SARA-R5 series

IoT security with 5G-ready cellular module and chipset for low power wide area IoT applications
Microchip Technology Inc. in partnership with The Things Industries, provides an end-to-end security solution that adds secure, trusted and managed authentication to LoRaWAN devices at a global scale. This solution brings hardware-based security to the LoRa ecosystem for the following applications:

- IoT network endpoint key management and exchange
- Encryption for small messages and PII data
- Secure Boot and Protected Download
- Ecosystem Control, Anti-cloning

Contact Dirk Venter - Altron Arrow Field Application Engineer on 082 339 8648 or dventer@arrow.altech.co.za for more information.

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on the cover

The SARA R5 series of LTE M and NB-IoT modules, designed for low-power wide-area (LPWA) IoT applications, is the recipient of a Dataweek ‘Product of the Year 2019’ award (read more on page 22). Built with IoT security in mind, the secure element is compliant with EAL5+ High common criteria certification, which makes the modules well suited to protect sensitive assets and communications.

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

features

Telecommunications, wireless, IoT, RF & microwave................................................................. 16

Design considerations for powering remote Bluetooth beacons, RF technology evolution for 5G millimetre-wave radios, and more.

Products of the year 2019 .................................................. 22

A selection of some of the best components to hit the electronic engineering market this year.

regulars

News.................................................................................. 3

Events................................................................................ 3

Systems, components, design.............................. 11

General ................................................................. 27

Hot chips ............................................................. 31

Open [re]sources .................................................. 32

QuickFind index .................................................. 33
Getting charged up for the new year

The Springboks’ Rugby World Cup triumph in Japan couldn’t have come at a better time for South Africa, as the country was in desperate need of a jolt of positive energy going into the festive season. And it’s precisely because of energy, or Eskom’s ability to deliver it, that is behind much of the current angst.

A recent report by Deloitte projected overall GDP growth for SA at 0.5 percent for 2019 – compared with 3.0 percent globally and 3.9 percent for developing economies, and also down from the 1.5 percent forecast in government’s 2019 budget speech. The budget deficit for 2018/19 came in as expected at 4.2 percent, however the deficit under the medium-term estimate is projected to worsen to 6.5 percent in 2020/21, reducing to 5.9 percent in 2022/23.

The Deloitte report identified the poor financial position of some state-owned enterprises (SOEs) as a significant concern, and further burdens the public finances. Additions to the in-year expenditure include some R26 billion to Eskom.

Against this backdrop, it is encouraging to see that plans are underway to expand the country’s capacity for generating energy from renewable sources. Three new Renewable Energy Development Zones (REDZs) have been proposed for wind and solar photovoltaic energy projects. When one considers the abundance of sunshine this country is blessed with and the rate at which the cost of producing electricity from renewable sources is coming down, solar should really be a no-brainer for augmenting our energy diet.

Batteries are a key enabler of large-scale renewable energy efforts, and a strong focus of several of the presentations at the recent Batteries Technology Conference was the establishment of a circular economy in South Africa for batteries (lithium-based in particular). We have the natural resources, we have the know-how, we have an enormous market locally and throughout Africa, all that’s needed now is investment.

Tesla recently announced it is building a new ‘Gigafactory’ for electric cars and batteries near Berlin, Germany, which is expected to create upwards of 7000 new jobs. Imagine if we could convince a company the size of Tesla to build a plant here, where many of the natural resources necessary for battery production are readily available.

We can always dream, but for now most of us will be focused on getting 2019 done and dusted. While this is the last issue of Dataweek for the year, there is no rest for the wicked, and work is already underway for our January edition as well as our annual EMP – Electronics Manufacturing & Production Handbook. Until then, it’s goodbye and best wishes to our readers for the festive season, and a happy and prosperous 2020.
Overseas Business

• Texas Instruments reported third quarter revenue of $3.77 billion, net income of $1.43 billion and earnings per share of $1.49. Overall, revenue decreased 11% from the same quarter a year ago, as most markets weakened further – in its core businesses, analog revenue declined 8% and embedded processing declined 19%. The company’s fourth quarter outlook is for revenue in the range of $3.07 billion to $3.33 billion, and earnings per share between $0.91 and $1.09.

• Third quarter group revenues for ams were $645.0 million, up 57% sequentially compared to the second quarter and up 41% from $458.7 million in the same quarter of 2018. Adjusted net income for the third quarter was $158.1 million, compared to $178.8 million for the same period last year. Driven by its consumer solutions and positive trends in the smartphone market, the company expects continued strength in the fourth quarter with expected revenues of $610 to $650 million.

• STMicroelectronics reported third quarter net revenues of $2.35 billion, and net income of $302 million or $0.34 diluted earnings per share. This represents revenue growth both quarter-on-quarter ($2.17 billion in revenue, $160 million net income in Q2 2019) and year-on-year ($2.52 billion in revenue, $369 million net income in Q3 2018).

• NXP Semiconductors delivered revenue of $2.3 billion for the third quarter of 2019, and returned $79 million to its shareholders, for a total of $6.6 billion returned to shareholders since July 2018. That revenue figure was up 2% quarter-on-quarter but down 7% year-on-year.

Companies

• ams’ previously aborted takeover bid for OSRAM Licht AG has received a new shot in the arm thanks to a recommendation by OSRAM’s management board and supervisory board for ams’ all-cash takeover for 100% of the share capital of OSRAM at a price of 41.00 Euros per share. In addition, ams has entered into a business combination agreement in an effort to deliver the joint strategic vision and a successful combination of the two companies.

Industry

• The Semiconductor Industry Association (SIA) announced worldwide sales of semiconductors for the month of September 2019 were $35.6 billion, an increase of 3.4 percent over the previous month’s total but 14.6 percent less than sales from September 2018. Sales were down across all regions compared to September 2018: Europe (+6.4 percent), Asia Pacific/All Other (+6.9 percent), Japan (-10.0 percent), China (-12.9 percent), and the Americas (-30.4 percent). The SIA’s board of directors recently elected Keith Jackson, president, CEO and director of ON Semiconductor, as its 2020 chair and Robert Bruggeworth, president, CEO and director of Qorvo, as its 2020 vice chair.

• Texas Instruments’ recent decision to cancel its distribution agreements in China was all the talk at the recent Global Distribution and Supply Chain Leaders’ Summit in Shenzhen. The low-key announcement in early October means the company will do business in China directly, and is expected to lead to the loss of at least 1000 jobs of sales and field application engineers (FAEs) in the country. Rumours are circulating that other chip manufacturers may follow suit, with STMicroelectronics and Qualcomm being consistently named.

• In a further blow to China’s distribution establishment, Avnet launched an Avnet Super Store on Alibaba Group’s China-focused B2B purchasing and wholesale marketplace, 1688.com. The marketplace is home to more than 10 million enterprise storefronts, with 150 million users visiting the site per day. The site serves as a dedicated sourcing channel for wholesale buyers in China and has been expanding its cross-border wholesale business, including bringing foreign suppliers onto the platform.

• Leading companies from the automotive and computing industries announced a collaborative effort toward making fully self-driving vehicles a reality. The new Autonomous Vehicle Computing Consortium (AVCC) brings together industry leaders from automotive, automotive supply, semiconductor and computing to serve as the leading organisation for autonomous computing expertise. Initial members include Arm, Bosch, Continental, Denso, General Motors, Nvidia, NXP Semiconductors and Toyota.

• The microprocessor (MPU) market’s string of nine straight record-high annual sales between 2010 and 2018 is expected to end this year with worldwide MPU revenue dropping 4% to about $77.3 billion because of weakness in smartphone shipments, excess inventories in data centre computers, and the global fallout from the US-China trade war, according to IC Insights. Microprocessor sales are expected to stage a modest rebound in 2020, growing 2.7% to $79.3 billion, and then are forecast to reach a new record-high level of about $82.3 billion in 2021.
Battery Technologies Conference 2019

Batteries are a critical enabler of the Fourth Industrial Revolution, powering technology in products from laptops and handheld devices to electric vehicles and renewable energy storage. However, with more batteries placed on the market, the need for solutions when they reach their end of life is rising.

The increasing demand for batteries is also revealing and amplifying a wide spectrum of risks associated with the materials that make up the batteries themselves.

The risks present significant reputational, legal, compliance and commercial concerns for major industries while simultaneously responding to external pressure concerning their products. Some promising solutions to address these issues are already underway although there are still gaps that need to be filled through increased interactions and accelerated cooperation towards common transformational goals.

A primary reason for this is that the battery value chain is a complex system that comprises participants from various industries and sectors. Similarly, although lithium-ion batteries for instance are not toxic in the same way as lead-acid or nickel cadmium batteries, they do contain elements that should be prevented from being exposed to the environment.

Equally important is the potential to recover the materials in waste batteries for the reuse in new batteries. With the unprecedented growth in the market, the demand for raw materials has increased significantly and recycled materials can be a positive contribution from both an environmental and an economic perspective.

It is against this background that the Battery Technologies Conference 2019 was held at Emperor’s Palace on 25 October. Featuring a diverse array of speakers, the conference addressed developments impacting batteries and power management in portable devices including smartphones, laptops/tablets, medical devices, wearable, electric vehicles, military and the various industrial applications.

Exploring zinc-bromine flow batteries as standby energy storage for mobile phone towers in South Africa

Keith MacTaggart, chief deployment officer at Redflow, highlighted the performance benefits and applications of the company’s ZBM2 battery. Established in Australia in 2005, Redflow designs and manufactures zinc-bromine flow batteries, which have been deployed in Australia, Asia-Pacific, southern Africa, the Middle East and Europe.

One of the key characteristics of Redflow’s flow chemistry is the that it acts like a reversible electroplating process, so the battery can repeatedly use 100% of its energy capacity and run flat without incurring any damage. It has a high tolerance to ambient temperatures without external cooling and its modular design enables scalability from 10 kWh to several MWh.

These features make the ZBM2 battery particularly suitable for telecommunications deployments such as cellphone towers. In appearance it is very unlike any conventional battery, and can’t be broken down and re-configured for resale. The battery furthermore has a mechanical anti-theft feature which kills the battery if it is moved without properly shutting it down first, and a software anti-theft feature that can be configured so the battery can be killed if it is disconnected from the BMS (battery management system) server.

Recycling batteries in a circular economy

Next to speak was Keith Anderson, chairman of eWASA (e-Waste Association of South Africa). eWASA’s functions include the management of an e-waste recycling system on behalf of industry, education and training, management of data, clearance and controlling, and research and development. eWASA has also submitted an Industry Waste Management Plan (IWMP) to the minister of the environment, forests and fisheries which includes batteries.

The South African e-waste recycling industry is already well structured, consisting of 4 tiers: 1) Cradle to cradle recyclers; 2) First line recyclers; 3) Entry level dismantlers; 4) Waste pickers. Working in unison, this tiered structure enables job creation as well as a circular economy for e-waste.

Various initiatives are underway to control e-waste across the country’s public and private sectors. Roughly 45% of e-waste is produced by national and provincial government, 35% by the business sector, and 20% by households. The main culprits are CRT monitors, CFLs (compact fluorescent lights), printer cartridges and toner ink bottles, and batteries.

There is currently no lithium-ion battery recycling facility in South Africa, but eWASA is hard at work lobbying for change. While it would require a concerted effort from many role-players, the successful establishment of such a facility would provide environmental as well as economic benefits to South African society.

