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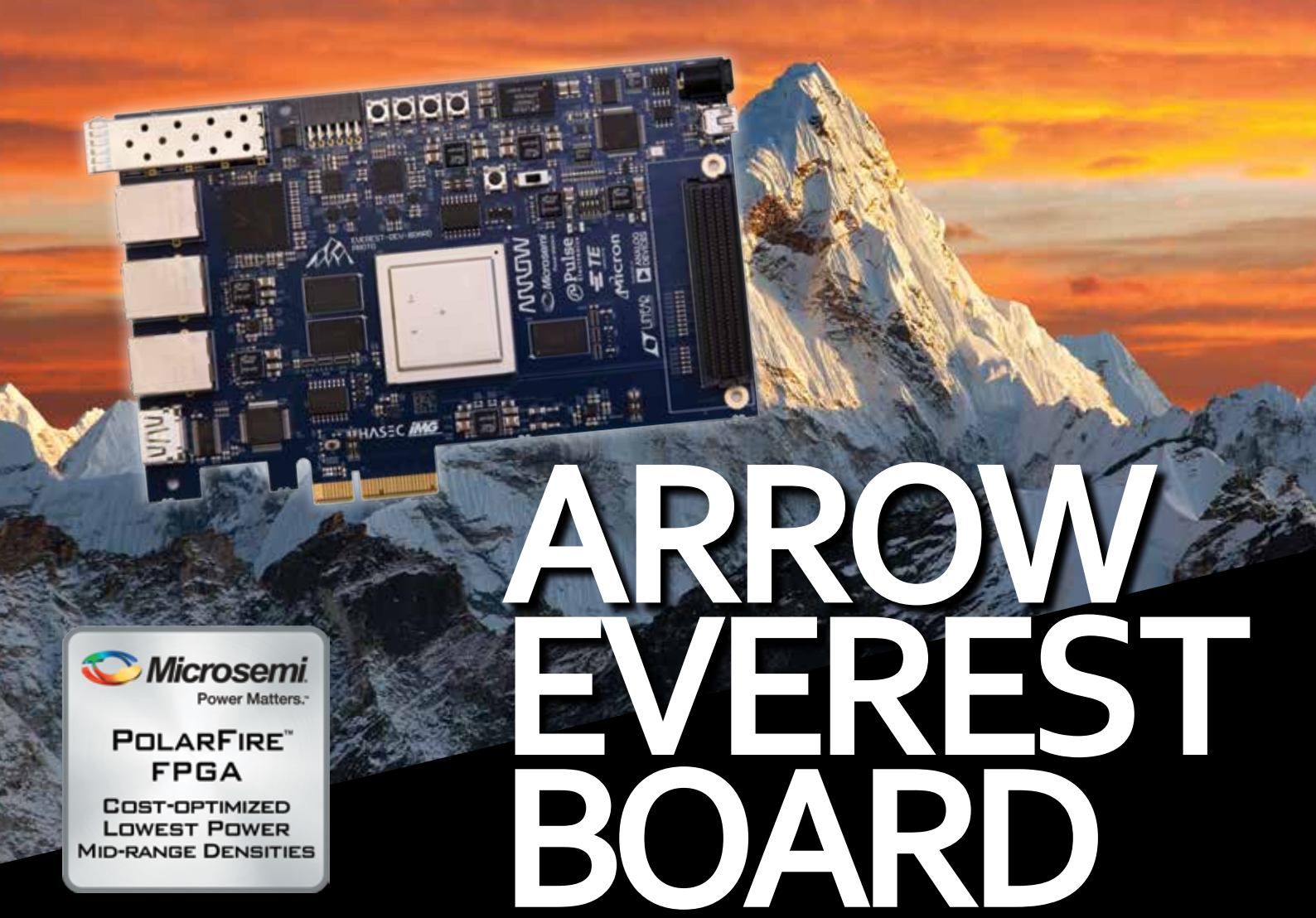

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Microsemi
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PolarFire™ FPGA
Cost-optimized
Lowest Power
Mid-range Densities

About PolarFire FPGAs

Microsemi's new cost-optimized PolarFire FPGAs deliver the industry's lowest power at mid-range densities with exceptional security and reliability. The product family features 12.7 Gbps Serializer/Deserializer (SerDes) transceivers at up to 50 percent lower power than competing FPGAs. Densities span from 100K to 500K logic elements (LEs) and are ideal for a wide range of applications within wireline access networks and cellular infrastructure, defense and commercial aviation markets, as well as industry 4.0 which includes the industrial automation and Internet of Things (IoT) markets.

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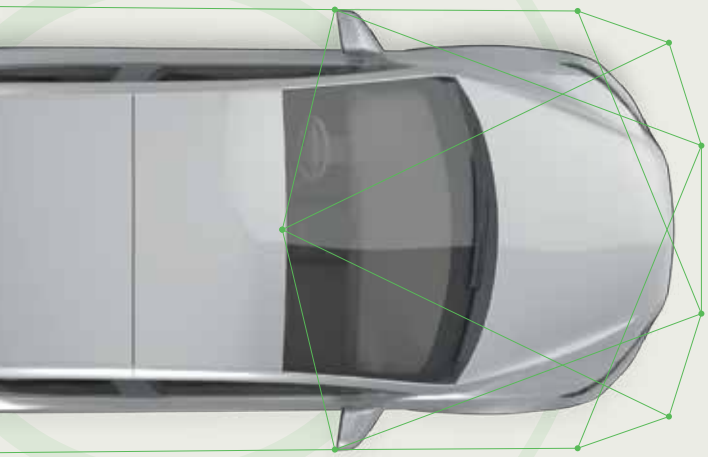

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About New-Tech Magazines Group

'New-Tech Magazines' A world leader in publishing high-tech and electronics, producing top quality publications read by tens of thousands professionals from all over the world especially from Europe, innovative electronics, IoT, microwave, homeland security, aerospace, automotive and technological industries.

Our specialized target audiences prefer New-Tech Europe because they know that our publications are a reliable source of the latest information in their respective fields. Our multidimensional editorials, news items, interviews and feature articles provide them with a full, well-rounded picture of the markets in which they operate - an essential asset for every technological leader striving to stay ahead, make the right decisions, and generate the next global innovation.

Moreover, as an attractive platform for advertisers from around the world, New-Tech Europe has become a hub for bustling international commercial activity. Here, through ads and other promotional materials, Israeli readers obtain crucial information about developers and manufacturers worldwide, finding the tools, instruments, systems and components they need to facilitate their innovative endeavors.

Targeting the needs of both the global and european industries and global advertisers, New-Tech Magazines Group constantly expands and upgrades its services. Over the years, the company has been able to formulate a remarkably effective, multi-medium mix of offerings, combining magazine publications with useful online activities, newsletters and special events and exhibitions.

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Communications policing is the new community policing

Collaborative research between Cardiff University academics and the police has found that current UK policing approaches to social media analytics are fragmented and struggling to keep up with technological advances and their disruptive social impacts.

The Open Source Communications Analytics Research Centre (OSCAR) led by Cardiff University was funded via the Police Knowledge Fund by the College of Policing and the Higher Education Funding Council for England, to look at how the police service is using social media and 'big data technologies'.

Big data

The work examined how social media and other forms of publicly available 'big data' are changing: how police investigate crimes and respond to critical incidents; the ways they develop intelligence; and methods for engaging with communities. Importantly, and unlike previous research in this area, it adopted a holistic and comprehensive approach, investigating these impacts across the full range of policing disciplines including; Counter-terrorism; serious organized crime; public order; and Neighbourhood Policing. A second key innovation of the approach is that it was jointly conducted by academic researchers in direct collaboration with police officers, to develop unique insights into this aspect of policing.

Key findings of the research conducted are:

- Too much attention nationally has focused upon purchasing increasingly sophisticated 'big data' technologies and not enough upon developing the skills of analysts and users within police organisations.
- Nationally, the approach is fragmented with different agencies and police forces adopting very different approaches. There does not seem to be a consensus about how much of this work is 'generalist' and how much should be 'specialist'.
- Communications policing is the new community policing, and should be treated as such, to reflect how more and more of social life has a digital component.
- Only a relatively small proportion of police officers and staff have the digital skills and tools needed to exploit the opportunities for digital intelligence and evidence to inform their investigations and enquiries.
- Police organisations should seek to recruit data scientists within their workforce, to enable new ways of working for the information age.
- Nationally, there is an 'R&D gap' in terms of police developing the tools and techniques needed to keep up with the rapid advances in social media technologies.

An important element of the OSCAR approach was that the academic research was conducted on live policing operations, in the process triggering a new counter-terrorism investigation. This showcased how adopting innovative ways of working can help improve the delivery of services to the public, but also improve the skills and training of police in new areas of their practice. Work from the programme has been influential internationally, with presentations on its work provided to: the US Department of Homeland Security; NATO; and Europol.

Saving the taxpayer significant money

Reflecting upon the value and benefits of the pioneering OSCAR approach, the National Lead for Open Source and Digital for counter-terrorism policing said: "One of the most important pieces of work was reviewing the ways of working within open source practitioners. This insight has allowed us to improve training programmes and change our thinking about how we hire staff. OSCAR has saved the taxpayer significant money assisting us in these areas."

Professor Martin Innes who led the OSCAR Centre said: "It is clear that social media and associated technologies are having transformative impacts upon how all public agencies are delivering their services…"

Mouser-Sponsored Vaillante Rebellion Team Eyes the Lead in Mexico

With a top-5 finish at the tough Six Hours of Nürburgring, the Mouser-sponsored Vaillante Rebellion racing team has high expectations as it eagerly prepares for the grueling Six Hours of Mexico City. The September 3 outing in the Mexico capital will be Round 5 of the 2017 Season of the FIA World Endurance Championship.

In the race for the Endurance Trophy for LMP2 Teams, the Mouser-sponsored Vaillante Rebellion No. 31 car has a firm hold on second place with 70 points and is positioned to mount a bid for the lead. The Vaillante Rebellion No. 13 car is at eighth place with 26 points but is still in the hunt with four races to go.

"We're impressed by Vaillante Rebellion's exceptional performance this season. In Nürburgring, both cars came off the line strong and attacked the field throughout the race," said Todd McAtee, Mouser's Vice President of Americas Business Development. "We are proud of the team and look forward to seeing them on the course in Mexico City." At the German track, the No. 31 car, piloted by Filipe Albuquerque, Bruno Senna and Julien Canal, led the pack in the first hour and bravely fought off several challenges to secure a second place win in the LMP2 category. Vaillante Rebellion's No. 13 car, driven by Pipo Derani, Mathias Beche and David Heinemeier Hansson, followed closely to place fourth in the category. Mouser is proud to again partner with valued supplier LEMO, a global leader in the design and production of precision custom connection solutions, to sponsor Vaillante Rebellion for the entire 2017 FIA World Endurance Championship season.

Mouser distributes the full line of quality LEMO connector solutions including their original push-pull connectors. Racing is all about speed and endurance, and racing sponsorships are an innovative way for Mouser to communicate its performance-driven business model and promote the newest technologies from its manufacturer partners. The Mouser-backed Rebellion team ran away with the crown in the LMP1 Privateer Class last year, and with a new class comes new challenges.

After Mexico City, the series travels to Fuji, Japan, on October 15 and Shanghai on November 5, before ending the season at Sakhir, Bahrain, on November 18.

With its broad product line and unsurpassed customer service, Mouser strives to empower innovation among design engineers and buyers by delivering advanced technologies. Mouser stocks the world's widest selection of the latest semiconductors and electronic components for the newest design projects. Mouser Electronics' website is continually updated and offers advanced search methods to help customers quickly locate inventory. Mouser.com also houses data sheets, supplier-specific reference designs, application notes, technical design information, and engineering tools.

T-Mobile lays 5G foundation with expanded 600 MHz rollout

Ericsson's 5G-ready network equipment is future-proofing T-Mobile's rollout of the new 600 MHz spectrum.

T-Mobile is accelerating its LTE network expansion with new 600 MHz spectrum starting in rural America, which is live in Scarborough, Maine today. This milestone is the latest development in the long-term partnership between Ericsson and T-Mobile which includes plans to build a nationwide 5G network in the US that takes full advantage of the extended coverage range of the new 600 MHz spectrum.

Ericsson's 600 MHz radio solution is enabling T-Mobile to meet an aggressive timetable to start field deployments already this year. The 600 MHz equipment maximizes low-band spectral efficiency and coverage range through advanced MIMO (Multiple-Input Multiple-Output) capabilities.

Börje Ekholm, President and CEO, Ericsson, says: "The US has hit another milestone with the historic rollout of 5G-ready technology in record-breaking time. The work we're doing with T-Mobile on its low-band spectrum is paving the way for 5G in rural America and nationwide."

Nano Dimension Technologies Ltd. Signs Agreement with First Customer, Jabil, for Commercial 3D Printer

Nano Dimension Ltd., a leader in the field of 3D printed electronics (NASDAQ, TASE: NNDM), announced today that its wholly owned subsidiary, Nano Dimension Technologies Ltd., has signed an agreement with Jabil Inc. (NYSE: JBL), its first commercial customer. Jabil is a product solutions company providing comprehensive electronics design, production and product management services to global electronics and technology companies. According to the agreement, Jabil will lease the DragonFly 2020 3D printer from Nano Dimension.Jabil is the first customer that will receive Nano Dimension's commercial 3D printer. The agreement with Jabil is a part of Nano Dimension's transition to commercial sales. The company previously announced the completion of recruitment to its beta program and that it met the targets for its beta program.

About Nano Dimension

Nano Dimension (TASE: NNDM, NASDAQ: NNDM) is a leading additive manufacturing technology company. Nano Dimension is disrupting, reshaping and defining the future of how electronics are made. With its unique 3D printing technologies, Nano Dimension is targeting the growing demand for electronic devices that require increasingly sophisticated features and rely on printed circuit boards (PCBs). Demand for circuitry, including PCBs – which are the heart of every electronic device – covers a diverse range of industries, including consumer electronics, medical devices, defense, aerospace, automotive, IoT and telecom. These sectors can all benefit greatly from Nano Dimension's 3D printed electronics solutions for rapid prototyping and short-run manufacturing.

Forward-Looking Statements

This press release contains forward-looking statements within the meaning of the "safe harbor" provisions of the Private Securities Litigation Reform Act of 1995 and other Federal securities laws. Words such as "expects," "anticipates," "intends," "plans," "believes," "seeks," "estimates" and similar expressions or variations of such words are intended to identify forward-looking statements. For example, Nano Dimension is using forward-looking statements in this press release when it discusses supplying its DragonFly 2020 3D printer to Jabil. Because such statements deal with future events and are based on Nano Dimension's current expectations, they are subject to various risks and uncertainties. Actual results, performance or achievements of Nano Dimension could differ materially from those described in or implied by the statements in this press release.

The forward-looking statements contained or implied in this press release are subject to other risks and uncertainties, including those discussed under the heading "Risk Factors" in Nano Dimension's annual report on Form 20-F filed with the Securities and Exchange Commission ("SEC") on March 7, 2017, and in any subsequent filings with the SEC. Except as otherwise required by law, Nano Dimension undertakes no obligation to publicly release any revisions to these forward-looking statements to reflect events or circumstances after the date hereof or to reflect the occurrence of unanticipated events.

Rimac Automobili Accelerates its Next Electric Super Sports Car with Dassault Systèmes

Dassault Systèmes is enabling Rimac Automobili to scale its business from European startup to major supplier to the global automotive industry as market demands for electric vehicles increase. Rimac Automobili is using the "Electro Mobility Accelerator" industry solution experience to quickly design and develop high-performance electric vehicles, drivetrains and battery systems, including the next generation of its Concept One fully electric super sports car.

More and more consumers are looking to buy electric cars worldwide, without sacrificing the sleek aesthetics and fast, powerful performance of the traditional sports car. Rimac Automobili recognized the market potential for electric vehicles and its own role as an integral supplier to major automobile manufacturers.

Based on Dassault Systèmes' 3DEXPERIENCE platform, "Electro Mobility Accelerator" provides Rimac Automobili with digital applications to industrialize its operations, expand its production capacity and connect its workforce in

11 countries. Its teams have access to real-time information for full visibility on projects, changes and product data throughout the development phases. They can detect and resolve issues earlier, reuse data, and organize and prepare complex production processes. Hence, Rimac Automobili can accelerate its full vehicle development business and successfully deliver on programs for customers.

"The 'Electro Mobility Accelerator' industry solution experience enables quicker design, simulation and collaboration that will improve our productivity and satisfy customer requirements," said Mate Rimac, Founder and Chief Executive Officer, Rimac Automobili. "We've long used SOLIDWORKS for specific projects and looked to Dassault Systèmes to accompany us as we scale up our business. With a digital platform we can align our resources and capabilities to fully carry out any kind of electric vehicle program in-house."

"The automotive landscape is evolving every day. Today's electric car startup is working to create tomorrow's autonomous car sharing vehicle," said Olivier Sappin, Vice President, Transportation & Mobility Industry, Dassault Systèmes. "Collaborative, intelligent and intuitive digital environments are the innovation labs for creating new experiences in this sector. The 3DEXPERIENCE platform is a scalable and adaptable tool for companies to accelerate their evolution from startups to the next generation of car makers."

"The complex automotive development cycle is requiring greater collaboration and integration across the industry, and this can be supported only by a single source of information. The result is innovative and reliable products, based on faster decision-making, the reuse of existing models, know-how and comprehensive requirements management," said Zlatko Simunec, Chief Executive Officer, CADCAM Group. "We are working with Rimac Automobili to provide them with consulting and implementation services related to the 3DEXPERIENCE platform that will support them across multiple business processes."

Scientists are testing out a device that could heal organs and brain injuries in seconds.

Breakthrough Device Heals Organs with a Single Touch Device instantly delivers new DNA or RNA into living skin cells to change their function

COLUMBUS, Ohio – Researchers at The Ohio State University Wexner Medical Center and Ohio State's College of Engineering have developed a new technology, Tissue Nanotransfection (TNT), that can generate any cell type of interest for treatment within the patient's own body. This technology may be used to repair injured tissue or restore function of aging tissue, including organs, blood vessels and nerve cells.Results of the regenerative medicine study published in the journal Nature Nanotechnology.

"By using our novel nanochip technology, injured or compromised organs can be replaced. We have shown that skin is a fertile land where we can grow the elements of any organ that is declining," said Dr. Chandan Sen, director of Ohio State's Center for Regenerative Medicine & Cell Based Therapies, who co-led the study with L. James Lee, professor of chemical and biomolecular engineering with Ohio State's College of Engineering in collaboration with Ohio State's Nanoscale Science and Engineering Center. Researchers studied mice and pigs in these experiments. In the study, researchers were able to reprogram skin cells to become vascular cells in badly injured legs that lacked blood flow. Within one week, active blood vessels appeared in the injured leg, and by the second week, the leg was saved. In lab tests, this technology was also shown to reprogram skin cells in the live body into nerve cells that were injected into brain-injured mice to help them

recover from stroke.

"This is difficult to imagine, but it is achievable, successfully working about 98 percent of the time. With this technology, we can convert skin cells into elements of any organ with just one touch. This process only takes less than a second and is non-invasive, and then you're off. The chip does not stay with you, and the reprogramming of the cell starts. Our technology keeps the cells in the body under immune surveillance, so immune suppression is not necessary," said Sen, who also is executive director of Ohio State's Comprehensive Wound Center.

TNT technology has two major components: First is a nanotechnology-based chip designed to deliver cargo to adult cells in the live body. Second is the design of specific biological cargo for cell conversion. This cargo, when delivered using the chip, converts an adult cell from one type to another, said first author Daniel Gallego-Perez, an assistant professor of biomedical engineering and general surgery who also was a postdoctoral researcher in both Sen's and Lee's laboratories.

TNT doesn't require any laboratory-based procedures and may be implemented at the point of care. The procedure is also non-invasive. The cargo is delivered by zapping the device with a small electrical charge that's barely felt by the patient.

"The concept is very simple," Lee said. "As a matter of fact, we were even surprised how it worked so well. In my lab, we have ongoing research trying to understand the mechanism and do even better. So, this is the beginning, more to come."

Researchers plan to start clinical trials next year to test this technology in humans, Sen said.

Funding for this research was provided by Ohio State's Center for Regenerative Medicine and Cell-Based Therapies, Ohio State's Nanoscale Science and Engineering Center and Leslie and Abigail Wexner.

SCHURTER is IATF 16469 Certified

SCHURTER AG in Lucerne successfully passed the certification audits according to the new IATF 16949:2016 automotive standard. This new standard of the IATF (International Automotive Task Force) demands the highest system and process quality standards of a company.

Certifications are the mark of distinction for a company. They recognize a defined quality level. The IATF 16949:2016 automotive standard represents one of the strictest and most demanding certifications.

SCHURTER approached this certification with the clear objective of further development of its own company. SCHURTER wishes to engage in continuous improvement in order to meet the steadily growing requirements of its customers now and in the future.

After scrupulous analyses, internal workflows were optimized. The documentation for all products and production processes was refined down to the most minute detail. Even management was included and held accountable. In the future, there will be a greater integration into all process and production phases.

The interdisciplinary and process-oriented aspects are gaining in importance. The goal is clearly defined: The reliability of the processes is being increased, allowing product quality to be maintained at a high and – very important – constant level. The aim is zero errors. A goal that requires a continuous optimization process.

Thus, this certification is not important just for automotive customers. It is important for all SCHURTER customers.

About IATF 16469

In October 2016, the new IATF 16949:2016 standard was published. The first edition of IATF 16949 replaces ISO/TS 16949:2009. The aim of the revised IATF 16949 standard is continuous improvement of the system and process quality of companies in the automotive industry. The continuous optimization process is intended to increase customer satisfaction, detect errors and risks in the production process and the supply chain, eliminate their causes and check the corrective actions and preventive measures taken for their effectiveness.

Intel Xeon Scalable Processors Accelerate Creation and Innovation in Next-Generation Workstations

Workstations powered by Intel® Xeon® processors meet the most stringent demands for professionals seeking to increase productivity and rapidly bring data to life. Intel today disclosed that the world-record performance of the Intel Xeon Scalable processors is now available for next-generation expert workstations to enable photorealistic design, modeling, artificial intelligence (AI), analytics and virtual-reality (VR) content creation.

One of the most exciting trends in entertainment today is immersive 3D VR media, and professional workstations are a key component to the creation of this content. Rendering immersive media is a time-consuming process that demands the highest performance workstations. Companies like Technicolor* are using Intel Xeon Scalable processors to push the boundaries of immersive media by accelerating the creation, rendering and processing of this data, and bringing the ultimate VR creation experience to life. Marcie Jastrow, Technicolor senior vice president, Immersive Media and Head of The Technicolor Experience Center, stated, "Intel Xeon Scalable processors represent the ultimate in what is possible in VR today, and it also makes me feel very hopeful about what will happen tomorrow in immersive VR media."

Beyond VR, many organizations are taking advantage of workstations to accelerate creation and innovation. From faster time to market with computer-aided design tools and creating ultrahigh-definition (HD) and 3D content, to improving medical care and driving faster financial trades and AI analytics, workstations give professionals a powerful productivity tool.

Unveiled in July 2017, Intel Xeon Scalable processors deliver breakthrough dual-socket performance1 for the most advanced workstation professionals, offering up to 56 cores, up to 112 threads and an Intel® Turbo Boost Technology frequency up to 4.2 GHz. Expert workstations will experience up to a 2.71x boost in performance compared to a 4-year-old system2 and up to 1.65x higher performance compared to the previous generation.3

As part of today's news, Intel also unveiled the new Intel Xeon W processors, targeting mainstream workstations. The Intel Xeon W processor delivers optimized performance1 for traditional workstation professionals by combining mainstream performance, enhanced memory capabilities, and hardware-enhanced security and reliability features.

he single-socket Intel Xeon W processor delivers mainstream performance optimized1 for the needs of traditional workstation professionals. The Intel Xeon W processor features up to 18 cores and up to 36 threads, with an Intel Turbo Boost Technology frequency up to 4.5 GHz. Mainstream workstations will experience up to a 1.87x boost in performance compared to a 4-year-old system4 and up to 1.38x higher performance compared to the previous generation.5

Orbotech Announces Multi-Million-Dollar Deal with Unimicron Germany for Automotive, Renewable Energy and Industrial Manufacturing

Orbotech Ltd., (NASDAQ: ORBK) a leading global supplier of yield-enhancing and process-enabling solutions for the manufacture of electronics products, today announced a multi-million-dollar agreement with Unimicron Germany GmbH (formerly RUWEL International) for the purchase of Orbotech's direct imaging (DI), automated optical inspection (AOI) and automated optical shaping (AOS) PCB production solutions. Unimicron Germany is in the process of rebuilding its inner layer fab as a fully automated Industry 4.0, state-of-the-art facility, and upgrading its Outerlayer and Solder Mask capacity and capabilities.

Unimicron Germany GmbH specializes in high-end, high-reliability manufacturing for automotive electronics, renewable energy and industrial markets. The site is expected to be fully functional in the first half of 2018.

Among the Orbotech solutions Unimicron Germany has ordered are the latest members of the Nuvogo™ family for direct →

imaging; Orbotech Diamond™ 8 for high throughput solder mask direct imaging; Fusion™ 22 AOI with 2D metrology in process quality control (IPQC); Precise™ 800 AOS system for 3D shaping of any layer HDI and complex multi-layer boards; and Orbotech Smart Factory for Industry 4.0-compliant, integrated PCB production.

"Following the fire which devastated our facility last year, we have a unique opportunity to rebuild and improve on our past successes," said Mr. Gerard van Dierendonck, CEO of Unimicron Germany. "We are committed to making the facility more environmentally and energy friendly, as well as ensuring the highest level of flexibility with the lowest total cost of ownership. We selected Orbotech's solutions because they enable us to achieve our goals and are the best fit for our customers' present and anticipated production and technology needs."

"We are delighted to be able to provide a wide range of PCB production solutions as part of Unimicron Germany's rebuilding project and to further deepen our relationship," stated Mr. Sharon Cohen, President of Orbotech West. "Our Industry 4.0-compliant solutions meet Unimicron's specific advanced technology and reliability needs and enable and ensures traceability, which is critical for automotive and other high-reliability PCB applications. In addition, our comprehensive customer service offering, with our one-stop monitoring center, is designed to provide pro-active, preventative measures which can troubleshoot any potential issues, such as downtime, before they even occur."

"Orbotech's solutions are a perfect fit for our strategy moving forward and our aim of building the most modern inner layer factory possible," said Mr. Rico Schlüter, CTO of Unimicron Germany. "As the European PCB industry continues to make significant changes, we are determined to invest in state-of-the-art equipment that will grow with us."

Rohde & Schwarz Cybersecurity's Deep Packet Inspection Software Now Detects Bitcoin Transactions in Network Traffic

The new Bitcoin protocol classification functionality enhances network analytics and security solutions to identify Bitcoin network activity. This enables enterprises to identify, control and block bitcoin transactions within a network.

Rohde & Schwarz Cybersecurity, a leading IT security company, today announced the availability of its new Bitcoin protocol classification capabilities provided by the deep packet inspection (DPI) engine R&S PACE 2. The OEM software solution is now able to reliably detect and classify the Bitcoin protocol in network traffic in real time.

Bitcoin is a cryptocurrency and a digital payment system. Transactions are made peer-to-peer and are written directly on a distributed ledger named "blockchain". The digital money is issued and managed without any central authority – meaning no governments or banks are involved. The virtual money can be exchanged for other currencies, products and services and shopping web sites accept cryptocurrencies as a method of payment.

With the new Bitcoin protocol classification capabilities provided by R&S PACE 2, vendors embedding the DPI engine in their network security and analytics solutions are now able to classify Bitcoin transactions within IP-based network traffic in order to fully understand how a network is utilized.

They can accurately and reliably identify Bitcoin network activities and implement security policies accordingly. This increases their visibility of and their control over potential security risks related to Bitcoin transactions.

The DPI software library R&S PACE 2 provides powerful and reliable detection and classification of thousands of applications and protocols by combining deep packet inspection and behavioral traffic analysis – regardless of whether the protocols use advanced obfuscation, port-hopping techniques or encryption. DPI is needed everywhere in the network where intelligent decisions need to be made based on the nature of IP traffic, whether it is wanted or unwanted traffic, good or malicious.

Honeywell Backs Scuderia Ferrari In Championship Hunt At Midpoint Of F1 Season

Honeywell (NYSE: HON) has partnered with Scuderia Ferrari in an ambitious project to develop advanced turbocharging systems in Formula 1 racing as the famed team seeks the 2017 World Constructors' Championship. Scuderia Ferrari has recorded four wins and 12 podium finishes through the first half of the season.

Honeywell, a global leader and innovator in turbocharging and Connected Vehicle technology, has worked with the team since the series changed its rules for the 2014 season to include smaller 1.6L V6 turbocharged engines as part of an overall power unit designed with the latest in energy recovery technology.

"The partnership we have forged with Scuderia Ferrari in recent years is based upon continuous improvement and a constant push for ever-increasing power density and engine efficiency," said Honeywell Transportation Systems Chief Technology Officer Craig Balis. "Our motorsport efforts allow us the opportunity to work in uncharted areas that are well above anything that has been certified for production vehicles. By pushing the known limits in turbocharging technologies, we strengthen our ability to continue to bring the world's leading turbochargers to market."

