New-Tech Europe December 2016

December
2016

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Intelligent Systems

DragonBoard™ 410c

This DragonBoard™ 410c based on 96Boards™ specification features the Qualcomm® Snapdragon™ 410 processor, a Quad-core ARM® Cortex™ A53 at up to 1.2GHz clock speed per core, capable of 32-bit and 64-bit operation.

More Information

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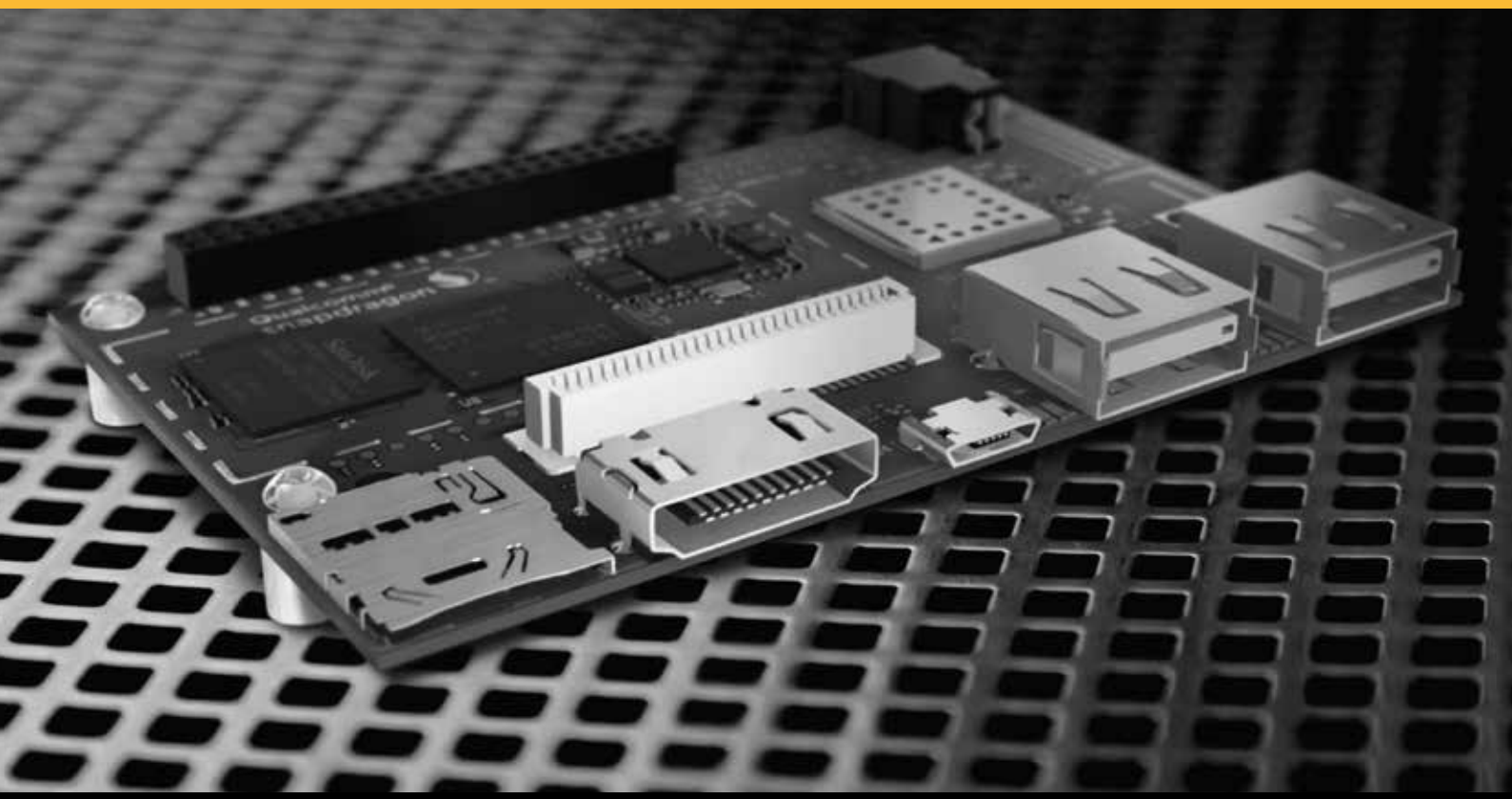
DragonBoard 410c supports Android 5.1 and Linux based on Ubuntu at launch and also support windows10 IoT and offers advanced processing power, WLAN, Bluetooth, and GPS, all packed into a board the size of a credit card. It is designed to support feature-rich functionality, including multimedia, with the Qualcomm® Adreno™ 306 GPU, integrated ISP with up to 13 MP camera support, and 1080p HD video playback and capture with H.264 (AVC).



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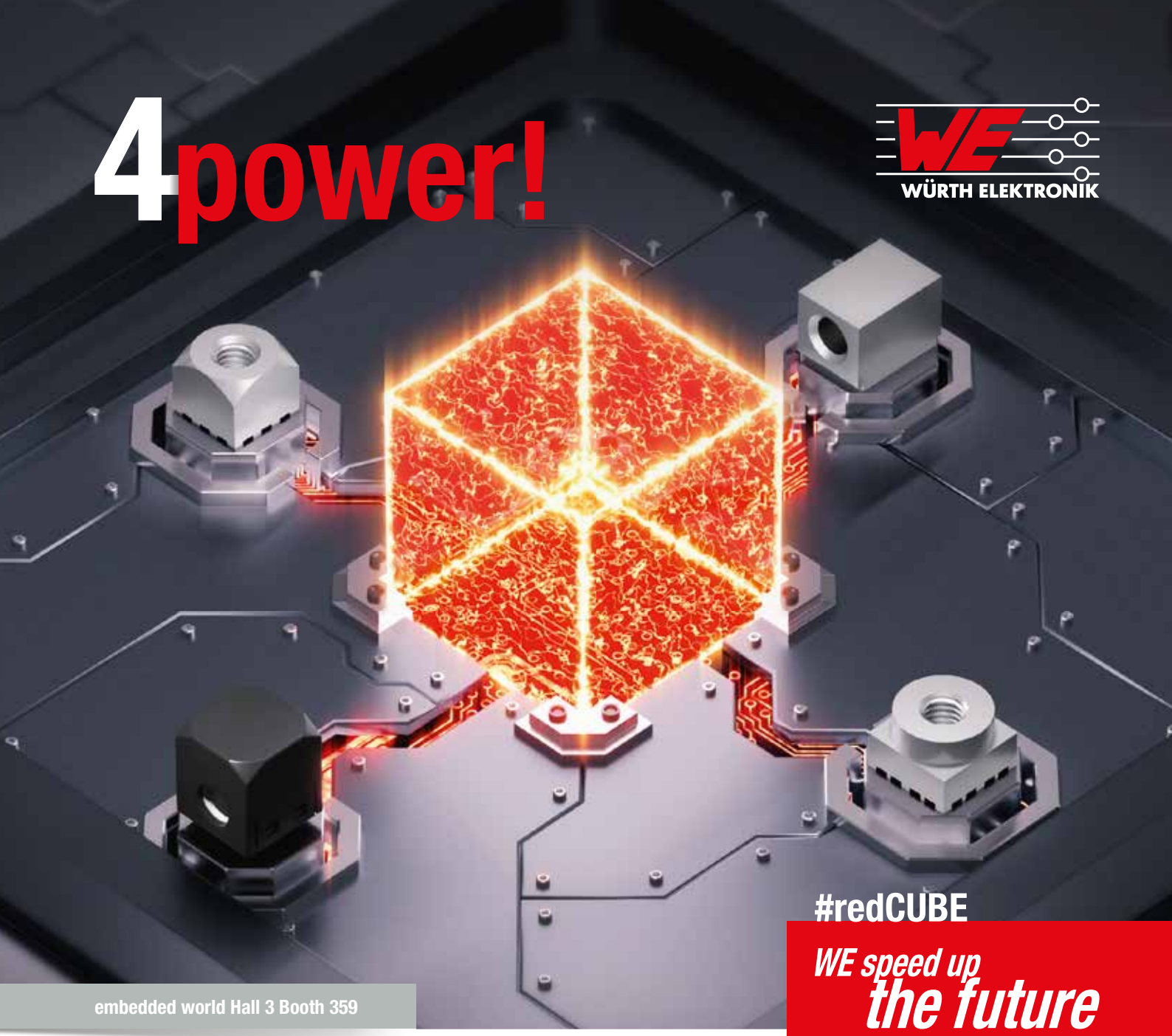

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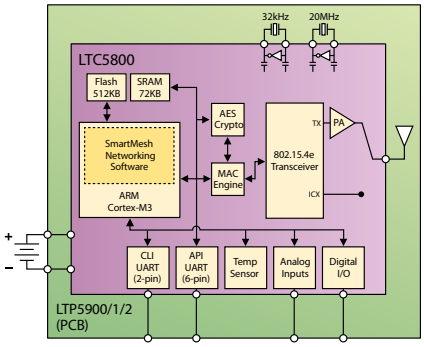

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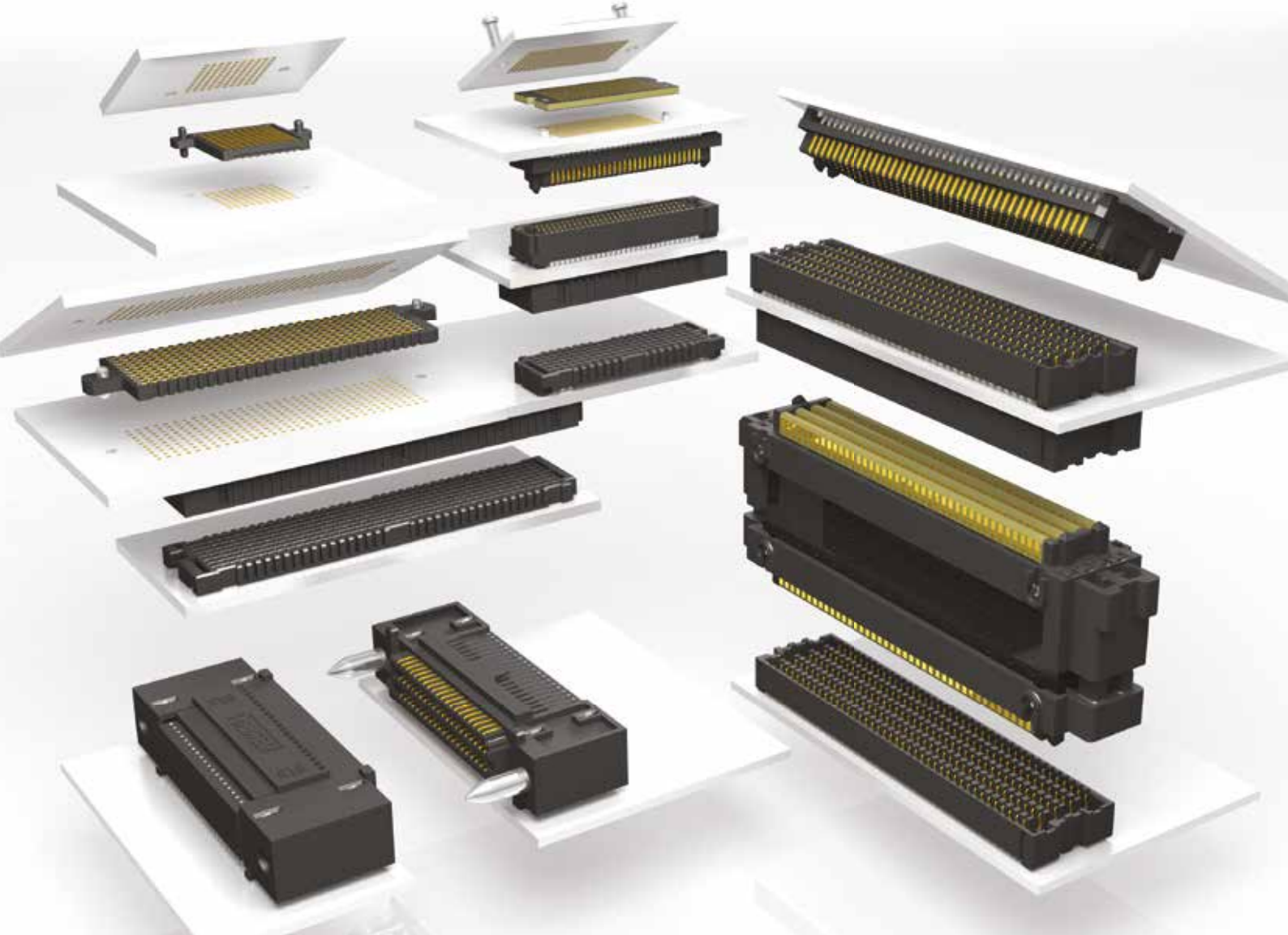

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December 2016

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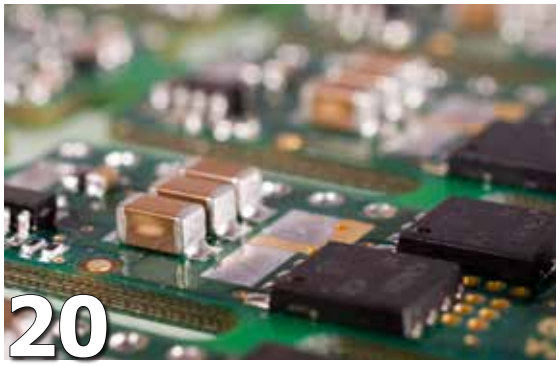


Siemens to host Germany-wide young researchers competition

Siemens partner company for Jugend forscht for third time Germany-wide competition to be held in Erlangen in May 2017 Siemens to honor ten researchers for 558 inventions

Siemens is teaming up for the third time with the Stiftung Jugend forscht to host Germany's best-known youth competition. The company previously hosted the nationwide event in 1976 and 1997. This year's competition, the fifty-second, will be held in Erlangen, Germany, on May 25-28, 2017. The final winners will be selected by a jury from among the 200 winners of statewide contests and presented with their awards on May 28 by the German Minister of Education and Research.

The competition's location is traditionally chosen by the host company. Siemens has opted for Erlangen, a major company location, where it has more than 23,000 employees. The nurturing of young talents has a long tradition in Erlangen, where Siemens employed some 1,000 trainees in fiscal 2016.

As host of the Jugend forscht competition, Siemens is fostering outstanding achievements and abilities in mathematics, computer science, the natural sciences and technology. Frank Anton, who heads the Electric Aircraft Team at Siemens in Erlangen, is the contact and competition officer for aspiring young talents. Anton was himself a Jugend forscht winner in 1975 in the area of technology. Today, he is helping develop electric aircraft drives at Siemens. In 2015, Anton and his team presented a world-record-setting electric motor, which completed its maiden flight in the summer of 2016.

Today, as every year, Siemens will honor in Munich particularly ingenious researchers as Inventors of the Year. The winners of this year's award – ten scientists from Germany, Austria, the U.S and Denmark – are together responsible for some 558 invention disclosures and 597 individual patents.

For this reason, the award, which has been presented to the company's outstanding researchers and developers annually since 1995, has greater importance than ever. New Talents, Outstanding Innovation, Lifework and Open Innovation are the categories in which inventors who have made a major contribution to the company's success will be honored.

For the first time, the prize in the fourth category, Open Innovation, will also be awarded to external researchers. For example, one award will go to Prof. Christian Moser of the Technical University in Graz, Austria. Working with colleagues at Siemens Mobility, he has succeeded in reducing the weight of chassis frames in passenger trains by 50 percent. The company will also honor Dr. Roland Gersch, a former Siemens employee who set up the successful spinoff Caterva, a startup business that now offers energy storage models for private solar systems.

LETI SHOWS THE WAY TO FABRICATING CMOS DEVICES FOR 5-NM NODE USING NANOWIRE TECHNOLOGY BRICKS

Leti, an institute of CEA Tech, presented two papers at IEDM 2016 today that demonstrate its ability to provide industry with all the elements required for building a competitive 5-nm node with nanowire architectures.

Nanowire architectures are seen as the best candidates for that node, and Leti is addressing some of its biggest challenges, such as of performance and parasitic capacitances. Its results suggest that strain can be introduced into stacked nanowire and that parasitic capacitances can be reduced thanks to inner spacer

integration.

The paper, "Vertically Stacked-Nanowires MOSFETs in a Replacement Metal Gate Process with Inner Spacer and SiGe Source/Drain", is the first demonstration of functional devices with SiGe source and drain to induce strain in the channel to boost performance, and inner spacer to reduce parasitic capacitances. Both building blocks are required for the 5-nm node. This MOSFET architecture extends the scaling limits of CMOS technology, and is also seen as a possible extension to FinFET.

Leti, at IEDM 2008, was among the world's first organizations to report stacked nanowire and nanosheet results.

The second paper, "NSP: Physical Compact Model for Stacked-planar and Vertical Gate-All-Around MOSFETs", presents a predictive and physical compact model for nanowire and nanosheet gate-all-around MOSFETs.

"This is the first compact model, or SPICE model, that can simulate stacked nanowire and nanosheet devices with various geometries," said Olivier Faynot, Leti's microelectronics section manager and a co-author of both papers. "It also enables the simulation of vertical nanowire, which is one of the key achievements of this model."

The paper presents a physically based SPICE model for stacked nanowires that can enable circuit designers to accurately project their existing circuits into the 5-nm node, and investigate novel designs.

Tokyo Institute of Technology research: 3D solutions to energy savings in silicon power transistor

Tokyo Tech researchers demonstrate operation energy-savings in a low price silicon power transistor structure by scaling down in all three dimensions.

In electronics, lower power consumption leads to operation cost savings, environmental benefits and the convenience advantages from longer running devices. While progress in energy efficiencies has been reported with alternative materials such as SiC and GaN, energy-savings in the standard inexpensive and widely used silicon devices are still keenly sought. K Tsutsui at Tokyo Institute of Technology and colleagues in Japan have now shown that by scaling down size parameters in all three dimensions their device they can achieve significant energy savings.

Tsutsui and colleagues studied silicon insulated gate bipolar transistors (IGBTs), a fast-operating switch that features in a number of every day appliances. While the efficiency of IGBTs is good, reducing the ON resistance, or the voltage from collector to emitter required for saturation (Vce(sat)), could help increase the energy efficiency of these devices further.

Previous investigations have highlighted that increases in the "injection enhancement (IE) effect", which give rise to more charge carriers, leads to a reduction in Vce(sat). Although this has been achieved by reducing the mesa width in the device structure, the mesa resistance was thereby increased as well. Reducing the mesa height could help counter the increased resistance but is prone to impeding the (IE) effect. Instead the researchers reduced the mesa width, gate length, and the oxide thickness in the MOSFET to increase the IE effect and so reduce Vce(sat) from 1.70 to 1.26 V. With these alterations the researchers also used a reduced gate voltage, which has advantages for CMOS integration.

They conclude, "It was experimentally confirmed for the first time that significant Vce(sat) reduction can be achieved by scaling the IGBT both in the lateral and vertical dimensions with a decrease in the gate voltage."

Background

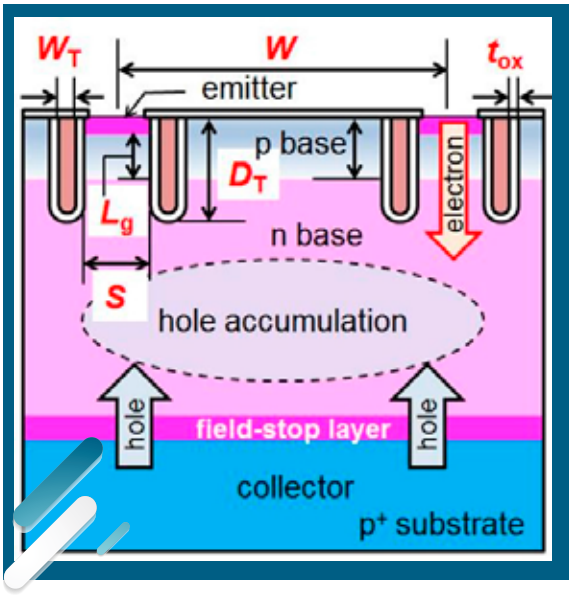
Insulated gate bipolar transistors (IGBTs)

These are three terminal devices used as switches or rectifiers. With simple gate-drive characteristics and high-current and low-saturation-voltage capabilities they combine the benefits of two other types of transistors – metal-oxide-semiconductor field effect transistors (MOSFETs) and bipolar transistors.

3D scaling of IGBTs

The researchers reduced the mesa width, gate length, and the oxide thickness in the MOSFET by a factor of 1/k, and compared devices with values of 1 and 3 for k. Because the fabrication of narrow mesas can cause problems

they also reduced the trench depth by 1/k. Although this has a slightly negative effect on the IE effect, it has considerable benefits for fabrication ease and cost and the dependence of (Vce(sat)) on the trench depth was deemed to be small. The gate voltage was also decreased by a factor of 1/k, while the cell pitch was maintained at 16 µm.



Reference

K. Kakushima1, T. Hoshii1, K. Tsutsui1, A. Nakajima2, S. Nishizawa2, H. Wakabayashi1, I. Muneta1, K. Sato3, T. Matsudai4, W. Saito4, T. Saraya5, K. Itou5, M. Fukui5, S. Suzuki5, M. Kobayashi5, T. Takakura5, T. Hiramoto5, A. Ogura6, Y. Numasawa6, I. Omura7, H. Ohashi1, and H. Iwai1, Experimental verification of a 3D scaling principle for low Vce(sat) IGBT, Technical Digest of IEDM2016, Session 10.6, (2016), http://ieee-iedm.org/

1. Tokyo Inst. of Technology, Yokohama, Japan
2. Nat. Inst. Advanced Industrial Science and Technology, Tsukuba, Japan
3. Mitusbishi Electric, Fukuoka, Japan
4. Toshiba Corp., Tokyo, Japan
5. The University of Tokyo, Tokyo, Japan
6. Meiji University, Kawasaki, Japan
7. Kyushu Inst. of Technology, Kitakyushu, Japan

Advantest Unveils New Pick-and-Place IC Handler to Improve Efficiency in High-Volume Semiconductor Manufacturing and Device Characterization

Leading semiconductor test equipment supplier Advantest Corporation (TSE: 6857) has introduced its M4872 pick-and-place handler to improve productivity in testing system-on-chip (SoC) devices in high-volume manufacturing (HVM) and device characterization pre-production environments. This helps users to keep pace with the rapidly changing SoC market and quickly adapt to changes in device technology.

The new handler matches all of the leading-edge performance specifications of its predecessor, the M4871 handler, including throughput of up to 15,000 units per hour, in a footprint that is approximately 10 percent smaller. The portable M4872 handler has advanced vision-alignment capabilities and can accommodate an optional active thermal control system.

The vision alignment-equipped M4872 incorporates a common change kit, which saves time and money as well as helps to safeguard devices under test from potentially damaging package. Using a common change kit also significantly shortens time to market. In total, the time it takes to change device types is reduced by more than 45 percent, enabling nearly twice the throughput of handlers that rely on standard change kits.

By using Advantest's on-the-fly vision-alignment technology, devices under test can be precisely positioned, making the new handler ideally suited for testing fine-pitch ICs and devices with both top- and bottom-side contacts. The resulting improvements in test yields

and cycle times contribute to higher overall productivity.

The M4872 includes an automatic re-test function that transfers all failed ICs into the loader stocker, helping to avoid time-consuming operator assistance. Compared to handlers that require operator intervention for re-testing, the M4872 can reduce lot test times by 20 percent or more, increase daily output by more than 25 percent and lower the number of test systems needed.

In addition, the handler's optional active thermal control unit deploys efficient heating/cooling to maintain set point temperatures within 1°C over the range of -45° C to 125° C while achieving fast temperature ramp times. Both electric and air capacity requirements are reduced, helping users to be more efficient in facility management.

The scalable M4872 handler is compatible with the V93000 platform and the new T2000 AiR system, designed for low-cost testing in R&D and high-mix, low-volume production. Handler operation is made simple by a user-friendly GUI with pre-defined functions.

"With this new handler, we are continuing to help our customers improve their HVM operations, increase their overall equipment effectiveness and reduce time to market for new device designs," said Hiroki Ikeda, factory automation division manager at Advantest.

Commercial units of the M4872 handler are scheduled to begin shipping to customers by the end of this calendar year.

VOKE, an Intel Company, and NFL to Make Game Highlights Available in Virtual Reality

VOKE, an Intel company and a leader in live event virtual reality, and the National Football League announced today a collaboration to create a personalized, fully immersive virtual reality highlights experience for fans worldwide using VOKE's TrueVR™ technology.

This month, VOKE will produce highlights in virtual reality from four NFL games that will allow fans to be transported onto the field no matter where they are.

Fans were able to experience in-game and postgame highlights for the following games:

Denver Broncos vs. Jacksonville Jaguars, Dec. 4

New Orleans Saints vs. Tampa Bay Buccaneers, Dec. 11

Jacksonville Jaguars vs. Houston Texans, Dec. 18

Dallas Cowboys vs. Philadelphia Eagles, Jan. 1, 2017

Intel acquired VOKE last month as part of Intel's digitization of sports strategy. The acquisition is part of Intel's ongoing work with leagues and teams across the globe to reinvent the way we experience sports. The company is building out a portfolio of technologies including virtual reality, 360-degree replay and analytics technologies that will immerse fans in the action of their favorite sport.

"Through this deal with VOKE - the newest members of our Intel family - and the NFL, we're transporting fans right into the heart of the action during the homestretch of the season," said James Carwana, general manager of the Intel Sports Group. "This immersive content will offer customization and personalization like we've never experienced before, and I believe NFL fans are going to be absolutely captivated by what they see."

"We are committed to building unprecedented user experiences and completely changing the way fans engage around live events," VOKE co-founder Sankar Jayaram said. "The popularity and passion for the NFL is global and fans want to be a part of it. Through the power of our technology we are able to provide fans with the most personalized, immersive experiences from anywhere in the world."

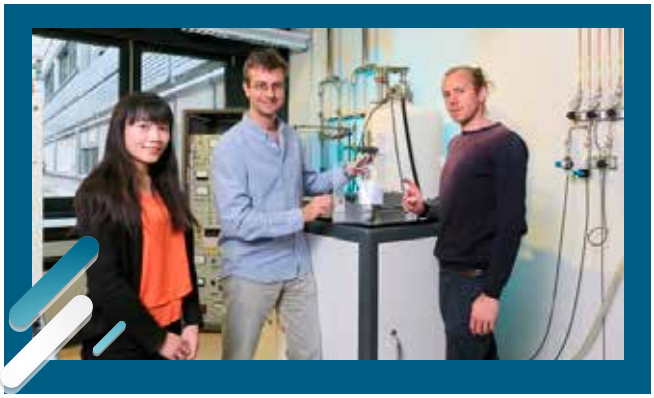
Fans will be able to access the NFL VR experience for free in the NFL channel within the VOKE app. For details on how to access the VOKE app, go to vokevr.com/experiencevr.

For more information, read the announcement from the NFL and VOKE.

An innovative window system earns a European patent

A window-glazing system developed by an EPFL team uses micro-mirrors to improve the lighting and visual comfort inside buildings and could also make window blinds obsolete one day. The European Patent Office has just granted the system patent protection.

Are window blinds about to become a thing of the past? They just might, thanks to a ground-breaking window glazing system developed by a team at EPFL's Solar Energy and Building Physics Laboratory (LESO-PB). The innovation's quality and potential have also now been recognized by the European Patent Office, which has granted it patent protection.



Jing Gong, Andreas Schüler and André Kostro with a prototype of the window-glazing system. © Alain Herzog - 2016 EPFL

"This patent shows that our approach is original and that our system is unique and merits patent protection," says Andreas Schüler, a research associate at the LESO-PB. "It's also reassuring for industry, in the event manufacturers want to use this discovery in the future." Schüler designed the system together with PhD student Jing Gong and André Kostro, a researcher currently based in Basel.

Schüler's team fitted their windows with a layer of micro-mirrors whose thickness ranges from 0.15 to 0.2 millimeters. This allows the windows to make better use of natural light in the room and reduce both heating and cooling costs in the building. In the summer, the micro-mirrors reflect light back outward, which eliminates direct sunlight and overheating. In the winter, the micro-mirrors redirect light into the building to improve the occupants' visual comfort.

A high-precision laser is used to cut the micro-mirrors, which are then embedded in a polymer film that is placed between the layers of double-glazed windows. "The challenge was ensuring that the windows remained transparent despite the layer of micro-mirrors," says Schüler. These windows are meant for building facades that are highly exposed to the sun. The design process took into account the need to keep costs down and enable large-scale production.