An assessment towards a low-cost industrialisation of lithium batteries

Professor B.J. Bladergroen from the South African Institute For Advanced Material Chemistry (SAIAMC) at the University of the Western Cape discussed the global proliferation of lithium-ion batteries in recent years, and how this has led to a rapid decrease in the cost of these batteries.

He focused on what a game-changer it could be for South Africa if it were able to establish production facilities for lithium-ion batteries. He emphasised that SA has 80% of high-quality manganese resources and sufficient nickel resources, both key ingredients in Li-ion battery production. There is also no reason why the country couldn’t produce other components for battery production, including anode material and aluminium and copper foil.

As things stand, Bladergroen identified the following as the primary challenges to commercialising Li-ion battery production across the African continent:

- Africa has copper but no battery grade copper foil.
- Africa has aluminium but no battery grade aluminium foil.
- Africa has nickel, cobalt and manganese but no NMC (nickel-manganese-cobalt).
- Africa has fluor but no battery grade electrolyte.
- Africa has high quality graphite but no battery grade graphite.
- Africa has Li2CO3 deposits but no cost effective battery grade LiOH.

Exploring a pivot towards battery technologies: Does SA’s environmental regulatory framework promote the uptake of such technology?

“Battery technology is a valuable tool for meeting sustainability goals, and an enabler in SA’s transition to a low carbon economy (a commitment made in terms of our NDC under the Paris Agreement),” stated Webber Wentzel’s Gillian Niven.

She pointed out that storing electricity can provide a number of environmental benefits:

- No GHG emissions.
- Accelerates broader adoption of renewable energy – increases economic value of renewables.
- Allows renewable energy to have flexible generation – promotes efficiency.

As a result, SA has the potential to become a global player in the lithium-ion battery market by commercialising the production of Li-ions. However, this would require increased investment and an infrastructure to support the production of key components such as aluminium and copper foil.

ZBM2 batteries are particularly suitable for telecommunications, including both mobile phone towers and data centre UPS systems. Redflow has also secured orders for ZBM2 batteries for South Africa, including phone towers in South Africa.
The added capacity provided by electricity storage can delay or displace current dependence on fossil fuel generated energy. The drawbacks she identified include the fact that the legal framework is lagging behind, as it was not developed with such technologies in mind – which may pose unduly burdensome obstacles to producers. This depends on the type and efficiency of storage technology, for example batteries use raw materials such as lithium, vanadium and lead, which present environmental hazards if they are not disposed of or recycled properly; and there are emissions produced in the manufacturing of these technologies.

To address some of the challenges, Niven suggested that more mines are required to support battery associated minerals (i.e., cobalt, iron, lithium, manganese and nickel). Co-locating BESS (battery energy storage system) facilities with the solar or wind generating source may further streamline the process and provide economic advantages. BESS projects may fail within permitted uses for electrical substations and transmission and distribution facilities.

The vanadium redox flow battery as a safe, long-duration storage solution for Africa

Bushveld Energy’s minerals division has the ambition to grow into one of the world’s most significant, lowest cost and vertically integrated vanadium companies, stated Peter Oldacre, the company’s head of origination and investment. Its key focus is on electrolyte manufacturing (with an initial target of 200 MWh per annum) and vanadium redox flow battery (VFRB) assembly and manufacturing, MW-scale energy storage projects, deployment models and leasing models (targeting 1000 MWh opportunities by 2020).

Some of the advantages of VFRB batteries include their ability to repeatedly charge/discharge over 35 000 times for a lifespan of over 20 years, 100% depth of discharge without performance degradation, low cost per kWh, and safety, to name a few. There are hundreds of VRFBs deployed globally, including the largest battery currently under construction in Dalian City, China – with a rated power of 200 MW and capacity of 800 MWh.

Looking at the big picture, Oldacre noted that there is currently a regional misalignment between new renewables and existing transmission and distribution infrastructure in SA, as most new renewable energy IPP (independent power producer) generation capacity has been installed in the Northern Cape, especially solar PV, and the Eastern Cape, especially wind. Yet, those two provinces have the least installed transmission and distribution capacity in the South African power system.

This creates multiple challenges locally that may not appear in national models, such as power evacuation constraints, power quality, and demand and load imbalance. “Strategically positioned energy storage would alleviate these locational challenges,” Oldacre stated.

The energy transition and opportunities for South Africa

David Sekgororwana, project development manager at the IDC (Industrial Development Corporation), explored the role of the IDC in the development of the energy storage industry, through a coordinated strategy that aims to position South Africa in adapting to global trends in energy transition to remain relevant and competitive.

One example of IDC’s involvement is a partnership with Bushveld Energy to develop the aforementioned vanadium value chain in energy storage. Further projects aimed at supporting the development of the lithium-ion battery value chain include:

- Production of cobalt sulphate and cobalt oxide as feedstock to produce NMC battery material for the Li-ion battery technology – capex is estimated at R350 million.
- Production of nickel sulphate as feedstock to produce NMC.
- Production of manganese sulphate as feedstock to produce NMC and LMO (lithium manganese oxide) based on Delta EMD technology now owned by University of Limpopo (UL).
- Production of NMC precursor material in collaboration with technology provider Beijing EASpring in China and with local technical expertise support from UL. Capex is estimated at R2 billion. Cobalt supply and price volatility are major risks to the project.
- Production of LMO precursor material in collaboration with UL and the department of science and innovation (DSI). Project is suspended pending improvements in market conditions.
- Expansion of the NMC precursor plant with lithiation capacity to advance the NMC precursor materials to NMC cathode materials.
- Production and development of lithium, nickel and cobalt resources as feedstock to affect the lithiation of NMC precursor materials to produce NMC cathode materials.

Automotive batteries and powertrain technologies

Hiten Parmar, director at uYilo eMobility Programme, focused on the increased uptake of electric vehicles (EV), driven in large part by worldwide regulatory requirements on fuel economy for emissions. He outlined the essential roles performed by batteries in automotive applications, from the conventional internal combustion engine through to hybrid and full electric vehicles.

Although electric vehicles are still a rare sight on South Africa’s roads, there is more going on than most of us realise. Parmar’s presentation showed that, as at June 2019, there were 4827 hybrid electric vehicles, 535 plug-in hybrid electric vehicles, and 472 battery electric vehicles in the country. Their utility is viable but somewhat constrained by a charging infrastructure which is mainly concentrated around major cities, with a total of 118 charging points countrywide.

SA is highly active in the electric mobility sector, which efforts are assisted by the national uYilo eMobility Technology Innovation Programme, which was established in 1993 to serve as a multi-stakeholder, collaborative programme focused on enabling, facilitating and mobilising the growth within the transport and complementary green economy sector in South Africa.

The resulting ecosystem encompasses everything from energy generation and smart grids, standards and charging infrastructure, to battery recycling, battery second life, mobility options and connectivity.

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Boom, doom and gloom, or something completely different?

As the end of 2019 looms, it's time to look ahead to what next year might have in store, and reflect on the year gone by. And what a year it's been. We've seen load shedding on a massive scale, outbreaks of xenophobic violence, Johannesburg City Power held to ransom by hackers, and now tornadoes – in South Africa!

The silver (or rather, gold) lining was undoubtedly the Springboks winning the Rugby World Cup – despite the fact that we had to witness images of Faf de Klerk in a speedo.

Running a profitable business in South Africa is not for the fainthearted. With the national treasury downgrading this year's growth forecast from 1.5% to 0.5%, and state-owned entities like Eskom negotiating more bail-out terms, local businesses and South African residents feel the urge to throw in the towel and look for greener pastures.

The truth, however, is that business is tough all over the world. Looking at protests in Hong Kong, Brexit and trade negotiations between China and the US, it is clear that there is no 'perfect' economy or country.

Our business has without a doubt experienced the weight of tough economic trading conditions, and we've had to work hard to remain competitive and profitable. But even though there are multiple economic factors within South Africa that we cannot control, we can determine how we respond to them.

In an ongoing effort to remain competitive and give our clients the best service, our business has matured into Actum Group. In 2006 management took over what was a relatively small, niche importer and distributor of electronic interconnect components. The business had been around for 35 years at the time, with an excellent name and reputation in the local electronics market. Actum Electronics is synonymous with quality and our customers have access to the best global brands on an exclusive basis.

We believe that Actum Group is in a favourable position to make a positive difference within the South African economy. We believe that honesty and integrity are more important than ever when doing business on our developing continent.

In conclusion
We know that in a harsh economic climate and hard world, that a company that cares, is a company that's strong. We are believers. We build trust. We invest in relationships and we will not compromise on quality. We look forward to continue growing our business and making a difference in South Africa in 2020.

For more information contact Actum Group, +27 11 608 3001, sales@actum.co.za

Actum Group remains resilient and optimistic for 2020

By the directors of Actum Group.
have been particularly noteworthy, or that I foresee for the electronics industry in 2020.

**Shifting distribution landscape**

All the broad-line electronic component distributors have virtual storefronts nowadays, but it's the online-only specialists – most notably Mouser and Digi-Key – that have really grown hand over fist in recent years, to the detriment of the old-school establishment. Two recent announcements have the potential to shake things up yet further.

In probably the biggest shock, Texas Instruments announced that it is terminating three of its major distribution agreements – with Avnet, World Peace Group (WPG) and Asia-Pacific distributor WT Micro – effective 31 December 2020. That followed just weeks after Avnet announced a deal with Chinese e-commerce giant Alibaba to open a superstore on Alibaba's 1688.com website.

I doubt whether this trend will migrate to our shores anytime soon (if ever) because in our local industry FAEs (field application engineers) play a vital role in product development rather than simply peddling components. What's more, Alibaba hardly registers on South African radar, or most other places in the Western world, but if Avnet starts selling through Alibaba, who's to say they (or another distributor) won't start selling through Amazon, or Takealot?

**The Icarus delusion**

Yekani Manufacturing took a big gamble last year when it invested R1 billion in a new mega-factory in East London. It seemed like a longshot at the time but there was generally hope that the company could reach the critical mass necessary to sustain such an ambitious venture.

Now, just 16 months after promising it would employ more than 1000 people, the company is instead retrenching more than 200 workers, according to an article from the *Daily Dispatch*. The article quotes Yekani group CEO Dr Siphiwe Cele taking an apparent swipe at the government by saying countless investment conferences would not solve the country's unemployment – but supporting local businesses would.

These comments come as President Cyril Ramaphosa addressed an investment summit in Johannesburg, and amid speculation that the Eastern Cape education department had bought tablet devices for R900 million from a company that imported them from China, rather than from Yekani which also manufactures similar devices. Members of state and provincial government hit back at Cele, instead blaming the company's failings on poor management.

I guess the moral of the story is that in the current climate, it’s wiser for electronics manufacturers to ‘stay in their lane’ and focus on niche markets and smaller opportunities, rather than flying too close to the sun.

**The Fourth Industrial Revolution, IoT, and AI**

Because, of course. No matter where in the world you are, there’s no getting away from these themes, and they invariably go hand in hand. There is indeed enormous potential in using these modern concepts to create innovative solutions for African challenges. Not all South Africans are convinced, however.

A recent survey by Kagiso Trust on how aware, prepared and enabled South Africa is for the impact of the Fourth Industrial Revolution (4IR) found that:

- Almost half (49,1%) of the respondents believed that there will be a societal impact from 4IR.
- Two in five of the respondents believe that there will be no job creation with the advent of 4IR.
- Just over half of the respondents were of the view that 4IR will result in large-scale job losses, with two in five believing it will lead to social unrest.
- Only a quarter of the respondents believe that the 4IR will improve societal equality.
- A third of the respondents believe that during the 4IR there will be an improvement to service delivery.
- More than half of the respondents believe that there will be an improvement in re-industrialisation from the 4IR. Government and private sector respondents were optimistic about 4IR.

