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Nano Dimension, developer of the DragonFly 2020 Pro 3D PCB Printer, appoints Emona as Australian and New Zealand distributor.

The printer is dedicated to the production of professional multilayer PCBs and 3D circuitry in-house, within hours, making it a useful rapid prototyping tool for electronics professionals. The DragonFly 2020 Pro system brings together a precise inkjet deposition printer with high-performance silver nanoparticle conductive and dielectric inks as well as dedicated software, offering design flexibility for R&D, prototyping and custom manufacturing projects.

The printer’s rapid prototyping capabilities mean product development teams no longer need to wait days or weeks for a custom PCB prototype that has to be fabricated offsite. It offers the flexibility to print an entire board or just part of a circuit; users can develop the RF and digital sections of the board in parallel, test and iterate on the fly. It is designed to encourage innovation, lessening development risks and enabling faster time-to-market.

The 3D printer deposits two materials, one conductive and one dielectric, in order to build a complete multilayer PCB from the bottom up. Each pass of the printhead deposits dielectric and conductive material at the location specified by the design file. Starting from the underside conductive traces, the materials are built up to finish with the topside conductors. This means that vias are built up, drop by drop, either as blind, open or complete vias. Plated and non-plated through-holes are created by repeatedly leaving a space at a particular XY coordinate, thereby building surrounding materials up around a void. The dielectric ends up as a solid piece within which the conductive traces are positioned at the XYZ coordinates specified.
5G USHERS IN A NEW ERA OF WIRELESS TEST

Charles Schroeder, NI Business and Technology Fellow
Since the beginning of cellular communication, test engineers have been iterating on an accepted set of measurements and techniques to test wireless communications technology in high volumes, from RF semiconductors to base stations and mobile handsets. But with 5G, the technology inside these wireless devices will be more complex, and the highly optimised techniques that have been used to test previous generations will need to be rethought.

Testing 5G components and devices with over-the-air (OTA) methods instead of the cabled methods currently in use will be necessary to validate the performance of 5G technology. As engineering leaders, we need new test methods to ensure the viable commercialisation of 5G products and solutions across many industries and applications.

Boosting bandwidth
One of the key goals of the 5G standard is to significantly increase data capacity as user data demands continue to rise, but to achieve the target peak bandwidth of 10 Gbps per user, new technologies are being introduced. First, the 5G spec includes Multiuser MIMO (MU-MIMO) technology that allows users to simultaneously share the same frequency band through beamforming technology that creates unique, focused wireless connections for each user. Second, the 5G standard adds more wireless spectrum, expanding into centimetre and millimetre wave (mmWave) frequencies.

Physical implementations of both the MU-MIMO and mmWave technologies use significantly more antenna elements than previous generations of cellular standards. The laws of physics dictate that signals at mmWave frequencies will attenuate considerably faster as they travel through free space than signals at the current cellular frequencies. So, for a similar transmitted power level, mmWave cellular frequencies will have a much smaller range than current cellular bands.

To overcome this path loss, 5G transmitters and receivers will utilise antenna arrays working simultaneously and using beamforming technology to boost the signal power instead of the single antenna per band in current devices. Though important for increasing the signal power, these same antenna arrays and beamforming techniques are crucial to implementing MU-MIMO techniques.

How will we fit all these antennas into tomorrow’s mobile phones? Luckily, the antennas at mmWave frequencies will be much smaller than the cellular antennas used for current standards. New packaging technologies, like antenna in package (AiP), will ease the integration of these antennas into the small space constraints of the modern smartphone, but the arrays of antennas may be completely enclosed without any directly contactable test points.

Using OTA to address new challenges
For test engineers, the increased frequencies, new package technologies and greater antenna counts will make it difficult to keep quality high while limiting increases in both capital costs (cost of test equipment) and operating costs (time to test each device). New OTA techniques can help with these, but they present challenges as well.

First, measurement accuracy will be challenging. Unlike cabled tests, when making OTA measurements, test engineers will deal with the additional measurement uncertainty that comes with antenna calibration and accuracy, fixtureing tolerance and signal reflections. Second, brand new measurements must be integrated into device test plans for anechoic chamber integration, beam characterisation, optimal code-book calculation and antenna parameter characterisation. Third, as RF bandwidths continue to increase, the processing needs for calibrating and making measurements on these wide bandwidths increase as well, which adds to test time concerns. Finally, test managers must make additional business considerations to ensure product quality while minimising the impact to time to market, capital cost, operating cost and floor space (to accommodate the OTA chambers).

Over the next few years, the test and measurement industry will be rapidly responding to these challenges with many new innovations. Test groups should consider highly flexible, software-defined test strategies and platforms as a way to ensure their capital expenses today can keep pace with this rapid cycle of innovation.

Though OTA presents challenges, it also offers benefits. First, OTA is the only option for AiP technologies because the antenna arrays are integrated inside a package with no way to directly cable to the array elements. Even if test engineers could contact individual antenna elements using cabled test methods, they face the difficult choice of testing them in parallel (at the capital expense of needing more instruments) or testing them serially (at the operating expense of needing more test equipment). Many technical issues still need to be solved, but OTA test offers the possibility of testing the array as a system instead of a set of individual elements, which could lead to the greater efficiency promises of system-level test.

In the past, test equipment suppliers and test engineers have risen to the challenge of testing increasing performance and complexity while minimising time to market and cost of test, and they’ll do it again for 5G. Though the challenges of testing 5G look complex today, engineers around the world are already developing the new test instruments and methods, like OTA, that are necessary to make 5G a commercial success.

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WORLD ELECTRONICS FORUM COMING TO ADELAIDE

The 2019 Annual Meeting of the World Electronics Forum (WEF) will be held in Adelaide from 4–6 December 2019, in conjunction with an international conference themed ‘Electronics — Enabling Our Future’. The meeting and related events will be hosted by Electronics Industry Development Adelaide (EIDA), the association of the 300 high-technology electronics design, manufacturing and support companies in Adelaide.

Annual meetings of WEF are held in a different global city — and usually on a different continent — each year, with the 2018 meeting having been held in Beijing and Hebei, China, and the only previous Australian meeting held in Canberra in 2003. The 2019 event was secured by EIDA Chairman Donald Kay with a presentation to the panel of international delegates at a WEF meeting held in Las Vegas in early January.

The 2019 meeting will be part of an International Electronics Conference featuring specialist streams in Space Technology, AgTech and WEF, with attendees set to learn about developments and trends from industry leaders from more than 20 advanced electronics technology countries. A concurrent electronics exhibition will showcase the diverse and specialist products and services of Adelaide and the wider Australian electronics industry.

The meeting serves as Adelaide’s chance to show the capability and versatility of the local electronics industry to world electronics industry leaders. Visits are planned to engage with Adelaide’s extensive innovation community as well as established Adelaide electronics firms and research institutions. A number of local cultural activities are also in the pipeline.

For more information, send an email to henrietta@eida.asn.au.

FAREWELL TO FAULTY ELECTRONICS WITH DEFECT DETECTION TOOL

Engineers at the Australian National University (ANU) have developed a powerful new tool to help manufacturers spot defects or unwanted features in everyday technology — such as mobile phones, batteries and solar cells — more easily and much earlier in the fabrication process than current methods. Their work has been described in the journal Advanced Energy Materials.

Working with scientists from the National Renewable Energy Laboratory in the US, the ANU researchers discovered that the light emitted from various semiconductor materials — including silicon, perovskites and many thin films— had some very distinct qualities. By capturing this light on camera, the optical images can be used to gather important information about how the material works.

Dr Hieu Nguyen, lead author on the study, explained that the team’s invention works by capturing high-resolution images of semiconductor materials, including many potential defects, within seconds. He said, “It’s not just several times faster than techniques currently being used — it’s tens of thousands of times faster.

“Now we know much more about the property of the light — and, just from the image, we can extract different information with incredible depth.”

Dr Nguyen said his team demonstrated their method by capturing images of the optical bandgap, one of the first pieces of information researchers need to know about a material. This bandgap determines many properties of semiconductors, including the ability to absorb light and conduct electricity.

“We tested this invention extensively on various state-of-the-art perovskite solar cells made here at ANU and independently confirmed the results with many other low-speed or low-resolution techniques. They matched perfectly,” he said.

“The beautiful part of this research is that we used ordinary tools that are commercially available, and converted them into something extraordinary.”

Co-author Boyi Chen, also from ANU, said he was thrilled by the results of the research. “Before this invention, it took an entire week to get a high-quality bandgap image on a device,” he said. “Now, with our invention, it takes just a few seconds to get an image with the same quality.

“This invention will help to produce more robust mobile phones, solar cells, sensors and other optical devices as it can spot defects very early in the fabrication process.”

According to Dr Nguyen, the invention will open the door to a new generation of ultrahigh-resolution, precise characterisation and defect-detection tools for both research and industry sectors. The team is currently refining the tool so that it can be commercialised.
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Researchers from Aalto University and Université Paris-Sud have made a breakthrough in photonics, using a nanosized amplifier to improve the propagation of data inside a microchip.

Light is a more energy-efficient and faster way of transferring data than electricity. Until now, the rapid attenuation of light signals in microchips has prevented the use of light as a source of an information signal.

Now, researchers have developed an amplifier to help light signals propagate through microchips. Signal attenuation can be significantly reduced when data is transferred inside a microchip, for example, from one processor to another.

"Photonics, or light transfer that is already widely used in internet connections, is increasingly being used by microcircuit systems because light is a more energy-efficient and faster way of transferring data than electricity," said Aalto University doctoral candidate John Rönn. "The increase in information also requires an increase in performance. Boosting performance through electronic methods is getting to be very difficult, which is why we’re looking towards photonics for answers.”

The researchers made their breakthrough with the help of the atomic layer deposition method, which is apparently ideal for processing various kinds of microcircuits as it plays an important role in manufacturing today’s microprocessors. So far, the method has been used mainly in electronic applications; however, possible applications also exist in photonics, where new components must also ideally work with electricity — that is, in electronics.

"Silicon is a key material in electronics, and that’s why it’s also included in our light amplifiers together with the amplification element erbium,” Rönn said.

"Today’s compound semiconductors, which are used, for instance, in LED technology, can also be used effectively in light amplification. That being said, most compound semiconductors are not compatible with silicon, which is a problem for mass production.”

The study showed that a light signal can be potentially boosted in all kinds of structures and that the structure of a microchip is not limited to a specific type. The results indicate that atomic layer deposition is a promising method for developing microchip photonic processes.

