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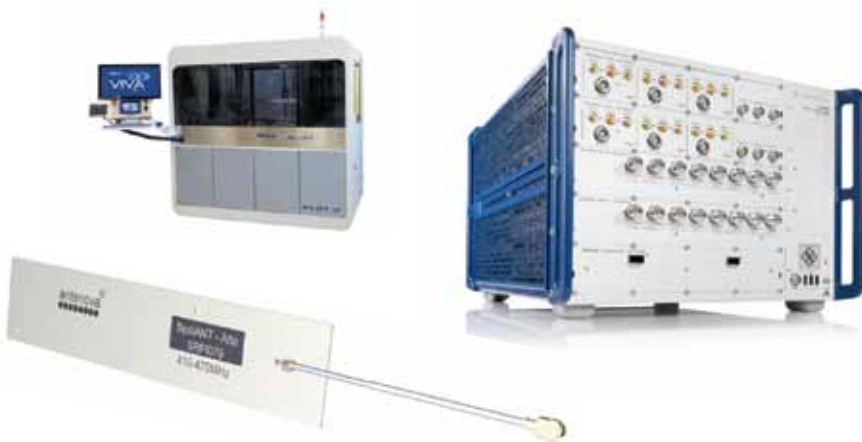
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QUANTUM COMPUTING IN SILICON SURPASSES 99% ACCURACY

Three new studies, published back-to-back in the journal *Nature*, have reported high-fidelity (>99%) two-qubit gates based on spin qubits in silicon, confirming that robust, reliable quantum computing in silicon is now a reality. Together, the trio of results amplifies the promise of semiconductor spin qubits.

The world is currently in a race to develop large-scale quantum computers that could vastly outperform classical computers in certain areas. However, these efforts have been hindered by a number of factors, including in particular the problem of decoherence, or noise generated in the qubits. This problem becomes more serious with the number of qubits, hampering scaling up.

In order to achieve a large-scale computer that could be used for useful applications, it is believed that a two-qubit gate fidelity (accuracy) of at least 99% to implement the surface code for error correction is required, as the laws of quantum physics pose severe restrictions on how the correction takes place in a quantum computer. This has been achieved in certain types of computers, using qubits based on superconducting circuits, trapped ions and nitrogen-vacancy centres in diamond, but these are hard to scale up to the millions of qubits required to implement practical quantum computation with an error correction.

Semiconductor spin qubits in silicon are stable enough to hold quantum information

for long periods and can be scaled up using techniques familiar from existing advanced semiconductor manufacturing technology, but have difficulty performing quantum logic operations with sufficiently high accuracy. The higher the accuracy of the operations, the higher the likelihood that near-term applications for quantum computers come in reach, and the higher the likelihood that errors can be corrected faster than they appear.

The first of the new studies, by RIKEN and QuTech (a collaboration between TU Delft and TNO, the Netherlands Organisation for Applied Scientific Research), saw researchers demonstrate a two-qubit gate fidelity of 99.5% — higher than the 99% considered to be the threshold for building

fault-tolerant computers — using electron spin qubits in silicon. To carry out their work, the researchers experimented with a quantum dot structure that was fabricated by nanofabrication on a strained silicon/silicon germanium quantum well substrate, using a controlled-NOT (CNOT) gate.

In previous experiments, the gate fidelity was limited due to slow gate speed. To improve the gate speed, the team carefully designed the device and tuned the device operation condition by voltages applied to gate electrodes to combine the established fast single-spin rotation technique using micromagnets and a large two-qubit coupling. This allows them to enhance the gate speed by a factor of 10 compared to previous work.

Interestingly, it was previously believed the increasing gate speed would always lead to better fidelity, but they found that there was a limit, and that beyond that the increasing speed actually made the fidelity worse.

Through the work, the researchers discovered that a property called the Rabi frequency — a marker of how the qubits change states in response to an oscillating field — is key to the performance of the system, and they found a range of frequencies for which the single-qubit gate fidelity was 99.8% and the two-qubit gate fidelity was 99.5%, clearing the required threshold. Through this, they demonstrated that they could achieve universal operations, meaning that all the basic operations that constitute

quantum operations, consisting of a single-qubit operation and a two-qubit operation, could be performed with the gate fidelities above the error correction threshold.

To test the capability of the new system, the researchers implemented a two-qubit Deutsch-Jozsa algorithm and the Grover search algorithm. Both algorithms output correct results with a high fidelity of 96–97%, demonstrating that silicon quantum computers can perform quantum calculations with high accuracy.

“We are very happy to have achieved high-fidelity universal quantum gate set, one of the key challenges for silicon quantum computers,” said Akito Noiri, the first author of the study.

“The presented result makes spin qubits, for the first time, competitive against superconducting circuits and ion traps in terms of universal quantum control performance,” added Seigo Tarucha, leader of the research group. “This study demonstrates that silicon quantum computers are promising candidates, along with superconductivity and ion traps, for research and development toward the realisation of large-scale quantum computers.”

Separately to the RIKEN study, another team at QuTech managed to surpass the 99% barrier for two-qubit gate fidelity in semiconductor spin qubits. Single-qubit operations of spin qubits in quantum dots had previously achieved fidelities of 99.9%, but

two-qubit gate fidelities had varied from 92% to 98%. The QuTech researchers managed to realise a spin-based quantum processor in silicon with single- and two-qubit gate fidelities all above 99.5%.

"We used a gate-defined double quantum dot in an isotopically enriched $^{28}\text{Si}/\text{SiGe}$ heterostructure, with each dot occupied by one single electron," said Xiao Xue, lead author of the study. "Pushing the two-qubit gate fidelity well beyond 99% required improved materials and specially designed qubit control and calibration methods.

"Now that this important 99% barrier for the two-qubit gate fidelity has been surpassed, semiconductor qubits have gained credibility as a leading platform, not only for scaling but also for high-fidelity control."

"A universal gate set with fidelity above 99.5% is an important step for semiconductor spin qubits," added supervising researcher Lieven Vandersypen. "Independent studies have shown spin qubit readout with a fidelity above 98% in only a few μs , with further improvements underway.

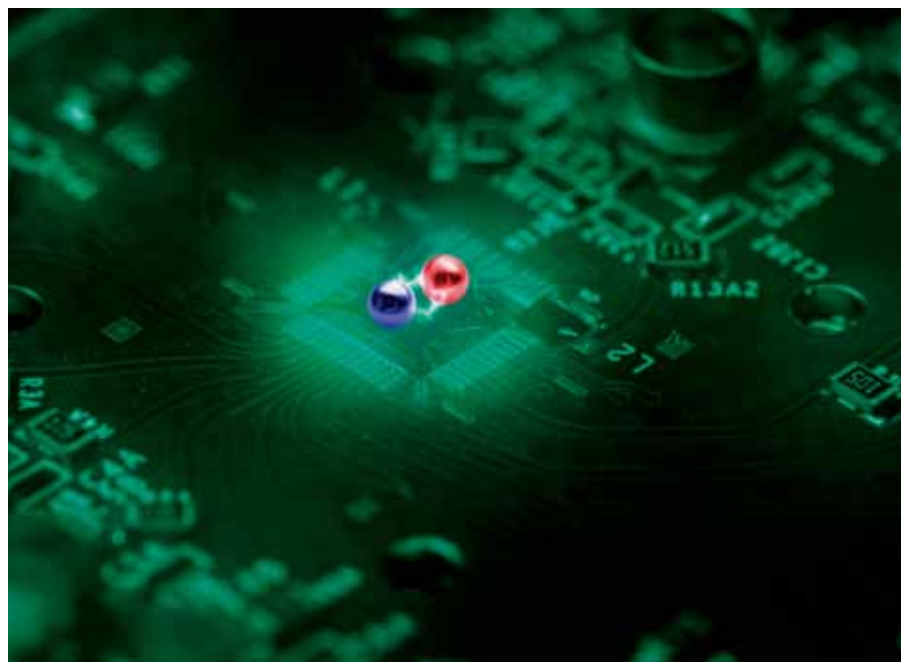


The silicon quantum computer chip used in the RIKEN study

"With a further effort in reducing crosstalk errors and in extending the device designs, we are optimistic that the individually demonstrated advantages of semiconductor spin qubits can be combined into a fault-tolerant and highly integrated quantum computer."

The last of the studies was led by Professor Andrea Morello and his team at UNSW Sydney, in collaboration with researchers at the University of Technology Sydney and The University of Melbourne as well as in the US, Japan and Egypt. Together, they achieved one-qubit operation fidelities up to 99.95% and two-qubit fidelity of 99.37% with a three-qubit system comprising an electron and two phosphorous atoms, introduced in silicon via ion implantation.

Prof Morello had previously demonstrated that he could preserve quantum information



Artistic image featuring the chip used in the QuTech research, with the two-qubit gate operation depicted in blue and red. Image credit: Marieke de Lorijn for QuTech.

in silicon for 35 seconds — described by Prof Morello as "an eternity" in the quantum world — due to the extreme isolation of nuclear spins from their environment. "To give a comparison," he said, "in the famous Google and IBM superconducting quantum computers the lifetime is about a hundred microseconds — nearly a million times shorter."

The trade-off was that isolating the qubits made it seemingly impossible for them to interact with each other, as necessary to perform actual computations. The new paper describes how Prof Morello's team overcame this problem by using an electron encompassing two nuclei of phosphorus atoms.

"If you have two nuclei that are connected to the same electron, you can make them do a quantum operation," said Mateusz Madzik, one of the lead experimental authors on the study.



Artist's impression of quantum entanglement between three qubits in silicon: the two nuclear spins (red spheres) and one electron spin (shiny ellipse) which wraps around both nuclei. Image credit: UNSW/Tony Melov.

"While you don't operate the electron, those nuclei safely store their quantum information. But now you have the option of making them talk to each other via the electron, to realise universal quantum operations that can be adapted to any computational problem."

"This really is an unlocking technology," said Dr Serwan Asaad, another lead experimental author. "The nuclear spins are the core quantum processor. If you entangle them with the electron, then the electron can then be moved to another place and entangled with other qubit nuclei further afield, opening the way to making large arrays of qubits capable of robust and useful computations."

Professor David Jamieson, research leader at The University of Melbourne, added, "The phosphorous atoms were introduced in the silicon chip using ion implantation, the same method used in all existing silicon computer chips. This ensures that our quantum breakthrough is compatible with the broader semiconductor industry."

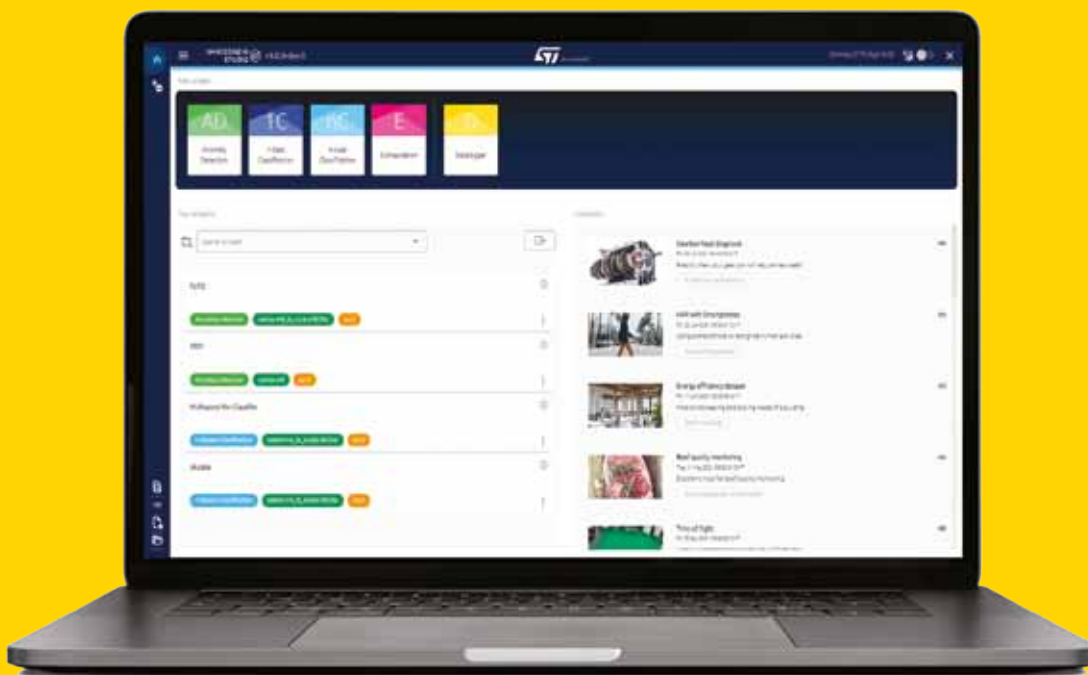
Having now achieved error rates below 1%, Prof Morello said researchers can start designing silicon quantum processors that scale up and operate reliably for useful calculations.

"When the errors are so rare, it becomes possible to detect them and correct them when they occur," he said. "This shows that it is possible to build quantum computers that have enough scale, and enough power, to handle meaningful computation."

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INCREASING PEROVSKITE SOLAR CELL EFFICIENCY

Researchers at The Australian National University (ANU) say they have broken their own record to create a more efficient solar cell, with the results of their breakthrough published in the journal *Nature*.

The team's study focused on 1 cm^2 solar cells made with perovskites — a family of materials with a specific crystal structure. Perovskite solar cells have the potential to be made more cheaply and simply than other solar cells, as well as to produce more power in a given area; but conversion efficiencies are limited by a fill factor — one measure of the quality of the solar cell — of less than 83%.

"This limitation results from non-ideal charge transport between the perovskite absorber and the cell's electrodes," the study authors wrote. "Reducing the electrical series resistance of charge transport layers is therefore crucial for improving efficiency."

To solve this problem, the researchers used standard fabrication techniques but applied them to a new material — titanium oxynitride — to create perovskite solar cells in a unique way. As published in the study, they introduced "a reverse-doping process to fabricate nitrogen-doped titanium oxide electron transport layers with outstanding charge transport performance".

By incorporating this charge transport material into perovskite solar cells, the team demonstrated 1 cm^2 cells with fill factors of $>86\%$, and an average fill factor of 85.3% . They also achieved a certified steady-state efficiency of 22.6% for a 1 cm^2 cell, meaning the cells can convert 22.6% of sunlight into energy.



The researchers say the solar cells they have produced are cheap and easy to manufacture, in addition to achieving high efficiency, while using an approach that is different to what has been done previously.

"We've also been able to overcome an energy loss in one of the layers that scientists didn't previously realise was there," said Professor Kylie Catchpole, co-author on the study.

"The modelling we've done shows this was a limitation in previous types of solar cells."



MICRO-SUPERCAPACITORS MADE FROM FALLEN LEAVES

South Korean researchers have developed a graphene-inorganic hybrid micro-supercapacitor made of leaves, using femtosecond direct laser writing lithography. Described in the journal *Advanced Functional Materials*, their work has potential applications in areas such as wearable electronics, smart houses and the Internet of Things.

Of the various energy storage devices, micro-supercapacitors have drawn a great deal of interest for their high electrical power density, long lifetimes and short charging times. However, there has been an increase in waste battery generation due to increase in the consumption and use of electronic equipment as well as the short replacement period that follows advancements in mobile devices. The safety and environmental issues involved in the collection, recycling, and processing of such waste batteries are creating a number of challenges.

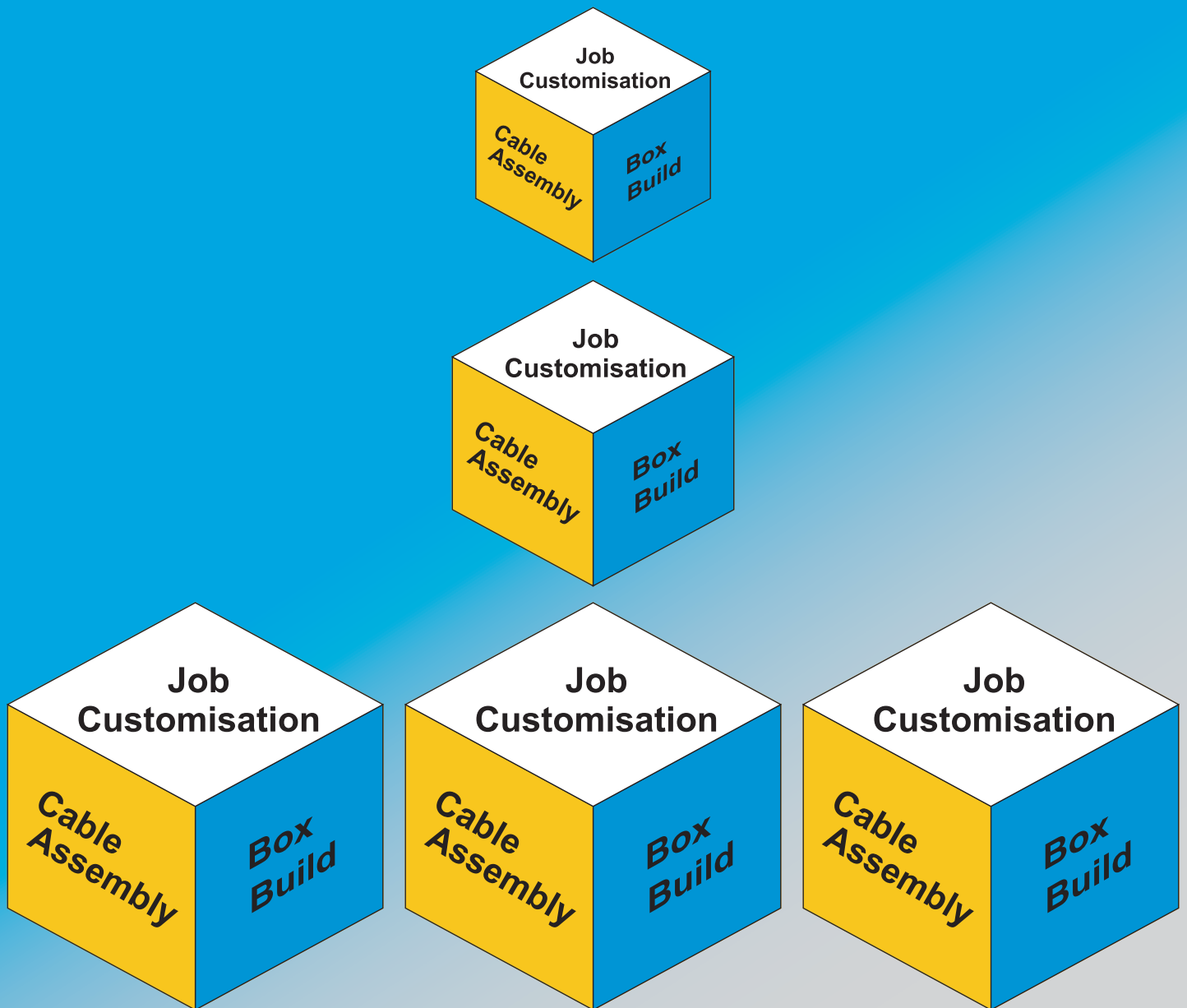
Forests cover about 30% of the Earth's surface, producing a huge amount of fallen leaves. This naturally occurring biomass comes in large quantities and is both biodegradable and reusable, which makes it an attractive, eco-friendly material. However, if the leaves are left neglected instead of being used efficiently, they can contribute to fires or water pollution.

