New-Tech Europe October 2017

October
2017

# New-Tech Magazine Europe

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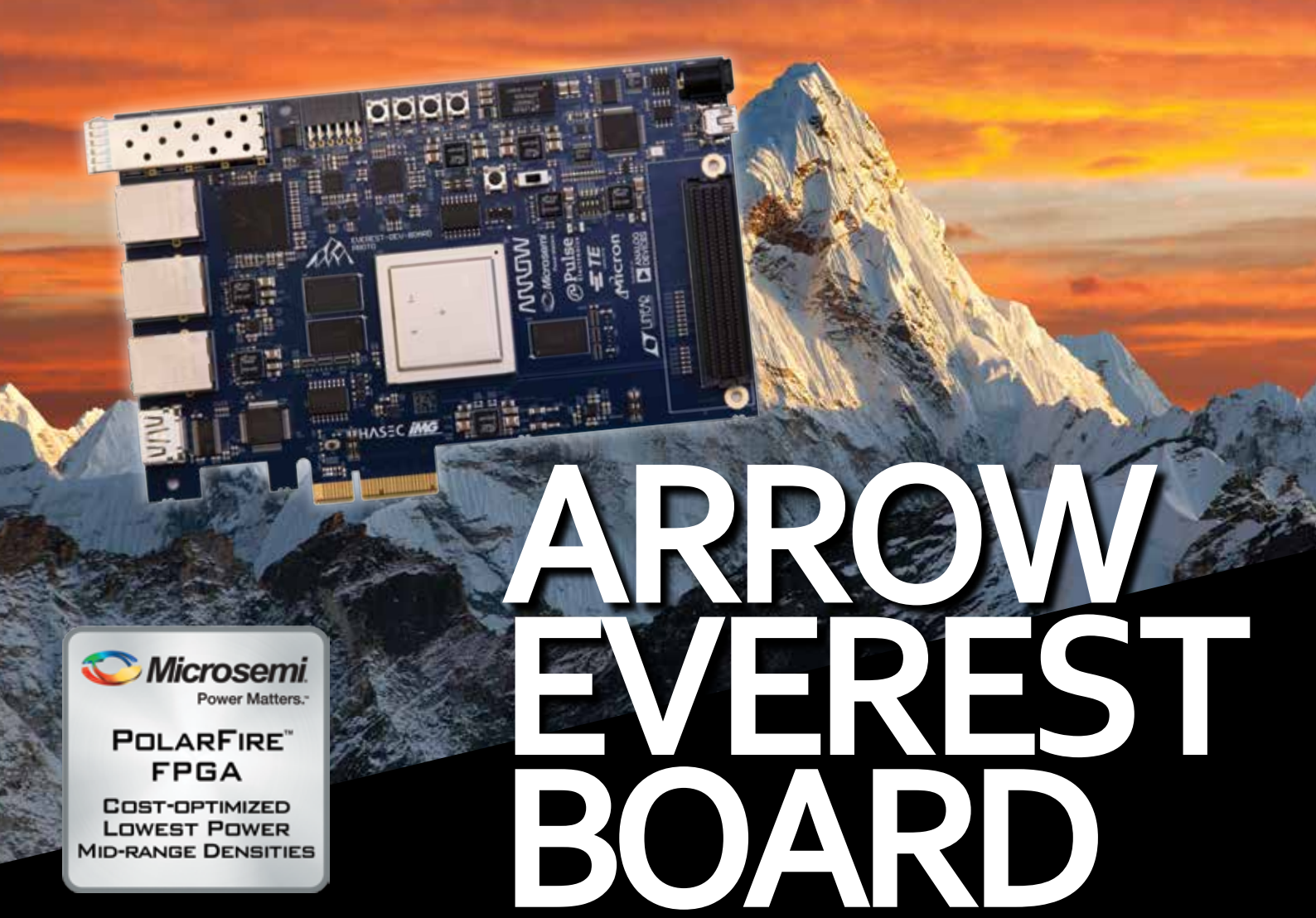

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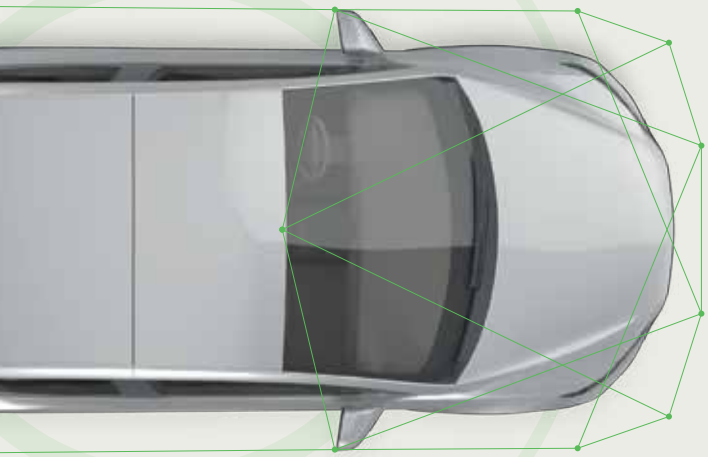

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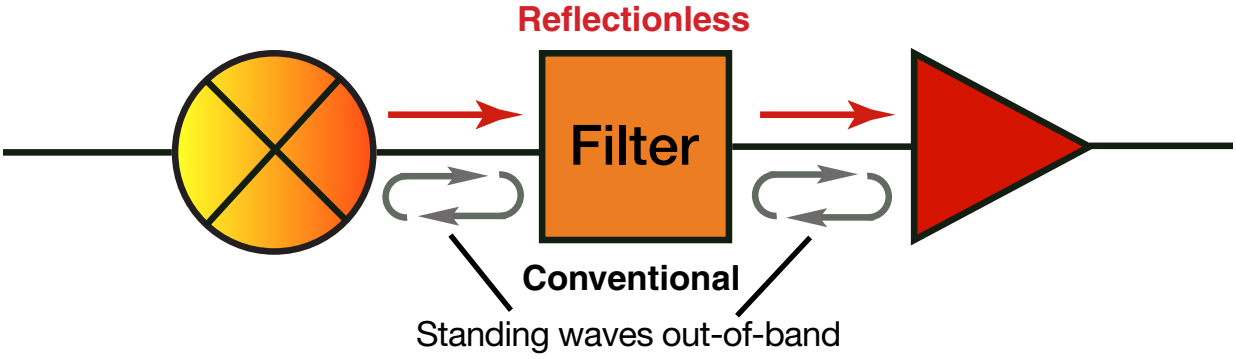


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October 2017



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# German broadcaster SWR selects Jordi's ADAM-System for massive digital archive migration with Rohde & Schwarz

The German public service broadcaster Suedwestrundfunk (SWR) solves a massive tape archive digitization challenge by using the ADAM solution from the Swiss-based archiving specialist Jordi AG which includes encoding and storage products of Rohde & Schwarz.

Rohde & Schwarz has announced a major digital archive migration project with German regional broadcaster SWR. The project sees Rohde & Schwarz working closely with Swiss-based retro-archiving specialist Jordi AG.

SWR's archiving challenge is massive: the broadcaster needs to archive over 40,000 tape hours of content each year. To alleviate its growing tape deterioration issues, the broadcaster took the strategic decision to digitize its entire tape-based archives. After careful evaluation of several vendors' systems SWR settled on a migration system that combines Jordi's automated digital migration system ADAM with Rohde & Schwarz's VENICE video servers and R&S SpycerBox modular storage system running IBM Spectrum Scale.

ADAM is a fully automated, self-monitoring archive migration system which orchestrates all the workflow steps from tape insertion to content migration. R&S VENICE video servers encode all of the content into the final archive format and then R&S SpycerBox Cell and Ultra TL storage units are employed to perform all data buffering and transfer operations to SWR's archive administration system.

The turnkey system is proving to be an ultra fast and totally reliable solution – more than 40 times faster than previous manual workflows. Such is the reliability of the system that it can run for 72 hours in lights out mode meaning that it can operate unattended throughout an entire weekend.

Six remote-controlled VTRs ingest content via a 4-channel R&S VENICE and another 2-channel R&S VENICE server which are FIMS-controlled from a Jordi AG controller. Media is recorded on to a single common R&S SpycerBox Cell SAS storage unit (27TB) and subsequently copied to another R&S SpycerBox Ultra TL unit which serves as a mid-term, non-realtime working buffer for the ingested clips. From there, the clips are made available to external LoRes creation engines and to external QC and reporting engines. The archive system backbone is created by a 40 GbE physical layer and IBM Spectrum Scale with NSD packets as a block-organized media exchange mechanism.

As part of the subsequent archiving process, LTO6 tapes are used as a long-term recording media. To maintain the required sustained data rate of 300 MB/s, ADAM uses a R&S SpycerBox Cell in combination with a R&S SpycerBox Ultra TL. These two storage systems are connected via 40 Gbit Ethernet, based on the IBM Spectrum Scale file system. The ultra fast R&S SpycerBox Cell storage system serves as a buffer memory and records the encoded files from R&S VENICE. This data is then transferred to a R&S SpycerBox Ultra TL which serves as a mid-term working buffer. The R&S SpycerBox Ultra TL guarantees a sustained data rate of at least 300 MB/s during the subsequent processes.

Frank Adam, Director Information, Documentation and Archive of SWR and SR: "At SWR, we have a massive tape archive migration project needing 40,000 hours of tape digitization each year. After extensive research, we found the optimum solution in ADAM by Jordi AG communication. The fully automatic and completely self-monitoring migration system combined with Rohde & Schwarz's VENICE servers and R&S SpycerBox storage together with IBM Spectrum Scale is designed to migrate large tape libraries. Once the System is fully loaded with tapes the system runs autonomous over the weekend without any manual intervention."

# VTT upgrades pilot environment for 3D printing of metals: powders a step towards the future of product development

VTT Technical Research Centre of Finland's new plasma equipment accelerates industrial production processes and the creation of new products. The entire production chain, from raw materials to product, has been accelerated and streamlined.

Material development is the next step forward in the 3D printing. Plasma equipment has been installed for VTT in Tampere, for the development and piloting of 3D printing powders. Plasma treatment changes the properties of various raw materials, for example the flowability of a material can be raised to the level required for 3D printing devices. The role of plasma treatment is emphasized especially in the processing of metal-ceramic composite powders.

There are only a few equivalent devices in Europe, which are mainly used by research departments only. VTT's equipment is available for academy and industry. VTT's ability to offer a range of material composition that fulfil the needs of industry and research teams is expanding considerably. Machine and equipment manufacturers and the energy sector will particularly benefit from the plasma equipment. Research institutions and universities could also benefit from it.

The new equipment is part of VTT's pilot environment for powder materials. It will enable pilot-scale demonstration across the entire production chain, from powder to product.

"We offer an easy way to bring ideas and research results much closer to industrial exploitation. Our pilot environment, which is based on the one-stop principle, will markedly accelerate the achievement of results. We facilitate the entire production chain, from raw material to the testing of the finished component, thereby avoiding interruptions in companies' own production processes," says Tomi Lindroos, Research Team Leader at VTT.

# Telia, Ericsson and Intel First to Make 5G Real in Europe

First Public 5G Live Network in Europe Shows Benefits of High-Speed, Fast-Response Connectivity to Consumers and Business

EU Digital Summit – Tallinn, Estonia, Sept. 29, 2017 – Telia is deploying the first public 5G live network use cases in Europe in collaboration with Ericsson and Intel. This includes a high-speed 5G connection to a commercial passenger cruise ship delivering internet connectivity to the ship and its passengers while in port, and an industrial use case featuring a construction excavator remotely controlled with a live 5G network.

The move is an important milestone in the global 5G roadmap, moving Ericsson, Intel and Telia, and more importantly Telia customers, closer to the goal of bringing 5G services to life in 2018 in both Tallinn and Stockholm, two of the world's most digitalized cities.

Gabriela Styf Sjöman, global head of networks for Telia Company, says: "We want to be early with 5G and will bring it to life in Stockholm, Tallinn and Helsinki in 2018. We work together with our partners in the whole ecosystem to explore the powerful effect it is going to have for our customers and in society. It's not only about building a new network but it's also about building a new way of thinking and perceiving what a mobile network can be and can do. High speed, low latency, guaranteed capacity and truly mobile is going to push the boundaries of digitalization and we want to be there pushing it together with our partners."

Deploying early 5G solutions in real-world settings is vital for the industry to learn how the various technologies integrate into different types of businesses, in what types of environments it performs best, and the interoperability

between systems across the network, cloud and devices. Telia and Ericsson announced a joint roadmap in 2016 that aims to let Telia customers experience 5G services in 2018 in Tallinn and Stockholm. Now in collaboration with Intel, early examples of these services have been brought to life in these use cases for consumers and businesses.

The "real life" 5G environment for Tallink was created at the Port of Tallinn to test and explore how the new mobile technology can provide higher data connection speeds and improved quality. During the test in September 2017, 5G technology was deployed for the whole ship while it was in harbor. The technology enabled Wi-Fi usage for 2,000 passengers and the ship's own information and communications technology systems. This is a first example of many uses that 5G will provide access to in transport situations, as well as very broad gigabit wireless services delivered to consumers.

Gearing up for 5G, the participants in the EU Digital Summit taking place today in Tallinn have a unique opportunity to experience what it feels like to remotely control machinery – in this case an industrial excavator – via an augmented reality remote control operated over an ultrafast live 5G link with very low latency. This shows how a machine operator can work with 5G remote controlled excavators in hazardous environments, from the comfort and safety of an office environment. This highlights the capabilities and opportunities 5G will bring to harsh or dangerous industrial settings.

The solution stack underpinning the cases in Estonia consists of technologies from Ericsson and Intel. An Ericsson 5G base station consisting of 5G antenna, radio and baseband, in conjunction with the Intel® 5G Mobile Trial Platform – provides millimeter wave and extends the Telia mobile network to 5G.

Arun Bansal, head of Europe and Latin America for Ericsson, says: "Our own report about the 5G business potential identifies a huge opportunity for telecom operators globally who address industry digitalization with 5G. We foresee that they can benefit from a market opportunity of $582 billion by 2026, and this represents a potential to add 34 percent growth in revenues. Capturing this market potential requires investment in 5G technology as well as business development and go-to-market models."

Asha Keddy, vice president and general manager of the Next Generation and Standards Group at Intel Corporation, says: "Our work together trialing early usages of 5G technologies and the experiences it will bring to different industries, demonstrates the importance of collaboration and the need for seamless flow of data across the network, cloud and devices to make 5G a reality. Intel's 5G platforms are critical enablers for today's active, real-world 5G trials with service providers around the globe, providing crucial insights and helping to define the future of 5G."

# Power Transistor Growth Returns After Volatile Period


Since the 2009 semiconductor downturn and strong 2010 recovery year, power transistor sales have been rocked by market volatility, falling in three of the last five years because of inventory corrections and drawdowns by systems makers worried about ongoing economic weakness and price erosion in some product categories. After recovering from a 7% drop in 2015, power transistor sales grew 5% in 2016 to $12.9 billion and are forecast to set a new record high this year with worldwide revenues rising 6% to $13.6 billion, according to IC Insights' 2017 O-S-D Report—A Market Analysis and Forecast for Optoelectronics, Sensors/Actuators, and Discrete Semiconductors.

The expected 2017 growth in power transistor sales will be the first back-to-back annual increase in this semiconductor market segment in six years, and that will push dollar volumes past the current record high of $13.5 billion set in 2011. In 2012 and 2013, power transistors suffered their first back-to-back annual sales decline in more than three decades—dropping 8% and 6%, respectively—after rising 12% in 2011 and surging 44% in the 2010 recovery from the 2009 downturn year. The power transistor market then rebounded in 2014 with a strong 14% increase, only to drop 7% in 2015. In 2016, this semiconductor discretes market category began to stabilize and is expected to continue expanding at a modest rate in the next several years, based on IC Insights' O-S-D Reportforecast

Power transistors are the primary growth engine in the $23 billion discrete semiconductor market because they play a vital role in controlling and conditioning electricity for all types of electronics—including a growing number of battery-operated systems. Worldwide efforts to reduce the waste of power in electric utility grids have significantly increased the importance of power transistors in consumer, commercial, and industrial systems. Renewable-energy applications (e.g., wind and solar systems) as well as electric and hybrid vehicles have also become important applications for power transistors in the last 15 years.

However, volatility in the first half of this decade resulted in an uncharacteristic drop in market size for power transistors during the last five years. Between 2011 and 2016, power transistor sales fell by a compound annual growth rate of -0.9% compared to a 25-year historical annual average increase of 6.4% (between 1991 and 2016). The 2017 O-S-D Report is projecting that worldwide power transistor sales will grow by a CAGR of 4.2% between 2016 and 2021, reaching $15.8 billion in the final year of the forecast.

All power transistor technology categories are expected to register sales growth in 2017 with MOS field effect transistor (FET) products increasing 6% to nearly $7.7 billion, insulated-gate bipolar transistor (IGBT) products also rising 6% to $4.1 billion, and bipolar junction transistor products growing 4% to about $875 million. RF/microwave power transistors and module sales are forecast to rise 3% in 2017 to $960 million, according to the O-S-D Report.

**Report Details: The 2017 O-S-D Report**

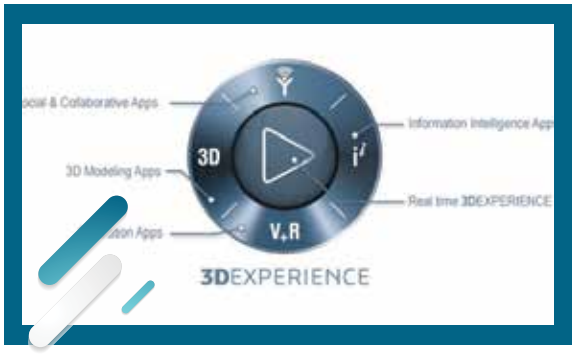
In a one-of-a-kind study, IC Insights continues to expand its coverage of the semiconductor industry with detailed analysis of trends and growth rates in the optoelectronics, sensors/actuators, and discretes market segments in its newly revised 360-page O-S-D Report—A Market Analysis and Forecast for the Optoelectronics, Sensors/Actuators, and Discretes.

Now in its 12th annual edition, the 2017 O-S-D Report contains a detailed forecast of sales, unit shipments, and selling prices for more than 30 individual product types and categories through 2021. Also included is a review of technology trends for each of the segments. The 2017 O-S-D Report, with more than 240 charts and figures, is attractively priced at $3,590 for an individual-user license and $6,690 for a multi-user corporate license.

# Dassault Systèmes to Acquire Exa Corporation

Strengthens Simulation Portfolio with Next Generation Fluid Dynamics Capabilities on the 3DEXPERIENCE Platform

- Proven Technology and Industrialized Solutions Available to Customers in All Industries
- Companies' Complementary Strengths Expand Power of Digital Engineering Throughout Value-Chain




Dassault Systèmes, a global innovator in simulation software for product engineering, today announced the signing of a definitive merger agreement for Dassault Systèmes to acquire Burlington, Massachusetts-based Exa. Under the terms of the merger agreement, unanimously approved by Exa's Board of Directors, a subsidiary of Dassault Systèmes will commence a tender offer within the next 10 business days to acquire all of the issued and outstanding shares of Exa common stock for a price of $24.25 per share payable in cash upon completion of the offer. This represents a fully diluted equity value for Exa of approximately $400 million. Exa's fiscal year ended January 31, 2017 and its revenue was $72 million.

With the addition of Exa, Dassault Systèmes' 3DEXPERIENCE platform will provide customers with a proven, diverse portfolio of combined Lattice Boltzmann fluid simulation technologies, as well as Exa's fully industrialized solutions and nearly 350 highly experienced simulation professionals. This set of solutions solves challenging fluids problems faster and more accurately than traditional methods for aerodynamics, aeroacoustics, thermal management, and a growing list of applications in other industries.

Exa's software is used by designers and engineers at more than 150 leading companies in transportation and mobility, as well as aerospace and defense, natural resources, and others to evaluate highly dynamic fluid flow throughout the design process. Customers include BMW, Tesla, Toyota, NASA,

Embraer, British Petroleum, and others. Nearly every transportation and mobility manufacturer uses Exa's solutions to simulate aerodynamic flow, aeroacoustics, and thermal management.

Simulation of fluid flow, such as the cooling of an engine or the lift of a wing, is a necessary component of simulating the physical behavior of products, nature and life. For the many situations where fluid flow conditions change rapidly, simulation of dynamically variable flows is critical to accurate assessments of a product and its behavior in its environment. For these applications, the combination of Exa's accuracy and timeliness provides results that are superior to those of alternative fluid simulation methods.

While providing continuity for Exa's customers, Dassault Systèmes will integrate Exa's solutions into its existing portfolio of industry solution experiences. This will offer a new industry standard in multiphysics and multiscale simulation. Combining the two companies greatly enhances collaboration with customers, facilitating the ability to offer integrated solutions and simplify both commercial and technical interactions. Customers will be able to quickly create and analyze fluid behavioral models that simulate highly dynamic fluid flow across a wide range of applications.

"Both Dassault Systèmes and Exa believe in the value of an integrated focus on science and industry. It is a critical part of our commitment to delivering 3DEXPERIENCE universes that harmonize products, nature and life. Simulation of dynamic fluid flow is an important part of our multiphysics and multiscale simulation strategy," said Bernard Charlès, Vice Chairman and CEO, Dassault Systèmes. "With Exa's valuable application knowledge in transportation and mobility and other industry verticals, we will accelerate our delivery of industry solution experiences to benefit our existing and future customers."

"Exa's proven Lattice Boltzmann simulation technologies and extensive professional and industrial expertise are why we've been successful in leading the highly dynamic flow simulation market," said Stephen Remondi, President and Chief Executive Officer of Exa Corporation. "Becoming part of Dassault Systèmes' 3DEXPERIENCE platform and SIMULIA portfolio will bring enormous value to our customers in all industries."

Completion of the transaction is expected in the fourth quarter of 2017, subject to the satisfaction of customary closing conditions, including required regulatory approvals. The transaction will be accretive to Dassault Systèmes' earnings.

Foros acted as financial advisor and Shearman & Sterling LLP as legal counsel to Dassault Systèmes in connection with the transaction.

# Renewable energy to cause major disruption to UK utilities by 2030

Residential renewable power generation and storage will become profitable for London households by 2030.

This could cause a major disruption to the UK utilities sector, report researchers from the Centre for Climate Finance & Investment at Imperial College Business School, in a new study.

The Centre's findings chart a step change in the energy consumer experience, at a time of rising customer concerns about energy prices and mounting criticism of the profit margins enjoyed by UK power distributors.

Although consumers are unlikely to leave the power grid completely until after 2030, their gradual withdrawal from traditional utilities to the comparable cost – and service – of renewable energy will have significant implications for electrical utilities and investors. London households can already profitably reduce what they consume from their electricity supplier, but the disruptive force of cheaper battery storage presents a potential game-changer for one of the world's largest industries over the next decade. For example, the mass adoption by consumers of a cheaper alternative may provoke a price hike on remaining consumers, prompting even further reductions in demand. This feedback loop has been referred to as "the utility death spiral".

**Grid parity vs. firm power parity**

Until now, existing energy pricing models have

systematically understated the potential of renewable technologies to provide a similar service at a lower cost than grid supplied electricity. The notion of "grid parity" has been at the heart of research in the past.

The Centre has developed a new framework, called "firm power parity", which is more accurate as it charts the milestones at which on-site renewables deliver the same service – in addition to the same cost – as conventional energy supplies.

Dr Charles Donovan, Director of the Centre for Climate Finance and Investment at Imperial College Business School, said: "The concept of grid parity does not capture the increasingly complex changes in the relationship between electricity producers and consumers and is flawed on several levels. Firstly, electricity generated from renewable energy is, by its very nature, intermittent. What's more, different consumers face different prices for their electricity – with residential consumers paying the most. Finally, the price that consumers pay for their electricity is not necessarily static. The framework created by the Centre takes these points into consideration and differentiates between consumer types and energy services provided.

"There is no doubt that technological innovation is moving the world towards a cleaner energy system. The results of our research are exciting as they show we will soon be entering a period where reliable and profitable solar power production by residential energy consumers becomes a reality in relatively cloudy places like London. The new concept of firm power parity that we have developed is more suited to the competitive landscape that renewable technologies currently find themselves in. Firm power is what's available when the sun is not shining.

The results of the Centre's research suggest the outlook for consumers in Munich is far more favourable than it is for Londoners, in terms of the profitability of onsite solar photovoltaic (PV) power generation and day storage. However, the outlook for London is an order of magnitude better than in Johannesburg, South Africa. The other cities featured in the study include New York, Santiago and Bangalore, all of which are progressing at a rate just behind London.

Dr Donovan added: "The UK government has a big problem on its hands: solar and storage technologies are advancing rapidly and will bleed revenues from the utilities sector, yet we need a financially healthy industry to enable large-scale investments in smarter, more flexible electric power networks. The transition ahead is going to be messy. For example, the expensive baseload power to be generated by Hinkley Point C may not even be needed if consumers make the profitable switch to onsite solar and storage indicated by our model."

## TowerJazz and Crocus Expand Presence in Magnetic Sensors Market through Successful Licensing of Crocus' IP and Volume Manufacturing by TowerJazz


TowerJazz, the global specialty foundry leader, and Crocus, a leading developer of TMR magnetic sensor technology and embedded MRAM, today announce volume manufacturing of Crocus TMR (Tunnel MagnetoResistance) sensors, using TowerJazz's 0.13um CMOS process with a dedicated magnetic module in the Cu BEOL. With Crocus' magnetic process, know-how and IP, and TowerJazz's process technology and integration expertise, Crocus has successfully licensed the TMR technology to an automotive Tier 1 customer, bringing increased business to both companies.

According to a 2016 MarketsandMarkets report, the overall magnetic field sensors market was valued at USD $2.25 billion in 2015 and is expected to reach S4.16 billion by 2022, at a CAGR of 8.87% between 2016 and 2022. The growth of this market is driven by the rising demand for MEMS-based sensors across industry verticals, surge in the automotive industry, increasing demand for high-quality sensing devices, and continuous growth in consumer electronics applications.

Magnetic transducers which sense magnetic field strength are widely used in modern industry and electronics to measure current, position, motion, direction, and other physical

parameters. Crocus' TMR technology is a CMOS-based, robust technology capable of offering important advantages in sensitivity, performance, power consumption, size and full integration with CMOS to create monolithic single die ICs. Benefits to customers come in the form of low power, a robust design and high temperature performance. Crocus TMR solutions are ideally suited for many applications ranging from IoT to consumer, medical, automotive and industrial equipment.

"We selected TowerJazz because of their high flexibility and capabilities to adapt their TS13 platform to incorporate our TMR technology which includes magnetic materials that are typically not used in CMOS. TowerJazz's vast manufacturing expertise is enabling us to successfully fulfill the needs of several market sectors combined with increased performance required in next-generation sensors. TowerJazz has been our development partner for many years and together we have achieved technology maturity leading to expanded business and successful licensing of Crocus IP," said Michel Desbard, Crocus CEO.

"As the demand for IoT applications in our daily life is ever-increasing, there is an even greater need for intelligent sensing, low power and improved performance. Crocus' successful licensing of their IP, along with TowerJazz's manufacturing capability and know-how, enables us to deliver highly-advanced and competitive embedded-solutions to multiple customers in various markets. Through our partnership with Crocus, we are broadening our presence in the sensors' market, complementing our MEMS and image sensing programs," said Zmira Shternfeld-Lavie, VP of TOPS BU and R&D Process Engineering."

Crocus's TMR magnetic sensor is expected to displace existing sensor technologies in many applications. Crocus' TMR magnetic sensor product family includes multiple architectures which are based on its Magnetic Logic Unit™ (MLU™), a disruptive CMOS-based rugged magnetic technology.

# Toshiba Opens New European Retail Innovation Experience Theatre

MADRID–(BUSINESS WIRE)–Toshiba Global Commerce Solutions, Inc. (Toshiba) today announces the opening of its new European Retail Theatre showroom in Madrid, Spain to help retailers and business partners navigate the fast-moving retail marketplace. Focused on the needs of retailers and their shoppers both today and tomorrow, the showroom will allow Toshiba customers and business partners to experience Brilliant CommerceTM and discover new ways to become more agile, improve store productivity and increase profits.

Located in the Toshiba office strategically situated near the Madrid airport, Toshiba's new state-of-the art showroom will allow visitors an immersive experience to transform into the role of the shopper or store associate. Toshiba designed a retail store experience and meeting space on 400 square meters called the "Retail Experience Theatre." The theatre is highly adaptable with retractable seating, making it an excellent demonstration and meeting space. The spatial design also incorporates education space for classes to be offered to customers and business partners.

