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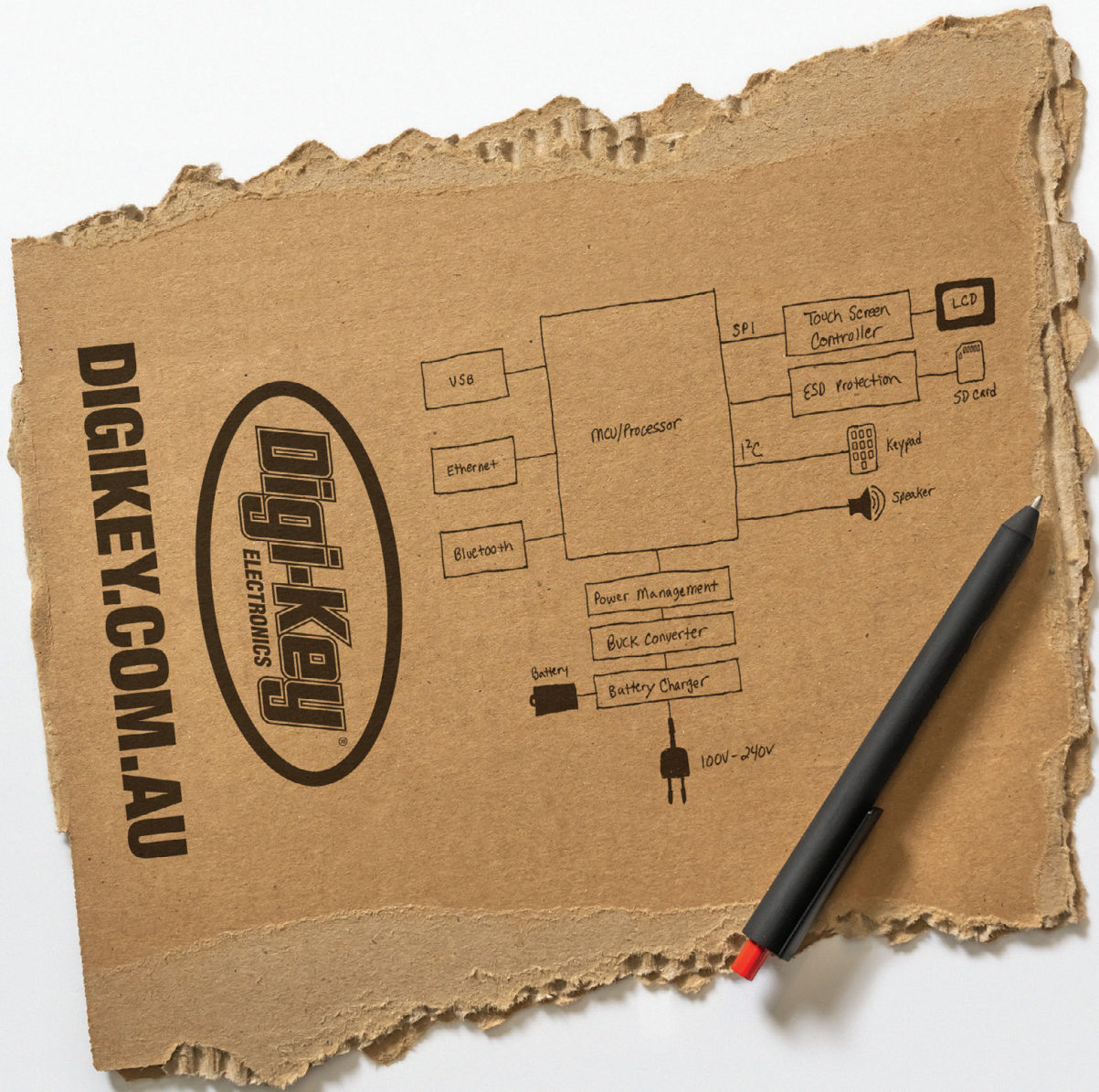


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COVER STORY



The 2 Series MSO is a tiny yet mighty scope — weighing in at less than 1.8kg and just 40mm thin — can go seamlessly from bench to field and back again. Plus, with the battery option providing hours of cordless power, users can expect to discover a whole new level of freedom on the job.

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DC VOLTAGE CONVERTERS — HOW TO CHOOSE THE RIGHT ONE?

Voltage converter, voltage divider, linear stabiliser — which one should you choose?

Every electronic device requires a suitable power source. In most cases we simply insert the plug into the socket. It is worth noting, however, that there are very few devices powered by variable voltage of 230 V, which is available from the socket, while much more commonly it is constant voltage of much lower electric potential that is required. To supply such voltage, manufacturers design appropriate, often very extensive, power supply sections, or equip their devices with a port to which you can plug the connector of a standard plug-in power supply. It may also happen that the correct operation of the device requires several voltages with different values. In this case, the developers have to appropriately lower or sometimes increase the input voltage.

Three power supply methods: voltage converter, voltage divider, linear stabiliser

There are basically three ways to supply power: the power supply section can be based on a voltage divider, a linear stabiliser or a voltage converter. Each of these methods can be applied to lower the voltage, but only converters allow to increase the voltage.

Voltage dividers

The first method of implementing the power supply section that you may encounter is based on a voltage divider. The operation of such a circuit is based on Ohm's law and the voltage deposited on individual resistors. By manipulating their value, you can get a voltage of any value at the output, but it will be lower than the input voltage.

However, this way of powering the device has some disadvantages. The first of them is the current efficiency — a voltage divider is made of resistors whose power is usually very low. Any higher current will cause the resistors to burn very quickly. Of course, you can use more powerful resistors, but this would considerably increase the price of such a circuit. Another major disadvantage is that the divider is always designed with a specific input voltage in mind. If it is increased or decreased, the output voltage will also change.

Linear stabilisers

Linear stabilisers are another solution to lower the input voltage. Produced mostly in the form of components with three legs, they are quite common in consumer electronics. Their task is very simple — to maintain a constant value of voltage at the output, regardless of the input voltage. Of course, it should be remembered that the input voltage must be higher than the output voltage. Components of this type are characterised by a low price, but have a problem of heat dissipation. Any linear stabiliser must convert the difference between the input voltage and the desired output voltage into heat energy. This results in the fact that even at low currents, the component heats up very quickly, due to which additional heat sinks must be used, which of course translates into higher costs.

Voltage converters

A third possibility of implementing a power supply system is to base it on a voltage converter. It consists of several basic components: a coil, a switching transistor, capacitors, resistors and a silicon diode. A

voltage converter is a much more complex device compared to the previously presented solutions. They come in several variants and can both increase and decrease the output voltage in relation to the input voltage.

Why is it worth choosing a voltage converter?

Voltage converters are characterised by one feature that is useful in the process of designing electronic devices, namely efficiency. As you already know, power losses are quite a big disadvantage of linear stabilisers. In this respect, converters are much more economical. Every voltage converter has a parameter defined as efficiency, which is expressed as a percentage and refers to the ratio of the output power to the power drawn from the source. In other words, if the device has an efficiency level of 80%, it means that 20% of power is lost in the form of heat dissipated mainly by the transistor and the coil. However, it is important to know that the efficiency is not a constant value and depends on the operating conditions of the converter, mainly on the supply voltage, output voltage and load current.

Beside their advantages, voltage converters also have a disadvantage, ie, interference. Due to their design and operating principle, the output voltage of an inverter is not perfectly constant. This can be a problem if we need to power a circuit that needs a perfectly constant voltage. In such a case it is necessary to place an RC filter at the output of the converter.

Thanks to their compact dimensions and high efficiency, voltage converters can be used virtually anywhere. When designing any device, it is worth choosing this type of component.

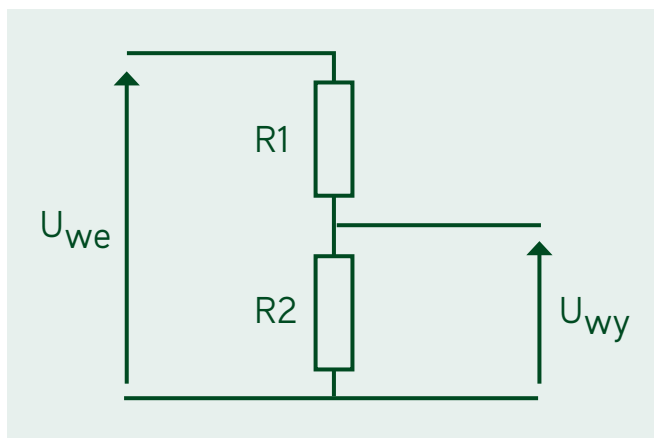


Figure 1: A diagram of a simple voltage divider.

Voltage converter — how does it work?

A voltage converter is a pulse element that, in simple terms, reduces voltage by switching it (alternating on and off). This process is so fast that it does not interfere with the operation of the powered device or system. The element controlling the switching in DC/DC converters is usually a MOSFET. However, for the DC voltage to appear at the output of the device, additional elements such as capacitors and an inductor (choke) are needed. While capacitors only play the role of filters here, the inductive element has the task of storing energy while the device is working, in order to return it later. In addition, a silicon diode controlling the direction of the flowing current must be placed in the converter circuit.

Voltage converter: types

There are several types of voltage converters available on the market, the most popular being:

- step-down (buck) converter — reduces voltage
- step-up (boost) converter — increases voltage
- step-up/down (SEPIC) converter — reduces or increases the output voltage.

In addition, there are other designs, the most interesting of which include:

- Forward converter — a type of DC/DC converter based on a transformer. It is a single-switch element — the energy drawn from the source is transferred to the output in real time. Thanks to the use of a transformer, the forward converter allows the input and output to be galvanically separated.

Forward converters are used in switching power supplies with a power output of less than a few hundred watts and in inverter welders.

