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The WE-CMBNC is a VDE certified series of common mode chokes with a highly permeable nanocrystalline core material. Despite the small size, it delivers outstanding broadband attenuation performance, high rated currents and low DC resistance values. Low profile and high voltage ratings can also be realized by the common mode chokes of the WE-CMB family.

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- High permeability nanocrystalline core material
- High $I_e$ & low $R_{dc}$ in a small size
- Broadband suppression
- Stable inductance values at high temperatures
- Improved isolation through plastic case and patented winding spacer
Wisol announced the world's first value-added and unique Sigfox Monarch module solution to feature its intercontinental logistics tracking solution. Sigfox Monarch provides a unique radio recognition service enabling devices to manage the radio frequency changes, without any additional hardware such as a GPS or Wi-Fi chipset. This service enables devices to run seamlessly in all parts of the world, by automatically recognising and adapting to the local radio frequencies standards. Learn more on page 18.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za.

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Collateral jobs in the gig economy

The rise of the so-called ‘gig economy’ – a labour market characterised by freelance work and short-term contracts – in combination with peer-to-peer and managed marketplaces, has had a profound impact on our modern lives. Enabled by our ubiquitous mobile technologies, platforms like Uber and AirBnB have opened up entirely new ways for users to access services, providing convenience and pricing previously inconceivable.

This does not come without controversy, however. Just look at how Uber has disrupted the metered taxi industry around the world, and the protests and violence associated with this in South Africa over the past couple of years. Even the people who actually drive for Uber are disgruntled, particularly in the US where the company has come under heavy fire for its labour practices, with many drivers complaining that it is next to impossible to make a decent living, and what’s more they do not have the security and protections that a more traditional, permanent job would provide. On the AirBnB side, I’ve read stories from users that range from horror, to awkward and embarrassing, to just plain funny.

Analyses and predictions about the gig economy vary wildly, and are being updated almost by the minute (so don’t hold me to any of the figures I’m about to quote). Staffing Industry Analysts’ president Barry Asin gave a keynote speech at the ‘Collaboration in the Gig Economy’ conference on 4 October 2018 in which he estimated the size of the gig economy in 2017 was $3.4 trillion. Research from another source showed that in 2016, 34% of the US workforce (nearly 53 million Americans) were freelancers, and predicted this to rise to 43% by 2020. I haven’t been able to find any South African research, but it’s reasonable to assume that it will follow a similar trajectory.

While some types of jobs and some classes of workers are suffering collateral damage, the gig economy does also give rise to new and often surprising opportunities. A really interesting one I read about recently is the sit-in autonomous driving, and I’m not talking about industries such as mining and airports. When one gets stuck or a passenger hits a button requesting intervention, an alert is sent to Phantom Auto, at which point a remotely situated human operator logs into their computer and takes control. The setup they use is similar to what you see the racing drivers test with nowadays, with full steering wheel, pedal and other controls, and widescreen monitors streaming various camera views from the vehicle – in real time and high definition. The wonders of the Internet also mean it doesn’t matter where in the world the vehicle is, or where the human operator is.

Maybe a similar opportunity lies in the world of sport, specifically on the refereeing side. I’m thinking about the decision made by Aussie referee Angus Gardner in the dying moments of the rugby test match between the Springboks and England at Twickenham on 3 November. In the interest of objectivity, let me just state for the record: we were robbed.

England’s co-captain Owen Farrell clearly shoulder charged Bok centre Andre Esterhuizen – any half-blind or blind-drunk South African supporter could see it. Had one of them been put in charge of refereeing, even from half way around the world, they would have been able to make a better decision than the referee who was standing right there.
South Africa

- The Independent Communications Authority of South Africa (ICASA) has moved its head offices from Sandton to 350 Witch-Hazel Avenue, Eco Point Office Park, Eco Park, Centurion. Its offices in Sandton officially ceased operations on 26 October, and services to licensees and general stakeholders as well as consumers of electronic communications, broadcasting and postal services, were expected to remain unaffected.

Overseas

Business

- Third quarter group revenues for ams were $479.6 million, up 92% sequentially compared to the second quarter and up 57% from the same quarter in 2017. Adjusted net income for the latest quarter was $18.6 million (compared to $23.5 million for the same period in 2017), while adjusted diluted earnings per share were $0.22 (compared to $0.27 in the third quarter of 2017).

- Silicon Labs’ revenue in the third quarter established a new all-time record for the company, exceeding the high end of guidance at $230.2 million, up from $217.1 million in the second quarter. Third quarter diluted earnings per share (EPS) established an eight-year record high at $0.63.

- For its third quarter, STMicroelectronics reported net revenues of $2.52 billion, and net income of $369 million or $0.41 diluted earnings per share. On a year-over-year basis, third quarter net revenues increased 18.1% with all product groups delivering revenue growth. Year-over-year sales to OEMs and distribution were up 21.6% and 11.2%, respectively.

- Dialog Semiconductor experienced a 6% year-on-year rise in revenue to $384 million in the third quarter of 2018. When excluding the contribution of its acquisition of Silego, however, revenue was 2% below the third quarter of 2017. Diluted EPS of $0.60 in this most recent quarter was 3% below the same period a year ago.

- Micron Technology announced that it will invest up to $100 million in startups with a strong focus on AI and machine learning through its strategic investments entity, Micron Ventures. The announcement was made at the inaugural Micron Insight 2018 event where the technology industry’s top minds gathered in San Francisco to discuss the future technology landscape and how memory technology brings it to life.

- Texas Instruments reported third-quarter revenue of $4.26 billion, net income of $1.57 billion and earnings per share of $1.58. By comparison, the third quarter of 2017 yielded revenue of $4.12 billion, net income of $1.29 billion and earnings per share of $1.26. Despite the rise in revenue, the company reported that demand for its products slowed across most markets.

Companies

- Dialog Semiconductor entered into an agreement with Apple to license its power management technologies, and transfer certain of its assets and over 300 employees from Dialog to support chip research and development. Apple will pay $300 million in cash for the transaction and prepay $300 million for Dialog products to be delivered over the next three years. Dialog has been awarded a broad range of new contracts from Apple for the development and supply of power management, audio subsystem, charging and other mixed-signal ICs.

Industry

- According to World Semiconductor Trade Statistics (WSTS) figures released by the Semiconductor Industry Association (SIA), worldwide sales of semiconductors reached $122.7 billion during the third quarter of 2018, an increase of 4.1% over the previous quarter and 13.8% more than the third quarter of 2017. Global sales for the month of September 2018 reached $40.9 billion, an uptick of 2.0% over August’s total and 13.8% more than sales from June 2017.

- With tight supplies of widely used power transistors and diodes driving up prices and new optical-imaging applications moving into more systems, the diverse marketplace for optoelectronics, sensors and actuators, and discrete semiconductors (O-S-D) is on pace to grow by 11% for the second year in a row in 2018 and set a ninth consecutive record-high level in combined annual revenues worldwide. An update to IC Insights’ forecast shows total sales across the three market segments reaching $83.2 billion this year, followed by 9% growth in 2019, when revenues are expected to hit an all-time high of $90.6 billion.

Technology

- Xilinx unveiled Versal, the industry’s first adaptive compute acceleration platform (ACAP). Versal ACAPs combine scalar processing engines, adaptable hardware engines, and intelligent engines with leading-edge memory and interfacing technologies to deliver powerful heterogeneous acceleration for any application. Most importantly, the hardware and software can be programmed and optimised by software developers, data scientists and hardware developers alike, enabled by a host of tools, software, libraries, IP, middleware and frameworks that enable industry-standard design flows.
Before looking forward, just a short reflection on the past year. For most South Africans, 15 February 2018 was a day of hope, with the start of a new era as Cyril Ramaphosa was sworn in as our new president. Almost immediately we saw positive reaction from the markets, the currency strengthened and a new energy was evident in the way we went about business.

But as ‘Ramaphoria’ has faded, we have settled back into our trusted, regular routines. Much like a step change in an electronic circuit, there is an overshoot, and then as the overshoot is damped, the signal settles down to a new steady state. With Ramaphosa at the helm, I do believe that the new steady state is at a much higher level than before, but still below where it could be.

What are the prospects for the electronics industry in 2019? There will be new challenges and opportunities, and this is what engineers thrive on, is it not? By definition engineers are problem solvers, but often the problems are outside our domain or outside our control.

As AREI (Association of Representatives for the Electronics Industry), we have realised that we need to make our collective voice heard more loudly. To this end we are reaching out to other engineering disciplines, educational institutes, and of course government (specifically the department of trade and industry and the department of science and technology) to assist in growing our important industry. But this is no easy task, and we must simply keep knocking at doors. One thing we cannot afford to do is stand still; for if we stand still… we go backwards.

For 2019 one of the disruptive technologies we will hear more about is the 4th industrial revolution, also referred to at the Digital Industrial Revolution (DIR). The key components of the DIR – the Internet of things, big data, artificial intelligence, automation, robotics, new processes and materials, additive manufacturing, logistics, marketing techniques and sales channels – will mean we all have to start thinking differently about how we do things. If you are interested in seeing developments of this in South Africa, you can visit www.4ir.co.za.

A major problem that has faced the electronics industry in 2018 from
Widest selection of electronic components

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Readers of Dataweek are being offered an exclusive chance to win one of these kits.

The new SAM L11 MCU features Arm TrustZone for Armv8-M, a programmable environment that provides hardware isolation between certified libraries, IP and application code. Microchip enables robust security by including chip-level tamper resistance, secure boot and secure key storage which, when combined with TrustZone technology, protects customer applications from both remote and physical attacks.

The evaluation kit features a microBUS socket and Xplained Pro extension headers to expand the development with Mikroelektronika click boards and Xplained Pro extension kits. The kit also includes an on-board embedded debugger and an Xplained Pro Analog Module (XAM) that can be used with the data visualiser tool to monitor and analyse power consumption in real time.

The Pro evaluation kit supports all SAM L10/11 MCUs by the Atmel Studio 7 integrated development environment (IDE), IAR Embedded Workbench, Arm Keil MDK as well as the Atmel START online tool for intuitive, graphical configuration of embedded software projects. Microchip’s QTouch modular library, 2D touch surface library and QTouch configurator are also available to simplify touch development.

For your chance to win a Microchip SAM L11 Xplained Pro evaluation kit, visit http://page.microchip.com/dataweek-saml11.html and enter your details in the online entry form.

Continued from page 4

A component supply point has been the severe shortage of multi-layer ceramic chip capacitors (MLCC). Who would ever have imagined a simple component like a capacitor could go on allocation? MLCC chip capacitors are used in almost every electronic product, and even with annual production estimated to be around 1 trillion pieces, demand is still outpacing supply. This of course is a worldwide problem, and according to many of the chip capacitor manufacturers, the situation will only improve in 2020.

On a more positive note, AREI and our members will be exhibiting at the Local Manufacturing Expo taking place in May 2019 at NASREC. This expo will be attracting exhibitors and visitors from all manufacturing industries, including our electronics industry. If you are interested in exhibiting, please contact AREI for more information.

In closing, the South African electronics industry has proved its resilience and innovation over many decades. Our engineers are still some of the best trained and skilled. Because of our remote location, our engineers must often find their own solutions, and cannot easily rely on help from Europe and the US. But what we need is greater support from government.

AREI’s mission is to grow the South African electronics industry through collaboration with all stakeholders.

For more information contact AREI, info@arei.co.za.