Today's retailers have to bring all of their channels, touchpoints and applications together to spark innovation and bridge to a whole new generation of technologies that will power the future of commerce. The concept of the theatre is to take all visitors on a customer journey and let retailers and partners experience the way we can shop tomorrow — which is possible today. The centerpiece behind the scenes is Toshiba's new TCxTM Elevate platform which affords all retail customers the capacity to implement creative and impactful solutions at their own pace. Fully-integrated interactive shopping scenarios have been developed in cooperation with Toshiba's large strategic partner network, with a wide range of capabilities featured in the Madrid Theatre including:

- Home shopping with click and collect based on digital shopping list, home delivery
- In-store mobile self scanning
- Frictionless checkout
- Optimized "no waste" innovation for perishable goods

- Real-time digital pricing
- Smart weigh scales with built-in clienteling
- Interactive digital experiences featuring facial analysis and actionable consumer insights

"The new Madrid showroom is the ideal location for our clients to get inspired, meet with Toshiba retail experts, collaborate with our strategic partners and experience Toshiba as the one-stop shop in providing commerce solutions to meet the dynamic needs of the rapidly changing retail landscape," said Yevgeni Tsirulnik, Group Vice President, EMEA Sales and Omni Channels, Toshiba Global Commerce Solutions.

Says Adam Sheppard, President and CEO, Toshiba TEC European Retail Operations: "Our customer and business partner growth has inspired the opening of a centrally located Retail Experience Theatre in Europe that will allow retailers from many countries to experience first-hand the end-to-end customer shopping experiences. The future is already here!"

"The power of Toshiba and our full integration with an extensive network of Together Commerce Alliance partners delivers proven end-to-end solutions that offer retailers significant business value and improved performance," said Gerard Pruijn, European Director of Strategic Partnerships, Toshiba TEC.

# Google and HTC Announce US$1.1 Billion Cooperation Agreement

Google and HTC Corporation today announced a definitive agreement under which certain HTC employees – many of whom are already working with Google to develop Pixel smartphones – will join Google. HTC will receive US$1.1 billion in cash from Google as part of the transaction. Separately, Google will receive a non-exclusive license for HTC intellectual property (IP).

The agreement is a testament to the decade-long strategic relationship between HTC and Google around the development of premium smartphones.

This agreement also supports HTC's continued branded smartphone strategy, enabling a more streamlined product portfolio, greater operational efficiency and financial flexibility. HTC will continue to have best-in-class engineering talent, which is currently working on the next flagship phone, following the successful launch of the HTC U11 earlier this year. HTC will also continue to build the virtual reality ecosystem to grow its VIVE business, while investing in other next-generation technologies, including the Internet of Things, augmented reality and artificial intelligence.

For Google, this agreement further reinforces its commitment to smartphones and overall investment in its emerging hardware business. In addition to the talented and experienced team of professionals, Google will continue to have access to HTC's IP to support the Pixel smartphone family. Additionally, this agreement also represents a significant investment by Google in Taiwan as a key innovation and technology hub.

"As a pioneer of the smartphone market, we are very proud of our history of innovation. Our unmatched smartphone value chain, including our IP portfolio, and world-class talent and system integration capabilities, have supported Google in bolstering the Android market," said Cher Wang, Chairwoman and CEO of HTC. "This agreement is a brilliant next step in our longstanding partnership, enabling Google to supercharge their hardware business while ensuring continued innovation within our HTC smartphone and VIVE virtual reality businesses. We believe HTC is well positioned to maintain our rich legacy of innovation and realize the potential of a new generation of connected products and services."

"HTC has been a longtime partner of Google and has created some of the most beautiful, premium devices on the market," said Rick Osterloh, Senior Vice President of Hardware at Google. "We're excited and can't wait to welcome members of the HTC team who will be joining Google to fuel further innovation and future product development in consumer hardware."

The transaction, which is subject to regulatory approvals and customary closing conditions, is expected to close by early 2018.

Evercore served as financial advisor to HTC and Gibson Dunn and Tsar & Tsai acted as legal counsel. Lazard served as financial advisor to Google and Cleary Gottlieb and Lee & Li acted as legal counsel.

# IFA 2017 Provides a Huge Boost for Industry and Retail

› New Tech Magazine

**World's biggest technology trade show and innovation powerhouse inspires visitors - IFA Global Markets delivers supply chain success - Sensational Kick-Off for IFA NEXT**

IFA 2017 has attracted more than 253,000 visitors to Berlin, as the power of innovation and brands yet again turned the event into the world's most important tradeshow for consumer electronics and home appliances. With more than half of all trade visitors coming from abroad, IFA Berlin provided a huge boost for both manufacturers and retailers in the crucial run-up to the holiday period, which runs from Thanksgiving in the United States all the way to Christmas and the New Year. Once again, IFA was operating at full capacity, with 1,805 exhibitors showing their latest products and services on 159,000 square meters of fully booked show floor at Messe Berlin. The mood among exhibitors was highly optimistic, not least given the expected order volume of 4.7 billion euro achieved during the six days of the event. IFA Berlin is closing its doors on 6 September.

Once again, IFA 2017 demonstrated that it is a key driving force for both brands and retailers. In the run-up to the industry's most important sales season, the high order volumes seen in Berlin point to a strong and positive end-of-year business. IFA was also the showcase for numerous innovations and product launches, which demonstrates that "IFA is and remains the ideal meeting place and market place for trade and industry," said Hans-Joachim Kamp, Chairman of the Supervisory Board of the IFA organizer, gfu Consumer & Home Electronics GmbH.

"IFA has strengthened its role as the world's most important trade show in this anniversary year, with the tenth edition of Home Appliances@ IFA. It just shows the extraordinary contribution of the event to the expected positive development in the global market for domestic appliances," said Dr. Reinhard Zinkann, Chairman of the ZVEI

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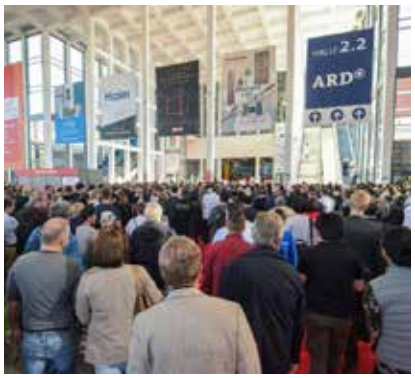



**IFA 2017 -** South Entrance

**Source: Messe Berlin**

Association for Electric Appliances and CECED President.

"By bringing together the world´s great innovators, brands, technologies, products, entrepreneurs and media all in one place, IFA is the most efficient platform to tell your story worldwide – whether you are a start-up or a long-established brand," said Dr. Christian Göke, CEO of Messe Berlin. "We are extremely happy with the enthusiasm and energy shown by all our exhibitors."

## Exceptional global media awareness

Journalists from more than 70 countries came to Berlin to report on the flood of new and innovative products and technology trends shown this year at IFA.

Jens Heithecker, IFA Executive Director, said: "IFA is the global powerhouse for innovation, and the volume of media coverage around the world just serves to underline IFA's global importance. In 2017, we welcomed 6,000 journalists here in Berlin, and nearly 2,800 came from more than 70 countries."

IFA's Global Broadcast Center played host to broadcasters from all around the world, including news agencies such as AP and Reuters, public broadcasters from the EBU and commercial broadcasters partnering through ENEX. Among the broadcasters reporting from IFA were Al Jazeera from the United Arab Emirates, Nine Network from Australia, CCTV and Tianjin TV from China, 01net TV, LCI, BFM TV and OUATCH.tv from France, Eurosport, the BBC and BeIn Sport from the UK, RAI from Italy, NHK from Japan, YTN and KBS from South Korea, IBA International from Israel, TRT from Turkey and NDTV from India as well as US broadcasters CNBC / NBC and CNN.

## Huge Success for IFA Global Markets

This year also saw a huge success for IFA Global Markets, which brings together OEMs and ODMs at one location in the heart of Berlin, in what is now Europe's largest sourcing and supply chain event for the consumer electronics and home appliances industry.

The CEO of Messe Berlin, Dr.


**IFA Opening Press Conference 2017 –** Dr. Christian Göke, Chief Executive Officer Messe Berlin; Dr. Reinhard Zinkann, Chairman of the Household Appliances Division at ZVEI; Miss IFA; Hans-Joachim Kamp, Chairman of the Supervisory Board of gfu; Melinda Crane, Moderator; Jens Heithecker, IFA Executive Director (l.t.r.)


**IFA Opening Press Conference 2017 –** Hans-Joachim Kamp (chairman of the board, gfu), Miss IFA, Dr. Christian Göke (CEO, Messe Berlin), Jens Heithecker (IFA Executive Director) with Cosplayer, break dancer and the olympic champion rowing, Karl Schulze

**Source: Messe Berlin**

Christian Göke, described the event as "absolutely impressive". "This year, IFA Global Markets truly made a quantum leap, both in terms of size and quality," he said.

"Our exhibitors are thrilled," said Zhang Jing, director of the Chinese Chamber of Commerce, who supports 150 IFA Global Markets exhibitors. "Just an hour after the opening, my exhibitors already had some of the biggest and most important customers at their booths," she said.

Changwoo Yoon, senior researcher at the Korean Electronics and Telecommunications Research Institute praised the high quality of the event: "Last year, we gained a large company from China as an important customer. IFA Global Markets is an opportunity for us to meet global companies all in one space."

With IFA Global Markets, the growing B2B segment of OEM / ODM manufacturers has an exclusive new home at STATION Berlin. Compared to last year, the size of IFA Global Markets doubled, and still the event was fully booked.

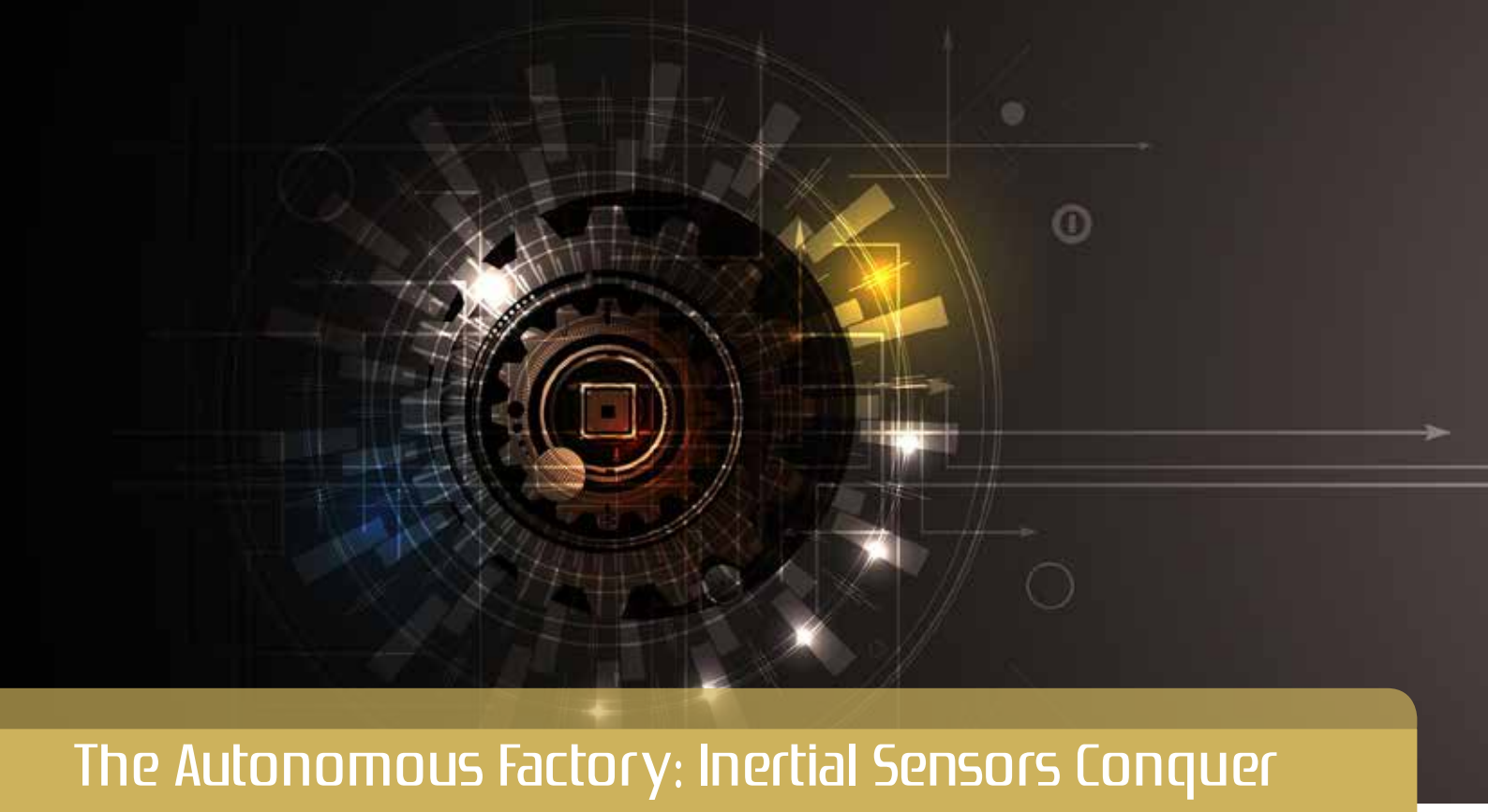
## Sensational Kick-Off for IFA NEXT

However, the biggest success was arguably delivered by a new concept - IFA NEXT, which exceeded all expectations. From the very first day, IFA's new innovation hub was hugely popular with all visitors, bringing together a full range of 130 start-ups, 70 companies, as well as industry alliances, organizations and research facilities.

IFA NEXT benefited from the fact that it was based right next to the venue for all IFA Keynotes, the IFA + Summit congress as well as IFA guest conferences. The layout of the new venue gave the event an extra boost, making IFA NEXT an attractive location for both exhibitors and visitors. The open layout of the hall, with clear paths leading to the stage at its center, together with the modern, modular design of the stands, all contributed to the overall impression that this was a marketplace for ideas and the perfect meeting point for a lively community of innovators. Many international encounters, together with visits by ambassadors from Japan and Korea, and leading politicians and business leaders provided plenty of buzz for all at IFA NEXT. The great feedback from journalists also underlined that IFA NEXT is a fantastic platform for innovators of all sizes.

Exhibitor statements will soon be available online.

IFA 2018 will take place from 31 August to 5 September.



# The Autonomous Factory: Inertial Sensors Conquer IoMT Challenges

› Bob Scannell

**Building around location-aware, industrial smart sensors helps boost the quality and accuracy of information retrieval, leading to much more efficient machine automation.**

The automation of industrial machinery, whether it be in manufacturing, agriculture, logistics, energy, automotive, or unmanned aerial vehicles, promises great gains in resource efficiency, equipment accuracy, and safety. Key to enabling these gains is the identification of the appropriate sensing technologies to enhance the contextual knowledge of the equipment's condition.

Since location or position of the equipment is also a valuable input to the equation, precision inertial sensors hold the promise of essentially pinpointing location or maintaining accurate positioning. Coupling both the location and the contextual sensor information is of substantial value in applications where mobility is a factor.

In many situations, the determination of position while operating in a complex or harsh environment is of especially critical value. The Internet of Moving Things (IoMT) has many challenges on the path to great efficiency gains, and high-performance inertial sensors are helping make the difference.

## Sensors Propel Machine Automation

As machinery has evolved from making simple passive measurements, to containing embedded control functions, and now on to fully autonomous operation, sensors are playing an enabling role. Whether for simple measurement supporting offline analysis, or for process control, many such sensors worked sufficiently in isolation.the reference (master) clock and the end application.

The illustration below gives an example of how this specification can be broken down to provide equipment specifications for Grand Master devices, PTP aware network switches/routers (Boundary or Transparent Clocks), and slave functionality at the server (likely integrated into a NIC).

Dependent on the number of network hops between the end points of the network, BC and TC performance limits can vary by application and deployment. As per the illustration, 5 hops would give a per device limit of ±600ns / 5 = 120ns per device.

The desire to extract real-time benefits, and the availability of an

increasingly wide breadth of sensing types and efficient processing, has brought about important advances in sensor fusion to best determine context across multiple application/environmental states. Finally, in complex systems involving the interaction of multiple platforms, and requiring knowledge of past system states, advances in connectivity are supporting increasingly intelligent sensor systems (Table 1)

These intelligent and accessible sensor systems are revolutionizing what would otherwise be mature industries, turning agriculture into smart agriculture, infrastructure into smart Infrastructure, and cities into smart cities. As sensors are deployed to gather relevant contextual information in these environments, new complexities arise in database management and communication, requiring sophisticated fusing not just from sensor to sensor, but across platforms and across time (examples include cloud-based analytics of an infrastructure's condition over time, last year's crop yield, or traffic conditions and patterns) (Fig. 1).

In some cases where mobility is important, geolocating this contextual sensor data is then required. In fact, little of the Internet of Things can be considered "static." Equipment in factories, fields, and hospitals is more useful when mobile, and an optical sensor on a geographically static piece of equipment is still likely locally mobile, requiring steering/pointing.

This IoMT (Table 2) fuses contextual and positional data, and essentially amplifies the usefulness of the data, and the efficiency gains. As an example, for analyzing yield enhancement opportunities, imagine the difference in relevance of knowing the temperature, moisture, and precise location of an individually planted seed, versus simply knowing the temperature and soil condition of a field of randomly planted seeds.

**Table 1: Sensor Integration and Connectivity Levels**

| | |
|---|---|
| Sensor | Basic, single, sensing element |
| Multisensors | Identification of multiple sensing types, to fit application need |
| Fused sensors | Using one sensor to correct another, or state-driven handoff between sensors |
| Smart sensors | Localized, embedded processing, supporting real-time analysis, and decision |
| Connected sensors | Communication links support cross-platform information sharing |
| Intelligent sensors | Leverage of information across time (for example: cloud, databasing) to adapt and learn |

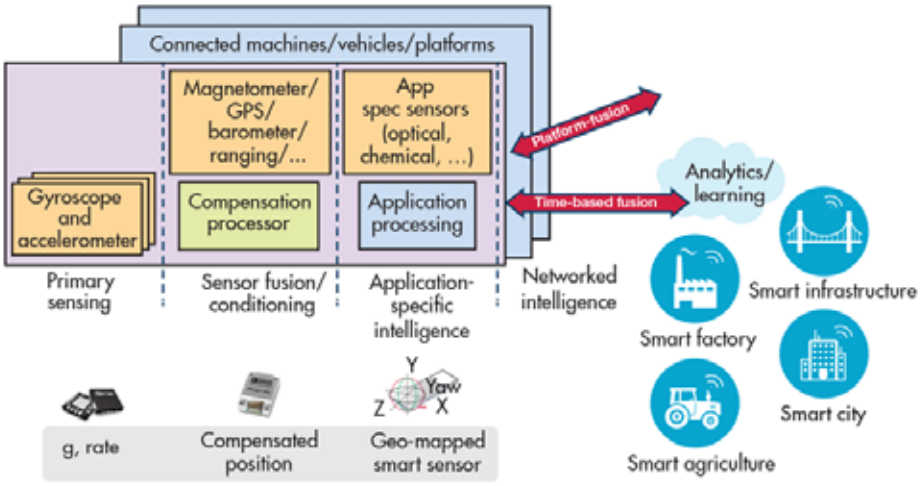



**Figure 1.** Inertial measurement units serve a critical stabilization and positioning role in applications where other traditional sensors have limitations.

**Table 2: Accurate Positioning Coupled with Context, Enabling the Internet of Moving Things**

| IoT Contextual Sensors | | Position Sensors | | |
|---|---|---|---|---|
| Temperature | | Inertial | | |
| Optical | | GPS | | |
| Chemical | + | Magnetometer | = | IoMT |
| Gas | | Barometer | | |
| Vibration | | Ranging | | |
| Other | | Other | | |

## Inertial Sensors within Smart Machines

Inertial sensors serve two primary functions within most Smart Machines: equipment stabilization/pointing or navigation/guidance (Fig. 2). (A separate and important use is for vibration analysis and condition monitoring, which is covered separately.)

While GPS may be considered the navigational aid of choice for most systems due to its ubiquity, in fact

for many industrial systems, there exist significant concerns to relying on GPS, primarily due to potential blockages. Transitioning to inertial sensing during a GPS blockage is effective, but only assuming the inertials are of sufficient quality to provide adequate precision for the duration of the outage. In the case of a stabilization/servo loop, inertial sensors may be relied on in the feedback mechanism to maintain a reliable pointing angle of an antenna, crane platform, construction blade, farming implement, or camera on a UAV.

In all of these examples, the purpose goes beyond providing a useful feature (e.g., gesture control in a mobile phone), to delivering critical accuracy or safety mechanisms in the midst of incredibly difficult environments (Table 3).

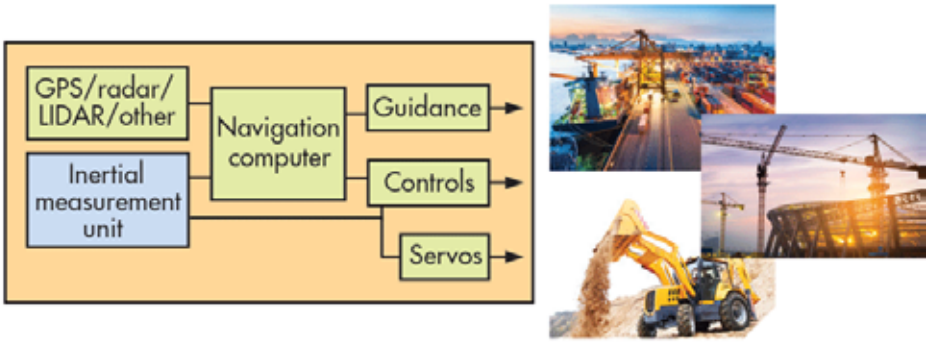



**Figure 2.** Inertial measurement units serve a critical stabilization and positioning role in applications where other traditional sensors have limitations.

**Table 3: Challenges for Sensors in Environmentally Challenged Industrial Apps**

| Key Challenges |
| --- |
| Centimeter-level accuracy in midst of GSP blockage |
| Maintain accuracy even under vibration, temperature extremes, wind, etc. |
| Reliable, safe operation, all conditions |

## Sensor Quality Matters

There is a myth, or perhaps dream, that sensor-fusion algorithms can be used to essentially "code" good performance into otherwise marginal sensor technology. Sensor fusion can be used for some corrections; for instance, a temperature sensor to correct for temperature drift of another sensor, or an accelerometer (g) sensor to correct for gravitational effect on a gyroscope.

Even in these cases, though, this actually only calibrates the given sensor to the environment. It doesn't improve its inherent ability to maintain performance between calibration points, it only interpolates it. A poor quality sensor typically drifts rapidly enough whereby without extensive/expensive calibration points, accuracy falls off quickly.

Nevertheless, some amount of calibration is typically desired even in high-quality sensors to extract the highest possible performance from the device. The most cost-effective approach to doing this depends on the intricate details of the sensor, and a deep knowledge of the motion dynamics (Fig. 3), not to mention access to relatively unique test equipment. For this reason, the calibration/compensation step is increasingly seen as an embedded necessity from the sensor manufacturer.

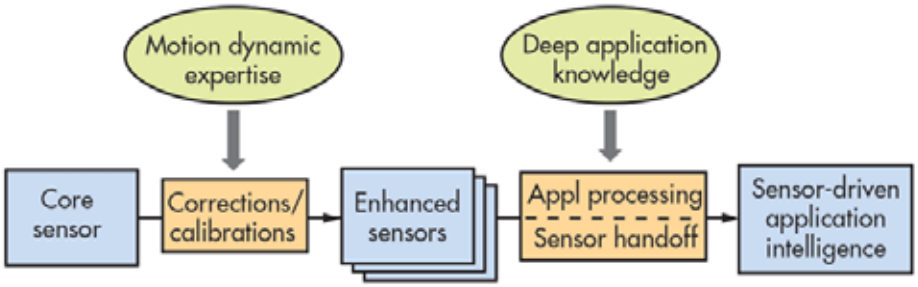



**Figure 3.** Extracting valuable application-level information from inertial sensors requires sophisticated calibrations and high-order processing.

A second significant step in the path of converting basic sensing outputs into useful application-level intelligence is state-driven sensor handoff. This requires expansive knowledge of the application dynamics, as well as the capabilities of the sensors, in order to best determine which sensor can be relied on at any given point in time. Figure 4 illustrates a conceptual example of the role of sensor fusion in an industrial application. Here, for a precision-driven industrial

application, a careful selection of sensors has been done to support an expected need to operate within high potential GPS-blockages, and potentially difficult magnetic and other environmental disturbances. For this reason, the infrastructure-free nature of inertial sensors is most heavily relied on, with other sensing aids chosen to support specific environmental challenges, and to help correct for any long term inertial drift.

While it's preferable to plan sensor selection to allow for precise tracking under all conditions, this is practically impossible. Thus, the small segment of "uncertainty" is still retained in the scenario planning. The algorithms exist for valuable sensor calibrations, as well as to manage the sophisticated sensor-to-sensor handoff driven by the application state.

Ultimately, the end application will dictate the level of accuracy required, and the quality of sensor chosen will determine whether this is achievable. Table 4 contrasts two scenarios, illustrating the significance of sensor choice to not only the design process, but to the equipment precision. A low-precision sensor may in fact be suitable if it's only to be relied on in limited instances, and if the application has tolerance for error-i.e., if it's not safety- or life-critical, or if relatively imprecise accuracy is good enough.

Though most consumer level sensors have low noise and perform adequately in benign conditions, they aren't suitable for machinery subject to dynamic motion. This includes vibration, which in a low-performance inertial measurement unit can't be separated from the simple linear acceleration or inclination measurement that's desired.

To achieve accuracy of better than 1 degree, while operating in an industrial environment, the selection focuses to sensors that are designed specifically to reject error drift from vibration or temperature influences. Such a high-precision sensor is then able to support a larger span of the expected application states, and over longer time periods.

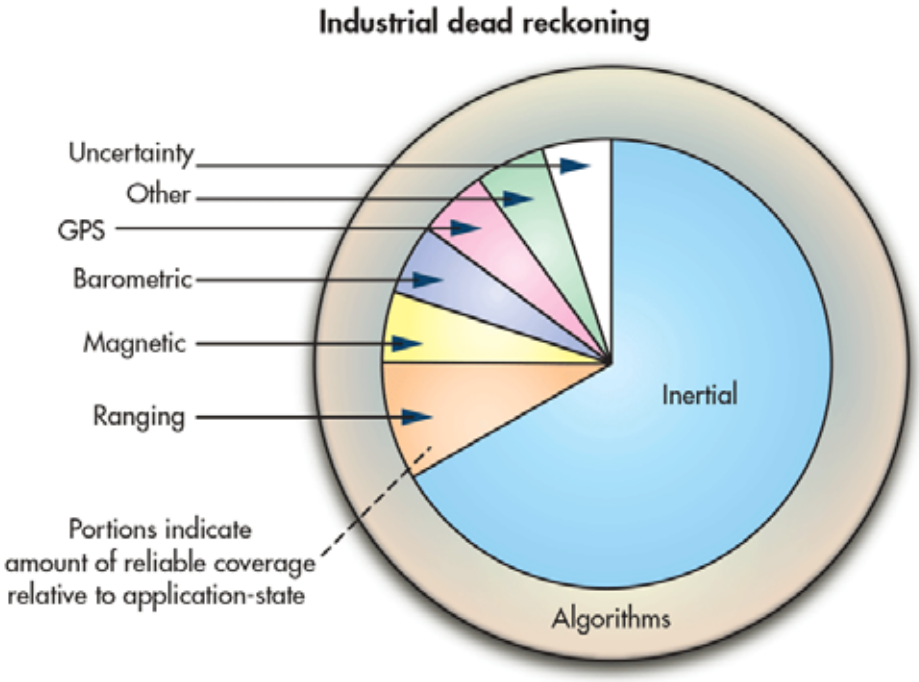



**Figure 4.** Sensor-fusion algorithms rely on precision sensors, properly chosen to support a specific application environment.

**Table 4: High-Precision Sensors in Industrial Apps with Mission-Critical Requirements**

| Inertial Sensor Quality | Characteristics | Role in Sensor Fusion | Accuracy after Sensor Fusion | Suitable for: |
|---|---|---|---|---|
| High precision | Ultra-low-noise, stable operation under all conditions | Primary sensor, heavily relied on, capable of supporting rugged/ unpredictable conditions | ~0.1° | Complex motion, long life, mission-critical |
| Low precision | Low to moderate noise, poor stability, unspecified drift under vibration, temp shock | Backup sensor with low weighting, restricted or conditional reliability | 3° to 5° | Simple motion, short life, error-tolerant use cases |

## High-Performance Inertials

Designing for performance needn't be exclusive of designing for efficiency in cost, size, and power. However, designing a microelectromechanical-system (MEMS) structure with a primary goal of cost reduction will typically

sacrifice performance, sometimes significantly. Some simple choices for reducing cost, such as less silicon mass and plastic encapsulated consumer packaging, are largely detrimental to MEMS performance.

Extracting accurate and stable information from a MEMS device like that in Figure 5 requires strong signal-to-noise ratio driven by silicon area and thickness, as well as minimized stress imposed to the silicon from the selection of component packaging through to system-level enclosures. With end-use performance requirements in mind at the onset of the sensor definition, the silicon, integration, packaging, and test/calibration approaches can be optimized to maintain native performance even under complex environments, and minimize cost.