Improved visual comfort

This smart-glazing system offers other advantages as well. Preliminary hypotheses developed by the LESO-PB suggest that the system could reduce the thermal load (both heating and cooling) by 10%-20% compared to traditional window glazing. It can improve visual comfort as well by distributing light evenly throughout the room and eliminating sharp contrasts and glare. It also brings in a higher amount of light: up to 150% more light reaches the back of the room and up to three times as much hits the ceiling. Finally, the system was designed to last longer than traditional slatted venetian blinds.

But will people get used to this new system? The answer will come from the NEST in Dübendorf (Zurich Canton), a futuristic house where the LESO-PB's innovation will soon be put to the test.

This project was developed with the support of the Swiss Federal Office of Energy (SFOE).

Reference:

Jing Gong, André Kostro, Ali Motamed, Andreas Schüler, Potential advantages of multifunctional complex fenestration system with embedded micro-mirrors in daylighting, Solar Energy, 10 October 2016.

A European Defence Action Plan and "Clean Energy for All Europeans"

The Commission proposes a European Defence Fund as part of today's Defence Action Plan. The purpose of the "Clean Energy for All Europeans" package is to put energy efficiency first, achieve global leadership in renewable energies and provide a fair deal for consumers.

The European Defence Action Plan adopted by the Commission today is about creating the conditions for more defence cooperation to maximise the output and the efficiency of defence spending, and about fostering a strong, competitive and innovative defence industrial base. Member States will remain in the driving

seat when deciding on which technologies and assets to invest in, and will retain ownership of the defence capabilities.

In the context of the Action Plan, the Commission proposes a European Defence Fund which would include two "windows" which are complementary but different in their legal structure and budget sourcing.

The "research window" would fund collaborative research in innovative and strategic defence technologies. The Commission has already proposed EUR 25 million for defence research as part of the 2017 EU Budget and expects that this allocation could grow to a total of EUR 90 million until 2020. Under the post-2020 EU multiannual financial framework, the Commission intends to propose a dedicated defence research programme with an estimated amount of EUR 500 million per year The "capability window" would act as a financial tool allowing participating Member States to purchase certain assets together to reduce their costs. This window should be able to mobilise about EUR 5 billion per year.

The European Defence Action Plan also proposes to foster investments in SMEs, start-ups, mid-caps and other suppliers to the defence industry and to strengthen the Single Market for defence. It will foster the competitiveness of the European defence industry.

Over the last decade EU Member States have decreased defence spending by nearly 12% in real terms, but this has not been compensated by more European cooperation. The lack of cooperation between Member States in the field of defence and security is estimated tocost annually between EUR 25 billion and EUR 100 billion More Europe in defence will have a positive spill-over effect on the European economy. The European defence industry generates a total turnover of €100 billion per year and 1.4 million highly skilled peopled directly or indirectly employed in Europe. Each euro invested in defence generates a return of 1,6, in particular in skilled employment, research and technology and exports.

The European Commission today presents a package of measures to keep the European Union competitive as the clean energy transition is changing the global energy markets.

The European Commission wants the EU to lead the clean energy transition, not only to adapt to it. For this reason the EU has committed to cut CO2 emissions by at least 40% by 2030 while modernising the EU's economy and delivering on jobs and growth for all European citizens.

Today's proposals have three main goals:

putting energy efficiency first, achieving global leadership in renewable energies, and providing a fair deal for consumers.

Consumers are active and central players on the energy markets of the future. Consumers across the EU will in the future have a better choice of supply, access to reliable energy price comparison tools and the possibility to produce and sell their own electricity. Increased transparency and better regulation give more opportunities for civil society to become more involved in the energy system and respond to price signals. The package also contains a number of measures aimed at protecting the most vulnerable consumers.

The Clean Energy for All Europeans legislative proposals cover energy efficiency, renewable energy, the design of the electricity market, security of electricity supply and governance rules for the Energy Union. In addition the Commission proposes a new way forward for Ecodesign as well as a strategy for connected and automated mobility.

The package also includes actions to accelerate clean energy innovation and to renovate Europe's buildings. It provides measures to encourage public and private investment, promote EU industrial competitiveness and mitigate the societal impact of the clean energy transition. We are also exploring ways in which the EU can show further leadership in clean energy technology and services to help third countries achieve their policy goals.

NFU Mutual selects BAE Systems to safeguard against fraud

BAE Systems has teamed up with NFU Mutual to provide the insurance firm and its customers with comprehensive protection across underwriting, claims and financial crime services.

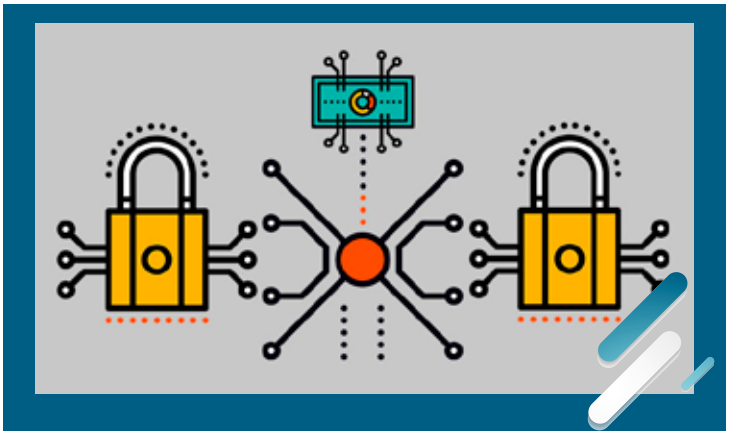
The contract will commence in 2017 and see BAE Systems' financial crime division provide NFU Mutual with a counter fraud solution that will detect and prevent financial crime throughout the customer lifecycle and across the business.

The partnership will enable NFU Mutual to exploit external and internal data sources to accurately identify fraudsters at the point of sale and point of claim, whilst ensuring customers are fast-tracked through the policy

application and claims processes.

George Robbins, VP EMEA, Commercial Solutions at BAE Systems Applied Intelligence, said:

"We will be working with NFU Mutual to help it deliver on its zero tolerance approach to fraud and financial crime by implementing faster and more accurate fraud detection, using the best data at the right time in the right way.



"Many businesses work in silos, which often means teams not only operate using different systems and technologies, they also duplicate effort and costs. By consolidating NFU Mutual's operations into a single group fraud and financial crime platform we can improve controls on financial crime and fraud detection.

"The decision to work with BAE Systems came from a recognition that we are able to provide a system that is proven within the insurance industry and which can be tailored towards the specific needs required for NFU Mutual. This, coupled with BAE Systems extensive data partnerships, enables us to create a platform which combines high quality analytics and data sources ultimately maximising value for NFU Mutual."

Steve Bower, Customer Services Director at NFU Mutual, said:

"The partnership with BAE Systems will help us continue to take a tough stance on fraud, while maintaining the first class levels of customer service that our members have come to expect. By embedding these new advanced capabilities across claims, underwriting and financial crime, we are tackling fraud more effectively and ultimately providing greater value to our members."

Milestone Aviation Names Daniel Rosenthal President and CEO

Milestone Aviation Group Limited ("Milestone"), a GE Capital Aviation Services company ("GECAS") and the global leader in helicopter leasing, today announced that President Daniel Rosenthal has been named President and Chief Executive Officer, effective January 1, 2017. Richard Santulli, GE Officer and Milestone Chairman, will leave GE but continue to serve Milestone in an advisory capacity.

Rosenthal, 41, has spent most of his career in leadership positions at some of the most innovative organizations in the aviation industry. In 2009, he co-founded Milestone, the first global helicopter leasing company. He previously spent four years at NetJets, where he held various leadership roles.

"Dan has been an outstanding company president and a strong leader since GE acquired Milestone in 2015, and this appointment reflects the great value he continues to create for Milestone and its partners," said Alec Burger, President and CEO of GECAS. "Milestone is the leader in helicopter financing because of the dedication Dan and his entire talented management team bring to their work serving customers and partners around the world. As the global helicopter industry continues to evolve, I am confident that Dan and his team have the skills and experience Milestone will need to continue as the industry leader."

Santulli, 72, is a visionary entrepreneur, businessman, and founding father of two major aviation industries. In 1986, he launched the first-ever fractional aircraft program, which he later named NetJets, and in 2009 he left NetJets to co-found Milestone.

"One of the greatest fortunes of my life was meeting Richard Santulli nearly 13 years ago," said Rosenthal. "It has been an honor to learn from Rich both at NetJets and as we built Milestone and established a critical new industry. Rich is an industry icon and set the standard for all of us at Milestone by creating a world-class culture for customers and employees. Looking forward, we will always carry with us his entrepreneurial spirit and dedication to providing our customers with creative aircraft financing solutions through unparalleled customer service. Beyond the business side, Rich is a close confidante, mentor and friend, and I'm delighted that he will continue as a Milestone advisor."

"It has been a pleasure working alongside Dan to build Milestone," said Santulli. "Together, he and the rest of our talented management team have created an incredible company committed to serving the needs of our customers and partners around the world. As company president, Dan's day-to-day leadership since joining GE Capital has ensured that Milestone stayed true to our core values. This is the right time for me to move into an advisory role and pursue other business opportunities, and I know Dan will continue to lead the company in our tradition of creative, flexible service to our clients."

"Milestone has succeeded because it has always put its customers and partners first," said Burger. "On behalf of GE, I want to express our gratitude to Rich for building a truly unique company with a powerful, customer-focused culture. The creative and entrepreneurial approach he instilled in Milestone will continue to drive its success and is an inspiration to the entire GE Capital team."

Student's award-winning graphene battery could slash electric-car charging times

A student engineer from the University of Sussex has won a national car industry award for designing a new battery that could revolutionise electric vehicles.

Josh de Wit, a second-year mechanical engineering student, has won the Autocar-Courland Next Generation Award for 2016 with a concept that could dramatically reduce charging times for electric vehicles.

This is a massive problem for the motor industry, with many considering the battery to be the biggest obstacle to electric cars going mainstream. Existing batteries are big and heavy, take a long time to charge and run out quickly.

Josh enjoys a selfie with James May and Richard Hammond from Amazon's The Grand Tour

Josh's design harnesses the remarkable qualities of graphene, a form of pure carbon in sheets that are just one atom thick.

A car battery made with stacked graphene, says Josh, would take far less time to charge, store more energy and be cheaper, stronger and lighter than existing products.

This is because graphene has incredible conductivity, lightness and strength, and you would need to use far less of it than traditional materials.

Josh, who studies in the University's School of Engineering and Informatics, is currently on placement with electric-motor company YASA. In the spring, he will begin a six-month work experience tour of some of the biggest names in the motor industry, including Honda, Jaguar Land Rover, McLaren, Nissan, Peugeot and Toyota.

He is also working with the University's business incubator, Sussex Innovation, to develop a prototype and bring his stacked-graphene battery concept to market.

He said: "From the outset, this has been a challenging but rewarding experience and the mentoring programme has really helped me to develop my idea and push myself further.

"I'm now excited at the prospect of working with some of the world's most renowned vehicle manufacturers, experience which I've no doubt will stand me in excellent stead for carving out a career after university."

Autocar editor-in-chief Steve Cropley said: "If this award is anything to go by, the future is certainly bright for the automotive industry."

Image: Josh enjoys a selfie with James May and Richard Hammond from Amazon's The Grand Tour

By: James Hakner

Digi-key and the European Electronic Market

› Tatiana Yamin, New-Tech Europe

At the 'electronica 2016' in Munich we got a few minutes to sit down for an interview with Tom Treichl, Digi-key's Senior Director of Production Business.

Q: What is your forecast for Digi-Key's growth in the next few years?

A: We expect to continue along the same course. We see an increase in our customer's account, and intend to broaden our supply base even further, in order to target a wider range of customers. This development continues as we move into 2017. Specifically in the European market, we have seen a nice growth over the years. Despite a small 'hiccup' last year, due to many currency headwinds, we are back on track, and should see over 20% growth this year in EMEA.

Q: What are Digi-Key's unique strengths in the global marketplace?

A: I believe that Digi-Key has three main strengths that draw customers worldwide: our inventory, which is the largest, most diversified of its kind in the world; our website, offering huge quantities of information, as well as great mix of products; and our highly popular EDA engineering tools. Digi-Key is definitely committed to the engineering community and enhancing our digital relationship. Many engineers say they like our website because it is so user-friendly, and we see that our website traffic has increased. I just came out of a meeting with a customer who said: "If it's not on the Digi-Key's website, we won't use it for our design." To me this just about says it all…

Tom Treichl, the Senior Director of Production Business

Q: How is Digi-Key handling the rise of automotive & IoT?

A: We are hosting more suppliers to support these new initiatives. This is particularly important because of the high electronic content in automotive and IoT products. A main part of our inventories already addresses these areas, and we will continue to expand these offerings next year.

Q: How has Digi-Key been affected by the recent mergers and acquisitions in the electronic market?

A: Every day when we wake up there is another merger or acquisition. Since most of the acquired or merging suppliers are already part of our current line, this is very good for us.

When companies merge, naturally there is going to be some rationalization of their product offering. Even if certain products are discontinued, Digi-Key's inventory is broad and deep enough to support these changes. In addition, we expect some of the initiatives from our supply base to steer us in the direction we want to go in our marketing campaigns. With regard to pricing, I can say that it is really at the suppliers' discretion. Sometimes merging companies tweak their pricing. As to the overall effect on the market, I think it is too soon to tell.

Power Modules - In Search of a Winning Combination

› Jon Cronk, Exar Corporation

Equipment designs increasingly utilize advanced MCU, DSP and FPGA devices to deliver the functionality and performance demanded of them. With this sophistication comes the challenge of providing the multiple power rails these devices require. The use of carefully chosen power modules can significantly ease this task and allow system designers to get to market on time and without compromise.

A quick examination of almost any piece of industrial and telecommunications equipment will clearly show that it requires a large number of individual DC bus voltages operating at different currents to provide power to all the sub-circuits in the design. Each DC bus voltage is typically supplied by a DC-DC switching regulator or an LDO that has to fit in ever smaller PCB footprints and yet meet tighter and more demanding performance specifications relating to efficiency, input and output voltage regulation, and operating temperature, to mention a few. These specifications are necessary to ensure the equipment can operate for longer, run cooler and achieve higher reliability. In order to design these converters in-house, electronic equipment companies must employ highly qualified and experienced power engineers and, depending on the number of converters needed, allow sufficient time in the project schedule for the design and prototyping of the power system, including full test and verification. This is a process that is expensive and time consuming, impacting both the project budget and time-to-market in a very competitive market where time and cost are rare commodities.

A "Wish List" for the ultimate power system design

From a cursory analysis of subsystem power requirements it is a short step to identifying a wish list for an ideal power delivery solution, which must:

1. Meet the most stringent specifications of the subsystem, e.g. voltage tolerance.
2. Operate with the highest possible efficiency - this allows battery-powered devices to last longer and reduces power dissipation so that devices can run cooler and be more reliable. Every 10□C rise in operating temperature halves the Mean Time Between Failure (MTBF).
3. Provide excellent transient response for FPGA and CPU operation to avoid spurious operation caused by false clocking or incorrect power sequencing.
4. Offer a programmable output

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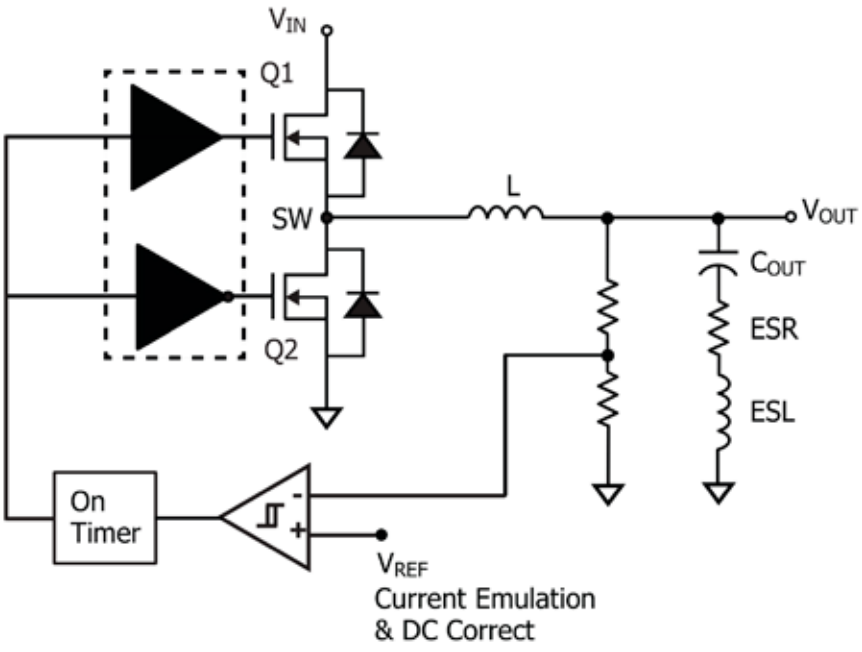


Figure 1: Simplified functional circuit schematic of a COT buck (step-down) switching regulator

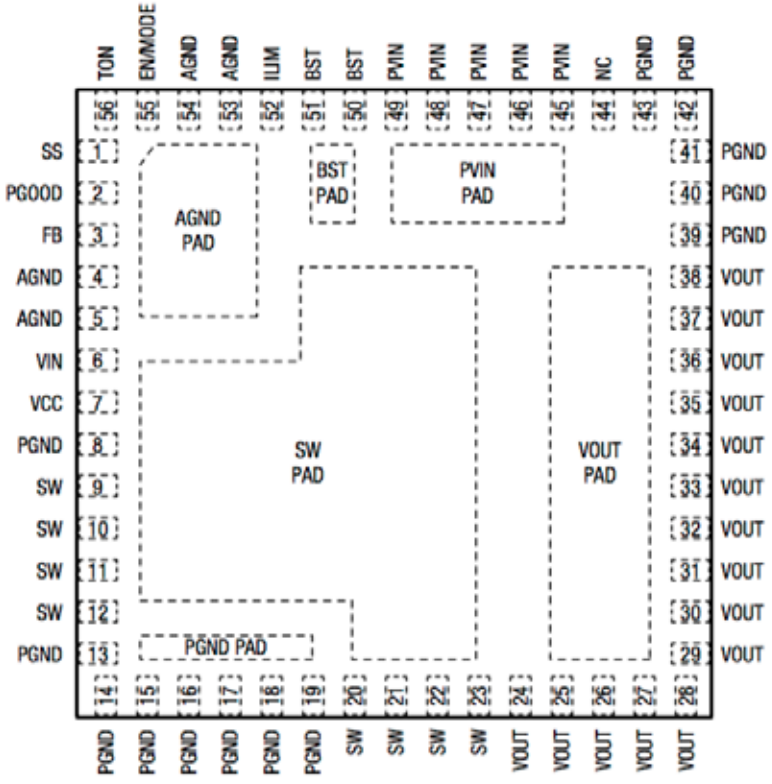


Figure 2. The QFN package used for Exar's XR79106 power module provides pads that ensure excellent thermal conductivity

voltage and switching frequency, and provide protection against over current and over voltage conditions.

5. Ideally require no external compensation - this can otherwise be a time consuming task to ensure design stability over worst-case conditions of input/output voltages and load currents.

6. Provide a solution that can fit in tight spaces without compromise.

7. Achieve "plug-and-play" simplicity, requiring no system troubleshooting once the PCB is properly designed.

8. Achieve all of the above objectives at a low cost in medium to large volumes.

The significance of these points can be appreciated by considering a modest subsystem that needs to provide five rails with output voltages ranging from 0.6V to 3.3V and operate from an input voltage of 5V 20V. A buck (step-down) DC-DC converter might typically be used to generate each of these rails, as illustrated by the simplified functional schematic in figure 1. But, implemented as a discrete solution, such a design can easily take from two to four months, with a good part of the time spent ensuring that the stability of the control loops and the resulting transient response of the outputs can be unconditionally guaranteed over worst case temperature conditions and across the 6 sigma distribution of discrete component parameter values. This length of time, in some cases, can make or break the chance of a new product making it to market ahead of the competition.

Greater integration helps

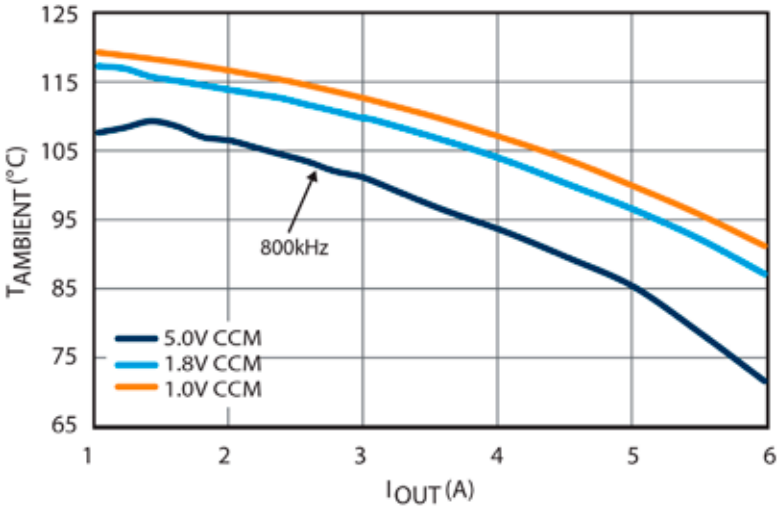


Figure 3. Thermal derating curve for Exar's XR79106 power module at VIN = 12V

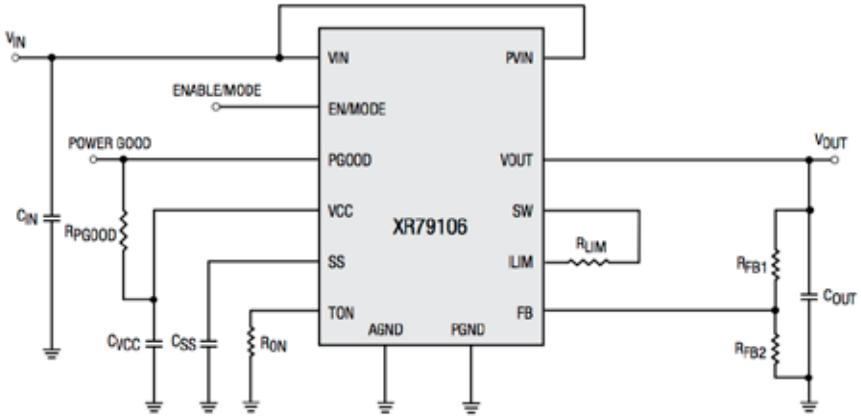


Figure 4. Power modules require just a few external housekeeping components and full details of how to calculate the values of these are provided in the datasheet

but is trumped by a module

Today many semiconductor companies provide DC-DC converter solutions that integrate many of the control elements of a switching regulator, such as the compensation amplifier and the ramp generator and comparator, which form the pulse-width modulator that controls the power switch. However this still leaves the MOSFET, LC output filter and most of the passive compensation feedback components off-chip. These components need to carefully chosen and their operation modeled, which even using the design tools many vendors offer is still time-consuming. Far better, especially for system designers who are not power experts, is to use power modules that integrate the PWM controller, MOSFET power switches and inductor in a single small form-factor package. These modules are typically designed, optimized and tested by a multi-disciplinary team of engineers who are each experts in their own field. Consequently this provides the application design engineer with a device that delivers superior performance, high reliability and the benefit of immediate availability, cutting down the time to market by several months.

Good examples of these devices are the latest members of Exar's expanding family of modules; the XR79103/06 and XR79203/06 deliver 3A and 6A outputs at voltages down to 0.6V from input supplies of up to 22V and 40V respectively.

What do these modules offer?

Implemented as synchronous step-down buck converters, these power modules employ a proprietary emulated current-mode Constant On-Time (COT) control loop. They require no external loop compensation and are unconditionally stable using ceramic output capacitors and operate at near-constant switching frequency, requiring very few external housekeeping components. The wide input voltage range allows the XR79103/06 to operate from industry standard 5V, 12V and 19.6V rails while the XR79203/06 can cope with standard 24V and 18-36V DC rails, and also rectified 18VAC and 24VAC rails.

Consequently these modules not only fulfill the earlier wish list, which

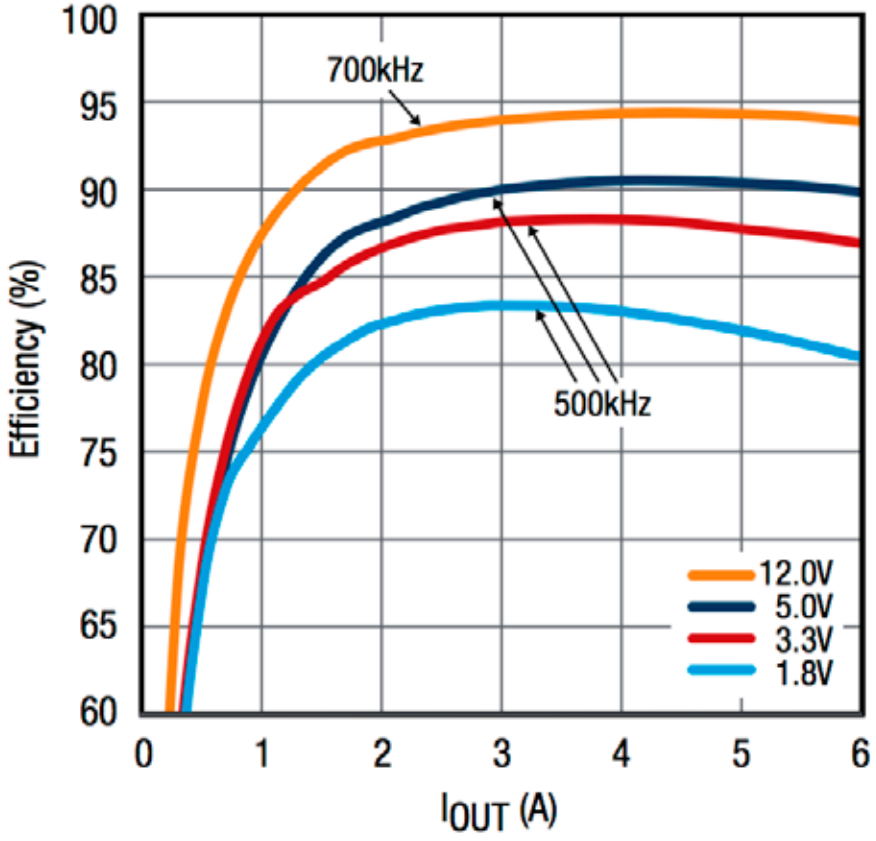


Figure 5. The XR79206 achieves nearly 95% efficiency at 700kHz switching frequency and VIN = 24V

was key to their design brief and hence the requirements of modern electronic equipment, but do so at a competitive price.

Modules do not have to be a compromise

The controllers used in Exar's power modules offer the same performance as their IC counterparts and provide exceptional line and load regulation. Furthermore, to achieve maximum efficiency at both ends of the output current range, operation can be switched from the regular constant current mode (CCM) to discontinuous conduction mode (DCM) to save power at light load currents. These modules also provide all the usual protection features, such as over current, over temperature, short circuit and under voltage lockout, to ensure safe operation under abnormal operating conditions. Additional features include: programmable soft-start, a programmable hiccup current limit with thermal compensation, flags for Power-Good and Precision Enable, and an integrated bootstrap diode.

Where the module approach really wins out is in integrating the control IC, with its rich feature set, together with the power train components, which have been selected for optimal switching performance, in one very small, cost-effective package. The QFN packages used for these modules (see figure 2) include large pads that connect to key nodes in the power train, ensuring good Ohmic contact and minimizing EMI. These pads also provide excellent heatsinking for the module, which result in the package's low junction-to-case thermal resistance and superior thermal performance.