To solve both problems at once, a research team led by Professor Young-Jin Kim from the Korea Advanced Institute of Science and Technology (KAIST) and Dr Hana Yoon from the Korea Institute of Energy Research developed a one-step technology that can create porous 3D graphene micro-electrodes with high electrical conductivity, without additional treatment in atmospheric conditions, by irradiating femtosecond laser pulses on the surface of the leaves without additional materials. Taking this strategy further, the team also suggested a method for producing flexible micro-supercapacitors.

They showed that this technique could quickly and easily produce porous graphene-inorganic hybrid electrodes at a low price, and validated their performance by using the graphene micro-supercapacitors to power an LED and an electronic watch that could function as a thermometer, hygrometer and timer. These results open up the possibility of the mass production of flexible and green graphene-based electronic devices.

"Leaves create forest biomass that comes in unmanageable quantities, so using them for next-generation energy storage devices makes it possible for us to reuse waste resources, thereby establishing a virtuous cycle," Prof Young-Jin Kim said.

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ARTIFICIAL RETINA ENABLES BETTER COMPUTER VISION

Researchers at the King Abdullah University of Science and Technology (KAUST) have fabricated an array of photoreceptors that detect the intensity of visible light via a change in electrical capacitance, mimicking the behaviour of the eye's rod retina cells. When the array was connected to an electronic CMOS-sensing circuit and a spiking neural network (a single-layer network with 100 output neurons) it was able to recognise handwritten numbers with an accuracy of around 70%.

"The ultimate goal of our research in this area is to develop efficient neuromorphic vision sensors to build efficient cameras for computer vision applications," said researcher Khaled Nabil Salama. "Existing systems use photodetectors that require power for their operation and thus consume a lot of energy, even on standby. In contrast, our proposed photoreceptors are capacitive devices that don't consume static power for their operation."

The photoreceptor array is made by sandwiching a material with suitable optical and dielectric properties between a bottom aluminium electrode and a patterned top electrode of indium tin oxide to form a pixelated array of miniature light-sensitive metal-insulator-metal capacitors. The array is made on a thin substrate of polyimide so that it is flexible and can be curved as desired, including a hemispherical shape mimicking the human eye.

In selecting materials for their photoreceptor, the researchers used a hybrid material of perovskite (methylammonium lead bromide, or MAPbBr₃) nanocrystals embedded in terpolymer polyvinylidene fluoride trifluoroethylene-chlorofluoroethylene (PVDF-TrFE-CEF). MAPbBr₃ is a strong absorber of visible light, while PVDF-TrFE-CEF has a high dielectric constant.



"We chose hybrid perovskites because of their exceptional photoelectronic properties, such as excellent light absorption, long carrier lifetime and high carrier mobility," said PhD student Mani Teja Vijjapu.

Tests with a 4x4 array and LED illumination of different visible colours indicate that the optical response of the array mimics the response of the human eye with a maximum sensitivity to green light. The photoreceptors were also found to be highly stable, with no change in response even after being stored for 129 weeks in ambient conditions. The results were published in the journal *Light: Science & Applications*.

Future plans for the team include building larger arrays of photoreceptors, optimising the interface circuit design and employing a multilayered neural network to improve the accuracy of the recognition functionality.



Image credit: Kai Jacobson/UBC

STRETCHABLE, WASHABLE BATTERIES DESIGNED FOR WEARABLES

Researchers from The University of British Columbia (UBC) have created a battery that is both flexible and washable, meaning it works even when twisted or stretched to twice its normal length, or after being tossed in the laundry. The battery is described in the journal *Advanced Energy Materials*.

"Wearable electronics are a big market and stretchable batteries are essential to their development," said Dr Ngoc Tan Nguyen, a postdoctoral fellow at UBC. "However, up until now, stretchable batteries have not been washable. This is a critical addition if they are to withstand the demands of everyday use."

The battery developed by Dr Nguyen and colleagues offers a number of engineering advances. In normal batteries, the internal layers are hard materials encased in a rigid exterior. The UBC team made the key compounds — in this case, zinc and manganese dioxide — stretchable by grinding them into small pieces and then embedding them in a rubbery plastic, or polymer. The battery comprises several ultrathin layers of these polymers wrapped inside a casing of the same polymer. This construction creates an airtight, waterproof seal that ensures the integrity of the battery through repeated use.

PhD student Bahar Iranpour suggested throwing the battery in the laundry to test its seal; so far, the battery has withstood 39 wash cycles and the team expects to further improve its durability as they continue to develop the technology. The choice of zinc and manganese dioxide chemistry also confers another important advantage, with Dr Nguyen explaining, "We went with zinc-manganese because for devices worn next to the skin it's a safer chemistry than lithium-ion batteries, which can produce toxic compounds when they break."

Work is underway to increase the battery's power output and cycle life, but already the innovation has attracted commercial interest. The researchers believe that when the new battery is ready for consumers, it could cost the same as an ordinary rechargeable battery.

"The materials used are incredibly low cost, so if this is made in large numbers, it will be cheap," said Dr John Madden, who supervised the work. In addition to watches and patches for measuring vital signs, the battery might also be integrated with clothing that can actively change colour or temperature.

"Wearable devices need power," Dr Madden said. "By creating a cell that is soft, stretchable and washable, we are making wearable power comfortable and convenient."

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ROAD SENSOR DESIGNED TO MONITOR E-SCOOTERS, E-BIKES

The traffic and variety of personal mobility vehicles (PMVs) such as e-scooters and e-bikes has grown significantly in recent years, yet there are still no systems that allow us to monitor and control their use accurately and efficiently. Now, researchers from the Universitat Politècnica de València's Institute of Information and Communication Technologies (ITACA) have developed what they claim to be the first road sensor that is tailored for PMVs.

"While conventional vehicles are carefully monitored through the various sensors that are widely installed in cities, scooters, bikes and other personal mobility vehicles lack accurate and efficient tools to perform this monitoring," said Antonio Mocholí, Director of the ITACA's Traffic Control Systems team.

"This situation has negative repercussions at several levels, most importantly with regard to safety, as current technologies are not able to monitor ... the traffic flows of PMVs and interactions with other users, or to detect potential hazards for each of them. The system that we have designed and approved allows us to obtain highly valuable information using an extremely cheap and reliable circuit."

The new sensor uses magnetic loops and is capable of recording and categorising the use of PMVs. It is claimed to be an improvement on the current magnetic loop sensors used for motorised vehicles and provides highly useful tools for remotely analysing PMV traffic. One benefit is that it instantly obtains information about speed and direction of travel, making it possible to calculate traffic density in a given area, and even the types of scooters (based on their power) and the model of vehicle.



"The sensor is able to detect the magnetic footprint of each model of electric scooter and this allows us to identify its category and brand," said researcher Carlos Moyano Gómez. "Monitoring these parameters helps to improve compliance with municipal regulations and implement proper mobility planning, including the management of traffic lights, infrastructures and routes when roadworks and maintenance are being carried out, etc."

Now patented by the UPV, the sensor has been approved for urban settings and can be installed on streets and roads with PMV traffic, either for reserved or shared lanes and one- or two-way traffic. Implementing the sensor should help to monitor new modes of mobility and, in particular, road safety, both for pedestrians and the other vehicles that travel around the city every day.



NEUROMORPHIC 'MEMTRANSISTOR' RESEMBLES A HUMAN BRAIN

In this Internet of Things (IoT) era, massive amounts of data are produced, collected and transmitted through devices in real time — but the separation of memory and data processing units adversely affects the smooth functioning of optoelectronic devices. South Korean scientists have now designed a predictable optoelectronic device — a multifunctioning 'memtransistor' — to address these limitations.

The current computing systems which have separate memory and processing devices cause excess energy consumption and slow down data transmission. Even state-of-the-art 2D memtransistors — devices that can collect, store and process information — exhibit suboptimal electronic properties, such as unusually high operating voltages.

To overcome these limitations, scientists at Dongguk University designed a predictable multifunctioning memtransistor. As described in the journal *Small Methods*, they fabricated a highly efficient optoelectronic and memory device using two-dimensional (2D) materials — nanomaterials that are merely one or two atoms thick — by stacking 2D tellurium flakes on a thin rhenium disulfide flake, followed by the deposition of an aluminium oxide layer.

As explained by senior author Professor Hyunsik Im, the team developed an "electrically and optically tuneable p-n junction memtransistor fabricated with an Al_2O_3 encapsulated 2D Te/ReS₂ van der Waals (vdW) heterostructure. This combines the favourable optical and electrical properties of p-type 2D Te and n-type ReS₂ semiconductors with a stable Al_2O_3 charge trapping layer."

In this optoelectronic memory device, multiple resistance states can be tuned by applying different voltages, or light powers. The transition between the high or low resistance states is controlled by carriers trapped in the Al_2O_3 layer under high electric fields. This causes an additional gate bias that tunes the Schottky barrier height at the ReS₂/source electrode interface, while preserving p-n junction behaviours during the switching process, giving the device the added benefit of being electrically conductive, while being able to store memory efficiently.

Remarkably, the novel device is material-independent and scalable. Moreover, it allows the integration of additional electronic circuits for neuromorphic computing — a set of processes that attempt to mimic the brain's architecture and data processing capabilities.

"The development of these highly efficient memtransistor-based synaptic devices can decrease circuit complexity and minimise power consumption for neuromorphic computing and visual information processing," Prof Im said. "Mimicking synaptic activities in the human brain could become a much more manageable task in the near future."

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IMPROVING DEFECT DETECTION IN TRANSISTORS

Researchers at the US National Institute of Standards and Technology (NIST) have revived and improved a once-reliable technique known as charging pumping to identify and count defects in transistors — the building blocks of modern electronic devices such as smartphones and computers.

The new and improved method is sensitive enough for the most modern, minuscule technology, and is said to provide an accurate assessment of defects that could otherwise impair the performance of transistors and limit the reliability of the chips in which they reside. It has been described in the journal *Applied Physics Letters*.

Transistors act as electrical switches. In the on position, which represents the '1' of binary digital information, a designated amount of current flows from one side of a semiconductor to the other. In the off position, representing the '0' of binary logic, current ceases to flow.

Defects in a transistor can interfere with the reliable flow of current and significantly degrade the performance of transistors. These defects could be broken chemical bonds in the transistor

material or they could be atomic impurities that trap electrons in the material. Scientists have devised several ways to categorise defects and minimise their impact, tailored to the structure of the transistor under study.

In the traditional design known as the metal oxide semiconductor field effect transistor (MOSFET), a metal electrode called the gate sits atop a thin insulating layer of silicon dioxide. Below the insulating layer lies the interface region that separates the insulating layer and the main body of the semiconductor. In a typical transistor, current travels through a narrow channel, only one billionth of a metre thick, that extends from the source, which lies on one side of the gate, to a 'drain' on the other side; the gate controls the amount of current in the channel. In charge pumping,

the examiner alternately pulses the gate with a positive test voltage, then a negative one. (The transistor does not act as an on/off switch during this testing mode.) In traditional charge pumping, the alternating voltage pulses are applied at a single, set frequency.

In the first step of the test, the positive voltage attracts or pumps electrons, which are negatively charged, to the boundary or interface between the gate's insulating layer and the body of the transistor. Some of the pumped electrons become trapped in defects at the interface, but there are many electrons left over. In the second step, a negative voltage is applied to rid the interface of the excess electrons, leaving only the trapped ones behind. The negative voltage also attracts positive charge carriers, known as 'holes', to the region, where they combine with electrons trapped in the defects. This activity generates a current proportional to the number of defects: the greater the output current, the larger the number of defects.

But while the current used to be a reliable measure of defects, the insulating oxide layer in modern transistors is now too thin — just 10 to 20 hydrogen atoms wide — for the technique to be accurate. This is because, according to quantum theory, electrons and other subatomic particles can never be truly trapped; there's always some probability they will escape or 'tunnel' out of an enclosure or boundary layer. The thinner the material, the higher the probability that electrons will escape, creating a tunnelling current. As transistor dimensions have shrunk, the tunnelling current leaking through the insulating oxide layer made it nearly impossible to detect defects with ordinary charge pumping, leading scientists to all but abandon the technique.

NIST researchers James Ashton, Mark Anders and Jason Ryan have now found a way to salvage the technique so that it not only works for ultrathin transistor components but is also more sensitive, enabling scientists to record signals from a single defect. The solution arose when the scientists came to a key realisation: the current that results from quantum tunnelling remains virtually the same, regardless of the frequency at which charge pumping pulses the positive and negative voltages.

Armed with that knowledge, the team revised the charge pumping technique by alternately applying the method's positive and negative voltages at two different frequencies rather than the single frequency used in the traditional method. Applying the voltages at two different frequencies gave the researchers two different output currents. By subtracting one output current from the other, the constant signal from the quantum tunnelling current dropped out. With the confounding tunnelling current eliminated, the researchers were able to detect single defects as small as the diameter of a hydrogen atom (one-tenth of a billionth of a metre) and indicate where they're located in the transistor.

"We've given charge pumping a new lease on life," Ashton said.

"The modulated-frequency technique is now useful for looking at single interface defects, which gives engineers control of single electron charges in a very sensitive measurement scheme."

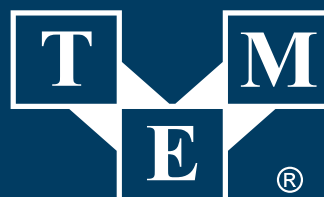
Since only one electron is involved, the output current is equal to multiples of the electron's charge — a fundamental physics constant calculated by NIST and other institutions. And because the method can detect single electrons, it could be used to detect and manipulate a property in each electron known as quantum spin.

Modulated-frequency charge pumping may provide a valuable guide to scientists who are now exploring how electron spin might store and transfer information in a computer of the future. It may also prove useful in quantum metrology, as a potential new way of determining a quantum standard of electrical current.

FIBOX

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Electronic Components



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STEPPER MOTOR

The AM3248 stepper motor from FAULHABER provides high speed and torque performance at 32 mm diameter. Offering up to 10,000 rpm (five times the speed of comparable steppers, the company claims) and a torque of 5 Nm when combined with 100:1 gearhead, the motor is suitable for a wide range of applications where high dynamics and speed are required.

The multi-pole, two-phase stepper motor performs 48 steps per revolution and high holding torque of 85 mNm. The motor starts with a high speed from the first step; due to its low inertia, it can be used in applications that require fast acceleration and fast changes of direction. Large ball bearings extend the already long service life and can also be combined with an encoder and FAULHABER's wide range of options.

The motor is suitable for demanding applications in areas such as aerospace, laboratory automation, large optical systems, the semiconductor industry, robotics and 3D printing. One specific application example is the aligning of solar panels in satellites, where motors must move the booms so that the panels are always directly facing the sun; work precisely over many years; and be able to withstand the extreme temperatures in outer space. Another example is in the semiconductor industry, where high dynamics and speed are required when positioning the wafers in confined installation conditions in the machines.

ERNTEC Pty Ltd
www.erntec.net

COMPUTER-ON-MODULES

Congatec introduces the 12th Generation Intel Core mobile and desktop processors (formerly code named Alder Lake) on 10 COM-HPC and COM Express computer-on-modules. Featuring the latest high-performance cores from Intel, the modules in COM-HPC Size A and C as well as COM Express Type 6 form factors are designed to offer performance gains and improvements for the world of embedded and edge computing systems. Particularly impressive is the fact that engineers can now leverage Intel's innovative performance hybrid architecture.

Offering up to 14 cores/20 threads on BGA and 16 cores/24 threads on desktop variants (LGA mounted), 12th Gen Intel Core processors are said to offer a leap in multitasking and scalability levels. Next-gen IoT and edge applications benefit from up to six or eight (BGA/LGA) optimised Performance-cores (P-cores) plus up to eight low-power Efficient-cores (E-cores) and DDR5 memory support to accelerate multithreaded applications and execute background tasks efficiently.

Optimised for high embedded client performance, the graphics of the LGA processor-based modules deliver now up to 94% faster performance and its image classification inference performance has nearly tripled with up to 181% higher throughput, the company says. In addition, the modules offer large bandwidth to connect discrete GPUs for maximum graphics and GPGPU based AI performance. Compared to the BGA versions, these and all other peripherals benefit from doubled lane speed as they come with ultrafast PCIe 5.0 interface technology in addition to PCIe 4.0 off the processor. The desktop chipsets provide up to 8x PCIe 3.0 lanes for additional connectivity and the mobile BGA variants also offer up to 16x PCIe 4.0 lanes off the CPU and up to eight PCIe 3.0 lanes off the chipset.

Congatec Australia Pty Ltd
www.congatec.com



TEST PROBE SERIES

Ingun has released a series of test probes called the Ingun E-Type Fusion. The series has been designed to overcome challenging contacting applications due to lead-free solder and contamination associated with OSP coatings.

