

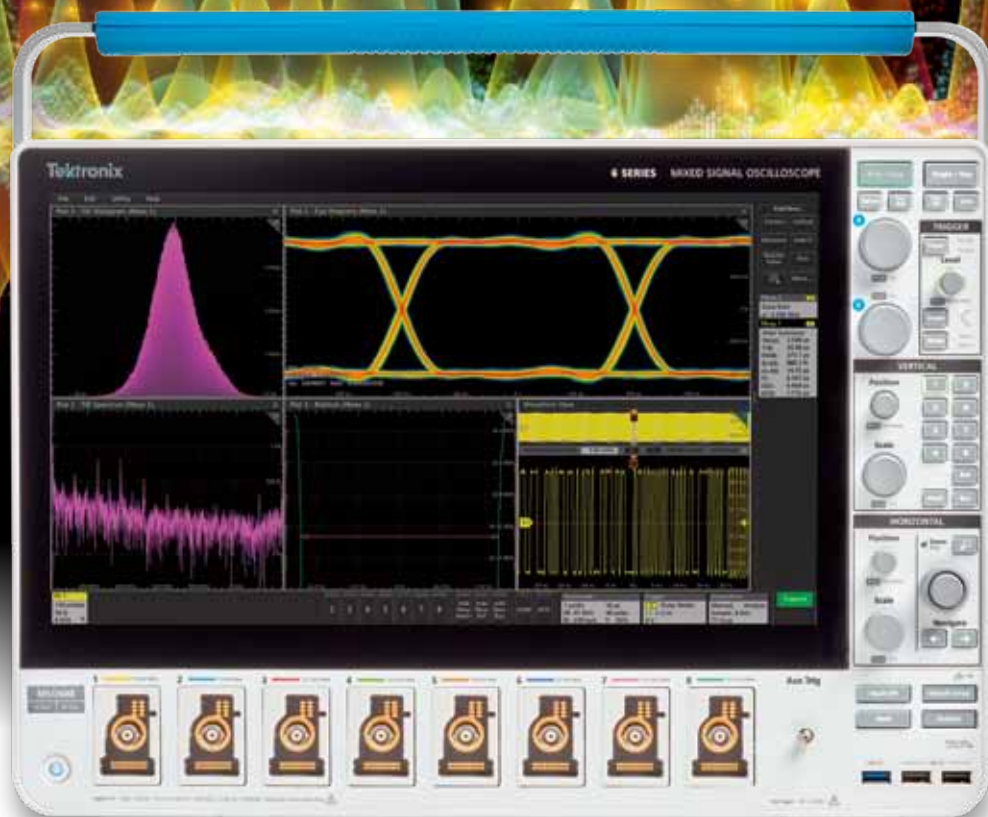
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SATELLITE LAUNCHED WITH AI ON BOARD



Image credit: Tim Herman/Intel Corporation.

As ubiquitous as artificial intelligence (AI) has become in modern life, the technology hasn't yet found its way into orbit — not until recently, that is.

On 2 September 2020, an experimental satellite about the size of a cereal box was ejected from a rocket's dispenser along with 45 other similarly small satellites. The satellite, named PhiSat-1, contains a new hyperspectral-thermal camera and onboard AI processing, thanks to an Intel Movidius Myriad 2 vision processing unit (VPU) — the same chip inside many smart cameras and even a \$99 selfie drone here on Earth.

PhiSat-1 is actually one of a pair of satellites on a mission to monitor polar ice and soil moisture, while also testing intersatellite communication systems in order to create a future network of federated satellites. Myriad 2, meanwhile, is focused on handling the large amount of data generated by high-fidelity cameras like the one on PhiSat-1.

"The capability that sensors have to produce data increases by a factor of 100 every generation, while our capabilities to download data are increasing, but only by a factor of three, four, five per generation," said Gianluca Furano, Data Systems and Onboard Computing Lead at the European Space Agency (ESA), which led the collaborative effort behind PhiSat-1.

At the same time, about two-thirds of our planet's surface is covered in clouds at any given time. That means a whole lot of useless images of clouds are typically captured, saved, sent over precious down-link bandwidth to Earth, saved again, and reviewed by a scientist (or an algorithm) on a computer hours or days later — only to be deleted.

"Artificial intelligence at the edge came to rescue us, the cavalry in the Western movie," Furano said. The idea the team rallied around was to use onboard processing to identify and discard cloudy images — thus saving about 30% of bandwidth.

Irish start-up company Ubotica built and tested PhiSat-1's AI technology, working in close partnership with camera developer cosine, as well as the University of Pisa and Sinergise, to create the complete solution. As explained by Ubotica's Chief Technology Officer, Aubrey Dunne, "The Myriad was absolutely designed from the ground up to have an impressive compute capability but in a very low-power envelope, and that really suits space applications."

The Myriad 2, however, was not intended for orbit. Spacecraft computers typically use very specialised "radiation-hardened" chips that can be "up to two decades behind state-of-the-art commercial technology", Dunne said. And AI has so far not been on the menu.

Dunne and the Ubotica team performed 'radiation characterisation', putting the Myriad chip through a series of tests to figure out how to handle any resulting errors or wear and tear. Furano noted that the ESA "had never tested a chip of this complexity for radiation", so they "had to write the handbook on how to perform a comprehensive test and characterisation for this chip from scratch".

The Myriad 2 passed the tests in off-the-shelf form, with no modifications needed. The low-power, high-performance computer vision chip was ready to venture beyond Earth's atmosphere. But then came another challenge.

Typically, AI algorithms are built, or 'trained', using large quantities of data to 'learn' — in this case, what is and isn't a cloud. But given the camera was so new, said Furano, "we didn't have any data. We had to train our application on synthetic data extracted from existing missions".

All this system and software integration and testing, with the involvement of half a dozen different organisations across Europe, took four months to complete. As far as spacecraft development goes, the timeline was "a miracle", according to Furano.

The satellite's launch from French Guiana went fast and flawlessly. For the initial verification, the satellite saved all images and recorded its AI cloud detection decision for each, so the team on the ground could verify that its implanted brain was behaving as expected.

The ESA soon confirmed "the first-ever hardware-accelerated AI inference of Earth observation images on an in-orbit satellite". By only sending useful pixels, the agency said, the satellite will "improve bandwidth utilisation and significantly reduce aggregated downlink costs" — not to mention saving scientists time on the ground.

Looking forward, the applications for low-cost, AI-enhanced satellites are innumerable — particularly when you add the ability to run multiple applications. As explained by Jonathan Byrne, Head of the Intel Movidius technology office, "Rather than having dedicated hardware in a satellite that does one thing, it's possible to switch networks in and out," Dunne calls this "satellite-as-a-service".



Employees in the operations centre at Tyvak International in Turin, Italy, monitor the orbit and performance of small satellites.



An employee at Tyvak International in Turin, Italy, inspects the computing and camera assembly of the PhiSat-1 satellite.



Intel's Myriad 2 VPU brings onboard artificial intelligence to satellites on a system built by Ubotica Technologies.

When flying over areas prone to wildfire, a satellite can spot fires and notify local responders in minutes rather than hours. Over oceans, which are typically ignored, a satellite can spot rogue ships or environmental accidents. Over forests and farms, a satellite can track soil moisture and the growth of crops. Over ice, it can track thickness and melting ponds to help monitor climate change.

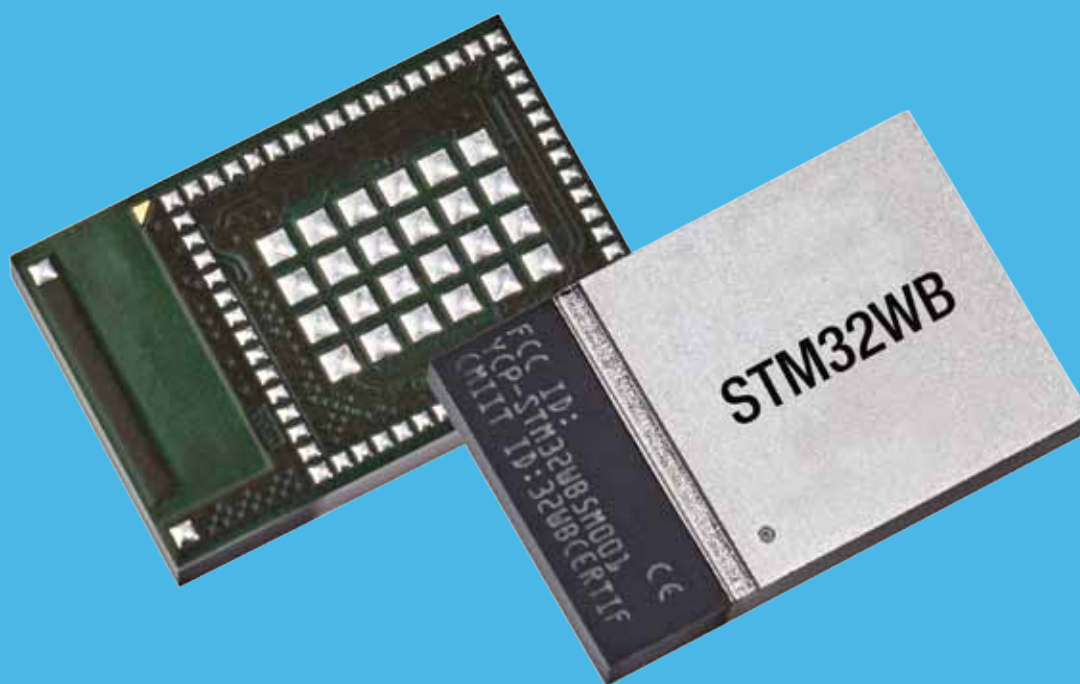
ESA and Ubotica are now working together on PhiSat-2, which will carry another Myriad 2 into orbit. PhiSat-2 will be capable of running AI apps that can be installed, validated and operated on the spacecraft during their flight using a simple user interface. According to Intel, the potential impact is unquestionable.