I find it unsurprising that so many people are unconvinced about 4IR having a positive societal impact. Perhaps that perception will gradually change, but one thing for certain, going by the number of conferences and private and public sector initiatives centred on 4IR, is everybody’s going to be talking about it, a lot.
Additional renewable energy development zones proposed

The second phase of the Strategic Environmental Assessment (SEA) for wind and solar photovoltaic (PV) energy in South Africa proposes three additional Renewable Energy Development Zones (REDZs) for wind and solar photovoltaic energy projects.

The REDZs support the responsible implementation of the Integrated Resource Plan (IRP 2019) that was recently gazetted by the minister of mineral resources and energy on 17 October 2019. Renewable energy projects that could be developed in these new REDZ have the potential to make significant contributions to mine rehabilitation and to support a just energy transition in the specified areas, including where 12 GW of existing coal power stations are planned to be decommissioned by 2030.

The IRP 2019 has identified the requirement for at least an additional 14,4 GW of wind and 6,0 GW of solar PV power by 2030 amongst a range of other new-build capacity including coal, gas, imported hydro and storage. There is a distinct need for rehabilitating areas where existing coal power stations are expected to be decommissioned and possibly repurposing these for a range of diverse economic activities including renewable energy deployment which can be fast tracked if within the new REDZs.

The outcomes of the second phase of the SEA for wind and solar PV energy in South Africa were presented to stakeholders at the CSIR in Pretoria on 26 September 2019. This study was commissioned by the national Department of Environment, Fisheries and Forestry (DEFF). The two new REDZs for PV are in the Emalahleni and Klerksdorp areas and the third one, which focuses on wind energy, is located to the east of Beaufort West.

CSIR environmental scientist, Abulele Adams, conveyed that one of the main aims of the Phase 2 SEA was to identify previously mined areas close to the Gauteng area where the highest demand for energy is, in order to incentivise large-scale solar PV projects in this area.

“...In this way, the new renewable energy projects can contribute towards the rehabilitation of previously mined areas, support job creation in the areas, especially where there may be a decline in mining, and potentially make use of existing infrastructure, such as the electricity grid and roads from previous mining activities,” she explained.

She further emphasised that it is important to plan renewable energy development in these previously mined areas to ensure that renewables play a role in the just transition to a low-carbon economy.

The identification of the new REDZs involved positive mapping (i.e., ‘pull factors’), which included factors such as the abundance of the existing wind and solar PV energy resources, access to the power corridors, and other technical criteria required for renewable energy facilities.

This was followed by negative mapping (i.e., ‘push factors’), which included environmental features and areas that are sensitive to the placement of large-scale wind and solar PV facilities. Thereafter, an industry prioritisation exercise was conducted to ensure that the
Locally developed electronic circuit builder for students

K Measure, creator of the award-winning Seebox engineering education solution, has created a new innovation to enable quick and easy electronic circuit-building. The SeeBlocks electronic circuit creator comes from a different angle to address a real problem for engineering students in a novel way.

An essential part of mastering electrical and electronic engineering is practical circuit-building. Those new to electronics find building circuits difficult because they have to interpret the circuit diagram and then translate that to actual components, which look nothing like the symbols. SeeBlocks remove this barrier by integrating the abstract symbols and the actual circuit boards into one easy-to-use circuit-builder kit.

The patented SeeBlocks are component blocks each containing one electronic component on the bottom of the block, with the symbol on the top. The blocks fit together with an innovative locking mechanism on an expandable baseboard. With SeeBlocks you build circuits almost like you would a puzzle, fitting together the blocks by following the symbols. SeeBlocks aim to make it easy for users, young and old, to explore the world of science and electronics through lots of practical experimentation. SeeBlocks also come with a free introductory online course with videos and experiments to get the user started.

Paid follow-up courses cover the fundamentals of electricity and electronics and give a good basic foundation for further studies in engineering. The online courses consist of explainer videos, questions and maths problems, integrated with practical experiments done on the SeeBlocks circuit-builder system.

The creators of SeeBlocks say this innovation was born from their passion for engineering education, and after many educators told them that the practical component of electrical and electronic technology is especially challenging to learners. They set out to create an easier way to build electronic circuits, in the belief that the actual building of the circuit should not be a barrier to understanding electronics, but rather actual building of the circuit should not be a barrier to understanding electronics, but rather rather through lots of practical experimentation. SeeBlocks also come with a free introductory online course with videos and experiments to get the user started.

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For more information contact K Measure, info@seeblocks.education

Clearing the Static

with Greg Barron, Actum Group
director

Topic 9:
Time to audit your ESD environment

Now that we are nearing the end of the year, it is a good time to audit your existing static control products and procedures. The first line of defence should be your antistatic floor, since this is the biggest component within your static control programme.

The scuff of a shoe or scraping of a chair on a floor could create an electrostatic imbalance, causing an electrostatic discharge. Take the necessary precautions now to ensure your business enters the new year compliant and guarded.

The Polyflor ESD Range
(Content provided by Polyflor)

The Polyflor ESD range has been specifically engineered to combat electrostatic discharge (ESD) at the source by facilitating a uniform flow of static electricity directly to a ground point. The range includes static dissipative, electrostatic conductive, and conductive ROF floorings.

This flooring has excellent abrasion and chemical resistance, and can be welded to create a completely impervious floor, offering no sanctuary to dirt and bacteria. The closed surface and high vinyl content make Polyflor ESD floor coverings easy and economical to maintain.

Treatments for older flooring

If your floor has been in use for five years or longer and is looking dull, we do have a range of specialised ESD cleaning or strip and seal applications.

Apart from daily sweeping and mopping, it is recommended to seal your floor with an antistatic coating to restore its electrical properties, physical longevity, and gloss. For vinyl flooring we recommend the ACL Staticide 4600 Floor Finish range. For daily floor cleaning, we recommend the ACL Staticide 4020: an antistatic, neutral and non-abrasive cleaner that can be used in all facilities.

Altico Static Control Solutions can visit your premises and inspect your flooring to ensure your business is compliant and guarded.

For more information contact Altico Static Control Solutions on +27 11 608 3001 or email sales@actum.co.za to discuss your static control requirements.
Winning hackathon entry curbs cell tower battery theft

The fourth annual TADHackJHB was held at MTN’s head office in Fairland, Johannesburg, on 12 and 13 October, with a cell tower protection app emerging as the winner.

The theme for the 2019 global TADHack was ‘Localised and Contextualised – Battle of the Bots’, in which participants were required to develop technology solutions to address challenges facing communities in South African townships. A duo calling themselves ‘#1632’ pocketed the prize of $1000 (approximately R15 000) for their winning solution CharOn, which allows individuals to report suspicious activity within the vicinity of cell towers. If the app collects enough data of the same case being reported, authorities will be notified.

“Hackathons such as the TADHack serve as an invaluable incubation hub where innovative and scalable solutions that address some of the socio-economic challenges are created. At MTN, we are proud to provide young people with the platform to showcase their creative talent and to leverage the power of technology to develop home-grown solutions. We believe that by supporting initiatives such as TADHack, we are contributing positively to the growth and development of the app development industry, and we are positioning our youth to play a meaningful role in the Fourth Industrial Revolution,” said MTN’s executive: Information Technology, Phinda Ncala.

The submissions were evaluated by a panel of judges with industry experience. This year’s edition attracted 200 participants, making TADHackJHB the largest location globally with a high number of participants who submitted 47 projects vying for the top prize.

TADHack runs simultaneously in more than 30 locations and encourages young creative minds to build solutions to problems using telecoms and other application programming interfaces (API).

According to statistics from Hackathon.com, the largest online hackathon community worldwide, 5636 public and internal hackathons were organised in 2018 globally, nearly 40% more than in 2016. Hackathon.com noted that 64% of hackathons in 2018 were public hackathons where companies tap into the expertise of the developer and startup ecosystem. The organisation also found that other industries are beginning to realise the importance of hackathons as sources of innovation.

“This format is gaining more popularity as 18% of financial services institutions, 17% of manufacturing and 16% of retail companies ran internal hackathons this year (2018), as they are profiting from using internal expertise to foster intrapreneurship and boost cross-team collaboration to develop business solutions in order to remain competitive and improve overall working processes,” Hackathon.com noted.

For more information visit http://tadhack.mtn.co.za
Extending its RT FPGA offering to bring these capabilities to emerging high-performance space applications, Microchip Technology introduced the RT PolarFire FPGA that is optimised to meet the most demanding requirements in spacecraft payload systems’ high-speed data paths with the lowest possible power consumption and heat generation.

“We are supporting an evolving set of on-orbit space applications that need high levels of operating performance and density, low power consumption and minimal heat dissipation, while reducing system-level costs,” said Bruce Weyer, vice president of Microchip’s FPGA business unit. “Our RT PolarFire FPGA enables the major leap in computing throughput required for these applications including processing-intensive neural networks for object detection and recognition, high-resolution passive and active imaging, and high-precision remote scientific measurement, while maintaining a path to QML qualification.”

A growing number of space applications need greater computational performance so they can transmit processed information rather than raw data and make optimal use of limited downlink bandwidth. The RT PolarFire FPGA enables this at significantly lower cost and with faster design cycles than possible with application-specific integrated circuits (ASICs).

It also reduces power as compared to the alternative of using FPGAs based on static random access memory (SRAM) while eliminating their vulnerability to radiation-induced configuration upsets. The RT PolarFire FPGA is supported by all necessary radiation data, specifications, package details and tools customers need to start new designs now, initially with the commercial version of the device.

The RT PolarFire FPGA builds on the success of Microchip’s RTG4 FPGA, which has been widely deployed in space applications that require its radiation-hardening by design against single event upsets (SEUs) and inherent immunity to single event latch-ups (SELs) and configuration upsets.

For space applications that require up to five times the computing throughput, the RT PolarFire FPGA provides 50 percent more performance and triple the logic elements and serialiser-deserialiser (SERDES) bandwidth. It also provides six times the amount of embedded SRAM to enable more system complexity than previously possible using FPGAs and withstands total ionising dose (TID) exposure beyond the 100 kilorads (kRads) that is typical of most earth-orbiting satellites and many deep-space missions.

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

Radiation-tolerant PolarFire FPGA

Developers of spacecraft electronics use radiation-tolerant (RT) field programmable gate arrays (FPGAs) to create on-board systems that meet the demanding performance needs of future space missions, survive the brutal launch process and continue to operate reliably in the harsh environment of space.

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Rugged single-board computer

ETION Create released the 2nd in its family of 3U OpenVPX COTS modules. The VF370 3U OpenVPX single-board computer (SBC) is based on the Intel Atom E3900 series of embedded processors and Intel Cyclone V FPGA technology. Combined with an FMC mezzanine site, the VF370 provides a scalable platform with real-time processing power and flexible I/O options for reduced size, weight and power (SWaP) applications. It is available in standard air-cooled and rugged conduction-cooled variants.

The Intel Atom E3900 series dual- and quad-core processors offer enhanced processing power in a compact, low-power package running at burst speeds of up to 2.0 GHz with 4 GB of DDR3L ECC memory for high-reliability applications.