- Flyback converter — a type of DC/DC converter which also uses galvanic separation of input and output. It is a two-switch device; the energy is accumulated in the magnetic field of the coil in the first phase and returned in the second phase. Systems of this type are used primarily in low-power switched-mode power supplies.

Voltage converter: what should you consider when choosing one?

The choice of a suitable converter depends mainly on what device you are designing. If you want to design a small portable device, it is worth considering miniature converters. For larger equipment, you can use converters of bigger dimensions with a built-in heat sink to facilitate heat dissipation. Additionally, it is necessary to specify the type of converter needed — step-up, step-down or step-up/down.

If you wish to minimise energy losses, it is worth equipping yourself with voltage converters of the highest possible efficiency. The standard efficiency of such devices falls within the range of 80–95%. Additionally, it is worth remembering about the basic parameters of the converter, such as: maximum output current, output voltage range and input voltage range.

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THE CHOICE OF A SUITABLE CONVERTER DEPENDS MAINLY ON WHAT DEVICE YOU ARE DESIGNING.

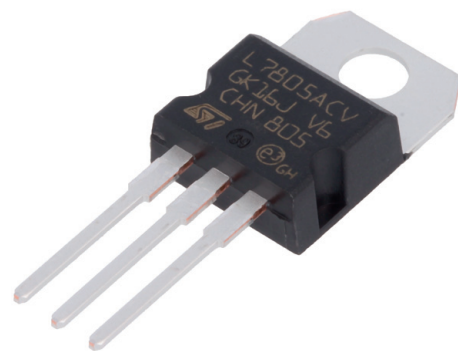


Figure 2: Linear stabiliser L7805ACV.



Figure 3: Voltage converter OKY3497-5.

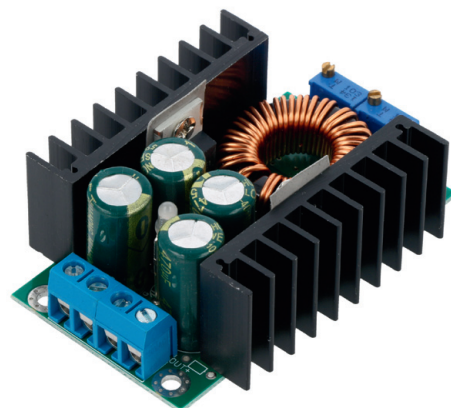


Figure 4: Voltage converter OKY3497-4.

STM32G4

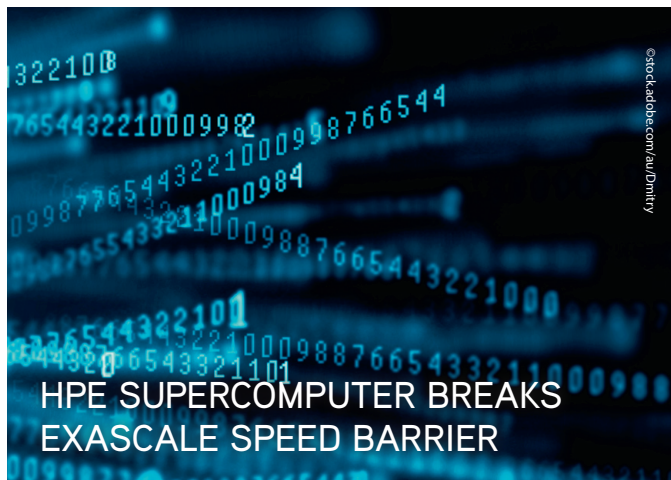


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Frontier, a new supercomputer built by Hewlett Packard Enterprise (HPE) for the US Department of Energy's Oak Ridge National Laboratory, has become the first supercomputer to break the exascale speed barrier.

The supercomputer has been rated at 1.1 exaflops, according to the Top500 list of the world's most powerful supercomputers, which would make it both the world's fastest supercomputer and the world's first supercomputer to break the exascale speed barrier.

At the same time, Frontier has been rated as the world's most

energy-efficient supercomputer on the Green500 list, with 32% higher efficiency compared to the previous leader. Frontier also ranked number one in a category called mixed-precision computing, which rates performance in formats commonly used for artificial intelligence, with a performance of 6.88 exaflops.

The supercomputer is able to solve problems that are eight times more complex up to 10 times faster, and is expected to reach even faster speeds with a theoretical peak performance of 2 exaflops, according to HPE Executive Vice President and General Manager, HPC & AI Justin Hotard.

"Today's debut of the Frontier exascale supercomputer delivers a breakthrough of speed and performance, and will give us the opportunity to answer questions we never knew to ask," he said.

"Frontier is a first-of-its-kind system that was envisioned by technologists, scientists and researchers to unleash a new level of capability to deliver open science, AI and other breakthroughs that will benefit humanity. We are proud of this moment, which continues the United States' leadership in supercomputing, now including exascale, made possible by the ongoing public and private partnership between the US Department of Energy, Oak Ridge National Laboratory, HPE and AMD."

Frontier is built with HPE Cray EX supercomputer units that are expected to enable dramatic breakthroughs in AI as well as supporting modelling and simulating complex scientific research, across biological, physical and chemical sciences, with higher resolution.

STORAGE CAPACITY IMPROVED IN ORGANIC RADICAL BATTERIES

With the aim of one day powering small electronic devices and diverting toxic waste from landfill, researchers at Flinders University and Zhejiang Sci-Tech University have used a catalysis strategy to produce two-electron storage in organic radical batteries, or 'ORBs' — a big advance in improving their storage capability.

The emerging rechargeable battery technology uses more environmentally friendly materials than current metal-based batteries. ORBs can be made from sustainable organic compounds to reduce reliance on lithium and cobalt — rare materials that are usually not recycled in modern batteries and end up in rubbish.

The take-up of ORBs in electronics and other small device markets has so far been limited because of their lower capacity than commercialised lithium-ion batteries. Previous research has found that only one electron can be reversibly stored in the materials, which only provides the battery with a maximum capacity of 110 mAh/g.

"Catalysis has been widely used in lithium-based batteries such as lithium-oxygen batteries and lithium-sulfur batteries to improve their energy and power performance," said Dr Zhongfan Jia, a research leader at Flinders' Institute for Nanoscale Science & Technology. The research team applied this strategy to ORBs and successfully achieved reversible two-electron storage in a polymer-based ORB.



Dr Zhongfan Jia is developing better battery storage capability for electroactive polymer 'organic radical batteries' at his Flinders University laboratory.

The research team recently reported in *Chemical Engineering Journal* the development of an all-organic polymer battery with a cell voltage of 2.8 V, which is one of the highest voltages in organic batteries. Their latest work, published in *ACS Energy Letters*, further increases the energy storage capability.

"This battery can deliver a capacity of 175 mAh/g, which is comparable to the commercialised lithium-ion battery," Jia said.

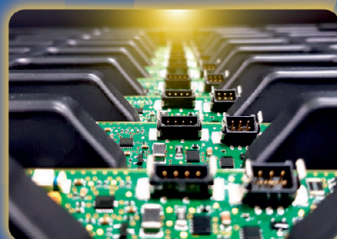
"Our next goal is to combine these advances to develop organic batteries that can be implemented in consumer electronics."



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WEARABLE MOTION SENSORS CREATED BY EXTRUSION PRINTING

The advent of high-resolution extrusion printing — think 3D printing but with ink that conducts electricity — has enabled researchers at The University of British Columbia (UBC) to explore the potential of wearable motion sensor devices that can be integrated into clothing and equipment.

In collaboration with Drexel University and the University of Toronto, the UBC research team is exploring a high-resolution extrusion printing approach to develop tiny devices with dual functionality — electromagnetic interference (EMI) shields and a body motion sensor. Tiny and lightweight, these EMI shields can have applications in the healthcare, aerospace and automotive industries.

“Advanced or smart materials that provide electrical conductivity and flexibility are highly sought-after,” said UBC’s Dr Mohammad Arjmand. “Extrusion printing of these conductive materials will allow for macro-scale patterning, meaning we can produce different shapes or geometries, and the product will have outstanding architecture flexibility.”

Currently, manufacturing technologies of these functional materials are mostly limited to laminated and unsophisticated structures that don’t enable the integration of monitoring technologies. But UBC doctoral student Ahmadreza Ghaffarkhah explained that these printed structures can be seeded with tiny cracks in the structures to track small vibrations in their surroundings, thus resulting in highly sensitive sensors.

“These vibrations can monitor a multitude of human activities, including breathing [and] facial movements, talking as well as the contraction and relaxation of a muscle,” Ghaffarkhah said.

Previously, extrusion printing technology didn’t allow for high enough printing resolution, so it was difficult to manufacture highly precise structures. Using a two-dimensional inorganic nanomaterial called MXene, alongside a conductive polymer, the research team has now customised a conductive ink with a number of properties that make it easier to adapt into wearable technologies.

“Compared to conventional manufacturing technologies, extrusion printing offers customisation, reduction in materials waste and rapid production, while opening up numerous opportunities for wearable and smart electronics,” Arjmand said. “As extrusion printing techniques improve, it is opening the door to many unique innovations.”

With their study now published in the journal *Carbon*, the researchers continue to investigate additional applications for extrusion printing inks that go beyond EMI shields and wearable electronics.