Win a Microchip SAM L11 Xplained Pro evaluation kit

The Microchip SAM L11 Xplained Pro evaluation kit is ideal for evaluating and prototyping with Microchip Technology’s ultra-low power SAM L11 ARM Cortex-M23 based microcontrollers.

For more information contact AREI, info@arei.co.za.
Würth offers more than expected

Würth Elektronik eiSos is well known as a manufacturer of electronic and electromechanical components for the electronics industry.

Part of the global market leader in fastener technology, Würth Group, the company currently employs 8300 people and generated sales of 926 million Euros in 2017. We sat down with Jason Page, who has been spearheading the company’s South African operations since mid-2017, to find out more about what it can offer the local industry.

The components in Würth Elektronik eiSos’ catalogue include EMC components, capacitors, inductors, RF inductors, LTCC components, transformers, components for circuit protection, power modules, LEDs, wireless connectivity, connectors, switches, high-power contacts and assembly products. But as one of Europe’s largest manufacturers of passive components, it sets itself apart from other component manufacturers in a number of ways, Page explains.

“All our catalogue products are available from stock, and we offer a free sample service with delivery within 2-4 days, as well as design kits with free refills,” he says. “What is more, we require no minimum order quantity (MOQ) and we guarantee that we have stock on hand for 98% of our portfolio. We also make purchasers’ lives easier by offering a 30-day cancellation policy on orders, and we assist customers with forecasting to help them maintain their stock levels.

“We support designers through our highly knowledgeable technical sales force and field application engineers (FAEs) in addition to offering free EMC and power seminars.”

Another way of providing engineers with design expertise is via application manuals such as ‘Trilogy of Magnetics,’ ‘ABC of Capacitors,’ ‘Trilogy of Connectors’ and ‘Simulation in LTspice IV,’ providing professionals and other interested parties with a compendium of practice-oriented expertise which is unique of its kind. The company also offers software tools for selection of components, and collaborates with leading IC manufacturers to develop reference designs.

Another, less well known fact is that Würth Elektronik eiSos is one of Europe’s leading manufacturers of printed circuit boards (PCBs), providing electronics developers with PCBs in all conventional technologies. Over 120 new printed circuit board designs pass through its production every day, from the initial idea for a system, such as within the scope of development projects, to samples and prototypes, right through to series production in medium and large volumes.

“Würth Elektronik eiSos has a reputation for being expensive, but we pride ourselves on being a premium brand of guaranteed high-quality products, and on treating all our customers – whether they be Tier 1, 2 or 3 – exactly the same. We are active with direct sales in 50 countries across the world, and our 17 manufacturing facilities located in all important markets worldwide guarantee the rapid delivery of components. This ensures that we can always deliver on our motto: more than you expect!” Page concludes.

For more information contact Jason Page, Würth Elektronik eiSos, +27 71 259 9381, jason.page@we-online.com.
Resolution Circle names new CEO

The board of directors of Resolution Circle has appointed Gideon Potgieter as chief executive officer and member of the board effective immediately.

Potgieter previously held the position of group senior manager: business development and has served as interim CEO since May this year.

Resolution Circle, a University of Johannesburg (UJ) initiative, is a training hub that provides experiential learning opportunities to undergraduate electrical and mechanical engineering students from universities of technology, practical in-service project training, various short-learning and candidacy programmes applicable to the world of engineering and engineering technology.

The company also offers skills development modules that are not necessarily linked to a qualification, and short learning courses in technology like Arduino, fibre optic, programmable logic control (PLC) and solar photovoltaics. The current Arduino and PLC courses are building blocks of the Industry 4.0 revolution.

“During the time of renewing the focus of Resolution Circle in support of technical professional education, I’m pleased that Mr Gideon Potgieter has been selected as CEO. This selection brings both the element of continuity and change – this remains helpful for a transition,” said Professor Saurabh Sinha, Resolution Circle’s chairman of the interim board and UJ deputy vice-chancellor: research and internationalisation.

Potgieter studied electronics, obtaining his National Diploma and later his National Higher Diploma at the institution that has now been amalgamated into the University of Johannesburg. He later completed his MBA at the Rotterdam School of Management at the Erasmus University.

Having followed the same path as Resolution Circle’s interns, he understands their needs as well as the needs of the industry.

Potgieter has worked in several industries ranging from high-tech electronics and information technology to automotive, education and medical insurance in South Africa and abroad. Most recently he became involved with the product and technology development for startups in the biotech, clean-tech and high-tech areas through Resolution Circle.

Since joining Resolution Circle in 2014, Potgieter has spearheaded major strategy and technical shifts across the company’s portfolio of products and services. He has also been fundamental in redefining the company’s core offering which is professional technical training and programmes for market readiness, targeted at learners from TVET, comprehensive universities such as UJ, and universities of technology.

“During my time at Resolution Circle I have become involved in the product and technology development of other companies, and I have learned a great deal about the startup and entrepreneurship scene in South Africa,” says Gideon. “I believe in participative management – I encourage and appreciate the input of employees and look forward to working with and leading my team in taking our strategy forward.

“The opportunity ahead for Resolution Circle is vast, but to seize it, we must focus clearly and continue to transform. A big part of my job is to accelerate our ability to bring innovative products to our customers more quickly. I would rather try something and fail than not try at all.”

Speaking on behalf of the board, Professor Sinha said, “We believe Gideon has the right operational and communication skills and leadership abilities to deliver improved execution and financial performance.”

For more information visit www.resolutioncircle.co.za.
Development kits for students and hobbyists

RS Components has introduced new ranges of tools from Seeed Studio, Arduino and Bare Conductive that target academic institutions, including educators and students of electronics, as well as inspiring electronics design engineers with new projects and prototypes.

The first launch is the Seeed Studio hardware innovation platform, which specialises in open-source electronic modules and embedded devices for designers and makers. The platform includes the Grove series of modules and starter kits, including the GrovePi+ starter kit for Raspberry Pi, and the BeagleBone Green.

The Grove series is a collection of single-function modules with standardised connectors. The system offers a user-friendly, building-block approach to simplify the building of circuits without solder or breadboards. Each module comes with documentation and demo codes. Grove starter kits also include expansion boards for microcontrollers such as the Arduino Uno and a selection of Grove modules.

The BeagleBone Green is a Linux-based development board that is designed for fast interaction with general-purpose I/O and is based on the open-source hardware design of the BeagleBone Black. It includes two Grove connectors, enabling the connection of the board to sensors without requiring a daughter card. In addition, the Grove starter kit for BeagleBone Green contains ten modules and three step-by-step guides to help users quickly build their projects.

The second product now available from RS is the Arduino Engineering Kit, which targets a range of users including students learning about engineering at a university or at a secondary school; engineering professors that want practical resources to demonstrate engineering concepts; and makers with an interest or background in engineering, either professionally or as a hobby.

In conjunction with the Arduino online platform, the kit includes three Arduino-based projects to help students learn about fundamental engineering concepts, key aspects of mechatronics, and MATLAB and Simulink programming for system modelling and embedded algorithm development. Buildable projects in the kit include a self-balancing motorcycle, a mobile rover and a whiteboard drawing robot. The kit also includes an easy-to-use Arduino MKR1000 board, several customised parts and a complete set of components required to assemble all three projects.

Lastly, RS has also made available three educational kits that use conductive paint from Bare Conductive: the ‘Printed Sensors’ set comprises three A5 printed sensors and enables users to integrate touch sensors into any project; the Lamp Kit enables the building of touch, dimmer and proximity lamps; and the Pro Kit includes all the required tools and resources to prototype electric paint and touch board projects.

For more information contact RS Components, +27 11 691 9300, sales.za@rs-components.com.

Handheld spectrum analyser

Transcom Instruments’ SpecMini is an Android-based, handheld spectrum analyser featuring high testing sensitivity, light weight, compact size and portable design. Its performance characteristics meet the testing and measurement requirements of the majority of RF signals.

The instrument’s Android operating system and high-resolution, multi-touchscreen allow for user-friendly testing and measurement of signals across the frequency range of 1 MHz to 6 GHz. Features include general spectrum test, occupied bandwidth test, channel power measurement, adjacent channel leakage power ratio measurement, and interference search.

The SpecMini measures 200 x 96 x 67 mm and weighs 1,25 kg (including the battery).

For more information contact Andrew Hannay, RFiber Solutions, +27 82 494 5466, sales@rfibersolutions.com
Optical networking and sensing with POF

By Mark Patrick, Mouser Electronics.

Traditional optical networking using high-performance glass fibres has typically provided what is referred to as carrier-class engineering – predominantly fulfilling high-bandwidth, high-capacity applications such as telecom and data centre networking. Additional attributes including noise immunity, galvanic isolation and elimination of electromagnetic effects also enable optical networking technology to address industrial applications – particularly in safety-critical situations or hazardous environments.

On the other hand, installing optical connections using glass fibres can of course be prohibitively expensive. This has less to do with the prices of optical cables or transceivers themselves, than the time and expertise needed to properly terminate each connection.

Special equipment is called for in order to cut the fibre without damaging its surface (which can otherwise cause reflections that interfere with data integrity). Moreover, since the core diameter of a typical single-mode fibre is less than 10 µm, while that of a multi-mode fibre is usually 50 – 62.5 µm, the optical axes of the fibre and transceiver must be aligned with a very high degree of accuracy to achieve the expected link performance.

All of this makes creating optical connections an extremely specialised task that can only be performed by trained people.

Democratising optical technology
Historically, Ethernet communication over plastic optical fibre (POF) has achieved maximum bit rates of about 150 Mbps over distances up to 50 m, with proprietary protocols achieving about 250 Mbps. More recently, however, advancements in polymer technology have enabled superior transparency, effectively reducing the signal attenuation coefficient and ultimately allowing higher bit rates over longer distances.

Effective data speeds of 1 Gbps have been demonstrated in POF-backbone applications, which could potentially scale to 10 Gbps in the future. Although this remains below the ultimate performance potential offered by glass fibre, it is more than adequate to satisfy expected home networking demands for the foreseeable future.

In addition to these performance gains, POF delivers notable cost-of-ownership advantages over glass, because connections can be terminated adequately with no specialist equipment or expertise. The fibre can be cut with a sharp blade, and subsequent polishing can be accomplished quickly using a simple manual polishing fixture using ordinary abrasive followed by lapping film. Also, because POF has a larger core diameter than glass fibre (typically 960 – 980 µm in a 1 mm gauge cable), aligning the fibre and transmitter axes is faster and easier.

Alternatives, such as power-line communication (PLC), are also not entirely satisfactory. Although no new wires are required, electrical noise and the behaviour of safety circuit breakers can impair data speeds and quality of service.

POF can now offer an alternative to overcome the disadvantages of conventional Wi-Fi networks that are based on a single, central router. It provides a cost-effective medium for a high-speed backbone that can be installed throughout the house more easily and less obtrusively than ordinary Ethernet cable. It can coexist easily with mains cabling, unaffected by noise, and so can be passed through the same conduits to reach required locations throughout the building.

By linking individual Wi-Fi access points in each room that requires a connection, an economical POF high-speed backbone can alleviate the congestion issues that challenge ordinary home or SOHO Wi-Fi networks, and ensure the full bandwidth provided at the main access point reaches all the individual rooms.

The typical RF signal-power requirement for each access point is also lower than for a central access point covering the entire property. Taking advantage of the easy cutting, fibre preparation and alignment when connecting cables and transceivers, a general contractor or even a careful homeowner should be capable of installing the backbone with little difficulty.