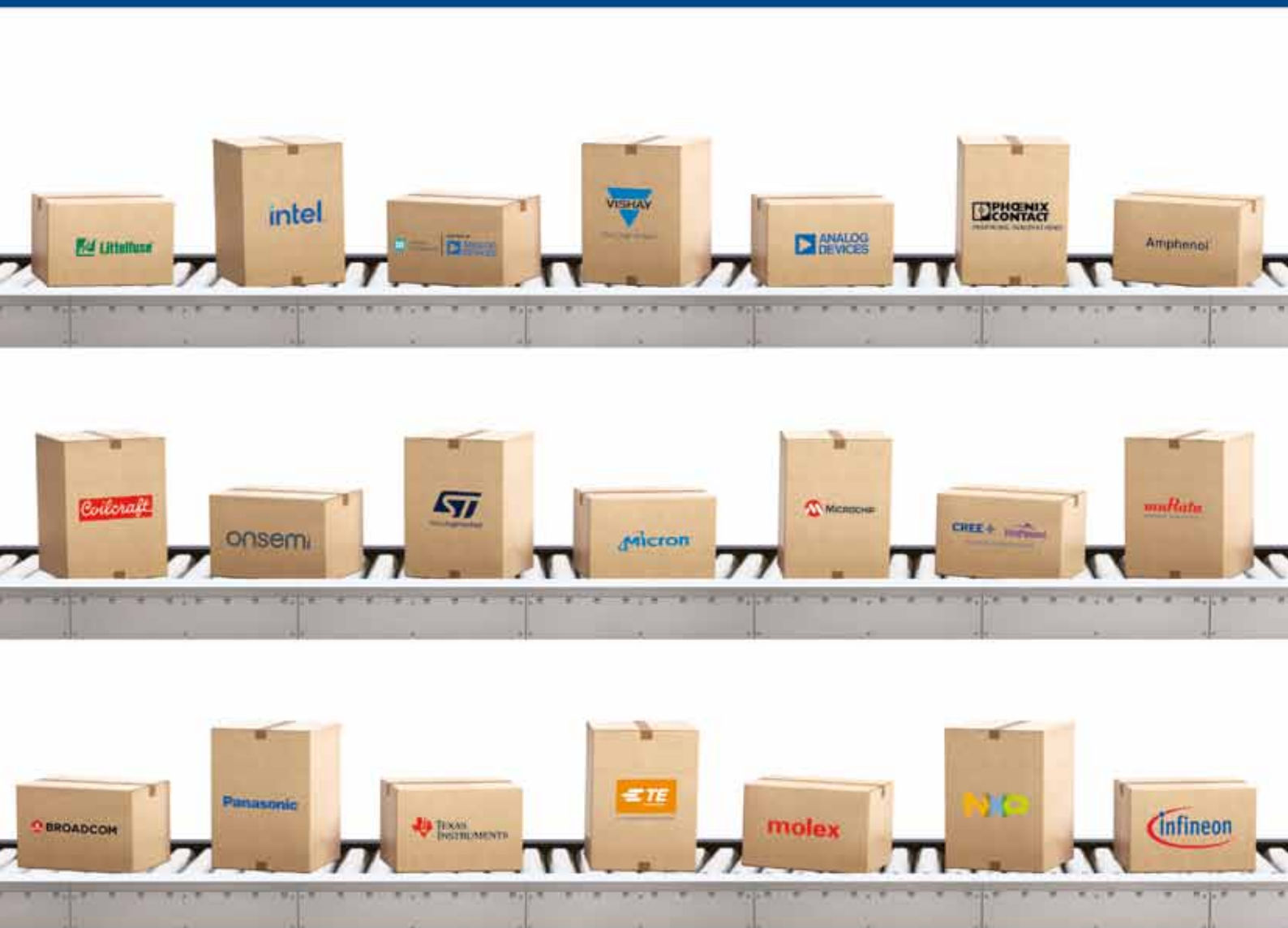
The Ingun E-Type Fusion series has seen the development of new tip styles and specialised nickel palladium plating which, coupled with a high pre-load spring force, result in high performance.

The Fusion series is designed to increase the user's first pass yield, increase efficiency of test and offer a long lifespan due to the hard-wearing nickel-palladium plating.

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END MILLS

Jabil Cutting Tools has released the long-lasting DK20004JS end mill for mould steel. The product is a suitable cutting solution for finishing and fine machining mould steel HRC 50±2 material used in industrial manufacturing operations. The cutter has a flute diameter of 2 mm, a shank diameter of 4 mm and a total length of 45 mm. The company's in-house coating capability extends the cutter's lifespan and performance.

The DK01001ZO CBN ball end mill is a solution for high-quality surface machining of mould steel HRC 50-68. The tool has a flute diameter of 1 mm, a shank diameter of 4 mm and total length of 50 mm.

The company's products serve key markets including automotive, smart home, defence and aerospace, energy, industrial and building, health care, packaged goods, networking, photonics, transportation and more.

element14

au.element14.com



DATA LOGGER

The SLX Datalogger from SolderStar not only benefits from 12 measurements, it is also now autoconfigurable. The updated device can also be used with the original shuttle units for convection, vapour phase, wave and selective ovens.

Whether it's used in convection, vapour phase, wave or selective technology, the data logger includes smart adapters to allow profiling of soldering machines with zero set-up and configuration. The device also benefits from 12 memories so that it can be utilised to capture more data before this needs downloading. Additional sensors such as vibration can also be used, as well as the existing thermocouples and contact sensors.

In addition to hardware updates, the updated software features integrated tools for automatic profile set-up and checking, and a Statistical Process Control tool to leverage profile data for trend analysis and prediction of process problems before they happen.

Hawker Richardson

www.hawkerrichardson.com.au

NON-HYBRID, SPACE-GRADE POWER CONVERTERS

Microchip Technology's SA50-28 family is an off-the-shelf, 28 V-input, radiation-tolerant power converter offering that is based on discrete components with surface-mount construction and non-hybrid assembly processes. Designed to deliver more capabilities than alternative off-the-shelf, space-grade power converters, a single SA50-28 device with customised parameters eliminates the volume, weight and complexity problems of using hybrid solutions with their multiple devices and surrounding circuitry.

The comprehensive product line is a 20 to 40 V-input, 50 W family with nine standard outputs of 3.3, 5, 12, 15 and 28 V in single- and triple-output configurations. The devices can be tailored to a system's exacting power needs in a relatively short time with minimal additional costs as compared to hybrid-style power converter products, the company says. Other features include high efficiency, low output noise, output inhibit control, overcurrent protection, external synchronisation and full-rated power operation through -55 to +85°C with linear derating to +125°C.

The SA50-28 family is part of Microchip's growing line of standard non-hybrid, space-grade power converters that enable designers to use commercially available, off-the-shelf components whose circuitry has a proven spaceflight heritage. The products join the radiation-hardened SA50-120 power converter family, introduced in February 2021, designed to reduce risk and development time for qualified space systems by allowing designers to start with commercially available off-the-shelf technology in ceramic or plastic packages and quickly scale up development using lower screening levels than traditional qualified manufacturing list (QML) requirements.

Microchip Technology Australia

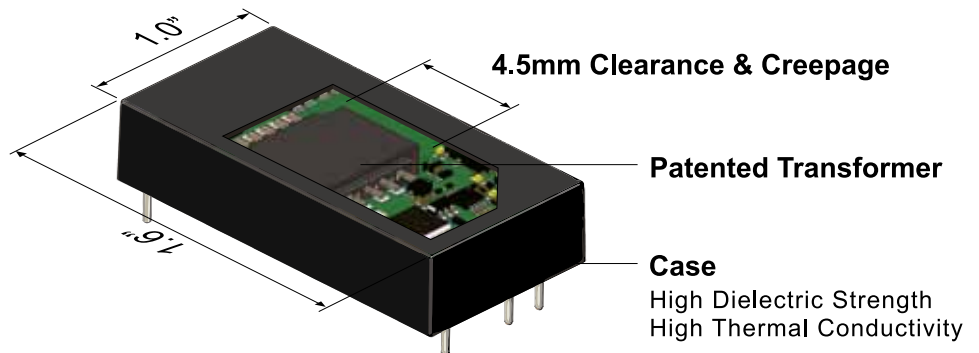
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ELECTRONEX TO RECONNECT THE ELECTRONICS INDUSTRY

Following severe disruptions to exhibitions due to COVID-19, with many events cancelled or postponed, Electronex charges back to life on 5–6 April at Rosehill Gardens in Sydney.

Electronex – The Electronics Design and Assembly Expo and Conference will feature over 90 companies and exhibitors who are looking forward to meeting with industry decision-makers and electronics enthusiasts. Show organiser Noel Gray said, “With restrictions lifted, borders again open and business returning to normal in Australia, there is pent-up demand from visitors to return to face-to-face discussions with companies to explore the latest products and technology and discuss their manufacturing requirements. The increased focus on high-tech manufacturing in Australia is expected to boost attendance, and Electronex brings together Australia’s leading suppliers to showcase the latest technology and solutions.”

In addition to featuring a wide range of electronic components, surface mount and inspection equipment, test and measurement products and other ancillary products and services, companies can also discuss their specific requirements with contract manufacturers that can design and produce turnkey solutions for specific applications. Electronex is pitched as a must-see event for designers, engineers, managers and other decision-makers who are involved in designing or manufacturing products that utilise electronics. A large number of companies will also be launching and demonstrating new products and technology at the event. A series of free seminars with overviews of some of the latest technology and insights into future developments will be also held on the show floor and the sessions and times are available on the show website.

Visitors to the expo can register for free at www.electronex.com.au and their badge will be emailed to them to avoid crowding and queuing at the entrance. Hours are 10 am–6 pm on Tuesday, 5 April and 9 am–4 pm on Wednesday, 6 April. Free parking is also provided at Rosehill Gardens with entry off James Ruse Drive.

SMCBA Conference

Since 1988, the Surface Mount & Circuit Board Association (SMCBA) has conducted Australia’s only conference dedicated to electronics design and manufacture. The 2022 conference is again being held in conjunction with Electronex and workshops and presentations will be held concurrently with the expo.

Susy Webb, Snr PCB Designer at Design Science PCB, USA, is conducting two half-day workshops. ‘Designing the Signal Return Path’ will address how, when designing a PC board, the signal

routing and its return are critical to the circuit working properly. The presentation will talk about the importance of designing the return path, with a discussion of the physics involved, where the energy flows, the interference caused when it is not controlled, and the planes and stack-up needed.

‘HDI Routing Solutions’ will meanwhile go into the different possible stack-up types and discuss ways to get signals and powers from layer to layer in the board. Then it will move on into possible patterns and grids to maximise fanout and routing opportunities, all the while keeping routing return, power distribution and layer paired routing in mind. Lastly, it will talk about the benefits to other parts on the board that HDI can provide, and the manufacturing needs of these types of boards.

Keith Sweatman, Senior Technical Advisor at Nihon Superior, Japan, will present ‘Low-Temperature Soldering — A new challenge in electronics assembly’. Just as the electronics industry is getting settled into the use of the current generation of lead-free solders, new issues are forcing consideration of a change to lead-free solders that can be used at process temperatures even lower than those that were used with tin-lead solder. This presentation will review the emerging low-temperature soldering technology and identify the challenges to be addressed.

Bob Willis operates a training and process consultancy business based in UK and has created one of the largest collections of interactive training material in the industry. In ‘Printed Circuit Board Inspection & Field Failures — Causes and Cures’, Willis will highlight test methods you can try and tricks of the trade to understand how PCBs can fail and how to eliminate many of the common causes.

Matt Wild, General Manager at Future Electronics Australia and New Zealand, is presenting ‘Supply Chain Challenges and Strategies’, a discussion about the current issues and their causes with their resulting change in supply trends and costs, with a focus on recommended practices to mitigate impact and what is being done to ensure future supply.

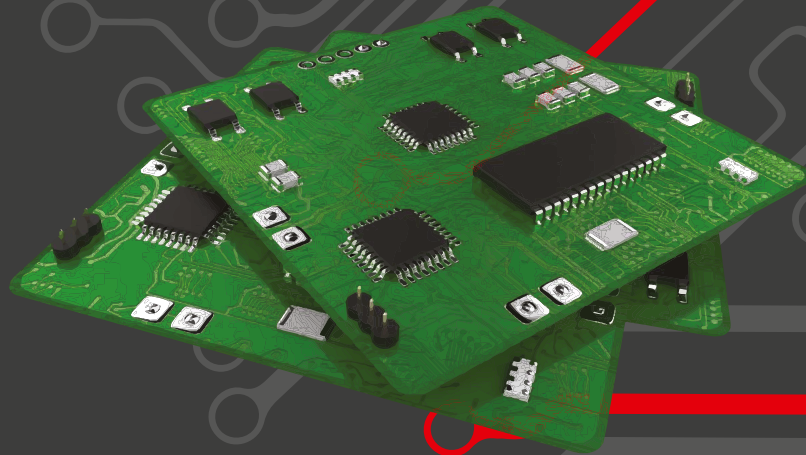
Delegates can see the full program and book for sessions at www.smcba.asn.au.

Australasian Exhibitions and Events Pty Ltd
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- IPC-A-610 Class 3
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BLUETOOTH HEADS IN A NEW DIRECTION

Steven Keeping*

Bluetooth wireless's constant evolution is impressive; originally designed as a method to transfer information between handsets without cables, the technology — particularly since the 2010 launch of the Low Energy (LE) version as a 'hallmark element' of Bluetooth 4.0 — has expanded dramatically.

Bluetooth LE extended the technology's reach to devices with modest battery resources and, at a stroke, opened up wireless connectivity to thousands of previously 'dumb' products.

In the early years, the growth of Bluetooth LE was primarily driven by the market for 'appcessories' — wireless products such as wearables, toys, bike lights and coffee machines — that could be controlled directly from a smartphone. Fortuitously, the key attributes of the technology also ideally suited the demands of the wireless sensors that form the foundation of the Internet of Things (IoT). More recently, the introduction of Bluetooth 5 — which added enhanced throughput, increased range and improved coexistence — cemented Bluetooth technology's position as a major technology driving the 'smart' future.

Bluetooth 4.0 and 5 were launched with the degree of hype that marketing folk do so well, and to be fair, those revisions to the standard did bring significant techni-

cal enhancements. In contrast, the latest upgrade, Bluetooth 5.1, received a little less marketing pizzazz yet promises a solution to a problem that no other wireless technology has addressed.

Where am I?

Global navigation satellite services such as Galileo, global positioning systems (GPS) and global navigation satellite systems (GLONASS) form the backbone of many guidance and tracking applications. But without 'line of sight' to the satellites, the systems fail. Engineers have implemented alternative solutions such as determining a location based on the known position of a Wi-Fi router, but such solutions are limited to an accuracy of around 10 m.

For its part, Bluetooth has employed a received signal strength indicator (RSSI) methodology for estimating the position of a Bluetooth transceiver (embedded, for example, in a consumer's smartphone). As the name suggests, the technique works

by estimating the distance from the transceiver to a known fixed point (for example, a beacon) based on the Bluetooth signal strength. Such a system is generally unable to determine the exact location of the target transceiver being limited to an estimate of position on the circumference of a circle of known radius around the beacon (for a Bluetooth transceiver restricted to a horizontal plane such as a floor). Precision is further undermined by the (typically unknown) attenuation of signal strength by walls and other obstacles.

Both Wi-Fi and Bluetooth technology's proximity systems have found favour in retail applications whereby consumers can be fed contextual information based on their approximate location, but the lack of precision of each means neither is up to the task of indoor navigation or asset tracking.

Working the angles

According to John Leonard, a Senior Product Marketing Manager with Bluetooth chip



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promise an angular accuracy of $\pm 2^\circ$ and around half-a-metre positional precision.

Design dilemmas

Bluetooth 5.1 Direction Finding is an elegant theoretical approach to position confirmation, and several manufacturers already offer commercial solutions. But developing a practical application is far from easy. Many Bluetooth developers will be familiar with a transceiver's lone antenna but not with antenna arrays. And even with a decent array, factors such as polarisation, multipath interference, clock jitter and propagation delays make it very difficult to extract the pure phase information from the noise.

Because calculating the angle of a radio signal has historical applications across medical, security and military applications, there are some proven algorithms that designers can use as the basis for Bluetooth Direction Finding. However, they do require a lot of fine-tuning to suit the likely scenarios in which the target application is likely to be employed. And the algorithms demand the services of Bluetooth systems-on-chip (SoCs) with powerful processors and lots of Flash and RAM.

Adding Bluetooth 5.1 Direction Finding to the wireless technology offers the potential for many new applications, including indoor navigation, asset tracking and a new generation of more sophisticated beacons. The Bluetooth Special Interest Group (SIG) — custodian of all things Bluetooth — forecast some 400 million Bluetooth 'location services' products per annum by 2022. But getting there won't be easy. Curious engineers are advised to turn to their trusted distributor for guidance and advice before embarking on their first project.

**Steven Keeping gained a BEng (Hons) degree at Brighton University, UK, before working in the electronics divisions of Eurotherm and BOC for seven years. He then joined Electronic Production magazine and subsequently spent 13 years in senior editorial and publishing roles on electronics manufacturing, test and design titles across the UK and Australia. In 2006, Steven became a freelance journalist specialising in electronics. He is based in Sydney.*

Mouser Electronics
au.mouser.com

vendor Nordic Semiconductor, Bluetooth 5.1 introduces 'Direction Finding' technology that significantly improves the protocol's usefulness for indoor navigation and asset tracking. Leonard explains that the revision brings "precise positioning of things in three-dimensional space [that will have] a similar impact for indoor situations as GPS did for outdoor positioning".

The key to the enhancement brought by Bluetooth 5.1 Direction Finding results from combining RSSI with the apparent direction a signal is coming from. In this way, instead of just placing the transceiver somewhere on the circumference of a circle, its position in space is determined to an accuracy of about 1 m. The details of the new technology are complex and require a longer article to describe, but in essence, there are two methods for determining direction:

- Angle of arrival (AoA) of the received signal
- Angle of departure (AoD) of the transmitted signal

More specifically, AoA is determined by measuring the phase difference between signals from a specific source arriving at multiple antennas. If the antennas are perpendicular to the transmitter, there will be virtually zero phase difference; as the angle increases, the distance from transmitter to each antenna will subtly change, increasing the phase difference. The phase difference data can then be crunched by an algorithm to estimate the angle between transmitter and receiver. AoA enables the receiving device to estimate the location of the transmitter.

When employing the alternative AoD technique, the receiver uses only one antenna, and the transmitter is fitted with multiple antennas which sequentially transmit. AoD enables the receiving device to calculate its own position in space using angles derived from multiple fixed receivers.

Direction Finding operates in either two or three dimensions depending on the complexity of the antenna array. And with a well-designed antenna array and software, AoA and AoD

VEHICLE PC SURVEILLANCE SYSTEM

iEi's IVS-200-ULT2 vehicle computer surveillance system is powered by the Intel Core i5-5350U (dual-core, 1.8 GHz, 15 W TDP) or Intel Celeron 3765U (dual-core, 1.9 GHz, 15 W TDP).

The product is a fanless system with a 2.5" removable SATA HDD bay and 4 GB memory pre-installed; thus, it is effective and well-equipped to handle challenges. It can also endure tough environmental conditions, with an operating temperature of -20 to +60°C with airflow.