Table 5 shows performance demonstrated in a mid-level industrial device, in comparison to a typical consumer sensor that may be found in a mobile phone. (Note that higher-end industrial devices are also available which are an order of magnitude better than those shown.) Most low-end consumer devices don't provide specifications for parameters such as linear acceleration effect, vibration rectification, angular random walk, and others that actually can be the largest error sources in industrial applications.

This industrial sensor is designed for use in a scenario anticipating relatively rapid or extreme movement (2000-degree-per-second, 40 g), where a wide bandwidth sensor output is also critical to enable best discrimination of signal. Minimum drift of offset during operation (in-run stability) is desired to reduce the reliance on a larger suite of complementary sensors to "correct" performance, and in some cases, minimization of turn-on drift (repeatability) is

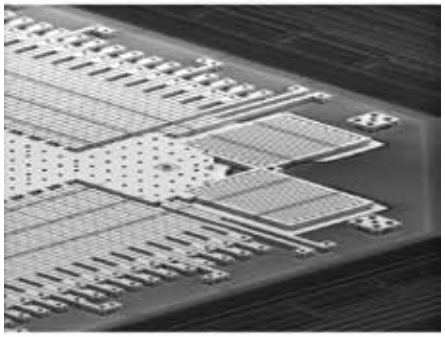


**Figure 5.** A MEMS structure is used for precision motion determination.

critical in applications that can't afford the time required for back-end system filtering corrections. Low-noise accelerometers are used in cooperation with gyroscopes to help distinguish and correct for any g-related drift.

The gyroscope sensors have actually been designed to directly eliminate the effect of any g-event (vibration, shock, acceleration, gravity) on the device offset, providing a substantial advantage in linear-g. And, via calibration, both temperature drift and alignment have been corrected. Without alignment correction, a typical multi-axis MEMS device, even when integrated into a single silicon structure, can be misaligned to the point of being the major contributor to an error budget.

While noise has become less of a distinguishing factor among sensor classes in recent years, parameters such as linear-g effect and misalignment, which are most costly to improve, either through a silicon design approach or part-

**Table 5: Improvements Achieved with Industrial MEMS Devices**

| Parameter | Typical Industrial Specification | Units | Delta Improvement over Typical Consumer Device |
|---|---|---|---|
| Gyroscopes | | | |
| Dynamic range | Up to 2000 | °/sec | ~ |
| Noise density | 0.004 | °/sec/√Hz rms | 2× |
| Angular random walk | 0.2 | °/√Hr | 2× |
| In-run stability | 6 | °/hr | 3× |
| Bias repeatability | 0.2 | °/sec | 100× |
| –3 dB bandwidth | 465 | Hz | 2× |
| | | | |
| Accelerometers | | | |
| Dynamic range | Up to 40 | g | 3× |
| Noise denisty | 25 | micro-g/√Hz rms | 10× |
| Velocity random walk | 0.03 | m/s/√Hr | 10× |
| In-run stability | 10 | micro-g | 10× |
| Bias repeatability | 25 | mg | 100× |
| –3 dB bandwidth | 500 | Hz | 2× |
| | | | |
| Axial alignment | 0.05 | deg | 20× |
| Linear acceleration effect | 0.01 | °/sec/g | 10× |
| Vibration rectification | 0.004 | °/sec/g$^2$ | 10× |
| Sensitivity tempco | 25 | ppm/°C | 10× |
| Bias tempco | 0.007 | °/s/°C | 10× |

specific calibration, become noise adders in any application beyond simple or relatively static motion determination. Table 6 provides a use-case example comparing an actual industrial MEMS inertial measurement unit (IMU) to a consumer IMU, both of which have relatively strong noise performance. However, the consumer device isn't designed or corrected for vibration or alignment.

The example shows the device specification, and its impact on the error budget based on the stated assumptions. The total error is a root sum square of the three illustrated error sources. As can be seen, linear-g and cross-axis (misalignment) dominate the error in the case of the consumer device, whereas the industrial device is better balanced. Ultimately a minimum of 20X difference in performance is realized, without looking at additional potential error sources of the less-rugged consumer product.

## System Tradeoffs

The majority of complex motion applications require a full IMU (three axes of both linear acceleration and angular rate motion) to adequately determine positioning. IMU functionality is available today in both chip-level (consumer) form, and in module level integration (industrial) (Fig. 6). Though logically it may seem that the consumer chip-level IMU is more advanced in system integration, the opposite is in fact true when the end goal is accurate motion determination in a complex industrial environment.

In the case of the industrial IMU, high performance is available out of the box. The same high performance is reliably attained over the life of the application, with minimal

**Table 6: Reduction of Error with Industrial Devices**

Jitter = RSS of noise + vibration + cross-axis sensitivity

| Example IMUs | Industrial | | Consumer | |
|---|---|---|---|---|
| Performance | Spec | Impact | Spec | Impact |
| Noise density (°/sec/√Hz) | 0.004 | 0.036 | 0.0100 | 0.089 |
| Linear-g (°/sec/g) | 0.01 | 0.020 | 0.100 | 0.200 |
| Cross-axis (%) | 0.09% | 0.090 | 2.00% | 2.000 |
| Projected error (°/sec) | | 0.099 | | 2.012 |

Best case; does not include other drift factors

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

requirement, if any, for in-system correction. The consumer IMU, though seemingly fully integrated and complete, requires significant added time, integration, and cost (Fig. 7) to attempt to achieve similar levels of performance (typically not even possible), and likely still never achieves equally reliable operation.

## Conclusion

Location-aware industrial smart sensors are bringing about tremendous efficiency gains within machine automation. Accuracy and reliability at the system level is primarily a function of the core sensor quality, not the systems and software wrapped around it. Nonetheless, the overall integration, embedded software, and connectivity of the approach, when built around quality sensors, allows intelligent sensing solutions that can greatly enhance the quality and utility of information, without sacrificing equally important safety and reliability.


**Figure 6.** The ADIS16460, a six-degree-of-freedom IMU, is specified for precision even within complex and dynamic environments.


**Figure 7.** Low component cost of consumer sensors becomes burdened by necessary system-level expenditures, and ultimately reliability and performance tradeoffs.

# Reduce Your System-Level Design Verification Effort Using PSpice and MATLAB Integration

› Kishore Karnane and Alok Tripathi, Cadence

Simulation tools are of great assistance to engineers and researchers and they reduce product-development cycle time, improve design quality, and simplify analysis without costly and time-consuming experiments and physical setup. Increasing design complexity, shorter design cycles, and pressure to reduce costs are taking design simulation challenges to the next level. In today's design world, a designer cannot just rely upon the simulation and optimization of individual blocks and hope that these different blocks will work to design specifications when assembled together. The majority of system design issues are detected at the initial prototype stages and found to be at the interconnect level. A well-integrated powerful modeling and simulation environment would enable designers to identify and correct these issues at the design stage.

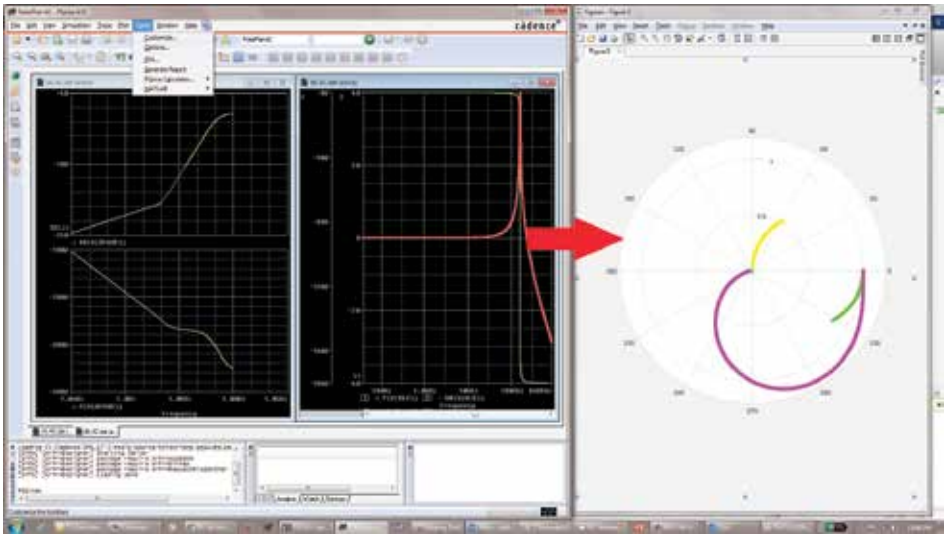
Any conventional electronics or electro-mechanical system can be modeled mathematically or electrically. Let's take the example of a Hybrid Electrical Vehicle (HEV) system to understand this better. The design for such a system requires modeling and simulation capabilities for various non-electrical systems, such as engine, transmission, fuel consumption and emission control, braking, and a variety of electrical systems. The electrical systems include inverters, converters, control logic that uses semiconductor devices (such as IGBT and precision electronics components), ADC/DAC, etc.

Currently, no single tool offers the ability to model and simulate both systems together. Co-simulation between different toolsets to model these diverse sets of modules is one way forward. In this space, MATLAB offers comprehensive capabilities to model and simulate automotive and other mechanical and thermal modules mathematically, and PSpice is renowned for its electronics and power semiconductor device modeling and simulation capabilities. The PSpice 17.2-2016 release enhances the existing PSpice-MATLAB co-simulation interface to a well-integrated, bidirectional co-simulation flow. This flow enables designers to use these two tools together in different configurations.

At the initial stages of the HEV design, the engine and other mechanical systems are designed and optimized as standalone blocks in MATLAB, and all electrical systems are designed in PSpice as standalone modules. A typical HEV electrical system consists of a battery, power

converter, inverter, an electric motor, and a set of sensors, and is designed using a true electrical simulator, such as PSpice. Simulating an electrical subsystem using PSpice offers significant advantages over simulating with a mathematical computation tool. With the PSpice Designer's exhaustive built-in device libraries, designers save significant time in modeling semiconductor devices, and simulation results are much closer to the prototype results. Additionally, the designers can optimize these electrical modules for various operating and environmental conditions to match physical systems. This electrical system and its control logic can be efficiently simulated using PSpice to optimize super capacitor size, DC/DC converter voltage range, PWM control, and the overall control logic. Once this design cycle is complete, the traditional design flow is to take these subsystems at the prototype stage and start refining the design to resolve interconnect issues. Using this new system design flow, designers can now take a model-based design approach to the next level of virtual prototyping by interconnecting these subsystems that were developed by different teams using different tools (MATLAB and PSpice/SPICE), and simulate the full HEV together using PSpice Simulink.

The regenerative braking system is a critical block of the HEV system. To recover maximum energy, one needs to simulate bidirectional DC/DC converters over a wide range of voltage variations. Let's look at the regenerative braking module closely to see the real advantages of co-simulation. During the regenerative braking phase of functioning and recovering energy, the electrical system is highly dependent on the vehicle's mechanical and operating conditions, such as brake force distribution, aerodynamics resistance, rolling resistances, the slope of the road, and the vehicle speed and weight. These behaviors would have already been modeled and simulated in the mathematical world (MATLAB). Thus co-simulation of these two systems eliminates any assumption and provides a true virtual prototype environment. One can just interconnect these two without worrying about redeveloping these models using SPICE, resulting in huge savings in modeling time and in the analysis of the system as a whole.



**The PSpice Systems option enables the transfer of PSpice analysis data into MATLAB with the click of a button**

Since co-simulation consumes respective models as-is without any translation, an additional advantage is that the designs get reused and simulations are done with updated models without requiring any additional effort.

The PSpice Systems option also enables designers to transfer PSpice analysis data into MATLAB with the click of a button to generate customize plots in MATLAB and to perform complex calculations with simulation data in PSpice environment using MATLAB functions. This solution provides three key benefits. Designers can:

1. Utilize all post-process MATLAB analysis and measurement functions in a single, integrated system design and debug environment.
2. Simulate the algorithmic and circuit/electrical-level blocks together reusing test benches, signal sources, and common measurements.
3. Perform functional verification of full system. Using the new flow improves the designer's productivity and the quality of simulations. Time to market gets reduced.

Consider any complex system, such as a wave energy system, grid-tie inverters (GTIs) with wind turbines, solar energy systems, or IoT-based systems—a designer must model several modules in an integrated environment for each of them. The approach described here applies to all these and similar applications.

To summarize, this new PSpice system option enables modeling and simulation of a multi-domain system into one integrated environment.

# Combining MMIC Reflectionless Filters to Create Ultra-Wideband (UWB) Bandpass Filters

› Brandon Kaplan, Mini-Circuits, Matt Morgan, National Radio Astronomy Observatory, Tod Boyd, National Radio Astronomy Observatory

## UWB: Background and Emerging Applications

Ultra-Wideband (UWB) radio is defined as any RF technology utilizing a bandwidth of greater than ¼ the center frequency or a bandwidth greater than 500 MHz [1] [2]. While UWB has been a known technology since the end of the 19th century, restrictions on transmission to prevent interference with narrow-band, continuous wave signals have limited its applications to defense and relatively few specially licensed operators [1]. In 2002, the FCC opened the 3.1 to 10.6 GHz band for commercial applications of Ultra-Wideband technology, and since then UWB has become a focus of academic study and industry research for a promising variety of emerging applications. To prevent interference with neighboring spectrum allocations like GPS at 1.6 GHz, the FCC has imposed specific rules for indoor and outdoor transmission of UWB signals, limiting transmissions in the permitted frequency range to power levels of -41 dBm/MHz or less.

Research to date has explored many potentially valuable applications for UWB technology. For example, the wide bandwidth of UWB provides high channel capacity, allowing very high-speed data transfer at very low power. While the FCC power mask limits the range of UWB transmission to within roughly 10 meters, its high-speed, low-power characteristics have made UWB an attractive technology for certain short-range M2M communication applications like Wireless Personal Area Networking (WPAN) as well as low power sensor networks.[1]

UWB has also proven viable as a technology for new applications in detection, positioning and imaging. Modulation of UWB signals using ultra-short pulses in the order of nanoseconds enables precise location and ranging at the centimeter level [1] [6]. This capability has useful potential for military surveillance systems and other high-accuracy location and detection applications. The same high-resolution, high-penetration properties have also attracted research in the medical field, and a number of medical imaging applications have shown successful results. UWB systems have been used for non-invasive, precise detection of heart movements, and high-fidelity imaging using safe, non-ionizing radiation as an alternative to more harmful X-ray imaging.[3]

# New-Tech Europe

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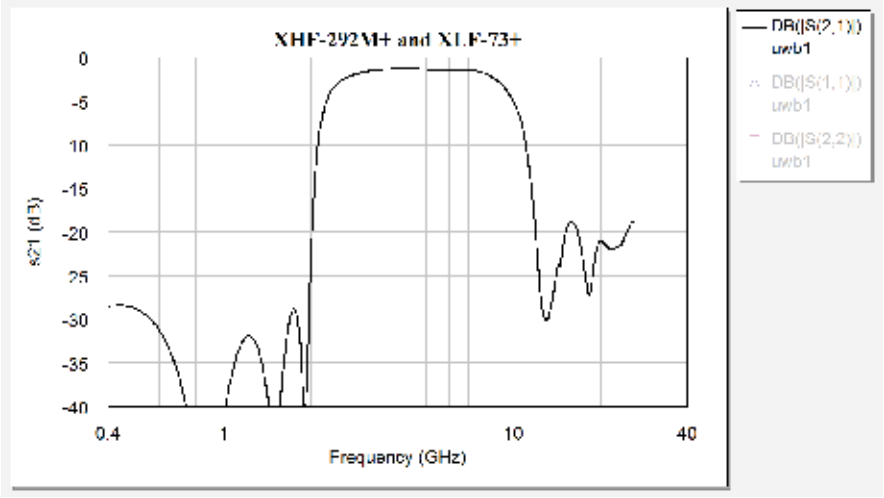


**Figure 1:** Simulation of band pass response combing XHF-292M+ with XLF-73+.

## Suitability or Reflectionless Filters for UWB RF Front End

While UWB technology has shown much potential, many design challenges remain in bringing the technology to a stage of wider industry adoption and commercialization. One of those challenges has been developing RF filters with a wide enough passband, flat response over the whole band, and sufficient selectivity to meet FCC specifications. Several approaches have been studied to achieve the desired response utilizing microstrip technology [2] [4] [5]. While these approaches have achieved varying degrees of success, they each come with drawbacks. Microstrip UWB filter designs typically occupy greater than a square inch of board space and tend to be costlier than practical for volume production.

Mini-Circuits' reflectionless filters present an attractive alternative to existing approaches for UWB filters. Because reflectionless filters absorb and terminate stopband signals rather than reflecting them back to the source, they give designers the ability to cascade filters in multiple sections without generating standing waves due to impedance mismatch between stages and other undesirable effects. This characteristic allows combination of low pass and high pass filters to create a bandpass response, a technique that becomes useful for the purpose of designing UWB filters.

In addition to their intrinsic cascadability, reflectionless filters are uniquely suited for UWB filter designs for at least three reasons. First, reflectionless high pass filters have broad enough passbands to achieve the desired bandwidths for UWB; most other filter technologies do not. Second, the low pass filters offer cut-offs that extend high enough in frequency to achieve 3 dB bandwidths well above 100%. Finally, the good impedance match at the band edges allows multiple filters to be cascaded in series without causing distortion of the passband shape, whereas cascading conventional filters can often create standing waves between stages and introduce passband ripple and phase instability.

Moreover, while competing approaches employ transmission lines, reflectionless filter topologies are based on lumped elements and produced using MMIC technology resulting in much smaller size, lower cost, and excellent repeatability, making them suitable candidates for volume production. Models are available in package sizes as small as 2x2mm and in bare die format for chip and wire integration.

With these advantages in mind, this article explores possibilities for use of reflectionless filters in UWB filter design. Five case studies are presented using standard reflectionless filter models available off the shelf from Mini-Circuits. Simulation results and measured data are presented to illustrate the various advantages of reflectionless filters in UWB applications. Finally, a design is presented that meets UWB bandwidth requirements and conforms to the specifications of the FCC spectral mask.

## Case 1: General Proof of Concept

To illustrate the technique, two reflectionless filters were combined to create a bandpass response. In this case, high pass model XHF-292M+ and low pass model XLF-73+ were used. The preliminary simulation shown in figure 1 exhibits a 3 dB passband from 2.3 to 9.7 GHz (4.2:1 or 123% bandwidth).

To validate these results, the filters were mounted on a test board as shown in figure 2. Insertion loss and input / output return loss were swept from 0.1 to 40 GHz and again from 45 MHz to 2 GHz, the later with fine resolution to capture the low frequency details. The measurement was then corrected for the fixture by subtracting the measured loss of a straight thru-line.

The measured data for this filter is plotted in figure 3, with insertion loss in black. The response confirms the simulation results, exhibiting a 3 dB bandwidth of roughly 2.4 to 9.7 GHz (121% or 4:1). As expected, cascading the units shows no effect on the flatness of the passband. The higher rejection on the low end is due to the two-section design of

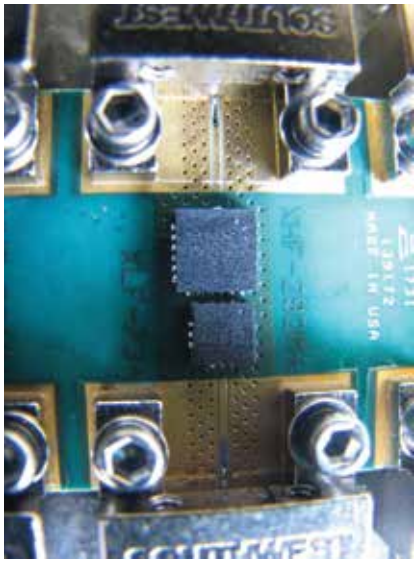

**Figure 2:** Test board for XHF-292M+ and XLF-73+

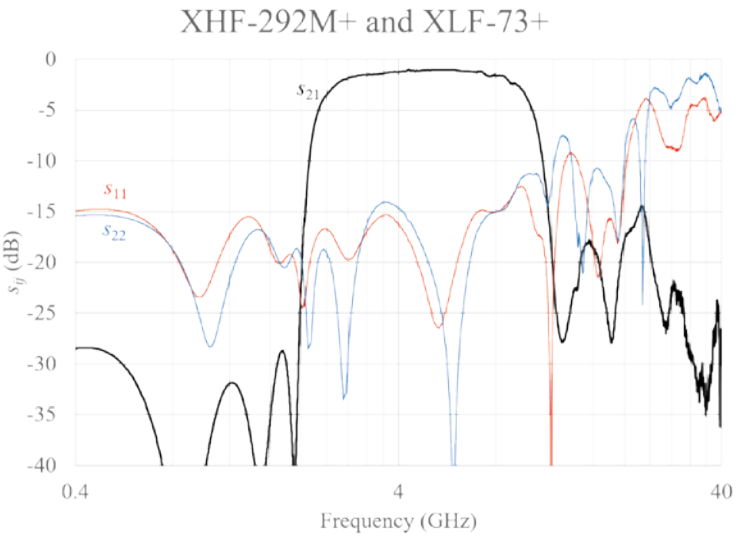


**Figure 3:** Measurement plots of S21 (black), S11 (red), and S22 (blue) for combined XHF-292M+ and XLF-73+, exhibiting a bandpass response with roughly 121% bandwidth.

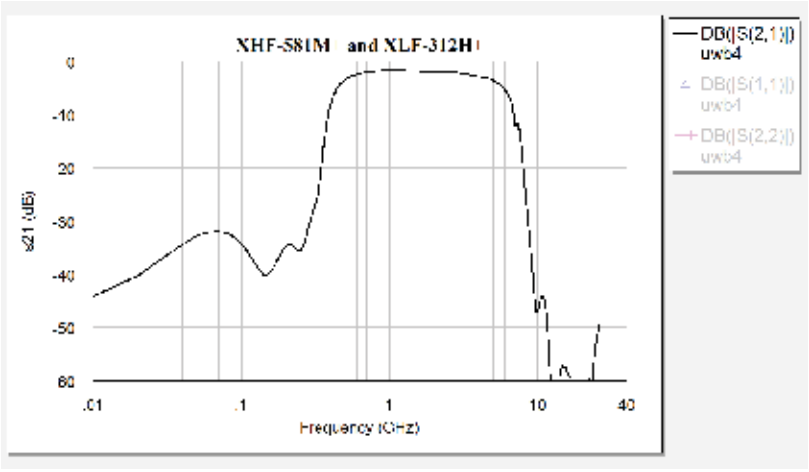


**Figure 4:** Simulation of band pass response combining XHF-581M+ and XLF-312H+

the high-pass filter used in this case. Input and output return loss are also plotted in red and blue, respectively, simply to highlight the good matching in the passband and the stopband, which is a differentiating feature of these filter designs.

## Case 2: Maximizing Bandwidth

Case 1 establishes the viability of the technique by combining high pass and low pass reflectionless filters to create an ultra-wideband bandpass response. By employing the same technique, we can now experiment with different models to shape the response and achieve desirable characteristics. In this case, we seek to create the widest passband possible with models available, combining two-section, high pass model XHF-581M+ and low pass, three-section model XLF-312H+. In addition to the wide bandwidth, because this filter incorporates two and three section designs, we also expect to see very high rejection in the upper and lower stopbands.

A simulation combining these two models in series is shown in figure 4, exhibiting a 3 dB passband from 450 MHz to 5.7 GHz (12.7:1 or 171% bandwidth). Note that a logarithmic frequency scale is used to better show the shape of the response. Also note the lower stopband rejection greater than 30 dB and upper stopband rejection reaching the 50 to 60 dB range, again a function of the two- and three-section designs used in this case.

The filters were mounted on the test board shown in figure 5, and again insertion loss, input and output return loss were swept from 0.1 to 40 GHz and from 450 MHz to 2 GHz at fine resolution to capture more detail at low frequency. The measurements were corrected for the fixture by subtracting the loss of a straight thru-line.

The measurement plots are shown in figure 6. Again, note the logarithmic frequency scale to better represent the filter behavior.

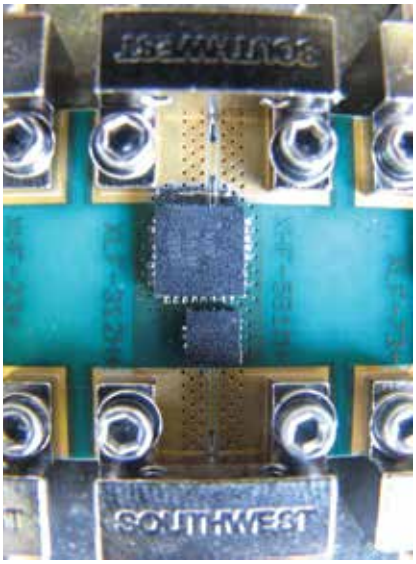


**Figure 5:** Test board for XHF-581M+ and XLF-312H+

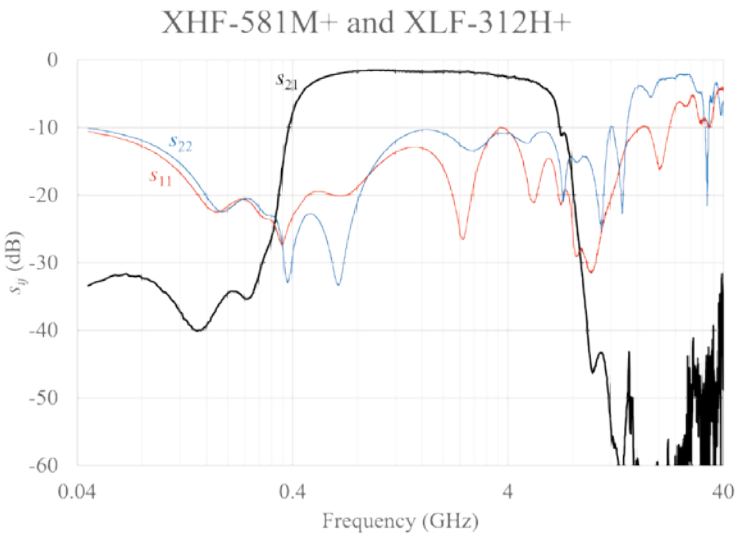


**Figure 6:** Measurement plots of S21 (black), S11 (red), and S22 (blue) for combined XHF-581M+ and XLF-312H+, exhibiting a bandpass response with roughly 165% bandwidth.

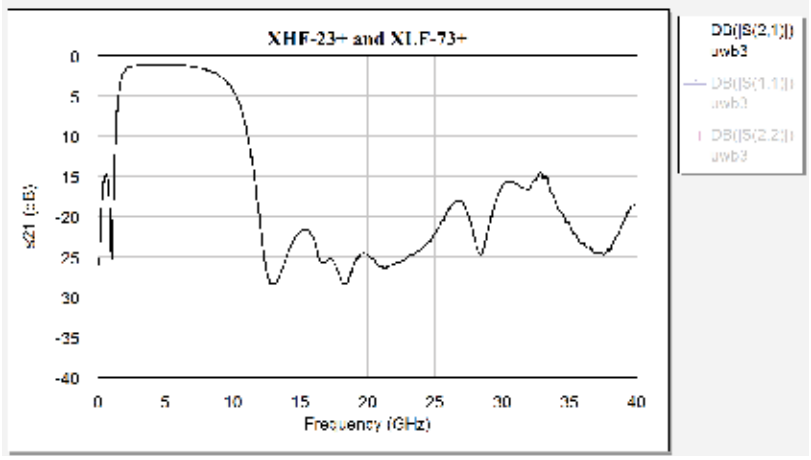


**Figure 4:** Simulation of band pass response combining XHF-23+ and XLF-73+

The filter achieves a 3 dB bandwidth from roughly 500 MHz to 5.2 GHz (10:1 or 165% bandwidth). The measured data exhibits a slightly narrower passband than the simulation, but still achieves full decade of bandwidth. As expected lower stopband rejection is between 30 and 40 dB, and upper stopband rejection ranges from 40 to greater than 60 dB. The passband shows excellent flatness with no distortion from adverse interactions between the filter stages.

## Case 3: Confirming Stopband Rejection up to 40 GHz without Re-Entry

It's clear from Cases 1 and 2 that combining reflectionless filters can achieve ultra-wide passbands, allowing bandwidth at least up to a full decade, amply supporting the bandwidth requirements of UWB applications. Another concern for system designers building UWB transmitters is the potential for "re-entry" out of band at higher frequencies. Such unintentional radiation can potentially interfere with signals at neighboring frequencies and violate the FCC rules. Therefore, UWB filters must exhibit good stopband rejection without re-entry up to a very high frequency.

Reflectionless filters offer advantages in this regard. In part due to their fabrication using MMIC technology, reflectionless low-pass filters provide stopband rejection extending up to 40 GHz. Many conventional filter approaches would suffer re-entry over this bandwidth. This characteristic allows us to create a UWB filter response that meets the FCC power mask up to 40 GHz without re-entry. In this case, we combine high pass model XHF-23+ and XLF-73+, both single section designs. S-parameter simulation for these models is shown in figure 7, exhibiting a 3 dB passband from 1.6 GHz to 10 GHz (6.25:1 or 145% bandwidth). Stopband rejection remains better than 15 dB up to 40 GHz without re-entry.