Powering automotive networks
In addition, POF is establishing a presence in

Continued on page 12
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Continued from page 10

Programming and debugging probe

Next-generation STLINK-V3 probe

In addition to providing typical JTAG/Serial-Wire Debug (SWD) and Single-Wire Interface Module (SWIM) connections, STLINK-V3’s virtual COM port and multipath bridge allow communication through the microcontroller UART, I²C, SPI or CAN interface, or GPIOs. This lets developers conveniently automate tests using custom control commands and observe run-time data on the host PC, or use the STLINK-V3 to program devices with a bootloader and simplify product maintenance.

Major development tools already support STLINK-V3, allowing users to take advantage of the powerful features from within a convenient graphical environment such as the STM32Cube programmer and integrated development environments (IDE) such as Keil MDK-ARM, IAR EWARM, and GCC-based IDEs. ST also allows free access to STLINK-V3 low-level APIs, to facilitate integration with custom or automated test platforms.

供電和调试探针

Next-generation STLINK-V3探针

除了提供典型的JTAG/串行电线调试（SWD）和单电线接口模块（SWIM）连接外，STLINK-V3的虚拟COM端口和多路径桥接允许与微控制器 UART、I²C、SPI或CAN接口通信，或使用GPIOs。这让开发者能够方便地自动化测试使用自定义控制命令，并在主机PC上观察运行时数据，或使用STLINK-V3来编程设备，同时使用引导加载器来简化产品维护。

主要开发工具已经支持STLINK-V3，允许用户利用其强大的功能，从一个方便的图形环境，如STM32Cube程序员和集成开发环境（IDE）等Keil MDK-ARM，IAR EWARM，和GCC-based IDEs。ST还允许用户免费访问STLINK-V3低级别APIs，以方便地集成自定义或自动测试平台。
Determining coil losses accurately

By Ranjith Bramanpalli, Würth Elektronik eiSos.

For the construction of highly efficient switch mode power supplies, it is important to know the losses in the core and winding of inductive components. Conventional calculation methods only provide reliable values under specific conditions and with exact knowledge of the core materials. Therefore, Würth Elektronik eiSos developed REDEXPERT, a new model that is available to design engineers as an easy-to-use development tool.

In switch mode power supplies, the power inductor serves as a storage component. It stores energy in the form of a magnetic field during the on phase of the switching controller and discharges the energy to the load during the off phase.

Generally, the storage inductor consists of a copper wire winding and a core with magnetic properties. The power losses result partly due to the DC resistance ($R_{dc}$) of the windings. However, skin and proximity effects in the winding and hysteresis and eddy current losses in the core also cause losses. These are collectively referred to as the AC resistance ($R_{ac}$) of the inductor, which primarily depends on the operation frequency.

There are several methods to determine these effects in magnetic components. However, to achieve even approximate values for these losses, complicated calculations such as the Dowell method are required.

Core losses

We know from electromagnetic physics that if a magnetomotive force is applied to a coil, over time it induces a magnetic flux $\Phi(t)$. At any time, the magnetic flux density $B$ is always proportional to the field strength $H$:

$$B(t) = \mu_0 \int \mu_r H(t)$$

$B$ is the magnetic flow density ($G/\Lambda$), $\mu_r$ is the permeability of the material, $\mu_0$ the permeability of the air and $H$ the magnetic field strength. $B$ is measured, while $H$ is increased. The relationship between $B$ and $H$ is non-linear and shows a hysteresis (hence the name hysteresis curve). The hysteresis shows the characteristics of the core material that cause power loss in the coil core.

Figure 1 shows the typical BH curve for a sinusoidal excitation of the core.

The energy loss of one switching cycle in the core equals the difference between the magnetic energy applied to the core during the on phase, and the magnetic energy released by the core during the off phase. This is caused by molecular magnets, which during the off phase do not return on their own into their initial position and instead have to be reset using energy.

Applying Ampère’s and Faraday’s laws, the energy in the core can be expressed as follows:

$$E = \int H dB$$

The second type of core losses result from eddy currents that are induced by a time-varying flux ($d\Phi/dt$) in the core material. According to Lenz’s law, a current is induced due to the change in flux. The current then induces a magnetic flux that opposes the original flux. This eddy current flows through the conductive core material and generates $I^2R$ losses.

Determining the losses

Initially core losses were determined using the power equation, also known as the Steinmetz equation:

$$P_v = K \times f^\alpha \times B^\beta$$

Here, $P_v$ are the core losses (due to hysteresis and eddy currents) for each unit of volume, $f$ the frequency, $B_{pk}$ the maximum flow density of a sinusoidal excitation and $K, \alpha$ and $\beta$ the constants that are derived from the core loss graph.

The main disadvantage of the Steinmetz equation is that it mainly applies for sinusoidal excitations. However, in power electronics applications, the coil is mainly exposed to non-sinusoidal magnetic flux waveforms. There are certainly other models that try to solve the problem of non-sinusoidal waveforms by separating the hysteresis and eddy current losses, yet the empirical Steinmetz equation has proven to be a useful choice and, for sinusoidal magnetic flux waveforms, offers high accuracy combined with simple application.

That is why there are extensions for this power equation, intended to make it usable for non-sinusoidal magnetic flux waveforms as well. An extension called MSE (Modified Steinmetz Equation) has been applied for some time to estimate the core losses using the Steinmetz equation for non-sinusoidal waveforms:

$$P_v = (K \times f^\alpha \times B_{pk}^\beta) \times f$$

In this:

$$f_{eq} = 2\pi \times \left( f - f_{non} \right)$$

$f_{eq}$ is the equivalent frequency relating to the change in the duty factor for non-sinusoidal waveforms.

Due to the disadvantages inherent to MSE, GSE (Generalised Steinmetz Equation) was developed. It is shown in the following equation:

$$P_v = \left( K \times f^{\alpha} \times B_{pk}^{\beta} \right)_{eq}$$

In this:

$$B_{eq} = \frac{1}{2} \int \frac{d\Phi}{dt} \, dt$$

GSE and MSE core loss graphs are also based on a sinusoidal excitation. The following main disadvantages apply to the Steinmetz model and its extensions:

- Firstly, the empirical data provided by the core manufacturer has to be used for the creation of core loss graphs.
- Manufacturers of passive components have no influence on the test setup.
- Because core loss graphs are also based
on data that results from a sinusoidal excitation, the pulse and the triangle waveforms are not accurate enough.

Due to errors during parameter conversion, the extension of the Steinmetz model only works optimally with a duty factor of 50% and an unlimited frequency range. This method is limited to certain materials, and due to the high complexity during the estimation of the magnetic path length, the estimation of the core losses using existing models for iron powder and metal alloy materials is not only complicated, but also delivers strongly fluctuating accuracy. For components that consist of several materials, an estimation of the losses is impossible.

And the final point of criticism for the described approaches is that alternating current losses of the winding are not taken into account.

**New alternating current loss model**

Würth Elektronik eiSos developed a new model to allow developers to choose the right inductance with high effectiveness for optimising their circuit. It is based on empirical data that is generated using a real-time application setup. Here, the overall inductance losses are separated into alternating current and direct current losses. Power losses due to the direct current in the coil windings are referred to as direct current losses. The power losses due to the magnetic modulation within the coil and the core are referred to as alternating current losses.

Empirical data is recorded by a DC-DC-converter, as shown in Figure 2. An oscillating voltage is applied to the inductor, then the input power \( P_{in} \) and the output power \( P_{out} \) are measured. Based on this, \( P_{loss} = P_{in} - P_{out} \) is estimated and the alternating current losses of the coil \( P_{AC} \) are separated.

To be able to record the empirical data, this operation is measured for different sets of parameters – for example, fluctuations of the magnetic modulation, frequency, ripple current etc. Based on this, the model for calculating the alternating current losses is created:

\[
P_{AC} = f(\Delta I, \text{freq}, \text{DC}, k_1, k_2)
\]

The hysteresis curves shown in the datasheets for typical core materials represent the magnetic modulation from positive to negative of the core using a sinusoidal waveform. Here, the hysteresis curve indicates the energy loss shown in Figure 3(a). However, for a switch mode power supply application, the core is generally driven by a significantly smaller square waveform with maximum flow density that, due to the core losses, is limited to a smaller hysteresis curve (Figure 3(b)).

Continued on page 16
Power loss depends on how often per second the hysteresis curve is traversed. This means the hysteresis losses depend directly on the frequency. The hysteresis curve changes its shape if the waveform, drive current, drive voltage or temperature change. These fluctuations make an exact prediction of the core losses extremely difficult.

The smaller hysteresis curve depends on the voltage across the inductor. This smaller hysteresis curve is used exactly at the operating point to generate empirical data for the alternating current loss model from Würth Elektronik. It has proven to be robust and precise for a wide range of parameters such as frequency, ripple current and duty factor.

Evaluation of Würth Elektronik’s AC loss model

Because the empirical data is solely based on real-time parameters, the losses for any given duty factor can be accurately determined using this model. The model works very accurately for a wide frequency range (10 kHz to 10 MHz), because the constants of the power equation were determined for a wide range, taking into account the magnetic modulation.

Even minimal changes in the core material or winding structure are taken into account, and the model is valid for components consisting of more than one material. It allows precise determination of losses for iron powder and new ‘metal alloy’ materials. The model is valid for any core shape and winding structure, and includes AC winding losses.

Würth Elektronik’s model has been exhaustively validated and compared with existing models and measured data. The alternating current losses for different materials, such as WE-Superflux, iron powder, NiZn, MnZn etc., are measured across large duty factor and frequency ranges and compared with theoretical models.

Figures 4 to 6 show the core losses determined using the Steinmetz power equation (Pst), modified Steinmetz equation (Pmse) and the generalised Steinmetz equation (Pgse). REDEXPERT is the alternating current loss resulting from the calculation using Würth Elektronik’s AC loss model. ‘Real’ is the measured AC loss.

Application in the online platform

Using the described approach, Würth Elektronik developed the REDEXPERT online platform (Figure 7). It allows developers to quickly compare inductances and to very easily choose the most suitable power inductor for the respective applications. The user enters input and output parameters into the required...
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Figure 7. The online platform REDEXPERT.

topology and REDEXPERT calculates the inductance values and shows the matching inductances (Figure 8).

Würth Elektronik eiSos offers a comprehensive range of power inductors for all kinds of applications, therefore users should be able to find a component suitable for their specific conditions by entering the required parameters. The integration of the new AC loss model into REDEXPERT eliminates the complex and erroneous calculation of AC losses. The accurate results for all AC losses can also be used to estimate temperature deltas.

Currently, REDEXPERT supports three topologies for which the customer can select the component for the application: step-up converters, step-down converters and SEPICs (single ended primary inductance converters). Furthermore, there is a loss calculator that computes the losses for power inductors independently of the topology. REDEXPERT is a web-based online platform (www.we-online.com/redexpert/), therefore users neither need to download nor update it.

For more information contact Jason Page, Würth Elektronik eiSos, +27 71 259 9381, jason.page@we-online.com

1800 W electronic load

Itech announced the release of the latest addition to its electronic load range, the IT8615. This e-Load has a compact height of only 3U for an 1800 Watt load, with an AC frequency adjustable from 45 Hz to 450 Hz. The IT8615 has a unique oscilloscope display function providing an insight into the voltage and current input waveform.

The unit is equipped with a number of measurement modes to test different parameters such as Vrms, Vpk, Vdc, Irms, Ipk, Idc, W, VA, VAR, PF and frequency, but including voltage harmonics analysis as high as the 50th order to verify the harmonic interference of equipment like UPS and generators.

