside an M3, instead of choosing to base the device on an M4 core, and Toshiba already has a similar solution in the market. TI claims that a dual core approach preserves the real-time performance and, to a point, the safety credentials of a device targeting motor control applications.

Freescale this week has also announced a digital signal controller and, like Toshiba's and TI's, it isn't based on the M4. In fact, it doesn't integrate an MCU of any sort, rather it is based on a proprietary 32-bit DSP core.

"We have been in the DSC business for many years, but we are taking it to a whole different level," said Dr Kazerounian. What unifies the latest breed of digital signal controllers is the integration of precision analogue components for motor control, in the form of fast and accurate ADCs and PWMs. But Dr Kazerounian doesn't accept that this application area also needs an MCU core sitting alongside the DSP. He said that Kinetis is being adopted by many customers, and that there are parts that apply to motor control, metering and general purpose applications. He concluded: "Kinetis is not only about the fact that we have the Cortex-M4 in there, Kinetis is about the integration that we have put together and the scalability of the portfolio. It is way beyond a question of 'do I need an M4 or M3.'" ■



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European solar incentive cuts initiate global photovoltaic market shift

By Julien Happich

CONTINUED GOVERNMENT POLICY adjustments are causing major shifts in the sizes, growth rates and customer segment mix of photovoltaic (PV) markets in 2011, according to the conclusions of three new Regional Downstream PV Market reports issued by Solarbuzz. Specifically, European markets, led by Germany and Italy, have absorbed Feed-In Tariff (FIT) rate cuts of up to one-third between January 1, 2010 and July 1, 2011.

These reductions have caused Q1'11 demand in Germany, the world's largest PV market, to collapse to less than half of its Q1'10 size. In addition, overall European full year demand is expected to flatten in 2011 after increasing more than 170% from 2009 to 2010. These policy adjustments have particularly hit large ground-mount systems on agricultural land. Even though investment returns across the range of residential and commercial roof-mounted installations remained attractive in 1H'11, end-customers did not start to respond to fast-falling prices until June.

Europe is now projected to represent 65% of world PV demand in 2011, down from 82% in 2010, while the US will grow from 5% to 9%. The top five Asia Pacific markets led by Japan and China accounted for 11% of global demand in 2010, a share that will grow to 16% in 2011. The market share of these Asia Pacific countries is projected to increase steadily to reach at least 26% by 2015, while the US share rises to 14% by that year. In contrast to the European challenges, PV project pipelines in the US, China and India collectively now stand at a huge 25 gigawatt (GW).

"Project development activity is intense in these countries," said Craig Stevens, President of Solarbuzz. "Successful delivery

of these pipelines will first require a host of incentive mechanisms. Regulatory, financing, project structure and permitting issues must be overcome."

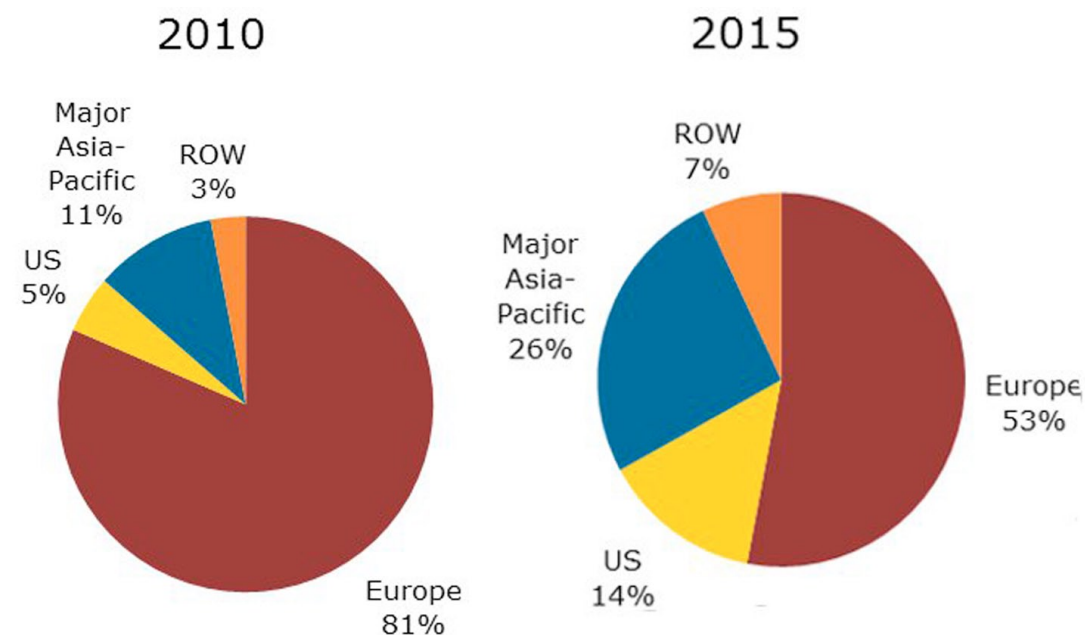
European distribution margins held up better than expected during 2010 and early 2011, as project margins collapsed, causing a refocusing of business models and channels to market. Europe benefited from sharply lower prices during 1H'11 which, in particular, helped maintain Italian demand impetus. The avoidance of mid-year FIT reductions in Germany will now aid demand recovery in 2H'11. Chinese module supplier prices in Europe were as much as 25% below their European and Japanese competitors back in Q1'10. This discount steadily reduced to a low of only 10% in February 2011. However, it spiked again toward the end of Q2'11.

2010 China PV demand to double

In China, domestic demand more than doubled in 2010, with Ningxia and Jiangsu once again the two largest provincial mar-

kets, while the utility segment accounted for 49% of the national market. In 2010, China was the second largest market in the Asia Pacific region, second only to a rejuvenated Japan whose 111% Y/Y growth was driven by residential demand, accounting for 82% of the market. Strong solar policy support already in place before the Fukushima nuclear disaster indicates that the Japanese market is projected to grow to between 1.3-1.5 GW in 2011.

In the US, soaring utility demand is redefining end-market, product mix and channels to market. Chinese module manufacturer market share increased to 37% in 2010, led by Suntech Power, Trina Solar and Yingli Solar, with their share building again during Q1'11. In 2010, distribution channel shipment share saw a small drop to 23%, while project developer and direct utility procurement emerged as formidable new channels. In 2011, the US market is projected to reach around 2 GW, growing to as high as 6.4 GW by 2015. ■



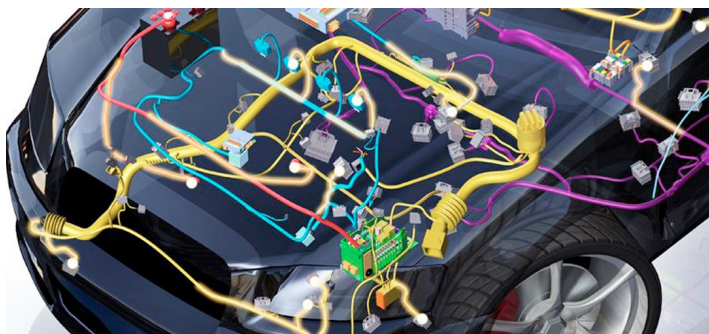
Global Photovoltaic Demand Share in 2010 and 2015 Forecast. Source: Solarbuzz Regional Downstream PV Market.

Delphi opens wiring harness assembly plant in Romania

By Christoph Hammerschmidt

DELPHI AUTOMOTIVE is opening a new manufacturing facility at Moldova Noua, in the southwest region of Romania. The site will produce wiring harness modules for vehicle manufacturers across Europe. Employment at the new plant could potentially approach 1,000 by the end of the year.

According to Cristian Gulicska, regional director, Delphi Electrical/Electronic Distribution Systems, Romania East, electrical/electronic distribution systems are comprised of many different modules, each with a specification that is dependent on the content of the vehicle and the options chosen by the consumer. "These modules are increasingly complex, often with built-in control electronics," explains Gulicska. "At Moldova Noua, we will focus on manufacturing a range of these customized modules, removing complexity from our other manufacturing operations and allowing for better overall efficiency."



As part of the first phase of development, the company opened 1,400 square meters of the Moldova Noua facility. During this phase, the manufacturing team is validating processes and gaining valuable production experience. An additional 2,400 square meters of the facility will be opened in September 2011.

Delphi currently operates three plants in Romania, employing more than 10,000 people at facilities that manufacture wiring harnesses and components for high-precision diesel common rail systems. Many of the systems manufactured by Delphi use the company's innovative lightweight cable, which has a gage size of just 0.13mm compared with an industry average of 0.35mm. The company claims that by substantially reducing the size and weight of wiring harnesses, the cable helps vehicle manufacturers improve fuel economy, reduce emissions and improve packaging. The small gage cable also reduces exposure to fluctuating copper prices. Delphi has operated in Romania since 1997. The company's plants in Sannicolau Mare, Moldova Noua and Ineu produce electrical/electronic distribution systems while its plant in Iasi produces diesel engine management systems. ■

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Neul opens up on 'white space' radio network

By Peter Clarke

NEUL LTD HAS ANNOUNCED some more details of its first white-space radio network called Neulnet and the standard behind that Neul has dubbed Weightless. The company has said it intends to make its money partly by the control of data that passes over a potentially global "white space" network and through databases it will control, and partly by the sale of equipment and the licensing of production details relevant to the white-space M2M standard that it is now finalizing.

The company was formed in 2010 by some of the original founders of Cambridge Silicon Radio, which went on to become CSR plc on success providing single-chip CMOS implementations of the Bluetooth standard. Neul does not intend to be a chip company, but rather a technology enabler for other companies. Its network is intended for machine-to-machine communications and to operate in the license-free and payment-free "white-space spectrum" between 400 and 800 MHz being made available by the retirement of analogue television broadcasting.

Although the company is starting in the United Kingdom the company said the principles are applicable globally as just about all broadcast television is in the UHF band and just about all governments are digitizing those broadcasts creating white-space opportunities. Signals in these frequencies can travel long distances and easily penetrate walls. This makes white space radio suitable for long-range applications that require wide-area connectivity.

Neul offers an FCC-certifiable white-space network in a box. The simplicity of the terminal nodes is intended to provide 10 years of battery life for low data applications such as smart meters. It should also reduce chipset costs to \$5 in prototype volumes and \$1 in high volumes. Neul executives said they intend to sign up mainstream chip companies to make the chips.

With predictions of 50 billion M2M connections by 2020 it is clear that Neul is not going to make all the chips needed, said CEO Collier. It needs the likes of Texas Instruments, Qualcomm, CSR, STMicroelectronics and Broadcom to get involved. However, Collier would not confirm whether these or similar chip companies are working with Neul on the Weightless standard.

The NeulNET system, which includes a basestation unit and portable battery powered terminal, makes it easy to create white space networks that deliver up to 16Mbps per available white space channel at a range of up to 10km. Neul's next steps are to confirm the system specification meets all requirements and then look to deploy trial systems during 2011, according to William Webb, CTO of Neul. Production systems will be available in 2012 while regulatory work continues to open up white space as a harmonized global frequency band world-wide.

Should Google be in 'white-space' radio?

It is clear that James Collier and Glenn Collinson, two of the founders of startup Neul Ltd., intend to leverage much of their successful Bluetooth experience with Cambridge Silicon Radio in their next tilt at the market. It is interesting to note that Neul does not intend to be a fabless chip company as Cambridge Silicon Radio was. Perhaps the lesson there is that Collier and Collinson feel that more money was made with less effort by the originators of standard than by CSR, which quickly became one of the leading fabless chip company implementors of the standard.

Neul does intend to be a provider of infrastructure equipment and intellectual property. In that regard Collinson admits Neul wants to be more like an Ericsson or a Qualcomm. The additional wrinkle is that Neul intends to retain control of the application databases and traffic that flows over the M2M white-space radio network. The value is in the data and there is money to be made administering those databases and controlling access to the network.

It is also informative to look back at who were the founders of the Bluetooth special interest group in 1998. They were: Ericsson, IBM, Intel, Nokia and Toshiba. Ericsson was the primary inventor of the technology. Much debate at the time was around the absence of Microsoft from the party. And when one considers the linking up of headsets with mobile phones and mobile phones with laptop computers was the first initial goal of Bluetooth it is clear why that cast of characters had a special interest in the short-haul radio link.

So who would be the equivalent players



for a Weightless white-space radio special interest group? The equivalent first application in white-space radio is smart metering for which there are government mandates in multiple territories. According to Luke D'Arcy, vice president of marketing at Neul, some 200 million smart meters will be installed across Europe over the next ten years. Clearly white-space radio M2M communications are not restricted to that but could be roll out quickly to electronic-point-of-sale, home automation and on to the Internet-of-things (IoT). It therefore seems clear that a natural partner for Neul in this area is Google Inc. Google is a master of the compilation and hosting of databases. It also has aspirations in terms of smart metering with its PowerMeter software. Google PowerMeter is a free piece of software that allows viewing of home energy consumption from a personalized iGoogle homepage. Other partners must include chip companies and why not CSR itself?

Having ridden the Bluetooth wave as far as it can CSR increasingly looks like a fabless chip company that could do with a new vision and new markets to conquer to drive it forward. One could also expect a telecommunications service provider, a natural customer for equipment, and an energy company to rise to this bait, which could pull in Vodafone and Electricite de France (EDF). So on a purely speculative basis my guess at the five founders of the Weightless SIG are Neul, CSR, Electricite de France, Google and Vodafone. Of course that guarantees that there will be more than five founder members, or less, and these names may not be anywhere in sight. But if Weightless and Neul are to be a success we could expect players of a similar calibre to sign-up. The remaining question is whether a small privately-held startup can continue to hold the ring when surrounded by these or similar heavyweights. That could become apparent by the end of September 2011 when Neul is planning to host the first Weightless SIG conference. ■

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Innovation from tradition

Fairchild to open a power technology development centre in Munich

By Julien Happich

WHILE HIRING ALREADY STARTED a couple of weeks ago, Dr. Thomas Neyer, senior vice president and fellow of high voltage power technologies at Fairchild Semiconductor Europe gave *EETimes Europe* a preview of the company's Technology Development Centre due to open in Q4 of 2011 in the East of Munich.

EETimes Europe: What will be the focus of this research centre?

Dr. Thomas Neyer: Initially the team will focus on high voltage switches, rectifiers and process simulation. Key focuses are next Generation IGBT and Superjunction MOSFETs operating over 600V. Mid-term, we intend to develop power packaging and high power modules and extend our expertise in wide bandgap devices. Other fields of research are under discussion. We hope this will lay a good foundation for Fairchild to take the lead position in power management for industrial and automotive applications in a mid- to long-term timeframe.

EETimes Europe: What is the current opening roadmap and staffing strategy?

Neyer: In the first phase, we will allocate about 400m² in the TDC for laboratories, some support and business functions. Then by the end of 2013, we expect to have expanded our floor space to 1800m², covering three floors and potentially relocating more functions into this new location. Eventually, we'll also move our Furstenfeldbruck offices (20km from Munich) to this new location. Our initial investment is very low since the building is newly refurbished and our specific requirements are reflected in our long term rental agreement with the landlord. Within the next 12 to 18 month, our workforce at this Technology Development Centre should reach about 15 device and technology experts and we aim to grow our operation to about 50 employees.

EETimes Europe: What is Fairchild's budget on this and how will it affect the company's global R&D spending?

Neyer: Fairchild is growing rapidly in terms of its revenues from mid- to high-power application and has made the decision to invest more R&D money into this field, which, overall will remain in the range of 7% for power semiconductors.



"We should be able to attract talents from all over Europe where the main Power Semiconductor expertise is located."

In April, Fairchild has acquired SiC components manufacturer Transic as well as the foundations for the Technology Development Centre in Munich where significant investments will be made in characterization and application labs.

EETimes Europe: Will it be a Fairchild "exclusive" R&D centre or will there be joint ventures with universities and other research centres?

Neyer: The TDC will be working closely with Fairchild established R&D teams in the US and Korea, and as such will be exclusive to Fairchild. At the same time, we will be open to collaboration with Universities or research centres when exciting opportunities arise. This could include new partners

or even competitors in a shared laboratory scheme. In terms of IP ownership for future partnerships, Fairchild will always strive for clear ownership and fair treatment of R&D partners. Details are to be negotiated on a case by case basis.

EETimes Europe: What will be the equipment at this facility and will there be specific lines that are not available at other Fairchild design centres?

Neyer: The labs will comprise state of the art simulation environment, HV device and wafer testing equipment sets for parameter extraction and high speed/high power characterization. No pilot lines or manufacturing equipment will be required, since wafer and package manufacturing will remain in our established sites within Asia.

The differentiating factor for this R&D centre will be its location, in the centre of Europe. We should be able to attract talents from all over Europe where the main Power Semiconductor expertise is located. Suppliers and several end-user R&D centres are just located nearby too.

EETimes Europe: Do you plan to investigate 3D die stacking using integrated vias of highly thermally and electrically conductive materials?

Neyer: Fairchild has a wide range of power packages available, including the SMartPowerModule line in high volume production. While we are assessing and partially using alternative interconnect technologies like ribbon bonding and copper-clips, there are several system level requirements, which rule out 3D stacking technologies in high power applications. I believe that 3D vias (TSV or interposers) will stay in low power, RF and high speed applications, where they have a significant contribution towards the system's miniaturization. The physical requirements to prevent electromigration, creepage distance as well as a low cost are paramount for a new technology to be accepted in high power devices. ■

Analog startup goes old school, gets funding

By Dylan McGrath

AN ANALOG IC STARTUP with a seasoned management team and a throwback business model emerged from semi-stealth mode to disclose the receipt of \$12 million in series A venture capital funding and announce several new analog comparator products.

Touchstone Semiconductor Inc formed by analog veterans from Maxim Integrated Products, Linear Technology and Analog Devices in 2010, plans to cut its teeth by providing a second source for commonly used, high-performance analog parts. According to Touchstone CEO Brett Fox, this is the same business model that billion dollar analog firms Maxim and Linear used to get their starts three decades ago.

"It's not an obvious strategy," said Fox, who has 25 years experience in analog ICs, including 11 years at Maxim and four years at Micrel. Fox notes that in the early days of the semiconductor industry, a host of companies, including household names like Intel, Advanced Micro Devices and National Semiconductor, got their starts as second-source suppliers. "In the last 20 years, the recipe just got lost."

While Touchstone is initially focusing on marketing parts as drop-in replacements for others supplied by the likes of Maxim and Linear, the company will eventually bring to market proprietary parts, which are already in development (one has already been announced), according to Fox. Starting by attacking existing, high-margin markets will enable Touchstone to build revenue and credibility with customers, Fox said. "When you look at the analog market today, at least 90 percent of the products are sole sourced," Fox said.

The \$12 million in funding, which Touchstone actually received last year but did not announce until two weeks ago (the 23rd of June 2011), came primarily from Silicon Valley venture capital firms Opus Capital and Khosla Ventures. Fox said he is almost certain that Touchstone was the only semiconductor company to receive series A funding from Silicon Valley VCs in 2010. Venture capital funding - once the lifeblood

of semiconductor innovation - has nearly dried up for chip firms in recent years. The skyrocketing costs involved in designing and bringing to market a leading-edge technology SoC have made VCs who once lined up to invest in chip firms with hot new technology cautious about investing.

Ironically, Touchstone scored funding not by enticing VCs with intriguing digital IC technology - which used to be the recipe for landing funding five to 10 years ago - but with a retro business model and analog technology implemented at 0.18 micron, hardly exciting process technology wise in a world where leading-edge digital IC vendors are preparing to offer 22-nm chips.

Will Touchstone's funding usher in a wave of VC investment in analog chip vendors and others that are less capital intensive and have business models seen as safer? Gil Cogan, founding general partner of Opus Capital, isn't sure. "I don't know if there is a trend," said Cogan, who was an original investor in Maxim in the early 1980s. "I think it is an older school business model and capital efficient and that's exactly what our fund and some other funds like about it. You start a digital IC company now, you have to raise a lot of money."

Fox credits Cogan and Pierre Lamond, a partner at Khosla Ventures who was an original investor in Linear, a founder of National Semiconductor and formerly chairman of Cypress Semiconductor, Microchip Technology and Vitesse Semiconductor, with seeing that Touchstone was a compelling proposition. Many other VCs did not, he said. "Both investors knew that our model worked because of what they had done in the past," Fox said. "There are only two people like that in the VC world."

The 'fully depreciated fab myth'

Touchstone owns no fabs and will rely solely on chip foundries for manufacturing (the company has a foundry agreement with TSMC). Most established analog chip companies use older fabs - including in some cases some of the oldest fabs in the semiconductor

industry - to produce parts at very mature process technologies. This, they argue, is an advantage because analog parts are not made at the leading edge of process technology and can be built on six-inch wafers using older equipment that is completely depreciated, giving them very low manufacturing costs compared to most digital IC makers.

Fox acknowledged that the depreciated fabs are a boon to older analog IC companies. But while those companies by and large build parts on 150-mm wafers using process technology that is 0.6 micron and older, Touchstone uses TSMC to build 0.18-micron devices on 200-mm wafers, he said. This superior die density allows Touchstone to compete very well on a price-per-wafer basis.

"Their manufacturing costs are very low, but ours are very low, also," Fox said. The playing field has tilted, he said, allowing Touchstone to compete extremely effectively. "I think if [Maxim Founder] Jack Gifford were around today, he would do it the way we are doing it. There's no sense in buying fabs today," Fox said. Gifford, who was also a co-founder of AMD, died in 2009.