Figure 9 shows measured insertion

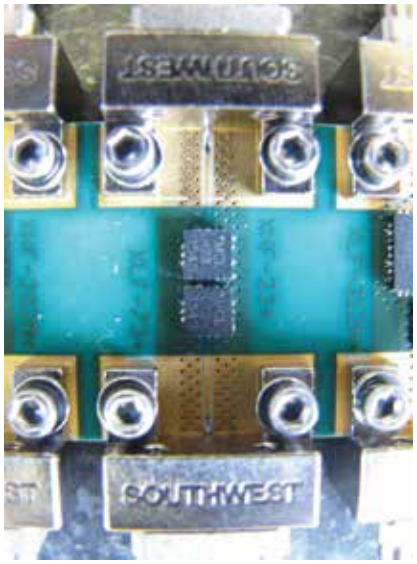


**Figure 8:** Test board for XHF-23+ and XLF-73+

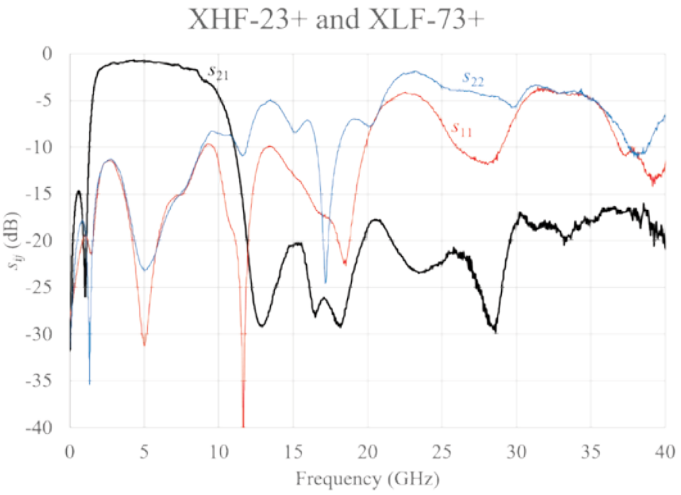


**Figure 9:** Measurement plots of S21 (black), S11 (red), and S22 (blue) for combined XHF-23+ and XLF-73+, exhibiting a bandpass response with roughly 138% bandwidth and good stopband rejection up to 40 GHz.

loss, input and output return loss for the two filters on the test board shown in figure 8. The same measurement method was used as in the previous cases. The measured response shows a 3 dB passband from roughly 1.7 to 9.3 GHz (5.5:1 or 138% bandwidth), with stopband rejection well above 15 dB up to 40 GHz. This result confirms that this technique can be used in UWB applications without unintentional emissions out of band due to re-entry.

## Case 4: Combining Reflectionless Filters and LTCC Filters to Sharpen Selectivity

We've shown that reflectionless filters can be combined to achieve ultra-wide passbands and that this approach provides excellent stopband rejection up to 40 GHz without re-entry. To come closer to the real-world requirements of a UWB system under FCC specifications, it may be necessary to sharpen the transition to conform to the FCC spectral mask.

The absorptive characteristic of reflectionless filters means that they're not only cascadable with other reflectionless filters, but also with all manner of conventional filters. This hybrid approach allows us to achieve the desired wideband response while incorporating the selectivity of another filter technology. In this case, we combine a two-section, high pass reflectionless filter (XHF-292M+) with a low pass LTCC filter (LFCW-1062+) to take advantage of the greater selectivity of the latter. Simulation results of this combination are shown in figure 10 along with the FCC spectral mask for indoor UWB transmissions (dotted line and right axis).

This combination exhibits a passband from 2.4 to 10.9 GHz (4.5:1 or 128% bandwidth). The deep rejection at the lower stopband below 2.4 GHz keeps transmissions

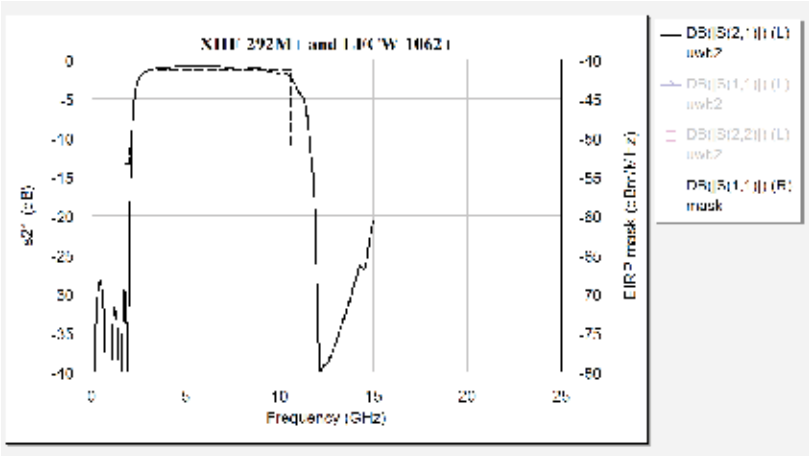


**Figure 4:** Simulation of band pass response combining XHF-292M+ and LFCW-1062+
with FCC spectral mask for UWB indoor transmissions (dotted line and right axis).

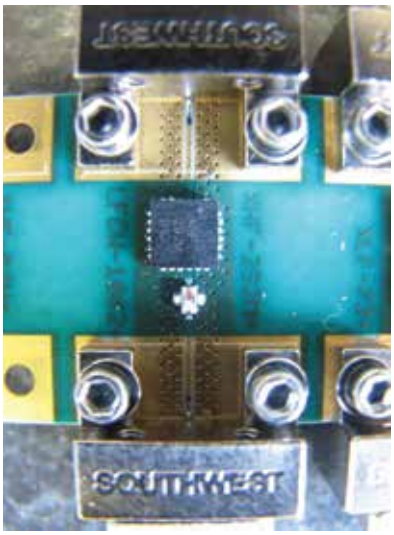


**Figure 11:** Test board for XHF-292M+ and LFCW-1062+

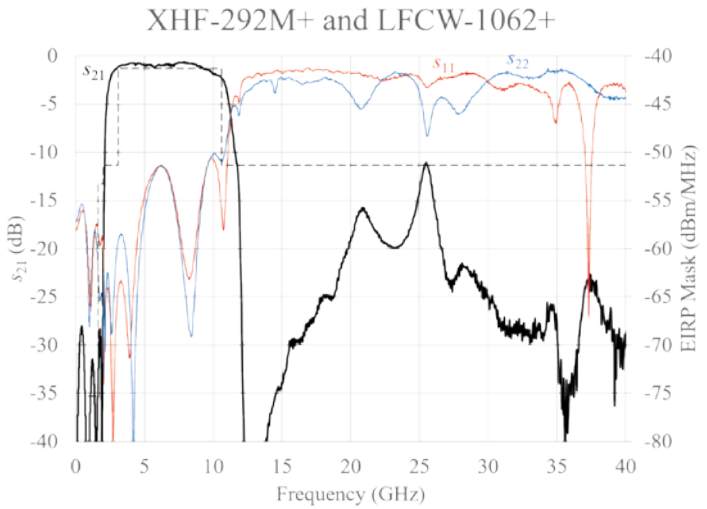


**Figure 12:** Measurement plots of S21 (black), S11 (red), and S22 (blue) for combined XHF-292M+ and LFCW-1062+, exhibiting a bandpass response with roughly 127% bandwidth and good stopband rejection up to 40 GHz. The FCC UWB spectral mask is shown as dotted line corresponding to right **axis.**

at neighboring frequencies like GPS at 1.6 GHz clean of emissions. Note that while the data for the LTCC filter stops at 15 GHz, it's clearly approaching some re-entry at that point. This is a trade-off of incorporating a different filter technology.

The test board for this filter combination is shown in figure 11, and the measured data for insertion loss, input and output return loss shown in figure 12. This filter has a measured 3 dB passband from roughly 2.45 to 10.9 GHz (4.5:1 or 127% bandwidth), very consistent with the simulation. Combination with the LTCC filter introduces a few noteworthy differences from the previous cases. First, the insertion loss suffers some re-entry around 25 GHz, enough to just cross the FCC limit. Also, the return loss in the upper stopband clearly degrades because the LTCC filter is fully reflective in its stopband.

Overall, the filter approaches the desired response for real-world UWB transmission, but is still a little wider than ideal. A similar approach with the right combination of filters may come closer to the ideal filter behavior.

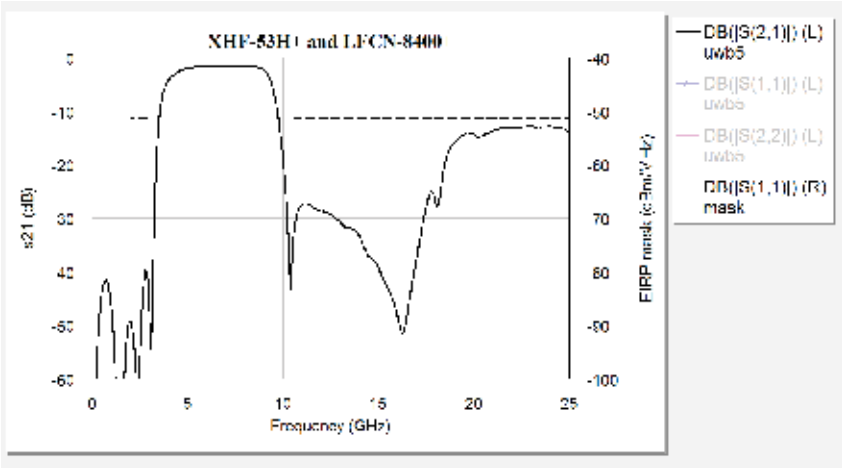


**Figure 13:** Simulation of band pass response combining XHF-53H+ and LFCN-8400+
with FCC spectral mask for UWB indoor transmissions.

## Case 5: UWB Filter Meeting the FCC Emission Mask for Indoor UWB Transmission

To realize filter response closer to the ideal for real-world UWB transmission, careful model selection led to a combination of three-section, high pass reflectionless filter, XHF-53H+ and low-pass LTCC filter LFCN-8400+. A simulation of these filters is shown in figure 13 with the FCC mask for indoor UWB transmission (dotted line and right axis). The simulated 3 dB passband is from 3.9 to 9.4 GHz (2.4:1 or 83% bandwidth). Although the LTCC filter does show some re-entry in the upper stopband, it isn't significant enough as to become a

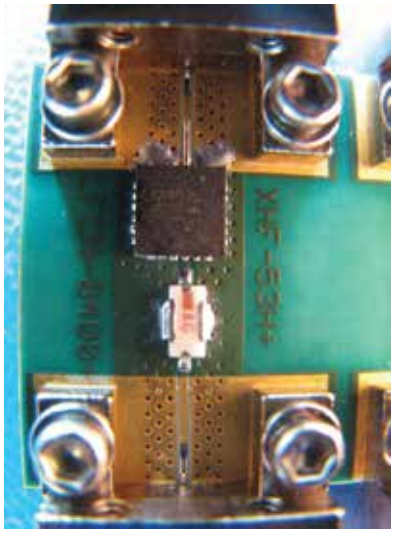


**Figure 14:** Test board for XHF-53H+ and LFCN-8400+

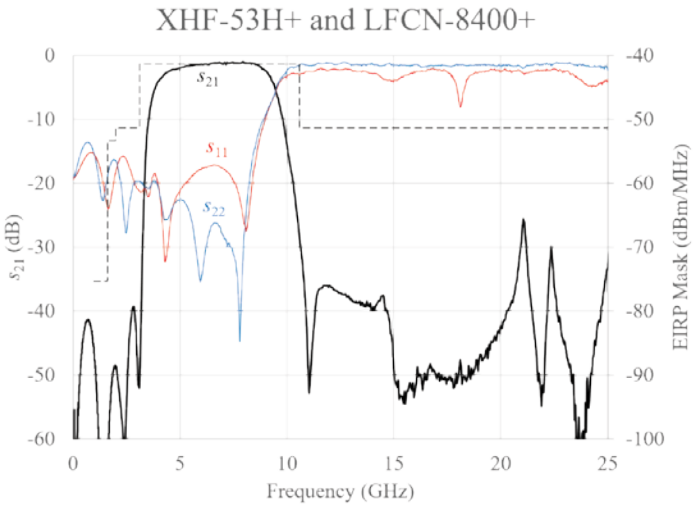


**Figure 15:** Measurement plots of S21 (black), S11 (red), and S22 (blue) for combined XHF-53H+ and LFCN-8400+, exhibiting a bandpass response with roughly 73% bandwidth and good stopband rejection up to 25 GHz. The FCC UWB spectral mask is shown as dotted line corresponding to right axis

secondary passband and remains well below the FCC mask.

The test board for this filter combination is shown in figure 14, and the measured data for insertion loss, input and output return loss is shown in figure 15. The filter response exhibits a 3 dB passband from 4.25 to 9.15 GHz (2.2:1 or 73%), and conforms nicely to the FCC spectral mask. Again, the reflectionless-LTCC hybrid approach comes with some tradeoffs that warrant mention. First, as expected the filter exhibits reflective behavior in the upper stopband as seen from the S11 and S22 plots above 9 GHz. Second, while the upper stopband achieves excellent rejection up to 25 GHz, it suffers some unexpected re-entry around the 30 to 35 GHz region. A different low pass filter model may suppress this re-entry at higher frequencies, but nonetheless, this example illustrates how reflectionless filters can be successfully cascaded with other filter designs to achieve the desired passband shape for UWB communications.

## Conclusion

The experiments in this article show how reflectionless filters provide a novel and highly viable approach to filter design for UWB front end applications. The examples shown all employ standard, catalog models available off the shelf from Mini-Circuits. Mini-Circuits currently offers over 50 reflectionless filter models from stock, and custom designs are available on request to refine performance to meet exact application requirements.

The approach demonstrated here provides designers several practical advantages over previously studied approaches. In addition to electrical properties that make reflectionless filters ideal for the requirements of UWB applications, the filters are smaller, less costly, and more repeatable relative to competing technologies, making them suitable candidates for use in commercial applications where volume manufacturability may be a requirement.

While this article highlights the specific suitability of reflectionless filters for UWB applications, it should also broaden the reader's appreciation for the flexibility of these innovative products as building blocks with many valuable advantages in RF system design, many of which still remain to be explored

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# DISTRIBUTED PLD SOLUTION FOR REDUCED SERVER COST AND INCREASED FLEXIBILITY

› Lattice Semiconductor

## Introduction

Servers come in many different types: From rack and blade versions to tower and modular configurations for high density computing. Ideally each server is optimized to perform its specific task. On closer observation, however, most server designs share a number of common characteristics. Typically, they feature multiple processors, hot swappable storage, wide range of peripherals connected to CPU and PCH via PCIe, security services, and power management resources to name just a few common elements. So, while designers appear to create very different solutions for various applications, in most cases, they are customizing a basic server architecture.

Fig. 1 below illustrates this common architecture. More often than not, server designers customize this basic architecture to meet the needs of different markets. The use of peripheral hardware blocks, system level interface blocks, BMC interfaces, and other key components may vary from one server design to another. However, the power management, control and glue logic function (shown as Socket Function #1) block consistently plays a key role in the customization of a design to meet specific application requirements. Designers need to modify functions such as power management, board specific glue logic, or I/O expansion for each server type. Although Socket Function #1 does not play a role in any of the payload functions such as CPU, hard disk or networking, it is needed to make all the major devices on the board function within their operational limits. Consequently, designers are constantly trying to reduce the cost and complexity of these functions without trading off the board reliability.

This paper discusses the traditional approach of implementing Function #1 in older generation server designs and compares them with the approach used in modern server designs, where PLDs are used to integrate these functionalities. In addition, this paper discusses other functions commonly found in servers integrated into other programmable devices in order to reduce complexity and cost.

## Socket Function #1 – Power Management, Control and Glue Logic Functions

Historically, designers have typically opted for implementing the power management, control and other glue logic functions using many types of discrete components. For many years, that approach offered the more cost effective path. But as server designs

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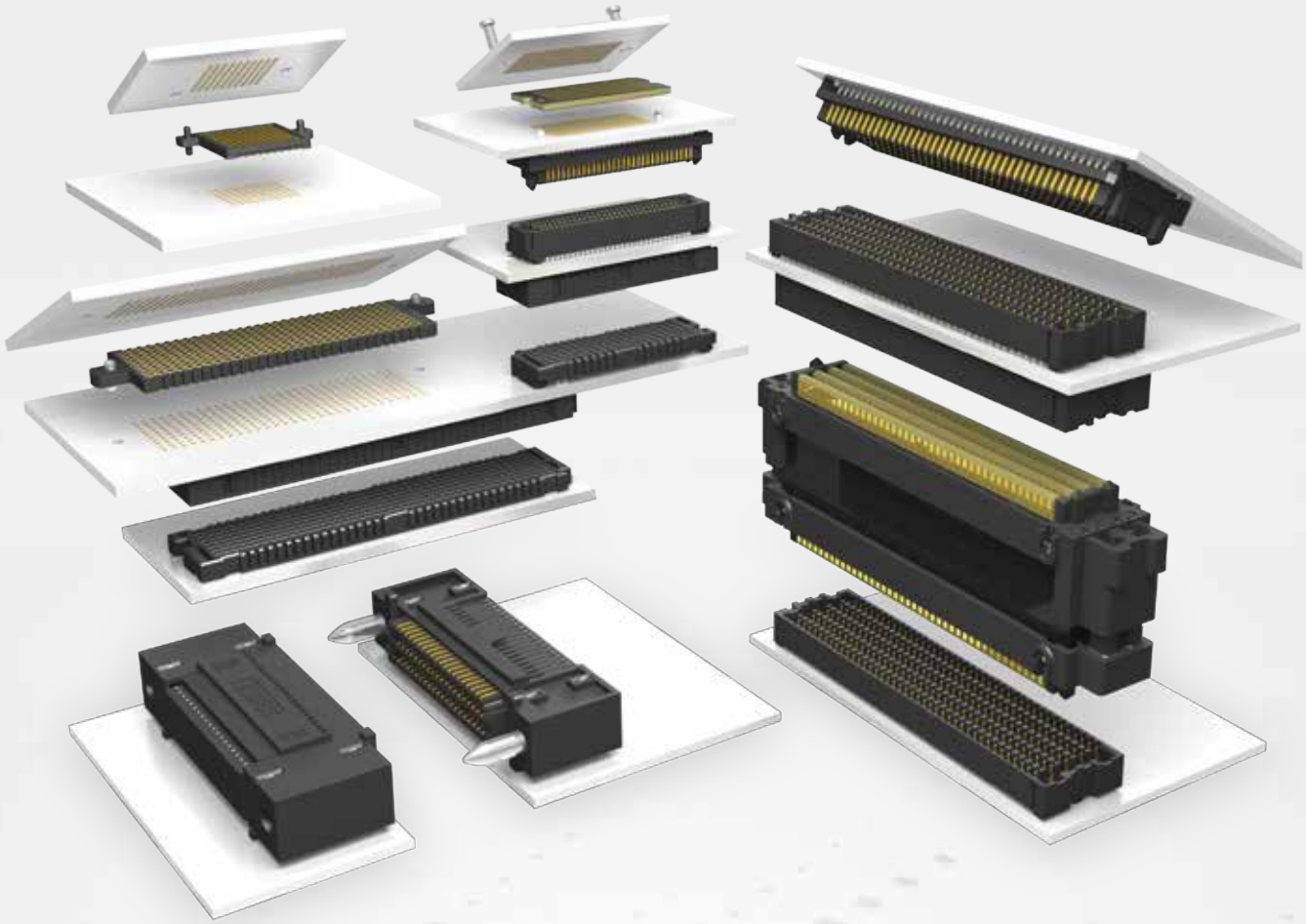

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have grown increasingly complex and the number of functions rose proportionately, discrete designs started to require larger and larger numbers of devices. Today, designers who are using the discrete approach end up spending more time and resources to design the Socket Function #1 block for multiple server types. For example, changing of the number of complex SoC devices on the board may result in altering the number of supplies, glue logic and other control functions. This may warrant significant changes to the logic and the underlying timing.

Consequently, the use of discrete device solutions not only delays the release of newer types of server hardware, but also increases the cost as the number of components required for implementation grows. In addition, design changes sometimes require a re-spin of the entire circuit board, which further delays the project and adds cost.

Modern server systems typically integrate Socket Function #1 into non-volatile PLDs. These PLDs are expected to commence their operations as soon as the power to the board is applied (instant-on). Typically, the logic density and the number of I/Os required to implement Socket Function #1 depends on the server type. Consequently, a PLD family rich in I/Os and density options is ideally suited for implementing Function #1.

Lattice's MachXO3 FPGA family, and its predecessor, the MachXO2 family (referred to as MachXO2/3), both deliver those capabilities. The MachXO2/3 devices are instant-on, non-volatile PLDs, ranging from 640 LUTs up to 9400 LUTs and offer from 22 I/Os up to 384 I/Os. These PLDs can be transparently updated in the system and offer Dual Boot to recover from any in-system update errors. These devices only need a single 3.3 V supply to operate and the server board power management algorithm starts to become operational when

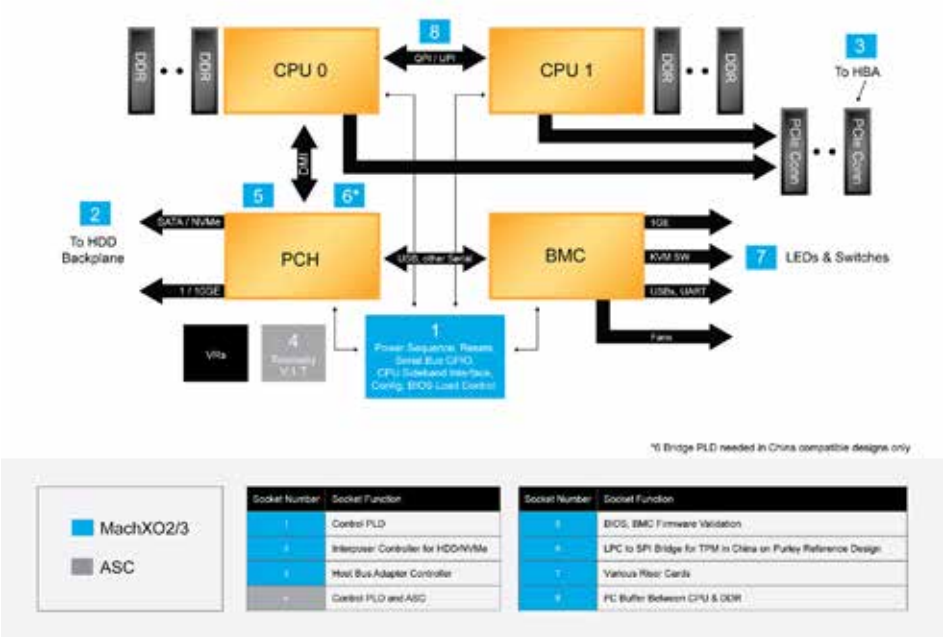


**Fig. 1:** Server block diagram with 8 PLD Socket Functions (use cases)

the 3.3 V supply is above 2.2 V. As a result, the MachXO2/XO3 is the first device on the board to turn on and the last device to turn off. These devices support multiple I/O banks that can be powered on or off individually without affecting the operation of other blocks. This enables them to integrate multiple heterogeneous functions, such as multi-power domain control, out-of-band signaling, and power stand-by control. They also offer designers the ability to add SPI, I2C and timer/counter interfaces to legacy designs, and support multi-time programmable on-chip configuration Flash memory. Finally, these state-of-the-art devices are available in 5 mm x 5 mm QFN and BGA packages with 1 mm and 0.80 mm ball pitch.

## Function #1 Integrated into a Control PLD (MachXO2/3)

In Fig. 2, the MachXO2/3 device is used for the implementation of control PLD functions, such as power/reset sequencing, various types of serial busses (I2C, SPI, eSPI, SGPIO, etc.), debug ports, LED drives, FAN PWM driver, front panel switches sensing and other general GPIO functions. The MachXO2/3 devices support 1V signaling, which enables them to perform out of band signal integration without the need for external GTL transceivers. Lattice's software package tool, Reveal, can be used to debug the control PLD circuit, while the chip is functioning. Running on a PC, this tool can be considered a logic analyzer for monitoring and capturing of various states, leading up to a fault event. For example, the Reveal debug tool enables designers to capture a number of event traces (comprised of registers, nodes and pins states) leading to the faulty condition and displays them on a PC monitor. This significantly reduces the board debug time of their system.

## Hitless I/O

Control PLDs enable the designers to significantly reduce time-to-market and enable them to meet the market pressures of bringing out a new customized hardware within the allotted time. Sometimes, there

could be bugs in the implementation of the control function or the overall system architecture that may require a new function. A common approach to accomplish a modification to the design is through an in-system update and power cycling of the system to bring the newly programmed image into service. This act of power cycling interrupts the operation of the entire server hardware, reducing its availability. To ensure the continuous operation of high availability systems, the MachXO3 devices can hold the I/Os unchanged, while the configuration refresh occurs and the new configuration initializes. This feature is called Hitless I/O.

## Hitless I/O Operation (Fig. 3)

To enable zero-downtime updates, the MachX02/MachX03 devices undergo a "background update" that loads new configuration data into its configuration Flash memory. When the upload is complete, a "TransFR" command moves the new PLD image from the configuration Flash memory to the PLD's configuration SRAM. At the same time a "Leave Alone" function ensures that all I/O values are held in their last known value. Finally, during the "Logic Initialization" stage, the state machines begin to restart the power management and reset distribution functions, which results in turning the power supplies off and forces the board to undergo power recycling.

How does the system hold the outputs controlling the supplies and other logic control signals, while the state machines created by the new image undergo initialization? To keep the critical I/O unchanged during the initialization process, Lattice adds a latch MUX to every critical I/O. These elements hold the outputs at their last known value during the state machine initialization process and, once the process is complete, pass the output control back to the state machines.

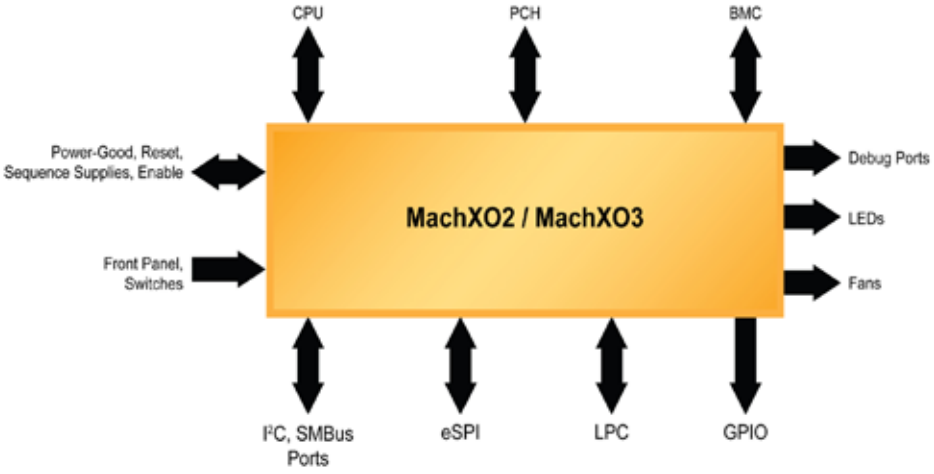


**Fig. 2:** Control PLDs based on the MachX02/MachX03

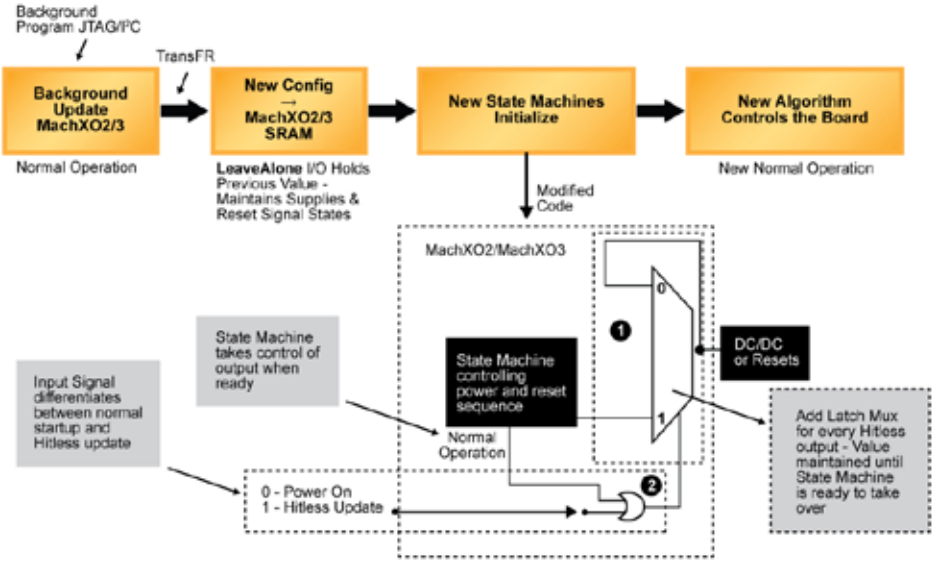


**Fig. 3:** How Hitless I/O works

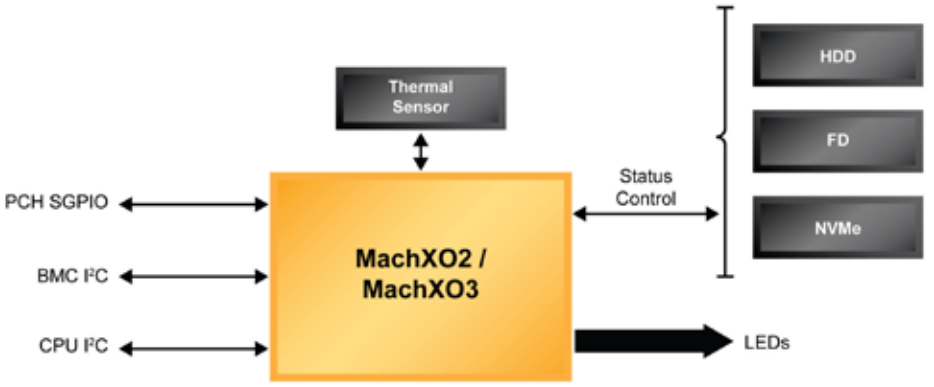


**Fig. 4:** Simplifying backplane control of hot swappable drives using MachXO2/MachXO3 PLDs

Key to this process is the circuit's ability to differentiate between a normal (power-on) startup and after a reconfiguration event using a separate "Hitless_I/O_Enable" input that prevents a lock of critical outputs during a normal power-on sequence.
The advantages of this new capability are tremendous. It gives manufacturers the flexibility to implement on-the-fly configuration changes to correct design flaws or add new capabilities to their products. It can also be very useful during product development as it allows designers to quickly turnaround a product during debugging or create specialized product variants during a rack installation procedure.
The convenience and cost advantages of PLDs make them ideal for supporting in-system design updates and manage power supplies, monitor and control critical signals, while performing basic housekeeping functions.