Turbochargers developed for Formula 1 typically achieve rotational speeds that are 20 to 35 percent faster than similarly sized turbochargers used in passenger vehicles. The wear and tear an engine and turbocharger experience during a typical Formula 1 race is estimated to be more than an average passenger car would see in 20,000 miles of regular road driving.

Honeywell has helped Scuderia Ferrari develop a turbocharger that weighs nearly one-sixth of a typical production turbo of the same size and produces the equivalent power of a production Honeywell turbocharged 16L commercial vehicle engine.

VTT and Fläkt Woods have developed an intelligent flow sensor for demand - controlled ventilation

Existing ventilation systems are based on estimated average occupancy rates and cannot adapt to unexpected changes in them. For example, the air can be poor in a meeting room due to inadequate ventilation, if more than the expected number of occupants arrive; or the ventilation can be humming away in an empty room, wasting energy.

Under the ULVI joint project, funded by Tekes, VTT and Fläkt Woods have developed a new flow sensor, which enables reliable measurement across the entire speed range, even at low flow rates. No dirt-gathering or bulky measuring devices are needed for the ventilation system. This maintenance-free, quiet, precise and intelligent sensor solution does not cause pressure drops.

"Our flow sensor is based on ultrasound technology. An ultrasound pulse is transmitted in the radial direction of the air channel and is measured differentially. This measurement system enables us to eliminate several sources of error and obtain highly accurate measurements," says Anu Kärkkäinen of VTT, who is leading the research team.

"The new flow controller allows just the right volume of air to be pumped into a room, based on the current load. The overall lifecycle costs of a property fall when the ventilation works precisely and is demand-controlled," says Product Manager Timo Kaasalainen of Fläkt Woods. "Demand-controlled ventilation reduces energy costs by 45–50 percent," he estimates.

The product will be launched on the Finnish and Swedish markets first, in September.

"The ULVI project is a good example of the cost-effective application of technology to a new area. VTT has been developing silicon-based MEMS (Micro Electro Mechanical System) sensors since the 90s and we now have a strong basis for meeting the measurement technology challenges faced by companies," says Kärkkäinen.

Industry Lessons: Until Power Is Better Understood, BA Won't Be an Isolated Incident

› Janne Paananen, Eaton

Feeling the heat

Summer, with its long hot days, warm evenings and holidays, it's all fun in the sun. But if summer is your business's busiest time of year and all its critical IT systems go down, causing chaos for thousands of your customers and damaging the company's reputation, then the fun fades quicker than any holiday suntan.

There are certain events that shouldn't happen - they can't be blamed on the weather, unscheduled maintenance or even a "power surge" – as poor planning is always the better explanation. There has been much speculation on what went wrong at BA and there's also surprise that anything went wrong at all given the complexity and immense scale of an airline's business and data centre operations, estimated at 500 cabinets. It's second only to the banking industry in its size and scale and need for 100% uptime. Safety, security and customer service depend on it.

Outages are not isolated incidents

And yet - at a data centre industry level – this is by far an isolated incident. A survey commissioned by Eaton of IT and Data Centre managers across Europe found that 27% of respondents had suffered a prolonged outage leading to a disruptive level of downtime in the last 3 months. The vast majority of respondents (82%) agree that most critical business processes are dependent on IT and 74% say the health of the data centre directly impacts the quality of IT services. This paints a clear picture that the business depends on IT and IT depends on the data centre to function, so the fact that more than one in four data centres had recently suffered a prolonged outage tells us that something is wrong at an industry level.

Poor power planning

Just as critical business processes depend on IT, the data centre itself must provide resilience to keep the business running. It's a core facet of a business's risk management strategy.

The only thing we know for certain with the example of BA is that someone or something killed the power from the data centre, and whether it was a panicked response or a lack of knowledge, when they reapplied the power, incorrect processes exacerbated all the issues even further. We should be careful not to attribute this failure to any individual technology or person; it's a problem of poor understanding of power that could have and should have been prevented by proper processes and power system design, especially if they'd followed

the simple rule of data centre power management – actions have consequences and consequences require action.

The BA example demonstrates again that power misunderstanding is a common problem. Two-thirds of data centre professionals in Eaton's research weren't fully confident in power, and until organisations get to grips with power management we can expect to see more power-related outages. There is a profound concern around skills availability, that it's hard to acquire and retain the relevant expertise or talent, whether it's designing for energy efficiency, managing consumption on an ongoing basis, or dealing with power-related failures quickly and effectively to avoid and mitigate outages.

Have you tried switching it off and on again?

Should a full power outage occur then it's absolutely imperative to have a disaster recovery process in place that clearly defines the steps to be taken when re-energising the data centre, detailing which systems must be brought back online first. In a full outage situation where people are in a state of panic and under pressure to resume normal services, staggering the re-energisation of the systems in your data centre may seem counter intuitive as the goal is to get back online as quickly as possible, but such a process helps to avoid further extension of the outage. The restoration of a data centre post going black needs to be done gently and in a clearly defined methodical fashion, simply trying to get everything back up in a hastily and unplanned way will only cause in-rush which could cause more outages, quickly crippling the data centre again. Power management is all about understanding the dependencies between the different parts of the power system and the IT load and having appropriate levels of resilience in the hardware, software and processes.

Recovering from an outage requires patience and a systematic process – two things that were seemingly missing according to reports on BA's outage. No data centre professional has ever asked 'have you tried switching it off and on again?' The skill is to pace oneself and follow each step in turn, controlling and monitoring a phased restart so that batches of systems are only brought online when it's safe to do so and one is sure of the correct phase balancing and loads. Skipping any steps in the rush to get back online can create a power surge, overloading circuits, tripping breakers and, to put it mildly, cause chaos.

Resilience and infrastructure upgrades

Alongside skills and power processes, the facilities infrastructure itself often needs upgrading to meet today's efficiency, reliability and flexibility expectations. Around half of respondents in Eaton's survey report that their core IT infrastructure needs strengthening, and this number is closer to two-thirds when it comes to facilities such as power and cooling.

Power management is increasingly becoming a software defined activity; given the skills gap, software can play an important role in bridging the divide between IT and power by presenting power management options in dashboard styles that are familiar to an IT audience, making it easier to understand and even automating management of power infrastructure. This could have prevented the outage that faced BA as the automated processes would have brought systems back online in a controlled and monitored fashion.

We've moved towards more virtualised environments in data centres, IT and data centre professionals are familiar with using virtualisation to maintain hardware, so the question is why not use the same principles in power? It is important that all power distribution designs, and associated resiliency software tools, are compatible with all the major virtualisation vendors to ensure future-proofing of the infrastructure. This approach will enable data centre professionals to do concurrent maintenance to mitigate risks of infrastructure maintenance and upgrades.

Learning lessons

While we may never fully understand what happened within BA's data centre, it's near guaranteed that it won't be an isolated incident across the wider data centre industry, even if it's unlikely we'll see anything on the same scale for a long time. The issue comes down to either poor preparation or implementation of disaster recovery. Better preparation of the data centre disaster recovery process would have seen it designed with resilience in mind, meaning firstly the DR site should have kicked in to cover the demand during the outage and, secondly, when restarting the hardware and applications, it should have been done in a far more controlled manner. This would have meant that the reintroduction of power to systems in a slow and phased manner, allowed for a smooth and steady recovery. We, as a data centre industry, need to make sure that we all learn lessons from BA's high-profile outage and take actions to ensure that effective power management is a 'must have' and not a 'nice to have'.

Dynamic power scaling

› Bruce Petipas, Analog Devices

In today's data acquisition systems (DAQs), performance boundaries are continually being pushed. System designers require higher speed, lower noise, and better total harmonic distortion (THD) performance; all of which are possible but none of which are free. These performance improvements typically come at the cost of higher operating currents, which in turn result in greater power dissipation. However, in many applications sensitivity to power consumption is also an ever-increasing concern.

The reasons are varied. It may be a remote system operating from a coin cell battery where the primary concern is battery life, or perhaps a multi-channel system where the concentration of heat from high channel count and high circuit density can add up to temperature induced drift problems. In either case, minimizing current draw and power dissipation is of paramount importance. The system designer must strike a balance between the competing priorities of higher performance and lower power consumption. One path toward a solution is through a process called dynamic power scaling (DPS).

What is it?

Simply stated, DPS is the process of dynamically enabling an electronic component when it is needed and disabling it when it is not. Figure 1 shows a typical SAR ADC based data acquisition sub-system. One of the key attributes of the SAR ADC is that its power scales with the throughput rate, making it a very attractive option for power sensitive applications.

Historically, the ADC driver and reference buffer have not shared the automatic power scaling enjoyed by the SAR. They are typically powered up and enabled any time the system is running, thus consuming excess power. Assuming a sufficiently fast enable time, the amplifier power down pin can be dynamically driven to disable the amplifier between ADC conversions. This is dynamic power scaling (DPS).

By applying DPS to the amplifier its average current draw can be greatly reduced. With DPS the amplifier quiescent current is a function of the duty cycle with which the power down pin is being driven.

The theoretical average quiescent current is given by

$$I_{AVG} = I_{Q\_ON} \times \frac{t_{ON}}{t_S} + I_{Q\_OFF} \times \frac{t_S - t_{ON}}{t_S}$$

Where:

i_{AVG} is the average DPS quiescent current

i_{Q_ON} is the quiescent current of the amplifier enabled

i_{Q_OFF} is the quiescent current of the amplifier disabled

t_{ON} is the time the amplifier is enabled

t_S is the sampling frequency period

We are using the ADC driver

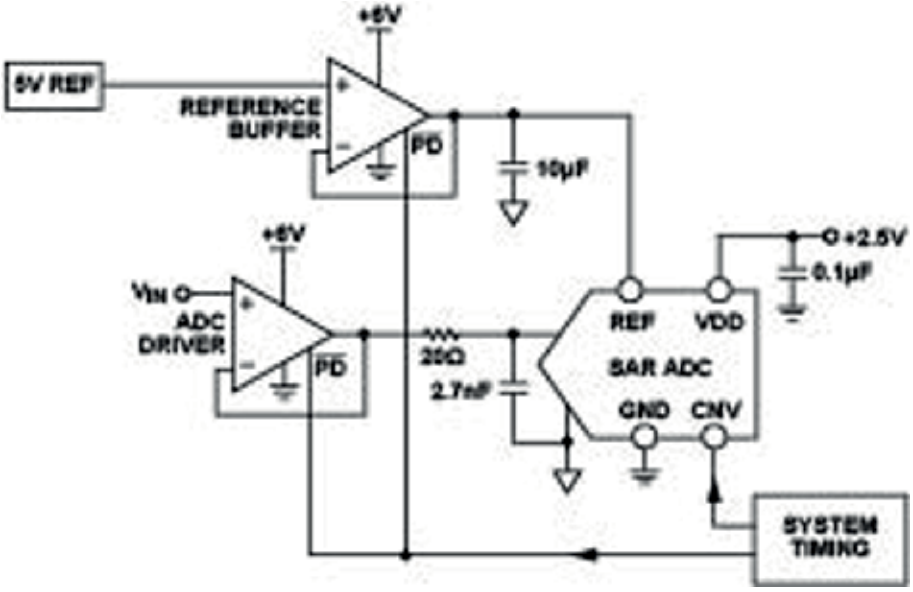

Figure 1. Block Diagram of SAR ADC Based Data Acquisition Sub-system

amplifier as our example, but these DPS concepts can be applied to the reference buffer with similar results.

Efficiency

Figure 2 shows the theoretical efficiency improvements in amplifier quiescent power possible through DPS for a typical 16-18-bit amplifier/SAR ADC combination. In this generic example the horizontal reference line at 100% represents the power consumption of the ADC driver amplifier when it is constantly enabled. The vertical reference line at fR represents the sampling frequency at which the power consumption of the ADC equals that of the constantly enabled driver amplifier.

At lower sample rates the amplifier dominates the power consumption and at higher sample rates the ADC dominates. The reference frequency (fR) will vary depending on the power consumption of the amplifier and ADC chosen but the basic concepts remain the same. The relative efficiency improvements for the same amplifier being power scaled are shown for three different values of tON. As expected a shorter tON results in greater efficiency at a given sample rate and enables the use of DPS at higher sample rates. The shaded region shows that the area of greatest improvement for incremental shortening of tON generally extends down to about one decade below fR. As the sample rate continues to decrease below that point, the greatest overall power savings is realized, but the added benefit of further shortening tON is negligible as the power consumption asymptotically approaches that of the power down or disabled state. To achieve optimum performance with DPS, system timing and determination of minimum tON are critical.

Figure 3 shows a simplified timing diagram for the ADC and driver amplifier. The system timing block (FPGA, DSP, µcontroller, etc.) from Figure 1 provides the properly timed ADC conversion start (CNV) and amplifier power down (PD) signals. The SAR ADC initiates a conversion on the rising edge of CNV. The amplifier is powered on during the ADC acquisition phase for some period of time (tON) prior to the rising edge of CNV, and is then powered down synchronous with the rising edge of CNV. But what is the correct period of time for tON? While Figure 2 illustrates the concept using somewhat arbitrary times for tON it clearly shows that the full value in DPS will be realized only

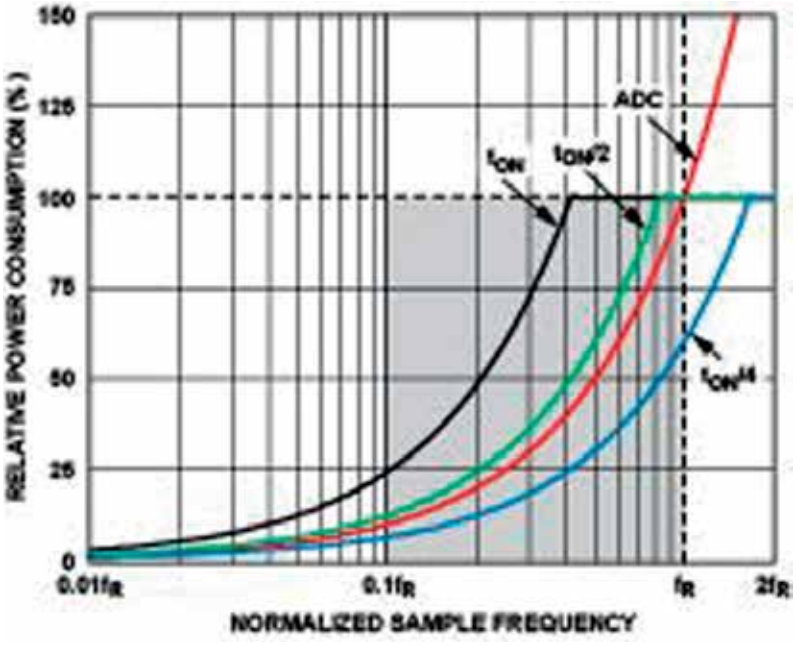

Figure 2. Theoretical amplifier power consumption for DPS at selected tON (relative to amplifier constantly enabled)

when the minimum tON is used. This is the minimum time for which the amplifier must be enabled prior to the ADC conversion to ensure an accurate result. Any time shorter than this will result in erosion of SNR or THD while any time longer will not result in any performance improvements. In practice the minimum tON is not constant across sample rates and must be empirically determined for the unique application. The minimum tON will vary from amplifier to amplifier and system to system.

For example, using an amplifier/ADC combination of the ADA4805-1 and AD7980 in the circuit of Figure 1, the minimum tON decreases with increasing sample rate, typically requiring ~4 us at 1 ksps and only ~600 ns at 1 Msps. At low sample rates the long period provides more time for internal amplifier nodes to discharge due to an extended time in the power down state, resulting in longer turn-on time.

Conversely, the shorter period of higher sample rates doesn't allow for as much internal discharging. In fact, as sample rate increases the finite turn-off time of the amplifier will become longer than the time spent in the power down state. In effect, the amplifier is turning back on before it has finished turning off. This gives the appearance of an artificially fast turn-on time but is validated when performance data shows no degradation.

Input signal frequency

One final point to consider when predicting potential power savings is the effect of the input signal frequency. Thus far the concept of DPS has been illustrated using the calculated quiescent current of a given amplifier. With a signal applied to the amplifier input, there will also be dynamic current that increases with the input signal frequency. If the input frequency is low enough the effect is inconsequential. As the frequency increases the RC network at the amplifier output presents a heavier load, requiring more current from the amplifier to process the signal.

Using the ADA4805-1 and AD7980 mentioned above and putting this all together yields the curves in Figure 4. This figure shows the power consumption, in percent, of the dynamically power scaled ADC driver amplifier relative to the same amplifier when constantly enabled. The DPS efficiency is plotted for selected input frequencies to illustrate the effect of higher input frequencies on power consumption. The minimum tON was determined for multiple sample rates from 1 ksps to 1 Msps and is defined as the shortest tON that results in <0.5dB erosion in SINAD (signal to noise and distortion) from the case with the amplifier constantly enabled.

The figure shows that power savings up to 95% can be realized when processing slow input signals at low sample rates. But perhaps more importantly, for higher throughput systems the potential savings is still significant, up to 65% at 100 ksps and up to 35% at 1 Msps. It is important to note that Figure 4 reflects the performance of a single unity gain buffer in a continuously sampled system. However, as previously stated, these DPS concepts can be readily applied to the reference buffer with the expectation of similar results.

While DPS is a relatively new concept, and there are design and timing considerations to take into account, the initial results are promising. One thing is very clear, the desire for higher performance and lower power consumption will continue into the future, which will further increase the need for creative low power solutions.

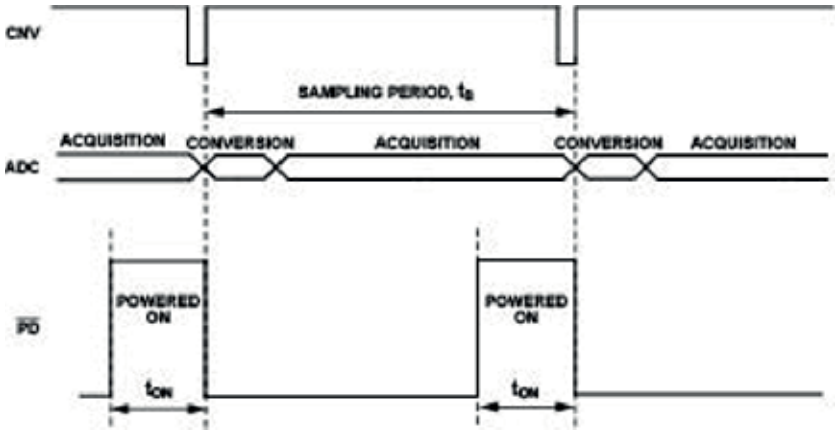

Figure 3. Simplified Timing Diagram for Amplifier and ADC Control Signals

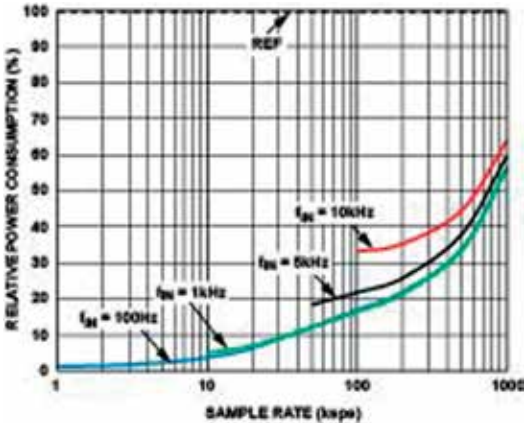

Figure 4. Relative Amplifier Power with Dynamic Power Scaling, Experimental Results

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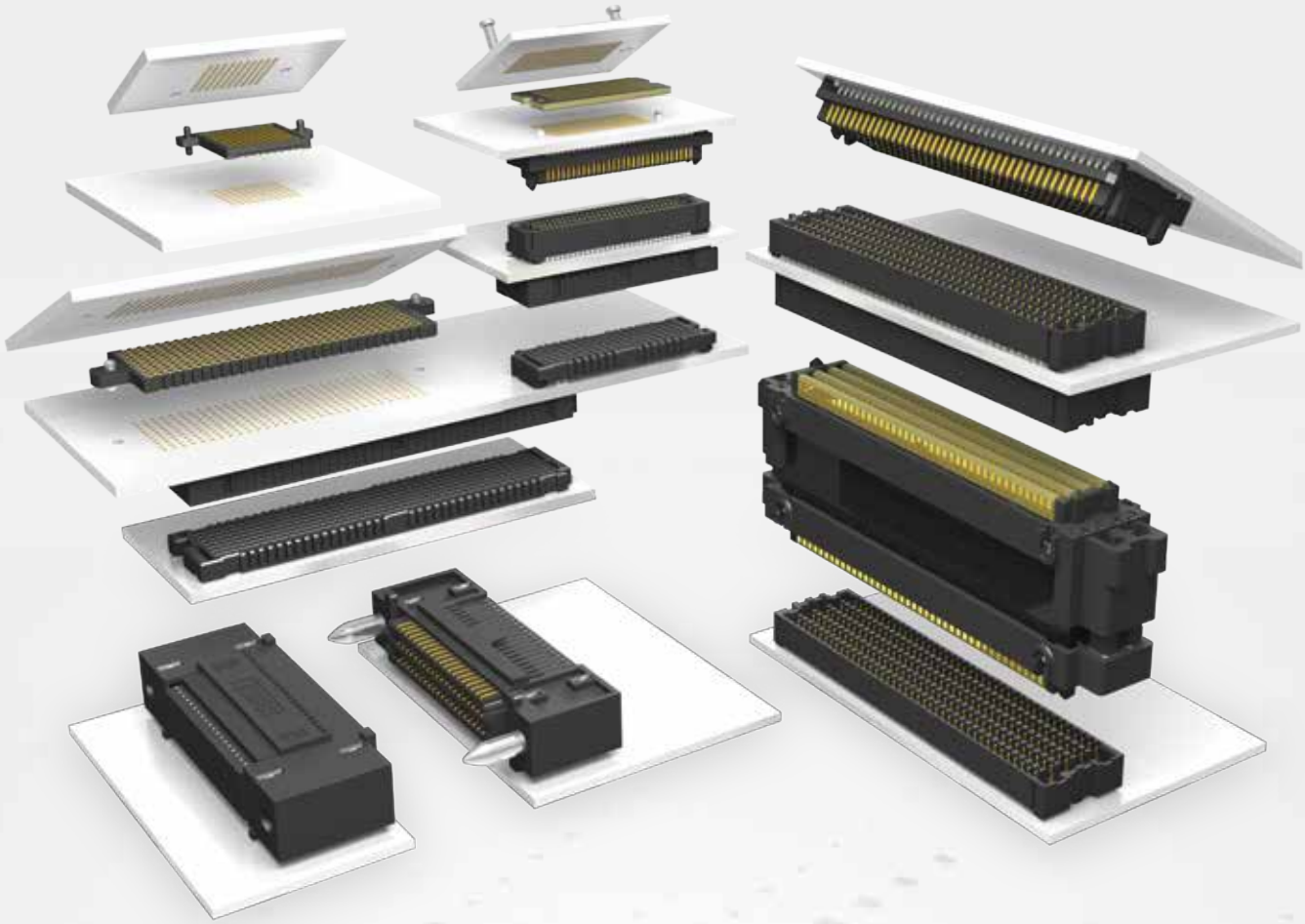

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reVISION: Accelerates your Surveillance Application

Nick Ni and Adam Taylor

Surveillance systems rely heavily upon the capability provided by embedded vision systems to enable deployment across a wide range of markets and applications. These surveillance systems are used for numerous applications from event and traffic monitoring, safety and security applications, to ISR and business intelligence. This diversity brings with it several driving challenges which need to be addressed by the system designers in their solution. These are:

- Multi Camera Vision – The ability to interface with multiple homogeneous or heterogeneous sensor types.
- Computer Vision Techniques - The ability to develop using high level libraries and frameworks like OpenCV and OpenVX.
- Machine Learning Techniques - The ability to use frameworks like Caffe to implement machine learning inference engines.
- Increasing Resolutions and Frame rates – Increases the data processing required for each frame of the image.

Depending upon the application, the surveillance systems will implement algorithms such as optical flow to detect motion within the image. Stereo vision provides depth perception within the image, while machine learning techniques are also used to detect and classify objects within an image.

Heterogeneous System on Chip devices like the All Programmable Zynq®-7000 and the Zynq® Ultrascale+™ MPSoC are increasingly being used for the development of surveillance applications. These devices combine high performance ARM® cores to form a Processing System (PS) with Programmable Logic (PL) fabric.

This tight coupling of PL and PS allows for the creation of a system which is more responsive, reconfigurable, and power efficient when compared to a traditional approach. Traditional CPU / GPU based SoC approaches require the use of system memory to transfer images from one stage of processing to the next. This reduces determinism, increases power dissipation and latency of the system response, as multiple resources will be accessing the same memory creating a bottleneck

Figure 1: Example Applications (Top: facial detection and classification, Bottom: Optical Flow)

in the processing algorithm. This bottleneck increases as the frame rate and resolution of the image increases.

This bottleneck is removed when the solution is implemented using a Zynq-7000 or Zynq UltraScale+ MPSoC device. These devices allow the designer to implement the image processing pipeline within the PL of the device. Creating a true image pipeline in parallel within the PL where the output of one stage is passed to the input of another. This allows for a deterministic response time with a reduced latency and power optimal solution.

The use of the PL to implement the image processing pipeline also brings with it a wider interfacing capability than traditional CPU/GPU SoC approaches, which come with fixed interfaces. The flexible nature of PL IO structures allows for any to any connectivity, enabling industry standard interfaces such as MIPI, Camera Link, HDMI, etc. The flexible nature also enables bespoke legacy interfaces to be implemented along with the ability to upgrade to support the latest interface standards. Use of the PL also enables the system to be able to interface with multiple cameras in parallel.

What is critical however is the ability to implement the application algorithms without the need to rewrite all the high level algorithms in a hardware description language like Verilog or VHDL. This is where the reVISION™ Stack comes into play.

reVISION Stack

The reVISION stack enables developers to implement computer vision and machine learning techniques. This is possible using the same high level frame works and libraries when targeting the Zynq-7000 and Zynq UltraScale+ MPSoC. To enable this, reVISION combines a wide range of resources enabling platform, application and algorithm development. As such, the stack is aligned into three distinct levels:

1. Platform Development - This is the lowest level of the stack and is the one on which the remaining layers of the stack are built. This layer provides the platform definition for the SDSoC™ tool.

2. Algorithm Development - The middle layer of the stack provides support implementing the algorithms required. This layer also provides support for acceleration of both image processing and machine learning inference engines into the programmable logic.

3. Application Development – The highest layer of the stack provides support for industry standard frameworks. These allow for the

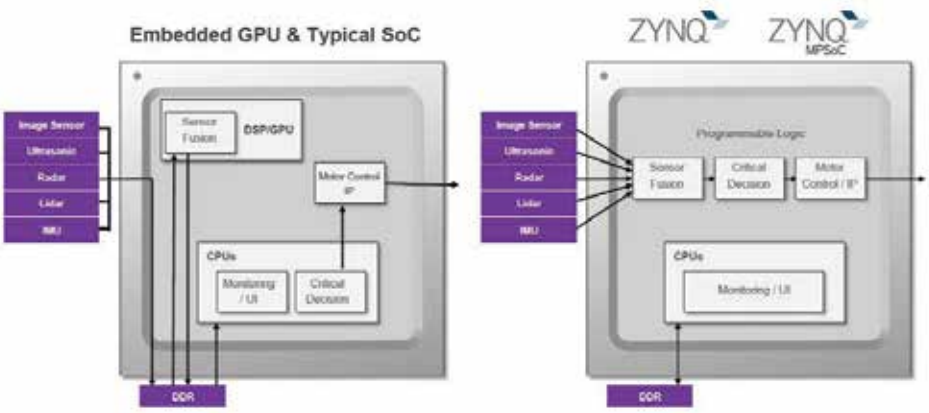

Figure 2: Traditional CPU/GPU approach compared with Zynq-7000 / Zynq UltraScale+ MPSoC

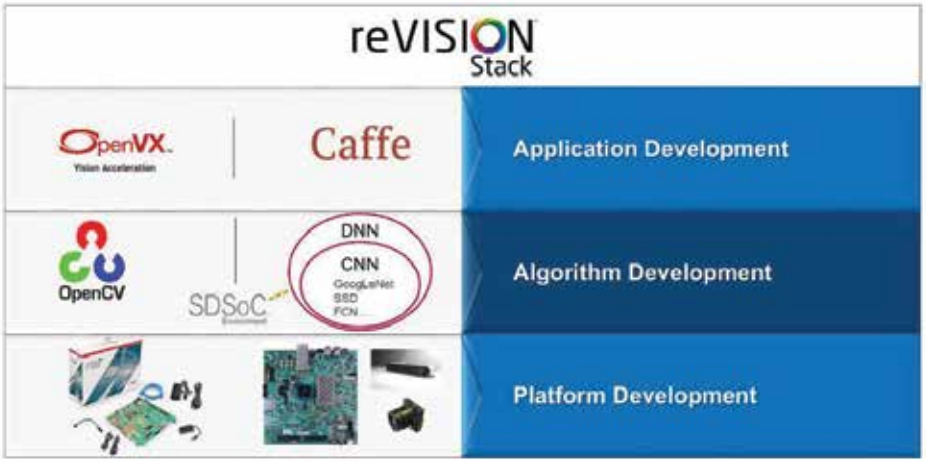

Figure 3: reVISION Stack

development of the application which leverages the platform and algorithm development layers.