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NEW WORLD RECORD IN PEROVSKITE SOLAR CELL EFFICIENCY

Researchers at the Australian National University (ANU) have reached 21.6% efficiency in converting sunlight into electricity — a new world record for perovskite solar cells larger than 1 cm² in size. They achieved their breakthrough by adapting a technique which has already proven successful with silicon solar cells, according to lead researcher Associate Professor Tom White.

“A common problem with solar cells is that any defects in the cell can trap electrons, taking away the energy they gained by absorbing sunlight,” Assoc Prof White said.

“A way around this is to ‘passivate’ the surface by coating the light-absorbing material with a thin layer of another material to reduce defects. But the materials used to reduce defects are often poor conductors of electricity.”

The solution to this problem was proposed by Dr Jun Peng, who explained, “Some silicon cells use holes to let the electrons through this insulating layer, creating a kind of conductive pathway. We decided to take a similar approach with our perovskite cells.

“The idea behind it and the reasons it works are the same, but our models showed us that to make it work on perovskite solar cells, we would need to manufacture these holes on the scale of nanometres — thousands of times smaller than is used in silicon.

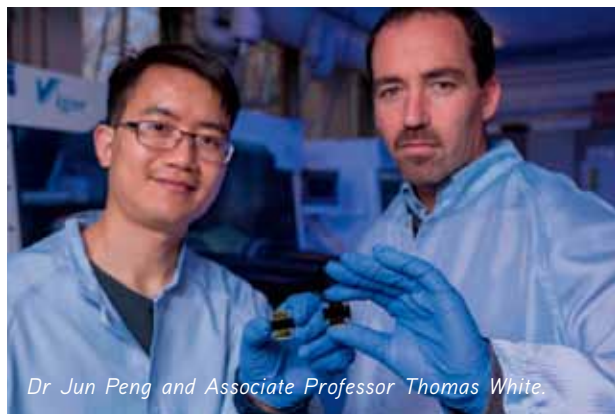
“Thus, instead of holes, we used nanoscale rods that poke through the insulating layer.”

This is the first time this technique has been applied to perovskite cells, so the researchers used computer simulations to prove it worked. Modelling work on the project was led by Dr Daniel Walter, who said, “Computer models are really useful in a study like this.

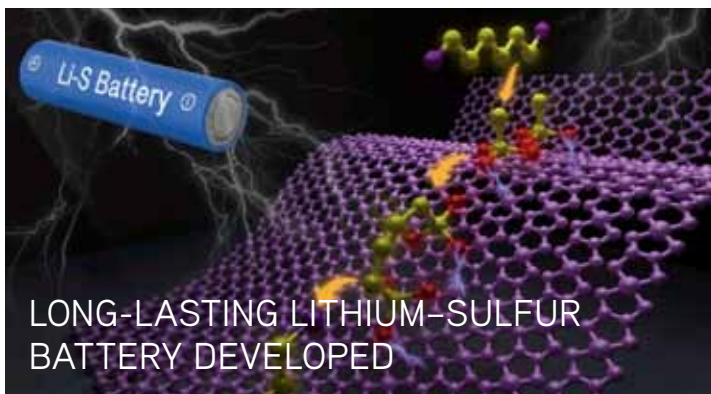
“Once you have made a solar cell it can be difficult to probe inside them to see what is happening. We were able to simulate what was happening inside the cells to explain how the nanorods improved the cell performance.”

The team’s record result was published in the journal *Science* and has been independently verified by CSIRO’s Photovoltaics Performance Laboratory. But their work is not over yet, with Assoc Prof White saying, “We’ll continue to work to achieve even higher efficiencies with perovskite.

“Silicon will reach its upper limit of efficiency very soon, so we see these perovskites cells as the way forward,” he said.



Dr Jun Peng and Associate Professor Thomas White.



LONG-LASTING LITHIUM-SULFUR BATTERY DEVELOPED

Researchers at South Korea’s Gwangju Institute of Science and Technology (GIST) have improved the performance and durability of lithium-sulfur batteries, which are attracting attention as a potential next-generation energy storage technology. The research team introduced cobalt oxalate as an electrochemical catalyst at the anode interface of a lithium-sulfur battery and succeeded in identifying the electrochemical catalyst reaction during the charging and discharging process.

Theoretically, lithium-sulfur batteries have five times more energy density than conventional lithium-ion batteries, as well as being economical and eco-friendly. They can be used for medium and large energy storage devices such as electric vehicles, as well as portable electronic devices and ultralight and ultrasmall special equipment. However, low life expectancy due to the non-conductive properties of sulfur and the elution of lithium polysulfides generated during the charging and discharging process act as a major obstacle to commercialisation.

Recently, catalyst research has been underway to improve the performance of lithium-sulfur batteries, but to improve the performance more efficiently, high-efficiency conversion of sulfur — which has low production costs and is non-conductive — is needed. There is a lack of research to identify electrochemical reaction mechanisms that enable this transformation.

Led by Professor Jaeyoung Lee, the GIST research team synthesised cobalt oxalate as an electrochemical oxidation/reduction catalyst using a very simple chemical precipitation method to produce gram units and applied it to the positive electrode of a lithium-sulfur battery. The results of their work were published in the journal *ChemSusChem*.

The cobalt oxalate electrochemical catalyst-based anodes were able to minimise the self-discharge generated by the lithium polysulfide moving inside the cell by absorbing the generated lithium polysulfide on the catalyst and the surface of the positive electrode. In addition, it was confirmed that cell performance continued without performance degradation due to self-discharge, even if the battery was left for about a week, at about 1.5 times the level of conventional lithium-sulfur batteries.

“The research results are most significant in securing capacity improvement and durability of lithium-sulfur batteries, which can implement high energy density at low cost through electrochemical catalyst reactions,” Prof Lee said. “Subsequent research is expected to contribute greatly to the development of next-generation energy storage technologies by gradually improving the durability of lithium-sulfur batteries.”

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STABLE SILVER WIRE MEASURES JUST ONE ATOM WIDE

An international research team has developed a stable silver wire that is just one atom wide, in a major step towards the goal of shrinking electronic devices to the molecular scale. Their breakthrough has been published in the journal *Nature Communications*.

For the past two decades, researchers wanting to develop nanodevices have rarely been successful in creating long atomic wires assembling into a coherently oriented array. In addition, such wires have been unstable in anything outside of a vacuum.

The research team from Fudan University, Japan's National Institute for Materials Science and the Queensland University of Technology (QUT) found they had surprising success when they did not try to create a wire, atom by atom, within a vacuum. Instead, the researchers put nanoparticles of silver onto the outside of tiny nanorods that have channels inside.

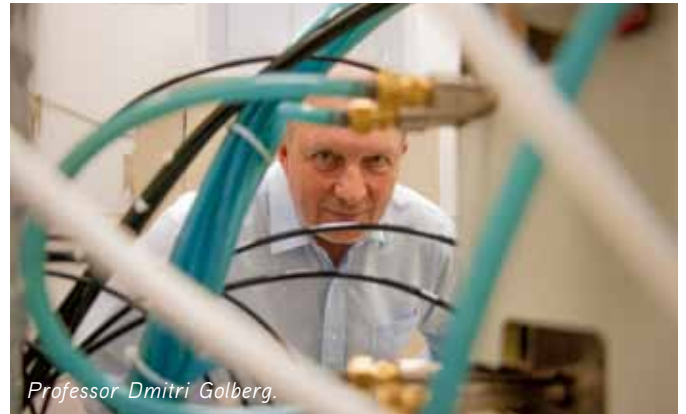
"When we do this in a vacuum, or in some inert atmosphere as people usually do, nothing happens," said QUT's Professor Dmitri Golberg, a material scientist and physicist with more than 30 years of experience in working with nanomaterials.

"But we did it in air. The atoms from silver particles diffused very fast and they diffused inside the channels."

Prof Golberg said the expected result on an experiment like this would be that the silver would react with the oxygen in the air and form silver oxide. "Instead, the atoms go inside the channels to accommodate themselves and make these small strings," he said.

"It wasn't intentional, it wasn't planned to make wires."

Prof Golberg said the process was like water drops going through a sieve; the result was that wires, as thin as just one atom, formed inside the channels in a self-organisation process, with up to 200



Professor Dmitri Golberg.

strings in each channel. The researchers then attached the nanowires to electrodes and ran a current through the wire, expecting it to behave like a metal in that current should increase as voltage was increased.

"But at some temperature, the material became an insulator. This is not common for silver and is called metal insulator transition," Prof Golberg said.

"This is quite an interesting transition in physics."

"And this is a major point, because it means the silver wire could be used as a thermal switch. Depending on the temperature, you change the properties of the material by changing the temperature."

In the work towards building nanodevices the wire is considered quite long, although it only measures around one-fiftieth of the width of a human hair. According to Prof Golberg, "It's still pretty small but for me it's quite long. In the electron microscope, it's very big."

ELECTRONEX RESCHEDULED TO SEPTEMBER 2021

Electronex – The Electronics Design & Assembly Expo, which was to be held in May this year, has been rescheduled to 15–16 September at Rosehill Gardens in Sydney.

Noel Gray, Managing Director of show organiser AEE, said, "Plans were well underway to hold the event in May this year; however, with the uncertainty that was created by the COVID-19 outbreaks and state border closures over Christmas, we decided to take a cautious approach and reschedule to September, which is the time the expo is normally held. A large number of exhibitors and visitors attend from interstate and the move to September allows time for the vaccine rollout and a more consistent approach from state governments around border closures."

Electronex was first held in 2010 and has grown to become the pre-eminent high-tech trade event for engineers, management and decision-makers that utilise electronics in manufacturing, design, assembly or servicing and attracts over 1000 trade visitors and around 90 Australian-based exhibitors.

Exhibitors were extremely supportive of the move and around 85% of the space had already been sold. Electronex has also been approved for the federal Business Events program, enabling larger stands to claim up to 50% of the costs associated with their participation.

For information about exhibiting at Electronex 2021, contact AEE on 03 9676 2133 or email info@auexhibitions.com.au.



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DON'T TRUST YOUR DATA SHEET SAMPLING RATE

Michelle Tate*

Digital storage oscilloscopes (DSOs) are the primary tools used today by digital designers to perform signal integrity measurements such as set-up/hold times, eye margin and rise/fall times. The two key banner specifications that affect the accuracy of an oscilloscope's signal integrity measurements are bandwidth and sample rate.