In terms of I/O interface, the IVS-100-ULT2 supports 2 x USB3.0, 2 x USB2.0, 4 x RJ-45 GbE Lan, 2 x DB-9 RS-232/422/485, 3 x DB-9 RS-232 (optional), 1 x VGA, 1 x HDMI, 8-bit digital I/O (4-bit input, 4-bit output) (optional), 1 x SIM slot, 1 x Line out and 1 x Mic in. In regards to expansion slots it supports 1 x full size (co-lay mSATA) and 1 x half size.

Other features include four Intel GbE LAN ports, 9-36 VDC input and e-mark certification. The product is suited to a wide range of in-vehicle applications in the market, including emergency vehicles, taxis, buses, heavy-duty trucks and mining vehicles.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



RUGGED GPU SERVER

Equipped with up to four long-life GPUs, Crystal Group's FG2 2U GPU server brings extreme, scalable compute power for demanding high-density graphics, virtual displays, situational awareness and artificial intelligence into the field.

Designed specifically to handle challenging yet critical inference obstacles, the platform is said to provide ultralow latency and seamless operation, even in the most volatile, mission-critical conditions. The server's rugged design and durability delivers high tensor core performance allowing users to capture, analyse and prioritise massive amounts of data at the tactical edge, without compromising on speed or security.

The integrated system combines two 3rd Gen Intel Xeon Scalable processors and advanced GPUs in a compact rugged server that tackles workloads at 260 TFLOPS mixed precision using more than 10K CUDA cores and 1280 tensor cores. A dedicated air plenum prevents thermal throttling from the heavy GPU workload. At just under 12.7 kg, the configuration of the system is validated for optimal performance, manageability, security and scalability.

The platform can be configured for temporary or permanent data storage applications — including those requiring FIPS 140-2 certification — with up to six NVMe drives. InfiniBand I/O connectivity provides state-of-the-art, rapid data transfer for backhaul applications.

Suitable for the ever-changing landscape of battlespace management, command and control, intelligence gathering and dissemination, and sensor fusion across complex networks for pinpoint situational awareness, the 2U GPU server takes compute-intensive workloads out of the data centre and into the field for seamless operation in time-sensitive, unpredictable situations.

Metromatics Pty Ltd

www.metromatics.com.au



ROCKER SWITCHES

The R13-220B-DC series rocker switches, by SCI, are designed for panel mounting. They are suitable for 12 VDC and currents up to 20 A, and so fulfil the role of on/off switches as well as control elements.

The switches are distinguished by various contact configurations and switching methods, including both on/off switches and switches with two or three positions (the middle position leaves both connected circuits open). The status of the switch is indicated by coloured LEDs, designed to improve the readability of the panel and the safety of users.

The switches are compatible with typical 6.35 mm connectors (wires can also be soldered directly to the terminals). Their good electrical performance, ergonomic shape and compact size make them suitable for both industrial and consumer applications.

Transfer Multisort Elektronik

www.tme.eu



ENSURING EMC COMPLIANCE



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Every developer of an electrical or electronic device is faced with the same problem: in the end, the device must comply with international electromagnetic compatibility (EMC) guidelines regarding emissions and immunity. In the age of the substitution of mechanical and mechatronic systems by purely electrical ones, EMC is becoming increasingly important.

The use of electrical energy always involves its transformation into other forms of energy, such as radiant energy (light bulbs), mechanical energy (motors) or heat. Transforming or transporting electrical energy causes electromagnetic fields that do not necessarily remain within the electrical appliances, but may also spread outside the appliance into the air or to the power supply. Fields that are allowed to spread freely may penetrate electrical appliances and affect their performance. These fields are perceived as interference.

EMC interference sources include the following:

- Electromagnetic fields, deliberately generated by transmitters operating in frequencies ranging from a few kHz up to more than 30 GHz (microwaves).
- Lightning strikes.
- Switching events in low-voltage networks cause high-energy surges.
- Switching events in power electronics (switching power supplies) cause high-frequency transients and flicker.
- Nuclear electromagnetic pulse (NEMP) caused by a nuclear explosion.
- Electrostatic discharges (ESD).
- High-frequency signals caused for instance by load changes in microprocessors or when using frequency converters.

According to the law, electrical appliance manufacturers must ensure EMC compliance by putting in place appropriate

protection requirements. If attention is paid too little or too late to the EMC requirements, there is a threat of delays in obtaining marketing authorisation, with all the potential negative consequences for a company. A subsequent re-engineering leads to rising costs; the roadmap leading to series production must be revised and, in the worst-case scenario, supplier loyalty is at stake.

For example...

Industrial touch panels are one example of a product where EMC compliance is essential. Other electrical equipment in the vicinity should not disturb the operation of the product, and the product should also not disturb other equipment.

To obtain an EMC-stable input system, two main sources of interference have to be considered. The first source of interference is the displays which have to be integrated behind the touch panel and the power supplies being clocked. The EMC standard IEC 61000-4-3 refers to these interference sources.

Furthermore, the EMC standard IEC 61000-4-6 defines conducted coupling of interfering voltage peaks and frequencies, to eliminate these interference signals that the HMI system operates with positional accuracy without deviation of the touch function. This in turn does not cause false alarms and is a prerequisite for achieving EMC compliance to Class A.

With optimised AD converters in the evaluation electronics of the PCAP controller, increased signal voltages through charge pumps, special algorithms (frequency-hopping method and hardware/software filters) and interference sources can be suppressed comprehensively. With a sensor design specially adapted to the electronics, an optimum signal-to-noise difference is achieved.

EMC products

Your product should comply with EMC standards and regulations. Prior to the final EMC test at an accredited test lab, it is recommended to investigate the EMC behaviour at the early design phase by performing pre-compliance tests. SCHURTER can assist with this process to help find the optimal EMC solution for each user's specific application.

The company can conduct EMC tests, provide interference suppression for equipment, fabricate specific product samples, and support product life cycle from development all the way to series production. In addition to providing customer-specific products such as filters and inductive components, it offers a wide selection of standard EMC products including power entry modules with line filters, chokes, and one- and three-phase block filters. For more information, visit <http://emc-service.schurter.com>

SCHURTER (S) PTE LTD
www.schurter.com

INSTRUMENT ENCLOSURES

METCASE TECHNOMET instrument enclosures can be specified in custom colours — even in low volumes. Options range from trim and bezel highlights to bespoke colours for the whole enclosure.

The desktop and portable instrument enclosures are suitable for medical and wellness devices, test and measurement equipment, industrial control, peripheral devices and interfaces, switchboxes, communications and laboratory equipment. They are engineered to fine tolerances to offer a modern and cohesive design.

Diecast front and rear bezels fit flush with the case body for a smooth appearance. Snap-on trims hide the fixing screws. All sizes are available with either a tilt/swivel carry handle (that doubles as a desk stand) or ABS side handles. Three sizes offer a sloping front bezel.

TECHNOMET's base panel is pre-fitted with four M3 PCB mounting pillars — and the internal chassis is pre-punched for installing snap-in PCB guides (accessories) in three, five, seven or nine positions. The removable rear panel is recessed to protect connectors and switches; the accessory anodised front panel is also recessed to protect keypads and displays. All case panels are fitted with M4 threaded pillars for earthing connectors. Each enclosure is supplied with four ABS feet with non-slip pads.

The aluminium enclosures are available in 11 sizes from 225 x 200 x 75 mm to 350 x 320 x 150 mm. The standard colours are light grey or anthracite — and custom colours cost no more than standard. Accessories include front panels, a PCB mounting kit, PCB guides and PCB/panel fixing screws.

In addition to special colours, customising options include bespoke sizes, CNC punching/machining, fixings and inserts, digital printing of legends and logos.

ROLEC OKW Australia New Zealand P/L

www.metcase.com.au



INFRARED SWITCH

The airTouch series infrared switch features the user's housing material choice of stainless steel, aluminium or chrome-plated brass, with an LED dot that indicates visual feedback. airTouch is designed especially for high-traffic public environments: light switches, door controls, sanitary dispensers, lifts, exit switches and more.



As COVID-19 continues to increase the demand for touch-free infrared switches, the fully programmable airTouch switch offers a range of health and public safety advantages, including no actual contact; hygienic dispensing of disinfectors; preventing spread of bacteria on frequently touched surfaces; helping to maintain social distancing; and has IP67 protection.

The touch-free infrared switch featuring capsule technology that places all electronics inside. Its high level of resistance and durability enables intensive use in outdoor, humid or inhospitable environments, and it has the ability to connect to IoT modules via Bluetooth or Wi-Fi. Easily installed and hygienic, it has an operating voltage of 12/24 VDC, switching power up to 1 A and an operating temperature from -20 to +75°C.

Everswitch

www.everswitch.com



DC/DC CONVERTERS

The WAF150 series is a compact and ruggedised range of DC/DC converters that will deliver 150 W output power for harsh industrial environments.

The series features ultrawide input range voltages of 9 to 36 V, 18 to 75 V and 43 to 160 VDC. Available in five single outputs of 12, 15, 24, 28 and 48 VDC, the output can be trimmed up to 20% of nominal.

Features include an operating temperature range of -40 to +100°C ambient; remote ON/OFF; OCP, OVP and OTP protection; and adjustability. The WAF series convection/conduction-cooled package construction makes it suitable for extreme environmental and electrically demanding applications.

The fully enclosed and encapsulated converters come in a compact package of 98 x 52 x 17 mm. They comply with the stringent requirements for railway EN50155 standard, vibration MIL-STD-810F and UL 62368-1 approval.

Helios Power Solutions

www.heliosps.com.au

LIGHTING TRANSFORMERS

The ETZ series electronic transformers, by Zamel, are intended to work with halogen (and selected LED) light sources in modern, energy-saving interior design in plants, industry, offices and households.

The transformers are supplied with the typical mains voltage of 230 VAC (connected using screw terminals). The nominal output voltage is 11.5 VAC. Depending on the model, installation contractors can choose models with a maximum power of 50, 60, 70, 105, 150, 210 or 250 W (the maximum output current from 4.3 to 22 A).

The series features overtemperature protection (triggered by a temperature above 100°C), short-circuit protection and overload protection. In the case of the first two, the switched-off converter automatically returns to normal operation after cooling down/removing the short circuit. The products are designed for surface mounting and can work in an environment with a maximum temperature of 40°C.

The electronic transformers have the ability to work with intelligent dimmers and with small loads (from 0 W), which occur when powering some LED light sources. In addition, the products comply with the international standards EN 60598 and EN 61347 (general and safety requirements for lamp control gear), EN 61547 and EN 61000 (electromagnetic compatibility requirements), and EN 55015 (radiofrequency disturbances from all lighting equipment).

Transfer Multisort Elektronik

www.tme.eu



Cut Through the Noise

Quick and Reliable Sensor Interfaces in Harsh Environments

The ATtiny1627 Family of microcontrollers (MCUs) comes with a 12-bit true differential ADC with Programmable Gain Amplifier (PGA) enabling measurement of small amplitude signals, reclaiming signals from noisy environments, and fast conversion of signals for real-time applications. The ATtiny1627 Family is drop-in compatible with the tinyAVR® 1 and 0 MCU families and migration between them is a breeze.

The ATtiny1627 Family is a perfect fit for sensor nodes, as well as small and efficient control applications. With up to two USARTs, you can easily set-up to communication with different interfaces. Sensor node applications can include Passive Infrared (PIR) motion detectors, measuring thermocouples,

measuring low resistance current, measuring of shunt and magnetic encoder. The second USART included in the ATtiny1627 Family enables it to communicate with several interfaces within the application.

Key Features

- Fast and accurate signal measurement with 12-bit differential Analog-to-Digital Converter (ADC)
- Measure small amplitude signals using the PGA
- Improve noise suppression with built-in hardware accumulation and oversampling of up to 1024 samples

Contact Information

Microchip Technology Australia
Email: aust_nz.inquiry@microchip.com
Phone: +61 (2) 9868-6733



microchip.com/WNIE-attiny1627

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SEMICONDUCTOR 'FLIPPED' TO INSULATOR ABOVE ROOM TEMPERATURE

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Researchers at the University of Michigan (U-M), supported by Cornell University, the U.S. Naval Research Laboratory and the Chinese Academy of Sciences, have developed a semiconducting material that performed a quantum 'flip' from a conductor to an insulator above room temperature — potentially bringing the world closer to a new generation of quantum devices and ultra-efficient electronics.

Observed in two-dimensional layers of tantalum sulfide only a single atom thick, the exotic electronic structure that supported this quantum flip was previously only stable at ultra-cold temperatures of -73°C . The new material remains stable at up to 77°C , according to a study published in the journal *Nature Communications*.

Today's electronics use tiny electronic switches to store data; 'on' is one and 'off' is zero, and the data disappears when the power is turned off. Future devices could use other states, like 'conductor' or 'insulator', to store digital data, requiring only a quick blip of energy to switch between states rather than a steady stream of electricity. That could lead to far more powerful and more energy-efficient devices.

In the past, however, such exotic behaviour has only been observed in materials at super-cold temperatures. The ultimate goal is to develop materials that can quickly 'flip' from one state to another on demand and at room temperature. The U-M research could be an important step in that direction, according to corresponding author Robert Hovden.

"Previous research at ultra-cold temperatures has shown that it's possible to make these kinds of flips happen on demand, over and over again," Hovden said. "The fact that we were able to keep even one flip stable at room temperature opens a lot of exciting possibilities."

The flip from conductor to insulator is supported by a phenomenon called a charge density wave — an ordered, crystal-like pattern of positive and negative electrical charge that occurs spontaneously in certain conditions. According to Hovden, "Charge density waves have been observed before in bulk samples of tantalum sulfide, but the material had to be at ultra-cold temperatures. By interleaving several two-dimensional layers together, we were able to make it much more stable."

The team began by fabricating a sample of several single-atom-thick layers of tantalum sulfide sandwiched together. Each layer was a semiconductor in what's called an octahedral state, which refers to a specific arrangement of tantalum and sulfur atoms. While some charge density waves were present, they were too unstable and disordered to give rise to exotic behaviour like a conductor-insulator flip.

Suk Hyun Sung, a graduate researcher in Hovden's lab and the first author of the study, changed the sample's properties by heating it in an oxygen-free environment while observing the process under an electron microscope. As the sample heated, layers began to switch, one by one, into a prismatic state — a different arrangement of the same atoms.

When most, but not all, layers had switched to prismatic state, Sung cooled the sample back to room temperature. He found that the layers that remained in the octahedral state were exhibiting charge density waves that were orderly and stable, and stayed that way at temperatures of up to 77°C . In addition, those layers had flipped from semiconductors to insulators.

"Most 2D materials are subject to all the defects of whatever they're sitting on, whatever's in the air, and that makes them very unstable," Sung said. "But we discovered that when octahedral layers are nestled between several prismatic layers, they're much more stable."

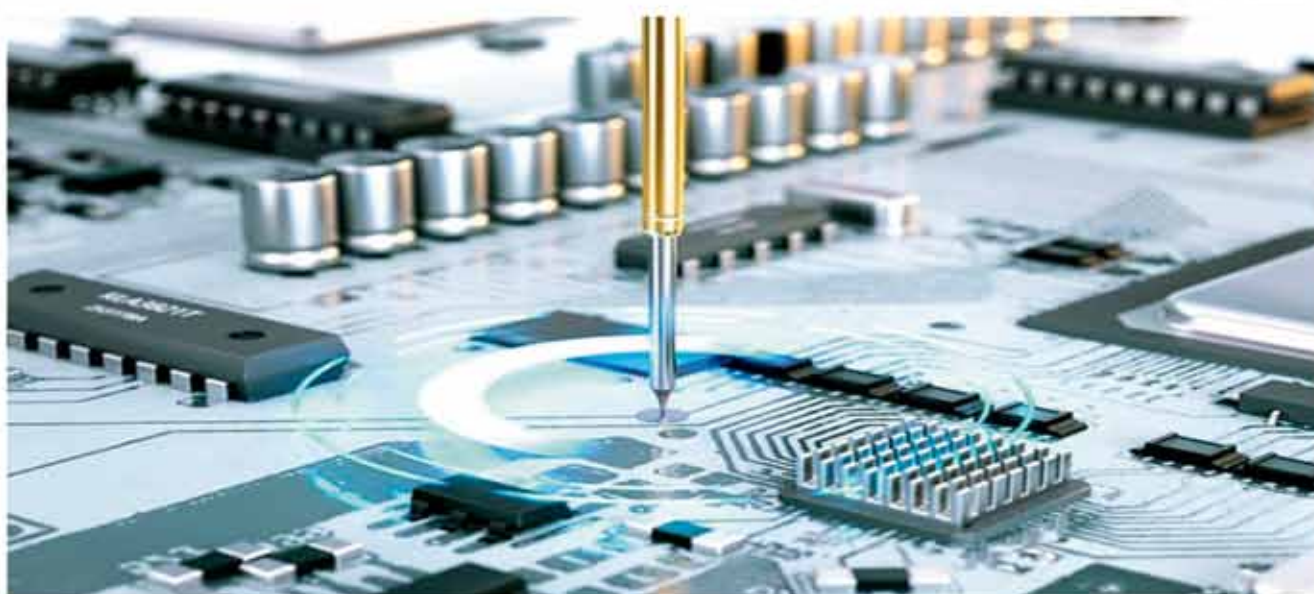
The team is now examining the phenomenon further, tweaking more variables of the process and testing mechanisms to control the exotic behaviours spurred by the charge density waves. For now, the new discovery has given them an important glimpse into the workings of quantum states and two-dimensional materials.

"We've opened up a new playground for the future of electronic and quantum materials," Hovden said. "It represents a whole new way to access exotic states."



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BIODEGRADABLE BATTERIES MADE OUT OF PAPER

Scientists from Nanyang Technological University, Singapore (NTU Singapore) have developed paper-thin biodegradable zinc batteries that could one day become an environmentally sustainable option for powering flexible and wearable electronic systems. Their work has been published in the journal *Advanced Science*.

The internal workings of a battery are usually housed within a metal or plastic case. Inside this case are the cathode and anode — the electrodes where the electrochemical reactions occur. A separator added between the cathode and anode creates a barrier and prevents the electrodes from touching while allowing electrical charge to flow freely between them, avoiding short circuits. Also inside the battery is a medium known as the electrolyte, which allows the electric charge to flow between the cathode and anode.

The NTU batteries are made up of electrodes screen-printed onto both sides of a piece of cellulose paper that has been reinforced with hydrogel. The scientists adopted a ‘sandwich design’ for their batteries — the electrodes are like the bread slices and the cellulose paper that the electrodes are printed on is like the sandwich filling.

The fabrication process starts with reinforcing the cellulose paper with hydrogel to fill up the fibre gaps found naturally in cellulose. This forms a dense separator that effectively prevents the mixing of the electrodes, which are formulated as ‘electrode inks’ and screen-printed onto both sides of the hydrogel-reinforced cellulose paper.