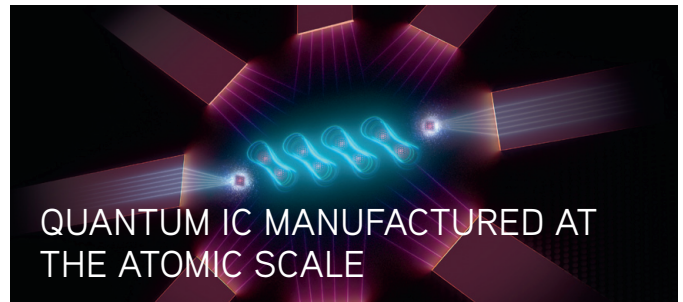
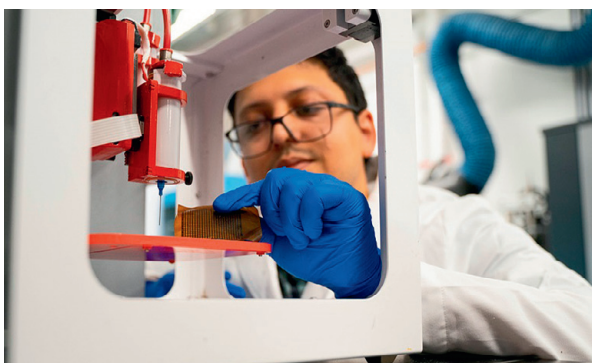


Image credit: SQC

QUANTUM IC MANUFACTURED AT THE ATOMIC SCALE

Australian quantum computing manufacturer Silicon Quantum Computing (SQC) has developed what is claimed to be the world’s first integrated circuit manufactured at the atomic scale. The breakthrough comes less than a decade after the company’s founder, Michelle Simmons, contributed to the fabrication of the world’s first functioning single-atom transistor.

Delivery of the atomic-scale integrated circuit, which operates as an analog quantum processor, has been achieved two years ahead of schedule. SQC has already used this quantum processor to model the quantum states of a small, organic polyacetylene molecule — something that traditional computers would struggle to do — proving the validity of the company’s technology for modelling quantum systems. Their modelling has been described in the journal *Nature*.

To achieve the quantum integrated circuit, SQC needed to realise three separate technological feats of atomic engineering: the creation of small dots of atoms of uniform size so that their energy levels aligned and electrons could easily pass through them; the ability to tune the energy levels of each dot individually, but also of all dots collectively, to control the passage of quantum information; and the ability to control the distances between the dots with sub-nanometre precision so that the dots were close enough but remained independent for the quantum coherent transport of electrons across the chain.

“This is a major breakthrough,” said Simmons, who was named Australian of the Year in 2018 for her work in quantum physics.

“Today’s classical computers struggle to simulate even relatively small molecules due to the large number of possible interactions between atoms. Development of SQC’s atomic-scale circuit technology will allow the company and its customers to construct quantum models for a range of new materials, whether they be pharmaceuticals, materials for batteries or catalysts. It won’t be long before we can start to realise new materials that have never existed before.”

The result is also a validation of SQC’s atomic manufacturing capabilities. To build the processor, SQC had to integrate multiple atomic components within a single device, which it did from its facility in Sydney.

“The exquisite precision of the device validates SQC’s technical strategy to focus on quality as opposed to quantity,” Simmons said. “We have created a superbly precise manufacturing technology that is opening the door to a whole new world. It is a huge step towards building a commercial quantum computer.”

The breakthrough quantum processor meets the stringent requirements for scaling quantum computing hardware, representing a milestone on the road to achieving the company’s goal of delivering an error-corrected processor. SQC is now scaling its quantum hardware to take on heavy-duty computational tasks that cannot be performed by traditional computers.

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STRETCHABLE

FABRIC GENERATES ELECTRICITY FROM BODY MOVEMENT

Scientists at Nanyang Technological University, Singapore (NTU Singapore) have developed a stretchable and waterproof fabric that turns energy generated from body movements into electrical energy. It is made with stretchable spandex as a base layer and integrated with a rubber-like material to keep it strong, flexible and waterproof.

The fabric developed by the NTU team is an energy-harvesting device that turns vibrations produced from the smallest body movements in everyday life into electricity. The prototype fabric produces electricity in two ways: when it is pressed or squashed (piezoelectricity); and when it comes into contact or is in friction with other materials, such as skin or rubber gloves (triboelectric effect).

To fabricate the prototype, the scientists first made a stretchable electrode by screen-printing an 'ink' comprising silver and styrene-ethylene-butylene-styrene (SEBS), a rubber-like material found in teething rings and handlebar grips, to make it more stretchable and waterproof. This stretchable electrode is then attached to a piece of nanofibre fabric that is made up of two main components: poly(vinylidene fluoride)-co-hexafluoropropylene (PVDF-HPF), a polymer that produces an electrical charge when compressed, bent or stretched; and lead-free perovskites, a promising ma-

terial in the field of solar cells and LEDs.

"Embedding perovskites in PVDF-HPF increases the prototype's electrical output," said PhD student Jiang Feng, a member of the research team. "In our study, we opted for lead-free perovskites as a more environmentally friendly option."

"While perovskites are brittle by nature, integrating them into PVDF-HPF gives the perovskites exceptional mechanical durability and flexibility. The PVDF-HPF also acts as an extra layer of protection to the perovskites, adding to its mechanical property and stability."

The result is a prototype fabric that generates 2.34 W/m^2 of electricity — enough to power small electronic devices, such as LEDs and commercial capacitors. In a proof-of-concept experiment reported in the journal *Advanced Materials*, the team showed how a hand tapping on a $3 \times 4 \text{ cm}$ piece of the fabric generated enough electrical energy to light up 100 LEDs or charge various capacitors, which store

electrical energy and are found in devices like mobile phones.

The fabric demonstrated good durability and stability — its electrical properties did not deteriorate following washing, folding and crumpling. It also continued to produce a continuous stable electrical output for up to five months, demonstrating its potential for use as a smart textile and wearable power source.

"There have been many attempts to develop fabric or garments that can harvest energy from movement, but a big challenge has been to develop something that does not degrade in function after being washed, and at the same time retains excellent electrical output," said study leader Professor Lee Pooi See. "In our study, we demonstrated that our prototype continues to function well after washing and crumpling."

The scientists showed that the fabric could harness energy from a range of human movements by attaching it to the arm, leg, hand and elbow, as well as to the insoles of



shoes, and did so without impacting on the movements. According to Lee, “We think it could be woven into T-shirts or integrated into soles of shoes to collect energy from the body’s smallest movements, piping electricity to mobile devices.”

Lee continued, “Despite improved battery capacity and reduced power demand, power sources for wearable devices still require frequent battery replacements. Our results show that our energy-harvesting prototype fabric can harness vibration energy from a human to potentially extend the lifetime of a battery or even to build self-powered systems.

“To our knowledge, this is the first hybrid perovskite-based energy device that is stable, stretchable, breathable, waterproof, and at the same time capable of delivering outstanding electrical output performance,” Lee concluded. The team is now looking at how the same fabric could be adapted to harvest different forms of energy.

IoT EXPLORER KIT

The u-blox XPLR-IOT-1 IoT explorer kit is an all-in-one package to test, evaluate and validate IoT applications. Integrating all relevant u-blox technologies and services into a capable prototyping platform with a vast selection of sensors and interfaces as well as cloud connectivity, the multifunctional application board gives users everything they need to prototype low-power IoT use cases such as logistics container trackers, industrial automation, sensor-to-cloud applications and fleet management solutions.

The board’s u-blox NORA-B106 Bluetooth LE 5.2 radio module doubles as its main MCU, hosting the application software and controlling the other modules. The board also hosts an ultralow-power MAX-M10S positioning module capable of concurrently tracking four global navigation satellite system (GNSS) constellations, delivering location data wherever GNSS coverage is available.

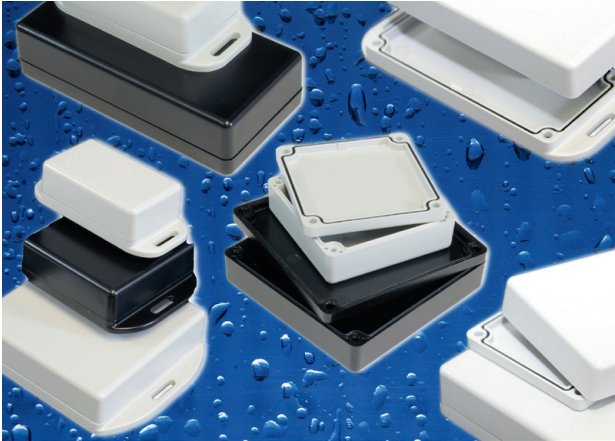
The hardware is complemented by a broad selection of sensors commonly used in IoT applications, including accelerometers and gyroscopes, a magnetometer, and temperature, humidity, pressure and ambient light sensors. A power-on switch, LEDs and user buttons make it easy for users to interact with the device.

The product offers engineers an easy way to start working with u-blox’s services offering. It includes a trial of MQTT Anywhere, which delivers ultralow power by communicating data between the device and the enterprise using the MQTT-SN (MQTT for sensor networks) protocol. Tracking applications with stringent power requirements such as freight container trackers can realise long battery life with u-blox’s positioning in cloud service, CloudLocate, while the CellLocate mobile-network-based location service extends tracking beyond the reach of GNSS signals.

Developers working with the kit can use code from u-blox’s ubxlib GitHub repository, a library of software examples for key use cases, to speed up the prototyping of solutions, which can range from wireless sensor networks to indoor and outdoor tracking solutions to industrial or smart building gateways. Because all hardware design files, software, smartphone app and online dashboard source code are shared, the kit can also serve as a starting point for commercial end-product design.

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MINIATURE IP68 SEALED ENCLOSURES

Hammond Electronics has introduced the 1551W Series — IP68 sealed versions of its 1551 miniature enclosure family. Launched in an initial five sizes, all available with a plain or flanged lid, the UL94-V0 polycarbonate enclosures are suitable for use inside or outside.

They are available in black and grey with a soft texture finish, fitted with PCB stand-offs in the base. The pre-formed silicone sealing gasket provides protection against the ingress of dust or water, protecting the housed electronics.

The initial five sizes range from 60 x 35 x 22 to 100 x 59 x 25 mm. The flanged lid versions make mounting to any surface a simple process and provide a degree of tamper resistance by preventing access to the lid and base securing screws.

