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CONTENTS

- 4 You are here
- 12 Building robust distributed systems
- 15 Laminates and prototype PCBs
- 20 Advanced 'light switch' to control data transmission
- 24 From a five-layer graphene sandwich, a rare electronic state emerges
- 27 Preventing catastrophes with next-gen sensors
- 29 Researchers design a pulsing nanomotor
- 34 Silicon-compatible metal oxides to power electronics



With the all-new R&S MXO 5, Rohde & Schwarz continues to evolve its series of oscilloscopes, which started with the R&S MXO 4 in 2022. The R&S MXO 5 is the company's first eight-channel oscilloscope, expanding upon the R&S MXO 4 and empowering engineers to tackle even more demanding design challenges.

The new R&S MXO 5 shows a signal's activity in both the time and the frequency domains. With 4.5 million acquisitions per second and 18 million waveforms per second across multiple channels, engineers can capture intricate signal details and infrequent events with precision. Digital triggering on all eight channels enables users to isolate small signal anomalies. With a capability of 45,000 FFTs per second, engineers are provided with enhanced spectrum signal viewing, particularly for EMI and harmonic testing.

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CELLULAR SERVICES AND
WI-FI CAN COMPLEMENT
GNSS TO KEEP TRACK OF
VALUABLE GOODS

*Finn Boetius, Product Marketing Engineer, Nordic
Semiconductor*

GPS, the principal component of the global navigation satellite system (GNSS), which also includes Galileo, BeiDou and GLONASS among others, is a technological marvel.

The GPS constellation is made up of 24 satellites positioned around 20,000 kilometres above the Earth. The arrangement of the constellation ensures at least four satellites can be observed at any point on the planet. A GPS receiver picks up the signals from the satellites which provide their locations, status and the precise time from onboard atomic clocks. The receiver notes the arrival time of the signal and then determines the distance to each satellite from the difference in time between signal transmission and reception, and then multiplying by the speed of light. Information from four satellites fixes the receiver's position to a unique point.

Billions of people rely on GNSS daily to help them determine where they are on the Earth's surface. GNSS is also now providing a foundation for many IoT applications in the logistics and transportation sectors helping keep track of valuable assets that might otherwise go missing. This is why for asset tracking and other applications, Nordic's cellular IoT solution, the nRF9160 SiP, incorporates GNSS capability.

Satellite signal lost

Despite its impressive technical foundation, GNSS is not flawless. Some problems do occur with the satellites, such as inaccuracies with the onboard clocks resulting in timing errors. To mitigate such drift errors, GNSS systems compare multiple satellites and use algorithms to determine which clocks are in error and then reset them compared with an earthbound reference.

Other problems occur because the relatively weak signal between satellites and earthbound receivers can easily be disrupted. For example, 'urban canyons' — formed by rows of tall buildings — can obstruct the signal. And there's little chance of GNSS signals penetrating buildings.

But even if the signal does get through, so-called multipath errors can occur when it reflects off buildings before reaching the receiver. That can result in timing errors which in turn lead to incorrect positional information. Other errors can occur because of anomalies in the Earth's atmosphere that can delay or distort the GNSS signal. Electromagnetic interference (EMI) from other radio sources can also cause timing errors. To mitigate these problems, receivers use techniques such as filtering, correlation and signal power measurement, and for the atmospheric challenges, methods such as ionosphere and troposphere modelling are employed.

Another challenge with a GNSS modem is that it can take several minutes to fix the location of a group of satellites from a cold start. That uses significant battery capacity. One solution, used by Nordic's nRF9160 together with the company's nRF Cloud Location Services, is Assisted- and Predicted-GPS (A-GPS and P-GPS). These methods use satellite assistance data stored in a database which is relayed to the nRF9160 via the LTE-M or NB-IoT network — saving significant power compared to an extended first fix. When required, the IoT device can then find the satellites in seconds, saving further energy. The P-GPS technique builds on A-GPS by providing over two weeks of assistance data to the IoT device resulting in even greater power savings.

Even with power saving techniques, GNSS can still extract a heavy toll from batteries; that's an important consideration for things like wearables or asset trackers which are typically equipped with modest batteries yet are expected to deliver long battery life.

Complementing GNSS

If high accuracy is needed then the battery trade-off of GNSS is worth it, but if less accurate locationing is acceptable there are ways to save power. One option to overcome the power consumption of GNSS — and which is also supported by the nRF9160 SiP and nRF Cloud Location Services — is to use the known location of cellular base stations to narrow down the position of the receiver. The single-cell location method relies on identifying in which cell the tracked device is situated and then referencing the cell identification against a database of known base station locations. The technique offers accuracy down to kilometre level while only modestly impacting the receiver's battery life.

Multi-cell location builds on the single-cell technique by referencing the position of several nearby base stations instead of just one, to offer accuracy down to a few hundred metres while keeping power consumption low.

An interesting locationing technique which complements GNSS — and which can also be used to trade-off location precision against battery life — is Wi-Fi Service Set Identifier (SSID) scanning. Every Wi-Fi access point (AP) network is identified with an SSID — a technical reference for the AP's name. With knowledge of the network's SSID it's possible to cross-reference against databases that will detail its location.

SSID locationing is supported by Nordic's nRF70 Series of companion ICs. When used for Wi-Fi locationing, the nRF70 Series devices scan any nearby Wi-Fi AP for its SSID; a partner nRF9160 SiP then forwards the SSID (and other useful information) to nRF Cloud using cellular connectivity. nRF Cloud then checks one or more Wi-Fi SSID databases and returns the SSID's location, plus a degree of uncertainty for that location, to the nRF9160, or elsewhere as directed.

It's hard to beat the precision of GNSS. But when precision of tens of metres is acceptable and battery life is critical, or when the GNSS signal is interrupted, Wi-Fi SSID locationing is an excellent alternative as it consumes significantly less power than GNSS. If it's only necessary to determine the location of an asset to within a kilometre and battery life is critical, cell-based locationing is the answer. With Nordic's nRF91, nRF70 Series and nRF Cloud Location Services it's simple to switch seamlessly between all three methods to optimally trade-off location precision against battery life. With



A partner nRF9160 SiP forwards the SSID (and other useful information) from the nRF70 Series companion IC to nRF Cloud using cellular connectivity. Image credit: Nordic Semiconductor.

SSID locationing is supported by Nordic's nRF70 Series of companion ICs. Image credit: Nordic Semiconductor.



this locationing tech there is now no reason for valuable assets to ever be lost again.

Need to know

SSID information is found in the packet header of each communication transmitted over a Wi-Fi network and is distinct from the payload of the packet. The data is publicly broadcasted by every Wi-Fi enabled device and is accessible by any other Wi-Fi device within range, regardless of whether the Wi-Fi network uses encryption.

Never to be seen again

You might think that owners of valuable assets would make very sure they look after them. But no, just like your keys or pocketbook, items worth thousands or even millions of dollars have a habit of just disappearing.

Some, like the 1816 containers lost from the container ship *ONE Apus*, are down to pure bad luck. As reported in *Slash Gear*, the unfortunate vessel met with disaster due to extreme weather conditions in the Pacific Ocean, about 3000 kilometres from Hawaii. \$90 million worth of goods sank into the abyss. Others, such as the lost Nazi train of Walbrzych, said to have been loaded with 270 tonnes of gold, weapons, jewels and art, and which allegedly disappeared late in WWII between Breslau and Walbrzych, might just be the stuff of myth. An extensive search for the train revealed naught, leading many to believe it never set

off in the first place. If the carriages ever turn out to be real, the gold alone would be worth a cool \$19 billion at today's prices.

But then there are the foolhardy. Reported in UK newspaper *Metro*, in 2009 IT worker James Howells got his hands on 7500 bitcoin which he stored on his PC's hard drive. When Howells ditched the computer, the hard drive went with it to landfill, only for him to later realise the bitcoin therein were worth nearly \$5 million. Weeks of grubbing among the trash left him empty-handed. And then there was British journalist Nigel Reynolds. He was one of the first journalists to interview author JK Rowling and received a first edition copy of *Harry Potter and the Philosopher's Stone* for his trouble. Reynolds assumed the book would fall flat and threw it in the bin — yet today, similar copies sell for over \$60,000.

And finally, there's the downright incompetent. *Popular Mechanics* magazine reports over one million spare parts needed to keep F-35 fighter aircraft in the air have gone missing. The parts are believed to have a total value of at least \$85 million, but no one really knows because of some questionable bookkeeping. One can only hope the government keeps the actual weaponry on a tighter leash.

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PIEZORESISTOR THE SIZE OF A SINGLE MOLECULE

A team of researchers led by Dr Nadim Darwish from Curtin University, Professor Jeffrey Reimers from the University of Technology Sydney, Associate Professor Daniel Kosov from James Cook University, and Dr Thomas Fallon from the University of Newcastle, have developed a piezoresistor that is reportedly about 500,000 times smaller than the width of a human hair.

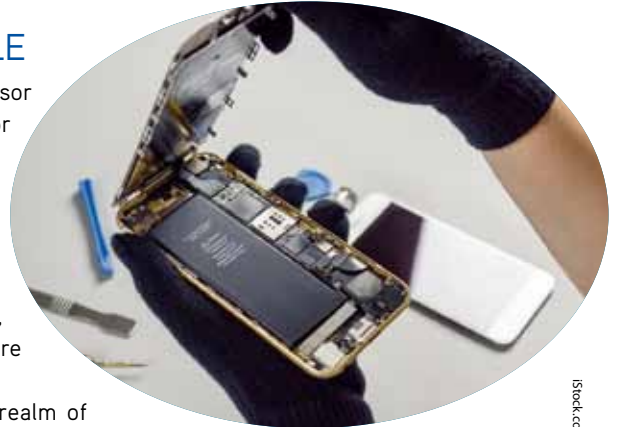
According to Kosov, piezoresistors are commonly used to detect vibrations in electronics and automobiles, such as in smartphones for counting steps, and for airbag deployment in cars. Darwish said they have developed a more sensitive, miniaturised type of this key electronic component that transforms force or pressure into an electrical signal and is used in many everyday applications.

Darwish believes that the new type of piezoresistor will open up a new realm of opportunities for human-machine interfaces, due to its size and chemical nature. "As they are molecular-based, our new sensors can be used to detect other chemicals or biomolecules like proteins and enzymes, which could be game-changing for detecting diseases," Darwish said.

Fallon said the piezoresistor was made from a single bullvalene molecule that, when mechanically strained, reacts to form a new molecule of a different shape, altering electricity flow by changing resistance. According to Fallon, the different chemical forms are known as isomers. "This is the first time that reactions between them have been used to develop piezoresistors. We have been able to model the complex series of reactions that take place, understanding how single molecules can react and transform in real time," Fallon said.

Reimers said the significance of this is the ability to electrically detect the change in the shape of a reacting module, back and forth, at approximately every one millisecond. Kosov said understanding the relationship between molecular shape and conductivity could enable researchers to determine the basic properties of junctions between molecules and attached metallic conductors. "This new capability is critical to the future development of all molecular electronics devices," Kosov said.

The research findings were published in the journal *Nature Communications*.



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STUDY SHOWS VIABILITY OF SOLAR FARMS IN SPACE

Research from the Universities of Surrey and Swansea has revealed that it is viable to produce low-cost, lightweight solar panels that can generate energy in place. The study followed a satellite over six years, observing how the panels generated power and withstood solar radiation over 30,000 orbits. The research findings, published in the journal *Acta Astronautica*, could pave the way for commercially viable solar farms in space.

