Many distributors make claims.

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Comtest's latest offering from AFL is the aeRos connected FOCIS WiFi2, the next generation fibre-optic connector inspection system that uses an Android or iOS wireless connection for live image video streaming, auto-focus and more. The FOCIS WiFi2 probe is an ergonomic fibre connector inspection system that, when paired with an iOS or Android smart device, provides fast and accurate IEC/IPC/AT&T compliant and user-defined pass/fail endface-clean analysis. Find out more on page 21.

For more information contact Comtest, +27 10 595 1821, sales@comtest.co.za.
From the editor’s desk

After a severe downturn triggered by the global economic collapse a few years ago, the electronics industry has recovered to reach all-time highs. DMASS reported record European semiconductor sales figures of 2.28 billion Euros for the first quarter of 2018, an almost 7% year-on-year increase. Worldwide, semiconductor sales painted an even rosier picture, with the World Semiconductor Trade Statistics (WSTS) organisation having reported a 20% year-on-year increase for the same period, topping $111 billion.

It is quite possible that even more growth is on the horizon, as market research firm IC Insights announced recently that the top 15 semiconductor companies’ sales surged by 26% in the first quarter of 2018 compared to the first quarter of 2017, six points higher than the total worldwide semiconductor industry increase, while the big three memory suppliers – Samsung, SK Hynix and Micron – each registered greater than 40% year-over-year growth.

Speaking of Samsung, 2017 was the year it stole Intel’s mantle of the world’s leading semiconductor supplier in the second quarter of the year as well as in the full-year 2017 ranking – the first time Intel was knocked from its perch since 1993. This was a hard-earned victory for Samsung, as its capex figures show, and the company’s growth shows no signs of slowing down either. Although it says it still does not have a full-year capital spending forecast for 2018 it did say it will spend less in semiconductor capital outlays than it did in 2017, when it spent $24.2 billion. However, as of the first quarter of 2018, figures show its foot is still on the gas, as it spent $6.72 billion in capex for its semiconductor division in the first quarter of 2018, slightly higher than the average of the previous three quarters and almost four times the amount the company spent just two years earlier in the first quarter of 2016. Over the past four quarters, Samsung has spent a remarkable $26.6 billion in capital outlays for its semiconductor group.

Rampant global semiconductor sales led Gartner to increase its forecast for the market in 2018 from 4% to 7.5%, which, if correct, would see it pass the $450 billion mark. Some new players might also be poised to enter the mix, as tech giants Apple, Google, Amazon and Facebook have all announced plans, or are rumoured to have plans, to design and build their own hardware chips in an effort to become increasingly self-reliant.

An unfortunate consequence of this strong market growth is the effect it is having on component lead times. The Electronic Components Industry Association (ECIA) recently issued a warning that lead times are escalating and there is a lack of stability. As the ECIA pointed out, there is no one cause, as it is a complicated situation exacerbated by shifts in market demand, allocated capacities, investment constraints, de-emphasised older form factors and regional supply shortages.

These long lead times are affecting all component categories, with industry average lead times for interconnect and electromechanical components sitting at around 67 days, passives at 85 days and semiconductors also at roughly 85 days. Digging into these categories, resistors (more than 125 days), capacitors (almost 110 days) and discrete semiconductors (roughly 130 days) are the worst offenders, but overall lead times for almost every component type are becoming longer, and industry experts are warning that the problem will get worse before it gets better.

There is not much electronics manufacturers can do about shortages upstream, but it never hurts to plan ahead.
South Africa

- Pasternack, a leading provider of RF, microwave and millimetre-wave products, has signed RF Design of Cape Town as an authorised distributor of Pasternack products in South Africa and Namibia. As an official distributor of Pasternack products, RF Design will now be able to offer its customers access to a large selection of RF, microwave and millimetre-wave products available with same-day shipping from the United States.

- Reunert's half-year results to 31st March 2018 reflect a 10% increase in revenue, from R4421 million to R4841 million. This was primarily driven by a 25% increase in revenue from the Applied Electronics segment arising from new segment subsidiaries and a large export order book. Group operating profit declined by 8% from R616 million to R567 million, driven in large part by the stronger exchange rate of the Rand with respect to the dollar.

- MTN and Huawei recently conducted what they claimed was Africa's first field trial of 5G mobile broadband. Built on an end-to-end Huawei 5G solution using 28 GHz millimetre-wave technology, the trial demonstrated a fixed-wireless access case in a real-world environment in Hatfield, Pretoria. Downlink speeds of 520 Mbps and uplink speeds of 77 Mbps were achieved.

Overseas

Business

- Net sales for Microchip Technology's fiscal year ended 31 March 2018 were $3,981 billion, an increase of 16.8% from net sales of $3,408 billion in the prior fiscal year. Net income was $255,4 million, or $1.03 per diluted share, an increase of 49.7% over the prior fiscal year. The prior year's net income results were significantly adversely impacted by purchase accounting adjustments associated with the acquisition of Atmel, while 2018's results were detrimentally impacted by one-time tax adjustments related to the US Tax Cuts and Jobs Act of 2017.

Companies

- XP Power has acquired the business and assets of Glassman High Voltage Inc., a US-based designer and manufacturer of high-voltage, high-power supplies. The $44.5 million deal expands XP Power’s product offering into standard, modified and custom high-voltage, high-power conversion products. Typical applications include semiconductor manufacturing equipment, vacuum/plasma processing, analytical instrumentation, medical diagnostics and test equipment.

- TDK acquired Faraday Semi LLC, a US-based, venture-backed company engaged in the design of advanced power semiconductor ICs. Now a wholly owned subsidiary of TDK, Faraday Semi’s solutions incorporate high-performance semiconductor in advanced packaging technologies such as semiconductor embedded in substrate (SESUB), resulting in the world’s smallest class of high power density point-of-load solutions under the brand μPOL.

- Adesto Technologies announced its acquisition of Dublin-based S3 Semiconductors, a global supplier of mixed-signal and RF application specific integrated circuits (ASICs) and an extensive library of design IP. The transaction is valued at approximately $35 million, with an additional earn-out provision based on certain milestones to the end of calendar year 2019.

Industry

- Artificial Intelligence (AI) will see a significant shift out of the cloud and on to the edge. This will happen initially in terms of inference (machine learning) and then by training. This shift means a huge opportunity for those chipset vendors with power-efficient chipsets and other products that can meet the demand for edge AI computing. ABI Research predicts that edge AI inference will grow from just 6% in 2017 to 43% in 2023, and has identified 11 verticals ripe for the adoption of AI, including automotive, mobile devices, wearables, smart home, robotics, small unmanned aerial vehicles, smart manufacturing, smart retail, smart video, smart building, and oil and gas sectors. By 2023 the market will witness 1.2 billion shipments of devices capable of on-device AI inference – up from 79 million in 2017.

- The Wi-Fi Alliance has released a mesh networking standard to simplify the creation of Wi-Fi networks that cover larger areas. EasyMesh delivers a standards-based approach to deploying adaptable networks comprised of multiple access points from different vendors, extending uniform Wi-Fi coverage and enhancing performance throughout a larger service area than is possible with a single access point.

- According to DMASS, European semiconductor sales as reported by its members in the first quarter of 2018 ended at a record 2.28 billion Euros, 6.9% above the first quarter of 2017 and 13% above the fourth quarter of 2017. A closer look at the products breakdown reveals strong and solid growth in discretes, power discretes (MOSFETs) and sensors as well as in programmable logic – all double-digit – while opto, analog, memories and other logic (ASSPs) came in short – between 1% and 2.5%. Analog, the biggest product group, grew by 2.4% to 672 million Euros, MOS micro by 8% to 477 million Euros, power by 16.9% to 241 million Euro, opto (including LEDs) by 2.3% to 217 million Euros, memories by 2.4% to 184 million Euros and programmable logic by 13.5% to 153 million Euros.

- IC Insights has raised its expectations for 2018 semiconductor capital spending by six percentage points to a 14% increase. If this increase occurs, it would be the first time that semiconductor industry capital outlays exceeded $100 billion. The worldwide 2018 capital spending forecast figure is 53% higher than the spending just two years earlier in 2016.
Modern markets need fit-for-purpose distributors

By Ralf Buehler, senior vice president, sales and marketing, Premier Farnell.

Distributors are the cornerstone of keeping businesses moving, by providing essential supplies and support. In the past five years, businesses who rely on distributors have seen their customers’ needs change, prompting a shift in buying behaviour, which has had a knock-on effect all the way up the supply chain and back again.

Customers and buyers are more clued up than ever and not afraid to shop around, which means that distribution businesses face the challenge of meeting these changing needs. In such a competitive marketplace, distributors need to find ways to serve their customers in the way that suits the customer best, which in changing times is a tall order.

A changing customer landscape

The rapid surge in connected devices and miniaturised wearables has driven growth in the burgeoning Internet of Things (IoT) sector, with professional makers at the cutting edge of this growth. The IoT is one of the most exciting and accessible markets for designers, opening up the opportunity to bring new products to market, to a broader range of customers than ever before, each with different needs.

In addition to traditional market entrants and smaller design houses that have experience in bringing products to market, there is now a new customer group – professional makers who may be bringing a product to market for the first time. Professional makers value support with high-volume production, which includes careful management of inventory and obsolescence, setting them aside from the traditional hobbyist who sees value in broader product lines and portability that can quickly anywhere in the world.

The pressure to keep up is felt strongly by design engineers and there is a growing trend to work with distributors that can support them right from the beginning with research and design expertise as well as broad product portfolios, high-volume distribution and supply chain support, logistics, finance and excellent customer service.

Challenges for distributors

Traditionally, distributors provide competitive advantage by ensuring components are in stock in high volume and at a competitive price. The distributor will manage this stock, ensuring appropriate buffer levels, allowing customers to place call-off orders and have them shipped quickly anywhere in the world.

They make account management simple and easy through an account manager, online system or a combination of both these options, and have resources to offer advice, both technical and commercial. Reliability and flexibility are therefore two of the big deliverables that mark out a distributor fit for these emerging markets’ demands.

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Purchasing departments still value price and availability over other factors. This provision is challenging enough for a distributor to deliver for this type of customer, but in the modern marketplace, distributors have many customer groups to please. In today’s market, however, business customers are focused on the total cost of doing business, driving increased use of approved vendor lists (AVLs). This means that the variety of needs within any one customer will naturally place higher demands on a ‘one stop shop’ distributor.

The growth of the professional maker and hobbyist sector is putting distributors under particular pressure. For this customer group, technical support is the biggest area in which a distributor can provide added value. Although their needs are similar to engineers in traditional companies, the IoT boom has meant that more makers and hobbyists, many of which may have limited technical knowledge, are getting involved with developing projects that demand greater levels of connectivity, flexibility and customisation.

Despite the amount of plug and play modules available to this segment of a distributor’s customer base, makers and hobbyists still require deeper levels of technical and product support. This need has been addressed in part through the investment in distributor-led online forums and communities as well as business modules focused purely on software and design services. Nevertheless, servicing the maker and hobbyist market is still demanding and these customers favour a distributor that carries a broad line card, has items in stock and offers excellent delivery options, technical support and customer service.

In order to better service engineers, makers

Continued on page 6
Farnell element14

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[Image of various electronic component brands]
and hobbyists, distributors have needed to focus attention on their web presence, to attract new customers as well as support existing ones. With the overwhelming number of products now available online, distributor websites need to balance easy navigation with the right amount of technical information and support resources to retain customers and reach new audiences.

Bearing all of these factors in mind and the distinct but overlapping needs of the market - place, is it possible for a distributor to keep everybody happy or is it necessary to choose one target customer group and focus on them alone?

**A new breed of distributor**

Last year saw two of the world’s most well-known distributors join forces, when Avnet acquired Premier Farnell. The combination brings together two companies to create a unique technology distribution business that serves both design engineers and the maker and hobbyist markets. The initial feedback is incredibly promising... so how does it work?

Premier Farnell is the ‘Development Distributor’, specialising in helping customers from product idea and design through to prototype and low-volume manufacturing. Our strong customer base ranges from hobbyists through to engineers and professional makers. As the number one manufacturer and distributor of Raspberry Pi, exclusive manufacturer of BBC micro:bit and the official manufacturer of BeagleBone Black, we also manufacturer many of the products we provide. Avnet is a global high-volume oriented franchise distributor with deep expertise in large volume, broad line distribution and world-class global logistics and supply chain management.

This joining of forces creates a new breed of distributor that we believe can offer better support at all stages of the product development process, from design through to volume manufacturing and product lifecycle management, providing a seamless service for all customers. Premier Farnell is experienced at working with customers from early stage design and helping them take their ideas to production – from initial support from our 200 in-house design engineers to optimising the product for production and leveraging our manufacturing capabilities, right through to ongoing test and maintenance through our bench-to-board offering. Now, as part of the Avnet family, we are able to draw on Avnet’s expertise in high-volume production to support our customers at every stage of their journey.

The joining of the Avnet and Premier Farnell business is not about crunching together two businesses and looking for opportunities to drive out costs, but looking for growth synergies across our businesses that enable us to serve our customers better and provide a truly holistic solution, which we feel is unique.

As mentioned at the outset, new markets are expanding fast and we believe that the combination of Avnet and Premier Farnell offers the heavyweight resources needed by large manufacturers along with the finer touch to work with inventors, makers and engineers to help them turn their ideas into prototypes. The ability to engage in the earliest stages of product design and development with innovators is fuelling a new chapter of growth.

It’s clear today’s customers need the best of both worlds – to work with companies with scale, size and global reach of a broad line business, while still having the specialised capabilities to serve them through all stages of the product lifecycle. From assessing the market’s needs and customer demands, it’s evident that this amalgamation offers benefits to all of its customers, no matter their level of experience, turnover or geographical location, and sets the bar for distributors the world over.

For more information contact Farnell element14, 0800 111 057, info-za@farnell.com.
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Wits researchers make carbon nanotube discovery

Researchers at the University of the Witwatersrand (Wits) have found ways to control the spin transport in networks of the smallest electrical conductor known to man.

By chemically attaching nanoparticles of the rare earth element gadolinium, to carbon nanotubes, the researchers have found that the electrical conductivity in the nanotubes can be increased by incorporating the spin properties of the gadolinium which arises from its magnetic nature. To put it plainly, the presence of a magnet in an electron transfer media introduces another degree of freedom that enhances the electron transfer, but only if tailored precisely.