Experienced design team

Fox is joined on Touchstone's executive team by Vice President of Engineering Jeroen Fonderie, a former director of design engineering at Maxim, and Vice President of Marketing Adolfo Garcia, a 29-year analog IC veteran who held various positions at ADI, Linear and several other firms. The company's board of directors is comprised of Fox, Cogan, Open-Silicon Inc. CEO Naveed Sherwani and Cathal Phelan, chief technology officer at Cypress, who officially joined the board Thursday. Touchstone has about 25 employees total, nearly all of which have worked with at least one fellow Touchstone employee in a previous post, Fox said. Members of the company's design team average 20 years of experience and 10 patents to their credit, Fox said. "In the analog business, you want people to have experience," Fox said. "You can't just hire them straight out of school and have them be able to do what you want to do." ■

Optimizing fast switching frequency power supplies

SPECIAL FOCUS:
POWER ELECTRONICS

By Maurizio Granato and Roberto Massolini

FROM A POWER-STAGE'S point of view, going high frequency is very desirable for a number of reasons: it decreases the size of magnetic components, reducing the amount of capacitance required and leading to potentially higher bandwidth while using smaller EMC suppression filters. What's more, very low Q_g - R_{ds} power FETs allow for very low conduction losses without increasing the gate driving losses, which are more significant at higher switching frequencies. Efficient powdered iron cores allow for reduced losses in the inductors too.

From the designer's perspective, the shift towards higher frequencies requires greater effort, since the static performances of the converter are often not consistent. The efficiency calculation, for example, can no longer be approximated using only the conduction

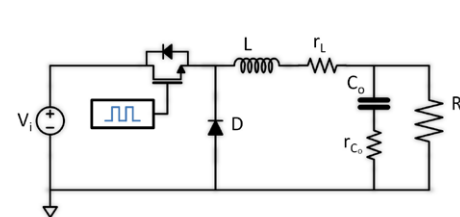


Fig. 1: Schematic of a buck converter.

losses, but requires at least a rough estimate of switching losses (involving the highly non-linear capacitances of the FETs), gate driving losses (involving the parameters of the driving IC), and

magnetic core losses. The small capacitance values required may lead to the use of highly reliable ceramic capacitors; the ripples calculation becomes more complex, since ESR is not dominant anymore and the voltage ripple cannot be approximated using only the Ohm's law (like in electrolytic ones). Moreover, moving to higher frequencies alone doesn't solve and may even worsen the usual issues with component selection, from footprint constraints to voltage and current rating, thermal issues and parasitics.

So far the only problem addressed has been the power stage design, dealing with static performances like efficiency, ripples, temperature, and size. If we look at the dynamic performances, the benefits of high frequency converters should go together with a careful design of the control stage, in order to find the optimal trade-off point. The best way to achieve such an optimal control stage design is to have the dynamic model of the device in hand.

There are several possible theoretical approaches that can be followed to achieve an accurate dynamic model of a Switch Mode Power Supply (SMPS); we could name just the most famous ones: PWM switch cell, State Space Averaging, Circuit Averaging. Each of

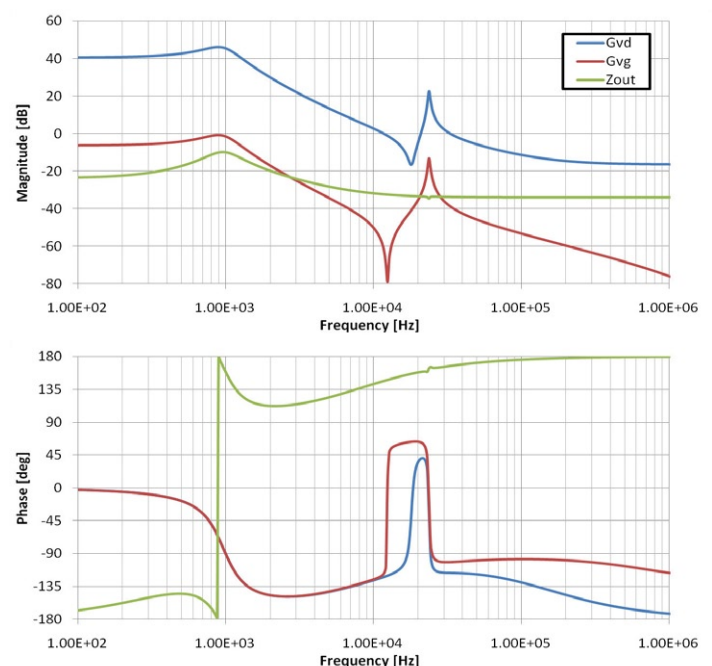


Fig. 2: Voltage mode open loop transfer functions of a 400 kHz SEPIC: duty-to-output voltage (red), input-to-output voltage (blue-dotted), output impedance (magenta-dashed).

these models has its pros and cons, but all of them represent a small signal approximation of the highly nonlinear transfer function of a switching converter; moreover, being a local linearization of the transfer function, the common tools for analyzing stability, like Bode or Nyquist plots, are not completely reliable to verify large signal variations, like load or line transients. For this reason, we will also need a time domain simulation tool.

Unfortunately, the implementation of an accurate model for frequency domain simulations is hard work, and requires a significant amount of time to be spent. The latest CAD tools can be very helpful in this case, but they are often expensive and complicated to learn. Once we have learned how to set up a good symbolic computation system, like Matlab, MathCAD or SAGE, we can try to derive the transfer function of the switching converter of interest. Let's take, for example, the basic non isolated converters (buck, boost, buck-boost), without taking into account any parasitic element, like the capacitors' ESR-ESL or the inductor DCR, in peak current mode control. Table 1 compares the control-to-output voltage transfer function of the main converters in peak current mode control.

These functions look simple, but they are actually useful only if the parasitic components are negligible, and only in the small ripple approximation, which means that the ripple of the controlled

Both Maurizio Granato and Roberto Massolini are senior design engineers at National Semiconductor - www.nsc.com - They can be reached at maurizio.granato@nsc.com and roberto.massolini@nsc.com, respectively.

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Fig. 3. WEBENCH allows the initial selection of the power converter, showing at glance the trade-off between cost, size and efficiency.

current is very small. By simply removing this approximation, the transfer function of the well-beloved buck converter becomes significantly more complex. In Table 2, we compare the voltage mode transfer function of a buck converter with and without the parasitic components (inductor and capacitor series resistance).

Moreover, the complexity of high order converters can increase the amount of work needed by orders of magnitude; this is one of the reasons why very elegant and high-potential converters like SEPIC or Cuk are not widely used.

We should also keep in mind that every control technique (voltage mode, peak current mode, emulated peak current mode, etc.) requires a different set of functions to be analyzed, plus any controller IC has a different internal error amplifier (which can be either a voltage or transconductance amplifier) with different parameters. This means that the designer should adapt its spreadsheet any time a different controller is used.

Obviously, when the topic is optimization, the problem is not only to let the system work reliably, but also to improve its performances by making the right design choices in terms of deciding what the best control technique is. Let's see a short overview of the most widespread methodologies.

Voltage mode

The most common analogue control technique is Voltage Mode (VM), where there is a single regulation loop, consisting of: output voltage sensing, using an appropriate scaling factor; amplification of the error between output and reference voltage, providing the required gain and phase boost; and comparison of the output of the error amplifier with the PWM saw tooth to produce the gate driving signal with the appropriate duty cycle.

VM characteristics are: simplicity (single loop), low converter output impedance, complex conjugated poles, high susceptibility to input voltage, and no intrinsic overcurrent protection. National Semiconductor adopts VM in many regulators, like LM5115 and LM5025.

Peak current mode

Another common technique is Peak Current Programmed Control (PCPC), where an inner loop sensing a switcher current (generally the inductor or the switch current) is used to produce the reference

voltage of the outer voltage loop (the same aforementioned).

It provides some intrinsic advantages, like simpler duty-to-output transfer function for the voltage loop, intrinsic overcurrent protection, and much reduced sensitivity with respect to input voltage variations. On the other hand, the modulator is very sensitive to sensed current disturbances, which have to be filtered, and need the design of a stabilizing ramp to avoid sub-harmonic oscillations. Moreover, PCPC effectively controls the peak inductor (or switch) current, which means that a higher current ripple implies higher discrepancy with respect to the average current, while lower current ripple implies higher susceptibility to disturbances.

Other control techniques

A more complex variant of the current mode control is the Average Current Programmed Control (ACPC), which allows the average value of the current to be controlled effectively, but requires the stabilization of another inner loop, besides the outer voltage loop. Another simpler variant of the current mode control is the Emulated Peak Current (EPC) control, implemented by National Semiconductor in many controllers like LM3495 and LM5116, which grants the simplicity of the PCPC, while improving the operation at very low duty cycle, usually impossible to achieve with PCPC because of high noise on the sensed current.

Other control techniques not involving analogue control loops are: hysteretic control, constant on-time (COT), constant off-time. These are very simple, because they don't require any stabilization loop and regulate the output voltage by comparing it with a hysteretic window. They suffer from non-fixed switching frequency and they usually don't work properly with low ESR ceramic capacitors because they rely on output voltage ripple. For this reason, National Semiconductor introduced the Emulated Ripple Mode, which is an improvement over classical COT techniques but without any problems with ceramic capacitors, in the LM3100 Simple Switcher family.

Have you picked one?

In complex situations, the selection of a control technique a priori is not enough. When dealing with high frequencies, it may be difficult to state from the beginning which is the optimal technique, and it may be necessary to make multiple designs and then compare them to assess their performances over the entire parameters domain.

An accurate comparison requires at least a good set of stable loop functions in the four corners of the input/output parameters of the system (V_{in} , I_{out}); nonetheless, it doesn't necessarily ensure that we also have good responses to line voltage and load current transients (this is due to the fact that the transfer function is only a linear approximation of the system in the operating point).

To evaluate those performances before manufacturing a prototype, it is necessary to implement a time domain simulation of the system, usually by means of SPICE tools. This may seem an easier task with respect to the AC model, because there is no need for a complex analytical tool, and everything is left to the matrix solver of the SPICE core. The hard reality is that in order to obtain accurate results we also need an updated database of thorough component models, which are not easily available and often force the designer to create a separate database, which is very time consuming.

Control loop design

Given all these difficulties in producing an accurate static and dynamic model of a switching converter, many designers prefer to

BUCK	BOOST	BUCK-BOOST	BUCK – without parasitics	BUCK – with parasitics
$G_{vc}(s) = \frac{R}{1 + sRC}$	$G_{vc}(s) = \frac{RD'1 - \frac{sL}{RD'^2}}{2 \cdot 1 + \frac{sRC}{2}}$ $D' = 1 - D$	$G_{vc}(s) = \frac{RD'1 - \frac{sDL}{RD'^2}}{1 + D \cdot 1 + \frac{sRC}{1 + D}}$ $D' = 1 - D$	$G_{vd}(s) = \frac{V_i}{1 + s \frac{L}{R} + s^2 LC_o}$	$G_{vd}(s) = \frac{R}{R + r_L} \cdot \frac{V_i(1 + sr_c C_o)}{1 + s \frac{L + C_o(r_c r_L + R r_L + R r_c)}{R + r_L} + s^2 LC_o \frac{R + r_c}{R + r_L}}$

Table 1: Comparison of control-to-output voltage transfer function of the main converters in peak current mode control.

Table 2: Comparison of duty-to-output voltage transfer function of buck converter with and without parasitics in voltage mode control.

make the initial design draft using first order approximations and well known simple equations. Then the debug phase of the prototype consists of trial and error, relying on accumulated experience and inspection capabilities to achieve the desired performances.

Sometimes this turns out to be an incredibly effective and fast method, but often it requires a huge amount of hours spent on the bench and a significant amount of patience. Improving performances may seem easy, but the awful surprise comes when we find out that our fine-tuned very high bandwidth control network makes the system unstable at the maximum input voltage or minimum output current; of course, we will never be able to test the system in all the possible operating conditions at the same time.

Once we have repeated the design steps many times, we finally have a working prototype with acceptable performances. Yay! Is it the optimal design, though? Is there any other component set which allows us to obtain the same results at a lower cost, or occupying less space, or requiring less heat-sinking?

The WEBENCH approach

A radical new approach to obtain a constrained multi-objective optimized solution is to throw away all your beloved (or hated) CAD tools and try the dedicated power optimizer tool provided by National Semiconductor: WEBENCH.


Every designer working on SMPS, either expert or novice, has at least heard about the WEBENCH Power Architect. Sometimes they judge it to be a good tool to handle simple designs, other times a good selection tool for finding only the right spot in the component set (e.g. only the controller IC) for complex designs; but once engineers overcome their instinctive mistrust for automatic design systems, they discover that WEBENCH is an overall system optimizer. It provides all the tools needed to go deep into the design and optimize, with a single

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visual interface, all the operating conditions and the performances of the application: efficiency, bandwidth, size and cost. WEBENCH contains dynamic models for many converter topologies and control techniques, allowing for high bandwidth control loop design with optimized phase/gain margin (high stability). Moreover, it also provides thermal simulations, which are usually outside the scope of an electronic engineer, and custom layouts with full BOM list. In the end, it is also possible to directly buy the fully populated PCB prototype, and have it delivered within a few days.

As we have shown, it is very important to collect the results of both time domain and frequency domain simulations, and then compare them with the bench results. The time domain simulations very effectively predict the response to line and load transients, and verify that the desired overshoot/undershoot requirements are achieved. The frequency domain simulations, on the other hand, optimize the loop function as far as possible and improve the gain and

phase margins, which ensure the best small signal dynamic performances for the system.

It is possible to find CAD tools for all the aspects of the design: SPICE simulator, MATLAB equivalent control loop designer, thermal simulator etc. In this case, the big issue is to collect the right models for all the possible components involved in the design and the needs to use a set of different tools at a time in order to cover all the different facades of the power converter. No matter which design methodology you choose, either trial and error or the CAD way, there is a tremendous amount of work ahead. None of the aforementioned small

details can be neglected if you are to achieve a representation which can be productively used to design the power and control stage of the system. As we have seen, the complexity to do that is even higher in cases where advanced performance is needed, where the smallest inaccuracy can lead to long debugging sessions in the lab. ■

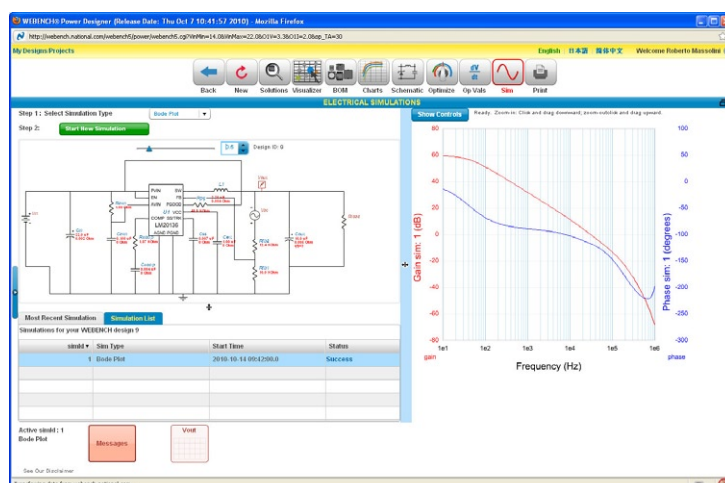


Fig. 4: Bode plot and control network optimization using WEBENCH
<http://webench.national.com>

Moving to higher-voltage LEDs to improve light bulb efficiency

By Robert Kollman

THERE IS MUCH INTEREST in replacing incandescent screw-in light bulbs with bulbs that use LEDs as the light source. Typically, a small number of LEDs, between five and nine, are connected in series and a power supply has to convert the line voltage to a low voltage, typically tens of volts, at currents around 350 to 700 mA.

There are a number of trade-offs in determining how to best isolate the consumer from the line voltage. Isolation can be accomplished either in the power supply or in the mounting of the LEDs. In these lower-power designs, physical isolation of the LEDs is a common choice as it allows the use of a cheaper, non-isolated power supply.

Figure 1 shows a typical LED light



Fig. 1: A light bulb replacement has little room for a power supply.


Robert Kollman is a senior applications manager and distinguished member of technical staff at Texas Instruments - www.ti.com

replacement. The power supply in this example is non-isolated, meaning the isolation

that protects the consumer from high-voltage is built into the package rather than the

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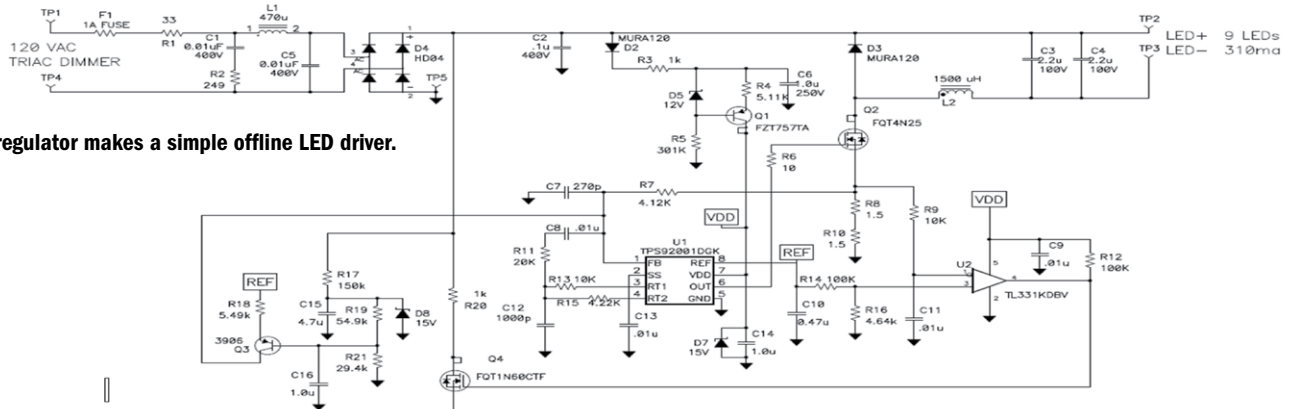


Fig. 2: A buck regulator makes a simple offline LED driver.

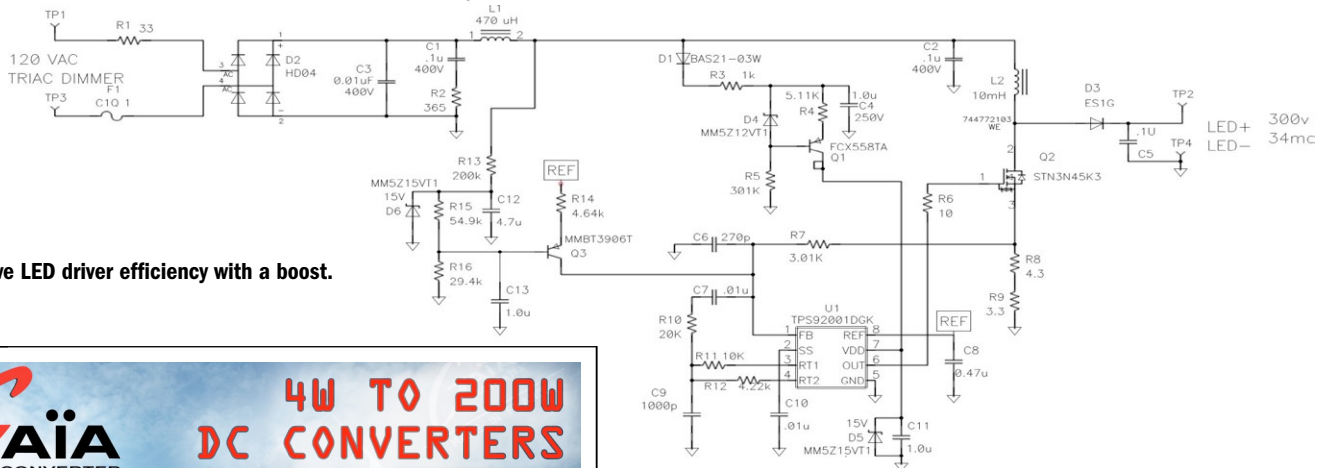


Fig. 3: Improve LED driver efficiency with a boost.

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power supply. It is quite evident that there is very little room for the power supply, which makes it a challenge to package. Furthermore, the power supply is buried within the package, which hinders cooling and makes good efficiency key.

Figure 2 illustrates a non-isolated circuit that powers LEDs from a 120-volt AC source. It contains a rectifier bridge that feeds a buck power stage. The buck is the “upside-down version” where the power switch, Q2, is in the return and the catch diode, D3, is connected to the source. Current is regulated during the on time of the power switch through a source resistor.

While fairly efficient (80 to 90 percent), this circuit has several efficiency-limiting drawbacks. The power switch has to carry the full output current when “on”, and when the power switch is off, the output current flows through the catch diode. Also, the voltage across the current sense resistors, R8 and R10, is around one volt. All three of these voltage drops are significant when compared to an LED voltage of 15 to 30 volts, and will limit the power supply efficiency.

More importantly, these losses contribute to the temperature rise of the light bulb assembly. An LED’s ability to produce light diminishes in time and is a strong function of its operating temperature. For instance, an LED light output will diminish by 30 percent over 50,000 hours at 70°C, while at 80°C, you can only count on 30,000 hours. The thermal problem is further compounded since the bulbs get installed in “cans” that tend to trap the heat and are not conducive to convection cooling. LED manufacturers have started making higher-voltage emitters by connecting several LEDs in series on a common substrate. These higher-voltage offerings allow for either

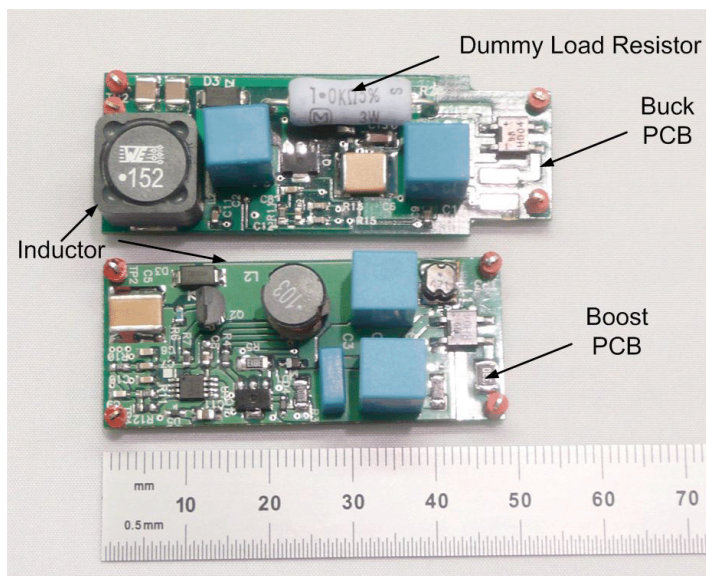


Fig. 4: Boost supply is smaller and more efficient than buck supply.

reduced costs or improved power supply efficiency. With these higher voltage products, a cheaper approach for the power supply simply can be a set of rectifiers and a ballast resistor. While this approach can produce a reasonably good power factor, the efficiency is poor, as a significant portion of the input voltage is applied to the ballast resistor, resulting in losses on the order of 30 to 50 percent of the LED power. This may be an option in lower-power applications where size is at a premium.