Most engineers have a good idea of how much bandwidth they need for their digital measurements. However, required sample rates often cause confusion, and engineers often assume that oscilloscopes with the highest sample rates produce the most accurate digital measurements. But is this true?

Let's review Nyquist's Sampling Theorem

Nyquist's Sampling Theorem states that for a limited bandwidth signal with a maximum frequency (f_{MAX}), the equally spaced sampling frequency (f_s) must be greater than twice (2X) the maximum frequency (f_{MAX}) in order to have the signal be uniquely reconstructed without aliasing:

$$f_s > 2f_{\text{max}}$$

Nyquist's Sampling Theorem can be summarised as two simple rules:

1. The highest frequency component sampled must be less than half the sampling frequency.
2. Samples must be equally spaced. (This second rule is often forgotten, but is equally, if not more important to remember. More on this later.)

Some engineers have total trust in Nyquist and claim that just 2X sampling over the oscilloscope's bandwidth is enough. Other engineers don't trust digital filtering techniques based on Nyquist criteria and prefer that their oscilloscopes sample at rates that are 10X to 20X over the oscilloscope's bandwidth specification. While higher sampling rates are advantageous, accurately reconstructing a signal relies on more than a data sheet specification.

Sample rate versus measurement accuracy

Increase sample rate with interleaved real-time sampling

Producing higher sample rates in oscilloscopes is not always as easy as simply selecting an off-the-shelf analog-to-digital converter (ADC) that has a higher sample rate. When ADC technology has been stretched to the limit in terms of maximum sample rate, a common technique adopted by all major oscilloscope vendors is to interleave multiple real-time ADCs. Interleaving is the process of multiplexing

two or more parallel ADCs to achieve a higher net sample rate than the individual ADCs can achieve alone.

Figure 1 shows a block diagram of a real-time interleaved ADC system consisting of two ADCs with phase-delayed sampling. In this example, ADC #2 always samples $\frac{1}{2}$ of a clock period after ADC #1 samples. After each real-time acquisition cycle is complete, the oscilloscope's central processing unit (CPU) or waveform processing application-specific integrated circuit (ASIC) retrieves the data stored in each ADC's acquisition memory and then interleaves the samples to produce a real-time digitised waveform with twice the sample density (ie, 2X sample rate).

Higher sample rate doesn't always make for more accurate measurements

Although counterintuitive, increasing the sample rate by interleaving multiple real-time ADCs does not necessarily produce more accurate digital measurements, and can, in some cases, result in poorer signal fidelity due to poorly aligned ADCs.

Figure 2 illustrates incorrect timing of interleaved samples if the phase-delayed clock system of two interleaved ADCs is not exactly $\frac{1}{2}$ a sample period delayed relative to each other. When phase-delayed clocking isn't properly aligned, these digitised points (red dots) are not evenly spaced, which violates Nyquist's second rule.

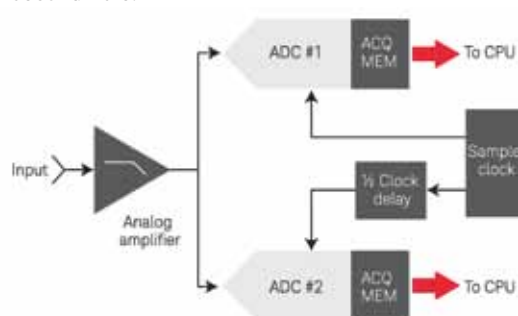


Figure 1: Real-time sampling system block diagram consisting of two interleaved ADCs.

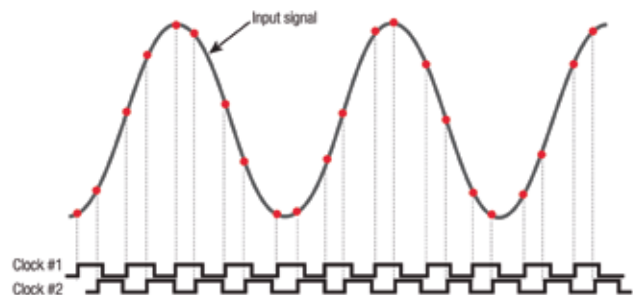


Figure 3: Timing diagram showing distorted reconstruction of the waveform using a $\text{Sin}(x)/x$ filter due to poor phase-delayed clocking.

When the oscilloscope's waveform processing engine retrieves the stored data from each ADC's acquisition memory, it automatically assumes that samples from each memory device are equally spaced. In an attempt to reconstruct the shape of the original input signal, the oscilloscope's $\text{Sin}(x)/x$ reconstruction filter produces a severely distorted representation of the signal, as shown in Figure 3.

So how do we increase the sampling rate and ensure measurement accuracy?

Simply speaking, *how* your oscilloscope interleaves the samples is more important than the number of samples that are interleaved. So, increasing measurement accuracy can be done when using interleaved real-time sampling — if done the correct way.

The key to achieving accurate, distortion-free interleaving — and in turn more accurate measurements — is following two rules:

1. Each ADC's vertical gain offset and frequency response are closely matched.
2. The timing of phase-delayed clocks aligns with high precision to satisfy Nyquist's second rule, which dictates equally spaced samples. (Remember I mentioned this second rule would be important!!)

Testing for interleave distortion

Unfortunately, unlike sampling rate, oscilloscope data sheets don't have a specification that directly quantifies the quality of an oscil-

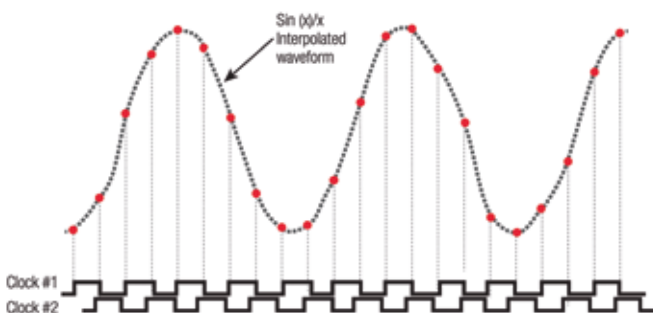


Figure 2: Timing diagram showing non-evenly spaced samples.

loscope's interleaving process. However, you can easily perform a variety of tests not only to identify sampling distortion, but also to measure and quantify the effect of sampling distortion. Below is a list of tests you can perform:

1. Effective number of bits (ENOB) analysis using sine waves
2. Visual sine wave test
3. Spectrum analysis
4. Digital clock measurement stability comparison tests

When you compare the waveform fidelity of scopes of similar bandwidths, Keysight's real-time scopes produce a true representation of input signals using high-precision ADC technology and precise interleaving.

Keysight has done some of these tests for you. If you want to learn more about how to perform these tests or see the results, check out Keysight Technologies' Evaluating Oscilloscope Sample Rates versus Sampling Fidelity.¹

Summary

Now you know why you can't completely trust the data sheet when it comes to sampling rates. While a higher sampling rate is typically preferred, when improper interleaving technology (such as uneven intervals) enters the process, it introduces enough inaccuracy to negate this method of achieving a faster sample rate. To truly reap the benefits of higher sampling rates through real-time interleaving, your oscilloscope must follow two rules and not just one.

Want to learn more about oscilloscope sampling? Check out Keysight Technologies' Evaluating Oscilloscope Sample Rates versus Sampling Fidelity.²

References

1. <https://www.keysight.com/us/en/assets/7018-01454/application-notes/5989-5732.pdf>
2. As above.

**Michelle Tate is currently a Product Marketing Manager for InfiniiVision Oscilloscopes. She worked in the semiconductor industry prior to joining Keysight Technologies.*

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'WORLD'S FASTEST'

OPTICAL NEUROMORPHIC PROCESSOR REVEALED

An international team of researchers have demonstrated what they claim is the world's fastest and most powerful optical neuromorphic processor for artificial intelligence (AI), which operates faster than 10 trillion operations per second (TeraOPs/s) and is capable of processing ultralarge-scale data. Published in the journal *Nature*, the team's breakthrough is said to represent a leap forward for neural networks and neuromorphic processing in general.

Artificial neural networks, a key form of AI, can 'learn' and perform complex operations with wide applications to computer vision, natural language processing, facial recognition, speech translation, playing strategy games, medical diagnosis and many other areas. Inspired by the biological structure of the brain's visual cortex system, artificial neural networks extract key features of raw data to predict properties and behaviour with unprecedented accuracy and simplicity.

Led by Melbourne's Swinburne University of Technology, the international research team achieved an exceptional feat in optical neural networks: dramatically accelerating their computing speed and processing power. They demonstrated an optical neuromorphic processor operating more than 1000 times faster than any previous processor, with the system also processing record-sized ultralarge-scale images — enough to achieve full facial image recognition, which other optical processors have been unable to accomplish.

"This breakthrough was achieved with 'optical micro-combs', as was our world-record internet data speed reported in May 2020," said Professor David Moss, Director of Swinburne's Optical Sciences Centre and co-leader of the research.

While state-of-the-art electronic processors such as the Google TPU can operate beyond 100 TeraOPs/s, this is done with tens of thousands of parallel processors. In contrast, the optical system demonstrated by the team uses a single processor and was achieved using a new technique of simultaneously interleaving the data in time, wavelength and spatial dimensions through an integrated micro-comb source. Micro-combs are relatively new devices that act like a rainbow made up of hundreds of high-quality infrared lasers on a single chip, and are said to be much faster, smaller, lighter and cheaper than any other optical source.

"In the 10 years since I co-invented them, integrated micro-comb chips have become enormously important and it is truly

exciting to see them enabling these huge advances in information communication and processing," Prof Moss said. "Micro-combs offer enormous promise for us to meet the world's insatiable need for information."