The Atom's integrated graphics processor (GPU) with 18 execution units, running at up to 650 MHz, provides greatly increased video encode and playback performance, with Ultra HD 4K resolution @ 60 Hz for surveillance and other video intensive applications.

Intel's Time Coordinated Computing technology (TCC) can synchronise networks of devices to within 1 μs, greatly improving the real-time deterministic behaviour of time-critical systems. The new Intel Trusted Execution Engine (TXE) offers enhanced data and operations protection, complemented by fast cryptographic execution (through Intel AES new instructions) and secure boot features, such as Intel Boot Guard 2.0 to ensure operating system, application and user data integrity and protection.

The combination of the Atom processor, Cyclone V FPGA and FMC site provides a highly flexible architecture that supports a wide range of I/O requirements for real-time applications requiring FPGA pre-processing together with post-processing running on the multi-core Atom processor.

The Cyclone V FPGA's logic and DSP resources, combined with dedicated DDR3 memory and high-speed SERDES interfaces, supports processing of algorithms with large memory size and bandwidth requirements.

The FPGA connects to a VITA 57 high pin count (HPC) FMC connector through 58 pairs of LVDS/LVTTL signals and four high-speed SERDES interfaces for JESD204B and other protocols.

The novel, zero footprint FMC IO connector routes up to 32 differential signals from the FMC site to the P2 VPX connector for backplane- or rear-I/O from the FMC module, as is typically required in conduction-cooled systems.

The optimised OpenVPX interface with slot profile SLT3-PAY-2F2U-14.2.3 provides a wide range of backbone interfaces and a highly-configurable PCIe Gen2 based data plane, supporting high data throughput into and out of the VF370.

The VF370 Payload module can act as a VPX system controller (PCIe root complex) or PCIe endpoint, and supports non-transparent PCIe bridge (NTB) mode on the DP01 or DP02 PCIe interfaces for applications requiring multiple processing cards or redundant system controllers.

Processor interfaces include USB3, SATA, DP/HDMI, I2C, GPIO, RS-422/485, 2x Ethernet and others. A maintenance USB interface facilitates development, system integration and maintenance of processor software and FPGA firmware.

The VF370 is Mil-Std-810G environmentally qualified and targets applications such as rugged mission computers for aerospace, maritime and land systems, Ultra HD video and graphics processing, industrial control, low-power (SWaP) and many others. The following board support packages (BSP) are available:

- Linux distribution and BSP.
- Windows 10 BSP.
- FPGA firmware development kit (FDK).

ETION Create’s range of COTS-ZA board level products are proudly South African designed products that provide high local content multipliers to the local industrial and defence markets, and provide additional benefits such as local product support and obsolescence management, software and FPGA firmware development services, and custom FMC development services to accommodate bespoke I/O requirements.

For more information contact ETION Create, sales.etioncreate@etion.co.za

Neuromorphic memory solution for AI

As artificial intelligence (AI) processing moves from the cloud to the edge of the network, battery powered and deeply embedded devices are challenged to perform AI functions – like computer vision and voice recognition. Microchip Technology, via its Silicon Storage Technology (SST) subsidiary, is addressing this challenge by significantly reducing power with its analog memory technology, the memBrain neuromorphic memory solution.

Based on its industry proven SuperFlash technology and optimised to perform vector matrix multiplication (VMM) for neural networks, Microchip’s analog Flash memory solution improves system architecture implementation of VMM through an analog in-memory compute approach, enhancing AI inference at the edge.

As current neural net models may require 50 million or more synapses (weights) for processing, it becomes challenging to have enough bandwidth for an off-chip DRAM, creating a bottleneck for neural net computing and an increase in overall compute power. In contrast, the memBrain solution stores synaptic weights in the on-chip floating gate – offering significant improvements in system latency.

When compared to traditional digital DSP and SRAM/DRAM based approaches, it delivers 10 to 20 times lower power and significantly reduced overall BOM.

The memBrain solution is being adopted by today’s companies looking to advance machine learning capacities in edge devices. Due to its ability to significantly reduce power, this analog in-memory compute solution is ideal for any AI application.

For more information contact Dirk Venter, Altron Arrow, +27 11 923 9600, dventer@arrow.alitech.co.za
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Signal recorder for military intelligence

A new addition has been made to the family of Talon signal recording and playback systems from Pentek. The RTR 2654 26,5 GHz RF Sentinel intelligent signal scanning rackmount recorder combines the power of a Pentek Talon recording system with a 25,6 GHz RF tuner and Pentek’s Sentinel signal scanning software.

The RTR 2654 automatically scans the RF spectrum from 800 MHz to 26,5 GHz for signals of interest and monitors or records bandwidths up to 500 MHz wide, making it very suitable for military, security and government intelligence (SIGINT, COMINT and ELINT) applications.

A Pentek Model 78141 Jade transceiver module serves as the data acquisition engine of the recorder. One of its dual 3,2 GSps 12-bit A/D converters is operated at a sample rate of 2,8 GSps. The Model 78141 is coupled to the 500 MHz bandwidth IF output signal of a 6 GHz RF tuner front end with high dynamic range across its entire spectrum. A digital downconverter (DDC) provides frequency zooming for signal bandwidth steps of 500, 280 or 140 MHz.

The Sentinel recorder provides automated signal monitoring and detection. The user specifies a start and stop frequency for the scan, covering any range between 800 MHz and 26,5 GHz. The RF tuner and DDC step across the scan range in consecutive bands, each programmable up to 500 MHz in width. Threshold RF energy in each band can be automatically started during a scan by configuring signal strength threshold levels to trigger a recording of the detected band. Once a signal of interest is detected, the real-time recorder can capture and store hundreds of terabytes of data to disk, allowing users to store data spanning multiple days.

Sentinel recorders are built on a Windows workstation with an Intel Core i7 processor and provide both a GUI (graphical user interface) and API (application programming interface) to control the system. Systems are fully supported with Pentek’s SystemFlow software for system control and turnkey operation.

The SystemFlow software has been enhanced to include intelligent scanning and integrated control of the RF tuner and optional RF up-converter. The software provides a GUI with point-and-click configuration management and can store custom configurations for single-click setup. It also includes a virtual oscilloscope, spectrum analyser and spectrum to monitor signals before, during and after data collection.

Post-processing and analysis software tools like Matlab can be installed on the Talon RTR 2654 platform. Data files are recorded to the Windows native NTFS file system, which gives operators immediate access to recordings without the need for any file format conversion.

The Talon RTR 2654 is packaged in a 4U 19” rack-mountable chassis, with removable front panel and hot-swappable solid state drives (SSDs), front panel USB ports and I/O connectors on the rear panel. The SSDs are available in 7,6 to 245,7 TB configurations, supporting RAID levels 0, 5 or 6. Options include GPS time and position stamping and 10GbE or 40GbE offload facilities.

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

New edition of Altium Designer announced

Altium recently announced the newest version of Altium Designer, a complete software environment for the design and realisation of printed circuit boards (PCB).

The latest release, Altium Designer 20, features major upgrades to the software’s unified design environment, user experience, and PCB design capabilities.

New ‘push and shove’ capabilities enable routing of complex HDI boards and can speed up design times by over 20%, even for simple printed circuit boards, according to Altium. More advanced routing enables users to efficiently design high-density and high-speed boards using modern SerDes like PCIe 4.0/5.0, USB 3.2, 100G Ethernet and parallel buses like DDR3/4.

The latest release leverages ‘ActiveBOM’ capabilities, including supplier search, BOM (bill of materials) rule checking, and live part choices, for multi-board assemblies. Users can also export 3D PDF files of the multi-board assembly, allowing collaborators to view and manipulate 3D assemblies.

For applications where high-voltage design is critical (e.g. spacecraft, high-altitude aircraft, and high-tech lasers), Altium Designer 20 provides new creepage rules that help maintain high-voltage clearances across the PCB surfaces for prevention of electrical arcing hazards for power supply and mixed-signal device designs.

User productivity is improved with new dynamic compilation capability, providing quick access to data across schematic, layout, BOM generation, design documentation, and other elements of Altium Designer’s unified design environment.

Cloud-based ECAD component management

Altium also unveiled Concord Pro, a cloud-based application for ECAD (electronic computer-aided design) component management.

Electronic components play a central role in the design and realisation of PCBs, and the effective creation and reuse of component data in the PCB design process is key, including footprints, schematic symbols, and 3D models. Until now, most PCB designers have created and stored component data in private file systems rather than in a shared, managed, and maintained library. Others have tried to use shared spreadsheets or proprietary databases.

These outdated approaches led to multiple redesign cycles due to redundant, inaccurate or outdated component data that is often discovered only late in the product development process, when board designs are sent to manufacturers.

Altium Concord Pro helps ensure that all of an organisation’s designers, buyers, and manufacturing partners have access to the same set of component data by simplifying the setup, configuration, use, and maintenance of managed component libraries. The system also ensures that component information is reliable and up to date through its built-in connectivity to Octopart supply chain information.

Users can try using Concord Pro in the cloud, powered by Altium 365, Altium’s newly launched collaborative platform. Concord Pro is also available on-premise, accessible through Altium Designer 19 and Altium Designer 20.

For more information contact EDA Technologies, +27 12 665 0375, sales@edatech.co.za
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Design considerations for powering remote Bluetooth beacons

By Tim Parker, Avnet Abacus.

One of the most exciting low-power wireless technologies to emerge in the last couple of years is Bluetooth beacon technology, which involves placing small electronic beacon devices at points of interest that broadcast packets of information via Bluetooth low energy to the smartphones of passers-by.

These packets of information can be used to help the smartphone determine where it is, since the location of the beacon is known, which can be useful for navigating around indoor areas like airports and shopping malls where GPS isn’t available.

The other major use case is retail advertising, whereby a beacon placed within a display for a certain product broadcasts a coupon or offer code for that product to the smartphone of a user who is lingering at that particular display. There are many hundreds more use cases for Bluetooth beacons but these are probably the most popular for this technology to date.

Fitting a Bluetooth beacon in a retail environment or airport must of course involve consideration of how the device will be powered. Mains power may be available for new installations, but more often than not it is easier and more convenient to have the beacon powered by small batteries.

Batteries mean the devices can be installed instantly, and moved whenever required, and Bluetooth low energy technology, combined with today’s battery technology, means it may be months or years before the batteries need replacing.

The first thing to consider when selecting a battery for a Bluetooth beacon design is whether to go with primary chemistries (non-rechargeable) or rechargeable types. For primary battery solutions, the batteries’ capacity and longevity is obviously of paramount importance to avoid costs incurred when replacing them, including both the cost of the new batteries and the labour cost associated with changing them – this may seem small but if an airport has hundreds of beacons installed for indoor navigation it quickly becomes significant. If beacons are deployed in remote or inaccessible locations this problem is compounded. Replacement costs also apply to rechargeable batteries that may have failed for whatever reason; reliability is therefore crucial for both battery types.

Both primary and rechargeable batteries will need to work across a wide operating temperature range, and rechargeables will need to be able to recharge at these temperatures too. For industrial applications, this might mean operating at up to 85°C, though some indoor applications (particularly in confined spaces) also get very hot.

If it’s outdoors, it will need to work in negative temperatures and when the weather is humid. Another key consideration is the physical size of the batteries. Beacons are compact devices, designed to be fitted in small spaces, and they also have to look unobtrusive. This means that both batteries’ size and their power density/energy density are important.