Discovered in Japan in 1993, carbon nanotubes are the thinnest tubes in the universe, consisting of a cylinder of single carbon atoms. At the time of its discovery it was revolutionary, and it was expected that it could replace silicon in electronic circuits such as microchips and computer hard drives.

“Carbon nanotubes are known for their ability to carry a high amount of electrical current and they are very strong. They are very thin but electrons can move very fast in them, with speeds of up to gigahertz or terahertz, and when coupled to nanomagnets they greatly extend the functionality of the carbon nanotubes, which is required to advance modern technology through the development of high-speed spintronic devices,” says Siphephile Ncube, a PhD student at the Wits School of Physics and the lead author of the study. Her research was published in Scientific Reports on 23 May 2018.

During her PhD, Ncube collaborated with a team of researchers from the University of the Witwatersrand, University of Johannesburg and the Paul Sabatier University in France. The researchers chemically attached gadolinium nanoparticles on the surface of the carbon nanotubes to test whether the magnetism increases or inhibits the transfer of electrons through the system. The measurements to interrogate the effect of magnetic nanoparticles on a network of multi-walled carbon nanotubes were carried out at the Nanoscale Transport Laboratory (NSTPL) at Wits. This facility is dedicated to novel nano-electronics and it was initiated by the NRF Nanotechnology flagship programme.

“We found that the effect of the magnetic nanoparticles is read off in the electronic transport of the nanotubes. Due to the presence of the magnet the electrons become spin polarised and the charge transfer is dependent on the magnetic state of the gadolinium. When the overall magnetic poles of the gadolinium are oppositely aligned, it causes higher resistance in the nanotubes and slows down the flows of electrons. When the magnetic poles are misaligned, it has a low resistance, and assists the electron transport,” says Ncube. This phenomenon is known as the spin valve effect, which finds wide application in the development of hard disk drives used for data storage.

Ncube started her research on carbon nanotubes as a Master’s student at the Wits School of Physics in 2011, where she made single walled carbon nanotubes by establishing a laser synthesis technique. Her work, which led to the publishing of various research articles in the field, was performed on instruments from the CSIR National Laser Centre rental pool programme. She is also the first researcher in Africa to build an electronic device that can measure the electron transfer properties of the carbon nanotubes coupled to magnetic nanoparticles. She was funded by the DST-NRF Centre of Excellence in Strong Materials.

“Ncube’s research established the great potential of carbon nanotubes for ultra-fast switching device and magnetic memory applications, a realisation we have been working towards since the establishment of the NSTPL facility in 2009,” says Ncube’s PhD supervisor, Professor Somnath Bhattacharyya. “To date, modified nanotubes have demonstrated good spin transport for devices made from individual nanotubes. For the first time we have demonstrated spin mediated electron transport in a network of nanotubes without incorporation of magnetic leads.”

For more information contact Siphephile Ncube, Wits School of Physics, 530659@students.wits.ac.za.

Sierra Wireless hosts ‘Simplifying IoT’ seminars

Based around the theme ‘Simplifying IoT’, Sierra Wireless recently held one-day seminars in Cape Town, Centurion and Durban.

Presentations covering a variety of product ranges and topics were delivered by a team of Sierra Wireless staff: regional manager Andrew Roesch and local FAE Phillip Nel; Paul Anand (sales director key accounts and energy) Francois Freulon (director product management) and Rabii Kobeissi (sales manager IoT Solutions, EMEA) from France; and Rafik Jallad (SR director short range products) from the UK.

A consistent theme throughout the seminars was LPWA (low-power, wide-area) technology, which the company is clearly focusing on as a market with high growth potential. An example of this is its cooperation with Vodacom on trialling a NB-IoT (narrowband Internet of Things) network. Sierra is also targeting GNSS (global navigation satellite systems) with a new dedicated product line of fully integrated modules, which are available with or without an embedded antenna.

Another key area that was emphasised is the company’s support for open-source communities, specifically Legato (a Linux embedded application development platform) and MangOH (sensor-to-cloud hardware platform).

The seminars were supported by the Sierra Wireless distributor for South Africa, Arrow Altech Distribution, as well as EDA Technologies. Comb Communications, a local developer of access control products, also gave a presentation outlining its involvement with Sierra Wireless – one pioneering project the two companies worked on earned Comb an invitation to exhibit its solution at the annual Sierra Wireless Innovation Summit in Paris last year.

For more information contact Andrew Roesch, Sierra Wireless, +27 12 665 1369, aroesch@sierrawireless.com.
AAD and Resolution Circle upskill students

Arrow Altech Distribution (AAD) and Resolution Circle, the University of Johannesburg initiative which offers in-service training, have launched a joint youth skills development programme that shall see 120 student engineers receive in-service training in cellphone screen and battery repairs.

Arrow Altech’s managing director, Peter Griffiths, handed over mobile phone repair kits, ESD devices and cellphones, which the students will use during the training, to Resolution Circle’s group senior manager of business incubation and internships, Sibusiso Shange. Resolution Circle’s group senior manager of research and development, Dr. Wiehan le Roux, group senior manager of operational services, Lieze Malan, interim CEO Gideon Potgieter, and HoD of manufacturing Fiston Nselike were also present at the handover.

Griffiths states that the aim of this joint initiative is to upskill students so that they may seek employment in the formal mobile phone repair sector or be equipped to offer community based mobile phone repair services. “The partnership with Resolution Circle enables the repair market to gain access to a nationwide ecosystem of formalised technology based training that develops both practical skills as well as leadership and entrepreneurship in the youth sector,” he says.

According to Statista, there are currently 20.3 million cellphone users in South Africa with annual growth in handsets estimated at 7% year on year. This ownership comes with vulnerability as cellphone users are likely to damage their phone approximately 10 weeks after purchase and battery life expectancy being limited to a set number of charge and discharge cycles.

Corporates, according to Griffiths, need to take steps to build strategic alliances and partnerships with entities like the University of Johannesburg and Resolution Circle as investment in youth will generate business opportunities and potential which expand current markets. He adds that small steps such as this allow the country to contribute to long-term social stability through financial inclusion and introduce new approaches to the market where the potential of digitalisation continues to affect the status quo.

For more information contact Peter Griffiths, Arrow Altech Distribution, +27 11 923 9600, info@arrow.altech.co.za.

Win a Microchip in-circuit debugger

Readers of Dataweek are being offered the chance to win one of Microchip Technology’s MPLAB PICkit 4 in-circuit debuggers. The tool allows fast and easy debugging and programming of PIC and dsPIC Flash microcontrollers, using the powerful graphical user interface of MPLAB X integrated development environment (IDE).

The MPLAB PICkit 4 programs faster than its predecessor with a powerful 32-bit, 300 MHz SAME70 MCU, and comes ready to support PIC and dsPIC MCU devices. Along with a wider target voltage, the PICkit 4 supports advanced interfaces such as 4-wire JTAG and serial wire debug with streaming data gateway, while being backward compatible for demo boards, headers and target systems using 2-wire JTAG and ICSP.

Key features of the PICkit 4 include matching silicon clocking speed, supplying up to 50 mA, a minimal current consumption at less than 100 µA from target, and an option to be self-powered from the target. The debugger 4 is connected to the design engineer’s computer using a high-speed 2.0 USB interface and can be connected to the target via an 8-pin single in-line (SIL) connector. The connector uses two device I/O pins and the reset line to imple-
Versatile quad-channel ADC

Teledyne e2v has released its most advanced analog-to-digital converter (ADC) to date – the EV12AQ600. The 16 x 16 mm chip can operate as a single-, dual- or quad-channel device, and includes a radiation-tolerant version, making it the first quad-channel ADC suitable for space applications.

Customers can design systems that operate the EV12AQ600 independently or synchronised, in quad-channel at 1.5 GSPs, dual-channel at 3 GSPs or single-channel at 6 GSPs, while only having to qualify one ADC. This makes it highly capable and customisable, suitable for ultra-wideband microwave backhaul systems, data acquisition systems and test and measurement applications.

The device is the first 12-bit ADC to feature a cross point switch (CPS), which allows it to operate its four cores simultaneously, independently or paired, to assign its 6 GSPs sampling speed across the user’s desired channel count. It also contains the proven chain synchronisation feature, as seen in some of Teledyne e2v’s most recent data converters. This feature allows it to meet the growing trend of increasing channel counts in large phased-array and multiple-input, multiple-output (MIMO) systems.

Software for distributed systems management

National Instruments announced the release of SystemLink application software for distributed systems management. SystemLink helps improve operational efficiency and decrease maintenance costs through a centralised interface for automating tasks such as software deployment, remote device configuration and system health performance monitoring.

Trends like the Industrial Internet of Things, 5G and the electrification of vehicles, coupled with existing realities, like maintaining distributed legacy systems, are inspiring companies to seek new approaches to systems management.

The push towards connected and centrally coordinated systems has transformed theories into practical applications. This challenge includes tasks like remote software and system configuration as well as data management and performance monitoring, and applies to industries such as aerospace and defence, transportation and manufacturing.

SystemLink enables engineers to connect, deploy, and manage distributed systems, both National Instruments and third-party, through a centralised interface accessible from anywhere, making it possible for them to remotely configure and deploy software, monitor the health and performance of their equipment, manage alarms and visualise application parameters. Additionally, engineers can automate the communication of data to customer-defined dashboards and remote operator interfaces.

DFT assistant for Mentor Xpedition

Developed by XJTAG, the free XJTAG DFT Assistant for the Mentor Xpedition Designer product increase the design for test (DFT) and debug capabilities of the schematic capture and PCB design environment.

Printed circuit boards (PCB) are increasingly densely populated and access to pins under many packages, such as ball grid arrays (BGA), is virtually impossible. JTAG was designed to solve the problem of access and so it is vitally important to get the JTAG chain right at the design stage. Failure to identify and fix design errors at an early stage can result in a board re-spin and a costly delay to a project. XJTAG DFT Assistant helps validate correct JTAG chain connectivity, through full integration with the Xpedition schematic capture environment.

The XJTAG DFT Assistant comprises two key elements: the XJTAG Chain Checker and the XJTAG Access Viewer. The chain checker identifies common errors in a JTAG scan chain, such as incorrectly connected test access ports (TAP), where a single connection error would inhibit an entire scan chain from working. XJTAG Chain Checker identifies connection errors and reports them to the developer during the design process. Incorrectly terminated TAPs are also identified.

XJTAG Access Viewer overlays the extent of boundary scan access onto the schematic diagram, allowing users to instantly see which components are accessible using boundary scan, and where test coverage could be further extended. Engineers can highlight the nets individually to show read, write, power/ground and the nets that don’t have any JTAG access on the schematic.

While the first prototype is being manufactured, XJTAG DFT Assistant allows engineers to export a preliminary XJTAG project from the Xpedition schematic capture environment to the XJTAG development software, where additional tests can be developed. These can then be used to test real hardware, as soon as it’s available.

This software is free for Xpedition users of VX.2.1 or higher and can be downloaded from www.xjtag.com/Xpedition.

For more information contact Test Dynamics, +27 11 315 8316, info@asic.co.za.
Software library for touch pads

Capacitive touch has become ubiquitous across a wide range of industries and applications, replacing the knobs and buttons that once controlled our electronics with smooth, intuitive touch panels. Previously a novelty on high-end products, consumers now expect touch control on everyday devices such as headphones, remote controls, coffee makers and thermostats without paying a premium for the interface.

Microchip Technology announced a new 2D Touch Surface library that enables designers to easily implement touch pads using the company’s 8-bit PIC and AVR microcontrollers (MCUs) and 32-bit SAM MCUs. Available free of charge with the purchase of any compatible MCU, the library provides a simplified, low-cost solution for embedded applications.

Ideal for implementing small touch pads and screens, the software library eliminates costs by running on a device’s existing MCU. This removes the need for a dedicated touch controller, giving product designers the flexibility to add finger position tracking and gesture detection, such as swipes, pinch and zoom, to products.

The touch library is provided through Microchip’s code configurators: MPLAB Code Configurator (MCC) for PIC MCUs and Atmel START for AVR and SAM MCUs. Both software tools enable simplified graphical configuration and accelerate development with lean C code tailored for individual project needs. The 2D Touch Surface library is available already on Atmel START and will be available on MCC by the end of June 2018.

Intuitive, attractive user interfaces are central to the success of products, and the 2D Touch Surface library eliminates the need to integrate a costly operating system to fulfill consumers’ smartphone-like interface expectations. The library is well suited for adding touch to a variety of applications across consumer electronics, automotive and industrial industries, such as smart speakers, steering wheels or thermostats.

Low-power performance for touch pads is built in through the library, as complete surfaces are scanned at once while in deep sleep. Reliability is a fundamental requirement for touch, and the solution provides continued responsiveness and functionality through the impact of water and noise, meeting the demands of automotive and home appliance applications. Implementations operate through wet conditions and can sustain 10 V in conducted noise, in alignment with International Electrotechnical Commission (IEC) 6100-4-6 test level 3.

The DM080101 Water Tolerant Touch Surface development kit enables easy evaluation of the 2D Touch Surface library. The kit demonstrates water tolerance and noise immunity on a touch pad and has two touch buttons, all controlled by the same MCU.

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

ESP32 development software updated

ESP-IDF, Espressif Systems’ official development framework for the ESP32 wireless module range, has been updated to version 3.0, featuring a host of major changes and improvements.

The main thrust of the new release was to integrate software libraries and support for networking protocols, along with other requirements that developers have highlighted as particularly important to them when building their programs.

The list of changes includes, but is not limited to:
- Improvements to the stability of the Wi-Fi/Bluetooth/LwIP stacks, Bluetooth/Bluetooth Low Energy (BLE) stack compatibility, and BLE connection success rate and receiver performance.
- Improved throughput for UDP (60 Mbps TX/RX) and TCP (35 Mbps RX, 50 Mbps TX)
- Support for external PSRAM
- Many FreeRTOS 9.0 features
- Boot time optimisations
- New power saving features, such as light sleep and dynamic frequency scaling, and better modem sleep performance
- New debugging features, such as tracing and coverage analysis over JTAG
- New examples for BLE, WiFi, and peripherals

Espressif stated that it will continue to work on improvements to ESP-IDF in the form of major releases with new functionality and bug fixes backported to the present release.