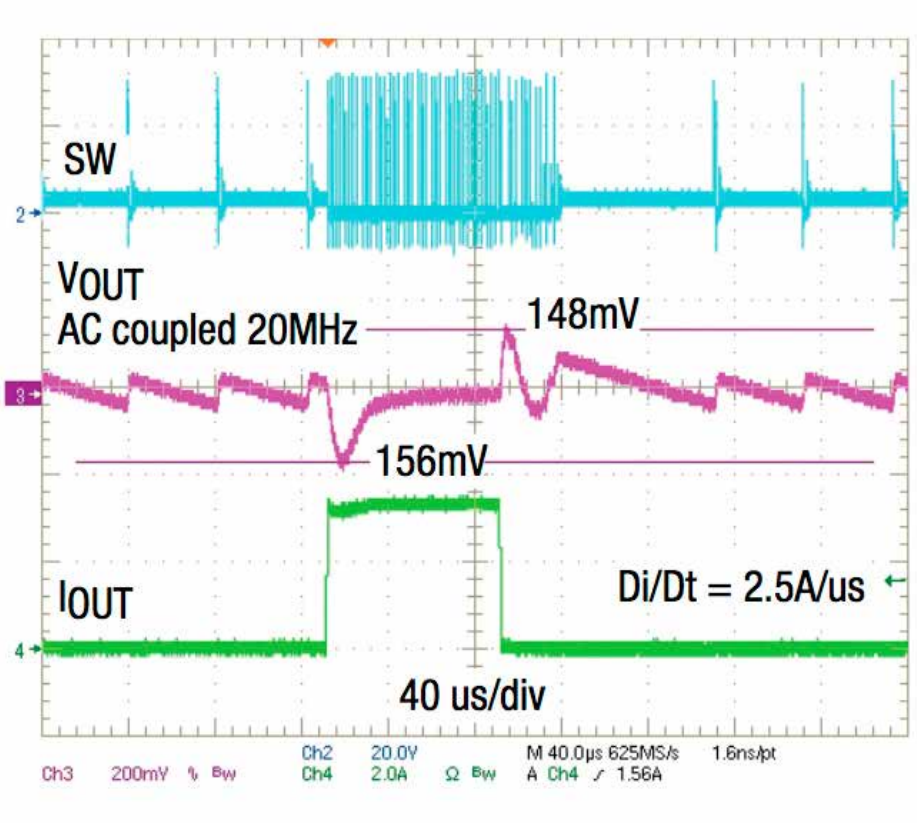
Combined with the regulator's intrinsic high power conversion efficiency that minimizes internal losses, these modules can deliver full power with little or no de-rating required – see figure 3. This solid performance specification allows the modules to be easily used in multiple applications simply by replacing a few passive components. This saves development time and R&D expense and results in a faster time-to-market and a more competitive product positioning.

Summary

Today's fast paced innovative electronic design environment places enormous pressure on the practicing engineer to complete his/her designs in record times without any sacrifice in performance or cost. Coming to their rescue is a family of fully integrated power modules that are conceived, designed and produced to help turn the development of a power delivery subsystem into an easy five step process:

(1) Know your requirement
(2) Select the appropriate module
(3) Calculate the values of the housekeeping components – see figure 4 below
(4) Layout your PCB
(5) Test and verify your prototype … then move on to your next achievement!

The first three tasks should take less than 30 minutes for guaranteed



performance and reliability.

Sidebar: Modules can still be highly efficient

Modules should not compromise power converter performance and much less their efficiency, which needs to be as high as possible to reduce power losses and issues with heat dissipation. The efficiency plot of the XR79206 in figure 5 below shows it achieving almost 95% efficiency at a 700KHz switching frequency. Figure 6 further illustrates how the module switches mode briefly from DCM to CCM operation to execute a fast transient response before returning back to DCM to save power.

Figure 6. The XR79206 executes a load step from 0.05A to 3A by seamlessly changing from DCM to CCM

Comparing CPLD-Based Circuit Board Power Management Architectures

› Shyam Chandra, Lattice Semiconductor

Introduction

The growing complexity of board-level designs has begun to strain the capabilities of today's hardware/power management architectures. While any one of the four most commonly used management architectures can be used to support these complex designs, they each require different sets of compromises and design trade-offs in terms of scalability, design effort or cost.

Recently, a fifth board management architecture has emerged which provides the best possible performance, safety and flexibility while requiring far less design effort and implementation cost. This article will explore this new architecture, primarily with a focus on the Power Management functions it provides.

Overview

A circuit board is typically divided into 2 functional blocks (Figure 1), the Payload Management section and the Hardware Management section. In most boards, 80% - 90% of the circuit board is typically devoted to "payload" functionality (data/control plane elements and/or processors). The remaining 10%-20% of board space is occupied by the circuitry which performs hardware-level monitoring/control or housekeeping functions.

Unfortunately, most existing Hardware Management solutions have difficulty scaling to address the growing complexity of modern Payload Elements. For example, although the Hardware Management section typically occupies only 10% - 20% of the board, its design/debug effort can consume a much larger percentage the overall development time (30% - 40%). Likewise, the Hardware Manager often consumes a disproportionate share of the overall Bill of Materials (BOM) cost.

Recently however, a new distributed architecture has been developed which is much more scalable and can be implemented at a much lower BOM cost. In order to better understand the advantages a distributed architecture offers, we'll look at how Power Management is implemented in four of the most commonly used Hardware Management architectures (illustrated in Figures 2-5) before taking a deep dive into the distributed architecture (illustrated in Figure 7).

A comparison of Control PLD based power management architectures

In the following analysis, we'll compare how these supplies are managed by each of four commonly used architectures (illustrated in

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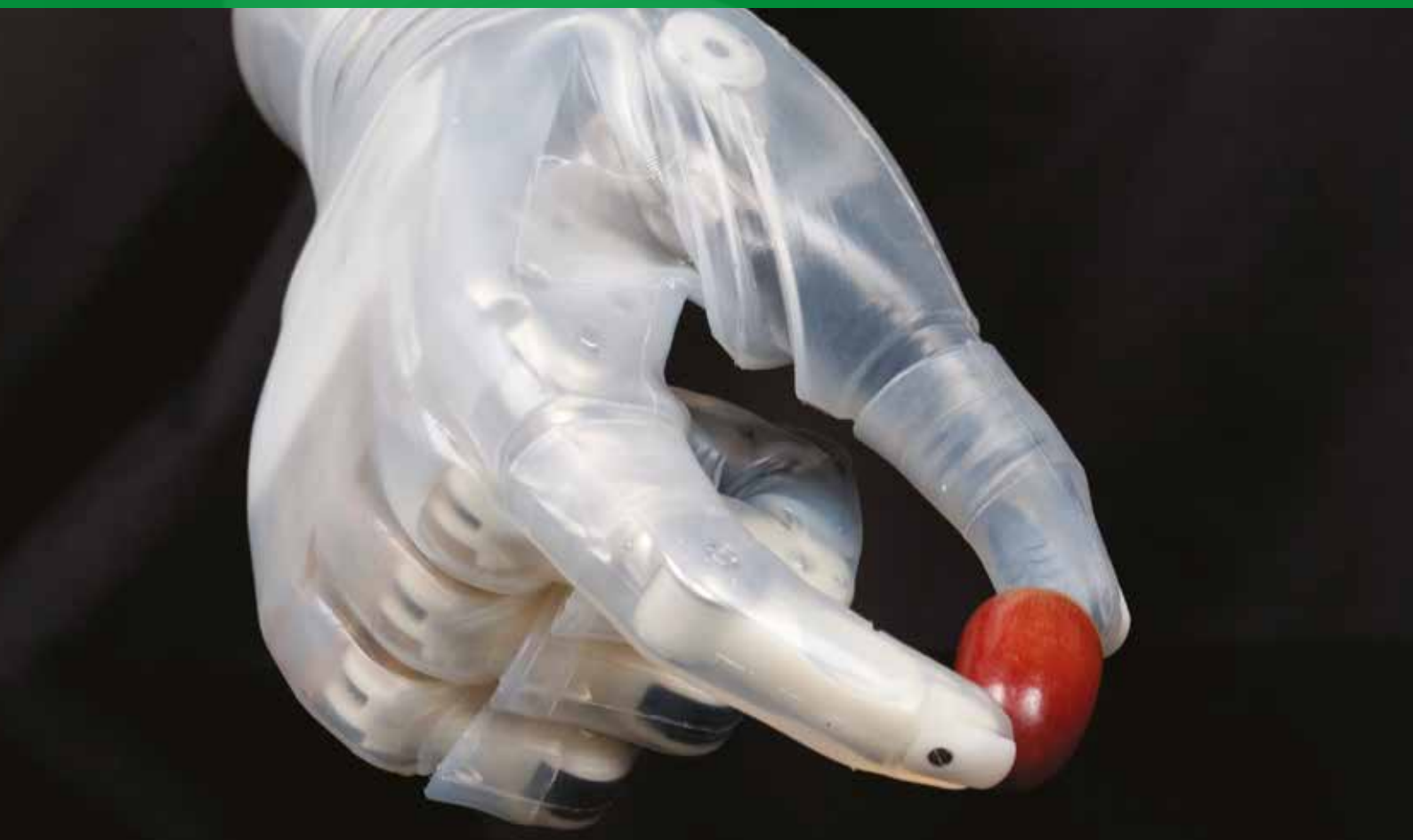

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Figure 1. Smart car systems

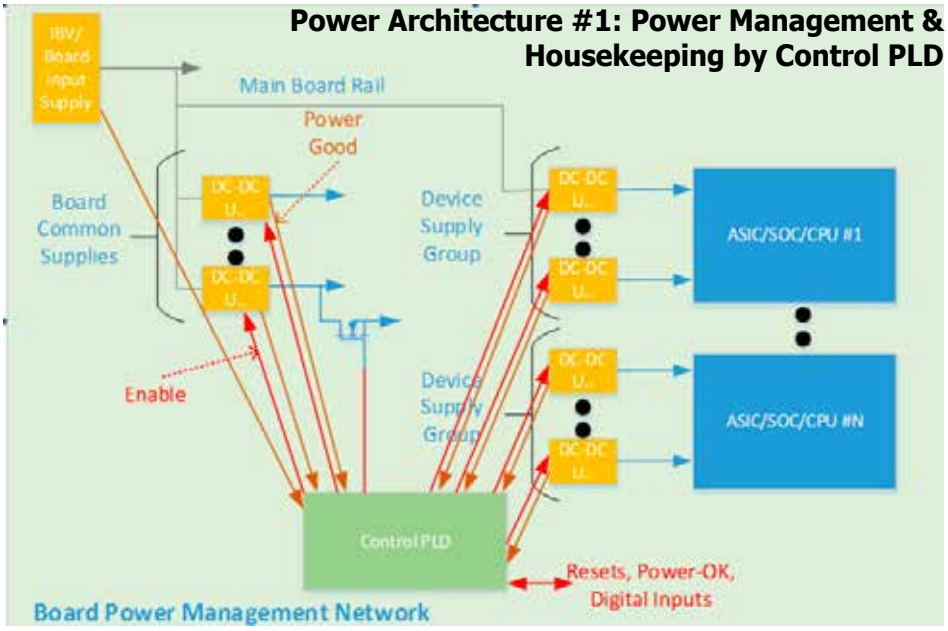

Fig.2: A Hardware Management system implemented using a Control PLD to perform Power Management and Housekeeping.

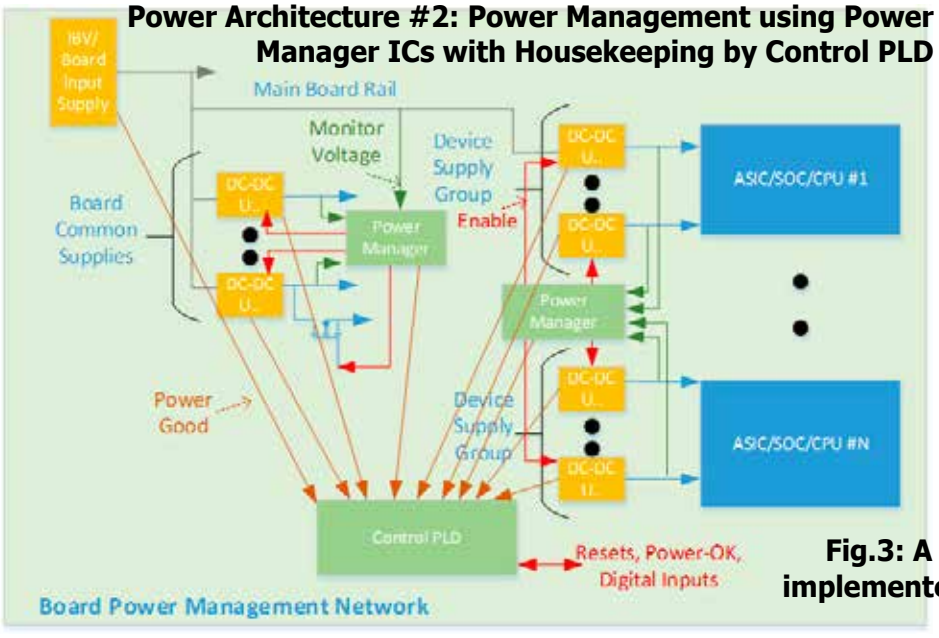

Fig.3: A Hardware Management system implemented using Power Manager ICs and a Control PLD.

Figures 2-5).

In this architecture, the power management functions are added to the on-board control PLD. The control PLD monitors the "Power Good" signals of the input supply and each DC-DC converter (Fig.2). The sequencing algorithm implemented in a Control PLD generates the sequence of "Enable" signals needed to turn on the power to the payloads without causing damage or logical errors.

The Control PLD also generates logical signals such as resets and power good to ensure that the payload devices can begin operation during power up or terminate their operations during power down. It is also responsible for generating a sequence to safely disable the supplies during power-down or when a fault is detected. PLDs can easily support Event-Based solutions which provide different responses to different combinations of faults.

For this class of designs, all the power sequencing, protection and control functionality is implemented within the Control PLD, typically using VHDL or Verilog.

Pros:

- Low cost
- Straightforward architecture enables the Control PLD's sequencing logic to be easily scaled to accommodate new applications.
- Designs can be implemented using a single design environment (typically VERILOG).
- Event-based architecture can respond to individual fault modes in a flexible manner.

Cons:

- Since each supply requires two signal paths, larger, more

Power Architecture #3: Housekeeping using Control PLD with Microcontroller-based Power Management through a PMBus

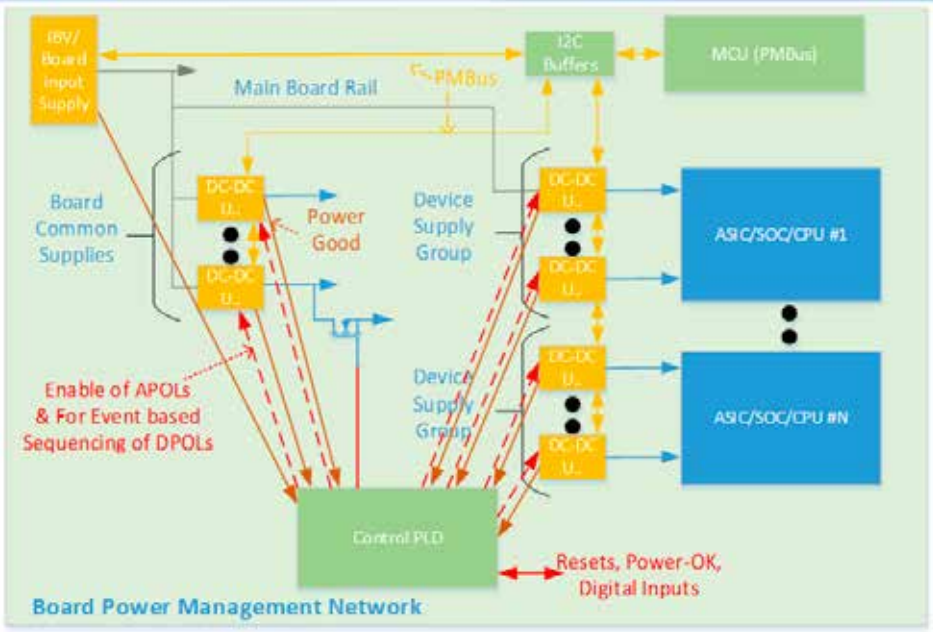

Fig.4: A Hardware Management system implemented using a Control PLD and an MCU

Power Architecture #4: Power Management and Housekeeping using a Control PLD with on-chip ADC

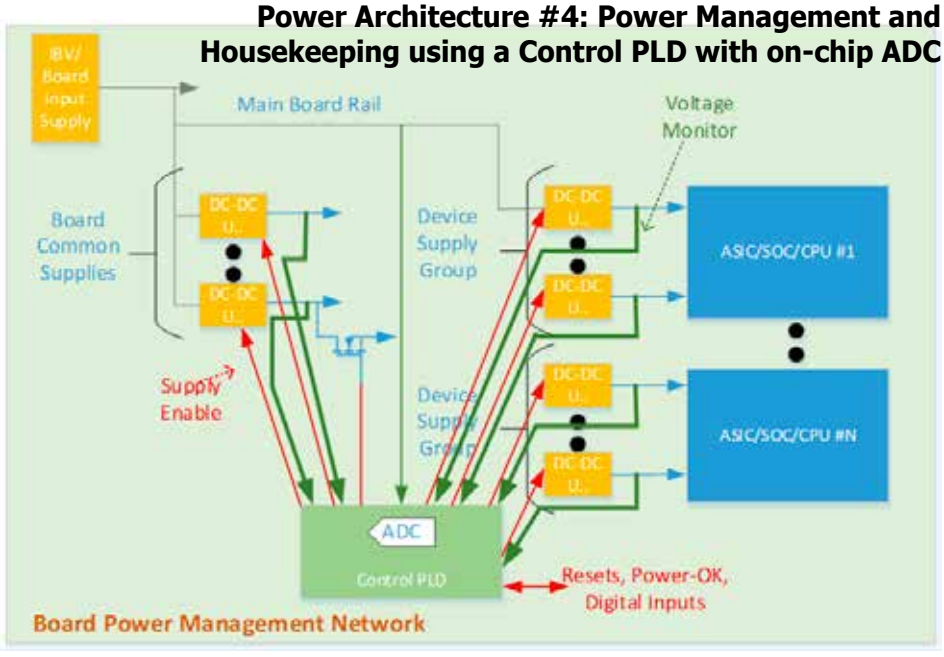

Fig.5: A Hardware Management system implemented using a Control PLD with an on-chip ADC

complex designs begin to suffer from high Control PLD I/O count and board congestion.

- Reduced reliability because the Power Good fault detection is inaccurate (typically 8% to 20% error) and cannot monitor trends in supply voltage.
- Adding Telemetry (monitoring the actual supply voltages instead of the Power Good signal) requires adding an A/D converter, increases cost & complexity to the board.
- Requires a board-level engineer (with digital expertise) to implement, someone who, in many cases, is not be a power supply expert.

In this split-function architecture, a Power Manager IC is responsible for monitoring and sequencing the board's DC-DC converters (Fig.3). Because it directly monitors the supply's voltage the Power Monitor can also perform trimming and margining. The Control PLD uses the supplies' Power Good status lines to generate the necessary control, status and housekeeping signals.

For these designs, the Power Manager functionality is typically defined using GUI-based configuration tools while the Control PLD logic is defined using VHDL or Verilog.

Pros:

- Lower Control PLD I/O count because the Enable function is handled by the Power Manager.
- Lower board congestion means a simpler layout and fewer board layers.
- By directly monitoring the supply voltages, the Power Monitor IC can get a more accurate picture of overall system health and enable higher system reliability.

Cons:

- Power manager ICs increase BOM cost – especially if multiple devices are required.
- This architecture can provide Event-Based response but it adds to design complexity if more than one Power Manager is employed.
- Scaling sequencing to more complex designs can be difficult – especially if it involves partitioning functionality across multiple Power Manager ICs.
- Since the design process is

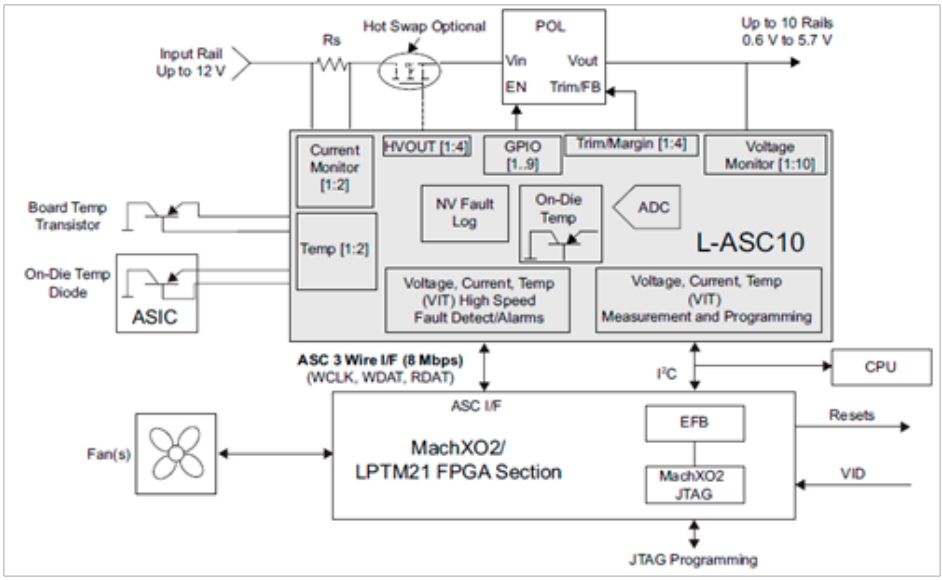

Fig.6: The L-ASC10 remote sensing element.

Power Architecture #5: Power Management and Housekeeping performed by a Control PLD with L-ASC10 (ASC) providing Distributed Voltage Sensing & control

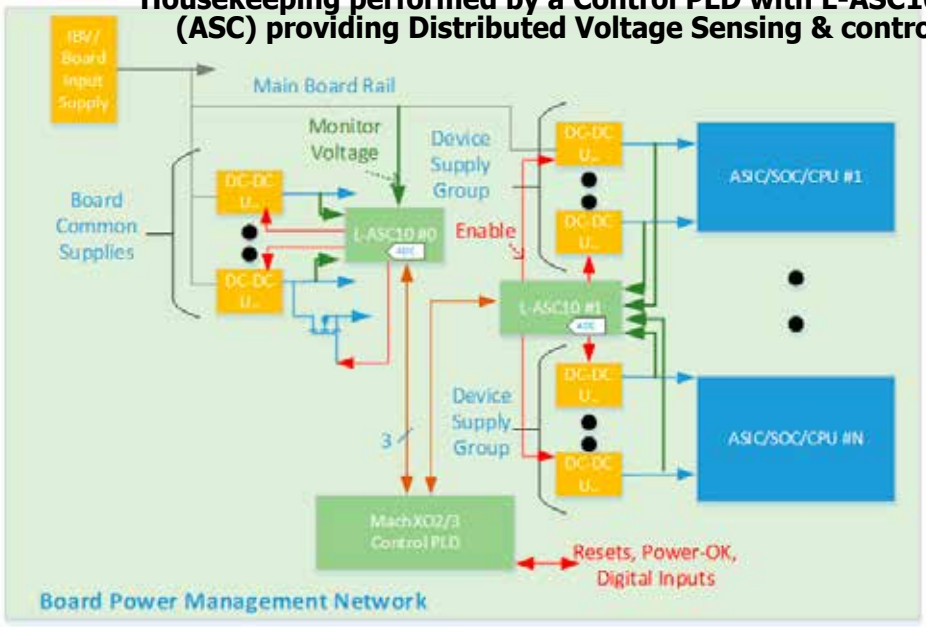

Fig.7: - A Hardware Management system implemented using a distributed architecture

spread across multiple tools (GUI + VHDL/Verilog), it may require multiple engineers and increase design risk.

Figure 4 illustrates an architecture which uses a microcontroller (MCU) to perform the sequencing of digitally-controlled point of load (DPOL) supplies. The MCU manages the DPOLs using the Power Management Bus (PMBus), a two wire communications protocol based on the I²C bus. This leaves the Control PLD responsible for supporting the board's housekeeping functions as well as controlling any point-of-load DC-DC converters which have an analog control interface (APOLs).

To simplify the software design, most MCU-driven power management designs employ Time-Based sequencing schemes which issue a single fixed sequence of disable signals to power down the board when a normal turn-off is requested or when a fault condition is detected. Another potential drawback of software-based power management is that it is slower to respond to fault conditions (typically 10-15 milliseconds versus the microsecond-scale response of a Control PLD). If some fault conditions require a faster response (or Event-Based sequencing), a second layer of protection may be added using the Control PLD.

Implementing software-based Power Management requires both, software for the MCU and a Control PLD design, written in either VHDL or Verilog.

Pros:

- Designs are easily scalable (for time-based sequencing only).
- Abundant software development tools make MCU-based solutions faster and easier to debug.
- Designs can be quickly modified using firmware updates.
- Simpler PCB designs - routing congestion reduced around DPOLs

Cons:

- More expensive BOM
- Difficult to scale if Event Based sequencing is required.
- Multiple design tools required (Verilog/VHDL + Software)
- Mix of APOL & DPOL requires a hybrid control solution which has several drawbacks:

o It cannot be simulated easily.
o Hardware management functions can only be tested in a prototype board environment.
o Complexity increases system

debug times.
In order to overcome issues with inaccurate Power-Good signals, it's possible to monitor the board's supply voltages using a Control PLD that's equipped with an on-chip digital converter (ADC). In this architecture, the Control PLD implements the power management functions using an on-chip soft/hard processor core while housekeeping functions are implemented in hard logic (Fig.4).
For these types of designs, the designer usually develops the Power Management function in software and the other housekeeping functions using VHDL/ Verilog.
Pros:

- The solution can be easily scaled or adapted for other designs.
- Combining Power Management and housekeeping functions reduces design time.
- This architecture can provide voltage telemetry to a remote system manager.

Cons:

- Requires a larger CPLD with higher density and I/O pin count.
- Complex CPLD increases solution cost.
- Routing low-voltage analog telemetry to a single location increases circuit board congestion.
- Forces a digital engineer to implement both power management function as well as digital control functions.

Introducing a Distributed Power Management Architecture

A Distributed Power Management architecture eliminates the need for many of these trade-offs through the use of a low-cost Analog Sense and Control (ASC) power management element. These devices enable the implementation of complete hardware management functions (Power and temperature management as well as control path and housekeeping functions are collectively referred to as hardware management function).
Lattice Semiconductor's L-ASC10, is a Hardware Management (Power, Thermal, and Control Plane Management) Expander. It can be used in conjunction with Control PLDs such as Lattice's low-cost MachXO2 series to implement the Hardware Management function in a circuit board. Figure 6 illustrates how the Hardware Management functionality would be divided up between the L-ASC10 and its companion MachXO2 Control PLD.
Each of the analog sense channels is monitored through two independently programmable comparators to support both high/low and in-bounds/out-of-bounds (window-compare) monitor functions. Communication between the ASC and the Control PLD is accomplished through a single 3-wire serial bus (Tx/Rx/Ck).
As we'll see in the following scenario, using a single serial bus to monitor and control multiple power supplies greatly reduces both the number of I/O pins required for the PLD.
In a distributed Hardware Management architecture, the Control PLD uses several external ASC devices to monitor supply voltages. The Control PLD also transmits Enable/Disable commands to the DC-DC supplies and performs other housekeeping functions.
Both Power Management & housekeeping functions can be implemented using a GUI tool, VHDL/Verilog, or a combination of both.
PROs:

- Common 3-wire bus requires the minimum number of Control PLD I/O pins.
- Simplified PCB traces create the least board congestion.
- The entire system can be implemented in a single design environment (GUI or VHDL/Verilog)
- Distributed architecture is highly scalable.
- Reduced solution cost because the voltage, current and temperature monitoring functions are integrated within the ASC.
- Reduced design time as Power Management and housekeeping functions are together.
- Dramatically reduce board debug time using Lattice's standard power debug utilities.

Conclusions

As the complexity of board-level systems has grown, Hardware Management systems have begun to consume a disproportionate share of design effort and BOM costs. Now, a distributed Hardware Management architecture is available which connects a control PLD to low-cost sensing elements through a 3-wire serial link. In addition to reducing design complexity, board space requirements and BOM costs, this architecture may be implemented with a wide variety of tools, commonly used by power and digital designers.

For Further Reading:
"Revolutionary Hardware management Solutions", A Lattice Semiconductor White Paper, April 2015 http://www.latticesemi.com/view_document?document_id=51004
L-ASC10 Data Sheet - http://www.latticesemi.com/view_document?document_id=50120
"Adding Scalable Power and Thermal Management to MachXO using L-ASC10" A Lattice Application Note http://www.latticesemi.com/view_document?document_id=50995

A Sensor-Fusion Approach to First Responder Precision Location/Tracking

› Bob Scannell, Analog Devices Inc.

Locating first responders deep within GPS-denied infrastructure with high precision has been an elusive goal of the fire safety and emergency personnel community for well over a decade. The objective is to pinpoint location to within a few meters, over the course of tens of minutes. These coincidentally are nearly the same goals for guidance systems on tactical missiles, and the preferred solutions today for such systems can cost $10K minimum, in addition to having prohibitive size/weight/power. Those same solutions were used in early proof-of-concept demonstrators for first responders, but proved to be barriers (cost and size) to actual deployment.