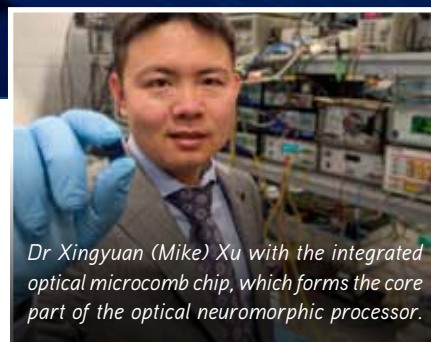
"This processor can serve as a universal ultrahigh-bandwidth front end for any neuromorphic hardware — optical or electronic based — bringing massive-data machine learning for real-time ultrahigh-bandwidth data within reach," added co-lead author Dr Xingyuan (Mike) Xu, Swinburne alum and postdoctoral fellow at Monash University.

"We're currently getting a sneak peek of how the processors of the future will look. It's really showing us how dramatically we can scale the power of our processors through the innovative use of microcombs."

Distinguished Professor Arnan Mitchell, study co-leader from RMIT University, added, "This technology is applicable to all forms of processing and communications — it will have a huge impact. Long term we hope to realise fully integrated systems on a chip, greatly reducing cost and energy consumption."

Professor Damien Hicks, from Swinburne and the Walter and Eliza Hall Institute, is a key supporter of the research team. He said, "Convolutional neural networks have been central to the artificial intelligence revolution, but existing silicon technology increasingly presents a bottleneck in processing speed and energy efficiency."

"This breakthrough shows how a new optical technology makes such networks faster and more efficient and is a profound demonstration of the benefits of cross-disciplinary thinking, in having the inspiration and courage to take an idea from one field and using it to solve a fundamental problem in another."



Dr Xingyuan (Mike) Xu with the integrated optical microcomb chip, which forms the core part of the optical neuromorphic processor.

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Helios Power Solutions Australia
www.heliosps.com.au

Office Address
Unit 6, 2-8 South St, Rydalmere,
NSW, Australia, 2116

Contact Info
Email: sales@heliosps.com.au
Phone: +61 2 7200 9200

EMBEDDED DATA ACQUISITION SYSTEM

Dewesoft's IOLITE LX embedded data acquisition system is based on a dual-core, 1.5 GHz ARM processor, which runs Dewesoft RT data acquisition software on a Linux OS. This combination gives the system the flexibility to act as a standalone data logger, a real-time control system, or a signal conditioning system with cloud or Industry 4.0 connectivity.

The product is powerful but designed to operate with low power consumption, making it suitable for any measurement application. It offers the same high-end signal conditioning modules as the IOLITE DAQ and control system; amplifiers are available for IEPE, voltage, current, resistance, strain gauge, bridge, digital counters, RTDs and thermocouples. It offers 32 GB of internal storage, expandable with an SD card of up to 1 TB.

Instead of being used internally by Dewesoft RT, the primary EtherCAT bus can be switched to external mode, allowing IOLITE LX to be used like a regular IOLITE system for full-speed buffered data acquisition to a computer running DewesoftX DAQ software. A secondary EtherCAT bus can be used in parallel to serve real-time data to any third-party control system. Standard data interfaces are available to transfer the data to real-time controllers, cloud servers and Industry 4.0 clients, using standard data interfaces such as EtherCAT, OPC UA, XCP and CAN.

The system includes DewesoftX data acquisition software, which is easy to use yet rich in functionality. It is also equipped with a redundant power supply. If the primary power supply fails, the system will be powered by a secondary power supply without any interruption or system shutdown/restart.

Metromatics Pty Ltd

www.metromatics.com.au



REWIREABLE IEC CONNECTORS

SCHURTER expands its portfolio of rewirable IEC cord connectors, the series 4782 (C13, 70°C) and 4781 (C15, 120°C), to include grey and white versions in addition to black. The added colours allow distinction between multiphases, especially in data centres, and the colour white is also a preferred option for medical applications as far as aesthetics is concerned.

The detachable cord connectors are particularly suited to small series builds with varying cable lengths and country-specific plugs that would otherwise require a large minimum order. The protective cable guard with a diameter of 8.5 mm or 10 mm is pre-assembled at the factory, and the screw terminals accept cables with cross-sections between a minimum of 3 x 0.75 mm²/18 AWG (0.82 mm²) and a maximum of 3 x 1.5 mm²/14 AWG (2.08 mm²).

The 4782 and 4781 series are compliant to the UL 60320 standard, and are also approved by safety agencies for the European, Chinese, Japanese and North American markets. No halogens are used in the cable guard or any of the other plastic components.

SCHURTER (S) PTE LTD

www.schurter.com

RF FRONT-END IC FOR GNSS RECEIVERS

STMicroelectronics' BPF8089-01SC6 RF front-end IC for global navigation satellite system (GNSS) receivers simplifies design and saves real estate by integrating the impedance-matching and electrostatic-discharge (ESD) protection circuitry typically implemented using discrete components.

The product provides a 50Ω matched interface between the receiver's antenna and low-noise amplifier (LNA), and is ready to plug and play with ST's STA8089 and STA8090 LNAs. The compact, integrated device typically replaces a matching network containing up to five capacitors, resistors and inductors, as well as two discrete protection devices, resulting in a small footprint.

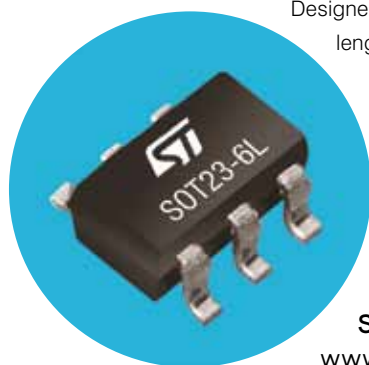
Designers can also leverage PCB-track specifications provided in the device datasheet to ease design challenges and ensure optimal performance.

The ESD protection provided complies with IEC 61000-4-2 and exceeds level 4: 8 kV for contact discharge and 15 kV for air discharge. The device also withstands 2 kV pulse voltage in accordance with MIL STD 883C.

The product is suitable for use in portable satellite receivers for GPS, Galileo, GLONASS, BeiDou and QZSS constellations, which may be used in a number of applications including consumer satellite navigation, radio base stations, drones and tracking of assets or livestock. It is housed in a SOT23-6L package that is compatible with automatic optical inspection.

STMicroelectronics Pty Ltd

www.st.com





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64-BIT MPUs

Renesas has expanded its RZ/G2 general-purpose 64-bit microprocessor (MPU) series, delivering improved AI processing for a wide range of applications. The expanded product line-up includes three entry-level MPU models built around the latest Arm Cortex-A55 core: the RZ/G2L, RZ/G2LC and RZ/G2UL. Together with the existing mid- to high-end RZ/G2E, RZ/G2N, RZ/G2M and RZ/G2H MPUs, the series provides scalability from entry-level to high-end design.

The latest MPUs are built around the Cortex-A55 CPU core, which is said to deliver approximately 20% improved processing performance compared with the previous Cortex-A53 core and to provide approximately six times faster essential processing for AI applications. In addition, the MPUs integrate camera input interfaces, a 3D graphics engine and a video codec, providing support for sophisticated functionality for human-machine interface (HMI) applications, such as multimedia processing, GUI rendering and AI image processing. The MPUs also feature the Cortex-M33 core, which makes it possible to perform real-time processing for tasks such as sensor data collection without the need for external microcontrollers (MCUs).



The entry-level MPUs feature error checking and correction (ECC) protection for both on-chip memory and external DDR memory. Support for security functions means that users can confidently adopt the MPUs for industrial applications requiring extended service life, making it possible to bring their products to market quickly. For cases where more sophisticated AI functionality may be required, Renesas plans to enhance the functions and performance of the MPUs with its AI accelerator, the DRP-AI.

Renesas Electronics
www.renesas.com

INLINE MEASUREMENT AND CONTROL SYSTEM

As the production of lithium-ion batteries continues to increase, driven by the growth in demand for electric vehicles and renewable energy storage, lithium-ion battery manufacturers are seeking to scale up operations while maintaining quality, uniformity, traceability and safety in their battery products. The Thermo Scientific LInspector inline measurement and control system addresses that demand and is specifically designed to detect defects in lithium-ion battery electrode coatings, electrode calendaring and separator films during the manufacturing process while reducing waste and improving battery quality.

The measurement and control system is said to offer a combination of improved basis weight determination; increased scan coverage; measurement precision; and novel remote instrument health and status monitoring capabilities. These developments enable good coating and thickness control, allowing manufacturers to confidently deliver quality lithium-ion battery products at scale. The system also includes innovative diagnostic display screens and data reporting purpose-built for battery factory environments.

The product enables battery manufacturers to consistently qualify the thickness and coating uniformity of battery electrodes during the production process. The system has intelligent instrument performance monitoring (IPM) with secure data archival and full traceability of product defects. These innovations should enable battery manufacturers to improve their product quality and prevent defective batteries from reaching cars, clean energy storage systems and consumer electronics.

Thermo Fisher Scientific
thermofisher.com



PCB CONNECTOR SYSTEM

HARTING's har-modular is a connector system for PCBs. It is a modular concept based on DIN 41612 connectors, but modularly configurable as from batch size 1. Modularity is thereby redefined for design-in devices.

With an online configurator, it is possible to select from a trillion possible combinations and thereby always arrive at the optimal solution, even for small series and prototypes. This represents a simplification of work and time savings on the way to the finished product. Users can choose from any number of contacts for power, signals and data. Where several connectors used to be necessary, the system combines all the desired lifelines signal, data and power in one single connection.

HARTING Pty Ltd
www.harting.com.au

HIGH-CAPACITY MAGNETIC TAPE

DEVELOPED FOR THE BIG DATA ERA

than ever. The robust nature of the material means that the data would last for longer than with other mediums, and the novel process operates at low power. As an added bonus, the system would also be very cheap to run.

“Our new magnetic material is called epsilon iron oxide; it is particularly suitable for long-term digital storage,” said Prof Ohkoshi. “When data is written to it, the magnetic states that represent bits become resistant to external stray magnetic fields that might otherwise interfere with the data. We say it has a strong magnetic anisotropy. Of course, this feature also means that it is harder to write the data in the first place; however, we have a novel approach to that part of the process too.”