"Our international collaboration made a breakthrough with one component: a nanosized amplifier,” said Aalto Professor Zhipei Sun. "The amplification that we got was very significant. But we’ll still need more components before light can completely replace electricity in data transfer systems. The first possible applications are in nanolasers, and in sending and amplifying data.”

SEMI WORKS TO PROVIDE ELECTRONICS EDUCATION PROGRAMS

SEMI, the global industry association serving the electronics manufacturing supply chain, has announced SEMI Works — a comprehensive program to attract, develop and retain the talent critical to the worldwide electronics industry’s continued innovation and growth. It is designed to improve the industry’s image and provide educational programs for all age groups across the education continuum.

Under the initiative, SEMI will establish scalable and sustainable education programs extending from grade-schoolers to adults, offering experiential learning and training programs linked to the skill sets the industry needs most.

“SEMI has made workforce development and talent advocacy a top priority and dedicated significant resources and expertise to tackle the issue,” said SEMI President and CEO Ajit Manocha. “As the global industry association anchoring the $2 trillion global electronics industry and representing the end-to-end semiconductor supply chain, SEMI is uniquely positioned to address this problem.”

Leading SEMI Works is Mike Russo, Vice President of Global Industry Advocacy at SEMI.

“The global electronics industry’s shortage of high-skilled workers will only become more severe as technology advances,” Russo said. “We need a highly skilled workforce throughout the supply chain to develop new technologies and bring these advances to market. SEMI Works will be anchored by both detailed competency models continually updated to support the industry’s rapidly evolving workforce needs and certified education and training aligned to these competencies.”

With SEMI Works, SEMI is building on its growing suite of workforce initiatives and involving a consortium of member companies along with its strategic alliances. The program will expand to include public and private sector partners.

Organisations interested in taking part in or contributing to SEMI Works should visit the program webpage: www.semi.org/en/collaborate/advocacy/semi-works.
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FERRIMAGNETIC MATERIALS MAKE SPINTRONIC MEMORY MORE STABLE

A research team led by the National University of Singapore has invented a magnetic memory device which is able to manipulate digital information 20 times more efficiently and with 10 times more stability than commercial spintronic digital memories.

There is an increasing demand for low-cost, low-power, highly stable and highly scalable memory and computing products. One way this is being achieved is with spintronic materials, where digital data are stored in up or down magnetic states of tiny magnets. However, spintronic memory products based on ferromagnets are still very costly due to scalability and stability issues.

“Ferromagnet-based memories cannot be grown beyond a few nanometres thick, as their writing efficiency decays exponentially with increasing thickness,” explained Dr Yu Jiawei. “This thickness range is insufficient to ensure the stability of stored digital data against normal temperature variations.”

To address these challenges, the team fabricated a magnetic memory device using an interesting class of magnetic material — ferrimagnets. Crucially, it was discovered that ferrimagnetic materials can be grown 10 times thicker without compromising on the overall data writing efficiency.

“The spin of the current-carrying electrons, which basically represents the data you want to write, experiences minimal resistance in ferrimagnets,” said research team member Rahul Mishra. “While a ferromagnet is like a city street for an electron’s spin, a ferrimagnet is a welcoming freeway, where its spin or the underlying information can survive for a very long distance.”

Using an electronic current, the researchers were able to write information in a ferrimagnet memory element which was 10 times more stable and 20 times more efficient than a ferromagnet. This was made possible due to the unique atomic arrangement in a ferrimagnet.

“In ferrimagnets, the neighbouring atomic magnets are opposite to each other,” said Associate Professor Hyunsoo Yang. “The disturbance caused by one atom to an incoming spin is compensated by the next one, and as a result information travels faster and further with less power. We hope that the computing and storage industry can take advantage of our invention to improve the performance and data retention capabilities of emerging spin memories.”

The research team is now planning to look into the data writing and reading speed of their device, as they expect its distinctive atomic properties will also result in ultrafast performance.

NEW MATERIAL DEVELOPED FOR HIGH-VOLTAGE SUPERCAPACITORS

Researchers at Japan’s Tohoku University have developed a stable and high-voltage material for supercapacitors.

Supercapacitors are rechargeable energy storage devices with a broad range of applications, from machinery to smart meters. They offer many advantages over batteries, including faster charging and longer lifespans, but they are not so good at storing lots of energy. Scientists have thus been looking for high-performance materials for supercapacitors that can meet the requirements for energy-intensive applications.

“It is very challenging to find materials which can both operate at high voltage and remain stable under harsh conditions,” said Hirotomo Nishihara, a materials scientist at Tohoku University. With this in mind, he and his colleagues collaborated with supercapacitor production company TOC Capacitor Co to develop a new material that exhibits extraordinarily high stability under conditions of high voltage and high temperature.

The new material is a sheet made from a continuous three-dimensional framework of graphene mesopore, a carbon-based material containing nanoscale pores. A key feature of the material is that it is seamless — it contains a very small amount of carbon edges, the sites where corrosion reactions originate, and this makes it extremely stable.

Conventionally, activated carbons are used for the electrodes in capacitors, but these are limited by low voltage in single cells, the building blocks that make up capacitors. This means that a large number of cells must be stacked together to achieve the required voltage. The new material has higher single-cell voltage, reducing the stacking number and allowing devices to be more compact.

The researchers investigated the physical properties of their material using electron microscopy and a range of physical tests. They also tested commercial graphene-based materials, using activated carbons as a benchmark for comparison.

They showed that the material had excellent stability at high temperatures of 60°C and high voltage of 3.5 V in a conventional organic electrolyte. Significantly, it showed ultrahigh stability at 25°C and 4.4 V — 2.7 times higher than conventional activated carbons and other graphene-based materials.

“This is a world record for voltage stability of carbon materials in a symmetric supercapacitor,” Nishihara said.

The new material thus paves the way for development of highly durable, high-voltage supercapacitors.
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Moore’s law, which has predicted the rate of technological advancement for the past 50 years, is coming to an end. Engineers now have the luxury of taking the time to optimise, which should result in more efficient systems at a given process node. What does this mean for component design?

Since the 1970s, Moore’s law has successfully predicted that the number of transistors per unit area on a chip would double every two years. This growth was possible because the cost per transistor went down with every new generation of silicon. However, once we reached transistor sizes of 28 nm — and particularly after we crossed the 20 nm threshold into fin field-effect transistor (FinFET) territory — this once-standard rate of technological progress began decelerating as lithographic light sources failed to keep pace. This trend forced manufacturers into a Faustian bargain between adding more process complexity using traditional light sources or decreasing throughput with new light sources. Either way, even though manufacturers can still technically produce...
chips at even finer line widths, it’s less economically viable to do so because the cost per transistor is starting to rise.

As Moore’s law begins to slow down, the electronics industry must consider new technologies and novel approaches to systems design. For the first time in quite a while, they are incentivised to move to the latest generation process only if they require enhanced performance or greater transistor density (which comes at a higher price instead of getting both for less). As a corollary, value-conscious market segments will continue to use older processes while looking for new ways to accommodate a lower performance in order to hit the price targets that the market will bear.

It used to be that if it took more than two years to optimise a system by customising an interconnect fabric, parallelising the code, and ultimately building a supercomputer around a given process node, that the project would be considered dead on arrival. The reason is that by the time it was finished, a new computer would already be on the market that would run twice as fast and cost about the same. But now that the succession of process nodes on a two-year timescale is no longer a given, system-level designers and system integrators looking to deliver more value must pay closer attention to factors like bandwidth limits, data locality, core utilisation and power efficiency. As a result, optimisation will become a more common refrain among engineers, which may ultimately result in more efficient systems for a given process node.

For example, intriguing application-specific architectures (ASICs), such as the Tensor Processing Unit (TPU) that Google and its artificial intelligence (AI) partners have created to accelerate machine learning workloads, are starting to appear. To service machine learning computational loads, engineers have spent time and effort turning out architectures with massive arrays of 8-bit multipliers and adders that can calculate with less precision than a graphics processing unit (GPU) but that are perfectly suited for machine learning applications. Until recently, by the time you finished such a project, regular computers running at twice the speed would have already outstripped all the advantage of a custom-built ASIC. Now, in the post-Moore’s law world, it has become practical — perhaps even imperative — to build ASICs that achieve far greater efficiency and performance.

Greater design optimisation is also evident in the mobile space, which is extremely power sensitive. You’ll find that algorithms implemented in software in the CPU are inevitably going to cost much more in terms of power than algorithms reduced directly into silicon gates. In a Moore’s law regime, it would not be worth your while to cast an algorithm into silicon, because first, algorithms would constantly evolve to take advantage of faster and greater numbers of transistors, then the standards would change, and then a faster general-purpose CPU would come along and blow your custom silicon away. All your investment would have been wasted. However, in a post-Moore world, as speed and density increases level off, it’s less risky to cast malleable software algorithms into silicon and save some power.

Software developers are finding greater incentives to optimise as well. In the late 1990s and early 2000s it was okay — nay, expected — to pack so many new features into a software release that it could barely run on average machines because within a couple years Moore’s law would take care of any per-
formance deficiencies. Today, this sort of practice would not be bearable. Instead, now engineers can spend months to refine performance without worrying too much about being obsoleted by a legacy codebase running on a new CPU, with significantly faster single-threaded performance.

In a post-Moore world, as speed and density increases level off, it’s less risky to cast malleable software algorithms into silicon and save some power.

Open hardware and boutique hardware engineering will enjoy increased prominence, too. Open source projects typically take several years to take off and reach maturity. Unfortunately, in a Moore’s law world, only hobby projects can afford to take three to four years to take off. Now it’s conceivable that after spending three or four years implementing something in a field-programmable gate array (FPGA), you may find that you might actually have the world’s best-performing product for that specific problem domain. We’re not quite at that stage for general problems, because Moore’s law is still moving a little bit upward, but this could become a reasonable general expectation if Moore’s law continues to slow.

The design tool and chip-building ecosystems will also have reasons to become more open in this new world. Historically, there has been a real economic benefit from timely access to the latest technologies, so foundries typically have not made their latest processes available to everybody, just to those who could pay the most for it. However, as the shine wears off of a new process node and replacement nodes seem farther and farther away, the greatest economic benefit to a foundry will shift from charging a premium just to get into the door to opening the doors to get more customers into the shop. Thus, once the initial investment of building a fab depreciates, the market logic can shift towards a more open model, where the non-recurring engineering (NRE) costs are more reflective of the mere time and materials required to set up a fab run, rather than the amortisation of a multibillion-dollar investment.

In the future, we may just have a big tent under which everyone can come together, including more designers who are making more application-specific circuits. No longer will you have to go to a big supplier for your analog components. Instead, you might be able to simply pay someone a few thousand dollars for a design, then pay a reasonable price for a spin of a few wafers, to have exactly the chip you require for your application.