## Socket Function #2 – Logic Functions Needed to Support Hot Swappable Disks

Rack servers support hot swappable HDD/FD/NVMe drives. These disk drives are plugged into a back plane. The back plane interfaces to the main mother board through serial interfaces, such as SGPIO and I2C. A MachXO2/3 device can be used to integrate the logic function like the one depicted in Fig. 4 to provide backplane control. For example, when an NVMe drive is plugged into the drive slot, the logic in the MachXO2/3 device will automatically route the status and control signals to I2C bus instead of SGPIO bus.

## Socket Function #3 – Hardware Management of Host Bus Adapter Board

Another potential application for Lattice's MachXO2/3 devices lies in the integration of host bus adapter control logic. As indicated in Fig. 5 below, this solution integrates SGPIO and other out-of-band signaling, manages power/reset sequencing and other PLD functions, including fast supply fault detect, and status save. Designers can also add features and bug fixes to the logic implemented in the MachXO2/3 device in the field, without interrupting system operation via the Hitless I/O feature and an I2C interface.

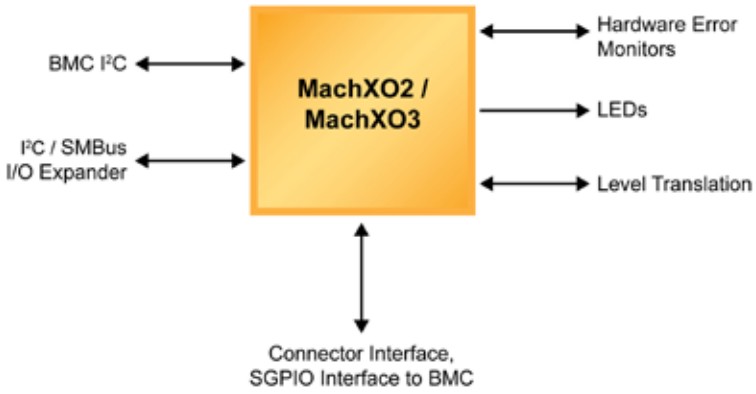


**Fig. 5:** Control PLDs based on the MachX02/MachX03

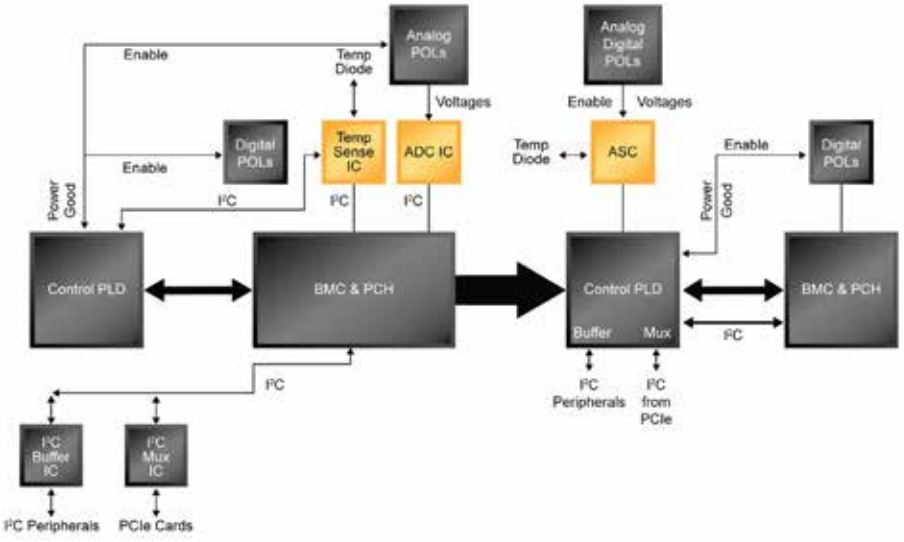


**Fig. 6:** New approach to integration of telemetry functions

## Socket Function #4 – Voltage Current and Temperature Telemetry

Typically, systems measure onboard supply voltages, board and device temperatures and current load on some important supplies on an ongoing basis. To assist in the measurement of these parameters server boards use Analog to digital converter ICs to supplement the number of channels integrated into the BMC, external temperature sense ICs and current sense ICs. In addition, the board uses I2C buffer ICs and I2C multiplexer ICs to manage the telemetry I2C busses (Fig. 6). The DC-DC converters on the board are used to supply power to the ICs, are controlled by the Control PLD device. The Control PLD also monitors the 'Power-Good' digital signals from

the DC-DC converters.

Designers can take advantage of the Lattice's ASC (Analog Sense and Control) device in conjunction with the control PLD to integrate the ADC IC and some of the temperature sense ICs. At the same time, the device transfers the "Enable" and "Power-Good" signals from the control PLD to the ASC devices. This frees up I/Os on the control PLD, which then can be used to integrate I2C buffers and I2C multiplexer ICs functions. This results in overall reduced cost and BOM of the telemetry circuit. Additionally, by sensing the supply voltages for "Power-Good" condition, as well as power-off condition, ASC also helps improve the reliability of power down sequencing and minimizes circuit board congestion.

## Socket Function #5 – Bios and BMC Firmware Authentication

To help ensure BIOS and BMC firmware authentication, a MachXO2/3 device can serve as a hardware root-of-trust security (Fig. 7). In this configuration, these devices can be used to validate the system BIOS and BMC firmware using Elliptic Curve Signature Authentication. They can also be used to manage automatic golden image switchover in the case of a compromised active image.

## Socket Function #6 – Bridging Between TPM/ TCM and Single SPI Interface on PCH

Lattice's MachX02/3 devices offer extensive bridging capabilities. For example, server designers can use these devices to bridge between a PCH SPI interface with a TPM module (used in countries outside China) or with a TCM module (used in China) on the same hardware (Fig. 8). This bridge is compatible with a wide range of operating frequencies at ingress and egress points.

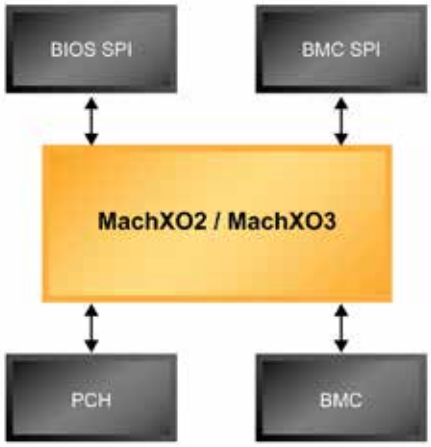


**Fig. 7:** MachX02/3-based solutions manages and validates BIOS and BMC firmware authentication

## Socket Function #7 – Integrating Multiple Functions on Riser Cards

Often servers use riser cards to connect LED drive, control, and enclosure sense function on a riser card to reduce the number of interconnections on the main board. Often, these functions are implemented using discrete logic ICs, which results in multiple types of riser cards, each with slightly different functionality. An option to reduce the number of riser card types is to integrate the functions for each of the cards onto a MachXO2/3 PLD. One can then customize the logic on the card by simply modifying the logic integrated in the MachXO2/3 device during manufacturing.

## Socket Function #8 – Integrating Multiple I2C Buffers

The CPU in a server system communicates with the DDR memory DIMMs via a pair of I2C buffers (Fig. 9). The CPU also monitors the SSD drive through another I2C interface. Designers are required to use voltage level translator buffers to map CPU's 1.05 V I2C interface with the DDR memories operating with 1.2 V and the SSD drives operating at 3.3 V. The CPU also generates multiple out-of-band signals using 1.05 V logic signal interface. These out-of-band logic signals are required to communicate with other devices operating with a signal interface of 2.5 V or 3.3 V. This requires the use of GTL buffers on the board.

Low cost MachXO3 devices in a small QFN package (5 mm x 5 mm) can be used to integrate level translation from 1.05 V I2C and other logic signals to 1.2 V, 3.3 and 2.5 V. This reduces the circuit board area, BOM and more importantly cost of implementation of this functionality.

## Conclusion

Like their predecessors, today's server designers are constantly trying to pack more functionality on their boards as quickly and cost-effectively as possible. One often overlooked strategy to accomplish that task is the implementation of control PLDs. By offering designers a simple way to integrate all control path functions into a single programmable device, and by adding new capabilities that allow designers to modify designs even after they have shipped to the field, control PLDs promise to significantly simplify board design and debug.


**Fig. 8:** LPC to SPI Bridge for TCM.

# Easy to Integrate

## BLE module from AMBER wireless for smart IoT solutions

› Matthias Hauser, AMBER

**Industry 4.0 and IoT rely upon devices networking together. Although the Internet Protocol (IP) and WLAN connectivity are at the forefront of the Internet of Things, there are scenarios in which other techniques have advantages. Bluetooth Low Energy for example.**

With its AMB2621 Bluetooth-LE-4.2 module, AMBER wireless, a Würth Elektronik eiSos Group company, opens up new possibilities in the Smart Factory and Smart Home. The main thrust is the use of smartphones or tablet PCs as the user interface for other devices. Bluetooth Low Energy (BLE) offers the perfect basis, as this wireless interface is integrated in modern smart devices as standard and can transmit "small quantities of data" very energy-efficiently. This makes BLE interesting, not only for mains powered industrial machine, but also for battery-powered devices, such as mobile temperature sensors or household devices like smoke detectors, which can be equipped with such an interface. Furthermore, for devices with displays there is the potential to save the display and if required to visualize data on a smartphone or tablet connected over BLE.

### Interface configuration

The Smart Factory or the Smart Home rarely originate as green field developments. Intelligent networking of devices and sensors is far more likely to be introduced as an upgrade to existing products and solutions. AMBER wireless therefore paid special attention to easy integration. From its inherent design, AMB2621 has a firmware stack which can be controlled via a serial interface with commands similar to the AT command set. The commands available allow developers to configure the BLE interface for their purposes to allow adjustment of the power and speed of data transmission, as well as the resulting electricity consumption of the respective application. Other commands control connection set-up, data transmission and switching to various power saving modes.

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**The commands of the AMBER firmware stack follow a simple structure:**

| Start signal | Command | Length | Payload data | Checksum |
|---|---|---|---|---|
| byte 1 | byte 1 | bytes, least sig- 2 nificant byte first | x bytes | byte 1 |

**The commands of the AMBER firmware stack follow a simple structure:**

| Command | Description |
|---|---|
| **0x04** | Send data |
| **0x84** | Data have been received |
| **0x86** | Connection is established |
| **0xC6** | Connection is open, data transfer now possible |

followed by a 2-byte length field, the command-specific payload data and the attached checksum, which guarantees correct transmission of the byte sequence.
The following example shows how this syntax looks in practice.

In the case in which a smartphone with MAC 0x825CA7E287D0 connects with AMB2621, the AMB2621 sends the following notification via UART (Universal Asynchronous Receiver Transmitter) to the host connected:
0x02 **0x86** 0x07 0x00 0x00 0x82 0x5C 0xA7 0xE2 0x87 0xD0 0x4F
(connection to the device with MAC 0x825CA7E287D0 is opened)
0x02 **0xC6** 0x08 0x00 0x00 0x82 0x5C 0xA7 0xE2 0x87 0xD0 0x13 0x13
(connection to the device with MAC 0x825CA7E287D0 has been opened


If the smartphone now sends a notification "Hey AMB2621!", e.g. with the help of the AMB2621 toolbox app, the AMB2621 transmits the following data via UART to the host connected:
0x02 **0x84** 0x13 0x00 0x82 0x5C 0xA7 0xE2 0x87 0xD0 0xC8 Hey AMB2621! 0x89
(Data have been received from the device with MAC 0x825CA7E287D0. The data

## Peripheral Only: Bluetooth as a transparent cable replacement

Operation of the Bluetooth module with command control serves functionality – for example configuration in ongoing operation – and is ideal in terms of safety considerations (checksum). But sometimes the requirements are different.
Alongside operation of the module using commands, there is the "Peripheral Only" mode in such cases. Upgrading of devices is possible thanks to the transparent UART interface, whereby modification of the serial interface is neither desired nor possible. These could be industrial machines with an existing RS232 interface for instance.
The manufacturer Amber wireless intentionally introduced the option of operating the wireless module as 'Peripheral' in the sense of the Bluetooth protocol, as this is interesting for very many applications. Devices are equipped with this kind of wireless module so you can connect with them. This means that pairing is initiated by a mobile device. Even without command control that would be necessary to switch off the module that is not required, AMB2621 is particularly power-saving in the "Peripheral Only" operating mode, as the UART interface is only active on establishing a wireless connection. Uncomplicated static passkey pairing is used as a security feature, as in the hands-free car kit. AMB2621 with Peripheral mode is recommended whenever the module does not initiate any connections itself (i.e. it is only contacted from the outside) or no user interface can be implemented, as the rest of the product is already finished.
Bluetooth is the "cable replacement" in this application and communication is correspondingly simple. In the above example, in the "Peripheral Only" mode the host would only receive "Hey AMB2621!" without header and checksum bytes and would only need to send "Hey App!" to the module such

are "Hey AMB2621!". The associated Received Signal Strength Indication (RSSI) value is 0xC8, i.e. -56 dBm.)
If now the AMB2621 is to transmit data such as "Hey App!" to the smartphone, the host connected has to send the following data to AMB2621 via UART:


that these data are transmitted to the smartphone connected.

## BLE possibilities fully exploited

With the Peripheral Only mode, Amber wireless uses a typical function in mobile communications applications for industrial purposes. In another place, the manufacturer purposefully moves away from the common standards. For wireless, AMB2621 offers the "AMBER-SPP-like" profile, which allows transmission of general data between the two connection partners. The Bluetooth Serial Port Profile (SPP) does not actually exist anymore for BLE, which is why AMBER wireless offers its own solution here. Here the optional Bluetooth 4.2 feature "data length extension" (DLE) is used, such that payload sizes up to 243 bytes per Bluetooth packet are possible with the AMB2621. This raises throughput up to 5 kB/s. Familiar pairing methods like JustWorks or StaticPasskey are made available in order to ensure stable data transmission. In the case of StaticPasskey, a 6-digit key has to be entered on a terminal device such that a secure connection can be established. The bonding function, i.e. the use of keys already used for re-authentication, is available in AMB2621.

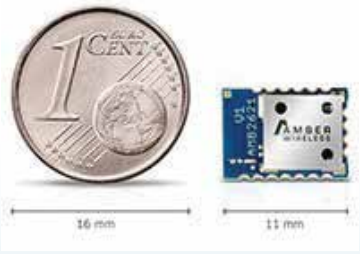
## Further application options

In many cases, the decision between command control of the chip and the Peripheral mode is clearly prescribed by the requirements of the application. However, it is also possible to provide the otherwise firmly soldered pins with a switch for mode selection. This can be useful if the wireless module is normally used for the data request initiated by the mobile device, but is occasionally opened by the device for more complex communication tasks, such as maintenance or configuration tasks.
The module is also capable of all other Bluetooth modes. Broadcasting for example: In place of connection-oriented data transmission, so-called beacons are used to emit power-saving data – the module "sleeps" when it does not transmit. This function is well-suited for battery-operated sensor applications like the periodic transmission of temperature or other environmental data. Distance estimation of a transmitter by means of the RSSI value or position determination by triangulation of several beacons is also conceivable.

## Conclusion

Instead of equipping a device with a display, making a smartphone fit for use as a user interface or developing a door control system with a mobile device – these are typical applications that should ideally be run independently of WLAN availability – here Bluetooth is a viable alternative. The wireless module introduced here makes integration especially easy. By the way, samples of AMB2621 and the associated evaluation board AMB2621-EV are available from stock. Field sales engineers are available on-site to provide support in the design-in process and also to elaborate specifications if customer-specific adaptation of the AMBER firmware stack is required.

AMBER wireless AMB2621
- FCC and CE certified BLE module
- Just 8x11x1.8 mm in size
- Nordic Semiconductor nRF52832 BLE chip
- 32 bit ARM Cortex-M4 CPU, 512 kB Flash memory
- Amber SPP-over-BLE profile
- Low power consumption (TX 5.3mA@0dBm, RX 5.4mA, sleep 0.4µA)
- Ideal for expanding battery-operated systems with a BLE interface




**AMB2621 is a 2.4-GHz-BLE wireless module compliant with the Bluetooth-Smart-4.2 standard.**

# Synchronizing Networks and Demonstrating

## CALNEX

### RTS 25 – Levels of Accuracy for Business Clocks

In advance of MiFID II coming into effect, it is essential that trading venues ensure they have the correct permissions in place to carry out the relevant regulated activities. Time accuracy of business clocks – as outlined in RTS 25 – is an essential part of this for purposes such as reporting of post-trade transparency data. Combinations of technologies will be used to achieve this, but the requirement to have consistent timestamping across applications within a trading venue means that Ethernet synchronization via PTP (Precision Time Protocol, defined in IEEE1588-2008) will play a key role. Elaborating on the need for accurate time when reporting on trades, it is made clear that timing sources within and between trading venues must have both accuracy (a maximum divergence from reference time) and a commonality to the reference time, to ensure that authorities can establish the timeline of reportable events correctly.

The levels of accuracy and maximum divergence from Coordinated Universal Time (UTC) specified for business clocks are dependent on the gateway-to-gateway latency of trading systems (in the case of Operators of trading venues) or the types of trading activities (in the case of members/participants). The resultant requirements are illustrated below.

As seen, accuracy levels as high as 1µs, with no more than 100µs divergence from UTC, can be required for regulatory compliance.

The joint task of equipment vendors and trading venues is to determine:

**1.** How to deliver timing accurately to - and within – venues.

**2.** How to demonstrate time traceability, required for regulatory compliance at least once a year (RTS 25 Article 4).

'ESMA RTS 25: Regulatory technical standards on clock synchronization' provides further guidance on the requirements for timing accuracy and traceability required to be compliant to MiFID II.

### Introduction to PTP (1588)

GPS is commonly used for time synchronisation in communications networks around the globe. However, GPS installations need outside antennas with clear sight of satellites (often difficult to achieve in urban environments) and suffer from an inherent lack of security (susceptible to jamming and

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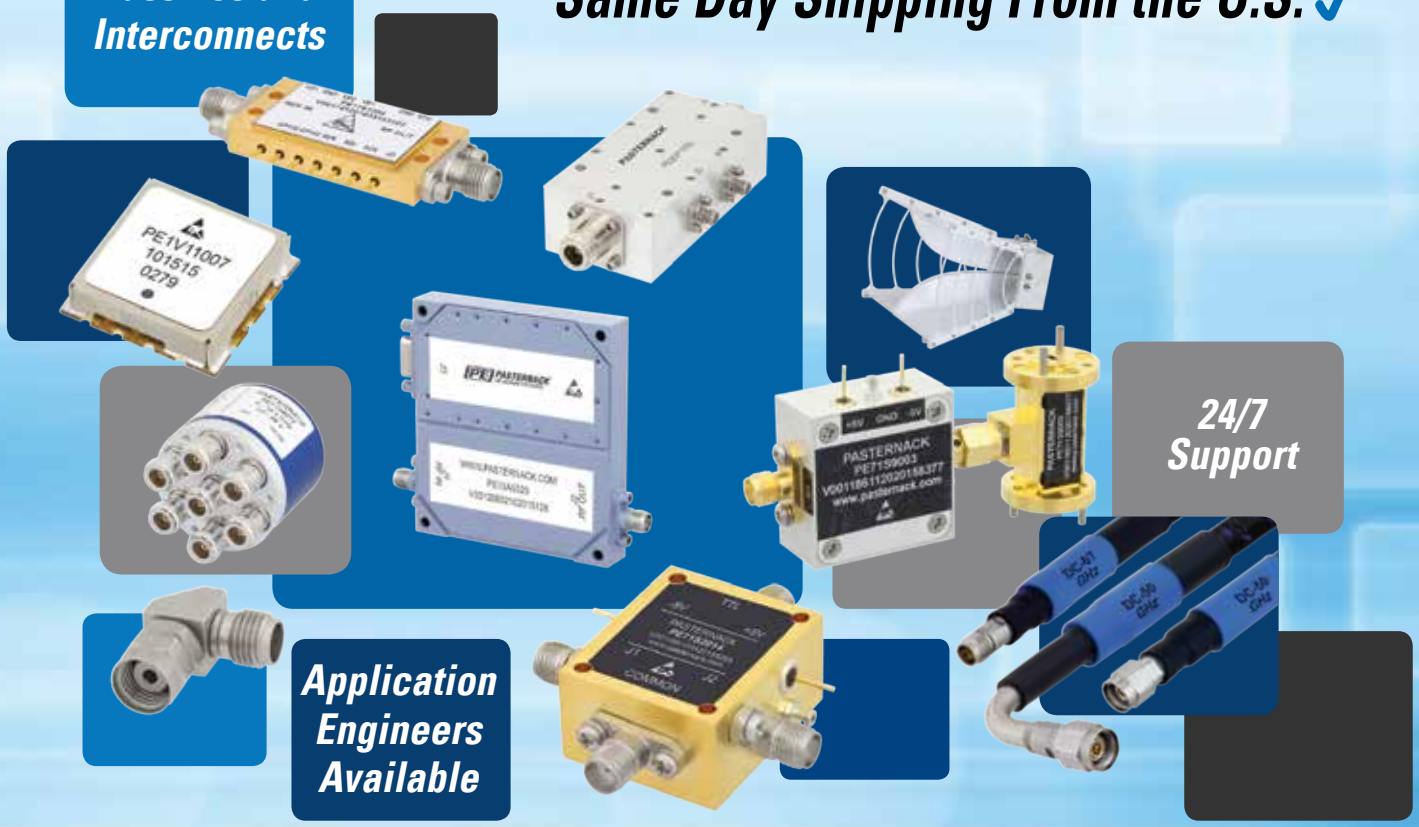


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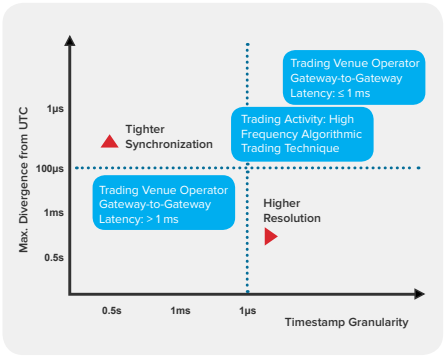



MiFID II/ESMA RTS 25 Timing Levels of Accuracy for Business Clocks

spoofing). Relying solely on GPS to accurately transfer time from one place to another clearly carries a risk.

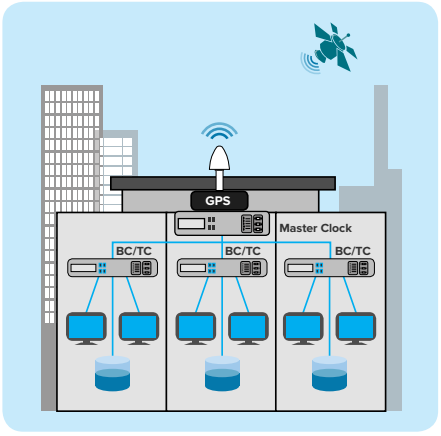
An alternative, and highly accurate, method of transferring time is PTP. Furthermore, in trading institutions as in other markets and applications such as telecoms, utilities and broadcast, the benefits of delivering robust timing through Ethernet networks already being used for application critical information has numerous benefits.

## What is PTP?

PTP is a message-based time transfer protocol that is used for transferring time (phase) and/or frequency across a packet- based network. It ensures various points in the network are precisely synchronized to the reference (master) clock so that the network meets specific performance limits according to the network's application.

PTP timing messages are carried within the packet payload. The precise time a packet passes an ingress or egress point of a PTP-aware device is recorded using a timestamp. Because packets take different lengths of time to travel through the network – caused by queuing in switches and routers on the path – this results in Packet Delay Variation (PDV). To reduce the impact of PDV, Boundary Clocks (BCs) or Transparent Clocks (TCs) can be used to meet the target accuracy of the network.

Assessing the Time Error introduced by these devices is critical to determining network topology, suitability of equipment, and demonstrating network timing compliance.

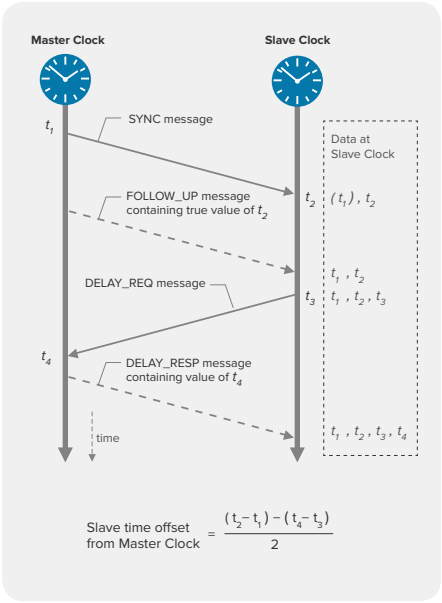



BCs calibrate themselves by recovering and regenerating the PTP timing from the previous clock in the chain, thereby minimizing the PDV accumulation at the slave.

If TCs are used, the PDV is written by each TC into a correction field within the packet. The end slave then has a record of the delay for each TC on the path.

## How does PTP work?

PTP uses the exchange of timed messages to communicate time from a master clock to a number of slave clocks. The timed messages are SYNC, FOLLOW_UP, DELAY_REQ and DELAY_RESP as shown below.




These messages yield four timestamps (t1, t2, t3 and t4), from which it is possible to calculate the round trip time for messages from the master to the slave, and back to themaster (assuming that the slave clock is advancing at a similar rate to the master).

The time offset is then estimated using the assumption that the one-way network delay is half the round trip delay, and is used to correct the slave time base to align to the master.

Note that this assumes asymmetry, that is, the forward and reverse paths are of equal length. If they are of different lengths, usually caused by queuing in switches and routers, this will introduce an error into the time offset estimate; this is asymmetry.

## Determining and validating PTP performance

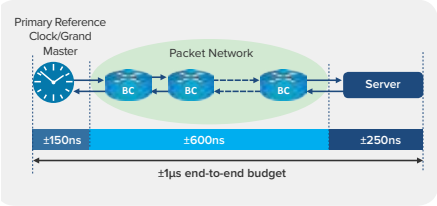
What is the required network and equipment performance?

As described, RTS-25 allows for a maximum of ±1µs time-signal

divergence between the reference (master) clock and the end application.

The illustration below gives an example of how this specification can be broken down to provide equipment specifications for Grand Master devices, PTP aware network switches/routers (Boundary or Transparent Clocks), and slave functionality at the server (likely integrated into a NIC).

Dependent on the number of network hops between the end points of the network, BC and TC performance limits can vary by application and deployment. As per the illustration, 5 hops would give a per device limit of ±600ns / 5 = 120ns per device.