The recording process relies on high-frequency millimetre waves in the region of 30–300 GHz, or billions of cycles per second. These high-frequency waves are directed at strips of epsilon iron oxide, which is an excellent absorber of such waves. When an external magnetic field is applied, the epsilon iron oxide allows its magnetic direction, which represents either a binary 1 or 0, to flip in the presence of the high-frequency waves. Once the tape has passed by the recording head where this takes place, the data is then locked into the tape until it is overwritten.

“This is how we overcome what is called in the data science field ‘the magnetic recording trilemma’,” said Project Assistant Professor Marie Yoshikiyo. “The trilemma describes how, to increase storage density, you need smaller magnetic particles, but the smaller particles come with greater

The latest development in magnetic tape technology should see magnetic tapes with 10 times the current capacities within five to 10 years, thanks to work conducted at The University of Tokyo and published in the journal *Advanced Materials*.

Although they are slower to access than other storage devices, such as hard disk drives and solid state memory, digital tapes have very high storage densities. More information can be kept on a tape than other devices of similar sizes, and they can also be more cost effective. So for data-intensive applications such as archives, backups and anything covered by the broad term big data, they are extremely important. And as demand for these applications increases, so does the demand for high-capacity digital tapes.

Professor Shin-ichi Ohkoshi and his team at The University of Tokyo have now developed a magnetic material which, together with a special process to access it, can offer greater storage densities

instability and the data can easily be lost. So we had to use more stable magnetic materials and produce an entirely new way to write to them. What surprised me was that this process could also be power efficient too.”

Epsilon iron oxide may also find uses beyond magnetic recording tape. The frequencies it absorbs well for recording purposes are also the frequencies that are intended for use in next-generation cellular communication technologies beyond 5G. So in the not-too-distant future, when you are accessing a website on your 6G smartphone, both it and the data centre behind the website may very well be making use of epsilon iron oxide.

“We knew early on that millimetre waves should theoretically be capable of flipping magnetic poles in epsilon iron oxide — but since it’s a newly observed phenomenon, we had to try various methods before finding one that worked,” said Prof Ohkoshi. “Although the experiments were very difficult and challenging, the sight of the first successful signals was incredibly moving. I anticipate we will see magnetic tapes based on our new technology with 10 times the current capacities within five to 10 years.”

Coating increases durability of EV management system

With the rise in demand for electric and hybrid vehicles, protecting battery systems from harsh environments has never been more critical. The secret to enhancing battery performance, safety and reliability lies in implementing the most effective electrochemical protection materials, particularly given the increasing trend towards high-capacity, fast-charging battery packs. Electrolube's extensive portfolio of resins, coatings and thermal management solutions supports the entire protection of EV batteries.

An EV customer in India recently approached Electrolube to help provide a solution for an issue with an existing coating they had used from a different supplier for their battery management system (BMS). The BMS continuously monitors parameters such as temperature, voltage and current in and out of the battery pack to ensure it is operating in safe conditions at all times. BMS is a critical system that's responsible for the thermal management of the battery and not only adjusts cooling, but can also trigger other safety mechanisms to stop operations and minimise risk. For instance, if overheating of the battery pack is detected by the BMS, the vehicle's power output is automatically limited and the vehicle is put into failsafe mode.

The EV battery customer required a robust, high-performance coating that was scratch-resistant and solvent-free, and provided a high level of protection against harsh environments. Electrolube's next-generation coating, UVCL — part of a wider range of UV cure coatings — was selected to protect the BMS with excellent results. And since the customer didn't have a UV curing facility in-house, Electrolube's customer service team in India sourced a reputable supplier to assist them.



The low-viscosity, single-component UVCL provides a high level of protection for electronic circuitry at high production throughputs. The coating also cures within seconds upon exposure to the correct dose of UV light and has a highly effective, moisture-initiated secondary cure mechanism to ensure curing in shadowed areas. UVCL eliminates the use of solvents, being both VOC-free and non-flammable, and is applied via selective spray equipment. It has been widely tested and demonstrates ease and speed of application in an automated process, achieving high-speed surface cure.

The UVCL coating allows the application of relatively thin films and requires no dilution,

so it is ready to use instantly. It also provides good storage stability and a long shelf life. With a high level of flexibility, the coating provides protection in harsh environments, including high-humidity, thermal shock, moisture, corrosive and chemical atmospheres at minimal cost. The coating also fluoresces under UV light for ease of inspection and offers good electrical properties with a wide operating temperature range of -65 to +135°C.

"We are very pleased to have provided such a successful solution for this EV application, especially given the critical nature of BMS," said Ron Jakeman, Managing Director of Electrolube. "Electrolube is experiencing increasing demand from EV battery designers and manufacturers, and we have been providing effective solutions that have been tested and proven to address heat, performance and protection issues. We have always relished challenges — it's what drives us to innovate constantly — and the EV battery industry is increasingly reaching out to us for solutions that safeguard every conceivable aspect of an EV battery to ensure they have every box ticked when it comes to safety, reliability and performance."

Electrolube
www.electrolube.com.au



HIGH-SIDE CURRENT SENSE AMPLIFIERS

With the proliferation of automation and connectivity throughout the automotive and industrial markets, the need to accurately measure a dynamic current in the presence of high frequency noise often plagues modern vehicle and factory applications. In order to combat electrically noisy environments and address the need for higher accuracy current measurement, Microchip Technology introduced its high-side current sense amplifiers — said to feature the industry's lowest offset for AEC-Q100 Grade 0 qualified high-side current sense amplifier devices.

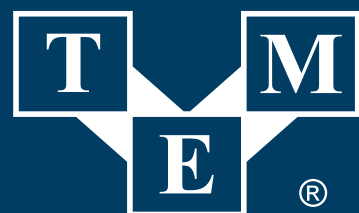
AEC-Q100 qualified, the MCP6C02 amplifier is offered in both a Grade 1 6-pin SOT-23 package and a Grade 0 8-pin 3x3 VDFN package. Delivering a maximum offset error of only 12 μ V, the VDFN package was designed to offer the lowest offset voltage for any Grade 0 high-side current sense amplifier. Specified over a temperature range of -40 to +150°C, its low offset error allows the use of small value shunt resistors while also maintaining a high measurement resolution. This enables an energy-efficient current measurement solution for those applications exposed to extreme temperatures, like the motor within a vehicle's water pump. In addition, the VDFN package is processed with wettable flank plating, allowing for visual inspection of the solder joints and removing the need for X-ray scanning as required for traditional DFN packages.

Microchip's MCP6C02 and MCP6C04 devices also feature an on-chip electromagnetic interference (EMI) filter and a zero-drift architecture. The EMI filter helps provide added protection against high-frequency electrical interference, such as wireless hotspots and radio frequencies, while the self-correcting architecture should bring increased accuracy to current measurement. Together these features enable developers to create high-performance solutions in a wide variety of applications, such as creating a current controlled feedback loop for a power supply or motor, monitoring and charging batteries, or monitoring current levels for safety reasons.

Microchip Technology Australia
www.microchip.com

LS ELECTRIC

**a Korean manufacturer
of power equipment
and industrial automation**



Electronic Components

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Transfer Multisort Elektronik Sp. z o.o.
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youtube.com/TMElectroniComponent

POWER ENTRY MODULE

SCHURTER's DD11 series power entry module provides a high level of functional integration with minimal package dimensions. It is suitable for equipment with low-profile panels.

Consisting of an IEC appliance inlet (C14), which is compatible with cord retention, 1- or 2-pole fuseholder, and power ON/OFF switch, the module is now available with side mounting flanges in addition to the existing model with top and bottom flanges. The latest model is designed to minimise height when vertically mounted.

The compact design makes the series suitable for use in devices with limited space, and where high electrical and mechanical loads are present at the same time. Especially suited to medical applications, the series is designed to comply with IEC 60601-2. The fuse-drawer is offered as 1- or 2-pole and accepts 5 x 20 mm fuses. An extra-safe feature prevents users from removing the fusedrawer while the power cord is plugged into the equipment. The cord retention feature protects against inadvertent disconnection. Other application areas include IT and telecom, office and household equipment, and automation systems.

The product is rated for current levels up to 10 A at 250 VAC according to IEC and UL/CSA and is ENEC and cURus approved. Versions with EMC filters are also available. SCHURTER power entry modules with fuseholders meet the enhanced requirements of glow wire tests according to IEC 60695-2-11 or -12 and -13.

SCHURTER (S) PTE LTD

www.schurter.com



PROGRAMMABLE LAB POWER SUPPLIES

The SP series are the latest addition to the Helios range of laboratory power supplies. The compact supplies come in 1RU (up to 1600 W) and 2RU 19" rack mount packages in power levels from 600 to 4000 W. Voltage ranges from 0–800 VDC and current ranges from 0–200 A (model dependent).

The SP series are a full-feature, high-precision range of lab test power supplies. Features include front push-button controls and alphanumeric display; USB/LAN/RS485/RS232 communication interface as standard; up to nine recall stored functions; sequence wave form setting; operation in CV and CC modes; and built-in protection for OVP/OC/OTP and OPP.

Helios Power Solutions

www.heliosps.com.au



ALL-IN-ONE CELL SITE INSTALLATION AND MAINTENANCE TEST TOOL

The VIAVI OneAdvisor-800 all-in-one tool has received enhancements to streamline cell site maintenance of 5G and 4G technologies. With the addition of 5G NR and 4G LTE signal analyser functionality, field technicians can efficiently deploy, integrate and troubleshoot today's multitechnology networks with a single instrument.

The product consolidates all key 5G and 4G cell site installation and integration tests, with support for fibre, coaxial cable, PIM detection, fronthaul and spectrum/signal analysis. In addition to the efficiency of an all-in-one device, built-in automated workflows guide technicians through each test process and automatically store test results, further streamlining cell site certification and optimisation.

The tool's 5G NR signal analyser provides comprehensive signal analysis measurements for 5G, including beam analysis and carrier scanner for single or multiple 5G channel verification. Its 4G LTE signal analyser meanwhile enables one-button testing for standards-based RF channel power, an over-the-air channel scanner and an ID scanner verifying LTE-FDD/LTE-TDD signal performance, allowing fast validation and troubleshooting.