We are looking forward to seeing what novel sensors might crop up as access to ultralow power and dense transistors becomes increasingly affordable.

The end of Moore’s law points to the creation of a new regime, with ‘brand-new’ market incentives influencing the rate of technological advancement. This new regime is altogether different from how the electronics industry has been operating for the past several decades. It is a disruptive development (to be sure), but one that offers intriguing possibilities for the future.

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**TEST PLATFORM FOR 5G NR RF AND PROTOCOL TEST**

Anritsu has released its MT8000A solution with a 5G base station emulation function. The product supports 5G NR RF Tx measurements and protocol tests needed to support advances in communications technologies in line with the development of 5G NR.

A single MT8000A test platform supports both the sub-6 GHz, including band n41, and the millimetre wave bands used by 5G. Combining it with the OTA Chamber enables both millimetre wave band RF measurements and beamforming tests using call connections specified by 3GPP.

The flexible, scalable design uses a modular architecture. As well as supporting 4x4 MIMO and 8CA implemented by eMBB (enhanced mobile broadband), it provides a flexible environment for future 5G test requirements, including URLLC (ultra-reliable and low latency communications) and mMTC (massive machine-type communications).

A comprehensive test environment is provided by making use of Anritsu’s LTE test platform offering innovative functions based on the company’s experience in this market. Easy configuration of a linked environment is possible for simulating 5G and LTE NSA (non-standalone).

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**EXTRA-DEEP RACK CASES**

METCASE has launched an extra-deep 24” version of its COMBIMET 19” enclosures, suitable for server rack type applications.

**COMBIMET** is METCASE’s range of aluminium 19” rack cases. Applications include networking, communications, AV and studio systems, laboratory instruments, industrial computers and control systems.

The latest cases are 610 mm (24") deep — much deeper than the existing standard depths of 265 and 365 mm. This depth is suitable for deep 19” racks, eg, 1000 mm.

The enclosures offer complete access to the PCBs: the top, base and rear panels are removable. The top and base can be specified as either vented or unvented. Other features include ergonomic front panel handles and mounting holes for PCBs and chassis. M4 earth studs on all components ensure electrical continuity.

The models are available in all heights from 1U to 6U and are painted in black, RAL 9005. The front panels are also in black. Cases are supplied fully assembled.

The cases can also be supplied fully customised. Services include CNC punching, folding, milling, drilling and tapping; fixings and inserts; painting and finishing, digital printing of legends and logos.

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IoT SENSOR ENCLOSURE SERIES

The Internet of Things (IoT) requires a large number of electronic devices which record, collect, evaluate and relay data. These devices range from sensors to communication nodes right up to gateways to the internet. With the BoLink series of sensor enclosures, BOPLA is now offering enclosure series for every type of IoT device.

The compact BoLink IoT sensor enclosure is made of flame-resistant PC UL94 V-0. Measuring 70 x 42 mm, it provides space for a sensor, wireless module and a power supply. Due to its moulded-on insertion opening, it is suitable for the integration of a pressure compensation element, including for outdoor use. Depending on the type of power requirement needed for wireless technology, BOPLA supplies the small plastic enclosure in three heights: 15 mm for a button cell, 22 mm for three AAA batteries and 26 mm for a CR 14250 lithium battery.

By using a basic mould shape, and various inserts for moulding different enclosure heights, wall brackets and screwing options, BOPLA can create a total of 18 variants of the basic IOT type. Each height is available in three different versions: with wall fitting and front access, which makes replacing the battery easy; with wall mounting and a rear screwing system to provide a clean, attractive look; and with a rear screwing system and without mounting brackets.

In addition, every variant of the enclosure is available with two IP protection classes: without a seal (IP40) and with a seal (IP65). If necessary, the installation height of the electronics compartment can be increased by 1.5 mm with the aid of a seal.

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As well as being the strongest material ever tested, graphene is also flexible, transparent and able to conduct heat and electricity 10 times better than copper. After graphene research won the Nobel Prize for Physics in 2010, it was hailed as a transformative material for flexible electronics, computer chips, solar panels, water filters and biosensors; however, its performance since then has been mixed and industry adoption slow.

Seeking answers to this mystery, a research team led by RMIT University inspected commercially available graphene samples, atom by atom, with a state-of-the-art scanning transition electron microscope. The results, published in the journal Nature Communications, revealed that high levels of silicon contamination were the root cause, with massive impacts on the material’s performance.

Testing showed that silicon present in natural graphite, the raw material used to make graphene, was not being fully removed when processed. Co-lead researcher Dr Dorna Esrafilzadeh said, “We believe this contamination is at the heart of many seemingly inconsistent reports on the properties of graphene and perhaps many other atomically thin two-dimensional (2D) materials.”

The testing not only identified these impurities but also demonstrated the major influence they have on performance, with contaminated material performing up to 50% worse when tested as electrodes.

“This level of inconsistency may have stymied the emergence of major industry applications for graphene-based systems,” Dr Esrafilzadeh said. “But it’s also preventing the development of regulatory frameworks governing the implementation of such layered nanomaterials, which are destined to become the backbone of next-generation devices.”

The two-dimensional property of graphene sheeting, which is only one atom thick, makes it ideal for electricity storage and new sensor technologies that rely on high surface area. The study reveals how that 2D property is also graphene’s Achilles heel, by making it extra vulnerable to surface contamination.

The good news is that pure graphene can still be produced using high-purity graphite, with the researchers demonstrating that such material performed extraordinarily well when used to build a supercapacitor. When tested, the device’s capacity to hold electrical charge was the biggest so far recorded for graphene — and within sight of the material’s predicted theoretical capacity.

The team then used pure graphene to build a versatile humidity sensor with the highest sensitivity and the lowest limit of detection ever reported. These findings constitute a milestone for the complete understanding of atomically thin two-dimensional materials and their successful integration within high-performance commercial devices.

“Graphene was billed as being transformative, but has so far failed to make a significant commercial impact, as have some similar 2D nanomaterials,” Dr Esrafilzadeh said. “Now we know why it has not been performing as promised, and what needs to be done to harness its full potential.”

Schematic representation of the available surface area of graphene for molecular interaction: a) pure surface vs b) contaminated surface. The red spheres represent molecules that can interact with the surface, while the orange rafts represent the contaminants.
UPS SYSTEMS


The rugged UPS models utilise true online technology, making them suitable for severe environments and military applications including HMMWV, UAV, shipboard, submarine, aircraft, mobile power units, shelters, transportable systems, tactical systems and ground support. They can also be used in communications systems as well as heavy-duty industrial and demanding commercial applications.

Features include: compact chassis (1–5U tall), ultralightweight design, power factor-corrected universal input and SNMP communications. Lithium iron phosphate batteries are available.

Metromatics Pty Ltd
www.metromatics.com.au

HIGH-POWER FLICKER, HARMONICS AND POWER QUALITY COMPLIANCE TESTING

The European Union (EU) requires electrical products to comply with a series of CE marking EMC standards relating to power quality. These include harmonics, flicker and inter-harmonics immunity standards. Harmonised standards are used to declare compliance against the EMC Directive 2014/30/EU, the Radio Equipment Directive 2014/53/EU and the Low Voltage Directive (LVD) 2014/35/EU.

EMC Technologies’ Melbourne laboratories have recently commissioned a sophisticated high-power full compliance test system that tests single- and three-phase electrical equipment at up to 75 A per phase, plus full compliance testing to a range of non-mandatory power quality AC and DC immunity standards. The system also provides compliance testing to the power quality requirements of Australian energy authorities for air conditioners and other domestic/residential equipment up to 75 A per phase.

The system meets IEC 61000-4-7 sampling rate and resolution requirements and provides arbitrary waveform generation, precision measurements and waveform analysis. The Flicker reference impedance IEC 868 complies up to 75 A per phase.

The system software supports a test file replay mode, which permits the viewing of both harmonics and flicker tests as if they are performed in real time. Complete test reports are generated automatically.

EMC Technologies also provides NATA ISO 17025 calibration of flicker and harmonics measurement systems per EN 61000-3-2 and EN 61000-3-3.

EMC Technologies
www.emctech.com.au
The iEi Integration TANK AIoT Developer Kit is designed for operational and information technologists, with an Intel core for optimal performance, a pre-installed OpenVINO toolkit, an Intel Media SDK and an Ubuntu operating system for out-of-the-box ease of use, enabling rapid development and deployment.

Featuring support for a choice of Intel’s Core i5-6500TE processor (2.3 GHz quad core, 35 W thermal design power) or Core i7-6700TE processor (2.4 GHz, quad core, 35 W thermal design power), the kit is capable of analysing multiple high-definition (HD) video streams and large amounts of sensor data. This is backed up by its 1 TB HDD, DDR4 memory and wide selection of I/O interfaces including 4x USB 3.0, 4x USB 2.0, 4x RS-232 (2x RJ-45, 2x DB-9 with isolation), 2x RS-232/422/485 (DB-9), 8-bit digital input (4-bit input, 4-bit output), 1x VGA and 1x HDMI plus DisplayPort.

In terms of expansion, the product supports 2x PCIe with eight data lines, 1x half-size PCIe Mini and 1x full-size PCIe Mini supporting mSATA. It is capable of operating in a wide temperature range of -20 to 60°C with air flow, allowing peace of mind during demanding applications in industrial environments.

ICP Electronics Australia Pty Ltd
www.icp-australia.com.au

MODULAR ELECTRONICS HOUSINGS
The ICS (Industrial Case System) electronics housings from Phoenix Contact are available in graduated sizes, and with standardised device connections such as RJ45, USB, D-SUB and antenna sockets.

The housing series provides the basis for Industry 4.0, power electronics and process automation applications, such as communication systems, interfaces and gateways, relay assemblies and safety technology.

Due to the highly flexible modular system, device manufacturers can adapt the housings to the requirements of their application. Optional DIN rail connectors, marking covers and various colour versions provide additional individualisation options.

Phoenix Contact Pty Ltd
www.phoenixcontact.com.au
TOPOLOGICAL TRANSISTORS
FOR ULTRALOW-ENERGY ELECTRONICS

Their work, published in the journal Nature, would thus bring us one step closer to minimising the energy wasted by modern telecommunications and computing. A significant proportion of the growing amount of energy used in information and communications technology (ICT)—such as mobile phones, computers and the data centres that connect them—is caused by transistor ‘switching’. Each time a transistor switches, a tiny amount of energy is burnt—and with trillions of transistors switching billions of times per second, this energy adds up.