The electrical considerations for different types of batteries include the voltage they can provide. Higher-voltage batteries are usually deemed more desirable as it may be possible to use fewer cells than an equivalent solution using lower-voltage types. The current that the batteries can provide at their peak discharge level is a useful measure of whether they can provide enough power for your application.

Other characteristics to look out for include self-discharge figures; for long-life applications like beacons, we need something without much self-discharge as we want the batteries to last for a long period of time. If your application recharges its batteries in situ, perhaps from a solar panel mounted on the beacon or some other form of energy.
harvesting, the battery must be able to accept a wide range of recharging voltages and currents from the energy harvesting solution, and be able to use the tiny amounts of energy these solutions provide.

**Primary chemistries**

Batteries' mechanical and electrical properties are in large part dependent on their different chemistries.

The most widely used primary chemistry in consumer electronics devices is alkaline, but these are unlikely to suit beacon applications as they simply don't last long enough. Their low cost and wide availability from convenient locations such as supermarkets is offset by the number of times alkaline batteries will need to be changed over the life of the product. They are also low-voltage (typically less than 1.5 V) and have a limited temperature range of 0°C to 60°C.

The major alternative to alkaline for primary batteries is chemistries based on lithium. Lithium cells have the highest available energy density and provide relatively high voltages, between 2.7 and 3.6 V dependent on their exact chemistry.

One of the most popular lithium chemistries is lithium iron disulphate (LiFeS2), as it's relatively inexpensive and can deliver high pulse currents. Lithium manganese dioxide (LiMnO2) batteries are also widely used in consumer electronics, particularly in compact applications, as they can provide 3 V (enough to replace two 1.5 V alkaline batteries). However, both these chemistries' temperature range is just -20°C to 60°C and they have a relatively high self-discharge rate.

Lithium thionyl chloride (LiSOCl2) cells are a more expensive choice than some of the other lithium chemistries, but they offer the highest energy density of all. They have several other advantages, including very long battery life, even under extreme temperature and humidity cycles.

Lithium thionyl chloride devices can typically operate at -40°C to +85°C, but those made with the most robust bobbin construction (such as in Figure 2) can withstand up to -80°C to 125°C in some cases. They can last between 10 and 40 years, depending on the quality of the raw materials and construction. Self-discharge can be as low as 0.7% per year, ideal for remote applications such as beacons.

A great example is Tadiran’s PulsesPlus series of lithium thionyl chloride batteries (Figure 3), which provide 3.6 V with only 0.7% self-discharge, ideal for Bluetooth beacon applications. Five models provide a choice of capacity between 2.5 and 38 Ah, and they can support high pulse current for transmission of RF signals.

**Rechargeable chemistries**

Rechargeable chemistries include nickel metal hydride, lithium ion and lithium polymer. Of these, consumer grade lithium-ion batteries are the most widely used today; they last up to five years if charged correctly and have an operating temperature range of -10°C to 60°C, which may suit a beacon application. Lithium polymer batteries, like the types used in smartphones, are primarily lauded for their thin form factor as they can be made in sheets.

Some modern nickel metal hydride (NiMH) cells, such as the Robust85 series from Varta, are reliable enough for beacon applications. Their temperature range is -25°C to 85°C, they last five years at 45°C, and can offer anywhere between 1.2 and 4.8 V to the application. Compared to lithium chemistries, their charging requirements are relatively simple, allowing continuous charging as the risk of overcharging is low.

Ultimately, the exact battery choice for a successful Bluetooth beacon design will depend on the exact nature of the deployment but, broadly speaking, lithium thionyl chloride and rechargeable nickel metal hydride batteries offer the best energy densities combined with longevity, reliability and cost effectiveness.

Avnet Abacus carries a wide range of both types from specialist suppliers including Tadiran, Varta, and many more. If you have specific battery requirements or would like to discuss your design in more detail, get in touch with local representative, Avnet South Africa.

For more information contact Avnet South Africa, +27 11 319 8600, sales@avnet.co.za
Bits to beams: RF technology evolution for 5G millimetre-wave radios

By Thomas Cameron, Ph.D., Analog Devices.

When the wireless industry embarked on the creation of 5G, 2020 seemed so far away. Now we are quickly closing in on 2020 and this will most certainly be the 5G decade. Every day there are announcements in the press of new field trials and upcoming commercial 5G rollouts.

It’s a very exciting time for the wireless industry. Currently, much of the industry 5G focus is on enhanced mobile broadband, driving toward higher and higher network capacity and throughput utilising beamforming techniques in the mid-band and high-band spectrum. We are also beginning to see use cases emerge, such as industrial automation, that leverage the low latency features of the 5G network architecture.

It was only a few years ago that the industry was debating the feasibility of using the millimetre-wave spectrum for mobile communications and framing the challenges that lay ahead for the radio designer. Much has transpired in a short time and the industry has progressed rapidly from initial prototypes to successful field trials and now we are on the verge of the first commercial 5G millimetre-wave deployments.

Many of the initial deployments will be for fixed or nomadic wireless applications, but we will also see truly mobile connectivity at millimetre-wave frequencies in the not so distant future. The first standards are in place, technology is quickly evolving, and much learning has transpired around the deployment of millimetre-wave systems. While we have made much progress, there remain many challenges ahead for the radio designer. Let’s examine some of these challenges for the RF designer in the remainder of this article.

Deployment scenarios and propagation considerations

When we are developing technology, it’s critical to understand how the technology will ultimately be deployed. In all engineering exercises, there are trade-offs to be made, and with additional insight creative innovations may emerge. In Figure 1, we highlight two of the common scenarios being explored today in the 28 GHz and 39 GHz spectrum.

Figure 1a illustrates a fixed wireless access (FWA) use case, where we are trying to deliver high-bandwidth data to homes in a suburban environment. In such a case, the base station will be on a utility pole or tower and is required to cover a large area to produce a positive business case.

In the initial deployments, we assume that the coverage is outdoor to outdoor, whereby the customer premises equipment (CPE) is mounted outdoors and the link may be engineered to ensure the best over-the-air connection. Given that the antenna is pointing down and users are fixed, we may not require a large amount of vertical steering range, but the transmitted power may be quite high, in excess of 65 dBm EIRP to maximise the coverage and leverage existing infrastructure.

In Figure 1b we illustrate a dense urban scenario, where the base station will be mounted lower to the ground on a building rooftop or façade, possibly evolving to streetlight or other street-level mounting in the future. In any case, this type of base station will require vertical scanning ability to deliver signals across the entire building elevation and eventually to mobile or nomadic users on the ground (pedestrians and vehicles) as mobile devices emerge.

In this case the transmitted power may not need to be so high as in the suburban case, although low-E (low-emissivity) glass has proven to be a problem for outdoor to indoor penetration. As shown, we will need more flexibility in the beam scanning range, in both the horizontal and vertical axes. The major takeaway here is that there is not a one-size-fits-all solution. The deployment scenario will determine beamforming architecture and the architecture will influence the choice of RF technology.

Millimetre-wave beamforming

Now let’s consider the various approaches to beamforming: analog, digital, and hybrid, as shown in Figure 2. I’m sure we are all familiar with the concept of analog beamforming as this topic has been quite popular in the literature in recent years. Here we have data converters translating the digital signals to and from broadband baseband or IF signals, connecting a radio transceiver performing the up-conversion and down-conversion processes.

At RF (for example, 28 GHz), we split the single RF path into several paths where we perform the beamforming by controlling the phase of each path so that a beam is formed in the far field in the direction of the intended user. This enables a single beam to be steered per data path, so in theory we can serve one user at a time with this architecture.

The digital beamformer is exactly what it sounds like. The phase shift is purely implemented in the digital circuitry and then fed to the antenna array through an array of transceivers. Simply speaking, each radio transceiver is connected to a single antenna element, but in practice there could be several antenna elements per radio depending on the desired sector shape.

The digital approach enables the highest capacity and flexibility and enables the roadmap to multi-user MIMO at millimetre-wave frequency,
similar to mid band systems. It is highly complex and, given currently available technology, will consume an excessive amount of DC power both in RF and digital circuits. However, as technology evolves in the future, digital beamforming will emerge for millimetre-wave radios.

The most practical and effective beamforming approach in the near term is the hybrid digital-analog beamformer, which essentially combines digital precoding and analog beamforming to create several beams simultaneously in a space (spatial multiplexing). By directing power toward the intended users with narrow beams, the base station can reuse the same spectrum to simultaneously serve more than one user in a given timeslot.

While there are a few different approaches to the hybrid beamformer reported in the literature, the subarray approach shown here is most practically implemented and is essentially a step and repeat of analog beamformers. Currently, reported systems support from 2 up to 8 digital streams in practice, which can be utilised to simultaneously support individual users, or alternatively provide 2 or more layers of MIMO to a lesser number of users.

**Millimetre-wave radio: From bits to millimetre-wave and back**

Let’s move on now to the bits-to-millimetre-wave radio in more detail and explore the challenges in this section of the system. It’s critical to translate the bits to millimetre-wave and back with high fidelity to support high order modulation techniques such as 64 QAM and possibly as high as 256 QAM in future systems.

One of the main challenges for these new radios is bandwidth. The 5G millimetre-wave radios must nominally process 1 GHz of bandwidth or possibly higher depending on how the spectrum is allocated in practice. While 1 GHz of bandwidth at 28 GHz is a low relative (3.5%) bandwidth, that same bandwidth at an IF of, say, 3 GHz is much more challenging to design for and requires some leading-edge technology to achieve a high-performance design.

Figure 3 illustrates an example of a block diagram for a high-performance bits-to-millimetre-wave radio based on components from Analog Devices’ broad RF and mixed-signal product portfolio. This signal chain has been demonstrated to support contiguous 8 - 100 MHz NR carriers at 28 GHz with exceptional error vector magnitude (EVM) performance. More details on this signal chain and its demonstrated performance can be found in the Analog Devices video, ‘5G Millimetre-wave Base Station’ ([www.dataweek.co.za/*ADI-5G-vid](http://www.dataweek.co.za/*ADI-5G-vid), redirects to www.analog.com/en/education/education-library/videos/5804450511001.html).

Let’s consider data converters. In the example in Figure 3, we show direct high-IF transmitter launch and high-IF receiver sampling used, where the data converters are launching and receiving at the intermediate frequency. The IF needs to be as high as can be reasonably achieved to avoid unwieldy image filtering at RF, driving the IF frequency to 3 GHz and above. Fortunately, leading-edge data converters are capable of operating at this frequency.

The AD9172 is a high performance, dual, 16-bit DAC that supports sample rates up to 12.6 GSps. The device features an 8-lane, 15 Gbps JESD204B data input port, a high-performance, on-chip DAC clock multiplier, and digital signal processing capabilities supporting broadband and multiband direct-to-RF signal generation up to 6 GHz.

In the receiver we show the AD9208, a dual, 14-bit, 3 GSps ADC. The device has an on-chip buffer and a sample-and-hold circuit designed for low power, small size, and ease of use. This product is designed to support communications applications capable of direct sampling wide bandwidth analog signals of up to 5 GHz.

In both the transmit and receive IF stages we suggest digital gain amplifiers that convert from single to balanced and vice versa to avoid the use of baluns. Here we show the ADL5335 in the transmit chain and the ADL5669 in the receive chain as examples of high performance broadband amplifiers.