However, at higher powers, the reduced efficiency renders this unviable. Figure 3 presents another alternative using a boost power supply. Much of the circuitry is similar in the two approaches. However, the switch, diode, and current sense losses are much smaller, resulting in efficiencies in the 90 to 95 percent range. Additionally, this circuit has good power factor with measurements showing 97 percent.

Figure 4 is a photo of the two power supplies depicted in the schematics of figure 2 and figure 3. Even though this power supply produces about the same output power, there are several notable differences which impact the size of the power supply. The size of the inductor on the boost is notably smaller, because its energy storage requirements are less. The buck design also has a larger resistor than the boost does. This resistor is a dummy load resistor (R20 in figure 2) that is used to determine when a dimmer fires a silicon-controlled rectifier SCR.

This is needed because the dimmers have an electromagnetic interference (EMI) suppression capacitor across the triac presents a relatively high voltage to the power supply without some loading. This confuses the power supply and results in erratic dimming.

This is not needed on the boost converter, as the LEDs are connected to the input through the boost inductor and provide sufficient loading for this not to be a problem. The back side of the board is not shown but, as shown in the schematics, the buck version has more low-level circuitry. So the boost provides the smaller power, which is extremely important in space-constrained applications such as the LED light bulb replacement. ■



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Leveraging decoupling capacitance of regular power grids

By Chetan Verma, Piyush Mishra and Pankaj Jha

WITH EACH PASSING year and each lower technology node, design speeds are increasing tremendously. High frequency designs take a toll on the power integrity of ICs and induce more noise and ringing into the power supply network because of the increased signal switching speeds. This leads to the need for increased decoupling capacitance to address the power supply noise. The decoupling capacitance required in this case would be most beneficial, if present on the die itself. However, more on-die decap implementation would be an overhead and would increase silicon cost. Hence, there is a strong need to increase the effectiveness of the 'used-up' resources on the die to reduce the cost overhead, without impacting any of the existing design parameters. This paper discusses a method for increasing the effectiveness of the power grid mesh and provide additional on die de-coupling capacitance at no extra cost.

Problem definition

A methodology to increase the inherent capacitance of the power grid without compromising any of the existing parameters of the chip which the power grid directly effects such as voltage drop (or the current carrying capability of the grid) and the routability (or the space left over by the grid for signal net routing) of the design is discussed. The increased capacitance between power and ground supply enabled by this technique acts as additional decoupling capacitance. This additional capacitance

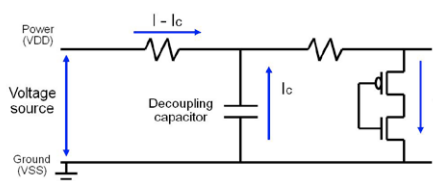


Fig. 1: How decoupling capacitance can help in decreasing dynamic voltage drop.

helps decrease dynamic voltage drop by acting as a distributed local current source to the sudden demands of current due to, highly concentrated, high frequency local switching.

Figure 1 illustrates how decoupling capacitance helps in decreasing dynamic voltage drop. As can be seen, a charged capacitor acts as a local current source to the sudden demands of current by the device. Since all the current is not being drawn all the way from the pads, the voltage drop is less. When the sudden demands of current cease to exist, the capacitor is charged again. In this way, the decoupling capacitor helps reduce the ringing in the power grid by averaging out the noise peaks.

The chip level power grid for synthesizable designs is drawn in the form of a mesh of metal stripes with each alternating metal laid out at right angles to the preceding metal. The current implementation of the power grid structure (width and frequency of stripes) is based on two criteria: IR drop and design routability.

Since the intent is always to close the design using the least possible area, the power grid has to be optimized in terms of widths and stripe placement to provide a balanced trade-off between the voltage drop and the routability. A good amount of resources get used in the power grid design (on average 15 % on-die metal is for routing). The methodology discussed herein is intended to be a "welcome by-product" off this already "used-up" power grid without impacting any of the existing parameters. A sample conventional power grid snapshot view is shown in Figure 2.

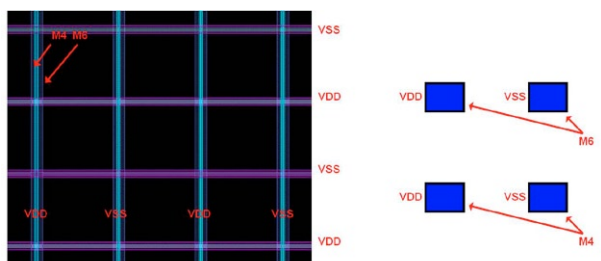


Fig. 2: Top view of Power Grid (snapshot) and cross-section view.

Distance between VDD and VSS stripes in same metal are placed adjacent to each other (0.5um for C65)

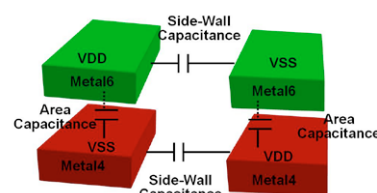


Fig. 3: a 3-D snapshot of metal4 and metal6 layers.

Distance between VDD and VSS stripes is high (30um for C65)

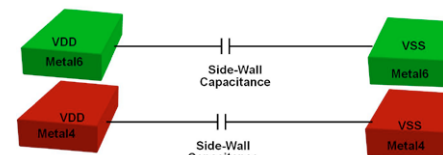


Fig. 4: actual 3-D snapshots of metal4 and metal6 for a conventional design.

Looking at capacitance to drive relative placement

Our solution is to use the basic fundamentals of metal plate capacitance to drive the relative placement of power and ground stripes in a power grid. This informed relative placement increases the local capacitance between the power and ground lines, which acts as a local current source and provides decoupling between power and ground lines, hence improving the power integrity of the design and reducing the power supply noise.

Figure 3 is a 3-D snapshot of metal4 and metal6. Other metal layers have similar profiles. Two improvements to the power grid structure are provided for increased decoupling capacitance. The power and ground stripes in the same plane have been brought together and placed alongside at the minimum possible distance allowed by the design rule spacing's. This increases the side-wall capacitance between power and ground to the maximum possible.

In the planes which have the same metal routing direction we have placed the power (vdd) and ground (vss) stripes in such



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MPLAB Starter Kit for PIC24F (DM240011)



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PIC32 USB Starter Kit II (DM320003-2)



This kit provides the easiest and lowest cost method to experience the USB and CAN functionality of the PIC32 microcontrollers. Users can develop CAN applications using PIC32 expansion boards. The board contains everything need to develop USB embedded host/device/OTG applications by combining this board with Microchip's free USB software.

FS USB Plug-In Module (PIM) Demo Boards

These full-speed USB demonstration and development boards feature the PIC18FXXJ50 8-bit MCUs. The boards can be operated either standalone or as a PIM plugged into the PICDEM PIC18 Explorer board (DM183032).

PIC18F46J50 FS USB PIM Demo Board (MA180024) PIC18F47J53 FS USB PIM Demo Board (MA180029)



The PIC18F46J50 and PIC18F47J53 FS USB PIM demo boards are full speed USB demonstration and development boards featuring the PIC18F46J50 and PIC18F47J53 respectively.

PIC18F87J50 FS USB PIM Demo Board (MA180021)



The PIC18F87J50 FS USB PIM demo board is a full speed USB demonstration and development board featuring the PIC18F87J50.

Explorer 16 Development Platform

Combine the Explorer 16, low-cost modular development board with the USB PICtail™ Plus daughter board for easy USB development with 16- and 32-bit MCUs. Several different PIMs are available that allow development with a variety of MCU platforms.

Explorer 16 Development Board (DM240001)



Use this efficient, low-cost development board to evaluate the features and performance of Microchip's 16-bit PIC24F and PIC24H MCU, dsPIC33 DSC and 32-bit PIC32MX families. Interface with the MPLAB ICD 3 In-Circuit Debugger or MPLAB REAL ICE™ In-Circuit Emulator to speed evaluation and prototyping of application circuitry.

USB PICtail Plus Daughter Board (AC164131)



This module enables USB hardware connectivity when using an Explorer 16 and USB-capable PIM. Provides support for USB device, host and OTG development.

Plug-in Modules



Various PIMs are available for use with the Explorer 16 development board. Individual PIMs feature different PIC24F, PIC24E and PIC32 microcontrollers and dsPIC33E digital signal controllers with USB modules.

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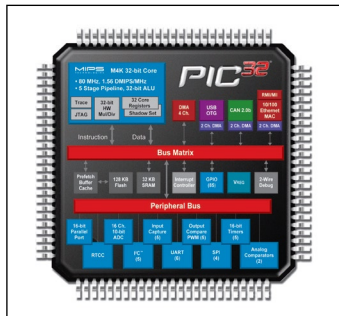
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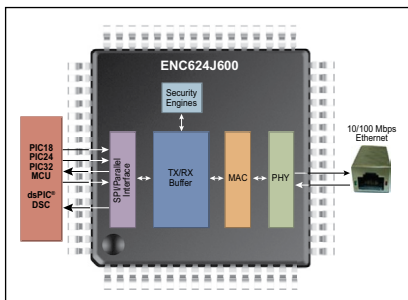
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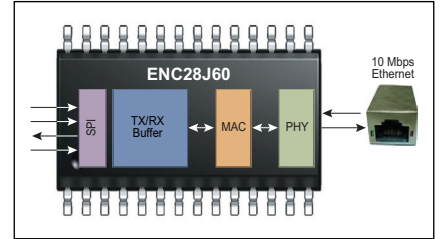
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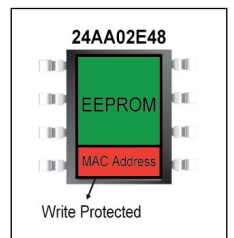
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PIC32 Ethernet Starter Kit (DM320004)



Contains everything needed to develop Ethernet or USB peripheral/host/OTG applications using the PIC32. The kit contains free Microchip TCP/IP software and the necessary cables. There is an integrated debugger/programmer on the board as well as an expansion connector.

Fast 100 Mbps Ethernet PICtail Plus Daughter Board (AC164132)



Populated with the ENC624J600, this Ethernet board interfaces to the RJ-45 connector. It can be plugged into the Explorer 16 development board (DM240001) and the PIC18 Explorer board (DM183032) allowing connection to any of Microchip's 8-, 16- and 32-bit products.

Ethernet PICtail™ Plus Daughter Board (AC164123)



This board is populated with the 28-pin ENC28J60 Ethernet controller which interfaces to the RJ-45 connector. It can be plugged into the Explorer 16 development board (DM240001), allowing connection to any of Microchip's 16- and 32-bit products when used in conjunction with the free Microchip TCP/IP stack.

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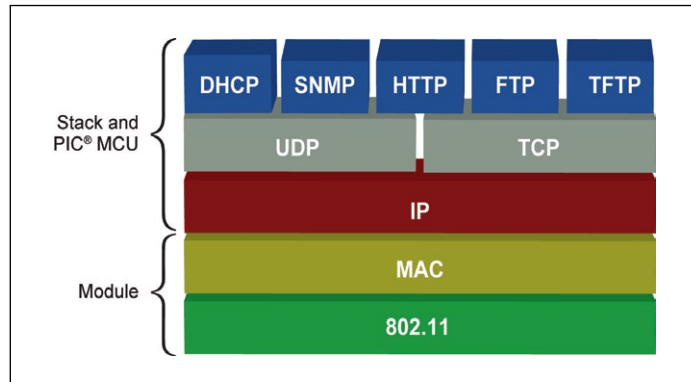
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- Supports ZigBee and MiWi development environment



Microchip offers ZigBee certified compliant platforms for ZigBee PRO and ZigBee RF4CE protocol stacks ensuring interoperability and reliable communication.

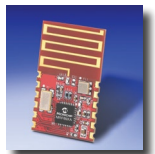
- ZigBee PRO Stack
- Smart Energy Profile
- ZigBee RF4CE and ZRC Profile

More information is available at: www.microchip.com/zigbee.

Sub-GHz Solutions – 433/868/915/950 MHz

MRF89XA/M8A/M9A Modules

- 868/915/950 MHz transceiver and modules
- Low receive current = 3 mA
- Transmit power = +12.5 dBm
- Receiver sensitivity: -107 dBm FSK/-113 dBm OOK
- Integrated PCB antenna and matching circuit components
- FCC, IC and ETSI agency certified
- Surface-mountable PCB
- Supports MiWi development environment



MiWi Development Environment

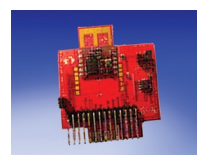
MiWi DE is designed to provide a smaller footprint, lower cost, communication protocol stack for peer-to-peer and mesh wireless networks. Intended for customers who desire robust communication in a closed or private wireless network at either 2.4 GHz or Sub-GHz operation frequency.

- MiWi P2P
- MiWi
- MiWi PRO

More information is available at: www.microchip.com/miwi.

Development Tools Support

- MRF24J40MA PICtail™/PICtail Plus (AC164134-1)
- MRF24J40MB PICtail/PICtail Plus (AC164134-2)
- MRF24WB0MA Wi-Fi PICtail/PICtail Plus (AC164136-4)
- MRF49XA PICtail/PICtail Plus 433 MHz (AC164137-1)
- MRF49XA PICtail/PICtail Plus 868/915 MHz (AC164137-2)
- MRF89XAM8A PICtail/PICtail Plus 868 MHz (AC164138-1)



LIN and CAN Bus Solutions

Taking Communication and Connectivity in Deeply Embedded Designs to the Next Level

Local Interconnect Network (LIN)

LIN/J2602 is a communication standard designed to address low-cost networking within vehicles. LIN enables a cost-effective communication network for lower speed switch, smart sensor and actuator applications within the vehicle where the bandwidth and versatility of CAN is not required.

LIN can be implemented on any PIC microcontroller (MCU) with a USART interface. Microchip also offers a robust physical layer interface, data link layer implementation, LIN compliant drivers and a variety of development resources.

Standalone LIN Transceivers

The MCP2003/4 family of LIN transceivers offers a stand-alone LIN transceiver option. Both parts meet LIN bus specification versions 1.3, 2.0 and 2.1 and SAE J2602. The transceivers' EMC/ESD performance is among the best in the industry and meets all automotive requirements.

The MCP2003 is available in an industry standard 8-pin SOIC pinout. The MCP2004 offers a TXE/Fault pin which allows users the ability to disable the transmitter in addition to providing data related to a fault condition.

LIN Transceivers With Voltage Regulator

The MCP202X family of LIN transceivers integrates the LIN physical layer, 3.3V or 5V internal voltage regulator, with a maximum output current of 50 mA.

The devices support LIN bus specification versions 1.3, 2.0 and 2.1 and SAE J2602 and are designed to meet the stringent EMC/ESD requirements of the world's auto makers.

PIC18F14K22 LIN System in Package Solution

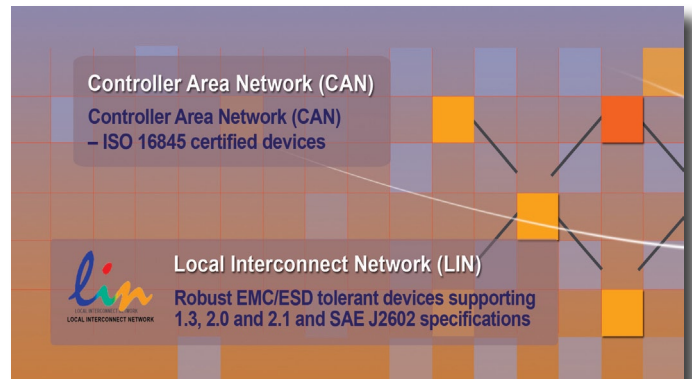
Microchip's latest product offering includes a 8-bit, 20-pin microcontroller with an onboard LIN transceiver and a 5V voltage regulator. The device meets LIN bus specification versions 1.3, 2.0 and 2.1 and SAE J2602.

The device offers all the features of the MCP202X family of transceivers and supports the latest 'nanoWatt XLP' technology providing the lowest sleep currents in the industry.

Controller Area Network (CAN)

CAN is a serial communication protocol used extensively for high speed embedded applications where noise immunity and robustness is necessary. CAN protocol supports speeds up to 1 Mbps and is highly fault-tolerant, making it ideal for safety critical applications.

Microchip offers a complete line of products to meet the needs of high-performance embedded applications using the CAN protocol – including 8-, 16- and 32-bit microcontrollers and 16-bit digital signal controllers with integrated CAN, standalone CAN controllers, I/O expanders and CAN transceivers.



CAN MCUs and DSCs

The 8-bit PIC18F66K80 family offers the industry's best Sleep current of less than 20 nA, a wide operating voltage range of 1.8 to 5.5V and an advanced touch sensing interface. The 16-bit PIC24 and dsPIC33 families offer higher density Flash memories and high temperature operation of up to 150°C ambient. The 32-bit PIC32 family offers higher performance and better peripheral integration like Ethernet and USB.

At the heart of Microchip's CAN offering is the enhanced CAN module offered on-board many Microchip microcontrollers.

Key features include:

- CAN 1.2, CAN 2.0A and CAN 2.0B support
- 32 buffers for TX/RX
- 32 acceptance filters
- 4 acceptance mask filters
- Time stamping
- DMA support in 16-bit PIC24H and PIC32 microcontrollers and dsPIC33F digital signal controllers
- DeviceNet™ support
- Legacy mode

Standalone CAN Controller

Microchip Technology's MCP2515 is a stand-alone Controller Area Network (CAN) controller that implements the CAN specification, version 2.0B. It is capable of transmitting and receiving both standard and extended data and remote frames. The MCP2515 interfaces with MCUs via an industry standard Serial Peripheral Interface (SPI) and can be used as an easy method to implement CAN in an existing system.

CAN Transceivers

The MCP2551 is a high-speed CAN device that serves as the interface between a CAN controller and the physical bus. The MCP2551 provides differential transmit and receive capability for the CAN protocol controller and is fully compatible with the ISO-11898 standard, including 24V requirements.

Development Resources and Other Connectivity Options

Providing Comprehensive System Solutions

CAN/LIN Development Tools

With easy-to-use development systems and application notes, Microchip provides a total CAN/LIN solution that enables low-risk product development, lower total system cost and faster time to market for high performance embedded designs.

LIN Serial Analyzer Development System (APGDT001) CAN BUS Analyzer (APGDT002)



The LIN and CAN analyzer development tools enables a PC to communicate with the LIN and CAN buses. The PC program uses a graphical user interface to enter and display message frames occurring on the target bus, allowing for easy debug. The tools can also be used as an active node on a bus to send and receive messages, therefore reducing the application development time.



CAN/LIN PICTail™ Plus Daughter Board (AC164130-2)



This daughter board can be used with the Explorer 16 and PIC18 Explorer boards to facilitate rapid implementation and evaluation of CAN/LIN applications using the 8-, 16- and 32-bit PIC® MCU and dsPIC® DSC families.

PICKit™ 28-pin LIN Demonstration Board (DM164130-3)



The PICKit 28-pin LIN demo board enables a quick start in developing and debugging applications with the LIN drivers. The kit includes a 28-pin socket which supports various PIC16F devices, includes a LIN transceiver, plus a generous prototype area

with various indicator LEDs and buttons to support the test and debug of the application.

PICDEM™ CAN-LIN 3 Demonstration Board (DM163015)

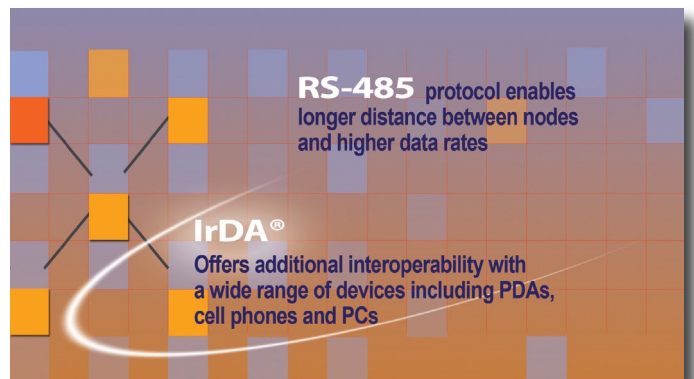


The PICDEM CAN-LIN 3 demo board is an easy way to discover the power of Microchip's CAN and LIN products. The board demonstrates the main features of the 64-pin TQFP PIC18F6680 and 80-pin TQFP PIC18F8680 devices,

including those features of the integrated CAN module. In addition, the board employs a LIN sub-network using Microchip's 20-pin SSOP PIC18F1320 and MCP201 LIN Bus.

LIN Software Library

LIN Data Link Layer firmware can be downloaded free-of-charge from Microchip's web site. Many third party companies also offer LIN Data Link Layer firmware, providing additional design options.



Other Connectivity Options

While the most sophisticated protocols and interfaces tend to garner a significant amount of attention, a number of simpler connectivity options are and will remain the embedded interconnects of choice for many deeply embedded applications. Microchip's focus on the embedded market ensures an ongoing commitment to support all of the connectivity solutions utilized by leading designers, including the microcontroller peripherals, application notes and software necessary to implement robust, highly reliable embedded networks.

RS-485 Protocol

The RS-485 protocol is typically used as a more feature-rich alternative to RS-232. The protocol enables longer distance between nodes and higher data rates. Any PIC microcontroller with an on-board UART can support RS-485 communication. Many PIC microcontrollers include enhanced peripherals with an RS-485 mode.

IrDA® Protocol

The IrDA protocol provides many portable devices with an affordable, short distance optical data communications link. IrDA can be implemented on many Microchip MCUs using Microchip's free-of-charge IrDA software stack. In addition, Microchip offers UART to IrDA protocol converter products (MCP2140A, MCP2150) to enable any system to easily add IrDA wireless connectivity.