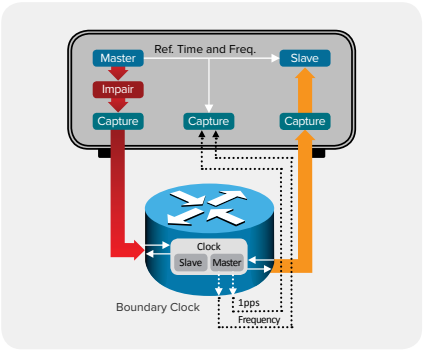

## PTP protocol interoperability

Often overlooked, a key item in deploying robust PTP networks is ensuring all devices apply the same PTP profile correctly and consistently. Initial 'onboarding' and evaluation should include validation of PTP message fields. This avoids lost time due to misconfiguration, and identifies large scale interoperability issues.

## Are devices fit for purpose?

As outlined previously, by first understanding the applicable accuracy and traceability requirements for a particular application, then understanding the intended deployed network topology, performance requirements for individual devices can be determined – both for Operators of trading venues evaluating equipment, and also manufacturers of equipment providing proof-of-concept To prove the PTP performance of network equipment:

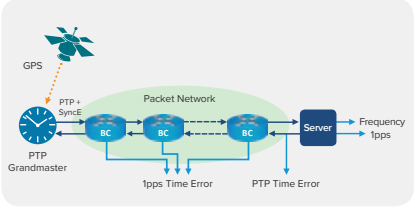
1. It must be shown that the equipment can connect and engage in a PTP session correctly. It is recommended to use test equipment that can generate and control PTP message exchanges to avoid, for example, 'masking' of interoperability issues (a common problem when using commercial network equipment for test purposes).
2. 'Steady state' timing accuracy should be measured either directly on PTP messages, or on external timing outputs if present. It is essential that test equipment validating performance should have measurement accuracy an order of magnitude better than the device performance spec (note: this should cover the entire stimulus to measurement setup, which must be time aligned to confirm, for example, time traceability).
3. Response to likely negative conditions (protocol errors, timing offsets, etc.) should also be tested and measured i.e. 'worst-case performance'. Both long-term gradual timing offsets and short- term jumps in timing should be applied to check robustness of equipment. Again, this should be possible without affecting simultaneous timing accuracy measurements.




## How can I verify and demonstrate network performance?

The Time Error of PTP and recovered clock (1pps/Phase) can also be measured at various points in the network to ensure performance before, during and after deployment, allowing Operators of trading venues to demonstrate continuing compliance to MiFID II as outlined in RTS 25.

Network probing, sample testing, and device 'self-reports' are all potentially useful approaches, depending on the needs of the organization.



# Back to Basics: Choosing the Perfect Regulator

› VICOR

A voltage regulator provides two functions: changing the input voltage to a different level at the output and regulation (maintaining a constant output voltage despite changing load conditions). DC-DC Regulators are a key component in any power system, and so choosing the correct regulator is critical if an optimum solution is to be developed. Although engineers understand regulator functionality, less experienced engineers often find it difficult to identify the best regulator for their application. This blog post identifies criteria that anyone who is not an experienced power developer can use to ensure they choose the perfect regulator.

## Buck, Boost or Buck-Boost Regulator?

There are three basic categories:

- Buck - regulators with an output that is a lower voltage than the input
- Boost - regulators with an output that is a higher voltage than the input
- Buck-Boost - regulators that can supply output voltages that are higher, lower or the same as the input

In most applications voltages are stepped down from the bus to the load and therefore buck regulators are commonly used. Other applications require the voltage to be increased with a boost regulator: for example, if DC power must be transmitted using a long cable, the I2R losses can be reduced by boosting the voltage before transmission and then stepping it down again at the load. In battery applications buck-boost regulators are often used to provide a constant stable voltage, overcoming the change of output voltage that is seen as batteries charge and discharge.

## Nominal Inputs and Outputs

Many systems have clear requirements for input and output voltage – for example you may need to step down a 12V rail to 3.3V. For many applications, there

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will be a suitable regulator available off-the-shelf to meet the voltage requirements.

Obviously, the regulator must be able to deliver the power required by the load. Regulator power is typically specified by a maximum output current.

## Input and Output Ranges

Although applications often require a specific voltage, others will require an adjustable output. This might be because the loads change – for example in a piece of test equipment – or it may be that the load is supplied by a long cable, and the voltage needs to be trimmed a little higher than required by the load to compensate for the voltage drop across the cable.

Input voltage ranges are particularly important for applications such as battery-powered systems. In an automotive application, a nominal 12V battery might deliver 12.5V at full charge and drop to 10V or less as the battery discharges. A regulator with a narrow input range may no longer function as the battery voltage drops, meaning that the full capacity of the battery cannot be used. Ensuring a sufficiently wide input range is therefore an important criterion for selecting your regulator. Choosing wide input regulators also has another benefit: they can also reduce inventory costs as a single regulator can be used in a variety of different situations.

## Efficiency

Efficiency is one of the criteria for most power systems designed today. Selecting a regulator with high power losses can make it almost impossible to meet efficiency goals. It's important to also remember that regulator efficiency is not constant: typically, the efficiency of the regulator will fall dramatically as the step-down or step-up ratio increases and as the current drawn from the output decreases.

Modern regulators, such as those based on Vicor's Zero Voltage Switching (ZVS) topology offer inherently high efficiency and are more consistent across the whole operating range.

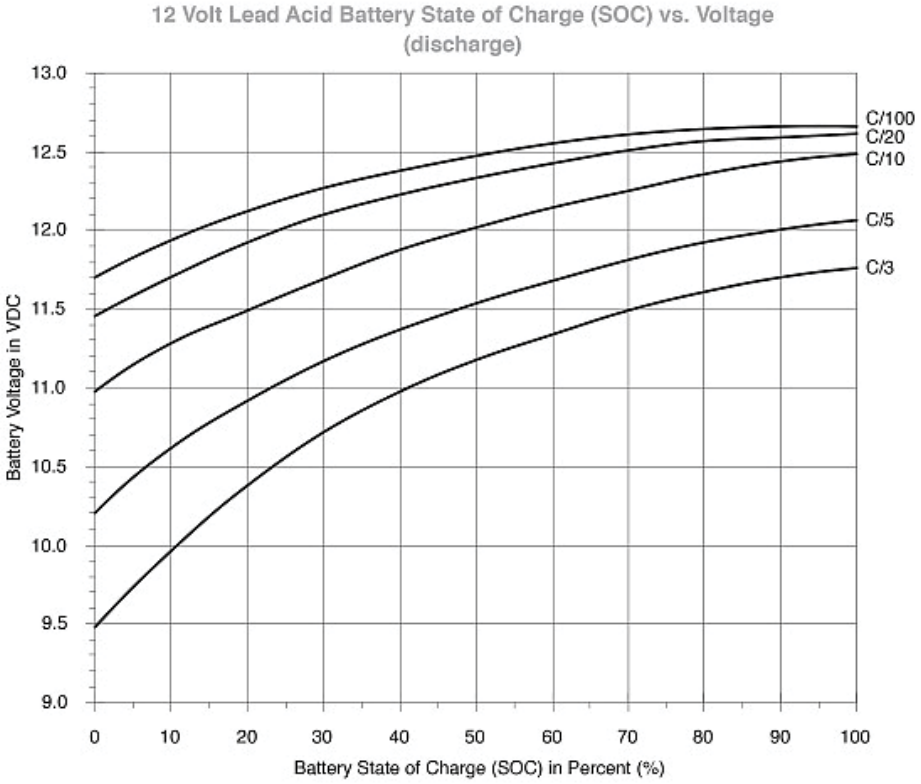


**Figure 1:** Battery Output Voltage Variations

## Noise

Switching regulators provide high efficiency, but the switching circuit generates noise. In some systems, particularly those with sensitive analog components, the power supply noise can limit overall performance. Unnecessary electronic noise can also make it more difficult to achieve EMC certification.

As with efficiency, the regulator topology is key to achieving low noise: it's much easier to use a component that doesn't generate noise than it is to try to filter that noise out. ZVS, for example, is

a soft-switching topology that is inherently low-noise, making it easier to develop high-performance systems.

## Size and Packaging

Today electronic systems are often space constrained. Even if the goal is not to make the system as small as possible, such as products housed in standardized 19" rack units, reducing the size of the power system allows the space saved to be used to add additional functionality. Any calculation of size should also consider the peripheral components required by the regulator. With higher levels of integration and high switching frequency, the size and number of peripheral components can be reduced, which can potentially offer a greater space saving than simply picking a regulator in a smaller package.

The package types available don't only determine the space required: often smaller packages can be located closer to the load, enabling more accurate regulation at the load and faster transient response.

In addition to size, weight can also be an important factor, particularly in applications where the equipment can move. Examples of such systems range from hand-carried portable equipment to automotive electronics and drones.

## Operating Temperature & Thermal Performance

Regulators cannot be 100% efficient, so they will always dissipate heat that must be removed. If a heatsink is required, this can significantly increase both the size and weight of the power system. Failure to dissipate heat can also impact the system performance in other ways: for example, in lighting or display applications if the regulator causes an increase in temperature of the LEDs, this will reduce the intensity and change the wavelength, and therefore the hue, of the light generated.

The regulator must function reliably across the range of temperatures to which it can be exposed. In general, more efficient regulators will be able to operate at higher temperatures, as they do not need to dissipate so much heat, but products from different suppliers can vary widely so it is important to check the data sheet.

## Additional Features

In addition to the criteria described above, your application may require some specific functionality, which can limit choice. Examples of these additional features include:

- Paralleling Capability: if regulators can be paralleled, then higher output currents can be delivered. Not all regulators can have their outputs paralleled, as with many topologies this will cause instability.
- Constant Current Output: in battery applications, a constant voltage is needed to supply the load, but constant current is required for charging. Some regulators offer outputs that can be configured both as constant current and constant voltage, making them ideal for these systems.
- Soft start: the ability to ramp up the voltage slowly helps to ensure the power system is stable, even when large amounts of capacitance are connected to the output of the regulator.
- Overvoltage protection: regulators that have protection to ensure they cannot deliver more than the defined output voltage ensure that the load will not be damaged even during a fault. Other protection circuitry might disable the regulator if the input voltage is out of range.
- Transient response: some loads rapidly change the current they demand. A fast transient response ensures that the regulator can deliver the power needed, without large output capacitors to store energy.

## Conclusion

Although regulators are conceptually simple components – they take a voltage at the input and deliver a different voltage at the output – there are many factors that determine the best regulator for your application. Carefully considering the criteria outlined above will help to ensure you pick the ideal regulator for your system.

# Mission-critical machine vision in an insecure IoT world

## Intelligent machine vision cameras are driven by heterogeneous computing architectures

› Dr. Lars Asplund and Dr. Fredrik Bruhn, Unibap AB

We are on the threshold of the next industrial revolution where machine vision will be the major game-changer, as intelligent vision can now even incorporate deep-learning algorithms. These enable cooperative work environments between humans and machines or machine vision that is part of critical-control feedback loops. And these algorithms are most efficiently executed on heterogeneous system architectures.

### Machine vision moving to "sense-plan-act'"

In early applications, machine vision was used with frame grabbers and Digital Signal Processors (DSP). Today, with the development of reasonably priced high performance sensors - one of three major enablers for the new robotics revolution - we can see examples of applications in which recognition is not simply just a means of identifying well-known schematics in a 'sense-compare-decide' manner. Today, robotics – starting with simple stationary systems right up to autonomous vehicles - are transforming towards more sophisticated 'sense-plan-act' behavior. In this respect, a vision system is the most powerful eye of a robot which informs it of its position and its environment. And the computing power of Heterogeneous System Architecture-based embedded processors like the AMD G-series SoC provides the brain that understands and interprets the environment. The second enabler is the processor which delivers the required high performance with moderate power consumption. The final part of a smart robot is the act component. Acting robots require high power density in the batteries and high efficiency motors. So state-of-the-art batteries and BLDC (Brushless DC motors) are enabler number three. The combination of all these three enablers, i.e., their enhanced technologies, makes vision systems and robotics so revolutionary today.

### New intelligent vision systems

So let's take a closer look at the vision part of this industrial revolution. Human eyes are connected via nerves to the 'visual cortex' in our brain. Out of our five senses, the visual cortex accounts for the largest section of the brain. Machine vision systems, such as the IVS-70 (see figure 2) based on parallel computing offered by heterogeneous SoCs, are the enablers of Artificial Visual Cortex for machine vision systems. Their eyes are lenses and optical sensors. Their optic nerves to the Artificial Visual Cortex are high speed connections between the


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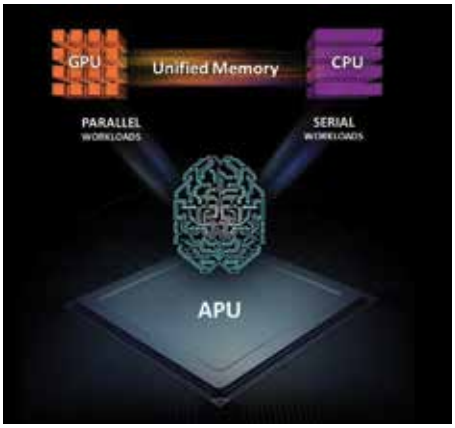



**Figure 1:** HSA provides a unified view of fundamental computing elements, allowing a programmer to write applications that seamlessly integrate CPUs with GPUs while benefiting from the best attributes of each.

sensors and the compute units. These systems not only provide high speed and high resolution to compete with our human vision, they also provide accurate spatial information on where landmarks or objects are located. To achieve this, stereoscopic vision is the natural choice. Industrial applications for this type of stereoscopic vision system can be found, for example, in item-picking from unsorted bins. Mounted on a robot arm, a vision system can carry out 'visual servoing' with 50 fps and identify the most suitable item to pick at the same time the gripper of the robot arm is approaching the bin. This makes scanning - which can take a couple of seconds – and reprogramming the robot arm superfluous. Autonomous cars are another obvious application for vision technologies, as well as a whole range of domestic robot applications.

## The artificial visual cortex

So how does this process work in detail? The first stages of information handling are strictly localized to each pixel, and are therefore executed in a FPGA. Common to all machine vision is the fact that color cameras think in RGB (and the pixels are Red, Green and Blue) just like the human eye, but this method is not suitable for accurately calculating an image. Thus, firstly RGB has to be transferred into HIS (Hue, Saturation and Intensity). Rectifying the image to compensate for distortion in the lenses is the next necessary step. Following this, stereo matching can be performed between the two cameras. These steps are executed within an FPGA that is seconding the x86 core processor. All the following calculations are application-specific and best executed on the integrated, highly flexible programmable x86 processor platform which has to fulfill quite challenging tasks to understand and interpret the content of a picture. To understand how complex these tasks are, it is necessary to understand that interpreting picture content is extremely complex for software programmers and that, until recently, the human visual cortex has been superior to computer technology. These days, however, technological advancements are, quite literally, changing the game: An excellent example of computer technology improvement is Google's AlphaGo computer which managed to beat the world's best Go player. And this was achieved by executing neural network algorithms. Is this really so revolutionary? Haven't we seen neural network algorithms in the recent past? Indeed we have. Neural networks are not new. They are just one of many AI (Artificial Intelligence) methods. Although exactly this kind of network was considered very promising in the nineties it is even more promising today as all the basic technologies now have far more computing power. Progress simply came to a halt due to the limited performance. To be even more precise, the barrier came down partly due to a lack of compute power and partly due to problems with networks with too many hidden layers. Recent methods use even more layers

**Figure 2:** Unibap's mission-critical stereo Intelligent Vision System (IVS) with 70 mm baseline features advanced heterogeneous processing. Extensive error correction is enabled on the electronics and particularly on the integrated AMD G-Series SoC and Microsemi SmartFusion2 FPGA.

in building the neural networks and today the term deep-learning means a neural network with many more layers than were used previously. Plus, the heterogeneous system architecture of modern SoCs allows deep-learning algorithms to be used efficiently (e.g. with the Deep Learning Framework Caffe from Berkley).

x86 technology is also interesting for intelligent stereoscopic machine vision systems due to its optimized streaming and vector instructions developed over a long period of time and very extensive and mature software ecosystem, vision system algorithms and driver base. Plus, new initiatives like Shared Virtual Memory (SVM) and the Heterogeneous System Architecture (HSA) now offer an additional important companion technology to x86 systems by increasing the raw throughput capacities needed for intelligent machine vision.

## HSA enables efficient use of all resources

With the introduction of latest generation AMD SoCs, a hardware ecosystem is now in place which accelerates artificial intelligence

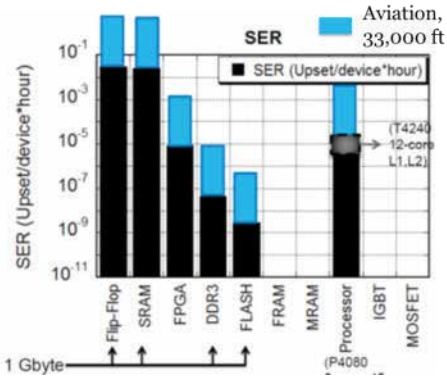



**Figure 3:** Susceptibility of common electronics for the background neutron radiation cross-section Single Event Ratio (Upset/device*hour). In order to compare different technologies, the SER values have been normalized to a size of 1 GByte for each relevant technology.

algorithms in distributed, highly integrated sensor logic. Thus, software developers can now also take advantage of a powerful processing component that has been sitting on the sidelines and woefully underused - the graphics processor.

In fact, the graphics processor can accomplish parallel compute-intensive processing tasks far more efficiently than the CPU, which is important for increased parallel computational loads. The key to all this is the availability of Heterogeneous System Architecture, which in terms of x86 technology has mainly been driven by AMD but has also been joined by many industry leaders. HSA supporting microarchitectures seamlessly combine the specialized capabilities of the CPU, GPU and various other processing elements onto a single chip – the Accelerated Processing Unit (APU). By harnessing the untapped potential of the GPU, HSA promises to not only boost performance – but deliver new levels of performance (and performance-per-watt) that will fundamentally transform the way we interact with our devices. With HSA, the programming is also simplified, using open standards tools like MATLAB® or OpenCL/OpenCV libraries. And it is not only the vision system that can leverage this HSA processing performance. All forms of perceptive computing play a role too. These enable a robot to understand what we say.

The AMD G-series System-on-Chip (SoC) perfectly matches all the points discussed above. It offers HSA combining x86 architecture with powerful GPU, PCIe and a wealth of I/Os. On top of this, AMD G-Series SoCs have an additional benefit, which is not at all common but extremely important for the growing demands of application safety: an extreme high radiation resistance for highest data integrity:

Guaranteed data integrity is one of the most important preconditions to meet the highest reliability and safety requirements. Every single calculation and autonomous decision depends on this. So, it is crucial that, for example, data stored in the RAM is protected against corruption and that calculations in the CPU and GPU are carried out conforming to code. Errors, however, can happen due to so-called Single Events. These are caused by the background neutron radiation which is always present and originates when high energy particles from the sun and deep space hit the earth's upper atmosphere and

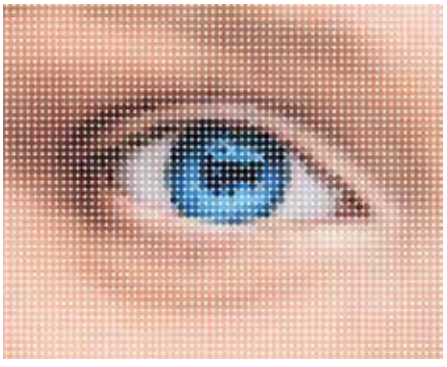


**Figure 5:** x can be used for illustration. Unibap is the owner of this picture

**Figure 4:** A single simple raw picture without any filtering from the camera. Fredrik Bruhn, CEO (left) and Research Engineers Fabian Kunkel

generate a flood of secondary isotropic neutrons all the way down to ground or sea level.

The Single Event probability at sea level is between 10-8 to 10-2 upsets per device*hour for commonly used electronics. This means that within every 100 hours one single event could potentially lead to unwanted, jeopardizing behavior. This is where the AMD embedded G-Series SoCs provides the highest level of radiation resistance and, therefore, safety. Tests performed by NASA Goddard Space Flight Center showed that the AMD G-Series SoCs can tolerate a total ionizing radiation dose of 17 Mrad(Si). This surpasses the requirements by far, when comparing it to current maximum permissible values: For humans, 400 rad in a week is lethal. In standard space programs usually components are required to withstand 300 krad. Even a space mission to Jupiter would only require a resistance against 1 Mrad. Additionally, AMD supports advanced error correction memory (ECC RAM) which is a further crucial feature to correct data errors in the memory caused by Single Events.


# Machine Preparation for Connection to the Industrial Internet of Things (IoT)

› EATON

## Connecting machines and systems to the IoT through the use of smart components

### Introduction

Control system solutions based on industrial PCs are firm fixtures in the design of machines and systems, having demonstrated operational reliability. Now that the automation sector has merged with the first generation of information technology, the next step is for the use of smart components to be networked and connected to the Internet of Things (IoT).

Industry 4.0, the fourth industrial revolution, requires that machines, devices, sensors, and people are able to communicate and share data seamlessly, lowering the cost of production and to give a clear advantage in the competitive global environment. Utilising cloud-based services, production resources and even entire production sites can be networked together. In automation technology, it is often more efficient to develop modular, distributed (or rather decentralised) systems, presenting the opportunity to reduce development effort, perform upgrades easier and lower maintenance costs.

To achieve this aim, it is necessary for simple components such as variable frequency drives, protection, switching and push-buttons to become communication-enabled devices that are able to make independent decisions based on the available environmental data. In this way they become intelligent components - or smart devices. Rather than being considered at the end of the machine development process, these devices should become the first module for a machine designed for Industry 4.0.

### From smart device to a cyber physical production system

A component such as a motor, when used in conjunction with sensors and a smart device can become a cyber physical system (CPS). With a machine with multiple motors, these CPSs can communicate


**Figure 1:** Global Smart Factory production resources are horizontally integrated into a network of logistic content providers and entities calling for products like sales departments, customers, channel partners, etc


**Figure 2:** Several autonomous Cyber Physical Systems (CPS) are vertically integrated into a Cyber Physical Production System (CPPS) that is connected to the Smart Factory Cloud and controlled by a Smart Factory Manager

with each other and become an independent cyber physical production system (CPPS). Only production commands (a change of configuration for example) or CPPS information that require external actions (like predictive maintenance) are exchanged based on industry standard protocols like OPC-UA between the CPPS and the Smart Factory controller. This decentralised approach reduces the amount of 'big data' communicated with the cloud.

## Motor protection with added value

An example of how a device with this technology can become smart is the PKE electronic motor-protective circuit breaker or the DE1 variable speed starter from Eaton. By connecting these and other smart devices, such as sensors and actuators, to Eaton's SmartWire-DT intelligent wiring system the switching device easily turns into a CPS. Via its electronic unit, the PKE and the DE1 can collect data, such as motor current, overload along with various items of status information, and pass this on via the intelligent wiring system. This is not sufficient on its own to meet all the requirements of a smart device, without the connection module used for the intelligent wiring system being equipped with a latest-generation ASIC module.

The ASIC module can not only analyse the data supplied by the motor-protective component, such as a variable speed starter, but it also provides sufficient programme memory and computing capacity to analyse and interpret the data, and make autonomous decisions, e.g. reducing the speed of the connected motor. In combination with other sensors, this creates a CPS, for example a transport element of a conveyor system, which is then able to independently establish communication with another CPS. These provide the first modules of a consistent, modular and decentralised system.

Any deviations in the normal motor current are detected immediately, and this happens without any additional effort and costs relating to additional measurement technology. Rising values may indicate signs of wear and tear and help plan maintenance activities in advance. In the case of applications with pumps, a drop in the current for instance, can identify whether the pump is running dry. If there is the threat of an overload, counter-measures can be implemented within the machine or system, preventing the protective circuit breaker from tripping and causing machine downtime. Conversely, by taking into account the load status of the motors in different climate conditions, a conveyor belt can be loaded in the ideal way to ensure that the system always delivers the maximum production capacity

without overloading the components involved. In this scenario, using a smart device ensures reliable operation and increased availability, while supporting the maximum workload.

## Creating a CPS from components both in the control cabinet and in the field

The use of the intelligent wiring and communication system is not limited to just the control cabinet. It can even be extended to peripherals using IP67 protection type I/O modules. Intelligent wiring offers clear benefits, as up to 99 devices can be simply and quickly configured as smart devices on a cable up to 600m in length. Motor starters, soft starters, variable frequency drives, circuit breakers, miniature and residual current circuit breakers as well as push-buttons, situated in a high protection class or a suitable small enclosure, can be installed in the exact location in the field where they will form a CPS along with the motor.

The real strength is demonstrated by machines with a distributed structure (especially if they conform to the Industry 4.0 system) when expansions are carried out. This is true irrespective of whether expansion occurs when the machine is first being commissioned, when it is already up and running. Problems caused by a lack of space in the control cabinet are a thing of the past, as all the key sensors and actuators are installed in the field. Additional I/O modules for a central PLC are not required.


**Figure 3:** Smart Data. CPSs are controlling the processes autonomously between themselves.

## Conclusion

One basic principle is to consistently follow the distributed model. Many industries, mechanical engineering in particular, companies are at an early stage in using this approach, as until now the right technologies have not been available. Obviously conventional, centrally-controlled machines do offer opportunities for connecting to the world of Industry 4.0. However, the lack of seamless connectivity means that these solutions remain workarounds, and the numerous benefits that the Internet of Things could provide for machine design are still untapped. Those companies just beginning to use CPSs and work in terms of a distributed approach will enjoy these benefits sooner rather than later.

Eaton has set itself the objective of providing the mechanical engineering sector with support in making their machines IoT-ready. The power management company is developing components, systems and solutions that enable all customers to implement the basic principles of Industry 4.0 in their products, regardless of whether they are small, compact machines or complex, sprawling systems.

One of the company's core tasks is to help specifically medium-sized mechanical engineering firms to make their products IoT-ready. Within its "Authorised Lean Solution Partner" programme, Eaton collaborates with a network of application specialists to be able to offer customers solutions going beyond the components and wiring solutions.

# Imec spin-off develops revolutionary digital glasses

› Paul Marchal & Jelle De Smet, EYeco eyeCO

## EYEco eyeCO uses a foil made out of liquid crystal to integrate in glasses and 'activate' your reading glasses.

About a year ago EYeco eyeCO was founded as a spin-off of imec and Ghent University. Today the start-up has 7 employees, 1.4 million euros in seed capital and a finished prototype. The digital glasses that they've developed are targeted at people aged 40+ who start to struggle with seeing up close and still want to enjoy a comfortable and active lifestyle.

## How it all beganproduction system

In 2014 Paul and Jelle met for the first time. At the time Paul worked as an account director at imec San Francisco where he defined new projects in the field of thin-film electronics and optics with start-ups as well as large technology players.

Meanwhile, Jelle was working on a postdoc at CMST (a lab affiliated to imec at Ghent University) where he developed smart contact lenses with integrated sensors, batteries and solar cells. For this research, he was praised as an 'MIT Innovator Under 35' in 2017. Paul and Jelle got along well and soon the idea started to grow to use this kind of unique technology to help people over forty who start to notice the effects of presbyopia.

## Presbyopia

*"Presbyopia is an age-related condition that is caused by the hardening of the eye lens, which loses its elasticity."*

That makes it harder for the eye to focus on objects up close. Today many people with this condition wear reading glasses – or if they already had an eye correction – bifocal, multifocal or progressive glasses. In general, you could say that the top of these glasses is the right lens power for seeing objects far away and the bottom is the right lens power for viewing objects up close.

Nevertheless, this is not an ideal solution. You often see people wearing these glasses assume weird positions. Suppose you want to read

what's on your computer screen, you have to move your head backwards to see through the lowest part of the lens. Reading while lying down is not an option either because you need to look through the bottom of the lens, i.e. the 'reading part' of your glasses. Because of the way the lens is designed, only a specific (small) part gives you a clear vision. As a consequence, you have to move your head from left to right if you want to read something, instead of just moving your eyes across the page.

So, is it a better idea to use two kinds of glasses, one for reading and one for viewing objects further away? Not a good idea if you go running or cycling, because then you do not only want a clear vision when looking at the road ahead, but also when you're taking a look at your bike computer or sports watch.

*"For middle-aged people with an active lifestyle, presbyopia is a real problem. And also for sportsmen (archers, cyclists, golfers, fishermen, etc.)"*

## The solution: digital glasses

How does EYEco eyeCO tackle this problem? By developing digital glasses that can be activated when necessary (e.g. by tapping the frame). The right correction is provided across the entire surface of the lenses, providing a broad field of vision to see up close or further way. This way you have a clear and comfortable vision, both at work and at home. This solution could even reduce absenteeism - as people wouldn't have as many neck and back complaints - and could help people to work longer and more comfortably.

*"The secret ingredient to the digital glasses is a foil made out of liquid crystal that is integrated into the lenses. By changing the electric field of the crystal, the refractive index is manipulated and changes the lens power."*

The electronics needed to make this work are so small that they can be invisibly integrated into regular spectacle frames. This is essential, because eyewear has become a fashion statement. Nobody wants to walk around with some electronic gadget on their noses.