The anode ink is mainly made up of zinc and carbon black, a conductive type of carbon. For the cathode ink, the scientists developed one type with manganese and another with nickel as a proof of concept, though the research team said that other metals could possibly be used.

After the electrodes are printed, the battery is immersed in an electrolyte. A layer of gold thin foil is then coated on the electrodes to increase the conductivity of the battery. The final product is about 0.4 mm thick — about the thickness of two strands of human hair.

In a proof-of-concept experiment, the NTU team demonstrated how a 4 x 4 cm square of printed paper battery could power a small electric fan for at least 45 minutes; bending or twisting the

battery did not interrupt the power supply. In another experiment using a 4 x 4 cm battery to power an LED, the scientists showed that despite cutting away parts of the paper battery, the LED remained lit, indicating that cutting does not affect the functionality of the battery.

With hydrogel and cellulose naturally broken down by bacteria, fungi and other microorganisms, the battery can simply be buried in soil at the end of its life span. It breaks down in a matter of weeks, making it a fully biodegradable product.

“When decomposition happens, the electrode materials are released into the environment,” said Professor Fan Hongjin, co-lead author on the study. “The nickel or manganese used in the cathodes will remain in their oxide or hydroxide forms, which are close to the form of natural minerals. The zinc found in the anode will be naturally oxidised to form a non-toxic hydroxide. This points to the battery’s potential as a more sustainable alternative to current batteries.”

“We believe the paper battery we have developed could potentially help with the electronic waste problem, given that our printed paper battery is non-toxic and does not require aluminium or plastic casings to encapsulate the battery components,” added co-lead author Assistant Professor Lee Seok Woo. “Avoiding the packaging layers also enables our battery to store a higher amount of energy, and thus power, within a smaller system.”

Going forward, the NTU researchers hope to demonstrate the complete integration of the printed paper battery in printed electronics, electronic skins and energy storage systems. By developing a single large piece of battery that can be cut to desired shapes and sizes without loss of efficiency, Prof Fan said the team has created a simpler, cheaper way of manufacturing batteries that are “ideal for integration in the sorts of flexible electronics that are gradually being developed”.



WHAT IF

WHAT IF BATTERIES COULD HAVE A BETTER LIFE? AND THEN A BETTER REBIRTH?

If we could give EV batteries a better life, they could give us a brighter, greener future in return. But today, too many wind up wasted in a landfill. ADI's battery management solutions aid in optimizing charge and discharge—helping to give batteries a longer first life, and a smooth transition into a second life.

Analog Devices. Where what if becomes what is.
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RUGGED SERVER

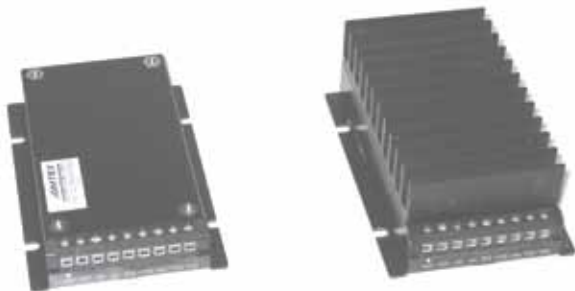
As processing performance continues to improve, Crystal Group is minimising the SWaP envelope of the RS41110L2 — a rugged server with a high-end computing performance in a 4U chassis with a depth of 52.6 cm that fits most any rack space. Weighing 26.3 to 29.9 kg, the RS41110L21 is designed to provide optimised value for end users in DSP, SIGINT, C4ISR and radar applications.

The server provides high-performance computing and high-capacity data storage in a rugged, all-aluminium package able to withstand rough terrains and tough applications, providing military and industrial programs with integrated solutions for everything from communications and networking to weapons control, sensor and surveillance, and unmanned aircraft systems. It is designed for two high-powered GPGPUs operating at 50°C, with other features including up to 4 TB of DDR4 memory; 1200 W AC power supply; versatility with 10 modular SSD bays for up to 20 SSDs; expandability with 11 PCIe slots; and Intel Xeon Scalable processors.

Crystal Group's rugged and industrial computing products are engineered and tested to withstand challenging environments, meeting and exceeding military and industrial standards, and provide the latest COTS technologies to best manage availability, upgradability and flexibility.

Metromatics Pty Ltd

www.metromatics.com.au



UNDER-DASH TELEMATICS ANTENNAS

The Trigger under-dash antenna family has been released by Laird Connectivity. The innovative five-port VPJ



and four-port VQJ Trigger devices are IP67-rated, multiport/multiband telematics antennas that offer cellular 3G/4G/5G/ISM/CBRS, Wi-Fi and GNSS functionality for automotive and Internet of Things (IoT) applications, including transportation, public safety, fleet operations, asset tracking and in-vehicle and to-vehicle communications.

The antennas feature an L-shaped format and dual-axis VHB adhesive backing, enabling quick and secure mounting in awkward locations. The antennas can be covertly mounted alongside or over bulky non-metallic objects, such as ventilator ducts, with no drilling required. This allows the devices to be mounted close to the vehicle's router or gateway, usually located under the dashboard or a seat or in the trunk.

Each device comes with vertical and horizontal V-Pol/H-Pol cellular radiating elements within the same antenna to provide better coverage while offering signal performance improvements and more consistent connectivity and data throughput than traditional antennas, the company claims. With optimised performance and around-the-vehicle coverage, the devices can be used in either dense urban environments or remote locations where signals may be weak or obstructed.

Mouser Electronics

au.mouser.com

APPLIANCE OUTLETS

SCHURTER's NR020 and NR021 series of appliance outlets are designed to meet increased fire protection and safety standards according to UL 498, as well as to facilitate compliance for receptacles used in household and commercial furniture according to UL 962 and UL 962A. High temperature ratings (-25 to 150°C) and added configurations for the series NR010 and NR020 meanwhile respond to the power demands facing the datacom industry today.

The NR010 with IDC terminals in Along and Cross orientation to the pin axis provides a version with an independent L terminal for the IDC-Along version. The neutral and ground terminals can still be bussed, while the line terminal can be used for maximum load according to UL rating 15 A, 125 V. It also extends the capability of adding functionality to each individual outlet.

The NR021 NEMA 5-15R Tamper Resistant series meets the expanded code requirements according to UL 498. Tamper-resistant receptacles feature a UL-recognised safety shutter system that prevents the insertion of foreign objects into the receptacle; the safety shutters will only open upon simultaneous insertion of two plug blades. With the option of an added insulated wall between the L and N terminals, compliance with the UL 962 Spill Test is made possible for manufacturers of household and commercial furniture and furniture power distribution units (FPDUs).

SCHURTER (S) PTE LTD

www.schurter.com



Hawker Richardson helps Gallagher to meet production needs

Gallagher Group is a multinational company based in Hamilton, New Zealand, that designs, manufactures and distributes a range of innovative solutions including, but not limited to, security (integrated access control) and animal management (electric fencing). To help drive its challenging production demands, Gallagher has invested in a range of SMT solutions from Hawker Richardson — ranging from the latest Yamaha mounters, printers and reflow ovens to selective soldering and conformal coating solutions.

With a global increase in demand for Gallagher Group's innovative products, newer and faster mounters were needed to ensure production was optimised for the forecasted accelerated growth of up to 25% year on year.

Gallagher already operates with three SMT lines, with two of the SMT lines now incorporating two of Yamaha's YSM20 mounters on each line. Running two shifts in production means the lines get put through their paces and so it's imperative they invest in good quality, reliable machines. Similarly, as the mounters are worked hard over two shifts, systems are often considered for replacement every 10 years. This is usually because of general wear and tear with spare parts becoming harder to get hold of, and new technology means it makes more sense to invest in new equipment.

Between the three lines, Gallagher boasted a jaw-dropping 12,000,000 component placements in November of 2021, consisting of a range of components including BGAs and 0402s.



Ensuring Gallagher has continuity of supplies means the products have to be of good quality so only planned maintenance occurs, especially with every minute planned out in production. Julian Thornton, Engineering Manager Electronics, explained: "We have invested in numerous SMT brands in the past, but since using Yamaha we haven't looked back. We have found Yamaha systems to be reliable and repeatable and that's what you want in a busy production environment."

In addition to utilising the latest technology, Gallagher has found it extremely important to adapt to any external challenges. With the chip shortage causing quite a few headaches in the electronics industry, Gallagher Group's responsive R&D department was able to redesign some of the boards, adapting them to accommodate alternative components. This has allowed Gallagher to maintain its impressive production quantity to meet with increasing demand.

Gallagher utilises specialised machine software, which is very flexible in allowing the engineers to optimise speeds and balance the mounters, as well as enabling the team in production to use alternative components from a range of suppliers, ie, different size reels and even supplies on sticks. This is particularly important when it is increasingly hard to obtain stock for some SMT components.

Thornton said: "Programming and planning production with the reel and nozzle changes can be a challenge, and so ensuring we have software that provides that flexibility is very important for our business. It is also pivotal that we can implement this offline and plan for the next job, because we can't afford the luxury of planning and programming only when the systems are idle."

Having comprehensive software with data at your fingertips can provide information to help drive better quality and quantity, but sometimes it's the difficulties you don't foresee that become issues.

Although Gallagher has a strong team of engineers in production that are very experienced with all of the SMT equipment, Thornton emphasises how important it is to work with suppliers that are reliable and trusted, so if things do happen they know their equipment supplier will do everything they can to minimise downtime.

"We have been working with Hawker Richardson for decades and as we have ambitious production targets, it's imperative that if anything goes wrong, we have a supplier who will do everything they can to minimise our downtime."

The latest mounter installed relied on the strong relationship Gallagher has with Hawker Richardson. Due to COVID restrictions, Hawker Richardson worked with the experienced team at Gallagher to commission the system remotely.

With the additional systems and high production throughput, Gallagher continues to go from strength to strength. Reliable partners that can work with the highly skilled team at Gallagher (whether it's onsite or remotely) are essential in ensuring systems continue to perform to meet with demands.

Hawker Richardson
www.hawker-richardson.com.au

ATX MOTHERBOARD

iEi's IMBA-Q470 motherboard supports both 10th and 11th Gen Intel Core processors, allowing for performance improvements of up to 80% compared to the previous generation on the i5 processor. The 10th Gen Intel Core platform supports up to 10 cores and improved performance over Coffee Lake-Refresh, the company claims. With good I/O capacity and the latest DDR4-2933 memory support, the processors deliver the performance required to consolidate industrial multiple workloads.

The motherboard is equipped with Intel UHD Graphics to display videos and images in 4K resolution. Among its three independent display ports (VGA+HDMI+DP), the HDMI and DisplayPort can both support up to 4K high resolution. The visual quality should thus fulfil users' demands.

The product is also equipped with two Intel 2.5 GbE controllers, which are ready for the latest-performance router. With two 2.5 GbE ports offering low latency and high throughput, the device can meet bandwidth-intensive requirements such as large file transfers and high-resolution video streaming, making it suitable for machine vision and AI edge computing applications.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



EXTRUDED ENCLOSURES

Designed to house single or multiple PCBs, mounted horizontally into internal slots in the body of the case, Hammond Electronics' 1455 Series enclosures are also suitable for housing any small electronic, electrical or pneumatic systems or components.



They are available in 33 different sizes from 60 x 45 x 25 to 280 x 191 x 66 mm in rounded rectangle or slimline profiles with a choice of aluminium or plastic end panels. All but the smallest sizes have a removable cover on the case body to allow access to the PCB when it is in situ; some sizes accept standard 100 x 160 or 100 x 220 mm Eurocards.

Variants of the standard 1455 enclosure are available for more specialist requirements. The watertight 1457 is sealed to IP65, the 1457-EMI provides greater EMC capability for use in electrically noisy environments and the 1457HD gives enhanced heat removal for high-power applications.

Hammond Electronics Pty Ltd

www.hammfg.com

AI INFERENCE SYSTEMS

Advantech's AIR-020 series of ultra-compact, edge AI systems are powered by the NVIDIA Jetson family. They deliver low-power computing with powerful AI inferencing capabilities using NVIDIA Jetson Nano, TX2 NX and Xavier NX SoM.

The AIR-020X supports up to 21 TOPS (tera operations per second) and 1058 FPS (frames per second), targeting high-resolution imaging processes. Meanwhile, the AIR-020T and AIR-020N support 1.33/0.5 TFLOPS and up to 109/48 FPS. The entire AIR-020 series supports wide-range 12–24 VDC input, a -10 to +55°C operating temperature, and vibration and humidity resistance.

The series is also equipped with a range of I/O ports including two USB 3.2 Type A, USB 3.2 Type C, one or two GbE ports, one or two RS-232/422/485 serial ports, 8-bit DIO, and CANBus for data acquisition and communication. These compact AI boxes are pre-installed with 4 or 8 GB LPDDR4 RAM and 16 GB eMMC 5.1. The series also provides 128 GB of M.2 storage as the data storage default for AI usage.

The AIR-020 series is bundled with the Ubuntu 18.04 LTS operating system, Advantech Edge AI Suite and JetPack SDK 4.5.1. For data security, the series adopts the TPM 2.0 trusted platform module and secure boot, which allows for compute-intensive industrial applications and better system security on the edge. This series is suitable for edge AI applications such as traffic monitoring, defect inspection, AGV/AMR, people counting, medical imaging and more.

Advantech Australia Pty Ltd

www.advantech.net.au



NEW UPGRADED PA METERING MODULE

The product provides users with an easier way to evaluate system performance, and to validate their applications.

General Description

Accurate weak current signal measurement is critical for scientific analytic equipment, environmental monitoring and process control, which is a great challenge for design engineers especially when the weak current signal reaches pA or even fA level. Excelpoint's new upgraded pA Metering reference design EPSH-PAM2.0 will provide users with an easier way to evaluate system performance, and to validate their prototype development.

EPSH-PAM2.0 is a full signal chain module: the current is input from the femtoampere level input bias current operational amplifier ADA4530-1 through to the ADA4522-1, as the buffering and/or gain setting stage, to the low noise 24-bit Sigma-Delta ADC, then to the Microchip ATSAML21 ultralow power ARM Cortex-M0+ MCU, finally connecting to PC via USB port. Through the specially designed Labview GUI, which provides module configuration function, features such as real-time waveform display, histogram and statistics analysis, and Excel test data export are provided. It can help achieve a better user experience.

Applications include:

- Laboratory and analytical instrumentation: spectrophotometers, chromatographs, mass spectrometers, pH meters, titrators, instrumentation, picoammeters, etc
- Environmental monitoring equipment
- PCB leakage measurement and ICT/FCT testing
- IVD
- Industrial process control

As per the block diagram in Figure 1, the module is powered up by PC USB connection. Two test points are to be provided for the measurements of ADA4530-1 output and AD7124-4 input separately.

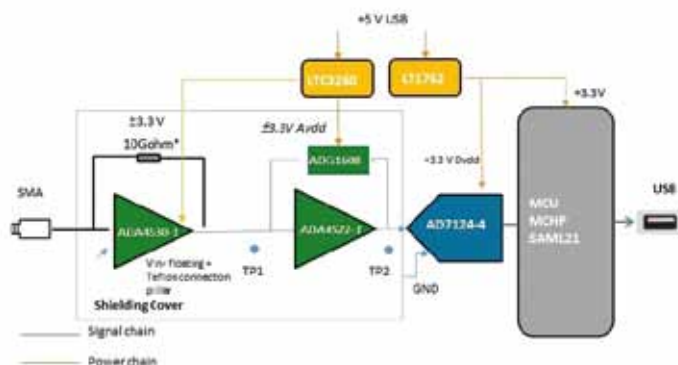


Figure 1: Block diagram of the pA Metering Module.

Key Features

- ADA4530-1 on the pA Meter Module is populated in transimpedance configuration with an input SMA connector that connects to amplifier inverting pin.

- By high value through-hole 10GΩ feedback resistor, the output of ADA4530-1 will be 10mV for the relevant input current of 1pA after calibration (with default module setup).
- With low leakage design and shielding consideration, the EPSH-PAM2.0 module can reach high performance to satisfy most target applications.
- Linearity: Measured by Keithley 6220, within the range of 0–20pA, the linearity of the module can reach 0.9999 in steps of 1pA (uncalibrated).
- RMS noise: Measured by Keithley 6220, its performance is better than 550μV (equal to 55fA input current), and the rms noise background is less than 50μV (with SMA cap).
- Input current dynamic range: 0 to -200 pA.

For main chip highlights, refer to Table 1. Figure 2 shows the waveform display and data of output value and RMS noise.

MPN	Description	Vendor
ADA4530-1	Femtoampere level input bias current operational amplifier	ADI
AD7124-4	Low power, low noise, completely integrated analog front end	ADI
LTC3260	Low noise dual polarity output power supply that includes an inverting charge pump with both positive and negative LDO regulators.	ADI
LT1762	Micropower, low noise, low dropout regulators	ADI
ATSAML21	MCU M0+ 48MHz	Microchip

Table 1: Chip highlights.



Figure 2: Waveform and test data (GUI).

Ordering Part Number: EPSH-PAM2.0

Inside the pA module packaging box:

- One pA module hardware
- One SMA to BNC coaxial transfer cable
- One USB Type-C transfer cable
- One USB thumb drive containing document and GUI software

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FLEXIBLE ELECTRONICS MADE FROM GOLD AND WATER-VAPOUR PLASMA

An OPV, an OLED and five wiring films were fabricated on different ultrathin substrates and then integrated using WVPAB. On the right, the integrated system is being wrapped around a stick (radius of 10 mm). Image credit: Masahito Takakuwa, Waseda University.



Researchers at Japan's RIKEN Center for Emergent Matter Science (CEMS) and RIKEN Cluster for Pioneering Research (CPR) have developed a technique to improve the flexibility of ultrathin electronics. The team used water-vapour plasma to directly bond gold electrodes fixed onto separate ultrathin polymer films, without needing adhesives or high temperatures.

With electronic devices getting smaller and smaller, and the desire to have bendable, wearable and on-skin electronics increasing, conventional methods of constructing these devices have become impractical. One of the biggest problems is how to connect and integrate multiple devices or pieces of a device that each reside on separate ultrathin polymer films. Conventional methods that use layers of adhesive to stick electrodes together reduce flexibility and require temperature and pressure that are damaging to super-thin electronics. Methods utilising direct metal-to-metal bonding are available, but require perfectly smooth and clean surfaces that are not typical in these types of electronics.