For many years, the energy demands of an exponentially growing number of computations were kept in check by ever more efficient and ever more compact CMOS (silicon-based) microchips. But as fundamental physics limits are approached, there are limited future efficiencies to be found.

“For computation to continue to grow, to keep up with changing demands, we need more-efficient electronics,” said study author Professor Michael Fuhrer.

“We need a new type of transistor that burns less energy when it switches.”

Over the last decade, there has been much excitement about the discovery that there are two types of insulators: normal insulators which don’t conduct electricity and topological insulators—newly discovered materials that conduct electricity only on their edges.

Researchers from the ARC Centre of Excellence in Future Low-Energy Electronics Technologies (FLEET), based at Monash University, have now succeeded in ‘switching’ a material between these two states of matter via application of an electric field. This is the first step in creating a functioning topological transistor.

Topological materials and topological transistors

Topological insulators are novel materials that behave as electrical insulators in their interior, but can carry a current along their edges. “In these edge paths, electrons can only travel in one direction,” said lead author Dr Mark Edmonds. “And this means there can be
no ‘back-scattering’, which is what causes electrical resistance in conventional electrical conductors.”

Unlike conventional electrical conductors, such topological edge paths can carry electrical current with near-zero dissipation of energy, meaning that topological transistors could burn much less energy than conventional electronics. They could also potentially switch much faster.

Topological materials would form a transistor’s active, ‘channel’ component, accomplishing the binary operation used in computing, switching between open (0) and closed (1). The electric field induces a quantum transition from ‘topological’ insulator to conventional insulator.

In order to be a viable alternative to silicon-based technology, topological transistors must operate at room temperature (without the need for expensive supercooling); ‘switch’ between conducting (1) and non-conducting (0); and switch extremely rapidly, by application of an electric field.

“While switchable topological insulators have been proposed in theory, this is the first time that experiment has proved that a material can switch at room temperature, which is crucial for any viable replacement technology,” Dr Edmonds said.

The study
The material Na3Bi is a topological Dirac semimetal (TDS), which has long been considered a promising system in which to look for topological field-effect switching as it lies at the boundary between conventional and topological phases. The FLEET researchers used scanning probe microscopy/spectroscopy (STM/STS) and angle-resolved photoelectron spectroscopy (ARPES) to study the structure and electronic state of Na3Bi.

The study found that when Na3Bi is made ‘atomically thin’ (i.e., only a few layers of atoms in thickness), it is possible to open an electronic band gap, turning the material into an insulator. This bandgap is an essential component in any electronic switch.

Specifically, the researchers found that:
- in the absence of an electrical field, atomically thin Na3Bi is a 2D topological insulator with a ‘bulk’ (i.e., interior) bandgap >300 meV (i.e., behaving as an electrical insulator), and no bandgap at the edges (i.e., only the edges conduct electricity, and they conduct without dissipation);
- at a critical applied electrical field, the bandgap closes to zero everywhere, and the material becomes a semimetal like graphene (i.e., it conducts everywhere — interior and edges);
- above that critical electrical field, the bandgap opens everywhere (to 90 meV) and there is no conduction (interior and edges).

“These large bandgaps are much greater than the thermal energy available at room temperature (25 meV), which demonstrates that ultrathin Na3Bi is suitable for room-temperature topological transistor operation,” said study author James Collins.

“ie, the material is capable of dissipationless transport of charge at room temperature.”

VECTOR NETWORK ANALYSER
Rohde & Schwarz presents the R&S ZNA high-end vector network analyser, a powerful, universal test platform for characterising active and passive DUTs.

The two models R&S ZNA26 (10 MHz to 26.5 GHz) and R&S ZNA43 (10 MHz to 43.5 GHz) offer a dynamic range of 146 dB (typ) and a trace noise as low as 0.001 dB at 1 kHz IF bandwidth. These two features are essential for measurements on high-rejection filters.

The R&S ZNA’s hardware concept enables it to perform mixer measurements for RF and IF in parallel, delivering measurement speed twice as fast as with the conventional approach. Amplifier characterisation becomes easy with a 100 dB power sweep range, a pulse generator and modulator per test port, versatile intermodulation measurement capabilities and spectrum analyser functionality.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com.au

4:1 INPUT DC/DC CONVERTERS
RECOM’s REC15E-Z series of 15 W isolated DC/DC converters features wide input ranges in a 1” x 1” case size. This is intended to save PCB space, while the wide input ranges increase flexibility by accepting several standard bus voltages.

The DC/DC converters are fully specified devices with 15 W, no minimum load, 1600 VDC isolation, high efficiency up to 90% and low ripple/noise. The series was designed for applications where board space is at a premium.

The wide 4:1 input ranges accept 9–36 or 18–75 V to cover multiple supply options such as lead-acid or lithium batteries or 12/24/36/48 V industrial bus voltages. The inputs are protected against transients of up to 100 V and feature UVLO to protect batteries from being over-discharged.

The single or dual outputs are continuously protected against short circuit and overload conditions and can drive high-capacitive loads. They are fully certified to industrial EMC and safety standards.

RECOM Power GmbH
www.recom-power.com
UPRIGHT HART SIGNAL FILTER

The HRT-370 is an upright HART signal filter which has been designed specifically by ICP DAS to solve the issue of analog signals being interfered with when an additional HART signal is added to the communications process.

When the filter is connected to another HART instrument, it splits the input HART signal into two output channels. The first channel retains the original HART signal and the second new channel filters the HART signal out in order to create an output of pure analog signal. The filter is thus designed to make the collection and processing of both HART and analog current data easier and more precise.

In addition, the product allows for two HART masters and supports a range of functions and modes, including HART burst mode, point-to-point HART mode and loop power function. When it comes to physical installation, the device supports DIN-rail installation for easy, convenient mounting inside an industrial control equipment rack.

ICP Electronics Australia Pty Ltd
www.icp-australia.com.au

THERMALLY CONDUCTIVE ENCAPSULATION RESIN

The ER2224 epoxy potting compound is a highly thermally conductive resin (1 W/m*K) that also offers strong thermal cycling properties. It is an off-white resin, which allows it to blend with LED designs, dissipating heat from the LED and extending the unit operating lifetime while offering environmental protection against the elements as well as showing good chemical resistance.

It has high temperature stability with a wide operating temperature range, which makes it suitable for a wide variety of applications. Other key properties include: high thermal conductivity; resistance to solvents and chemicals; low water absorption; and RoHS compliance.

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CABLE MODEM NETWORK ANALYSER

The VeEX CM3000 Cable Modem Network Analyser can assist users with service and plant verification testing and troubleshooting solutions. It has an intuitive user interface with VGA colour touchscreen and Windows CE operating system. It is available to rent from TechRentals.

The analyser has a Fast Spectrum with 0.3 µs sample rate and equaliser stress, frequency response and group delay measurement in Digital and Cable Mode. Its i-QAM option identifies impairments in a QAM signal and it features gated CCN, CSO, CTB and HUM tests on active channels.

It offers a high-resolution true non-interfering 5 to 1000 MHz downstream sweep system with manual and automatic gain and slope offsets, as well as fast 5 to 200 MHz upstream sweep, plus ingress detection and display.

TechRentals
www.techrentals.com.au

WHITE CHIP LED

ROHM has announced the availability of the SMLD12WBN1W, a white chip LED with 1608 (1.6 x 0.8 mm) size. The package offers good mountability and long operational life, which makes it suitable for use in display panels (eg, temperature control displays) in industrial and compact consumer equipment.

In recent years, the need to improve both design quality and visibility of industrial equipment has increased the use of white LEDs for numerical displays and visual indicators in these applications. But it has been difficult to achieve no degradation in luminosity due to the use of epoxy or silicone resins for moulding of typical white chip LEDs. These types of material could not prevent degradation in luminosity or provide enough package strength to facilitate mounting on circuit boards.

ROHM has been providing 1608-size chip LEDs in colours ranging from red to green, and now it is adding white to this product range to meet market demand. The adoption of a material that combines the benefits of epoxy and silicone resins made it possible to achieve a non-degradable white chip LED in such a small package.

ROHM’s tests have demonstrated that the SMLD12WBN1W maintained 100% of its luminosity after operating for 1000 h (@25°C, Iₛ=20 mA), which is said to represent an improvement of 20x in operational life when compared to other similar products available in the market. Additional tests showed that the package strength was improved 25 times with the material when compared to products using silicone resin. This should help reduce the occurrence of failures during fabrication when mounting on circuit boards.

Fairmont Marketing
www.fairmontmarketing.com.au

NETWORK APPLIANCE

The flexible FWA9500 network computing appliance, from iBASE, is a suitable workhorse for enterprise workloads, capable of managing vast quantities of data to enable robust levels of performance in industry-grade network security, firewall, VPN, UTM, WAN and network management applications.

It supports Intel Skylake-SP Xeon processors, useful for today’s ever-changing network environments. The 2U rackmount system features dual LGA3647 CPU sockets and an Intel C624 chipset supporting up to 512 GB RDIMM memory in 16x DDR4-2666 sockets. With 2x Intel I210-AT Gigabit Ethernet controllers on board and configurable NIC module slots, the product can be equipped with 8x IBN (iBASE proprietary network interface) cards to accommodate a maximum of 66 GbE ports.

The unit features a modular approach to its design as a network appliance, with high expandability and scalability. This allows rapid customisation and easy configuration by interchanging and combining modules in order to meet the user’s optimal requirements.

The inner storage expansion, with 2x 3.5” or 4x 2.5” swappable drive bays and an 800 W redundant power supply, ensures high availability and serviceability. The device comes with I/O connectivity and expansion slots including a PCIe x8 slot, an M.2 (M-key), a Mini PCIe, 2x USB 2.0 and an RJ45 serial console with LCM display for easy operation. Optional features include LAN bypass and the iBASE IDN100 IPMI 2.0 module.

Backplane Systems Technology Pty Ltd
www.backplane.com.au
IP65-RATED INDUSTRIAL TOUCH MONITORS

Advantech’s IDS-3315 front IP65-rated industrial touch monitor is built for water- and dust-resistant applications. It is equipped with Advantech’s well-engineered, in-house ruggedised front metal frames, providing optimal solutions for water- and dust-resistant applications while keeping a compact and narrow bezel design.

The rounded-corner design is ergonomic and sleek while reducing the likelihood of damage. The screen offers versatile touch-screen options, including cover glass, resistive touch screen and projected capacity touch screen, for different applications and user scenarios. Customisation services, such as brightness enhancement and AR coating for outdoor applications, are available.

The in-house, IP65-rated mechanical solution offers an ultrasmall design of 42 mm in depth and four rounded corners for maximum protection. IDS-3300 also provides different interfaces for easy fixing and integration: VESA 75 x 75 and 100 x 100 at the back and metal clamps on the sides.