Both the algorithm and application levels of the stack are designed to support both a traditional image processing flow and a machine learning flow. Within the algorithm layer, there is support provided for the development of image processing algorithms using the OpenCV library. This includes the ability to accelerate into the programmable logic a significant number of OpenCV functions (including the OpenVX core subset). While to support machine learning, the algorithm development layer provides several predefined hardware functions which can be placed within the PL to implement a machine learning inference engine. These image processing algorithms and machine learning inference engines are then accessed, and used by the application development layer to create the final application and provide support for high level frame works like OpenVX and Caffe.

The capability provided by the reVISION stack provides all the necessary elements to implement the algorithms required for high performance surveillance systems.

Accelerating OpenCV in reVISION

One of the most exciting aspects of the algorithm development layer is the ability to accelerate a wide range of OpenCV functions within it. Within this layer, the OpenCV functions capable of being accelerated can be grouped into one of four high level categories.

1. Computation – Includes functions such as absolute difference between two frames, pixel wise operations (addition, subtraction and multiplication), gradient and integral operations.
2. Input Processing – Provides support for bit depth conversions, channel operations, histogram equalisation, remapping and resizing.
3. Filtering - Provides support for a wide range of filters including Sobel, Custom Convolution and Gaussian filters.
4. Other - Provides a wide range of functions including Canny/Fast/Harris edge detection, thresholding and SVM and HoG classifiers.

These functions also form the core functions of the OpenVX subset, providing tight integration with the application development layer support for OpenVX. The development team can use these functions to create an algorithmic pipeline within the programmable logic. Being able to implement functions in the logic in this way significantly increases the performance of the algorithm implementation.

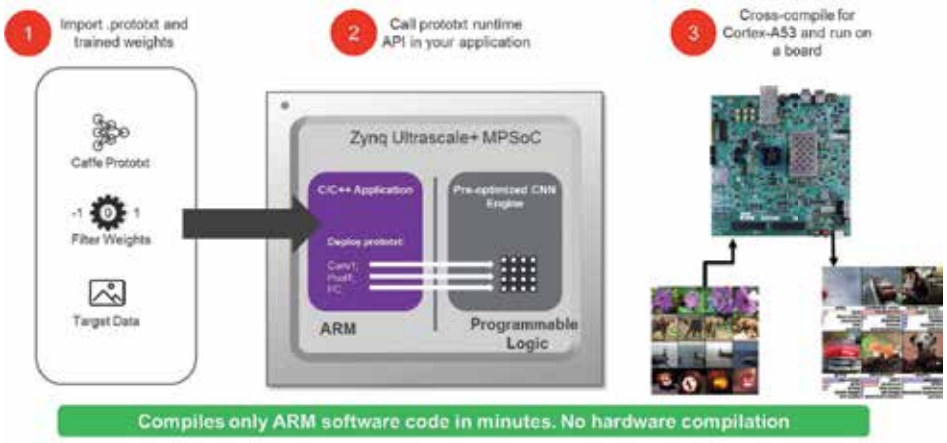

Figure 4: Caffe Flow Integration

Machine learning in reVISION

reVISION provides integration with Caffe providing the ability to implement machine learning inference engines. This integration with Caffe takes place at both the algorithm development and application development layers. The Caffe framework provides developers with a range of libraries, models and pre-trained weights within a C++ library, along with Python™ and MATLAB® bindings. This framework enables the user to create networks and train them to perform the operations desired, without the need to start from scratch. To aid reuse, Caffe users can share their models via the model zoo, which provides several network models that can be implemented and updated for a specialised task if desired. These networks and weights are defined within a prototxt file, when deployed in the machine learning environment it is this file which is used to define the inference engine. reVISION provides integration with Caffe, which makes implementing machine learning inference engines as easy as providing a prototxt file; the framework handles the rest. This prototxt file is then used to configure the processing system and the hardware optimised libraries within the programmable logic. The programmable logic is used to implement the inference engine and contains such functions as Conv, ReLu, Pooling and more.

The number representation systems used within machine learning inference engine implementations also play a significant role in its performance. Machine learning applications are increasingly using more efficient, reduced precision fixed point number systems, such as INT8 representation. The use of fixed point reduced precision number systems comes without a significant loss in accuracy when compared with a traditional floating point 32 (FP32) approach. As fixed point mathematics are also considerably easier to implement than floating point, this move to INT8 provides for more efficient, faster solutions in some implementations. This use of fixed point number systems is ideal for implementation within a programmable logic solution, reVISION provides the ability to work with INT8 representations in the PL. These INT8 representations enable the use of dedicated DSP blocks within the PL. The architecture of these DSP blocks enables up to two concurrent INT8 Multiply Accumulate operations to be performed when using the same kernel weights. This provides not only a high-performance implementation, but also one which provides a reduced power dissipation. The flexible nature of programmable logic also enables easy implementation of further reduced precision fixed point number representation systems as they are adopted.

Conclusion

reVISION provides developers with the ability to leverage the capability provided by Zynq-7000 and Zynq UltraScale+ MPSoC devices. This is especially true as there is no need to be a specialist to be able to implement the algorithms using programmable logic. These algorithms and machine learning applications can be implemented using high-level industry standard frameworks, reducing the development time of the system. This allows the developer to deliver a system which provides increased responsivity, is reconfigurable, and presents a power optimal solution.

For more information, please visit: http://www.xilinx.com/products/design-tools/embedded-vision-zone.html

The Growing Impact of Compliance in the RF/Microwave Supply Base

› Arthur Ackerman, Vice President of Quality, Mini-Circuits

Growing global concerns about environmental, social and ethical issues are changing the regulatory climate in electronics industries, and the impact of these issues on corporate policy and strategic decision making has grown in kind. In the RF/microwave industry, environmental standards such as RoHS and Reach have long been givens for most off-the-shelf parts, while more recent regulatory requirements have included documentation and disclosure of responsible sourcing of conflict minerals, and now reporting requirements for corporate social responsibility or "CSR."

The goals of these regulations are noble, and the social value of preventing environmental pollution, human rights abuses, and other forms of unethical business conduct is self-evident. However, what is less clear is the effectiveness of new and existing regulatory requirements in realizing those underlying goals. Driven in large part by new legislation, rising levels of shareholder activism among public companies, and consequent pressure up the supply chain, companies have assumed greater responsibility in addressing some of today's most challenging social, economic, and environmental problems. Unfortunately in the cases of regulations currently in place for the electronics industry, the ideal of social and political reform through flow-down regulation of global business is lost in the practical details of administering those regulations at the ground level.

As regulatory requirements increase in number and complexity, as they have in the cases of Conflict Minerals and CSR, companies incur high costs associated with management systems, legal reviews, data management platforms, and due diligence activities. These activities add significant administrative burden to operations, but no direct value to the products and services being sold to the customer. At the same time, evidence demonstrating the social benefits of these programs has been vague or absent altogether, and their efficacy has been met with skepticism by policy experts

Advocacy efforts by industry groups, most notably the IPC, have led US regulators to reconsider the effectiveness of such disclosure and reporting requirements. On April 7th, acting SEC chairman Mike Piwowar released a statement citing IPC comments relaxing enforcement of its conflict minerals rule, suspending requirements of costly due diligence reviews and audits. In a speech to the Economic Club of New York on July 12th, SEC chair, Jay Clayton remarked that lawmakers

and regulators have "significantly expanded the scope of required disclosures beyond the core concept of materiality." Statements like these indicate a change in sentiment on the part of regulators, at least with regard to Conflict Minerals, but for now, many of the costs for suppliers remain unabated. Meanwhile, with the EU Commission's new Guidelines for social responsibility reporting, customer requirements for expansive third-party surveys continue to grow in number.

The unfortunate result is an increasingly complex set of regulatory requirements that has created a shift in organizational focus from product quality and performance to paperwork; investment by companies and efforts by regulators largely wasted on merely documenting "compliance" without meaningfully effecting positive change in the social, economic and geopolitical crises that was their original intent to resolve.

Conflict Minerals: Flawed Means to a Noble End

Conflict minerals rules emerged in 2010 from section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act. The underlying goal of the legislation is to prevent funding of violent actors and human rights abuses in the eastern Democratic Republic of the Congo through the sourcing of "T3G" minerals (Tin, Tantalum, Tungsten, and Gold) from mines controlled or taxed by warring factions. The European Union and the Far East have developed their own versions of Conflict Minerals regulations based on the rules imposed on US manufacturers. In response electronics suppliers are required, either by regulatory bodies like the SEC or by their customers, to provide documented evidence tracing minerals in their products back to the smelter and further to the point of origin.

Due to the scale and complexity of the global electronics supply chain, establishing a reliable chain of custody from the finished product back to the mine comes with several significant challenges. For example, Mini-Circuits is fully committed to taking all necessary steps to meet the disclosure requirements of customers and regulators to comply with Conflict Minerals rules. However, we rarely if ever purchase T3G minerals directly, but rather in the bill of materials of sub-components, several levels downstream from the smelter. We maintain strict standards of documentation from our direct suppliers, but the difficulties obtaining relevant data suppliers further upstream and beyond the smelter, many of whom are not required to file disclosures under US Law, are well known. Therefore, our best efforts to provide traceability of minerals to a conflict-free source are ultimately only as reliable as the companies and individuals providing it down the line. It is our desire not only to meet our customers' requirements and comply with the rules of the Conflict Minerals agenda, but also to see that our efforts to do so contribute to its fundamental humanitarian goals. Unfortunately, much research on this issue has shown evidence to the contrary.

The IPC cites a study by Tulane University Adjunct Lecturer, Chris Bayer that found SEC issuers incurred an average annual expense $545,962 to comply with Dodd-Frank. A follow up study of 238 survey participants, 73% of whom were not SEC issuers but still performed conflict minerals due diligence to meet customer requirements, found that the average cost of due diligence activities was $129,000 per year. Despite this level of investment, a 2014 open letter signed by over 70 academics and experts policy in the region asserts, "The conflict minerals campaign fundamentally misunderstands the relationship between minerals and conflict in the eastern DRC." Profit from minerals does fuel conflict but is not the underlying cause, nor is it a necessary element to sustain violence. Mining is also vital to the local economy, employing eight to ten million people across the country.

The letter goes on to say, "nearly four years after the passing of the Dodd-Frank Act, only a small fraction of the hundreds of mining sites in the eastern DRC have been reached by traceability or certification efforts." The artisanal mining sites in question are located in isolated regions where systems for reliable auditing and certification, have yet to be established, making it difficult if not impossible to obtain proof that a mineral source is conflict-free. The requirements of section 1502 of Dodd-Frank unintentionally drive buyers to simply source minerals from other parts of the world. This may succeed in delivering more ethical products, but does nothing to improve the security and livelihood of the Congolese people, which was the original basis for the legislation.

The Conflict Minerals agenda has been a source of much debate, and in part due to its questionable results since the passing of Dodd-Frank in 2010, regulatory reform seems to be already underway. In addition to the statements of SEC senior officials, easing enforcement, in May, the House Financial Services

Committee passed the Financial Choice Act to repeal and replace Dodd-Frank, which includes a provision to repeal Section 1502 from the legislation. When these changes will have a palpable effect on the administration of compliance processes among electronics suppliers remains to be seen.

Corporate Social Responsibility: Not a One-Size-Fits-All Proposition

The recent industry trend toward Corporate Social Responsibility requirements spans a broad variety of issues ranging from environment, safety, labor, and ethics, among others. Most companies have policies and processes in place to reflect their organization's values and to ensure their business is contributing to the common good of society. At Mini-Circuits, for example, our company is deeply committed to supporting the education of the next generation of engineering talent and we've nurtured a successful program of donations to RF/microwave design labs at academic institutions around the world. As an ISO14001 certified company, we uphold an environmental management system that commits to regulatory compliance, pollution prevention, and continuous improvement. Community involvement is a cornerstone of our company values, and we believe in having a positive impact on the lives of our neighbors in the areas where we do business, so we sponsor our local baseball team, the Brooklyn Cyclones. These are a few examples of internal policies and management principles that comprise our social responsibility as an organization.

Due in part to the EU rules on non-financial reporting, customer requirements for expansive CSR disclosures, including surveys like ECOVADIS and CDP have recently grown in number. Again, while the underlying goal of this campaign is well-intentioned, the new disclosure requirements carry significant cost and administrative burden for suppliers while evidence of their benefit as a universal standard is questionable. Socially responsible behavior has been shown to benefit company shareholder value, but this benefit doesn't apply to private companies, and we've seen no evidence correlating the adoption of the new reporting requirements with a lower risk of socially or environmentally harmful events.

The goal of more socially responsible behavior and reduced reputational risk is desirable, but the standardized survey approach to enforcement results in inappropriate fit between some of the reporting requirements and many of the responding suppliers. For example, the CDP survey asks for documentation of the impact of a facility's water usage on the local reservoir. For a facility of over a thousand employees or a production process that uses large volumes of water, this may be significant, but for a small company of under a hundred employees with only incidental water consumption, it's irrelevant. As an upstream supplier to many OEMs, at Mini-Circuits, what we've seen is a diverse array of reporting requirements on CSR from many different customers, each with different areas of focus. The consequence is a need for ever expanding systems for gathering the different kinds of data requested by different customers, and again, a shift away from the quality, performance and value of our products and toward non-value-added documentation.

Mini-Circuits' Ongoing Commitment to Customers and Compliance

The purpose of this article is not to dispute the value and importance of ethical business conduct where it pertains to Conflict Minerals, environmental responsibility, and other social issues. At Mini-Circuits, and at most reputable suppliers in the RF/microwave industry, continuous improvement is a central principal of our business, and this applies to our products as much as it does to the benefits our business brings to our employees and our community. But it warrants asking how campaigns like Conflict Minerals and CSR are performing relative to their stated goals.

Mini-Circuits recognizes our responsibility to our customers, our employees and to our community. Just we were a leader at the forefront of conversion to the RoHS standard in the RF/microwave industry, we will continue to honor requirements for documentation for Conflict Minerals and CSR as we receive them. We see it as part of our commitment to customer service and support, just as we provide proper export documentation for international shipments.

In every area of our business, we measure our performance relative to a stated goal. This applies to everything from the electrical performance of our components to the promptness of our shipments to customers and more. The goals of the latest compliance campaigns in the RF/microwave space are clear, but the evidence of performance toward those goals under the reporting standards are less so. As an industry, we should be asking together if the effort is producing the desired result, and if not, we should be thinking about what a better way might look like.

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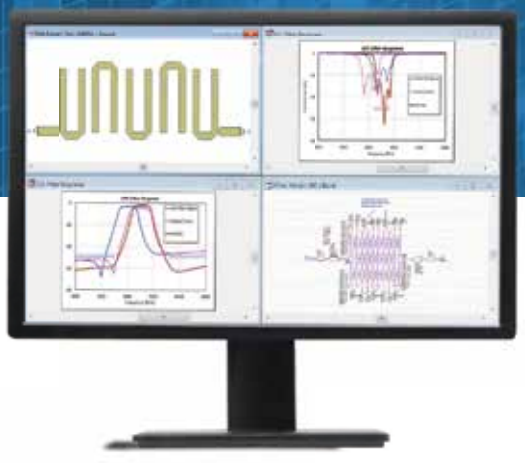

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NATIONAL INSTRUMENTS™

Power sequencing verification made easier with an 8-channel oscilloscope

› By Dave Pereles, Tektronix

Most embedded systems use more than one power rail and many use four or more. A single IC, such as an FPGA, DSP or microcontroller can require several power rails and these may have specific timing requirements. For example, a chip manufacturer may recommend that the core voltage supply stabilize before the I/O supply voltage is applied. Or a manufacturer may require that supplies come up within a specified time relative to each other to avoid prolonged voltage differences on various supply pins. The power-on sequence between processors and external memory can also be critical.

Chip manufacturers may specify that particular supplies must come up monotonically to avoid multiple power-on resets. This can be challenging since inrush currents can place high transient demands on point of load regulators. In this case the shape of power rail startup is as important as the timing sequence.

Once you combine the various chip supply requirements, bulk supplies, reference supplies and multiple point-of-load regulators for other ICs in a design, you can get up to seven or eight power rails in a hurry.

Using a 4-channel oscilloscope to verify power rail timing in an embedded system can be time-consuming, but this is how most engineers must do it. When we talk to oscilloscope users, evaluating power-on and power-off sequences is one of the most common reasons engineers give for wanting more than four channels. In this article, we'll briefly cover using a 4-channel scope for this purpose, and then we'll show some examples using an 8-channel scope.

Traditional 4-channel oscilloscope approaches

One approach is to analyze the power system in blocks - using multiple acquisitions to check the timing block by block. To compare between blocks, one of the rails or a power good/fail signal can be used as a trigger and multiple captures can be taken, determining the startup and shutdown timing relative to the reference signal. Since acquisitions are taken over multiple power cycles, variations in the relative timing of supplies will be difficult to characterize. However, the range of variation of each supply from cycle-to-cycle can be determined by measuring over multiple power cycles using infinite persistence on the oscilloscope.

Another common approach is to "cascade" multiple scopes. This is usually done by triggering the scopes on one of the power supplies or on a common power good/fail signal.

Both of these approaches are time-consuming and require special attention to synchronization:

- Dealing with synchronization and time uncertainty requires care
- Aggregating data to develop a system timing diagram is possible, but time-consuming
- Complexity increases with the number of power rails to be observed
- Setups must be perfectly consistent
- One measurement channel must be used to provide synchronization

Using an MSO to extend channel count

A mixed signal oscilloscope can provide additional channels for power supply sequencing. For this to work, the MSO must have suitable voltage range on the digital inputs and independently adjustable thresholds. For example, a Tektronix MDO4000C with the MSO option offers 16 digital inputs with independent thresholds for each channel and a ± 30 Vp-p dynamic range up to 200 MHz, making it suitable for most of the voltage levels you'd find in a typical design. Note that this approach works well if the objective is strictly to measure timing relationships, but it does not allow for measurement of rise/fall times or the shape (monotonicity) of the power-on/off.

8-channel scopes speed the process

Using an oscilloscope with 8 analog channels cuts the time and hassle significantly versus any of the methods covered so far. With an 8-channel oscilloscope, power supplies with up to eight power rails can be characterized using analog probes. To measure turn-on and turn-off timing relationships on power supplies with more than eight power rails, a mixed signal oscilloscope with digital signal inputs and independently adjustable thresholds can also be used.

Now, let's look at some typical power sequencing measurement applications.

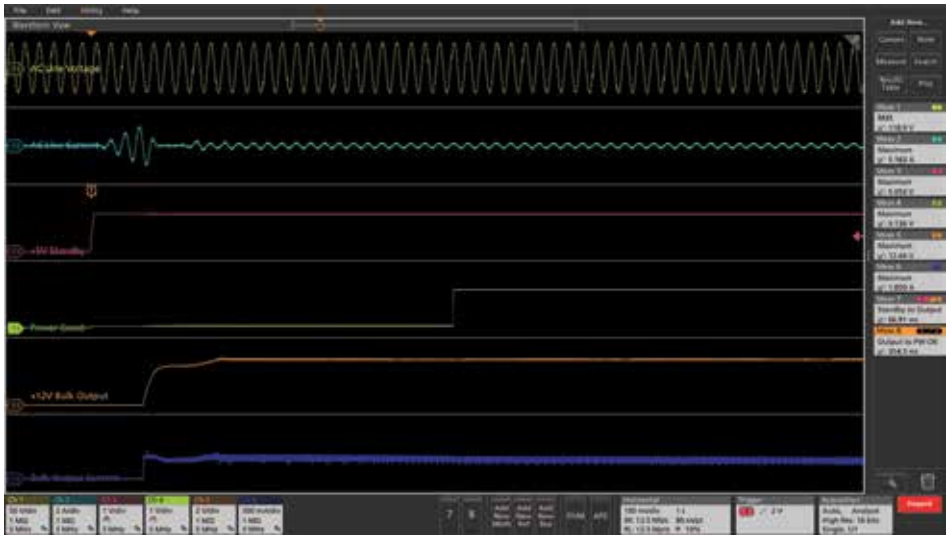

Fig. 1 This screen shot shows measurement of an AC/DC switching power supply turn-on after the front-panel switch was pressed.

Turn-on delay with remote on/off

The switching power supply under test in the screen shot below produces a high-current, regulated 12 VDC output. This power supply is remotely controlled with a switch on the front panel of the instrument. Shortly after the switch is pressed, the +5 V standby voltage is turned on, enabling the switching converter to start. After the +12 V output is in regulation, the Power Good (PW OK) signal goes high to indicate to the load that the supply is reliable.

The +5 V standby voltage signal provides a simple rising edge trigger for the acquisition of the relevant signals. Automatic measurements verify that the delay to the output voltage turn-on is <100 ms, and the delay from output voltage turn-on to PW OK is in the specification range of 100 - 500 ms.

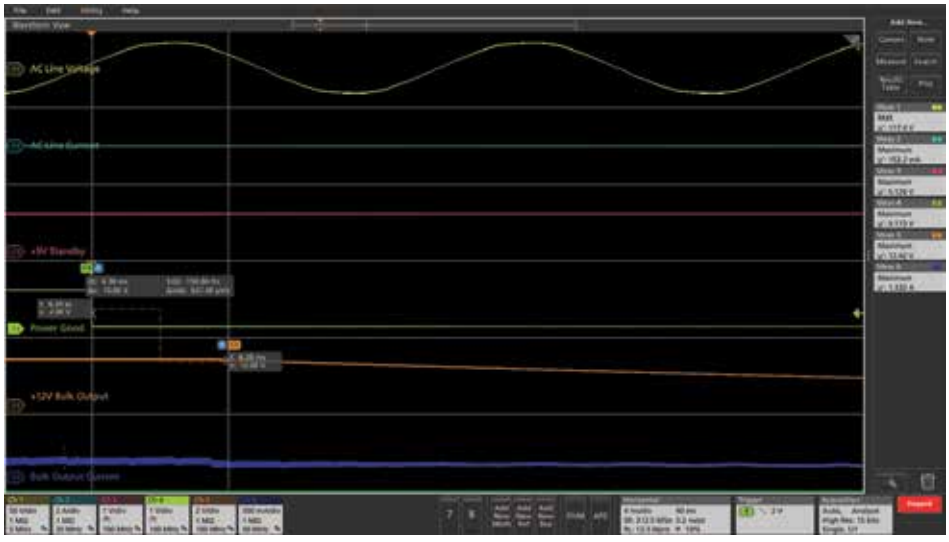

Fig. 2 This screen shot shows measurement of an AC/DC switching power supply turn-on after the front-panel switch was pressed.

Turn-off delay with remote on/off

After the power supply's main switch is turned off, the switching converter is turned off and the output voltage decreases. The power supply is specified to remain in regulation for at least 20 ms after the switch is pressed. Most importantly, the PW OK signal is specified to fall 5 – 7 ms before the +12 V output voltage falls out of regulation, allowing the load time to react and shut down cleanly.

As show below, the PW OK signal provides a falling edge trigger for the acquisition of the relevant signals. The waveform cursor measurement verifies that the PW OK pre-warning signal is operating as specified.

Verify timing over multiple power cycles

To verify that the power supply turn-on timing remains within specifications over multiple power cycles, infinite persistence can be used to display the signal timing variations and statistics displays of automated timing measurements quantify the variations. In the setup show below, the 50% point of the +5V standby voltage serves as the timing reference. The turn-on sequence is repeated 10 times and the timing variations over the 10 turn-on cycles are within a little over 1 percent.

Point-of-load regulated power supply timing

This screen capture below shows the turn-on timing of seven point-of-load supplies in a system board during power-up. The input power supplies to the circuit board are the +5V standby and bulk +12 VDC supply from the previous example.

The automated turn-on delay measurements in this test are made between the automatically-calculated 50 percent points of each of the waveforms, meaning that each measurement has a different configuration with a different set of measurement thresholds. The first measurement shows the delay from the +5 V standby signal to the bulk +12 V supply and the second measurement is the delay to the main +5 V supply. The remaining measurements are the sequence of critical delays from the main +5 V supply.

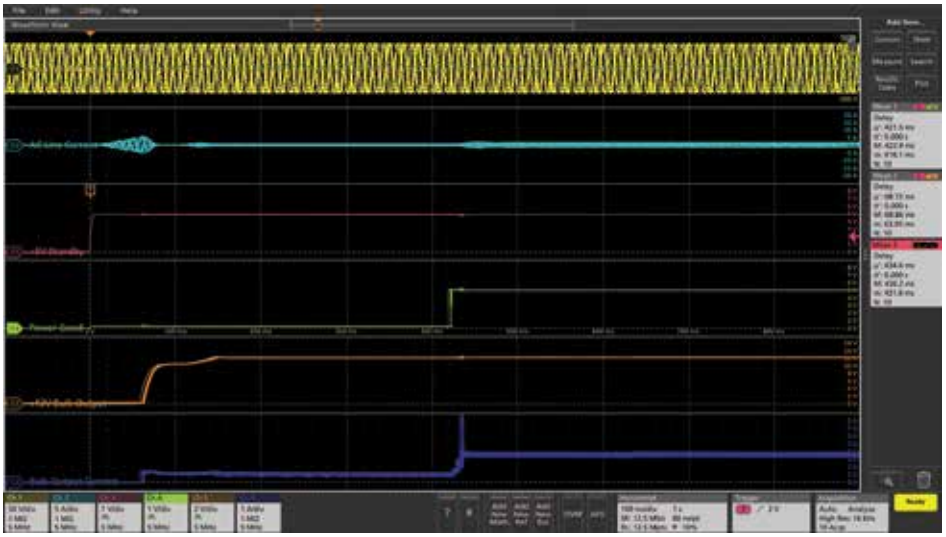

Fig. 3 Repetitive turn-on timing measurements can be accomplished using infinite persistence and measurement statistics.

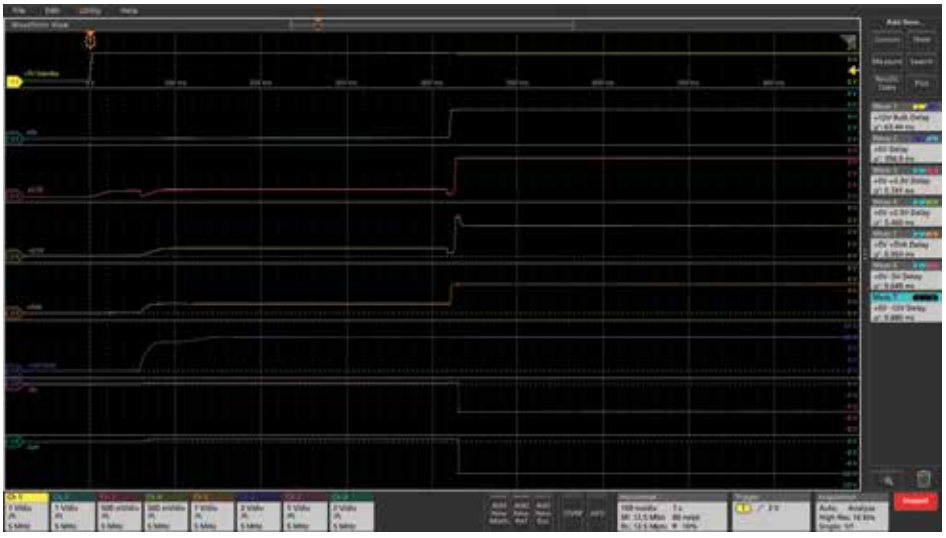

Fig. 4 This measurement shows turn-on timing of seven regulated power supplies.

Turn-off timing of regulated power supplies

The automated turn-off delay measurements in this test are made between the points of each of the waveforms that are 5 percent below their nominal value. Unlike the previous percentage-based measurement thresholds, each measurement has an absolute voltage threshold. As the power supply shuts down, the Power Good signal falls. As you can see in the screen shot below, some of the supplies are more heavily loaded and turn off more quickly than others.

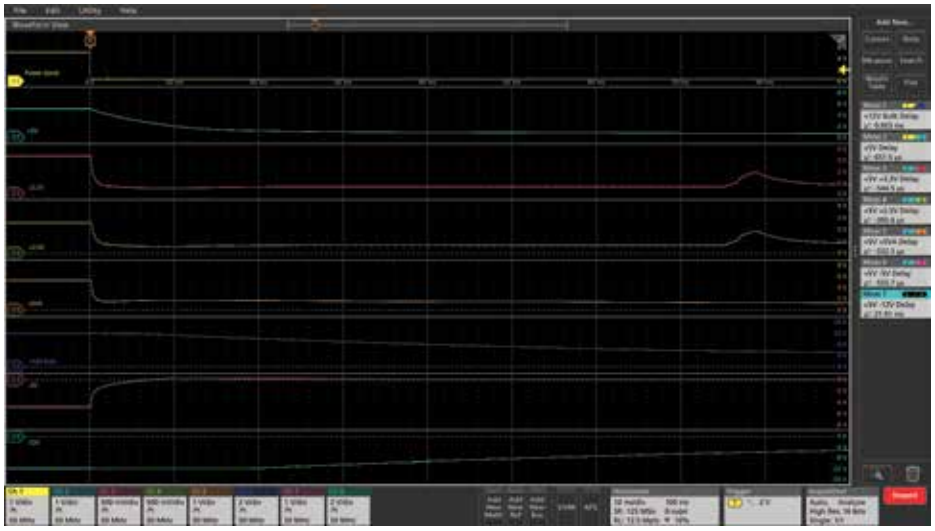

Fig. 5 Some of the supplies are more heavily loaded and turn off more quickly than others, as visible here.