Professor Craig Underwood from the Surrey Space Centre at the University of Surrey said the mission, initially designed to last one year, is still working after six. "These detailed data show the panels have resisted radiation and their thin-film structure has not deteriorated in the harsh thermal and vacuum conditions of space. This ultra-low mass solar cell technology could lead to large, low-cost solar power stations deployed in space, bringing clean energy back to Earth — and now we have the first evidence that the technology works reliably in orbit," Underwood said.



istock.com/bonhormoon

The new solar cells were developed from cadmium telluride. The panels cover a large area, are more lightweight and provide greater power than current technology. Scientists from the University of Surrey designed instruments that measured their performance in orbit. The satellite itself was designed and built at the Surrey Space Centre in partnership with a team of trainee engineers from the Algerian Space Agency.

Although the cells' power output became less efficient over time, researchers believe the study proves that solar

power satellites work and could be commercially viable. Dr Dan Lamb from the University of Swansea said the successful flight test of this novel thin film solar cell payload has leveraged funding opportunities to further develop this technology. "Large area solar arrays for space applications are a rapidly expanding market and demonstrations such as this help to build on the UK's world-class reputations for space technology," Lamb said.







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 Medical	MAF300	4" x 2"	300W 360W for 5 sec.	85-264 Vac 120-370 Vdc	12, 15, 18, 24, 28, 36, 48, 53 Vdc	2MOPP 4000 Vac Reinforced insulation	IEC/EN/ANSI/AAMI 60601-1 IEC/UL/EN 62368-1
 Industry	TAD180	3" x 2"	180W 220W for 5 sec.	85-264 Vac 120-370 Vdc	12, 15, 18, 24, 28, 36, 48, 53 Vdc	3000 Vac Reinforced insulation	IEC/UL/EN 62368-1
 Industry	TAF300	4" x 2"	300W 360W for 5 sec.	85-264 Vac 120-370 Vdc	12, 15, 18, 24, 28, 36, 48, 53 Vdc	3000 Vac Reinforced insulation	IEC/UL/EN 62368-1



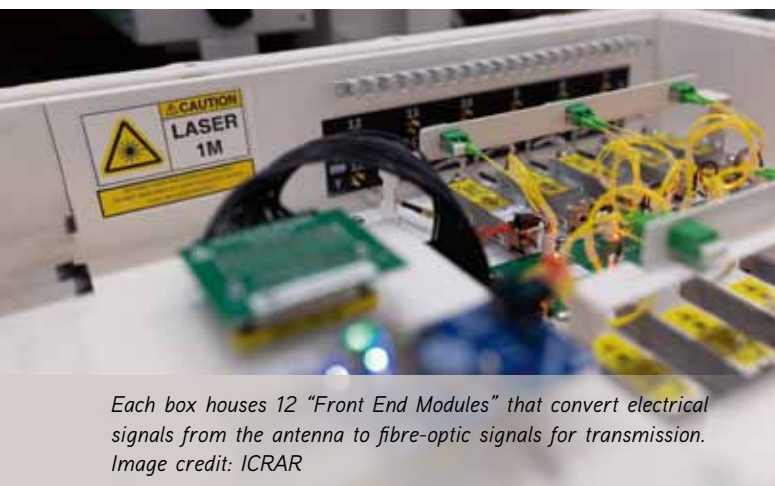
'SILENT' ELECTRONICS DESIGNED TO POWER SKA-LOW TELESCOPE

A team of researchers, engineers and technicians has developed a 'SMART box' to power the Square Kilometre Array Low frequency (SKA-Low) telescope, currently under construction at Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, in Western Australia. The SMART boxes provide electrical power to the SKA-Low telescope's 131,072 antennas and collect signals received from the sky to go off-site for processing.

The Engineering & Operations team at the Curtin University node of the International Centre for Radio Astronomy Research (ICRAR) designed and built the first set of 24 SMART boxes. Tom Booler, Program Lead for Engineering and Operations at ICRAR, said they are the only electrical devices that must be placed among the antennas, creating a challenge for the sensitive equipment.

"The SKA-Low telescope will receive exquisitely faint signals that have travelled across the Universe for billions of years. To detect them, the SKA-Low telescope is being built in a pristine radio quiet zone far from the interference created by modern technology. It's so radio quiet at the observatory site that the biggest potential source of interference is the electronics like ours, due to the proximity to the antennas. That meant our project had to meet the strictest radio emission requirements across the entire Australian SKA site," Booler said.

The researchers sourced 'radio quiet' parts that emit minimal interference, replacing the more 'noisy' ones. The parts were then wrapped in a specially designed case to prevent any stray radio waves from escaping. The boxes were tested at an electromagnetic test facility in South Africa. The 'radio quiet' results that the SMART boxes achieved were reportedly to the highest standards in radio astronomy.



Each box houses 12 "Front End Modules" that convert electrical signals from the antenna to fibre-optic signals for transmission. Image credit: ICRAR

A contract to build up to 12,000 SMART boxes for the entire fit-out of the SKA-Low telescope was awarded to AVI, a company based in Perth. Booler said he was pleased to see that the SMART boxes would be built in Western Australia, an indication of the nation's capability in the space industry that could be leveraged into the future.

"Extreme temperatures, ingress protection and the low noise requirements, coupled with the remoteness of this location, offer more opportunities to learn and evolve. I think we are all eager to be a part of what findings may eventually be revealed by the radio telescope," Tony Routledge, AVI Managing Director, said.



USING LASERS TO 'HEAT AND BEAT' 3D-PRINTED METALS

Scientists from Nanyang Technological University, Singapore (NTU Singapore) and the University of Cambridge have developed a new method that can make customised 3D-printed metal parts containing different properties — such as having some regions of the metal stronger than others. The new technique uses 3D-printing steps, and unlike traditional metal manufacturing processes, it does not require additional raw materials, mechanical treatment or drastic machining processes to achieve a similar effect, such as coating the metal with a different material.

Besides designing a 3D-printed metal part with different strength levels, the new process should also allow manufacturers to design a part with other features, such as differing levels of electrical conductivity or corrosion resistance in the same metal. The researchers, led by Professor Gao Huajian from NTU Singapore, took inspiration from 'heating and beating' methods similar to the steps originally involved in blacksmithing to develop the new process.

This led them to combine materials science and mechanical engineering principles to apply the 3D-printing techniques usually used to remove and prevent defects in printed metals to alter microscopic structures in the metals. The novel method also lets manufacturers determine what type of internal microstructure they want — and thus the type of property — and precisely where it can be formed in the metal. This improves on traditional means that do not have such fine control.

Gao said the new method paves the way for designing high-performance metal parts with microstructures that can be fine-tuned to adjust the parts' mechanical and functional properties. The method also allows them to be shaped in complex ways with 3D printing.

The research findings were detailed in a paper published in the journal *Nature Communications*.



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BUILDING ROBUST DISTRIBUTED SYSTEMS

Tanya Petersen, EPFL

Consensus is one of the fundamental problems in distributed systems. It allows a group of machines to maintain multiple copies of data and update them consistently, even when a fraction of the machines might fail.

Take the example of three servers that need to store three copies of data and keep track of any updates to information so that all three servers remain consistent. If one server fails, the remaining two must keep the data consistent and allow updates to continue normally as if there was no failure.

Current state-of-the-art consensus protocols to achieve consensus rely on one computer node being designated a leader at any given time, continually supervising and handling any updates to data. If the leader fails another node wakes up and takes over, but there's a challenge. How long should another node wait before taking over from an unresponsive leader?

"If the leader fails or the network is bad, the problem with the classic consensus protocols is that there's the very tricky question of how you decide how big or small the timeout should be," explained Professor Bryan Ford, Head of the Decentralized and Distributed Systems Laboratory (DEDIS) in EPFL's School of Computer and Communications Sciences (IC). "If you set it too big, then when a leader fails, you might be waiting a long time and the system is just dead. On the other hand, consider if you

set the timeout too short — this is where the real disaster can happen.

"Suppose the old leader hasn't failed, suppose the network is just a little slower than you thought it was, the next leader comes and tries to take over, but the way all the existing protocols work, the new leader's actions will cancel what the old leader's actions did so it can no longer finish what it was doing and all its work is wasted. These kinds of issues can cause major reliability problems and these leader-based protocols can fail entirely if there's a deliberate denial of service attack," he continued.

To overcome these challenges, DEDIS researchers have been investigating a rarely used class of consensus algorithms, known as asynchronous consensus protocols. Unlike current leader-based protocols, their asynchronous cousins are not vulnerable to leader failures and denial-of-service attacks. But there's a big trade-off — prior asynchronous protocols are much less efficient under normal conditions, and that's one reason they are almost never deployed.

For the first time, Ford said, their QuePaxa protocol changes this dynamic. "We've come up with a win-win. What is new and unique to QuePaxa is that it's an asynchronous consensus protocol that finally achieves efficiency equivalent to the widely deployed leader-based protocols under normal network conditions. QuePaxa is just as fast, efficient, low latency and low

cost in terms of network bandwidth, under normal conditions."

The new algorithm is designed in such a way that one leader at a time is usually expected to lead the task of making progress, but a second leader can come in and help in the same round without interfering with the first one. A third leader could even join and help the other two finish the work more quickly. There will be some redundancy of effort, but the non-leaders don't destructively interfere. Short delays don't cause leaders to cancel each other's work as with current protocols.

Another advantage of QuePaxa is that it is also extremely robust under bad conditions such as noisy networks, high communication delays, unpredictably- varying network delays or deliberate denial-of-service attacks.

"Under these conditions existing consensus protocols will just die completely. QuePaxa will keep going; it's much more robust," he continued. "In any place where there are significant concerns about performance, reliability or vulnerability to these kinds of attacks I believe this is a game changer for robustness reasons and this should be the new standard consensus protocol."

The DEDIS team has already built an open source prototype of QuePaxa, which is available on the well-known GitHub repository. The new protocol has already gone through an artefact evaluation review process at SOSOP, where peer reviewers have tested its capabilities.

FANLESS PANEL PC

ICP Electronics Australia has launched the iEi PPC2-CW22-EHL, a 21.5" fanless panel PC. The panel PC is powered by the Intel Celeron J6412 processor, to enable the system to deliver high levels of performance at ultra-low power consumption. With a burst speed of up to 2.6 GHz, multitasking becomes efficient. This is complemented by an 8 GB LPDDR4x memory, which offers faster memory speeds and lower power consumption, providing stability even in vibration-prone applications.

The fanless panel PC's true flat surface with an industrial-grade TFT LCD is easy to maintain and clean, preventing dust and liquid penetration. Its touchscreen, robust with anti-glare, anti-UV and scratch-resistant features, supports operations even with gloved or wet hands — a benefit in industries like food processing.

The panel PC also features dual 2.5GbE LAN ports for enhanced networking, high-speed 10 Gbps USB connections and a 4K HDMI dual independent display capability, providing versatile connectivity options. The panel PC is also equipped with Intel Platform Trust Technology.

The panel PC's mechanical design is compatible with previous models, allowing for easy replacements. Other features like touch-enabled BIOS and customisable I/O interfaces make it adaptable to various industrial needs.

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PROBE

The STLINK-V3 is designed to debug and program an STM32 microcontroller. The probe is designed to transfer data faster than the previous generation and with more flexibility, due to its STDC-14 connector and its support of a virtual COM port. Besides traditional programming and debugging, the probe can measure the power consumption of an STM32, draw energy profiles and help visualise current draws to help developers enhance their code.

The probe can sense currents from 100 nA to 50 mA, 300 nA to 150 mA, 600 nA to 300 mA and a 500 mA peak mode. It can also perform power measurements from 160 nW to 1.65 W with a 2% accuracy on the whole range to enable developers to target any microcontrollers, from the ultra-low-power ones to the highest-performing models.