IrDA PICTail Plus Daughter Board (AC164124)



Enables IrDA connectivity when used with the Explorer 16 development board (DM240001).

MCP2140 Wireless Temperature Sensor Demonstration Board (MCP2140DM-TMPSNS)



Demonstrates the communication of temperature data to a primary device (PDA or PC with IR port) via IrDA.

Support

Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. In addition, the following service areas are available at www.microchip.com:

- **Support** link provides a way to get questions answered fast: <http://support.microchip.com>
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Training

If additional training interests you, then Microchip can help. We continue to expand our technical training options, offering a growing list of courses and in-depth curriculum locally, as well as significant online resources – whenever you want to use them.

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- Resources from our Distribution and Third Party Partners www.microchip.com/training

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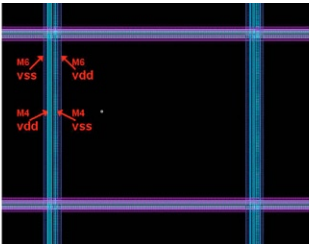


Fig. 5: Snapshot showing the power grid implementation based on the proposed concept.

a way that a vdd stripe in M4 is sandwiched between vss stripes in M2 and M4. Similarly a vss stripe in M4 is sandwiched between vdd stripes in M2 and M6. This increases the area capacitance between power and ground to the maximum possible. Figure 4 shows actual 3-D snapshots of metal4 and metal6 for a conventional design. Other metal layers have similar profiles. Figure 5 illustrates the physical implementation of the power grid mesh using such a methodology.

There is no decoupling 'area capacitance' effect in the conventional approach to the next level metal layer (eg. Metal6 to metal 4) and "side-wall" capacitance is 60 times less in

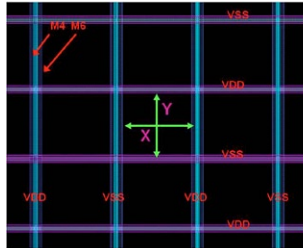


Fig. 6: Conventional power stripe placement (left) versus the proposed methodology.

the conventional approach.

Experimental results

To prove this concept, a power grid was implemented following both the conventional and the proposed designs, using a C65 process on a 25mm² die. The power and ground mesh was then extracted for capacitance. As shown in Table 1, using the

same resources, the decoupling capacitance was increased nearly three folds with the new methodology, without affecting the voltage drop and the routability found in the conventional design.

The resultant increase in power-ground capacitance decouples any noise induced between these nets due to high frequency circuitry. What's more, the actual implementation of the proposed methodology is straight forward and does not require any change of tools. ■

Parameter Checked	Prior-Art	Proposed Approach	Percentage Change
Voltage Drop (Rail to Rail)	39mV	39mV	No change
Number of Routable Tracks	103868	103868	No change
Decoupling Capacitance Offered by Power Grid	12pF	35pF	292%

Table 1: Experimental results - proposed approach versus prior-art.

Protecting automotive power components from thermal runaway

By Matt Williams

THE GROWING DEMAND for electronics that can operate in harsh environments such as under-hood automotive systems and rugged industrial applications is fueling a trend toward new materials and more efficient power components. High-power, high-temperature applications place greater demands on power electronic systems, resulting in the potential for serious thermal issues when components such as power Field Effect Transistors (powerFETs), capacitors, resistors or integrated circuits fail due to long-term exposure to harsh environments.

Improving power component performance, using design techniques that spread heat more evenly, and incorporating new heat sink materials are some of the solutions that have been proposed to enhance thermal

management. Nevertheless, many designers currently rely on secondary protection to help stop thermal runaway events that can be generated by power component failures or corrosion-induced heating.

The most common approach is to use a thermal fuse/Thermal Cut Off (TCO) or a thermal switch. These devices both offer the designer wide and specific temperature activation characteristics in both AC and DC applications, but they present challenges in the board assembly process. Because more and more PCBs use only surface mount components, using a through-hole device can translate to special mounting procedures, increasing cost and complexity. Additionally, standard devices may not provide the ruggedness and reliability needed for automotive applications; whereas components that are qualified for the automotive environment are fully tested to meet stringent shock and vibration specifications and provide the

proper DC ratings. In response to the need for a robust, reliable surface mount device that can help prevent thermal damage resulting from failed power electronics, Tyco Electronics recently introduced the Reflowable Thermal Protection (RTP) device. The secondary thermal protection device can be used to replace redundant powerFETs, relays and heavy heat sinks typically used in automotive and industrial electronic designs.

In the harsh automotive environment, powerFETs are routinely subjected to extreme temperature variations and thermo-mechanical stress. Intermittent shorts, cold operating environments, high arcing or noisy short circuits, as well as inductive loads and multiple short circuits can, over time, fatigue the device and cause it to fail in open, short or resistive mode. Although powerFETs are increasingly robust, they are prone to failures which can occur very

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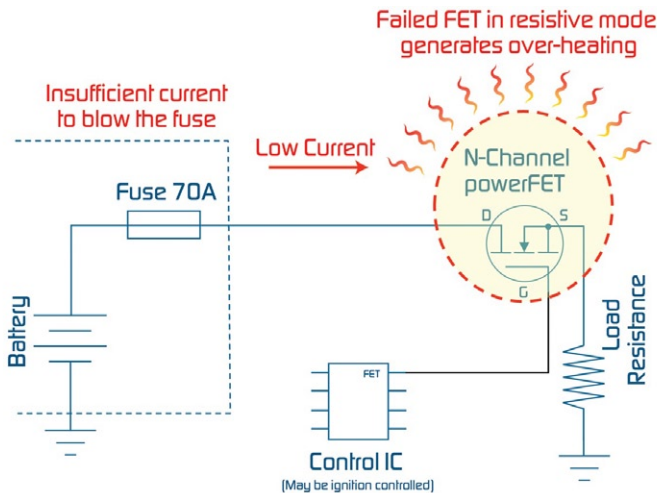


Fig. 1: PowerFET failure in resistive mode can lead to unsafe overtemperature conditions.

quickly if their ratings are exceeded. If the maximum operating voltage of a powerFET is exceeded, it goes into avalanche breakdown. If the energy contained in the transient overvoltage is above the rated avalanche energy level, the device will fail; causing a destructive thermal event that may result in smoking, flame or desoldering.

Automotive and industrial powerFETs have been shown to be more prone to fatigue and failure than devices that are installed in less demanding applications. When comparing powerFET failure rates over time, devices used in harsh environments exhibit greater ppm failure rates. After five years in the field the difference can be more than a factor of ten.

Although a powerFET may pass initial testing, it has been demonstrated that, given certain conditions, random weak points in

the PCB. As little as 10W may generate a localized hot spot of more than 180°C, well above the typical PCB's glass transition temperature of 135°C, leading to damage of the board's epoxy structure and a thermal event.

Figure 1 describes a scenario where a failed powerFET may not generate a hard short overcurrent condition but rather a resistive short, producing unsafe temperatures through I^2R heating. In this case the resulting current may not be high enough to blow a standard fuse and stop thermal runaway on the PCB. If a power component failure or a board defect generates unsafe overtemperature conditions the RTP device, which opens at 200°C (a value above normal operating temperatures but below lead (Pb)-free solder reflow temperatures), will interrupt the current and help prevent a thermal runaway condition that may lead to critical damage.

the device can result in field failure. Even in situations where the powerFET is functioning within specified operating conditions, random and unpredictable resistive shorts at varying resistance values have been reported.

The resistive mode failure is of particular concern, not only for the powerFET but for

As shown in Figure 2, when the RTP device is placed in series on the power line in close proximity to the FET, it tracks the FET temperature and opens the circuit before a slow thermal runaway condition can generate an undesirable thermal condition on the board. Although this article focuses on powerFETs, the RTP device also helps protect against thermal-runaway damage caused by capacitors, ICs, resistors and other power components that may crack or fail, or from the effects of any type of corrosion-induced heating.

How it works

To allow it to open at 200°C in the field, the RTP device uses a one-time electronic arming procedure to become thermally sensitive. Before arming, it can withstand three Pb-free solder reflow steps without opening. Timing of electronic arming is user-determined, and can be implemented to occur automatically at system power up or during system testing. The RTP device's 200°C open temperature helps prevent false activations and improves system reliability since it is a value above the normal operating window of most normally functioning electronics, but below the melting point of typical Pb-free solders. As a result, the device will not open if surrounding components are operating in their target temperature range, but it will open before a component de-solders and creates the potential risk of additional short circuits.

The RTP device meets the reliability requirements of automotive power electronics systems such as cooling fan applications, as well as ABS, power steering, PTC heaters, etc. The surface mount device can be quickly and easily installed using industry-standard pick-and-place and Pb-free reflow equipment, and can withstand multiple reflow passes with peak temperatures exceeding well over 200°C and yet, in the field, will open if it detects a temperature above 200°C. The device's thermal sensitivity is beneficial since, in some cases, failed power components may not generate a dead short circuit overcurrent condition, but instead may create a resistive short that cannot be opened by a traditional fuse. This type of event may actually reduce load current, but can still result in unsafe thermal runaway conditions. The RTP device helps prevent damage caused by both dead short circuit and resistive short circuit conditions. ■

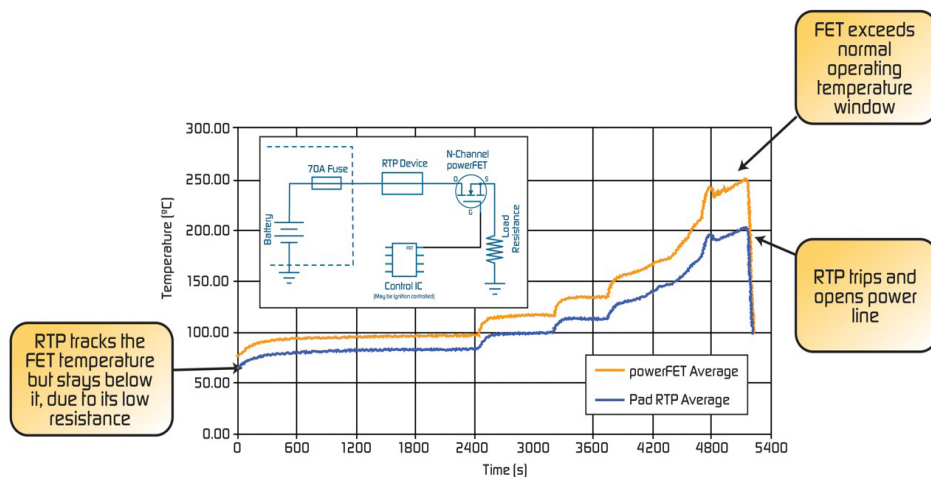
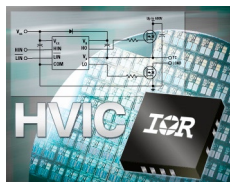


Fig. 2: In a slow thermal runaway condition, the RTP device tracks the powerFET temperature until it opens the circuit at 200°C.

High-voltage gate drive ICs *up to 85 percent smaller footprint*

International Rectifier has extended the company's packaging portfolio with the introduction of a PQFN 4x4mm package featuring IR's latest high-voltage gate drive ICs that deliver an ultra-compact, high density and efficient solution for a wide variety of applications including home appliance, industrial automa-



tion, power tools and alternative energy. Featuring a footprint of just 16mm², the PQFN4x4 package can accommodate many

of IR's high performance high-voltage gate drive ICs that previously required packages as large as the wide-body SOIC-16, offering up to a 85% smaller footprint. The new package has been designed with the appropriate creepage and clearance requirements to enable rugged and reliable designs at voltages up to 600V. Featuring a low profile of less than 1 mm, the PQFN 4x4 package is SMT-compatible.

International Rectifier

www.irf.com

Ceramic heat-sink *scalable, cools up to 100W/cm²*

The compact CeramCool Box from CeramTec is made for homogeneous and efficient cooling of packing densities up to 100W/cm². For example, with an edge length of just 16x40x40mm it has a total cooling capacity of 1600W at 90°C, which corresponds to a thermal capacity of 1200W. This ceramic heatsink offers unlimited



scalability in every direction, with the electric conductors placed directly on it and permanently connected to it without thermal

barriers and without the risk of delamination. Four symmetrically arranged spiral condensers with innovative flow paths ensure balanced cooling on the complete surface. The ceramic walls are merely 1mm thick. This enables the coolant to get closer to the heat source than any other concept with a comparably long system lifetime. The CeramCool Box uses Alunit, an aluminium nitride ceramic material with a thermal conductivity over 170W/mK.

CeramTec

www.ceramtec.com

4-way connector *handles up to 500VDC and 34A*

ITT Interconnect Solutions has developed a high voltage connector series which can conduct ten times more VDC than standard APD interconnects. The new APD High Voltage connector can handle operating voltages of up to 500VDC and operating current of up to 34A while remaining cost effective and



highly reliable. The APD 4-way high voltage series suits automotive applications such as power

distribution boxes, controls and junction boxes and also electric and hybrid vehicles. Impulse voltage is rated at 3.5kV and operating current up to 34A for wire size 4.0mm². The APD 4-way high voltage connector is bayonet mated and rated to IP67, increasing to IP69k when using individual wire sealing. Other product features include 3.5kV rated impulse voltage.

ITT Interconnect Solutions

www.ittcannon.com

100MΩ flat wire inductors *for use at 120°C*

Featuring a "flat wire" design that is coiled and mounted directly to the circuit board to allow efficient heat dissipation, the DR79892 and DR79893 flat wire inductors from Datatronic Distribution are designed for performance in power supplies, industrial controls and instrumentation applications. The compact flat wire design provides for better thermal management and superior reliability. The DR79892 and DR79893 inductors are insulated to a minimum of 100MΩ at 500Vdc between coil and core. Rated to insulation Class E, they are operable to 120°C. The Model DR79892 flat wire inductor features an inductance of 4.0μH and a rated inductance of 2.5 μH. It offers a 45A rated current, a 0.8m Ohm maximum DC resistance and 500Vac isolation between coil and core. These inductors measure 16x29x29.5mm. The Model DR79893 features an inductance of 45μH and a rated inductance of 40 μH. It offers a 30A rated current, a 4.0 Ohm maximum DC resistance and 500Vac isolation between coil and core. These inductors measure 29x43x50mm.

Datatronic

www.datatronics.com



EMCO offers New Models to **Q Series** Miniature DC to HV DC Converters

New Models and Options Include:

- New "QH" Models: 2.5 times more power in the same package!
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- Control Pin Models: Designed for error amplifier control in closed loop systems, or easy On/Off function.
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Trench MOS barrier Schottky rectifiers

45V devices for PV bypass protection

Vishay Intertechnology, Inc., has expanded its offering of TMBS Trench MOS Barrier Schottky rectifiers with 12 new 45 V devices in three power package options that feature a wide range of current ratings from 10 A to 60 A. With low forward voltage drops down to 0.33 V typical at 10 A, the rectifiers are optimized for use in solar cell junction boxes as bypass diodes for protection.

The devices released include the dual-chip V(B,F)T1045CBP, V(B,F)T2045CBP, V(B,F)T3045CBP, and V(B,F)T6045CBP. Each device is offered in the power TO-220AB, ITO-220AB, and TO-263AB packages. All rectifiers feature a maximum operation junction



temperature of 150 and 200°C maximum junction temperature in DC forward current without reverse bias (t₀₁ hour). The devices are compliant to RoHS Directive 2002/95/EC and WEEE 2002/96/EC. The TO-263AB package offers an MSL moisture sensitivity level of 1, per J-STD-020, LF maximum peak of 245°C. The TO-220AB and ITO-220AB packages feature solder bath temperatures of 275°C maximum, 10 s, per JESD 22-B106, and are halogen-free according to the IEC 61249-2-2:21 definition. Samples and

production quantities of the new 45 V TMBS rectifiers are available now.

Vishay Intertechnology

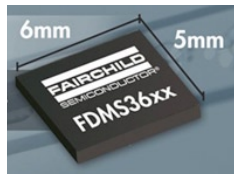
www.vishay.com

Dual asymmetric MOSFET module

for high power density and ease of design

Fairchild Semiconductor has developed the FDMS36xxS family of power stage dual asymmetric MOSFET modules to address two main challenges facing power supply engineers. The new devices reduce the amount of space they use and increase power density. The benefits are especially important in notebook, point-of-load, server, gaming and telecommunication applications.

The FDMS36xxS family incorporates a control and synchronous MOSFET, as well as a monolithic Schottky body diode in a PQFN package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous MOSFET (SyncFET) (Q2) have been designed to provide optimal power



efficiency for output currents up to 30 Amps. By integrating these devices into one module, the FDMS36xxS family reduces board space by replacing two or more 5 mm x 6 mm PQFN, So8 and

DPAK packages. The FDMS36XXS family of products is designed using Fairchild's advanced charge-balanced device architecture (Shielded Gate Technology) and advanced packaging technology to achieve industry-leading sub-2 mOhm low side RDS(ON) at high performance computing rated breakdown voltages. The product family is optimized to minimize the combination of conduction and switching losses from 300kHz to 600kHz.

Fairchild Semiconductor

www.fairchildsemi.com

100-V half-bridge gate driver

for enhancement-mode GaN power FETs

National Semiconductor has introduced what the company claims is the industry's first 100 V half-bridge gate driver optimized for use with enhancement-mode GaN power FETs in high-voltage power converters. The LM5113 is a highly-integrated, high-side and low-side GaN FET driver that

reduces component count by 75% and shrinks printed circuit board (PCB) area by up to 85 percent compared to discrete driver designs. Enhancement-mode GaN FETs enable new levels of efficiency and power density compared to standard metal-oxide semiconductor field-effect transistors (MOSFETs) due to their low on-resistance (R_{ds(on)}) and gate charge (Q_g) as well as

their ultra-small footprint, but driving them reliably presents significant new challenges. National's LM5113 driver IC eliminates these challenges, enabling power designers to

realize the benefits of GaN FETs in a variety of popular power topologies. National's LM5113 is a 100 V bridge driver for enhance-

ment-mode GaN FETs. Using proprietary technology, the device regulates the high side floating bootstrap capacitor voltage at approximately 5.25 V to optimally drive enhancement-mode GaN power FETs without exceeding the maximum gate-source voltage rating.

National Semiconductor

www.national.com



Design kit for digital power exploration

of digital power architectures

Enhanced performance, Energy management, and End-user value are the key design objectives of Ericsson's 3E range of digitally-controlled dc-dc converters. The newly-expanded product family comprises two intermediate-bus converters that source up to 240 and 396 W to power a choice of complementary 3E point-of-load

regulators that can each supply 12 to 40A. The 3E Gold Edition design kit hardware comprises two boards that accommodate one or two intermediate-bus converters and up to six point-of-load regulators. Sample devices include the BMR453 and BMR454 intermediate-bus converters together with examples of the 12A BMR462, 20A BMR463, and 40A BMR464 point-of-load regulators.

The boards can operate independently or be plugged together to form a representative PMBus-controlled power system.

The design kit includes a USB-to-PMBus adapter that provides a

seamless interface between the 3E GUI Gold Edition software running on a Windows PC and the target 3E family

dc-dc converters. At power-on, the software scans the PMBus to discover which devices are present. It then continually reads and displays each converter's key operating parameters—its input and output voltages, output current, and on-chip temperature—at intervals that users can specify.

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GPON system on chips with integrated optical control circuitry

By Frank Engel

GIGABIT PASSIVE OPTICAL NETWORK (GPON) technology is the key emerging access technology in FTTB and FTTH applications, as it provides a scalable and cost-effective architecture to satisfy the growing bandwidth requirements generated by advanced applications such as high-definition television (HDTV) or cloud computing.

The GPON technology provides a powerful point-to-multipoint solution to meet the increasing bandwidth demand, and at the same time is able to provide low maintenance in the access part of the communication infrastructure. A GPON Network consists of an Optical Line Terminal (OLT) located at the central office and multiple units of Optical Network Units (ONUs) at the customer sites. Depending on the individual FTTH/FTTB subscriber scenario the high bandwidth GPON link can be terminated within different client-side equipment options a SFU (Single Family Unit), SBU (Single Business Unit), HGU (Home Gateway Unit), MDU (Multi Dwelling Unit) or CBU (Cellular Backhaul Unit).

Different flavors of PON standards have been specified by two standard bodies, International Telecommunications Union (ITU), FSAN and Institute of Electrical and

Electronics Engineers (IEEE). Within the ITU, the earliest version was the Asynchronous Transfer Mode PON (APON) standard, followed by the Broadband PON (BPON) standard (ITU-T G.983). The next evolution was the ITU-T G.984 or so called Gigabit PON (GPON) standard, ratified in March 2008. The GPON standard provides an additional performance boost in terms of both the total bandwidth and bandwidth efficiency, with 2.488 Gbps of downstream bandwidth and 1.244 Gbps of upstream bandwidth. The GPON standard is widely deployed in all geographical regions with the exception of Japan, while the next-generation GPON standard, 10G GPON, is being worked on by the ITU and Full Service Access Network (FSAN) working group and expected to roll

out in 2014.

Within IEEE, the IEEE 802.3 Ethernet PON (EPON or GEAPON) standard has been completed in 2004. The EPON standard has mostly been adopted by operators in Japan and China. The key differences between GPON and EPON standards are the data rates and bandwidth utilization.

Key operator requirements

The main challenges for GPON equipment deployment on the operator side are cost reduction (OPEX) and thus require improved energy efficiency. The network equipment costs are mainly driven by the high component costs of the optical interface side. On the other hand energy efficiency requirements for reduced power consumption require power efficient GPON equipment.

In addition many FTTx ONU/ONT flavours are deployed, demanding for scalable, cost optimized high-performance GPON System-on-Chip (SoC) solutions. Last-but-not least network stability and interoperability have to be ensured. Quality of Service (QoS) capabilities and optical I/F are the challenges for improved optical network robustness, e.g. laser aging and rogue ONUs. Furthermore it has to be ensured that GPON equipment is interoperable from the starting point to enable mass deployment with different OLT and ONU solutions.