An EMF signal analyser provides electromagnetic field testing in spectral format and in the 5G beam analysis method, effectively assessing the amount of energy emissions from 5G active antenna-based radios. Finally, the DSS signal analyser enables concurrent signal analysis of 5G NR and 4G LTE signals transmitted on shared spectrum to quickly identify service availability and performance issues.

The automated tool means field technicians can become proficient with reduced risk of error, the company claims, and experienced technicians can work more quickly.

VIAVI Solutions Inc

www.viavisolutions.com.au

WI-FI AND BLUETOOTH MODULES

Laird Connectivity's Sterling-LWB5+ modules deliver Wi-Fi 5 (802.11ac) and Bluetooth 5.1 communications to next-generation Internet of Things (IoT) devices such as battery-powered medical devices, Industrial IoT sensors, rugged handheld devices and other connectivity solutions. They are powered by the Infineon CYW4373E solution, supporting secure performance in Industrial IoT settings.

Suitable for harsh environments, the modules feature a solder-down module form factor to minimise the effects of vibration and impacts, as well as an industrial temperature rating of -40 to +85°C. The range provides for several small-form-factor PCB modules with options for integrated and pre-certified external antennas, as well as a couple of M.2 form factor solutions for increased host integration flexibility for designers' Linux platforms.

For optimum integration Laird Connectivity has also produced and certified a range of internal and external antennas, along with a reverse polarity SMA cable assembly specifically for Sterling-LWB5+ modules. The antenna range includes the internal FlexPIFA, Nanoblade and Mini Nanoblade Flex antennas as well as an external dipole antenna.

The modules support the latest WPA3 security standards, with an integrated power amplifier and low-noise amplifier (LNA) that are designed to ensure connectivity even in challenging RF environments. The devices are available in multiple antenna options and are certified to FCC, IC, CE, MIC, AS/NZ and Bluetooth SIG certification.

Mouser Electronics
au.mouser.com



Compact, Powerful MCUs

PIC18-Q41 Family for Improved Sensor Interface Designs

The PIC18-Q41 family of microcontrollers (MCUs) combines sophisticated analog peripherals and powerful Core Independent Peripherals (CIPs) for small, high-performance data acquisition and sensor-interfacing applications. Available in small 14- and 20-pin packages, these MCUs are equipped with an operational amplifier, a 12-bit Analog-to-Digital Converter with Computation, and 8-bit Digital-to-Analog Converters providing a high level of analog integration for amplification, filtering and signal conditioning. With our comprehensive development tool suite, you can easily configure peripherals and functions, generate application code and simulate analog circuits prior to hardware prototyping to reduce your development time and speed your time to market.

PIC18-Q41 MCUs are well suited for IoT edge nodes, medical, wearables, LED lighting, home automation, automotive and industrial process control.

Key Features

- Up to 64 KB Flash program memory, up to 4 KB data SRAM, 512B data EEPROM
- Small-footprint packages for sensor interface applications
- Faster time to market with MPLAB® Code Configurator and MPLAB Mindi™ Analog Simulator
- Easy-to-use development tools to get your design to market faster



Contact Information

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

microchip.com/WNIE-Q41

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mmWAVE RADAR MOTION SENSOR MODULE

The MM5D91-00, manufactured by Jorjin Technologies, is an integrated millimetre-wave (mmWave) radar-sensing solution based on Infineon's XENSIV mmWave radar chip. The module enables engineers to rapidly deploy detecting and tracking capability of micro and macro motions with high sensitivity for developing next-generation smart home and building and healthcare applications.

Compared to traditional passive infrared and ultrasonic sensors, mmWave

radar-sensing technology offers many performance benefits. Radar sensors do not require operation with a direct line of sight, making it possible to be concealed or disguised underneath plywood or plastic enclosures for addressing privacy and security considerations. Radar sensing is also adaptable to environmental conditions such as darkness, sunshine, smoke, fog or haze, which should reduce detection errors.

The all-in-one integrated solution enables the detection of human presence within a configurable range. Micro-movement detection like typing in front of a notebook and macro-movement detection like walking inside a room can be detected. Powered by Infineon's XENSIV mmWave radar chip and its radar presence detection algorithms, the product incorporates a processor system based on Infineon's ARM Cortex-M4F, an integrated 1Tx/3Rx antenna, and an onboard power regulator.

The antenna in package (AIP) with built-in detector feature makes it easy for engineers to integrate mmWave radar sensing capability, without prior technical know-how in radio frequency, antenna design or radar signal processing. The product offers low power consumption and a small form factor, and is FCC pre-test ready.

Arrow Electronics Australia Pty Ltd
www.arrowaustralia.com



SIGNAL QUALITY ANALYSER

Anritsu is now supporting FEC tests of 400GbE and next-generation 800GbE QSFP-DD and OSFP transceiv-

ers by adding PAM4 PPG 8-channel synchronous/FEC pattern-generation functions to the company's Signal Quality Analyzer MP1900A series.

FEC is being adopted at data centres using PAM4 to implement faster and larger-capacity 400GbE, etc, communications with assured quality. In addition, there is also active development of four and eight multilanes as well as PAM4 technologies. As a result, transmission quality tests for QSFP-DD, OSFP, etc, optical modules urgently need techniques to confirm the degree of error correction using multilane FEC patterns with added jitter and ISI stress. Moreover, such measurements require a signal source for accurate control of the eight synchronised channels and the phase and patterns between channels.

The Signal Quality Analyzer MP1900A series Pulse Pattern Generator all-in-one BERT supports both generation of 400GbE PAM4-signal multichannel FEC patterns and jitter tolerance measurements. As well as supporting 1- and 4-channel patterns, 8-channel pattern synchronisation and FEC pattern generation functions have been added to this high-speed PAM4 BERT, supporting 8-lane transceivers for 400GbE communications.

Anritsu Pty Ltd
www.anritsu.com



SOLAR HARVESTER

Designers of space-constrained designs can now increase runtime with the MAX20361 single-/multi-cell solar harvester with maximum power point tracking (MPPT) from Maxim Integrated Products. The small solar harvester is suitable for space-constrained applications such as wearables and emerging Internet of Things (IoT) applications.

Designers are often challenged with the trade-off between small size and long runtime for wearable and IoT applications. By enabling solar charging in these space-constrained products, the solar harvester can extend the runtime of those devices by providing a supplemental

power source. For example, by harvesting 30 mW of solar power per day on a 300 mAh battery system that typically runs for three weeks, the user can extend that runtime by over 50%.

Compared to its closest competitor, the device is claimed to reduce solution size by at least half and to increase harvested energy with up to 5% better boost efficiency. Additional harvesting gains can be achieved through adaptive MPPT features, coupled with the integrated harvesting gauge for real-time indications of efficiency to optimise performance.

Avnet Electronics Marketing
www.em.avnetasia.com

USING THE RCM IN AUSTRALIA

Most manufacturers understand the use of the CE mark signifies the product meets all the applicable European directives. Australia and New Zealand are not part of the EU and therefore cannot legislate the use of these directives.



Not even the UK will be able to use the CE mark for much longer — UKCA will be the new mark required in the UK, and came into effect earlier this year.

Laws have been created in Australia and New Zealand to ensure the electrical products are compliant and bear the correct marks.

There are different regulatory schemes that electrical products have to comply with:

EESS (Australia and New Zealand)

Under EESS, certain kinds of equipment require an RCM. Those that do not require the RCM still must meet Australian and New Zealand electrical safety standards.

ACMA (Australia only)

Under the ACMA, the RCM indicates the product meets the applicable requirements for:

1. Telecommunications
2. Electromagnetic Compatibility (EMC)
3. Radiocommunication
4. Electromagnetic Radiation (EMR) or Human Exposure

What about New Zealand? The RSM

Products to be distributed in New Zealand are subject to the RSM scheme.

This means the RCM is used to indicate a product meets EMC standards or, in some cases, the NZ Radiocommunications standard.

The RNZ mark must be used where the applicable NZ radio standard is not harmonised with the ACMA standard.

New Zealand's telecommunications requirements are controlled by a permit system by carriers and further requirements by the NZ Ministry of Health.

Whichever scheme your product falls under, you are required to maintain records of compliance.

Hefty penalties apply for suppliers who:

- distribute products that do not comply with the applicable regulatory schemes
- use incorrect markings, ie, using a CE mark
- fail to keep proper records

To summarise, the RCM is used under the ACMA and EESS, but in some cases the RSM.

What suppliers can do

We understand this is a complex process for retailers and suppliers, which is why we have provided a few options:

1. Compliance Folder Management

Comtest Group can compile your compliance documentation for you, ensuring you have the correct test reports or certification.

We can also act as an Australian representative, registering you as a supplier if necessary and liaising with authorities.

This eliminates the hassle and potential repercussions of having the wrong documentation.

2. Testing

You don't have to know what regulatory schemes or exact standards you are testing for. Upon consultation, we can determine the standards the product needs for Australia and NZ, then arrange relevant testing.

This saves time arranging each individual electrical test.

You'll also receive upfront quotes and we will only test what you need.

3. Virtual Compliance Manager

This is our most comprehensive option.

We start at the very beginning of a product's life cycle, where we review the design of your product to avoid unnecessary production costs.

As a cooperation partner of TÜV SÜD, we arrange your testing and certification through our network.

Then Comtest Group handles your ongoing compliance, investigating product faults, liaising with authorities, and updating your documents if you change your product.

If you have any electrical or telecommunications devices, we're here to help manage your compliance. Contact us below.

Email: comtest@comtest.com.au Phone: +613 9645 5933



Comtest Group
www.comtest.com.au

ABSOLUTE ENCODER

The magnetic AEMT-12/16 L absolute encoder from FAULHABER delivers absolute angle information with a preset multiturn resolution of 16 bits (65536 revolutions) and a single-turn resolution of 12 bits (4096 steps) for commutation, speed control and motion control.

The encoder can be combined with brushless DC motors of the B, BX4 and BP4 series. The encoder is connected via ribbon cable; suitable connectors and different filter modules and adapters for connecting to FAULHABER speed and motion controllers are available. Advantages include a cable length of up to 5 m; efficient operation with low torque ripple; and no reference run is necessary after switch-on.