## Investors and dream team

When EYEco eyeCO was founded, Paul and Jelle soon managed to get the support of 4 partners – Tokai Optecs NV, FIDIMEC N, QBIC ARKIV NV and SOFI – good for 1.4 million euros in seed capital. Raising the interest of these players wasn't that hard as market research had indicated that a better solution for presbyopia was in high demand.

In addition, the spin-off can also count on a top team. Paul and Jelle's employees have years of experience in display technology and an extensive business network. This allowed them to produce about 10 prototypes for first testing in just one year (August 2017).

"At the beginning of 2018, they will do a bigger test with glasses for office work on the one hand and glasses for sports on the other hand. They chose to focus on these two target groups as they suffer most from the effects of presbyopia. EYEco eyeCO plan to launch their first product in the summer of 2018."

## Another field to explore: augmented reality

The technology used in these glasses also offers opportunities for augmented and virtual reality. Typical AR or VR glasses project the information in your rear sight. When you use these kinds of glasses for an activity close to you, e.g. working on a machine, problems can arise because your eyes simultaneously need to focus on information nearby and further way. This is called a convergence mismatch.

*"Patented technology from EYEco eyeCO can be used to project the AR/VR information in the near or rear vision depending on what's convenient."*

Although this offers interesting opportunities, the company's main focus at the moment is and remains developing digital glasses for presbyopia.

Paul Marchal, CEO has 16 years experiences in semiconductor R&D and management at imec, Belgium. He co-founded and headed imec's advanced packaging program with >30M/y revenue. During this period, he supported companies such as Xilinx, Qualcomm, Samsung, Panasonic, etc in adopting Through Silicon Via. Thereafter, Paul became responsible for supporting customers for all imec technologies and developing new business in USA, realizing over >$10M in deals with significant growth potential, across a wide range of technologies and industries, including large data companies. Paul obtained his PhD in electrical engineering from the Catholic University of Leuven, Belgium

# Intelligent World Drive – five continents in five months: On the road to autonomous driving: Mercedes-Benz on automated worldwide test drive


With the “Intelligent World Drive”, Mercedes-Benz is testing automated driving functions on all five continents using a vehicle based on the S’Class. At the International Motor Show (IAA) in Frankfurt, Dr. Dieter Zetsche, President and CEO of Daimler AG and Head of Mercedes-Benz Cars, fired the starting gun to send the test vehicle off on its worldwide test drive. The test vehicle is based on the new series production saloon. Between now and January 2018, this S’C lass, which has been automated for test purposes, will face a variety of complex traffic situations. In the process, it will gather valuable experience on the road to autonomous driving. After the launch in Germany the next test drive will take Place in China followed by others in Australia in November and South Africa in December. The final stop of the tour will be the CES in Las Vegas in January. The purpose of the “Intelligent World Drive” is to collect information on what happens under real traffic conditions around the world, so that future automated and autonomous driving functions can be brought into line with country-specific user/traffic habits.

“Recording, processing and interpreting highly complex traffic situations is the key to safe automated and autonomous driving. This is particularly demanding in dense urban traffic. This is why we are deliberately testing our automated driving functions in everyday driving situations in large cities”, says Ola Kllenius, Member of the Board of Management of Daimler AG responsible for Group Research & Mercedes-Benz Cars Development. “In this way not only do our vehicles become more intelligent, they also become safer.”

## New technologies need legal certainty

In addition, the Stuttgart-based automotive company is an advocate of an internationally harmonised legal framework for automated and autonomous driving. There is a need for action especially in relation to international agreements on road traffic law, which set the binding framework for national legislation and

which currently still compulsorily require a driver. Further changes are also important with regard to vehicle certification as well as data storage.

"Progress must not stop at national borders. Legislation must keep pace with technological development. Otherwise it will not be possible for important innovations in automated and autonomous driving to hit the road," says Renata Jungo Brngger, Member of the Board of Management of Daimler AG, responsible for Integrity and Legal Affairs. "Legal certainty is essential for the acceptance of autonomous driving in society. So we quickly need further international harmonisation of the legal framework."

Autonomous driving is one of the four strategic areas for the future which form an integral part of the corporate strategy of Daimler AG under the acronym CASE. CASE "these letters are shaping the future of mobility. They stand for Connected, Autonomous, Shared & Services and Electric. The aim is to provide intuitive mobility for customers by intelligently intermeshing all four CASE areas.

## "Intelligent World Drive" each continent with different test focuses

While the main area of interest in Germany is specific driving behaviours on motorways and in traffic jams, the focus of the test drive in China is on driving behaviour in the dense traffic of Shanghai with its millions of inhabitants. On a drive from Sydney to Melbourne, the developers in Australia will test the latest, digital maps from HERE. Also in the Cape Town area in South Africa, the focus is on testing the available maps in everyday use as well as on country-specific peculiarities. The test drive in the Los Angeles area and afterwards on to Las Vegas will concentrate on an evaluation of driving behaviour in dense urban traffic and traffic jams as well as traffic overtaking on the right on highways.

## DIGITAL LIGHT testing the innovative lighting system

As lighting also plays a key role on the road to automated and autonomous mobility, Mercedes-Benz's "Intelligent World Drive" is additionally testing a prototype headlamp featuring innovative DIGITAL LIGHT technology. This revolutionary lighting system allows features that were unveiled as a vision of the future in the F 015 Luxury in Motion research vehicle in early 2015. The non-dazzle continuous high beam in HD quality uses chips with over one million micro-mirrors, and therefore pixels, per headlamp. Among other things, DIGITAL LIGHT is thus able to project light corridors onto the road in order to communicate with the surroundings.

## Samsung Starts Producing Industry's First Universal Flash Storage For Next-Generation Automotive Applications

Samsung Electronics, the world leader in advanced memory technology, today announced that it is introducing the industry's first embedded Universal Flash Storage (eUFS) solution for use in next-generation automotive applications. Consisting of 128-gigabyte (GB) and 64GB versions, the new eUFS solution has been designed for advanced driver-assistance systems (ADAS), next-generation dashboards and infotainment systems that provide comprehensive connected features for drivers and passengers worldwide.

"We are taking a major step in accelerating the introduction of next-generation ADAS and automotive infotainment systems by offering the industry's first eUFS solution for the market much earlier than expected," said Jinman Han, Senior Vice President of Memory Product Planning & Application Engineering at Samsung Electronics. "Samsung is taking the lead in the growth of the memory market for sophisticated automotive applications, while continuing to deliver leading-edge UFS solutions with higher performance, density and reliability."

Embedded UFS solutions have been used in a variety of mobile applications since early 2015, when Samsung introduced 128GB embedded memory based on the JEDEC UFS 2.0 standard, for the first time in the industry. Since then, the high performance and proven quality of UFS has led to its wide adoption in large numbers of mobile devices from flagship smartphones initially, to also now in mid-market smartphones.

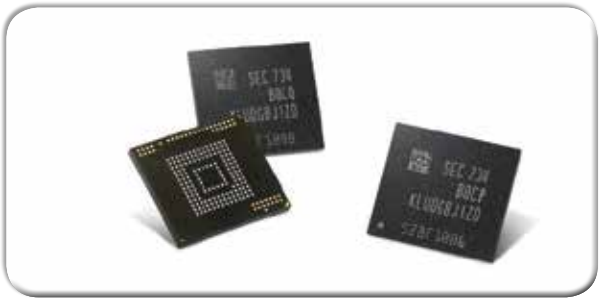
Configured on the most up-to-date UFS standard (JEDEC UFS 2.1), the new Samsung eUFSwill provide advanced data transfer speeds and robust data reliability. For example, the new Samsung 128GB eUFS can read data at up to 850 megabytes per second (MB/s), which is approximately 3.4 times faster than the 250MB/s read speed of today's eMMC 5.0 solutions. It also offers about 6.3 times faster random reading than eMMC at 45,000 IOPS. This will contribute to significantly enhanced performance in upcoming automotive infotainment systems for better managing audio content, increasing navigation responsiveness, accessing Internet-enabled traffic and weather reports, improving handling of hands-free voice commands, and speeding up rear-seat social media interplay.

The new eUFS solution also features an efficient and reliable error-handling process, which is essential for next-generation in-vehicle infotainment. Based on the MIPI UniPro®* protocol, the eUFS enables detecting and recovering from I/O error on hardware layers, without having to involve the host software or restarting tasks.

In addition, the Samsung eUFS supports advanced data refresh and temperature notification features for superior system reliability. The advanced data refresh operation allows a choice of refresh methods, and provides information on the refresh unit, frequency and progress for the host device's control. This enables optimal data reliability, an essential element of automotive applications.

When it comes to thermal management, the Samsung eUFS equips the temperature sensor inside the controller to enable highly reliable device temperature control. This prevents the eUFS from crossing well-defined upper and lower temperature boundaries, thereby allowing its NAND cells to flawlessly function within a tough automotive temperature environment.

In light of the eUFS' high performance and reliability, Samsung expects rapid adoption in the automotive market. Samsung will continue to satisfy the growing storage needs of leading automotive manufacturers by offering a variety of advanced eUFS lineups, while more thoroughly addressing the ever-increasing demand for leading-edge memory solutions in other market segments, too.



## Maxim's CAN Transceiver Eliminates Installation Errors and Improves Reliability for HVAC and Building Automation Systems

MAX14883E delivers ±60V fault protection, selectable polarity, and robust communications to reduce installation errors

Reduce installation errors for heating, ventilation, and air conditioning (HVAC) and building automation systems with the MAX14883E Control Area Network (CAN) transceiver from Maxim Integrated Products, Inc. (NASDAQ: MXIM).

Nowadays, CAN is widely deployed in various industrial

applications. In extreme industrial environments, operators can incorrectly connect the CANH (CAN Bus Line High) and CANL (CAN Bus Line Low) lines when installing their systems. As a result, users have the potential of spending valuable time and money uncovering the issue of an incorrect installation which can increase field returns and the risk of communication failures.

The MAX14883E with selectable polarity and high-speed CAN transceiver is optimized for industrial network applications to reduce installation errors and ensure robust communications. It features a polarity selection input (POL) to swap the CANH and CANL I/Os and allow for software correction of cross-wired field cables. In addition, the MAX14883E features ±60V of fault protection, high ±22kV ESD protection (HBM), and ±25V of common mode range on the CANH and CANL lines to ensure robust communications. The transceiver operates at the maximum CAN high-speed data rate (up to 1Mbps on small networks) from a single 5V supply (VCC) and includes a logic-level supply input (VL) for interfacing with 1.8V to 5V logic. The MAX14883E is available in a narrow, 8-pin SOIC package and operates over the -40°C to +125°C temperature range.

**Key Advantages**

- Smart: Integrated selectable polarity reversal
- Robust: ±60V of fault protection, ±22kV ESD protection (HBM), ±25V of common mode range
- Flexible: Logic interface simplifies designs, from 1.71V to 5.5V logic-supply (VL) range

**Commentary**

- "We have focused on smart integration to simplify installation and enable robust communications for our customers," said Jeff DeAngelis, Managing Director of Business Management at Maxim Integrated.

**Availability and Pricing**

- The MAX14883E is available for $1.36 (1000-up, FOB USA) at Maxim's website and select authorized distributors
- The MAX14883EEVKIT evaluation kit is available for $99


## NXP Launches World's First Scalable, Single-Chip Secure Vehicle-to-X Platform

NXP Semiconductors N.V. (NASDAQ:NXPI), the world's largest supplier of automotive semiconductor solutions, has expanded its leadership in secure vehicle-to-everything communications (V2X) with its next generation RoadLINK™ solution. The new NXP SAF5400 is the world's first automotive qualified, high-performance single-chip DSRC modem. Its unique scalable architecture, new industry-leading security features, and leading edge RFCMOS and software defined radio (SDR) technologies offer OEMs flexible options for cross-regional secure V2X adoption and field upgradeability.

V2X technology allows vehicles to communicate with other cars, infrastructure and vulnerable road users to increase driver safety and smooth out the autonomous driving experience. The DSRC/802.11p version of V2X delivers minimum latency for real-time communication and an operating range that exceeds 1 mile even in areas where cellular network connections are not available. DSRC also provides dedicated secure safety channel operation to enable the secure communication of safety messages and other data in real time, forming an essential part of the suite of autonomous driving sensors for today's connected cars and trucks. V2X based on DSRC is also instrumental in truck platooning, a forerunner of future eco-friendly driving scenarios.

The NXP SAF5400 modem integrates advanced transceiver technology plus the full baseband, MAC and firmware into a complete one-chip standalone modem. It provides superior RF performance for industry-leading range under all channel conditions and is the industry's first single-chip modem with the capability to verify more than 2000 messages per second on chip. The SAF5400 architecture is fully scalable to enable its combination with application processors such as NXP's powerful i.MX family, security, power management and in-vehicle networking solutions, all offered as part of the NXP secure V2X system platform.

To enable the highest security, NXP provides the SXF1800, a dedicated hardware secure element based on technology used today in many of the world's most sensitive security environments from electronic passports, banking cards, smartphones and now automobiles. Confirmed by third party security evaluations and certifications, the SXF1800

demonstrates very high resistance to physical probing and tampering. V2X security requirements can also be met with software functions on NXP's i.MX processors, offering customers a performance/cost trade-off choice. The secure single-chip V2X solution incorporates NXP's software defined radio technology which provides customers with a platform that supports different regional standards with a single hardware solution. This integration reduces development, qualification and maintenance efforts significantly and eases the challenges of global V2X rollouts. The ultra-compact, one-chip integration of analog RF with digital baseband processing into a single chip leverages NXP's RFCMOS technology for a smaller hardware footprint.

"NXP has delivered a secure single chip V2X platform that will enhance a vehicle's ability to "see" around corners and will contribute to our efforts to save lives," said Kurt Sievers, executive vice president and general manager, NXP Automotive. "The next generation NXP RoadLINK™ builds on NXP's existing industry leading solution, which is already on the roads of the world and provides a high-performance platform that is scalable and easy for OEMs to adopt across the globe."

The NXP V2X system platform operates in the 5.9 GHz and 760 MHz bands and is compatible with global software protocols from all leading vendors, enabling a true global V2X solution. The platform meets and exceeds the current guidelines of the US DOT's Notice of Proposed Rulemaking, as well as emerging standards in Europe, Japan and Korea.

**The NXP SAF5400 Modem**

The NXP SAF5400 single-chip modem is the core of the secure V2X system platform called RoadLINK™. RoadLINK is the secure V2X solution of choice across the globe, as it has completed more than 1 million test days to date and is the only 5.9 GHz V2X system solution proven in volume production today.

**Quick Facts on SAF5400:**

- Based on the proven first generation NXP secure V2X solution that is on the road today and used in many RSU/smart city trials
- SAF5400 has a unique scalable architecture which enables combination with the i.MX product family, offering the option to use the same V2X silicon in a system platform to scale from "low end" toward "high end" OBUs
- SXF1800 V2X secure element can be added to the system to provide a very high level of security for today's connected cars and trucks
- Software stack agnostic, backward compatible with NXP's first generation RoadLINK chipset

Supports all global V2X standards in US, EU, JPN and KOR

- Supports dual antenna diversity use cases and provides the highest integration and lowest system cost V2X solution in the market
- Enables very low system power consumption and superior RF performance under all channel conditions
- Optimized scalability and built-in antenna compensator support leveraging NXP's safe launch approach and high quality standards
- NXP has completed more than 1 million days of V2X field testing with a solution already in automotive production
- NXP's secure V2X solutions are automotive grade, offer industry leading range and RF performance and follow all proven automotive development processes

**Availability of NXP SAF5400:**

Sampling with lead customers starting December 2017

## Renesas Electronics High-Performance Automotive Chips Adopted by Nissan for its New LEAF Automated-Parking System

Renesas Electronics Corporation (TSE:6723), a premier supplier of advanced semiconductor solutions today announced that its R-Car system-on-chip (SoC) for car infotainment and advanced driving assistant systems (ADAS) as well as its RH850 automotive control microcontroller (MCU) have been adopted by Nissan for the ProPILOT Park, a full-fledged automated-parking system, of its new LEAF, Nissanλ€™s new 100 percent electric vehicle which debuted on September 6, 2017.

The R-Car SoC adopted in the ProPILOT Park of the new Nissan LEAF recognizes spaces adequate for parking, verifies that there are no obstacles in the way, and handles the role of issuing control commands for acceleration, braking, steering and shifting. The R-Car SoC includes Renesas" exclusive parallel image

processor (IMP) dedicated for image processing. The IMP takes the high-resolution images from the latest automotive CMOS digital cameras and performs high-speed, low-power signal processing. The RH850 MCU accepts the chassis control commands from the R-Car SoC and transmits these commands to the various electronic control units (ECUs) used. This enables the Nissan LEAF's ProPILOT Park to achieve safe and reliable parking operation.

"As part of our efforts to promote the spread of the driving assistant technologies, Nissan has been the pioneer in the industry in around view monitor implementation thanks to Renesas" image processors,"said Takashi Yoshizawa, Vice President and Alliance Global Director of EE and Systems Engineering Division, at Nissan Motor Corporation. "I am very pleased that together with Renesas we were able to bring the ProPILOT Park, which is a full-fledged automated-parking features in our new Nissan LEAF."

"We believe from our expertise and long-time experience in the automotive area that, in addition to achieving performance and quality, the balance between the control of heat, space, and other parameters is also essential," said Ryuji Omura, Executive Vice President, Renesas Electronics Corporation. "We are proud that our track record has been recognized with the adoption of our automotive chips in Nissan's new automated-parking system. Renesas is poised to delivering innovative technologies for autonomous driving to foster the advancement of the automotive industry."

Based on the newly-launched Renesas autonomy, a new advanced driving assistance systems (ADAS) and automated driving platform, Renesas enables a safe, secure, and convenient driving experience by providing innovative solutions for next-generation car.


## New High Resolution Audio SoC Supports a Variety of Sound Sources

ROHM also offers the industry's first high resolution audio reference design

ROHM has recently announced the availability of a high resolution audio SoC designed to act as the 'brain' in audio applications such as Bluetooth speakers, USB DACs, and mini/micro component systems by carrying out control and management of peripheral components and input/output I/F as well as enable playback of a wide range of audio sources.

In recent years, a variety of audio devices are required to faithfully reproduce information from different sound sources (media/music files) – not just high-resolution audio.

However, in order to support a wide range of audio sources multiple media decoders are required (i.e. CD, USB, Bluetooth) along with additional peripheral components, leading to challenges relating to increased software complexity and development load.

For the audio sector ROHM not only offers general-purpose ICs such as opamps, but audio-related ICs as well, ranging from media decoders and speaker amps to sound processors. This time, ROHM developed an audio SoC that acts as the 'brain' of audio devices along with a reference design that improves audio quality for the entire system while minimizing development load.

The BM94803AEKU integrates a processor chip with SDRAM featuring an optimized architecture that leverages software and circuit elements such as ASIC (Application Specific IC), MCU, and various media decoders (developed by the ROHM Group) on a single chip. The media decoder supports a wide range of audio sources, and utilizing over 20 years of expertise allows ROHM to ensure stable playback of damaged CDs and even non-standard USB. In addition, SDRAM is built in that contributes to greater miniaturization.

This SoC allowed ROHM to achieve the industry's first high-resolution reference audio design. The design maximizes the performance of audio devices and peripheral applications by configuring ROHM's amp, CD driver, and other elements around the audio SoC. Furthermore, providing dedicated software enables rapid development of audio devices capable of stable playback of a wide range of audio sources, shortening development time considerably.

**Key Features**

**1.** Compatible with a broad range of audio formats

The BM94803AEKU supports a variety of media, from conventional (CD, USB, SD) to newer protocols (smartphones, Bluetooth), while at the same time covering a range of music formats, including FLAC and DSD.

**2.** Ensures smooth playback

Expertise cultivated for over 20 years in developing media decoder sensures smooth playback without

skipping, even with CDs featuring surface scratches. Non-standard USB memory prevalent in emerging countries can also be read, while unmatched playback stability allows ROHM to meet customer expectations for audio equipment.

**3.** Full software suite supports audio device development
Providing an audio SoC optimized for audio devices along with a reference design that includes dedicated software for maximizing performance significantly reduces development load required by audio equipment makers, speeding up development and shortening time-to-market considerably.

**4.** Built-in CD DSP and SDRAM contribute to greater miniaturization
ROHM's audio SoC integrates both a CD DSP (CD media decoder) and 16Mb SDRAM (LAPIS Semiconductor product), which were previously implemented separately, in a single package. This not only reduces mounting area, but also eliminates the need to consider radiation noise between components.

**Reference Audio Design**

This reference design maximizes the performance of ROHM audio devices, in particular the new audio SoC. Besides audio components, peripheral applications such as a tuner module, Bluetooth module, and CD driver are built in, making it possible to immediately verify playback operation and enable quick development of high-resolution audio equipment.


## NXP S32V Processor for Vision and Machine Learning Applications Now Available

S32V processor enhanced with Vision SDK and expanded ecosystem enablement partners

Offers powerful GPU for surround view image stitching and offloads advanced vision processing and machine learning algorithms to APEX-2 engines

Robust sensor fusion solution with multiple layers of functional safety and security

High-performance per power envelope (GHz/mW) for low power ADAS vision processing, for adding additional capabilities within the same system environment

NXP Semiconductors (NASDAQ:NXPI) today announced the full availability of the NXP S32V processor along with complementary S32 Design Studio IDE enablement to simplify and accelerate the deployment of ADAS vision and neural network solutions in automotive, transportation and industrial applications.

Success in the race to fully autonomous level-5 vehicles will depend on how accurately a car can interpret its surroundings with the fusion of vision and sensor data. Systems such as the NCAP front camera and surround view, which the S32V processor is designed for, will also have the ability to locate, identify, track and classify multiple objects simultaneously.

Neural networks and machine learning are critical to develop autonomous vehicles since they will need to adapt to changing environments and adverse conditions. These technologies are being deployed into multiple industries to identify speech, recognize objects, understand behavior and predict events. As processing scales to meet the needs of autonomous driving, designers will need architectural flexibility to add differentiation and provide clear safety certification that S32V processors provide.

**The S32V Processor**

Meets the needs of autonomous vehicle development with its blend of safety fusion and high performance processing using NXP's second generation APEX-2 vision accelerators.

Includes dual APEX-2 engines with 128 parallel computational vector units that process image data faster and at lower power than traditional GPU based solutions.

APEX-2 engines are easily programmed using APEX-CV library for computer vision algorithms.

Included in the Vision SDK are APEX-CV base level and APEX-CV pro library algorithms as Canny, ORB, Harris, HOG, Gaussian, Hough and other detection algorithms to simplify development.

Quote

"The launch of the S32V processor provides a dedicated solution for vision processing and machine learning to a wide range of automotive and industrial customers," said Paul Lee, global distribution marketing manager for NXP's Automotive Microcontroller and Processors Business Line. "We look forward to the next generation of innovative applications that design engineers will develop with our Vision SDK and software enablement tools."


## Lattice's Low Power, Small Form Factor ECP5 FPGA Enables Ximmerse VR/AR Tracking Platform

Lattice Semiconductor Corporation (NASDAQ: LSCC), the leading provider of customizable smart connectivity solutions, today announced that Guangdong Virtual Reality Technology Co., Ltd. (Ximmerse), a provider of interaction systems for mobile AR/VR applications, has selected Lattice's ECP5™ FPGA to perform stereo vision computing in their AR/VR tracking platform. Lattice's market-leading ECP5 FPGAs are ideal for flexible connectivity and acceleration at the edge due to their low power, small form factor and low cost, delivering an energy-efficient, low latency solution.

As the market need for AR/VR environments continues to grow, current head mounted display (HMD)-based systems witness performance issues running content on mobile applications processors (APs). As such, performing visual based positional tracking on the processor has proven challenging. With up to 85K LUTs in a small 10 x 10 mm package, Lattice's ECP5 FPGA offers lower latency and increased power-efficiency image processing compared to an AP. The programmable fabric and I/Os also allow Ximmerse to easily choose and source the camera sensor from different vendors based on the product requirement.

"Lattice has been a valuable partner in overcoming design and performance challenges we previously faced when building our mobile AR/VR solutions," said Jingwen Dai, CTO at Ximmerse. "Their video expertise and top-notch customer support, along with their flexible ECP5 FPGA, helped us deliver a solution that's far smarter and higher performance. We look forward to continuing our work together."

This announcement underscores Lattice's continued success and leadership in AR and VR applications. Its extensive product suite includes WirelessHD® modules for sub-frame latency video transmission in wireless VR systems, CrossLink™ FPGAs for MIPI® display bridging and multi-camera aggregation in 360 cameras and SLAM (simultaneous localization and mapping), and iCE40™ FPGAs for concurrent data acquisition for sensor based positional tracking systems.

"Lattice's ECP5 FPGA continues to accelerate the adoption of mobile-influenced technology in rapidly evolving systems at the edge," said Ying Chen, senior marketing manager for new consumer markets at Lattice Semiconductor. "In the past year alone, we've seen companies from around the globe implement our small form factor, low power, low latency FPGAs for a wide array of products from AR/VR systems, robotics and drones to machine vision and smart surveillance cameras. This is just the beginning; we are enthusiastic about what's ahead for innovation and design at the edge."

Ximmerse currently offers both inside-out and outside-in tracking products and solutions that are already licensed by the industry's hottest AR and VR HMD vendors. To learn more about the Ximmerse offering, please visit: www.ximmerse.com.

For more details on the ECP5 family of low power, small form factor connectivity FPGAs, please visit www.latticesemi.com/ECP5. To learn more about the recently announced Embedded Vision Development Kit, visit www.latticesemi.com/evdkit. Lattice's complete product portfolio for embedded vision solutions can be found at www.latticesemi.com/EVsolutions.


## Renesas Electronics and Cogent Embedded Collaborate to Make 3D Surround View Parking Assist System Standard in All New Cars

**New Solution Combining Customizable 3D Surround View Software and R-Car V3M Realizes Parking Assist System Without Using GPU**

Renesas Electronics Corporation (TSE:6723), a premier supplier of advanced semiconductor solutions, and Cogent Embedded Inc., a leading embedded software provider to the automotive industry, today announced their joint development of a 3D surround

view solution to assist drivers during parking or low-speed maneuvers. Designed for parking assist systems in entry- and mid-level cars, the new solution combines the Renesas R-Car V3M system-on-chip (SoC), an SoC optimized for smart camera and surround view systems, with Cogent's customizable 3D surround view software on a reference board. By using this solution, OEMs and Tier 1s can quickly customize and create their individual 3D surround view parking assist systems. On-demand customization services can also be provided by Cogent Embedded to enable system developers to concentrate on developing application software to differentiate their systems.

The new 3D surround view solution will be demonstrated at AutoSens 2017 (booth #9), which will be held from September 19 to 20, 2017 in Brussels, Belgium.

"As in-vehicle infotainment and ADAS systems converge, automotive system designers require technologies that deliver predictable performance for safety while securing the flexibility to customize," said Shinichi Yoshioka, Senior Vice President and Deputy General Manager of Automotive Solution Business Unit, Renesas Electronics Corporation. "Renesas is expanding its relationship with software expert Cogent Embedded to deliver new solutions that address both of these growing markets with our R-Car V3M SoC that delivers 3D function and performance comparable to other surround view SoCs, at lower power and cost levels."

"We are excited about the opportunity our cooperation with Renesas provides. The R-Car V3M SoC provides the right set of functions for entry-to-mid-level surround view to run efficiently our state-of-the-art 3D surround view with pedestrian detection, cross-traffic-alert and lane tracking algorithms, an ideal combination of surround view and computer vision features," said Artemi Ivanov, President of Cogent Embedded Inc. "Combining the power and cost effectiveness of Renesas hardware with our royalty-free software allows carmakers to offer surround view in lower priced vehicles. We believe that with the new collaboration, Renesas and Cogent can contribute to making surround view a standard on all new vehicles, and we are proud to be part of that solution."

It is necessary for next-generation 3D surround view systems to achieve not only display functionality but also object recognition. Surround view is a vehicle camera system that provides an all-round panorama view and assists the driver when parking. A control display on the vehicle's interior control panels shows data from surround view cameras and offers the driver a realistic 360-degree surround view to assist in maneuvering the vehicle to park and to alert the driver to obstacles in its path that may not be immediately visible.

The R-Car V3M is equipped with an integrated image signal processor (ISP), the IMR for low-power image rendering and the IMP-X5 computer vision engine. It delivers robust functional safety and high performance at lowpower consumption required for use in smart camera applications, surround view systems, and lidars, including NCAP (New Car Assessment Program) features.

The R-Car V3M is part of the Renesas autonomy™ Platform, an open, innovative and trusted platform for ADAS and automated driving. With this open platform, Renesas is the only automotive semiconductor supplier in the industry to cover end-to-end solutions from secure cloud connectivity and sensing to vehicle control.

**Key features of the 3D surround view solution**

Highly-customizable 3D surround view software

The new 3D surround view solution includes Cogent's highly acclaimed 3D surround

view software which is presently used by several industry players. The software is optimized for the R-Car V3M and enables a highly customizable and expandable white label solution for OEMs and Tier1s.