The IDS-3300 series offers flexible surface options such as cover glass (when touch is not required), resistive touch screen and a projection capacity touch screen to meet different specifications. The series comes with VGA/DVI/HDMI signal interfaces for easy integration to all embedded boards and systems. USB and RS-232 ports are reserved for connections to different touch screens: projection capacity or resistive.

The IDS-3315 (15”), with cover glass, resistive and PCAP touch screen options, is available for order now while the IDS-3319 (19”) and IDS-3310 (10.4”) will be available for order in Q2 2019.

Advantech Australia Pty Ltd
www.advantech.net.au

EVERYTHING FOR CONNECTING ANYTHING TO THE INTERNET OF THINGS.

Bopla’s new BoLink range of enclosures and accessories was specifically designed for Internet of Things (IoT) applications. Compact and flame-resistant, BoLink’s modular design allows for indoor and outdoor placement of both sensors and small controllers.

• Heights: three
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To discuss anything you need, call Erntec, distributors of Bopla in Australia and NZ, on +61 3 9756 4000 or email sales@erntec.com.au
While some features overlap between test tools as you move up the hierarchical ladder from verification to certification, each type of testing answers one of the following questions to help you make the right choice.

Is the cabling connected correctly?
Verification testing answers this question. For copper cabling, these simple-to-use, low-cost tools perform basic continuity functions such as wire map and toning. Wire mapping will tell you that each pair is connected to the right pins at plugs and jacks with good contacts in the terminations, while toning is used to help identify a specific cable in a bundle or at the remote end.

Some verification testers, like Fluke Networks’ MicroScanner² Cable Verifier, include a time-domain reflectometer (TDR) feature to help determine the distance to the end of a cable or a trouble spot. It can also detect if a switch is connected to the cable under test.

For fibre, a simple visual fault locator (VFL) can serve as a verification tool as it verifies continuous fibre connections to help find breaks, connectors and splices. It also verifies the proper polarity and orientation of fibres within multi-fibre connectors.

While verification is ideal for troubleshooting and really the first line of defence in finding cabling problems, most cable testing requires more than simple verification. Hence it is rarely the only method used — unless testing POTS (plain old telephone service) voice-only applications running over simple voice-grade cable like Category 3.

Verification testing alone will not verify the ability of the cabling to support specific applications. And it certainly won’t result
in the ability to ensure the standards compliance required for a manufacturer warranty.

Can the cabling support the desired application?
Qualification testers include verification functionality but are more sophisticated with their ability to qualify cabling bandwidth. Qualification provides the information needed to determine if the cabling under test will support the signalling of specific applications. For example, if you have two cables that pass verification testing, Fluke Networks’ CableIQ Qualification Tester might also show that only one of the cables can support 10BASE-T (i.e., 10 Mbps Ethernet) while the other can support 1000BASE-T (Gigabit Ethernet).

Combined with verification functionality, qualification testers are also excellent troubleshooting tools. They are ideal for small adds, moves, and changes, or for setting up a temporary network that needs to be qualified for a specific network technology. They can also help in deciding whether an existing cabling plant needs to be upgraded to support a new application.

But like verification testing, qualification does not perform the certification required by cabling manufacturers.

Does the cabling comply with industry standards?
Certification testers are the only answer to this question. Used by commercial installers/contractors and enterprise facility managers to ensure that new cabling fully meets the requirements of cabling standards such as TIA-568-C.2 Category 6A or ISO 11801 2nd Edition Class E6a, certification is the most rigorous of all cable testing. It is required by cabling manufacturers to receive a warranty.

Certification includes all the testing that goes into verification and qualification, but also makes several measurements across predefined frequency ranges and compares the detailed results to standards set by TIA or ISO. The results determine Pass or Fail in accordance with the standard and indicate if a link is compliant with a specific category or class of cable, such as Category 6A or E6a. This in turn tells you which application it is able to support.

The choice matters
While the decision to use verification, qualification or certification testing ultimately comes down to what your customer requires, the bottom line is this: if you want the support and financial security offered by a cable manufacturer warranty, certification to industry standards with a tester such as the DSX CableAnalyzer is your only option.

Anything else puts the sole warranty responsibility upon you. And with an average cost-per-link of at least $100 for a commercial installation, the dollars at risk are huge.

This article was originally published on the Fluke Networks blog and is reproduced here with permission.

Fluke Networks
www.flukenetworks.com
ENERGY-HARVESTING EMBEDDED CONTROLLER

Renesas Electronics has announced an energy-harvesting embedded controller that can eliminate the need to use or replace batteries in IoT devices. Developed based on the company’s SOTB (silicon-on-thin-buried-oxide) process technology, the product achieves reduction in both active and standby current consumption.

The R7F0E is a 32-bit, Arm Cortex-based embedded controller capable of operating up to 64 MHz for rapid local processing of sensor data and execution of complex analysis and control functions. Consuming just 20 µA/MHz active current and 150 nA deep standby current, the product is suitable for low-power and energy harvesting applications.

The low current levels of the embedded controller enable system manufacturers to eliminate the need for batteries in some of their products through harvesting ambient energy sources such as light, vibration and flow. This makes it useful for industrial, business, residential, agricultural, healthcare and public infrastructure IoT applications, as well as health and fitness apparel, shoes, wearables, smartwatches and drones.

The Energy Harvest Controller (EHC) function is included to increase robustness and minimise external components. The EHC enables direct connection to many different types of ambient energy sources, such as solar, vibration or piezoelectric, while protecting against harmful inrush current at start-up. It also manages the charging of external power storage devices such as supercapacitors or optional rechargeable batteries.

Renesas Electronics
www.renesas.com

NETWORKING PLATFORM

The G.hn Wave-2 networking chipset, from MaxLinear, features the G.hn digital baseband and G.hn analog front ends. The networking platform offers designers the flexibility to combine footprint-compatible components to address multiple G.hn applications.

The MaxLinear G.hn digital broadband (DBB) processors provide high-speed networking solutions with 1 Gbps maximum throughput over power lines and 1.7 Gbps maximum throughput over coaxial cables and phone lines. The DBB processors feature a G.hn physical layer (PHY), G.hn datalink layer (DLL) and an embedded CPU for management and control functions. The G.hn analog front ends (AFEs) provide up to 2 Gbps physical data rates over any wired medium. Housed in a small 4 x 4 mm QFN package, the devices deliver programmable transmission and reception gains for each wired medium.

The Wave-2 networking G.hn processors deliver connectivity and reduced congestion in smart grid, security, broadband, industrial, smart home and automotive applications. The platform also includes a set of software development kits (SDKs) that enable designers to create custom solutions that meet requirements such as IPv4/IPv6 support, quality of service (QoS) and TR-069 management. Engineers can also use the SDKs to develop customised applications that run on a DBB processor’s embedded CPU.

Mouser Electronics
www.mouser.com

SENSOR ENCLOSURES FOR THE IoT

The 1551V miniature ventilated sensor enclosures from Hammond Electronics are designed to house sensors and small subsystems installed in the manufacturing environment as part of IoT systems. While there is no relevant international standard, the 1551V enclosures are designed around the PCB sizes selected by leading sensor manufacturers for their latest generations of products.

The ABS UL94-HB 1551V is available in black, grey and white. Four plan sizes — 80 x 80, 80 x 40, 60 x 60 and 40 x 40 mm — are all 20 mm high. Maximum PCB sizes are 58 x 49, 58 x 23, 38 x 29 and 23 x 23 mm respectively. Four PCB mounts are moulded into the base and the 20 mm height gives enough space for board-mounted RJ45, USB and other standard communication interfaces.

To simplify access, the snap-fit closure allows repeated opening and closing without tools. There are ventilation slots on all four vertical faces and mounting slots and a 15 mm cable knock out in the base.

Environmental sensors monitoring basics such as temperature, humidity and pressure are widely installed, and are now increasingly intelligent subsystems, with data processing and communications capability embedded on a small PCB. For active components that produce relatively large amounts of waste heat, the product obviously provides good airflow for cooling purposes.

Hammond Electronics Pty Ltd
www.hammondmfg.com
IoT WIRELESS SENSOR DEVICES
Advantech’s WISE-4210 series of IoT wireless sensor devices includes a wireless LPWAN-to-Ethernet AP and three wireless sensor nodes. The device-to-cloud total solution provided by this series allows IT, OT and cloud platform system developers to easily implement a private LPWAN, acquire field site data and achieve seamless integration with both public cloud, such as Microsoft Azure, and private enterprise clouds.

Based on proprietary LPWAN technology, the WISE-4210 series minimise frequency band interference, support a wider data transmission range, are compatible with lithium batteries and enable cloud platform integration. By locking the sub-GHz frequency band, the series significantly reduces susceptibility to interference for 2.4 GHz wireless communication technologies such as Wi-Fi, Bluetooth and Zigbee. By supporting a network transmission distance of up to 5 km, the series meets the requirements of large-scale interior environments such as data centres, factories and warehouses for collecting and applying a wide range of interior data.

With LPWAN technology, only three 3.6 V lithium batteries are required to operate the nodes for up to five years, eliminating the need for additional wiring and frequent recharging. Additionally, the WISE-4210 series supports multiple transfer protocols, including MQTT, RESTful, Modbus/TCP and Modbus/RTU, for simple device-to-cloud connections.

The WISE-4210 series of LPWAN IoT wireless AP and sensor nodes provides the necessary device-to-cloud integration functions for conventional automation and emerging IoT applications. The series allows users to easily deploy private networks and quickly develop systems.

Advantech Australia Pty Ltd
www.advantech.net.au

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In addition to one-phase systems, three-phase systems are also used in many places in industry and commerce. They often offer decisive advantages. It is important to ensure safe load balancing in order to prevent overloads.

Power Distribution Units (PDU) with multiple IEC outlets are a practical, space-saving solution for supplying power to a variety of devices. Nevertheless, this large number of loads can also tempt you to want to operate the electrical power capacity of the PDU up to its limit or even above it. This must be prevented under all circumstances. SCHURTER provides a wide range of technologies and components to ensure the safe use of power distribution units in one-phase and three-phase systems.

Choice of IEC appliance outlets

The correct dimensioning and selection of the IEC outlets (type J with 10 A or type F with 16 A) must be the very beginning. How much power is required from the distribution unit? How many loads must the distribution unit be able to supply? Should or must the supply be one-phase or three-phase for power reasons? These questions are elementary for a safe load distribution of the PDU. A primary fuse on the respective phase ensures that the permissible supply power of 2.5 kW, for example, is not exceeded.