Hammond Electronics Pty Ltd
www.hammfg.com

HIGH-VOLTAGE, NON-ISOLATED DC-DC CONVERTERS

The NiQor converter series offers solutions for converting high-powered variable voltages to a wide range of output voltages. With ultra-wide input up to 9–60 V, the series provides an adjustable range of 0–90 VDC output. The high-power converters can provide maximum output power up to 2000 W in a half-brick package, with quarter- and eighth-brick packages for lower power. The non-isolated, buck-boost DC-DC converter is designed to provide engineers with higher efficiency (up to 96%), more power and more design flexibility.

The output voltage is user selectable via external resistor from 0 to 90 V. The converter also features a settable output current limit, suitable for battery charging applications. Other features include an operating temperature range from -40 to +100°C, no minimum load requirement, remote sense and current analog signal provided for control function. The converter's efficiency and maximum output current are dependent on the input and output voltage. Users can refer to the datasheet for performance based on their specific application requirements.

The high-density power converters provide 60 W output power in a quarter-brick package. Their patented transformer design allows the converters to perform with a high efficiency of up to 92.5%. The optimised manufacturing process and construction, certified to ISO 13485, is designed to provide high reliability.

Helios Power Solutions
www.heliosps.com.au

RUGGED MOBILE WORKSTATIONS

Getac has announced its X600 and X600 Pro, two powerful 15.6" fully rugged mobile workstations for professionals needing optimal performance when conducting complex operations in the field. Built to withstand physical impacts, harsh temperatures, moisture and dust, rugged features include IP66-rated ingress protection, MIL-STD-810H, MIL-STD-461G and optional CID2 (ANSI/UL 12.12.91) certification, vibration and 1.2 m drop resistance, with optional salt-fog resistance.

The X600 runs Windows 11 Pro and features an 11th gen Intel Core H-series processor (i5/i7/i9) with integrated Intel UHD graphics. The result is high performance in a diverse range of data- and/or graphically-intensive operational scenarios, such as defence command and control, railway track inspection, and oil and gas sensor analysis. An optional NVIDIA Quadro RTX3000 discrete graphics controller can elevate the graphical performance, while capacity for up to 128 GB of memory enables ultrafast processing speeds. The product also offers expandability, supporting three PCIe SSDs for up to 6 TB internal storage.

The X600 Pro features dual hot-swappable batteries, alongside capacity for two additional media bay batteries, which together deliver more than 240 Wh in a single device. It also includes PCMCIA and Express card slots and DVD super drive/optional Blu-ray drive support, for greater capability in and out of the field.

The devices feature connectivity options including dual 2.5GBASE-T Ethernet, Wi-Fi 6E, Bluetooth v5.2, optional dedicated GPS and optional 4G LTE with integrated GPS. They include multiple I/O interfaces, such as Thunderbolt 4, USB 3.2 Gen 2 Type-A, HDMI, DisplayPort, VGA and serial port. Physical and data security features include self-encrypting drives, smart card reader, TPM 2.0, Intel vPro technology, optional Windows Hello face authentication and optional fingerprint reader. A built-in Kensington lock slot can be used to protect the device against theft.

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TINY PoE ETHERNET MODULE

ICP DAS's tPET-P2C2 is a tiny PoE Ethernet module with 2-ch DI and 2-ch DO. The module can be remotely controlled through a 10/100 M Ethernet network by using Modbus TCP protocol. Modbus has become a de facto standard communications protocol in industry and is now the most commonly available means of connecting industrial electronic devices.

The tET/tPET series tiny Ethernet I/O modules support various I/O types, like photo-isolated digital input, relay contact, photoMOS relay and open-collector output. The modules also provide dual watchdog: CPU watchdog and host watchdog. The CPU watchdog automatically resets itself when the built-in firmware runs abnormally. The host watchdog monitors the host controller (PC or PLC), and the output of the module can go to a predefined state (safe value) when the host fails.

For space savings, the series is offered in a tiny form factor that means it can be easily installed anywhere, even directly embedded into a machine. It is equipped with two removable terminal block connectors for easy wiring and features a powerful 32-bit ARM MCU to handle efficient network trafficking.

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



SWITCH MODE DESKTOP POWER SUPPLIES

Desktop power supplies are practical solutions for both industrial and consumer equipment. Current conversion circuits are among the most important electronic circuits — and at the same time they are prone to failures caused by external factors (power surges, short circuits, etc). The use of high-quality power supplies extends the life of equipment and improves user safety. POS's POSC series desktop power supplies are an example of such a solution.

The series consists of 22 products. Depending on the model, the output voltage ranges from 12 V to 48 VDC and the nominal power is 24 to 120 W. This meets the needs of most electronic devices powered by this type of power supply. The devices have a wide input voltage range from 90 V to 264 VAC (at a frequency of 47–63 Hz) and use C8 and C14 input connectors, so they can be used all over the world.

The products have a MTBF of 100,000 h and can work in ambient temperatures from -5 to +40°C (and humidity up to 95%). Protection functions include overcurrent protection, short circuit protection and overvoltage protection. In all cases, the power supplies automatically return to normal operation when the fault is removed.

POS devices comply with a number of international standards, such as EN 62368 (power supply standards for audio/video, IT and communication products) and EN 55032 and EN 61000 (electromagnetic compatibility of multimedia equipment – emission requirements).

Transfer Multisort Elektronik
www.tme.eu

1200 V SIC FIELD-EFFECT TRANSISTORS

Qorvo has released the UF4C and UF4SC 1200 V silicon carbide field-effect transistors (FETs), a fourth-generation family of devices offering leading figures of merit in on-resistance. This makes the series suitable for power solutions in mainstream 800 V bus architectures in applications such as onboard chargers for EVs, industrial battery chargers, industrial power supplies, DC-DC solar inverters and more.

The FETs provide designers with multiple on-resistance and package options. They are offered in versions with on-resistance ($R_{DS(on)}$) values of 23 to 70 mΩ and either a three-lead TO-247-3L package or a four-lead TO-247-4L package. The TO-247-4L package incorporates a Kelvin gate to deliver ultralow gate charge and good reverse recovery characteristics, enabling designers to switch inductive loads and any application requiring a standard gate drive.

All the devices in the range can be safely driven with standard 0 to 12 or 15 V gate drive voltage, creating a suitable replacement for silicon IGBTs, FETs or super-junction devices without changing the gate drive voltage. Other notable features include an impressive threshold noise margin, preserved with a true 5 V threshold voltage, and a built-in ESD gate protection clamp.

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DC/DC converters
that help to rescue lives

DC/DC

1W to 60W with patented 2xMOPP transformers for highest performance



Approvals

IEC/EN/ES 60601-1 3.1 Ed.
IEC/EN/UL 62368-1
IEC/EN/ES 60601-1-2 4 Ed.

ISO 14971/ ISO 13485

Risk Management
Manufacturing Process
and Construction

2xMOPP

8mm Clearance/ Creepage
for CF applied Part
Equipment

< 4.5µA

Low Leakage
Current

5000m
















































































































































Operating
Altitude

-40 to +105°C

Operating
Temperature

5 Yrs

Warranty

Series	Output Power (W)	Input Ratio			Input Voltage Range (VDC)	Output Voltage										Efficiency (%)	Leakage Current max. (µA)	Package
		Semi-Regulated	2:1	4:1		3.3V	5V	5.1V	9V	12V	15V	24V	±5V	±12V	±15V			
MPU01	1				4.5-5.5, 9.6-14.4, 12-18, 19.2-28.8											85	2	SIP-9
MPL02	2				4.5-13.2, 9-18, 18-36											85	2	SIP-8
MPS02	2				4.5-12, 9-18, 18-36, 36-75											82	2	SMD-16 DIP-16
MPS04	3.5				4.5-12, 9-18, 18-36, 36-75											83	2	SMD-16 DIP-16
MPP03 MPP03W	3				4.5-9, 9-18, 18-36, 36-75 9-36, 18-75											87	2	DIP-24
MPP06 MPP06W	6				4.5-9, 9-18, 18-36, 36-75 9-36, 18-75											89	2	DIP-24
MPP10 MPP10W	10				4.5-9, 9-18, 18-36, 36-75 9-36, 18-75											89	2	DIP-24
MPM15 MPM15W	15				9-18, 18-36, 36-75 9-36, 18-75											90	2	1.6"x1"
MPM20 MPM20W	20				9-18, 18-36, 36-75 9-36, 18-75											90	2	1.6"x1"
MPD30 MPD30W	30				9-18, 18-36, 36-75 9-36, 18-75											90.5	2	2"x1"
MPQ60W	60				9-36, 18-75											92.5	4.5	Quarter Brick

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RESEARCHERS REALISE FAULT-TOLERANT OPERATION OF A QUBIT

Future large-scale quantum computers must be fault tolerant, so that reliable computations can be performed with noisy components.

Now researchers from QuTech, in collaboration with Fujitsu and Element Six, have demonstrated the fault-tolerant operation of a quantum bit using a quantum processor based on spin qubits in diamond. Their results, published in the journal *Nature*, open the door to experimentally exploring the concepts of fault-tolerant quantum computation.

Quantum computers are anticipated to be able to solve important problems that are beyond the capabilities of classical computers. To realise useful computations, billions of operations will need to be performed on the quantum bits that make up the computer. However, the basic components of a quantum computer are inevitably imperfect. So how can we ensure that such a complex system can perform computations faithfully, without error?

The solution, as originally proposed in the 90s, is to encode quantum information in 'logical' qubits that are spread out over many 'physical' qubits. This redundancy enables one to detect and correct errors, thus protecting the encoded information. A key challenge is to ensure that all operations are fault tolerant. This means that errors on a single or a few operations — for example, any one of the physical qubits inadvertently flipping its state — should not corrupt the information encoded in the logical qubits. Such fault tolerance enables reliable computation with noisy components and is the key to realising quantum computers.