For more information contact ICORP Technologies, +27 11 781 2029, enquiries@icorptech.com.co.za.
Thermal design incorporating EDA and MDA design flows

The main source of heat in electronic equipment is their semiconductor chips, and the temperature sensitivities of these chips present a challenge in designing cooling mechanisms. Overheating causes the chips to fail prematurely – and failure of only one chip can disable the entire equipment. The higher the chip temperature, the earlier and more certain the failure.

As functionality has increased, the associated heat dissipation has escalated to the extent that it is recognised as a potential limitation on the pace of electronics development. Appropriate cooling strategies are needed to prevent overheating, and failure, of critical components.

In electronics, the complete design cycle from concept to first customer ship is much shorter than in traditional manufacturing industries – in some sectors, now as short as nine months – and delays in product release of even a few weeks can severely affect profit.

Electronics cooling design and simulation applications have to be quick, reliable and integrated into a fast-moving, complex design process. The people responsible are not experts in CFD or fluid dynamics, and they do not want to spend a lot of time learning detailed CFD concepts, or running potentially time-consuming operations such as sophisticated grid generation.

Mechanical engineers are responsible for all aspects of the physical design of the equipment, that is, everything beyond the electronics design, which typically culminates in the printed circuit board (PCB) layout. They are responsible for the enclosure, appropriate location of the PCBs and other components, and for ensuring structural integrity as well as safe, reliable operation of the equipment. Cooling and thermal design is only one of the issues they are concerned with, although often it is a crucial issue.

Mechanical engineers have to collaborate with electronic designers using electronic design automation (EDA) software and with other mechanical designers using mechanical design automation (MDA) software. Thermal design software is expected to contribute at all stages of the design process, from concept, through design exploration and optimisation, to final verification.

These diverse needs have major implications for software development, especially with regard to interface, data management and integration.

Traditionally, CFD-based thermal design software has targeted engineering analysts with specialised knowledge of thermal design and the use of CFD techniques. These engineers still form a core group in electronics companies today; however, CFD-based thermal design has broadened to include electrical engineers, general mechanical design engineers, industrial designers and marketing engineers (Figure 1).

As a result, the requirements for designing a software solution have become more challenging in terms of user interface (UI) design, geometry and attribute pre-processing, interoperability with other mechanical-aided design (MCAD), CAE and EDA software, obfuscation of CFD terminology and functionality, post-processing results and meshing/solver performance.

General-purpose CFD software is far from ideal in satisfying these requirements, which is why special-purpose software, such as Mentor Graphics FloTHERM XT, optimised for electronics thermal applications, with industry-specific input and control, was developed.

Thermal design issues
Inside electronics equipment is a complex assembly of many solid objects (such as PCBs, electronics packages and devices, cabling, fans and heatsinks). Air flow is confined within narrow regions between these solid objects. As well as convective transport within the air, conduction within the solid objects (which can have extremely complex internal structures) is critical. Analyses involve large numbers of such objects (sometimes thousands), as well as extreme disparities in scale (from metres to micron scale).

Because of this complexity, electronics products pose a unique set of challenges for thermal simulation, including geometry capture, scale disparity, uncertainty over missing data (component thermal data, power dissipation, material properties, layer thicknesses, interface resistances), transitional flow regime, mesh generation, hardware environment, and the need for increased accuracy.

Geometry capture
During detailed design, the geometry comes from both the EDA and MDA design flows. One particular challenge is that EDA systems deal with 2D representations of the electronics because both IC and PCB design are done using schematics. PCB design tools require only the component layout and often do not contain even the most basic geometric information about the components, such as component height. Detailed information about the internal geometry of the chip packages is typically unavailable.

Scale disparity
Miniaturisation resulting from Moore’s Law has caused an increasing disparity of length scales, between the size of the physical product and the size of the internal components and circuitry. Typically, a product consisting of micron scale geometry has to be accommodated within the same model. The presence of small gaps, in the casing for example, can also have a profound effect on the cooling of the electronics.

As a result, scale disparity continues to increase over time – this results in the requirement for behavioural models when the geometry cannot be represented directly within the simulation, as is usually the case with PCB traces on multilayer PCBs, and compact thermal models (CTMs) for IC packages to avoid having to model the internal geometry, which is often unknown.

Missing data
This leads to another challenge unique to electronics cooling applications – missing data. Material property data is absent from MCAD systems, so CFD simulations in general suffer from this problem. In the case of electronics cooling applications, systems are essentially constructed from many components from many different suppliers, the...
thermal characteristics of which are typically not well understood. These include IC packages, PCBs, heat pipes, fans, Peltier devices, etc.

The geometry comes in part from the EDA system, which often does not include any information on the materials being used. This adds complications during electronic systems assembly where thermal interface materials (TIMs) and gap pads are used to maximise the thermal contact between different parts of the system to implement an effective cooling solution.

Also, operational power information is needed for the active components to predict system temperatures under operational conditions, which vary as a function of the product’s usage. Design for steady-state operation at maximum power, which leads to significant over-design, is no longer tolerable. Increasingly, transient simulations are needed to ensure reliable operation and minimise overdesign.

Flow regime
In highly cluttered electronic systems, air is forced through channels that contain all manner of protuberances that induce low Reynolds Number transitional flow. However, this wall-induced turbulence is not self-sustaining, and the flow would be laminar if the channel were smooth. Turbulence modelling is, therefore, a particular challenge. Within a fast-paced design environment, providing a sufficiently fine mesh to perform large eddy simulation (LES) is completely impractical because of the large number of flow channels, objects, etc. combined with a large system residence time.

Until recently, the practicality of using standard two-equation Reynolds Averaged Navier-Stokes (RANS) models has been questionable. Zero-equation ‘effective viscosity’ models have been favoured to impose an estimated turbulent viscosity because the low mesh densities often used would cause one- and two-equation models to predict less realistic turbulent viscosity values than can be estimated based on empirical data and knowledge of the bulk flow velocity.

A key issue with one- and two-equation models is the need to refine the mesh near to the surface when used with standard, generalised and scalable wall function treatments (log law, van Driest, 1/7th Power Law, etc.), to provide a y+ value of roughly 30 for the near wall cell, with a low mesh size inflation rate out to the core flow.

In electronics applications, boundary layers start at the leading edge of components, PCBs, heatsink fins, etc. resulting in a large number of very thin boundary layers to resolve within the system, so the standard advice on y+ simply cannot be followed. Consequently, LVEL remains the model of choice. However, the recent application of immersed boundary treatments to electronics cooling applications overcomes this drawback.

Mesh generation
Although generic to CFD, mesh generation for electronics cooling applications presents a challenge because of the sheer number of solid-fluid and solid-solid surfaces that need to be captured. As a consequence of the need for fully automated optimisation including geometry changes, the meshing also must be fully automated with no manual intervention beyond predefining the required mesh sizes before meshing is started.

A fortuitous outcome of using EDA systems to design components and PCBs in 2D, with no aesthetic requirements for the unpackaged electronics, is that electronics tend to contain large numbers of Cartesian-aligned objects, so Cartesian-based grid systems are the natural choice for this application. However, size constraints are forcing electronics designers to angle components on boards, insert DIMMs at an angle, and design heatsinks with non-Cartesian profiles.

Use of simple Cartesian meshes with grid lines that ‘bleed’ out from an object to the edges of the solution domain are inadequate because they quickly lead to unacceptable mesh counts when increasing geometric detail is added to the model. As a result, the use of locally refined Cartesian overset grids to refine the mesh within and around objects has become prevalent, allowing either porosity or voxelisation treatments to approximate non-Cartesian and non-aligned Cartesian objects with acceptable accuracy in many cases.

As the amount of non-Cartesian geometry present within electronics systems has increased, so has the need for more sophisticated meshing strategies. Over recent years, Octree meshes with MCAD-embedded CFD in early product design have increasingly been used across a range of industries and applications where the product design process is built on a company’s MCAD system.

In electronics, design processes vary considerably from company to company. Embedding CFD within the MCAD system may not facilitate its use because often much of the early design work will be done outside the MCAD environment, and the design process may be centred on the company’s EDA flow. Thus, the simulation approach used in MCAD-embedded CFD needs to be available within a standalone product.

Hardware environment
Traditionally, thermal design has been done alongside electronic design. The use of high-performance computing (HPC) infrastructure for CFD has been far less than in other industry sectors; for example, in automotive, HPC has facilitated the use of LES to undertake ‘high fidelity’ CFD to address difficult aspects of the product design, such as aero-acoustics. But in electronics cooling applications, increased simulation precision does not translate into improved product quality. The quality of the simulation model is limited by far greater uncertainty in the input data.

To date, good scalar performance with reasonable scaling up to 8 - 16 cores has matched market requirements. Good scaling for a limited number of shared memory nodes is likely to remain the target for hardware performance. The hardware environment may change away from desktop to cloud-based computing, which will greatly facilitate design space exploration by the use of numerical design of experiment techniques.

Increased accuracy
As a consequence of design margins shrinking, the need for simulation accuracy is increasing. This, however, does not translate directly into a need for higher-fidelity CFD. Indeed, since the early 2000s, clock speeds have not increased, capping die-level power density, and power increases have occurred at higher levels of packaging, such as the PCB.

What has this to do with accuracy? The allowable temperature rise from ambient to junction is not increasing, but as power densities increase within the package, PCB, etc., the proportion of the temperature rise that occurs in the air is diminishing.

Put another way, the importance of modelling the conduction within the solid structures is increasing. This explains the emphasis placed on MCAD integration (e.g. for heatsink design), and perhaps more importantly EDA integration, to accurately capture the copper content and distribution on PCBs, effects such as Joule heating in traces, and power and ground planes, and to accurately measure the thermal conductivity of TIM materials, particularly the softer Type I and Type II materials.

Continued on page 14
Continued from page 13

that are not well suited to being measured in
ASTM D5470–based equipment.

Solving thermal design challenges

The electronics-cooling CFD software,
FloTHERM XT, has been created to address these
challenges. FloTHERM XT provides easier model-
ing of more complex devices and enclosures,
connected with SmartPart technology where
required, particularly for LED lighting, consumer
electronics, aerospace/defence and automotive
design engineers.

Meshing can take up a significant amount
of time and energy in some general-purpose
CFD codes and can be a cause of frustration
when it goes wrong. Most general mechanical
engineers would like to simply have the soft-
ware do the job for them wherever possible,
but with the ability to switch to more manual
definition should the need arise, and this has
reinforced the need for more sophisticated
meshing strategies. The advanced code in
FloTHERM XT provides semi-automatic, object-
based algorithms, with options to adjust the
mesh manually where necessary or to allow the
freedom and control that is required by the
more experienced, and CFD-aware, thermal
engineers.

FloTHERM XT uses highly stable numerical
schemes and solution controls that operate
semi-automatically to control the convergence
of the solution with only the minimum of inter-
vention ever being required.

For electronics cooling applications, issues
relating to turbulence modelling are rarely, if
ever, the largest source of error in the results.
It is more likely to be uncertainties in power
dissipation, materials, flow rates or interface
resistances. However, turbulence can be a
source of concern for some more specialised
designs.

The FloTHERM XT CFD solution provides the
best possible model for the application area of
interest and only provides alternatives if there is
a clear reason to do so. The software provides
options for laminar, transitional and turbulent
flows, but limits the turbulence models that are
available to avoid confusion.

FloTHERM XT makes use of a general two-
equation model combined with a proprietary
immersed boundary treatment for near-wall
effects that smoothly transitions between the
different flow regimes, resulting in excellent
benchmark results appropriate for electronics
applications.

Editor’s note: For a full description of the
capabilities and features of FloTHERM XT, as well
as a case study demonstrating the software in
action, readers can access the full white paper at

For more information contact ASIC Design
Services, +27 11 315 8316, info@asic.co.za.

Rugged CompactPCI Serial system

The SRP-3201-BLUBOXX series of miniature Compact-
PCI Serial systems from EKF is suitable for all industrial
requirements, even under harsh conditions.

With its small dimensions of 172 x 168 x 208 mm (4U/32HP), the systems
provide space for up to five CompactPCI Serial boards (single size Euro-
card style), and include a bottom mount fan unit and an industrial grade
removable power supply.

CompactPCI Serial (CPCI-S.0) is a PICMG standard for modular indus-
trial computers, which provides high-speed serial I/O (PCI Express, SATA,
USB, Gigabit Ethernet) over the backplane. The SRS-3201-BLUBOXX
system rack is configured with a 5-slot CompactPCI Serial backplane:
a system slot for CPU boards and four peripheral slots supporting two
PCIe Gen3 x8 lanes and two PCIe Gen3 x4 lanes. The optional J6 connec-
tor provides Ethernet backplane routing according to CPCI-S.0 single
star architecture.

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

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 is the
first mass market multiband receiver to
currently 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. Featuring on-chip integration
of advanced multiband RTK algorithms, it
requires no additional hardware or third-party
RTK libraries. Ready to use on delivery and
easy to integrate, it helps product developers
quickly bring their ideas to the market.

For more information contact Andrew Hutton,
RF Design, +27 21 535 8400,
andrew@rfdesign.co.za.
App helps to find the ideal ST MCU

STMicroelectronics has updated its ST-MCU-FINDER application to include an improved development board view, export to Excel feature, and a fuzzy matching tool that highlights MCUs with similar characteristics.

The application allows exploring and connecting to the complete portfolio of STM32 Arm Cortex-M and STM8 microcontrollers and development boards, from any mobile device or directly from the developer’s desktop environment. It features easy-to-use selection tools, self-maintaining documentation and connections to MCU communities.

Users find the MCU and development board part number that best fits their application thanks to an easy search with multiple criteria including core type, CPU frequency, memory, price, package, I/Os, temperature grade and peripherals such as control, timers, analog, connectivity, multimedia and security. Users can also buy devices online.

Developers have quick access to data and technical resources to support their microcontroller projects. The technical documentation for a selected device (including datasheets, reference manuals, application notes, user manuals, programming manuals and errata sheets) is available in one place and can be downloaded for offline viewing. Documents are automatically updated with their latest version.