First responder location determination therefore remains one of the most complex location applications in existence today. No one silver-bullet sensor can achieve the desired goals—instead, multiple technology nodes are necessary, each being at the leading edge of capability. Further, it involves a large-scale sensor-fusion and system-integration approach.

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Q&A: Freescale's Ian Chen Discusses Sensor Fusion

Interview: Movea's Tim Kelliher Discusses Sensor Fusion Trends

Cost-effective high-performance MEMS inertial sensors can now provide the seed for a potential solution. This article envisions a complete sensor-to-cloud sensor-fused system including highly sophisticated algorithms. The major approaches and enabling technologies are described in Table 1. The major challenges facing system developers can be summarized into three broad categories: procedural, environmental, and sensor fusion. The highly complex nature of the first-responder mission, coupled with the challenges posed by the varied and extreme environment, must be comprehended without compromise in the course of designing a multi-sensor solution.

Procedural

The fire safety search and rescue mission follows a highly disciplined process, which at the same time must adapt to fully non-deterministic real-life scenarios. A deployable precision location system must adapt to existing processes and equipment, to the greatest extent possible.

Thus, one requirement is to be operational without any fixed or ad hoc infrastructure. Because first responders are typically burdened with significant equipment (weight

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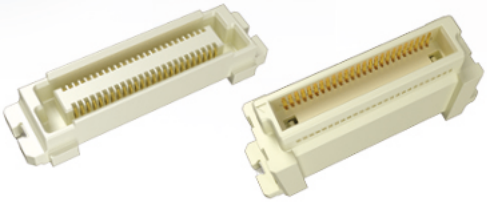

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TABLE 1: FULL-SYSTEMS APPROACH	
Goal	**Approach**
Infrastructure-less means to detect movement/position	Inertial sensors
Ability to precisely determine an absolute reference point	UWB radio ranging
Sensor processing to optimally merge all "signals of opportunity"	Kalman and particle-filtering algorithms
Robust communications links	Body and backhaul reliable comms
Maps, search/rescue coordination	Cloud-based analytics and databasing

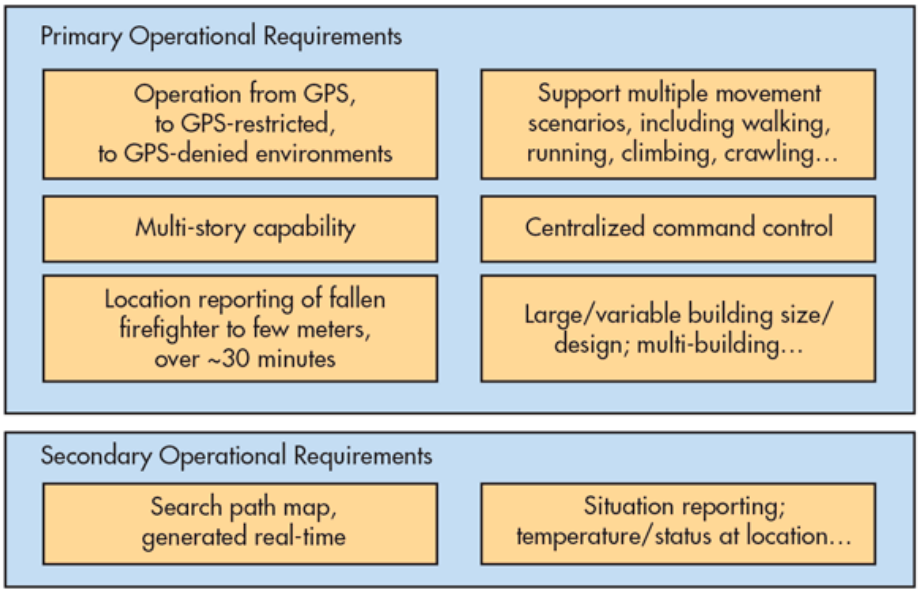

Figure 1. These key operational requirements define the first responder design problem.

and cost) already, any system development should be guided from the early stages by the goals of achieving miniaturized embedded equipment, and per responder costs on the order of a smartphone (it's useful to point out here that existing smartphone location performance is highly inadequate; thus the challenge). Fig. 1 outlines the most relevant primary and secondary operational requirements of the desired system.

Environmental

While outdoor positioning has become ubiquitous with GPS coverage, a fully indoor or mixed (indoor/challenged-outdoor) environment is far less supported. Some indoor positioning situations (e.g., shopping mall) can be realized with installed infrastructure. However, these are neither precision, nor practical, for the first responder goal. For the system designer of a tracking system, the following considerations drive design definition, component choices, and risk-mitigation approaches:

- RF propagation paths
- Temperature/shock effects on sensors
- Potential for damaged/altered infrastructure

Sensor Fusion

The challenges noted above in process and environment form the basis of the central design approach to this problem: sensor fusion. Relevant primary sensing modes are selected to provide uncompromised performance in critical operational modes, while at the same time complementary sensors are matched to the key obstacles for each phase of the application (Table 2).

Due to the ability of microelectromechanical systems (MEMS) to operate free of external infrastructure, and provide precision in a dynamic environment, they're expected to play a primary role in the overall solution. That is, of course, if they can operate in extreme environments, and are coupled with the appropriate secondary sensors.

Progress in MEMS

While consumer inertial MEMS devices race toward commoditization (with limited focus on performance specifications), and military MEMs remain prohibitively expensive, industrial and automotive MEMS (Fig. 2) are aiming for an enabling level of both performance and cost.

2. Industrial-targeted MEMS devices are capable of low noise and stable operation, even under extreme motion dynamics.

TABLE 2: SENSOR BENEFITS AND LIMITATIONS				
Sensor	Benefit			Limitation
	Absolute reference	Dynamic response	Infrastructure-free	
External GPS/RF	X			No line-of-sight access
Inertial MEMS		X	X	Drift error
Magnetic	X		X	Field interference
Barometric	X		X	Environmental sensitivity

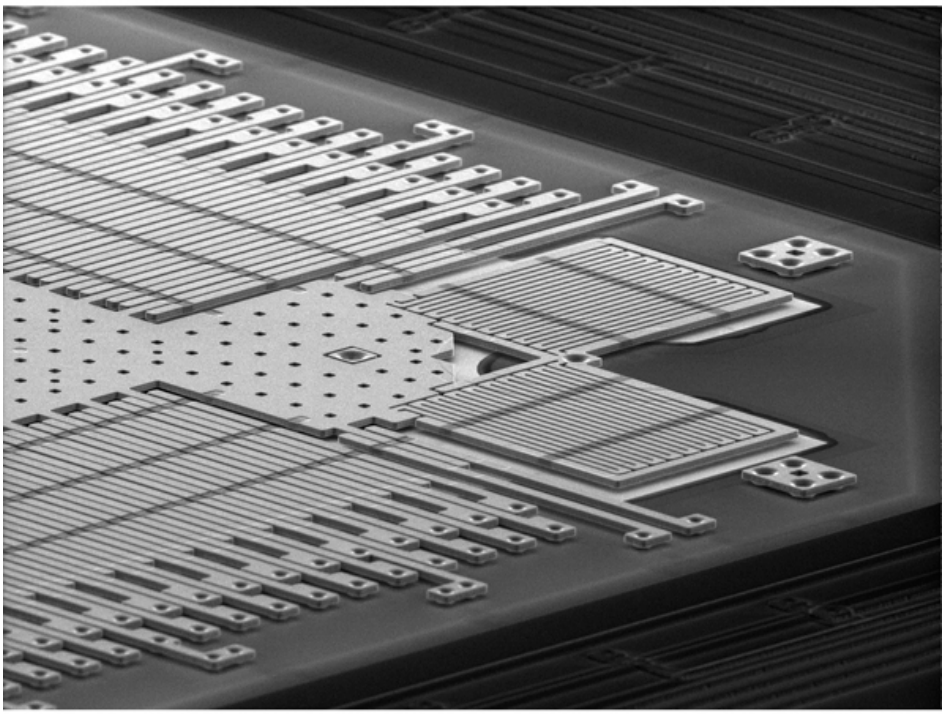

Figure 2. Industrial-targeted MEMS devices are capable of low noise and stable operation, even under extreme motion dynamics

The industrial and automotive sectors require accurate sensing in relatively complex and extreme environments, compared to the consumer sector. As a result, suppliers to this sector have incorporated architectural features that are specifically tuned to reject performance detractors such as off-axis motion, vibration and shock events, and errors induced from time and temperature.

Though such design features are often most easily accommodated via larger sensors or more costly processes, the economic pressures of both automotive and an increasingly important industrial market force a more critical approach to designing for performance and cost-effectiveness. The result is a highly attractive performance/price positioning for MEMS components specifically developed for industrial applications.

Table 3 compares the percentage of error relative to distance traveled for three major classes of components. Industrial-grade MEMS can provide nearly as good navigation capability as high-end military devices, while at a reasonable price delta to the commoditized consumer MEMS components.

To understand this advantage, one must look deeper into the critical specifications of a MEMS component relative to the targeted application. In the case of the first responder goal, one critical task of MEMS sensors is to discern the type of movement being experienced, and then measure the steps and stride.

As opposed to a pedestrian motion model, first responder movement will be more random, dynamic, and difficult to discern. Further, because of the accuracy goals, the sensor must be able to reject "false" motion such as vibration, shock, and side-to-side rock/sway of the foot or body. Rather than a simple accuracy analysis based around the noise of the sensor, which may be sufficient for a pedestrian model, the first responder model must also include key specifications such as linear-g rejection and cross-axis sensitivity.

Table 4 provides a side-by-side comparison of an industrial and low-end MEMS device, looking at the RSS error combination of three notable specifications. It can be readily seen that noise isn't the determinant factor. Rather, the overriding concerns are linear-g and cross-axis performance, which many low-end devices don't even specify.

TABLE 3: MEMS NAVIGATIONAL PERFORMANCE	
MEMS performance	Error, as % of distance traveled
Mil-grade	~0.1%
Industrial	~0.5%
Consumer	>>25%

TABLE 4: INDUSTRIAL VS. LOW-END MEMS SENSORS				
	Industrial		Low-end	
Performance	Spec	Impact	Spec	Impact
Noise density (°/sec/√Hz)	0.004	0.036	0.0100	0.089
Linear-g (°/sec/g)	0.01	0.020	0.100	0.200
Cross-axis (%)	0.09	0.090	2.00	2.000
Projected error (°/sec)		0.099		2.012

Assumptions: 50-Hz bandwidth; 2 g-rms vibration; 100°/s off-axis rotation

TABLE 5: INDUSTRIAL MEMS VS. FIBER-OPTIC GYROS		
Error	Industrial MEMS	Fiber-optic gyros
Heading	0.14°	0.13°
Roll	0.10°	0.08°
Pitch	0.10°	0.08°

Only a short number of years ago, high-performance inertial sensors were primarily achieved only via approaches such as fiber optics. Now, however, industrial MEMS processes have clearly proven they're up to the task—Table 5 offers a relative comparison of key navigational metrics.

An example of an industrial MEMS inertial measurement unit (IMU) is Analog Devices' ADIS16488A (Fig. 2, again), which incorporates 10 degree-of-freedom high-performance sensing. It has been qualified for commercial avionics (Table 6), demonstrating its readiness for the extreme demands of first responder applications.

Advances in inertial MEMS performance, with continued proof of quality and ruggedness, are now being combined with significant strides in Integration. This last hurdle is particularly challenging, as sensor size can be inversely proportional to both performance and ruggedness if not carefully managed otherwise. A highly strategic, coordinated, and challenging series of process advances must be proven and merged to enable the level of "performance density" required of this application (Fig. 3).

Sensor Weighting

The selection of appropriate sensors for a given application is generally followed by deep analysis to understand their weighting (relevance) during different phases of the overall mission. In the case of "pedestrian dead reckoning," the solution is dictated primarily by available equipment (i.e., embedded sensors in a smartphone) rather than by designing for performance. As such, there's a heavy reliance on GPS, with the other available sensors like embedded inertial and magnetic offering only a small percentage

TABLE 6: SYSTEM-LEVEL OVERVIEW OF ADI INERTIAL MEASUREMENT UNIT	
Inertial sensor, stability	5°/hr, 32 µg
Bandwidth	330 Hz
Linear-g effect, vibration rectification	9 md/s, 0.1 md/s/g^2
Temperature coefficient (bias, sensitivity)	2.5 md/s/°C, 35 ppm/°C
Temperature/vibration/ shock	DO-160G, MIL-STD-810G
Reliability	>35,000 hours
Design assurance	DO178/254

MEMS performance and integration advances that enable a deployable system

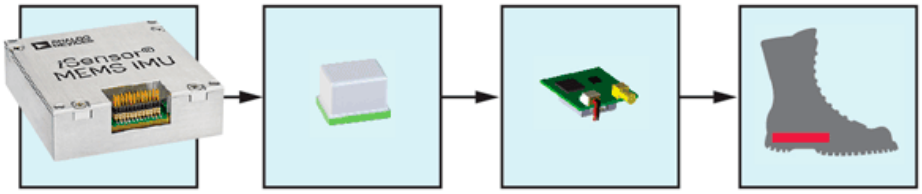

Figure 3. Industrial MEMS inertial measurement units (IMUs) are advancing in performance, size, cost-effectiveness, and integration (no compromise) to uniquely enable critical applications such as first responder

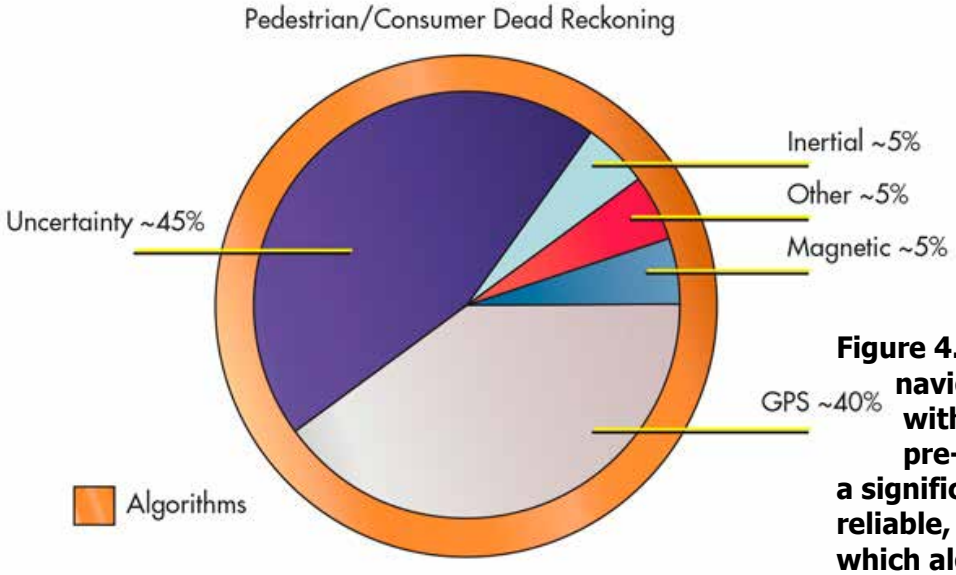

Figure 4. Smartphone-based pedestrian navigation relies primarily on GPS, with supplemental but not optimized pre-embedded sensors. This leaves a significant gap in high-confidence, or reliable, coverage of motion detection, which algorithms alone cannot fix

contribution to the task of determining useful position information.

3. Industrial MEMS inertial measurement units (IMUs) are advancing in performance, size, cost-effectiveness, and integration (no compromise) to uniquely enable critical applications such as first responder.

This works reasonably well outside, but in a challenged urban environment or indoors, GPS isn't available. Couple that with the poor quality of other available sensors, and it leaves a large gap or "uncertainty" in the quality of the position information. Advanced filters and algorithms are typically employed to merge these sensors, but without either additional sensors or better-quality sensors, the software does little to actually close the uncertainty gap. Ultimately, it significantly lowers the confidence in the reported position. This is conceptually illustrated in Fig. 4.

4. Smartphone-based pedestrian navigation relies primarily on GPS, with supplemental but not optimized pre-embedded sensors. This leaves a significant gap in high-confidence, or reliable, coverage of motion detection, which algorithms alone cannot fix.

In contrast, the industrial dead-reckoning scenario, such as first responder, is designed for performance, with system definition and component selection guided by specific accuracy requirements. Significantly better-quality inertial

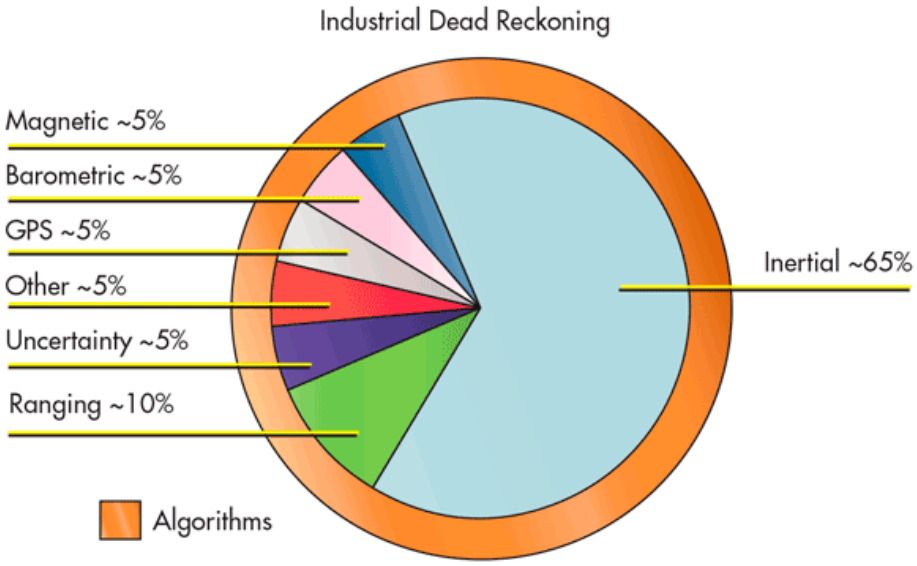

Figure 5. Sensor selection specifically targeted at "full" coverage of the first responder mission greatly enhances the accuracy and reliability of the system

TABLE 7: PHASES OF FIRST RESPONDER MISSION

Mission interval	Primary sensing	Auxiliary sensing	Period	Accuracy
Arrival at scene	GPS	Inertial	---	Map fix
Deployment	UWB	Inertial	Unknown	Decimeters
Inside building	Inertial	Signals of opportunity	~30 minutes	Meters
Rescue	Inertial	Path map, other	Minutes	

sensors allow them to take the primary role, with other sensors carefully leveraged to reduce the uncertainty gap. Algorithms are more focused on optimal weighting/handoff/cross-correlation between the sensors along with an awareness of environment and real-time motion dynamics, rather than extrapolating/estimating position between reliable sensor readings (Fig. 5).

5. Sensor selection specifically targeted at "full" coverage of the first responder mission greatly enhances the accuracy and reliability of the system.

Accuracy in either case above can be enhanced via improved quality sensors. However, while the sensor filtering and algorithms are a critical part of the solution, they don't alone eliminate the gap in coverage from limited quality sensors.

Precision Location and Mapping (PLM) System

For the specific case of first responder tracking, the mission has been partitioned into the following stages to best assess sensor-processing requirements: arrival at scene; deployment; inside the building; and rescue (Table 7).

It's envisioned that the fire truck is equipped with a high-end GPS/INS system that's capable of geo-fixing the position of the vehicle upon arrival at the scene, as a known reference point. From this point, and until the firefighter enters the building, there's an indeterminate and random sequence of movement. At this stage, the Precision Location and Mapping System relies on an ultrawideband (UWB) ranging implementation to maintain an accurate fix of the firefighter position and orientation. Upon entry into the structure, the inertial sensors become the primary tracking sensor, with the goal of providing location accuracy of a few meters.

The system is designed to solely rely on inertial sensors if need be, but also be able to take advantage of other signals of opportunity when available and reliable, such as UWB ranging signals, magnetometer corrections, and barometric pressure measurements. The implemented algorithms not only track location, but generate a real-time path map of the search pattern. If a firefighter goes down or is in distress, the map generated from the initial path is a supplemental "sensor" input to the rescue firefighter who is also guided by inertial sensing.

While high-performance sensors are certainly at the heart of the PLM system, the following are critical enablers of the system as well:

- Deep understanding of the component sensors and their drift characteristics/limitations under

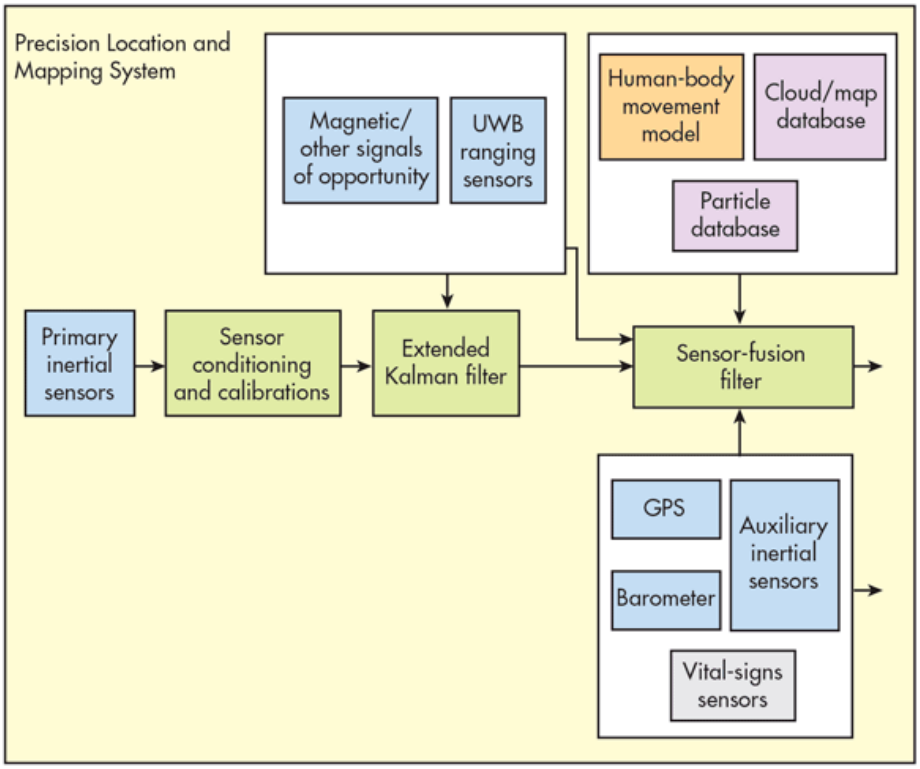

Figure 6. The PLM system is a complete sensor-fused solution, based on high-performance sensors, complementary sensor filtering and processing, and cloud-based databases and analysis. The outputs are precise location and a search path map

stress

• Extensive knowledge of the human-body movement model

• Detailed application-level insights, and operational-modes definition

The above provide the definition, guidance, and boundaries for implementing sensor-fusion processing (Fig. 6). The core of the processing is a particle filter that tracks multiple possible movements over time, eliminating errant paths as the filter distinguishes them. The sensors themselves are distributed on the firefighter for optimal performance, and a wireless body network plus rugged backhaul communications network seamlessly connect firefighter, rescuer, and command & control, as well as cloud-based maps and coordination where possible and useful.

6. The PLM system is a complete sensor-fused solution, based on high-performance sensors, complementary sensor filtering and processing, and cloud-based databases and analysis. The outputs are precise location and a search path map.

The PLM System provides an infrastructure-free approach to detecting position, leveraging high-performance sensors and advanced algorithms to optimally merge all signals of opportunity. The system goals are meter-level accuracy and real-time path-map generation. Advances in industrial-grade MEMS inertial sensors have enabled PLM, and a full systems-development approach makes it possible to address technical hurdles while also achieving commercial metrics.

Continuing work is focused on integrating the latest-generation sensor advances, and matching these to new insights in the first responder operational scenario definition. Final integration will include optimized form factors and body placement, as well as more complete implementation of the required communications links and final system qualifications.

Automotive Security: A Hacker's Eye View

› Paul McLellan, Cadence

Charlie Miller gave a keynote at ARM TechCon on automotive security. He is regarded as one of the world's most proficient hacker, although he is one of the good guys (a white hat in security parlance). He has a PhD, worked for the NSA, and is currently the senior security engineer at Uber. He works alongside Chris Valasek. You probably don't know their names, but you may know of their work. They were the two engineers who took control of a Wired journalist's Jeep, memorably reported as Hackers Remotely Kill a Jeep on the Highway—With Me in It. Or watch the video:

Car Hacking History

Charlie said that car hacking started around 2010. Some academic researchers from University of Washington and UCSD plugged a device into the federally mandated on-board diagnostic port (OBD-II port) and could control the brakes, the windscreen wipers, and so on. They published their results under the catchy title Experimental Security Analysis of a Modern Automobile. This was not well received by either academia nor the car companies, who all pointed out that if you have physical access to the car (which you need to plug something into the OBD port) then of course you can do bad stuff. You could cut the brake lines, too.

So they took on that challenge. The next year, they produced another paper, even more catchily titled Comprehensive Experimental Analysis of Automotive Attack Surfaces. This time they attacked remotely and showed three ways to do it. The first involved Bluetooth (so was remote, but you had to be nearby), one was using a CD with a malicious MP3 track, and the most important was through OnStar. They could dial in from anywhere and take control. They could dial up the cellular modem in the car with a real phone, get the audio modulation tones, and then provide their own data. Charlies said it was "right out of an 80s TV show."

Charlie and Chris Get Interested

Charlie started to get interested in this. The academics had basically done everything but not given any technical details about what bugs they were exploiting, or even what kind of car it was (a Malibu). Nobody

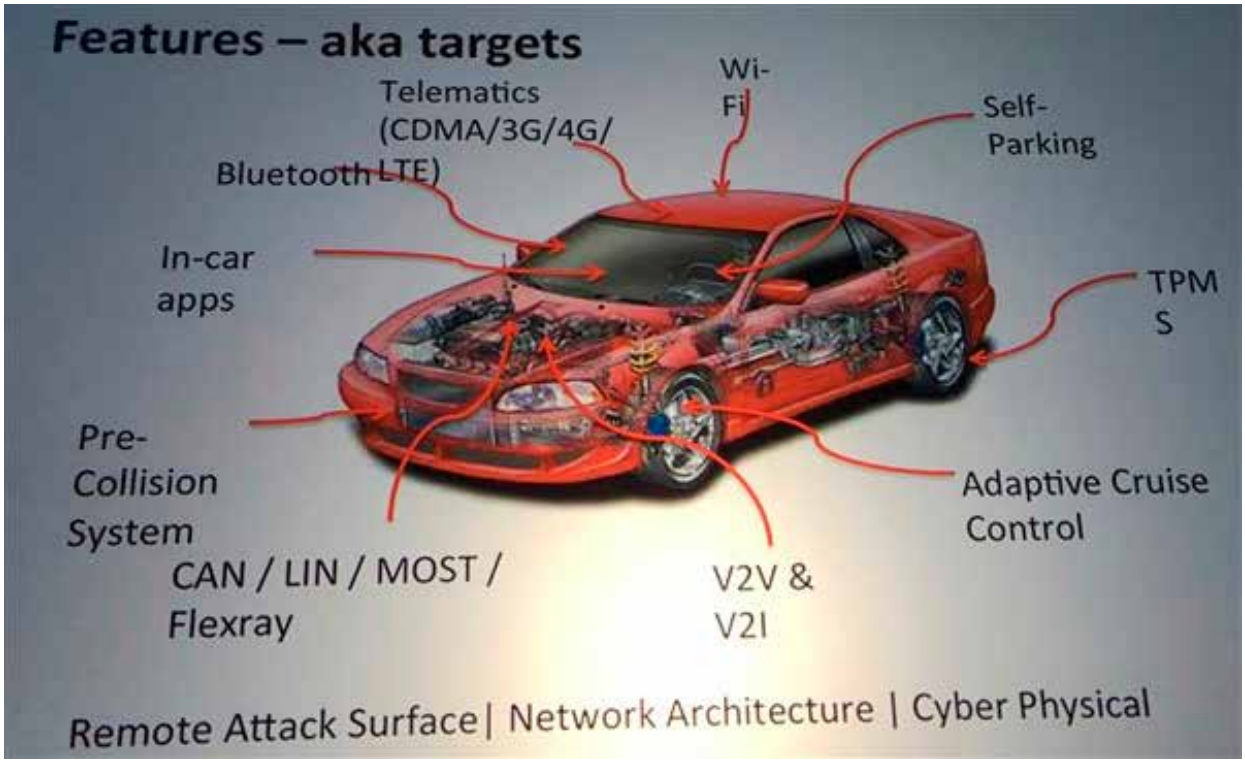

Figure 1. Smart car systems

knew if it was just that one car, or all models, all cars.