The product is equipped with standard RS-232, GPIB, LAN and USB communication interfaces for reliable and fast control. The IT8615 provides parallel and three-phase functions for high power and three-phase applications, and can be connected in star or delta configurations.

The e-Load is ideal for testing UPS, inverters, AC power supplies and relevant AC electronic components.

For more information contact Conical Technologies, +27 66 231 1900, daniel.haywood@conical.co.za
**Module solution for Sigfox Monarch**

Wisol announced the world’s first value-added and unique Sigfox Monarch module solution to feature its intercontinental logistics tracking solution.

Sigfox Monarch provides a unique radio recognition service enabling devices to manage the radio frequency changes, without any additional hardware such as a GPS or Wi-Fi chipset. This service enables devices to run seamlessly in all parts of the world, by automatically recognising and adapting to the local radio frequencies standards. It unlocks numerous use cases in logistics and supply chain, the consumer industry, and in automated maintenance for the shipping, aircraft and railway industries. Sigfox’s technology operates in unlicensed bands worldwide, with radio frequencies ranging from 862 to 928 MHz.

JinDuk Kim, senior vice president at Wisol, said, “By increasing the demand of the intercontinental logistic tracking solution, we definitely believe the Sigfox Monarch module solution will be a game changer for logistics businesses. So far, the existing global inter-continental logistic tracking solution requires expensive payment and it blocks wide use of the tracking system.

“To solve this obstacle, we, as pioneers for the global Sigfox module solution, designed tiny, low-power and value-added modules to fit IoT tracking devices. Because we already have various Sigfox module lineups which are market proven worldwide, we are very excited that this brand-new Sigfox Monarch module provides broad options to global customers to select a Sigfox module depending on their target application, and it will have synergy with our currently available Sigfox module lineups.”

The 25 x 20 x 2.5 mm module adopts STMicroelectronics’ S2-LP ultra-low-power, sub-1 GHz RF transceiver and BlueNRG-2 Bluetooth low energy SoC, along with the ST dual-radio software development kit, highlighting the readiness of ST’s reference solution for the Sigfox Monarch technology.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za.

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**Former SA cricketer partners with Otto Wireless Solutions**

Otto Wireless Solutions has collaborated with former SA cricketer Daryll Cullinan to offer the local market a roaming solution for international travellers.

Cullinan is the representative agent for Majesti-Fi in Africa, and selected Otto Wireless solutions as one of his avenues to market. The announcement and product launch took place at the MyBroadband Conference at Gallagher Estate on 18 October.

“Otto Wireless Solutions has made its name synonymous with a number of niche wireless hardware product offerings over the past nine years,” explains managing director, Chris Viveiros. “From humble beginnings as the SIMCom distributor we have grown our offering to include the industry leading industrial wireless routers brand, Wlink, which offers a host of hardware options, and strategically a free backend management platform.”

Late in 2017, the company brought Ottennas to the market, a range of attractively priced, outdoor high-performance antennas that have been well received by a broad spectrum of customers ranging from the man on the street, to large-scale industrial clients servicing various sectors of the market.

“Unlike many industry suppliers, Otto Wireless Solutions has remained very strategic in terms of the products we select to add to our portfolio, with the focus always being on introducing quality product lines which add value to existing customers, and open the door to new markets. It is based on this reason, and the past success in terms of products launched, that one should take notice when we bring something new to the market,” Viveiros continues.

“Enter Majesti-Fi. Imagine doing away with the hassles and dangers of international roaming when on a business trip. Think for a second how attractive it would be to have a plan which provides you with fixed data costs, no dangers of bill shock, with data being either purchased on a monthly enterprise solution or a pay-as-you-go solution at extremely affordable rates which has shown savings costs of up to 90% on corporate travel.”

For more information contact Otto Wireless Solutions, +27 11 791 1033, wireless@otto.co.za.
Webb Industries has reported a growing demand for its upgraded Glass-Mount mobile antennas. This is according to Webb chief engineer, Terry Reuss, who says that sales have been excellent since the latest version was brought to market.

The Glass-Mount antenna was first produced by Webb more than 15 years ago, when it was very popular for cellphone car kits as it could be attached to the windscreen, obviating the need to drill holes in the vehicle. “By extending the offering to the public mobile radio (PMR) market there is newfound demand for the Glass-Mount antenna, which is proving particularly popular in the mining environment where it is being fitted to a wide range of mining vehicles,” Reuss says.

From a technical perspective the Glass-Mounts are VHF, half-wave, end-fed antennas with the radio signal transmitted through the glass to the antenna. Bandwidth is 10 MHz, rated power is 30 W and the radiation pattern is omnidirectional. The roughly 350 mm long whip is easily adjustable to the vertical position and is removable when required.

Reuss says that because of the resurgent demand for the Glass-Mount, Webb is now looking at extending the range to include other frequencies as well.

For more information contact Webb Industries, +27 11 719 0000, prichards@webb.co.za.

Developers often overcome these challenges with large software frameworks and real-time operating systems (RTOS), which results in increased development time, effort, cost and security vulnerabilities.

Microchip Technology recently announced a new Internet of Things (IoT) rapid development board as part of an expanded partnership with Google Cloud, enabling designers to prototype connected devices within minutes. The solution combines a powerful AVR microcontroller (MCU), a CryptoAuthentication secure element IC and a fully certified Wi-Fi network controller to provide a simple and effective way to connect embedded applications. Once connected, Google Cloud IoT Core makes it easy to collect, process and analyse data to inform decisions at scale.

The AVR-IoT WG development board gives developers the ability to add Google Cloud connectivity to new and existing projects with a single click, using a free online portal at www.AVR-IoT.com. Once connected, developers can use Microchip’s rapid development tools, MPLAB Code Configurator (MCC) and Atmel START, to develop and debug in the cloud.

For more information contact Shane Padayachee, Avnet South Africa, +27 11 319 8600, shane.padayachee@avnet.com.

Creating cloud-connected applications traditionally can require significant time and resources for embedded designers to develop necessary expertise in communications protocols, security and hardware compatibility. Developers often overcome these challenges with large software frameworks and real-time operating systems (RTOS), which results in increased development time, effort, cost and security vulnerabilities.

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The board combines smart, connected and secure devices to enable designers to quickly connect IoT designs to the cloud, including the following:

- The ATmega4808 8-bit MCU brings the processing power and simplicity of the AVR architecture with added advanced sensing and robust actuation features. With the latest core independent peripherals (CIPs) that decrease power consumption, it provides advanced performance in real-time sensing and control applications.

- The ATECC608A CryptoAuthentication device provides a trusted and protected identity for each device that can be securely authenticated. ATECC608A devices come pre-registered on Google Cloud IoT Core and are ready for use with zero touch provisioning.

- The ATWINC1510 is an industrial-grade, fully certified IEEE 802.11 b/g/n IoT network controller that provides an easy connection to an MCU of choice via a flexible SPI interface. The module relieves designers from needing expertise in networking protocols.

For more information contact Shane Padayachee, Avnet South Africa, +27 11 319 8600, shane.padayachee@avnet.com.

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For more information contact Shane Padayachee, Avnet South Africa, +27 11 319 8600, shane.padayachee@avnet.com.
NB-IoT’s place in the South African LPWAN picture

When it comes to enabling the Internet of Things (IoT), low-power wide-area networks (LPWAN) are a key element of the big picture. Several different LPWAN technologies currently exist in the marketplace, and while there is no one-size-fits-all favourite and each is best suited to certain types of applications, NB-IoT (narrowband IoT) is emerging as one of the leaders.

We asked Mark Coxen, South African sales manager for Quectel Wireless Solutions, for his insights into how NB-IoT is shaping up.

Do you see NB-IoT as the frontrunner amongst the LPWAN technologies being rolled out?

There is much controversy around the LPWAN technologies in the South African marketplace, and not much information around the ‘who, where and what’ for this technology. The non-cellular technologies have made some inroads around the value-adds and benefits of utilising the specified technology. The key point is that all of these technologies come down to the simple fact of monthly, billable costs.

The second point is on network infrastructure, and the trade-off here is population based coverage vs geographical coverage. So in essence, should the cellular and non-cellular network providers offer a good mix of both, then this will improve development across the LPWAN spectrum.

LTE-Cat NB1 (aka NB-IoT) may not storm the current vehicle tracking customers due to limitation on network handover, but will definitely increase in markets outside of this 2G dominated market. From discussions with mobile network operators (MNOs), 2G sunsetting is not currently on the cards until 2025. This may change in the near future with countries like Australia and North America already fully operational on NB-IoT and LTE CAT M1 (aka CM1).

I do believe that once the smaller issues on the cellular networks have been ironed out, this will fast track the local market into this new era of cellular based LPWAN products. Quectel has geared its product offering to allow for ease of migration from a 2G solution to an NB-IoT solution – yes there are small software changes but in comparison to a complete redesign that incorporates a different LPWAN technology, the changeover is possible within 4-6 weeks.

This changeover keeps with three key aspects for end user demands:
1. Firmware over the air (FOTA) updates of the ‘black box’.
2. Data on demand and not limited to data packet size.
3. 2-way communication between backend and field device.

What is the status of the rollout by SA telcos?

Currently Vodacom have ‘open[ed] a large number of sites for NB-IoT in Gauteng, but the spread is limited as some areas are densely allocated and others have almost no connectivity.

MTN has been rather quiet, but from my understanding they are ready for both NB-IoT and CM1, however they are looking into business cases and will ‘switch on’ the required LPWAN on a solid case.

NB-IoT SIM cards will be required, but may be limited to customers with genuine applications; this will need to be enquired with the desired MNO.

The billing information and how this will work has not been refined, but it is safe to say that for budgetary purposes it is safe to use the current GPRS data rates.

Quectel has done numerous testing on the NB-IoT networks with both local and international companies. The results have proven successful and our local FAE is geared to support customers using Quectel 2G products, who want to future proof their products.

For what applications should electronics designers consider NB-IoT?

This may be the most controversial question around the NB-IoT space. The 3GPPP specification was updated to allow for NB-IoT handover as this was not possible before. With that being said, it may not suit tracking a high-speed chase and in the vehicle tracking markets is currently not deemed a suitable 2G replacement.

Locally the vehicle tracking market is by far the dominant force when it comes to technology implementation. I believe that some pointers regarding the finished product will offer suitable guidelines for engineers wanting to implement this technology (this is not conclusive, but only a guideline):
1. Fixed installation – where the product will not move at all, i.e., alarm systems, cold storage management, server rooms, etc.
2. Geo-locked installation – the equipment can be moved to various locations for use and operates only within that location, i.e., generator management, containers on hire, etc.
3. Metering – where any form of pre- or post-paid metering is required, with low power and low cost (no external MCU required). The key here is ensuring that the data was actually sent, and if the service needs to be suspended the server advises the field unit and the action is carried out.
4. Renewable energy – with solar, wind and other emerging energy sources and hybrid vehicles requiring charging stations, maintenance and support are key for ensuring uninterrupted supply. This management and decision making can be managed on the unit or from a cloud based platform, allowing the end user a customisable interface.

5. Remote management – this unit will typically gather outside information and pass it to a cloud or backend server. The server can then analyse the data, make a decision and then instruct the field unit to action a specific task. An example here would be a standard gate motor controller that enables monitoring time and attendance of a domestic worker, or allowing a garden service access to a property within a dedicated time on a specific day.

Changes are made on the cloud platform and then update the unit as required.

What products does Quectel offer for NB-IoT?