For the up-conversion and down-conversion between IF and millimetre-wave, we have recently introduced both a silicon-based broadband up-converter, the ADMV1013, and a down-converter, the ADMV1014. These broadband frequency conversion devices operate from 24.5 GHz to 43.5 GHz. This broad frequency coverage allows the designer to address all of the currently defined 5G millimetre-wave spectrum bands (3GPP bands n257, n258, n260, and n261) with a single radio design. Both support an IF interface up to 6 GHz and two frequency conversion modes.

**Figure 2. Various approaches to beamforming.**

Continued on page 20
As shown in Figure 3, both devices include an on-chip 4x local oscillator (LO) multiplier with LO input ranging from 5.4 GHz to 11.75 GHz. The ADMV1013 supports both direct conversion from baseband I/Q to RF and simple sideband up-conversion from IF. It provides 14 dB of conversion gain at a high output IP3 of 24 dBm. If implemented in a single sideband conversion, as illustrated in Figure 3, the device provides 25 dB of sideband suppression.

The ADMV1014 supports both direct conversion from RF to baseband I/Q and image reject down-conversion to IF. It provides a conversion gain of 20 dB with a noise figure of 3.5 dB and an input IP3 of -4 dBm. The sideband suppression in image reject mode is 28 dB.

The final component in the RF chain is the ADRF5020 broadband silicon SPDT switch. The ADRF5020 provides both a low insertion loss of 2 dB and high isolation of 60 dB at 30 GHz.

Finally, let’s discuss the frequency sources. Given that the local oscillator may be a large contributor to the EVM budget, it’s important to use a source with very low phase noise for the millimetre-wave LO generation.

The ADF4372 is a wideband microwave synthesiser with an industry-leading integrated PLL and ultralow phase noise VCO with output capable of 62.5 MHz to 16 GHz. It allows for the implementation of fractional-N or integer-N phase-locked loop (PLL) frequency synthesizers when used with an external loop filter and an external reference frequency. VCO phase noise at 8 GHz is an impressive -111 dBc/Hz for 100 kHz off set and -134 dBc/Hz at 1 MHz offset.

The u-blox NINA B4 enables wireless mesh networks, which offer robust communication between large numbers of connected devices, extending the reach of messages by relaying them from node to node until they reach their destination. By simplifying the control of groups of devices, mesh networks are well suited for applications such as smart lighting systems in cities and buildings, which further benefit from the module’s enhanced operating temperature range (up to 105°C).

Featuring Bluetooth long range, the NINA B4 series is ideal for deployments in harsh environments, e.g. to enable wirelessly connected and configurable equipment. Long range not only increases the distance that Bluetooth signals can travel in undisturbed environments, it also makes communications more robust and reliable in unfavourable ones, common in production plants or on factory floors.

The NINA B4 series comes with the u-blox u-connect software, simplifying the integration of Bluetooth into new and existing products by providing an easy-to-use interface to configure the connectivity required.

As the 5G ecosystem continues to evolve, Analog Devices will continue to bring its leading-edge technologies and signal chain solutions to enable its customers to develop differentiated systems for the emerging 5G millimetre-wave market.

For more information contact Conrad Coetzee, Altron Arrow, +27 11 923 9600, ccoetzee@arrow.altech.co.za

NINA B4 further stands out for its powerful Arm Cortex-M4F MCU with an open CPU architecture, allowing customers to run their own applications right on the module. Supporting Zigbee and Thread, the first members of the NINA B4 family come with an internal PCB antenna, or alternatively, with a U.FL connector for an external antenna of choice.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za
5G RF components for the next generation

Pasternack recently announced a comprehensive portfolio of 5G RF solutions serving the urgent needs of engineers and technicians around the world with high-grade RF components and cable assemblies shipped same-day to support 5G innovation, testing and deployments.

The ‘RF Components for the Next Generation’ suite is comprised of thousands of active, passive, interconnect and antenna products supporting global sub-6 GHz and mmWave (millimetre-wave) frequency band applications. Pasternack’s high-quality, precision-grade 5G RF components serve as building blocks in 5G deployments and are powering 5G application development and testing for enhanced mobile broadband, mission-critical communications and emerging Internet of Things (IoT) applications.

In addition to offering a broad selection of ready-to-ship 5G RF components, Pasternack helps to accelerate the process of selecting the right components with application-engineering-level support and immediate online access to detailed datasheets, CAD drawings, pricing and inventory.

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

Bluetooth 5.0 audio IC and module

To help Bluetooth speaker and headphone manufacturers maintain product differentiation in the competitive wireless audio market, Microchip Technology released the next generation of its Bluetooth 5.0-qualified dual-mode audio IC and fully certified module.

Measuring just 5.5 x 5.5 mm, the low-power IS2083BM IC is ideal for small form factor designs and gives developers more space to use larger batteries in end products. Both the IS2083BM IC and BM83 module enable customers to reduce bill of materials with highly integrated features, including:

- Embedded mode: Eliminates the need for an external host MCU to support application functionality.
- Integrated power amplifier: The integrated power amplifier includes up to +9.5 dBm output power, removing the need for an external power amplifier.
- Large Flash memory: With an integrated 2 MByte Flash memory, this feature provides the ability to store updated files during over-the-air (OTA) updates and software settings without external storage.
- Support for Sony’s LDAC audio codec technology: This technology extends high-resolution audio beyond audiophiles and into mass market Bluetooth wireless products.

The IS2083BM IC and BM83 come with a suite of development tools, Microchip’s mobile application and example codes for rapid development.

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

Automotive dead reckoning module

The MC-1612-DG, made by Locosys, is a single-band multi-system with an Arm base processor. It not only supports GPS, GLONASS, Galileo, QZSS and SBAS, but also has a Flash memory, TCXO, RTC crystal, LNA and SAW filter, in addition to embedded MEMS sensors (6-axis accelerometers gyro, 1-hole pressure as an option), and comes with dead-reckoning (DR) intelligence built in.

The extended Kalman filter algorithm combines GNSS (global navigation satellite system) and MEMS (micro electro-mechanical system) sensor data with a weighting function that relies on GNSS signal quality. With adverse GNSS conditions in urban canyons, tunnels, or parking garages, DR boosts the accuracy and the software fills the gaps. It supports three-dimensional DR, standard NMEA output, and fully supports various mapping demands.

In ADR mode, the module’s high-precision positioning and dead reckoning performance offers real-time heading and positioning data accurate to 1.5 m with low power consumption. The software includes features to receive and use data from the built-in sensors along with external signals for wheel speed and forward/reverse direction – these vehicle signals are used to provide a high level of accuracy in the navigation solution.

In UDR mode, when in an environment with pool signal like in a tunnel, ‘urban canyon’ or underground, in addition to a lack of speed feedback from the vehicle, the MC-1612-DG can continue to ascertain positioning thanks to its built-in MEMS sensing.

For more information contact Electrocomp, +27 11 458 9000, andrew@electrocomp.co.za
Adesto Technologies announced general availability of its next-generation edge server for building automation and industrial IoT applications. SmartServer IoT is the industry’s first truly open, full-featured and end-to-end industrial-rated IoT edge server. Its out-of-the-box device management services, intuitive user interface and programmable interfaces and applications enable system integrators to deploy solutions in an afternoon, and OEMs to create custom applications with ease.

SmartServer IoT supports multiple protocols and applications, enabling the convergence of diverse systems into a single edge networking and compute platform. It features built-in support for popular building automation protocols and services; open northbound interfaces to any remote client, workstation or Web application; open southbound interfaces; and a data abstraction layer for connecting with emerging IoT protocols and devices.

With SmartServer IoT, businesses can embrace their existing, perfectly functional control and management systems, and enhance them by securely connecting them to advanced IoT technologies. For example, in building automation and control (BAC) systems, customers can integrate their systems’ multitude of non-interoperable communications protocols – which have evolved over the years to support each building’s diverse functions, such as lighting, security, HVAC, fire detection and others – with new sensing, analytics and predictive AI services not available through BAC systems.

For more information contact Conrad Coetzee, Altron Arrow, +27 11 923 9600, ccoetzee@arrow.altech.co.za

Texas Instruments debuted new bulk acoustic wave (BAW)-based embedded processing and analog chips for the next generation of connectivity and communications infrastructure. The first two devices developed with the technology – the SimpleLink CC2652RB wireless microcontroller (MCU) and the LMK05318 network synchroniser clock – integrate reference clocking resonators to provide the highest frequency in a small form factor.

The CC2652RB integrates a BAW resonator within the QFN package, eliminating the need for an external high-speed 48 MHz crystal. It supports Zigbee, Thread, Bluetooth low energy and proprietary 2.4 GHz connectivity solutions on a single chip.

The LMK05318 single-channel network synchroniser clock for 400 Gbps links helps systems transmit more data faster while also providing higher margin for system jitter budgets. By delivering very low bit errors for 56 Gbps and emerging 112 Gbps pulse-amplitude modulation-4 links, it enables overall better network performance.

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

u-blox debuted the SARA RS series of LTE M and NB-IoT modules for low-power wide-area (LPWA) IoT applications. The secure element is compliant with EAL5+ High common criteria certification, which makes the modules well suited to protect sensitive assets and communications.

SARA RS comes in two product variants. Featuring a built-in M8 GNSS receiver, the RS11M targets mobile applications in the automotive, fleet management, tracking and telematics sectors. The GNSS receiver’s chip-down design includes a dedicated GNSS antenna interface and can run in parallel with the cellular connection.

The second product variant, SARA RS10M, is optimised to deliver the lowest achievable power consumption, drawing less than 1 µA of current in power save mode, making it ideal for metering, smart city, connected health, security and surveillance, remote monitoring and other battery powered applications.

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

Silicon Labs introduced the newest generation of its Wireless Gecko platform, Series 2. Building on the RF and multiprotocol capabilities of the Wireless Gecko portfolio, the initial Series 2 products include small-form-factor system-on-chip (SoC) devices with a dedicated security core and an on-chip radio delivering extended wireless range.

The first products in Silicon Labs’ Series 2 portfolio include EFR32MG21 SoCs supporting multiprotocol, Zigbee, Thread and Bluetooth mesh networking, and EFR32BG21 SoCs dedicated to Bluetooth Low Energy and Bluetooth mesh. These SoCs provide ideal solutions for line-powered IoT products including gateways, hubs, lights, voice assistants and smart electric meters.

Performance figures include: +20 dBm output power and up to +124.5 dB link budget; a robust wireless radio with improved blocking performance; powerful processing with an 80 MHz Arm Cortex-M33 core with TrustZone technology; and low active current (50.9 µA/MHz) to meet stringent green energy requirements.

For more information contact NuVision Electronics, +27 11 608 0144, gdekker@nuvisionelec.co.za
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Secure element for IoT authentication

The Microchip ATECC608A secure element from Microchip Technology integrates ECDH (Elliptic Curve Diffie Hellman) security protocol, an ultra-secure method to provide key agreement for encryption/decryption, along with ECDSA (Elliptic Curve Digital Signature Algorithm) sign-verify authentication for the Internet of Things (IoT) market. In addition, the ATECC608A offers an integrated AES hardware accelerator strengthening hardware-based security for LoRaWAN applications and enabling secure boot capabilities for very small microcontrollers.

Similar to all Microchip CryptoAuthentication products, the ATECC608A employs ultra-secure hardware-based cryptographic key storage and cryptographic countermeasures which eliminate potential backdoors linked to software weaknesses.