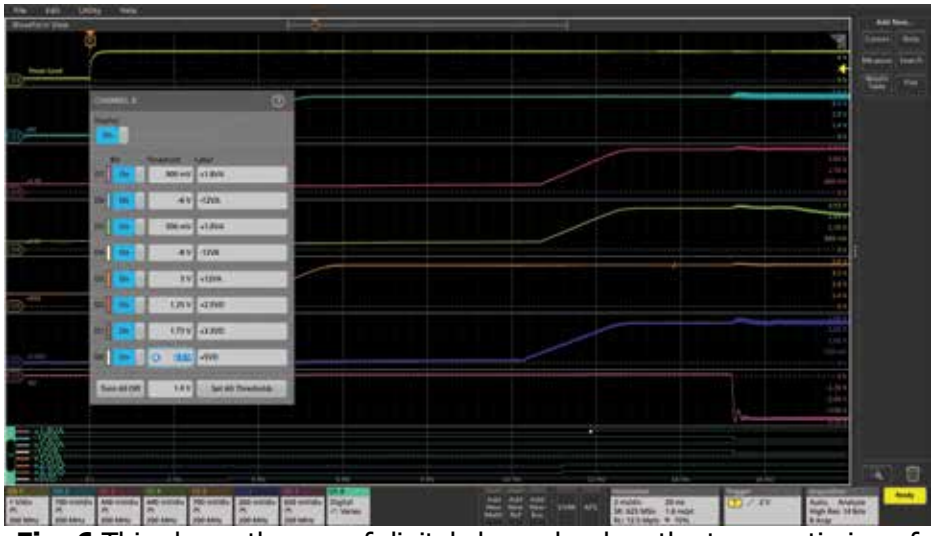

Fig. 6 This shows the use of digital channels when the turn-on timing of more than eight regulated power supplies needs to be verified.

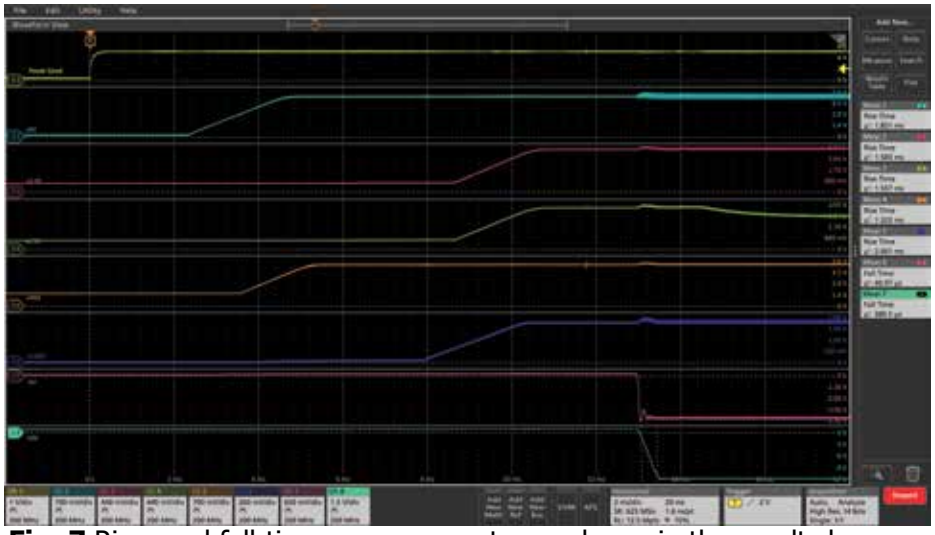

Fig. 7 Rise- and fall-time measurements are shown in the results boxes on the right side of the display

Turn-on timing of more than 8 rails

Automated timing delay measurements are simply based on the times at which the signals cross their respective threshold voltages. Since each automated measurement configuration can include a unique threshold value (typically 50 percent of the signal amplitude) and each digital channel can have a unique threshold value (also typically set to 50 percent of the power supply voltage), mixed signal oscilloscopes can make power supply timing delay measurements as shown below up to the number of available digital inputs. Depending on the MSO model, the number of channels can range from 8 to 64.

Power supply rise-time measurements

In addition to the power supply sequencing, the rise-times of power supplies must be controlled to meet the specifications of some critical components in a system. Automated rise- and fall-time measurements are also made based on voltage reference points which are, by default, automatically calculated to be 10 percent and 90 percent of the signal amplitude of each channel. In the simple example show below, the rise-times of the positive supplies and the fall-times of the negative supplies are shown in the results boxes on the right side of the display.

About the Author:

Dave Pereles is a technical marketing manager at Tektronix and has worked in the test and measurement industry in various roles including applications engineering and product management for over 25 years. He holds a BS in electrical engineering from Trinity College, Hartford, CT and an MBA from Seattle University.

TEMPERATURE SENSORS - NOW YOU SEE THEM, NOW YOU DON'T

TE CONNECTIVITY

You may not know it, but temperature sensors are present throughout many of the daily tasks in our lives. Thinking back on your day today -did you turn on the kettle for a cup of coffee or take the milk out of the refrigerator? Did you take the train to work or have you charged your phone battery? These tasks, and more, all use temperature sensors - even the computer you may be using now depends on a temperature sensor!

Monitoring and regulating temperature is clearly fundamental to human life, and creating the technology to achieve this has been the work of many great scientists. Galileo invented the first documented thermometer in 1592, using a simple air system in a glass bulb. It wasn't until the 18th century that Daniel Gabriel Fahrenheit created the more accurate mercury thermometers, and Anders Celsius introduced the 0-100 degrees calibration references that we all know of today.

Fast forward to now, and we see many types of advanced temperature sensors available with different technologies and designs. New inventions such as the thermistor, thermocouple, thermopile, digital and platinum sensors all offer a wide range of benefits for different situations and environments. They have become highly sophisticated devices that help people throughout many facets of life: in factories, hospitals, schools, homes and more.

Nowadays, there is a huge market for temperature sensors: it was valued at USD 5.13 billion in 2016 and is estimated to grow by 4.8% until 2022, reaching USD 6.79 billion for the entire temperature sensor market. This is fueled by changing consumer and industrial trends, and technological shifts that place new demands on temperature sensors and drive innovation. Many producers, such as in the high-tech automotive and semi-conductor sectors, need advanced temperature sensors to better run their production facilities, such as for energy efficiency and automated process control. To manage this, temperature sensors must be smarter with precise communication and self-diagnostic functions. Meanwhile, as electronic devices become slimmer and more portable, it is a challenge for engineers to create corresponding designs for temperature sensors.

Standing at the center of this dynamic industry is TE Connectivity – one of the largest sensor technology companies in the world. With a broad product portfolio and an experienced team of engineers, they are well- placed to meet the needs of the marketplace. While

TE Connectivity's sensor technology is undoubtedly impressive, what gives them most pride is seeing how this technology is applied across multiple industries, and how it helps people every day in their jobs and in their lives. When looking at TE Connectivity's product portfolio, you'll find that there really is something for all scenarios.

NTC THERMISTOR

There has been a greater demand in recent years for light-weight products with high efficiency and low-cost. TE Connectivity's NTC Thermistor meets exactly these criteria.

With thermo-sensitive materials, its resistance decreases as temperature increases, meaning it is extremely sensitive to temperature movement without causing thermal load. What's more, although NTC Thermistors aresmall, they can operate at -150°C, and are very useful across many fields. They are typically used in medical devices such as dialysis equipment, DNA sequencers and blood analyzers as well as home appliances suchas the stove. One of its key applications is in the automotive industry, where it monitors the temperature of batteries in electric cars, preventing battery overheating.

THERMOCOUPLE

Like the NTC Thermistor, the Thermocouple sensor is light-weight and competitively priced. The thermocouple sensor is made of two different metal wires connected at one point. When one end is exposed to a heat source, potential differences are generated within the circuit. The thermocouples use this measurable electrical potential difference to calculate the temperature and activate the HVAC device, for example, to regulate the ambient temperature. The core benefit of the Thermocouple sensor is that it can be used in very high temperature conditions or harsh environments, with some models operating at up to 1700°C.

PLATINUM TEMPERATURE

As the name suggests, one of core materials for the Platinum Temperature sensor is platinum. Platinum is best known by many for its use in wedding rings, however, in the eyes of TE Connectivity, platinum is the best material for producing a stable and reliable temperature sensor. Its resistance is perfectly linear under different temperatures, allowing for highly precise and stable temperature monitoring. The operating temperature range is quite wide, and can run from -200°C to +1000°C. The applications for RTD sensors are extremely broad, including uses in food processing, stoves and grills. They are prominently used in the tough environment of space rockets, where TE's sensors monitor changes that reach extremely high temperatures in several stages of the rocket launch, thus ensuring a regular performance of the rocket's journey from launch through to orbit. Moreover, Platinum temperature sensors are particularly

common in exhaust gas temperature measurement, where they can be placed in a car to monitor pollution and optimize fuel consumption.

THERMOPILE

Thermopiles are leader in the non-contact category of sensors. What that means is that it can effectively measure physical objects from a far range, even several meters away. Thermopiles have been used in a broad range of applications ranging from industrial process monitoring to occupancy and motion sensing to medical temperature readers such as the Ear Thermometer. Other applications include home appliances such as microwave ovens, fire and heat alarms, automotive seat occupancy and road and highway ice detection. TE Thermopile not only measures temperature, but can also be used for gas concentration measurement such CO2 and other gases.

DIGITAL TEMPERATURE SENSORS

Digital Temperature sensors can convert temperature physical quantity and humidity quantity into a digital sensor through a temperature and corresponding circuit. In addition, it can be directly read by computer, plc, intelligent instruments and other data acquisition devices. It is commonly used in thermostats and as board mounted sensors in many electronic devices such as home appliances, medical devices and consumer electronics. Digital temperature sensors are used in all IoT systems, like smart home applications. The digital temperature sensor can trigger home heating or air-conditioning systems, helping to maintain a comfortable home temperature and optimizing energy consumption.

SUMMARY

Temperature sensors are one of the most widely applied technological devices in the world - helping people in many unique ways. Whether you are sipping your coffee while reading newspaper in your home, or navigating your car through the city to get to your office or even simply sitting in your office comfortably enjoying the "right" temperature as you type through your daily work, you may not always notice them in your life because they secretly monitor all temperature around you to ensure everything will function properly with appropriate temperature range, but you would certainly notice them if they were gone! TE Connectivity is proud to be a part of this story, and to offer a wide range of temperature sensor products to meet your needs.

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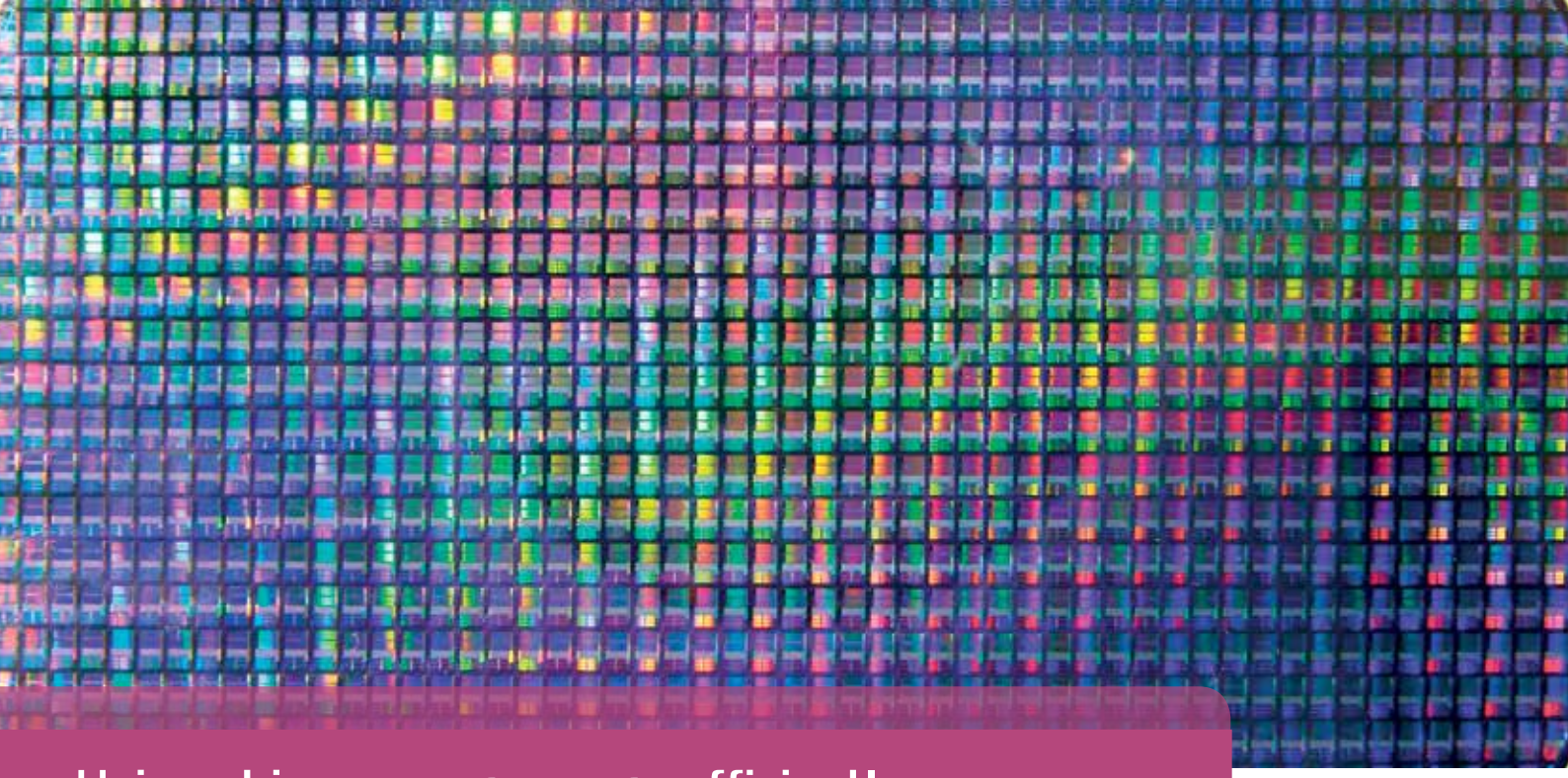


Using chip memory more efficiently

› Larry Hardesty | MIT News Office

System for generating ad hoc "cache hierarchies" increases processing speed while reducing energy consumption.

For decades, computer chips have increased efficiency by using "caches," small, local memory banks that store frequently used data and cut down on time- and energy-consuming communication with off-chip memory.

Today's chips generally have three or even four different levels of cache, each of which is more capacious but slower than the last. The sizes of the caches represent a compromise between the needs of different kinds of programs, but it's rare that they're exactly suited to any one program.

Researchers at MIT's Computer Science and Artificial Intelligence Laboratory have designed a system that reallocates cache access on the fly, to create new "cache hierarchies" tailored to the needs of particular programs.

The researchers tested their system on a simulation of a chip with 36 cores, or processing units. They found that, compared to its best-performing predecessors, the system increased processing speed by 20 to 30 percent while reducing energy consumption by 30 to 85 percent.

"What you would like is to take these distributed physical memory resources and build application-specific hierarchies that maximize the performance for your particular application," says Daniel Sanchez, an assistant professor in the Department of Electrical Engineering and Computer Science (EECS), whose group developed the new system.

"And that depends on many things in the application. What's the size of the data it accesses? Does it have hierarchical reuse, so that it would benefit from a hierarchy of progressively larger memories? Or is it scanning through a data structure, so we'd be better off having a single but very large level? How often does it access data? How much would its performance suffer if we just let data drop to main memory? There are all these different tradeoffs."

Sanchez and his coauthors - Po-An Tsai, a graduate student in EECS at MIT, and Nathan Beckmann, who was an MIT graduate student when the work was done and is now an assistant professor of computer science at Carnegie Mellon University - presented the new system, dubbed Jenga, at the International Symposium on Computer Architecture last week.

Staying local

For the past 10 years or so, improvements in computer chips' processing power have come from the addition of more cores. The chips in most of today's desktop computers have four cores, but several major chipmakers have announced plans to move to six cores in the next year

or so, and 16-core processors are not uncommon in high-end servers. Most industry watchers assume that the core count will continue to climb. Each core in a multicore chip usually has two levels of private cache. All the cores share a third cache, which is actually broken up into discrete memory banks scattered around the chip. Some new chips also include a so-called DRAM cache, which is etched into a second chip that is mounted on top of the first.

For a given core, accessing the nearest memory bank of the shared cache is more efficient than accessing more distant cores. Unlike today's cache management systems, Jenga distinguishes between the physical locations of the separate memory banks that make up the shared cache. For each core, Jenga knows how long it would take to retrieve information from any on-chip memory bank, a measure known as "latency."

Jenga builds on an earlier system from Sanchez's group, called Jigsaw, which also allocated cache access on the fly. But Jigsaw didn't build cache hierarchies, which makes the allocation problem much more complex.

For every task running on every core, Jigsaw had to calculate a latency-space curve, which indicated how much latency the core could expect with caches of what size. It then had to aggregate all those curves to find a space allocation that minimized latency for the chip as a whole.

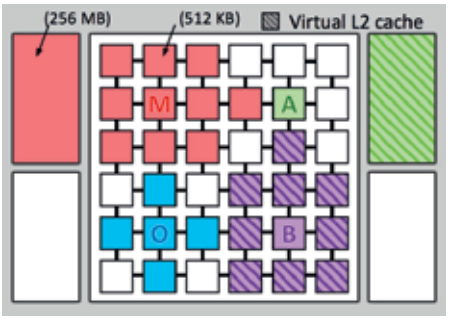
Curves to surfaces

But Jenga has to evaluate the tradeoff between latency and space for two layers of cache simultaneously, which turns the two-dimensional latency-space curve into a three-dimensional surface. Fortunately, that surface turns out to be fairly smooth: It may undulate, but it usually won't have sudden, narrow spikes and dips.

That means that sampling points on the surface will give a pretty good sense of what the surface as a whole looks like. The researchers developed a clever sampling algorithm tailored to the problem of cache allocation, which systematically increases the distances between sampled points. "The insight here is that caches with similar capacities - say, 100 megabytes and 101 megabytes - usually have similar performance," Tsai says. "So a geometrically increased sequence captures the full picture quite well."

Once it has deduced the shape of the surface, Jenga finds the path across it that minimizes latency. Then it extracts the component of that path contributed by the first level of cache, which is a 2-D curve. At that point, it can reuse Jigsaw's space-allocation machinery.

In experiments, the researchers found that this approach yielded an aggregate space allocation that was, on average, within 1 percent of that produced by a full-blown analysis of the 3-D surface, which would be prohibitively time consuming. Adopting the computational short cut enables Jenga to update its memory allocations every 100 milliseconds, to accommodate changes in programs' memory-access patterns.



This figure shows a 36-tile Jenga system that's running four applications. Jenga gives each application a custom virtual cache hierarchy.

End run

Jenga also features a data-placement procedure motivated by the increasing popularity of DRAM cache. Because they're close to the cores accessing them, most caches have virtually no bandwidth restrictions: They can deliver and receive as much data as a core needs. But sending data longer distances requires more energy, and since DRAM caches are off-chip, they have lower data rates.

If multiple cores are retrieving data from the same DRAM cache, this can cause bottlenecks that introduce new latencies. So after Jenga has come up with a set of cache assignments, cores don't simply dump all their data into the nearest available memory bank. Instead, Jenga parcels out the data a little at a time, then estimates the effect on bandwidth consumption and latency. Thus, even within the 100-millisecond intervals between chip-wide cache re-allocations, Jenga adjusts the priorities that each core gives to the memory banks allocated to it.

"There's been a lot of work over the years on the right way to design a cache hierarchy," says David Wood, a professor of computer science at the University of Wisconsin at Madison. "There have been a number of previous schemes that tried to do some kind of dynamic creation of the hierarchy. Jenga is different in that it really uses the software to try to characterize what the workload is and then do an optimal allocation of the resources between the competing processes. And that, I think, is fundamentally more powerful than what people have been doing before. That's why I think it's really interesting."

Fuel Cells for Business Continuity

GenCell

With grid electricity forecasted to be increasingly precarious in many countries, a long duration backup solution is increasingly a necessity for business continuity. GenCell fuel-cell-based power solutions produce 5kW of electricity and overcome the significant weaknesses of legacy power solutions: the limited duration of batteries, the smell, noise and startup time of diesel generators, and the weather/daylight limitations of solar energy systems.

GenCell has succeeded in developing a number of patents to reduce the CAPEX and OPEX of their fuel-cell power solution, including the use of a non-platinum catalyst, as well as mechanisms for using plain air as an oxidant and lower-cost industrial-grade hydrogen as a fuel. The cost breakthroughs associated with our patented alkaline fuel cell technology will enable GenCell to deliver fuel cell solutions that are affordable for the mainstream.

GenCell currently offers two solutions that produce 5kW of auxiliary power:

- The GenCell G5 long-duration UPS (uninterruptible power supply) for telecom, homeland security, healthcare and niche industrial markets. Designed to be extremely reliable, the GenCell solution has minimal moving parts, redundant internal systems and is highly resilient to extreme temperatures, humidity and air salinity.
- The GenCell G5rx utility backup power solution for substations during power outages of any duration. Designed to operate as a direct source of backup power or to supplement the limited duration of legacy auxiliary battery systems, the GenCell G5rx solution offers an immediate injection of power and keeps circuit breaker "auto reclosers" operational until the grid recovers.

Rami Reshef CEO GenCell

Both GenCell solutions are comprised

of the following components: an electrochemical generator (i.e., the fuel cell), an energy bridge, a heat utilization unit and a hydrogen fuel supply. The GenCell G5rx also includes a shelter that is resistant to high-voltage interference, earthquakes and EMPs. An optional Network Operations Center (NOC) offers remote manage and maintenance of all GenCell solutions from a control room, web browser or mobile device.

Hydrogen based fuel cell technology seems to be a hot topic at the moment, especially in the automotive market, what are your thoughts on this?

It's true that the automotive industry sees great potential in fuel cells. No doubt this is the result of growing consumer concern for the environmental effect of car emissions. In general, transport is responsible for 12% of carbon dioxide emissions in Europe and more than 20% in the USA. As a result, governments are keen to reduce these figures, putting pressure on manufacturers to invest in fossil fuel alternative technologies. Hydrogen-based fuel cells have become one way to achieve this.

The automotive industry has certainly raised the awareness of fuel cells again, which is great, but this is not a new technology.

Fuel cells have been used in other markets, very successfully for many years now. For instance, NASA pioneered the use of Alkaline-fuel cells in its Apollo program in the 1960's. It used fuel cells to provide critical light and heat, as well as the electricity to power other onboard equipment on each space shuttle. It chose fuel cells to achieve this as it needed extreme reliability – batteries were simply too heavy and they also couldn't provide the necessary extended life.

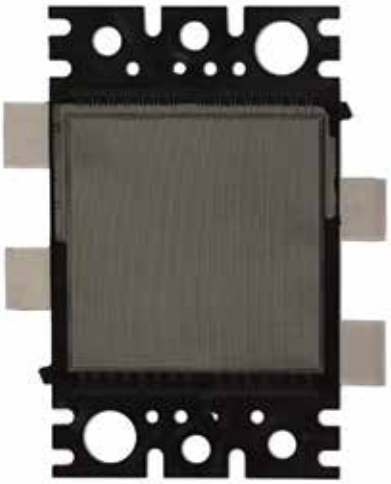
Consequently, this proven space technology enhanced and validated the quality and resilience of fuel cells, for which would later be used for many other commercial applications.

If it's not a new technology, what's prohibited the wider adoption of fuel cells in other markets?

In the early days of fuel cell development, the promise of the technology was huge and many businesses were attracted to its many benefits. However, as scientists tried to commercialize the technology, issues with scalability and manufacturability became apparent.

As a result, early adopters didn't receive the promised benefits and this tarnished the reputation of fuel cells as a viable alternative power. But as with most technology introductions, this same technology has since been redesigned, refined and the early issues resolved – now enabling fuel cells to compete with more conventional technologies such as diesel generators.

Fuel cell manufacturers such as ourselves are now enjoying significant success with this technology in several markets. But from a reputation perspective, we are all rebuilding market confidence in the technology,



Anode frame 2 5000W

GenCell Fuel Cell

GenCell G5 Long-Duration UPS

utilizing important proof points and customer endorsements to validate its success.

What have fuel cell manufacturers overcome to enable it to be a saleable, commercial technology?

Over the years, many companies have spent significant amounts of time and money in trying to solve the two main barriers to fuel cell use, CAPEX (Capital Expenditure) and OPEX (Operating Expenditure).

I can't talk for others, but in our case, we worked very hard for six years to meet this challenge. We have succeeded in developing a number of patented solutions that have enabled us to reduce our CAPEX and OPEX costs, including the use of a non-platinum catalyst, as well as mechanisms for using plain air as an oxidizer and lower-cost industrial-grade hydrogen as a fuel.

One of the key factors regarding the OPEX of fuel cells is related to the cost of hydrogen. While the production costs of hydrogen have been historically lower than gasoline or methane, the current cost of distribution makes it more expensive than gasoline or methane for commercial usage. Fortunately, the increased emphasis on sustainable energy and growing demand for hydrogen has led to the deployment of new hydrogen distribution systems in Japan, California and other US states that should eventually help resolve this issue.

In addition, there are also new methods of hydrogen production that use wind, solar, geothermal and hydroelectric power to split water. The potential of the newer eco-friendly methods coupled with the new distribution channels, will help make hydrogen increasingly economical as new economies of scale are reached.

GenCell non-platinum catalyst

Which markets and applications are most impacted by fuel cell technology?

The possibilities for fuel cell applications are almost endless - just about anywhere you use energy - but there are already a few key markets where the technology is gaining significant adoption and maturity. These include the transport and automotive industries, industrial power generation and backup power for critical systems at utilities, telecoms and many more.

Indeed, the challenges of aging electrical grids in many parts of our very connected world, makes a steady supply of electricity imperative. For many industries, the cost of business failure outweighs the cost of a business continuity solution. This is especially true at telecom providers where the business model is pay-per-use (talk). For them, network downtime causes a complete cessation of revenue and is extremely expensive. For electricity providers and other utility companies, grid downtime is extremely expensive too - and not just to utilities. In 2015, grid failures cost an estimated USD 110 billion to the US economy.

Are all fuel cell technologies applicable for these markets or are there specialist applications for each?

There are a wide range of fuel cells available on the market, and these are adapted to specific applications.

Each fuel cell has its distinct advantages. For instance, the technology most used in the auto/transport industry is PEM (Polymer Electrolyte Membrane) - a low-temperature fuel cell operating between 80-100 degrees Celsius. Thanks to their small size and light weight, PEM fuel cells are currently the first-choice energy source for a range of materials handling and plant hire applications such as forklifts trucks, portable lighting rigs and more.

Others, like molten carbonate and solid oxide fuel cells, operate at 650 and 1000 degrees respectively and are used mainly for constant power in large utility applications.

GenCell uses alkaline fuel cell (AFC) technology, another low-temperature

type of fuel cell. Alkaline fuel cells are extremely reliable and highly efficient, in fact the most energy efficient of all fuel cell technologies. In addition, they are highly resilient to extreme temperatures, humidity and air salinity.

This makes them an ideal fuel cell technology for providing green backup energy in the event of a power failure. However, in the future, the technology has even greater potential for additional usages beyond back-up applications.

In what scenario might fuel cells be used outside of a back-up application?

In short, continuous power.

When the grid isn't available, options for providing continuous power is currently limited to diesel generators and batteries. Historically, fuel cells have mainly been used for back-up applications, as there hasn't been a solution available to match the reliability and running costs of these alternative power sources. But, fuel cell technology is catching up.

And should it be possible to provide this in the future, there is a clear appetite for fuel cell technology use for continuous power. Why? To realize the same benefits as provided in back-up applications: fuel cells emit no greenhouse gases, they require very little maintenance and don't require regular recharging, they are near silent, vibration and odor free, can be operated in extreme temperatures and have water and heat as their only by-product.

Not only does this technology represent an opportunity to hugely reduce our greenhouse gas emissions, but it could also be used to achieve an enormous amount of social good too.

In what way could fuel cells for continuous power support social benefits?

For example, imagine a situation where fuel cells are sent out with first responder units to natural disasters such as earthquakes or tsunamis. They could instantly provide lifesaving power for the emergency services, critical power for local or pop-up medical facilities, schools or even light and heat for refugee camps.

What's more, this same highly reliable, low maintenance based fuel cell technology could be installed in any off grid remote location around the world. For some, it would provide life changing electricity to communities for the first time, or for others, simply make continuous power more reliable, accessible and easier to maintain.

It also has the potential to significantly boost communications in these regions too. In remote areas with extreme weather, such as in Brazil with its high humidity or Canada with its extreme cold, telecom providers often struggle to provide communities with a reliable and continuous telecom network. In the future, fuel cells could bridge this gap and revolutionize telecom tower reliability.

In short, we see alkaline fuel cells as becoming a mainstream fuel cell technology.