In the desktop version, the development begins immediately after the device selection by launching STM32CubeMX initialisation-code generator directly from the application. ST-MCU-FINDER connects users with developer communities on popular social platforms such as Facebook, Twitter, the STM32 YouTube channel and ST Community.

For more information contact Robin Scholes, Arrow Altech Distribution, +27 11 923 9600, rscholes@arrow.altech.co.za.

Class D speaker amplifiers

With the MAX98357 and MAX98358 digital-input Class D audio power amplifiers by Maxim Integrated Products, designers can achieve high efficiency in a compact, cost-efficient solution. Despite their ultra-small form factors, these amplifiers deliver 3.2 W of Class AB audio performance for enhanced audio quality and are ideal for a wide variety of applications.

Traditionally, electronics designers use analog amplifiers requiring a digital-to-analog converter (DAC) and line driver amplifier on the application processor. This adds overall die cost to the speaker output and affects the form factor of the overall solution size.

The MAX98357 pulse-code modulation (PCM) and MAX98358 pulse-density modulation (PDM) speaker amplifiers reduce overall solution size by taking advantage of Maxim’s clever pin-out and by significantly reducing the number of required components compared to typical analog amplifier designs.

Since most customers control their volume digitally upstream, these features enable customers to take advantage of wafer-level packaging without the need for expensive vertical interconnect access (VIAs). The ICs feature a digital input for noise immunity, along with high jitter tolerance and excellent electromagnetic interference (EMI) performance allowing the use of longer traces to the speakers without added external filtering.

To simplify design, the chips only require users to connect a single power supply and feed the bit clock (BCLK) and left-right clock (LRCLK), without needing a master clock (MCLK). These amplifiers further simplify designs by auto-configuring for up to 35 different clocking configurations and 128 different digital audio formats. This automatic configuration eliminates complicated I²C programming as there is no need to rewrite base code to configure a design just to add audio functionality.

As more applications (such as smart speakers) start requiring multi-directional/channel audio, the need for amplifiers like the MAX98357 and MAX98358 that can be easily daisy-chained to support speaker arrays (up to 8 channels supported by time division multiplex) will continue to grow.

For more information contact CST Electronics, +27 11 608 0070, sales@cstelectronics.co.za.
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The path to 5G requires a strong optical network

5G mobile communications networks will be based on virtualised architecture – specifically, a network functions virtualisation (NFV) standard – which is an evolution of the centralised radio access network (C-RAN).

However, 5G is more than just an architecture. It also brings optimal performance requirements, such as huge throughput performance for advanced video services, with less than 1 ms latency, for services such as real-time Internet of Things (IoT).

LTE Advanced Pro bridging the gap
5G is still far off, with a target for massive deployments scheduled for 2020, and mobile operators thus need to stretch existing LTE-A networks to address some of the 5G requirements with accurate performance figures. The pressure is therefore on mobile operators to adopt a C-RAN architecture.

LTE Advanced Pro (3GPP Release 13), and 5G requirements later on, will have an impact on the RAN and fronthaul parts of the network, in particular. A key part of a C-RAN/Cloud-RAN architecture is the optical distribution network. The challenge is to reach each cell site and small cells with a high-performance optical network. In fact, the 5G-PPP group, which is the European committee for mobile telecommunications standardisation, identified the availability of an ad hoc optical network as the major roadblock to successful 5G deployment.

Considering how critical it is for the distribution of the fronthaul signal to be transported over the optical network from the baseband unit (BBU) to each remote radio head (RRH), it is very important to pay close attention to several parameters during the deployment and operation of a C-RAN/Cloud-RAN network.

Operators must accelerate their path to 5G
Mobile operators are facing several challenges like the shortage of spectrum to grow the data throughput and serve more subscribers with video applications/business segments. Some of these challenges may be required or apparent. This is known as latency asymmetry (see Table 1 on page 18).

5G will address these expectations through apparently contradictory requirements: 10 to 100 times the throughput, 10 times lower latency, and 10 to 100 times more connected devices. Tier 1 operators are accelerating trials of 5G radio technologies and evaluating new bands, like 5 GHz or 28 GHz radio bands with bit rate of the fronthaul as well. (1 Gbps throughput would require a common public radio interface (CPRI) rate above 15 Gbps).

2. Massive machine communication (MMC), for example, offers connectivity to billions of IoT devices. IoT embraces numerous very different applications/business segments. Some of them require deep analytics with regards to the data being received from the sensors and other devices. More processing will have to be done in the RAN at the BBU level, based on mobile edge computing (MEC) technology. Critical machine communication (CMC) will play a role for several industries. For example, for production (remote robot control) to delivery (piloting drones). These require ultra-low latency (1 ms) and high reliability. Fronthaul performance will subsequently be key to meeting these high requirements.

Network slicing, based on virtualisation and C-RAN
The standardisation of 5G is based on the concept of network slicing. Each slice supports a profile of end users with specific performance parameters (latency, accuracy, data rate, coverage, etc.). This approach requires the virtualisation of the mobile network (NFV), where all the slices share the same infrastructure, including the radio network. The slices for each of the 5G verticals can be very diverse in performance, so real-time coordination of the radio resources is necessary in order to serve all the slices according to their performance requirements. Such coordination can only be achieved by using a centralised RAN.

Pressure on RAN centralisation
Before any mass deployment of 5G, mobile operators will keep improving the capabilities of LTE with new standards, like 3GPP Release 13 and the branded version of 4G LTE Advanced Pro.

To reach the 1 Gbps throughput target, new techniques, like coordinated multipoint (CoMP), will be used. CoMP requires a shorter path between RRH locations, through the X2 interface. The X2 delay must be much lower than 5 ms to benefit from the CoMP technology. This is difficult to achieve without a centralised RAN architecture (see Figure 1).

There are several other benefits of adopting C-RAN for mobile operators. These include lower capex and opex, since antennas site are simplified (no BBU cabinet), energy consumption is reduced by approximately 50%, and efficiency is improved for the field service team. It also provides for more flexible operation, as the pool of BBUs are in a secured place, which means that more field service jobs (maintenance) can be carried through from the central office, thus reducing truck roll cost.

C-RAN technical requirements
The C-RAN architecture involves some specific requirements, like the maximum distance between the BBU and the RRHs.

The round trip time (RTT) of the HARQ (packet handshaking protocol) must be less than 3 ms. Consequently, the optical distance between the RRH and the BBU is limited to 15 - 25 km (it may vary between RAN vendors). Most of this RTT is induced by the BBU Layer 1. Power budget is also an important parameter to consider, specifically in the case of a passive optical network (typical budget is 15 - 20 dB). The power budget is affected by wavelength division multiplexing (WDM) mux/ demux, connectors, splices, bended fibres, etc.

Some difference in latency between the downlink and the uplink fronthaul connections may be required or apparent. This is known as latency asymmetry (see Table 1 on page 18).

Figure 1. C-RAN architecture.
In the future, another challenge imposed on fronthaul will be the required increase in the CPRI bit rate. In general, the basic rule is that the CPRI rate is 16 times that of the data rate on the backhaul (for example, 2.4 Gbps CPRI means that 150 Mbps is required for LTE service). Thus, we can anticipate that the bit rates will exceed 10 Gbps in the future to support the 1 Gbps throughput, which is what LTE Advanced Pro is promising. Some compression will be possible certainly, but this will have its limitations.

This will be the breaking point where designing, deploying and troubleshooting a RAN will require specific optical networking skills. Optical engineers understand that, beyond a 10 km distance and above 10 Gbps throughput, optical fibres may be subject to dispersion (CD and PMD).

Cloud-RAN and BBU virtualisation
The natural evolution of C-RAN will consist of the virtualisation of the BBU functions. While the virtualisation of the mobile core network is already in progress (based on the impressive efforts of ETSI NFV and all the vendor initiatives) with virtualised IP multimedia subsystem (vIMS) and virtualised evolved packet core (vEPC) networks, the next phase of mobile network virtualisation is the RAN. Moreover, there are significant financial benefits for this transformation given that the RAN is the costlier network segment. As discussed earlier, 5G and its network slicing concept require precisely this kind of virtualised network (see Figure 2).

A BBU fulfills several functions, some with strict real-time constraints, others that include software based protocols. Vendors are splitting these functions into three layers.

Layer 1 includes real-time digital RF processing, alarms and error handling (OAM), and error correction (FEC). For the time being, this layer is difficult to virtualise. Layers 2 and 3 consist of MAC/RLC and interface protocol software. These layers could run as virtual network functions (VNFs) in the NFV cloud.

With the splitting of Layer 1 and its relocation in the RRH, there is the possibility of using the more flexible transport protocol Ethernet instead of CPRI in what is referred to as packet-based fronthaul. If Layers 2 and 3 are running in an NFV cloud, the connection from the access/edge data centre and the cell site becomes a new type of interface, and they require a combination of backhaul and fronthaul.

New definition of fronthaul
The main reason the bit rate on the CPRI interface is so high is the digitisation of the baseband RF signal before its transmission through the fronthaul. The relocation of this Layer 1 function in the RRH would significantly reduce the bit rate on the new form of fronthaul interface (option – Layer2/3 split), IEEE is working on its standardisation (cf. IEEE P.1914.1) and the 5G PPP is evaluating several projects, called Xhaul or CrossHaul.

Optical network options and challenges for C-RAN
The 5G-PPP identifies the availability of a sustainable optical distribution service as a major roadblock to massive 5G networks deployment. The key element in a C-RAN architecture is the optical distribution network, which distributes the CPRI signal between the BBU hotels and cell sites. It takes one optical link per cell, per carrier band and per technology. For example, a cell site with three sectors and 2G, 3G, plus two LTE bands would require 12 CPRI links in each direction, uplink and downlink.

Several optical distribution technologies are available off the shelf, with more to come (e.g. Ethernet fronthaul). The network planning team must select the technology that meets their technical requirements for CPRI and the 3GPP specification (as described in Table 1), in particular, for round trip latency, latency and optical power attenuation.

Each technique has its advantages and disadvantages. For example, passive optical networks (using mux/demux) induce a significant power loss (5 - 10 dB), but they do so from a latency perspective. Active WDM networks (like OTN) are regenerating the signal at each hop, which eliminates the power loss issue but adds significant latency.

The following are some specific attributes of each of the optical distribution technologies:

<table>
<thead>
<tr>
<th>Table 1. Fronthaul parameters.</th>
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<tbody>
<tr>
<td><strong>Maximum SER</strong></td>
</tr>
<tr>
<td><strong>Jitter</strong></td>
</tr>
<tr>
<td><strong>Latency</strong></td>
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<td><strong>Latency</strong></td>
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<tr>
<td><strong>Latency</strong></td>
</tr>
<tr>
<td><strong>Q2 Delay in bit transmission</strong></td>
</tr>
<tr>
<td><strong>Latency Asymmetry</strong></td>
</tr>
<tr>
<td><strong>Frequency accuracy</strong></td>
</tr>
<tr>
<td><strong>Time and phase synchronisation is required for LTE-Advanced</strong></td>
</tr>
<tr>
<td><strong>Optical power budget</strong></td>
</tr>
</tbody>
</table>

Figure 2. BBU functions split into three layers.

The coarse wavelength division multiplexing (CWDM) passive solution can support up to 16 CPRI links per fibre; it does not include any active components, such as amplifiers or switches, along the path from the BBU to the RRH, therefore it does not introduce any transport latency. The disadvantage is that it requires two expensive small form factor pluggable (SFP) modules per link – one on the RRH side and one on the BBU side. If more than 16 RRHs have to be deployed on the same site, then a second CWDM fibre must be used. Alternatively, a dense wavelength division multiplexing (DWDM) system can be deployed with up to 40 channels at 100 GHz spacing.

Active WDM systems would reduce the fibre requirement, however the insertion of active equipment like transponders and an optical add/drop multiplexer (OADM) will add to latency. To be more specific, with the insertion of these active elements, the latency of the uplink and downlink paths will differ, causing latency asymmetry.

Optical transport networks (OTNs) offer numerous advantages, including an error recovery mechanism (FEC), operation, administration and maintenance (OAM), path monitoring and scalability. However, the challenge is meeting the CPRI jitter requirement of ±2 ppb. It also presents the risk of asymmetry.

C-RAN testing considerations
Fronthaul, with the CPRI transport layer, was initially designed for relatively short distances between the BBU cabinet and the RRH, located at the top of the tower or on the roof of a building, typically below 100 metres. In such a topology, the fronthaul parameters (RTT, jitter, etc.) are easier to meet.

Most of the operators and their contractors associate the FTTA deployment in a distributed RAN architecture as plug and play. The latency of the fibre will never exceed 1 µs and the optical power loss will be below 3 dB – very far from the requirements outlined in Table 1.

With C-RAN, the game changes completely. The insertion of optical network elements between the BBU hotel and the cell site, and the distance between the two ranging from 15 to 25 km, make a huge difference. Testing of the cell site (RRH) must be performed separately from the tests performed at the BBU hotel. They are deployed at different points in time, by different teams, and in most cases one of these two points is not available or active.
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From a testing perspective, several use cases should be considered:

1. During the rollout (deployment) of cell sites:
   - Validation of the optical power budget (power loss) on the cell site.
   - Validation of the latency between the cell site and the BBU hotel.
   - Validation of the optical network to the BBU hotel: latency, optical loss.
   - Verification of cleanliness of the optical connectors.

2. During the BBU hotel rollout:
   - Testing the functionality of the BBU by emulating the RRH: alarm management, clock synchronisation, etc.
   - Verification of the optical link up to the demarcation point with the optical network provider.

3. Additional tests can be performed on the optical distribution network:
   - WDM wavelength addressing.
   - Measuring the optical distance/latency to the cell sites.
   - Measuring the power loss.

4. For network operation and troubleshooting, performed from the central office or BBU hotel:
   - Detection of radio interferences in the digitised baseband signal in the CPRI payload: the radio frequency (RF) spectrum is analysed directly from the digital RF signal.
   - OTDR tests can be used to find the root cause and location of an optical transmission problem.

**Loss budget calculation**

Loss budget varies widely between vendors and various network topologies. For example, when comparing SFP+ vendors on the market for a 20 km reach, their power budget will range from 10,4 dB to 18 dB. Some may regard this as a non-issue, because newer SFP modules have a much better dynamic and are more powerful. Therefore, a higher attenuation of the end-to-end signal is easy to compensate for. However, this is not an optimal approach, primarily because these power SFPs are much more expensive, in particular for CWDM and DWDM.