Researchers led by Takao Someya at RIKEN CEMS/CPR have now developed a new method to secure these connections that does not use adhesive, high temperature or high pressure, and does not require totally smooth or clean surfaces. In fact, the process takes less than a minute at room temperature, followed by about a 12-hour wait. The new technique, called water-vapour plasma-assisted bonding (WVPAB) and described in the journal *Science Advances*, creates stable bonds between gold electrodes that are printed into 2 μm -thick polymer sheets using a thermal evaporator.

"This is the first demonstration of ultrathin, flexible gold electronics fabricated without any adhesive," said Kenjiro Fukuda, a senior research scientist at RIKEN CEMS/CPR. "Using this new direct bond technology, we were able to fabricate an integrated system of flexible organic solar cells and organic LEDs."

Experiments showed that WVPAB performed better than conventional adhesive or direct bonding techniques. In particular, the

strength and consistency of the bonds were greater than what standard surface-assisted direct bonding achieved. At the same time, the material conformed better to curved surfaces and was more durable than what could be achieved using a standard adhesive technique.

According to Fukuda, the method itself is surprisingly simple. After fixing the gold electrodes onto polymer sheets, a machine is used to expose the electrode sides of the sheets to water-vapour plasma for 40 seconds. Then, the polymer sheets are pressed together so that the electrodes overlap in the correct location. After waiting 12 hours at room temperature, they are ready to use. Another advantage of this system is that after activation with water-vapour plasma, but before being bonded together, the films can be stored in vacuum packs for days. This is an important practical aspect when considering the potential for ordering and distributing pre-activated components.

As proof of concept, the team integrated ultrathin organic photovoltaic and LED-light modules that were printed on separate films and connected by five additional polymer films. The devices withstood extensive testing, including being wrapped around a stick and being crumpled and twisted to extremes. Additionally, the power efficiency of the LEDs did not suffer from the treatment. The technique was also able to join pre-packaged LED chips to a flexible surface.

"We expect this new method to become a flexible wiring and mounting technology for next-generation wearable electronics that can be attached to clothes and skin," Fukuda said. "The next step is to develop this technology for use with cheaper metals, such as copper or aluminium."



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BTB



EMI FILTER

The VEMI256A-SD2, from Vishay Intertechnology, is a highly integrated two-channel filter in an ultracompact chip level package for space-constrained applications. Engineered as a dual-channel filter array, the product helps suppress electromagnetic interference (EMI) and radio frequency interference (RFI) for two protection paths while providing robust system-level electrostatic discharge (ESD) protection for interface line filtering.

The device offers a low leakage current for ESD protection and enables designers to filter and clamp two different signal or data lines to the device's ground. The clamping voltage is rated at ± 30 kV and helps prevent damage to the protected device when subjected to ESD pulses. The product has been tested per IEC 61000-4-2 standards, meeting ESD immunity requirements with ratings at ± 25 kV for both contact and air discharge. The filter also features a cut-off frequency of 60 MHz (typical), line resistance of 60Ω (typical) and an operating temperature of -40 to $+150^\circ\text{C}$.

The filter is available in a 0.45 mg, CLP1007-5M package that prevents device shorts while offering optimum stand-off and minimal tilt and rotation for space-sensitive devices. The filter also meets the UL 94 flammability standard and has a moisture sensitivity level classified to level 1 according to J-STD-020. It is suitable for a variety of mobile and wired communication devices, including smartphones, tablets, portable electronic devices, display interfaces, keypads and high-speed I/O data ports.

Mouser Electronics

au.mouser.com



IIoT ENCLOSURES

In addition to the Internet of Things (IoT), the Industrial Internet of Things (IIoT) is a leading technology in digital transformation. Here, the focus is not on the entertainment or comfort of consumers, but rather on collecting and centrally delivering numer-

ous amounts of data on machines, special work scenarios or across the entire value-added chain. IIoT sensor technologies require robust enclosures to meet the diverse needs of the smart factory. OKW Gehäusesysteme offers suitable enclosure solutions for the applications described above.

IIoT devices should be high quality and equipped with sensitive, precise electronics. This also places special demands on the packaging of the most diverse sensor technologies. The plastic enclosures as well as the aluminium enclosures should be robust and properly sealed, preferably in different sizes and versions, with a wide range of accessories. Many enclosure ranges can be equipped with an optional seal to ensure a high degree of protection (up to IP65). This offers the electronics protection from dust, dirt and splash water. This makes the packaging suitable for applications in harsh industrial environments. The material also plays an important part, which is why numerous enclosures are available from stock in high-quality materials with high levels of UV protection.

The installation of the units offers different approaches, depending on the type of enclosure. The EASYTEC flanged enclosure and the large-volume NET-BOX are suitable for stationary use with wall mounting or in machines/systems. The PROTEC and the high-quality SMART-TERMINAL aluminium profile enclosure are available as suitable tabletop/desktop versions. Both enclosure ranges are available with an ergonomically favourable inclination angle for easy operation and improved reading of the data. For technologies that are worn close to or on the body, special wearable enclosures such as the BODY-CASE are suitable.

ROLEC OKW Australia New Zealand P/L

www.okw.com.au



UWB TRANSCEIVERS

SPARK Microsystems' SR1010 and SR1020 are versatile, integrated, short-range wireless transceivers that feature ultralow power consumption and ultrashort latency for high-performance personal area networks and IoT-connected devices. They enable high-data-rate communications and signals that are difficult to intercept.

The transceivers communicate in the licence-free ultra-wideband (UWB) spectrum from 3.1 to 9.25 GHz, enabling robust and energy-efficient communications. Their versatility includes power consumption of 2 mW while transmitting and receiving at 1 Mbps, and scaling to $6\mu\text{W}$ at 1 Kbps.

The transceivers feature ultralow power consumption for enhanced battery life: down to 0.25 nJ/bit TX energy efficiency and 1.15 nJ/bit RX energy efficiency. They also offer ultralow latency for real-time communications (50 μs airtime for 1 Kb) and time-of-flight positioning at 30 cm accuracy.

The products will be of interest to the worldwide design community, particularly those designing technology for industries such as AR/VR, audio, gaming and IoT sensors.

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TEST ELECTRONIC DESIGNS

WITH DIGILENT ANALOG DISCOVERY PRO 3000 PORTABLE HIGH RESOLUTION MIXED SIGNAL OSCILLOSCOPES

Provide the utility of professional benchtop equipment with the flexibility of a portable instrument.

Engineers all over the world use Digilent Test and Measurement devices to decrease their design cycle time and increase their impact by always having an oscilloscope, logic analyzer, waveform generator and more within reach.

Digilent expands the Test and Measurement line into professional engineering and introduces ADP 3450 and ADP3250, in the line of Analog Discovery Pro devices, offering 4 channels (ADP3450) / 2 channels (ADP3250) of analog input with 14-bit resolution at up to 0.5 GS/s. Additionally, to meet the needs of an increasingly digital world, 16 dedicated digital channels make the ADP3450 a true mixed signal oscilloscope. With the included digital power supply, digital outputs, two channel arbitrary waveform generator and two dedicated external triggers, Analog Discovery Pro comes with 12 instruments ready to analyze mixed signal systems through our free software, WaveForms:

- Oscilloscope
- Waveform Generator
- Power Supplies
- Voltmeter
- Data Logger
- Logic Analyzer
- Pattern Generator
- Static I/O
- Spectrum Analyzer
- Network Analyzer
- Impedance Analyzer
- Protocol Analyzer

Powerful Multi-instrument Software Applications

WaveForms is the free software application for the ADP3450 and ADP3250 and enables use of the available analog and digital instruments. The software has been refined by customer feedback for over 10 years and features a computer- and laptop-friendly user interface that has the feel of traditional benchtop software. The device communicates with WaveForms via a USB or ethernet connection to your computer, allowing users to capture, record, analyze, and generate mixed signal and mixed domain waveforms. WaveForms can be downloaded and installed in under 60 seconds and can be tested without hardware using its demo mode feature. In addition to the use of instruments in the application, the WaveForms application has a script editor tool, which allows custom scripting of the instrument in JavaScript. WaveForms is designed to be run on a laptop or desktop computer and is Mac, Windows, and Linux compatible. WaveForms SDK is a set of software libraries and examples that can be used to develop custom applications that can control Digilent Test and Measurement devices. Supported languages include C, C++, C#, Visual

Basic, and Python. Third-party toolkits are available for LabVIEW and MATLAB.

Linux Test Environment

Analog Discovery Pro introduces Linux Mode. Linux Mode provides an on-device terminal-based operating system that, when combined with WaveForms SDK, is a flexible starting point for all kinds of custom tests and applications. Running embedded on the device itself or via WaveForms, engineers and measurement enthusiasts alike can take advantage of data streaming via ethernet, and the on-device storage to capture buffers of millions of samples.

Advanced Triggering

Analog Discovery Pro features a variety of advanced triggering options. Instruments within WaveForms can be cross-triggered for example, activating an oscilloscope capture based on a received and decoded digital protocol. And external signals can trigger events using the two dedicated external trigger inputs on the back of the device.

Enabling professional engineers

Digilent has invested in creating a bunch of support resources to make Analog Discovery Pro's multiple features more accessible to engineers:

1. Getting Started Guide to walk you through the first measurement in GUI and Linux environment.

2. Example Projects demonstrate a wide range of applications.

You can find an example of the Automated Testing in Linux environment, which uses WaveForms SDK from within Linux mode, in order to run scripts directly, without a host. The example of streaming data over Ethernet demonstrates how to set up a direct connection from the device to a host computer running WaveForms, or connect both devices to a network, and control the Analog Discovery Pro remotely. The tutorial of sampling a signal at 0.5 GS/s with the Analog Discovery Pro shows how to achieve the highest sampling rate of Analog Discovery Pro.

Check out the Analog Discovery Pro Resource Center for more guides, tutorials and applications.

Digilent Inc
www.digilent.com



DDR5 MEMORY SERIES

Advantech's SGRAM DDR5 4800 series leverages next-generation DRAM technology to deliver high performance and compatibility as well as efficient power management for industrial applications.

The SGRAM DDR5 extended temperature series undergoes strict laboratory testing for use in mission-critical applications. Furthermore, DIMM power management IC (PMIC) is placed on module to facilitate efficiency and stable operation. These features make the series suitable for edge computing and AIoT applications in medical and semiconductor automation.

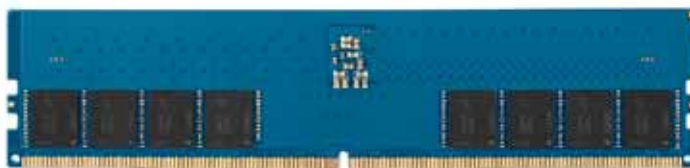
The SGRAM DDR5 4800 series provides 4800 MHz of performance using the 12th Gen Intel Core processors. Products come in a wide selection of form factors including RDIMM, unbuffered DIMM, SODIMM and rugged DIMM, with maximum capacities up to 32 GB.

The series is supported by SGRAM's intelligent software: SQ Manager. This software, developed for DDR5, comes in onsite and cloud versions and can monitor system DRAM operation. It conveys real-time information that helps users to stabilise operation and decrease the risk of equipment error.

The SGRAM series comprises a comprehensive selection of extended temperature solutions.

Advantech Australia Pty Ltd

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AUTOMOTIVE BOOST CONTROLLER

Analog Devices introduces an efficient, multiphase synchronous boost controller that regulates high-power Class-D amplifiers in automotive infotainment systems. The MAX25203 features both programmable gate drive voltage and current limit blanking time, as well as current balancing, and operates at a high switching frequency designed to reduce the bill of materials cost and shrink PCB space by 36%.

The controller starts with a battery input voltage from 4.5 to 42 V and operates down to 1.8 V after start-up. It sustains an absolute maximum output voltage of up to 70 V and features a low shutdown supply current of 5 μ A. Useful for generating backlight and Class-D audio amplifier voltages, the product offers I²C bus diagnostics including die temperature, phase current monitoring and optional true shutdown. Output voltage is scalable via the PWM input or I²C interface and a sync-out feature supports additional phases for higher power systems.

Factory-programmable gate drive voltage from 5.5 to 10 V increases power density by reducing MOSFET R_{ds(on)} loss for higher efficiency. Programmable current limit blanking time supports short peak current events without power supply overdesign. The resistor-programmable switching frequency up to 2.1 MHz is designed to improve EMI and reduce external components' size and count, while the $\pm 5\%$ current share accuracy from phase to phase reduces inductor size.

Analog Devices Pty Ltd

www.analog.com

DUAL HIGH-SIDE SWITCHES

STMicroelectronics' latest high-side switches, the IPS2050H and IPS2050H-32, permit two programmable current-limit values for smart driving of capacitive loads that draw high startup current.

The dual-channel switches have an input-voltage range from 8 to 60 V and can withstand up to 65 V on the input pin, enabling flexibility and robust performance in industrial applications. The integrated power MOSFET has low $R_{DS(on)}$, resulting in high energy efficiency and low thermal dissipation. In addition, MOSFET single-pulse avalanche energy greater than 1 J at 2 A boosts the ability to handle inductive loads. There is also an active clamp for fast demagnetisation.

The IPS2050H allows the main current limit to be programmed up to 2.5 A for driving loads controlled by a PLC module and for use in equipment such as factory automation I/O peripherals, computer numerical control (CNC) machines and general driving of resistive, inductive and capacitive loads. The IPS2050H-32 has a higher maximum current limit of 5.7 A for use with unidirectional motors in equipment such as vending machines. The current-activation threshold and limit values are configurable using external resistors. An external capacitor sets the duration of the startup current limit for smart driving of capacitive loads.

Extensive built-in protection features and diagnostics enhance safety, including undervoltage lockout (UVLO) and protection against over-voltage, overload, short-circuit, ground disconnection and Vcc disconnection. Individual fault signalling for each channel indicates overload and junction overtemperature events. An additional sensor is provided for case overtemperature protection.

The switches meet IEC 61000-4-2 ESD, IEC 61000-4-4 and IEC 61000-4-5 specifications for ESD, fast-transient and surge immunity. Demonstration boards and software are available to help quickly evaluate the driving and diagnostic capabilities when connected to industrial loads.

STMicroelectronics Pty Ltd

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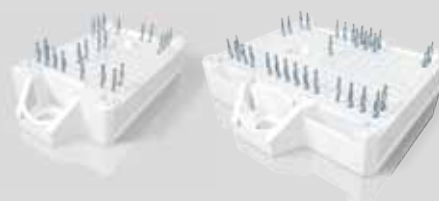
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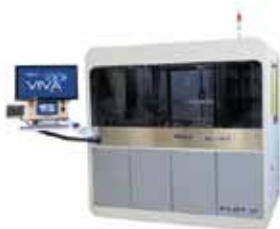
FLYING PROBE TEST PLATFORM

Seica's PILOT VX platform offers high flying probe test performance, with cutting-edge solutions that address the fundamental concerns of electronic board manufacturers looking to optimise their investment. The state-of-the-art mechanical performance and motion control offer a reduction of up to 50% in test time compared to other products, the company claims.

The platform has 12 multifunction test heads providing the capability to contact up to 44 points simultaneously; technologically advanced measurement hardware; microwave-based measurement techniques; and optimised VIVA software that enables the parallelisation of different types of tests, saving even more time. The platform also includes smart analysis capabilities, together with algorithms based on the principles of artificial intelligence, which can automatically optimise the test flow in run-time, while maintaining test coverage targets.

Onboard Solutions

www.onboardsolutions.com.au



5G RADIO COMMUNICATION TESTER

Rohde & Schwarz is looking to eliminate the complexities of 5G NR device testing by combining ease of use and high performance in a single instrument. With its one-box tester approach, the R&S CMX500 5G radio communication tester enables

even complex test set-ups for all 5G NR deployments, supporting a large variety of the present and future 3GPP band combinations. The simplified set-up in a single easy-to-use test platform results in a small footprint in the lab.

The one-box tester provides extensive device testing capability, including support for all 5G NR deployments covering LTE, 5G NR FR1 and FR2 in non-standalone (NSA) and standalone (SA) mode, for both FDD and TDD with simple set-up and high performance. Manufacturers of cutting-edge 5G NR capable chipsets and devices as well as certification providers can cover the entire product life cycle, from all early R&D design phases to end-to-end application testing, including device certification.

Rohde & Schwarz has integrated sub 8 GHz RF units for FR1 into the one-box tester, in combination with the remote radio heads (RRH) which now cover mmWave frequencies up to 50 GHz in FR2. Consequently, even challenging 5G NR band combinations can now be simulated. For example, higher order carrier aggregation with up to 8CC combinations of FR1 and FR2 in downlink is possible, which can achieve data rates of 10 Gbps and beyond on the IP layer.

Data-hungry enhanced mobile broadband (eMBB) applications like 8K video streaming or augmented and virtual reality will call for data rates as high as 10 Gbps in uplink and 20 Gbps in the downlink. The futureproof concept of the one-box tester is now ready to validate such high data throughput, all in a single box, making it 10 times more powerful than the R&S CMW500 wideband radio communication tester.

Rohde & Schwarz (Australia) Pty Ltd

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SILICON-CARBIDE MOSFETs

STMicroelectronics introduces its third generation of STPOWER silicon-carbide (SiC) MOSFETs, designed to advance the state of the art in power devices for electric-vehicle (EV) powertrains and other applications where power density and energy efficiency are important target criteria.

The SiC devices are optimised for high-end automotive applications including EV traction inverters, onboard chargers (OBCs) and DC/DC converters, as well as e-climate compressors. The latest generation also suits industrial applications by boosting the efficiency of motor drives, renewable-energy converters and storage systems, as well as telecom and data-centre power supplies. Devices with nominal voltage ratings from 650 and 750 V up to 1200 V will be available, giving more choices for designers to address applications operating from ordinary AC-line voltages up to those of high-voltage EV batteries and chargers.

SiC MOSFETs have a high voltage rating in relation to their die size, compared to silicon alternatives, making the technology suitable for EV applications and fast-charging EV infrastructures. In addition, they benefit from a fast intrinsic diode that delivers the bidirectional properties needed for automotive OBCs used in vehicle-to-X (V2X) power flow allowing the transmission of electricity from an OBC battery to the infrastructure. Moreover, their high frequency capability allows small passive components within power systems, which permit compact and lightweight electrical equipment in the vehicle.

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EMBEDDING AN ANTENNA INTO A CELLULAR IoT DESIGN

By following some simple design guidelines, a single compact antenna can serve multiple radios in a cellular IoT product.

Regardless of how much innovation has gone into the design of the hardware and software of a cellular IoT device, if the antenna doesn't work properly, the product will be useless.