How far away is this 'mainstream' fuel cell technology?

It's difficult to say, but I estimate that we're likely to see this kind of technology enter the market within the next 12-24 months – initially offering all the benefits of fuel cells and later delivering economies of scale that will give it a price point to replace diesel generators for mainstream energy.

However, we should not let this detract from what's available today, as there are substantial opportunities to be enjoyed from the maturing fuel cell markets.

What are the barriers to success in fuel cell adoption in the short term?

To our minds, simple education. There's a lot of misinformation out there surrounding modern fuel cell technology, and when talking to prospects, our first job is often to correct what they think they know.

We do that by explaining what we and others have done to overcome previous technology limitations to make modern fuel cells one of the cleanest, most reliable, robust, and highly efficient power sources available.

We then show them how it's being adopted by many international market leading businesses, who all go through their own comprehensive due diligence processes to approve the use of fuel cells within their businesses.

Our second job is to talk to them about hydrogen in general, as many businesses are not familiar with it. We explain that it's the lightest and most abundant element in the universe, considered the most environmentally friendly fuel and is as safe or even safer than gasoline or natural gas (methane). In addition, we also educate them about sourcing hydrogen and compare its costs to other energy alternatives such as solar, wind, batteries and diesel.

No doubt this is common to all low temperature fuel cell manufacturers out there. The good news is, that the fuel cell business case is so compelling that after a little time invested to understand it, especially in leading businesses where the costs of downtime run into the millions, the cost of a fuel cell to minimize their impact becomes a very obvious and sensible decision.

3D systems-on-chip: a clever partition-ing of circuits to improve area, cost, power and performance

› Dr. Mieke Van Bavel

In recent years, the technology of 3D integration has evolved into an economically interesting road. In particular, the technology is used to package the CMOS imagers you find in your smartphone, the high-bandwidth DRAM memory stacks used in high-end com-puting but also in advanced graphics cards. 3D integration allows a significant reduction of a system's footprint, and enables ever shorter and faster connections between that system's sub-components. Rather than stacking chips, it is also possible to rep-artition a 2D systems-on-chip (2D-SOC) design into circuit blocks, realized in separate wafers that are stacked and tightly intercon-nected. This is called 3D systems-on-chip (3D-SOC). By clever partitioning of the circuits, the power-performance-area can be significantly improved, providing a path to extend Moore's law scaling.

The 3D technology landscape

The continued scaling of microelectronic circuits has allowed the crea-tion of extremely complex systems-on-chip (SOC). At the same time, several specific applications (such as high density memory, high voltage, analog signaling and sensors) have driven technology developments in various directions. In this complex landscape, on the one hand, many electronic systems still consist of a multitude of components that are packaged individually and interconnected using conventional printed circuit boards. On the other hand, more advanced 3D integration and interconnect technologies have emerged, reducing the size of the electronic systems, and enabling faster and shorter connections between their sub-circuits. These abilities have made 3D integration one of the techniques that will allow the industry to keep pace with Moore's Law.

In this 3D technology landscape, several classes of 3D integration can be defined. The main difference between these classes is related to the level of partitioning, in other words: at which level in the interconnect hierarchy the systems are 'cut' into different pieces. Each of these clas-ses requires different process schemes and 3D integration techniques, achieving progressively smaller contact pitches. A first class is what we call system-in-a-package (or SiP), where the partitioning is done at package level – by stacking packages on top of each other, or by inte-grating multiple die in a single package. Among the technologies used to realize SiPs are package-to-package reflow and fan-out wafer

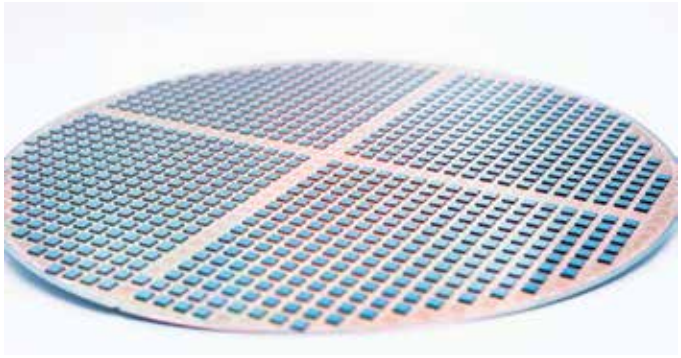


Fig 1: 3D stacked IC: processed wafer with chips stacked on top using a die-to-wafer process.

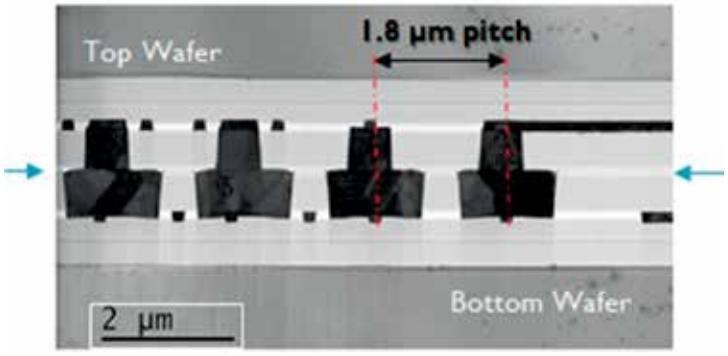


Fig 2: Wafer-to-wafer bonding with 1.8 micrometer pitch overlay accuracy.

level packaging, in combination with solder balls. Contact pitches of current solutions are rather coarse, in the 400 micrometer range. Imec's re-search into new approaches to fan-out wafer level packaging intends to increase the interconnectivity of this class of SiP by a factor 100, target-ing interconnect pitches of 40 micrometer. The technique is applied for example for mobile applications such as smartphones. In a second class, called 3D stacked IC or 3D-SIC, the partitioning is done at die level and individual dies are stacked on top of each other. 3D-SIC partitioning is achieved using die-to-interposer stacking or die-to-wafer stacking, where finished dies are bonded on top of a fully processed wafer. Dies are interconnected using through-Si vias and microbumps. In the industry, microbump pitches down to 40 micrometer are achieved today. Imec's research goal is to bring this pitch down, well below 20 micrometer, as such increasing the interconnectivity by one to two orders of magnitude. A typical application example is wide I/O memory, where vertically stacked DRAM chips (3D-DRAM) are connected on a Si interposer together with a logic die and an optical I/O unit.

3D systems-on-chip: higher density through heterogeneous integration

With advanced CMOS scaling, new opportunities for 3D chip integration with even higher interconnect densities and smaller pitches arise. Rather than realizing a SOC as a single chip, it has now become possible to realize different functional partitions of a SOC circuit. Stacking such partitions results in a so-called 3D system-on-chip. These are packages in which partitions with varying functions and technologies are stacked heterogeneously, with interconnect densities below 5 micrometer. The system partitioning can be done at different levels of the interconnect hierarchy – at the global wiring level (long wires, cross chip), intermediate wiring level, or local wiring level (short wires, interconnecting e.g. intra-core modules). The main technological approach to stack these partitions is wafer-to-wafer bonding – either through hybrid (via middle) wafer-to-wafer bonding or dielectric (via last) wafer-to-wafer bonding techniques. This is achieved by aligning top and bottom wafers that are then bonded. Recently, excellent results in wafer-to-wafer overlay accuracy have been obtained, for both hybrid bonding (1.8 micrometer pitch) and dielectric bonding (300nm overlay across wafer). Accurate overlay is needed to align the bonding pads of the stacked wafers and it is essential to achieving a high yield.

One of the main drivers for 3D-SOC development is functional repartitioning of high performance systems. In such approach, different parts of the SOC system are realized using tailored technologies in different physical layers, but remain tightly interconnected.

The trend in processor development, for example, has been towards an ever increasing number of cores. This trend will continue, enabled by the scaling towards 7nm and 5nm technology nodes. More cores will however also need more on-chip memory. And all this will result in more overall silicon area and more back-end-of-line needs – and hence, in an increasing wafer cost. One way to cope with this trend is by functional repartitioning of the processor followed by heterogeneous 3D integration.

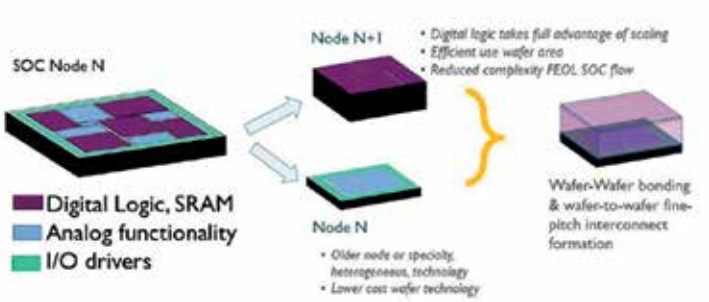


Fig 3: Illustration of 3D-SOC partitioning based on the scalability of the technologies

Fig 4: Video illustrating the principle of multicore processor repartitioning. (https://vimeo.com/171362602)

Power, performance, area and cost benefits through clever partitioning

The imec researchers use physical design tools to find an optimal 3D functional partitioning of high-performance systems. A typical example is a larger SOC which consists of many cores, L1 memories associated with these cores and L2 memory that is shared. This can be ripped up so that all the memory is brought to a top die, and the logic to a bottom die. We now end up with two dies, half the size of the original big die. And this significantly improves the system's yield (defined as the percentage of good dies on a wafer) which decreases as a function of the die's area. In addition to this cost and area gain, the length of the wires between the processor and the memory becomes significantly shorter after stacking the two dies, giving additional gain in power and performance. These gains are typical for anything that is 3D. But there is more. For the original 2D die, the wafer manufacturing process needs to be optimized for both logic and memory technologies. By splitting the die into two dies, one for logic, one for memory, the processes can be tuned for logic and memory separately. And this will further improve the yield. Also, logic typically requires a large number of metal layers (typically 12 to 14), while memory typically requires fewer layers (5 or 6). This implies that the wafer containing the memory part can now be made relatively cheap – as the back-end-of-line cost makes up a large part of the total wafer cost.

In a next step, the partitioning can be revised by making even smaller functional IP blocks and rearrange them into another shape that would further reduce the wire length. The (re-)partitioning should however be done in a clever way, avoiding over-partitioning. For example, if a circuit consists of sub-circuits that are extremely interconnected, ripping them apart may result in too many wires that go up and down between the two resulting dies. And that would cause more problems than solving anything. A clever way of partitioning may for example be based on the scalability of the different technologies. While we keep on scaling transistors according to Moore's Law, it gets more and more difficult to get an

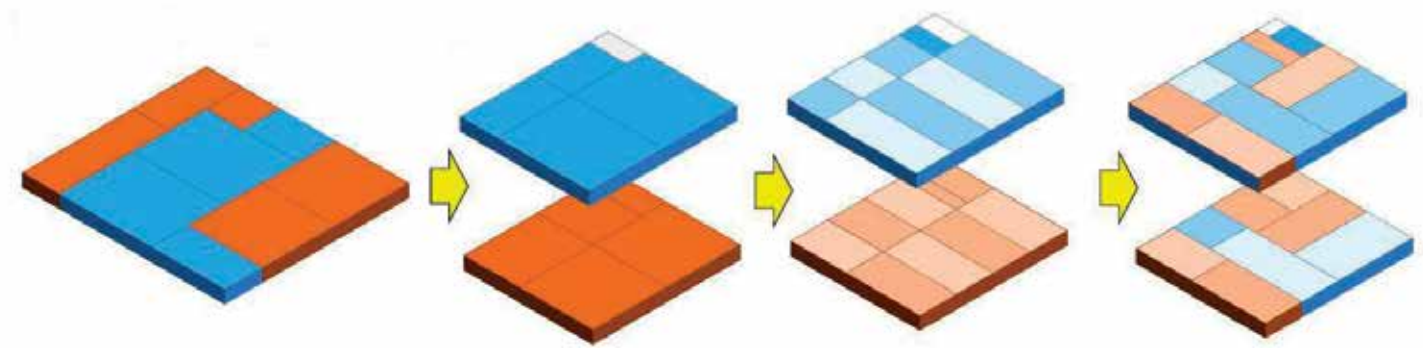


Fig 5: From a 2D-SOC (multiple large IP blocks) to a 3D-SOC (IP blocks re-arranged across two chip levels and further IP block sub-partitioning).

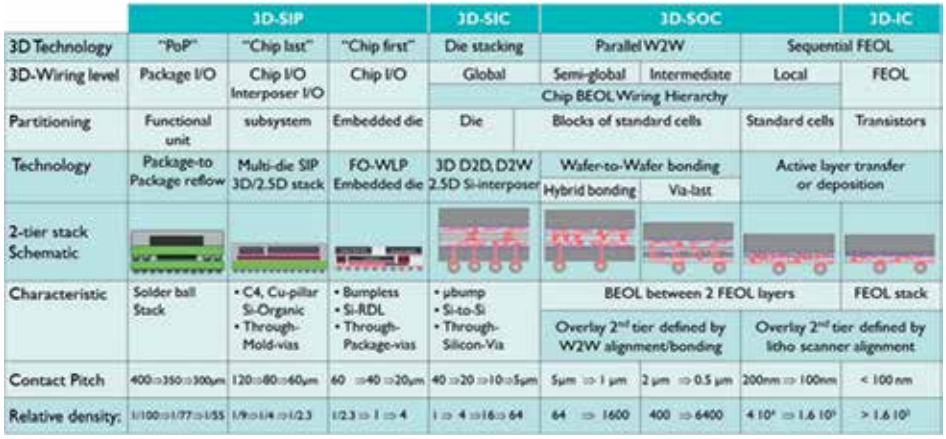


Fig 6: Imec's 3D interconnect technology landscape.

overall process which encompasses everything of the SOC. For these applications, partitioning in function of scalability turns out an interesting solution. If you split the technology into parts that highly scale (e.g. digital blocks) and parts that hardly scale (e.g. analog blocks and I/O drivers), you can optimize the die with highly scalable technologies separately from the die containing less scalable technologies.

Further down the road: 3D-ICs

Eventually, the roadmap will lead to even tighter integration, by stacking transistors on top of each other, achieving contact pitches as small as (a few) 100nm. Imec explores ways of stacking for example nMOS transistors on top of pMOS transistors – or vice versa – instead of put-ting them next to each other – also known as CFET (or CMOS FET). This however involves a completely different technology. It is not about through-silicon-via-like processes: it will be realized through sequential processes or layer transfer processes. The alignment of the two transis-tors in a CFET should not be wafer alignment defined but lithography defined. A

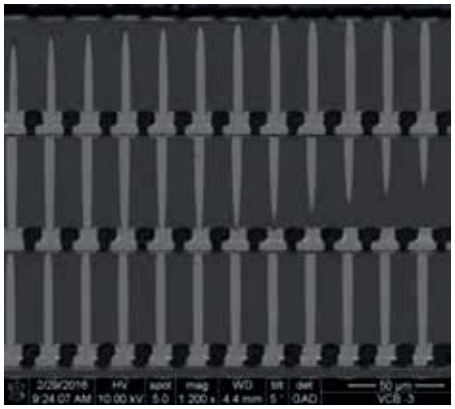


Fig 7: 3D-die stack: four die, connected vertically using 20 micrometer pitch microbumps and 5 micrometer diameter, 50 micrometer deep TSV connections.

typical application is an SRAM cell in a 3D format, which will have a much smaller footprint than its 2D equivalent. Another example is 3D NAND technology, where a single channel contains multiple transistors or bits (up to 58), integrated into one single structure. So it is a few levels of granularity lower than 3D-SOC partitioning. It is surely one of the future paths with a potential to extend Moore's law scaling.

3D-SOCs and 3D-ICs complete imec's 3D technology roadmap that out-lines different paths for 3D integration. However, imec researchers refer to a '3D technology landscape' instead of a 'roadmap'. It is not like a clear traditional roadmap that can be read from left to right. For 3D, there are a lot of technology options that will coexist, even within the same system. The technologies differ in where they intercept the hierarchy of interconnects on the chip, in other words, where we cut the devices and make the 3D interconnectivity. And this will determine the required 3D pitch. So it is more like a collection of technologies that allow a system to be integrated into a much smaller form factor, with increased performance and lower manufacturing cost.

Dr. Mieke Van Bavel is science editor at imec, reporting about imec's research and R&D results in international magazines and newsletters, and in imec's public magazine. Mieke has a PhD degree in Physics (1995) from KU Leuven, Belgium. Before joining imec, she worked as a researcher in various science institutes.

Electrolytic Capacitor Lifetime in Power Supplies

Gary Bocock, XP Power

Electrolytic capacitors are an essential ingredient in AC/DC power supplies, providing high Capacitance x Voltage (CV) and low Equivalent Series Resistance (ESR) in low-volume packages that simply cannot be achieved cost-effectively using alternative parts. The service life of these electrolytic capacitors is an increasingly key design parameter in power supplies.

With power density demands increasing and as the only component wear out mechanism in the product, the electrolytic capacitors used in the design determine the service life of the power supply and hence either the service life or the service interval, if the equipment is maintained, of the end application.

To determine the service life of the power supply it is important to understand the shortest lifetime part in the overall design which, depending on topology & applied ripple current, design layout, capacitor design lifetime, capacitor temperature rating and local heating effects, varies from one product to another and may change under low and high line input conditions.

It is not unusual for the external heating effects to outweigh the internal heating effects especially in today's increasingly compact designs. Actual service life is also dependent on the temperature rises experienced when installed in the application and the mission profile of the end equipment defining average operating temperature over the equipment lifetime, usage hours per day etc.

As described above, there are a number of key factors determining the expected service life of electrolytic capacitors used within the supply; design lifetime at rated temperature, local heating effects, temperature de-rating and magnitude and frequency of applied ripple currents

Design Lifetime at Rated Temperature

Manufacturers of electrolytic capacitors specify the design lifetime at the maximum rated ambient temperature, usually 105 C. This design lifetime can vary from as little as one or two thousand hours, to ten thousand hours or more. The longer the design lifetime, the longer the component will last in a given application and ambient temperature.

Manufacturers also provide calculations to determine lifetime in

$$L = L_0 \times 2^{\left(\frac{T_{max} - T_a}{10}\right)}$$

L : Estimated life (Hr)
L_0 : Life at rated temperature (Hr)
T_{max} : Rated Temperature (°C)
T_a : Ambient Temperature (°C)

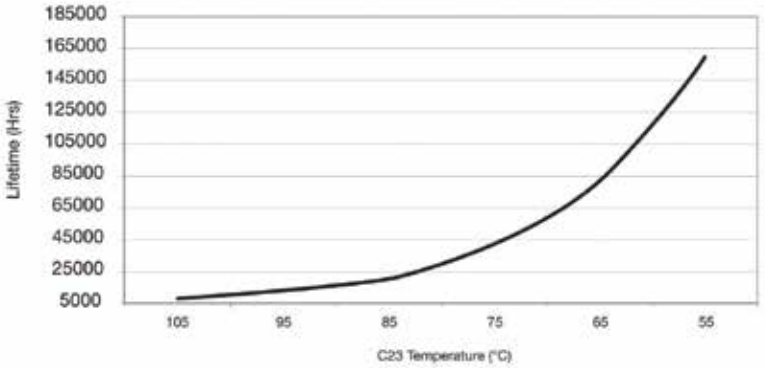


Figure 1: The curve plots the service life against ambient temperature

application. These are based on the Arrhenius equation for temperature dependence of reaction rates, which determines that the reaction rate doubles for every 10 °C rise in temperature. Put another way, the lifetime doubles for each 10 °C reduction in temperature, meaning that a capacitor rated at 5000 hours at 105 °C would have a service life of 10,000 hours at 95 C and 20,000 hours at 85 °C.

The basic equation is given in figure 1. The curve plots the service life against ambient temperature.

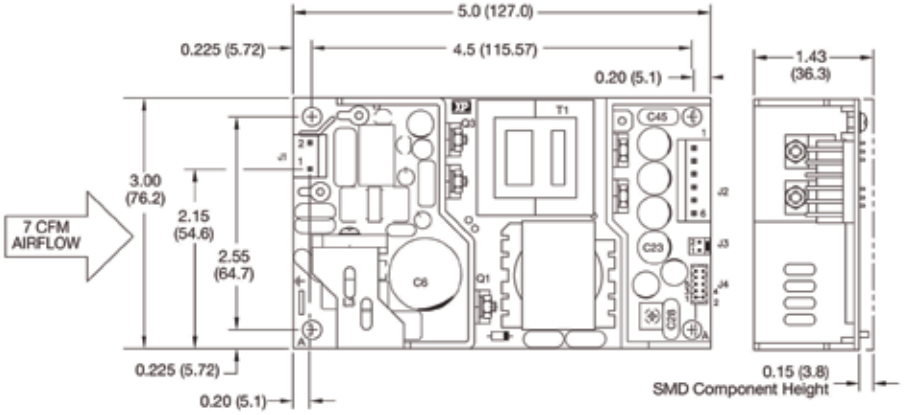


Figure 2: identifies the components and the curves indicate expected service life of the power supply based on the temperature of two capacitors (C6 & C23).

Applied Ripple Current and Frequency of Operation

In addition to the ambient temperature and local heating effects, the application of ripple currents further heat the capacitor core and are generally factored into the manufacturer's lifetime equations.

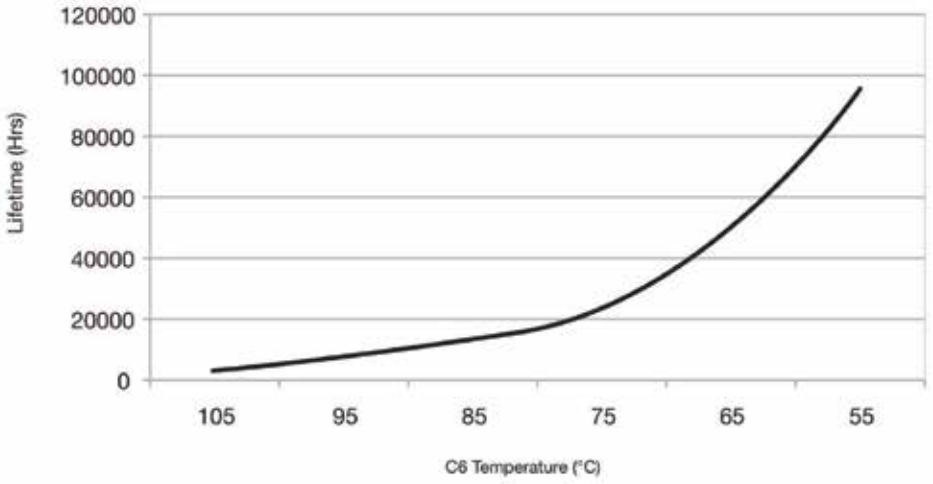
Ripple currents are generated by the switching and rectification processes on both the input and output stages of the supply, causing power dissipation within the electrolytic capacitor. The magnitude & frequency of these ripple currents depend on the topology adopted in the design of active Power Factor Correction (PFC), where used, and the main converter power stage and these vary from design to design. The power dissipated within the capacitor is determined by the RMS ripple current and the capacitor ESR at the applied frequency. The temperature rise at the component core is determined by the power dissipated, the radiation factor of the component package and the temperature difference factor or slope from the core to the case as determined by the component manufacturer.

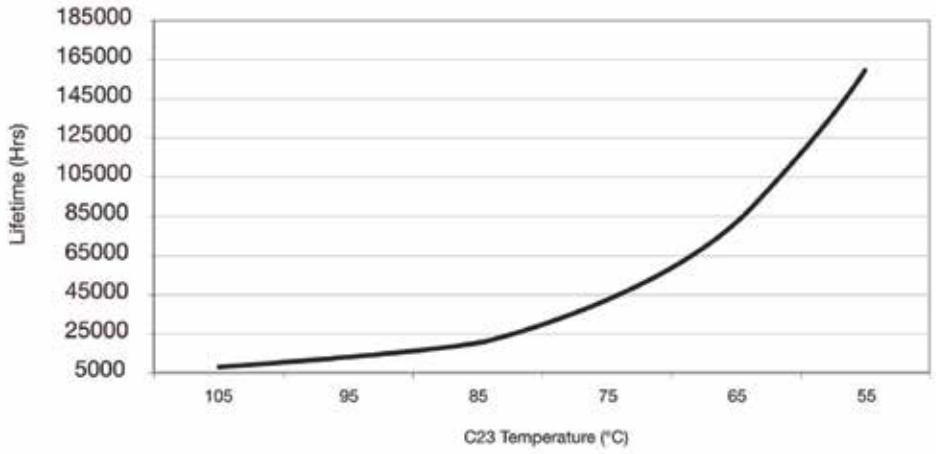
The maximum ripple current that may be applied to the capacitor is usually specified at maximum ambient temperature and 100/120 Hz. Multiplication factors can be applied depending upon the ambient temperature in actual use and the frequency of the applied ripple current with ESR decreasing as frequency increases.

Power Supply Lifetime

These factors are all taken into account by the power supply designer and power supply manufacturers apply design de-rating rules to ensure that product lifetime is adequate.

These design de-rating rules do not account for the mission profile, environment, mounting orientation, positioning, surrounding space, applied load and system cooling/





venting arrangements once installed in the end equipment. Capacitor lifetime, particularly in convection or naturally cooled environments should be reassessed based on the installation. Clearly, measurement of applied ripple currents is not practical but, given that all factors in the overall equipment and power supply design result in the effective operating temperature of the component, a good indication of the service life of each capacitor can be determined by measurement of its case temperature and the application of the Arrhenius equation and mission profile to the base lifetime specified by the component manufacturer. Many power supply data sheets, such as XPs GCS series, identify the key components determining the service life of the product, particularly those requiring external cooling to be provided by the end equipment and those designed for convection cooled applications. This is to assist the system designer in determining power supply service life in the end application.

The mechanical drawing figure 2 identifies the components and the curves indicate expected service life of the power supply based on the temperature of two capacitors (C6 & C23).

Enclosed power supplies incorporating their own cooling fan are less susceptible to the end application environment provided that the ambient temperature is within specification and there is adequate clearance for cooling.

The table below indicates the estimated service life of capacitors with design lifetimes of 2000 and 5000 hours at various temperatures and assumes twenty four hour operation for seven days per week when converting the service hours to service years. Equipment with a mission profile of 8-10 hours per day, 5 days per week, for example, would experience significantly longer service life as a result.

Temperature	2000 Hour Rated	5000 Hour Rated
105 °C	2000 hrs (0.23 years)	5000 hrs (0.57 years)
95 °C	4000 hrs (0.46 years)	10000 hrs (1.14 years)
85 °C	8000 hrs (0.91 years)	20000 hrs (2.28 years)
75 °C	16000 hrs (1.82 years)	40000 hrs (4.56 years)
65 °C	32000 hrs (3.65 years)	80000 hrs (9.31 years)
55 °C	64000 hrs (7.30 years)	160000 hrs (18.2 years)*

*Lifetime calculations above 15 years should be considered as 15 years maximum

New-Tech Europe

Read To Lead

Shaping Smarter Cities: More Than Meets the Eye: Augmented Reality in Medical Applications

› Paul Pickering

The Pokémon Go craze may have tapered off, but key takeaways remain: Users downloaded the mobile app more than 500 million times, and until the craze abated, hordes of fans flocked to malls, memorials, and even cemeteries trying to capture a rare virtual pocket monster or accrue points to progress in the game.

What can we learn here? That augmented reality (AR) engages users and enables them to see and do what they couldn't before. The social game that blended physical and virtual worlds propelled the AR to the forefront of technologies that have the potential to transform industries. What's more, we can draw on how various industries like medicine have applied AR to ease procedures and educate practitioners.

AR in Medical Applications

Vein Visualization

Venipuncture, the technique of puncturing a vein to draw blood or deliver an intravenous injection, is one of the most common medical procedures. Some patients, though, present extra challenges, including the elderly, burn victims, drug abusers, and patients undergoing chemotherapy. Of the three million procedures performed daily in the U.S., an estimated 30 percent require multiple attempts before finding a suitable vein.

Augmented reality can help. Huntington, NY company AccuVein uses noninvasive infrared (IR) technology to scan the target site and display the underlying vein structure. Because the hemoglobin in blood absorbs more red light than the surrounding tissue, the resulting image (Figure 1) shows the veins as a web of black lines on a background of red.

AR vein illumination can increase the first-stick success rate by up to 3.5 times, which increases first-time success and leads to increased patient satisfaction, reduced pain, reduced workload, and reduced cost. In a surgical application, vein illumination can help the surgeon to identify the optimal incision site, which reduces bleeding and lowers costs.

Surgical Navigation

For surgeons, AR offers a hands-free and seamless way to access digital information while performing a delicate operation. German technology supplier Scopis has just introduced an application that combines Microsoft's HoloLens

head-mounted display with a surgical navigation system to help surgeons performing spine surgery (Figure 2). The platform provides a hands-free display and a holographic overlay that indicates exactly where the surgeon should operate.

The next stage of development will be to combine data from multiple sources such as MRI (magnetic resonance imaging) or PET-CT (positron emission tomography-computed tomography) into a fused AR image that can provide the surgeon with customized information for each procedure.

Medical AR Applications in Development

Medical Education

Beginning in 2019, Case Western Reserve University will be teaching anatomy to future doctors without the use of cadavers. Instead, medical students will use head-mounted displays to view an AR representation of a human body (Figure 3).