Quectel offers two major lines regarding the NB-IoT space. The base line is simple, 2G to get the proof of concept working with a drop-in replacement NB-IoT. Both modules allow for having the application run on the module, thus eliminating the need for an external MCU, so in essence there are four parts to the design: module, PSU / battery charger and antenna. The peripheral interfaces are I2C, SPI and UART to integrate into CAN bus, sensors, Modbus / RS-485 and so on. This is the M66/BC68 option.

The development environment is based on Eclipse and is C programming compliant.

The flagship range offers a wider spectrum allowing for moving from 2G to 3G to NB-IoT, CAT M1 and even as far as LTE CAT 1, with some variants incorporating GNSS (global navigation satellite services) in a single solution. This range is the x91/95/96 series. More in-depth development is required and requires an external CPU.

Are you seeing much adoption of NB-IoT locally?

At the start of 2018, there was much talk on the NB-IoT side but little design activity, however in the third quarter of this year we are seeing greater interest in the base line solution, with a few clients already busy with designs and preparation for production rollout for supply as early as the second quarter of 2019. Some will be for export, but local deployment will depend on the networks’ rollout.

For more information contact Mark Coxen, Quectel Wireless Solutions, +27 82 888 6275, mark.coxen@quectel.com.
Programmable Ethernet-serial controllers

Available from Tibbo is a trio of compact and affordable serial controllers which are programmable in Tibbo BASIC and Tibbo C. Features include Wi-Fi, PoE (Power over Ethernet), display, RS-232, RS-485, DIN rail and wall mounting options. Users can write their own app using the streamlined Tibbo IDE software or run one of the company’s published open-source projects.

The DS1102 is a 3-channel RS-232/422/485, BASIC/C-programmable controller with Ethernet and optional Wi-Fi connectivity, and a universal RS-232/422/485 port. Three channels are available in RS-232 mode, two channels in RS-422 mode, and one channel in RS-485 mode. It comes with an optional OLED display and PoE.

The DS1101 is a 3,5-channel RS-232 model with Ethernet and optional Wi-Fi connectivity. It has a 3,5-channel RS-232 port with power input/output on pin 9 of the DB9 connector. An OLED display and PoE support can be included as options.

Finally, for cost-sensitive applications, the DS1100 supports Ethernet connectivity only, and comes with a single-channel RS-232 port with power input on pin 9 of the DB9 connector. PoE is optional.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za.

Silicon Labs is offering a new Wireless Xpress solution to help developers get IoT applications connected and running in a day, with no software development necessary. The solution provides a configuration-based development experience with everything developers need, including certified Bluetooth 5 Low Energy (LE) and Wi-Fi modules, integrated protocol stacks and easy-to-use tools.

With on-board wireless stacks controlled through a high-level API for setup and control, Wireless Xpress devices require only modest resources from a host processor, enabling developers to add wireless connectivity to any microcontroller (MCU).

Bluetooth and Wi-Fi IoT products based on Wireless Xpress can be remotely managed and updated over the air (OTA) using native device management features. With Silicon Labs’ Zentri device management service (DMS), end users can easily install and update firmware, view real-time device health metrics and adjust product settings through mobile apps.

To ease the complexity of adding Bluetooth or Wi-Fi connectivity to mobile applications, Wireless Xpress includes a mobile app SDK for Android and iOS. The mobile app framework comprises examples and libraries and offers simple communications and OTA APIs to accelerate app development and simplify wireless design for mobile platforms.

Wireless Xpress takes advantage of Silicon Labs’ Gecko OS, an intuitive, simple-to-use IoT operating system that accelerates the development of market-ready connected products. Silicon Labs plans to offer additional Gecko OS-based products and solutions in the future.

For more information contact NuVision Electronics, +27 11 608 0144, gdeklerk@nuvisionelec.co.za.

Silicon Labs, 14 November 2018

www.dataweek.co.za
Strategies for deploying Xilinx’s RFSoC

On February 21, 2017, Xilinx announced the introduction of a new technology called RFSoC, with the rather dramatic headline ‘Xilinx Unveils Disruptive Integration and Architectural Breakthrough for 5G Wireless with RF-Class Analog Technology’

The proposition was simple: add RF-class analog-to-digital and digital-to-analog data converters to Xilinx’s already powerful MPSoC, ARM processor-enhanced family of high-performance FPGAs. And while the concept was simple, the implications were profound, changing the way engineers could design and package small, high-channel-count systems.

This technology not only offers new possibilities for 5G applications, but has significant impact in military and scientific systems, justifying the claim in Xilinx’s announcement. To get better appreciation of the capabilities of RFSoC and understand how to best use the advantages of this technology, it’s worth taking a quick look at current trends in data converters and signal processing.

What is RFSoC?
RFSoC, or more properly, Zynq UltraScale+ RFSoC, is based on Xilinx’s prior family, the Zynq UltraScale+ MPSoC. The MPSoC is a system-on-chip architecture that includes up to four ARM Cortex-A53 application processors and two ARM Cortex-R5 real-time processors integrated into the UltraScale+ programmable logic. This solution offers the software programmability and flexibility of a processor with the hardware programmability and performance of an FPGA in a single IC.

RFSoC builds on the MPSoC foundation and adds eight 4 Gsps 12-bit analog-to-digital converters (ADC) and digital-to-analog converters (DAC), each equipped with programmable digital downconverters (DDC), and eight 6.4 Gsps 14-bit DACs, each equipped with digital upconverters (DUC). While other ADC and DAC configurations are available, we’ll consider the eight ADC and eight DAC configuration for the rest of this article.

Improvements in SWaP and cost
A common term in military applications is SWaP, which stands for Size, Weight and Power, and refers to the ongoing requirement to reduce these attributes for communications, reconnaissance, radar and various types of signal acquisition and processing systems.

The need for smaller, lighter and less power becomes obvious when you think about where these systems are often deployed. Unmanned vehicles, like unmanned aerial vehicles (UAV) and unmanned underwater vehicles (UUV), frequently require stealth to achieve their mission. Smaller, lighter and less power usually equates to stealthier, enabling these systems to be more effective.

Manpack (or womanpack) systems, where the communications or direction finding equipment and associated power supply are worn by personnel, are another target for SWaP reduction. Here again, smaller, lighter and less power is needed for making a practical, human carried system.

RFSoC’s high level of integration provides a significant amount of SWaP reduction when compared to designing the same functionality with discrete components. Figure 1 shows the reduction in size by representing component footprints graphically. In the comparison, each component is roughly to scale, and space has been left between the discrete components to model a typical PCB layout, where ICs need space between them for assembly and placement of passive components. The RFSoC implementation can save 50% or more in overall size compared to the discrete approach.

While RFSoC can reduce weight at the component level, that saving is minimal when you consider the total weight of nine ICs compared to a single RFSoC. Where weight savings can be appreciated is when you look at power. For every Watt of power in a system comes the weight of a cooling solution, either in metal or composite heatsinks, or in some systems, more exotic solutions like liquid and vapour cooling.

RFSoC can easily bring power savings of 30% to 40% or more compared to typical discrete solutions, reducing the cooling solution complexity and weight. And in portable systems, every Watt that can be eliminated results in smaller, lighter batteries and longer operation time.

A key reason for the reduced power of RFSoC is the elimination of the interfaces needed to connect the various ICs in a discrete solution. Most data converters sampling at 1 or 2 GHz or higher depend on serial interfaces to move digital data between the converter and the FPGA. These interfaces expend power at both the data converter side and the FPGA side in serialising and deserialising (SerDes) circuitry.

The most common serial interface protocol used for converters is JESD204. By integrating the converters directly into the FPGA, the serial interfaces are eliminated, as well as data transfer latency which the SerDes process and protocol introduce (more on serial versus parallel converter interfaces and latency later).

Another parameter often tacked on to SWaP is cost, sometimes referred to as SWaP-C. Here again, RFSoC addresses the requirement. The same comparison used earlier of implementing the functions of the RFSoC as discrete components yields the results illustrated in Figure 2.

The cost of a typical multi-core ARM processor plus (4 x dual 4 Gsps ADCs) plus (4 x dual 6.4 Gsps DACs) plus Kintex UltraScale+ FPGA (with equivalent programmable logic and DSP density of the RFSoC) equals approximately double the cost of the same functionality delivered in a single RFSoC.

While savings at any level are always welcome, the real benefit of the reduced cost can be seen in systems where many channels of ADCs and DACs are required. Massive multiple-input multiple-output (MIMO) antennas are being targeted for applications from Wi-Fi to LTE to 5G. Massive MIMO antennas typically start at 8x8 configurations (8 receive channels and 8 transmit channels) and can be multiples of that configuration. This is a perfect match for the converters in the RFSoC.

Another high channel count application is phased array radar. The Multi-Function Phased Array Radar (MPAR) initiative combines the functions of several national radar networks into a single system for aircraft and weather surveillance. It is not uncommon for these antenna arrays to be specified with 64 or more elements, with each element requiring an ADC.
and DAC pair combined with signal generation and receive and control processing. With these systems, as well as military surveillance and targeting systems where hundreds of elements can be required, the savings found in RFSoC’s integrated solution can add up quickly.

**Data converter interfaces**

Up to this point, the advantages of RFSoC have been primarily in improving on already available solutions, saving on size, weight, power and cost compared to discrete component solutions. But by integrating the data converters into the FPGA, RFSoC offers a solution that is currently unavailable using existing technology.

To understand this, one must first look at how data converters connect to FPGAs. Using ADCs as an example (but this is the same for DACs), connecting a 12-bit ADC to an FPGA using a parallel interface might look like Figure 3, where each bit is represented by an LVDS pair and an additional pair is used for data ready or clock.

In some cases the interface can make use of double data rate (DDR) technology, where data is transferred on the rising and falling edge of the clock, effectively doubling the amount of data transferred in a single clock cycle. But even with DDR, parallel converter interfaces become problematic for data converters with sample rates above about 1.5 GHz due to the speed limitations of the LVDS interfaces on FPGAs.

One solution to overcome this is to use a 1:2 demultiplexed interface (DeMux) where data is sent over two parallel interfaces each running at half of the sample rate. In the 12-bit ADC converter example, if the converter is sampling at 2 GHz, each of the 12-bit paths following the DeMux are running at 1 GHz. This keeps each 12-bit interface below the maximum clock rate allowed by the FPGA LVDS interface but still delivers the data needed to support the 2 GHz sample rate.

But this solution also becomes problematic at higher speeds. Using this same technique, a 4 GHz ADC would require a 1:4 DeMux. This quickly starts to become a PCB design challenge when you consider the number of pairs needed and that these signals need to be critically routed to maintain tight length matching between pairs so data arrives at the FPGA across all 12 bits at the same time.

In addition to the routing challenge, a 12-bit ADC converter now requires 4 sets of 12 pairs (or 96 individual I/O pins, not including clock pins) to interface to the FPGA. In a typical FPGA device where 400 to 600 I/O pins might be available for interfacing all parallel devices like ADC and DAC converters and memory, half the pins could easily be used to connect just two 4 GHz ADC converters.

An alternative solution to the high pin count interface is to use a serial interface to connect data converters. JESD204 was created for this exact purpose. JESD204 makes use of the FPGA gigabit serial interfaces instead of LVDS. Figure 4 (on page 24) shows a PCB routed for a 1 GHz, 12-bit ADC connected via parallel LVDS and a PCB routed for a similar 1 GHz, 12-bit ADC connected via four high-speed serial interfaces (or lanes) using JESD204. The four lanes pose less of a PCB design challenge because of the limited number of signals as well as the fact that the interface standard includes clock and data recovery features which eliminate the need to critically match the length of all lanes.