EXFO’s recommendation is based on the qualification of the power budget between the BBU hotel and the RRsHs at a given cell site, in order to select the most cost effective SFP/SFP+ modules. These modules must be carefully selected. The specification sheets usually provide the minimum and maximum transmission power (launch power). The loss budget is calculated as the difference between the minimum launch power and the receiver sensitivity, and it will vary significantly between vendors and models.

**Conclusion**

To support the LTE Advanced Pro evolution, and 5G by way of virtualising the RAN in particular, the optical link between the cell sites and the BBU hotel (or the virtual BBU data centres) will be a critical component of the C-RAN/Cloud-RAN architecture.

Fibre to the antenna (FTTA) is not going anywhere anytime soon and we predict that we will be seeing this type of architecture over the next decade. However, it is important to note that the requirements such as latency, power loss, CPRI bit error rate, among others, which are not critical for 3G and LTE Release 8 deployments, will become major concerns when operators are migrating to LTE Advanced Pro and 5G.

Even in the case of the longer-term evolution of front haul technology to an Ethernet based transport layer, the optical infrastructure will remain the same. Therefore, the transformations that mobile operators are carrying out today are investments that will support both current and future front haul technologies.

It starts with FTTA and the replacement of copper cables to fibre running to the RRH located at the top of the tower or roof. This is followed by the concentration of the BBUs in a central location, up to 25 km away from the cell sites.

The evolution of radio access to C-RAN and Cloud-RAN is driven by the densification of radio access technologies, such as small cells and indoor cells, the multiplication of frequency bands and their aggregation to form larger basebands. This growing complexity requires improved coordination of the radio resources, and C-RAN/Cloud-RAN is the perfect architecture for the new and future mobile evolutions of LTE Advanced Pro and 5G.

**The importance of testing**

The deployment of FTTA and C-RAN is not a simple plug-and-play exercise. For example, it may be incorrectly viewed as an unnecessary step to test the performance of a few metre-high FTTA installations that support CPRI at 2,4 Gbps. When you consider that this segment will eventually be inserted into a longer C-RAN optical path, or that bit rates will grow beyond 10 Gbps to feed the RRH with CPRI options 9 and 10 (12,16 and 24,3 Gbps, respectively), it is therefore critical to make sure that these cell sites are configured correctly the first time during deployment. Testing the cleanliness of the connectors, integrity of the fibre path and the end-to-end bit error rate of the CPRI link are all common and important practices that rollout teams and contractors should always adopt.

Returning to the cell site, climbing up to the antenna mast and troubleshooting the root cause of the degradation of radio performance will significantly increase operational expenses for mobile operators while also reducing revenue due to poor subscriber quality of experience (QoE) and, ultimately, an increase in customer churn. Testing during the deployment phase is a small investment to make compared to the substantial benefits it will provide during commercial operation. It will lead to less service interruptions, improved customer experience and thus, a better ARPU.

Testing the optical distribution network and CPRI transport protocol today will support network transformation, making 5G feasible and sustainable, and will protect future investments.

For more information contact Chris Nel, Lambda Test Equipment, +27 12 349 1341, chris@lambdatest.co.za.
Wi-Fi-connected fibre-optic inspection system

Comtest’s latest offering from AFL is the aeRos connected FOCIS WiFi2, a next-generation fibre-optic connector inspection system that uses an Android or iOS wireless connection for live image video streaming, auto-focus and more.

The probe is an ergonomic fibre connector inspection system, that when paired with an iOS or Android smart device, provides fast and accurate IEC/IPC/AT&T compliant and user-defined pass/fail end-face cleanliness analysis.

The FOCIS WiFi2 probe is lightweight and balances perfectly in the hand. It has a single multipurpose button, a single multi-colour functional status LED, and a battery charging port for all-day mobility. The status LED enhances workflow productivity by allowing rapid operator assessment of the cleanliness of the fibre endface – either passing or failing standard rules – as well as ‘fibref not found’ error notification.

“According to industry studies, contaminated fibre endfaces typically account for 85% of optical network failures,” explained Maury Wood, product line manager for AFL’s test and inspection division. “With the advent of broadband and enterprise data centre links at 100 Gbps and higher, the universal adherence to best practice fibre cleaning and inspection methods is an operational imperative.”

The FOCIS WiFi2 uses AFL’s large portfolio of inspection adaptor tips for both connectors and bulkhead sleeves, including all 2.5 mm (SC, FC, ST) and 1.25 mm (LC) ferrules, as well as multi-fibre connectors and bulkhead sleeves (MPO/MTP/MPO16). AFL offers an adaptor tip for high-density LC FC/UPC optical distribution frames as well.

The free FOCIS WiFi2 app (both Android and iOS) supports live image video streaming, auto-focus, IEC/IPC standard and user-customised pass/fail auto-analysis, pinch-to-zoom on endface images, report generation, multi-language GUI support and day/time stamped job saving.

For more information contact Comtest, +27 10 595 1821, sales@comtest.co.za.

4-in-1 SOLT calibration kits

Pasternack has released a new line of 3,5 mm calibration kits for test and measurement, field testing, antenna measurement and cable verification applications.

The new series consists of two models, both with a compact, lightweight, 4-in-1 design package. These short-open-load-through (SOLT) calibration kits have a 26,5 GHz calibration capability, and they feature gold-plated 3,5 mm connectors and a handy lanyard. They are available off-the-shelf and can be shipped immediately with no minimum order quantity.

These SOLT calibration kits have an impedance level of 50 Ω nominal. They also have a phase deviation of ±2 degrees maximum and return loss of 30 dB minimum. They are ideal for telecommunications, military electronics, automotive, medical, aerospace and consumer electronics industries.

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

Search the Internet for ‘fibre-optic connector inspection’ and you will certainly see a lot of information from just about every company you associate with fibre-optic communications.

Everyone in the fibre installation and network world is talking about inspection. In a study by NTT-Advanced Technology, 98% of installers and 80% of network owners reported that issues with connector contamination were the greatest cause of network failures.

As bandwidth demands rise, and loss budgets get tighter, specks of dust and dirt, oils and anything else on a connector endface can wreak havoc on network performance. In the world of fibre-optics, where light is transmitting through an 8-micron fibre core, a speck of dirt can be likened to a boulder in the middle of the road. It does not take much to put that low-loss connector out of commission.

The push for tighter specs has prompted a wide variety of connector inspection solutions both for manufacturing facilities and for the field. Unfortunately, many of us have realised that connector dust caps are just that: caps with dust in them. Even a very carefully controlled manufacturing environment does not ensure that your connectors are ready for mating when they arrive on site. With so much riding on your network, cleaning and inspecting are worthwhile pursuits that can prevent the need for costly troubleshooting and truck rolls later.

Seeing is believing

Many types of inspection tools are available for field use today. Most manufacturers of test equipment offer standalone field scopes for viewing connector endfaces. Many also provide scopes that plug into an OTDR or another platform with a display that will show the connector on the screen.

A new option provides a Wi-Fi connection to your phone or tablet with a free app. There are software tools that compare the connector before and after cleaning and software upgrades that provide automatic pass/fail analysis against pre-set industry or customised standards (see Figure 1).

Every vendor will give you a reason to buy its solution, but in the end, all would agree – get something to inspect your connectors. Make inspection and cleaning part of your installation/test standard practices and reap the rewards in the long run.

In order to properly evaluate a connector, the endface is sectioned into different zones radiating outward from the centre of the core of the fibre. Standards have been set by IEC 61300-3-35 that define the characteristics of any dirt, dust or scratches that can be found in a specific zone. Criteria are specific to MM and SM, UPC and APC and ribbon fibre connectors. The strictest requirements are, of course, found in zone A – the core of the fibre (see Figure 2).

For anyone who has wiped a connector on his/her sleeve or the palm of their hand or used a regular tissue: please stop! Special materials, wipes and tools for cleaning fibre connectors have evolved over the years for a reason. They must remove anything on the connector and leave nothing else behind (see Figure 3).

Even the right products sometimes need a second swipe to get everything clean. By inspecting before connecting, you can be sure that all is clean. Some dirt and oils require more than a dry cleaning solution to really get clean. But be cautious of wet cleaning, as this can also leave a residue.

Once a connector has been properly cleaned, an inspection scope can provide only a visual check that will be subjective and relies on the technician to determine if this is ‘clean enough’. Automated products that include pass/fail analysis will provide results based on accepted industry standards, and better ensure clean mating and optimum performance. These products have software designed to quickly measure all defects found in the field of view, evaluate the size of the defect against the standard being used for each zone and then report if the endface is within specification or not.

Whichever option you choose, most vendors will agree that good practice is to inspect all fibre connectors before mating.

For more information contact Comtest, +27 10 595 1821, sales@comtest.co.za.
LabVIEW 2018 released

A new release of National Instruments’ LabVIEW software has been built with the aim of giving engineers new tools that simplify system integration and grant more control through hardware accessibility.

Users can integrate more third-party IP from tools like Python to make the most of the strengths of each package or existing IP from their stakeholders. Test engineers can use new functionality in LabVIEW 2018 to strengthen code reliability by automating the building and execution of software through integration with open interface tools like Jenkins for continuous delivery.

Capabilities like this empower test engineers to focus on system integration and development where they can offer unique differentiation, rather than get bogged down in the semantics of how to use software tools or move IP from one to another. For test engineers using FPGAs for high-performance processing, new deep learning functions and improved floating-point operations can reduce time to market.

To meet demands like testing higher complexity DUTs (devices under test) and shorter timeframes, engineers need tools tailored to their needs that they can efficiently use through their workflow, helping them to meet their exact application requirements. LabVIEW 2018 features products tailored to needs within distinct stages of their workflow – products that have been adopted in whole or in part by more than 300,000 active users.

With InstrumentStudio software providing an interactive multi-instrument experience, TestStand test management software handling overall execution and reporting, and SystemLink software managing assets and software deployments, this workflow improves the productivity of test and validation labs across many industries. Each piece of the workflow is also interoperable with third-party software to maximise code and IP reuse and draws on the LabVIEW Tools Network ecosystem of add-ons and tools for more application-specific requirements.

For more information contact Test Dynamics, +27 62 217 0063.

Current clamp for on-off control

Universal Technic is offering a new current clamp for on-off control. The model M4.TOR provides an open contact up to the threshold of 1 A and will close from 1 A to 300 A; other detection ranges are also available.

The M4.TOR has been designed for use with multimeters, recorders, power analysers, safety testers, etc. for accurate, non-intrusive measurement of AC current threshold. Using the latest transformer technology, the self-powered clamp is designed to trigger a switch for current from 0.5 to 50 A.

The clamp will accommodate conductor sizes up to 15 mm diameter or a bar of 15 x 17 mm. Universal Technic also offers AC and DC current probes over the range 1 mA–8000 A.

For more information contact Denver Technical Products, +27 11 626 2023, denvertech@pixie.co.za.
The increased need for low-cost and large-scale storage of electricity from renewable sources has led to a new wave of research on advanced battery technology.

The current king of the hill is still lead-acid. It’s the cheapest and most stable when compared to the other chemistries. Lead-acid batteries are a tried and tested technology that has been used in off-grid energy systems for decades. If you want to go off the grid and need lots of energy storage, lead-acid is still the best option. However, the search is on for innovative battery technology, be it for an increase in your smartphone battery lifespan or a storage bank for the electrical power you harvest from renewable sources such as solar, wind, water, etc.

**Best of the rest**

So, lead-acid claims the current king of the hill top spot for renewable energy storage, but what else looks promising for the future? Without a doubt, lithium-ion (Li-ion) is perhaps a future contender for the coveted top spot. It is a promising battery chemistry and low maintenance – an advantage for sure. There is no ‘memory’ effect and no scheduled cycling is required to prolong the battery’s life.

From cell phones and laptops to electric vehicles, lithium-ion batteries are the power source that fuel everyday applications. However, safety and price are still a drawback, but manufacturers are constantly improving the chemistry of the Li-ion battery to develop a cheaper, safer battery.

The traditional lithium-ion battery has given birth to a variety of other advanced lithium batteries. The lithium-sulphur battery is such an example. The lithium-sulphur battery has been hailed as the next generation of batteries to replace the current lithium-ion variety. Lithium-sulphur batteries are more cost-effective and energy-dense than lithium-ion batteries. A contender perhaps? We wait and see.

The more recently developed lithium-air battery in the lithium-ion battery family could be our next revolutionary technology. It has the potential to hold up to five times more energy than the lithium-ion batteries that power our everyday devices. The batteries work by combining lithium present in the anode with oxygen from the air to produce lithium peroxide on the cathode during the discharge phase. The lithium peroxide is broken down into its lithium and oxygen components during the charge phase. However, several obstacles have plagued this development and there is still more work to be done to commercialise this type of battery. A future contender perhaps, but not just yet.

The lithium-sulphur battery has given birth to a variety of other advanced battery technology. Lithium-sulphur batteries are cheaper, safer and more energy-dense than lithium-ion batteries, but what else looks promising for the future?

**S.J. Andrews Electronics is a leading supplier of lead-acid batteries, including the full range of Forbatt lead-acid and other chemistries.**

There have also been some developments in the water-based batteries. Stanford University researchers have developed a water-based battery that could provide a cheap way to store wind or solar energy. The prototype manganese-hydrogen battery stands just three inches tall and generates 20 milliwatt-hours of electricity. It’s a long way off but, if perfected, could challenge the price of the current king of the hill. Research is still in progress to find new ways to achieve low-cost, long-lasting, utility-scale batteries of the water-based variety.

In the now booming power and energy industry, there has been a high degree of fragmentation in the global supercapacitor market. In Australia, a new project is underway to develop hybrid supercapacitors into power rolling stock with high energy and power densities, and advanced supercapacitor management systems.

The supercapacitors are believed to have the potential to revolutionise the rail industry – these technologies could reduce the need for overhead electrical infrastructure and aid the future development of hybrid-powered trains. The new technology will effectively provide voltage stabilisation for rail systems; advancing the locomotive engine starting technologies and improving the performance of propulsion for light rail vehicles.

There you have it, the current winner and a promising fight for the renewables and energy storage industry. At the end of the day, it’s the best kind of fight there is because the winner is the future generations that will have affordable, renewable power for their next great leap in the human race.