The technology adds a vital element missing from earlier attempts to teach the subject using large touch screens. Users can now walk around a 3-D image of the body skeleton, organs, and veins and view the display from any orientation.

The next stage of development will allow users to interact with the image in real time-rotating the body or "moving" an organ to examine the underlying arteries, for example.

Enabling Vision

Oxford (UK) start-up Oxsight is testing AR glasses to help visually-impaired patients recognize objects and move around their environment. The smart glasses detect light, movement, and shapes, and then display sensor data in a way that helps the user make the most of his or her remaining vision. Each

Figure 1: The rechargeable AV400 AR scanner weighs less than 10 ounces and displays the veins underneath the skin. (Image source: AccuVein)

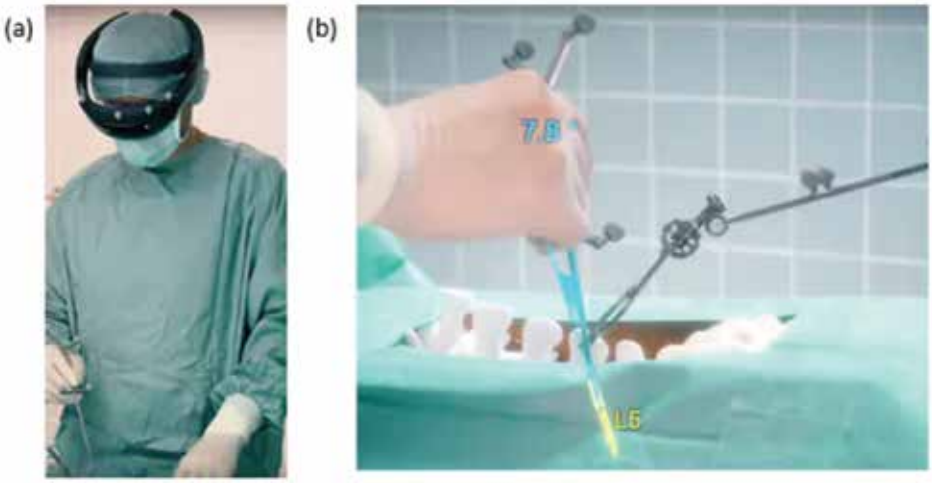


Figure 2: The Scopis surgical navigation tool: (a) Surgeon headset; (b) AR image. (Source: Scopis)

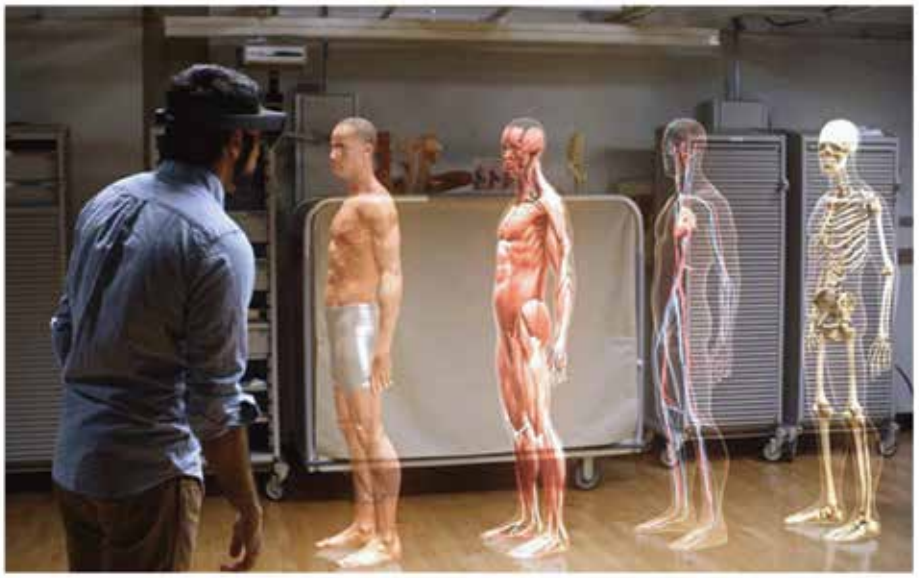


Figure 3: An AR headset enables anatomy students to examine a virtual human body and navigate through successive layers of skin, muscle and organs. (Source: Microsoft)

person's needs are different, so the display can be adjusted to customize the view. For example, the display can project a cardboard cutout of a person's appearance, boost certain colors, or zoom in or out.

These are only a couple of examples. Many other medical AR applications are in the "proof-of-concept" stage, including live-streaming of patient visits with remote transcription services; remote consultation during surgical procedures; and assistive learning for children with autism.

Building Blocks For AR Systems

What building blocks for AR design? Many AR applications are still on the drawing board, but existing wearable and portable medical devices already incorporate many of the core hardware technologies, with Microchip Technology at the forefront. The block diagram for Microchip's wearable home health monitor design (Figure 4), for example, includes a powerful processor with analog functions, sensor fusion capability, low power operation, and cloud connectivity.

Similarly, the XLP (eXtreme Low Power) family of PIC microcontrollers is designed to maximize battery life in wearable and portable applications. XLP devices feature low-power sleep modes with current consumption down to 9nA and a wide choice of peripherals. The PIC32MK1024GPD064, for example, is a mixed-signal 32-bit machine that runs at 120MHz, with a double-precision floating-point unit and 1MB of program memory. Signal conditioning peripheral blocks include four operational amplifiers (op amps), 26 channels of 12-bit analog-to-digital conversion (ADC), three digital-to-analog converters (DACs), and numerous connectivity options.

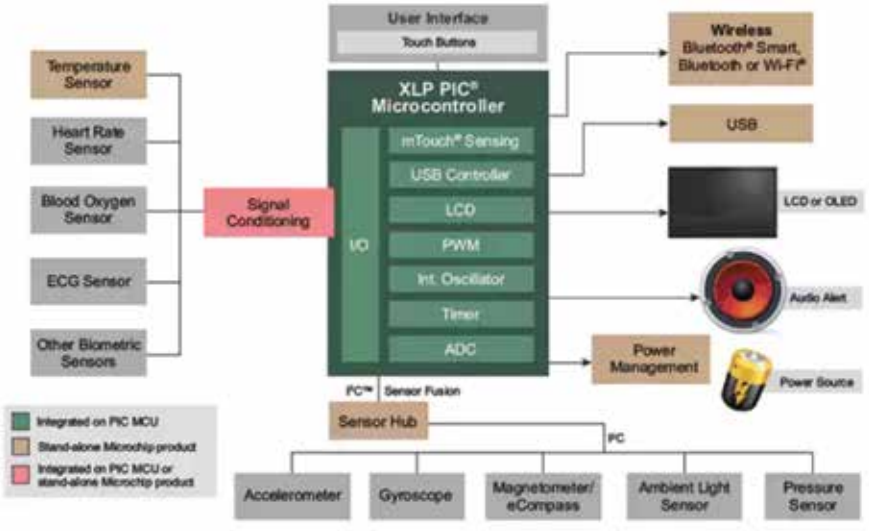


Figure 4: A high-end wearable home health monitor includes many of the blocks needs for an AR application (Source: Microchip Technology)

Microchip also offers a sensor fusion hub, as well as several wireless connectivity options including Bluetooth and Wi-Fi modules. Combined with third-party optics and other blocks, these components can form the basis of a low-cost AR solution.

Finally, The Microsoft HoloLens core combines a 32-bit processor, a sensor fusion processor, and a high-definition optical projection system. Other key components include wireless connectivity, a camera and audio interface, power management, and cloud-based data analytics.

Conclusion

AR technologies have already demonstrated their value in medical applications and promise to bring big changes over the next few years to both the clinic and the operating room. Although the optics add a new dimension, many of the hardware building blocks have already been proven in high-volume wearable and portable products.

Paul Pickering: As a freelance technical writer, Paul Pickering has written on a wide range of topics including: semiconductor components & technology, passives, packaging, power electronic systems, automotive electronics, IoT, embedded software, EMC, and alternative energy. Paul has over 35 years of engineering and marketing experience in the electronics industry, including time spent in automotive electronics, precision analog, power semiconductors, embedded systems, logic devices, flight simulation and robotics. He has hands-on experience in both digital and analog circuit design, embedded software, and Web technologies. Originally from the North-East of England, he has lived and worked in Europe, the US, and Japan. He has a B.Sc. (Hons) in Physics & Electronics from Royal Holloway College, University of London, and has done graduate work at Tulsa University

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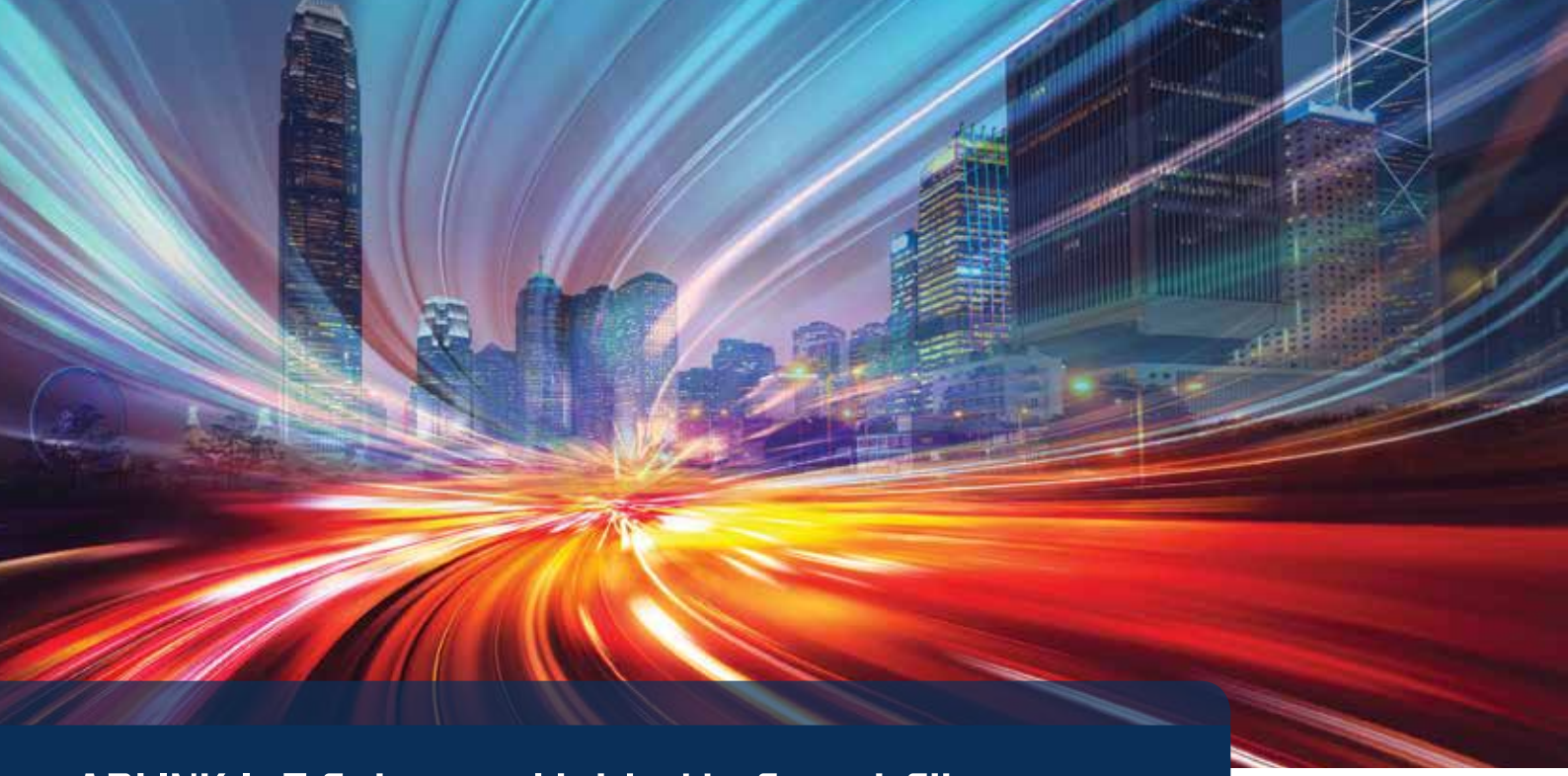


ADLINK IoT Gateway Lights Up Smart City

› Zane TProduct Manager, saiSenior Product Mark, Devine Chao eting Specialist

Application

Street lighting is more than just a public security measure. It also plays a pivotal role in a city's financial burden and energy consumption. It is estimated that conventional street lights, utilizing less than efficient lighting technology combined with limited management, can seriously compromise a municipality's energy expenditures, as well as contributing to Greenhouse Gas (GHG) emissions. In light of environmental and financial concerns, many cities are adopting state-of-the-art IoT-enabled technologies to implement intelligent control and management over street lighting, pursuing agendas of a greener, smarter city and healthier municipal finances.

Some cities have initiated smart street lighting, in a bid to reduce both electrical consumption and carbon footprint. The program can include replacing traditional mercury and sodium lamps with more power-efficient LED lights and deploying remote monitoring and management, based on Power Line Communications (PLC).

Power Line Communications (PLC) utilizes existing power lines to street lights to transmit data between the street lights and IoT gateways, establishing two-way communications by means of which the Street Light Management System can issue control commands to specific street lights, and collect operational data and sensor data therefrom.

A PLC-based smart light solution enables street light administrators to control remotely control on/off status of the street lights based on either pre-determined schedules or manually. Further, by collecting operational data of the lights preventive maintenance can be implemented to repair or replace lamps as needed, eliminating the need to dispatch crews for onsite tasking. Moreover, installed sensors allow dimming control of specific street lights according to environmental changes.

It is estimated that, by using more efficient lamps and implementing smart management control, power expenditures can be reduced by 50-80% and CO2 emissions by up to 40%.

Advantages and Benefits

■ **Reduced infrastructure requirement**

Utilizing existing electrical grid to communicate removes the need for dedicated communication network, saving time and budget.

***PLC: :Cower Line Communication**
Each ADLINK MXE-110i controls around 20 tand c ,o 30 street lightsommunicates with the control centor L ,4G ,er wirelessly via 3Gora.

■ **Reliable communication**

Power line-based communication circumvents many of the interference problems associated with wireless RF communication, from buildings, trees, and other obstructions, as well as conflicts with similar frequencies and unauthorized access.

■ **Energy conservation**

On/off control of individual street lights based on automatic lighting schedules allows flexible remote control and management, supporting power saving strategies. With the aid of environmental sensors, dimming of specific lights can also be automatically adjusted in real time according to onsite environmental conditions.

■ **Reduced carbon footprint**

More efficient street lighting technologies and intelligent management can decrease actual energy used by street lights, with greenhouse gas emissions lessened accordingly.

■ **Streamlined management and maintenance**

Remote monitoring and GPS implementation allow centralized administration to monitor status of each individual light, dispatching maintenance personnel only as needed. Physical onsite inspection is not required to identify faulty or burnt-out units, representing considerable savings of manpower and expense. Implementation of big data analysis for long-term data acquisition, expiry of individual lamps can be predicted and preventive maintenance employed.

ADLINK's solution

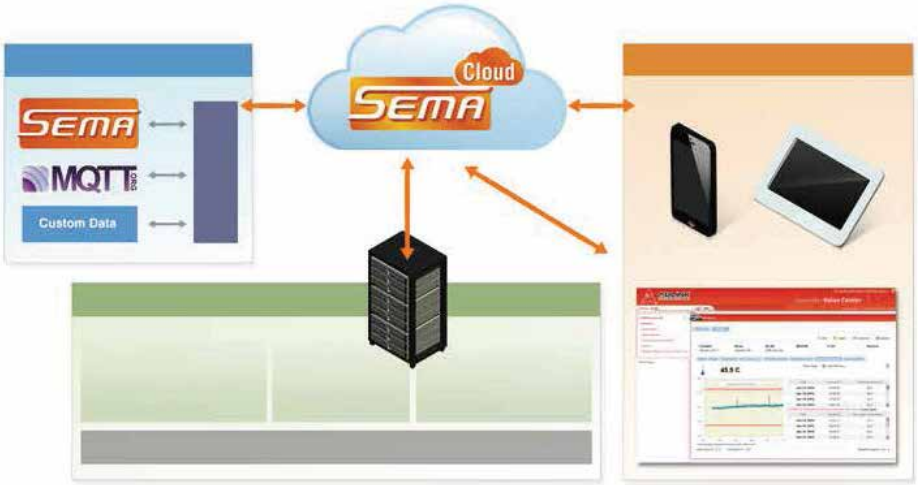
ADLINK has helped realize these projects with its Matrix MXE-110i IoT gateway, serving as a smart master controller deployed in the field enabling PLC and IoT communications.

With the implementation of ADLINK"s proprietary SEMA Cloud solution and integration of Wind River® Intelligent Device Platform XT and McAfee Embedded Control, the MXE-110i maximizes manageability and security critical for IoT-based operations.

The MXE-110i further integrates PLC transceiver functionality to receive commands from cloud admin (smart light management center), modulating signal packets into a frequency length suitable

With ADLINK's IoT GatewaSmart City Street Light solution bec, yomes more environmental friendly.

ADLINK MXE-110i IoT Gateway is a smart choice to the smart city light solution.



SEMA Cloud offers remote manageability and enhances system reliability

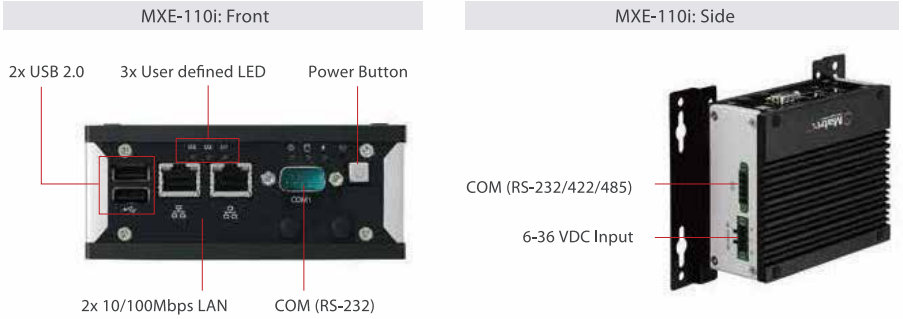
for AC power-based transmission, and forwarding the commands to specific street lights via power lines. Each street light carries a PLC transceiver, by which commands are received from the gateway via power line, and onsite operational data returned to the gateway and management center.

In this case, multiple MXE-110i gateways are deployed in the field, in roadside installations, each controlling around 20 to 30 street lights in the vicinity.

In addition to PLC communications, the MXE-110i can receive and transmit data via other methods, including Zigbee, LoRa, Modbus TCP, 3G, WiFi, and others. Communications among gateways and servers are accomplished using 3G and Ethernet.

The ADLINK MXE-110i, powered by an Intel® Quark™ SoC X1021 and incorporating Intel® IoT Gateway technology, empowers solutions that provide leading performance and security for intelligence at the edge, enabling near real- time analysis and tighter, more efficient process control while reducing data transmission costs. The MXE-110i also incorporates ADLINK's own proven technologies, including mini-compact 120 mm (W)
x 100 mm (D) x 55 mm (H) size and extreme rugged construction, ideal for outdoor deployment. Though small in size, the MXE-110i delivers rich and versatile communication I/O capabilities, including two High-Speed LAN ports, two COM ports, three USB 2.0 hosts, SDI/O, and dual mini PCIe slots, as well as a USIM socket supporting connection to WiFi, BT and 3G. Practically any communications requirement can met flexibly in any IoT deployment.

Low power consumption in a fanless and compact system, the MXE-110i conserves both space and energy expenditure, in an extremely rugged package. Withstanding operating vibration up to 5Grms, shock up to 100 G and operating temperatures of -20°C to 70°C (optional), ADLINK's MXE-110i assures 24/7 operations in the harshest outdoor deployment conditions.



MXE-110i delivers rich and versatile communication I/O capabilities.

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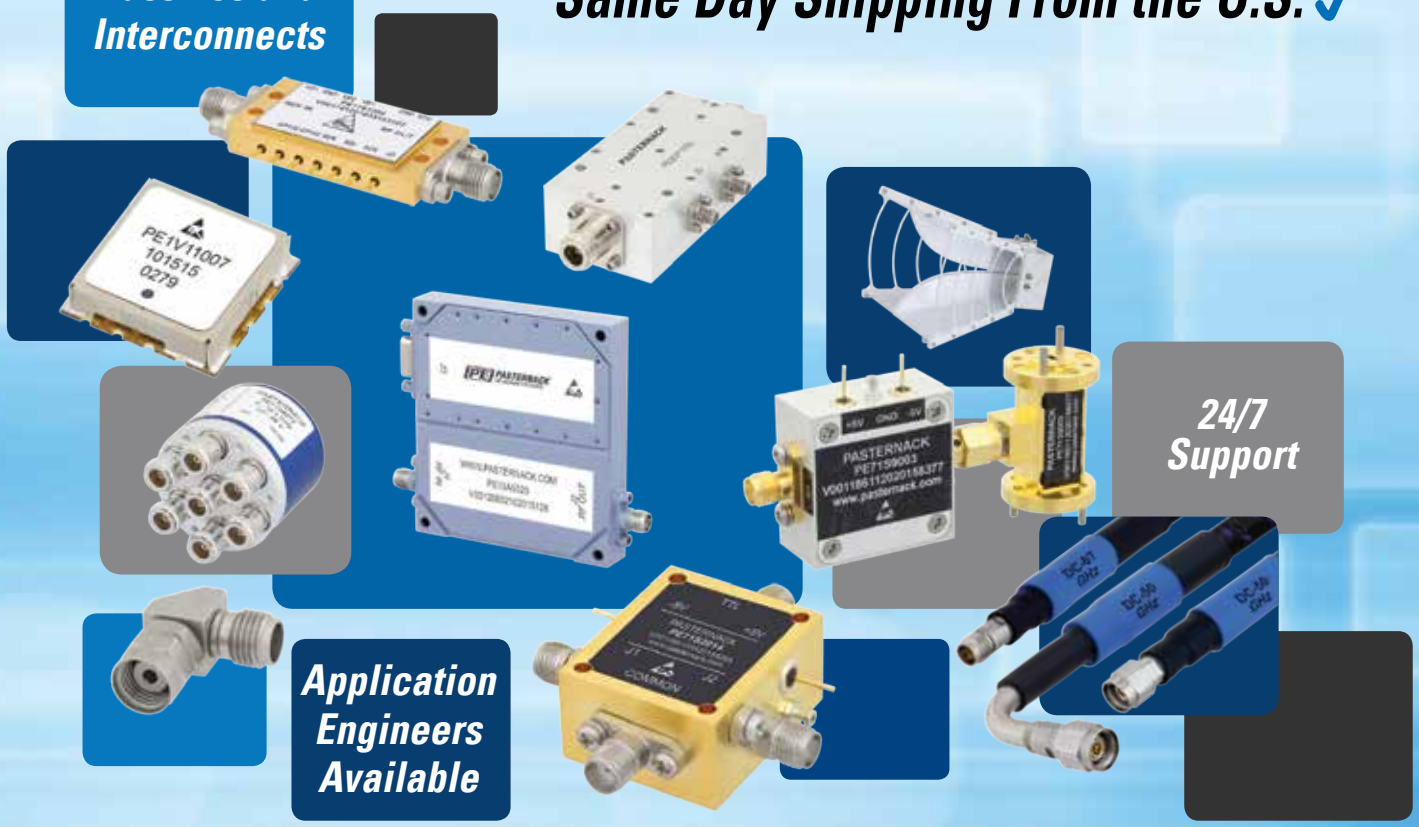

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Considering EMC Emissions Early in the Design Process

› Bruce Rose, Applications Engineer, CUI

One of the design activities often left to the end of a project is verifying that the product meets electro-magnetic compatibility (EMC) emissions requirements. EMC regulations help to ensure unintentional electro-magnetic conducted and radiated emissions do not interfere with other electronic devices. While delaying EMC compliance testing until the end of the project is a common practice, unexpected costs and project delays can be avoided by considering EMC compliance earlier in the design process.

Electro-magnetic conducted and radiated emissions are the radio frequency (RF) energy emitted by a product. The level of RF emissions are regulated to ensure they do not cause unreasonable harm to other electronic products. At low frequencies (less than about 30 MHz) the conductors and cables of most electronic devices are ineffective as antennas and thus radiated emissions are not an issue. At these low frequencies the conductors and cables can conduct RF energy through shared power sources or loads and cause issues with other electronic products, while at high frequencies (above about 30 MHz) the impedances of the conductors and cables attenuate the conducted energy sufficiently to prevent it from being an issue. However, at these higher frequencies the conductors and cables can serve as antennas and radiate the RF energy with the ability to cause interference with nearby electronic products.

Most industrial and consumer electronic products sold in the United States are required to meet conducted and radiated emissions standards as described in FCC regulations Title 47 Part 15, often referred to as FCC Part 15. Similar standards for products sold in Europe are governed by European regulations CISPR 22/EN 55022. Both sets of these regulations describe limits for conducted and radiated emissions and are applied to the final system, including the internal or external power supply. While these two sets of regulations are created and administered by separate organizations they have been constructed to be similar or "harmonized". One benefit of harmonizing these regulations is that designing a product to meet one set of regulations typically ensures it will also satisfy the requirements set forth in the other set of regulations.

Conducted radiation specifications cover emissions in the frequency range of 150 kHz through 30 MHz. A separate set of radiated emissions specifications covers the spectrum of 30 MHz and greater. Test procedures and tools are slightly different for conducted versus radiated

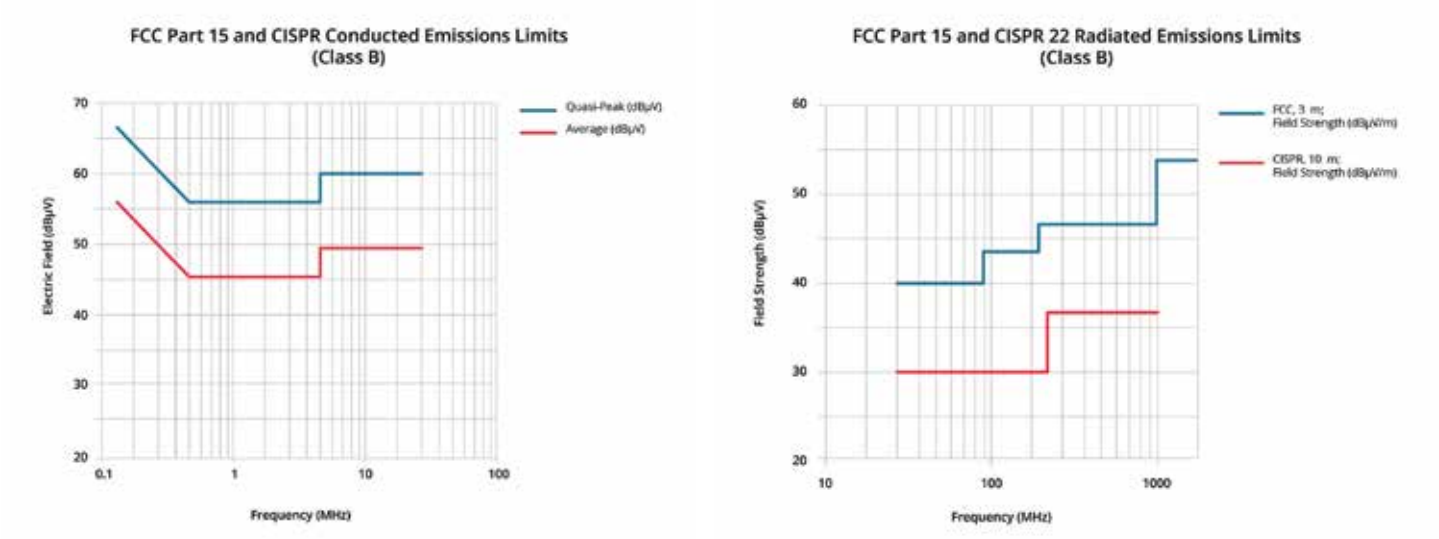


Figure 1: Conducted and radiated emissions limits

emissions and the filter components used to mitigate the EMC issues are similar but differ in electrical values. The conducted emissions frequency band is lower than the radiated emissions frequency band and thus the filter components used to address conducted emissions will be electrically and physically larger than those required to address radiated emissions.

EMC for Power Supplies

Most internally mounted power supplies are designed and tested to meet EMC regulations and the testing is performed with the supply configured as a stand-alone product. After the power supply has been installed into a system the completed system must also be tested to ensure it meets EMC regulations. Incorporating compliant power supplies into systems minimizes the potential for EMC related issues during system testing, but does not guarantee that the completed system will pass emissions testing. Many vendors of internally mounted power supplies will provide recommended circuits to address EMC issues encountered during system integration. Because the requirements vary with each application, these recommendations are left to the discretion of the designer; this way each design incorporates only the components required for the specific application. Similarly, most wall plug and desktop versions of external power supplies are also designed and tested to meet EMC regulations as stand-alone units. If the power supply customer is a manufacturer combining the power supply with a load then they will be required to perform testing to ensure the complete system meets EMC regulations. As the circuitry is housed in an enclosed case, adding external components to address EMC issues will be more challenging for wall plug and desktop versions as compared to internally mounted power supplies.