Cost optimization

Having a look on GPON SFU solutions today the optical interface is the main cost driver. In a typical SFU implementation (4x 1000Base-T, 2 POTS) about 50 percent of the Bill of Material (BOM) account for the GPON optical transceiver module.

Typically the SFF (small form factor) optical module integrates the BOSA (BiDi-Optical Sub Assembly) with the Laser and Monitor Diode for transmit direction and the Avalanche Photo Diode (APD) and Transimpedance Amplifier (TIA) for receive direction as well as the Laser Driver, Limiting Amplifier, EEPROM, optical control - and APD high voltage control circuitry.

Lantiq developed the worlds first GPON

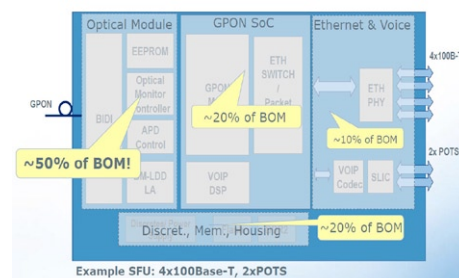


Fig. 2: Optical interface is the main cost driver for GPON deployments.

SoC with integrated optical control circuitry for ONU applications. Feature integration on the FALC ON devices allows GPON ONU manufacturers to reduce BOM cost for optical components by up to 40 percent while reducing system power consumption, improving overall robustness of the optical network and reducing the footprint of ONU network equipment. All members of the new GPON chipset family feature integrated burst mode laser driver and APD/PIN-receiver-control circuitry which allows direct interfacing to a low-cost BOSA. This unique approach allows system integrators to offer GPON ONU solutions without the need for costly and area-consuming optical transceiver modules.

In addition the combination of the optical control circuitry with its ITU-T G.984 compliant GPON MAC and its on-chip CPU enables automatic calibration and compensation of optical component variations. This leads to an efficient manufacturing process, long term stability, improved optical network robustness and overall optical system performance, as defined in the ITU-T G.984.2 standard. With a dedicated Firmware the new GPON SOC's will enable the self-learning of laser operational parameters and measurement on laser parameters drift.

Energy efficiency

The Importance of energy conservation for the PON network which is part of the access network is simply expressed by the following two numbers. In particular, the access network contributes up to 80% and the CPE devices alone contribute up to 60% of the total network power consumption.

The FALC ON as a 17x17mm single chip GPON ONU system solution together with

Frank Engel is senior manager product marketing at Lantiq – www.lantiq.com – he can be reached at frank.engel@lantiq.com

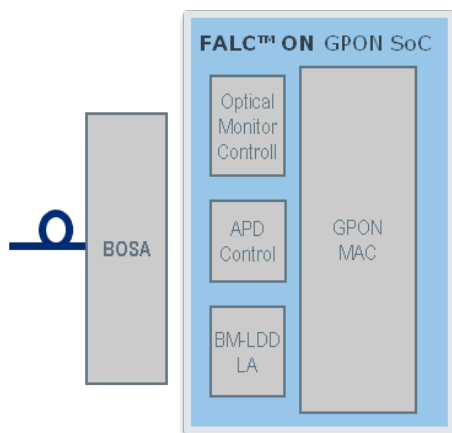


Fig. 3: FALC ON – the first GPON-SOCs with integrated optical control circuitry.

a power management unit addresses the energy conservation requirements perfectly. A power management unit (PMU) tailored for GPON ONU systems allows a scalable platform for all FTTx deployment scenarios. The device provides all the functions needed for the system power management with a minimized BOM of external components. Since this device requires only a single external power supply of 3.3 V it provides the different supply voltages for the system using high efficient on Chip DC/DC converters. This flexible power management is a combined hardware and software approach which also includes network system level power saving concepts. Only modules and interfaces are activated which are required for the selected application while unused modules are deactivated in order to increase power savings. Energy efficient Ethernet is fully supported for the on-chip Ethernet PHYs. While the Ethernet MACs and Ethernet PHYs are compliant to the IEEE 802.3az specification.

Furthermore the optical interface integration leads to significantly reduced system power consumption as external components and high speed interfaces get obsolete. In addition the laser driver is only activated during upstream transmission. All the above-mentioned power saving measures lead to reduced costs of ownership and extended battery back-up time for ONUs.

Diversity and scalability

As various FTTx GPON ONU flavours are deployed, there is a need for scalable, flexible and cost optimized GPON SoCs. The wide spread of deployments include SFUs with one or more LAN ports, or variants with voice support and MDUs or CBUs. Scalable, cost optimized SoCs address all ONU applications.

The scalable chips with integrated optical

control circuitry, intelligent and high-efficient power management offer up to four GE LAN ports with two/four integrated rooB-T/rooB-T PHYs, integrated voice processing for up to four FXS ports, wire-speed packet processor with high-performance traffic management and a time of day/PPS synchronization interface for mobile backhauling.

Network stability

On-chip, automatic calibration and compensation of optical components lead to long term stability and improved network robustness. Typical laser aging is automatically compensated. In a GPON downstream data packets are transmitted from an OLT to a number of ONUs and upstream data packets, on the other hand, are transmitted from the ONUs back to the OLT.

During normal operation, the ONUs transmit data packets to the OLT only during their assigned timeslots. One problem which

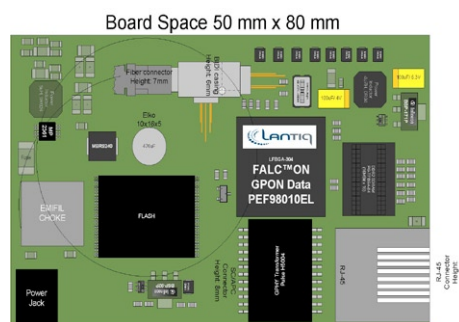


Fig. 4: A complete ONU solution takes only 50x80mm of board space.

can arise is when, due to a failure, an ONU transmits outside of its own TDM (Time Division Multiplex) upstream timeslot. If a first ONU transmits during a time slot which has been assigned to a second ONU and both ONUs attempt to transmit at the same time, a collision results which can prevent the OLT from being able to receive the data packets correctly. In the worst case the complete upstream traffic of the optical distribution network (ODN) can be jeopardized. An ONU that transmits outside the assigned upstream timeslots is known as a "rogue ONU".

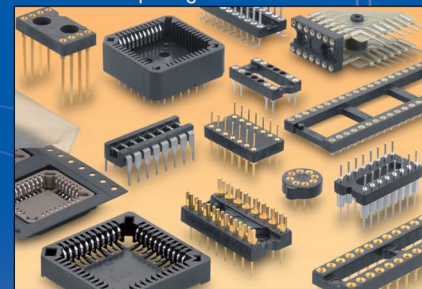
Integrated rogue ONU detection and hardware based prevention is not possible with a standard optical module solution, while a discrete optical solution requires additional external components and increase of BOM. The FALC ON family provides rogue ONU detection and prevention, monitoring the upstream transmission during and after burst and automatically shut-down in failure case. ■

Perfection & competence

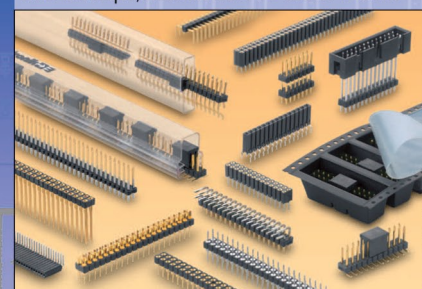
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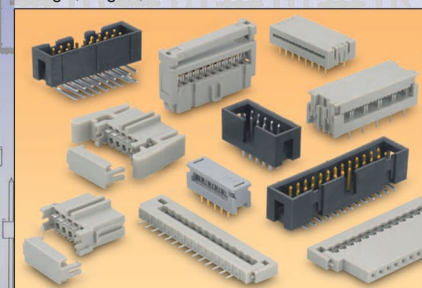
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Car makers announce additional 48V supply, standard charging plug

By Christoph Hammerschmidt

CAR MAKERS AUDI, BMW, Daimler, Porsche and Volkswagen have agreed to jointly incorporate a number of common architectural elements for their on-board power network. These include an additional 48V section, a uniform charging connector type for all electric and hybrid vehicles and partial network operation for the CAN bus.

At the 15th Automobil Elektronik Kongress in June in Ludwigsburg (Germany), the companies announced to establish a 48V supply network supplementing the current 12V supply. They also said they agreed upon measures supporting partial CAN bus operation and a common charging plug as a joint de-facto standard.

"At a growing extend, high-current loads are used in the vehicles," said Volker Wilhelmi, Head of Electrical/Electronic on-board networks for Daimler. "It becomes increasingly difficult under technological and cost aspects to implement these functions and devices in a 12V supply network." For this reason, E/E engineering managers of the five OEMs agreed to implement a supplementary 48V supply in future car generations. Both subnets will be connected through a bidirectional DC/DC converter. "This enables us to integrate high-current devices into our cars at lower cost, better quality and more easily", Wilhelmi said.

The discussion about a higher supply voltage in cars is almost 20 years old, albeit the voltage initially in question was 42V. Also, the rationale to increase the supply voltage in cars has changed: While initially the focus was on higher performance for the entire vehicle, the topic is driven now by the desire to reduce CO₂ emissions. Also, the battery technology has changed since the initial discussions: 20 years ago, the lead-acid battery was the only technology used in cars. Now the engineers focus on Lithium-ion batteries.

According to experts, most elements in the 12V domain will remain unchanged.

However, the generator will be moved into the 48V section; the 12V section will be coupled to the 48V section by means of a bidirectional DC/DC converter in the power range of about 3 kW. Since the 48V generator will function as a motor during certain phases of driving, a 48V inverter controlling motor/generator has to be added. A new 48V

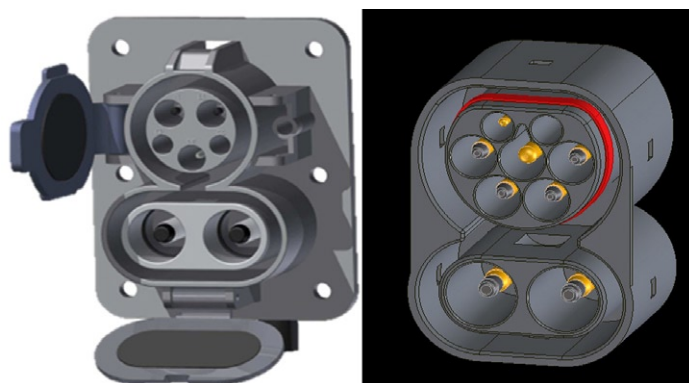
in the vehicles translates into major design challenges for the value chain. In particular, providers of semiconductors and ECUs will be affected - they need to adjust their product range to the higher voltage and in part re-design their products. Infineon as the number one chip vendor in this kind of applications pointed out that the company

already has significant expertise in 24V systems through its activities in the truck market. While the company claims to have already volume products that meet the requirements for 48V, the product portfolio is far less densely populated than its 12V portfolio. Similar challenges will apply to all semiconductor providers.

The second part of the announcement referred to the CAN data bus. The OEMs agreed that in specific situations it should be possible that only parts of the data bus are activated. The OEMs - for this part of the announcement

they were joined by Burkhard Milke, top E/E manager for GM subsidiary Opel - said they will make arrangements to support partial bus operation. "This is about saving energy", said Rick Hudi who oversees E/E development at Audi. Hudi estimated that thus the supply current throughout the CAN bus can be reduced by about 10A.

On behalf of the group, Volkswagen E/E top dog Volkmar Tanneberger announced a common power plug for electric vehicles. This so called Combo plug aims at DC charging and is backwards compatible with the earlier Type 1 and Type 2 designs. These designs have already been introduced in the industry; Type 1 originated in Japan while Type 2 is a European development. Tanneberger said that the proposal has been coordinated with U.S. OEMs as well as the SAE. According to Tanneberger, the OEMs also agreed to include powerline communications into their new standards proposal. According to the VW manager, the new plug is scheduled for roll-out already in the first quarter of 2013. ■



German carmakers jointly announced a new common charging plug for e-cars and HEVs. The new plug will be backwards compatible with existing designs type 1 (left) and type 2 (right). Moreover, the new plug will feature powerline communications.

battery will be complete the 48V section. Unlike "dumb" lead-acid batteries, this energy storage will be equipped with a sophisticated battery management system.

The 48V option will improve power recuperation in electric and hybrid electric vehicles and thus reduce CO₂ emissions. Also heating and air conditioning could benefit from the higher operating voltage: blowers for the engine cooling system as well as for the HVAC would achieve higher efficiency when operated with 48V. Other candidates for the higher voltage include PTC auxiliary heaters and actuators for electric power steering as well as for roll stabilization.

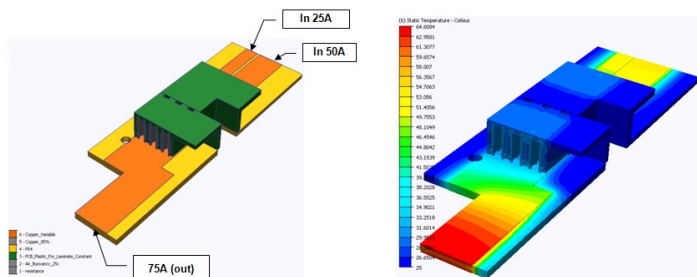
In their statement the carmakers made clear that they all are developing 48V components and requested the semiconductor providers and control unit manufacturers to actively join the development process for serial production. In the meantime, Audi acknowledged that the production of first vehicles equipped with the 48V section will start within three years. The implementation of an additional 48V supply network

Power integrity engineering for interconnects

By Ken Stead

THE NEED FOR HIGH-CURRENT interconnect solutions in increasingly smaller spaces continues to rise rapidly. As demand grows for more power in smaller packages, solving the power equation on new architectures and system platforms can pose electrical and mechanical design challenges. Yet OEM system and power designers charged with specifying interconnect components must ensure both signal and power integrity.

Unlike signal connectors, which continue to get smaller at higher transmission speeds, power connectors require a specific amount of conductive material to carry specific amounts of current or amperage. There are no special recipes to design that will allow smaller power contacts to carry more current. While progress is being made in perfecting low interference interfaces, as power needs increase so does the amount of space needed for higher current-capacity.



Predictive modeling input results.

In this article, we will look at key factors design engineers need to evaluate in the early stages of the design process. And, we will discuss how connector innovations and sound power integrity engineering principles can not only drive smarter design, but also help to ensure that the interconnect solutions specified will deliver optimal electrical performance, as well as safety and long-term reliability.

Even though new system designs often require more power to travel across a limited amount of space, several factors still affect the density of a design and how much power it can actually handle. A clear understanding of each of these elements is critical to successfully designing power integrity and safety into the system. This will help streamline the overall design process.

Balancing space and power

First, it is necessary to determine how much space is required for a power interconnect versus how much available space has been allotted in the finished product design. While saving space is a high priority for most OEMs, the height, width and length of the con-

Ken Stead is global new product development manager for power products at Molex - www.molex.com



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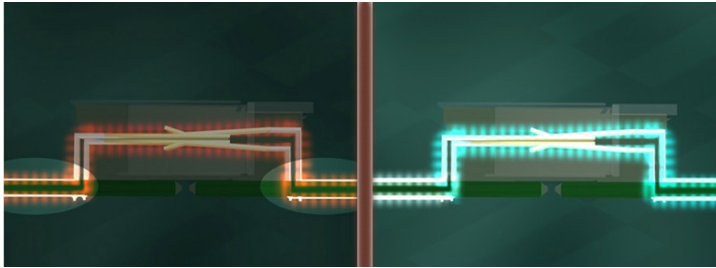
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connector, and particularly its copper content, will directly affect the achievable current density. System architects always want to get more power in the same space, which can pose a challenge for connector manufacturers.

However, leading global connector manufacturers continue to develop new and innovative designs that use higher conductivity materials and utilize space more creatively to improve power delivery and electrical performance without expanding space requirements. For example, in some cases, a lower profile connector may be preferable to maximize air flow for cooling. In other cases, a taller connector offering improved contact performance may be the right solution to properly handle the amount of current generated in less card edge space. What's important is striking the optimal balance



Light copper can restrict current flow by constriction resistance (left) while how heavier copper allows better current flow due to less resistance (right).

of power and its resultant thermal effects on the PCB with the spatial design requirements to ensure the end product's safety and performance.

Thermal management

Thermal issues caused by contact or constriction resistance and inefficient air flow are always a concern and should be carefully considered early on. The PCB copper content is one element of this. Too little copper can restrict current flow causing constriction resistance. Appropriate copper trace sizes decreases bulk resistance, allowing for cooler temperatures and less loss. Otherwise that heat could be "sunked" to the connector interface, increasing reliability concerns. Power supply manufacturers are very creative in supplementing PCB structures with features to alleviate thermal and constriction concerns. In addition, as systems are packaged into smaller boxes with more

components, it is critical to ensure proper management of air flow around connectors which are positioned at the intersection point (such as between a power supply and a server) and can block the free flow of air. Ample air flow around and through the connector helps cool the power contact, allowing for more current and/or an increased margin of safety.

At the same time, connectors are sometimes located at key points and block airflow. Cooling connectors is not high on the list of priorities for designers when considering air flow. With operational safety in mind, the designer needs to consider the entire system and its power architecture to understand what potential may exist, from end to end, for constriction areas and voltage drops that affect thermal and electrical performance. Typically,

a maximum 30mV drop defines the threshold of thermal stability for a power contact. Once this threshold is crossed, the probability of thermal instability increases significantly. Manufacturers of innovative connector designs are working with their customers to develop improved power interconnect solutions for safe operation and reliable performance in smaller spaces at higher temperatures over long product life. New designs incorporate new alloys and moulding resins, plating, improved contact technology, all to increase current density without sacrificing safety and reliability.

Risk mitigation

Connector manufacturers have traditionally based current ratings on their products' electrical performance tested under ideal circumstances. These published ratings, while accurate for what they measure, rarely tell the whole story because they fail to take

into account the various conditions and interactions that will affect the environment in which the connector actually will be operating. As a result, a common practice among OEMs has been to de-rate the connectors in order to build in a thermal safety margin over product ratings published in the connector manufacturer-

ers' literature. Many use a simple approach, testing a smaller circuit count along with a longer one and charting a range of T rise versus current showing lower current carrying capability as the circuit count increases. Some customers assign another arbitrary percentage, so if a connector supplier submitted a product rated at say 100A, the user would automatically de-rate it by 30 percent to ensure a built-in safety margin against the possibility of overheating.

Today's leading connector providers understand this and will work closely with OEMs and their design team to match their connector selection to the specific application, based on scientific testing and performance analysis under real-world application conditions.

To provide accurate ratings, top manufacturers conduct extensive testing and predictive modelling, such as Joule Heating FEA (finite element analysis) and CFD software (Computational Fluid Dynamics) with inputs pertaining to the connector, the PCB geometry and material properties, current, contact resistances (actual test data) and air flow. In this way, they can estimate the performance of each of their interconnect products and provide reliable counsel to customers as to which of their products would be the best match for the application requirements. It is not practical to simulate and or test every possible environment but these models can help guide designers to smarter choices in a shorter amount of time.

Power integrity planning

The benefits of proactive power integrity engineering simply cannot be overstated. Gaining a clear understanding of all the requirements early in the design phase, before specifying interconnect components, can help ensure the right decisions and avoid costly missteps. Most importantly, high quality power integrity engineering enables OEMs and their product designers to maximize the performance, reliability and safety of their products, resulting in higher sales and customer satisfaction. ■

SPECIAL FOCUS:
INTERCONNECT

Miniature circular connectors

with RoHS zinc nickel protection

Souriau has extended its RoHS Zinc Nickel protection to its latest range of miniature circular connectors, the micro38999 series. This gives the range three key advantages: record compactness on the market of connections for harsh environments (-50% of compactness as compared with size 9), specifications

in line with a military standard and an environmentally friendly RoHS protection. Zinc nickel plating also has the advantage of being backed up by a recognized standard (American Society for Testing and Materials, ASTM B841 for Zinc Nickel).

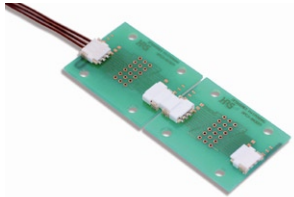
Souriau


www.souriau.com

LED lighting connector

helps reduce component count

MSC Vertriebs GmbH is making available Hirose's DF59 multifunctional connector, which is applicable for wire to board power supply connections and board to board 'bridge' connections. In addition a shortening plug version is available. Only one type of receptacle is needed, irrespective of



whether the cable plug or board mount plug is used, allowing a reduction in the number of

components needed. DF59 has a pitch of 2.0 mm or 4.0 mm, dependent on the application and the related requirement such as higher clearance and creepage distances for power supply applications. The connection system can be applied with 3 A by using the defined cable gauge with AWG 22 (\varnothing 1.26 mm / UL1061). The voltage is specified with 100 V or 230 V dependent on the pin size used. DF59 is currently available in 2, 3 or 4 and 6 positions which satisfy a broad range of lighting applications. The low mated height of 2.5 mm and overall small size of 8x9mm (3 pos wire to board) targets bright lighting applications where many narrowly mounted LEDs are used. The compact size of the connector prevents formation of shades and the natural white color of the molding material makes DF59 more invisible. The board to board 'bridge' connector is ganged by a "friction lock" system. This has a floating structure to allow a tolerance of ± 0.5 mm, in all three triaxial directions allowing greater flexibility during the installation process. Typical applications for DF59 are LED lighting, battery connections, small DC motor drives, power supplies.