So while JESD204 can be a good solution for many high-speed data converter applications, it’s not a perfect solution. The JESD204 IP and gigabit serial interface add about 1 W to the power budget for every four lanes used. JESD204 is a proprietary IP core and typically requires a paid licence to use it. In addition, using JESD204 can add complexity to the FPGA IP design.

In applications where multiple converters across multiple ICs need to be synchronised, JESD204 requires a more elaborate clocking solution than parallel interfaces, adding some additional circuitry and complexity. But while each of these obstacles can add power, cost, complexity and increased size, none is typically a showstopper.

Where JESD204 becomes a true impediment for some applications is in link latency. Where a parallel converter interface can delay the data by at most a few sample clock cycles for local buffering, the JESD204 protocol and the SerDes required to support it can add 80 sample clock cycles or more of latency from when the data is converted to when it is available in the FPGA for an ADC converter, and in the reverse direction for a DAC.

In some applications where data is streamed and processing results are not required in real-time, this poses no problem. As long as the data arrives at the FPGA without losing any samples, how long it takes to get there is not critical. But in many applications, including high-speed, tight control loop systems, some radar systems, and electronic warfare-like countermeasures, where there is a very short time allowed for acquiring the data, processing it and turning it around, this latency is a non-starter and eliminates JESD204 based solutions.

So, what does all this have to do with RFSoC? With the data converters integrated directly into the FPGA using parallel interfaces, they don’t require the prohibitively high pin count external connections needed for discrete parallel interface converters, allowing more converter channels to be supported by a single FPGA. In addition, the latency associated with a JESD204 serial interface is not an issue. This makes RFSoC an attractive solution for high channel count and low latency applications.

**Hardware design with RFSoC**

The circuit density and small size of the RFSoC create some unique challenges for circuit and PCB designers when engineering systems are using the FPGA. Designing and laying out the PCB for the analog interface containing 16 channels (8 ADC and 8 DAC) requires attention to even the smallest details, to maintain signal quality and reduce crosstalk in such a dense configuration.

Similarly, the RFSoCs GTYs (gigabit serial interfaces) are capable of running at higher than 32 Gbps. This poses another layout and routing challenge.

Continued on page 24
Continued from page 23

Challenge to the PCB design to maintain these speeds with signal integrity. For some operating modes, the RFSoC requires up to nine different supply voltages. Add to that another four or five supplies for peripheral circuitry and the power generation and management design can become complex very quickly.

While each of these challenges can be demanding on their own, consider that many of the applications where RFSoC can bring the greatest benefit are in space restricted and harsh environments, exacerbating the design challenge.

Pentek has taken a unique approach to delivering RFSoC functionality to its customers. Its QuartzXM Express Module is a small 63.5 x 10,16 mm board containing the Zynq UltraScale+ RFSoC FPGA and all peripheral and power circuitry needed for support and operation.

The concept behind the QuartzXM is simple: to provide the RFSoC functionality in a small, fully designed package that can be used on different carriers as needed, to match the specific interface requirements of different applications. By offering the RFSoC on the QuartzXM, Pentek is delivering not only the RFSoC functionality, but is delivering a solution where many of the most demanding circuitry and packaging challenges have been solved.

The company's Quartz line includes board products in standard from factors, like 3U VPX and PCIe, delivering the QuartzXM in turnkey solutions ready for immediate deployment. The products are available in commercial and rugged, conduction cooled versions, and in many situations will be the final deployed solution.

But with the modular design of QuartzXM, the standard form factor board can be the platform where the application is developed and proven, and then migrated to a custom carrier platform for deployment. More information about Pentek's Quartz products can be found at https://www.pentek.com/rf soc.

Software and IP design

With each new family of FPGA, there has been a constant progression towards more powerful processing solutions. Each new family adds more logic density, faster logic fabric, more DSP resources, more on-chip memory, faster interface and now with RFSoC, high sample rate ADC and DAC converters.

While these new capabilities are certainly welcome, and they do enable more and more complex applications to be targeted at FPGAs, they also raise the bar for better and more capable design tools to handle the increasing complexity and size of the new IP that can be created.

Xilinx has addressed the design tool challenge with its Vivado Design Suite. It includes tools for every aspect of the design cycle. The latest version has improvements in performance with faster routing and more efficient FPGA resource usage, allowing denser designs.

Vivado also addresses the increasing design complexity challenges with tools for creating processing IP with C-language specification, an integrated software development kit that targets the ARM processors, and plug-and-play block diagram based IP integration with IP Integrator.

While all of these tool improvements go a long way in enabling both software and IP engineers, the job of creating a complete system solution can be greatly accelerated when manufacturers of FPGA based hardware products provide IP and software libraries to support the specific features of the hardware.

The better the manufacturer can provide a foundation of software and IP for the engineer to build their application on, the faster the engineer can complete the job of producing a final, robust system.

All Pentek hardware products include a full suite of FPGA-based functions, allowing the product to be used immediately in a range of applications without the need to create any FPGA IP. For all of its ADC or DAC based products, the functions can include data acquisition and waveform generator engines, data tagging and metadata creation, VITA-49 packet creation, digital downconverters, multi-channel and multi-board synchronisation, optimised DMA for moving data on and off board through PCIe or 10 GiGE, in addition to IP targeted at specific applications.

RFSoC again brings new challenges and solutions with the sheer amount of data the ADC and DAC converters can introduce and the minimum latency interfaces between data converters and programmable logic in time critical applications.

Pentek's Quartz products address some of the most common requirements of RFSoC targeted applications with new built-in IP ready to use with no additional IP design needed. These include a programmable digital RF memory (DRFM), a programmable chirp generator, an enhanced acquisition engine that supports the full bandwidth 4 GHz sample rate with options to snapshot data to on-board memory or to stream over dual 100 GiGE interfaces, an optimised x16 decoder for data reduction in high channel count applications, and an enhanced waveform generator engine for outputting DAC data supplied by the 100 GiGE interface or from waveforms loaded to on-board memory.

In each case the installed functions can provide a final solution or be the basis of a custom solution when built upon using the Pentek Navigator FPGA Design Kit (FDK). The Navigator FDK provides a library of all of Pentek's IP functions as blocks that can be used in Xilinx's Vivado IP Integrator, giving the IP designer immediate access to the product's entire FPGA design as a block diagram.

Individual IP blocks can be removed, modified or replaced with custom IP to meet the application's processing requirements. If at any time a designer needs to work with the VHDL source code directly, it is always accessible in a source window, as well as full online documentation of every Pentek IP core.

Navigator FDK leverages the features of Vivado, allowing an engineer to start designing with the FDK immediately without the need to learn new software tools, and streamlines the path to a final application solution by providing the foundation for custom IP to be built on.

The companion product to the Pentek Navigator FDK is the Navigator Board Support Package (BSP). With every creation of, or modification to, an IP block, a change to software, most likely running on the RFSoC's ARM processors, to control the new or modified IP might be needed. The Navigator BSP was designed to help manage this relationship between IP and software.

The BSP provides C language functions and utilities structured to map the IP blocks provided in the FDK. This one-to-one relationship between IP and the software to control it is another path to manage the increasing complexity of applications.

Conclusion

RFSoC brings new possibilities for addressing some of the most challenging requirements of high bandwidth, high channel count systems. Understanding how this new technology can specifically address SWaP-C and low latency applications is key to matching it to many applications that can benefit from it the most.

And while Xilinx has provided a rich set of tools, IP and support at the chip level, equipment manufactures like Pentek, using RFSoC at the centre of their board architecture, can leverage the power of RFSoC by providing unique solutions to streamline the path from RFSoC to a deployed system solution.

For more information contact Rugged Interconnect Technologies, +27 21 975 8894, sales@ri-tech.co.za.
Accelerator cards for AI and data centres

At the recently held Xilinx Developer Forum (XDF), Xilinx launched the Alveo portfolio of powerful accelerator cards designed to increase performance in industry-standard servers across cloud and on-premise data centres.

The platform delivers advanced performance at low latency when running key data centre applications like real-time machine learning inference, as well as video processing, genomics and data analytics, among others.

The Alveo U200 and Alveo U250 are powered by the Xilinx UltraScale+ FPGA and are available now for production orders. Like all Xilinx technology, customers can reconfigure the hardware, enabling them to optimise for shifting workloads, new standards and updated algorithms without incurring replacement costs.

For machine learning, the Alveo U250 increases real-time inference throughput by a claimed twenty times versus high-end CPUs, and more than four times for sub-two-millisecond, low-latency applications versus fixed-function accelerators like high-end GPUs. Moreover, Xilinx says the cards reduce latency by three times versus GPUs, providing a significant advantage when running real-time inference applications, and that some applications like database search can be radically accelerated to deliver more than ninety times, versus CPUs.

Alveo is supported by an ecosystem of partners and OEMs who have developed and qualified key applications in artificial intelligence/machine learning, video transcoding, data analytics, financial risk modelling, security and genomics. Fourteen ecosystem partners have developed applications for immediate deployment. Additionally, top OEMs are collaborating with Xilinx to qualify multiple server SKUs with Alveo accelerator cards.

For more information contact Erich Nast, Avnet South Africa, +27 11 319 8600, erich.nast@avnet.eu.

CompactPCI Serial board for networking

Pentek’s SY8-Cyclone is a CompactPCI Serial peripheral board, equipped with a powerful FPGA and up to ten RJ45 connectors for 100BASE-TX Ethernet. With its PCI Express x4 interface, the Cyclone-V FPGA can be used, for example, as an Ethernet NIC, switch, router or gateway. Industrial Ethernet real-time protocols and custom specific applications may be integrated.

The board provides five RJ45 connectors in 4HP front panel width, or optionally ten ports in 8HP width. As an additional option, it can accommodate a mezzanine module with a secondary, identical FPGA. This would allow for either safety critical applications by redundancy, or additional logic elements for custom specific solutions.

The Intel (formerly Altera) SGXFC7C6F2317N Cyclone-V FPGA operates over the industrial temperature range and contains 150K logic elements, and also hard IPs for the PCI Express controller. In addition to non-volatile flash memory, 512 MB DDR3L soldered RAM is wired on-board to the Cyclone-V FPGA.

A reference design based on Quartus is available as a starting point for customers.

For more information contact Rugged Interconnect Technologies, +27 21 975 8894, sales@ri-tech.co.za.
**OpenVPX board for radar and DRFM**

Pentek introduced its first product in the Quartz architecture family, the Model 5950 – an eight-channel A/D and D/A converter, 3U OpenVPX board based on the Xilinx Zynq UltraScale+ RFSoC FPGA. The low latency benefits of the architecture support DRFM (digital RF memory) and radar applications that were previously not possible with earlier generation products.

Designed to work with Pentek’s Navigator Design Suite tools, the combination of Quartz and Navigator offers users an efficient path to developing and deploying FPGA software and IP for data and signal processing. The Xilinx Zynq UltraScale+ RFSoC Processor integrates 8 RF-class A/D and D/A converters into the Zynq FPGA fabric and quad ARM Cortex-A53 and dual ARM Cortex-R5 processors.

The board can be used out-of-the-box with the built-in functions requiring no FPGA development. It comes pre-installed with IP for DRFM, triggered waveform and radar chirp generator, triggered radar range gate engine, wideband real-time transient capture, flexible multi-mode data acquisition and extended decimation.