Article by S.J. Andrews, a leading supplier of lead-acid batteries including the full range of Forbatt lead-acid and other chemistries, electronics components, lighting solutions and all things electronic.

For more information contact S.J. Andrews Electronics, +27 11 444 1521, sjandrew@icon.co.za.
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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- Stable inductance values at high temperatures
- Improved isolation through plastic case and patented winding spacer
Why do old Li-ion batteries take so long to charge?

Battery users often ask: “Why does an old Li-ion take so long to charge?” Indeed, when Li-ion gets older, the battery takes its time to charge even if there is little to fill. We call this the ‘old-man syndrome.’ Figure 1 illustrates the charge time of a new Li-ion battery with a capacity of 100% versus an aged pack delivering only 82%. Both take roughly 150 minutes to charge.

When charging Li-ion, the voltage shoots up, similar to lifting a weight with a rubber band. The new pack as demonstrated in Figure 2 is ‘hungrier’ and can take on more ‘food’ before reaching the 4.20 V/cell voltage limit compared to the aged Li-ion that hits V Limit in stage 1 after only about 60 minutes. In terms of a rubber band analogy, the new battery has less slack than the aged pack and can accept charge longer before going into saturation.

Figure 3 demonstrates the different saturation times in stage 2 as the current trails from the fully regulated current before triggering ready mode. The trailing on a good battery is short and is prolonged on an aged pack. This explains the longer charge time of an older Li-ion with less capacity. An analogy is a young athlete running a sprint with little or no slow-down towards the end, while the old man gets out of breath and begins walking, prolonging the time to reach the goal.

A common ageing effect of Li-ion is loss of charge transfer capability. This is caused by the formation of passive materials on the electrodes, which inhibits the flow of free electrons. This reduces the porosity on the electrodes, decreases the surface area, lowers the lower ionic conductivity and raises migration resistance. The ageing phenomenon is permanent and cannot be reversed.

The health of a battery is based on these three fundamental attributes:
• Capacity, the ability to store energy. Capacity is the leading health indicator of a battery.
• Internal resistance, the ability to deliver current.
• Self-discharge, indicator of the mechanical integrity.

The charge signature reveals valuable health indicators of Li-ion. A good battery absorbs most of the charge in stage 1 before reaching 4.20 V/cell and the trailing in stage 2 is short. ‘Lack of hunger’ on a Li-ion can be attributed to a battery being partially charged; exceptionally long trailing times relate to a battery with low capacity, high internal resistance and/or elevated self-discharge.

For more information contact Michael Rogers, Uniross Batteries, +27 11 466 1156, michael.rogers@uniross.co.za.

Figure 1. New and aged Li-ion batteries are charged.

Figure 2. Observing charge times of a new and aged Li-ion battery in stage 1.

Figure 3. Observing saturation times of new and aged Li-ion battery in stage 2 before switching to ready.
Microchip's digital power design suite includes the Digital Compensation Design Tool (DCDT), MPLAB® Code Configurator (MCC), Microchip compensator libraries and design examples.

These four components of the digital power design suite provide the tools and required guidance for developing complete digital power designs. Once the initial simulation model of your design is ready, the DCDT can be used to analyze the design and the feedback transfer function, and to generate compensator coefficients. Device initialization code can be generated with the help of MCC; and the final firmware can be created with some help from the code examples and the code generated from MCC and the DCDT.

**Key Features**
- Digital Compensation Design Tool to analyze your design
- Libraries and design examples to jump start your development
- Feature-rich dsPIC33EP "GS" family of DSCs

www.microchip.com/DDSMCU16
1000 W enclosed power supply

To offer more choices for high-power applications, Mean Well has added to its established HRPG-600 series of power factor corrected, enclosed type power supplies, with the launch of the 1000 Watt HRPG-1000 series.

Isolated converter for renewable energy

TDK announced the development of the TDK-Lambda brand of isolated DC-DC converter TEP200-280, which supports wide-range, high-voltage inputs from 300 to 1000 V d.c.

The new product is an isolated, board-type DC-DC converter that converts high voltage obtained from renewable energy sources to 280 V d.c., the input voltage for standard power supply for general industrial devices. As the output voltage is a general input voltage for TDK-Lambda’s standard power supplies, it can be easily converted to the required voltage with a standard switching power supply at the subsequent stage.

This product does not require a fan and employs a convection cooling method. Although the rated output power is 200 W, this can be increased by parallel operation. The TEP200-280 can be optimally used as an interface for standard power supplies used in equipment that handles high voltages, such as power supplies for power conditioners, BMU (battery management unit) power supplies for high-voltage lithium ion batteries and power supplies for high-voltage secondary battery systems.

For more information contact Vepac Electronics, +27 11 454 8053, sales@vepac.co.za

60 V power MOSFET

Now available through TTI is Vishay’s new 60 V MOSFET, the SiR626DP. The product elevates DC-DC efficiency and performance across the load with minimum circuit rework.

Vishay claims peak efficiency is up to 15% higher than competition, and power loss and power savings are more than 12% higher.

The SiR626DP device reduces $I^2R$ conduction loss and features a 40% lower $R_{DS(on)}$ than the prior generation. This low $R_{DS(on)}$ is even achieved in an 80% smaller package footprint compared to the last generation. The component increases both power density and output current per device.

Main target applications for the 60 V SiR626DP MOSFET are synchronous rectification, 24 V systems, motor drive control, DC-DC topologies, solar micro inverters, as well as power tools and industrial applications.

For more information contact TRX Electronics, +27 12 997 0509, info@trx.e.com
Programmable DC power supply

Utilising digital signal processing technology, these units address a very broad market, including component, aerospace and automotive testing, semiconductor fabrication, water treatment, plating and solar array simulation.

Housed in a 19" (483 mm) wide rack package, the 5 kW model offers high power density and weighs less than 7 kg. Five voltage models are available: 0-10 V/500 A, 0-20 V/250 A, 0-30 V/170 A, 0-300 V/17 A and 0-600 V/8.5 A. The units can operate in constant current, constant voltage or constant power modes and offer internal resistance simulation. They can accept three-phase 170 to 265 V a.c., 342 to 460 V a.c. or wide range 342 to 528 V a.c. inputs, with active power factor correction. Operating efficiencies are up to 93%.

In addition to doubling the power density over the Genesys 5 kW 2U series, Genesys+ offers advancements such as a high contrast, wide viewing angle LCD display with user controllable brightness and dimming functions for improved readability and display life. Faster up and down programming response times speed up operation, with user adjustable voltage and current slew rate control.

Two user programmable output control pins (open drain) are available to activate external devices, such as load disconnect relays. Arbitrary waveform profiles, such as car battery simulation at vehicle startup, of up to 100 steps can be generated. These are stored in four memory cells and activated by commands from the communication ports or the front panel controls.

A parallel master/slave system allows a multi-PSU system to achieve dynamic response and ripple and noise performance comparable to that of a single power supply. Up to four Genesys+ units can be connected in parallel very simply by connecting a single data link cable between units and connecting the DC outputs in parallel. The master and slave units auto-configure by detecting the parallel data connection and set their parameters accordingly. The master unit becomes the single point for programming, measurement and status of the total current of the paralleled system.

The product range is compatible with both the TDK-Lambda Genesys and Z+ models, using the same communication protocols and signals. 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 provided, and an optional GPIB (IEEE488) is available.

The Genesys+ design incorporates the Anybus CompactCom interface platform to enable various interface options as they are introduced, e.g. Devicenet, Ethercat, Modbus and Profinbus. A full package of software drivers, waveform creator and virtual front panel GUI is provided.

A full package of software drivers, waveform creator and virtual front panel GUI is provided.

Safety features include safe/auto restart and last setting memory, and built-in protective functions such as over-voltage protection, under-voltage, fold-back protection and over-temperature protection. The series conforms to the industrial environment IEC/EN61326-1 standard for conducted EMI, radiated EMI and EMC immunity.

For more information contact Tobie Muller, Accutronics, +27 11 782 8728, tmuller@accutronics.co.za.
Power efficiency boosted by Sic and GaN technologies

By Sameer Pendharkar, high-voltage technology roadmap manager, Texas Instruments.

You may not know it, but the number of semiconductor chips per person can easily cover a small wall. These chips are used in a wide variety of applications from consumer electronics, devices for the Internet of Things (IoT), along with automotive and industrial machinery.

In fact, according to World Semiconductor Trade Statistics, each person on the planet purchased an average of 111 chips or integrated circuits (ICs) in 2016. The use of these semiconductor devices is growing at five times the human population growth rate. Soon the wall you can fill with your share of chips out there will no longer be so small.

This mushrooming expansion of semiconductor applications brings with it a similar growth in demand for operating power. But costs and the need to cut greenhouse gas emissions dictate that the ICs do more work using less power. These contradictory requirements confront all devices, but none more than those that convert line or battery voltage to voltages that the other chips in the system can use – the power supplies.

The growing need to use energy more efficiently has driven a continued evolution in silicon-based technologies, as well as in the development of technologies using new wide-bandgap materials, such as gallium-nitride (GaN) and silicon-carbide (SiC). Devices using these new materials offer greater power and size efficiency and are beginning to penetrate the power supply market.

As a result of these developments, today’s power systems designers have an increased range of power technology options – a necessity given the diversity of today’s electronic systems. It is not surprising that this increased range of technology is coupled with the requirement for light weight. Power weight density, measured as kilowatts per kilogram (kW/kg), is another form of efficiency used to make design trade-offs for these systems.

Power density, measured as watts per cubic centimetre (W/cm³) or watts per cubic inch (W/in³), is an important metric for the efficient use of space in all systems, but especially in those that are highly populated, such as data centres and telecom switches.

In other equipment, such as vehicles and portable electronics, space efficiency is coupled with the requirement for light weight. Power weight density, measured as kilowatts per kilogram (kW/kg), is another form of efficiency used to make design trade-offs for these systems.

Besides the need for power and space efficiency, along with weight, is cost. Every system design must meet a cost budget. In some cases, cost may even force compromises on power efficiency, space and weight if the best-rated options are not affordable. Quality and reliability are also crucial, as it is very costly to replace semiconductor devices and end equipment failing in the field.

The objective of power semiconductor development is to drive these efficiencies as high as possible, or in other words, drive power loss, space, weight, cost and failure rates toward zero. Power semiconductors that offer the best design trade-offs for one application area may not be optimal for another. This means that several types of power technologies are necessary, and equipment designers must carefully select the appropriate technology based on the requirements for their application.

Trends in power conversion improvement

Moore's Law, the gold standard for years for digital CMOS and memory scaling, does not typically apply to power semiconductors. Digital circuitry and ICs have evolved from 5 V to less than 1 V, increasing switching speeds and driving smaller lithography. Power supplies also have to process increasing levels of power to keep input voltages high.

Another consideration is the design of power and other analog components, which is more multidimensional than digital chip design, where the effort is to repeat transistors with the same characteristics billions of times. New power transistor developments require that the electronic ‘ecosystem’ be retrofitted as shown in Figure 1, including control circuitry, packaging, thermal characteristics, protection from voltage transients, various forms of signal interference and magnetics. These environmental issues have to be addressed, and can sometimes involve considerable development across several areas for power transistors to advance to the next level of performance.

Despite the challenges, advancements in power ICs have been notable over time. For at least two decades, power losses have been cut in half every five years. Power supply modules have doubled in density every 10 years since the 1970s in space-critical applications like telecom.

Power technology issues in switching

The transition to switched mode power supplies (SMPS) is one important contributor to the rise in power efficiency. SMPS control voltage in the time domain through high-frequency pulse-width modulated (PWM) switching. SMPS can also double power efficiency over linear power supplies. However, they do bring new issues in the form of a higher bill of materials and greater design complexity. These factors become increasingly important as technology pushes towards higher power ratings and higher switching frequencies.

Because the industry has an established manufacturing base and expertise, silicon (Si) remains the least expensive power semiconductor material. Device innovations like the gate-controlled thyristor, insulated gate bipolar transistor (IGBT) and SuperJunction MOSFET have helped drive increased wattage ratings for power devices. However, Si devices cannot process large amounts of power while simultaneously switching very fast. This makes them less efficient in power conversion efficiency, as well as more heavy and bulky.

Figure 1. New power technology requires a new ecosystem.
With increased use of GaN and SiC, the landscape for power systems is changing. The wider bandgap of these materials can enable devices capable of supporting higher voltages and high switching frequencies to permit the use of smaller passives. GaN and SiC power devices enable power systems that are more efficient, smaller and lighter than Si-based systems.

While GaN and SiC outstrip Si, there are differences in performance to also consider. GaN operates at higher frequencies, while SiC handles greater input voltages and drives higher-power outputs (though appropriate power stage designs can enable GaN to achieve significantly high-power output). At this time, GaN tends to be the preferred choice for power supplies up to the 600 V to 700 V range in applications such as telecom and servers. In areas such as electric and hybrid vehicles and solar inverters, where higher voltage is required, SiC becomes a more suitable option.

Figure 2 shows the different power technologies and position relative to power levels and frequency. It should be noted, however, that while the areas shown are approximately correct, continued technology development will increase their range of support. Also note that there is a lot of overlap among these competing technologies, and no single power transistor type is a price-performance hands-down winner in every situation.

**Solutions for the power ecosystem**

While the overall market for power devices will demand all options mentioned in this article, GaN and SiC will drive the future of high power, density and weight efficiency. As the technologies become more mature and more offerings emerge, GaN and SiC will become more cost competitive with silicon, elevating their importance when evaluating design trade-offs. Thorough characterisation, physical understanding and continuous improvement in the reliability of wide-bandgap semiconductor devices will also be critical to help foster adoption.

Because GaN and SiC deliver higher switching frequencies, this can create some design challenges that can be dealt with successfully. These potential problems include high-frequency feedback from the switch onto the power line; high-frequency switching interference; timing issues that arise from narrow switching windows; and the increased criticality of any parasitic inductances in the switching path.

TI offers modules today that provide verified, ready-made solutions to address these challenges and significantly reduce development time and anxiety from system designers who may shy away from what is perceived as the overly complex nature of designing with wide-bandgap technologies.