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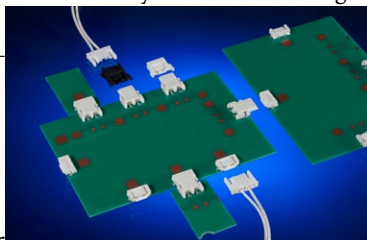
The Flexi-Mate connector system from Molex is designed to address the backlighting needs of LED TVs, as well as room lighting applications. The 3.70mm pitch connector system

enables the secure placement of LEDs on interconnecting panels across the full width of

a TV display or lighting fixture. The 3.00 mm mated height provides optimal design flexibility in thinner, space-saving applications. The Flexi-Mate system delivers a 25 percent lower profile than other LED connector products on the market, claims the company. It includes coplanar board-to-board connectors used to snap together small

panels containing LED lights. The system includes a wire-to-board option to connect the LED boards to the main power board. A terminating connector used as a shorting device completes an

open-loop signal. Currently available in a standard two-circuit design, Flexi-Mate Connector System key features include a dual-con-



tact terminal design for secure electrical contact and robust, space-saving positive side locks for wire-to-board connectors. A mating guide on PCB versions facilitates smooth mating and protects terminals during mating and unmating.

Molex

www.molex.com

Optical monitoring boxes for permanent network control

Trans data elektronik launched (tde) a 1/2 rack unit comprising an optical monitoring box for the control of up to 12 full-duplex fibre-optic lines by passive access, without disturbing the

data transmission of the network. Be it either for Voice over IP, video conferencing or security applications, an accurate network monitoring is required to ensure a constant availability. The optical monitoring box is used to split a fibre optic port into two ports: on the reverse side of the box the monitored fibre optic line is "guided through". In the box, all the fibres are split. Therefore, the additional ports can be connected to monitoring devices that allow a passive monitoring of the network traffic. The box supports

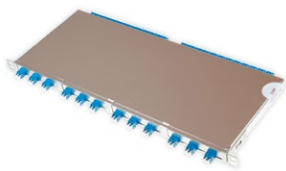
the monitoring of 12 LC duplex ports on a half rack unit (U) at data transmission speeds of 10 Gigabit per second. tde's optical monitoring boxes offer a very good optical performance, so

that the available loss budget will not be unnecessarily burdened. There are multimode and singlemode

versions available and even the combination of both transmission media in a box is possible upon request. As a standard connector the LC-duplex is used but other connectors can be implemented on demand. Due to the usage of MPO/MTP multi-fiber connectors for instance, a port density of up to 24 duplex ports can be realized.

Trans data elektronik

www.tde.de



Cable harness engineering suite from definition to workshop service

Recognizing the importance of cable harnesses as a pivotal component in today's cars and aircraft systems, design software vendor Mentor Graphics has significantly enhanced its Capital Harness software suite to cover

it aligns configuration and product marketing intentions. The second new tool also addresses complexity. While it also supports conventional superset approaches Capital Modular XC focuses more on modular



the entire product life cycle from definition to workshop service. The existing software for cable harness design will be complemented by three components which extend the workflow to upstream and downstream segments. The complete tool suite covers cable harness complexity management, manufacturing, documentation and servicing of vehicles. The move reflects the increasing importance of cable harnesses in today's vehicles: The cable harness is not only the second heaviest component in cars today; it is also the lynchpin for the individualization and differentiation of the cars, which in turn is the key to the market strategy of many OEMs. The increasing number of car options and variants translates into an enormous complexity in the harness, since each option requires a different version of the harness.

Two of the new tools introduced by Mentor address the complexity topic. The first one, Capital Level Manager, helps designers to minimize the costs caused by the complexity of the configurations. It is based on a property-oriented design paradigm and produces a numerical feedback of the complexity and the resulting costs. Connecting marketing and engineering aspects,

processes, allowing designers to generate several configuration options based on harness fragments. The tool will typically be used in the production phase. Mentor already announced to introduce further software tools aiming at this phase of the product life cycle. Capital Publisher is another tool of the newly formed suite. It speeds the documentation of electrical systems as well as repair and service. It aggregates data about the electrical design such as circuit schematics, cable lists etc in comprehensive formatted electronic documentations. In this, it can read in data from upstream processes or from third-party suppliers. The system also can select the data to visualize according to the respective make and model of the vehicle. On top of this product roll-out Mentor announced to offer integration options for further existing tools into the Capital product suite. In addition to the automotive industry, the software can also be used on other industries where cable harnesses and the diversity variants are business critical. Examples are aviation and defense industry, commercial vehicles production as well as, to a certain extent, shipbuilding.

Mentor Graphics

www.mentor.com

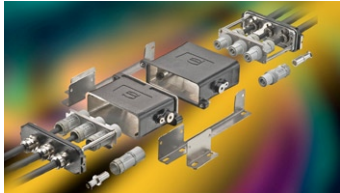
High-current connector

for simple assembly in rail applications

The Han(R) 24 HPR EasyCon from Harting is a high-current connector designed as an optimum solution to the demanding requirements of motor drive applications in the railway industry.

The new connector offers simple, swift and certain

assembly to respond to the growing trend in the rail technology sector towards pluggable motor applications. The Han(R) 24 HPR EasyCon is based on the size 24 B Han(R) HPR series housings, but differs in essentially comprising a two-piece surface-mounted housing and hood. Dividing the



housing into an assembly cover and a housing body results in an 'open' system which considerably simplifies the assembly while offering substantial

advantages, particularly for shielded cables. The new connector allows a secure and visible assembly of the cable's shield braid thanks to a newly developed cable clamp. The Han(R) HC modular 350 high-current contacts are used to handle the actual power transmission.

Harting

www.harting.com

Ethernet IP core

with high availability seamless recovery

Lattice Semiconductor and Flexibilis Oy have announced the immediate availability of the Flexibilis Ethernet Switch (FES) IP core. The triple speed (10Mbps/100Mbps/1Gbps) FES IP cores operate on Ethernet

Layer 2 and can switch with gigabit forwarding capacity per port. Data forwarding and classification inside the switch is based on MAC address information in the packets and the prioritisation scheme. Quality of service is supported with up to four queues per port. This Ethernet switch IP core is available in five versions that vary in their number of ports and functionality; from 3, 4 and 8 FES ports, and the HSR QuadBox and RedBox versions. The FES with HSR IP cores enables designers

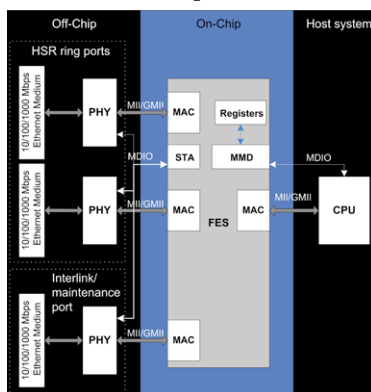
of substation automation and industrial networking applications to apply the emerging High Availability Seamless Redundancy (HSR) protocol using LatticeECP3 FPGAs. This IEC protocol (IEC62439-3) claims

to provide cost effective redundancy with no single point of failure and zero recovery time in case of failure. Target applications include smart grid

substation automation and networked industrial automation gear, as well as in high availability network equipment. The FES IP cores are equipped with IEEE 1588 version 2 end-to-end transparent switch functionality.

Lattice Semiconductor

www.flexibilis.com



High voltage connectors

500V for the automotive, industrial markets

Connector manufacturer and supplier ITT Interconnect Solutions has announced a connector series developed to drive forward increased specifications in many new and future customer products. Trident High Voltage connectors are aimed at applications such as electric vehicles and industrial devices



which require robust and secure interconnects able to handle high power and high voltage in a small form factor interconnect. Based on ITT ICS's Trident Neptune connectors, the new Trident High Voltage series has a robust and shielded metal housing which is fully RoHS compliant, yet is 10% smaller than compa-

table interconnects, saving both space and weight. Trident High Voltage connectors feature a new insulator body design which enables them to cope with an operating voltage of 500V (AC and DC) and a maximum operating current of 34A (for wire size 4.0mm at 20°C. Safe and reliable,

Trident High Voltage connectors are fully VDE certified with 6KV rated impulse voltage. When mated, they remain sealed in conformance with IP67 against dust and water ingress up to a depth of 1m.

ITT Interconnect Solutions

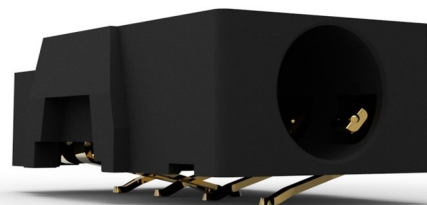
www.ittcannon.com

Compressive 3.5mm A/V jack

for small form factor devices

TE Connectivity's compressive 3.5mm A/V jack fits in various mobile and other small form factor devices. The compressive contact design allows for floating connectors, therefore avoiding solder joint breakage. If damage is done to the connector,

And the switch contact position offers enhanced protection from dust or other contamination, therefore increasing the connector's durability. Moreover, the connector design is highly resistant to contact push out during insertion thanks to



it can be easily replaced in the service center without soldering, thus saving the cost of service. The switch contact design of the connector enables wiping action, which helps increase the reliability of the switch function.

perpendicular contact insertion. The durable design allows for 6000 mating cycles, double contacts provide increased unmating forces.

TE Connectivity

www.te.com

Paper photovoltaic cells ready to take-off

By Julien Happich

AMONG THE MANY FACETS of foil-based flexible electronics, thin-film organic photovoltaic (OPV) cells are drawing a lot of attention from researchers. Even at about half the efficiency of rigid silicon or gallium arsenide-based photovoltaic panels, new organic materials suited for roll-to-roll printing processes could beat them on economic grounds, weight and scalability.

In its recurrent industry reports, ID Tech Ex the exhibition organizer of Printed Electronics & Photovoltaics Europe, expects OPV to become sooner or later the dominant technology in the thin film PV market. Several substrates are competing to replace glass, such as PET/PEN for lower processing temperatures, transparent polyimides, glass fibre reinforced polymers, or even metal foils.

Ascent Solar for example, is already commercializing thin-film CIGS (copper indium gallium di-selenide) cells on a flexible polyimide-substrate for high volume applications on roof-tops. German company Heliatek uses PET foil and a low temperature process to develop very low cost semi-transparent photovoltaics that could be laminated on glass. The foils would combine power generation with adjustable shading properties on window panes, acting as progressive curtains.

In a joint R&D-project with the Technische Universität Dresden (IAPP) and BASF SE, Heliatek presented efficiencies over 8% for tandem solar cells combining oligothiophene-based absorbers (in the red and green

spectrum bands). The company bets on the solvent-free vacuum deposition of small organic molecules and laser scribing to bring large scale manufacturing in a roll-to-roll process at a width up to one meter. It is aiming at an efficiency of over 10% and expects its first products early 2012 on a roll width of 300mm.

Using its own polymer chemistries, Massachusetts-based company Konarka has just announced what it believes to be the largest OPV installation (about 16.5 square metres in seven window panels measuring each 1.4x1.7m), covering both the South and East-facing glass walls of its new Bedford facility with its commercial offering dubbed Power Plastic. The solar windows are connected to the grid via inverters. Such building-integrated photovoltaic curtain walls have the potential to deliver more electrical output than roof-top only installations, especially on tall buildings that have a high aspect-ratio. The coloured semi-transparent solar installations are lightweight and can be laminated inexpensively onto glass. The company has demonstrated organic PV cells with a solar energy conversion efficiency of 8.3%.

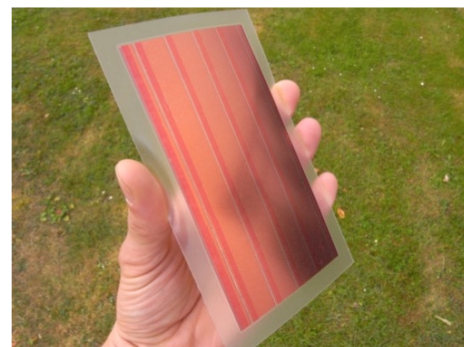
One big advantage of the roll-to-roll processes used in the manufacture of OPVs is their relatively low equipment cost compared with the high-temperature processes needed to grow crystalline Si or GaAs; OPVs are less energy intensive too. This means that the total production costs of organic solar cells are often dominated by the cost of materials (foil, barrier, organic compounds) rather than by process equipment, hence less upfront costs and possibly a competitive manufacturing cost per watt capacity.

A recent spin-out from Cambridge University, Eight19 focuses on high speed, ambient temperature manufacturing techniques to create lightweight, non-toxic, flexible solar films. The company wants to leverage the low production costs inherent



Konarka's Power Plastic® semi-transparent photovoltaic sheets can be used to laminate glass walls. Credit George Disario.

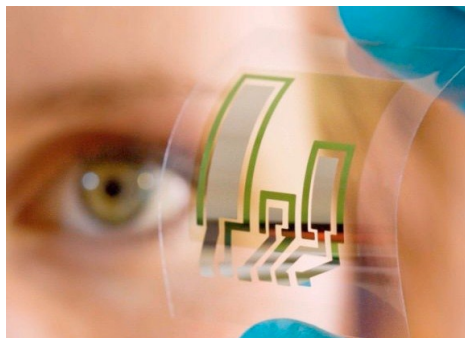
to existing roll-to-roll printing and coating processes used in the packaging printing industry. It positions itself as a provider of IP integration and manufacturing know-how for the design of custom solutions using commercial photoactive nanomaterials.



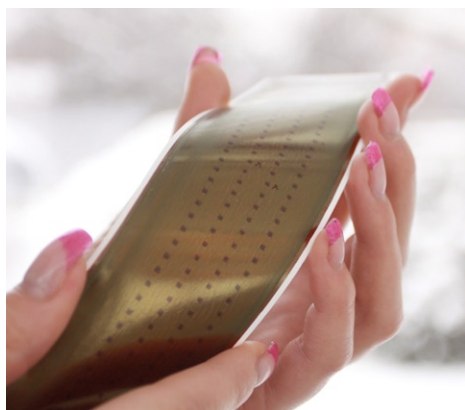
Startup Eight19 is to design custom foil-based OPVs using commercial photoactive nanomaterials.

As Eight19's CEO Simon Bransfield-Garth puts it, with traditional solar cells, you pay for 25 years of electricity up front and then you try to recoup these costs over the PV panels' lifetime. Using existing ambient-temperature printing and coating processes could enable the high-volume manufacture of OPVs to address a huge off-grid market currently unavailable purely on economic grounds, cutting short the capital expenditure problem.

Professor Arved C. Hübner from the Institute for Print and Media Technology at Chemnitz University of Technology takes paper as the cheapest possible substrate to meet common printing requirements and envisions changing the economics of solar energy. Inspired by nature's seasonal solar energy conversion capabilities, Hübner's team has spent the last three years devel-



Heliatek's PET tandem solar cell could combine power generation with adjustable shading properties on window panes.

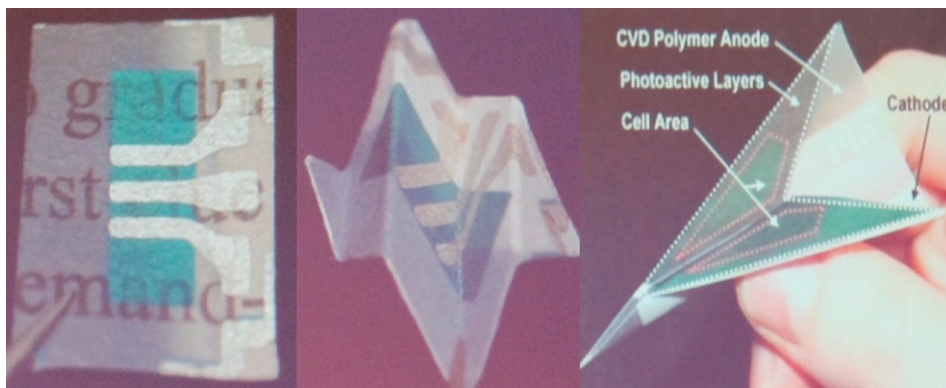


An early version of the 3PV approach from the Chemnitz University of Technology, with a silver electrode, P3HT-PCBM as the active layer and PEDOT as the transparent electrode.

oping printed paper photovoltaics (3PV), focusing on the renewable aspect of solar cells more than on their longevity (like the low-efficiency renewable leaves of a tree).

According to the researcher, this approach is the only way to answer the pressing energy needs of billions of people who can't afford a connection to the grid in emerging countries or who live in remote places. It is about finding the right balance between production costs and efficiency, and looking at high efficiencies with costly materials won't solve the problem, he says.

Today, the German laboratory is about to publish its results on 3PV with an efficiency of 1.3%. Its first commercial goal would be to reach 3.5% for printed paper in a non-clean room environment. Printed paper photovoltaics would bring a whole new concept to



The MIT's oxidative chemical vapour deposition works on any paper substrate, from tissue paper to newsprint. The paper cells are still functional when folded.

off-grid energy. One could buy hundreds of 3PV-sheets locally produced by conventional print shops, clip the sheets to wires and connect them to a power management box to tap the energy. After several months of use (variable depending on climate conditions), the damaged sheets could be changed and recycled. Such an approach would only require low investments and would work via decentralized local businesses.

Interestingly, the Massachusetts Institute of Technology is also working on using paper as a substrate, chiefly to reduce the cost and weight of solar cells. Professor Karen K. Gleason, associate dean of engineering for research in the department of chemical engineering, presented her results with various paper substrates, from tissue paper to newsprint. Using a layered approach of BCP (bathocuproine), fullerene (C60), copper phthalocyanine (CuPc) and PEDOT sand-

wiched between silver and ITO electrodes, the paper cell prototypes are manufactured through step-growth polymerization using oxidative chemical vapour deposition (oCVD) under vacuum.

This roll-to-roll vapour-printing approach is temperature-controlled in the fairly low 20 to 100°C range and yields no defects or residual solvents, hence the process is not affected by wettability issues, explained Gleason. "It is as if the oCVD was shrink-wrapping the individual paper fibres", commented Gleason, "this makes the paper photovoltaic cells very homogeneous in their bulk. Hence they are easy to handle, can be stapled or glued to any support and are still functional when folded".

A 7x7cm monolithic solar array was shown, clipped to a voltmeter, it was then folded into a paper plane, still delivering sub-micro amps of current. ■

3D modelling integrates flexible PCB design

By Manuel Rei

OVER THE LAST DECADE, electronic products have become increasingly complex and dense as they support more functions into dramatically reduced footprints. The need for flexible circuits has grown exponentially, since they are often the preferred solution to achieve package weight-reduction, compared to rigid planar boards.

They are also easier to manufacture, reducing total assembly time while driving down cost and errors. Through their proven suitability for handling more than 25 point

to point wires connections, flexible PCBs also provide greater system reliability. Additionally, their main advantage is their ability to bend in order to accommodate the most cramped environments, enabling denser component layouts within the specified mechanical constraints of consumer products.

This makes flexible PCBs suitable for use in almost all electronics-based equipment, from consumer products such as digital cameras, computers and hard drives, to internal medical devices and military equipment. Several generations of notebooks, tablet computers and other devices have been able to slim down while increasing their

functionalities thanks to flexible layouts and interconnects.

Reducing the design cycle

Looking at how some flexible PCBs are designed today, and considering their development cycles, it is clear that there is considerable room for improvement. When Dassault Systèmes started to work on this subject with a leading Japanese worldwide consumer electronics company, we soon realized that their design process was slow, extremely complex and time consuming.

The first steps of the development process were purely manual and involved placing

Manuel Rei is industry solution leader for collaborative mechatronics engineering solution Dassault Systèmes - www.3ds.com/hightech

the flexible PCB assembly within the product. Even today, some companies are still making paper PCBs by hand, and check the components' positions manually throughout the product's physical mock up stages. Following this procedure, 2D drawings were generated and shared with the ECAD designer for component placement and routing.

Within this outdated methodology, mechanical and electronic design processes were conducted separately. Only late in the development cycle was it possible to exchange critical design data between MCAD and ECAD systems. The limitations in data exchange and the lack of co-design functionality resulted in the need for additional design iterations, driving up development times and costs.

3D adds flexibility

Designing a flexible PCB and making it fit into a complex mechanical housing is a significant challenge. It requires using a sophisticated application of mechanical and electronic CAD tools in order to address the design challenges and removing data exchange limitations. Using CATIA 3D Flexible PCB Design, the end-to-end process is 100% digital. There are no workflow breaks or manual operations – figure 1.

A typical use case scenario is to design the mechanical housing, including the shape of the flex board using CATIA. Hardware assemblies containing rigid and flexible boards, and mechanical components are developed first. The flexible PCB board outline is created by mechanical designers using CATIA which also acts as a unified repository for evolving designs.

This means that the PCB board designs created in CATIA remain as digital models throughout their development cycle. The PCB board outlines can be flattened and folded back to their original 3D position.

Critical components are placed in 3D and thereby benefit from a 3D virtual mock-up of the product. This allows them to be located on the board in the correct location, first time – see figure 2.

In many cases stiffeners will be added to the 3D virtual board model. Constraint areas are then added in 3D and the flexible PCB board is flattened using CATIA.

This flattened view of the flexible PCB contains all 3D design information, along with the components and constraint areas. Data is exchanged with the electronic designers and the flexible PCB model is translated to ECAD via an IDF file. All remaining electrical components are placed and coppers/wires are routed in ECAD.

Electronic circuit design and electrical constraints are forward-annotated to the flex board shape and the board outline is created. Automatic placement of electronic components and routing is available. After completion of the board layout, design rule checks are applied, and the board layout is forwarded to the MCAD system. Comparing this new design to the previous one and updating the MCAD session is key to increasing user efficiency.

Components and copper traces are imported and added to the design and then folded back to their 3D position. Finally, the flexible PCB can be validated against the full 3D virtual mock-up – see figure 3.

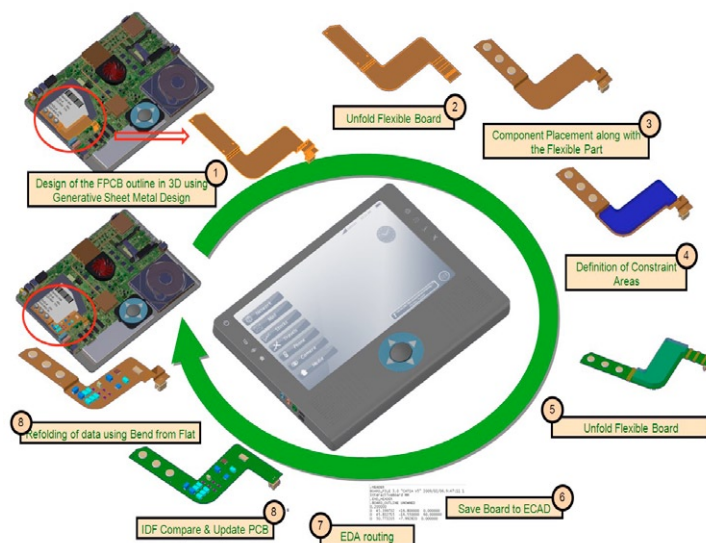


Fig. 1: The end to end 3D design process in CATIA.