Users can connect the power and ground of the STLINK-V3PWR probe to the correct pins on their development board and use the USB-C interface to send data to a PC. The probe also supports JTAG, SWD and VCOM, and provides bridge capabilities like UART, I2C, SPI or USB. Hence, teams prioritising power consumption can use the STLINK-V3PWR as their only probe. Additionally, it can supply the target STM32 board with up to 2 A and offer overcurrent protection through the USB-C cable, which can be useful when engineers are in the field and need to power their system.

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ENCLOSURE RANGE

The SOLID-BOX enclosure range by OKW Gehäusesysteme is designed to meet a range of requirements for modern electronics packaging in industrial environments or in protected outdoor areas. Flush-fitting, snap-on trims conceal the screw attachments and, together with the polished enclosure surface, provide a streamlined appearance.

The two-part robust industrial enclosure is available from stock in the two standard colours anthracite grey (RAL 7016) and light grey (RAL 7035). Three different versions with 135 x 115 x 50 mm, 180 x 145 x 60 mm as well as 225 x 175 x 70 mm (L x W x H) allow the assembly of visually uniform enclosure series. A recessed panel for integrating membrane keyboards is located on the top surface.

The enclosure range is made of flame-retardant V0 material (PC+ABS-FR) with an improved heat distortion temperature (Vicat/B 120 = 110°C). To protect

the electronics from moisture, dust and dirt, the interior is sealed to IP66/IP67. The enclosure design also allows increased resistance to impact and shock stress according to IK08.

The upper and lower parts are assembled using rust-proof and captured Torx screws outside the sealed interior. The enclosure screw connections, as well as the channels for direct wall mounting, are then innovatively concealed by the supplied design trims (surface slightly structured). Each enclosure bottom part has two recessed surfaces for installing and protecting interfaces and cable connections. To match the appearance, black cable glands and bushings in various designs (M12-M20, Quick-Fix assembly, easy-to-pierce membrane, etc) and a cable gland with integrated pressure compensation are available as accessories.

As a wall-mounted and desktop enclosure, the SOLID-BOX is suitable for robust electrical and electronic applications. Typical applications include heating and air conditioning, plant engineering and construction, diverse areas of the IIoT and the smart factory as well as safety engineering, etc. For desktop positioning, a set of suitable enclosure feet is available. To prevent the top part from falling during initial assembly or in the event of subsequent servicing, the enclosure range is supplemented by a cover retention device. If users need to open the enclosure several times, they can also use the internal hinge set (both are included in the range of accessories). Fastening pillars inside the enclosure allow the installation of PCBs, DIN rails and mounting plates. The larger versions also include pre-moulded mounts for VESA standard holders (version 145 for VESA 75 x 75 mm, version 175 for VESA 100 x 100 mm). Like all the services listed below, the holes required for this can be drilled in the in-house service centre: EMC aluminium coating, printing, mechanical processing, laser marking, decor foils/labels/stickers and assembly work.

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LAMINATES AND PROTOTYPE PCBs

The 'DIY' PCB-making techniques are not reserved for hobbyists only — they are also used by professionals and small manufacturers, especially for PCB prototyping.

Copper laminates

Individual PCBs are made using laminates, ie, sheets of plastic (usually epoxy glass) that are factory-coated with a homogenous layer of copper. Traces, solder pads and other PCB components are made by removing the conductive layer chemically or mechanically. The former technology is etching (more about it later), while the latter one involves the use of a CNC machine. There, a digitally controlled milling machine removes the copper so that only a computer-designed PCB layout is left on the laminate surface. For this kind of processing,

istock.com/joy_znism



Making a PCB with the use of a CNC milling machine. Image credit: Transfer Multisort Elektronik

adequately sized material is required — a thicker laminate board will be the optimal choice as it will provide tolerance in terms of the milling depth and, in addition, retain mechanical resistance (even if processed on both sides). The products available from the TME catalogue are up to 2.4 mm thick, so the customers will surely find the right items for their needs.

'Classic' etching

PCB etching makes use of chemical reactions. One of the most popular methods is the oxidation of copper using sodium persulphate. Before immersing the PCB in the solution, the layout of the circuit is applied onto the board with the use of an insoluble substance that protects metal fragments from coming into contact with the etching agent.

There are several technologies for applying the protective layer. In fully amateur conditions, a toner transfer from a laser printout is used. Sometimes (in the case of the simplest circuits), drawing the traces with a special marker pen is enough. Both methods can produce satisfactory results, but their accuracy is limited. Any laminate (even 0.6 mm) can be used for such work, but the thickness of the copper layer has to be taken into account (there are products where this value ranges from 18 to 105 μm). The more solid the metal layer is, the longer the etching process will take, and such prolonged immersion in the solution may cause damage ('over-etching') to the smallest parts of the layout, eg, narrow traces.

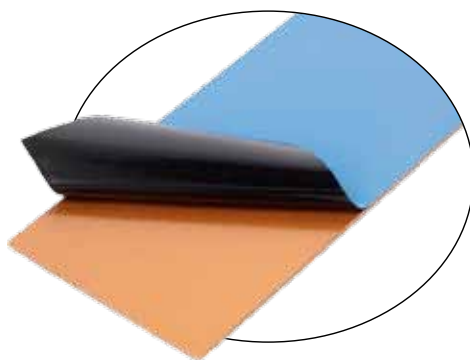
'Photo-transfer'

Electronic components are getting increasingly smaller, and some of them are only available in SMD packages. Nowadays, not only electronic device manufacturers, but also amateurs feel the need to make precise circuits characterised by tolerance of a few dozen, or even just a few micrometres. This is why the photo-transfer technology — which allows almost professional results to be achieved, but without the

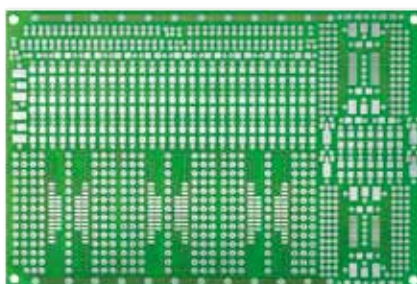
use of specialist machinery — is becoming increasingly popular.

Photo-transfer does not refer to a method of making PCBs as such (traces are made by etching, as described above), but to a technology of applying a protective layer to the laminate. First, the copper is coated with a photosensitive substance (photoresist) cured by using ultraviolet light (UV). The surface prepared in this way is covered with transparent film with a negative image of the circuit layout printed on it (it is advisable to darken the layout image as much as possible) and then exposed to light. In the unprinted areas, the photoresist covering the metallised layer is cured, while in the other areas it is rinsed off after it is immersed in a developer (developers are available in our range of chemicals, eg, UNI-DEV-22G). From now on, the process looks exactly the same as described above: the board is immersed in an oxidising solution which removes the copper from the laminate (except for the areas protected by the photoresist). The protective layer is then washed off with isopropyl alcohol or acetone.

One way to get a photosensitive layer on a PCB is to make it yourself; there are special means to do it. However, you can also purchase ready-made laminates with a machine-applied photosensitive substance. Such products bring the best and most consistent results (due to the ho-



Film-protected photoresist-coated laminate. Image credit: Transfer Multisort Elektronik



PCB acting as an adapter, designed to work with a variety of SMD components. Image credit: Transfer Multisort Elektronik

mogenous coating with a strictly controlled concentration of photoresist). The coating is protected from light by a peel-off film so that the products can be stored for a longer period of time and mechanically processed before use. Such boards are available in a variety of formats: from 100 x 50 mm to 300 x 210 mm, the latter being equivalent to an A4 sheet.

Important characteristics of laminates

It should be noted that the range of laminates is very diverse. In addition to variants with dimensions of even 610 x 457 mm and single- and double-sided coppered variants, more specialised items are also available. While most boards are made with the use of FR4 (a flame-resistant combination of epoxy resin and fibreglass), selected products have been developed for high-power circuits and better heat dissipation — they contain a layer of aluminium. The offering also includes laminates without copper, which are used as materials for insulation, construction and for making non-standard circuits.

Universal and prototype PCBs

Laminates are used in the final stage of prototyping, eg. to test a designed circuit. Sometimes, they are used to produce one or a few pieces of a device, eg. if it is a custom order for a circuit with a very specific functionality. When planning circuits, making your own designs or testing design solutions, the PCB production stage can be completely excluded.

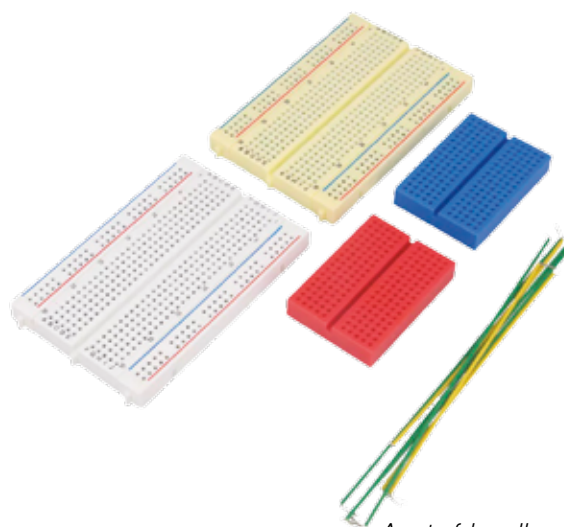
Universal PCBs are laminates with straight traces (or solder pads alone) and holes drilled at a standard spacing (usually 2.54 mm). Electronic components can be attached and soldered to them to facilitate the circuit production. In the case of PCBs with rows of interconnected solder pads, the traces are cut with a knife or reamed — in the case of PCBs that only have holes and solder pads, connections are made by solder bridging.

Since such PCBs are, by their nature, regularly perforated and often made from hard paper (rather than FR4), you can adjust their size to your needs by cutting and breaking, which will speed up your work significantly. However, it should be noted that universal PCBs are available in a wide variety of sizes, often with machine-made fixing holes, so in all likelihood such a treatment will not be needed at all.

A special type of prototype PCB is a multi-adapter with pads for mounting



ELECTRONIC COMPONENTS ARE GETTING INCREASINGLY SMALLER, AND SOME OF THEM ARE ONLY AVAILABLE IN SMD PACKAGES.



A set of breadboards with a set of connecting cables. Image credit: Transfer Multisort Elektronik

components that are housed in a specific type of package. Multi-adapters facilitate, among other things, prototyping with the use of surface-mounted components, especially integrated circuits with multiple leads, such as multiplexers, drivers or microcontrollers. They are made in such a way that each SMT pad is connected to at least one THT hole, to which wires or pin headers can be easily soldered.

Prototyping with breadboards

The fastest method for demonstrating and prototyping circuits is to use breadboards. These are flat bodies made of plastic. They have holes at a standard pitch of 2.54 mm on top, suitable for fitting typical THT components. Underneath the holes, there are elongated metal contacts that provide connectivity between all points in each row (each row has a separate set of contacts). The fields placed on the sides of the PCB remain shorted over the entire length of the column, as they have been designed to act as power traces, shared by multiple components. Thanks to this layout, you can produce circuits

(even complex ones) without using tools. THT components and connecting wires alone will be enough. Some products are delivered together with such connectors.

TME offers a wide selection of breadboards — from the smallest (100 fields) to extensive models (3200 fields) placed on a loaded, shielded base and with holes for mounting banana plugs (for easy power connection). Such products are an excellent educational accessory, which invites users to experiment freely with electronics. Nevertheless, professionals are also eager to use them — for example to carry out a quick test of a design solution or to make a temporary replacement circuit. Apart from different sizes, the PCBs can also be distinguished by their colours. What is more, selected models have a modular design and can be connected to form larger boards.