A diamond logical qubit

The researchers at QuTech — a collaboration between the Delft University of Technology and the Netherlands Organisation for Applied Scientific Research — have now realised such a logical qubit using their 29-qubit quantum processor. Their qubits consist of electron and nuclear spins associated with a nitrogen-vacancy centre in diamond. These spin qubits can operate at relatively high temperatures up to 10 Kelvin and, by using ultrapure diamonds grown by Element Six, the team has previously shown that they can store quantum states coherently for minutes.

"We used five nuclear-spin qubits to encode one logical qubit and used two additional qubits to perform the measurements that identify errors," said Mohamed Abobeih, lead author on the study. A recent theoretical advance by researchers from the University of Southern California has shown that such a 7-qubit system is the smallest possible configuration that allows for fault-tolerant error correction.

The team showed that this logical qubit could be operated fault tolerantly. "First," said co-author Yang Wang, "to encode the logical qubit, we had to invent a new encoding scheme that is optimised for our processor." After that the team could show that the encoding, various basic qubit operations and the measurements used to identify errors could all be performed fault tolerantly.

"Crucially, a single fault anywhere in the system does not lead to the corruption of the logical qubit information," Abobeih said.

An important challenge that the team addressed was to process the information about errors in real time. As explained by project supervisor Tim Taminiau, "Because of the long coherence times of our qubits we could process the outcomes of the measurements 'on the fly', while the processor was running. Very few systems around the world currently have this essential capability".

More advances are needed on the path towards useful quantum computation. Barbara Terhal, who co-supervised the research, said, "While this is an exciting step forward, especially for solid-state spin qubits, there is still a long way to go for large-scale fault-tolerant computation. Truly suppressing errors will require further improvements in the number of qubits and the quality of operations."

New territory

With this demonstration, the quantum processors at QuTech have entered a new territory. Taminiau said, "It is exciting to see that we can now operate fault tolerantly on logical qubits. Until now, we were limited to operating on physical qubits, for which a single error can mean your entire computation has failed. It now becomes possible to experimentally investigate the concepts of fault tolerance."

To realise larger quantum processors, the researchers aim to take a modular approach. Small processors — similar to the one demonstrated in this work — can be linked together into a single larger processor through optical quantum interconnects.

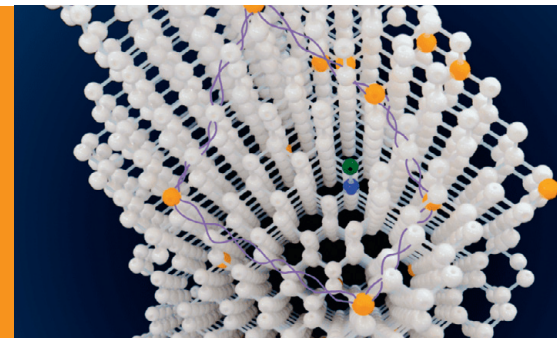
“Such optical connections have been pioneered by Ronald Hanson, also at QuTech,” Taminiau said. “Making many copies of small processors, and connecting them together into one large quantum computer, is a flexible way to address the challenge of scaling up the number of qubits.”

Realising such modular quantum processors is the focus of a larger research effort at QuTech and of its collaboration with Fujitsu. The team takes a full stack approach, in which not only improved quantum bits are studied, but also the required classical control electronics, scalable fabrication methods and new types of quantum computer architectures.

“Making the next big step will require bringing together scientists, engineers and industry,” Taminiau said.

Model of the quantum processor used in the research. The qubits are formed by the nitrogen-vacancy centre (green and blue), and ¹³C nuclear spins (orange). By spreading out a single qubit of information over five entangled spin qubits (purple connections), a logical qubit of information is formed that can be operated fault tolerantly.

Image credit: Taminiau lab at QuTech.



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Put the “Smart” in Smart Home

Easy Design with the PIC16F18076 Family of MCUs

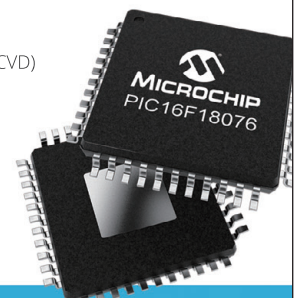
No matter what you're building, the PIC16F18076 family of MCUs can help you create faster, more feature-rich smart home technology. Now, you can easily add capacitive touch buttons, control motors, integrate IoT connectivity and monitor system health using the family's on-chip smart peripherals. And, these cost-effective MCUs integrate seamlessly with our latest GUI-based code configuration tools for a refreshingly simple development experience. Start building your next smart home appliance today using Curiosity Nano rapid prototyping hardware.

Key Features

- 8 to 44-pin packages
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- CPU Speed up to 32 MHz
- 10-bit Analog-to-Digital Converter with Computation (ADCC)
- Automated Capacitive Voltage Divider (CVD)
- 8-bit Digital-to-Analog Converter (DAC) module

Contact Information

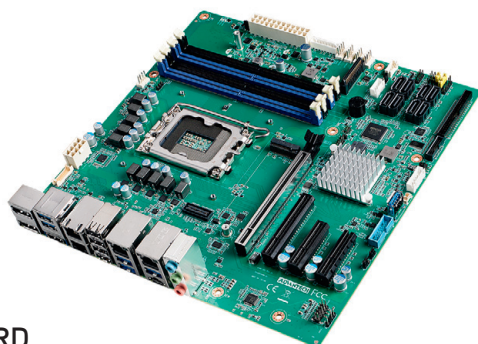
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INDUSTRIAL MOTHERBOARD

Advantech's AIMB-588 enables the delivery of good visual performance via graphics cards. These features are combined with diverse I/O, yielding an adaptable solution for medical imaging, smart surveillance and AI recognition applications. It is a suitable choice for applications requiring real-time processing and high-level graphics capabilities.

AIMB-588 provides advanced graphics processing capabilities via PCIe Gen 5 x16. Research from Intel indicates that PCIe Gen 5 x16 provides double the bandwidth and giga-transferring rate as PCIe Gen 4 — allowing data to be transferred at speeds up to 32 GT/s. These capabilities empower the use of high-performance graphics cards (like the RTX3090) for complex processing tasks including facial and object recognition.

The 12th Gen Intel Core processor features an innovative hybrid architecture with dual cores for comprehensive computing management that empowers AIMB-588 to provide good visual computing capabilities. The motherboard also features high-resolution visual output through high-compatibility I/O design.

AIMB-588 avoids system failures using WISE-DeviceOn software. WISE-DeviceOn provides real-time hardware, software and peripheral monitoring for real-time alert notifications. These features are supported with an over-the-air (OTA) BIOS system that facilitates remote BIOS updates, and provides backup recovery mechanisms that prevent interruptions and boot up failures. The board also uses USB power on/off functions that prevent unauthorised access and reboot the USB device without turning the power off.

Advantech Australia Pty Ltd
www.advantech.net.au



MEDICAL ENCLOSURES

Medical equipment is used in sensitive and clean areas with challenging working conditions. Whether in a doctor's surgery, a laboratory, a cleanroom or a clinic, high demands are placed on the quality of electronic medical equipment: it should have an attractive appearance with a robust, durable design, and it should be ergonomic, sturdy and tamper-proof. All of these electronic medical products require packaging to optimally meet the abovementioned criteria. OKW offers a wide portfolio of enclosure solutions especially for this purpose.

In the health sector, there are many devices into which something has to be entered or in which something is displayed, be it patient data, important analyses of substances, emergency and notification systems, or operating terminals for access areas. This medical equipment must be able to perform a variety of tasks: smooth, continuous use around the clock, use by a wide variety of users, and in some cases they must be mobile and portable. The material from which the enclosure is made is particularly important — it must withstand wear and tear, as well as cleaning with common cleaning agents or disinfectants, without damage. The plastic enclosures and aluminium profile enclosures by OKW are available in high-quality materials, in a modern and timeless design.

Another important point is protection against electromagnetic interference in order to prevent fatal failures of the equipment. With an EMC coating, the electronics are protected from external interference as well as their own increased interference emission. For further individual requirements, such as mechanical processing for interfaces or printing, the standard enclosures can be modified as required.

Various enclosure solutions are available for medical technology. The CARRYTEC, with its functional handle, is a portable version that can be transported from room to room or even mounted on the round rails of patient beds. The PROTEC and EVOTEC enclosure ranges are available for entering data at an ergonomically favourable angle on a wall, desk or table. Sometimes it is necessary to wear medical equipment directly on the body; special wearable enclosures, such as the BODY-CASE, are suitable for this purpose.

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HIGH-PERFORMANCE FANLESS EMBEDDED COMPUTER

ICP Australia introduces iEi's TANK-XM810, a high-performance fanless embedded computer with a 10th/11th Generation Intel Core processor. It is equipped with a Q470/Q470E chipset, 2 x SO-DIMM DDR4 2933 MHz (up to 64 GB) and 12–28 VDC power, making the product efficient at performing set functions.

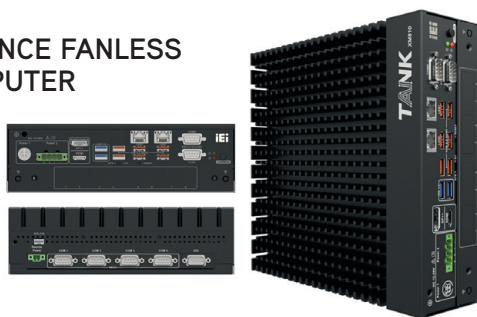
In terms of I/O interface the device supports 6 x USB 3.2 Gen 2, 2 x USB 2.0, 1 x HDMI, 1 x DP++ and 12-bit digital I/O. Furthermore, the fanless system facilitates 1 x 2.5" SATA 6 Gbps HDD/SSD bay and M.2: 2 x 2280 M-key. The product is thus versatile enough to be an asset to multiple applications, across various industries.