Cutting design times by 5

Dassault Systèmes' customers that have implemented this design approach using CATIA Flexible PCB Design have claimed to have reduced their design time cycle by up to 80%. Concurrent mechanical and electronic design of flexible PCBs facilitates an optimum floor planning and routing on flexible boards, potentially reducing their size. Designing the flexible PCB in context with the 3D virtual product mock-up allows design iterations between MCAD and ECAD to be minimized.

This makes it possible to achieve right-first-time design, and reduces the need for physical prototypes. The 3D and flattened views of the flexible PCB will be used in downstream applications such as drafting and manufacturing. In case of design change, modifications are propagated seamlessly, leading to significant development cost reduction.

These benefits allow Flexible PCB Design users to obtain a quick return on investment. As an example, a worldwide leading cell phone manufacturer could reduce its design time from 5 days to less than one day for a new flexible PCB, thanks to the complete, end-to-end, 100% digital integrated design process provided by Flexible PCB Design.

Dassault Systèmes works closely with its users to improve their process coverage as well as their product functionality and reliability. Considering the remaining space inside a device such as a car radio or a GPS system, it is easy to understand why using an application like Flexible PCB Design provides users with the ammunition to create globally competitive products. ■



Fig. 2: Critical components are placed in 3D to ensure they respect the mechanical design constraints.

Fig. 3: The flexible PCB can be validated against the full 3D virtual mock-up.

Exploring bend gesture control for future flexible phones

By Julien Happich

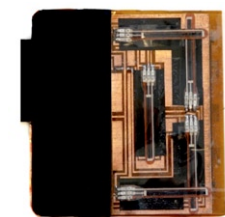
AN ADVANCED “THIN-FILM” flexible paper computer has been developed through collaborative efforts of researchers at Queen's University in Ontario, Canada, and Arizona State University. Called PaperPhone, it's described as a “flexible iPhone” by its inventor, Roel Vertegaal, the director of the Human Media Lab at Queen's University.

“This computer looks, feels and operates like a small sheet of interactive paper,” Vertegaal says. “You interact with it by bending it into a cell phone, flipping the corner to turn pages, or writing on it with a pen.” Leaders of the Queen's University and ASU research groups also plan to demonstrate at the conference a thin-film wrist-band computer called Snaplet.

Hardware for a prototype of the thin-film computer/phone device has been provided by Nicholas Colaneri, director of ASU's Flexible Display Center, and Jann Kaminski, a display engineering manager at the center.

An interactive gesture-recognition system for the PaperPhone has been developed by Byron Lahey, a doctoral student in ASU's School of Arts, Media and Engineering, and Winslow Burleson, an assistant professor in the School of Computing, Informatics and Decision Systems Engineering, one of ASU's Ira A. Fulton Schools of Engineering.

“Using real-time sensing and modelling of dynamic inputs we were able to develop and evaluate an entirely new array of interactions on a first-of-its-kind mobile platform,” says Burleson, who specializes in human-computer interaction and leads the Motivational Environments Research Group.



The array of bend sensors on a flexible PCB.

“This allows natural bend gestures and interaction on the Paperphone display to navigate through maps, contact lists, or music play lists, in ways that resemble how such content appears on paper documents,” he explains. “You fold or bend the page to move forward in a book. Now, with this device, you can do that on your phone, too.” Using a 9.5 centimetre diagonal thin-film flexible electronic ink display, it does

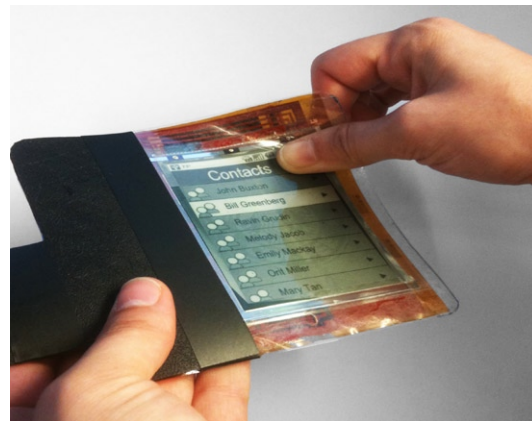
everything a smartphone does, including store books, play music or enable phone calls, Vertegaal says.

The flexibility of the display makes it more portable than any current mobile computer, and it could be made to fit the shape of a pocket, he says. The ability to store and interact with documents on larger versions of the light, flexible computers could mean offices will no longer have to rely on paper or printers.

The initial prototype featuring five integrated bend-sensors was designed to allow users to build their own bend gesture vocabulary, allowing the researchers to study their preferences for mapping specific bend gestures to specific actions on the flexible display.

The studies revealed that users had a strong preference for 6 out of 24 bend gesture pairs and in general, users selected individual bend gestures and bend gesture pairs that were conceptually simple and less physically demanding.

For actions with a strong directional cue, there was strong consensus on the polarity of the bend gestures. ■



The PaperPhone prototype created at Queen's University Human Media Lab has a flexible E Ink display featuring bend gesture input recognition.

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Printed passive memory array reaches 40-bit

The Thinfilm passive memory array from Thin Film Electronics is a fully printed non-volatile rewriteable memory suitable for secure documents. The passive array architecture separates the memory from the read/write electronics and dispenses with the need for active circuitry within the memory array and memory cell, making it suitable for very high-volume manufacturing and consumer applications. The ferroelectric polymer-based 40-bit memories are in test production, and

engineering samples will be available later this year. Higher density memories are under development, with planned production in 2012 (up to 121-bit per memory array) to meet the needs of secure archiving, ticketing, and other applications that demand encryption or user-programmed stored IDs. The company is also prototyping addressable array memories that include printed transistors to drive logic for reading and writing data to the memory cells. ■

Lab-on-chip platform

differentiates several food-borne pathogens

Singapore-based medical diagnostics company Veredus Laboratories, a provider of molecular detection tests, and its technology partner, STMicroelectronics, announced the commercialization of VereFoodborne, a Lab-on-Chip application that is able to detect 10 to 12 food-borne pathogens in one test, including the Shiga toxin-producing *Escherichia coli* (E. coli) responsible for the recent severe food poisoning outbreak in Europe. The ability of the VereFoodborne chip to simultaneously lock on multiple segments of the genes of food-borne pathogens enables it to identify bacteria and viruses with a much higher degree of confidence compared to other



tests. This capability is made possible with a microarray on the chip that allows it to detect multiple pathogens in one test, saving time and resources over existing approaches. With

VereFoodborne, health authorities can speed up their investigations of food-borne poisoning outbreaks. Major food companies, on the other hand, vigorously test all their ingredients pre and post processing. The traditional method, which takes much longer to complete, means that perishable ingredients need to be held-up longer in storage while their shelf-life clock is ticking away.

STMicroelectronics

www.st.com

OEM pressure sensors

from 500mbar to 100bar with custom options

Sensortech's new KMA series measures gage pressures of corrosive and aggressive gases and liquids in ranges from 500 mbar to 100 bar. These pressure sensors use internal digital signal conditioning to deliver calibrated and temperature compensated 0.5 to 4.5 V output signals. The KMA sensors are based on very accurate and long-term stable ceramic pressure cells with excellent media compatibility. The small stainless steel sensor housing, with a G 1/8 (BSP) threaded pressure port, is well suited for space-saving integration into demanding OEM devices and machines. The KMA series offers different options in order to adapt the sensors to the specific customer application.



The selection of the right o-ring material (e.g. NBR, FKM, others on request) ensures best compatibility with the process media. An optional parylene coating of the ceramic pressure cell allows

for an additional protection against particularly aggressive fluids and harsh environments. Further, custom pressure ranges and a wide selection of pressure fittings are readily available. For the safe pressure measurement of gaseous oxygen Sensortech offers special manufacturing and cleaning processes which ensure the KMA sensors are free from oil, grease and other combustible contaminants.

Sensortech

www.sensortech.com

New space qualified Li-ion cell

targets LEO satellite missions

Saft is launching its new VES16 lithium-ion (Li-ion) space cell specifically developed and qualified for Low Earth Orbit (LEO) satellite missions. The new VES16 is a low capacity cylindrical cell that has been developed and qualified by Saft for LEO missions in a project that has been partially financed by France's CNES (Centre National d'Etudes Spaciales). The cell features the same nickel-based oxide Li-ion chemistry that has been demonstrated to deliver an extended service life on Saft's extensively spaceflight proven VES140 cells that are already operating on a number of successful satellite missions. The VES16 cell has a nominal capacity of 4.5 Ah with a specific energy higher than 155 Wh/kg. The cell is designed to provide the building blocks for the creation of onboard battery modules to cover a large range of satellite power requirements. During the proving tests, the new cell has completed 15,000 LEO cycles to date – the tests

are still continuing. It has also demonstrated the capability to support 22 GEO seasons with minimal fading (a loss of less than one percent). VES cells are manufactured in Saft's facility in Bordeaux, France and are assembled into battery modules in Saft's facility in Poitiers. The VES16 cells will be commercially available by the end of 2011. Saft battery modules work in conjunction with a LEO satellite's solar array to provide the electrical power for its onboard electronics. When the solar array is fully exposed to the sun it will provide the satellite's power as well as charging the batteries. When the solar array is 'eclipsed' by the earth, with no direct sunlight, the batteries will power the satellite. LEO satellites have a typical period of around 90 minutes, so this charge and discharge cycle is repeated 14 times a day throughout the mission's design life.

Saft

www.saftbatteries.com

Washdown-safe gearmotor

in IP69K-rated stainless steel housing

Bison's new IP69K rated stainless steel SANIMotor gearmotor completely encapsulates all electrical components in thermally conductive epoxy resin, allowing its use at up to 40°C ambient temperatures. The encapsulated SANIMotor is housed in 304 stainless steel tubing, sealed with EDPM rubber o-rings and secured with hex bolts to guarantee against leaking. Electrical termination is completed with a removable IP69K ABS cordset with a modular, multi-pin power connector. Two frame sizes are

available in 88.4mm and 127.0 mm for the three-phase, 230V SANIMotor. Each frame size is mated to 7 standard gearing ratios which offer output speeds from 345 RPM to 8 RPM with rated torques ranging from 0.8 to 56.5 N-m. The gearmotor was designed for use with variable frequency drives in constant torque configuration from 6 to 60 Hz and constant horsepower configuration from 60 to 90 Hz.

Bison Gear

www.BisonGear.com



Video signal splitter

bundles up to four signals for in-vehicle cameras

Jetter AG introduced a video signal for rear-view cameras in cars. The JXM-MUX bundles up to four video signals and offers the possibility to display one, two, three or four camera images at the same time on a monitor.

According to the vendor, the robust design of the JXM-MUX meets the requirements with respect to ambient temperature, shock, vibrations and electro-magnetic interference of in-vehicle environments. These features make the signal splitter suited for integration into cars; an application example would be rear-view camera signal capturing. All cameras with FBAS signal output and 12V power supply can be connected to the JXM-MUX. The device can be remote controlled through a CAN interface and CANopen protocol.



through a CAN interface and CANopen protocol.

Jetter AG

www.jetter.de

LED backlight driver for slim TVs

powers up to 32 parallel strings of 15 LEDs

iWatt has expanded its family of DC/DC LED backlight drivers with the iW7032 which can power up to 32 parallel strings of LEDs. The mixed-signal IC features iWatt's digital adaptive switching technology with integrated MOSFETs.

Adaptive switching reduces thermal overhead and power consumption, while the integrated MOSFETs reduce component count, form factors and costs for dynamic backlighting. The 32-channel iW7032 targets mainstream direct or segment-edge-dimmed



TVs, while iWatt's existing 64-channel iW7040 is suited for high-end, direct-dimmed TVs. Both drivers are designed to enable real cost savings in dynamic backlighting, as well as easy integration into ultra-thin LED TVs. With high voltage support (up to 56 V) and adaptive switching to overcome thermal problems, the iW7032 is capable of driving more parallel strings of LEDs from a single IC than exist-

ing solutions, reducing component count for TV manufacturers. The iW7032 can drive up to 32 parallel strings, numbering 15 LEDs per string, to power 480 total LEDs from one IC. iWatt's high-voltage support also saves the cost of any additional protection MOSFETs required by ICs with lower string voltages.

iWatt's proprietary digital adaptive switching technology solves the thermal problems of driving a large number of parallel strings of LEDs, where a significant amount of wasted power typically heats the inside of the TV and increases the chance of thermal-stress-related LED failures. iWatt's adaptive switching technology senses the mismatch of the varying forward voltages (V_f) of the multiple strings of LEDs and adjusts appropriately for each string. This reduces the wasted power by up to 90%, minimizes the heat generated, and enables a single iWatt IC to drive many multiples of LED strings.

iWatt

www.iwatt.com

Multi-sensor board

completes Libelium's Smart Cities platform

Libelium completed its Smart Cities platform with a new sensor board aimed at measuring noise pollution, dust quantities, structural health and garbage levels. This board may be combined in a network with previously available sensor boards, for gas monitoring, radiation detection and smart parking, thus offering a comprehensive range of sensors for urban use.

System integrators can now deploy a heterogeneous wireless sensor network with a combination of sensor boards to support a comprehensive range of city council services.

The sensor board includes four new sensors, making it more economical for cities to implement multi-purpose sensor networks. A noise sensor detects sound pressure level (dB SPL) to monitor noise from traffic and people. It is suitable for creating a real-time noise map of a city. A particulate matter (dust) sensor measures PM-10 concentrations, capable of measuring concentrations down to 0.1 micrograms per cubic metre. A crack sensor

for measuring cracks in public structures such as buildings and bridges can detect displacements as small as 10 micrometres as well as oscillations and dilata-



tions. An ultrasound sensor capable of measuring garbage levels in bins, enables waste management services to empty rubbish only from bins that are sufficiently full thus saving time and fuel. The board also includes temperature, light and humidity sensors.

The platform is based on Libelium's modular Wasp mote wireless sensing technology, running open source software to create custom solutions. Motes or nodes in the network communicate with their gateway using ZigBee radio links.

Libelium

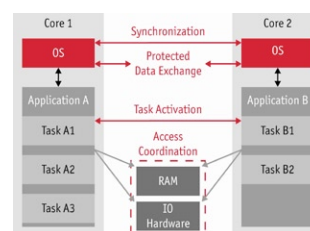
www.libelium.com

AUTOSAR-compliant embedded OS

targets multi-core processors

Vector's Microsar OS Multi-Core has been designed as a robust operating system for automotive applications on multi-core processors. It enables independent execution of the application software on multiple processor cores by using synchronization methods and coordinated

optimal for embedded applications. It can be extended by memory protection or execution time protection. The operating system services provide the



interfaces known from OSEK/VDX and AUTOSAR, making it easy for automotive ECU developers to use. The new OS conforms to the

AUTOSAR standard.

Vector

www.vector.com

4-channels 36 GHz acquisition module for Lecroy's LabMaster 9 Zi-A

LeCroy added a 36 GHz acquisition module to its LabMaster 9 Zi-A modular oscilloscope system, providing higher bandwidth to customers performing optical coherent modulation analysis at data rates of 28+ GBaud (112+ Gb/s) or for 10 to 28 Gb/s electrical non-return to zero (NRZ) serial data testing. The new acquisition module can be configured in a LabMaster 9 Zi-A system to provide up to 10 channels at 36 GHz and 20 channels at 20 GHz, with analysis memory up to 512 Mpts/ch. It is also backwards-compatible with previously



purchased LabMaster 9 Zi-A "Master" acquisition modules. In addition, customers needing even more bandwidth than 36 GHz can purchase LabMaster 9 Zi-A modular oscilloscope systems that provide up to five channels at 45 GHz. The LabMaster 936SZi-A slave acquisition module is used with a LabMaster 9CZi-A master control module that contains the front panel controls, 15.3" WXGA display, ChannelSync 10

GHz distributed clock architecture, and server-class CPU.

Lecroy

www.lecroy.com

EEPROM portfolio expanded to 1Mb operates in the 1.8 to 5.5V supply voltage range

ON Semiconductor's latest EEPROM devices include the high density 512 kilobit CAT24C512 and 1 megabit CAT24M01, which have a 1.8 to 5.5V supply voltage range. The CAT24C512 and CAT24M01 employ 256 byte and 128 byte page write buffers respectively. Both devices support standard 100 kHz, fast 400 kHz, and fast-plus 1 MHz serial I2C protocols. These devices are manufactured on a 0.18 µm low power CMOS process at the company's owned and operated Gresham, Oregon facility. In addition, the manufacturer introduced a series of AEC-Q100 qualified EEPROMs for automotive designs. These devices have a 2.5 V to 5.5 V supply voltage range and support the standard



and fast I2C protocols. Both the 64 kb CAV24C64 and the 32 kb CAV24C32 feature 32 byte page write buffers, while the 2 kb CAV24C02, 4 kb CAV24C04, 8 kb CAV24C08 and 16 kb CAV24C16 incorporate a 16 byte page write buffer. These devices are manufactured on a 0.35 µm process. All of the new EEPROMs feature a 100 year data retention period and support for 1,000,000 program/erase cycles.

The operating temperature range of these serial EEPROMs is -40 to +125 °C. The CAT24C512 and CAT24M01 are available in Pb-free, RoHS compliant SOIC-8, TSSOP-8 and PDIP-8 packages.

ON Semiconductor

www.onsemi.com

Win a toy development kit

with printed electronics re-writable memory cards



This month, Thin Film Electronics is giving away its toy development kit, worth 3,000 Euros, complete with the tools needed to efficiently design interactive toys and games. The Thinfilm Toy Development Kit contains a hand-held reader/writer for memory-labelled cards, eight samples of 17-20-bits Thinfilm Memory, laminated on card



and 12 Thinfilm Memory labels. A Thinfilm console with colour LCD screen and USB connection makes it easy to update software for the game and the hardware control. Three samples of the Thinfilm Memory Controller, an application-spe-

cific integrated circuit (ASIC), are also provided, together with an embedded technology demonstration reference game.

A manual completes the package with instructions on how to develop your own software and register with General Plus. Re-writability allows users to save game status, scores, and the game player's avatar evolution.

What's more, printed electronics has an absolute cost advantage compared to conventional electronics, such as flash and EEPROM. The manufacturing process is substantially cheaper, and material costs are typically lower.

Thin Film Electronics

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

MEMs infrared temperature sensor fully calibrated, accuracy up to 0.2 °C

Melexis has launched its 3rd generation of contactless MEMs infrared temperature sensors. The high accuracy of the newest member of the MLX90614 family makes it suitable for limitless applications in automotive, medical, industrial and consumer markets. A common problem in the use of infrared thermometers is the error induced due to fast temperature variations and/or thermal gradients. Melexis is able to reduce

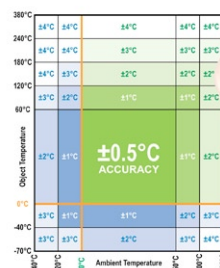
The latest MLX90614ESF-DCH and MLX90614ESF-DCI incorporate a refractive silicon lens to achieve small fields of view (down to 5 degrees) so small objects can also be measured from further distances. Furthermore they are able to measure human

body temperature with a high medical accuracy over a wide operating range. In this particular application the accuracy is 0.2 °C. This makes them

ideal for forehead thermometers and public area fever scanning gates. The parts are available in a standard setting TO-39 footprint with integrated lens.

Melexis

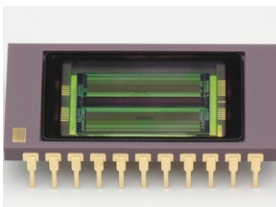
www.melexis.com/mlx90614



Back-illuminated InGaAs linear image sensors

uses the infrared spectrum for the detection of foreign body in food stuff

Hamamatsu Photonics' G11135 series of InGaAs linear image sensors are designed for foreign object inspection. These image sensors consist of an InGaAs photodiode array and CMOS chip containing a charge amplifier array, offset compensation circuit, shift register and a timing generator. The G11135 series are back-illuminated sensors and use indium bumps to connect the InGaAs array with the CMOS chip. The G11135 series is available in 256 and 512 pixel versions with 50x50µm and 25x25µm pixels respectively.



Both feature a high sensitivity from 0.95µm to 1.7µm and a single video line, which enables a high speed data rate of 5 MHz and excellent pixel-to-pixel linearity.

Hamamatsu Photonics

www.sales.hamamatsu.com

M2M smart services developer kit

with a deployable Intel Atom processor-based service-ready system

Kontron has introduced its machine-to-machine (M2M) Smart

Services Developer Kit with a deployable Intel Atom processor-based services-ready system. Developed in collaboration with Intel Corporation, the standards-based Computer-on-Module (COMs)-based kit is a



powerful development and deployment solution that provides simple 'plug & play' capability enabling designers to develop and test their application's connectivity and performance, then quickly deploy. The kit uses the COM Express compatible Kontron Computer-on-Module nanoETXexpress-TT powered by the Intel Atom processor and includes a M2M System Carrier Board and an AV board to support headed configuration use.

The M2M Smart Services Developer Kit is 802.11a/b/g/n WLAN (wireless local area network) and 802.15.4 WPAN (wireless personal area network) capable allowing rapid development of wireless connectivity solutions. 3G WWAN (wireless wide area network) is either pre-installed or easily enabled by dropping in a pre-certified PCI Express 3G/4G module for further broadband connectivity flexibility. The M2M solution and kit packaging may be easily customized to include the network operator's, OEM's, or ISV's brand. The M2M Smart Services Developer Kit works out-of-the-box, and its extensive capabilities allow the developer to test the smart services application in a connected environment similar to an actual deployment.