It is the antenna that generates the voltage and current which produces the transmitted electromagnetic (radio) wave, and in turn it's the antenna across which the incoming radio wave generates the voltage and current picked up by the receiver. Optimising the antenna's efficiency ensures it converts as much of the transmitter power into radiated radio energy and harvests as much energy as possible from the incoming signal to feed the receiver. This in turn largely determines the range and throughput of the cellular device.

More challenging still, cellular IoT products use radios operating at multiple frequencies. Consider, for example, the Nordic Thingy:91 cellular IoT prototyping platform; the device incorporates an nRF9160 SiP incorporating LTE-M/NB-IoT (operating on several bands in the 700 to 2200 MHz allocation) and GPS (1227 and 1575 MHz), and the nRF52840 SoC (Bluetooth LE operating on 2.4 GHz). It is not uncommon for cellular IoT solutions to also include Wi-Fi (2.4 and 5 GHz). Following conventional design, that means incorporating several different bulky antennas (and their circuitry) into a single product.

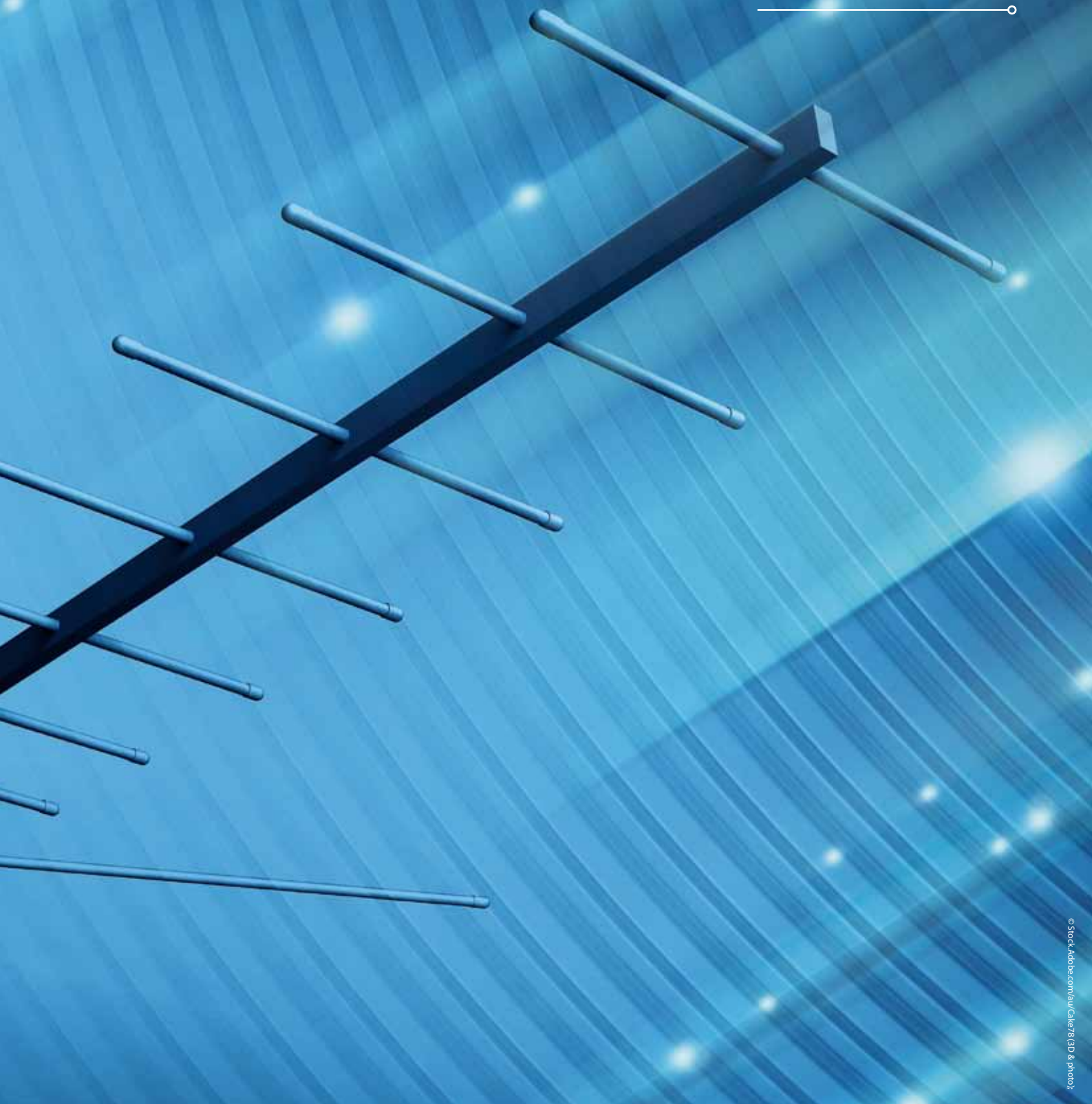
Fortunately, modern chip antenna components offer an elegant solution with compact designs that can cope with the multiple frequencies used by different radios. The single antenna in the Thingy:91, for example, services the platform's LTE-M/NB-IoT and GPS radios yet measures just 30 x 3 x 1 mm. (A separate antenna serves the Thingy:91's 2.4 GHz radio.) However, even with these clever chip antennas, there are some sensitivity compromises. That makes it important for the designer to follow some important design guidelines to maximise the antenna's efficiency and overall frequency response.



Where to place the antenna

The secret to modern chip antenna performance comes from the fact the device itself is only one part of the antenna system. The complete antenna system comprises the chip antenna, PCB ground plane and antenna matching circuit(s). The design of each part of the system directly affects its overall efficiency.

Chip antenna manufacturers, such as Nordic design partner Ignion, have expertise in maximising the antenna's efficiency for short-range radio and cellular IoT applications. The company also offers an alternative solution for single-, dual- and multiband sys-



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tems. With knowledge of the end product's intended operational frequency band(s), it is relatively simple to narrow down the shortlist of suitable chip antennas from the catalogue.

Once the chip antenna has been selected, the next step is to consider the ground plane. The size of the ground plane has a large impact on antenna efficiency. For example, at an operational frequency of 900 MHz, in a like-for-like comparison, a 10 cm² ground plane might exhibit 30% efficiency where a 40 cm² ground plane would boost that to 60%. Within the constraints of the end product form factor, it is good design practice to use as large

a PCB as possible and then dedicate one complete layer to the ground plane. (As the frequency increases, the ground plane size has less impact on antenna efficiency.)

Next, it's important to consider where to place the chip antenna on the PCB. A good guideline is to place the antenna at the corner of the device. It is also important to place the chip antenna as far as possible from other active components that could radiate energy during operation. For the transmission power levels typical of cellular IoT devices, a minimum clearance area of 20 mm from other components is satisfactory. The ground plane should be excluded

from this clearance area. The only conductors in the clearance area are the PCB pads and traces connecting the chip antenna to the rest of the circuitry. It's also good practice to keep the antenna away from housing screws, brackets and other metallic parts.

Minimising losses

Perhaps the most important part of the antenna system design is the matching circuit. The matching circuit sits between the chip antenna and the transceiver. Its purpose is to limit the energy reflected from the antenna or due to voltage standing wave ratio (VSWR) when the IoT device is transmitting.

Energy reflection or VSWR is minimised by transforming the antenna impedance to the system impedance (normally 50Ω). The matching network typically comprises inductors and capacitors in a network that transforms the impedance the transceiver 'sees' into the antenna in the intended frequency band(s). The use of high-quality factor (Q) and tight tolerance matching network components will enhance performance.



The Nordic Thingy:91 uses an Ignion Virtual Antenna. Note the position of the chip antenna (red) at the top right corner of the PCB and the clearance area between the antenna and the rest of the electronic components.

Designing matching networks can be challenging. The trick is to not only to design the appropriate circuit topology but also to select the appropriate inductor and capacitor values to transform the required impedance. For a single operational frequency band (eg, 2.4 GHz), the design is relatively straightforward, but for a cellular IoT product operating in multiple frequency bands the matching circuit becomes much more complex.

The matching network should be placed as close as feasible to the antenna (while maintaining the clearance area) to minimise the length of the connecting traces. Where there must be a trace directly between the transceiver and the antenna, make sure it is designed as a 50Ω transmission line. This minimises trace impedance mismatch and the chance of traces acting as miniature antennas and upsetting the efficiency of the system.

While it is often possible to design a single matching network that works well for a multiband device, this might not always be the



The Ignion TRIO mXTEND Virtual Antenna used in the Nordic Thingy:91 can work in the cellular RF bands, GNSS bands for systems such as GPS, GLONASS and Beidou, and short-range wireless bands for Bluetooth LE and Wi-Fi

case, particularly in a compact device with a small ground plane. An alternative is to design matching networks that work well for each of the intended operational frequency bands and then switch between them as required. Because each network only has to meet the needs of a single frequency band, it can typically be made up of just a few components making it relatively inexpensive and compact. The Nordic Thingy:91, for example, features five matching networks for the various LTE-M/NB-IoT bands and Bluetooth LE, and a further matching network for the GPS signal. (This network also includes an LNA to boost the GPS input to the nRF9160.) Switching between networks is controlled by the nRF9160 SiP's Arm Cortex M-33 application processor.

Testing the antenna system

The final design must be tested to ensure it not only demonstrates the predicted radiative efficiency but is also approximately omnidirectional (transmits and receives in all directions). The first test can be done by connecting a 50Ω micro-coaxial to the antenna, grounded at three or four points on the PCB and then connecting that cable to a network analyser. The results will not only indicate efficiency but also frequency response and bandwidth. The test typically reveals if some adjustment to the matching network components is needed.

The final examination of the cellular IoT device's performance should be made in an anechoic chamber. This is the ultimate test of a design and often reveals weaknesses in efficiency and omnidirectional performance that don't show up during network analyser testing and which require revised chip antenna selection, ground plane and clearance area redesign, and/or matching network tuning.

Even when adhering to proven development techniques, antenna design is challenging and often comes down to repeatedly testing a design's performance and then refining the layout. Moreover, small antennas are notoriously inefficient. If the design exhibits 50–60% efficiency, the designer has done a decent job. But there are often gains to be made, so it's always worth a further thorough review of the design.

This article is republished from Nordic Semiconductor's Wireless Quarter with permission: www.nordicsemi.com/News/Wireless-Quarter. A Nordic technical webinar, made in collaboration with Ignion and titled 'How to embed a compact antenna for your global cellular IoT product', is available here: bit.ly/3zVn7l4.

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PLC TRANSCEIVER

Wireless Technologies (WTE) has released the TRex PLC transceiver for control and automation across a site. Installation engineers would be familiar with the need for long cable runs required for a control system across a site; the integrated PLC with radio transceiver is designed to speed up this installation.

The transceiver has been designed to solve the constant challenge of connecting remote equipment and configuring and diagnosing problems onsite, while also freeing up cabinet space. Furthermore, it can be swapped out without even needing a screwdriver.

The product has been installed in a variety of markets such as POS retailing, health (paging, nurse call), fire panel monitoring and even pest control. It supports message formats that are used in critical communication markets such as POCsAG, MODBUS and DMR Tier 1. It is type approved for Australia and New Zealand.

Wireless Technologies

www.wte.co.nz



STEP-DOWN BUCK CONVERTER

Analog Devices' MAX77540 step-down buck converter provides single-stage power conversion in multi-cell battery applications, such as augmented reality/virtual reality (ARVR) headsets, land mobile radios (LMRs) and digital single-lens reflex (DSLR) cameras. The power-dense buck converter features 94% peak efficiency and wafer level packaging that is said to measure 61% smaller than traditional quad flat no-lead packages.

Multi-cell battery applications require two-stage power conversion and long battery life in the smallest package possible. Traditional methods, such as using a front-end converter to step down to 5 V or below, and subsequently, stepping down further to system level voltages, are inefficient and therefore impact the battery life of the system. This approach requires an additional converter, which often requires an inductor.

With the step-down buck converter, the design engineer can easily create either dual 3 A or a single 6 A output(s). Default power on configuration only requires two external resistors, and an I²C interface allows further control for advanced power management techniques. External frequency tracking and spread spectrum modulation provide low electromagnetic interference (EMI) power conversions for data sensing and processing equipment.

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OPTOCOUPERS

Würth Elektronik has expanded its optoelectronic portfolio with optocouplers in all common packages and CTR (current transfer ratio) values. This includes the WL-OCPT series of phototransistor optocouplers in DIP-4, SOP-4 and LSOP-4 packages and the WL-OCDA Darlington optocoupler series as DIP-4 and SOP-4.

The different packages are also available in a range of lead frame varieties. The CTR values of the components — classified according to binning type — range from 20 to 15,000%. In addition, the DIN EN 60747-5-5 certified components can be used in the operating temperature range from -55 to +110°C.

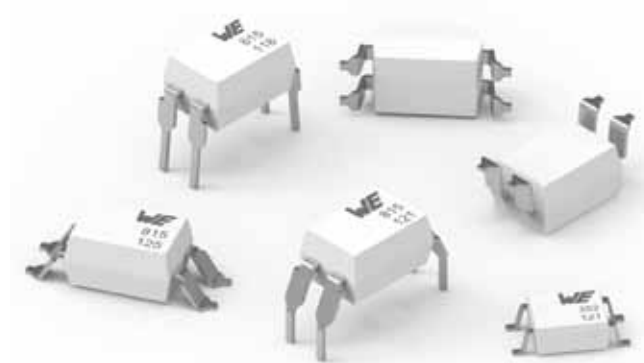
Galvanic isolation of low-power control circuits from high-power circuits is an important safety aspect in many applications. Optocouplers protect against interference and overvoltage in power supplies, chargers, computers, microprocessors, sequence controllers, programmable logic controllers, measuring devices and other applications.

In designing the optocouplers, Würth Elektronik has chosen the coplanar package with a constant isolation gap, for isolation up to 5000 V. High-quality silicone and polymer materials provide for 100% internal reflection and offer a stable CTR over the entire temperature range.

The optocouplers feature fast switching times and high DC transmission ratios even in low current operation. The copper lead frames are designed to provide optimal solderability and solid assembly in the application.

Würth Electronics Australia Pty

www.we-online.com



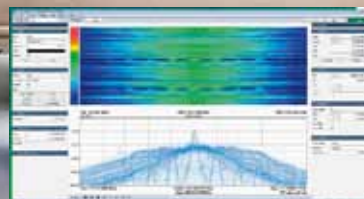
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THREE REASONS TO INCORPORATE PROPER ERGONOMICS

Derrick Teal and Megan Farell

Posture has become an important part of ergonomics, which is the concept of using items to position the body in a more efficient and safe manner.

The term ergonomics is used in a variety of contexts, usually to convey the idea of someone being comfortable. There's a great business case for proper posture and ergonomics.

1. Enhanced productivity

One of the primary concepts of ergonomics is keeping tools within easy reach. Think of it like a mechanic having a toolbox in the reception area instead of the shop floor. How much time would be wasted going back and forth to get the right tool? Having the tools necessary to do one's job in an easily accessible area can reduce the time it takes to complete a task, thereby improving productivity.

Another important factor in increasing productivity is prevention of repetitive injuries. Performing the same or similar tasks for prolonged periods of time with poor posture and excessive

reaching/straining can result in aches and injuries. In 2013, the US Bureau of Labor Statistics reported that work-related musculoskeletal disorders (MSDs) accounted for roughly one-third of all worker injury and illness cases. MSDs can affect various parts of the body, such as muscles and ligaments, and these injuries include tendinitis, carpal tunnel and muscle strains. Depending on the severity of the MSD, a worker could require rest, physical therapy and sometimes even surgery to remedy the pain. This can result in the worker unable to perform their job to full capacity, or even absenteeism.

2. Higher-quality work

Without being distracted by something like a nagging ache in the back or neck, employees are able to better focus on their work.

those incidents and their associated costs? Incorporating better ergonomics into the workplace can reduce costs. Poor ergonomics can contribute to MSDs, and these injuries can cost companies in worker compensation payouts and injury benefits. From an economic perspective, ergonomic workplaces should be seen as a good investment.

Since workplace ergonomics are paramount in preserving employee health and productivity, the US Center for Disease Control and Prevention's (CDC) National Institute for Occupational Safety Health (NIOSH) developed a program to evaluate and resolve ergonomics issues in the work environment. The Elements of Ergonomics Program utilises seven vital steps to prevent work-related MSDs. These steps include actions such as signage to warn workers of common repetitive injuries, organisational changes to address known problems and prevent future issues, training to educate management and workers on recognising risk factors of potential causes of MSDs, and identifying controls for duties that are high-risk for injuries.

Implementing change

Solutions to the problem of poor ergonomics don't have to be an involved process. Let's use industrial microscopy as an example. It is crucial that routine microscopists — users who operate a microscope for at least half of their workday — practise proper ergonomics to maintain their health and safety.

One of the easiest ways to incorporate proper ergonomics is to ensure tools are within easy reach. In microscopy, that can be as simple as placing the microscope near the edge of the table.

The next step is to maintain a neutral position. This includes keeping a straight back, only a minor tilt of the neck and a level line of sight.

It's important to maintain that posture and avoid hunching over, which is a habit that could take some time for employees to adopt. Ergonomic posture further includes keeping elbows close to one's obliques, placing arms on the table at roughly a right angle, and placing feet flat on the floor when operating a microscope while sitting down.

Placing the stereo microscope on an adjustable standing desk gives employees the option to alternate between sitting and standing. Switching positions while working, even if it is just shifting one's weight slightly, is important for ergonomics to relieve muscle tension.

Taking short breaks is advised in most occupations that involve sitting at a desk and repetitive tasks. To help avoid stiffness, employees should pause and readjust their position every one to two hours. In the case of microscopy, this has the added benefit of changing employees' eye focus, which should actually be done every 30 minutes. Shifting focus will help avoid eye strain and prevent headaches.

Find the right equipment provider

The equipment used by employees is an essential component in ergonomics. An equipment provider that is looking out for a business's best interest is one that places an emphasis on ergonomics. With stereo microscopes, for example, a good provider understands that there is no one-size-fits-all approach and has a variety of options and adjustable components to choose from to accommodate any operator.

There's a lot to gain, and save, through proper ergonomics. That's why finding the right equipment provider is essential.

Olympus
<https://www.olympus-ims.com/en/>

Attentiveness leads to a better quality of work, which leads to a better-quality product.

Product quality can also be influenced by the work atmosphere. It is important for companies to demonstrate that they value the time, effort and livelihood of their employees. Using proper ergonomic strategies and equipment setups to eliminate the aches and pains associated with poor workplace ergonomics can improve an individual's demeanour, which improves company morale. Generally speaking, a healthy worker is a happy worker.