EMC regulatory testing of power supplies is performed with static resistive loads, but almost all power supplies are based upon switching regulator topologies. A switching regulator inherently produces conducted and radiated emissions which need to be mitigated in the design of the supply. The load applied to the power supply may create additional emissions. The uncertainty of the conducted and radiated emissions from the combined power supply and load is addressed by allowing a margin in the stand-alone power supply test results to take into account variations when a load is applied to the power supply.

The Case for Early Testing

Often EMC testing is put off until the end of a project due to time, cost and workload constraints. Unfamiliarity with compliance testing also contributes to the perception of the difficulty of such testing. While the required equipment and facilities for EMC compliance testing can be unique, many testing labs are available with experienced staff to assist in the testing.

The costs associated with compliance testing often become a 'pay me now or pay me more later' event. As testing is usually done at the end for full certification this cost can be high, but for preliminary screening the cost is minimal. Availability of lab time can be an issue as many

labs are booked up several weeks out. However, small blocks of time for preliminary testing typically can be found outside of peak hours. The small amount of resources spent performing preliminary EMC testing early in the design cycle may prevent considerable and expensive redesign efforts late in the product schedule.

Another common reason for delaying the EMC testing of a system is the misconception that the power supply causes the EMC issues and thus a system will pass testing if the supply has already passed stand-alone regulatory testing. In many instances, the power supply is the recipient of the blame for EMC issues within the system when in reality it is 'only the messenger'.

While system conducted and radiated EMC issues are often addressed at the end of a project, that phase in the schedule is perhaps the worst time to introduce unexpected tasks and delays. A more reasonable and often lower cost strategy is to perform preliminary EMC compliance testing as soon as the system assembly has begun. Earlier in a project, schedules are more flexible and design teams are more receptive to modifications in the design.

By the end of a project much effort has been applied to designing the system to meet performance criteria and if an EMC compliance issue arises the power supply is perceived as the easiest target for compliance efforts without affecting other system performance parameters. Although the system is often the source of RF emissions, the cabling on the input and the output of the power supply may be serving as antennas for radiated emissions and conductors for conducted emissions. It is often possible to add noise suppression components to the power supply to address the EMC issues, but this activity should be recognized as mitigating the effects of the problem and not addressing the source of the problem. The EMC suppression activities associated with the power supply require time from the design team and may affect the safety certificates associated with the power supply. Any changes to the safety certificates will also require time and resources from the power supply vendor. The system circuitry may need to be modified to minimize the generation of RF signals if adding conducted and radiated emission suppression components are insufficient to adequately reduce the EMC problems.

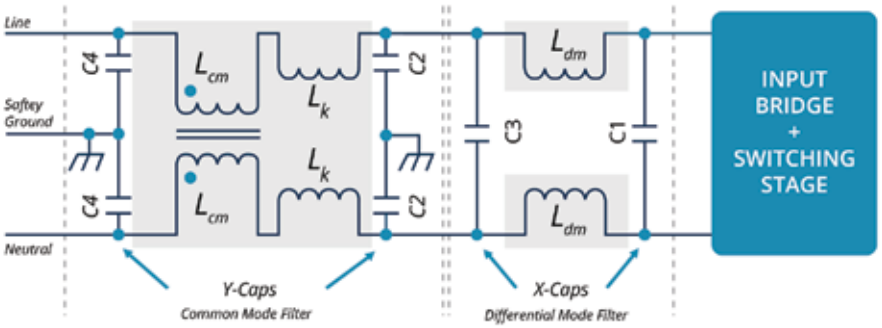


Figure 2: Conducted emissions filter components

For products which use internal power supplies, EMC noise suppression components can be added either on the conductors feeding into the power supply or on the cabling between the output of the power supply and the power input to the system. Bypass capacitors and ferrite cores are suppression components used to create filters to address EMC issues. Ferrite cores introduce additional inductive impedance in series with the path of the unintended noise and bypass capacitors provide a low impedance path to shunt noise signals to minimize signal propagation.

Systems employing external power supplies may be more limited in their ability to add EMC suppression components on the input or output paths of the power supply. Radiated emissions issues are typically addressed with a ferrite core placed on the cable between the power supply and the system. The frequencies of concern associated with conducted emissions are low enough such that the size of a ferrite core required to fit around a power cord and mitigate EMC issues will be unacceptable for many applications. Conducted emission issues observed in systems with external power supplies are often most easily addressed by working with the power supply vendor to modify the design of the existing supply or selecting a different external power supply incorporating enhanced conducted emissions suppression components.

Pre-Compliance Testing

Final testing of conducted and radiated emissions needs to be performed in a certified laboratory using calibrated test equipment and a controlled electrical environment. Testing labs will cooperate to perform pre-compliance testing early in the design phase. If the design team desires to conduct the

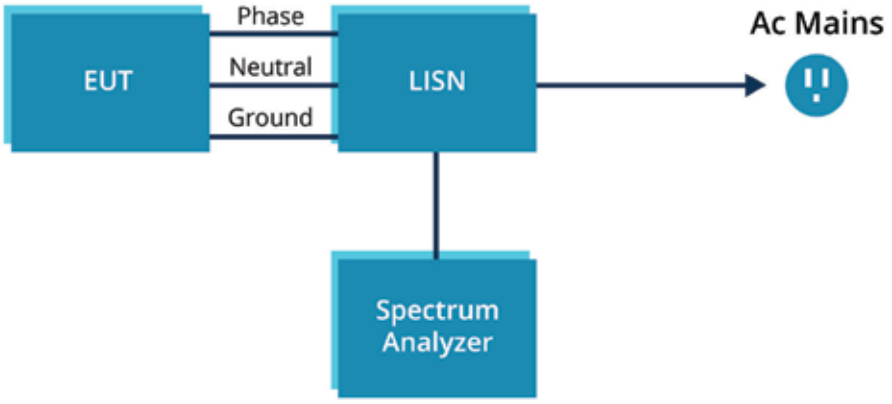


Figure 3: Conducted emissions test set-up

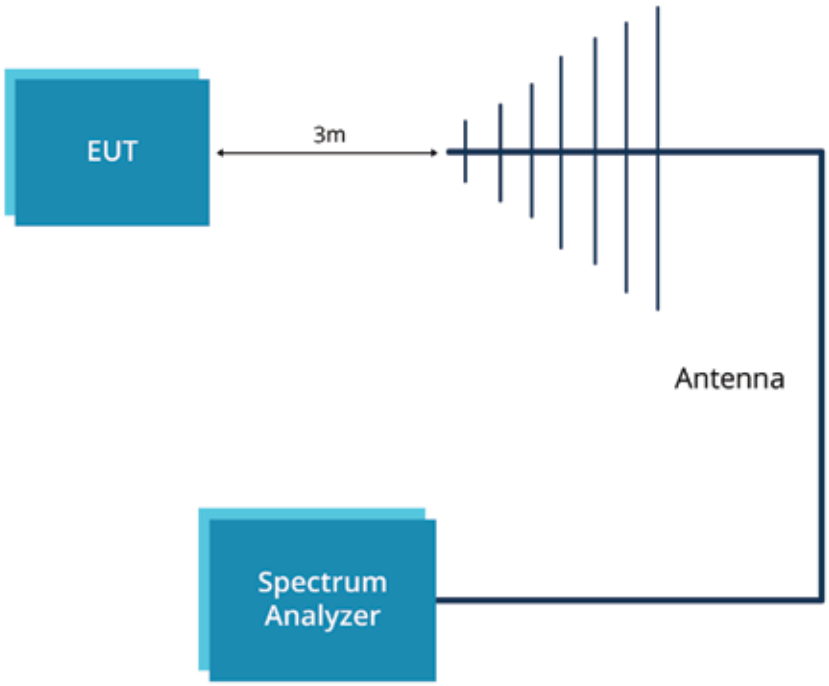


Figure 4: Radiated emissions test set-up

pre-compliance testing themselves the tests can be performed in a room with a minimal amount of test equipment. The equipment required for conducted emissions testing is an LISN (Line Impedance Stabilization Network) and a spectrum analyzer. The LISN is a passive network used to minimize the noise conducted from commercial power lines and also provides a controlled impedance test port to monitor the conducted emissions from the EUT (Equipment Under Test). The spectrum analyzer used for conducted emissions testing can be a basic model with the ability to perform measurements from 150 kHz through 30 MHz. Many vendors of spectrum analyzers include the ability to perform quasi-peak measurements and incorporate conformance parameter limits in the display to simplify EMC compliance testing.

Preliminary testing for radiated emissions can be accomplished with a spectrum analyzer and an appropriate antenna. The spectrum analyzer should have the capability to make measurements from 30 MHz through at least 900 MHz. The ability of the spectrum analyzer to perform quasi-peak measurements and display conformance parameter limits in the display will make the preliminary testing tasks easier to perform. The antenna used for preliminary radiated emissions testing should have a bandwidth similar to the spectrum analyzer and the gain versus frequency characteristics needing to be known. It is preferable to be able to perform the radiated emissions testing in an electrically quiet room with at least three meters (10 feet) between the radiated emissions EMC antenna and the EUT. An initial measurement in the room with the EUT powered off will provide information regarding the ambient RF noise present during the testing.

Most management teams appreciate projects completed under budget and ahead of schedule. Unfortunately, EMC compliance issues can be a common source of last minute budget and schedule increases for projects. Performing pre-compliance EMC testing during the system assembly phases of a project can help to eliminate those last minute changes to a design that impact budgets and schedules. Pre-compliance EMC testing also helps to ensure no issues arise during final compliance testing. Full service power supply vendors, such as CUI, have the equipment and experience to assist in power supply design and selection, including pre-compliance and final EMC testing.

Samsung's New, Enhanced Wearables – Gear Sport, Gear Fit2 Pro, Gear IconX – Combine the Best in Smart Living, Fitness and Health

Today introduced three new devices to its industry leading wearable portfolio: Gear Sport, a sleek and versatile fitness-focused smartwatch that is water resistant; Gear Fit2 Pro, an upgraded GPS sports band with smart features; and Gear IconX, a second generation of the company's groundbreaking cord-free earbuds. Samsung's new Gear devices were designed to help consumers get the most out of their day, and help them live a healthy and well-balanced life.

The new Gear devices assist with a range of activities – from robust fitness tracking to nutrition and sleep monitoring, as well as motivational coaching as a lifestyle companion. By introducing new smart capabilities and easy-to-use features, and by partnering with leading names in tech and fitness, Samsung is helping consumers go beyond fitness and accomplish big things.

"At Samsung, we celebrate the everyday athlete – whether you're going for a light jog, or training for your next triathlon. We have a long history of embracing choice and innovation, and our wearables are designed to help consumers of varying fitness levels meet their goals and aspirations. We want to help remove the stigma that fit can only mean one thing and that fitness trackers are complex and for only the most intense of workouts," said DJ Koh, President of Mobile Communications Business, Samsung Electronics. "Our new Samsung Gear wearables help consumers 'go beyond fitness' and enjoy an active, balanced and fulfilled life in a smart and seamless way."

As part of this updated line-up, Samsung created new capabilities for Gear Sport and Gear Fit2 Pro:

- **Industry-Leading Water Resistance and Swim Tracking:** An ideal companion for any swim – from laps to playing in the pool – these devices are 5 ATM certified for water resistance. Now with Speedo's latest swimming training app, Speedo On, the Gear Sport and Gear Fit2 Pro also allow you to easily track key swim metrics including lap count, lap time, stroke type and more.
- **Top-of-the-line Heart Rate Monitoring:** With improved accuracy, the devices offer advanced real-time heart rate monitoring. They help you continuously monitor your heart activity - whether it's enjoying a stress-free nap or an invigorating cycling class.

- **Premium Partnerships:** Daily activity can be supplemented with updated Under Armour and Spotify partnerships. Both devices provide access to Under Armour's fitness apps including Under Amour Record™, MyFitnessPal®, MapMyRun® and Endomondo™ for activity, nutrition, sleep and fitness tracking functions– these apps provide users with a holistic picture of their health and fitness. Spotify's Offline mode lets you listen to your favorite music online, offline or even without your smartphone so you can enjoy your favorite tunes regardless of location.
- **Auto Activity Detection:** Automatic activity detection built into the devices are in tune with your body and can recognize the following categories of activities: Walking, Running, Cycling and performing Dynamic Activities that could include dancing to basketball.
- **Personalized Motivation:** You can customize your own wellness plan with tailored goals and alerts.

Gear Sport: A new versatile smartwatch to support an active and balanced lifestyle

Gear Sport is stylish, yet practical with a minimalistic, circular bezel, Super AMOLED 1.2-inch display and improved user interface that makes it easy to view information, even when on-the-go. With Gear Sport, users can work to achieve health and wellness goals, and receive nutrition management alerts and activity recommendations even when they are offline.

Designed with military-level-durability, it can handle a wide-range of environments. With its sleek, ergonomic form that can be worn in a variety of colorful and easily changeable standard 20mm straps, it is perfect for any occasion so you can effortlessly transition from the gym to a night out with friends. Gear Sport will be available in Blue and Black and also includes Gear foundational functions:

- Control of Samsung IoT-enabled devices through Samsung Connect
- Act as a remote control, whether for a PowerPoint presentation or Samsung Gear VR headset
- Pay for goods with a flick of the wrist via Samsung Pay (NFC Only)

Gear Fit2 Pro: An advanced GPS fitness band

In addition to the new swim and heart rate monitoring capabilities, the new Gear Fit2 Pro features advanced built-in GPS tracking to capture your run or ride with accurate activity tracking. Gear Fit2 Pro's Super AMOLED curved 1.5-inch display and a high-resolution color touchscreen make real-time updates and notifications easier to read. The all-new secure, ergonomic band is light weight and comfortable to use for all activities. Available in Black and Red, its versatile design also makes it a stylish accessory.

Gear IconX: Comfortable fit, cord-free earbuds

IconX cord-free earbuds let you effortlessly listen to your favorite music – making your daily commute more enjoyable and helping you get more from your workout. Music can be enjoyed on and offline by transferring songs from a Samsung smartphone5 or PC, or accessing your favorite tunes through Bluetooth connectivity. The earbuds are also your newest connection to Bixby. With a simple tap and hold of the earbud you can use your voice to control your music or your phone – without even having it in your hand.

The updated design comes in Black, Gray and Pink and is even more ergonomic and lightweight so they are effectively secure, comfortable and stylish to use. For the fitness enthusiast, the Gear IconX automatically tracks your running routines, and also features the standalone Running Coach function which can be activated by simply tapping the earbud to provide in-ear audio exercise status updates – in real-time and without your phone. With a fast-charging and improved battery life of up to five hours of music streaming or seven hours of standalone music playback, and up to 4GB of internal storage, you can enjoy a seamless and fully standalone music listening experience.

Renesas Electronics Delivers 8.48 MP CMOS Image Sensor for 4K Network Security Cameras

Renesas Electronics Corporation (TSE:6723), a premier supplier of advanced semiconductor solutions, today announced a new high-sensitivity, high-resolution 8.48 megapixel (MP) CMOS image sensor (RAA462113FYL) that supports 4K video cameras. In conjunction with the existing Renesas 2.12 MP product that is already in mass production, Renesas will be providing full-scale sales support for its high-end CMOS image sensor for network security cameras.

To meet the increasing needs for network security cameras in financial institutions, transportation systems and commercial establishments, the new CMOS image sensor provides functions appropriate for imaging under the varied environmental conditions required by high-end devices and contributes to increased system performance.

Key features of the new CMOS image sensor

- **Achieves excellent low-light performance**
  The new sensor achieves clear, high-visibility full-color imaging even in a moonlit environment
- **High resolution at high data rates**
  The new sensor captures clear, high-visibility images even when digital zoom is used due to its capture of high-reliability 4K video at 60 fps.
- **High dynamic range**
  The new sensor supports a line-by-line HDR (high dynamic range) mode in which long exposure data and short exposure data are output separately for each line. This allows video capture, even for high-contrast scenes.

Renesas also provides a reference board that was developed together with a camera module manufacturer to allow users to evaluate the performance of the Renesas CMOS image sensor. Renesas plans to work with camera module manufacturers to supply camera modules with a variety of features such as autofocus functions, HDR (high dynamic range) functions, wide-area monitoring functions, and vibration reduction (image stabilization) functions. This will allow system manufacturers to reduce the development period and development costs for new high-performance network security camera products.

Renesas will continue to expand its line of security camera solutions for network security cameras, by providing its CMOS image sensors in combination with microcontrollers (MCU).

Pricing for MAX20078 and MAX20078EVKIT evaluation kit available upon request

Sony Introduces the IMX420/428 as the First Imaging Sensors that Features its 3rd Generation CMOS Global Shutter Mode

Sony Semiconductor Solutions launches the first models featuring its 3rd generation CMOS Global Shutter with the IMX420 and IMX428 image sensors. Both models come with 7 Megapixel resolution, with the IMX420 reaching frames rates of up to 170 fps at 10 bit pixel depth. Both sensors achieve an excellent saturation at 25.000e- for a pixel size of 4.5 µm. These sensors come equipped with the SLVS-EC interface and new features like High/Low Conversion Gain (HCG), Dual Trigger, Dual ADC and self-triggering to increase the maximum throughput for object recognition and quality assurance of moving objects in Machine Vision, Robotics, and Factory Automation.

The IMX420 has a scalable bit depth of 8, 10, and 12 bits, and can be programmed for multiple regions of interest (ROI). The IMX428 sensor, optimized for ITS applications, is available only with 12 bit, only one ROI window and achieves 35 fps. The innovations of the 3rd generation CMOS Global Shutter Mode sensors deliver clear improvements, mainly in terms of image quality and speed. An increase in performance, based on these improvements, is realized through the improved detection quality in applications with moving objects. The higher saturation, combined with the low readout noise of about 2.5e–, can achieve a maximum dynamic range of 80 dB, resulting in improved light-dark detection that is feasible even in difficult lighting conditions.

Sibel Yorulmaz-Cokugur, Line Manager for SONY Semiconductor Solutions at FRAMOS, explains the

new SLVS-EC interface: “Based on the different quality improvements, the existing standard interfaces would reach its limits transferring the high data volumes at faster speed. SONY has developed the SLVS-EC standard with 8 lanes. It answers the increasing demands in resolution and speed and doubles the maximum output to 18.4 Gbps compared to the second generation (9.5 Gbps).”

The IMX420 sensor is equipped with four additional features: The High Conversion Gain (HCG) allows the acquisition of images with better quality under low light conditions. This is achieved by increasing the conversion gain of the pixels while keeping the noise contribution of the analog circuit constant. Conversely, the Low Conversion Gain mode (LCG) is used under bright illumination conditions, being realized by lowering the conversion gain of the pixel. Dual triggering allows the possibility of different exposure times and gains in different regions of interest, to obtain an individual and effective image acquisition pipeline by using of two external trigger signals. The Dual ADC can read each pixel with separate gains. By combining the two images off-the-sensor a high dynamic range image can be obtained. The self-trigger feature, detects a change in a the predefined “sensing area” and acquires an image automatically when this change passes a certain threshold.

The IMX420 and IMX428, as the first sensor models featuring SONY’s 3rd generation CMOS Global Shutter mode, clearly show how the combination of high resolution and high frame rates, along with Global Shutter read-out technology boosts imaging quality and speed into new spheres. Mass production is scheduled around spring 2018, evaluation samples are now available at FRAMOS. Industry and product experts at FRAMOS are available to support customers with the integration of these new sensors in their applications and projects. In addition, FRAMOS also provides additional services like development support, customization, and logistics to customers.

CoolMOS™ P7 in SOT-223 combining performance and ease of use with a cost-effective package solution

Infineon Technologies AG (FSE: IFX / OTCQX: IFNNY) is expanding its recently launched CoolMOS™ P7 technology with a SOT-223 package. The device has been developed as a one-to-one drop-in replacement for DPAK. It is fully compatible with a typical DPAK footprint. The combination of the new CoolMOS P7 platform with the SOT-223 package is a perfect fit for applications such as charger for smartphones, laptop adapters, TV power supply, and lighting.

The new CoolMOS P7 is designed to address needs of the low power SMPS market. It offers excellent performance and ease-of-use, allowing designers to take advantage of improved form factors. It uses a price competitive Superjunction technology, which results in a reduced overall Bill of Materials (BOM) on the customer side.

The SOT-223 package is a cost-effective DPAK alternative and well established in price sensitive markets. The thermal behavior of the CoolMOS P7 in this package was assessed across several applications. When the SOT-223 was placed on a DPAK footprint, the temperature increased by a maximum of 2-3°C compared to a standard DPAK. With a size of the copper area of 20 mm² or more, the thermal performance was equal to DPAK.

Composite 38999 connectors from Aerco save weight without compromising performance

Aerco, the distributor and stockist of electrical and electronic components servicing hi-rel markets, is now stocking TE Connectivity (TE)’s DEUTSCH MIL-DTL-38999 series next generation ACT composite connectors which deliver up to 40 percent weight

savings over similar aluminum devices. TE's DEUTSCH group created one of the original composites in 1990, and its ACT series shells are not only very lightweight, they are also highly resistant to corrosion, withstanding 2000 hours of salt spray, and very durable, surviving 1,500 mating cycles.

ACT series circular connectors are among the most versatile and popular circular mil spec input/output connectors in the world. They are available in three shell styles, two plating options, six shell clockings, over 50 different insert arrangements supporting size 23, 22D, 20, 16, 12, 10, and 8 contacts for power and signal, as well as coax and twinax contacts.

Originally designed as military and aerospace components, ACT series connectors are now also used in many other hi-rel applications where extreme reliability is paramount. They feature a scoop-proof design for fast, easy, secure mating, and a triple-lead, threaded self-locking coupling for excellent vibration resistance. Devices are environmentally-sealed and feature grounding fingers and a trapezoidal thread which provides excellent shell-to-shell continuity, to help support high EMC performance.

Comments Alec Sluce, Aerco's Connector Product Manager: "These lightweight, rugged, environmentally-sealed connectors survive some of the harshest environments of commercial and military aerospace, ground defence, and marine applications. TE's DEUTSCH composite connectors have led the field in composite connectors for many years, and this latest generation ACT series reinforces their reputation for high quality, extreme reliability and ease-of-use."

Intersil Introduces High-Speed RS-485 Transceivers with Highest Reinforced Isolation

Intersil, a subsidiary of Renesas Electronics Corporation (TSE: 6723), today announced two new high-speed, isolated RS-485 differential bus transceivers that provide 40Mbps bidirectional data communication for Industrial Internet of Things (IIoT) networks. The ISL32741E offers 1,000VRMS working voltage and 6kV of reinforced isolation, more than 2x higher than competitive solutions. The higher working voltage and reinforced isolation is required for today's most rigorous medical and high-speed motor control applications. The ISL32740E with 2.5kV of isolation and 600VRMS working voltage comes in the industry's smallest package, enabling high channel density for programmable logic controllers (PLCs) in factory automation applications.

The ISL3274xE transceivers provide additional advantages over other isolation technologies, including ultra-low radiated emission and EMI susceptibility, support for up to 160 devices on the bus, and an extended 125°C temperature range. These devices leverage giant magnetoresistance (GMR) technology that provides galvanic isolation to keep the communication bus free from common-mode noise generated in electrically noisy factory and building automation environments. In addition, Intersil's GMR isolation does not require the elaborate encoding schemes found in capacitive and transformer-based isolators that use RF carriers or pulse-width modulation (PWM) to transfer DC and low frequency signals across the barrier.

The ISL3274xE transceivers are ideally suited for the equipment-to-bus interface in PROFIBUS DP and high-speed RS-485 networks that connect PLCs to instruments, robots, motor control drives, as well as data acquisition and digital I/O modules. In addition to not requiring any shielding, these transceivers simplify PCB layout, use less board space, and enhance data transmission reliability and integrity. The ISL3274xE devices also offer low power consumption. For example, the ISL32740EIAZ's 60mA supply current allows it to operate in a tiny 4mm x 5mm QSOP package at maximum speed without overheating.

On the non-isolated control-side, the ISL3274xE transceivers support direct connection to a 3V microcontroller (MCU) while the isolated bus-side connects

to a higher voltage 5V supply for communication of strong bus signals across 100 meters and longer distances. The ISL3274xE transceivers are fully compliant with the EN 50081 and EN 50082-2 electromagnetic compatibility (EMC) standards and the umbrella line-voltage standard for information technology equipment (ITE) EN 61000.

"Our latest high-speed RS-485 isolated transceivers radiate virtually no EMI, and they eliminate ground loops between bus nodes to protect data transmission," said Philip Chesley, vice president of Industrial Analog and Power products at Intersil. "The ISL32741E's high working voltage and ability to push its reinforced isolation barrier up to 6kV enables customers to solve their most difficult IIoT networking design problems.

Key Features and Specifications of ISL32741E and ISL32740E Family

- 40Mbps data rate enables high-speed data transmission
- Supports 3V to 5V power supplies
- Offers 5ns pulse skew and 20ns propagation delay
- The ISL32741E offers 6kVRMS isolation/1,000VRMS working voltage, and 12.8kV surge immunity
- The ISL32740E offers 2.5kVRMS isolation/600VRMS working voltage
- Single unit load allows up to 160 devices on the bus
- 50kV/µs (typ), 30kV/µs (min) common-mode transient immunity provides reliable data transmission in noisy environments
- Offers a barrier lifetime of 44,000 years

15kV ESD bus-pin protection, and low EMC footprint

- Thermal shutdown protection prevents damage during bus contention, or excessive current
- PROFIBUS compliant

The ISL3274xE can be combined with the ISL28025 precision digital power monitor, ISL12022M low power real time clock, and Renesas MCUs to create a system solution.

Defined spacing between PCBs!

WR-BTB is a new family of signal plug connectors from Würth Elektronik eiSos suitable for SMT assembly. The plugs with coded guide are available in versions with 40, 64, 80 or 100 pins. The models with 0.8 and 1-mm pitch are also available in various heights. Various male and female plugs can be combined to achieve precisely defined spacing between two boards through the use of stable board-to-board connectors – so purely mechanical spacers may not be necessary and could be dispensed with, under certain circumstances.

WR-BTB connectors with 1-mm pitch are achievable with a board spacing of 7.6 mm, 9.6 mm, 11.6 mm, 12.6 mm and 14.6 mm. The 0.8-mm pitch plugs allow even more combination options for spacing from 4.9 mm to 15.9 mm. The high-grade connectors are specified for operating temperatures from -55 to +85°C. The plugs are available from Würth Elektronik eiSos from stock in unlimited quantities and free samples can be requested.

TE's HDC connectors for Servo and Spindle motors

TE Connectivity's Heavy Duty Connectors Offer Servo and Spindle Motors Reliability and Lower Installation Times

DARMSTADT, Germany – August 14, 2017 – TE Connectivity (TE), a world leader in connectivity and sensors, offers a vast range of connectivity solutions for diverse motor types. With trends in connectivity toward more miniaturization, reduced installation times, improved reliability, and lower costs in installation and operation, TE's heavy duty connectors are suitable for numerous applications in servo and spindle motors.

Designed to perform reliably under the most demanding conditions, TE's heavy duty connectors offer IP69K

rated protection and can endure 1,000 hours of salt spray resistance. These heavy duty connectors are built on a modular basis so they can offer power, signal and data transmission in a single compact unit. A one-piece connector frame allows for easy assembly of the modular inserts, and a docking frame that allows for blind mating provides more savings in installation time and costs.

TE's heavy duty connector has a history dating back over 60 years, during which time it has gone through various generations and options, offering special features for a wide range of applications. "The heavy duty connector is an iconic product that stands the test of time," says Sascha Lambauer, product manager for TE's heavy duty connectors. "Like many other TE solutions, the HDC also withstands harsh environments, reliably performing under demanding operating conditions, and is engineered to give designers flexibility and reliability in their servo and spindle motor designs."

Servo motors are increasingly being chosen for their high efficiency, especially in material handling systems and inside machinery. Meanwhile, advances in machine tooling requiring high precision and reliability are leading to spindle motors being put at the heart of modern production systems, delivering high quality end products.

Expanded beam fibre optic cable assembly for connections in the toughest environments

HARTING has developed an expanded beam fibre optic connector for providing high-bandwidth transmission in the harsh environments found in tunnel drilling and mining applications, where industrial Ethernet over fibre optic cable is becoming the transmission medium of choice.

As digitisation makes increasing inroads into these sectors, the demands placed on the communication and control cabling become particularly stringent. The long distances involved, together with the high bandwidths that are required, make the use of fibre optic cable essential, but since optical interfaces are very sensitive to contamination, a rugged and more reliable solution has had to be devised.

HARTING's solution for high data rates under these extreme conditions is the Expanded Beam Cable Assembly. Its high bandwidth allows the high-definition video signals used in the vision systems that control the boring machines and associated equipment to be safely and securely transmitted. The fibre is safely packed in a connector housing that cannot be affected by dust, water or other environmental factors.

In addition, the hermaphroditic mating design of the expanded beam connectors ensures that regular disconnection and re-connection of the cabling in these environments is easier than using standard fibre optic cabling. Even extending the length of the optical connection is as simple as connecting an additional cable, with no need to pay attention to the laying direction or any additional adaptors. As a result, the customer saves time and money, and eliminates the need to match different mating faces in the field.

In addition to applications in mining and tunnel boring machines, HARTING's Expanded Beam Cable Assembly can be used to link networks in other heavy-duty application areas, including outside broadcast events, concert and music festival stage installations and container ports.