Light pipe for status display

A typical application for light pipes is power distribution units in data centres. Switched outlets today have displays. However, these are usually located at the head of the strip. With the latest SCHURTER appliance outlets, the available information can be used intelligently.

The service technician on site, for example, can see at a glance which outlets are working or where a problem exists. For example, a failure can be signalled with a red LED or a critical power consumption pattern with a yellow LED. This makes both repairs and preventive interventions easier and more efficient.

The integration of the light pipe into the appliance outlet has several advantages. The light indicator is located directly at the socket, which makes it easy to assign the signal even in large power cabinets with many outlets and cables. The space requirement is also minimal and fewer openings are required in the PDU. The installation effort is significantly reduced.

Cord retention systems: V-Lock and Twylock

The high packing density of servers in modern data centres demands the same on PDUs. However, in order not to unintentionally pull out the wrong cable, high-quality, modern outlets offer a pull-out protection. Depending on the arrangement of the outlets in the PDU — horizontal or vertical — the SCHURTER V-Lock or other systems with lateral locking (eg, SCHURTER Twylock, SecureLock, etc) are available. Both cord retention versions, which are approximately equal in value, are available as standard.

Tamper Resistant Outlet Lock Type F/Type J

In order to prevent overload of modern power distribution units with multiple IEC outlets, individual outlets can be blocked by means of protective caps: so-called Tamper Resistant Outlet Locks. In most cases, you have more outlets than loads on one strip. These Tamper Resistant Outlet Locks are plugged onto the power distribution unit just like a plug. For safety reasons, the optionally available protective caps cannot be removed without a special tool. This solution is particularly suitable for the supply of very different loads, which are also noticeable by increased operating temperatures.

Colour coding of the outlets by phase

Power distribution units in three-phase systems are ideal for colour-coding the individual phases. Various IEC outlets of SCHURTER types J and F are therefore no longer only available in black, but also in white and grey. In the often poorly lit server and control cabinets of a data centre, this makes it easier to visually distinguish the individual phases.

The matching connector

SCHURTER stands for safe and easy power supply and, in addition to the components for PDUs, also offers the appropriate plug connections. Mains connection cables, country-specific or also connection plugs for cable installation are included in the range of device plugs.

About SCHURTER

SCHURTER continues to be a progressive innovator and manufacturer of electronic and electrical components worldwide. Our products ensure safe and clean supply of power, while making equipment easy to use.

https://www.youtube.com/watch?v=kfHmlWcPFVs

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MULTIFUNCTION CALIBRATOR
The NATA certified Beamex MC6 Multifunction Calibrator provides calibration capability for pressure, temperature, electrical and frequency signals. Its usability makes it a suitable measurement device for field use in industries such as food and beverage, pharmaceutical, energy, oil and gas. It is available to rent from TechRentals.

The product features a large 5.7” colour touch screen and user-friendly multilingual interface which is divided into different operational modes including meter, calibrator, documenting calibrator, data logger and HART communicator. As the calibrator replaces several individual devices, there is no need to carry several other units into the field. The ergonomic design is lightweight and water/dust-proof (IP65), and includes a rechargeable Li-ion battery.

The device can communicate with Beamex Calibration Software enabling fully automatic and paperless calibration documentation, which can help improve quality of records.

TechRentals
www.techrentals.com.au

SECURE-ELEMENT EVALUATION KIT
STMicroelectronics’ STSAFE-A100 Evaluation Pack extends the richly supportive STM32 Nucleo ecosystem to accelerate secure-element integration, leveraging re-usable source code that simplifies the creation of secure IoT devices and high-value consumables such as medical probes, IT accessories and consumer products.

The pack comprises the X-NUCLEO-STSA100 expansion board, which contains the STSAFE-A100 secure element, and the STSW-STSA100 software pack. The software includes device drivers, STM32 microcontroller source code and STSAFE-A100 source code for use cases including brand and ecosystem protection, device enrolment and secure cloud connection.

The product is a convenient 8-pin device that provides robust, immutable, hardware-based authentication and secure data-management services to a host system. Resistant to cyber attacks, it features a secure OS running on a state-of-the-art, CC EAL5+ certified secure microcontroller, advanced symmetric and asymmetric cryptography, crypto key management, and built-in protection against physical and side-channel attacks.

Using the evaluation pack in conjunction with any compatible STM32 Nucleo development boards, device designers can combine the STSAFE-A100 secure element with an unrestricted variety of STM32 microcontrollers, sensors and actuators to protect products ranging from simple IoT endpoints to industrial networking and control equipment, computer peripherals, wearables, gaming equipment and mobile accessories.

STMicroelectronics Pty Ltd
www.st.com
QUALITY CONTROL

BENEFITS OF DIGITAL MICROSCOPES IN QUALITY CONTROL

Using a digital microscope instead of traditional magnification tools to repair and/or rework defective boards will improve the operator’s user experience and pave the way for more efficient quality control, thanks to the bigger working area and real-time image display.

Once a printed circuit board has been identified as faulty during quality control, repairing and reworking will most likely include hand soldering. However, due to the miniaturisation of components in, for example, smartphones and tablets, traditional tools such as magnification lamps and optical microscopes become insufficient or inexpedient.

Digital microscopes replace traditional magnification tools

Today, higher magnification levels than previously are needed when hand-soldering ICs and capacitors due to the increasingly smaller components. However, many operators find that magnifying lamps are no longer able to provide the required magnification levels. Moreover, optical microscopes, usually considered the alternative to magnifying lamps, have a small field of view, creating a limited working area and thus making it difficult for the operator to work under. A digital microscope will also improve cooperation between colleagues by looking at a shared monitor.

Repair and rework in real time

Using a digital microscope to repair and rework defective boards will provide high magnification levels and increase usability, making quality control easier for the operator and thus enabling them to work more efficiently. A digital microscope will also display a live image of what happens beneath the camera with no delay, eliminating moments of irritation and improving the quality control working conditions.

Improved ergonomics and hand–eye coordination

With a digital microscope, the user can see the magnified object on a monitor, alleviating the operators of unnecessary neck pains and headaches as they are no longer bending their necks to look through an ocular or magnifying lamp. Cases show that the elimination of straining work postures leads to less sick leave and staff infirmities.

With the help of an inline flex arm, the operator can also stand directly in front of the camera and object under the microscope. This further improves the ergonomics and hand–eye coordination of the operator and thus paves the way for more efficient rework.

TAGARNO specialises in digital microscopes for quality control processes in the electronics industry. By combining advanced technological practices with high-quality cameras and original software interfaces and apps, businesses can renew and optimise their visual inspection and quality control processes.

TAGARNO
www.tagarno.com
DUAL-CORE DIGITAL SIGNAL CONTROLLERS

System developers designing high-end embedded control applications with multiple software teams can now benefit from a family of dual-core digital signal controllers (DSCs) in a single chip, enabling easy software integration.

Microchip Technology’s dsPIC33CH has one core designed to function as a master, while the other functions as a slave. The slave core can be used for executing dedicated, time-critical control code, while the master core is busy running system-level functions, including user interface (UI), monitoring and communications, customised for the end application.

The product is designed to facilitate independent code development for each core by separate design teams — and later enables seamless integration when they are brought together in one chip. Its dual independent cores enable a multiteam software development approach, with two workflows running in parallel. Time-critical control loops can be separated from housekeeping functions, allowing each core’s code to be individually and effectively optimised.

Another key benefit of distributing processing workload across two DSC cores in a single device is the ability to achieve higher power density through higher switching frequencies (more than 2 MHz compared to around 1 MHz for a single-core controller), which can result in smaller components. Additionally, the two cores can be programmed to monitor each other for functional safety reasons, facilitating robust system design.

The range is optimised for high-performance digital power, motor control and embedded applications requiring sophisticated algorithms. Typical power applications include wireless charging, server power supplies, DC to DC converters, chargers and inverters. The product can also be used as a motor control in pumps, fans, drones, robotics, power tools and consumer appliances; in automotive electronic sensors, industrial automation and control, and medical diagnostic equipment; and as a gateway or central processor for IoT applications.

Microchip Technology Hong Kong
www.microchip.com
360° STATIC ELIMINATOR

EXAIR’s Gen4 Super Ion Air Wipe provides a uniform, 360° ionised airstream that clamps around a continuously moving part to eliminate static electricity and contaminants. It is suitable for removing dust, particulates and personnel shocks on pipes, cables, extruded shapes, hoses, wires and more.

The device uses a small amount of compressed air to entrain high volumes of room air. Two shockless ionising points powered by a UL Component Recognised 5 kV power supply fill the airstream with static eliminating ions. That airflow attaches itself to the surface of the material running through the air wipe and neutralises the charge.

Design features include a metal armoured high-voltage cable to protect against abrasion and cuts, a replaceable emitter point, integrated ground connection and electromagnetic shielding. It has an aluminium construction that is lightweight and easy to mount using the tapped holes provided. It is available with a 51 or 102 mm diameter and there are no moving parts to wear out.

The product has undergone independent laboratory tests to certify it meets the rigorous safety, health and environmental standards of the USA, European Union and Canada that are required to attain the CE and UL marks. It is also RoHS compliant.

Compressed Air Australia Pty Ltd
www.caasafety.com.au

DC-DC CONVERTERS

The latest entries in Vicor’s DCM family are available in the 3623 (36 x 23 mm) ChiP (Converter housed in Package) format with a power density of 63 W/cm³. The 80 W ChiPs feature a wide-input voltage range of 9 to 75 V and are available with nominal output voltages of 12, 24, 28 and 48 V.

The DCM ChiP is a DC-DC converter module that is designed to provide a faster power system design option than alternate discrete solutions. DCMs operate from an unregulated, wide-range input to generate an isolated, regulated DC output. By utilising a high-frequency, zero-voltage switching (ZVS) topology, DCMs consistently deliver high efficiency across their entire input voltage range.

The modules are used broadly across defence and industrial applications where tight output voltage regulation is required. These applications include UAV, ground vehicle, radar, transportation and industrial controls. The ChiPs are available in M-grade, which can perform at temperatures as low as -55°C.

Vicor Corporation
www.vicorpower.com

FLAT BRUSHLESS DC SERVOMOTORS

FAULHABER has introduced the BXT family of flat brushless DC motors, featuring high performance, external rotor and slotted drives. They are suitable for applications which require high torque in a short length, including robotics, prosthetics, laboratory automation, medical device technology, pumps and more.

Due to innovative winding technology and optimised design, the motors are 14, 16 and 21 mm in length but deliver torques up to 134 mNm, within a diameter of 22, 32 and 42 mm respectively. They are designed for a continuous output power up to 100 W, with a good ratio between the torque to length, volume and weight. Combined with their flat design, this makes them useful for applications where available space is at a premium.