3. Regulatory compliance

In some countries, ergonomics is included in the local or regional workplace health and safety regulations that fall under the purview of the government. Companies that have incident rates higher than the industry average can make a business case for ergonomic improvements. Why continuously pay out for ergonomic-related incidents when you could devise and pay for a solution to reduce

ULTRALOW-CAPACITANCE TVS DIODE

Toshiba Electronic Devices & Storage has launched the DF2B6M4BSL — an ultralow-capacitance TVS diode for high-frequency antennas. The diode protects semiconductors and other electronic components from static electricity and noise while suppressing signal deterioration.

Electronic components in the high-frequency antennas used in radio communications, such as Wi-Fi, need to be protected by suppressing high harmonic distortion. The TVS diode delivers a total capacitance of 0.15 pF (max), the lowest offered by Toshiba; it uses this ultralow capacitance to suppress high harmonic distortion that affects antenna reception performance, and also reduces static electricity and noise that affect the components.

ESD suppressors are sometimes used in high-frequency antennas, and they can be replaced by the diode. TVS diodes have higher protection performance than ESD suppressors, Toshiba says, and can reduce static electricity voltage. The product is also suitable for ESD protection in high-speed signal lines in electronic equipment, such as IoT and mobile devices.

Toshiba (Australia) Pty Ltd
www.toshiba.com.au



DIGITAL CERTIFICATE MANAGER FOR IoT DEVICES

u-blox has announced the IoT certificate manager, a security service that continuously renews device credentials in fully automated mode. Together with the company's existing zero-touch provisioning service, it provides out-of-the-box onboarding to IoT cloud platforms with total control of the device certificate life cycle.



Certificate life cycle control targets IoT devices that integrate with IoT cloud platforms including the AWS IoT Core, Azure IoT Hub and DPS services. While these take charge of device management and data aggregation, the u-blox service provides an effortless and secure way to manage the X.509 certificates required for device authentication.

Certificate management efforts grow exponentially with increasing fleet size. While in the past issued certificates remained valid throughout a device's life cycle, increases in infrastructure complexity and risks have forced regulatory authorities to demand more frequent renewals. Failure to meet renewal deadlines can expose devices to cyber threats, disrupt service availability and undermine business.

The IoT certificate manager eliminates the task of manually managing credential renewal on thousands of devices. Designed and optimised for IoT scenarios, it eliminates the errors that can occur during manual operation on large IoT deployments, freeing resources for other activities. Delivery via the intuitive Thingstream IoT service delivery platform, with its simple and flexible price plans, enables users to reduce time to market.

The certificate manager futureproofs protection by increasing security levels over the entire device lifetime. Building on the root of trust included in u-blox SARA-R5 series LTE-M cellular modems, it provides a fully integrated silicon-to-cloud security solution. It enables IoT solution developers to easily manage device credentials for an IoT lifetime, to scale seamlessly from prototyping to huge fleets, and to minimise set-up costs.

u-blox Singapore Pte Ltd
www.u-blox.com

ELECTRICALLY CONDUCTIVE INK

Creative Materials introduces the 129-32 thermoformable in-mould compatible electrically conductive ink. Applied by conventional screen printing, the product is formulated to provide good thermoforming characteristics and meets the high temperature and pressure requirements of the in-mould electronics (IME) process.

The material is designed to be flexible for forming and is resistant to washout during the moulding process. It features good adhesion to ABS, polyester, PMMA, polycarbonate (PC) and a variety of other high-energy surfaces. Applications include, but are not limited to, EMI/RFI shielding, polymer thick film circuitry, bus bars for backlight switches, and capacitive or resistive touch circuitry.

Creative Materials Inc
www.creativematerials.com





MANUFACTURING IN 2022 AND BEYOND

SC Manufacturing Solutions, with over 30 years' experience, has been a trusted name in providing high-quality equipment, spare parts, repairs, process assistance and know-how. With extensive knowledge on screen printing, pick and place, reflow, AOI, X-ray, smart storage, board handling, wave soldering, selective soldering and board handling, we will have the right solution for your manufacturing needs.

Cluso Smart Inventory Management Systems has everything you need to be able to streamline your production. With hand scanners and RGB lights, your staff can now easily retrieve the right part at the right time, dramatically cutting down time to replenish parts to your pick-and-place machines creating higher utilization rates. Setting up kits/jobs for the next production run has never been easier. Select the job from the hand scanner and follow the lights to your parts.

With full traceability to ISO13485, Cluso keeps track of all of your stock in the whole of the factory, so there are no more lost reels. With the introduction of the S2, Cluso has been able to double the storage density of 7" reels and the integration of optical sensors has cut down the storage and retrieval times of reels even more.

Key Features

- Simplifies receiving, storage and retrieval.
- Eliminates kitting.
- Automatically monitors stock levels.
- Enforces first-in-first-out.
- Delivers full traceability to ISO13485.
- Reduces warehousing space.
- Multi Simultaneous Users

CyberOptics SQ3000 3D System is a leap forward in inspection technology. Loaded with powerful tools combining SPI, 3D AOI and CMM in a single machine, you will have all your needs covered. The proprietary 3D projector, multi-sensor placement, multi-suppression reflection (MSR) technology provides you with unparalleled image and measuring/inspection capabilities. Every pixel of every measurement is a multi 3D height measurement.

The SQ3000 offers unmatched accuracy with the revolutionary Multi-Reflection Suppression™ (MRS) technology by meticulously identifying and rejecting reflections caused by shiny components. Effective suppression of multiple reflections is critical for accurate measurement, making MRS an ideal technology solution for



a wide range of applications including those with very high quality requirements.

Metrology-Grade Accuracy at Production Speed

- Achieve metrology-grade accuracy at production speed enabled by MRS technology.
- Attain repeatable and reproducible measurements for SMT, semiconductor, microelectronics and metrology applications.

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- Add on CyberReport™ for full-fledged machine-level to factory-level SPC capability.

Richer SPI Experience with Closed Loop, Feedback - Feed Forward

- Optimize printing process by proactively analyzing current trend data with the standalone SPI software and CyberPrint Optimizer.
- Enable smarter and faster inspection that provides reduction in rework costs, minimizes scrap and optimizes print process.



SC Manufacturing Solutions Pty Ltd
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EMBEDDED ANTENNA

Antenova has released its latest antenna, the Atta, for LTE and smart wireless deployments in the 410 and 450 MHz bands. It comes in a flexible printed circuit (FPC) form and measures 101 x 20 x 0.15 mm.

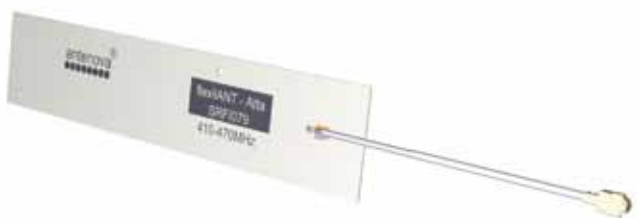
LTE 450 MHz is used by private network providers in the utilities, public safety and transport sectors, who use it for M2M traffic, smart grids, smart cities, EV charging and rural broadband networks. The 450 MHz band compares favourably to 900 MHz for these applications, because at 900 MHz four times as many base stations are needed to cover the same geographical area.

The antenna provides connectivity for devices on these networks, in particular meters and rugged smartphones, and handheld mobile devices using Cat 4 modules. It is supplied with an I-PEX mating connector for direct integration to a circuit board and a self-adhesive pad to fix it easily in position. It is therefore easy to integrate into a design.

The 450 MHz frequency allows good antenna propagation and large coverage for each base station, and a flexible antenna gives designers a number of options for product design. The antenna can be folded, curved or placed flat in a design, or tucked inside the housing of a small device. Available in samples or production quantities, it is suitable for OEMs and specialist wireless design projects.

Antenova Limited

www.antenova.com



SMARC MODULE

ADLINK Technology has released the LEC-RB5 SMARC module — its first SMARC AI-on-module based on a Qualcomm Technologies processor. It is capable of powering robots and drones in consumer, enterprise, defence, industrial and logistics sectors.

The Qualcomm QRB5165 processor is designed for robotics and drones applications and integrates several IoT technologies in a single solution. The LEC-RB5 SMARC module provides on-device artificial intelligence (AI) capabilities, support for up to six cameras and low power consumption, making it suitable for the next generation of high-compute, low-power robots and drones. It empowers users to do everything they need for complex AI and deep learning workloads at the edge without relying on the cloud.

The SMARC module provides the capability to build powerful robots for use in harsh industrial conditions and in temperatures that range from -30 to +85°C. Part of ADLINK's portfolio of SMARC form factors that support both ARM and x86 designs, it will support the proliferation of 5G in robotics and intelligent systems.

The module provides enhancements for computer vision (CV) applications with low latencies for real-time image processing decisions, freeing up capacity for other critical AI applications while delivering mobile-optimised CV experiences. Hardware acceleration for advanced CV applications with on-device AI capable of running complex AI and deep learning workloads with low power makes the module advantageous for a wide variety of industrial and consumer applications.

ADLINK Technology Inc

www.adlinktech.com

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					SigFox
					LoRaWAN

GRAPHIC OPERATION TERMINALS

Mitsubishi Electric has added two graphic operation terminals (GOTs) to its GOT SIMPLE Series line-up. The 10" GS2110-WTBD-N and 7" GS2107-WTBD-N widescreen models, which support virtual network computing (VNC), can be used as VNC servers enabling remote access from offices or other remote locations where field engineers may find themselves. This feature will help meet users' needs for improved work efficiencies when performing monitoring and maintenance in factories, buildings, utilities and other automation applications.

Another key feature of the GOT models is a 1.5x increase in onboard memory capacity to 15 MB, making it easier to save more screen designs. Furthermore, by using an SDHC memory card, operation logs can be recorded in chronological order to achieve enhanced traceability. This can be useful for validating operations as well as troubleshooting when identifying misoperation or the potential root causes of problems.

The latest models in the series support outline fonts, offering clearer visibility of text on the screen by smoothing out edges of textual characters. This increased clarity can help prevent misreading but can also aid reading at a distance.

Mitsubishi Electric has enhanced the built-in interfaces for the latest models. In addition to the standard GOT SIMPLE Series interfaces of Ethernet, RS-232 and RS-422, the units also offer RS-485 support. This facilitates the connection of a wider variety of devices, such as temperature controllers and MODBUS peripherals, making it easier for users to implement connected digital manufacturing strategies in their operations.

Mitsubishi Electric Australia

www.mitsubishielectric.com.au



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BOX PC

Neusys's Nuvo-8111 series is a box PC with three expansion slots designed specifically to support a mid- to high-end 200 W NVIDIA graphics card, such as an RTX 3060/3060 Ti, to offer impressive edge AI performance. Offering GPU power up to 20 TFLOPS in FP32 for emerging GPU-accelerated applications, the product is designed to boost the performance and efficiency of factory automation, image recognition, product inspection, pick-and-place robots, etc.

The series leverages an Intel 9th/8th-Gen Core processor with H310 chipset. It has one x16 Gen3 PCIe slot for accommodating a GPU card, and an additional x4 PCIe and PCI slot for industrial I/O cards such as for DIO, AIO, communication or motion control. It features front-accessible I/Os including two GbE, four USB 3.1 Gen1 and five COM ports for easy access when it is rack-mounted or placed inside a cabinet. The system supports two 2.5" SATA SSDs/HDDs plus one mSATA socket to house an mSATA SSD.

The product seeks to fulfil the demand for edge AI in traditional production and factory automation applications. Its mid- to high-end GPU support, expansion capability, and compact and rugged design will help play a role in bringing artificial intelligence to the edge and factory floor.

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Sensor connectivity vital as SP80 attempts sailing speed record

The designers of the wind-powered boat SP80 have chosen Fischer Connectors for the data-transmission solutions interconnecting the various sensors that will equip the boat and its pilot to break the world sailing speed record. The technical challenge is to sail at a speed of 80 knots (148.16 km/h), powered only by the wind — 14.55 knots faster than the record of 65.45 knots (121.21 km/h) set in 2012.

The carbon-fibre SP80 boat looks like a Formula 1 car combined with a fighter jet designed specially to glide on the water, featuring a super-ventilating triangular hydrofoil and towed by a huge kite wing. It is one of several projects in the running to break the longstanding world sailing speed record, according to Mayeul van den Broek, CEO of the SP80 start-up based in Renens, Switzerland.

"This technological adventure is fascinating, as we're confronted with extremely challenging physical laws," said van den Broek. "That's why our international team of nearly 50 people ... is anxious to get the very best in terms of data-transmission performance and reliability. These technical requirements are crucial when it comes to interconnecting the various sensors with which our boat and its pilot will be equipped during the launch and the boat's enhancement runs scheduled for the end of the year, and the record-breaking event scheduled for next year."



The data collected by the multiple sensors and loggers monitoring the boat's structure and the pilot's performance will be transferred through the connectors, associated cables and electronic solutions of Fischer Connectors, a Swiss-headquartered supplier of high-performance connectivity solutions that are known for their ruggedness and resistance to demanding operating conditions such as marine and underwater, defence and security, medical and test and measurement.

"The technology partnership with Fischer Connectors is a logical step forward in our record-breaking ambition," said van den Broek. "The innovations we're putting in place to enhance our boat's aerodynamics above water and minimise the friction of its hull and foil under water

need to be monitored during the boat's development phase as well as during the speed run itself. To ensure the efficient transfer of these monitoring data, we need a solutions provider that has not only expertise in signal integrity and data transmission and management, but also a holistic approach to electronic systems in order to provide the end-to-end connectivity solutions required for our sensing system."

During the design phase, sensors are used to improve and control the robustness of the high-performance materials (carbon, titan, stainless steel) of the boat's structure. Thanks to the design of the super-ventilated foil, stability is optimised and the impact of cavitation — a phenomenon in which water starts boiling around foils at extreme velocities, slowing the boat down — is avoided. During the speed run, data are collected from the various electronic modules and control sensors directly integrated into the boat, and from the monitoring sensor communications between the pilot and the technical crew onshore, including biometric data transferred through sensors worn on the pilot's body such as vital and security parameters.

"The SP80 project is exciting and inspiring, as it combines innovation and performance to push the boundaries of physical laws thanks to unique solutions and daring concepts," said Fischer Connectors CEO Jonathan Brossard. "One member of the SP80 R&D team is part of our own R&D centre, making the exchange of expertise all the more efficient and easier. We look forward to discovering the technological breakthroughs on which the SP80 team is working, and which Fischer Connectors is proud to support."

The launch of the boat will take place at the end of 2022, while the first tests are scheduled in the South of France for the spring or autumn of 2023 — the two periods of the year that offer the best weather conditions for sailing.

Fischer Connectors
<https://fischerconnectors.com/en/>

RESEARCHERS DEVELOP A 3D-PRINTED, FLEXIBLE OLED DISPLAY

Researchers at the University of Minnesota Twin Cities have used a customised printer to fully 3D print a flexible organic light-emitting diode (OLED) display.

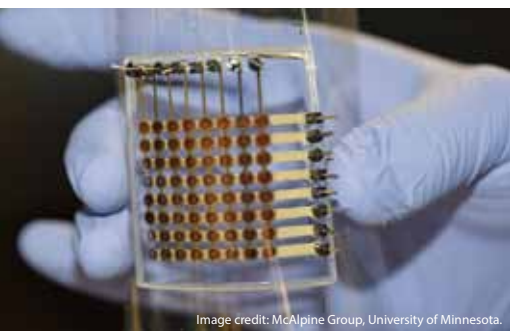


Image credit: McAlpine Group, University of Minnesota.

Described in the journal *Science Advances*, their discovery could result in low-cost OLED displays that could be widely produced using 3D printers by anyone at home, instead of by technicians in expensive microfabrication facilities.

OLED display technology is based on the conversion of electricity into light using an organic material layer. OLEDs function as high-quality digital displays, which can be made flexible and used in both large-scale devices such as television screens and monitors as well as handheld electronics such as smartphones. OLED displays

have gained popularity because they are lightweight, power-efficient, thin and flexible, and offer a wide viewing angle and high contrast ratio.

"OLED displays are usually produced in big, expensive, ultraclean fabrication facilities," said Professor Michael McAlpine, senior author of the study. "We wanted to see if we could basically condense all of that down and print an OLED display on our tabletop 3D printer, which was custom-built and costs about the same as a Tesla Model S."

The group had previously tried 3D printing OLED displays, but they struggled with the uniformity of the light-emitting layers. Other groups partially printed displays but also relied on spin-coating or thermal evaporation to deposit certain components and create functional devices.

In this latest study, the research team combined two different modes of printing to print the six device layers that resulted in a fully 3D-printed, flexible organic light-emitting diode display. The electrodes, interconnects, insulation and encapsulation were all extrusion printed, while the active layers were spray printed using the same 3D printer at room temperature. The display prototype was about 1.5" on each side and had 64 pixels. Every pixel worked and displayed light.

"I thought I would get something, but maybe not a fully working display," said first author Ruitao Su, a University of Minnesota PhD graduate who is now a postdoctoral researcher at MIT. "But then it turns out all the pixels were working and I can display the text I designed. My first reaction was 'It is real!'"

The 3D-printed display is also flexible and can be packaged in an encapsulating material, Su said, which could make it useful for a wide variety of applications. "The device exhibited a relatively stable emission over the 2000 bending cycles, suggesting that fully 3D-printed OLEDs can potentially be used for important applications in soft electronics and wearable devices," he revealed.

The researchers said the next steps are to 3D print OLED displays that are higher resolution with improved brightness. According to Prof McAlpine, "It is not hard to imagine that you could translate this to printing all kinds of displays ourselves at home or on the go within just a few years, on a small portable printer."

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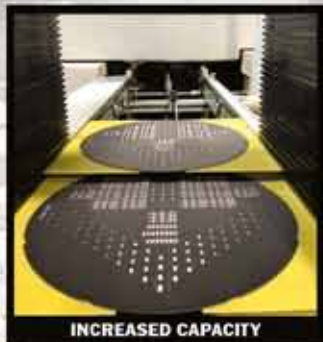
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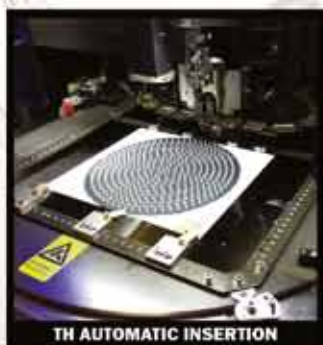
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