TME offers a wide selection of universal PCBs, laminates and other products for the prototyping of electronic devices. The components are suitable for large companies and small manufacturers alike, as well as for students and even amateurs.

SIGNAL CONDITIONER

ICP Electronics Australia has launched the ICP DAS tSG-3781B signal conditioner, featuring a state-of-the-art interface. This single-channel DC current input module transforms a 4~20 mA current input to a PWM output. With the ability to perform a linear conversion, the PWM output features a duty cycle ranging from 0 to 100%.

Adding to its versatility, the signal conditioner allows users to adjust the PWM output frequency anywhere between 600 to 800 Hz using the incorporated push buttons. A clear monochrome LCD display elevates user experience by offering real-time visuals of the duty cycle and frequency of the PWM signal.

The signal conditioner is designed to provide optimal energy usage for enhanced environmental responsiveness. Moreover, the signal conditioner can also be tasked with controlling servo-assisted diaphragm valves.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



GAS SENSOR

Backplane Systems Technology has launched the Innodisk IAGVOC total volatile organic compounds (TVOC) gas sensor. The gas sensor is designed for precision, efficiency, and adaptability, with a fast response and recovery time. This facilitates real-time monitoring and swift reaction to any fluctuation in TVOC levels, for immediate readings and adjustments. Coupled with its high stability and long life, users can expect consistent performance over extended periods.

The sensor features wide operating ranges, making it suitable for a variety of conditions, such as temperature fluctuations from -10 to +50°C, humidity shifts between 15 to 90%, or a VDD ranging from 3.1 to 3.5 V.

The gas sensor is also designed to provide hassle-free operation. With on-chip data processing and no need for external libraries, its integration into systems is smooth. Moreover, its presence doesn't affect the MCU, thereby providing consistent performance.

The gas sensor is also suitable for applications like indoor air quality monitoring, security surveillance or wireless sensor networks.

Backplane Systems Technology Pty Ltd

www.backplane.com.au

COAXIAL CABLES AND CONNECTORS

Würth Elektronik has expanded its range of coaxial cables and connectors to include a comprehensive portfolio of N-type cable connectors to satisfy MIL-STD-348 requirements with 50Ω impedance. Jacks for connecting to the application PCB are available in straight and angled THT versions, or as 4-hole flanged panel connectors with round post or solder cup. Besides pre-assembled cables, individual cable connections are also available for field assembly.

The coax connectors are suitable for use outdoors or in harsh environments like those in radio base stations, signal distributors, GPS systems or ship antennas — just the application for which the N-type was developed. The screw connections of the THT jacks and those for mounting packages are available in protection class IP67. The gold-plated THT contacts have enhanced corrosion resistance compared to the standard tin-plated connectors, and the gold-plated phosphor-bronze centre contact material is designed to reduce component costs compared to the beryllium-copper otherwise used.

Würth Elektronik offers various assembled cables including double-shielded Low Loss 195 and Low Loss 200, which are compatible with LMR195/200 or CFD195/200. The RG316 cable with FEP sheathing, for instance, is resistant to oil, chemicals and weathering and can be used at operating temperatures from -55 to +165°C. The various N-type cable connectors are designed for quick installation of cable assemblies in small quantities and for assembly in the field. The secure screw connection is achieved without tools using a knurled union nut. Both the IP67 and RG178 bulkhead jack are also suitable for microcoaxial cables (1.3, 1.32 and 1.37).

Würth Electronics Australia Pty

www.we-online.com



DDR5 MEMORY

Advantech has released the SGRAM DDR5 5600 series industrial-grade DDR5 memory. This series features speeds of up to 5600 MT/s. With its bandwidth capability from 8 to 48 GB and beyond, the series delivers fast data transfer rates that are designed to surpass the industrial benchmark. In addition, it has undergone laboratory testing to be suitable for mission-critical applications, supporting a -40 to 95°C operating temperature range. These features make the series a suitable choice for multitasking and data-intensive systems, such as Advanced Medical Imaging Inspection, AI and Machine Learning, and Edge Server systems.

The DDR5 memory series provides 5600 MT/s of performance adopting 13th Gen Intel Core processors with 20% increase in read/write speed 4800 MT/s as tested by AIDA64 Memory Benchmark v6.70. The memory architecture has bandwidth improvement of nearly 50% over DDR4 with increased efficiency as core-counts per CPU continue to expand, helping relieve the bandwidth-per-processor-core crunch. Additionally, the DDR5-5600 DIMMs feature 24 and 48 GB capacities, and are built with 3Gbx8 ICs to offer larger capacity to run multiple applications simultaneously without worrying about exhausting memory resources.

The wide temperature range makes the series suitable for outdoor installations, where extreme temperatures can be a challenge for conventional memory solutions. Additionally, SGRAM can provide other benefits such as anti-sulfuration, side fill, conformal coating, and SPD write protection for challenging environments.

Advantech SGRAM comes with its own software, SGRAM Manager & DeviceOn to monitor DRAM in real time, providing information such as dynamic memory speed, temperature and an advanced overheating alert. To maintain system performance stability, Advantech's software flexibly supports Cloud Remote Control mode and On-Premise versions on each device, which can be downloaded from the Advantech website.

Advantech Australia Pty Ltd

www.advantech.net.au



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Entry-level Bluetooth STM32



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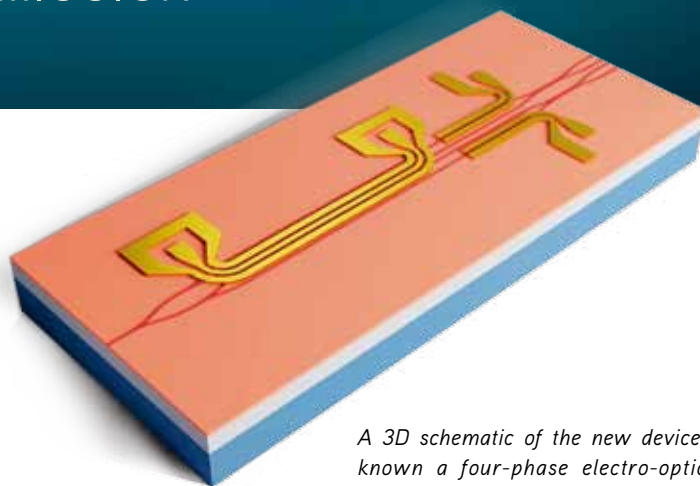


ADVANCED 'LIGHT SWITCH'

TO CONTROL DATA TRANSMISSION

Robert Wells

Whether you're battling foes in a virtual arena or collaborating with colleagues across the globe, lag-induced disruptions can be a major hindrance to seamless communication and immersive experiences. That's why researchers at the University of Florida's (UCF) College of Optics and Photonics (CREOL) and the University of California, Los Angeles (UCLA), have developed new technology to make data transfer over optical fibre communication faster and more efficient.



A 3D schematic of the new device, known as a four-phase electro-optic modulator. Image credit: University of Central Florida.

Their new development, a novel class of optical modulators, is detailed in a study published recently in the journal *Nature Communications*. Modulators can be thought of as like a light switch that controls certain properties of data-carrying light in an optical communication system.

"Carrying torrents of data between internet hubs and connecting servers, storage elements and switches inside data centres, optical fibre communication is the backbone on which the digital world is built," said Sasan Fathpour, the study's co-author and CREOL professor. "The basic constituents of such links, the optical fibre, semiconductor laser, optical modulator and photoreceiver, all place limits on the bandwidth and the accuracy of data transmission."

Fathpour says particularly the dispersion of optical fibres, or signal distortion over

long distances, and noise of semiconductor lasers, or unwanted signal interference, are two fundamental limitations of optical communication and signal processing systems that affect data transmission and reliability.

He says the researchers have invented a unique class of optical modulators that simultaneously address both limitations by taking advantage of phase diversity, or varied timing of signals, and differential operations, or comparison of light signals.

By doing so, the researchers have created an advanced 'light switch' that not only controls data transmission but does so while comparing the amount and timing of data moving through the system to ensure accurate and efficient transmission.

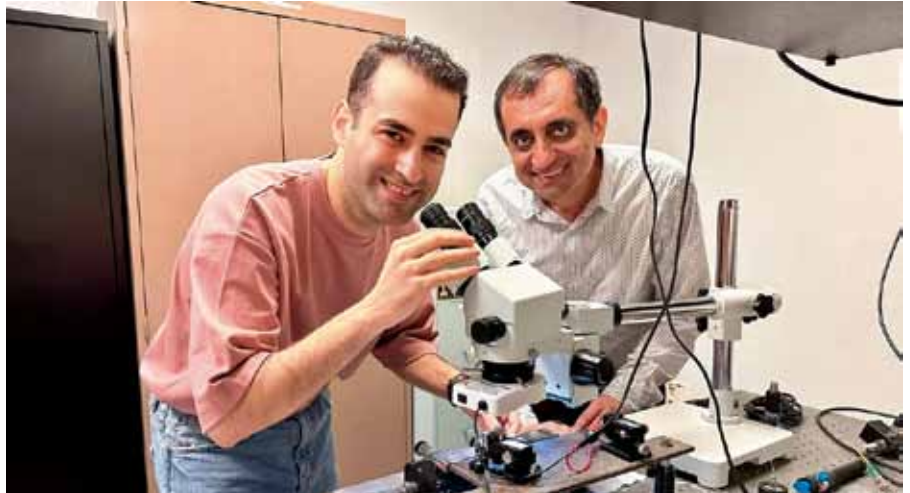
"Dubbed four-phase electro-optic modulators, the circuit is demonstrated on thin-film lithium niobate, which is an ultra-

compact platform for integrated photonic applications, including optical communication," Fathpour said.

The concepts of phase diversity and differential operation existed before this research and have been explored by the UCLA team, he said.

"The problem is that off-the-shelf optical components and existing modulator architectures are not capable of achieving these two operations simultaneously," Fathpour said. "The compactness of the thin-film lithium niobate platform allows tight integration of several components on the same small chip and helped shaping up the concept of four-phase electro-optic modulators."

Bahram Jalali, a distinguished professor emeritus and Fang Lu Chair in Engineering in the Electrical and Computer Engineering Department at UCLA, says the concept originated



UCF CREOL researchers Ehsan Ordouie and Sasan Fathpour have developed new technology to improve optical communication. Image credit: University of Central Florida.

ultrafast data onto a laser beam to enable time-stretch instruments with high bandwidth and high sensitivity."

How the research was performed

The four-phase electro-optic modulator was analysed within the context of a time-stretch system used for analysing signal processing, and a comprehensive analytical model was developed to explain its operation. The technology was also optimised for electro-optic bandwidth and modulation efficiency using simulation tools for fine-tuning.

The application of the four-phase electro-optic modulator in optical communication was also explored. It was shown that the four-phase electro-optic modulator can eliminate common mode noise and dispersion, and simulation results demonstrated its ability to improve signal quality and power budget in optical communication systems.

Ehsan Ordouie was a doctoral student in optics and photonics when the research was

conducted and is the study's lead author. He worked on mathematical modelling, device simulations, chip design, fabrication and more.

He says the innovative device enables both phase diversity and differential operations on a single photonic integrated circuit, thereby cancelling the dispersion penalty, or signal quality degradation, and noise in optical communication links.

"Our experiments demonstrate that this approach eliminates the inherent nulls in the frequency response, which is a significant advancement for photonic time-stretch systems and coherent optical communication systems," Ordouie said. "Although the proposed modulator is more complex than standard ones, leading to a larger chip size and potentially lower fabrication yield, we believe that the advantages of phase diversity and differential operations justify the added complexity. This breakthrough represents a noteworthy advancement in the practical implementation of photonic systems and opens up new possibilities for faster and more efficient data communication and acquisition."

from 25 years of research into time-stretch instruments, an optical slow-motion technique that stands as the most effective method for capturing ultrafast single-shot events.