In September 2012, Charlie and Chris got a DARPA Cyper Fast Track grant that gave them enough money to buy a car. They decided they wanted a car with automatic parking since then the steering would have to be controllable, too. And it had to be cheap. They got a Toyota Prius. Apparently it was the easiest sale ever for the dealership, since they didn't care about the color or the options. Provided it had automatic parking, they would take it.

They rapidly discovered how to control the car once plugged into the OBD-II port. They could control the brakes, the windscreen wipers, the radio, and so on. Once again, nobody was impressed since they had physical access to the vehicle. It seemed that they would have to repeat everything.

The Jeep

So this time, it was the Jeep. The short version of the story is that they discovered how to remotely compromise the vehicle, Wired magazine published the article, and a few days later Fiat Chrysler recalled 1.4 million vehicles at a cost of perhaps $14B.

But a lot of good came out of this since they released everything: the vulnerabilities, their code, and so on. Automotive hacking doesn't scale if it is just the two of them. The academic researchers published stuff without details, and were largely ignored. Charlie and Chris told Chrysler that they would publish in nine months, and as far as they could see, Chrysler did nothing. But once the Wired article came out, the recall happened within a week. Clearly, publishing everything was the approach that got people protected the quickest.

At this point, they could control a lot of the vehicle but only if it was moving slowly. There were interlocks in the car to stop, for example, trying to automatically park the car when going 50mph on the freeway. But then they got to the stage where they could control the vehicle at any speed.

electronic features aka targets

How does this happen? It came about historically. Lots of electrical stuff got added to cars. Eventually, the weight of the wiring harness was a big issue (it affects both cost and fuel economy) and the automotive industry came up with CAN bus, a network. It had no security since it was only used for trusted things talking to trusted things. Then cars started to get connectivity to the

Figure 2.

Figure 3. ARM-based OMAP system

outside world in various ways such as WiFi for passengers, wireless tire pressure monitoring, OnStar. So there were lots of signals coming into the car from outside. But people also wanted features like automatic emergency braking (AEB), lane following, autoparking. These mean that there is a computer than can control the brakes and control the steering wheel. Adaptive cruise control means there is a computer that controls how fast you are going. Lots of features. Or, as they call features in the security world, targets.

jeep head unit

The Jeep had lots of computers. The big one in the middle of the dashboard is known as the head unit. When Charlie and Chris started, they thought it would take a year or two to find and exploit a vulnerability. But they found something in three weeks and it took five minutes to exploit it. It wasn't even really an exploit since they found an internet-facing interface that had a method called "execute". You gave it a command, it would execute it. Inside the head-unit, there was a cellular modem connected to the Sprint network. Sprint wouldn't allow traffic in from outside but they did allow one Sprint device to talk to another. So they bought a Sprint phone and could find vulnerable cars, get them to send their VIN, and find out what model they were. So they knew all the vulnerable cars but were limited to controlling the head unit. Charlies was tempted to hack into a Dodge Viper (a $100K+ car) and turn the radio up to full volume, but he resisted the temptation. But how could they really take control? Changing the radio channel is not much more than a prank.

head unit subsystemsInside the head unit were two subsystems. One was an ARM-based OMAP system, the other was V850-based (you've probably never heard of this but I know from my VaST days that this is an NEC processor widely used in automotive). The ARM system, to which the radio was connected, couldn't access the CAN bus, only the V850 one. But it turns out that the ARM system can reflash the V850 one, and the code is not signed. Of course, if you try this and get it wrong, it bricks the whole head unit and you have to go back to the dealer to get it replaced. ("It's a real lemon, this car.") Eventually they got the brakes to work and so on.

You might ask, as they did, why the head unit is connected to the CAN bus at all. But people like speed-compensated volume (it turns up the volume as the car goes faster). People like being able to use their iPhone to start the car and get it warmed up. Cars are only going to get more connected.

The Wired article and video were made in the middle of this when they could control things like the radio and climate control, and also steering and brakes at low speed.

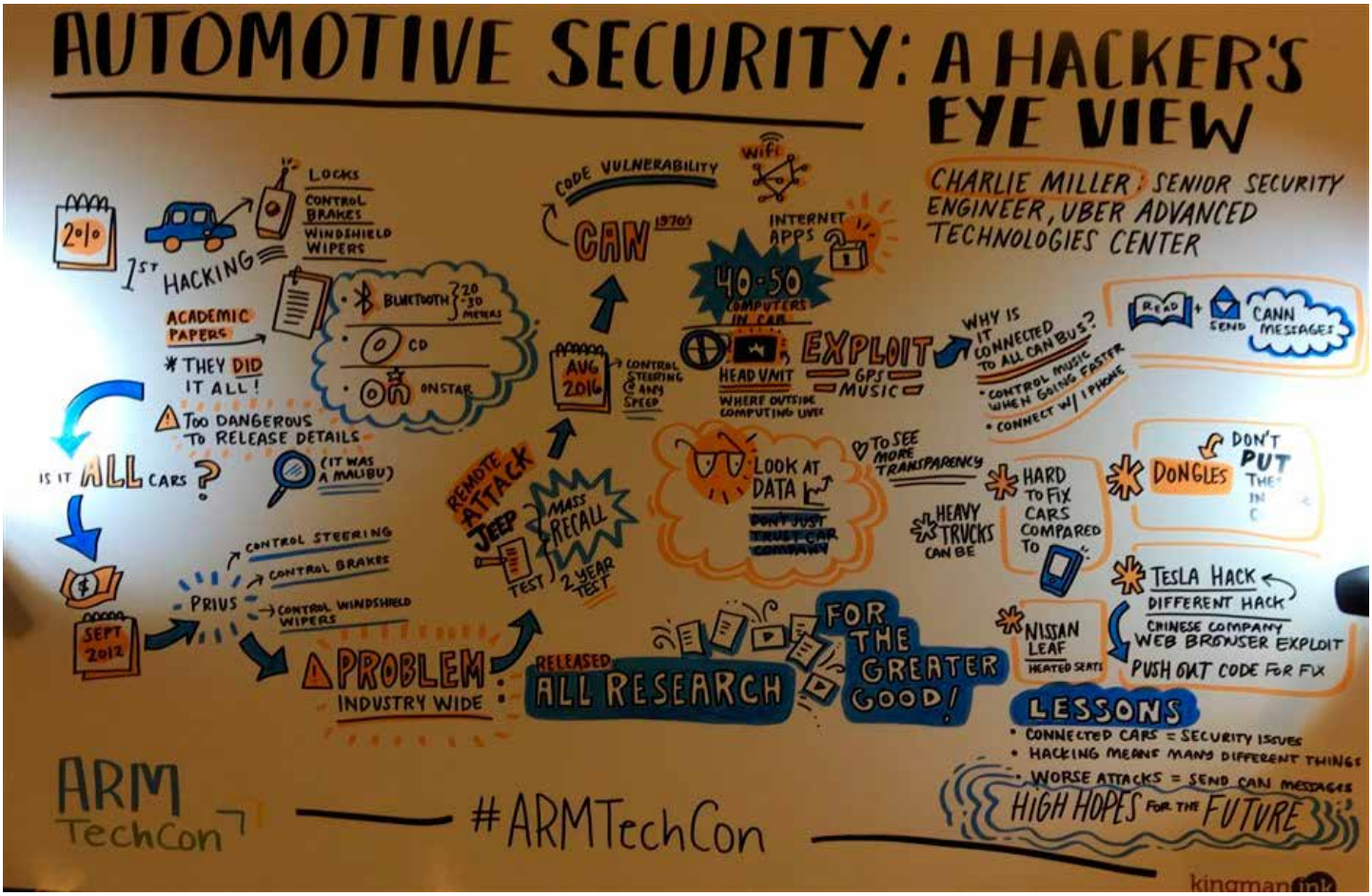

Figure 4. Automotive security: A hacker's eye view

Other Hacks in the News

Charlies talked a little about other car hacking in the news, things you might have heard about:

Some dongles exist to plug into your car to allow fleet management, or lower insurance rates for good drivers. All the dongles analyzed by academics were vulnerable. So most things that are in your car you can't do anything about, but here is one you can: don't plug a dongle into your car.

Troy Hunt discovered that with a Nissan Leaf the authentication back to the server was just the VIN. So you could walk up to a Leaf, read the VIN through the windshield, and turn on the heated seats. Since it is an electric car it would drain the battery and it wouldn't go. This wasn't physically dangerous but the attack was really easy.

There was a famous Tesla hack. It also needed physical access and could not access the CAN bus, but they could control radio, windows, door locks. Not the really scary stuff. Then they found a web browser exploit which meant that they could reflash the CAN gateway and send arbitrary messages. Tesla fixed it, and made it so that the code needed to be signed. Since they can update over the air, it didn't require a recall, it could just happen while all the owners were sleeping.

There were headlines about cars being stolen with electronic keys. But it turned out to be a low-technology approach. They stole the software for reprogramming keys, so they could then look up the VIN, create a key, open the car, and drive off.

All cars use proprietary message formats so an exploit in one car won't work directly in another. With trucks this is not the case. The message formats are standardized among all manufacturers. So any attack on a truck will work on all trucks.

Summary

Charlie said they are trying to get ahead of the curve and communicate with car companies but "they don't talk to us." There are no white papers like there are from companies like Microsoft, about how their systems are designed for security. Hopefully things will get better but they are not in good shape right now.

Implementing a class D audio amplifier

› Steve Bowling, Microchip Technology

A 16bit microcontroller and a few external peripherals can be used to create a class D audio amplifier

Class D amplifiers have become popular as an audio amplifier topology due to their high efficiency and low cost. The high current output stage uses binary switches, resulting in low heat generation and power loss. This allows the power supply, heat sink and overall physical size of the amplifier to be reduced.

The typical efficiency of a class D amplifier is more than 90%, as opposed to 50% for a typical class AB amplifier. In an AB design, most of the inefficiency is a result of the output stage devices being required to operate in the linear region. As current flows though the devices, it is converted to heat instead of being delivered to the load.

A single-channel, full-bridge push-pull class D amplifier can be made using only the analogue features of a 16bit microcontroller and a few external components. This leaves the processor available for other applications.

Class D topology

A class D audio amplifier is essentially a PWM amplifier. The input audio signal is used as the modulation reference for a PWM carrier. The resulting PWM signal drives a higher power output stage, and is filtered to recover the amplified audio. As Fig. 1 shows, there are four main functions in such a device – triangle waveform generator, audio modulation comparator, switch controller and output stage, and low pass filter.

Using a comparator, the analogue audio signal is first compared with a high frequency triangle wave to create a pulse waveform that is directly proportional to the instantaneous values of the audio signal. This results in a digital representation of the analogue signal that can drive the output devices only in on and off states.

Additional logic produces the inverse of the digital signal to drive the complementary switch pair. Next, a switch controller provides signal timing and gate drive voltages for the output devices. The output switches provide voltage gain proportional to the supply voltage, and high current capability to drive the speaker coil. Finally, a low pass filter removes the carrier frequency and recreates the analogue audio signal.

Analogue input

The incoming audio signal needs to

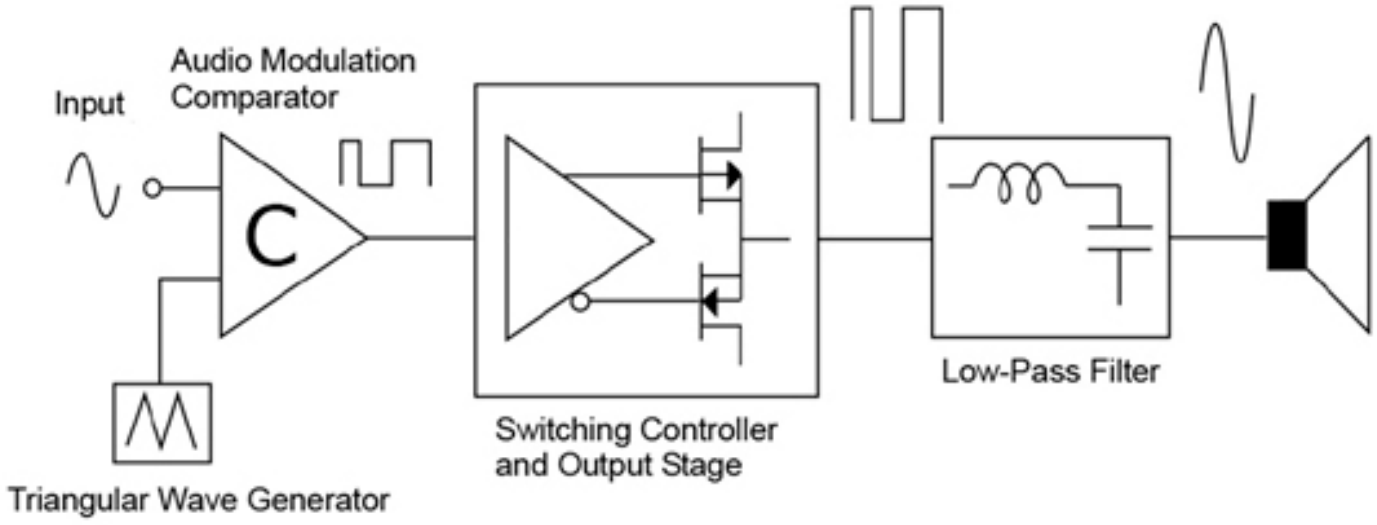

Figure 1: Block diagram of a class D amplifier

be conditioned and filtered before it is compared with the triangle wave. A low pass filter can prevent aliasing, and the level should be limited to below that of the triangle wave. The amplitude of the audio signal may need to be attenuated or amplified to match that of the comparator supplies and triangle wave amplitude. To improve signal-to-noise ratio, the peak level audio input should be as close to system full scale as possible. Depending on the application and loudspeaker to be driven, it may be beneficial to band limit the input signal. For example, if a small speaker is used that cannot produce tones below 100Hz, the input should be high pass filtered to reduce wasted energy and possible speaker damage.

Power supply

A stable DC power supply is important as it plays a critical role in the performance of the amplifier including gain, THD and noise. Class D amplifiers have little to no power supply noise rejection; any noise or voltage drops from loading will be passed on to the output. Due to the digital nature of the class D design, the power supply has to deliver large current transients each time the output devices switch. The power supply can also be affected by the energy storage elements in the low pass filter and loud-speaker coil.

Output stage

Using a full bridge output stage, as shown in Fig. 2, reduces the power supply's effect on performance degradation, and can be implemented with a single rail design.

Some dead time is needed to prevent damaging current flow though the switches. Dead time is a delay in driving a switch high due to the capacitive settling effects of the output switch. This prevents both switches from being closed at the same time, effectively shorting V+ to GND. The amount of dead time depends on the switch's on-off delay, and will affect THD. A full-bridge topology has reduced offset and THD compared with a half bridge, and can be implemented without a feedback circuit. When idle, the PWM duty cycle is 50% and the average voltage on both ends of the speaker coil is V+/2.

Output filter

A typical class D output filter is a second order L-C low pass filter with no resistive components to waste power. The filter cut off frequency should be at least four times lower than the switching frequency of the triangle generator. The application's speaker nominal impedance will guide the initial values of the inductors and capacitors. However, the speaker coil's own inductance and capacitance also interact with the filter elements and should be considered in the design.

The power level of the amplifier and resulting current delivered though the filter guides the power rating of the filter elements. Lastly, some designs may have restrictions on radiated emissions (EMI). The filter design, physical location and trace routing need to be considered for

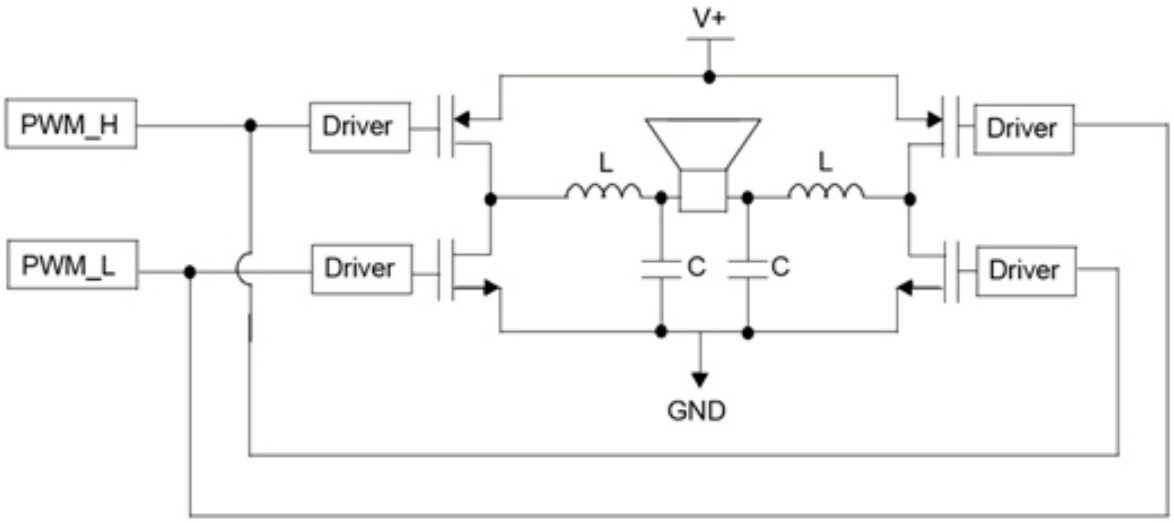

Fig. 2: Full bridge output circuit diagram

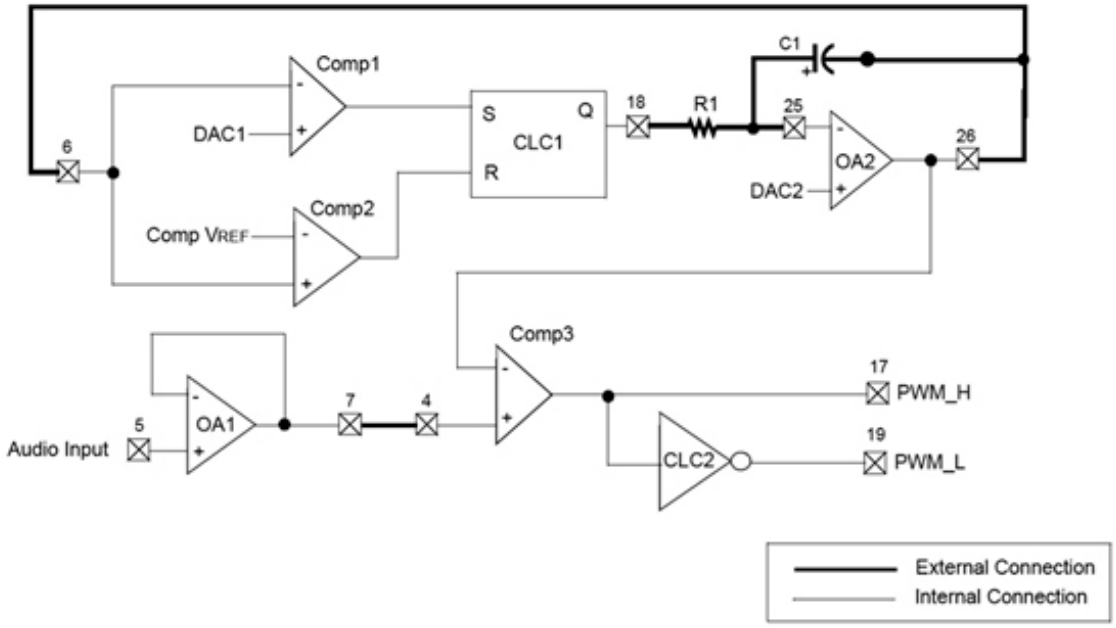

Fig. 3: Peripheral connections for the PIC24FV16KM202 microcontroller

best performance.

Implementation

A 16bit microcontroller, such as the PIC24FV16KM202 from Microchip, can have a wide range of analogue and digital peripherals for creating an analogue class D amplifier. The KM device also has configurable internal connections between the peripherals that reduce external PCB routing and free up IO pins for other uses. The FV variant of the family was chosen for its 5V operation, improving the signal-to-noise ratio of the system. Fig. 3 shows the peripherals and connections used for the amplifier.

Op amp OA1 is a buffer for the incoming audio signal. The triangle generator uses a pair of comparators, a configurable logic cell (CLC) module setup as an SR latch and an op amp configured as an integrator. The comparators are wired as a windowed comparator, with thresholds set by DAC1 and the comparator voltage reference.

The windowed comparator's output is then converted to a square wave using the SR latch, and finally a triangle wave via the integration function of OA1. The triangle wave is fed back to the window comparator completing the self resonator circuit. Comparator Comp3 creates the pulse waveform by comparing the triangle waveform with the audio input. CLC2 configured as an inverter provides the complement signal for the full bridge topology.

Three comparators are used in the design. Comparators Comp1 and Comp2 function as windowed comparators using the comparator voltage reference and DAC1 to set the voltage threshold levels. Comparator Comp3 compares the audio signal with the triangle wave to create the digital PWM signal.

OA1 acts as a buffer for the incoming analogue audio signal. It is set up as a voltage follower using the selectable internal connection from the output to the inverting input. Optionally, OA1 can be set up as a filter with or without gain. OA2 is used in the triangle generator as an integrator, with its output fed back to the window comparator to create an oscillator.

The digital-to-analogue converters (DACs) are used in a static state to provide a programmable DC voltage level for the triangle generator. DAC1 is internally connected to Comp1's non-inverting input as the upper voltage threshold of the window comparator. DAC2 is internally connected to OA2's non-inverting input and used to set the DC bias level at 2.5V (V+/2).

The CLCs provide digital logic for the triangle wave generator and digital output. CLC1 is configured as an RS flip-flop to create a single square wave from the window comparator's outputs. CLC1's inputs are internally connected to the comparator outputs. CLC2 is set up as an inverter to create a complementary PWM signal for the low side switches.

Conclusion

The microcontroller's wide range of analogue and digital peripherals allows it to be used to create a complete class D amplifier. The internal connections between peripherals reduce the pin count needed for implementation, leaving the IO pins available for other uses. Using the peripherals instead of discrete components to realise a Class D design reduces PCB area and overall cost.

Towards avionics safety certification on multi-core processor architectures

› Paul Parkinson, Wind River

Abstract
Single-core processor architectures which are widely-used in safety-critical avionics applications are now becoming scarce due to the migration of semi-conductor manufacturers to multi-core processor architectures. In this article, the suitability of commercial-off-the-shelf (COTS) multi-core processor architectures for safety-critical avionics applications will be considered, and the challenges of undertaking avionics safety-certification will be discussed.

The Challenge of Multi-core Processor Selection

Over the last decade, in order to meet the demands of ever increasing performance from the commercial market, and faced with the fundamental performance limit which could be achieved on a single-core processor due to clock speed ceiling, semi-conductor manufacturers transitioned to multi-core processor architectures to achieve performance gains.

The introduction of multi-core processor architectures has provided performance gains for enterprise general purpose applications; it has also presented some unique challenges for their use in safety-critical avionics systems. This is because avionics applications have specific requirements, including (but not limited to) application isolation and determinism, and these are not the primary considerations of semiconductor manufacturers when designing multi-core processors for the commercial market.

The avionics industry, academia and certification authorities have research projects into the use of multi-core processor architectures in avionics applications. A number of researchers have found that there is variation between multi-core processor designs in terms of their suitability for use in avionics applications, due to the impact of architectural design features on application isolation and determinism [1]. These relate to factors arising from shared resources on the device, which include use of a single memory controller or shared bus is used by multiple cores (providing a risk of resource contention), and similarly use of separate or shared Level 2 caches per core.

This uncertainty about the selection of multi-core processors for avionics programmes, has been compounded by the following factors:

i) Although the avionics safety certification agencies EASA and FAA have published the MULCORS research report and the CAST-32 position paper respectively, on the use of multi-core processors in avionics, this does not constitute formal policy or guidance.

ii) Single-core processors which have been used in safety-critical avionics applications are now nearing the end of silicon availability or are no longer available [2].

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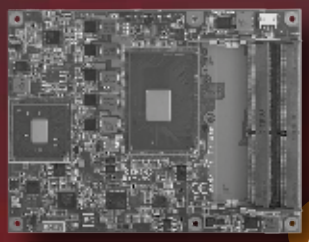

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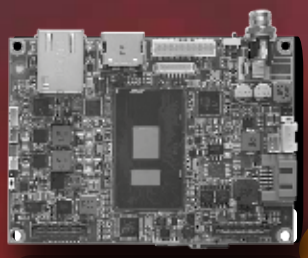

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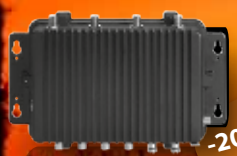

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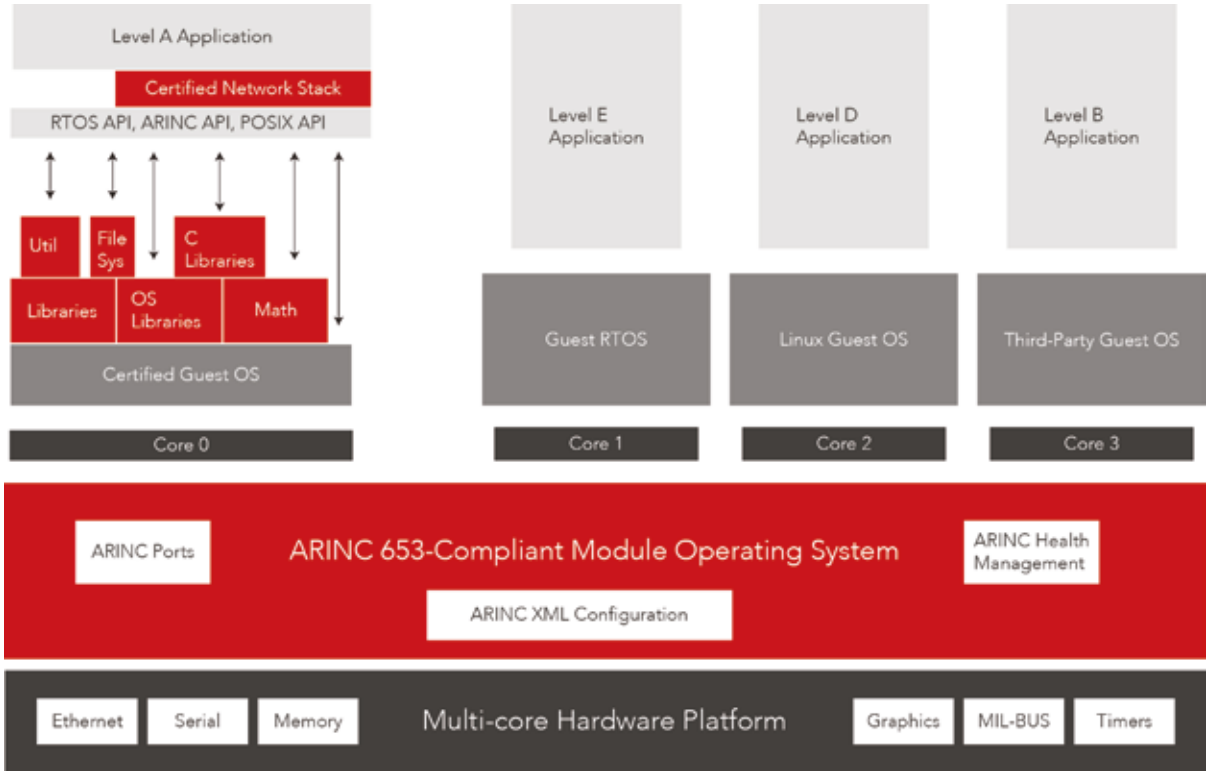

Fig: ARINC 653 compliant OS architecture

iii) The historical dominance of PowerPC in the embedded market appears to be somewhat in decline, and the long term future appears to be uncertain with NXP (formerly Freescale) developing ARM-based processors as well as to PowerPC. In addition, the large number of PowerPC QorIQ processor architecture variants makes it unclear if there will be a de facto choice for avionics.

iv) The increasing performance of ARM-based processors means that they may be considered as a viable option for some types of avionics application where PowerPC processors had been used previously.

v) Intel processors which historically were not widely considered for use in avionics applications due in part to their power dissipation requirements are now being considered due to Intel's low-power 14nm processor devices [3].

These market dynamics have resulted in fragmentation of processor selection for avionics, resulting in a lack of an obvious, single successor for widely-deployed PowerPC single core processors. We are now facing a wide range of contenders in terms of ARM multi-core, PowerPC QorIQ architecture families and Intel Core and Atom architectures.