**Advanced application areas**

Power supplies are a crucial part of all electronic systems, from handheld novelty products to large industrial equipment, and new developments in efficiency will continue to be driven by growing application areas with both volume production and high-performance requirements. Examples of such applications are data centres and automotive systems, which are both important areas requiring continued development and introduction of innovative power technologies.

In data centres, compact solutions that pack as many channels into the smallest volume possible are needed as power efficiency is important to minimise operating costs but also to reduce heat and the space required for cooling. GaN transistor-based power supplies provide these advantages by delivering higher inherent conversion efficiency and the use of smaller inductors and capacitors.

GaN power supplies also foster single-stage conversion, which helps lower the bill of materials and minimise conversion losses. Single-stage conversion also allows for higher input voltages to be brought directly on board with the application circuitry.

Another area that presents challenges with weight and space is the automotive market. Not only does cost have to be figured carefully for automobiles and light trucks, but voltages vary widely, from about 5 V to over 100 V in vehicles with internal combustion engines and even higher voltages in electric vehicles (EVs) or hybrids (HEVs).

As the EV and HEV market grows, efficient power conversion is even more critical, growing pressure to cost-effectively integrate systems with ever-greater performance into smaller volumes that weigh less and are more efficient. GaN and SiC-based power modules can help achieve many of these design goals for EV and HEV systems (see Figure 3). Other automotive applications that can benefit from improved efficiency and power density are found throughout the vehicle, from the engine and power train, to vehicle guidance and control, to the driving console and infotainment.

**Power technologies for improved conversion efficiency**

Data centres and automobiles are just two areas where new power solutions are enabling innovative designs. Smart factories, smart offices, smart houses and the smart grid can all benefit from the higher power conversion efficiency and from the superior power density offered by wide-bandgap GaN and SiC technologies.

At the same time, silicon-based devices will continue to evolve, pushing boundaries of manufacturing technology to become increasingly more efficient and stable competitive with wide-bandgap alternatives as they become more mature, reliable and cost-efficient.

For more information contact Dirk Venter, Arrow Altech Distribution, +27 11 923 9600, dventer@arrow.altech.co.za
**Rack power distribution units**

The RS Pro range has been bolstered with easily upgradeable power distribution units (PDUs) which give flexibility to retrofit power metering or networked power monitoring cost effectively and with minimal disruption.

The new family of PDUs offer versatile configurations, presenting an elegant solution for various types of racks. Choices include up to 24 Euro 2-pin (Shuko or NF 2P+T), UK 3-pin or IEC socket outlets, and with CEE 7/7 or British Standard (BS) mains plug, 16 A or 32 A BS4343 plug, or IEC inlet. All configurations are available as basic PDUs, which can be upgraded to metered PDUs with an ammeter module, or fully monitored PDUs featuring an SNMP management module with Ethernet ports for remote power monitoring.

A basic PDU without power monitoring can be installed quickly and easily at little cost, which can then be upgraded in the future simply by adding the desired power monitoring module, which can be ordered individually. Because the modules are hot-pluggable, operators can start monitoring power usage without having to take equipment offline. They can also save by investing in one module to share among several PDUs for temporary fault finding or data gathering.

Adding the metering module to a basic PDU gives access to power data via the module’s built-in LCD panel. The more sophisticated, firmware-upgradeable SNMP management module allows users to monitor input current, voltage, power, energy consumption and power factor via a web interface, and to set SNMP traps and receive automatic email alerts about any faults. Daisy chaining allows full monitoring of up to five PDUs.

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

**Body-worn enclosures**

The wearable enclosure Body-Case range by OKW has been extended by a smaller size. In addition, a cradle is also available now to hold the enclosure safely or, if necessary, to be able to charge the system housed within. Possible applications include mobile data recording and data transmission, measuring and control engineering, digital communications technology, emergency call and notification systems as well as bio-feedback sensors in the fields of healthcare, medical technology, leisure and sports etc.

The enclosure range is ideal for wearable technologies, as it can be carried around the neck, on the arm or wrist, on articles of clothing or loose in a sewn pocket. It is particularly unobtrusive and does not restrict movement in any way, similar to an accessory.

The enclosure shells of the Body-Case are highly polished and are made of high-quality ASA (UL 94 HB) in the colour traffic white (RAL 9016). The top parts are available from stock, either with or without a recessed surface for decor foils or membrane keyboards. The matt TPV sealing ring is available as standard in the colours vermilion (RAL 2002) as well as lava (similar to anthracite) and allows protection class IP65.

The Body-Case range is available in two different sizes with the dimensions (L x W x H) 55 x 46 x 17 mm (L), and the recently released version M measuring 50 x 41 x 16 mm. There are also various matching accessories such as a wrist strap, a belt / pocket clip or a lanyard.

For different applications, the enclosure can also be modified according to customer requirements. Processing and finishing techniques by OKW’s in-house service centre are also available, such as mechanical processing for interfaces and printing.

For more information contact Pieter Engelbrecht, Avnet South Africa, +27 11 319 8600, pieter.engelbrecht@avnet.com.
High-efficiency fans and controllers

RS Components has announced the availability of new energy-efficient fan controllers, together with the 4300N series of fans from ebm-papst.

The latest fan controller solutions are low-cost, credit-card-sized devices. The DCP controllers offer optimised power consumption by providing temperature-sensitive speed control for four-wire PWM controlled compact fans at 12, 24 and 48 V d.c. The EC range offers temperature control for compatible fans fitted with energy-saving motors.

Both ranges offer a choice of preset temperature profiles and are supplied with a two-metre temperature sensor lead, enabling a set of alarm functions, such as over-temperature, fan and sensor failure, all without the need for an additional power supply to operate them. This latest generation also includes the brand new configurable generic controller (CGC), which is suitable for both DC and EC fans and enables customers to adapt temperature profiles, making them ideal for use as a development kit.

Also available from RS is the 4300N series of DC axial fans, which offers high airflow (up to 285 m³/h) with low operating noise and high efficiency. The 119 x 119 x 32 mm series features improvements such as specially formed discharge vanes and innovative winglets on the blade tips to improve the aerodynamic efficiency and prevent turbulence that can cause noise.

More specialised versions are also available that offer speed signal output, PWM input, moisture protection, IP68 protection and external temperature sensor. This enables the fans to target a range of industries and applications including computing and telecommunications, drives, automation, solar inverters, as well as automation and a wide selection of other industrial applications.

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

Evotec is available in smaller size

With the new enclosure size 100, the range of Evotec enclosures by OKW has grown further. The small Evotec 100 is ideal for applications that require a reduced installation volume. The enclosures are particularly robust and are suitable for harsh working environments.

The variety of applications is further expanded by a wall suspension element for the sizes 200/250. Examples of possible applications would be measurement and control engineering, control technology, GSM modules, networks, medical and laboratory technology or information technology.

The new Evotec 100 enclosures are available with two flat top parts that differ only in height. The Evotec 150/200 or 250 from the standard range are suitable for even more installation volume, and desktop versions with/without recessed surfaces are available in the sizes 200 and 250.

The dimensions of the Evotec 100 enclosure are 100 x 62 x 26/31 mm (L x W x H). The other versions are available with the following dimensions:
- 150 with 150 x 93 x 35/45 mm, the 200 version with 200 x 124 x 45 mm and the Evotec 250 with 250 x 155 x 54 mm. All versions are made from high-quality ASA+PC-FR with high UV protection. Thanks to the optional seal, the enclosures achieve protection class IP65. Rubber feet included in the supply ensure reliable desktop positioning.

With the new suspension element, suitable for the versions 200/250, the enclosures can now be mounted quickly and easily onto a wall. One part of the suspension element is mounted on the rear side of the Evotec, while its counterpart is screwed to the wall. The enclosure can be clicked onto the wall element and removed again. A screw connection of the two wall suspension components from below provides for more safety and protects the enclosure from unauthorised removal.

Applications with the suspension element are conceivable in the field of wearables or also wireless communication. Additional modifications, such as mechanical processing for interfaces, lettering, painting/special colours and printing or EMC coating allow the enclosure to be customised according to the user’s individual requirements.

For more information contact Pieter Engelbrecht, Avnet South Africa, +27 11 319 8600, pieter.engelbrecht@avnet.com.
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**EMI filters for Hi-Rel applications**

Manufacturers of electronic equipment for Hi-Rel applications often struggle to meet stringent EMC and safety standards. Knowles Precision Devices (KPD) has a range of EMI components, under the Syfer brand, that particularly appeal to designers in the medical implantable and space sectors as well as industrial, automotive, aerospace and telecom applications.

The increasing use of SMD filters over conventional panel mounted filters has simplified assembly methods, reduced production costs and enabled smaller volumetric efficiencies to be gained, giving a greater choice of options to the designer – particularly shorter lead times for development samples.

KPD continues to refine existing ranges, explore new ones and bring on board new materials, like lead-free dielectrics.

For example, the Syfer E01 and E07 ranges of feed-through MLCC ‘C’ filters now have extended working voltages from 25 V d.c. to 200 V d.c, and in certain case sizes up to 500 V d.c. These surface-mount, three-terminal EMI filter chip devices are designed to offer reduced inductance compared to conventional MLCCs when used in signal line filtering. The filtered signal passes through the chip’s internal electrodes with the ‘noise’ filtered to the grounded side contacts, resulting in reduced length noise transmission paths. They are available in C0G/NP0 and X7R dielectrics, in case sizes 0805 to 1812, and with current ratings of 300 mA to 3 A.

Particularly effective in replacing conventional array filters in medical implantable devices is the Syfer E03 (X2Y) range. Available in case sizes from 0805 to 2220, these are integrated passive devices featuring both common and differential mode capacitance in a single MLCC chip. C0G and X7R dielectric versions are both available options. X7R dielectric versions are available with KPD’s proven FlexiCap termination which is strongly recommended for new designs.

Ideal for both signal and power lines, and ensuring impressive EMI filtering performance, is the Syfer SBSP range of surface mount pi-filters. With a size of only a 1206 chip they offer a beneficial combination of size and performance. Ideal for telecoms, power supplies and industrial electronic equipment, their operating temperature range of -55°C to 125°C ensures they are also suitable for military/aerospace applications. The use of X7R and C0G ceramic dielectrics sees capacitance values from 22 pF to 150 nF with a 1 A current rating, and they have working voltages up to 100 V d.c.

FlexiCap termination is used throughout the range and all versions are available with either tin or tin/lead finishes.

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

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**Steering diode/TVS arrays**

ProTek Devices has introduced two new steering diode/transient voltage suppressor (TVS) arrays for electrical circuit protection in various computing interfaces, such as Gigabit Ethernet, HDMI and USB.

The two new parts, in conjunction with passive components integrated into a TVS/filter network, can also be used for electromagnetic and radio frequency interference protection.

The new components are the PLR0504PLCN, with a 5,0 V rated stand-off voltage, and the PLR3304PLCN, with a 3,3 V rated stand-off voltage. Other suitable applications include DVI interfaces, high-speed data line ESD protection, FireWire, SATA and PCIe interfaces, and IEEE 1394 to 3,2 Gbps.

The arrays provide ultra-low capacitance of 1,5 pF max (I/O to GND) and 1,37 pF typical for 0 V d.c. They are rated at 250 W peak pulse power per line for an 8/20 microsecond waveform. Both components meet or exceed IEC standards requirements for 61000-4-2 (ESD), 61000-4-4 (EFT) and 61000-4-5 (surge). ESD protection is >25 kV and low-leakage current is less than 0,5 µA. They protect four lines and are also RoHS and REACH compliant.

For more information contact Jeva Narian, Arrow Altech Distribution, +27 11 923 9600, jnarian@arrow.altech.co.za

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**High-speed protection devices**

The high-speed protector (HSP) models of Bourns’ TBU product range are circuit protection devices constructed using MOSFET semiconductor technology. When placed in series with a signal line, the TBU HSP monitors the current flowing through the line. If the current exceeds a preset level, the device triggers, providing an effective barrier to high voltages and currents.

The HSP begins protecting in less than 1 μs, once line current exceeds the TBU device’s trigger current. When in the protected state, it restricts line current to less than 1 mA typically, and blocks voltages up to the maximum voltage rating of the device. After the surge, the TBU automatically resets itself when the voltage across the device falls to a settable level or below.

For more information contact TRX Electronics, +27 12 997 0509, info@trx electronics.com

www.dataweek.co.za
Rapidly deployable antenna masts

Webb Industries’ Rapid Deployment Solution (RDS) is a typically single-user site solution which does not require concrete or any excavation and has a very low environmental impact. “The main advantage of the RDS is the speed with which it can be installed. It takes only 1 to 4 days to erect depending on the size,” says Webb Masts and Towers general manager, Dave Beeming.

He adds that the RDS, designed by Webb’s in-house engineers, can be reused, relocated and erected on almost any site, both urban and rural. “While there are competitive products, ours is unique in terms of its flexibility, user-friendliness and cost-effectiveness,” Beeming claims.

The applications for the RDS are wide and varied. They are used wherever speed is the main requirement and users include GSM operators, the South African Police Services and event organisers for concerts, sports tournaments, political rallies and the like. The structures take up a site footprint no larger than 6 x 6 m, and a crane is not needed to erect them.

Beeming adds that for GSM operators the RDS serves a vital role in giving them time while they wait for a more permanent solution. “A permanent site solution can take months while the bureaucratic administration is completed. This delay can be very costly for the operators. Webb's RDS, not requiring the same complex licensing procedure, acts as a vital stopgap in a period that the operator would otherwise not be making any revenue,” he says. “Furthermore, it gives an operator a marketing edge in specific locations because of its ability to be fully operational even while waiting for the permanent solution.”

Webb Masts and Towers supplies a wide range of products made to the highest standards. These include tapered and parallel tubular/angle lattice towers, guyed lattice towers, rooftop solutions (penetrating and non-penetrating) and, of course, rapid deployment structures. “We also specialise in custom designing towers and solutions,” concludes Beeming.

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

Bandpass filters

AVX has released the new BP series of low-profile, high-performance bandpass filters based on its multilayer organic (MLO) high-density interconnect technology. The filters incorporate high-dielectric-constant and low-loss materials that are expansion matched to most organic PCB materials, providing improved reliability over standard silicon and ceramic devices, feature an ultra-low profile of less than 0.556 mm, and support 18 pass bands spanning 620 MHz to 5930 MHz.