Small, Black and Snappy

Würth Elektronik eiSos offers an addition to its "Wire Protection System WR-TBL" product family: Series 8050 is a horizontal entry clamp in 2.5-mm pitch, available either as a two or three-pole version. What

makes this component unique is its combination of properties: perfect for pure SMT assembly without drilling, extremely small (5 mm high) and these parts have screwless spring clamping. WR-TBL 8050 accepts wires from 0.129 to 0.518 mm² (AWG 26 to 20) and withstands up to 300 VAC. The operating current is 3 A (cULus approved) or 5 A (UL approved) and the working temperature extends from -45 to +120°C.

The WR-TBL 8050 SMT terminal blocks are available from stock. Free samples can be ordered immediately.

Rohde & Schwarz Mobile Network Testing pioneers NB-IoT field measurements

The Internet of things (IoT) translates into a future where a myriad of devices are connected to the Internet and to each other. Current LTE networks are optimized for delivering high data rates for multimedia applications requiring high bandwidth. Networks for IoT applications, however, will be optimized for highest availability (deep indoor penetration) and lowest battery consumption. For the various NB-IoT applications, good network coverage is required to ensure a proper NB-IoT connection. Unlike human beings, smart meters installed in basements are unable to change position for a better signal.

Rohde & Schwarz Mobile Network Testing now offers a new product for NB-IoT coverage measurements. The new NB-IoT coverage measurement solution is based on the field-proven R&S ROMES drive test software for measuring network quality with scanners and test mobiles in all mobile technologies. In combination with the R&S TSMW, TSMA, and TSME scanners, R&S ROMES offers the first LTE/NB-IoT coverage measurement solution that measures true NB-IoT network coverage.

The NB-IoT radio interface is less complex than legacy LTE, thus ensuring less costly NB-IoT user equipment (Cat-NB1). NB-IoT is a half-duplex mode access, meaning that NB-IoT user equipment can only either receive or transmit; it can never receive and transmit simultaneously, however. Another difference between NB-IoT and LTE user equipment concerns cell reselection: NB-IoT user equipment supports this mechanism only in idle mode. This affects the abilities of NB-IoT user equipment to perform continuous and accurate RF coverage measurements. Consequently, using a scanner is the only viable solution for accurate and comprehensive measurement results. Unlike testing with NB-IoT user equipment, scanner-based testing is passive and captures the measurement data directly from the RF air interface, including receive power levels and carrier-to-interference-and-noise-ratio (CINR).

Hanspeter Bobst, Vice President of Rohde & Schwarz Mobile Network Testing and CEO of SwissQual AG, a Rohde & Schwarz company, says: “With the world’s first LTE/NB-IoT coverage measurement solution, based on field-proven software and hardware products, Rohde & Schwarz Mobile Network Testing further strengthens its technological leadership in mobile network testing. For all our existing customers, we are delighted to ensure investment protection through a simple NB-IoT software upgrade.”

The NB-IoT coverage measurement solution with R&S ROMES and TSMx scanners is part of Rohde & Schwarz Mobile Network Testing’s latest software release.

Rohde & Schwarz Mobile Network Testing was also able to demonstrate the verification of device/network interworking by connecting NB-IoT user equipment to R&S ROMES. Apart from RF tests, this setup provided further metrics such as downlink and uplink latency and throughput, and protocol behavior.

For more information about Rohde & Schwarz Mobile Network Testing solutions for mobile network operators, infrastructure vendors, testing service providers, and regulators, visit the website at http:www.mobile-network-testing.com and the blog at https://blog.mobile-network-testing.com.

Top Image: The world’s first LTE/NB-IoT coverage measurement solution featuring R&S ROMES and R&S TSMx scanners

G+D Mobile Security, Murata, and STMicroelectronics Bring Flexible and Efficient Security Solutions to a Wide Range of IoT Devices

New long-range and low-power IoT (Internet of Things) technologies like Low-Power Wide Area Networks (LPWAN) are enabling new use cases in application areas such as smart cities, smart agriculture, smart manufacturing and work safety. Alongside robustness and availability, Security is a key to successful adoption of these new applications. G+D Mobile Security, Murata, and STMicroelectronicshave teamed up to integrate cost-effective security features into IoT devices. Available now for a wide range of applications and vertical markets, the joint solution aims to ensure integrity and confidentiality of the data exchanged and allow the distribution of LPWAN keys[1] in a fully secure manner.

The number of devices connected to the Internet is steadily increasing, and they are often used in a broad range of critical systems. Non-cellular connectivity, such as through LoRaWAN™, will play an important role in vital IoT applications. Non-secure devices in these important systems are an easy target for manipulation and attacks and therefore pose a serious risk to the application and indeed the whole infrastructure. The new solution by G+D Mobile Security, Murata, and STMicroelectronics makes it easy to integrate security already at the device production facility, adding value to the product and protection to the IoT ecosystem in an efficient and convenient way.

The solution consists of G+D's Key Management System that relies on an STSAFE-A secure element attached to an STM32 general-purpose microcontroller, both from ST – built into a compact, cost-efficient LoRaWAN module designed by Murata. The joint offering forms the basis of a secure LoRaWAN ecosystem that provides end-to-end device security, an easy onboarding and lifecycle management of the LoRaWAN module, easy network deployments and tracking, as well as data privacy and integrity. The solution will be available for trials starting 7 June, 2017.

"G+D Mobile Security is a technology leader in secure ID management, and it is only logical for us to extend our proven expertise in payment and telecommunication to the IoT market, where we see an increasingly urgent need to secure the IoT ecosystem. Our Key Management System can authenticate, manage and monitor an IoT device throughout its lifecycle, and our partner solution with Murata and STMicroelectronics is an easy way for IoT device manufacturers to implement security," says Carsten Ahrens, CEO of G+D Mobile Security.

Akira Sasaki, General Manager IoT Module Products at Murata, added: "It is very important to us to enable our customers to secure the IoT ecosystem. This partner offering, developed with trusted security and technology experts like G+D Mobile Security and STMicroelectronics, addresses this requirement and shows that implementing security in the IoT can be easy, scalable and cost effective, to the benefit of our customers and the entire LoRaWAN IoT ecosystem."

"ST is cooperating with G+D Mobile Security and Murata to offer LoRaWAN best-in-class secure solutions. Based on highly secure hardware, our solution ensures integrity and confidentiality of any communication through secure handling and storage of the secrets,"added Laurent Degauque, Secure Microcontroller Marketing Director, Microcontroller and Digital ICs Group at STMicroelectronics.

Rohde & Schwarz at DSEI 2017: system solutions for armed forces

Rohde & Schwarz offers secure communications solutions that provide interoperability as well as national information superiority for all branches of the armed forces. The Munich based technology group's advanced software defined radios (SDR) make an important contribution toward modernizing the German Armed Forces' mobile tactical communications systems. In June 2017, Rohde & Schwarz was awarded a contract from the German Federal Ministry of Defence (BMVg) to equip 50 command and control vehicles with the joint radio system for the German Armed Forces. This system, which is also known as SVFuA, is the first pillar in the MoTaKo modernization project for digitizing mobile tactical communications within the German Armed Forces. As part of this forward-looking project, Rohde & Schwarz for the first time ported diverse existing waveforms to the radios, based on the internationally established software communications architecture (SCA).

Effective operational communications require that national interests be protected. At the same time, the various branches of the armed forces and various nations must be able to communicate with one another. Secure communications is made possible by deploying innovative waveforms that enable the use of modern IP technology. Rohde & Schwarz created the R&S HDR high data rate, jam-resistant family of waveforms to match a variety of mission scenarios and to provide simultaneous voice and data communications. In combination with the advanced software defined radios from Rohde & Schwarz, system solutions are obtained that deliver mobile tactical communications in network centric operations for individual soldiers as well as vehicular, naval and airborne platforms.

Also on display will be R&S NAVICS from Rohde & Schwarz – the first system to take advantage of commercially available IT technologies for internal and external naval communications. R&S NAVICS is an IP-based, scalable, easy-to-operate solution. It serves as the backbone for voice and data communications on all classes of ships. The British Royal Navy equips its Type 26 Global Combat Ships (GCS) with this system.

Another highlight will be an ELINT system developed by Rohde & Schwarz to increase the effectiveness of R-ESM systems. Created with a focus on user-friendliness and comprehensive functionality, the system is optimized for detecting, monitoring and analyzing modern radar signals. It was designed to handle challenging signal scenarios and has already proven itself in operation, especially in acquiring weak and LPI signals in dense signal environments and analyzing state-of-the-art multifunctional radars with complex signal structures. The system's hardware and software are closely harmonized and ensure consistent operation from signal acquisition to updating national databases. The innovative ELINT system is modular, scalable and can be used on a variety of platforms. It is already deployed by major European countries.

Rohde & Schwarz will also showcase its COMINT/C-ESM solutions, which can be fully customized to meet the requirements of the most diverse intelligence missions. These radiomonitoring systems from Rohde & Schwarz are deployed worldwide in land-based mobile and stationary applications and on naval and airborne platforms. The company's portfolio is further enhanced with a solution that addresses a current and growing security threat. The R&S ARDRONIS radiomonitoring solution enables users to detect and identify drone control signals early on, take bearings of the signal source and, if necessary, prevent the drones from being used.

Top Image: German Armed Forces' future joint radio system SVFuA and the latest generation software defined tactical radio R&S SDTR

Low Noise Encapsulated Medical Power Supply from Gresham Power Electronic

Gresham Power Electronics the Salisbury based Defence and Commercial power conversion specialist,

announces the introduction of a new series of low noise AC-DC Converters for medical applications. The P3/P5/MHIA Medical AC/DC linearpower supply series from Polytron Devices is UL 60601-1 Third Edition recognised. The 2MOPP compliant linear encapsulated AC-DC power module is suitable for applications including surgical equipment, patient monitoring, imaging, laboratory and diagnostics equipment.

These single, dual and triple output power supplies provide 4000 Vac reinforced insulation and are available with either a PC mount or chassis mount footprint with screw terminal connections,. The P3/P5/MHIA Medical AC/DC linear series delivers an extremely low output noise of 1.0mV rms while providing a 2µA patient leakage current and a regulation line and load of 0.02 to 0.2%. In addition, these models feature short circuit protection, CE certification and optional international input voltages including dual and switchable.

Output voltages are available over the range 5 – 250Vdc for single outputs, +/-5 to +/124 Vdc for dual outputs and 5 +/-12 and 5 +/-15 Vdc for triple output units

Details of the Polytron P3/P5/MHIA Medical AC/DC Linear Series data sheets are available here:

http://www.greshampower.com/products/linear-encapsulated-power-modules

Jake Moir, Managing Director of Gresham Power, comments, “Encapsulated power supplies offer a safe and rugged solution to medical systems which may be operated in many different environments.”

Gresham Power now offers industrial, medical, CompactPCI, rail and transportation, test and laboratory power solutions from world class manufacturers including Polytron Devices, EOS Power, Vox Power, Magna-Power, Advice Electronics and Digital Power. The range include market leading and cost competitive open frame power supplies, modular configurable and encapsulated power supplies, programmable power supplies and electronic loads and DC:DC converters.

Gresham’s vast experience of designing and manufacturing defence power systems is available to customers to provide modified standard or full custom power supply designs if required. Gresham can also supply a new range of defence power products for land based or vehicle applications to complement its world-leading naval power systems.

The full Gresham Power Electronics product range includes; OEM and external power supplies for advanced multi-media applications, medical, industrial, defence, communications and broadcast systems and LED lighting. Hot-swap power shelves and products for telecoms as well as static frequency converters, DC UPS, distributed power systems and DC:AC inverters for Naval Defence markets. For more information visit www.greshampower.com, call +44 (0)1722 413060, email sales@greshampower.com or download the latest catalogue at http://www.greshampower.com/_literature_130736/Gresham_Brochure_2017

Tektronix Helps Content Creators Solve Critical Challenges Capturing 4K/UHD, WCG, HDR Content

New technologies such as 4K, Wide Color Gamut (WCG) and High Dynamic Range (HDR) allow video content creators to create stunning images and content for delivery to the home, but they also add considerable complexity to workflows. Tektronix, Inc., an industry-leading innovator of video test and monitoring solutions, today unveiled a comprehensive set of production tools to help content creators minimize and manage this complexity at its source – the camera. The new solutions, available now, will be demonstrated at IBC 2017 this September on Stand 10 D41.

In live environments, there is often a mix of HDR (High Dynamic Range) and SDR (Standard Dynamic Range) cameras used. When using traditional waveform monitors to balance these cameras the different trace levels for the same luminance levels forces operators to do a lot of guess work as they try to balance the cameras. In studio or episodic production environments, there is a high cost associated with scene setup and luminance levels, therefore, Operators and DP’s (Director of Photography) need quick and consistent ways to set lighting using displays that provide measurements and

levels that have a direct correlation to the relative light levels (Stops) rather than percentage scales available in traditional waveform displays. In addition, matching colors and skin tones across different color spaces (BT2020 and BT709) is challenging when producing content in multiple formats which means operators need familiar displays (such as BT709 Vector display) that enable them to make these checks quickly and accurately across color spaces.

"Multiple and still-evolving 4K, WCG and HDR standards and formats put content creators in the position of having to deal with an array of confusing and complex requirements almost daily. And when errors happen, they can end up being costly and time consuming," said Charlie Dunn, general manager, Video Product Line, Tektronix. "With our new comprehensive monitoring solution based on the PRISM platform, we are helping our customers confidently create high quality content with the latest technologies, giving them a competitive advantage and lowering costs and reducing risk."

As a software-based platform, PRISM offers a range of options and field-installable upgrades for monitoring hybrid IP/SDI networks among many other applications. With the addition of the new 4K/WCG/HDR toolset, PRISM now becomes a comprehensive production solution specifically designed to address multi-format and multi-standard challenges. PRISM is the ideal HDR and WCG solution for camera acquisition in OB Vans and production studios. The new toolset includes:

A Tektronix-patented Stop Waveform Display that allows operators to adjust camera exposure in a consistent manner without having to worry about the optical to electric transfer function (OETF) of a camera. It also allows cinematographers shooting episodic dramas to quickly create scene or subject lighting, saving production time and expense.

An industry first vector display with a 3D look-up table (LUT) that allows the familiar BT.709 vector to be used to evaluate skin tones, match colors to familiar reference marks and determine the degree of color gamut compatibility for BT.709 conversion. Because operators can stay in their comfort zone even when working with different color systems, the vector display helps to create high quality content without error and reduces the learning curve.

A combination of full, quad or vertical display modes that give operators extensive flexibility to view application displays optimally for their needs and thus maximize their efficiency.

Availability

Available in 3RU half-rack, 1RU full-rack and standalone configurations, the PRISM platform along with the new production toolset will be available at the end of September. For more information, please visit http://www.tek.com/media-analysis-solutions-ip-sdi-infrastructure.

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.

NI Announces New PXI Remote Control and Bus Extension Modules for High-Throughput Applications

NI (Nasdaq: NATI), the provider of platform-based systems that enable engineers and scientists to solve the world's greatest engineering challenges, announced today the release of a new family of high-performance PXI remote control and bus extension modules with PCI Express Gen 3 connectivity. PCI Express Gen 3 technology delivers increased bandwidth that is critical for data intensive applications like 5G cellular research, RF record and playback, and high-channel-count data acquisition.

"As technologies converge into smarter devices under test, you increasingly need to build smarter test and measurement systems that leverage the latest processing and data movement capabilities in order to lower the cost of test or improve coverage," said Luke Schreier, director of automated test marketing at NI. "This new family of remote control modules augments our existing portfolio of PCI Express Gen 3 chassis and embedded controllers and more than doubles the throughput for multichassis systems."

The PCIe-8398 host interface card communicates over a fully transparent PCI Express Gen 3 x16 link to either the single-port PXIe-8398 or dual-port PXIe-8399 remote control module to offer up to 13.7 GB/s of sustained data throughput. Engineers can use the second port on the PXIe-8399 to daisy chain additional chassis, making it possible to directly interface multiple PXI Express chassis to a single host computer, whether it is a desktop or rack-mount PC.

The PXIe-8394 bus extension module supports peer-to-peer streaming up to 6.8 GB/s between chassis-separated instruments with PCI Express Gen 3 connectivity such as the second-generation vector signal transceiver. In addition to multichassis systems, the PXIe-8394 allows high-throughput communication with peripheral devices like RAID data storage arrays or theATCA-3671 FPGA Module for ATCA. These peripherals typically operate with substantial data sets and can benefit from utilizing the latest PCI Express interfaces.

This new family of PXI remote control and bus extension modules complements the already-released PXIe-8880 embedded controller and PXIe-1085 24 GB/s chassis, both of which also feature PCI Express Gen 3 connectivity. This high-bandwidth portfolio of chassis and controllers is an important part of the NI ecosystem that engineers can use to build smarter test systems. These test systems benefit from more than 600 PXI products ranging from DC to mmWave and feature high-throughput data movement using PCI Express bus interfaces and sub-nanosecond synchronization with integrated timing and triggering. Supported by a vibrant ecosystem of partners, add-on IP and applications engineers, the NI platform helps dramatically lower the cost of test, reduce time to market and future-proof testers for tomorrow's challenging requirements.

Read this white paper to learn more about how NI's PCI Express Gen 3 chassis and controller offerings help engineers build smarter test and measurement systems.

Surface-Mount Intelligent Low-Power Modules from STMicroelectronics Save Space in Energy-Efficient Motor Drives

STMicroelectronics has added five space-saving surface-mount intelligent power modules (IPM) to its SLLIMM™-nano family, giving the choice of IGBT or MOSFET outputs for in-motor or other space-constrained drives all the way from very low power ratings up to 100W.

The new modules deliver high conduction and switching efficiency, especially in hard-switching circuits at frequencies up to 20kHz. The integrated gate-driver circuitry is engineered to minimize electromagnetic emissions (EMI) by managing switching voltage and current slopes (dV/dt, di/dt). The thermally efficient package enhances reliability and allows heatsink-free design, while 2.7mm creepage and 2.0mm clearance ensure safety isolation within the compact dual-inline SMD footprint. The module pin configuration is optimized to simplify circuit-board layout.

A wide range of domestic and industrial appliances, such as small fans, roller shutters, refrigerator compressors, dishwashers, draining and recirculation pumps, and general low-power motor drives, can benefit from the small size, high energy efficiency, excellent reliability, and safe, low-noise performance of ST's new IPMs.

Extra features integrated alongside the gate driver and 500V MOSFET or 600V IGBT/freewheel-diode array include an uncommitted operational amplifier and a comparator that let designers implement advanced current sensing and over-current protection with minimal external components. Smart shutdown with high-speed fault detection, interlocking, and under-voltage lockout are all built-in, and integrated bootstrap diodes simplify powering the module's gate-control circuitry.

The new SLLIMM -nano power modules, comprising the STIPNS1M50T-H, STIPNS2M50T-H, STIPNS2M50-H, STGIPNS3H60T-H, and STGIPNS3HD60-H, provide a choice of 1A, 2A, or 3A current rating (at 25°C). All are packaged as NSDIP-26L fully-molded dual-inline surface-mount devices. Engineering samples are available now and volume production will commence in Q4 2017. Pricing starts at $5 for 1000 pieces of the STIPNS1M50T-H.

Analog Devices Lays Foundation for 4G to 5G Migration with Expanded RadioVerse™ Wireless Technology and Design Ecosystem

(ADI) today announced the latest update to its award-winning RadioVerse™ technology and design ecosystem, which simplifies and accelerates radio development for wireless carriers and telecommunications equipment manufacturers as they transition their cellular base stations from 4G to 5G networks. ADI's expanded RadioVerse portfolio features new radio transceiver hardware, software tools, and a robust design environment that enables the smaller, lower power radios necessary in next generation networks. The new offering allows customers to quickly evaluate and develop radio designs for 4G small cell and Pre-5G massive MIMO systems, key building blocks in the transition to 5G, enabling faster data rates while improving connectivity and data throughput in densely populated, high-traffic areas such as office buildings, sport stadiums and public transit systems.

Addressing radio design at the circuit, architecture, system and software levels, the updated RadioVerse release includes the AD9375 RF transceiver, the newest addition to ADI's highly integrated wideband RF transceiver series. The AD9375 is the first RF transceiver to incorporate the digital pre-distortion (DPD) algorithm on-chip – a design breakthrough that reduces DPD power consumption by 90 percent compared to competing solutions.

The re-partitioning of the DPD system from the FPGA to the transceiver cuts the number of JESD204B serial data interface lanes in half, resulting in a dramatic power savings particularly as the number of antennas per base station increases from two to 128 in support of Pre-5G massive MIMO radio-channel density requirements. Other benefits include a more compact radio circuit layout, which simplifies routing and system design, reduces base station size, and allows designers to use a lower-cost, less complex FGPA. In small cells these benefits allow more frequency bands per cell for increased network capacity, while minimizing the impact to system power consumption and size.

The AD9375 transceiver enables a common radio platform design that is tunable over a range of 300 MHz to 6 GHz, operates on a 6-Gbps JESD204B interface and consumes less than 5 Watts. Similar to the award-winning AD9371, the AD9375 has two 100-MHz receivers, two 250-MHz transmitters, a two-input observation receiver and a three-input sniffer receiver. The transceiver's integrated DPD solution supports 3G and 4G waveforms with an instantaneous signal bandwidth of up to 40 MHz.

In addition to the AD9375, the RadioVerse transceiver hardware portfolio features wideband devices for base station architectures ranging from macro- to pico- and femto-cell form factors, in addition to ultra-low power, narrowband transceivers for industrial Internet of Things applications that require long range, network robustness, and long battery life.

RadioVerse Design and Technology Ecosystem Accelerates Wireless Development

Developed to help customers reduce radio size, weight and power (SWaP) while maintaining the highest possible radio performance, the RadioVerse technology and design ecosystem includes a new small-cell radio reference design with a full AD9375-enabled JESD204B-to-antenna radio signal chain. This helps customers further simplify design and accelerate time to market, while minimizing engineering costs. Developed in partnership with Benetel Ltd., a radio solutions provider, the reference design supports 2×2 20-MHz LTE with 250-mW output-power-per-antenna and consumes less than 10 Watts, all in a small form factor measuring 88 mm x 83 mm.

ADI's RadioVerse prototyping platforms also provide advanced simulation and analysis of the transceiver using MATLAB® and Simulink® modeling software, device drivers and full evaluation systems that directly connect to FPGA development platforms, and third-party

hardware for moving quickly from concept to market. The design environment accelerates customer time-to-market through access to ADI's EngineerZone® online technical support community, which hosts customer support forums, quick-start videos, technical articles, webcasts and product highlights.

Analog Devices will continue to expand its RadioVerse design environment through partnerships with leading power amplifier (PA) suppliers, including NXP Semiconductors N.V., and Skyworks Solutions, Inc., providing customers with test reports for AD9375 DPD with PA products of various output power and frequencies. Visit the RadioVerse alliance network site which has rapidly expanded to 20 companies in the past 12 months, including seven new reference designs targeting drone, wireless surveillance and software-defined radio markets.

ON Semiconductor Improves Imaging Performance for High Resolution Industrial Applications

ON Semiconductor (Nasdaq: ON), driving energy efficient innovations, is improving performance for industrial imaging applications that require both high resolution image capture and maximum image uniformity.

The new 29 megapixel KAI-29052 image sensor provides up to twice the imaging sensitivity of the existing KAI-29050 in the wavelength range of 500 nanometer (nm) to 1050 nm. This improved performance is particularly beneficial to applications operating in near-infrared (NIR) wavelengths, such as 850 nm. This enhanced pixel design retains isolation of charge from one photodiode to another, enabling this increase in sensitivity without any reduction to image sharpness (Modulation Transfer Function, or MTF). In addition, an improved amplifier design reduces read noise by 15%, increasing the linear dynamic range available from the device to 66 decibel (dB). With these enhancements, the KAI-29052 serves as a new performance benchmark for high resolution image capture.

"The evolving needs of industrial imaging applications such as high end security, machine vision, and aerial surveillance and mapping require continued advancements in the portfolio of image sensors serving this market," said Herb Erhardt, Vice President and GM, Industrial Solutions Division, Image Sensor Group at ON Semiconductor. "The enhanced performance available from the KAI-29052 is a further demonstration of ON Semiconductor's ongoing commitment to provide the most advanced CCD and CMOS image sensors for these demanding markets."

The KAI-29052 is now available in a RoHS-compliant CPGA-72 package in Monochrome, Bayer Color, and Sparse Color configurations, and is fully pin compatible not only with the existing KAI-29050 image sensor but also a full family of 5.5 micron and 7.4 micron CCD image sensors, enabling camera manufacturers to quickly adopt the new device.

Evaluation kits for ON Semiconductor's full family of Interline Transfer CCD image sensors are now available, allowing the performance of devices such as the KAI-29052 to be examined and reviewed under real-world conditions. Customers can order an evaluation kit by contacting their local ON Semiconductor sales representative or authorized distributor. More information on the KAI-29052 is available on the company's blog.

Belden Compliant with Mandatory New EU Radio Equipment Directive

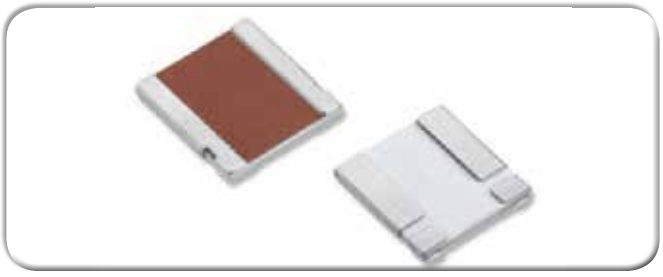
Belden Inc., a global leader in signal transmission solutions for mission-critical applications, confirmed today its compliance with the new Radio Equipment Directive (RED) 2014/53/EU. All Hirschmann wireless solutions fully adhere to the new guidelines, including the OpenBAT, BAT450-F, BAT867R and BAT-C Industrial Wireless LAN access points/clients, as well as all OWL Industrial Cellular Routers.

The new RED replaces the former R&TTE (Radio and Telecommunication Terminal Equipment Directive 1999/5/EC) after a year-long transition period. All radio products shipped to the European Union on or after June 13 must conform with the new directive. While

some radio equipment manufacturers faced challenges in meeting the deadline, all Hirschmann affected radio devices are RED-compliant on time.
Per the European Commission, the new RED ensures a single market for radio equipment by setting essential requirements for safety and health, electromagnetic compatibility and the efficient use of the radio spectrum. This applies to all products using the radio frequency spectrum, including Hirschmann products.
To meet the new requirements defined by RED, Hirschmann devices with the HiLCOS operating system (OpenBAT, BAT450-F and BAT867-R) are now being produced with new software versions (09.12.5700 and 09.14.5700).

VPG Foil Resistors Announces Ultra-High Precision Military and Space Grade Resistors for High-Performance Current Sensing within Mission-Critical Applications

The VPG Foil Resistors product group of Vishay Precision Group (NYSE: VPG) (www.vpgfoilresistors.com), manufacturers of the industry's most precise and stable precision resistors, today introduced the Model 303337 ultra-high precision military and space-grade resistor, offering high-performance current sensing within mission-critical applications.
The Model 303337 produces a highly precise voltage that is directly proportional to measured current levels, with significantly reduced component sensitivity to applied power changes, including PCR and thermal resistance values. The industry-exclusive design of the Model 303337 incorporates VPG's own proprietary Bulk Metal® Z Foil resistive technology, along with a four-terminal Kelvin connection, for ultra-high precision current sensing and temperature stability to 3W. Additional attributes include a low temperature coefficient of resistance (TCR) of ±5 ppm/°C (–55°C to +125°C, at +25°C ref.), for reduced risk of measurement errors due to temperature changes; improved load-life stability of ±0.02% (typ.), at +70°C for 2000 hours (rated power); a low power coefficient of resistance (PCR) of 5 ppm/W at rated power; a resistance tolerance to ±0.1%; a 100 to 200 mΩ resistance range; a short-time overload of 0.005% typical; an electrostatic discharge (ESD) limit of < 25 kV; solderable terminations; and a choice of either lead (Pb)-free or tin/lead alloy solder finish.
To ensure total resistor reliability and conformance to published specifications, each unit undergoes stringent testing across its full batch lot. A Quality Conformance Inspection report accompanies each shipment, detailing all test data collected during Environmental Test Laboratory studies. The report offers design engineers a reliable set of data for the anticipation of actual resistor performance within an intended installation environment. Data includes screen/test flow per EEE- INST-002 (Tables 2A and 3A, Film/Foil, Level 1), MIL-PRF-55342 and MIL-PRF-49465, among other parameters. For customer convenience, prototype quantities of the Model 303337 resistor are also available with expedited deliveries. Please contact foil@vpgsensors.com for details.
The Model 303337 ultra-high precision surface mount resistor may be specified within demanding and mission-critical military, aerospace, defense and space applications, including those where a precision resistor is required to quickly reach thermal equilibrium, within circuits that either require fast response times, or which are characterized by rapid current changes. Within the military, aerospace, defense and space industries, typical applications include commercial and military avionics, switching linear power supplies, power amplifiers, power management systems, feedback circuits, measurement instrumentation and associated automatic test equipment. Other applications include switching and linear power supplies, precision high current-sensing, power management systems, feedback circuits, power amplifiers, and precision electronic scales. To learn more about VPG Foil Resistors and its available product offerings, visit www.vpgfoilresistors.com.



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