The device is constructed with extruded aluminium and can withstand varying operating temperatures, from -20 to +60°C with airflow. This allows the fanless system to function effectively in extreme conditions.

Other features include: 2 x 2.5GbE ports; multiple USB ports and serial ports; multiple internal expansion boards for flexible selection; various optional backplanes and chassis; and CE/FCC compliance.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



CHIP RESISTORS

Panasonic's latest chip resistors are designed to provide users with high power operation in a compact package. Applications include inverters, battery management systems, ADAS, LiDAR, radar, lighting, onboard chargers, industrial robots and a wide range of automotive systems.

The global resistor market is demanding higher power ratings in smaller footprints to allow new designs to be optimised into smaller package sizes without compromising performance, even in harsh environments. Panasonic's chip resistors are said to offer double the power rating of conventional thick film resistors, enabling design engineers to upgrade to a high-value resistor with higher power in smaller case sizes, saving real estate on the PCB. Designed to withstand harsh environments, they feature soft termination for robust operation.

element14

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for Energy Storage
Converters with
SEMITRANS 10® MLI

Features

Increased diode rating: full power for the entire power factor range

Perfect for ESS with continuous 1500V_{DC}

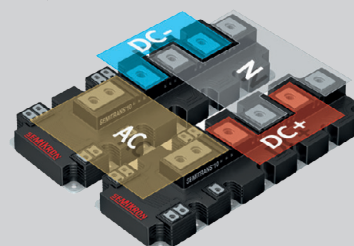
Split NPC topology for increased output power

Compatible with SKYPER 42 LJ PV Driver Core

Available in Power Electronic Stack for faster time-to-market



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IoT PHOTOVOLTAIC POWER FREQUENCY ANALYSER

The Lumel ND45 is an IoT intelligent electronic device (IED) with data-logging and report-generating capabilities. It offers measurement and recordings of over 500 electric energy quality parameters, including harmonics and inter-harmonics up to the 51st harmonic, energy measurement in four tariffs, recording measurements before and after events (dips and swells), monitoring of up to six additional energy meters with pulse outputs, a configurable display and web server.

The series can be used in order to combat the numerous power quality issues that could arise with the use of solar panels. The IoT device can be programmed to capture power RMS, power and energy, unbalance, voltage dip/sag, voltage swell, voltage sub-cycle events, phase angle deviation, rapid voltage change, total harmonic distortion (THD), total demand distortion (TDD), gapless harmonics, gapless inter-harmonics, frequency and flicker. Once all data has been captured, it is important to analyse it and understand the implications of the data gathered.

Control Devices Australia

www.controldevices.com.au



NFC READERS

STMicroelectronics' ST25R3916B and ST25R3917B NFC Forum readers combine high output power and energy efficiency. Supporting NFC initiator, target, reader and card-emulation modes, they can be used in contactless-payment, device-pairing, wireless-charging, brand protection, and other industrial and consumer applications.

The devices feature active wave shaping (AWS) and flexibility to simplify adjustment of the RF output to optimise overshoot and undershoot. The set-up can be done easily by register settings supported by a graphical tool and quickly validated with an oscilloscope. This eases certification according to EMVCo 3.1a and NFC Forum CR13 specifications without the need to touch the matching of the antenna.

The products deliver up to 1.6 W RF output power and can drive antennas directly at high efficiency. Dynamic power-output (DPO) adjustment enables designers to keep the radiated power between the upper and lower limits defined by EMVCo and the NFC Forum specifications.

Combining a noise-resistant input structure and ST's noise-suppression receivers (NSR), the devices have high immunity to interference from other nearby equipment such as power supplies and POS terminals. They offer a high level of resistance to both radiated noise and conducted noise.

The ICs offer a wide power-supply voltage range from 2.4 to 5.5 V and operating temperatures from -40 to 105°C. The peripheral I/O circuitry can operate from as little as 1.65 V.

STMicroelectronics Pty Ltd

www.st.com



VANDAL-RESISTANT PUSH-BUTTONS

EAO's 82 series of push-buttons are used in vending machines, production equipment, lifts, medical equipment, consumer electronics, coaches and buses, access and security systems, and the marine industry, among others.

The push-buttons are vandal-proof products, ie, they are resistant to mechanical damage and environmental factors. They are made of stainless steel and are enclosed in threaded bodies designed for through-hole mounting. They have a high degree of protection (IP65/IP67) and high thermal tolerance, including temperatures occurring in extreme weather conditions.

There is backlighting built into the key, so this is not a weak point in the design. Users can choose push-buttons with ring or dot illumination. Their current consumption does not exceed 7 mA, so they can also be used in applications requiring energy efficiency.

The products work with 240 V mains and are available with SPDT contact configuration. They are offered in three diameters: 16, 19 and 22 mm.

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FPGAs: WHAT ARE THEY GOOD FOR?

Adam Taylor*



Programmable logic has become widely adopted across a range of applications since its introduction in the mid-1980s. Modern programmable logic devices have evolved from the programmable logic device (PLD) and complex programmable logic device (CPLD) to the field-programmable gate array (FPGA).

Whereas PLDs and CPLDs offered a limited number of logic resources, FPGAs provide millions of configurable logic blocks (CLB) that enable developers to implement sequential and combinatorial circuits. Modern FPGA devices also provide developers with advanced features like DSP elements, Block RAMS, gigabit transceivers, PCIe endpoints, and even embedded Arm and RISC-V processors.

Of course, FPGAs require a different design capture, implementation and verification approach than traditional processors due to the truly parallel nature of programmable logic. This parallel implementation makes FPGAs ideal for applications that require one or more of the following characteristics in the solution.

- **Responsiveness:** Dedicated resources are used in the implementation so there is no need to share system resources.

- **Deterministic:** Dedicated resources are used to implement the processing pipeline so the processing time from input to output is deterministic.
- **High throughput:** The parallel structure of the programmable logic enables the processing pipeline to be implemented using discrete elements in a true parallel processing structure.
- **Flexibility of the IO within the FPGA:** IO flexibility within the FPGA enables any-to-any connectivity provided that the right PHY is enabled. This flexibility also frees the developer from constraints on the number of specific IO standards provided on more traditional processor solutions.

These characteristics make FPGAs ideal for a range of applications from automotive and aerospace to motor control, image and signal processing, networking and process control. Let's look at two applications to

better understand why FPGAs are ideal for that application.

Image processing is at the heart of many applications from smart cities to security and production line inspection as part of Industry 4.0. In these applications, the image processing solution is required to perform several complex image processing algorithms on a pixel-by-pixel basis. As frame rate and resolution increase, significant computational power is required. Implementation of an FPGA enables each stage of the processing pipeline to be implemented in logic gates, often using an existing vendor IP block. This processing chain can go from the MIPI or HDMI reception, De Bayer, Alpha channel correction, and then advanced processing algorithms such as enhancement, edge detection, segmentation and ML networks. Implementation of the pipeline in programmable logic enables the developer to achieve higher frame rates than using more traditional processing methods. Image processing applications are often used in automotive applications where they are used to increase the SAE level of autonomy.

Another use case for FPGAs is safety-critical or high-reliability applications. This is due to the responsive and deterministic



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characteristics of the FPGA. Many safety-critical systems had what is called a hard real-time requirement — meaning the data must be gathered, outcome determined, and the action implemented within a set time. Failure to implement the processing and decision within the allotted time results in a failure of the systems. Implementing the processing solution in logic enables each stage of the algorithm to be implemented in parallel. This parallel implementation enables the developer to achieve the response time because the calculation path does not share resources. As resources are not shared, the implemented solution also provides a deterministic response to a given input. This deterministic response also enables a more robust verification strategy because RTL simulation can be created which covers all states, branches, paths and register toggles within the RTL design. Thanks to their responsivity and determinism, FPGAs are ideal for safety-critical applications and are often used within aerospace, automotive, railway and process control applications where certifications to standards such as DO254, ISO26262 and IEC61508 are required.

One final use case of FPGAs is to leverage the flexibility of their interfacing

“


THANKS TO THEIR RESPONSIVITY AND DETERMINISM, FPGAS ARE IDEAL FOR SAFETY-CRITICAL APPLICATIONS AND ARE OFTEN USED WITHIN AEROSPACE, AUTOMOTIVE, RAILWAY AND PROCESS CONTROL APPLICATIONS.

capabilities. FPGAs can create solutions that have any-to-any interfacing thanks to the wide range of single and differential IO standards they support, combined with external PHY when required. This enables developers to be able to implement large numbers of the same interface on the same chip and multiple MIPI interfaces to recover several image processing streams. Alternatively, FPGAs can be used to implement protocol conversion from Gigabit Ethernet to SpaceWire, for example. Of course, the capabilities of the FPGA can also be leveraged alongside the IO flexibility. One such example is during video transcoding where a standard is received and another is transmitted after being transcoded within the FPGA logic. Here again, the ability of the FPGA to provide high throughput enables the implementation of the overall solution.

Conclusion

In summary, FPGAs are best deployed in systems that exhibit a need for one of the identified characteristics of responsivity, determinism, throughput, or interfacing. Applications that require these can leverage the parallel nature of the FPGA to implement a solution that achieves the requirements. As such, we see FPGAs being deployed in a variety of applications including aerospace, automotive, industrial, video transcoding, process control, and high-performance systems. As FPGA technologies evolve (and development tools in particular) we will see FPGAs more common in many applications. **Adam Taylor is a professor of embedded systems, engineering leader and world-recognised expert in FPGA/system on chip and electronic design.*

Mouser Electronics
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TURMERIC EXTRACT COULD BE KEY TO GREENER FUEL CELLS

Researchers at the Clemson Nanomaterials Institute (CNI) and the Sri Sathya Sai Institute of Higher Learning (SSSIHL) have discovered a novel way to combine curcumin — the substance in turmeric — and gold nanoparticles to create an electrode that requires 100 times less energy to efficiently convert ethanol into electricity.