The Challenge of RTOS Safety Certification

Undertaking DO-178B and ED-12B Level A software certification of an RTOS is extremely expensive, costing millions of Euros and is specific to an underlying processor architecture. It is cost-prohibitive COTS real-time operating system (RTOS) suppliers to undertake DO-178B and ED-12B safety certification on many different processor architectures, with no guarantee of being able to recoup the non-recurring engineering (NRE) costs.

For these reasons, DO-178B and ED-12B Level A COTS RTOS certification evidence packages have been developed for the most widely-used single-core processors in avionics. Wind River has used a COTS evidence approach for the VxWorks RTOS which has enabled the significant DO-178 and ED-12 certification NRE costs to be amortised across multiple customers and programmes using the same processor architecture, reducing the cost of certification on each programme. This also results in a virtuous circle, as these processors have provided the lowest cost options for follow-on certification projects, due to the ability to reuse existing DO-178 and ED-12 certification evidence, rather than having to develop it for a new processor architecture and associated incremental costs.

The Challenge of Multi-core Certification

The route to multi-core certification currently presents a challenge to avionics programmes due to lack of formal policy / guidance published by FAA and EASA. However, the EASA MULCORS research report and FAA CAST-32 position paper should be taken into consideration when planning a safety-critical multi-core avionics project.

Programmes may wish to consider the use of a multi-core processor in their next hardware platform even if their current processing requirements do not exceed that provided by a single core, in order to provide adequate processing capacity to meet future processing requirements. The selection of a multi-core processor may also become a necessity due to the lack of availability of single core processors as mentioned earlier. Similarly, some programmes may wish to use multi-core processors which have more than two cores, as 4-core and 8-core devices are now relatively common. However, CAST-32 does not consider multi-core processors with more than two active cores. Certifying multi-core processors will require substantial research and certification leadership to extend the guidance in the MULCORS and CAST-32 papers.

In both of the above scenarios, programmes will need to be able to utilise certain processor cores and deactivate the unused cores. To meet the multi-core determinism objectives of CAST-32, programmes will need to demonstrate that a deactivated core cannot unexpectedly become active and interfere with the operation of the processor's other cores. This could either use an approach of regularly reading control registers which are critical to safe operation and resetting the register value in the event of a change of state being detected; or by regularly overwriting the control registers to ensure that the desired state is maintained. Some processors may also provide performance monitoring units which enable the state of an individual core to be determined independently.

The software implementation of core deactivation is processor-specific, and depends on whether individual processor architecture provides the ability for a core to be able to write to a control register to deactivate another core or not. For example, on the PowerPC QorIQ T2080™ processor, deactivation of an individual core can be achieved by setting the relevant bit field in the Core Disable Register during Pre-Boot Initialisation or when the core is in boot hold off mode, and once a core has been deactivated it can only be re-enabled via power-on, hard reset or core reset [4].

The ability of safety-critical avionics programmes to be able to deactivate individual cores and develop a safety-case which includes robust arguments for the deterministic operation of the process may depend on the ability to obtain detailed technical information on the design and operation of the processor from the semiconductor manufacturer. Some companies may make this information publicly available, while others may only provide certain levels of information under non-disclosure agreement. For programmes undertaking DO-254 hardware certification, this will be a particularly important requirement, and will need to ensure that the selected semiconductor manufacturer will provide access to the required information, even if they do not formally support DO-254 certification in the way as companies such as Altera [5].

Conclusions

The avionics market is currently undergoing a significant transition from single-core to multi-core processor architectures, being driven by demands for greater system functionality and the semiconductor product lifecycles which primarily target the much larger commercial market segments. The advances made by semiconductor manufacturers now present a much broader range of viable processor choices for avionics applications than was available in the past. Although there currently appears to be some uncertainty about the best choice of processor for safety-critical avionics programmes, it is likely that positive experiences gained by early adopters on multi-core programmes will result in a virtuous circle of support, further adoption and success, in a similar way to single-core avionics programmes of previous decades generated a rich supplier ecosystem of COTS avionics certification solutions.

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Triangular relationship

› Dr. William Powell, R&S

A characteristic feature of mobile communications is that subscribers operate in a network of base stations used to process all communications. Future mobile devices will additionally be able to exchange data without an intermediate base station if they are in close proximity to each other. A tester for this scenario must be able to simulate not only a base station but also a mobile device with corresponding functionality – a case for the R&S®CMW500.

With the advent of device-to-device functionality (D2D) in Release 12 of the 3GPP specification, proximity services (ProSe) are possible for the first time in the history of cellular mobile communications. ProSe is based on a direct data transfer between two UEs. The use of such services has to be authorized, i.e. covered by the subscriber's cell phone contract. Once this is in place, the need for the base station is eliminated and under certain circumstances the devices can be used like walkie-talkies. The motivation for D2D is twofold. The first is an emergency or major disaster situation. If the mobile network is unavailable due to a power failure or if the rescuees or rescuers do not have network coverage, for instance in a cellar, self-sufficient mobile devices are exceptionally helpful. The second application scenario relates to local broadcast services, namely unidirectional data transfer.

To be able to handle D2D, the mobile device (UE) must have the new LTE D2D interface, which is called a sidelink. The UE is expected to be able to communicate over distances up to 500 m over the sidelink. D2D as per Release 12 can be implemented in two different forms: sidelink direct discovery (for broadcast) and sidelink direct communication (for groupcast). Both are possible in FDD as well as TDD networks and use the resources for the UL LTE Uu interface, which are allocated to the sidelink for this purpose. Direct communication is reserved for safety-related applications (see below for more detail), but the direct discovery feature is also open to commercial applications. In documentation from technology suppliers and network operators, this feature is referred to as LTE Direct (Qualcomm) and LTE Radar (T-Mobile).

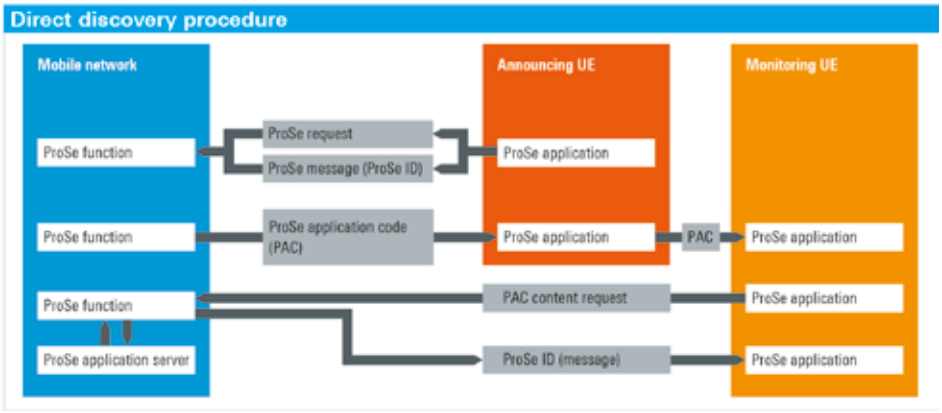

Figure 1: Direct discovery means that a UE uses the network to broadcast locally relevant information to nearby receivers

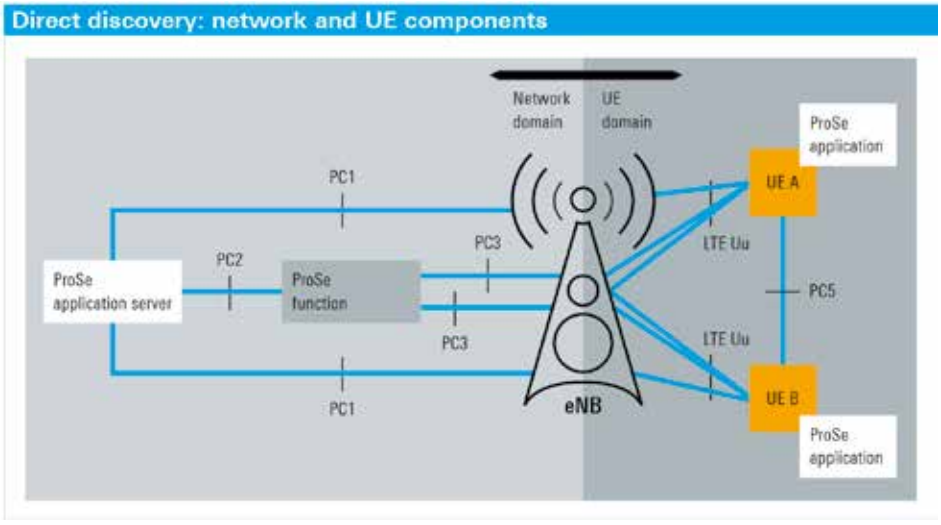

Fig. 2: Network resources and interfaces involved in ProSe

No ProSe usage without authorization

Irrespective of whether the user would like to use the direct discovery or direct communication service, the UE first determines if it is authorized. If the UE has network coverage, this is usually done via a network request. The UE uses existing DNS lookup procedures to find the responsible server (ProSe function) at the contracting company. If there is no network coverage, a UE can be pre-provisioned for ProSe services by having ProSe authorization stored on the SIM card or in the UE file system. Rohde & Schwarz offers the R&S®CMW-Z6 SIM card option to test this capability.

Direct discovery – efficient messaging with network support

Sidelink direct discovery is an extremely efficient method for broadcasting locally relevant information to other nearby receivers. For example, retail businesses can use this feature to advertise special promotions. The announcing UE periodically transmits the ProSe application code (PAC), a short 184-bit data telegram, over the sidelink air interface (see Fig. 1). The monitoring UE forwards the PAC to the network ProSe function, where it serves as an access key to the actual XML-based user information (ProSe ID). The ProSe function delivers this previously uploaded ProSe ID to the monitoring UE over the mobile network.

An announcing UE's ProSe application first requests a PAC, such as: "mcc123.mnc456.ProSeApp.Theatre.Tickets.Sales.Available.2", and forwards it together with the broadcast information to the provider. If the provider gives a green light (which depends on the current network load and other criteria), the mobile network operator (MNO) responds to the request by issuing a PAC that is intended for broadcasting.

The specific design of the whole process in actual networks has not yet been finalized. One of the open questions is how to ensure that the message reaches every LTE subscriber, even when the transmitter and receiver are operating on different frequencies or are registered with different providers. 3GPP does not specify how two MNOs allow access to each other's ProSe function. The technical principles, however, are established in Release 12 so that the basic process can be simulated. The R&S®CMW500 with the Release 12 option can simulate this process.

Comprehensive ProSe tests with the R&S®CMW500

Fig. 2 shows the network and UE components involved in direct discovery. Fig. 3 illustrates this in greater detail from the perspective of the R&S®CMW500 with a connected UE. The tester has to

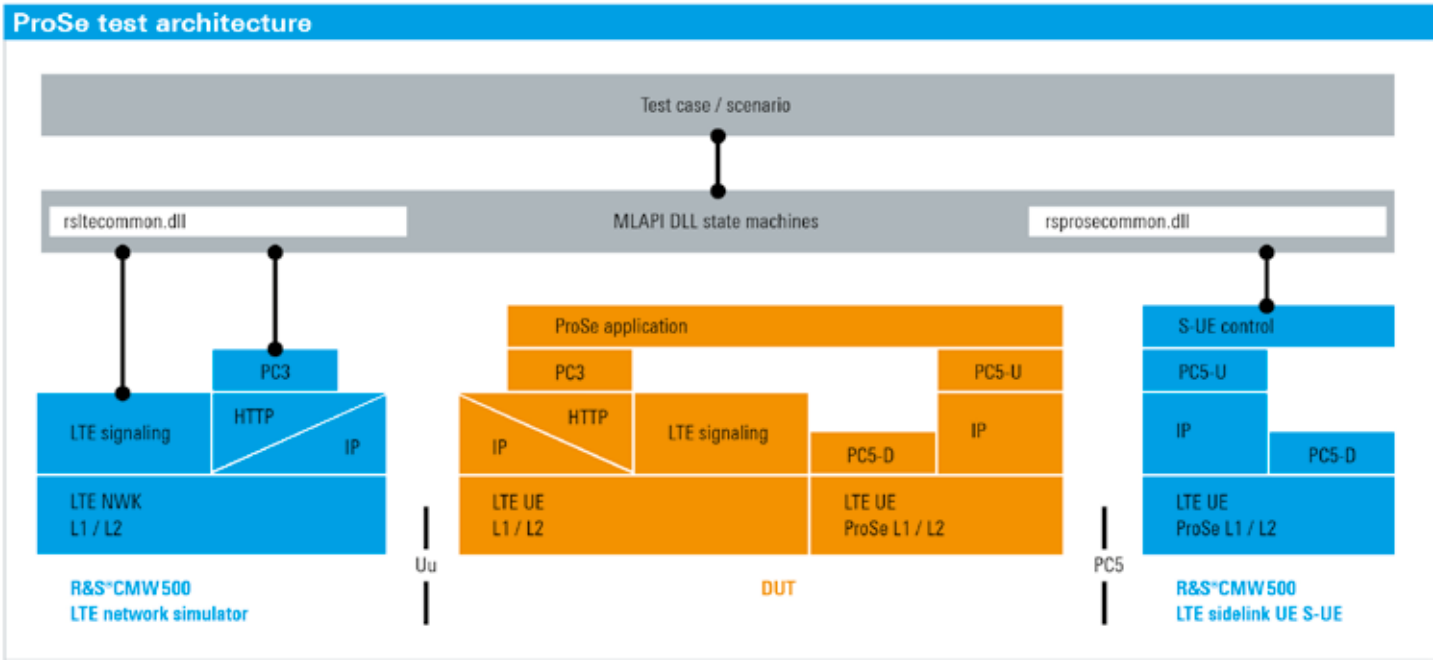

Fig. 3: Test architecture for ProSe tests, consisting of the R&S®CMW500 (blue) and the mobile device (DUT)

provide measurement functions for the sidelink interface (PC5) and also be able to simulate the data traffic with the ProSe function via the logical PC3 interface (XML over http, routed via the LTE Uu air interface). The UE under test functions alternately as a direct discovery transmitter (announcing UE) and receiver (monitoring UE). The medium level API (MLAPI) for the R&S®CMW500 includes a DLL implementation of the network's ProSe function so that the ProSe protocol can be tested. UE development often takes place in teams working in parallel. These teams are dedicated either to the RAT or to the core network-related layers and interfaces. Since each team assumes that the other team's functionality will work, the direct discovery implementation on the R&S®CMW500 offers the possibility of circumventing the PC3 interface and carrying out tests even without implemented ProSe protocols by using test loop mode D in line with 3GPP TS 36.509.

According to the 3GPP specification, a UE that supports direct discovery must be able to receive up to 50 messages per channel (assuming a 20 MHz cell) within a single transmission time interval (TTI, 1 ms). To test this capability, the R&S®CMW500 generates up to 50 sidelink UEs in a specified frequency band. In addition (although this is not a firm requirement), a UE should also be able to monitor frequency bands of other local LTE networks in order to receive messages transmitted there. This situation is also covered by the R&S®CMW500. Two active sidelinks, each capable of receiving up to 50 messages per TTI, are set up in parallel on different frequencies.

Direct communication – modern IP communications for public safety and security

Public safety and security organizations have special communications requirements. In the past, they generally relied on customized (trunked) radiocommunications systems such as TETRA. The capability of commercially deployed technologies like LTE leave such systems far behind when it comes to performance. LTE direct communication solves the need for such features. It extends network communications by adding groupcast and push-to-talk direct mode functions that are typical of trunked radio systems. Voice, photos and high-resolution videos (which are not possible using traditional trunked radio systems with their low data rates) can easily be sent to members of a group. Each UE can be a member of any number of groups. Reserving radio resources and the security mechanisms for direct communication are described in detail in Rohde & Schwarz white papers [1, 2].

Since direct communication is especially important when there is a network outage, a solution had to be found for the problem of

compensating for the absence of a common timebase, which is critical for synchronizing UEs. The problem was resolved by ensuring that each UE wishing to transmit that does not find a time reference declares itself as the synchronization master. It then transmits all necessary information that is usually contained in the master information block, such as the system bandwidth and duplex mode (direct synchronization). The sidelink UE simulated by the R&S®CMW500 implements all the functions needed to test the DUT in both roles, both as the synchronization master and as a receiver that needs to synchronize with the master.

Direct synchronization can also be used to extend network coverage. If required, a direct communication enabled UE (though direct synchronization is not restricted to direct communication) at the edge of network coverage can be prompted by the network to take on the role of synchronization master for the UEs in its vicinity. A typical application scenario might be an emergency situation in which the emergency personnel needs to penetrate a building where there is no network reception.

Outlook

The definition of the D2D air interface is far from finalized with 3GPP Release 12. Release 13, for example, will add functionality to turn a UE into a relay node for UEs that are out of coverage. This feature will enable UEs to use direct discovery even when they are not in direct contact with a base station. In addition, a service called mission critical push to talk is being defined. This service will encompass both public safety and commercial applications. Other D2D application areas will include vehicle-to-vehicle communications, although these will only be addressed in future standardization efforts since they require much lower latencies than are currently possible with LTE. For all existing and foreseeable D2D services, the R&S®CMW500 is the tester of choice – for RF, protocol or application testing.

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Circuit Protection a vital consideration for the machine builder

› Dr. Peter Terhoeven, R&D Group Manager at Eaton

How circuit protection ensures operator safety, machine uptime and manufacturing OEM profitability

In today's global market, machine builders must be aware of their manufacturing customers' priorities to gain a competitive edge – and these priorities centre on maximising uptime and productivity while protecting both personnel and equipment from harm.

Achieving these objectives depends heavily on a successful circuit protection strategy, however choosing and sourcing the right protection components and balancing them against one another across an entire power distribution network is complex and challenging.

This article reviews the electrical problems that can occur, and their possible consequences, outlining that with the help of the component partner, solutions that are successful for both the machine builders and their end user clients can be realised.

Manufacturers in all types of industries insist on high throughput machines, reliable performance, reduced costs and increased operator safety. As machine builders work to meet these demands, they face ever-greater challenges from an increasingly global marketplace. The consistency of electrical power quality, the suitability of installation locations and the availability of trained technicians can not be guaranteed everywhere. To provide optimum performance a machine must have suitable electrical circuit protection against four possible fault conditions.

The fault conditions can be broadly classified as over-currents, residual or leakage currents, arcing faults, and electrical surges induced by lightning strikes or other installed equipment. All four represent a hazard to operator safety as well as a risk of equipment damage leading to extensive down-time.

Over-currents (overload or short-circuit current)

Over-currents are caused by harsh environments, general deterioration, damage from accidents or natural causes, or overloading of the distribution system. They can be either in the form of overload or

short-circuit currents. An overload current is one that exceeds the normal operating parameters of the conductors, but is confined to the electrical distribution system, whereas a short-circuit current flows outside these normal conducting paths.

A temporary overload, frequently between one and six times the normal current level, is usually caused by a harmless electrical surge that occurs when motors start up or equipment is energised. Brief in duration, any conductor temperature rise is trivial, with no harmful effect, and it is imperative that protection devices should not react to them. Continuous overloading though can be caused by defective motors, worn bearings, equipment working beyond its normal operating parameters or too many loads connected to one circuit. These overloads are destructive and must be removed by protection equipment in a timely manner to prevent damage.

Unlike overload currents, a short-circuit current can be many hundred times larger than normal operating current levels, rising to in excess of 50,000 A. If not isolated within a few milliseconds, damage and destruction can become rampant, resulting in severe insulation damage, melting of conductors, metal vaporisation, arcing and fires. Two forms of protection are used; circuit breakers and fuses. Although the circuit breaker is considered a replacement for the fuse, both have their applications. The key advantage of the fuse is the response time, opening within 4-5ms, compared to that of a circuit breaker. High fault currents that can damage machine power electronics are therefore prevented. The fuse's voltage and current rating for both continuous operation as well as interruption must be carefully considered to provide the correct protection. Help with fuse selection is often useful, if not essential, as the breadth of applications where fuses can be used, together with the depth of choice available, is vast. Eaton, for example, catalogues 8,500 different fuse types.

Circuit breakers, however, are resettable – in some cases even remotely – after a fault. For some applications, the ability to reset a circuit breaker from another location rather than sending a technician can improve machine up-time. Circuit breakers also perform better than fuses in circuits with inductive loads such as motors or transformers that draw heavy transient start-up currents. They can more easily be set to open on genuine faults, without 'nuisance tripping' during the inductive transients.

Additionally, circuit breakers have adjustable protection characteristics suitable for many different applications, whereas a fuse with exactly the right parameters must

be selected for each individual application. Circuit breakers can also provide other functions like emergency stop and mains switching via a modular accessory assortment.

Residual or leakage currents

Residual or leakage currents are not as large or energetic as short-circuits, but if a leakage current as low as 30 mA is allowed to flow through a human being for more than a fraction of a second, it can cause cardiac arrest or serious harm. Accordingly, power distribution systems must include residual current devices (RCDs) that open when they detect an imbalance between energised line and neutral conductor currents. Any such imbalance normally indicates a short circuit or other electrical anomaly. Apart from electric shock risk, there is also the danger of fire arising from excessive residual currents.

However, machine systems often contain variable speed drives and these generate operational earth leakage currents. Therefore it is essential that the RCD reacts adequately to fault currents that are actually dangerous, without 'nuisance tripping' in response to normal drive system earth leakage currents, or allowing reduced protection of the operator.

Machine builders should be concerned with Type B RCDs to meet the protection requirements in machinery equipment. The challenge is to keep a high system up-time combined with a high protection level for the equipment and the operator wherever the machine is located. Therefore it is essential to consider the compliance with all standards and regulations.

Digital RCDs are now available that offer several advantages to machine users. With real-time measurement of the residual current, they can provide notification both locally via LEDs and remotely via potential-free contacts. Faults can be recognized before tripping occurs, which reduces the need for unscheduled maintenance, therefore increasing system uptime.

Arcing faults

Arcing faults can occur from insulation faults or loose contacts on wiring, and is the main cause of damage in electrical installations. As well as any such electrical installation damage, arc faults can easily ignite fires which may have severe impacts on operators, machinery and infrastructure. A typical cause for such an arc would be damage to a machine cable by a mechanical lifter. Insurance companies estimate that 25% of all fires caused by electrical failure have at one stage been an arc. Initially Arc Fault Detection Devices (AFDDs) were designed to protect people from fire hazards in residential buildings, but since the technology has proven to be reliable and affordable, they are now becoming increasingly attractive to machine builders.

The detection of an arc is handled by complex electronic circuitry that senses high frequency signals on the power line. Arcs have a noise pattern on a wider bandwidth, different to other high frequency noise. Once an arc is detected, a connected miniature circuit breaker (MCB) or residual current circuit breaker (RCBO) will trip and cut the supply power to the arc.

The most important quality differentiator for an AFDD is low nuisance tripping. This is a challenge for a machine builder as there are many signals on the line that might be misinterpreted as arcs, for example, relay switching. A quick and safe detection (and mitigation) of an arc is extensively tested during the approval period.

Accordingly, arc fault protection strategies centre on detection. AFDDs work in partnership with circuit breakers or RCBOs. The AFDD should trip on detection of any arc with the energy of 100 joules or greater, with the allowable trip time reducing as the energy of the arc increases. Overall, protection success depends critically on fast response to minimise arc energy.

AFDDs are essential even in systems that already have over-current protection. Circuit breakers and RCDs cannot detect arc faults, which typically cause neither overcurrent nor residual currents. AFDDs combined with miniature circuit breakers protect from serial arcing faults as well as phase-neutral or phase-phase parallel faults. AFDDs combined with RCDs provide protection from phase-protective conductor faults.

Surge Protection

The need for surge protection across the distribution network has grown steadily with the ever-increasing use of electronics in machinery. Computers, PLCs, displays and communication components are becoming increasingly common as Industry 4.0 is adopted. Surges can wreak havoc on electronics, causing catastrophic failures, process

interruptions and repetitive damage leading eventually to failure. Causes can be external events such as lightning or grid switching or internally located motor and relay switching.

Surges rise to dangerous voltage levels very quickly, often within nanoseconds. Fuses and circuit breakers cannot react quickly enough to prevent damage. Alternative approaches are therefore necessary to add surge protection to any overcurrent measures already in place. The most widely-used components are spark gaps and varistors. Spark gaps, which have a long lifetime and can absorb high amounts of energy, typically require some level of activation energy, whereas varistors are very fast without the need for energy to trigger.

It is recommended to install at least one Surge Protection device (SPD) per distribution cabinet, one per sensitive device and one per sensor line that leaves a building. The cost of SPDs is usually a tiny fraction compared to the damage it helps to prevent.

Conclusion

It is clear to see that there are many different types of fault conditions and suitable circuit protection methods. The ultimate success of any circuit protection strategy to increase uptime and improve operator safety depends very much on choosing the right partner. Circuit breakers, fuses and other devices rarely work best as standalone items. They are usually designed into hierarchical power systems where responsibility for protection is shared among components according to their position in the overall layout. It therefore makes sense to source all these elements from a single, preferably global, partner that can guarantee their efficacy in working together, and can advise on building a balanced solution.

Machine builders can bring a real competitive advantage to their offering if they can find a circuit protection component partner with sufficient breadth and depth of stock, matched by equally comprehensive global technical and logistics support. The issue of circuit protection can become a sales advantage instead of a design problem.

COTS+ and DSCC parts emerge as alternatives to MIL-STD

› Lee Thompson, TTI Inc.

Unfortunately, and as much as some would like you to believe, standard parts are generally not of a high enough performance or quality to be suitable for use in harsh environments, such as defence, aerospace and space applications. Extremes of shock, vibration and temperature, extended life cycles, possible attack by gases and liquids require components that have been designed to work under specific and often very demanding conditions. Not only that, but they must be ultra-reliable…often such applications simply must not fail, either because failure would risk life, or the cost of failure would be astronomical (sometimes literally!).

The most widely specified and used standard governing such 'high-performance' parts is the US defence standard known as MIL -STD. A huge variety of electronic components – active, passive, emech, interconnect, hybrid and even sub-systems – are covered by various different MIL-STDs which govern the manufacture and testing of the parts in question.

All well and good, but there is a problem. MIL-STD numbers are associated with a specific component. Developing MIL-STDs for new parts is a long process, and once the standard is developed, for a component manufacturer to get that part listed is a long a costly process. What this means is that engineers working on designs that require high performance, high reliability components will be limited to older technology components, as new smaller, lighter, faster – maybe even cheaper – parts will not yet have had a MIL-STD created for them, or of it has, the manufacturer may not yet have received approval.

Luckily a couple of alternatives are emerging.

COTS+

Many engineers will have heard the term COTS – Commercial Off-The-Shelf. In the USA, COTS is a Federal Acquisition Regulation (FAR) term for commercially-available items and services that can be bought and used under government contract. It has come to be a widely used term, and the concept appears especially appealing in the light of defence budget cuts and restrictions. However, to put it

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TTI, Inc. offers MIL-DTL-38999 QPL connector assembly service from its European facility in Munich

Standard parts are generally not of a high enough performance or quality to be suitable for use in harsh environments, such as defence, aerospace and space applications

plainly, components designed for use in the commercial world are often unsuitable for the rigours of military, space and aerospace applications.

COTS+ is a development from COTS which can address the disparity between the requirement for a lower cost, more easily available device and one which is fully-approved to meet harsh environment use. COTS+ programs start with an enhanced part – often an automotive grade device that may have, say, an elevated operational temperature range – then add specific tests as necessary for an application.

All COTS+ programs vary and some have different names. An example is KEMET's 'COTS program' – which we would describe as COTS +. KEMET regularly supplies 'up-screened' products by working with customer drawings and imposing specified design and test requirements. Their COTS program offers the same high quality and high reliability components as up-screened products, but at a lower cost to the customer. This is accomplished by eliminating the need for customer-specific drawings to achieve the reliability level required for customer applications. A series of tests and inspections have been selected to provide the accelerated conditioning and 100% screening necessary to eliminate infant mortal failures from the population.

KEMET's C0G dielectric features a 125°C maximum operating temperature and is considered 'stable.' The Electronics Components, Assemblies & Materials Association (EIA) characterizes C0G dielectric as a Class I material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q and stability of capacitance characteristics are required. C0G exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to ±30 ppm/°C from -55°C to +125°C.

KEMET's COTS testing includes voltage conditioning and post-electrical testing as per MIL–PRF–55681. For enhanced reliability, KEMET also provides the following test level options and conformance certifications (see Figure 1):

A: Testing per MIL–PRF–55681 PDA 8%

B: Testing per MIL–PRF–55681 PDA 8%, DPA per EIA–469

C: Testing per MIL–PRF–55681 PDA 8%, DPA per EIA–469, Humidity per MIL–STD–202, Method 103, Condition A

Various other manufacturers have COTS+ programs including Amphenol, AVX, Harwin, Honeywell, Souriau, TE, TT and Vishay.