"Invented at UCLA in the 1990s, time-stretch technology has yielded breakthroughs such as the creation of the world's fastest spectrometers, cameras, lidars, velocimeters, oscilloscopes and more, ultimately uncovering optical rogue waves and the introduction of innovative blood screening microscopes, among other advancements," Jalali said. "This new electro-optic modulator architecture culminated from the quest to create improved methods for encoding



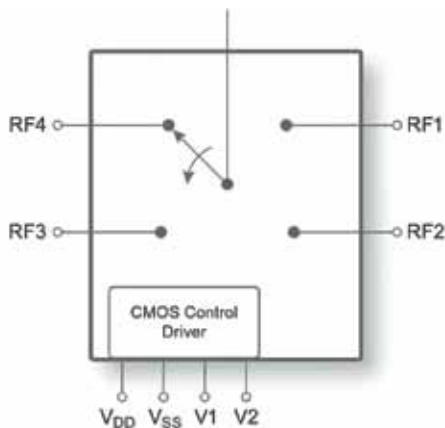
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SWITCH DIE



Richardson RFPD, Inc. has announced the availability and full design support capabilities for an RF switch and associated evaluation board from pSemi Corporation.

The PE42545 is a HaRP technology-enhanced reflective SP4T RF switch die that supports a wide frequency range from 9 kHz to 67 GHz. It delivers low insertion loss, fast switching time and high isolation performance, making it suitable for test and measurement, 5G mmWave, microwave backhaul, radar and satellite communication applications. No blocking capacitors are required if DC voltage is not present on the RF ports.

The switch die is manufactured on pSemi's UltraCMOS process, a patented variation of silicon-on-insulator technology. The switch die features an insertion loss of 2.6 dB at 45 GHz and a switching time of 75 ns. It also has an input of +33.5 dBm (for P1dB) and a return loss of 20 dB at 60 GHz.

An evaluation board is available now from stock.

Richardson RFPD

www.richardsonrfpd.com

INTERCONNECTS

Mouser Electronics, Inc. now ships the PowerWize BMI high-current panel-to-board/busbar interconnects from Molex. Dense electronic packaging often requires designs where subassemblies are mated without visual guidance. These interconnects provide engineers with high current-carrying capacity and accurate mating in hard-to-reach and visually obscured applications like data centre power transmission systems, base stations, battery management inverters and electric vehicle charging stations.

The high-current blind-mating panel-to-board/panel-to-busbar connectors incorporate Molex's COEUR socket technology, where the panel-mounted receptacle housing's guideposts align with the inner surfaces of the header sidewalls, before contacts and pins engage, to facilitate blind mating. These conical sockets also offer low contact resistance and low voltage drop, creating minimal heat generation at the contact interface, resulting in higher current-carrying capacity compared to other contact designs. The headers and receptacles are also designed to meet industry-standard, safe-to-touch requirements.

The PowerWize BMI High-Current Panel-to-Board/Busbar Interconnects offer screw-mount pins attached to printed circuit boards or busbars with solder tail pins to enhance manufacturing flexibility in three different sizes: 3.40 (75.0 A), 6.00 (110.0 A) and 8.00 mm (175.0 A). Cable assemblies feature ± 2.00 mm of radial self-alignment to mitigate stack-up tolerance issues. At the same time, the reflow-capable/wave solder-capable solder tail headers are suitable for either pin-in-paste reflow PCB

processing or wave solder PCB processing.

PowerWize BMI crimp machined contacts offer a wide range and will accept 1/0, 2, 4, 6, 8, or 10 AWG wires.

Mouser Electronics
au.mouser.com



IIoT GATEWAY

ADLINK Technology Inc. has launched the EMU-200 series, an application-ready IIoT gateway that is designed to meet the data

network requirements of various harsh application scenarios, including renewable energy, electric vehicle (EV) charging, building management and factory equipment monitoring.

To facilitate rapid deployment in diverse application environments, the IIoT gateway features a built-in smart software tool, the EGIFlow web console, which allows for seamless integration of multiple communication protocols. Paired with a range of connectivity options and adaptable hardware specifications, EGIFlow can cater to a variety of on-site configurations while reducing the efforts required by engineers on development and deployment.

Integrating EGIFlow with the EMU-200 series simplifies the data transfer process between different systems and provides preconfigured data flow settings, thereby expediting the set-up process for data collection, transferring and filtering from multiple sources.

To achieve broad connection coverage, the IIoT gateway integrates a variety of mainstream industrial communication protocols, such as Modbus TCP/RTU, MQTT and OPC UA. Additionally, open charging point protocols (OCPP) for electric vehicle charging will soon be integrated. This comprehensive protocol support facilitates data transmission compatibility, while avoiding issues caused by a lack of supported protocols. Furthermore, the IIoT gateway supports a range of I/O interfaces, along with Wi-Fi, 4G/LTE connectivity. This enables connection to data acquisition devices such as remote IO and Ethernet DAQ systems, facilitating connectivity from the edge to cloud platforms.

The IIoT gateway uses an ARM Cortex-A9 processor, known for its suitability for operating under power supply restrictions. Its compact dimensions, coupled with multiple mounting options and an operating temperature range of -20 to 70°C, help provide adaptability in harsh environmental conditions.

ADLINK Technology Inc
www.adlinktech.com





IoT MODULE

u-blox has launched the LEXI-R10, an ultra-small LTE Cat 1bis IoT module in a 16 x 16 mm form factor. The module is designed to adapt to size-demanding designs, making it suitable for use cases such as asset tracking and aftermarket telematics.

The module is suitable for applications requiring Cat 1bis connectivity without 2G fallback or positioning features. It has been designed as a singlemode LTE-only module. The small singlemode module provides indoor positioning and a US MNO-certified core. The module also offers Wi-Fi Radio to scan available Wi-Fi hotspots. This information can be used by positioning applications via a location-based service like the u-blox CellLocate Wi-Fi.

The first samples will be available by Q1 2024.

u-blox Singapore Pte Ltd

www.u-blox.com

USB ADAPTER

Würth Elektronik has launched the RD022 reference design GB-PoE+ Ethernet USB adapter. Devices networked via Ethernet usually depend on a separate power supply; however, if these terminal devices get by with low power consumption, then Power over Ethernet (PoE) is an alternative where data transmission and power supply are achieved via a network cable.

Devices with low power consumption, like IP cameras, VoIP phones, WiFi routers, network switches, LED lighting or access systems, are suitable for power supply through the Ethernet line. Würth Elektronik's RD022 reference design, which can provide up to 25 W of power, shows how this can work while still maintaining EMC compliance. The GB-PoE+ Ethernet USB adapter is based on the reference design of a 1 Gbps Ethernet USB adapter without PoE functionality.

The USB adapter provides three interfaces: a USB Type-C interface (USB 3.1), an RJ45 1 Gbps Ethernet interface with integrated PoE functionality, and a connection for a DC/DC converter with an adjustable output voltage of 6 to 18 V and a maximum output power of 25 W. The board makes it easier for customers to get started with PoE technology. The reference design familiarises users with the technology, signals, interface structure, power-up and PoE detection of a Gigabit PoE interface. It provides the hardware design for Power Sourcing Equipment (PSE) and the Powered Device (PD) and explains the conception and construction of the adapter board: current flow, USB controller and interface, and Ethernet interface, as well as power supply (PoE). Special importance is also placed on the EMC-compliant design.

Würth Electronics

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FROM A FIVE-LAYER GRAPHENE SANDWICH, A RARE ELECTRONIC STATE EMERGES

A NEWLY DISCOVERED TYPE OF ELECTRONIC BEHAVIOUR COULD HELP WITH PACKING MORE DATA INTO MAGNETIC MEMORY DEVICES.

Jennifer Chu, MIT News

Ordinary pencil lead holds extraordinary properties when shaved down to layers as thin as an atom.

A single, atom-thin sheet of graphite, known as graphene, is just a tiny fraction of the width of a human hair. Under a microscope, the material resembles a chicken-wire of carbon atoms linked in a hexagonal lattice. Despite its waif-like proportions, scientists have found over the years that graphene is exceptionally strong. And when the material is stacked and twisted in specific contortions, it can take on surprising electronic behaviour.

Now, MIT physicists have discovered another surprising property in graphene:

the team has coined ferro-valleytricity.

"Graphene is a fascinating material," says team leader Long Ju, assistant professor of physics at MIT. "Every layer you add gives you essentially a new material. And now this is the first time we see ferro-valleytricity, and unconventional magnetism, in five layers of graphene. But we don't see this property in one, two, three or four layers."

The discovery could help engineers design ultra-low-power, high-capacity data storage devices for classical and quantum computers.

"Having multiferroic properties in one material means that, if it could save energy

When stacked in five layers, in a rhombohedral pattern, graphene takes on a very rare, "multiferroic" state, in which the material exhibits both unconventional magnetism and an exotic type of electronic behaviour, which

and time to write a magnetic hard drive, you could also store double the amount of information compared to conventional devices," Ju says.

His team reported the discovery in *Nature*. MIT co-authors include lead author Tonghang Han, plus Zhengguang Lu, Tianyi Han and Liang Fu; along with Harvard University collaborators Giovanni Scuri, Jiho Sung, Jue Wang and Hongkun Park; and Kenji Watanabe and Takashi Taniguchi of the National Institute for Materials Science in Japan.

A preference for order

A ferroic material is one that displays some coordinated behaviour in its electric, magnetic or structural properties. A magnet is a common example of a ferroic material: its electrons can coordinate to spin in the same direction without an external magnetic field. As a result, the magnet points to a preferred direction in space, spontaneously.

domains could be switched by a faster, much lower-power electric field. Ju and his colleagues were curious about whether multiferroic behaviour would emerge in graphene. The material's extremely thin structure is a unique environment in which researchers have discovered otherwise hidden, quantum interactions. In particular, Ju wondered whether graphene would display multiferroic, coordinated behaviour among its electrons when arranged under certain conditions and configurations.

"We are looking for environments where electrons are slowed down — where their interactions with the surrounding lattice of atoms is small, so that their interactions with other electrons can come through," Ju explains. "That's when we have some chance of seeing interesting collective behaviours of electrons."

The team carried out some simple calculations and found that some coordinated behaviour among electrons should emerge in a structure of five graphene layers stacked together in a rhombohedral pattern. (Think of five chicken-wire fences, stacked and slightly shifted such that, viewed from the top, the structure would resemble a pattern of diamonds.)

"In five layers, electrons happen to be in a lattice environment where they move very slowly, so they can interact with other electrons effectively," Ju says. "That's when electron correlation effects start to dominate, and they can start to coordinate into certain preferred, ferroic orders."

Magic flakes

The researchers then went into the lab to see whether they could actually observe multiferroic behaviour in five-layer graphene. In their experiments, they started with a small block of graphite, from which they carefully exfoliated individual flakes. They used optical techniques to examine each flake, looking specifically for five-layer flakes, arranged naturally in a rhombohedral pattern.

"To some extent, nature does the magic," said lead author and graduate student Han. "And we can look at all these flakes and tell which has five layers, in this rhombohedral stacking, which is what should give you this slowing-down effect in electrons."

The team isolated several five-layer flakes and studied them at temperatures just above absolute zero. In such ultra-cold conditions, all other effects, such as thermally induced disorders within graphene,

should be dampened, allowing interactions between electrons to emerge. The researchers measured electrons' response to an electric field and a magnetic field, and found that indeed, two ferroic orders, or sets of coordinated behaviours, emerged.