Published in the journal *Nano Energy*, the team's breakthrough brings us one step closer to replacing hydrogen as a fuel cell feedstock.

Fuel cells generate electricity through a chemical reaction instead of combustion, and are used to power vehicles, buildings, portable electronic devices and backup power systems. Hydrogen fuel cells are highly efficient and do not produce greenhouse gases — but while hydrogen is the most common chemical element in the universe, it must be derived from substances such as natural gas and fossil fuels. This adds to hydrogen fuel cells' cost and environmental impact.

In addition, hydrogen used in fuel cells is a compressed gas, creating challenges for storage and transportation. Ethanol, an

alcohol made from corn or other agricultural-based feeds, is safer and easier to transport than hydrogen because it is a liquid.

"To make it a commercial product where we can fill our tanks with ethanol, the electrodes have to be highly efficient," said Lakshman Ventrapragada, who worked as a research assistant at CNI and is an alumnus of SSSIHL. "At the same time, we don't want very expensive electrodes or synthetic polymeric substrates that are not eco-friendly because that defeats the whole purpose. We wanted to look at something green for the fuel cell generation process and making the fuel cell itself."

Ventrapragada and his fellow researchers focused on the fuel cell's anode, where the ethanol or other feed source is oxidised. Fuel cells widely use platinum as a cata-



CURCUMIN IS USED TO DECORATE THE GOLD NANOPARTICLES TO STABILISE THEM, FORMING A POROUS NETWORK AROUND THE NANOPARTICLES.

lyst, but platinum suffers from poisoning because of reaction intermediates such as carbon monoxide, and is also costly. The researchers used gold as a catalyst instead.

Rather than using conducting polymers, metal-organic frameworks or other complex materials to deposit the gold on the surface of the electrode, the researchers used curcumin because of its structural uniqueness. Curcumin is used to decorate the gold nanoparticles to stabilise them, forming a porous network around the nanoparticles.

The researchers deposited the curcumin gold nanoparticle on the surface of the electrode at a 100 times lower electric current than in previous studies. Without the curcumin coating, the gold nanoparticles agglomerate, cutting down on the surface area exposed to the chemical reaction, Ventrapragada said.

"Without this curcumin coating, the performance is poor," said Professor Apparao Rao, CNI's founding director. "We need this coating to stabilise and create a porous environment around the nanoparticles, and then they do a super job with alcohol oxidation.

"There's a big push in the industry for alcohol oxidation. This discovery is an excellent enabler for that. The next step is to scale the process up and work with an industrial collaborator who can actually

make the fuel cells and build stacks of fuel cells for the real application."

The research could have broader implications than improved fuel cells. The electrode's unique properties could lend itself to future applications in sensors, supercapacitors and more, Ventrapragada said.

In collaboration with the SSSIHL research team, Rao's team is testing the electrode as a sensor that could help identify changes in the level of dopamine, which has been implicated in disorders such as Parkinson's disease and attention deficit hyperactivity disorder. When members of the research team tested urine samples obtained from healthy volunteers, they could measure dopamine to the approved clinical range with this electrode using a cost-effective method compared to standard ones used today, Rao said.

"In the beginning stages of the project, we did not imagine other applications that gold-coated curcumin could support," Ventrapragada said. "However, before the end of the alcohol oxidation experiments, we were fairly confident that other applications are possible.

"Although we don't have a complete understanding of what's happening at the atomic level, we know for sure that curcumin is stabilising the gold nanoparticles in a way that it can lend itself to other applications."

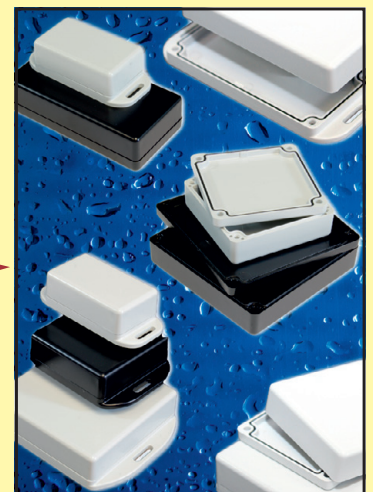
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8-BIT MCU DEVELOPMENT BOARD

IoT network developers are looking for an easy path to implement a secure cellular connection in their design applications but are faced with design complexities and high deployment costs. For those who need location flexibility, low power consumption and deployment simplicity, Microchip Technology announces the AVR-LoT Cellular Mini Development Board based on the AVR128DB48 8-bit microcontroller (MCU), providing a robust platform to start building sensor and actuator nodes on 5G narrowband IoT networks. Users can tap into the flexibility and ease of design offered by the MCU family — including security protection with Microchip's ATECC608 CryptoAuthentication device, which can be configured to most major cloud service providers through Microchip's IoT Provisioning Tool.

The board has a small form factor, making it suitable for developers who want to connect IoT devices to an available 5G network. This is an important feature for devices on the go or located in remote areas with limited availability of LoRa networks or other LPWAN solutions. Microchip partnered with Sequans to include its Monarch 2 GM02S single-chip radio equipped with 5G LTE-M and narrowband IoT, and with Truphone to provide a SIM card for cellular service that offers good coverage worldwide.

The board comes preconfigured to send data from onboard light and temperature sensors to the cloud, viewable using Microchip's sandbox portal. The portal provides users with the ability to track and monitor their device in real time from a remote location; this is useful for many applications in industries including agriculture, industrial and energy, as well as consumer spaces such as transportation of goods, alarm systems, building automation and remote monitoring.

The development board is suitable for makers and hobbyists as it fits the Adafruit Feather form factor. It features a Qwiic/Stemma I2C connector for easy functionality extension, creating a clear path to production. It is also Arduino-compatible and is supported by Microchip's Github Library, which provides functionality for HTTPS, MQ Telemetry Transport (MQTT), low power and more.

Microchip Technology Australia

www.microchip.com



FIXED STEP-DOWN REGULATOR MODULES

Würth Elektronik's Mag1³C-FDSM fixed step-down regulator modules now cover all bus voltages from 12 up to 48 V. The power modules facilitate development for applications with direct connection to bus voltages of 12, 24 or 48 V.

The wide input voltage range up to 74.5 V makes the module robust against voltage transients on the 48 V bus. The power modules are implemented in an SIP-3 package and provide fixed output voltages of 3.3, 5 and 12 V, with an output current up to 0.5 A.

The fully integrated DC/DC voltage converters feature fixed output voltage. Besides the power stage, the modules consist of a regulator, an inductor, and input and output capacitors.

The power modules are protected against short circuit and thermal overload. They are designed to reduce the workload involved in circuit design to a minimum, as no external components are required for operation.

For simple assembly, the family has been realised in a standard THT housing. Pre-compliance testing has shown the conducted and radiated EMI is below limits established by relevant standards.

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SELF-LEARNING AI SMART SENSOR

Bosch's BHI260AP, a self-learning AI sensor for wearables and hearables, integrates a six-axis inertial measurement unit (IMU), a 32-bit customer-programmable microcontroller and software functionalities in a system-in-package (SiP) solution. It is an all-in-one unit for always-on sensor applications, suitable for wrist wearables, hearables, smartphones, AR/VR headsets and controller devices.

The smart sensor features embedded edge artificial intelligence (AI) with self-learning AI software, including fitness tracking, navigation (pedestrian dead reckoning), machine learning analytics, and relative and absolute orientation estimation. The integrated, six-degrees-of-freedom IMU includes a 16-bit, three-axis accelerometer and 16-bit, three-axis gyroscope. The host interface is configurable as SPI or I²C, with two master interfaces (one selectable SPI/I²C and one I²C) and up to 12 GPIOs.

The smart sensor's self-learning and personalisation features enable users to easily train devices with customised fitness activities. The sensor includes more than 15 pre-learned fitness activities, so no training is required before use. In addition to the included activities, the device also offers the ability to learn, personalise, auto-track and enhance the user experience. Users can also enhance or add more fitness activities without modifying the software or requiring an original dataset.

Since the AI is running on the sensor itself, connecting to the cloud or a smartphone is not required. This innovative edge AI functionality is designed to reduce latency, minimise power consumption and improve user privacy.

Mouser Electronics
au.mouser.com



TABLET OSCILLOSCOPE

Micsig's STO-1004 Smart tablet oscilloscope adopts integrated touch screen technology and an upgraded hardware and software system. It features four analog channels, 100 MHz bandwidth, a maximum 1 GSA/s sampling rate (single channel), 70 Mpts of memory depth and a waveform capture rate up to 130,000 wfms/s.

With a large 8", 800 x 600 industrial capacitive touch screen, the scope can be used in three operation modes: full-touch operation, physical button control panel or a mixture of both. It is equipped with a sensitive digital trigger system, supports serial bus triggering and decoding, and has rich measurement and math functions.

The product comes with a digital filter module, 256-level intensity grading and colour temperature display functions; it also has Wi-Fi, USB 3.0/2.0 Host, USB Type-C, HDMI and trigger out connections. Combined with Micsig's touch algorithm technology, it offers a user-friendly operating experience.

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WATERPROOF EDGE INTELLIGENCE GATEWAY

Advantech's UNO-430 is a tough, high-performance intelligence gateway that can be employed in harsh industrial environments. It features all-around IP69K/68-rated ingress protection and M32 and M12 I/O connectors to provide a watertight solution that can withstand demanding applications.

For optimal operation under extreme conditions, the gateway is IP69K/68 rated for resistance to water and dust ingress. The waterproof enclosure features a front door for easy access and maintenance as well as a cable gland that offers further ingress protection, reducing the need for waterproof cables and wiring. This comprehensive protection also eliminates the need for a waterproof cabinet, allowing the UNO-430 to be used as a standalone data acquisition gateway. The IP69K rating indicates that the product can withstand high-pressure and high-temperature washdowns and steam cleaning, while the IP68 rating indicates the ability to withstand immersion in water under pressure for long periods, providing sufficient protection in case of exposure to chemicals or bad weather.