For more information contact Rugged Interconnect Technologies, +27 21 975 8894, sales@ri-tech.co.za.

**Altium Designer 18**

To meet the needs of today’s engineer, Altium rolled out the most powerful, modern, easy-to-use release of Altium Designer to date. Spurred by feedback from the user community and with significant efforts in research and development, Altium Designer 18 delivers key updates and performance enhancements, along with new and improved features that significantly increase design productivity.

This release simplifies the overall design experience with a modernised user interface that improves user commonality across all design domains, making it even more intuitive and accessible. This version also features the much-anticipated upgrade to 64-bit architecture combined with multi-threaded task optimisations, enabling users to design and release large, complex boards faster. This upgrade fully equips engineers to tackle even the most complex PCB designs, with key performance optimisations and increased user control through every stage of the design process.

Altium Designer 18 not only features huge structural improvements, but also includes major updates to ActiveRoute, a user-guided routing engine that now supports length tuning and pin swapping, enabling users to quickly produce high-quality routes.

The ACTIVEBOM editor also features several enhancements, including a new BoM rule checker that allows designers to easily verify each BoM line item. Users can also design and release large, complex boards faster than ever before using the new multi-board assembly capability and real-time connection management.

For more information contact EDA Technologies, +27 12 665 0375, sales@edatech.co.za.

**PICkit 4 in-circuit debugger**

The low-cost MPLAB PICkit 4 programming and debugging development tool replaced Microchip Technology’s PICkit 3 programmer by offering five times faster programming, a wider voltage range (1.2 – 5 V), improved USB connectivity and more debugging interface options. In addition to supporting Microchip’s PIC microcontrollers (MCUs) and dsPIC digital signal controllers (DSCs), the tool also supports debugging and programming for the CEC1702 family of hardware cryptography-enabled devices.

This low-cost solution is ideal for those designing in the 8-bit space, but is also perfectly suited for 16- and 32-bit development due, in part, to its 300 MHz, high-performance ATSAME70Q21B microcontroller onboard. The PICkit 4 enables debugging and programming using the graphical user interface of MPLAB X integrated development environment (IDE). The tool connects to the design engineer’s computer using a high-speed USB 2.0 interface and can be connected to the target via an 8-pin single inline header that supports advanced interfaces such as 4-wire JTAG and serial wire debug with streaming data gateway.

For more information contact Tempe Technologies, +27 11 455 5587, willem.hijbeek@tempetech.co.za.

**Time-of-flight sensor**

The VL53L1X time-of-flight sensor from STMicroelectronics, extends the detection range of the company’s FlightSense technology to four metres, bringing high-accuracy, low-power distance measurement and proximity detection to an even wider variety of applications.

Unlike other proximity sensors that use simple infrared technology, which only measure signal strength and can be affected by the object’s reflectivity, FlightSense sensors directly measure distance to the object based on the time for emitted photons to be reflected, enabling accurate distance-ranging regardless of the object’s surface characteristics.

With low power consumption and fast ranging performance, the VL53L1X is ideal for mobile robotics for wall following, cliff detection, collision avoidance and hover/landing assistance for drones or unmanned aerial vehicles (UAVs). The power-saving presence detection mode enables innovative auto-sleep/wake-on-approach use cases.

The fully integrated device measures only 4.9 x 2.5 x 1.56 mm, and contains the laser driver and emitter, as well as the single-photon avalanche diode (SPAD) light receiver that gives the sensor its ranging speed and reliability.

For more information contact Aveshen Nair, Avnet South Africa, +27 11 319 8600, aveshen.nair@avnet.eu.
Anritsu introduced the Spectrum Master MS2760A family of ultra-portable, millimetre wave (mmWave) spectrum analysers for verifying high-frequency designs, including those used in 5G and E-band applications. The MS2760A's size allows it to be placed in a technician's pocket, while its continuous sweep ability and USB-powered form factor using a tablet reduces the amount of equipment a technician must carry.

For R&D and test engineers in lab environments, the MS2760A conducts essential spectrum measurements, such as spectrum analysis, channel power, adjacent channel power, spurious emissions and occupied bandwidth. Users can make measurements directly at the DUT, unlike benchtop models that require cables that can add loss. Its ability to conduct sweeps from 9 kHz to 110 GHz also improves measurement confidence.

Available models support the 32 GHz, 44 GHz, 50 GHz, 70 GHz and 110 GHz frequencies. A 90 GHz model is also available for countries where an export licence is required for analysers above 90 GHz.

For more information contact Coral-i Solutions, +27 11 315 5500, sales@coral-i.com.

Keysight Technologies unveiled the Infiniium UXR series of oscilloscopes, with models ranging from 13 to 110 GHz of true analog bandwidth. They enable high-speed serial and optical designers, focused on current and next generation technologies, to quickly create comprehensive designs with higher margins.

High-performance levels, combined with a wide selection of bandwidth choices, make the Infiniium UXR-series an ideal solution for engineers and designers working with any generation of DDR, USB, PCIe or other serial technologies, as well as PAM4, 5G, radar, satellite communications and optical designs.

The oscilloscopes deliver a low noise floor and high vertical resolution to ensure measurements are not impacted by oscilloscope noise and signals are represented accurately. As a result, eye diagrams are significantly more open, and true margins and performance can be determined.

For more information contact Tshiamo Mogakwe, Concilium Technologies, +27 12 678 9200, info@concilium.co.za.
**Dual-core signal controller**

Microchip Technology packed two dsPIC digital signal controller (DSC) cores into a single chip to produce the dsPIC33CH, for high-end embedded control applications.

The dsPIC33CH has one core that is designed to function as a master while the other is designed as a slave. The slave core is useful for executing dedicated, time-critical control code while the master core is busy running the user interface, system monitoring and communications functions, customised for the end application. The chip is designed specifically to facilitate independent code development for each core by separate design teams and allows seamless integration when they are brought together in one chip.

The dsPIC33CH family is optimised for high-performance digital power, motor control and other applications requiring sophisticated algorithms. This includes applications such as wireless power, server power supplies, drones and automotive sensors. It comes in a 5 x 5 mm package and includes features such as CAN-FD communications and many peripherals.

**RFSoC architecture by Xilinx**

Xilinx rolled out its Zynq UltraScale+ RFSoC family, an architecture integrating the RF signal chain into a system-on-chip (SoC) for high-performance RF applications.

Based on the 16 nm UltraScale+ MPSoC architecture, the chips monolithically integrate RF data converters for up to 50% to 75% system power and footprint reduction, and soft-decision forward error correction (SD-FEC) cores to meet 5G and DOCSIS 3.1 standards.

Devices in the family feature eight 4 GSps or sixteen 2 GSps 12-bit ADCs; eight to sixteen 6,4 GSps 14-bit DACs; integrated SD-FEC cores with LDPC and Turbo codecs for 5G and DOCSIS 3.1; ARM processing subsystem with quad-core Cortex-A53 and dual-core Cortex-R5s; 16 nm UltraScale+ programmable logic with integrated Nx100G cores; and up to 930 000 logic cells and over 4200 DSP slices.

Applications include remote radio heads for massive-MIMO, millimetre-wave mobile backhaul, 5G baseband, fixed wireless access, Remote-PHY nodes for cable, radar, test and measurement, satcom, and milcom/airborne radio.

**High-precision GNSS module**

u-blox announced the ZED F9P multiband GNSS (global navigation satellite system) module with integrated multiband real-time kinematics (RTK) technology for machine control, ground robotic vehicles and high-precision unmanned aerial vehicles (UAV) applications. The module measures only 22 x 17 x 2,4 mm and uses technology from the recently debuted F9 platform to deliver robust, high-precision positioning performance in seconds.

According to u-blox, the ZED F9P was the first mass market multiband receiver to concurrently use GNSS signals from all four GNSS constellations (GPS, GLONASS, Galileo and BeiDou). Combining GNSS signals from multiple frequency bands (L1/L2/L5) and RTK technology lets the module achieve centimetre-level accuracy in seconds. And receiving more satellite signals at any given time maximises the availability of this level of accuracy even in challenging environments such as in cities.

With its high update rate, the ZED F9P is ideal for highly dynamic applications such as UAVs.

**Flexible antenna for NB-IoT**

The MFX3 from Taoglas is an NB-IoT / LTE Category M1 wideband, flexible antenna designed to provide the highest efficiency, and covers all working frequencies in the 698–3000 MHz spectrum, covering all cellular, 2,4 GHz Wi-Fi, ISM and Assisted GPS. The antenna is omnidirectional, delivered with a flexible body with high efficiencies on all bands.

The antenna, at 96 x 21 x 0,2 mm, is extremely thin, and is assembled by a simple ‘peel and stick’ process, attaching securely to non-metal surfaces via a 3M adhesive. It enables designers to use only one antenna that covers NB-IoT, Cat. M1 and all common LTE frequencies.

The MFX3 is made of durable, flexible polymer and is designed to be mounted directly onto a plastic or glass cover. It offers a peak gain of 5 dBi, an efficiency of more than 45% across the bands, and is a good choice for any device maker that needs to keep manufacturing costs down over the lifetime of a product.

For more information contact Shane Padayachee, Avnet South Africa, +27 11 319 8600, shane.padayachee@avnet.eu.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za.
**Electrical double-layer capacitors**

Vishay Intertechnology introduced a new series of ENYCAP electrical double-layer energy storage capacitors for energy harvesting, power backup and UPS power source applications. Available in power and energy versions with high stability, Vishay BCcomponents 220 EDLC ENYCAP series devices deliver high-power density and capacitance values in small case sizes ranging from 16 mm by 20 mm to 18 mm by 31 mm.

For the industrial, telecom and PC markets, the polarised energy storage capacitors offer power density up to 4,1 Wh/kg, capacitance values from 15 F to 40 F, and a maximum rated voltage of 2,7 V. 220 EDLC ENYCAP series devices feature very low internal resistance and rapid charge and discharge performance. The through-hole capacitors offer long leads and are RoHS-compliant.

For more information contact Dirk Venter, Altron Arrow, +27 11 923 9600, dventer@arrow.altech.co.za.

**High-power electronic fuse**

Sustaining up to 4 A continuous current over a wide operating input voltage range of 8 V to 48 V, with low insertion loss thanks to its integrated low-$R_{DS(on)}$ VIPower MOSFET, the STEF01 programmable electronic fuse from STMicroelectronics extends the benefits of fast-acting overload protection to applications at higher power ratings.

When connected in series to the main power rail, the device protects the load against over-current and over-voltage. The voltage is clamped to a user-defined maximum, preset with external resistors. Excessive current is restricted to the programmed safe limit by controlling the internal power MOSFET, and folds back to a lower limit if a strong over-current or short circuit is detected.

The STEF01 leverages ST’s BCD8 high-voltage process to integrate features including dV/dt control to prevent excessive inrush current during startup or hot-swap insertion. This slows the output voltage ramp-up time to at least 3 ms, which can be increased if desired by connecting an external capacitor.

For more information contact Dirk Venter, Altron Arrow, +27 11 923 9600, dventer@arrow.altech.co.za.

**Modular electronics housings**

Phoenix Contact introduced a range of modular electronics housings specially designed for the IoT devices of tomorrow. The ICS (Industrial Case System) housings are available in graduated sizes, and with standardised device connections such as RJ45, USB, D-SUB and antenna sockets.

The housing series provides the basis for Industry 4.0, power electronics and process automation applications, such as communication systems, interfaces and gateways, relay assemblies and safety technology. Thanks to the highly flexible modular system, the housings can be adapted to the requirements of any application.