The device is agnostic of any microprocessor (MPU) or microcontroller (MCU) and compatible with Microchip AVR/ARM MCUs or MPUs. As with all CryptoAuthentication devices, the ATECC608A delivers extremely low power consumption, requires only a single GPIO over a wide voltage range, and has a tiny form factor making it ideal for a variety of applications that require longer battery life and flexible form factors.

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

Safe, real-time automotive MCUs

STMicroelectronics advanced safer, smarter automotive electronics and domain controllers with the introduction of its Stellar automotive microcontroller (MCU) family. The Stellar MCUs support next-generation car architectures, which rely on broad domain controllers for areas such as drivetrain, chassis, and advanced driver assistance systems (ADAS). These domain controllers enable the transition toward software- and data-oriented architectures by providing data fusion from connected sensors while reducing harness complexity and electronic component weight.

Combining the advantages of 28 nm FD-SOI, on-chip phase change memory (PCM), advanced packaging, and multiple Arm Cortex-R52 cores, the Stellar family can operate at frequencies up to 600 MHz and integrate more than 40 MBytes of PCM while minimising power consumption even in harsh, high-temperature environments.

Stellar satisfies the automotive industry’s demanding ISO 26262 ASIL-D safety qualification by extending the Cortex-R52 cores with lockstep capabilities. To further enhance functional safety and reliability, Stellar features a hypervisor for software separation and memory protection. Bolstering the multicore Cortex-R52 performance, Stellar also packs three Arm Cortex-M4 cores with a floating-point unit and DSP extensions to provide application-specific acceleration.

Major applications for Stellar MCUs include smart control for hybrid powertrain, the broad electrification of car systems with on-board chargers, battery management systems and DC-DC controllers, as well as smart gateways, ADAS, and enhanced vehicle stability controls.

For more information contact EBV Electrolink, +27 21 402 1940, capetown@ebv.com

Secure microcontrollers for IoT

Renesas Electronics expanded its range of embedded artificial intelligence (e-AI) solutions for incorporating AI into embedded systems by bringing intelligence to endpoints. Its RZ/A2M microprocessor (MPU) delivers 10 times the image processing performance of its predecessor, the RZ/A1, and incorporates Renesas’ exclusive Dynamically Reconfigurable Processor (DRP) technology, which achieves real-time image processing at low power consumption.

This allows applications incorporating embedded devices – such as smart appliances, service robots, and compact industrial machinery – to carry out image recognition employing cameras and other AI functions while maintaining low power consumption.

Since real-time image processing can be accomplished while consuming very little power, battery-powered devices can perform tasks such as real-time image recognition based on camera input, biometric authentication using fingerprints or iris scans, and high-speed scanning by handheld scanners. This solves several issues associated with cloud-based approaches, such as the difficulty of achieving real-time performance, assuring privacy, and maintaining security.

For more information contact Jody Botha, Hi-Q Electronics, +27 11 894 8083, jody@hi-q.co.za

MPU for embedded AI solutions

Cypress Semiconductor announced a new line of its PSoC 6 microcontrollers (MCUs) designed to give Internet of Things (IoT) designers confidence in the security of their applications. The PSoC 64 Secure MCUs integrate robust, standards-based system layer security software with the hardware layer features available in the ultra-low-power PSoC 6 architecture.

Specifically, PSoC 64 Secure MCU devices provide an isolated root-of-trust with true attestation and provisioning services. In addition, the line includes devices that deliver a pre-configured secure execution environment supporting the system software of various IoT platforms, providing TLS authentication, secure storage, and secure firmware management.

The MCUs also include a rich execution environment for application development, with an embedded RTOS from Cypress’ ModusToolbox suite that manages communication with the secure execution environment.

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

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**Lattice AI stack for edge devices**

Lattice Semiconductor received a number of industry awards for sensAI – a complete technology stack combining modular hardware kits, neural network IP cores, software tools, reference designs and custom design services – to accelerate integration of machine learning inferencing into broad market IoT applications.

With solutions optimised for ultra-low power consumption (under 1 mW – 1 W), small package size (5.5 mm² – 100 mm²), interface flexibility (MIPI CSI-2, LVDS, GigE, etc.), and high-volume pricing, the Lattice sensAI stack fast-tracks implementation of edge computing close to the source of data.

By delivering a full-featured machine learning inferencing technology stack combining flexible, ultra-low power FPGA hardware and software solutions, the Lattice sensAI stack accelerates integration of on-device sensor data processing and analytics in edge devices.

“The Edge is getting smarter with more computing capabilities being deployed for real-time processing of data from an expanding range of sensors, as seen in the consumer IoT space, and the emergence of artificial intelligence is only accelerating this trend,” Lattice quoted Michael Palma, research director at IDC. “Low power, small size, and low cost silicon solutions that can perform such local sensor data processing, will be critical for implementation of AI in various broad market edge applications.”

For more information contact Future Electronics, +27 21 421 8292, marian.ledgerwood@futureelectronics.com

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**Silent switching converter from Analog Devices**

The LTC3310S from Analog Devices is a very small, low-noise, monolithic step-down DC-DC converter capable of providing up to 10 A of output current from a 2.25 V to 5.5 V input supply.

The device employs Silent Switcher 2 architecture with internal hot loop bypass capacitors to achieve both low EMI and high efficiency at switching frequencies as high as 5 MHz. For systems with higher power requirements, multi-phasing of parallel converters is readily implemented.

The LTC3310S uses a constant-frequency, peak current mode control architecture for fast transient response. A 500 mV reference allows for low-voltage outputs. 100% duty cycle operation delivers low drop-out.

Other features include a power good signal when the output is in regulation, precision enable threshold, output over-voltage protection, thermal shutdown, a temperature monitor, clock synchronisation, mode selection and output short circuit protection. The device is available in a compact 18-lead 3 mm x 3 mm LQFN package.

For more information contact Conrad Coetzee, Altron Arrow, +27 11 923 9600, ccoetzee@arrow.altech.co.za

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**Xilinx Versal ACAP platform**

Xilinx began shipping Versal AI Core series and Versal Prime series devices to multiple tier-one customers.

Versal is the industry’s first adaptive compute acceleration platform (ACAP), a new category of heterogeneous compute devices with capabilities that exceed those of conventional CPUs, GPUs and FPGAs.

An ACAP is a highly integrated, multicore, heterogeneous compute platform that can be changed at both the hardware and software levels to dynamically adapt to the needs of a wide range of applications and workloads in data centre, automotive, 5G wireless, wired and defence markets.

Built from the ground up to be natively software programmable, the Versal ACAP architecture features a flexible, multi-terabit-per-second network-on-chip (NoC). The NoC seamlessly integrates all engines and key interfaces, making the platform available at boot and easily programmed by software developers, data scientists and hardware developers alike.

Through a host of tools, software, libraries, IP, middleware and frameworks, ACAPs enable dynamically customisable accelerated computing solutions through industry-standard design flows.

For more information contact EBV Electrolink, +27 21 402 1940, capetown@ebv.com

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**Buck converter with lowest quiescent current**

Texas Instruments introduced an ultra-low-power switching regulator with what it claimed as the industry’s lowest operating quiescent current (IQ) at 60 nA. The TPS62840 synchronous step-down converter delivers very high load-efficiency of 80% at 1 µA load, which can enable designers to extend the battery life of their systems, or use fewer or smaller batteries to shrink their overall power supply solution size and reduce cost.

The device’s wide input voltage range of 1.8 V to 6.5 V supports a variety of battery chemistries and configurations. These features, plus its selectable functions, enable the TPS62840 to help engineers solve critical design challenges in many battery-powered, always-on industrial and personal electronics applications.

Selectable mode and stop functions improve noise performance and reduce signal distortion. These benefits can help lower the solution cost because designers can achieve system requirements without using more expensive precision signal-chain components, sensors or radio solutions to perform the same functions.

The mode pin allows for continuous conduction mode, also called forced pulse-width modulation mode, to improve ripple or noise performance and lessen the impact on transmissions in sensitive radio-frequency applications. The stop pin turns off all switching to reduce EMI or ripple, and minimises distortions passed to precision signal-chain, measurement, sensors or wireless connectivity components.

For more information contact Avnet South Africa, +27 11 319 8600, sales@avnet.co.za
Automotive-compliant linear regulators

Diodes Incorporated introduced the company’s first low-dropout (LDO) linear regulators compliant to AEC-Q100 Grade 1.

The AP7315Q and AP7343Q deliver 150 mA and 300 mA respectively and are suitable for any automotive application that requires tight voltage regulation across operating conditions, such as point-of-load power supplies in advanced driver assist systems (ADAS), RF communications, infotainment systems, and cameras.

Automotive manufacturers are integrating an increasing level of ADAS into vehicles with sensors and other sensitive circuits that demand highly stable power supplies. With full production part approval process (PPAP) capability, the AP7315Q and AP7343Q can be used in automotive applications that require products qualified to AEC-Q100 with a Grade 1 (-40°C to +125°C) temperature rating.

Both devices provide practical alternatives to switching regulators in highly demanding automotive applications. As well as current limiting and short-circuit protection, the LDOs feature an enable input that allows the linear regulators to be switched off when not required.

While in use, the regulators have a low quiescent current of just 35 μA. Both devices are also available with (AP7315DQ/43DQ) and without (AP7315Q/43Q) an output capacitor discharge feature, which is often required to protect sensitive loads during shutdown, such as CMOS image sensors.

The LDOs feature a high power-supply rejection ratio (PSRR) of 75 dB at 1 kHz to deliver stable output voltages for sensitive loads from an input voltage of between 1,7 V and 5,25 V. Output noise is just 60 μVrms between 10 Hz and 100 kHz for a fixed output voltage of 1,1 V to 3,3 V (AP7315Q) or 0,9 V to 3,6 V (AP7343Q).

Both regulators are supplied in the SOT25 package.

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

High-power chip resistors

Panasonic has released a line of resistors to help engineers produce cheaper, smaller and more efficient designs. The legacy resistors of the ERJ series have been made smaller while handling the same amount of power or more, while still having the same footprint.

ERJ-P Series high-power resistors offer the ability to use smaller case sizes while still maintaining the same level of power, or better, in comparison to conventional sized thick film resistors. The ERJ-P Series has a unique trimming pattern and high heat dissipation characteristics. These parts can be easily used as replacements for existing thick film resistors due to comparable technology and materials with use of better manufacturing processes.

The ERJ-P Series has an operating temperature of -55°C to 155°C, with a smaller part providing higher solder-joint reliability. Less material means less solder which lowers risk for solder fracture due to thermal expansion or contraction. Panasonic high-power resistors are AEC-Q200 qualified.

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

40 Watt DC-DC converters for industrial use

Traco Power announced the release of its new TEN 40WEI range of industrial converters. Due to a new design approach, it offers a cost-efficient solution with no concession on quality or reliability as well as improved specifications compared to its predecessor. It comes in a standard 5,08 x 2,54 cm metal package with a 4:1 input voltage range. The TEN 40WEI series has an output voltage range from 3,3 V to 24 V.

High efficiencies of up to 93% allow for an operating temperature range (using natural convection) of -40°C to +70°C without power derating (model dependent). Certified according to the latest IT standard (IEC/EN/UL 62368-1) and equipped with additional features like remote on/off function and protection against short circuit, over-voltage and over-temperature, the TEN 40WEI series is suitable for many industrial applications.

For more information contact Conical Technologies, +27 66 231 1900, daniel.haywood@conical.co.za.