Kontron

www.kontron.com/M2Mkit

Energy-harvesting and power-management IC

enables low-power wireless devices

Maxim Integrated Products has introduced the industry's first IC to integrate all of the power-management functions for ambient energy harvesting, as well as for charging and protecting micro-energy cells (MECs), a form of solid-state battery. Operating at an ultra-low current level, the MAX17710 accepts energy from a variety of poorly regulated energy harvesting sources with output levels ranging from 1 µW to 100 mW. Examples include light (captured by photovoltaic cells), vibration (captured by a piezoelectric element), heat (captured by a thermoelectric generator), and RF (e.g., near-field commu-

nications (NFC)). The MAX17710 integrates a programmable input boost regulator and needs no expensive external components to charge a MEC with energy sources as low as 0.8 V. It protects the MEC by using a linear shunt-series regulator. An ultra-low-quiescent current, adjustable low-dropout linear regulator (LDO) with selectable voltages of 3.3 V, 2.3 V, or 1.8 V allows the MAX17710 to adapt to a variety of loads. It is packaged in a 0.5 mm profile TQFN.

Maxim Integrated Products

www.maxim-ic.com

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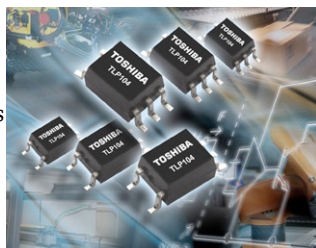
3750 Vrms isolation photocouplers

low propagation delays, operate from -40 to +125°C

The new TLP104 photocoupler from Toshiba Electronics Europe is supplied in an SO6 package and features a minimum isolation voltage rating of 3750Vrms. Along with a guaranteed ex-

tended temperature operation of -40 to 125°C, the device allows designers to minimise the space required for the isolation

interfaces between high-voltage and logic circuitry in a variety of industrial motor control and inverter-based designs. The TLP104 features an inverter logic, open collector output and supports requirements for high-speed operation thanks to



a design that optically couples GaAlAs LEDs with high-speed, high-gain photodetectors. This ensures maximum propagation delay times down to just 400ns. In addition, as the maximum

switching time dispersion is only 400ns, the new TLP104 is suitable for the control of Intelligent Power Modules (IPMs). The 7.0x3.7x2.2mm

device supports output voltages from -0.5 to 30V. An internal Faraday shield guarantees a minimum common mode transient immunity of $\pm 15\text{ kV}/\mu\text{s}$.

Toshiba Electronics

www.toshiba-components.com

Cost effective LDS antenna process

for laptops and tablets

Pulse Electronics introduced its new laser direct structuring (LDS) process for antenna parts which are too long or large to fit well into conventional laser machines. The company claims its lasering process saves as much as 30% over manufacturing done with previous LDS lasering

machines, making LDS antennas cost competitive alternatives for laptop comput-

ers, tablets, and notebooks while providing superior RF quality and freedom of design.

The new lasering concept is based on LPKF Laser & Electronics' new Fusion 3D 1100 laser machine, which is adapted with a Pulse-designed and manufactured part handling system. This newly developed system is capable of lasering longer and larger, or more complex parts. The process has less design and dimensional limitations, yet still meets production efficiency. The



laser beam transfers the antenna design directly onto a moulded 3D surface, making prototyping and production faster. It enables design freedom and flexibility with quick versioning during the project phase, design freezing in the late project phase, and the ability to fine-tune the

design during production to meet stringent carrier requirements. The production

process is fast and easy to implement with low customer-specific tooling costs. Pulse also manufactures cable assemblies that can be directly connected to all solderable materials, which is more cost effective than using connectors. With the RF performance benefits of LDS, this new process makes LDS antennas viable for the tablet and laptop market.

Pulse Electronics

www.pulseelectronics.com

Non-contact fluid sensors

self-calibrated, detect clear and opaque liquids

TT electronics' self-calibrating fluid sensors enable engineers to easily correct for system variations, saving up set-up time as well as maintaining the sensors' optimum accuracy over years of operation. Designated the OCB350 Series, the non-contact fluid sensor features an automatic calibration function.

The sensor operates with an infrared LED/phototransistor pair to determine the presence or absence of fluids in a tube that passes through the sensor housing, using the difference in refractive properties to vary the output current to signal different states, including "fluid present," "no fluid present," and "no tube present." It can also be used to identify the presence of

air bubbles in the fluid passing through the tube. The auto-calibration function enables the design engineer to narrow the device's initial output state, which helps maintain consistent

switching performance by compensating for several factors, including ambient light variation; LED/phototransistor performance degradation over time, overall system power variations; and fluctuations in am-

bient temperature. The sensors are available to fit applications using clear tubing with outer diameters of 1.6-, 3.2-, 4.8- or 6.3-mm. Operating temperature range is from -40 to +85°C.

TT electronics

www.optekinc.com



32bit MCU kit

targets hobbyists

Microchip has teamed up with Diligent to create the Diligent Cerebot 32MX7 Development Kit, based on Microchip's PIC32 MCU family. It addresses the growing interest in embedded-control and networking applications from academics and hobbyists. The kit includes a demonstration board with a

10/100 Ethernet interface, dual CAN and I2C interfaces, the ability to use Diligent Pmod peripheral modules, and an integrated programming/debugging circuit that is compatible with Microchip's free MPLAB IDE. Example applications include university embedded-systems and communications classes, senior capstone projects, and numerous other academic and

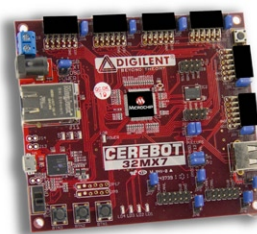
hobbyist projects. The Cerebot 32MX7 board features numerous I/O connectors, and power-supply options such as USB power, which give users the flexibility to use the board for a range of

embedded networking and control applications. The onboard PIC32 MCU operates at 80MHz, and features 512kbytes of Flash program

memory and 128kbytes of RAM, as well as numerous peripherals, such as a full speed USB On-The-Go (OTG)/Host/Device controller, Ethernet controller, dual CAN controllers, timer/counters, serial-interface controllers, an Analogue-to-Digital Converter (ADC), and more.

Microchip

www.microchip.com



Premier Farnell launches the element14 knode

interactive platform eases design tools selection

Through a single interface, Premier Farnell's element14 knode (KNOWledge for Design Engineers) portal is conceived to give design engineers immediate access to electronic design solutions that are relevant to the parts they chose, discarding non-compatible design tools or irrelevant tool associations. The on-line design framework supports the complete

design flow from concept to final production with documentation, tool recommendations, white-papers, enabling engineers to research, design, develop and manufacture prototypes in a single environment.

Farnell

www.element14.com

'green technology' battery deal

between Avnet Abacus and Cymbet Corporation

Avnet Abacus has signed a Pan-European distribution agreement with Cymbet Corporation, provider of solid-state energy storage solutions, to distribute Cymbet's complete range of rechargeable solid state batteries, power management devices, and evaluation kits.

This will include Cymbet's EnerChip solid

state batteries (SSB) and development tools, the new EnerChip EP energy processor, the universal energy harvesting EVAL-09 kit, and the EnerChip CC RF Induction Charger EVAL-11 kit.

Avnet Abacus

www.avnet-abacus.eu

Altium and Würth Elektronik

collaborate on new component libraries

A comprehensive set of passive components from Würth Elektronik is now available for Altium Designer 10 through the recently launched AltiumLive portal. Electronic designers will have access to eight new libraries comprising over 1,500 passive components provided by one of the leaders of EMC solutions for the electronics industry.

All components in the Würth Elektronik libraries include the schematic symbol, the PCB footprint and a detailed 3D model for 3D mechanical integration during PCB design.

Würth Elektronik

www.we-online.de

Gore selects Richardson RFPD

as global distributor for its 18 GHz test assemblies

W. L. Gore & Associates has selected Richardson RFPD as the global distributor for its new 18 GHz Gore Phaseflex microwave/RF test assemblies. Specifically engineered for high throughput production test applications, these rugged assemblies deliver consistently precise

and repeatable measurements and reduce operational costs by minimizing requirements commonly found in production testing.

W. L. Gore & Associates

www.richardsonrfpd.com

EBV Elektronik launches evaluation platform

for industrial communications

EBV Elektronik has announced the Caribou board as a development and evaluation platform for industrial communications. It is based on an OMAP L138 / AM1808 ARM microprocessor from Texas Instruments, together with an Altera Cyclone III FPGA and

analog interfaces from Texas Instruments. A range of different field buses and interfaces for industrial communications are available.

EBV Elektronik

www.ebv.com

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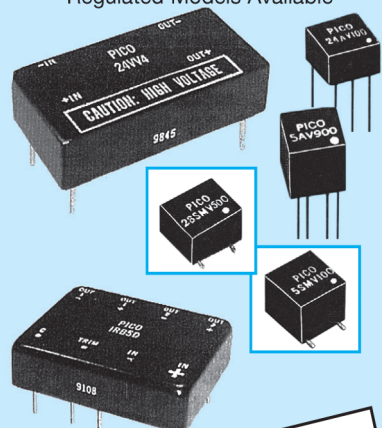
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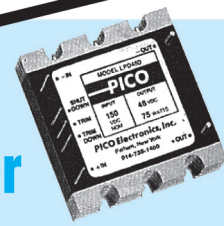
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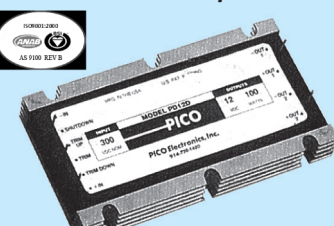


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Are you using live customer data outside of your production database?

By Richard Fine

SAY THAT YOU want to develop a new payment gateway for your online store. A team of developers are hired, the improvements you want are designed, and the new system is created. Finally, you need to test it all, to ensure that the improvements will work the way you intend them to, and also to ensure that all the old payment information still works correctly. What data do you use to test the system?

According to a recent report by the Ponemon Institute, 80% of companies use a copy of their 'live' production data. By 'production data' I mean they take real customer records and real credit card details, and give them to the developers. The developers run all the tests they want, send tests offshore and, once the system is working to an acceptable standard, deploy it and sign off. The test data is usually erased.

It seems obvious, but given that 80% of companies are doing it, maybe it isn't. Given the amount of money most organizations spend to secure their live environments from external threats, it is puzzling that the same companies will take direct copies of these systems and allow them to be used in non-secure environments. Imagine yours and my personal banking information being shared amongst numerous people in test and development teams. A scary thought.

You'd hope that all of your developers are competent, friendly, moral people, but you can't guarantee that. A disgruntled developer could use the data to severely damage your company's reputation and public image. Maybe that's not very likely, you look after your developers, of course, and ensure that they don't end up so antagonistic. But what is likely is that somebody makes a mistake. Maybe somebody accidentally places a real charge on the credit cards, rather than just a virtual charge. Maybe somebody takes a copy of the data onto their laptop to work with it while commuting, and their laptop is stolen. No matter how good your developers are, occasionally, everyone can have a bad day.

However, while you might be willing to

take the risk, the law is not willing to let you. There are a number of regulations governing the way that personal information is handled. Payment card information, for example, is governed by the PCI DSS standard. It dictates the security measures and policies that must be in place, such as encrypting all card data on public networks, and having firewalls and up-to-date antivirus software installed. Other standards include the USA's GLBA for financial data, HIPAA for healthcare information,



“Using live data in non-production is either illegal or expensive”

the UK's data protection act, the European Data Protection Directive, and many others. A common theme across all data protection acts is the principle that data should be kept on a 'need-to-know' basis.

Still, maybe you think you can justify that the developers 'need-to-know' the data, because the systems need to be tested. Even if you successfully argue that, you've then got another problem: now you need to take measures to protect the data on the developer machines, just as you have to for your production database servers. Just because it's 'non-production' doesn't mean it's exempt from the regulations. What does that mean in practice? If you're complying with HIPAA regulations, you have to keep the development offices physically secure, with full sign-in and sign-out logs for developers (HIPAA §164.310), and provide and maintain a full training program to ensure developers are using the data appropriately (HIPAA §164.308 (5)(i)). The PCI DSS will require that your developers

be fully audited (PCI DSS v2 10.2), and that the software they're developing is perpetually secure (PCI DSS v2 6.3), even while it's still in development. The UK Data Protection Act actually states that data may only be used for the specific purposes for which it was collected (DPA98 Sch1 I.2), so unless at the time of collection you tell the user that you'll use their data for testing purposes, then using it at all is a DPA violation.

In short: unless you're taking lengthy and expensive measures to ensure that your development and testing environment is just as secure as your production environment, then it's not legal to use production data in development and testing. What can be done about this?

You've got to test with some kind of data. The most popular approach is data masking. Data masking takes a copy of your live production data, and then de-identifies the sensitive content. The masked data no longer contains sensitive information, and so is not covered by any regulations, and can be freely shared with developers. Data masking is quick and fairly easy to understand, which is why it's a popular method. However, it's not without a fair number of problems, foremost of which is that successfully masking data to the point that sensitive information can't be inferred or deduced is often extremely hard. Likewise, once highly sensitive data is masked to the level where it can never be traced back to individuals or re-engineered, it is pretty much useless. For this reason, there is an alternative called test data creation, which is the automated creation of completely synthetic data; it can mimic your production data, but is not directly derived from it, making it free from regulation.

Using live data in non-production is either illegal or expensive. For the companies using it illegally, it's only a matter of time before somebody slips up and the practice is discovered. For the companies paying extra to keep their developers compliant, they'll find themselves resistant to new development and undercut by companies who've used their data in a strategic way. In the long run, the tiny benefit is just not worth the risk. ■

Richard Fine is a technical writer for Grid-Tools
- www.grid-tools.com

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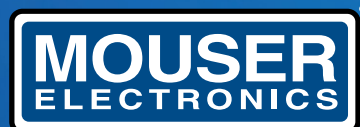
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EUROPEAN MICROWAVE WEEK 2011

THE ONLY EUROPEAN EVENT DEDICATED TO THE MICROWAVE AND RF INDUSTRY

European Microwave Week continues its series of successful events, with its 14th at Manchester Central, Manchester, UK. EuMW2011 returns to this wonderful city for what promises to be an important and unforgettable event. Bringing industry, academia and commerce together, European Microwave Week 2011 is a SIX day event, including THREE cutting edge conferences and ONE dynamic trade and technology exhibition featuring leading players from across the globe.

THE EXHIBITION

Concentrating on the needs of engineers the event showcases the latest trends and developments that are widening the field of application of microwaves. Pivotal to the week is the **European Microwave Exhibition**, which offers YOU the opportunity to see, first hand, the latest technological developments from global leaders in microwave technology, complemented by demonstrations and industrial workshops.

Registration to the Exhibition is FREE!

- **International Companies** - meet the industry's biggest names and network on a global scale
- **Cutting-edge Technology** - exhibitors showcase the latest product innovations, offer hands-on demonstrations and provide the opportunity to talk technical with the experts
- **Technical Workshops** - get first hand technical advice and guidance from some of the industry's leading innovators
- **Three Conferences** - European Microwave Integrated Circuits Conference (EuMIC), European Microwave Conference (EuMC), European Radar Conference (EuRAD)

BE THERE

Exhibition Dates	Opening Times
Tuesday 11th October	09.30 - 17.30
Wednesday 12th October	09.30 - 17.30
Thursday 13th October	09.30 - 16.30

New for EuMW2011 Fast Track Badge Retrieval

Entrance to the Exhibition is FREE and attending couldn't be easier.

VISITORS

Registering for the Exhibition

- Register as an Exhibition Visitor online at www.eumweek.com
- Receive a confirmation email with barcode
- Bring your barcode with you to the Exhibition
- Go to the Fast Track Check In Desk and print out your visitors badge
- Alternatively, you can register Onsite at the self service terminals during the Exhibition opening times.

Please note NO visitor badges will be mailed out prior to the Exhibition.

www.eumweek.com



**EUROPEAN
MICROWAVE
WEEK**
Manchester
9-14 October 2011
www.eumweek.com

EUROPEAN MICROWAVE WEEK 2011

THE CONFERENCES

Don't miss Europe's premier microwave conference event. The 2011 week consists of three conferences and associated workshops:

- The European Microwave Integrated Circuits Conference (EuMIC) - Monday & Tuesday
- The European Microwave Conference (EuMC) - Tuesday, Wednesday, Thursday
- The European Radar Conference (EuRAD) - Thursday & Friday

The three conferences specifically target ground breaking innovation in microwave research through a call for papers explicitly inviting the submission of presentations on the latest trends in the field, driven by industry roadmaps. The result is three superb conferences created from the very best papers, carefully selected from close to 1,000 submissions from all over the world. Special rates are available for EuMW delegates. For a detailed description of the conferences, workshops and short courses please visit www.eumweek.com. The full conference programme can be downloaded from there.

New for EuMW2011

Fast Track Badge Retrieval

Register online and print out your badge in seconds onsite at the Fast Track Check In Desk

Conference Prices

There are TWO different rates available for the EuMW conferences:

- **ADVANCE DISCOUNTED RATE** – for all registrations made online before 9th September
- **STANDARD RATE** – for all registrations made online after 9th September and onsite.

Please see the Conference Registration Rates table on the back page for complete pricing information.

All payments must be in £ sterling – cards will be debited in £ sterling.

Online registration is open now, up to and during the event until 14th October 2011.

DELEGATES

Registering for the Conference

- Register online at www.eumweek.com
- Receive a confirmation email receipt with barcode
- Bring your email, barcode and photo ID with you to the Event
- Go to the Fast Track Check In Desk and print out your delegates badge
- Alternatively, you can register Onsite at the self service terminals during the registration opening times below:
 - from 4pm on Saturday 8th October 2011
 - Saturday 8th October (16.00 – 19.00)
 - Sunday 9th October (07.30 – 17.00)
 - Monday 10th October (07.30 – 17.00)
 - Tuesday 11th October (07.30 – 17.00)
 - Wednesday 12th October (07.30 – 17.00)
 - Thursday 13th October (07.30 – 17.00)
 - Friday 14th October (07.30 – 10.00)

Once you have collected your badge, you can collect the conference proceedings on CD-ROM and delegate bag for the conferences from the specified delegate bag area by scanning your badge.

CONFERENCE PRICING AND INFORMATION

EUROPEAN MICROWAVE WEEK 2011, 9th - 14th October, Manchester, UK

Register Online at www.eumweek.com

ONLINE Registration is open from 6th June, 2011 up to and during the event until 14 October 2011.

ONSITE registration is open from 4pm on 8 October 2011

ADVANCE DISCOUNTED RATE (before 9 Sept), STANDARD RATE (after 9 Sept & Onsite)

Reduced rates are offered if you have society membership to any of the following: EuMA, GAAS, IET or IEEE

EuMA membership costs: Professional: £17/year - Student: £12/year

Reduced rates are also offered if you are a Student/Senior (Full-time students less than 30 yrs of age and Seniors 65 or older as 14 October 2011)

ADVANCE REGISTRATION CONFERENCE FEES (BEFORE 9 SEPT)

CONFERENCE FEES	ADVANCE DISCOUNTED RATE			
	Society Member (*any of above)		Non-member	
1 Conference	Standard	Student/Sr.	Standard	Student/Sr.
EuMC	£350.00	£87.00	£455.00	£113.00
EuMIC	£268.00	£78.00	£348.00	£101.00
EuRAD	£209.00	£76.00	£271.00	£98.00
2 Conferences				
EuMC + EuMIC	£556.00	£165.00	£723.00	£214.00
EuMC + EuRAD	£503.00	£163.00	£654.00	£211.00
EuMIC + EuRAD	£429.00	£154.00	£558.00	£199.00
3 Conferences				
EuMC + EuMIC + EuRAD	£661.00	£241.00	£860.00	£312.00

STANDARD REGISTRATION CONFERENCE FEES (AFTER 9 SEPT AND ONSITE)

CONFERENCE FEES	ADVANCE DISCOUNTED RATE			
	Society Member (*any of above)		Non-member	
1 Conference	Standard	Student/Sr.	Standard	Student/Sr.
EuMC	£455.00	£113.00	£591.00	£146.00
EuMIC	£348.00	£101.00	£452.00	£131.00
EuRAD	£271.00	£98.00	£352.00	£127.00
2 Conferences				
EuMC + EuMIC	£722.00	£214.00	£939.00	£277.00
EuMC + EuRAD	£653.00	£211.00	£849.00	£273.00
EuMIC + EuRAD	£557.00	£199.00	£724.00	£258.00
3 Conferences				
EuMC + EuMIC + EuRAD	£859.00	£312.00	£1,116.00	£404.00

WORKSHOP AND SHORT COURSE FEES (ONE STANDARD RATE THROUGHOUT)

For full details & titles of Workshops & Short Courses, visit www.eumweek.com

FEES	ADVANCE DISCOUNTED RATE			
	Society Member (*any of above)		Non-member	
	Standard	Student/Sr.	Standard	Student/Sr.
1/2 day WITH Conference registration	£70.00	£50.00	£95.00	£70.00
1/2 day WITHOUT Conference registration	£95.00	£70.00	£125.00	£95.00
Full day WITH Conference registration	£100.00	£75.00	£135.00	£95.00
Full day WITHOUT Conference registration	£135.00	£100.00	£175.00	£125.00

Other Items

Proceedings on CD-ROM

All papers published for presentation at each conference will be on a CD-ROM, given out FREE with the delegate bags to those attending conferences. For additional CD-ROMS the cost is £42

DVD Archive EuMC	EuMA Members	Non EuMA Members
DVD Archive EuMC 1969-2003	£8.00	£34.00
DVD Archive EuMC 2004-2008	£30.00	£106.00

Partner Programme and Social Events

For information on and registration to any of these events, please visit www.hotelzon.com/en/uk/events-eumw-pp or email: sally.garland@hotelzon.co.uk

FREE SPECIAL FORUMS & SESSIONS			
Date	Time	Title	Location
Weds 12th	09:00 - 19:00	The 2011 Defence & Security Forum	Charter 1
Thurs 13 & Fri 14th	08:30 - 17:00	Doctoral School of Microwaves	Central Meeting Rm 8