Position data is queried by an SSI interface with BiSS-C protocol. With a line driver, the interface is designed differentially and based on the RS422 standard. Therefore, it's possible to position the motor/encoder unit up to 5 m away from the controller.

The BiSS-C protocol is designed for applications in which high transmission speed, flexibility and simple implementation are required. For FAULHABER, Digital Hall sensors for commutation of the motors are no longer generally needed. With AEMT, sine commutation is possible, as is efficient operation of the motor with minimal torque ripple.

The encoder can be connected to a main supply and a backup supply (eg, a battery) so that the count is retained and a new reference run is not necessary. The multiturn count can be reset via an additional interface pin during start-up.

ERNTEC Pty Ltd
www.erntec.net



FULLY RUGGED TABLET

The RuggOn Rextorm PX501 rugged tablet is integrated with advanced touch technology, allowing the user to avoid unintended touches including hand palm, water mist and rain drops.

Paired with an IP54 digitiser pen or 2 mm hard tip stylus, the product is designed to enable a sensible writing experience. Combined with the hard Gorilla Glass and glove touch function, it is a dedicated device for mobile workers, resisting external damage and fulfilling on-field needs.

The tablet features high-resolution WUXGA (1920 x 1200) and a 1000-nit, sunlight-readable display. The hyper dimming option adapts to low ambient light conditions while increasing viewing performance.

The rugged Rextorm series come with a wealth of I/O ports and expansion options, meeting the various requirements of different applications including fingerprint readers, smart card readers, UHF RFID and integrated 2D barcode readers. The optional OCR capabilities allow for passport scanning and identity detection.

Equipped with the latest communication technology, mobile workers can experience precise positioning, fast processing, broad coverage and stable data transfer even around buildings or trees. The seamless connection is enhanced through the switchable dual pass-through connector.

The rugged tablet also aims to deliver enhanced power. It maximises uptime by optimising system design, hot-swap battery and fast charging. ECO mode enabled by the DashON app can extend battery life even further.

Metromatics Pty Ltd
www.metromatics.com.au




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NEW ELECTRODE MATERIAL IMPROVES ALL-SOLID-STATE BATTERIES

Japanese researchers have developed a novel electrode material for all-solid-state lithium secondary batteries by combining lithium sulfate and lithium ruthenate, which results in improved performance. The scientists hope that their novel approach, published in the journal *Science Advances*, will guide future research and the eventual commercialisation of such high-capacity batteries.

The invention of commercial lithium-ion batteries (LIBs) in the 1990s marked a turning point in the technological revolution. These lightweight, rechargeable batteries power most of the electronic devices we use today, from pacemakers to electric vehicles. However, with their ever-increasing popularity emerged two major problems. The first has to do with safety: if not manufactured with the highest standards, LIBs can malfunction. Secondly, because lithium is typically found in low concentrations in the Earth's crust, our 'addiction' to modern technologies is — slowly but surely — depleting our current reserves of the metal.

Anticipating the ever-growing demand for technology, scientists are looking at various alternatives to make batteries safer and more sustainable in the long run. A Japanese research team, led by Associate Professor Atsushi Sakuda and Dr Kenji Nagao at the Osaka Prefecture University (OPU), has been studying a type of battery that they believe holds the key to the future of energy storage: all-solid-state batteries (ASSBs).

"In 2019, we developed a solid electrolyte using sodium ions, which showed the highest conductivity in the world reported at room temperature," Dr Sakuda said. The team's latest study details an innovative method for developing novel electrode materials for safe and highly efficient ASSBs.

The main difference between ASSBs and conventional LIBs is that the former uses a solid electrolyte instead of a liquid one. The liquid electrolyte in LIBs is highly flammable and also tends to have a lower conductivity; it is also prone to leakage and is thus all the more

dangerous. Swapping this with a more stable solid electrolyte could solve the battery's safety and performance issues, the researchers said. The non-flammable nature of solid electrolytes makes ASSBs extremely safe. It is also possible to 'miniaturise' these cells, as they do not require separators or cooling systems.

However, one obstacle remains: it is difficult to achieve effective contact between the electrolyte and the electrode active material, and this decreases the energy density and the battery's performance. "Finding novel, efficient electrode materials is therefore key for manufacturing ASSBs with high energy density," Dr Sakuda said.

To solve this problem, the researchers looked at the electrode's composition. The active material in the electrode is what allows the battery to function: by losing or gaining electrons through redox (reduction-oxidation) reactions, the material enables charge transfers between the electrode and the electrolyte. The more redox reactions occur, the more charge is stored in the battery, and the more energy density it has.

Based on this knowledge, the researchers developed a positive electrode material, by combining two lithium compounds: lithium sulfate (Li_2SO_4) and lithium ruthenate (Li_2RuO_5). The resulting matrix provided more space for ions to flow through, enabling a faster transfer of charge. The addition of Li_2SO_4 also made the overall structure more ductile and amorphous, or easy to mould, which enables a reversible redox reaction and allows for the matrix to be further compressed to increase electronic and ionic conductivity — and thus stability.

The performance of these novel batteries is impressive: with a reversible capacity (the ability to charge and recharge) of 270 mAh/g, they outperform most previous ASSBs. But the researchers want to go further still, by swapping out the expensive ruthenium (Ru) element in the electrode with another, cheaper metal with similar properties.

The researchers believe their method provides a solid basis for the manufacture of next-generation batteries. They hope to be able to demonstrate the operational safety of ASSBs in electric vehicles; in doing so, they expect that ASSBs will become the prime candidate for next-generation batteries.

"We believe that safe and durable ASSBs such as these can be widely used in aeroplanes, ships, trains, personal computers, smartphones, households and other electronic items," Dr Sakuda said.

ETHERNET MEDIA CONVERTER

MPL's μ TX2FX is an ultracompact Ethernet media converter that translates transmission signals from a twisted-pair 100/1000Base-TX cable to a 100Base-FX or 1000Base-X fibre-optic cable. It expands the network data transmission distance beyond the 100 m limitation of copper wire to over 10 km by using single-mode fibre-optic cable.

For the fibre-optic port, any standard small form-factor pluggable (SFP) transceiver module that complies with the MSA standard and is Ethernet compatible can be used. SFP transceivers modules are available with a variety of different transmitter and receiver types, allowing users to select the appropriate transceiver for the required fibre-optic interface. Furthermore, the media converter provides automatic detection and initialising of the SFP module.

Since the product design is based on a PHY, the latency of the frame is constant. This allows using the device to be most effective in a time-sensitive network that needs to support IEEE 1588 PTP or IEEE 802.1AS gPTP traffic.

Backplane Systems Technology Pty Ltd

www.backplane.com.au



MINI FANLESS SYSTEMS

Avalue Technology has released the NUC-APL and NUC-APL-slim fanless systems, built around Intel's Next Unit of Computing (NUC) small form factor PC.

The NUC-APL is a tiny PC with a powerful processor, fast memory and massive storage comparable to full-size desktop PCs. It features the Intel Celeron Processor J3455/N3350 and offers dual HDMI, one DP, multiple USB3.0 ports and two COM ports on the rear side for use in various applications and scenarios. Adopted with Intel HD graphics, the product can handle HD media and more demanding applications than traditional low-power systems, the company claims, with high performance and a TDP of less than 22 W.

Avalue is also releasing another small-form-factor barebone computer — the NUC-APL-slim — with the same CPU, the same HD graphics and the same connection I/O ports arrangement as the NUC-APL, while removing one 2.5" hard drive, one COM port and one DP port. This makes it more compact for space-limited applications, with the option to install a solid-state M.2 module for storage.

The systems are armed for light industrial general-purpose applications, such as smart gateway, smart retail, smart education, smart service, videoconferencing and control units.

Avalue

www.avalue.com.tw



DIGITAL PRINTING FACILITY FOR ENCLOSURES

Metal enclosures manufacturer METCASE has invested in the latest technology for cases and front panels printed with photo-quality legends, logos and graphics. Having first introduced digital printing five years ago, increased demand has now prompted the company to double its capacity. The updated equipment is slightly larger and 40% faster than the existing 1800 x 1800 dpi flatbed printer, and the company is using inks which are more scratch resistant.

METCASE digitally prints user-specified legends, logos and graphics on its 19" rack cases, instrument enclosures and front panels. Digital printing is said to be quicker and easier than traditional silk screen and tampo methods, as there are no tooling costs, set-up is easy and there is low wastage. This helps to make customisation viable for low-volume orders.

The company can print in full-colour CMYK up to 1800 x 1800 dpi; the technology is suitable for painted or anodised metal surfaces (and plastics) with all different kinds of textures. Hard UV ink provides scratch resistance and a clear lacquer is applied on top for added protection. Simultaneous printing of colour and white speeds up production, the company says, while UV LED curing improves consistency and saves energy.

METCASE can print multiple panels or cases at once; the maximum object height is 150 mm. Digital printing enables the company to create different iterations more easily, making it simpler to add barcodes and QR codes to enclosures and front panels. Customers need only provide a high-resolution PDF or EPS file, or a DWG/DXF CAD file including the print details. Other formats are also possible.

Downloadable 3D models for enclosures and front panels are available on the website, allowing clients to modify the specifications and see how their components will look when installed. Other customisation services offered include custom sizes; custom front panels; CNC punching, folding, milling, drilling and tapping; fixings and inserts; painting and finishing.

ROLEC OKW Australia New Zealand P/L

www.metcase.com.au

TRACEABILITY IN TORQUE MEASUREMENT

The traceability procedure of calibrating torque tools within assembly processes is crucial for obtaining accurate data records within the production process.

The manufacture of critical joints that occur in high-stress components places heavy demands on manufacturers, thus making screw-tightening a very important task in today's assembly process. Industries such as aerospace, medicine, transport and electronics are utilising traceability for quality recording and statistical data that is used for ongoing processes and quality improvement, as well as meeting safety guidelines and quality control standards.