The motors come equipped with digital Hall sensors. They are designed for speeds of up to 10,000 rpm and can be combined with a wide variety of gears, encoders, brakes and drive electronics. They have good speed stability for constant speed control, due to the high polarity and high rotor inertia.

FAULHABER specialises in modifications to the mechanical and electrical interfaces of the motors to provide solutions configured to each application. The motors feature standard single lead wires and thus offer a flexible electrical interface with multiple industrial connectors.

ERNTEC Pty Ltd
www.erntec.net
**SERVER-ON-MODULE**

The conga-B7E3 server-on-module with the AMD EPYC Embedded 3000 processor, from congatec, is said to offer up to 52% more instructions per clock compared to legacy architectures.

As server-on-modules form the technology basis for complementary rugged server designs, developers can use the module as a drop-in replacement to boost performance within their closed loop engineering design cycles in manifold rugged edge applications. Use cases include Industry 4.0, smart robot cells with collaborative robotics, autonomous robotic and logistics vehicles, as well as virtualised on-premise equipment in harsh environments to perform functions such as industrial routing, firewall security and VPN technologies — optionally in combination with various real-time controls and neural network computing for AI.

The COM Express Type 7 modules are equipped with AMD EPYC Embedded 3000 processors with 4, 8, 12 or 16 high-performance cores, support simultaneous multi-threading (SMT) and up to 96 GB of DDR4 2666 RAM in the COM Express Basic form factor and up to 1 TB in full custom designs. Measuring 125 x 95 mm, the module supports up to 4x 10 GbE and up to 32 PCIe Gen 3 lanes.

For storage the module integrates an optional 1 TB NVMe SSD and offers 2x SATA Gen 3.0 ports for conventional drives. Further interfaces include 4x USB 3.1 Gen 1, 4x USB 2.0 as well as 2x UART, GPIO, I²C, LPC and SPI. Other features include seamless support of dedicated high-end GPUs and improved floating-point performance, which is important for emerging AI and HPC applications.

The modules feature efficient remote system monitoring, management and maintenance capabilities to optimise the total cost of ownership (TCO) in distributed deployments as known from commercial-grade data centres. An extended temperature range of -40 to 85°C is available for selected versions, which is useful for edge server deployments.

**Congatec Australia Pty Ltd**

www.congatec.com

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**RUGGED EMBEDDED POWERHOUSE**

The reliable, feature rich, configurable Crystal Group RE1012 Rugged Embedded Computer is engineered with the latest commercial off-the-shelf (COTS) technologies and housed in a compact, rugged enclosure to provide robust computing power over a long operational life even in the most extreme environments.

**Designed and tested for electrical substation operations and other critical Infrastructure applications such as Gas, Oil and Energy.**

**Features include:**

- **Compact Construction** - 6.09 cm H x 40.64 cm x 27.94 cm Footprint
- **Panel or Rack Mounting Options**
- **Six (6) Core Xenon D1228 CPU**
- **Dual 2.5” SSD Hard Drives**
- **Billet Construction from Milled and Strain Hardenied 6061-T6511 Structural Aircraft Aluminium**
- **IEEE 1613 + IEC 61850-3 Certification Ready**

[Logo: Crystal - Available at Metromatics]

07 3869 4255 | sales@metromatics.com.au | www.metromatics.com.au
Glass is an excellent barrier. It offers processing temperatures as well as high dimensional stability. It is also smoother and more transparent than plastic films. It is, however, in its traditional form, rigid.

This limitation has created space and need for flexible alternatives. Indeed, for more than a decade, companies and research institutes have been developing flexible, transparent and high-performance barriers. These approaches are mainly based on some variation of the multi-dyad principle where multiple alternative pairs of organic-inorganic layers are deposited. These approaches decouple the position of defects and pinholes, thus enhancing barrier properties. The inorganic is thin. Its deposition process has evolved from evaporation and sputtering to PECVD. Work is ongoing on spatial atomic layer deposition (s-ALD) too. The organic layer is often thicker. It planarises surfaces, plugs pin-holes and acts as stress-release layers to achieve repeated bendability.

Some approaches are film based. Here, the barrier film is produced separately then laminated onto the device substrate. This approach has the advantage of decoupling the barrier and device production
yields. In theory, it could also allow the process to run at faster web speeds. However, often, in practice the web speed is limited by the necessity of growing high-quality films under highly controlled growth conditions. This approach, however, adds extra substrate layers as well as extra adhesives. These both contribute to thickness while the latter can also adversely affect impermeability.

An emerging trend will be to combine barrier films with other functionalities such as ITO or polarisers to create all-in-one superthin films. This approach will require extensive know-how and faces a high technical barrier. The winner will, however, be able to capture the market for multiple films which in the past were supplied separately.

Some evolved the technology over many years to develop direct conformal thin film encapsulation (TFE). Here, the multilayer structure is deposited directly on top of the device using PECVD (inorganic) and inkjet printing (organic layer). This process has significantly evolved. In production, the number of required layers has been reduced while maintaining sufficient quality. This has reduced the TACT time and equipment/process counts. The challenge of this process, however, was always the high cost of yield since a production defect would waste the entire device, including the OLED stack, TFT, etc.

The technology has been commercial since 2014, indicating good yield on rigid small-sized samples. This technology will also form the basis of multiple emerging flexible OLED phones, also suggesting that producers have good confidence in its reliability under repeated bending.

The work on TFE has not stopped. There is always a need to reduce thickness and deposition time. Crucially, there will be a need to scale up the process to larger displays such as tablets. In some cases, the touch layer will also need to be integrated first atop then into the TFE structure. The bottom barrier layer may also go TFE for ultralow bending radius.

Flexible glass

We started this article by saying that glass is great, but it is rigid. Well, that is not always true. In fact, flexible glass has been demonstrated for many years. The first flexible glass targeting the display industry was demonstrated about a decade ago.

Flexible glass is essentially thin glass, often thinner than 100 µm. This thinness introduces flexibility. This potentially gives thin glass flexibility and all the other excellent attributes of rigid glass.

There were, however, numerous significant challenges. First, glass was not very flexible, especially compared to plastic-based solutions. The probability of failure would increase with even moderate bending radius. Furthermore, glass was difficult to handle because a crack on the sides could easily propagate through the glass, causing shattering. This was a major issue in vacuum systems since they would need to be shut down, flushed and cleaned.

Progress has been very steady. The bendability has significantly improved. This is largely thanks to a combination of embedding ions and chemically cleaning the edges and surfaces. The former builds in a compressive stress near the surfaces that impedes the propagation of edge cracks. The latter removes, as much as possible, sites or microcracks that could act as crack initiation sites. Today, highly bendable phones are demonstrated at shows around the world with flexible glass.

The handling, too, has also improved. This is mainly thanks to handling tricks. In particular, edge tapes are added to flexible glass rolls to prevent them from coming into direct contact with the equipment. This way we have seen demonstrated high-speed complex conveyance systems able to handle R2R glass. There are also nowadays good laser cutting processes that allow singulating devices without inducing stress or cracks.

All this means that flexible glass, after a decade or so of development, is edging towards commercialisation. Suppliers are now also contemplating offering wide-format glass. Users have also started some limited adoption. The most notable example is flexible 2S-made flexible lighting panels.

There is, however, much work to do to open up major markets such as big-volume flexible display uptake. The market uncertainty lingers for many suppliers, complicating the decisions as to whether and how much to commit to glass R&D and production efforts. Pricing questions also remain. The time from near technology readiness to full commercialisation will also be almost inevitably long. Many, however, now dare ask whether in the long term this technology will replace other flexible barrier solutions by offering the ultimate all-in-one performance.

To learn more about flexible barriers and thin film encapsulation technologies, see the IDTechEx Research report ‘Barrier Films and Thin Film Encapsulation for Flexible and/or Organic Electronics 2019–2029’ at www.IDTechEx.com/barriers.
HIGH-PERFORMANCE IMU
The BMI088 high-performance inertial measurement unit (IMU), from Bosch Sensortec, delivers a stable, low-noise, 6-axis inertial sensor designed for industrial and harsh environment drone and robotics applications.

The IMU incorporates a 16-bit digital, triaxial accelerometer and a 16-bit digital, triaxial gyroscope to measure orientation and detect motion along three orthogonal axes. The device offers acceleration ranges of ±3 to ±24 g and gyroscopic slew rates up to ±2000°/s.

The high performance and high speed of the product enable it to suppress vibrations, which can help ensure smooth navigation and avoid crashes in applications such as drones. It provides vibration-quelling speed and 16-bit accuracy to enable ultralow drift maximum bias drift of 2°/h.

With its vibration robustness and temperature stability even under sudden temperature fluctuations, the device is designed to enhance steering and navigation accuracy even in high-vibration environments. It is compatible with other Bosch sensors, such as the BMI085 IMU, to simplify integration into existing designs. It comes factory calibrated and ready to use in a compact 3 x 4.5 x 0.95 mm package.

For development, the BMI088 shuttle board enables designers to gain easy access to the sensor’s pins via a simple socket. Because all Bosch Sensortec sensor shuttle boards have identical footprints, they can interface with the company’s other development tools for optimal flexibility.

Mouser Electronics
www.mouser.com

HIGH-POWER DC-DC CONVERTERS
Technology Dynamics’ NTDC series of high-power DC-DC converters provides highly regulated DC output power from 2000–3000 W. Rugged construction and high quality make the DC-DC converters suitable for bulk power DC applications in the industrial, medical, military and electric vehicle markets.

A full range of converter solutions is on offer for DC power requirements, including fully customised units. The series has a wide input range of 19–72 and 72–144 VDC with available outputs of 12, 24, 28 and 48 VDC. Features include high efficiency, tightly regulated outputs and OV, OC and OT protections.

The series is suitable for commercial, industrial and military applications, including RF and microwave amplifiers, mass transit, utility, communications and ground mobile military applications. Standard units are easily modified for custom applications.

Metromatics Pty Ltd
www.metromatics.com.au

5G FIXED WIRELESS SELF-INSTALL TECHNOLOGY
NetComm has revealed its 5G Fixed Wireless Self-Install technology for global network operators, designed to remove the expense of sending an engineer to the customer’s premises to install an external reception antenna to receive the 5G signal.

By reducing the time and cost of connecting homes and businesses to 5G fixed wireless services, the technology creates a viable business case for 5G fixed wireless. The self-install platform allows end users to use an application on their phone to connect to the modem and the 5G network, guiding the end user to the most suitable position for their 5G modem to be placed in the house.