The first ferroic property was an unconventional magnetism: the electrons coordinated their orbital motion, like planets circling in the same direction. (In conventional magnets, electrons coordinate their 'spin' — rotating in the same direction, while staying relatively fixed in space.)

The second ferroic property had to do with graphene's electronic 'valley'. In every conductive material, there are certain energy levels that electrons can occupy. A valley represents the lowest energy state that an electron can naturally settle. As it turns out, there are two possible valleys in graphene. Normally, electrons have no preference for either valley and settle equally into both.

But in five-layer graphene, the team found that the electrons began to coordinate, and preferred to settle in one valley over the other. This second coordinated behaviour indicated a ferroic property that, combined with the electrons' unconventional magnetism, gave the structure a rare, multiferroic state.

"We knew something interesting would happen in this structure, but we didn't know exactly what, until we tested it," says co-first author Lu, a postdoc in Ju's group. "It's the first time we've seen a ferro-valleytronics, and also the first time we've seen a coexistence of ferro-valleytronics with unconventional ferro-magnet."

The team showed they could control both ferroic properties using an electric field. They envision that, if engineers can incorporate five-layer graphene or similar multiferroic materials into a memory chip, they could, in principle, use the same, low-power electric field to manipulate the material's electrons in two ways rather than one, and effectively double the data that could be stored on a chip compared to conventional multiferroics. While that vision is far from practical realisation, the team's results break new ground in the search for better, more efficient electronic, magnetic and valleytronic devices.

This research was done, in part, using the electron-beam lithography facility run by MIT. nano, and is funded, in part, by the National Science Foundation and the Sloan Foundation. *Reprinted with permission of MIT News.*

Other materials can be ferroic through different means. But only a handful have been found to be multiferroic — a rare state in which multiple properties can coordinate to exhibit multiple preferred states. In conventional multiferroics, it would be as if, in addition to the magnet pointing toward one direction, the electric charge also shifts in a direction that is independent from the magnetic direction.

Multiferroic materials are of interest for electronics because they could potentially increase the speed and lower the energy cost of hard drives. Magnetic hard drives store data in the form of magnetic domains — essentially, microscopic magnets that are read as either a 1 or a 0, depending on their magnetic orientation. The magnets are switched by an electric current, which consumes a lot of energy and cannot operate quickly. If a storage device could be made with multiferroic materials, the

CONNECTOR

Würth Elektronik has expanded its USB-C range with a 24-pin fully-configured horizontal receptacle for SMT assembly. The USB 3.1 Type-C connector features a high-rise design and allows complete visual control of soldering due to its two rows each with 12 contacts. As a fully equipped Type-C connector, it is not only compatible with USB 3.2 Gen 1x2 signalling and USB Power Delivery standards, but can also be used for alternative and accessory modes. This includes transmitting analog signals via the (D+/D-) pins.

The connector is designed for at least 10,000 mating cycles and operating temperatures from -40 to +120°C. Both the pin contacts and the outer retaining pins of the shielding are gold-plated in the contact zone to provide an optimised connection to the PCB. The stable receptacle is suitable for all consumer and IT applications that are designed to exploit the options provided by the USB 3.2 Gen 1x2 standard in terms of data and power transfer. The latest member of the USB product family is now available from stock without a minimum order quantity, and developers can order free samples.

Würth Electronics Australia Pty
www.we-online.com



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		www.emctech.com.au															
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MODULES

Congatec has launched the conga-TC570r COM Express Type 6 Compact module, based on the 11th Generation Intel Core processor family (code name "Tiger Lake"). The modules have received IEC-60068 certification. This certification qualifies the modules for operation in railway applications, confirming that they meet the requirements for extreme conditions such as extended temperatures, rapid temperature changes, shocks and vibrations.

The module suits various new railway applications, including Train Control and Management Systems (TCMS), predictive maintenance, passenger information systems, video surveillance and analytics, ticketing and fare collection, and fleet management. They are also suitable for applications beyond railway and transportation that are exposed to extreme conditions including automation, autonomous guided vehicles (AGV) and autonomous mobile robots (AMR). These applications require advanced embedded computing capabilities provided by Intel's 11th Gen Core processor technology, which the module offers in an industry-compliant design certified to meet all required IEC-60068 specifications.

The conga-TC570r module has undergone testing and certification against various IEC-60068 standards. It is certified for operation under extended temperatures ranging from -40 to +85°C, including change of temperature (IEC-60068-2-14 Nb) and rapid change of temperature (IEC-60068-2-14 Na). It also provides shock and vibration resistance on the basis of DIN EN 61373 April 2011 category 2 (railway applications). The module is also protected against severe environmental conditions, such as high humidity, in accordance with IEC-60721-3-7 class 7K3, 7M2. Optional features include conformal coatings to enhance resistance to liquids and moisture.

The modules are available in a range of standard configurations, with customisation options available on request.

Congatec Australia Pty Ltd
www.congatec.com

PREVENTING CATASTROPHES WITH NEXT-GEN SENSORS

The University of British Columbia

As the wind and rain pound the blades of a wind turbine, UBC Okanagan researchers carefully monitor screens hundreds of kilometres away, analysing whether the blade's coatings can withstand the onslaught.

istock.com/folkedak

While this was only a test in a lab, the researchers are working to improve the way structures such as turbines, helicopter propellers and even bridges are monitored for wear and tear from the weather.

A changing climate is increasing the need for better erosion-corrosion monitoring in a wide range of industries from aviation to marine transportation and from renewable energy generation to construction, explained UBC Okanagan doctoral student Vishal Balasubramanian.

In many industries, wear-resistant coatings are used to protect a structure from erosive wear. However, these coatings have a limited service life and can wear out with time. As a result, these coated structures are periodically inspected for abrasion and breaches, which are then fixed by recoating the damaged areas.

Currently, these inspections are done manually using a probe, and Balasubramanian — one of several researchers working in UBC's Okanagan Microelectronics and Gigahertz Applications (OMEGA) lab — is working to develop sensors that can be embedded directly into the coatings. This could take away any chance of human-caused errors and drastically reduce the inspection time. By integrating artificial intelligence (AI) and augmented reality (AR) into these embedded sensors the researchers can monitor in real time the wear and tear of protective mechanical coatings designed to prevent catastrophic failures.

"By leveraging AI technologies into our microwave resonator sensors, we're able

to detect not only surface-level coating erosion but we can also distinguish when an individual layer is being eroded within a multi-layer coating," Balasubramanian, lead author of the research recently published in *Nature Communications*, said.

Some studies suggest that metal corrosion in the United States has a cost of nearly \$300 billion a year — more than 3% of that country's gross domestic product.

But it's not just about money.

Erosion can cause irreversible damage to the exterior surfaces of bridges, aircraft, cars and naval infrastructure, explained Balasubramanian. History has a long list of disasters where erosion was identified as the primary reason for structural failures that have led to the loss of thousands of lives — including the 2018 Genoa bridge collapse in Italy, the 1984 Bhopal gas tragedy in India and the 2000 Carlsbad gas pipeline fire in Texas.

"Being able to proactively monitor and address equipment degradation — especially in harsh environments — can undoubtedly safeguard important infrastructure and reduce the effect on human life," said Dr Mohammad Zarifi, an Associate Professor in UBCO's School of Engineering and principal investigator at the OMEGA Lab. "For several years, we've been developing microwave-based sensors for ice detection and the addition of newer technologies like AI and AR can improve these sensors' effectiveness exponentially."

The newly developed sensors can detect and locate the eroding layer in multi-layered coatings and can also detect the total wear depth of protective coatings. This

information is collected and can provide a detailed understanding for engineers and stakeholders of the potential damage and danger of failures.

In the lab, the differential network device interface system was tested at varying temperatures — extreme hot and cold — and different levels of humidity and UV exposure to mimic several harsh environments. The developed system was tested with different types of coatings and its response was monitored in four different types of experimental set-ups that performed the desired environmental parameter variations.

"We tested our sensors under some of the harshest environments including various temperatures, humidity and UV exposures," Balasubramanian said. "We continue to push the limits of what these sensors are able to withstand in order to stay ahead of what's transpiring around the world."

For his work, Balasubramanian was recently recognised with an Award for Excellence in Microsystems CAD Tool & Design Methodology by CMC Microsystems and sponsored by COMSOL. The award recognises a graduate student who demonstrates a novel design technology advancement with the most potential for applicable improvements to microsystems manufacture and deployment.

The research was supported by funding from the Department of National Defence of Canada, the Natural Sciences and Engineering Research Council of Canada and the Canadian Foundation for Innovation.

MICROCONTROLLER DISCOVERY KIT

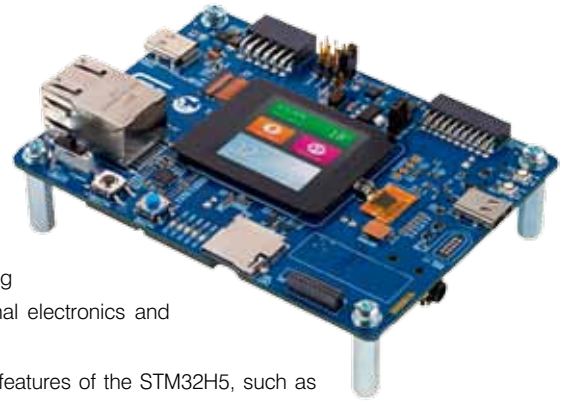
STMicroelectronics has released a development kit for creating a range of applications with STM32H5 microcontrollers (MCUs). The STM32H5 devices are suitable for high-performance processing and advanced security in a range of applications, including smart sensors, smart appliances, industrial controllers, networking equipment, personal electronics and medical devices.

The STM32H573I-DK Discovery kit enables developers to explore all the integrated features of the STM32H5, such as analog peripherals, timers, the ST ART (Adaptive Real-Time) Accelerator, media interfaces and mathematical accelerators. This makes it easy to evaluate new designs for industrial programmable logic controllers (PLC), motor drives and smart controllers for appliances like air conditioners, refrigerators and washing machines. Other potential applications include alarm controllers, communication hubs and smart lighting controls.

The discovery kit is a versatile development board that includes a colour touch display, digital microphone and interfaces such as USB, Ethernet and Wi-Fi. The board also features an audio codec, flash memory and headers for connecting expansion shields and daughterboards.

The discovery kit features examples that show how to use the security services, with all the necessary software tools and support integrated in the STM32Cube development ecosystem. This discovery kit as well as the H5 Nucleo Board NUCLEO-H563ZI are now available from ST's eStore and authorised distributors.

STMicroelectronics Pty Ltd
www.st.com



SINGLE-POLE, DOUBLE-THROW SWITCH

Richardson RFPD, Inc. has announced the availability and full design support capabilities for a single-pole, double-throw switch from Skyworks Solutions, Inc. The SKY59608-711LF SPDT uses advanced switching technologies to maintain low insertion loss and high isolation for all switching paths. The high-linearity performance and low insertion loss achieved by the switch make it a suitable choice for low-power transmit/receive applications.

The switch features a frequency range of 2.4 to 8.3 GHz and an insertion loss of 0.75 dB typical at 5 to 7 GHz. It achieves an isolation of 23 dB at 5 to 7 GHz and features a 0.1 dB input compression point (IP0.1dB), with +31 dBm. The switch also features single control logic, with 1.1 V and 3.6 V logic compatibility, and a supply voltage range of 2.7 to 5 V. The switch comes in a miniature MLPD, 6-pin package, measuring 1.1 x 0.7 x 0.45 mm (MSL1, 260°C per JEDEC J-STD-020).