DSCC

Defense Supply Center, Columbus (DSCC) qualification is another way to address the issue of needing to use approved parts that are latest generation technology offerings. In many ways it is very similar to MIL-STD, including being administrated from the same United States Department of Defense, Defense Logistics Agency (DLA) site (Columbus, Ohio).

Even more than that, DSCC approvals very often reference MIL-STDs for testing and procedure. Where they differ is that they are much more flexible and quicker to implement. It is, for example, much quicker to bring on a DSCC standard for an increased capacitor voltage range – ie from 50V to 100V – than it would be under the MIL-STD scheme. So designers get to work with the latest technologies rather than having to wait for the standards to catch up.

Currently there are DSCC approval covering passive and semiconductor parts, and it looks likely that it will migrate to cover electromech and connectors shortly.

TTI works with a number of suppliers that offer parts for high reliability applications. We urge designers to look beyond the limitations of the MIL-STD portfolio to see whether a COTS+ device or a component carrying DSCC approval might not offer the performance they need.

Lee Thompson, Director Industry Marketing, Europe, Defence, Aerospace & Space for TTI.

Digital lifestyle: MINI Connected expands to include a new personal mobility assistant

Munich. The launch of the new generation of MINI Connected takes the intelligent link-up of the vehicle, driver and outside world into a new dimension. The introduction of the upgraded technology sees MINI Connected start a new journey beyond the familiar in-car infotainment functions to include a personal mobility assistant which can also help with personal mobility planning outside the car as part of an integrated concept. Based on a flexible platform – the Open Mobility Cloud – MINI Connected weaves the car smoothly into the MINI driver's digital life via the Apple iPhone, as well as Android-based smartphones in the future.

At the heart of MINI Connected, which has been available as a free download from the Apple App Store since 3 November 2016, is innovative journey management. This uses a seamless connection between a customer's MINI and their iPhone to enable personal mobility planning. MINI Connected therefore acts as a personal mobility assistant that facilitates the everyday planning of appointments and sharing of destinations with the vehicle, and in so doing makes it even easier and more convenient to enjoy stress-free driving fun and on-time arrival.

The first version of MINI Connected, which has been launched as an app alongside the presentation of the new MINI Countryman, sees the personal mobility assistant performing a host of different tasks. Accessing the user's calendar and appointment reminders, searching for new or recent destinations and determining the ideal time to leave for a trip are all taken care of by MINI Connected's journey management technology. As with BMW Connected, the personalised mobility assistant is underpinned by a flexible platform (the Open Mobility Cloud) which can incorporate not only the car itself but also the driver's touchpoint devices, depending on chosen options and MINI generation – via Bluetooth or a USB connection. bmw

MINI Connected knows your appointments, destinations and expected journey time.

The new functions of MINI Connected take into account

that mobility starts far in advance of entering the car and that driving is always most enjoyable when stress, traffic jams and onerous searches for the correct route can be avoided. Addresses and appointments which drivers have stored in their calendars serve as the basis for personal planning and MINI Connected automatically brings them on board. MINI Connected takes the current location and pre-set destination, and factors in real-time information on the traffic situation to determine the ideal time to leave – and sends users a timely alert in the form of a notification on their smartphone.

MINI Connected launches the navigation system and shows the way ahead.

As soon as the connection between the car and the user's device has been established, calendar entries are automatically synced and the navigation system starts. Route guidance can therefore begin straightaway and without having to enter the destination all over again. And MINI Connected also offers the option of carrying over places and points of interest from other apps in order to transfer them to the car as destinations for the navigation system, together with the desired arrival time.

MINI Connected is a good learner.

MINI Connected can store locations the user has driven to several times as favourite destinations and recognise trips made regularly – such as the daily route between home and work – so that it can keep the driver informed in advance regarding unusual traffic hold-ups along the route. And information on the vehicle status also assists personal mobility planning. For example, the driver can use MINI Connected on their device to check the amount of fuel in their MINI's tank and the estimated driving range based in this result, allowing them to plan any necessary fuel stops. For the MINI Cooper S E Countryman ALL4, a hybrid-specific function is added to the service which, in addition to the battery charge and fuel tank level, also displays the range available on electric power alone and the overall range of the car.

As of now MINI Connected has been available as a free download from the Apple App Store in the following countries: USA, Germany, Austria, Switzerland, France, the Netherlands, Belgium, Luxembourg, Spain, Portugal, Italy, Sweden, Denmark, Norway, Finland, Poland, Czech Republic, United Kingdom, Ireland, Malaysia, New Zealand, South Africa, Brazil and Singapore. Regular updates will add even more features over time that improve the mobility experience of MINI customers.

Industry's first 2.1-MHz Class-D amplifier transforms automotive audio design

Texas Instruments (TI) (NASDAQ:TXN) today introduced the first 2.1-MHz Class-D audio amplifier specifically designed for automotive applications. Supporting high-resolution 96-kHz digital input, the compact TAS6424-Q1 enables high-fidelity audio with low distortion in automotive infotainment applications. For more information, visit www.ti.com/tas6424q1-pr-eu.

The TAS6424-Q1 enables the use of smaller external filters and eliminates up to 18 external components to reduce system size and cost compared to existing Class-D solutions. With maximum output power of 75 W per channel, the device features the industry's highest switching rate and is the only audio amplifier that switches above the AM band.

Key features and benefits of the TAS6424-Q1 Class-D audio amplifier

- Reduces electromagnetic interference (EMI): Switching above the AM band eliminates the need for complex avoidance schemes and eases electromagnetic compatibility (EMC) designs while enabling the system to meet Comité International Spécial des Perturbations Radioélectriques (CISPR) 25 Class 5 EMC requirements.
- Supports low impedance: Maintains stable audio playback while driving low impedance loads of 2 ohms.
- Advanced AC load diagnostics and line driver mode: The TAS6424-Q1 provides detailed on-chip phase and impedance measurements that designers can use to configure the device with various outputs, such as woofer, tweeter and line-level connections.
- Enhanced audio quality: Improves distortion, power-supply rejection and dynamic response with high-frequency switching.
- Lower noise: An integrated digital-to-analog converter helps deliver a low system output noise of 42 uVrms for automotive designs like external amplifiers and head units.
- Better thermal performance: Reduces power dissipation by as much as 60 percent compared to Class-AB amplifiers, greatly reducing the need for fans or large heat sinks.

Tools and support to jump-start design

The PurePath™ Console graphical user interface is available to help designers easily configure the TAS6424-Q1. To simulate and optimize the device, designers can download an IBIS model or request a TAS6424-Q1 evaluation module.

Package, availability and pricing

The TAS6424-Q1 is available now in a PowerPAD™ thermally enhanced shrink small-outline package (HSSOP) from the TI store and authorized distributors. Pricing is US$5.97 in 1,000-unit quantities.

Vicor introduces seven new DCMs in a ChiP package

The DCM in a ChiP package is an isolated, regulated DC-DC converter, operating from an unregulated, wide range input to generate an isolated DC output. With its high frequency zero-voltage switching (ZVS) topology, the DCM converter consistently delivers high efficiency across the input line range. Modular DCM converters and downstream DC-DC products support efficient power distribution, providing superior power system performance and connectivity from a variety of unregulated power sources to the point-of-load.

Aimed at a variety of applications, including UAV, ground vehicle, radar, transportation and industrial controls, Vicor has added four new 30 V input nominal modules (9 – 50V range) in a 3623 Chip package (1.52 x 0.90 x 0.29 in). These converters have output voltages of 5, 24, 28, and 48V, and power levels up to 160W, achieving a power density up to 404 W/in3. Also announced is a 28V input nominal module (16 – 50V range) in a 3623 ChiP package with a 3.3V output at 120W, a 375W module with a nominal input voltage of 275V (120 – 420V) and 12V output in a 4623 ChiP package, and a 270V input nominal module (160 – 420V range) in a 4623 ChiP package with a 48V output at 500W (1.89 x 0.90 x 0.29 in), achieving a power density of 1,014 W/in3.

Vishay Intertechnology Automotive Grade Low-Profile, High-Current Inductors Feature Integrated E-Shield to Lower Costs and Save Space Available in 2525, 3232, and 4040 Case Sizes, Devices Provide -20 dB Electric Field Reduction at 1 cm

Vishay Intertechnology, Inc. (NYSE: VSH) today expanded its IHLE series of low-profile, high-current inductors featuring integrated e-shields for reduction of EMI with new Automotive Grade devices in the 2525, 3232, and 4040 case sizes. The Vishay Dale IHLE-2525CD-5A, IHLE-3232DD-5A, and IHLE-4040DD-5A lower costs and save board space by eliminating the need for separate board-level Faraday shielding. The devices contain the electric field associated with EMI in a tin-plated copper integrated shield, providing up to -20 dB of electric field reduction at 1 cm (above the center of the inductor) when the integrated shield is connected to ground.

Featuring high-temperature operation to +155 °C and coplanarity of their four terminals within ≤ 100 µm, the AEC-Q200-qualified inductors released today are optimized for energy storage in DC/DC converters and high-current filtering for automotive engine and transmission control units, diesel injection drivers, noise suppression for motors, windshield wipers, power mirrors and seats, entertainment / navigation systems, and HID lighting. In addition, the devices' 4-terminal connection (two ground connection points for the shield) provides high-vibration performance for on-engine and chassis-mounted electronic circuits.

Built on Vishay Dale IHLP® technology, the IHLE-2525CD-5A, IHLE-3232DD-5A, and IHLE-4040DD-5A feature high efficiency with typical DCR from 1.55 mΩ to 167 mΩ and a wide range of inductance values from 0.22 µH to 47 µH. The devices provide rated currents to 36.0 A and handle high transient current spikes without saturation. Packaged in an RoHS-compliant, 100 % lead (Pb)-free shielded construction, the inductors offer high resistance to thermal shock, moisture, and mechanical shock. The devices are halogen-free and Vishay Green.

Samples and production quantities of the new IHLE devices are available now, with lead times of 10 to 12 weeks for large orders. Pricing for U.S. delivery only ranges from $0.50 to $0.75 per piece in 10,000-piece quantities.

Ultra-Compact Open Frame Ac-Dc Power Supplies are Ideal for Space-Constrained Applications

CUI Inc today announced a family of ultra compact ac-dc power supplies in an open frame SIP package. The 3 W and 5 W configurations of the PBO series measure as small as 35 x 11 x 18 mm (1.38 x 0.43 x 0.71 in), allowing them to occupy less board real-estate than other power solutions. The 3 W models are also available in low-profile, right-angle versions measuring as small 35 x 18 x 11 mm (1.38 x 0.43 x 0.71 in), making them ideal for applications where vertical board space is at a premium.

Available with typical efficiencies up to 80%, the high density PBO series offers a wide input voltage range of 85 to 264 Vac or 70 to 400 Vdc for high voltage dc-dc systems. Single output voltages of 3.3, 5, 9, 12, 15 and 24 Vdc are available depending upon the series. For use in challenging environments, the 3 W models offer a wide operating temperature range of -40 to +85°C while the 5 W models provide a range from -25 to +85°C. Additionally, all models are designed to provide 3,000 Vac input to output isolation.

The PBO series also meets UL60950-1/EN 60950-1 standards, complies with EN55022 Class B limits for

conducted and radiated emissions and includes over current and short circuit protections. The ultra compact models are ideally suited for a variety of applications including industrial systems, automation equipment, security, telecommunications and smart home devices.

The PBO-3, PBO-3-B, and PBO-5 series are available immediately with prices starting at $5.85 per unit at 500 pieces through distribution. Please contact CUI for OEM pricing.

Summary

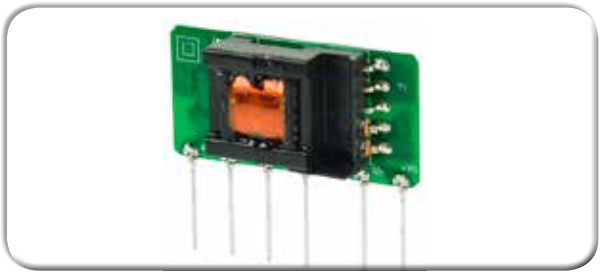
Product name: PBO-3, PBO-3-B, PBO-5

Availability: Stock to 8 weeks

Possible users: Industrial systems, automation, security, telecommunications, smart home

Primary features: Ultra-compact package, high density, wide operating temperature range

Cost: $5.85 per unit at 500 pieces through distribution



Timing-Architects and Vector join Forces for Multi-core Development

ISL9238 and ISL9238A add 5V-20V reverse boost for USB On-The-Go charging of smartphones, headphones and more

Intersil Corporation (NASDAQ: ISIL), a leading provider of innovative power management and precision analog solutions, today introduced two new USB-C™ buck-boost battery chargers that support bidirectional power delivery in ultrabooks, tablets, power banks and other mobile products. The single-chip ISL9238 and ISL9238A battery chargers replace competitive two-chip solutions to reduce customer bill of materials (BOM) costs by up to 40%. Both ICs employ Intersil's patented R3™ modulation technology to extend battery life and deliver acoustic noise-free operation, superior light-load efficiency and ultra-fast transient response.

The ISL9238 and ISL9238A operate in forward buck, boost or buck-boost mode to fast charge mobile battery packs with up to 4-cell Li-ion batteries. They also support USB 3.1 On-The-Go (OTG) with 5V/20V reverse buck, boost or buck-boost mode to deliver power out of a USB-C port for charging external devices such as smartphones, headphones or virtual reality goggles. At maximum power, both ICs provide 20V at 5A to the USB-C port for delivery of power up to 100W over a reversible USB Type-C connector cable. The ISL9238A features the same capabilities as the ISL9238, but also includes a different SMBus address for OEMs that want to use both ICs to design systems with dual USB-C ports.

In charging mode, the ISL9238 and ISL9238A take input power from a wide range of DC power sources, including AC/DC charger adapters, USB power delivery (PD) ports and any travel adapter. Both chargers include SMBus and I2C programmable features such as depleted battery trickle charging, and a two-level adapter current limit for turbo-mode events where the charger takes advantage of the adapter's milliseconds of surge current capability to minimize power draw and extend battery run-time. The ISL9238 and ISL9238A also feature programmable autonomous charging and an end of charge safety timer to stop battery charging.

"The new ISL9238/A USB-C buck-boost battery chargers give our customers more features, including 5V/20V reverse buck, boost and buck-boost modes, and the ability to add dual ports for two USB-C battery chargers in one system," said Andrew Cowell, senior vice president of Mobile Power Products at Intersil. "Mobile computing OEMs rely on Intersil to consistently deliver power management innovations that help them differentiate their products with thinner form factors and exceptionally long battery life."

The ISL9238 and ISL9238A are pin-compatible with the ISL9237 USB-C battery charger and join Intersil's family of mobile computing power management solutions, including the ISL95852 Vcore PMIC, ISL95908 peripheral PMIC, and discrete PWM controllers (ISL95853/54/55/57). These ICs power IMVP8-compliant mobile systems using 6th and 7th Gen Intel® Core™ processors.

Key Features and Specifications of ISL9238 and

ISL9238A

- Buck-boost NVDC charger for 1-, 2-, 3-, or 4-cell Li-ion batteries
- Input voltage range of 3.2V to 23.4V (no dead-zone)
- System output voltage of 2.4V to 18.304V
- Up to 1MHz operation allows use of smaller, lower cost inductors and automatically reduces switching frequency with no audible acoustic noise when charger is in DCM mode
- ASGATE FET control: actively controls inrush current to prevent FET damage
- Low-power and high-power LDO outputs tie to VDD pin to provide bias power and MOSFET gate drive power
- Compliant with Intel PROCHOT# and PSYS for protection against battery voltage drop, adapter over-current, battery over-current and overheat
- Allows trickle charging of depleted battery
- Autonomous charging option provides end of charge control using safety timer to stop battery charging
- SMBus/I2C programmable limit settings with adapter current monitor (AMON) and battery discharging current monitor (BMON)
- Battery learn mode calibrates the battery fuel gauge
- ISL9238A includes a different SMBus address to support charging a second battery

Pricing and Availability

The ISL9238 and ISL9238A buck-boost battery chargers are available now and priced at $3.50 USD in 1k quantities. Both battery chargers are supplied in 4mm x 4mm, 32-lead TQFN packages. For more information, please visit www.intersil.com/products/isl9238.

Miniature Multi-Sensor Module from STMicroelectronics Jumpstarts IoT and Wearable Designs

STMicroelectronics' 13.5mm x 13.5mm SensorTile is currently the smallest turnkey sensor board of its type, containing a MEMS accelerometer, gyroscope, magnetometer, pressure sensor, and a MEMS microphone. With the on-board low-power STM32L4 microcontroller, it can be used as a sensing and connectivity hub for developing products such as wearables, gaming accessories, and smart-home or Internet-of-Things (IoT) devices.

SensorTile has a complete Bluetooth® Low-Energy transceiver including a miniature single-chip balun on-board, as well as a broad set of system interfaces that support use as a sensor-fusion hub or as a platform for firmware development. It can be simply plugged to a host board, and when powered it immediately starts streaming inertial, audio, and environmental data to ST's BlueMS smartphone app that can be downloaded free of charge from popular app stores.

Software development is fast and easy thanks to a vast ecosystem of Application Program Interface (API) based on the STM32Cube Hardware Abstraction Layer and middleware components, including the STM32 Open Development Environment. The system is fully compatible with the Open Software eXpansion Libraries (Open.MEMS, Open.RF, and Open.AUDIO), as well as many third-party embedded sensing and voice-processing projects. Many example programs available in source code offer a starting point for evaluation and customization, including software for position sensing, activity recognition, and low-power voice communication.

The complete kit includes a cradle board, which carries the 13.5mm x 13.5mm SensorTile core system in standalone or hub mode and can be used as a reference design. This compact yet fully loaded board contains a humidity and temperature sensor, a micro-SD card socket, as well as a lithium-polymer battery (LiPo) charger. Its simple layout demonstrates how a complete wearable prototype customized with extra functionalities can be easily designed with the SensorTile core system. The pack also contains a LiPo rechargeable battery and a plastic case that provides a convenient housing for the cradle, SensorTile, and battery combination.

Also part of the SensorTile kit is a cradle/expansion board with an analog audio output, a micro-USB connector, and an Arduino-like interface that can be plugged into any STM32 Nucleo board to expand developers' options for system and software development. A programming cable is also included.

The SensorTile kit (STEVAL-STLKT01V1) is available now from distributors or can be purchased directly from st.com, priced at $89.00.

Main features of SensorTile core system:

LSM6DSM 3D accelerometer + 3D gyroscope

LSM303AGR 3D Magnetometer + 3D accelerometer

LPS22HB pressure sensor/barometer

MP34DT04 digital MEMS microphone

STM32L476 microcontroller

BlueNRG-MS network processor with integrated 2.4GHz radio

For further information please visit www.st.com/sensortile

Maxim Reference Design Speeds Development of Wearable Heart-Rate and Pulse-Oximetry Monitors

Developers of heart rate and blood oxygen (SpO2) monitors can now accelerate their efforts using the ultra-small MAXREFDES117# reference design from Maxim Integrated Products, Inc. (NASDAQ: MXIM/).

This optical heart-rate module reference design incorporates red and infrared LEDs, a sensor, power subsystem, and logic level translation. Measuring 13mm x 13mm, this tiny, low-power board can be placed on a finger or earlobe to accurately detect heart rate and SpO2 via personal wearable devices. The module works with both Arduino® and ARM® mbed™ platforms for ease of design, testing, and system integration, and includes eight "tap pads" for quick electrical connection to a development platform and/or wearable garment.

Maxim, already a leader in bio-sensing applications with more than 200 million units shipped, now provides this simple platform to enable all developers. The reference design includes three Maxim chips: a pulse oximeter and heart-rate sensor (MAX30102); an efficient, low-power step-down converter (MAX1921); and an accurate level translator (MAX14595). The design requires only a single 2V to 5.5V supply and typically dissipates less than 5.5mW when using the included firmware.

Key Advantages

Ease-of-Use: Compatible with both Arduino and ARM mbed platforms to simplify set-up

Fast Time-to-Market: Includes open-source heart-rate and SpO2 algorithm; BOM; schematics; layout, and Gerber files to accelerate development

Versatile: Can be used for product development or as a module in the final design

Commentary

"Maxim is providing a basic open-source heart-rate and SpO2 algorithm as part of the firmware, and we encourage users to build upon it," said David Andeen, Director of Reference Designs at Maxim Integrated. "Makers and developers can use this either as a 'starting point' reference design, or embed any variation in their final product or project."

"As we continue to bring innovative designs to our customers, we have started a collaboration with Maxim—this is the first product we manufactured and built with them," said Joey Jiang, Marketing Product Director, Seeed Studio. "We're excited to see what people will make with this reference design."

Availability and Pricing

The MAXREFDES117# reference design is available for $20 at Maxim's website, select franchised distributors, and http://bit.ly/Seeed_MAXREFDES117. Hardware and firmware design files, as well as test data, are provided free and available online.

For information on other reference designs, visit http://bit.ly/ReferenceDesigns.

ON Semiconductor to Debut First to Market, Truly Scalable Design Platform for Next Generation Wearable Technology at CES 2017

ON Semiconductor (Nasdaq: ON), driving energy efficient innovations, has utilized its strength and depth in a broad range of semiconductor disciplines – including analog, power management, sensor interface and signal conditioning – to introduce a comprehensive development resource for the wearable electronics sector. The newWearable Development Kit (WDK1.0) combines a wide array of highly optimized components, with the objective of assisting OEMs in bringing differentiated products to market. Using it can significantly accelerate design cycles for wearable electronics while mitigating heavy engineering costs.

"Despite the growing interest in wearable electronics, to date there is simply not a solution on the market that provides the scope needed by OEMs to help them develop feature rich designs that will attract strong consumer uptake," states AJ ElJallad, senior manager, corporate strategy and business development at ON Semiconductor. "The WDK1.0 is a multi-faceted design asset that will allow wearable technology projects to be expedited – shortening time to market and curbing the associated investment in engineering by leveraging the extent of ON Semiconductor's product portfolio."

For this new offering, a high efficiency programmable NCP6915 Power Management IC provides 5 LDOs and 1 DC-DC to support power requirement for the smartwatch and for additional development requirements. An NCP1855 battery charger IC, plus an LC709203F fuel gauge and a 10 watt (W) rated SCY1751 wireless charging front-end controller (supporting AirFuel compatible magnetic resonance charging) have also been incorporated. The kit's sensor capabilities stem from the MEMS-based FIS1100 inertial measurement unit (IMU), with 3□axis gyroscope and 3□axis accelerometer operation enabling accurate multi-dimensional motion tracking. There is also an embedded temperature sensor included and an LC898301 driver IC for initiating haptic feedback.

Critical to the WDK1.0 is its wireless connectivity, which is addressed via an ultra-lower power nRF52832 multi-protocol system-on-chip (SoC) from Nordic Semiconductor. This features a 32-bit ARM® Cortex™ processor core and a 2.4GHz transceiver – offering support for Bluetooth Low Energy (BLE) and other relevant wireless technologies. The kit is complemented by a SmartApp which can be downloaded directly from Android PlayStore and Apple AppStore. Using this, various pieces of information can be transposed, such as the steps taken, calories burnt, distance covered and activity period, as well as human machine interface aspects like screen brightness adjustment, clock face control, alarm settings and establishing fitness goals. An Eclipse-based IDE accompanies the kit. This presents engineering teams with all the resources they need to rapidly create and subsequently debug code necessary for designs. A highly intuitive Project Wizard further facilitates the development process, by giving engineers access to numerous useful wearable-related project examples.

The WDK1.0 solution also has a 1.44-inch format, 128 x 128 pixel TFT display into which a capacitive touch screen is integrated. A 26□pin expansion port complements all the other elements in the kit. Through this there is ample provision for further additions to the system design, such as supplementary microcontroller, signal processing or GPS functionality, the inclusion of more sensors or the specifying of different display. Hardware schematics and Cadence EDA design files are also made available. Read the WDK 1.0 blog and visit the website for more detailed information.

In addition to the WDK 1.0, ON Semiconductor will be demonstrating its latest solutions for Automotive, Internet of Things (IoT), Virtual Reality, and Wearable applications including CES Innovation Award Honorees at CES 2017 in Las Vegas from January 5 – 8. To schedule a private

tour of the company's demo room please contact your ON Semiconductor sales representative.

STMicroelectronics Boosts Trusted Computing with New Advanced Security Modules

STMicroelectronics (NYSE: STM), a global semiconductor leader serving customers across the spectrum of electronics applications and an active member of the Trusted Computing Group (TCG) for more than a decade, has introduced two state-of-the-art security modules that provide an industry-validated shield to protect computers and smart connected devices against cyber-attacks.

The new STSAFE Trusted Platform Modules (TPM) store system-authentication data such as cryptographic keys and software measurements in inaccessible and unalterable hardware, offering an industry-standardized way to protect PCs and servers, as well as other home and office equipment such as printers, copiers, home gateways, network routers, and switches. This protected storage prevents attackers from interfering with the device's integrity, stealing private data, or taking over the system to gain unauthorized access or privileges that would put the system, data, or its network at risk.

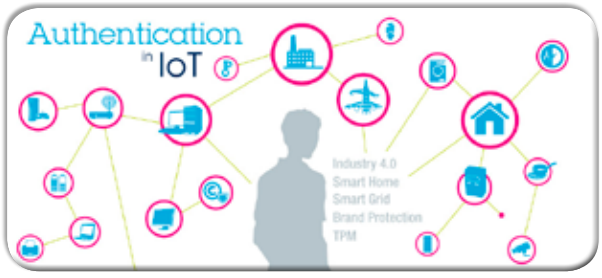
"Robust security is central to maintaining trust in the rapidly growing number of smart connected devices that support the way we live and work," said Marie-France Florentin, General Manager, Secure Microcontrollers Division, STMicroelectronics. "Our state-of-the-art security modules combine the latest trusted computing technology with value-added features that enable superior protection for end-users' privacy and safety."

The Trusted Computing Group's latest TPM 2.0 specification adds extra features over and above the earlier TPM 1.2[1], including cryptographic algorithms and support for user hierarchies. The first of ST's new STSAFE-TPM devices, the ST33TPHF2ESPI, supports both specifications and can switch easily between the two, allowing OEMs to provide TPM 1.2 or TPM 2.0 capability on the latest device technology. The second device is the ST33TPHF20SPI, which supports TPM 2.0 and has the largest non-volatile memory in the market to provide up to 110Kbytes storage for sensitive data.

The STSAFE-TPM modules leverage ST's expertise with the secure ARM® SecurCore® SC300™ processor, which has anti-tamper, data-watching, and memory-protection features. Both devices are Common Criteria (CC) and Trusted Computing Group (TCG) certified against the applicable TPM 1.2 and 2.0 protection profiles and US Federal Information Processing Standard (FIPS) 140-2 certifications are in progress. The new modules come with RSA and ECC[2] Endorsement Keys[3] (EKs) needed to support authentication and associated key certificates are provided, signed by the independent certification authority Globalsign Ltd to guarantee authenticity.

The ST33HTPH2ESPI and ST33HTPH20SPI are available in either a TSSOP28 or QFN32 package. Both devices are in production now. Please contact your ST sales office for pricing options and sample requests.

STSAFE is a family of authentication products offering turn-key solutions. All STSAFE products rely on highly secure MCUs that achieve top-level Common Criteria EAL5+ certification, as certified by independent labs. The STSAFE product family is aimed at offering well-tailored solutions to meet the increasing security challenges in Trusted Computing, Brand Protection, and the IoT.



Low-Power, Long-Range Radio Chip from STMicroelectronics Extends the Reach of the IoT, Adds Support for Sigfox Global Network

The latest radio chip for the Internet-of-Things (IoT) from STMicroelectronics (NYSE: STM) , a global semiconductor leader serving customers across the spectrum of electronics applications, delivers extremely high energy efficiency for smart connected objects to operate for up to 10 years without replacing batteries.

ST's new S2-LP transceiver is ideal for networked devices, such as alarm systems, surveillance equipment and smart energy-metering solutions, as well as long-range radio links used to connect devices like remote sensors directly to the Cloud without a local gateway. Other applications include building automation, industrial monitoring and control, and systems for managing lighting, traffic, or parking in smart cities.

The device operates in unlicensed sub-1GHz frequency bands, which are available globally. Ultra-narrowband operation allows highly efficient use of radio spectrum and reliable data exchange up to long distances using low-power signals.

In addition, the transceiver enables connectivity to the Sigfox global network, which is being rolled out worldwide to provide a reliable cost- and energy-efficient communication solution for billions of sensors and smart things.