Because of the varying characteristics of the 5G fixed wireless market — with different spectrum bands and cell sizes being used — NetComm has developed a portfolio of devices for the marketplace, all of which support both sub 6 GHz bands as well as mmWave. Indoor desk mount can be installed anywhere in the home and is most suitable in locations close to the base station for homes that already have a decent signal strength, while indoor window mount can be installed on the window to improve the signal quality and therefore the connection.

Outdoor wall mount devices also use directional antennas to allow for a longer reach and location further away from the base station; NetComm offers both a self-install outdoor wall mount as well one which requires engineer installation. Outdoor roof mount meanwhile uses high-quality directional antennas to allow for an extra reach from the base station with good connectivity.

NetComm Wireless Limited
www.netcommwireless.com.au
ENCCLOSURES AND TUNING KNOBS FOR TODAY’S ELECTRONICS EQUIPMENT!

www.okw.com.au

HIGH-EFFICIENCY SUPER-JUNCTION MOSFETS

STMicroelectronics’ MDmesh M6 series 600 V super-junction transistors are engineered for high efficiency in medium-power resonant and hard-switching converter topologies.

The threshold voltage optimised for soft switching makes the transistors suitable for LLC resonant converters and boost-PFC converters in energy-conscious applications. The devices perform efficiently in hard-switching topologies, too, with their capacitance profile enhancing light-load efficiency and gate charge (Qg) as low as 16 nC permitting high switching frequencies.

ST’s M6 super-junction technology helps reduce RDS(on) to as little as 0.036Ω, unleashing extra efficiency gains and increasing power density in equipment such as battery chargers, power adapters, PC power supplies, LED-lighting drivers, telecom and server power supplies, and solar micro-inverters.

Package options include the space-saving and thermally efficient leadless TO-LL, as well as through-hole and surface-mount packages including DPAK, D²PAK, TO-220, TO-247 and PowerFLAT. The JEDEC-registered TO-LL power-package outline has 30% smaller footprint and 50% lower height than the established D²PAK 7-pin, enabling more compact and space-efficient power converters. With low parasitic inductances, TO-LL also helps minimise electromagnetic interference.

STMicroelectronics Pty Ltd
www.st.com

SINGLE-BOARD COMPUTER

The Raspberry Pi Compute Module 3+ delivers the enhanced thermal performance and ease of use of Raspberry Pi 3 Model B+ in a smaller form factor, with a choice of memory variants suitable for a broad range of embedded applications including IoT devices and industrial automation, monitoring and control systems.

The product is based on the Broadcom BCM2837B0 64-bit application processor running at 1.2 GHz with 1 GB LPDDR2 SDRAM. Developers can now choose between 8, 16 and 32 GB eMMC flash variants and a ‘Lite’ variant, with no eMMC flash, to match their storage requirements. Developers thus no longer need to customise their board if they need additional memory.

Suitable for both makers and professional engineers, the device is designed to offer improved thermal performance, a wide ambient temperature range (-20 to +70°C), more storage options and access to Raspberry Pi’s community and software ecosystem. It is available to buy as a standalone board or as a development kit including a Raspberry Pi Compute Module I/O board, Raspberry Pi CM3+/32GB module, Raspberry Pi CM3+/Lite module, and display and camera adapters.

element14
au.element14.com
**WI-FI MODULE**

Würth Elektronik offers the Calypso Wi-Fi module — a compact, fully integrated wireless module for embedded systems in industrial applications. The module is Wi-Fi certified, which ensures industry-agreed standards for interoperability, security and a range of application-specific protocols.

The module, based on the IEEE-802.11-b/g/n standard, has its own antenna on board but, due to ‘smart antenna selection’, can be optionally operated with an external antenna. The tin-plated edges enable the module to be manually soldered for quick prototyping, as well as AOI in series production.

The product comes with an integrated TCP/IP stack and supports IPv4, IPv6 and common network applications, such as SNTP, DHCP, MOTT, mDNS and HTTP(S). As an alternative to the standard firmware, the user can select their own firmware, which is uploaded during manufacturing — thus obtaining a customised wireless solution for immediate use.

The AT command interface enables quick and easy expansion of an embedded system to incorporate a Wi-Fi interface. In order to adequately address security issues in Industrial Internet of Things applications, the company has equipped the Wi-Fi module with six simultaneous secure sockets, secure boot, secure storage and secure OTA firmware updates.

With dimensions of 19 x 27.5 x 4 mm, the module is designed for operating temperatures of -40 to +85°C and has a low power operating mode for battery-operated devices. It is pre-certified to save the user development time.

*Wurth Electronics Australia Pty*

www.we-online.com

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**BROADBAND MICROWAVE RF CONICAL INDUCTORS**

Gowanda Electronics has released broadband microwave RF conical inductors that provide DC current handling up to 10 A and low insertion loss.

The C305FL, C550FL, C750FL and C1000FL series were developed to address market needs and industry trends calling for ever-increasing performance from broadband conical components. They will be utilised in communication applications for bias T’s (filter signals, noise removal), broadband chip manufacturing, communication platforms, high frequency, microwave circuitry, RF test set-ups, test and measurement, test gear, test instrumentation and transmission amplifiers.

The four wirewound conical series include inductance from 0.30 to 22 µH, Q from 30 to 66, DCR ohms max from 0.02 to 0.265 and current rating mA DC from 1300 to 10500. All four series have been outgassing tested per ASTM E595 and meet the TML requirement of 1% max.

The series offer robust construction to ensure predictable frequency response and repeatable RF performance. The operating temperature range is -55 to +125°C, and standard and gold terminations are RoHS compliant. The broadband response of the coil is attributed to its precision winding, wire selection and coil configuration.

*KD Fisher & Co Pty Ltd*

www.kdfisher.com.au
A new way to 3D print, developed at the University of Michigan, uses two lights to control the solidification of resin, enabling complex shapes to be pulled from a vat at 100 times the print speed of conventional 3D printers.

3D printing could be a game changer for relatively small manufacturing jobs (producing <10,000 identical items), because it would mean that the objects could be made without the need for a mould costing upwards of $10,000.

But the most familiar form of 3D printing, which is sort of like building 3D objects with a series of 1D lines, hasn’t been able to fill that gap on typical production timescales of a week or two.

"Using conventional approaches, that’s not really attainable unless you have hundreds of machines," said Timothy Scott, an associate professor at U-M.

Together with Professor Mark Burns, Assoc Prof Scott developed a 3D printing technique that involves lifting complex shapes from a vat of liquid resin. Two lights are used to control both where the resin hardens and where it stays fluid, enabling the team to solidify the resin in more sophisticated patterns. The result is that the researchers can make a 3D bas-relief in a single shot rather than in a series of 1D lines or 2D cross-sections, and have so far printed a lattice, a toy boat and a block M.

According to the team, this approach was necessary to overcome the limitations of earlier vat-printing efforts. Previously, resin tended to solidify on the window that the light shines through, stopping the print job just as it gets started.

An early solution to the solidification-on-window problem was a window that lets oxygen through. The oxygen penetrates into the resin and halts the solidification near the window, allowing the newly printed surface to be pulled away.

But because this gap is only about as thick as a piece of transparent tape, the resin must be very runny to flow fast enough into the tiny gap between the newly solidified object and the window as the part is pulled up. This has limited vat printing to small, customised products that will be treated relatively gently, such as dental devices and shoe insoles.

By replacing the oxygen with a second light to halt solidification, the U-M team can produce a much larger gap between the object and the window — millimetres thick — allowing resin to flow in thousands of times faster. This means that thicker resins — potentially with strengthening powder additives — can be used to produce more durable objects. The method also bests the structural integrity of filament 3D printing, as those objects have weak points at the interfaces between layers.

"You can get much tougher, much more wear-resistant materials," Assoc Prof Scott said.

The researchers claim that the key to their success is the chemistry of the resin. In conventional systems there is only one reaction, with a photoactivator hardening the resin wherever light shines. In the U-M system, there is also a photoinhibitor, which responds to a different wavelength of light. Rather than merely controlling solidification in a 2D plane, as current vat-printing techniques do, the team can pattern the two kinds of light to harden the resin at essentially any 3D place near the illumination window.

"It’s one of the first true 3D printers ever made," Prof Burns claimed.

U-M has filed three patent applications to protect multiple aspects of the approach, and Assoc Prof Scott is preparing to launch a start-up company. The work has been published in the journal Science Advances.
Researchers at South Korea’s Electronics and Telecommunications Research Institute (ETRI) have developed technology capable of sending packets of digital information at 25 Gbps — 10 times faster than currently available speeds. This means it will operate at a speed fast enough to download a 3 GB movie within one second.

The technology, named TIC-TOC (Time Controlled Tactile Optical Access), is a critical component of the future Tactile Internet, in which information will be sent and received at speeds on par with human perception. Designed to work on 5G networks, the system enables more urgent data to jump ahead of other information packets and be transferred in 1 ms — the same speed at which the human sense of touch works.

The ETRI team developed TIC-TOC in order to help address the traffic jams that occur within current information processing systems, causing delays. By increasing the speed at which information can be transmitted, and allowing more important information to jump the queue, they have ensured that as soon as a user clicks on a webpage, it loads instantly, or they can watch a video live essentially without any delay.

Described in the Journal of Lightwave Technology, the TIC-TOC technology consists of internet access control chips and optical transceivers to speed up data processing time. The optical transceiver converts high-speed electrical data into optical signals to transmit over optical fibres. The chips guarantee latency (the time from data’s origin to destination) is less than 1 ms with ETRI’s low-latency-oriented packet scheduling technology controlling network traffic, and they could increase network speeds to faster than 25 Gbps by combining several channels for data transmission.

The researchers anticipate the TIC-TOC technology will help advance virtual reality and augmented reality in all sorts of sectors, from education and health care to entertainment and public safety. For example, it could deploy and operate robots in dangerous or disaster areas with instant sight and feel communication between human controllers and machines. When the machine sees something, the humans sees it, and when the human remotely controls the robot’s hand or head, the motion will happen immediately. The same could be true for telesurgery, with a doctor remotely controlling a robot performing the surgery, but the doctor feeling as if they were in the operating room because the response is instantaneous.

“The Tactile Internet is expected to be the Fourth Industrial Revolution,” said HwanSeok Chung, a project leader at ETRI. “We will see robots, cars and all other machines connected to the internet all around us. Tactile Internet will enable humans and machines to interact with each other even from far away.”

The researchers indicate that a few hurdles remain before commercialisation, such as system implementation. Nevertheless, ETRI is continuing its research in order to solve such hurdles, and forecasts that the Tactile Internet enabled by TIC-TOC should be available in one year.
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