The single-pole double-throw switch is intended for mode-switching in WLAN applications. It is part of Skyworks' Sky5 product portfolio that streamlines 5G architectural complexities with integrated transmit/receive front-end solutions and diversity receive (DRx) modules. Designed for new spectrum in the sub-6 GHz range, the Sky5 products offer a MIPI interface, are baseband-agnostic and comply with 3GPP standards.

Richardson RFPD
www.richardsonrfpd.com



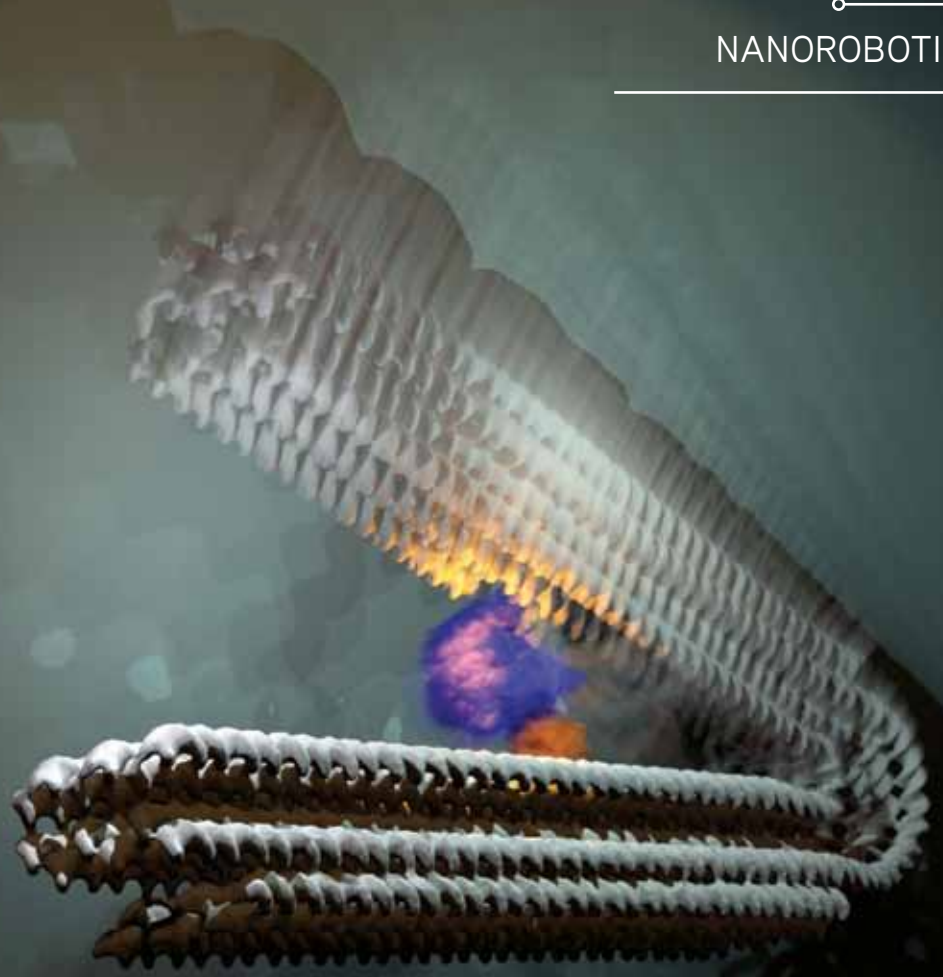
STAINLESS STEEL PANEL PC

Backplane Systems Technology now stocks the Winmate W24IT3S-SPA2-R stainless panel PC with round corner design. Powered by the 11th Generation Intel Core i5-1135G7, the panel PC is designed to operate at a frequency of 2.4 GHz with potential turbo boosts up to 4.2 GHz. This 23.8" device features a sleek round corner design, providing a contemporary edge to industrial set-ups. Beyond aesthetics, the device features a true flat, edge-to-edge front surface that is easy to clean, making it suitable for environments that require hygiene.

The panel PC is sealed to an IP65 rating, enabling it to stand against the onslaught of dust and water. This makes it suitable for sectors with rigorous hygiene standards, such as the pharmaceutical, food and beverage industries. The panel PC's touch sensitivity is another highlight. The panel PC's Projected Capacitive Multi-Touch (P-CAP) facilitates seamless user interactions.

Constructed from SUS 316/AISI 316 stainless steel, the device is resistant to corrosion, making it suitable for the food and chemical industries. Lastly, its versatile design allows for varied mounting solutions, from panel mounts to VESA brackets, for flexibility in deployment across different industrial scenarios.

Backplane Systems Technology Pty Ltd
www.backplane.com.au



Mathias Gerlach/Uni Bonn

RESEARCHERS DESIGN A PULSING NANOMOTOR

The novel type of nanomotor — with an RNA polymerase, which pulls the two 'handles' together and then releases them again. This generates a pulsing movement.

An international team of scientists headed by the University of Bonn has developed a novel type of nanomotor.

It is driven by a clever mechanism and can perform pulsing movements. The researchers are now planning to fit it with a coupling and install it as a drive in complex machines. Their findings have appeared in the journal *Nature Nanotechnology*.

This novel type of motor is similar to a hand grip trainer that strengthens your grip when used regularly. However, the motor is around one million times smaller. Two handles are connected by a spring in a V-shaped structure.

In a hand grip trainer, you squeeze the handles together against the resistance of the spring. Once you release your grip, the spring pushes the handles back to their original position. "Our motor uses a very similar principle," explained Professor Dr Michael Famulok from the Life and Medical Sciences (LIMES) Institute at the University of Bonn. "But the handles are not pressed together but rather pulled together."

For this purpose, the researchers have repurposed a mechanism without which

there would be no plants or animals. Every cell is equipped with a sort of library. It contains the blueprints for all types of proteins that the cell needs to perform its function. If the cell wants to produce a certain type of protein, it orders a copy of the respective blueprint. This transcript is produced by RNA polymerases.

RNA polymerases drive the pulsing movements

The original blueprint consists of long strands of DNA. The RNA polymerases move along these strands and copy the stored information letter by letter. "We

took an RNA polymerase and attached it to one of the handles in our nanomachine,” explained Famulok, who is also a member of the transdisciplinary research areas ‘Life & Health’ and ‘Matter’ at the University of Bonn. “In close proximity, we also strained a DNA strand between the two handles. The polymerase grabs on to this strand to copy it. It pulls itself along the strand and the non-transcribed section becomes increasingly smaller. This pulls the second handle bit by bit towards the first one, compressing the spring at the same time.”

The DNA strand between the handles contains a particular sequence of letters shortly before its end. This so-called termination sequence signals to the polymerase that it should let go of the DNA. The spring can now relax again and moves the handles apart. This brings the start sequence of the strand near to the polymerase and the molecular copier can start a new transcription process: The cycle thus repeats. “In this way, our

nanomotor performs a pulsing action,” said Mathias Centola from the research group headed by Famulok, who carried out a large proportion of the experiments.

An alphabet soup serves as fuel

This motor also needs energy just like any other type of motor. It is provided by the ‘alphabet soup’ from which the polymerase produces the transcripts. Every one of these letters (in technical terminology: nucleotides) has a small tail consisting of three phosphate groups — a triphosphate. In order to attach a new letter to an existing sentence, the polymerase has to remove two of these phosphate groups. This releases energy which it can use for linking the letters together. “Our motor thus uses nucleotide triphosphates as fuel,” said Famulok. “It can only continue to run when a sufficient number of them are available.”

By monitoring individual nanomotors, one of the cooperation partners based

in the US state of Michigan was able to demonstrate that they actually carry out the expected movement. A research group in Arizona also simulated the process on high-speed computers. The results could be used, for example, to optimise the motor to work at a particular pulsation rate.

Furthermore, the researchers were able to demonstrate that the motor can be easily combined with other structures. This should make it possible for it to, for example, wander across a surface — similar to an inchworm that pulls itself along a branch in its own characteristic style. “We are also planning to produce a type of clutch that will allow us to only utilise the power of the motor at certain times and otherwise leave it to idle,” explained Famulok. In the long term, the motor could become the heart of a complex nanomachine. “However, there is still a lot of work to be done before we reach this stage.”

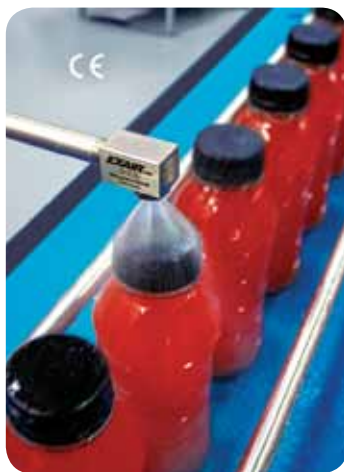
LIQUID ATOMISING SPRAY NOZZLE

The EXAIR 1/8 NPT HollowStream liquid atomising spray nozzle is the latest addition to EXAIR’s line of liquid atomising nozzles. Providing a hollow cone spray pattern, the HollowStream features a tangential flow design and is vaneless with wide open internal features to resist clogging. It is designed to produce a uniform distribution in a ring pattern with medium to large droplets to solve cooling, cleaning, foam breaking, rinsing and dust suppression applications for industry.

With HollowStream nozzles, the liquid is supplied into the body of the nozzle creating a swirling action within a vortex chamber. This vortex produces the spray pattern when the machined nozzle breaks the liquid surface tension as it exits the orifice and into a controlled spray angle. The open, right-angle design is compact and suitable for applications involving liquids that are thicker or containing particulate and operates at up to 250 psi liquid pressure.

Available from Compressed Air Australia, the stainless steel construction of liquid atomizing nozzles adds to their corrosion resistance. HollowStream nozzles are CE compliant and available in a variety of flow rates. They complement EXAIR’s line of 1/8, 1/4 and 1/2 NPT air atomising and no drip air atomising spray nozzles. Models come with a 5-year built to last warranty.

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



HIGH VOLTAGE CONTACTORS

Mouser Electronics, Inc. now stocks the ECPx50B high voltage contactors from TE Connectivity. Suitable for control in high-voltage environments such as battery energy storage systems and solar inverters, the contactors are designed to provide high performance and low coil power consumption. The high voltage contactors support a range of applications, including alternative energy storage systems, photovoltaic (PV) inverters and EV charging solutions.

The ECP150B, ECP250B and ECP350B high voltage contactors offer a switching voltage of up to 1500 VDC and a continuous carry current of up to 500 A. Supporting bi-directional loads, the contactors also feature hermetic sealing with ceramic sealing technology. The contactors can be integrated into space-constrained designs for PV and EV applications with a small form factor of 104 x 75 x 108 mm. The contactors also comply with the DC-1 utilisation category and meet UL, TUV and CE certifications.

Mouser Electronics
au.mouser.com





MEASURING INSTRUMENTS

Measuring instruments are required for the monitoring and optimisation of processes in a variety of industries and applications. Depending on the focus of the application, the OKW product range offers a range of solutions, such as DATEC-COMPACT, which is suitable for multimeters. This IP65 handheld enclosure in ASA+PC-FR is available in three different sizes and two standard colours. Due to its ergonomic shape, DATEC-COMPACT is comfortable to hold, allowing fatigue-free operation in different situations.

The SOLID-BOX is designed to meet the criteria required of a modern electronics enclosure in an industrial environment or protected outdoor area. This industrial enclosure (IP66, IP67, IK08, UL 94 V-0) is available as standard in three sizes and two colours, anthracite grey and light grey. Its large volume makes it suitable for applications such as fill measurement, for amplifiers or for long-term measurement, such as in smart farming.