Widths of 20 mm and 25 mm are available, with heights of 77,5 mm, 100 mm and 122,5 mm, and depths of 87,5 mm, 110 mm and 132,5 mm. Optional DIN rail connectors, marking covers, and various colour versions provide additional individualisation options. Light guides enable space-saving implementation of status indicators and signals in the ICS series housings, with up to 40 indicators.

For more information contact Richard Schoonebeek, Phoenix Contact, +27 11 801 8200, rschoonebeek@phoenixcontact.co.za.

**Screw fixing connectors**

Harwin’s Gecko range was expanded to include screw fixings variations, known as Gecko Screw-Lok (or Gecko-SL). Developed to meet customer demand, the series features ruggedised screw fixings for increased security and can withstand repeated mating cycles without damage. Up to 45% smaller than Micro-D connectors and up to 75% lighter, Gecko-SL delivers high reliability with a smaller footprint and increased flexibility for design engineers.

Contacts are rated to 2,8 A individually and 2,0 A for all contacts simultaneously. Able to withstand 1000 mating cycles, they are ideal for long life ‘fit and forget’ applications, in operational temperatures of -65°C to +150°C.

Shielded options with machined aluminium backshells are available to deliver enhanced electrical continuity and effective EMI/RFI shielding in affected applications. The backshells are designed to accommodate flexible metal braiding and are strong and lightweight. Flexible cabling options include complete cable harnesses in customised lengths, loose mouldings and pre-crimped wires, and loose mouldings and crimp contacts.

For more information contact TRX Electronics, +27 12 997 0509, info@trxe.com.
Fibre splicer and cleaver kit

Fujikura has announced the launch of the world’s first Core-Sense splicer – the Fujikura-41S – featuring innovative specifications like Bluetooth connectivity and a unique Core-Sense splicing algorithm.

Accompanying the new splicer is the new Fujikura-CT50 cleaver with automated blade control via Bluetooth.

The Fujikura-41S with Core-Sense is extremely accurate as a FTTx splicer and the technology ensures highly accurate loss estimation. It is a portable unit and comes as a complete kit with the CT50 cleaver, work bench, robust carry case and other accessories. Splicing time is from 6 seconds in full auto mode and heating time is around 20 seconds.

The 41S kit is fully backed by IC Logistix’ accredited calibration lab situated in Ferndale.

Power contacts for 2 mm pitch connectors

Harwin has announced the introduction of a new female contact for its Datamate connectors that enables significant increases in power delivery levels to be realised. Utilising a unique, proprietary 6-finger design which is machined from a single piece of beryllium copper, the T-contact raises the current capacity on compact 2 mm pitch interconnection systems, with up to 8.5 A per contact being supported.

The patented design employed in these components presents more contact points, which thereby enhances their resilience to shock (100 G) and vibrational forces (40 G for 6 hours – 2 hours on each axis). The crimp barrels accept #22 AWG wire and comply with IPC-A-620 cable harnessing specifications.

The contacts are also gold plated in order to ensure that reliable performance is maintained in even the most demanding of application environments (allowing US military requirements to be met, for example). It also means that a far greater number of mating cycles (up to 1000) can be undertaken, thereby extending the operation lifespan of connectors into which they are incorporated. Their operational temperature range spans from -55°C to +125°C.

The T-contact exhibits 60% greater contact wipe compared to existing Datamate contacts – which improves the self-cleaning action and reduces the possibility of surface contamination arising. To accompany these contacts, Harwin supplies a variety of dual-row housings with different jackscrews which are available direct from stock in a broad range of different sizes, from 4- to 50-position options.

Among their main target applications are defence, avionics (control systems, radar, UAVs, etc.), motorsport (navigation systems, sensors, telemetry equipment), industrial automation (drives/controls, robotics, motion control systems) and satellites.

For more information contact TRX Electronics, +27 12 997 0509, info@trxe.com.
TDK announced the addition of high-power GSP models to the TDK Lambda GENESYS+ series of programmable DC power supplies. This expansion now provides 2U high, 10 kW and 3U high, 15 kW versions with output voltages and currents of up to 0-10 V/1500 A to 0-600 V/255 A. The GENESYS+ series addresses a very broad market, including component, aerospace and automotive testing, semiconductor fabrication, water treatment, plating and solar array simulation.

Utilising DSP (digital signal processing) technology, these next-generation units provide improved efficiency, performance and functionality over existing products, with efficiencies of up to 92%. The 20 new high-power models can be programmed to operate in constant voltage, constant current or constant power modes, and also offer the ability to simulate an internal resistance for battery charging and long output cable voltage drop applications. The units are available for use with three-phase 170 to 265 V a.c., 342 to 460 V a.c. or 342 to 528 V a.c. inputs.

All GENESYS+ models feature an easy to read LCD display with user controllable brightness and dimming functions for extended life. Additionally, they include faster up and down programming response times with user adjustable voltage and current slew rate control. The provision of two user programmable output open drain control pins can be used to activate external devices like load disconnect relays.

Arbitrary waveform profiles, such as car battery simulation at vehicle startup, of up to 100 steps can be generated and stored in four memory cells. These can be activated by commands from the communication ports or the front panel controls, allowing the user to quickly switch between programs.

All functions can be programmed via the front panel or remotely using the LAN (LXI 1.5), USB 2.0 or RS-232/485 communications interfaces, which are provided as standard (SCPI compliant). An isolated analog control and monitoring interface (0-5 V or 0-10 V scale) is also included.

The product design includes options for GPIB (IEEE488.2) and the Anybus CompactCom interface platform for DeviceNet, EtherCat, Modbus, Profibus and other interface options as they are released. A full package of software drivers, a waveform creator and a virtual front panel GUI are provided in the software package.

Safety features include safe/auto restart, last setting memory and built-in protective functions. With safe-start configured, the power supply will return to its last operational settings after a power interruption but with the output disabled. With auto restart, the power supply returns to the last used operation settings after a power interruption where no user intervention is preferred.

Last setting memory retains settings such as the output voltage/current, output on/off, OVP/UVL level, fold-back and startup mode at each AC input turn-off sequence, even after extended periods of storage or non-use. Built-in protective functions include over-voltage protection (OVP), under-voltage limit (UVL), fold-back protection (FOLD) and over-temperature protection (OTP).

The five-year warranty series is safety certified to IEC/EN/UL 60950-1, CE marked to the Low Voltage, EMC and RoHS2 directives, and conforms to the industrial IEC/EN 61326 1 standard for conducted EMI, radiated EMI and EMC immunity.

For more information contact Tobie Muller, Accutronics, +27 11 782 8728, tmuller@accutronics.co.za.
The new AS6501 from ams is a two-channel time-to-digital converter (TDC) which enables high-speed scanning and high precision in single-beam optical ranging equipment and medical imaging systems. It features high-speed LVDS interfaces for the start and stop signals at the light source in optical ranging equipment and scanners, and LVDS measurement outputs. It can be used to measure the time-of-flight of optical signals to a precision of 20 ps over 2 to 5 channels. The family is ideal for applications migrating from 3.3 V systems to lower voltage rails, such as battery-operated IoT applications, personal computing devices, field-programmable gate arrays (FPGAs) and graphics processing units (GPUs).

Microchip Technology announced five new 1.8 V temperature sensors, including the industry’s smallest 5-channel temperature sensor with standard lead spacing. The EMC1811 temperature sensor family also introduces system temperature rate-of-change reporting, a feature that provides advance warning on how the temperature of a system is fluctuating. The EMC1811 temperature sensor family offers a variety of remote channels at 1.8 V operation to fit different design needs, ranging from 2 to 5 channels. The family is ideal for applications migrating from 3.3 V systems to lower voltage rails, such as battery-operated IoT applications, personal computing devices, field-programmable gate arrays (FPGAs) and graphics processing units (GPUs).

Designers of lithium-ion (Li-ion) battery-powered mobile and portable devices can improve the end-user experience by extending runtime and delivering accurate battery state-of-charge (SOC) data with the MAX17262 single-cell and MAX17263 single-/multi-cell fuel-gauge ICs from Maxim Integrated Products. The chips combine traditional coulomb counting with the ModelGauge m5 EZ algorithm for high-accuracy battery SOC without requiring battery characterisation. With their low quiescent current, they minimise current consumption during long periods of device standby time, extending battery life in the process. Both also have a dynamic power feature that enables the highest possible system performance without draining the battery.

With a focused feature set and compact package options, STMicroelectronics’ STM32L412 and STM32L422 microcontrollers (MCUs) bring ultra-low power technologies and high performance to budget-conscious consumer, industrial and medical applications. Combining economical 64 KB or 128 KB Flash density with features such as ST’s FlexPowerControl (FPC) and the 80 MHz Arm Cortex-M4 core, they set best-in-class EEMBC benchmarks for efficiency and performance: 273 CoreMark provides for speedy execution in devices like smart sensors or consumer wearables, while 167 ULPMark-PP (Peripheral Profile) and 447 ULPMark-CP (Core Profile) demonstrate optimised energy management.

pSemi has introduced the world’s first monolithic, silicon-on-insulator (SOI) Wi-Fi front-end module (FEM) – the PE651221. Ideal for Wi-Fi home gateways, routers and set-top boxes, this module uses a smart bias circuit to deliver a high-linearity signal and excellent long-packet error vector magnitude (EVM) performance. The PE651221 combines the intelligent integration capabilities of pSemi’s SOI technology and Murata’s expertise in Wi-Fi connectivity solutions and advanced packaging. This 2.4 GHz Wi-Fi FEM integrates a low-noise amplifier (LNA), a power amplifier (PA) and two RF switches (SP4T, SP3T). The monolithic die uses a compact 16-pin, 2 x 2 mm LGA package ideal for either standalone use or in 4 x 4 MIMO and 8 x 8 MIMO modules.

With its ultra-low power and excellent performance, the PE561221 combines the capabilities of pSemi’s SOI technology and Murata’s expertise in Wi-Fi connectivity solutions and advanced packaging. This 2.4 GHz Wi-Fi FEM integrates a low-noise amplifier (LNA), a power amplifier (PA) and two RF switches (SP4T, SP3T). The monolithic die uses a compact 16-pin, 2 x 2 mm LGA package ideal for either standalone use or in 4 x 4 MIMO and 8 x 8 MIMO modules.

u-blox announced the NINA W15 multiradio and gateway module series, which can simultaneously support both Wi-Fi 802.11 b/g/n connections and dual mode Bluetooth connectivity. This includes support for both Bluetooth low energy and Bluetooth BR/EDR. Key applications for the modules include industrial automation such as machine control, industrial terminal and remote controls, building automation, and smart building/home equipment such as HVAC and lighting control. The NINA W15 modules will help IoT device developers to secure their designs by supporting features such as secure boot, Wi-Fi enterprise security, end to end security, Bluetooth secure connections and secure simple pairing.

With a focused feature set and compact package options, STMicroelectronics’ STM32L412 and STM32L422 microcontrollers (MCUs) bring ultra-low power technologies and high performance to budget-conscious consumer, industrial and medical applications. Combining economical 64 KB or 128 KB Flash density with features such as ST’s FlexPowerControl (FPC) and the 80 MHz Arm Cortex-M4 core, they set best-in-class EEMBC benchmarks for efficiency and performance: 273 CoreMark provides for speedy execution in devices like smart sensors or consumer wearables, while 167 ULPMark-PP (Peripheral Profile) and 447 ULPMark-CP (Core Profile) demonstrate optimised energy management.

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