The R-Car V3M enables full-HD 3D surround view system with high quality resolutions and lower power consumption

The R-Car V3M includes a dedicated image rendering unit (IMR) that enables realistic 360-degree surround view and free view-points at lower power consumption than GPU-based SoCs. The R-Car V3M supports up to four 1.3 Megapixel cameras. These cameras can make use of the integrated ISP in the R-Car V3M, which eliminates the need to install an ISP per camera, thereby reduces bill-of-material (BOM) costs. The optimized video pipeline can generate up to Full HD resolution output to the infotainment units. The integrated IMP-X5 computer vision engine enables object recognition such as lane detection, pedestrian or obstacle detection. This enables OEMs and Tier 1s to design full-HD surround view systems with high-quality resolutions and lower power consumption.

**Availability**

Samples of the R-Car V3M SoC and reference board will be delivered by Renesas and will be available from December 2017. Cogent's software will be available from Q4 2017 onwards. (Availability is subject to change without notice.)


## 150°C rated 1206-inch chip ferrite beads for automotive power lines

Murata Manufacturing Co., Ltd. introduces the BLM31KN_BH series of 1206-inch (3.2 x 1.6mm) chip ferrite beads for supplying power with guaranteed usage at 150°C for automotive powertrain safety applications.

This product was designed primarily for automotive applications, for use as a noise suppression component of power lines circuit installed in automotive engine rooms and LED headlights which require guaranteed usage at high temperatures. Mass production of the product has already started.

Background

In today's automotive applications, there is increasing need for noise suppression in order to counteract rising conductive noise and radiation noise resulting from the development of motorization of various functions, including hybrid and electric cars.

As an example, the number of motor circuits installed in motor control circuits (with a brush) or inverter circuits (brushless) has increased with the motorization of powertrains, requiring noise suppression components which are capable of dealing with large currents. Furthermore, in order to reduce vehicle weight, which is directly related to fuel economy improvement, the electronic control units (ECU) of engine systems and safety systems tend to be located in engine rooms which reach high temperatures (mechatronic design), requiring noise suppression components used in ECUs that are also guaranteed to work at high temperatures. Murata has realized a product that supports large currents suitable for power lines (120ohm/4A at 125°C) by devising design specifications for internal and external electrodes that can also be used in environments of 150°C at a size of 1206 inches. Murata will continue to focus on development of noise suppression designs for these power lines.

**Features**

Conforming to AEC-Q200*1

Available within the range of -55°C to 150°C (with derating*2 of the rated current)

Small size (3.2 x 1.6mm) capable of dealing with large currents of up to 4A

Impedance up to 1000ohm (at 100MHz) is effective for noise suppression.

**Site URL for the product**

BLM31KN_BH Series

See the series lineup here.

**Terminology**

*1 AEC-Q200

Reliability testing standards required for automotive electric components and established by the Automotive Electronics Council

*2 Derating of the rated current

A 150°C guaranteed product determines the rated current at ambient temperatures of 125°C and 150°C and guarantees the specifications and reliability in environments of 150°C.

## ON Semiconductor Introduces World's Most Compact Sigfox Verified Solution with its First RF System-in-Package for Low Power IoT Designs

igfox RC1 verified SiP provides turnkey RF solution with module-like functionality in an IC form factor for device-to-cloud communications ON Semiconductor (Nasdaq: ON), driving energy efficient innovations, has announced a new programmable RF transceiver System in Package (SiP) integrating an advanced RF System-on-Chip (SoC) with all surrounding Bill of Material (including a TCXO). The AX-SIP-SFEU provides the most integrated Sigfox solution for both uplink (transmit) and downlink (receive) communications. The device is the first in a new family of SiPs that will be launched over the coming months, providing a comprehensive range of ready-to-use, turnkey radio frequency (RF) solutions to support applications requiring Internet of Things (IoT) connectivity.

With the challenging space constraints of many IoT applications – where, for example, connectivity is needed close to the sensor – ON Semiconductor's 7 mm x 9 mm x 1 mm SiP transceiver has almost one-third the footprint and is one-tenth the overall size of a module-based solution; this gives engineers much greater design freedom. Building on the success of the AX-SFEU SoC family and thanks to the integration of all necessary functionality, the AX-SIP-SFEU positions ON Semiconductor with a market leading one-chip solution for Sigfox applications. Delivered with conformal shielding and pre-certified radio regulatory approvals, the 'out of the box' solution helps to simplify design, speed time to market, and reduce overall development cost by allowing customers to focus on their application and antenna design.

Due to the need for long-life from a battery powered solution, a further concern for design engineers working on wireless communications applications is power consumption. Sigfox's predictable and claimed lowest energy consumption 'device-to-cloud', is complemented by ON Semiconductor's own ultra-low power design to give the new SiP standby, sleep and deep sleep mode currents of just 0.5 milliamps (mA), 1.3 microamps (µA) and 100 nanoamps (nA) respectively.

The AX-SIP-SFEU connects to the customer product via a simple universal asynchronous receiver transmitter (UART) interface. AT commands are used to send frames and configure radio parameters, with an Application Programming Interface (API) variant available for customers wishing to write their own software. The new device is part of an ON Semiconductor ecosystem which also comprises a development kit and an integrated IDE for software developers.

"ON Semiconductor's new SiP transceivers, of which the AX-SIP-SFEU is the first, provides all of the advantages, integration and convenience associated with a module, but with the form factor of an IC," said Thomas Wolff, Vice President of Wireless & Connectivity Solutions at ON Semiconductor. "Sigfox certification and compliancy with local regulation means that engineers, working on exciting and innovative IoT solutions across many market sectors, can focus on other aspects of the design knowing that the connectivity and communications element is already taken care of."

"Sigfox is delighted to have partners like ON Semiconductor that provide our ecosystems with innovative products and leading technologies," said Tony Francesca, VP of Global Ecosystem Partners at Sigfox. "The new SiP from ON Semiconductor is opening a new generation of devices, demonstrating with its high level of integration that the IoT market is developing now and gaining in maturity."


## Enable CAN Flexible Data Rate (CAN FD) in new and existing designs using Microchip's unique external CAN FD controller

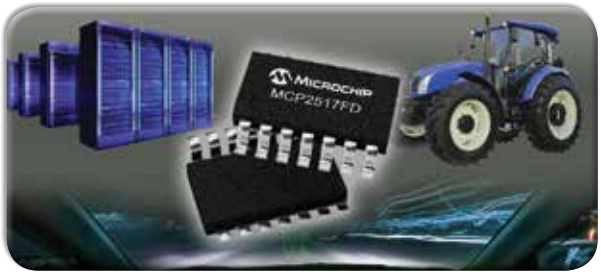
Microchip announces the availability of the industry's first external CAN Flexible Data Rate (CAN FD) controller. The MCP2517FD provides designers with a simplified path to upgrade from CAN 2.0 to CAN FD and benefit from CAN FD protocol enhancements.

CAN FD offers many benefits over traditional CAN 2.0 including faster data rates and data byte message expansion. The cutting-edge MCP2517FD CAN FD controller can be used with any microcontroller (MCU), enabling developers to easily implement this technology without a complete system redesign. Since the adoption and transition to CAN FD is in the beginning stages, there are a limited number of CAN FD MCUs available today. In addition, changing a system MCU can come with a significant cost, increased development time and risk. MCP2517FD allows system designers to enable CAN FD functionality by adding only one external component while continuing to utilise the majority of their design.

The MCP2517FD also allows designers to easily integrate additional CAN FD channels, on top of those that may be available on an MCU.

The MCP251XFD CAN FD Motherboard (Part #ADM00576), together with the MCP2517FD Click Board (Part #MIKROE-2379), provides a simple, low-cost evaluation board for implementing a CAN FD design. In addition, a firmware API written in C is available for rapid application development.

The MCP2517FD-H/SL is available today in a 14-lead SOIC package for sampling and in volume production. The MCP2517FD-H/JHA is available today in a 14-lead VQFN package with wettable flanks for sampling and in volume production.




## Unique DC/DC converter combines true fixed frequency and ultra-fast transient response with integrated compensation

TI's stackable 16-V input, 40-A SWIFT™ DC/DC buck converter features innovative control topology

Texas Instruments (TI) (NASDAQ: TXN) today introduced the industry's first 16-V input, 40-A synchronous DC/DC buck converter with an internally compensated advanced-current-mode (ACM) control topology supporting frequency synchronization. TI's TPS543C20 SWIFT™ converter provides enhanced efficiency by integrating its latest generation of low resistance high- and low-side MOSFETs into a thermally efficient small-footprint package. Designers can stack two converters side by side to drive loads up to 80 A for processors in space-constrained and power-dense applications in various markets, including wired and wireless communications, enterprise and cloud computing, and data storage systems. For more information, samples and an evaluation module, see www.ti.com/tps543c20-pr-eu.

The unique internally compensated ACM control topology with fast transient response maintains stability over a wide range of input and output voltages. What makes ACM different is that it is an emulated peak-current-mode control topology that internally generates a ramp with the ability to dynamically adjust for stability over a wide range of operating switching frequencies. This provides the best of both traditional fixed frequency for low noise operation and constant on-time (COT) control for fast transient without external compensation. Read the blog post, "Lightning-fast internally compensated ACM topology – what can it do for you?" and the "Control-Mode Quick Reference Guide" to understand the difference between TI's various control modes.

**TPS543C20 key features and benefits**

- Provides greater than 90 percent efficiency at a 40-A peak-load current.
- Maintains 0.5 percent reference-voltage accuracy over temperature and full differential remote-voltage sensing to meet the voltage-accuracy requirements of deep submicron processors.
- Provides up to 80 A at point-of-load when stacking two converters.
- Offers very high power density and the PowerStack™ quad flat no-leads (QFN) package enables easy heat sinking from the single ground pad.

**TPS543C20 support and tools**

- Download the 1V, 20A Highly Integrated Synchronous Buck Converter Reference Design and speed up your design process with TI's WEBENCH® online design tools.
- Order the 40-A TPS543C20EVM-799 or stacked 80-A TPS543C20EVM-869 evaluation modules.

For similar applications at 25 A, TI offers the TPS543B20 in a pin-to-pin-compatible PowerStack QFN package. For those applications requiring PMBus to support telemetry, TI offers the stackable 35-A TPS546C23 SWIFT synchronous buck converter.


## Mini-IO adopted as an International Electrotechnical Commission standard

IEC 61076-3-122 provides miniaturized connector standard for industrial applications in harsh environments

TE Connectivity (TE), a world leader in connectivity and sensors, announced the Mini-IO connector has been adopted as an international standard (IEC 61076-3-122) by the International Electrotechnical Commission (IEC).

IEC 61076-3-122 provides the minimum requirements for a miniaturized connector for industrial applications and thus ensures safety through consistent performance and interoperability. Connector requirements for industrial applications are high as they typically run in

harsh environments with high mechanical demands from vibrations and rapid movements, environmental stress through dust and humidity, and possible exposure to radiated electromagnetic fields.
"TE is pleased that with the completion and publication of IEC 61076-3-122, the Mini-IO is the first standardized miniaturized industrial communication connector for an IP20 environment. Beyond its advantages for industrial applications in harsh environments, the small dimensions of the connector enable smaller devices and therefore higher packing densities inside cabinets," said Guenter Feldmeier, global standardization & consortia leader of TE's Industrial business unit. "TE Connectivity is pleased that the mini- i/O Standard was based on our technology."
Referring to its current use in industrial automation systems such as MECHATROLINK and VARAN, Feldmeier adds: "The reliability of the Mini-IO in harsh environments is already demonstrated by industry users. The standard now offers an exciting opportunity to accelerate the adoption by further eco-systems."

## Microchip Debuts New Development Board for Designing with 16-bit and 32-bit PIC® Microcontrollers

Microchip Technology Inc. (NASDAQ: MCHP), a leading provider of microcontroller, mixed-signal, analog and Flash-IP solutions, today announced the new Explorer 16/32 Development Board for designing with 16-bit and 32-bit PIC® microcontrollers. This new board is offered at a reduced cost from Microchip's popular Explorer 16 Development Board and comes with an integrated programmer/debugger and several new features that address the latest embedded systems design needs. The board provides a flexible, convenient and easy-to-start tool while being backwards compatible to the classic Explorer 16 Board.
The Explorer 16/32 Development Board serves as a platform for customers to evaluate the 16-bit PIC24, dsPIC33 and 32-bit PIC32 families of devices through Processor Plug-In-Modules (PIMs) for easy device swapping. It facilitates prototyping the end application for proof of concept before migrating to the actual design. The board features a mikroBUS™ interface to easily add new functionalities using Click Boards™ from MikroElectronika. In addition, the board also supports an integrated USB for both power and communication, eliminating the need for an external power adapter and communication accessory.
This new board is backwards compatible with the popular Explorer 16 Board which allows users to continue using existing code, libraries, prototypes, PIMs, and PICtail™ Plus daughter cards interfaced via a side PICtail Plus connector. The PICtail Plus daughter cards interfaced via a vertical connector can be re-used via the additional PICtail Plus Expansion Board.
"The Explorer 16 Development Board has been one of Microchip's most popular development tools," said Terry Schmidt, director of marketing for Microchip's MCU16 division. "Backwards compatibility was extremely important to support our large 16- and 32-bit PIC MCU customer base. We listened to our customers and incorporated many new features and capabilities they requested such as an integrated programmer/debugger and USB power. With hundreds of application daughter cards, the possibilities with this board are endless."
For more information about the Explorer 16/32 development board, visit www.microchip.com/Explorer1632 or https://youtu.be/Gb8lPufjur4 to watch a short video.

**Pricing and Availability**

The Explorer 16/32 development kit (part# DM240001-3) includes the main Explorer 16/32 Development Board as well as a PIC24FJ1024GB610 Plug-In-Module and two USB cables. The Plug-In-Module features a 16-bit PIC24FJ1024GB610 microcontroller with 1MB Flash, a superset of memory and functions for the lower-power PIC24F family. This kit with PIM and cables is available for $109.99
For those who already have a Processor PIM and USB cables, the Explorer 16/32 Development Board (part# DM240001-2) is available at a lower cost of $79.99.
An optional PICtail Plus Expansion Board (part# AC240100) is also available to extend the Explorer 16/32 Development Board with vertical PICtail Plus application daughter cards as well as additional mikroBUS interfaces and a small prototyping area. It is available for $39.99.


Explorer 16/32 Development Kit
with PIC24FJ1024GB610 Plug-In Module
(Part # DM240001-3)

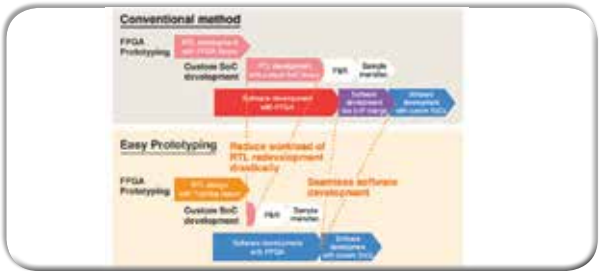
## Toshiba's "Easy Prototyping" Solution for Custom SoC Development Platform Reduces Need for Customer's Own Design Resources

Toshiba Corporation's (TOKYO: 6502) Storage & Electronic Devices Solutions Company announced today the immediate availability of "Easy Prototyping", a solution that allows reuse of the design assets required to develop large scale custom SoC*1 with FPGA prototyping*2. Adoption of the solution dramatically shortens the development time from FPGA prototyping to custom SoC development. Easy Prototyping is available on Toshiba's ASIC and FFSA™ *3 platforms.

In conventional FPGA prototyping, SoC designers cannot reuse FPGA hardware and software design assets for custom SoC development because FPGA libraries*4 and IPs*5 are FPGA specific. Easy Prototyping facilitates the reuse of these assets for the custom SoC design by adapting the FPGA prototyping libraries leveraging Toshiba's libraries and IP subsystems*6. This enables designers to identify the interface and easily switch between FPGA prototyping and SoC implementation with the Toshiba provided wrapper logic*7.

Toshiba supports third party IPs that have good track record in FPGA and provides these IPs as subsystems which are verified for connectivity with Toshiba's custom SoC solutions. 10 Gigabit Ethernet (MorethanIP), PCI Express®*8 3.0/2.1/1.1 (Northwest Logic), DDR3 SDRAM*9 controller (Northwest Logic) are available immediately for Easy Prototyping and the line-up is being expanded to cover additional solutions.

Going forward, Toshiba will continue to provide solutions that help customers to optimize system design and achieve timely product development.




## New congatec modules with 10 GbE bandwidth raise the bar for embedded edge computing

congatec - a leading technology company for embedded computer modules, single board computers and embedded design and manufacturing services – announces the launch of the conga-B7AC, a new Intel Atom C3000 processor based COM Express Type 7 Server-on-Module that raises the bar for embedded edge computing through 10 GbE bandwidth support. With a power consumption starting at only 11 Watt, the new low-power multicore Server-on-Modules with up to 16 cores offer up to 4x 10 GbE real-time capable network performance. The feature set is designed for modular industrial micro servers as well as rugged telecom and network equipment – such as small cells, factory gateways and storage systems – and is deployable even in the extended temperature range from -40°C to +85°C. The conga-B7AC is based on the new PICMG COM Express 3.0 specification and, as a commercially off-the-shelf available, standardized building block, perfectly suited for efficient custom designs of very small sized, solely passively cooled embedded edge devices.

"Distributed embedded edge devices supporting 10 GbE bandwidth can be utilized as small cells for next generation LTE networks, device nodes for cyber-virtual factories, or local micro data centers for sensor networks. For these tasks, they need to handle massive TCP/IP communication and storage bandwidths in real-time. These edge data centers have to offer high multi core capabilities, as they generally have to handle smaller package sizes in parallel. This is the application area, where the new server-grade Intel Atom C3000 processors are a perfect addition to our Intel Xeon D processor based Server-on-Module portfolio. Thanks to their reduced cost and power consumption we are now able to bring massive network bandwidth and storage capabilities deeply into the industrial field," explains Martin Danzer, Director of Product Management at congatec.

The new COM Express Type 7 Server-on-Modules from congatec are application ready for redundancy, real-time communication and virtualization technologies to maximize uptime and resilience, minimize latency and to get the most out of each processing core. Their cloud API for distributed embedded edge servers further provides all the capabilities that data center managers need to remotely monitor system health, power consumption and environmental conditions. With the support of up to 20 PCI Express (PCIe) lanes,

the new Intel Atom C3000 processor based COM Express Type 7 Server-on-Modules also offer minimum latency for storage devices as well as very fast access lanes to all the various sensor networks, field busses and industrial Ethernets.

**The feature set in detail**

The new conga-B7AC COM Express Type 7 Server-on-Modules are available with 8 different Intel Atom server processors, from the 16-core Intel Atom C3958 processor to the quad-core C3508 for the extended temperature range (-40°C to +85°C). All modules provide up to 48 GB of fast 2400 DDR4 memory with or without error correction code (ECC) depending on customers' requirements. They offer very high network capabilities with up to 4x 10 GbE and the Network Controller Sideband Interface (NC-SI) for connecting a baseboard management controller (BMC) allowing out-of-band remote manageability. Flexible system extensions including NVMe flash storage can be connected via up to 12x PCIe Gen 3.0 lanes and 8x PCIe Gen 2.0 lanes. 2x SATA 6G ports are available for conventional storage media. Further I/O interfaces include 2x USB 3.0, 4x USB 2.0, LPC, SPI, I2C Bus and 2x UART. Additionally, the module hosts a trusted platform module (TPM) for security sensitive network appliances.

congatec offers comprehensive board support packages for all current 64 bit Microsoft Windows variants as well as Red Hat Enterprise Linux Server. An extensive range of accessories, such as cooling solutions and the new COM Express Type 7 carrier board for evaluation, simplifies the design-in even further.

## Cypress Enables Next-generation Portable and Battery-operated IoT Devices with a New Ultra-low Power Wi-Fi and Bluetooth Combo Solution

(NASDAQ: CY), the leader in wireless connectivity solutions for the IoT, today announced a new combo solution that delivers ultra-low power Wi-Fi® and Bluetooth® connectivity to extend battery life for wearables, smart home products and portable audio applications. The new Cypress CYW43012 solution prolongs battery life by leveraging 28nm process technology to cut power consumption up to 70 percent in receive mode and up to 80 percent in sleep mode when compared to current solutions. The solution is IEEE 802.11a/b/g/n-compliant and 802.11ac-Friendly™, meaning it is interoperable with 802.11ac access points using standard modes. This enables it to offer higher throughput and better energy efficiency, along with the enhanced security and coverage of 802.11ac Wi-Fi networks.

The CYW43012 combo chip's advanced coexistence engine enables optimal combined performance for dual-band 2.4- and 5-GHz Wi-Fi and dual-mode Bluetooth/Bluetooth Low Energy (BLE) 5.0 applications simultaneously. The CYW43012 solution is supported in Cypress' all-inclusive, turnkey, WICED® Studio IoT development platform, which streamlines the integration of wireless technologies for developers. More information on Cypress' WICED combo solutions is available at http://www.cypress.com/802.11ac.

"Battery life is a key differentiator for a wide range of connected devices, including wearables, smart home security cameras and wireless speakers; everyone wants a great connected experience for longer without having to recharge," said Brian Bedrosian, vice president of marketing for the IoT Business Unit at Cypress. "Cypress' new combo solution is a game-changer, setting a new standard for power consumption that makes long battery life with Wi-Fi a reality. The 802.11ac-Friendly capability combined with Cypress' unmatched multi-radio coexistence engine provide cleaner air with high-fidelity connections and enhanced range, which is critical for the consumer experience in today's world with a rapidly increasing number of wireless devices competing for airtime."

Cypress CYW43012 ULP Wi-Fi Bluetooth Combo Solution

About Cypress WICED Studio IoT Development Platform

The Cypress WICED Studio IoT development platform features an integrated and interoperable wireless software development kit (SDK). The SDK includes the industry's most broadly deployed and rigorously tested Wi-Fi and Bluetooth protocol stacks, as well as simplified application programming interfaces that free developers from needing to learn complex wireless technologies. In line with the IoT trend toward dual-

mode connectivity, the SDK supports Cypress' Wi-Fi and Bluetooth combination solutions and its Bluetooth and Bluetooth Low Energy devices. The SDK enables cloud connectivity in minutes with its robust libraries that uniquely integrate popular cloud services such as Amazon Web Services, IBM Bluemix, Alibaba Cloud, and Microsoft Azure, along with services from private cloud partners. WICED also supports iCloud remote access for Wi-Fi-based accessories that support Apple® HomeKit™, which enables hub-independent platforms that connect directly to Siri voice control and the Apple Home app remotely.

Cypress' WICED Studio connectivity suite is microcontroller (MCU)-agnostic and provides ready support for a variety of third-party MCUs to address the needs of complex IoT applications. The platform also enables cost efficient solutions for simple IoT applications by integrating MCU functionality into the connectivity device. Wi-Fi and Bluetooth protocol stacks can run transparently on a host MCU or in embedded mode, allowing for flexible platform architectures with common firmware. More information on Cypress' WICED platform, ecosystem and community is available at http://www.cypress.com/wicedcommunity.

**Availability**

The CYW43012 combo solution is currently sampling to lead customers. Full production is expected in the fourth quarter of 2017.


## Vicor Introduces New 700V K of 1/16 Bus Converter

Vicor has added a new fixed-ratio high-voltage bus converter to its bus converter module (BCM) lineup. The new 700V K of 1/16 BCM offers a power level of 1.75 kW and a peak efficiency of 97%, with a power density of 700W/in³. The device is available in the thermally adept 4414 (111mm x 36mm x 9.3mm) VIA package, with either a chassis-mount or board-mount option and 4.3 kV of galvanic isolation. The robust VIA package also provides integrated PMBus™ communication, EMI filtering, and voltage transient protection. These flexible modules can be easily paralleled into higher power arrays. In addition, the BCM outputs can be connected in series for higher output voltages.

BCMs are ideal power components for a broad range of applications such as tethered unmanned vehicles, power distribution systems, and 3-Phase front ends. BCM's can also be used as isolated unregulated front ends, which can then feed a multiplicity of Vicor's ZVS PoL Buck and Buck-Boost regulators or PRMs and VTMs in a factorized power architecture.

The new higher voltage BCMs are available in either "T-Grade" (-40˚C to 100˚C) or "C-Grade" (-20˚C to 100˚C) temperature grades. A Mil-Grade rating (-55˚C to 100˚C) is scheduled for release by the end of 2017.

Providing DC-DC conversion after AC rectification and PFC, the 700V BCM provides a small, efficient, power component for power system designers to develop very compact and cost-effective 3-Phase systems with an SELV output. The 400V – 700V input capable device addresses nominal 380VRMS and 400VRMS input AC-DC conversion needs, commonly found in industrial applications.

**Remote Unmanned Vehicles Benefit from High-Voltage DC Transmission and Bidirectional Capability** The 1:16 transformation ratio and bidirectional operation makes the UHV BCM an ideal solution for remote unmanned vehicles used in air, sea, or underground exploration. Bidirectional operation enables systems to step up then step down line voltage to take advantage of reduced I2R losses, which dramatically improves power distribution cable size, weight, and costs with significant system efficiency improvements. By using higher voltages for transmission, the tether cross sectional area and thus the weight can be reduced to allow for greater operating range of the UAV.

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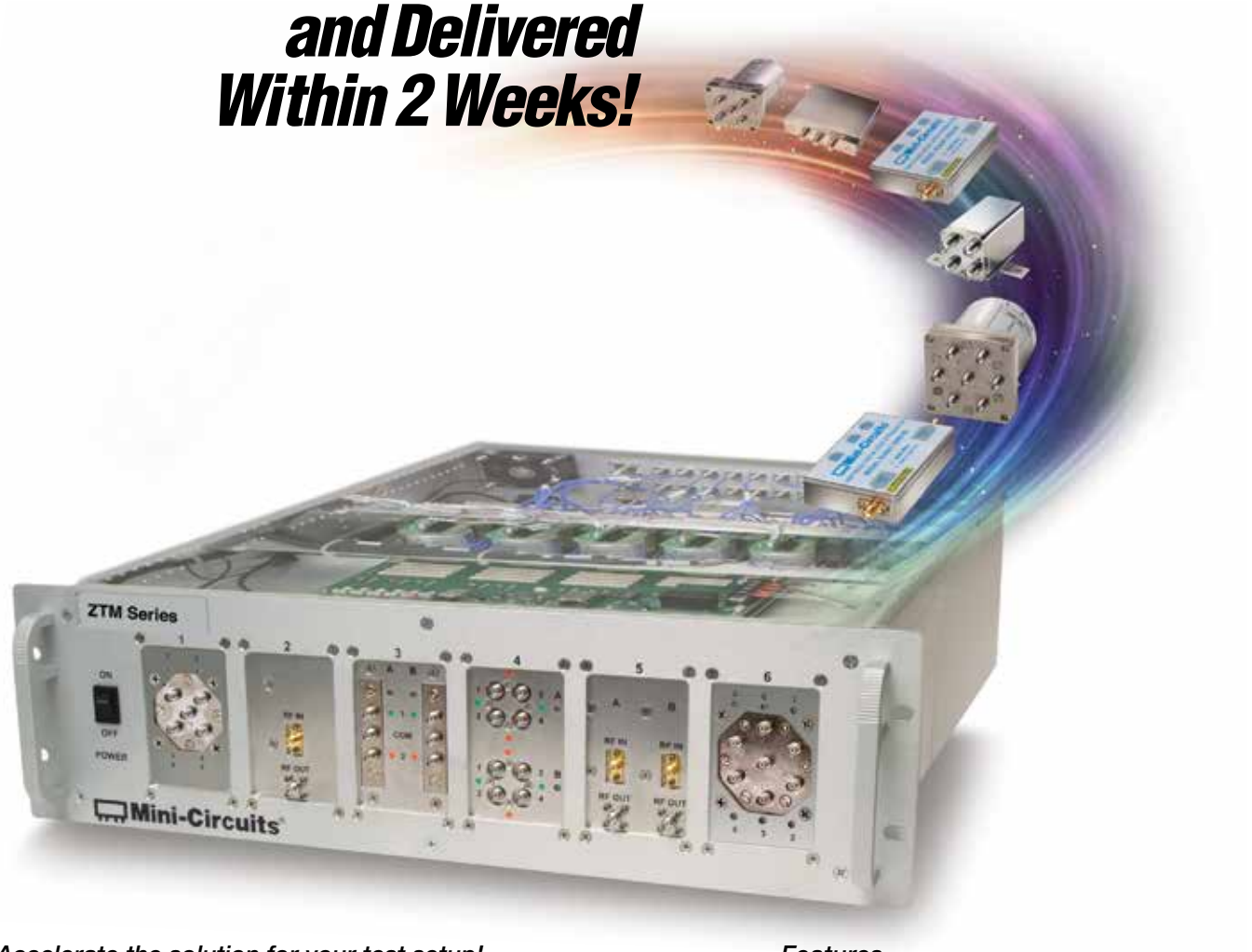


***Accelerate the solution for your test setup!***

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***Features***

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- *USB and Ethernet Controllable*
- *User-friendly GUI and DLLs Included*
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