The series also exhibits low insertion loss (1.57 – 2.41 dB typical), low parasitics, 50 Ω impedance, excellent rejection of out-of-band frequencies and favourable heat dissipation characteristics, and is rated for 1 W continuous RF power. This makes it ideal for use in a wide range of wireless applications, including communications systems, military and emergency first responder radios, UAVs, base stations, femtocells, microcells, wireless access points and terminals, and instrumentation equipment.

According to AVX, the BP series allows RF design engineers to achieve lower in-band insertion loss, better out-of-band attenuation with steeper roll-offs, and better heat dissipation than designs that utilise LTCC products. MLO filters integrate inductors and capacitors into a small, low-profile package, eliminating the need to construct filters using discrete capacitors and inductors. This improves performance and reliability, reduces the required board placement space, and removes the need for tuning using individual capacitors and inductors.

The bandpass filters are currently available in three case sizes – 3416, 4617 and 5021 – and are supplied with gold terminations that are compatible with automatic soldering technologies.

For more information contact
Deon Schoombee, Electrocomp, +27 11 458 9000, deon@electrocomp.co.za
**Fused filament 3D printer**

The new easy-to use RS Pro iTX 3D printer from RS Components targets a wide range of users in manufacturing and many other commercial and business applications, as well as being suitable for educational purposes and at home for anyone who wants to design and build things quickly and at low cost.

Along with all RS Pro 3D printers that leave the factory fully constructed, the iTX is made in Britain and is ready to use straight out of the box. A key element of the machine is its upgradability; the high-quality machined parts and circuit boards are designed to be easy to replace and/or upgrade in a matter of minutes.

All RS Pro 3D printers are open-source designed, which means they can easily be customised by advanced users and enthusiasts alike. In particular, the iTX’s RS Pro VariBLOCK head unit offers future-proofing, as it is easily interchangeable and upgradable to other extruder head systems, allowing the machine to use various other materials as they become available. In addition, all serviceable parts including the printer’s hot-end and filament extruder can be easily maintained.

The machine uses the fused filament fabrication (FFF) 3D printing process and comes with a fully heated build plate, handling temperatures in the 50°C to 100°C range. The printer also features a metal-gearbox-controlled filament extruder system to deliver maximum power and reliability. The extruder is designed for 1.75 mm filaments and is capable of printing a wide range of materials including ABS, PLA and PETG.

Other key specifications include nozzle size options including 0.2, 0.3, 0.4, 0.5, 0.8 and 1.0 mm; build volume of 8000 cm³ (200 x 200 x 200 mm); and a wide selection of layer resolutions from 0.8 mm for fast printing, down to layers as small as 0.08 mm (80 microns). Coming with a strong steel-powder-coated frame construction, the printer has dimensions of 450 (H) x 535 (W) x 370 (D) mm, expanding to 550 (H) and 535 (W) when fitted with the spool holder and umbilical wire.

Another key feature of the printer is its integrated and fully upgradable PC computer, which is based on an AMD Kabini A4 quad-core processor, along with an AMD Radeon graphics card, Ethernet networking, 8 GB of upgradeable memory, and an upgradeable 500 GB SATA hard-disk drive. The integration of a PC into the machine enables a number of accessory upgrades, such as adding a webcam or other networking and remote-access capabilities.

Also available separately is a safety-compliant cabinet system that has been designed especially for use with the printer.

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

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**RF surge protectors**

Pasternack has launched a new series of coaxial surge protectors that are designed to guard valuable communications equipment from power surges and indirect lightning strikes.

Its 46 new coaxial lightning arresters and surge protectors are ideal for use in cellular base stations, public safety systems, Wi-Fi networks, active antenna systems and GPS system applications.

The new surge protectors are available with 7/16 DIN, type-N and 4.3-10 connectors, and feature VSWR as low as 1.1:1, maximum power as high as 2 kW, multi-strike capability and low insertion loss. Additionally, these models support a frequency range of DC to 6 GHz and are CE and RoHS compliant. Most of these new surge protectors are IP67-rated for outdoor use and some models offer low-PIM performance. Furthermore, models are available with bracket mounting options and flexible bulkhead designs.

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

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www.dataweek.co.za Dataweek, 13 June 2018
Capacitors for decoupling, RF bypassing and DC blocking

DLI, a brand of Knowles, offers the Bar Cap and Gap Cap families of capacitor for decoupling, RF bypassing and DC blocking applications.

Bar Caps are multiple decoupling/blocking capacitors configured in a single array. They are specifically designed for MMIC (monolithic microwave integrated circuit) circuits and RF bypassing requiring multiple capacitor applications, such as multiple decoupling or RF bypassing networks.

Featuring high Q and low inductance, Bar Caps can be integrated into an IC package to reduce bond wire lengths and leading to improved performance and simplified assembly. Operating at frequencies up to 30 GHz, they are ideal for DC blocking, RF bypassing, decoupling and GaAs ICs. They are supplied with 100 mil gold metallisation, with a nickel barrier layer, for wire bonding. Standard and custom package sizes are available to provide different capacitance values.

Gap Caps are series configured precision capacitors for microwave applications such as DC blocking and RF bypassing where their low insertion loss and high resonant frequencies make them ideal devices. This product’s unique recessed metallisation configuration eliminates the need for wire bonding up to 100 GHz and minimises the potential of shorting during epoxy or solder attachment – therefore reducing performance variations. Capacitance values are available from 0.2 pF to 800 pF and, operating at frequencies up to 30 GHz, the parts are ideal for DC blocking, RF bypassing, filtering, tuning and coupling. Customised solutions are available alongside catalogue products.

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

Solderless and direct plug-in connectors

New from Würth Elektronik eiSos is the REDFIT IDC SKEDD WR-WST family of solderless, space-saving and multi-pluggable connectors for signal transmission. The product range is available in 4- to 20-pin versions and is suitable for permanent use on PCBs as well as for temporary connections for programming and debugging purposes.

REDFIT IDC is a solderless, reversible, direct plug-in connector with SKEDD technology. It can be manually mounted on the plated through-holes of the PCB, which eliminates the need for extra sockets and any related soldering processes. It also requires no mating plug, therefore saving on yet another component and reducing assembly and process costs.

For miniaturised components in particular, the less space required and the lower the height needed for any pin headers and other connector components, the better. REDFIT IDC SKEDD connectors only take up room for the connector itself on the PCB – there is no need for extra space above the circuit board.

The SKEDD connector is attached to the ribbon cable via insulation displacement technology. The plastic guides on the underside of the housing are longer than the contacts, thus preventing short circuits on the board underneath. Different thicknesses of the guiding pins provide reverse polarity protection during the simple and tool-free process of plugging and unplugging the connector. Depending on the application, between 10 and 25 mating cycles are specified.

The plastic housing of the REDFIT IDC SKEDD WR-WST connector family is made of halogen-free LCP (liquid crystal polymers) of flammability class UL94 V0. The specified operating temperature ranges from -25°C to +105°C. The contact material, a copper alloy, is gold-plated on the SKEDD site and tin-plated on the IDC.

The SKEDD contacts on the dual-row plug connector are offset with a 2.54 mm pitch. On the cable side, the AWG #28 ribbon cable is connected with a 1.27 mm pitch. Further technical features include a rated current of 1.0 A per pin, an operating voltage of 100 V, isolation resistance of more than 1000 MΩ, voltage stability of 500 V a.c./min, and contact resistance of 10 mΩ maximum.

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

www.dataweek.co.za
**Magnetic connector**

Amphenol announced the launch of the new magnetic connector Stingray, optimised for body-worn applications.

Stingray is a low-profile, compact and sealed connector that sits flat against the body to prevent snagging and damage. It is self-aligning due to its strong magnetic connection and allows customisation and flexibility of cable routing as the cable can be rotated through 360 degrees when the connector is mated.

Stingray is an excellent solution for audio, power or data signals and is ideal for first responders, security and military personnel. The connector features a magnetic, non-keyed mating system which allows it to be easily mated without the need for pre-alignment and eliminates the need to operate any coupling mechanisms.

**Power inductors for high frequencies**

The new XEL50xx family of high-performance, moulded power inductors from Coilcraft offer exceptionally low DC resistance and ultra-low AC losses, greatly improving power converter efficiency at high frequencies (2 to 5+ MHz) and high ripple current.

The use of high switching frequencies or high ripple current allows a corresponding lower inductance value, which results in a physically smaller part for the same electrical specs. XEL50xx inductors measure just 5.28 x 5.48 mm with a maximum height of 3.2 mm.

The product range is currently available in two models, the XEL5020 and XEL5030. A third model, the XEL5050, is expected late Q2 2018. The XEL5020 is available in six inductance values from 0.10 to 1.0 µH, with current ratings up to 39 A. The XEL5030 has ten values from 0.13 to 4.7 µH and current ratings up to 44 A. All models offer soft saturation characteristics to withstand high current spikes and have no thermal ageing issues.

The inductors are qualified to AEC-Q200 Grade 1 standards (-40°C to +125°C ambient) with a maximum part temperature of +165°C, making them suitable for automotive and other harsh-environment applications. They feature RoHS-compliant, tin-silver-over-copper terminations and are halogen free. Their composite construction also minimises audible buzzing.

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

**Board-to-board connectors**

Würth Elektronik eiSos has expanded its portfolio of board-to-board connectors. Under the designation WR-BTB, the manufacturer of electronic and electromechanical components offers a broad spectrum of plugs and receptacles. Examples for the new SMT assembly connectors are plugs and receptacles with collars and chamfers in 1.00 mm and 0.80 mm pitch.

The robust plug connectors are designed for 30 mating cycles, the insulation material is of flammability class UL94 V-0 (certified UL appoval E323964), and has an operating temperature of -55°C to +85°C. The rated current of the partially gold-plated copper-alloy contacts is 0.5 A, with voltage stability at 500 V. The contact resistance is just 50 mΩ.

The plugs are available in 1.00 mm pitch with heights of 8.35 and 6.35 mm; the matching receptacles are available with 10.30, 7.30 and 5.30 mm heights. For the 0.80 mm pitch plugs, these heights are 7.60, 5.60 and 4.60 mm; the counterparts have heights of 11.75, 7.75 and 3.75 mm. All WR-BTB series components also offer a variety of different numbers of poles.

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

Texas Instruments introduced a 5,5 V step-down power module that delivers continuous 6 A output current with up to 95% efficiency. The TPSM82480 DC-DC module integrates power MOSFETs and shielded inductors into a tiny, low-profile footprint for space- and height-constrained applications such as point-of-load telecommunications, networking, and test and measurement power supplies. The chip can be combined with two input/output capacitors and two resistors to make up a complete solution footprint of 80 mm² that measures just 1.5 mm in height. An optional automatic power-save mode maintains high efficiency across the full load range, and a thermal-good output is provided to alert the system to reduce power before overheating.

Mouser Electronics is now stocking the MGM13P Mighty Gecko wireless mesh modules from Silicon Labs. Featuring secure and flexible mesh protocol stacks, an integrated chip antenna, and radio frequency (RF) regulatory certifications, the modules incorporate a low-power wireless SoC with a 32-bit Arm Cortex-M4 core with DSP instruction and floating-point unit for efficient signal processing. The SoC offers 64 KB of RAM, 512 KB of Flash, and up to +10 dBm output power (with a +18 dBm version available), as well as a wide selection of peripherals. Integrating the crystals, RF passives and antenna necessary for a system-level implementation of wireless IoT mesh networks, the modules free developers from complex RF/antenna design and testing.

Mouser Electronics, +27 12 997 0509.

Cypress Semiconductor unveiled the PSoC 4700 series of microcontrollers (MCUs) that uses inductive sensing to detect touch inputs for products using metal surfaces. The MCUs are based on a 32-bit Arm Cortex-M0+ core and integrate programmable analog and digital blocks. They can support up to 16 sensors to implement digital functions or custom algorithms for interfaces in various form-factors, including buttons, linear and rotary encoders, proximity sensing or free-form. The inductive-sensing solution provides superior noise immunity for reliable operation, even in extreme environmental conditions.

TRX Electronics, +27 12 997 0509.

The G500-GL from Fibocom is a GPRS module supporting 850 MHz (B5), 900 MHz (B8), 1800 MHz (B3) and 1900 MHz (B2) bands, as well as positioning via GPS, Beidou, GLONASS, QZSS and SBAS. It is controlled through proprietary AT commands and supports SMS and embedded TCP/UDP/FTP/HTTP/HTTPS/MDM/PPP/OTA. Transmitting power is 2 W for 850/900 bands and 1 W for 1800/1900 bands, while receive sensitivity is -109 dBm for 850/900 bands and -108 dBm for 1800/1900 bands. Operating from a 3.3 to 4.5 V supply, the module comes in an 18.7 x 16.0 x 2.3 mm LCC+LGA package capable of operating in temperatures between -35°C and 75°C.

Electrocomp, +27 11 458 9000.

Qorvo’s QPC6742 RF switch IC is 75 Ω silicon-on-insulator (SOI) single-pole, four-throw (SP4T) switch, designed for use in CATV, satellite set-top, and other high-performance communications systems. This IC offers a high-isolation, symmetric topology with excellent linearity and power handling capability, and no necessity for blocking caps on the RF ports. The QPC6742 operates across the 5 MHz to 2000 MHz frequency range, and features high input IP3 of 82 dBm at 850 MHz. Applications include MDU amplifiers, point-to-point, optical nodes, set-top box, PCTV and multi-tuner DVR.

Qorvo, RF Design, +27 21 555 8400.

STMicroelectronics’ IIS3DHHC is a 3-axis accelerometer optimised for high measurement resolution and stability to ensure accuracy over time and temperature. It targets precision inclinometers in antenna-positioning mechanisms for communication systems, structural health monitoring (SHM) equipment for keeping buildings and bridges safe, and stabilisers or levellers for a wide variety of industrial platforms. Its long-term accuracy and robustness are also ideal for high-sensitivity tilt and security sensors, as well as image stabilisation in high-end digital still cameras (DSCs). The IIS3DHHC is in production now, in a 16-lead, 5 x 5 x 1.7 mm ceramic LGA package, and comes with a 10-year longevity commitment.

Avnet South Africa, +27 11 319 8600.

GPRS and GNSS module

SP4T RF switch

High-accuracy MEMS sensor
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