The PROTEC desktop and wall-mounted enclosures are designed for applications such as calibration. The enclosure is moulded from high-quality V-0 material and features an operating panel with a 20° slope. PROTEC is available in three versions and three sizes, all in off-white as standard. The top is recessed to accommodate a membrane keypad, touchscreen or other operating elements.

The MINI-DATA-BOX (IP65 optional) is moulded from flame-retardant ASA+PC material. It is suitable for small, stationary measuring units. This small-format enclosure range is available in two shapes (S square and E edge/rectangular), with or without flanges for wall mounting or easy installation on rails, profiles or masts. The range comprises 40 enclosures based on four plan sizes. The standard colours are traffic white, anthracite grey, and — for the flanged version only — a new two-colour combination of traffic grey A/traffic white.

ROLEC OKW Australia New Zealand P/L
www.okw.com.au

LOW NOISE AMPLIFIER

Richardson RFPD, Inc. has announced the in-stock availability and full design support capabilities for a new RF low noise amplifier from Guerrilla RF, Inc.

The GRF2133 is a broadband linear gain block featuring ultra-high gain and sub-0.85 dB noise figure for small cell, cellular booster, wireless infrastructure and other high-performance applications.

Configured as a linear driver, LNA or cascaded gain block, it offers high levels of reuse both within a design and across platforms. The device is operated from a supply voltage of 1.8 to 5 V, with a selectable IDDQ range of 35 to 120 mA for efficiency and linearity. The low noise amplifier features a 0.1-2.7 GHz frequency range and a compact 1.5 x 1.5 mm DFN-6 package.

Richardson RFPD
www.richardsonrfpd.com



APPLIANCE INLETS

SCHURTER has launched the DG11 and DG12 appliance inlets and an associated V-Lock power cable. The IP54-rated device connection is designed to meet high demands, and has been upgraded for an IEC 60320 and IEC 60529 compatible appliance inlet. In combination with the dedicated power cord, an IP54 protection rating is achieved when plugged in. An IP54 connection provides protection against dust particles and is splash-proof.

The appliance inlet as well as the connector of the power cord have been equipped with special sealing elements to achieve a higher IP protection. The new device plug connection also has the industry-proofed V-Lock cord retention system. Mechanical safety clips, which often must be designed for specific types, are no longer a necessity.

The appliance inlets are suitable for harsh working environments in a range of industries, including the medical and food processing sectors. Types 6080, DG11, DG12 are all available, with further products soon to follow. SCHURTER also plans to equip a complete family of device connections with this innovative technology.

SCHURTER (S) PTE LTD
www.schurter.com



INTEGRATED CIRCUIT

STMicroelectronics' SPSB081 automotive power-management IC includes a range of features including a main fixed-voltage low-dropout regulator (LDO), a secondary programmable LDO, four high-side drivers, a CAN FD transceiver and an optional LIN transceiver. The ICs provide multiple standby modes with very low quiescent current and programmable local or remote wake-up to help minimise power consumption.

The power sources and transceivers available on-chip help simplify the design of car-body controllers for a sunroof, seats, tailgate, doors and lighting modules. The controllers are also used in gateways, HVAC controllers, passive keyless entry systems, telematic control units and control panels.



The available variants include the SPSB081C3 and SPSB081C5, which contain a 3.3 or 5 V fixed LDO, respectively, with one CAN transceiver. The SPSB0813 and SPSB0815 contain the additional LIN transceiver. The secondary LDO, included in all variants, can be programmed through the IC's SPI port to operate as an independent 3.3 or 5 V regulator, or to track the main LDO. The four high-side drivers can source up to 140 mA to power LEDs and sensors, with current monitoring and a 10-bit PWM timer for each channel.

Extensive built-in protection is provided, as well as a diagnostic output pin for fail-safe signalling. These features support use in applications that must meet functional safety requirements in accordance with ISO 26262, even if not designed as a safety hardware element. All outputs feature overcurrent protection and open-load fault indication. The primary (fixed) LDO features overvoltage protection and thermal protection circuitry, while the secondary (programmable) LDO has overload, over-temperature, short-circuit and reverse-bias protection. Both have short-to-ground monitoring at start-up and continuous regulator-failure monitoring.

The SPSB081 family is AEC-Q100 qualified, specified from -40 to 150°C, and able to operate up to 175°C. All variants are in production and available in a thermally enhanced 5 x 5 x 1 mm QFN32L package.

STMicroelectronics Pty Ltd

www.st.com



CLICK BOARDS

Quectel Wireless Solutions and MikroElektronika have launched the LC29H series RTK (real-time kinematic) click boards. The LC29H is a series of dual-band, multi-constellation GNSS modules that support the concurrent reception

of global GNSS constellations including GPS, BDS, GLONASS and Galileo, delivering a reduction in multipath interference within dense urban canyons and an improvement in positioning accuracy.

The series of GNSS modules has been designed to meet consumer mass-market requirements and enables high-precision, small form factor and low-cost devices. The modules are based on the latest L1/L5 receiver and compared to existing L1/L2 receivers have equivalent performance accuracy, but achieve 70% less power consumption and enable solutions to be 50% smaller, Quectel claims.

The LC29H Series features dual-frequency support, for enhanced accuracy. In autonomous mode, it reportedly achieves accuracy values of 1 metre. The optional Dead Reckoning (DR) function is designed to provide optimal positioning performance, even in challenging scenarios characterised by weak signals or the absence of GNSS signals.

The LC29H Series also incorporates advanced power management capabilities. This feature makes the module suitable for applications where power efficiency is required, especially in battery-powered systems, including robotic lawn mowers, e-scooters, sport trackers, drones or handheld detectors such as metal detectors.

Quectel

www.quectel.com

ETHERNET CONTROLLER

Avalue Technology Inc.

has launched the EPM-1608

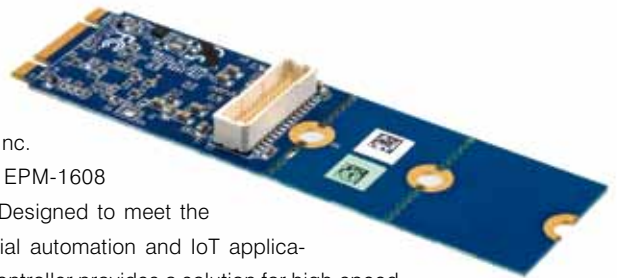
Ethernet controller. Designed to meet the demands of industrial automation and IoT applications, the Ethernet controller provides a solution for high-speed data transmission, stability and longevity.

The Ethernet controller leverages the power of the Intel i226 Ethernet controller to provide dual LAN ports with support for 2.5GbE. This enables a high-bandwidth connection that delivers fast data rates and near-instantaneous response times. With a range of safety features, including IEC 62368-1 2 kV HiPOT protection, EN61000-4-2 (ESD) Air-15 kV, Contact-8 kV Level 2 ± 4 kV and EN61000-4-5 2 kV surge protection, this module is designed to withstand 24/7 industrial operation and protect against unforeseen circumstances. The Ethernet controller also enables customers to meet the demands of applications that require performance.

The Ethernet controller offers upgrades and deployments with support for 2.5GbE and higher bandwidth, enabling organisations to take advantage of the latest network features without the need for redeployments. With added features like Wake On LAN and 2 kV isolation, it offers user-friendliness and integration into existing systems.

Avalue

www.avalue.com.tw



Nordic-powered sensors remotely supervise machinery lubrication

Ensuring appropriate machinery and equipment maintenance is vital for a range of industries, including manufacturing and mining. A sensor can often help to monitor the flow of industrial lubricant, which in turn helps companies remotely monitor their equipment and ensure grease is being applied evenly. Sufficient lubrication is key for these applications, as increased friction can lead to greater need for maintenance and shorten the lifespan of critical equipment and machinery. Unplanned downtime of equipment can be expensive, thereby making predictive maintenance beneficial.

Australian company GreaseBoss has developed a flow meter that is designed to ensure appropriate maintenance for machinery and equipment. The 'GreaseBoss Endpoint' sensor is placed in line with grease points to monitor the flow of lubricant, and is designed to measure and verify grease delivery at scale using cloud and IoT technologies. Nordic Semiconductor's nRF52833 SoC for data collection and sensor interface management is integrated into the flow meter, to relay metrics to a GreaseBoss gateway using Bluetooth LE connectivity. The SoC's 64 MHz, 32-bit Arm Cortex M4 processor uses edge processing to select and send relevant information, thereby avoiding unnecessary data transmission and conserving power.

From the gateway the key data is relayed to the cloud, from where it can be accessed and analysed by users. Automated and on-demand reports are available from the GreaseBoss Cloud web platform, allowing users to check whether machines are meeting their preset lubrication requirements and receive alerts if any areas of non-compliance are detected. Users can also configure the plant structure set-up from the web platform.

The system was developed using Memfault's IoT reliability platform for embedded observability, remote debugging and over-the-air (OTA) fleet management. The flow meter leverages Memfault's capabilities, such as metric, reboot and trace reporting, to reduce the need for unnecessary on-site visits and hardware returns to debug issues. It can also help increase the uptime of machinery and equipment. However, in order to develop the flow meter, the sensors needed to have a long life and the capability to perform while in harsh industrial environments with extreme temperatures. Therefore, the flow meter features an extended operating temperature range from -40 to 105°C and a maximum transmit power of +8 dBm. A wide input voltage range helps simplify the design, by powering the chip directly off the replaceable coin cell battery.

Due to the large number of sensors required, and their often hazardous or hard to reach placement, achieving a long battery life was key. The flow meter was able to do this due to the low power operating characteristics of the nRF52833 SoC.

Nordic Semiconductor
www.nordicsemi.com





istock.com/simomkr

SILICON-COMPATIBLE METAL OXIDES

TO POWER ELECTRONICS

Research conducted by Flinders University and UNSW Sydney has provided an observation of nanoscale intrinsic ferroelectricity in magnesium-substituted zinc oxide thin films (otherwise known as metal oxide thin films) with simple wurtzite crystal structures. This new class of silicon-compatible metal oxides could facilitate the development of advanced devices including high-density data storage, low-energy electronics, wearable devices and flexible energy harvesting.

Ferroelectric akin to magnets exhibit a corresponding electrical property known as permanent electric polarisation, which stems from electric dipoles featuring equal but oppositely charged ends or poles. The polarisation can be repeatedly altered between two or more equivalent states or directions when subjected to an external electric field. As a result, the switchable polar materials are under active consideration for numerous technological applications including fast nano-electronic computer memory and low-energy electronic devices.

Corresponding author Dr Pankaj Sharma from Flinders University said the research findings offer significant insights into the switchable polarisation in a new class of simple silicon-compatible metal oxides with wurtzite crystal structures. Co-author Jan Seidel said the material system offers “very real and important implications for new technology and translatable research”.

Historically, this technologically important property has been found to exist in complex perovskite oxides that incorporate a range of transition metal cations leading to physical phenomena such as multiferroicity, magnetism or superconductivity. “But, integrating these complex oxides into the semiconductor manufacturing processes has been a significant challenge due to stringent processing requirements related, for instance, to thermal budget and precise control of multiple constituent elements. The present study therefore provides a potential solution,” said first author Haoze Zhang.

The research findings were published in the journal *ACS Nano*.

40⁺
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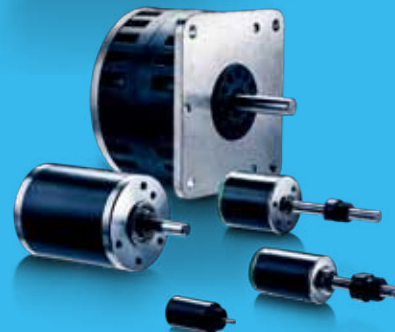
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