The Telegärtner STX M12x1 IP67 connector series for Railway and Vehicle applications offers various solutions in harsh environments
Highly customisable memory tokens and keys

Despite having well over 100 standard products, in recognition of the fact that every application is unique, Datakey offers extensive options for customisation of its memory key and token products.

All of its portable memory products come in a default colour (black for most products), while its keys and SlimLine tokens are offered in six standard colours: black, red, yellow, green, blue and grey. However, the company can colour-match its plastic to a Pantone colour, federal standard colour or physical sample.

Most of the standard products come with a Datakey logo moulded into the memory key/token, but clients’ company logos can be accommodated. Customers can even opt to modify the shape of the key or token, giving it a completely customised look.

One of the key values Datakey products deliver is long-term availability. Its standard products utilise industry-standard non-volatile memory ICs that have a track record of excellent long-term availability, but the company realises that there are a host of new memory technologies on the market today, and if one of these meets your needs better than one of the standard products, it will look at a custom solution using the memory device of your choice.

Sometimes customers don’t want a different memory IC in one of the rugged, portable form factors, but rather a microcontroller or ASIC – this too can be accommodated.

Datakey’s panel-mount SlimLine receptacles come with a standard 0,100” pitch 10-pin header – a general purpose connector that allows OEMs to use standard 10-conductor ribbon cables. Alternative connectors are offered as well, or a custom PCB can be produced for the back of the receptacle for a modest NRE fee.

For more information contact IPD Electronics, +27 12 345 3619, info@ipdelectronics.com
Solderable grounding seal

With the WE-SMGS, Würth Elektronik offers solderable seals for surface mounting.

The WE-SMGS consists of a temperature resistant foam material, which combines the conductive seals with high elasticity. After compression, they then return to their original shape. The layer surrounding the heat-resistant foam is made of copper weave with tinning. It facilitates the soldering process in a reflow oven.

WE-SMGS can be used to establish contact between the PCB ground and metallic housing or other external metallic elements. It can also be used for low-resistance, high-frequency connections between the grounding points of two superimposed PCBs.

These elements are designed for a pick-and-place/reflow process, thus representing an alternative to WE-SECF contact fingers. WE-SMGS is available from stock in various heights from 2,5 to 15 mm. Würth Elektronik provides free samples on request.

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

Waterproof Micro USB connector

As part of a new product line from GCT, the aquanex waterproof range brings together high-performance USB connectors with IP67 rated sealing. The first connector launched from the aquanex range, the USB3500, is a horizontal mid-plane mounted Micro USB connector.

The shell is made from a one-piece stainless steel construction for added integrity using an innovative metal injection moulding manufacturing process, then plated in nickel. A silicon seal is moulded to the exact connector profile to ensure reliability against the large flange, creating an optimal seal. The one-piece metal injected shell also provides the

USB3500 with a compact form factor at 10 x 4 x 5,3 mm.

Four mounting posts provide secure attachment to the PCB, reducing assembly time since no screws or fixing is required. Over 10 000 mounting cycles and an operating temperature between -20°C to +85°C add to the USB3500’s durability credentials.

Two new Micro USB variants, a unique vertical mounted connector and a top-of-PCB version, will be added to the range later in 2019.

For more information contact Electrocomp, +27 11 458 9000, andrew@electrocomp.co.za

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

For more information contact Electrocomp, +27 11 458 9000, andrew@electrocomp.co.za
The Shift also increases the link quality compared to any standard antenna system on the market which, in turn, lead to substantial throughput increases.

The antenna negates the need for expensive repeater solutions to provide Internet broadband connectivity and switches its link to another cell tower if one of the base stations goes down. It provides extended coverage in underground car parks, rural areas and other areas that the cellular signals find hard to reach.

Current LTE modems use a pair of passive antennas to provide MIMO connectivity. The difficulty with passive antennas in mobile or fixed applications where the node location is unknown is that the passive antenna is required to operate in all directions, i.e., omnidirectionally. Taoglas’ software-defined Shift antenna system uses an intelligent control driver to identify and dynamically select the optimal antenna configuration.

LTE beam-steering antenna

Taoglas has developed an LTE beam-steering antenna system that is capable of dynamically adapting its antenna radiation patterns in real time to extend coverage in areas of low signal quality.

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The antenna negates the need for expensive repeater solutions to provide Internet broadband connectivity and switches its link to another cell tower if one of the base stations goes down. It provides extended coverage in underground car parks, rural areas and other areas that the cellular signals find hard to reach.

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Würth Elektronik has developed a very compact MEMS-based (micro electro-mechanical system) absolute pressure sensor: the 2.0 x 2.0 x 0.8 mm sized WSEN-PADS measures pressure in the range between 26 and 126 kPa. Its output data rate can be selected between 1 and 200 Hz. The sensor contains an ASIC (application-specific integrated circuit) and a temperature sensor, meaning that the output values are already calibrated.

The sensor offers the possibility of preparing the measured data for various applications using activatable integrated algorithms in such a way that the programming workload for a connected controller is greatly reduced. The measured data can be read out via a standard I²C interface, which is extended by an additional interrupt pin whose function can be modified by the user.

An application example is the use of the pressure sensor as an altimeter. Thanks to its high resolution, the sensor provides information that enables the position of individual floors in buildings to be mapped. This supports an indoor navigation system.

WSEN-PADS is not only suitable for mobile devices on account of its slim design; since the sensor can be operated at very low power consumption, it is possible to supply it using batteries or even energy via energy harvesting – Würth Elektronik offers technical support here. The piezoresistive sensor is specified for an industrial temperature range from -40°C to +85°C. A tailored evaluation board is available.

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

For more information contact Jason Page, Würth Elektronik eiSos, +27 71 259 9381, jason.page@we-online.com.
The NL865H2 is a new LTE Category NB2 (also known as NB-IoT) addition to the widely deployed Telit xL865 product family. With its 24.4 x 24.4 mm VQFN footprint, the NL865H2 is designed for size-sensitive applications. The devices open up IoT-enabled business models by addressing connectivity and battery life concerns for the growing number of OEMs, integrators and device designers looking to dramatically increase the number of data points they can collect from their operations and customers via IoT devices.

Compliant with 3GPP Release 14, the NL865H2 LTE UE Cat NB2 module is optimised in cost, size and power consumption compared to higher UE categories. 3GPP Release 14 further improves these features and also adds techniques to increase the data rate for NB-IoT.

These advantages make the NL865H2 ideal for enabling quick implementation of LTE technology where low cost and low power consumption are more relevant than high speed. The NL865H2 is also backward compatible with 3GPP Release 13 and LTE UE Cat NB1 standard.

For more information contact Renaldo Fibiger, Altron Arrow, +27 11 923 9600, rfbiger@arrow.altech.co.za

Texas Instruments introduced a new switching battery charger IC that supports a termination current of 20 mA. Compared to competing devices, which typically support a termination current higher than 60 mA, the BQ25619 enables 7% higher battery capacity and longer run time.

The device also delivers three-in-one boost converter integration and ultra-fast charging, offering 95% efficiency at a 4.6 V and 0.5 A output. It helps engineers design more efficiently for small medical and personal electronics applications such as hearing aids, earbuds and wireless charging cases, IP network cameras, patient monitoring devices and personal care applications.

The BQ25619 reduces battery leakage down to 6 µA in ship mode, which conserves battery energy to double the shelf life for the device. While in battery-only operation, the device consumes only 10 µA, to support standby systems.

For more information contact Avnet South Africa, +27 11 319 8600, sales@avnet.co.za

New from ams is the AS621x-generation of temperature sensors delivering optimised performance for consumer electronic devices and wearables, health-related monitoring systems and heating, ventilation and air conditioning (HVAC) systems.

Prototyping and design verification are simplified thanks to the 1.5 mm² WLCSP’s industry-standard serial interface with eight I²C addresses and a factory-calibrated sensor. The sensors come in three accuracy versions: ±0.2°C for the AS6212; ±0.4°C for the AS6214; and ±0.8°C for the AS6218. ams has decreased the supply voltage range to a low level of 1.71 V, and by additionally increasing the number of I²C addresses to eight, customers have the added flexibility to monitor up to 8 hot spots in their systems at minimum effort – especially during prototyping.

The AS621x is a complete digital temperature system, which has been factory-calibrated to an accuracy down to ±0.2°C. For greater sensitivity to temperature change, the resolution of the temperature value output has also increased to 16 bits.

For more information contact Future Electronics, +27 21 421 8292, marian.ledgerwood@futureelectronics.com

STMicroelectronics is facilitating smarter city and industry infrastructures through the combination of powerline and wireless communication in its market-proven smart meter chipset.

Already widely used in smart electricity meters, the STB8500 powerline communication (PLC) chipset now enables smart meters to communicate through existing power cables or radio frequency (RF) waves, combining the strengths of both types of connection. Where power lines may be too noisy for PLC, or where local regulations dictate, equipment makers can now implement wireless and PLC quickly and efficiently using the STB8500.

By embedding support for RF Mesh at the physical (PHY) layer and in the chip-link layer (Media Access Control, MAC, and 6LoWPAN) firmware, the STB8500 gives developers extra flexibility to leverage the strengths of combined powerline and wireless mesh networking for communication between smart nodes and data collectors.

Unlike simple point-to-point links, hybrid mesh networking interconnects nodes extensively to create more reliable and fault-tolerant connections and extend communication distances.

For more information contact EBV Electrolink, +27 21 402 1940, capetown@ebv.com
New components often provide challenges to design, process and quality engineers. Solder joint failure, voiding plus contamination and corrosion are just a few of the problems experienced so far. Any large-area component with a low stand-off which needs to be reflow soldered to a substrate can be a challenge, but at ever decreasing pitch the need for good process validation and correct design is vital for high yields.

Key topics presented by Bob Willis in his webinar ‘QFN/LGA Design, Assembly Process Issues & Reliability Failures’ will include: design options to reduce failures; process improvements in design and assembly; void reduction; improvements in joint reliability; simple 5-minute solderability assessment; improved cleaning performance; results in cleaning and SIR on QFN packages; process results from vapour phase and convection reflow; solder joint reliability; IPC design and process guidelines.

Provided free with this webinar are Bob Willis QFN inspection and quality control wall charts to use in your own manufacturing and training facility.

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Not many people own one, and even fewer people want to, but there’s no doubting that the Apple Watch 5 is an astonishing engineering feat. The teardown supremoes at System Plus Consulting performed a 3D X-ray scan of the latest model, showing such minute detail as the gasket on the watch’s tiny button. Watch a video of the scan at www.dataweek.co.za/nov19-applewatch

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Fires are common and spread quickly in informal settlements where homes are packed tightly together. This video from the BBC features a South African company that designed an alarm to warn whole neighbourhoods when they could be in danger: www.dataweek.co.za/nov19-firealarm

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One of the most controversial issues with lithium-ion batteries is their tendency to suffer thermal runaway. Some of the most egregious cases of this phenomenon occurred when so-called ‘hoverboards’ took the world by storm in 2015/16. This video from UL (formerly Underwriters Laboratory) catches the explosive results on camera: www.dataweek.co.za/nov19-hoverboard

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Local company K Measure, as part of its Seebox developments, has developed a new educational innovation to make electronic circuit building quick, easy and intuitive for the learner. With SeeBlocks, building circuits is as easy as building a puzzle – just follow the component symbols on the top and click the individual component blocks together to build working electronic circuits. See SeeBlocks in action at www.dataweek.co.za/nov19-seeblocks

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Cost: £65
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