"Building on our strengths in MEMS Sensors, Analog and Microcontrollers, in 2009 we saw the coming need to support emerging IoT applications with a low-power ISM radio for medium-long-range wireless connections and we developed and introduced our own SPIRIT1 low-power sub-1GHz radio that is currently in many applications available in the market," said Benedetto Vigna, Executive Vice President, General Manager, Analog and MEMS Group, STMicroelectronics. "Now, in partnership with Sigfox, we are opening a new era in ISM radios for the IoT to extend battery life from months to more than 10 years while preserving the robustness and reliability of the connection and reducing maintenance costs for remote and difficult-to-reach sensors."

Tony Francesca, Vice President of Global Ecosystem Partners at Sigfox added, "Our global network, which has been optimized for the lowest device energy consumption and cost, provides an entirely new way of connecting the physical world to the Cloud. ST's support for Sigfox, integrated in the new S2-LP radio device, will help system designers bring their IoT concepts to life by leveraging the benefits of our fast global infrastructure and ecosystem."

The S2-LP long-range, low-data-rate transceiver is in production now in a 4mm x 4mm QFN24 package, priced $1.15 for orders of 1000 pieces.

Technical Notes

The S2-LP transceiver is a highly integrated device made possible by ST's wide-ranging competencies including low-power RF analog design and integration with digital blocks comprising the radio baseband. It:

Supports point-to-point, star, as well as mesh networking topologies thus resulting in a very flexible wireless transceiver for connected objects.

Delivers extremely low power consumption, drawing only 6.7mA in receive mode, and 10mA when transmitting at 10dBm. Sleep and standby modes reduce the current to just 600nA and 350nA, respectively.

Receiver sensitivity of -130dBm enables operation over distances up to several hundred kilometers, depending on the environment, thus enabling wide-area coverage.

Is a flexible solution that can be programmed for operation in multiple worldwide sub-1GHz ISM frequency band: support for Sigfox, Wireless M-Bus and 6LowPAN, as well as IEEE 802.15.4g, which is suitable for home energy-management systems.

Leverages a full-featured Software Development Kit (SDK) compatible with the STM32 microcontroller family that has proven credentials in the energy-conscious IoT space, and with the extensive STM32 development ecosystem including prototype boards and rich software tools and resources.

Is Sigfox-ready and comes with a pre-certified Development Kit enabling immediate connectivity to the Sigfox network for evaluation and easy prototyping purposes.

Xilinx Launches Developer Zone to Accelerate Embedded Vision Innovation

Xilinx, Inc. (NASDAQ:XLNX) launched the Embedded Vision Developer Zone for software, hardware, and system developers to accelerate their productivity and build All Programmable, differentiated Embedded Vision applications. Through the Embedded Vision Developer Zone, Xilinx is providing a one-stop location to jump start the development of next-generation vision systems employing sensor fusion, advanced computer vision algorithms, and real-time object detection and analytics capabilities based on machine learning techniques.

Central to the Embedded Vision Developer Zone is a pool of engineering resources comprised of optimized libraries for software development, vision IP for hardware developers, projects, and tutorials from Xilinx, Alliance Program Members, and community developers. All development resources are compatible with Xilinx FPGAs and All Programmable SoCs, including Zynq® UltraScale+™MPSoCs combining four ARM® Cortex™-A53 APUs, two ARM Cortex-R5 Real time Processors, an ARM Mali™-400 MP2 GPU, an HEVC Video Codec supporting 4Kp60 resolution, programmable logic, and programmable interfaces.

"Product developers are embracing embedded vision at an accelerating pace. From smart surveillance cameras to autonomous vehicles, just about everything, everywhere needs to 'see' something," said Jeff Bier, founder of the Embedded Vision Alliance. "Squeezing vision into tight cost and power budgets presents unique challenges to embedded vision developers. Providing them with a dedicated place to find a wide range of resources relevant to their applications is an important step in enabling more developers to meet these challenges."

For additional information, users can experience the Embedded Vision Developer Zone by visiting the site or by watching this short video.

Infineon complements iMOTION™ Modular Application Design Kit with two power boards

Infineon Technologies AG (FSE: IFX / OTCQX) adds two power boards to the family of iMOTION™ Modular Application Design Kits (MADK). The two half bridge boards complement the compact and flexible evaluation system providing a scalable design platform for 3-phase motor drives in the range from 20 W to 300 W. The MADK aims at applications in the field of industrial and home appliance, e.g. pumps, fans, air conditioners and major home appliances. The new power boards additionally address battery powered applications. Using the kit, a functional motor system will be running in less than one hour, enabling fast time to market.

The new power boards are based on the µIPM™ from Infineon and come in power ratings of 100 V/20 A and 40 V/6 A. They feature an overcurrent/under-voltage lockout protection with fault output and an onboard power supply of 15 V and 3.3 V, respectively. Since no heat sinks are required, developers can optimize the copper area of the PCB for thermal performance. In combination with an XMC1302or IRMCK099 control card, designers only need a few steps to run the motor: plug the cards into the PC, motor and grid equivallent voltage supply and download, install and set the parameters of the software.

The Field Oriented Control (FOC) software supports sensor-less motor control based on the XMC1302 microcontroller. The XMC1302 control card includes a debugger based on Segger J-Link technology. Additionally, the software support for this tool includes an easy to use µC-Probe based GUI. Further application software development can be implemented via DAVE™, Infineon's free-of-charge integrated development environment (IDE), or with major ARM® IDEs, like Keil, IAR or Atollic. The IRMCK099 based control card with debug MCE-tool 2.0 features the patented and field proven motor control engine (MCE) from former International Rectifier.

Availability

The two power boards will be available shortly at www.infineon.com/MADK and distributors worldwide. This link also leads to full software packages for each kit as well as additional information on the iMOTION MADK. Based on the CIPOS™ Mini, two additional power boards allowing for motor control of up to 2 kW will be launched in mid-2017.

ON Semiconductor Introduces Automotive Industry's Most Compact Intelligent Power Module at Electronica 2016

ON Semiconductor (Nasdaq: ON), driving energy efficient innovations, and a top 10 global automotive semiconductor supplier following its recent acquisition of Fairchild Semiconductor, has introduced the industry's most compact 650 volt (V), 50 ampere (A) automotive qualified intelligent power module for controlling vehicle air conditioning (A/C) compressors. The FAM65V05DF1 addresses numerous other high voltage auxiliary motor applications in hybrid and electric vehicles and helps designers increase the performance and efficiency of applications while simultaneously reducing costs.

The FAM65V05DF1 uniquely integrates IGBTs, freewheeling diodes and gate drivers in an automotive-qualified 12 cm2 footprint package which is up to 40% smaller than solutions assembled from multiple discrete components. The device greatly simplifies and shortens the process of designing the power stages of high voltage automotive auxiliary inverters for A/C compressors and oil pumps – applications that must comply with stringent performance standards in demanding operating environments and with tight space constraints.

ON Semiconductor's broad portfolio of automotive related products and technologies continues to address the latest applications throughout the vehicle, as areas such as automatic driver assistance systems (ADAS), LED lighting, motor control, vehicle connectivity and vehicle electrification evolve at a rapid pace. In addition, the company's products are important in helping enable progress towards semi and fully autonomous vehicles in the future.

The acquisition of Fairchild Semiconductor adds high voltage, plus a significantly broadened range of medium voltage devices, to a portfolio that already comprises industry-leading low and medium power solutions for traditional combustion engine vehicles as well as hybrid and full electric cars.

Underlining ON Semiconductor's strength and expertise in addressing the high-performance, challenging operating environments and quality requirements of the automotive industry is the landmark figure of one billion automotive ignition IGBTs sold to automakers worldwide being recently surpassed. The company maintains TS16949 certification, ISO26262 compliance, and has a zero defect program leveraging its advanced design techniques and testing methodologies.

At Electronica 2016, the company's 400 square metre booth will feature the latest products and innovations for automotive as well as for the Internet of Things (IoT), power management and motor control sectors. Among a total of sixteen live demonstrations there will be several focusing on automotive applications in the areas of ignition IGBTs, ADAS, driver occupancy / in cabin vision and monitoring, and laser front lighting. These will show how the various products and technologies of the new, expanded ON Semiconductor can be utilized and combined to enable energy efficient innovations in integrated systems throughout the vehicle.

ON Semiconductor Launches Advanced, Integrated Solutions for Power Management and Control at Electronica 2016

ON Semiconductor (Nasdaq: ON), driving energy efficient innovations, has launched new intelligent power module (IPM) technologies for industrial power management and motor control applications.

Reinforcing the company's position as a leading supplier of IPMs, the company's new STK57FU394AG-E (15A) and STK5MFU3C1A-E (30A) are advanced 600 V IPMs that integrate a power factor correction (PFC) converter,

three-phase inverter output stage, pre-drive circuitry and protection in a single, compact package. High levels of integration help to reduce part count and board space compared to discrete designs in applications that include motor control, inverter control and HVAC systems. Microcontroller-compatible low-voltage input and status outputs support further component and space reduction by eliminating the need for photocouplers between a host micro and the IPM.

The devices feature built-in cross conduction prevention, which reduces the possibility of system malfunctions caused by noise, and over-current protection for both the inverter and PFC section. Under-voltage lock-out ensures IGBT gate shutdown in the event of abnormal conditions. The devices are certified to UL1557 and offer an externally accessible embedded thermistor for high-precision monitoring of the temperature of the insulated metal substrate.

Sungil Yong, director of IPMs for the high power division at ON Semiconductor states: “Our advanced packaging and integration capabilities allow ON Semiconductor to deliver high-performance, efficient and compact power devices that address industry requirements to reduce BoMs and drive PCB real estate requirements. The STK57FU394AG-E and STK5MFU3C1A-E deliver the power density, functionality and reliability demanded by next-generation inverter-based systems.”

At Electronica 2016, the company’s 400 square meter booth will feature a variety of technologies and demonstrations covering power management and motor control, including an 800 W motor driver system solution featuring the STK5Q4U3xxJ compact IPM and NCP1631 interleaved PFC controller. The solution also utilizes ON Semiconductor’s NCP1063 AC/DC regulator for the auxiliary power supply and sensing using NCS20034 quad op-amps.

The NIS5020 and NIS5132 eFuse devices will be also be on display, demonstrating advantages over conventional PTC and other surge protection and inrush limiting technologies offering features such as 10 µs fault response time, over voltage clamp, thermal shutdown & adjustable current limit. In addition, in a classic double pulse test setup, the best-in-class performance of the NGTB40N120FL3 1200V/40Amp IGBT, accompanied by the FFSH40120ADN 1200V/40Amp SiC diode will be demonstrated.

Visitors to the ON Semiconductor booth will also have the opportunity to see smart passive sensor and DC/DC point of load demonstrations, test the ON Semiconductor online design and simulation tools, and view new innovations in automotive applications and solutions for the IoT.

Packaging and Pricing

The STK57FU394AG-E is offered in a 56 mm x 25.8 mm SIP2A package and priced at $7.40 per unit in 10,000 unit quantities. The STK5MFU3C1A-E is offered in a 70 mm x 30.1 mm SIP3B package and priced at $12.30 per unit in 10,000 unit quantities. The new IPMs are available today and two evaluation boards can also be ordered, the STK57FU394AGGEVB and STK5MFU3C1AGEVB, which are recommended for designers who want to evaluate the devices in detail. Visit the website for more detailed product information about ON Semiconductor’s IPM solutions.

Miniature 2 Watt DC-DC converters for use in medical applications now available

XP Power today announced the new IML02 & ISM02 miniature 2W rated DC-DC converters for use in medical device applications that require safety isolation between the input and output. These converters provide 4000 VAC reinforced isolation with 1 x MOPP at 300 VAC (250 VAC model IML02) working voltage and, ideal for use in patient connected devices, have a very low 2 µA patient leakage current.

Featuring 2W of output power and with both single and dual voltage output models, the converters are available in an SMD package (model ISM02) or a through hole, industry standard SIP7 package (model IML02).

The converters’ small size, only 19.5 x 9.8 x 12.5 mm for the SIP-7 packaged IML02, and 24.0 x 18.0 x 9.0 mm for the ISM02, takes up less PCB space, and in both cases afford the product designer with more room to add extra features, or alternatively reduce the overall size of the end product.

Both converters feature extended operating temperature ranges, -40 to +85 degrees C for IML02 and -25 to +105 degrees C for the ISM02. Offering high efficiency, wide operating temperature and very small footprints, the units are well suited to modern compact medical devices.

The IML02 is available in four different input voltage ranges for nominal 5, 12,15 or 24VDC inputs, while the ISM02 is available in three ranges for 5, 12 and 24VDC input applications. The ISM02 offers single output models of 5, 12, 15V, and +/-12V and +/-15V dual output models, while the IML02 has 3.3, 5, 9, 12, 15V and +\- dual versions of each voltage.

The converters meet Class B EMI EN55011 standards (conducted EMI requires a small input filter for the IML range) and carry worldwide medical safety approvals to 60601-1 standards.

XP Power's new medical 2 Watt DC-DC converters offer the latest technology and with their market leading extended operating range, excellent efficiency and compact dimensions, are their 'next generation' converters for medical device applications.

The series are available from Digi-Key, element14, Farnell, RS Components, approved regional distributors, or direct from XP Power and come with a 3-year warranty.

Timing-Architects and Vector join Forces for Multi-core Development

Vector Informatik GmbH (Vector) of Stuttgart invests in Timing-Architects Embedded Systems GmbH (TA) of Regensburg. Together they now offer a complete tool chain for developing distributed multi-core real-time systems for Electronic Control Units (ECU) in vehicles. Vector is also enabling global sales of TA products.

Through this partnership, ECU developers and automotive OEMs will benefit from a universal tool solution. The multi-core capable AUTOSAR basic software MICROSAR and the Vector tools PREEvision, DaVinci Developer and DaVinci Configurator Pro are complemented by the TA Tool Suite from Timing-Architects. By this means, engineers get an innovative and comprehensive solution which lets them cover all phases of software development for real-time multi-core processors. Software integration into the ECU is simplified by architectural design, simulation, optimization and the evaluation of real-time data.

To intensify the already successful collaboration, Vector Informatik GmbH has acquired 49% of Timing-Architects Embedded Systems GmbH shares. Vector also supports worldwide sales of the TA Tool Suite and provides local technical expertise as well. This sales partnership, which has already been launched in the USA and Japan, will soon be extended to other countries. TA and Vector will still remain autonomous and independent companies.

Dr. Michael Deubzer, CEO of Timing-Architects, sees many advantages how software and functional developers will benefit from the partnership: "Due to their complexity, it is nearly impossible to develop networked multi-core systems without tool support. The real-time behavior of such systems can be validated by a combination of Vector and TA tools. Now, our partnership with Vector ensures easy and competent access to our tools for customers worldwide."

Dr. Thomas Beck, CEO of Vector Informatik GmbH, adds: "Today, our customers are already benefiting from a jointly developed interface for our tools, which can be used to analyze and optimize an AUTOSAR-conformant system configuration. Our two companies can now network this special knowledge even better to optimally tune our products to one another."

In the framework of the partnership, Vector and TA are already planning additional steps towards realizing efficient and productive automotive engineering.

In using the joint solution during development, first the AUTOSAR tools from Vector are used to describe the software components (SWCs) and create a preliminary draft of the ECU configuration. Engineers use PREEvision, DaVinci Developer and DaVinci Configurator Pro for this purpose. Then, the TA tools are used to analyze this configuration and make comparisons to time requirements. The best distribution

of the SWCs to the cores and OS partitions is determined by simulation and optimization, and the configuration is then updated. The interplay of different ECUs is considered by simulating the network communication. Data is exchanged between the tools over an AUTOSAR-conformant file interface.

Due to their higher computing power, multi-core processors offer ideal conditions for innovative software applications in vehicles, such as for ADAS systems. However, when applications are running on multiple cores, runtime losses are incurred due to data communication between the cores. For time-critical applications, the challenge is to find an optimal distribution of the application software. With the joint solution from TA and Vector, the network of multi-core ECUs can now be analyzed and optimized consistently, resulting in a reliable and efficient system. Completely in the sense of the vision of AUTOSAR, now developers will have new degrees of freedom in distributing software functions in real-time multi-core processors.

More information at: www.timing-architects.com and www.vector.com/autosar

The world's smallest and lowest power consuming single transceiver solution features low-cost 24 GHz industrial radar chips from Infineon

Infineon Technologies AG (FSE: IFX / OTCQX: IFNNY) and RFbeam Microwave GmbH introduce a single Tx/Rx module which is among the world's smallest and lowest power consuming solutions. The new low-cost 24 GHz transceiver system modules from RFbeam utilize the 24 GHz radar sensors BGT24LTR11 and BGT24MR2 from Infineon. They provide a plug-and-play-solution for original equipment manufacturers in need of either motion detection for persons or speed/distance measurement capabilities.

Possible fields of usage include advanced motion detection, speed, direction and distance measurement. Application examples in these fields are movement and presence detection which can be integrated in e.g. advertising panels. In traffic applications, the radar system can be used for red light management for roadworks or speed detection, as well as car classification systems such as toll roads or car park barriers. Combining the technical features of the markets' smallest 24 GHz industrial MMIC from Infineon with the RFbeam modules reduces time to market. Additionally, efforts and cost for the development of complex algorithm are minimized.

Delivering best performance even in harsh environments

The modules of RFbeam include antennas either with or without an integrated signal processing enabling manufacturers of industrial radar systems to optimize their system's capability. If necessary, this allows for the detection of speed and direction of movement (approaching or retreating) in addition to the easier detection of motion only. The current RFbeam portfolio offers three modules with various antenna characteristics, for MCU signal processing and different options for Doppler, FMCW (frequency modulated) or FSK (frequency shift keying) operation modes.

The new K-LD2 module features the radar chip BGT24LTR11 of Infineon. The K-LD2 is one of the smallest (25 mm x 25 mm) radar transceivers available with integrated signal processing and 80° x 34° antenna pattern. The module can be used for a multitude of applications where indoor/outdoor motion detection is required.

The new K-MD2 features the BGT24MR2 twin receiver MMIC of Infineon. It supports speed, range and angle measurement and delivers a digital output. The integrated range-Doppler processing is perfectly suited for high-end traffic applications. Each module offers a reliable and robust solution defined for specific applications with a precise measurement of object detection.

The 24 GHz transceiver MMIC radar sensors BGT24LTR11 and BGT24MR2 offer a fully integrated low phase noise voltage controlled oscillator (VCO) and built-in temperature compensation circuit for VCO stabilization. Additionally, they have full ESD protection,

200 GHz bipolar SiGe: C technology B7HF200 and single supply voltage of 3.3 V. Thus, the transceiver MMICs are the ideal partners for the RFbeam modules.

Microchip Launches Its First Sigfox FCC-certified Long-Range RF Transceiver and Connectivity Development Kits for IoT Applications

Microchip Technology Inc. (NASDAQ: MCHP), a leading provider of microcontroller (MCU), mixed-signal, analog and Flash-IP solutions, and Sigfox, the world's leading provider of global solutions for the Internet of Things (IoT), today launched the industry's first FCC-certified, fully integrated RF transceiver and kits for developing IoT solutions for use on the Sigfox network.

Powered by Microchip's highly integrated ATA8520E, a low-power RF transceiver with an integrated AVR® microcontroller, the new kits contain the first FCC-certified board that allows developers to easily connect to Sigfox's long-range, two-way global IoT network – resulting in a low-cost, low-power device-to-cloud connectivity solution.

This is ideal for IoT applications in the US, ranging from logistics, to agriculture, smart cities and other Machine-to-Machine (M2M) sectors. The ATA8520E is also the first fully Sigfox-certified chip suitable for both North America and Europe.

The solution is available in two versions. Customers can either purchase Microchip's Sigfox-certified ATA8520E as a standalone kit, designed primarily to test the technology, or as a kit combined with an Xplained Pro board, a solution for system-design purposes. Both are dedicated for Sigfox's IoT network in the license-free ISM bands. The solutions come complete with the Sigfox library, modulation, ID and PAC code, and a security key enabling IoT developers to quickly get their designs to market.

Currently operating in 24 countries, Sigfox is on its way to establishing one global, seamless network that provides simple, ubiquitous, energy-efficient connectivity for billions of devices that periodically will send small quantities of data over long distances. Sigfox and Microchip are teaming together to drive down IoT device costs, operational costs and power consumption, ultimately resulting in substantially longer battery life compared to traditional cellular, Bluetooth® or Wi-Fi®connectivity.

"The applications for the rapidly growing IoT market are endless," said Matthias Kaestner, vice president of Microchip's Radio Frequency and Automotive business unit. "With this new FCC-certified solution combining the best of Microchip and Sigfox offerings, the possibilities are unlimited for the billions of IoT connections. Our Sigfox solution gives any IoT application the secure, long-range wireless connectivity required to get these 'smart' things 'connected' – at a fraction of the cost and power consumption of a cellular connection."

"We are excited with Microchip's long-range wireless solution as it is compelling, reliable and out-of-the-box ready," said Tony Francesca, Sigfox vice president of Global Ecosystem Partners. "With its FCC certification, we look forward in partnering with Microchip to enable many IoT use cases and billions of devices to be connected to Sigfox's network in the US and other countries that are based on FCC type approvals."

For more information about Microchip's Sigfox solutions, visit: www.atmel.com/products/wireless/sigfox

Tektronix Unveils Complete Solution for Volume, Surface Resistivity Measurements New Software Application Controls Keithley Test Instrumentation, Fixtures, Paving the Way to Faster, More Accurate and Repeatable Material Characterization

Tektronix, Inc., a leading worldwide provider of

measurement solutions, today unveiled a complete solution for performing high resistivity measurements in compliance with accepted industry standards including ASTM D257 and IEC 60093. Designed for use with the Keithley Model 6517B Electrometer and Model 8009 Resistivity Chamber, the new Model KICKSTARTFL-HRMA application automates volume and surface resistivity measurements for more accurate and repeatable results without the need for custom programming.

Material scientists and engineers use resistivity measurement to verify the electrical properties of insulating and other materials they are developing or evaluating. However, they tend to be materials experts rather than test equipment experts and need tools that allow them to characterize materials without having to learn how to program test instrumentation. The KICKSTARTFL-HRMA application requires no programming and performs all required computations based on the geometry of the Keithley test fixture.

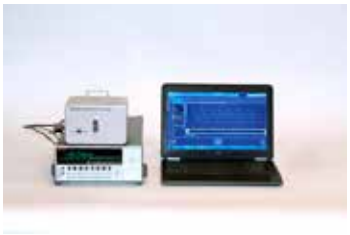
"High resistivity measurements are critical to evaluating not just electrical insulating materials, but many other materials. For instance, the resistivity of materials used in the production of car tires is important in balancing electrostatic discharge safety with properties that affect rolling friction," said Mike Flaherty, general manager, Keithley product line at Tektronix. "With this solution we are making these measurements much easier than they have ever been in the past, allowing our customers to focus on what they do best – developing new and improved materials for all types of applications."

The KICKSTARTFL-HRMA application quickly and reliably allows users to determine resistivity of materials using setups and methods consistent with ASTM D257 and IEC60093 standards. Users can visualize the step response of the material and make a good decision on an appropriate test time to use for volume or surface resistivity testing. For improved accuracy, the software uses the Keithley alternating polarity measurement technique to eliminate inherent background currents. And, using optional probes, users can also observe how resistivity changes due to environment factors such as temperature or humidity. Resulting data is presented in both graphical and tabular formats.

Pricing & Availability

An option for Keithley KickStart Instrument Control Software, the Model KICKSTARTFL-HRMA is available now and priced at $499. The full high-resistivity measurement solution includes Kickstart software, a Model 6517B Electrometer, and Model 8009 Resistivity Chamber. For more information go to: http://www.tek.com/keithley-kickstart.

Wondering what else Tektronix is up to? Check out the Tektronix Bandwidth Banter blog and stay up to date on the latest news from Tektronix on Twitter and Facebook.



Vector facilitates analysis and test of sensor protocols PSI5 and SENT

The analysis, simulation and testing of sensor-specific protocols, such as PSI5 and SENT, will be easier for developers in future. For this purpose, Vector is offering a new solution: CANoe .Sensor software and VT2710 hardware module. Users will profit from the functionalities especially matched to sensor protocols.

The increased use of intelligent sensors in fields, such as Powertrain, Safety and Comfort is supported by Vector with development tools adequately matched to each other. The new CANoe option .Sensor permits the user to analyze the sensor communication. It is possible to view sensor signals on the sensor bus as well as the distribution of the sensor signal in the vehicle network. Even complex communication scenarios are generated and analyzed quickly because proven CANoe analysis concepts and an intuitive configuration are used. By means of the possibility of simulating the ECU as well as the sensor, CANoe .Sensor supports the developer in setting up simple to demanding test environment in addition. Thus, the full control over all protocol-relevant data exists during simulation. In addition, sophisticated error detection mechanisms facilitate debugging of the system.

The physical connection to the sensor networks is also ensured by the new VT2710 hardware module. It is completely matched to the functionality of CANoe .Sensor, and is part of the modular test environment VT System of Vector. The flexible structure of VT2710 provides

many advantagesis advantageous: As required, up to four PSI5 or SENT channels can be configured via piggy circuit boards. With this module, users have a precise analysis tool, which permits the exact setting of bit rates and highly accurate message time stamping, and which in the operation concept as well as in the programming interface seamlessly integrates in the existing VT system environment. The module has been prepared for other sensor protocols. The software-side support by CANoe .Sensor will be carried out successively during the coming CANoe releases through mid 2017.

More intelligent sensors are fitted in modern vehicles. Frequently, a signal evaluation is integrated in the sensor. This also has an effect on the connection of sensors to the ECUs: instead of an analog sensor connection, more digital connections are used.connecting sensors analogously, more digital connections are used. They use sensor-specific protocols, such as PSI5 and SENT, which require adequately matched development tools.

Rohde & Schwarz presents the first over-the-air power measurement solution for 5G and wireless gigabit components

The R&S NRPM OTA power measurement solution is the first solution for measuring transmit power over the air interface for 5G and wireless gigabit components. The solution enables users working in development and production to calibrate the output power of the antenna on a DUT and to test the DUT's beamforming function.

Base stations, access points, wireless devices and radio modules use phased array antennas to transmit 5G and wireless gigabit radio signals. Beamforming is used to control the direction of radiation of the transmit antenna in order to maximize the power level at the receiver. The R&S NRPM OTA power measurement solution from Rohde & Schwarz now allows users to measure and calibrate the output power of a DUT as well as test its beamforming function – all with a single, simple test setup. The solution works in the frequency range from 27.5 GHz to 75 GHz and therefore covers the 28 GHz band currently being discussed for 5G as well as the frequency range from 55 GHz to 66 GHz for WLAN in line with IEEE 802.11ad and frequencies above 66 GHz in line with IEEE 802.11ay.

The R&S NRPM OTA power measurement solution consists of two core components: the antenna module and the three-channel sensor module.

The R&S NRPM A66 antenna module is a simple, polarized Vivaldi antenna with an integrated diode detector for power measurements. Thanks to its high linearity, it measures the relative power with a measurement accuracy better than 0.2 dB. Because the power is measured directly on the antenna, the user does not need any additional RF cables, which also eliminates complex compensation for cable loss. With a single antenna module, the user can calibrate the output power on a DUT, for example. With several spatially offset antenna modules, it is possible to test a DUT's beamforming function.

The R&S NRPM3 three-channel sensor module processes measurements from up to three antenna modules. If more than three antennas are needed for a test setup, users can operate any number of sensor modules in parallel. The additional measurement points increase the measurement resolution during beamforming tests.

The free R&S Power Viewer Plus PC software from Rohde & Schwarz is available for evaluating and processing the measurement data. It can be used to visually monitor measurements on up to twelve channels and, for example, to determine the average power.

For measurements in its R&S TS7124 19″ shielded chamber, Rohde & Schwarz also offers the R&S NRPM-ZD3 cable feedthrough with integrated feedthrough filter. This allows users to acquire signals in a shielded measurement environment for measurement results that are always reproducible.

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CBL	All-purpose workhorse cables for highly-reliable, precision 50Ω measurement through 18 GHz	DC-18	SMA, N
APC	Crush resistant armored cable construction for production floors where heavy machinery is used	DC-18	N
ULC	Ultra-flexible construction, highly popular for lab and production test where tight bends are needed	DC-18	SMA
FLC	Flexible construction and wideband coverage for point to point radios, SatCom Systems through K-Band, and more!	DC-26	SMA
NEW! VNAC	Precision VNA cables for test and measurement equipment through 40 GHz	DC-40	2.92mm (M to F)

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