With the provision of standard M.2 2230 Wi-Fi and M.2 3052/3042 5G/LTE sockets, the UNO-430 gateway offers expandable wireless connectivity for remote communications and data transfers. To enable flexible and convenient deployment in diverse usage scenarios, the product also supports a wide operating temperature range (-40 to 70°C) and input voltage (10–36 VDC), making it suitable for general outdoor and indoor installations, including roadside and manufacturing sites.

Advantech Australia Pty Ltd
www.advantech.net.au



DIRECT TIME-OF-FLIGHT SENSOR

STMicroelectronics has announced its latest FlightSense time-of-flight (ToF) ranging sensor for smartphone camera management and augmented/virtual reality. With enhancements to key components, the ToF module offers up to double the ranging performance — up to 4 m in all zones indoors — while reducing the power consumption by half compared to the previous-generation device, when operating in common conditions.

The VL53L8 ranging sensor features innovative metasurface lens technology, developed in partnership with Metalenz, which is said to enable optical systems to collect more light, provide multiple functions in a single layer, and deliver new forms of sensing in smartphones and other devices, all in its compact package. The sensor is suitable for smartphones and tablets in both user-facing and world-facing applications, but also for accessories in the personal electronics segment like smart speakers and AR/VR/MR. The sensor can also support indoor/outdoor detection and smart-focus bracketing, as well as consumer LiDAR, where depth mapping is required.

The 2nd-generation ranging sensor incorporates an efficient optically diffractive metasurface lens technology. In combining a VCSEL driver three times more capable than the previous generation with an efficient VCSEL, the sensor can, in comparable conditions, deliver twice the ranging performance of the VL53L5 or reduce power consumption by 50%. It delivers this performance while maintaining the same field of view and discrete output-ranging zones (4x4 at 60 fps or 8x8 at 15 fps). For easy system integration, the sensor is housed in a single reflowable component that offers 1.2 and 1.8 V I/O compatibility and reduces the host processor loading over the demands of the first-generation sensor.

STMicroelectronics Pty Ltd
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INDUSTRIAL CELLULAR IoT GATEWAY

The Robustel R1510 is an industrial cellular IoT gateway that was designed to provide high-speed wireless connectivity for IoT devices using Ethernet, Wi-Fi and 4G/LTE, with auto-failover to provide stability. It can be quickly deployed in IoT projects globally.

The product offers an industrial, ruggedised housing that can be used in harsh environments, with an operating temperature range from -25 to 75°C. In addition to the two Ethernet interfaces, the router can also support digital input/outputs (DI/DO) as well as Wi-Fi in client and access point modes.

With its compact size, industrial housing and LTE Cat-4, the product is a suitable entry-level IoT gateway for all major verticals.

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www.queenslandrail.com.au



Tablet-controlled robot conducts inspection tasks



Evonik, a global leader in the specialty chemicals industry, is using an autonomous robot to conduct maintenance and inspection tasks in critical areas at one of its company-owned chemical plants, as part of an innovation project with three other partners. The aim of the project is to evaluate the practicality of an automated robotic maintenance and inspection solution in the chemical industry.

Evonik relies on Getac's F110 ATEX-certified tablet to control the robot and teach it automated inspection routes around the facility, which the company said it chose due to its powerful performance and reliability compared to other rugged computing alternatives. In addition, Getac's fast response and high degree of flexibility while integrating the solution were key factors in creating an optimal working environment for the proof of concept. The robot's software was provided by Energy Robotics, while the robot itself was supplied by Boston Dynamics.

The robot's primary task is to travel along pre-programmed inspection routes, collecting important operational data. It will also conduct automated safety inspections that cannot be integrated into a remote maintenance concept (or only at great expense). Organisations can then use data collected to improve the intervals between inspections while simultaneously increasing asset reliability.

Getac's tablet plays a pivotal role in the project, serving as the main interface between robot, control software and human operator. For control and monitoring in the plant, the operator can access the software via the F110-EX, while an additional controller is used for quick interventions during operation.

"The robot receives its orders through the Getac F110-EX, which can also be used to control it during corresponding missions, such as in the tank farm," said Thorsten Schimpf, a process expert at Evonik. "The robot is equipped with sensors, as well as infrared and optical cameras, allowing it to navigate to specific locations within the facility and take photos of displays or record data, which can then be transmitted back for evaluation."

For effective operation, Schimpf said, Evonik required a portable rugged device with enough power to display video feeds from the robot in real time. The tablet needed to be highly robust and ATEX certified, with a screen that is easy to read outdoors — under a wide range of environmental conditions including rain — and fully functional in both hot and cold temperatures. Evonik also required a Windows operating system, as well as the ability to capture and process large amounts of data both quickly and effectively.

Connectivity and performance play a key role as well, allowing for fast video transmission and playback. In addition, an LTE connection is required because there is no WLAN in the tank farm. Finally, Bluetooth is needed to connect the controller to the tablet. With the appropriate Getac carrying strap, the tablet can be carried comfortably in front of the body, so the user has both hands free to operate the controller at the same time.

"Evonik not only recognised Getac as a good solution, but Getac responded immediately to our enquiry, was able to help quickly and offered the right solution for our needs," Schimpf said. "The F110-EX is extremely reliable and failsafe; it works flawlessly and meets our very high requirements for performance, functionality and connectivity."

"We are very satisfied with the F110-EX."

Eric Yeh, Managing Director at Getac Technology, concluded, "The Getac F110-EX is based on state-of-the-art rugged technologies, making it ideally suited to Evonik's ambitious project. We are very pleased to be able to contribute to the project's success and look forward to working closely with Evonik on similar initiatives in the future."

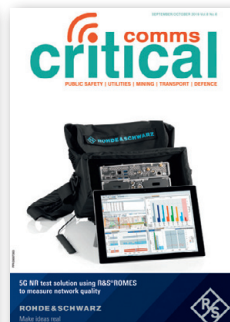
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HARNESSING WATER

TO GROW PEROVSKITE CRYSTALS

Water is the secret ingredient behind a new method of creating key components for solar cells, X-ray detectors and other optoelectronics devices, according to a study published in the journal *Advanced Functional Materials*.

The next generation of photovoltaics, semiconductors and LEDs could be made using perovskites — an exciting and versatile nanomaterial with a crystal structure. Perovskites have already shown similar efficiency to silicon, are cheaper to make, and feature a tuneable bandgap, meaning the energy they are able to absorb, reflect or conduct can be changed to suit different purposes.

Ordinarily, water is kept as far away as possible during the process of creating perovskites. The presence of moisture can lead to defects in the materials, causing them to fall apart more quickly when they're being used in a device. That's why perovskites for scientific research are often made via spin coating in the sealed environment of a nitrogen glove box.

Now, members of the ARC Centre of Excellence in Exciton Science have found a simple way to control the growth of phase-pure perovskite crystals by harnessing water as a positive factor. This liquid-based mechanism works at room temperature, so the approach remains cost-effective.

Led by researchers at Monash University, the team found that by changing the ratio of water to solvent during the early stages of the process, they could choose to grow different types of perovskite crystals, with structures to suit various purposes. As

explained by Monash's Dr Wenxin Mao, corresponding author on the study, "By carefully tuning the concentration of water in the precursor solution, we realised the precise control of particular perovskite phases."

Computational and thermodynamic analysis conducted by colleagues at The University of Sydney identified that the coordination of lead and bromide ions in the precursor solution was an important factor in determining which types of crystals are formed. Lead author Qingdong Lin, a PhD student at Monash, said, "We now understand the internal mechanics and function of water inside the precursor solution. By doing that, we can further use water to control the crystallisation process."

To demonstrate the quality of the end product, crystals produced via this approach were coupled with back-contact electrodes through nanofabrication to create X-ray detection devices. This test sample performed at a similar level to commercial X-ray detectors currently being used in real-world settings, like medical imaging and Geiger counters, and outperformed prototype perovskite X-ray detectors developed using slower, more complicated fabrication methods.

"We compared them with commercial X-ray detectors as well as other types of perovskites and we do have a very good responsivity and sensitivity to X-rays," Wenxin said. "Overall, this project shows that we have found a smart way to control inorganic perovskite single crystals."

"The methodology is flexible and feasible and doesn't require a very unique environment or technique to apply it."

As well as solar cells, X-ray detectors and LEDs, perovskites created with this method could also be useful in UV light detection, lasers and solar concentrators.

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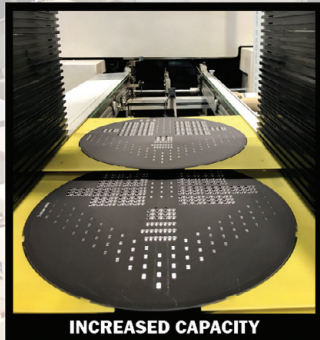
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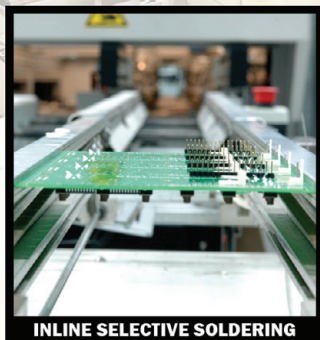
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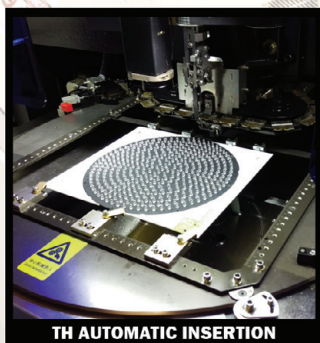
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