Importance of precise measurement

Precise measurement of torque requires each individual fastener and joint to be tightened precisely to the correct torque specification, which then needs to be individually checked, verified and recorded for traceability and quality purposes. In any kind of production process, not only the task should be properly designed but the measurement system should also be properly implemented. If the torque is not applied properly and the tension on the bolt torque is too low, varying loads will act upon the bolt and it will fail. The most important factor in a calibration process is decreasing its uncertainty and improving torque accuracy.

Intelligent transducerised assembly systems from Kolver

As challenging as this may all sound, fortunately there are many reliable screwdriving and screw feeding solutions on the market today. These are available in both handheld and fixtured configurations, which many industries use in situations where it is essential that all screws are tightened to the correct torque. At Hawker Richardson we strive to present a range of assembly tools that covers most of our customers' fastening requirements. We recently sourced the Kolver range of electric screwdrivers to cover the increasing demands of the electronics and high-tech industries, where torque accuracy and traceability is very important. K-DUCER is the new class A intelligent transducerised assembly system. The system consists of an advanced state-of-the-art controller and a range of handheld and fixtured electric screwdrivers. Kolver K-DUCER electric tools cover all assembly line requirements for accurate, high-quality torque and angle-controlled tightening. The built-in compact transducer provides torque control with excellent repeatability.

The Kolver K-DUCER range covers:

- Unsurpassed ergonomics and soft touch design
- LED status Indicators (ok, error, tightening, etc)
- Temperature protection
- Full traceability and error proofing capabilities: 100% compatible with Industry 4.0
- Touch screen colour display
- Multiple programs and sequences
- Intuitive programming interface



Cellcore range of assembly tools can store 15,000 cycles of rundown data within the tool.

- Precise torque and angle control
- Graphs output
- Perfect integration with Industry 4.0

Certificate of calibration traceable to a NATA certified instrument

Weber's product range of screw feeding equipment offer solutions for various applications. Their transducerised torque and angle control products are used for processes where the tightening torque is safety critical. Transducerised systems have a precision internal torque transducer and angle encoder and can be supplied with a certificate of calibration traceable to a NATA certified instrument.

Cellcore

The introduction of Cleco Cellcore 'Smart' battery tools is the latest weapon in Hawker Richardson's range of assembly tools with full error proofing and traceability.

This extremely versatile range of tools can handle torques from 0.5 to 2000 Nm with the advantage of being completely portable.

The tools can operate 'standalone' with an easy-to-program keypad interface on the tool and the ability to store the data of 15,000 rundowns. This makes them ideal for any off-site assembly requirements, particularly for solar and wind farms.

Traceability in torque measurement plays a critical and vital role in the assembly process, while ensuring tools are working as they should be, giving correct readings, providing a safe working environment for end users, and ensuring that companies are upholding their legal obligations.

**HR Hawker
Richardson**

Hawker Richardson
www.hawker-richardson.com.au



UNMANAGED NETWORK SWITCHES

The Ecoline unmanaged switch series from Weidmüller offers a compact solution for industrial Ethernet networking. With its space-saving design, the switches are offered in models with Fast Ethernet or Gigabit ports in sizes from 5–24 ports, and with options for fibre or pluggable SFP.

All models feature dual redundant power inputs and can operate in harsh environments of up to 75°C. The 5- and 8-port models can also operate on 24 VAC input, suitable for building automation.

Weidmuller Pty Ltd

www.weidmuller.com.au



INTERACTIVE PANEL PC

IEI's AFL3-W07A-AL2 is a light, industrial, interactive, widescreen panel PC for intelligent PoE management systems in building and industrial automation applications. The product features a low-power, 6 W Intel N3350 Celeron Processor and 4 GB of onboard RAM, with an optional 8 GB available.

The stylish panel PC supports an onboard PoE PD IEEE803.2 af/at port, allowing data and power to be supplied via a single cable. The 7" widescreen LCD has a 16:9 resolution, an IP65-compliant front panel and a projective capacitive touch screen with an anti-UV and anti-glare coating.

The device has a selectable AT/ATX power mode and a 12 VDC input with lockable DC jack. Two external USB 3.2 Gen 1 ports enable simplified connectivity to a variety of external peripheral devices. Wi-Fi 802.11 a/b/g/n/ac, Bluetooth V4.1 and Gigabit Ethernet capabilities provide the system with smooth connection to external networks.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



FRAME GRABBERS WITH DATA FORWARDING

The Matrox Rapixo CXP Quad Data Forwarding — the latest product in the Matrox Rapixo CXP series of frame grabbers — combines CoaXPress 2.0 connectivity with a data forwarding option to help distribute image processing across multiple computers. The frame grabbers offer high-rate acquisition while minimising CPU load; PC-based machine vision systems equipped with a frame grabber can thus deliver high throughput or perform demanding processing.

The data forwarding capability is available on two boards, one offering CXP-6 speed and the other supporting CXP-12 speed. It works by relaying images to another computer using four output connections running at up to 12.5 Gbps. The data forwarding functionality retransmits all image data prior to being stored in the onboard memory and is accomplished without the involvement of the host computer, minimising system latency. Multiple frame grabbers can be used, in a daisy-chain manner, to transfer an image to multiple computers. Each computer can then process a different part of the image or perform different processing on the whole image.

The series of frame grabbers includes models with one, two or four connections for interfacing to independent cameras. Supporting data rates of either up to 6.25 Gbps (CXP-6) or up to 12.5 Gbps (CXP-12) per connection, the Quad, Dual and Single models provide right-sized connectivity. Matrox Rapixo CXP Pro models — based on Xilinx Kintex UltraScale devices — meanwhile allow for integration of controlling, formatting and streaming logic of various interfaces directly on the frame grabber.

Dindima Group Pty Ltd

www.dindima.com

OVERTEMPERATURE PROTECTION FOR POWER SEMICONDUCTORS



SCHURTER reintroduces its RTS (Reflowable Thermal Switch) — a particularly compact overtemperature protection device using advanced SMD technology, suited for the highest demands of protection in power semiconductors.

Need for protection

Electrical and electronic equipment cannot always count on constant voltage, constant current or constant working temperatures. Various influences lead to fluctuations, which must be secured by suitable means. Thermal runaway, for example, refers to the overheating of a power semiconductor due to a self-reinforcing, heat-producing process. The reasons for this are ever-increasing power density and the trend towards miniaturisation of electronic circuits.

Inflated currents in power electronics with little power dissipation can lead to elevated temperatures of approximately 200°C. The possible consequences are serious: damage or detachment of surrounding components, damage to the printed circuit board structure or, in the worst case, triggering a fire.

With a power semiconductor (eg, MOSFET), the drain-source transmission resistance increases with rising temperatures when connected, resulting in an increasing loss of power in the barrier layer. If the elements are not sufficiently cooled — the high power density permits cooling — the power loss output in the form of heat can no longer be sufficiently dissipated, which also increases the transmission resistance. This process escalates and ultimately leads to destruction of the component.

The RTS

SCHURTER's RTS, which stands for 'Reflowable Thermal Switch', is a patented surface mount fuse that was developed to protect highly integrated power semiconductors like MOSFETs, ICs, IGBTs, Triacs, SCRs, etc, from overheating. It protects these devices not through a logic circuit but rather through basic laws of physics, providing physical protection in cases where all software-based security measures have failed. In case of thermal runaway, the RTS reliably interrupts the circuit precisely at the well-defined temperature.

Before mechanical activation, the RTS can be mounted using conventional reflow soldering techniques with temperature

profiles up to 260°C. There is no danger that the fuse will blow during the soldering process as its temperature sensitivity will be activated in the next step.

Mechanical activation

After having the RTS reflow soldered on a PCB, mechanical activation arms the RTS for tripping at 210°C. This activation can be done manually or through fully automated means. In contrast to electrical activation, the RTS activation status is immediately visible and clear to the installer. Furthermore, the third additional contact required for electrical activation is thereby eliminated.

Compact dimensions, high load capacity

The new type of overtemperature protection shines thanks to small dimensions and high load capacity. Operating currents up to 100 A at rated voltages of up to 60 VDC can be handled by the RTS at just 6.6 x 8.8 mm in size. Customer-specific variants are available with an integrated shunt or an additional overcurrent fuse. These integrated functions result in less space consumption on the printed circuit board.

Applications

The RTS meets the requirements of AEC-Q200 and MIL-STD and can be deployed wherever power transistors are used — such as in the automotive sector, which covers cooling fans, ABS power steering, PTC heaters, HVAC, glow plugs and diesel fuel heaters. It is also suited to the industrial sector, for battery protection, power supplies, lighting ballasts, H-bridge circuits and motor drivers.

For more information on thermal protection, visit www.schurter.com/Thermal-Protection and our previous article at <https://www.electronicsonline.net.au/content/protection/sponsored/the-final-authority-41463451>.

SCHURTER (S) PTE LTD
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TOP FIVE

GREEN MATERIALS FOR ELECTRONICS



When going 'green' with electronic products, the goal is to minimise energy use and have less of an environmental impact than traditional electronics. Jordan Flagel, guest author at materials database Matmatch, explains which green materials are the most suitable in electronics.

E-waste is a growing problem, its dangers stemming from elements such as lead, cadmium, copper, beryllium, barium and chromium entering the ecosystem through improperly discarded electronics. Many of these elements are used in circuit boards and electrical parts such as computer chips, touchscreens and wiring.

While it may be cheaper to use materials considered to be more toxic, many electronics producers are choosing to invest in greener materials.

Green materials come in many forms. They can range from degradable circuit boards and organic electronics to metals that are infinitely recyclable and reusable. Organic and inorganic materials can both be considered green, depending on the type of material and how it is implemented.

On the inorganic side, aluminium is considered a 'green metal' due to its recyclability and incredibly long lifespan. Borosilicate glass and graphene are other examples of eco-friendly, non-biological materials used in electronics.

As for organic materials, silk is a great option due to its biodegradability, biocompatibility and wide range of potential uses. Resins, gums, saccharides, cellulose, gelatine and peptides, which are all

biodegradable, are becoming more popular for use in applications such as sensors, signal transducers, transient, implantable and digestible electronics.

Besides being better for the planet, greener materials often perform just as well as their cheaper, non-green alternatives. If quality is equal, any company would be smart to market the greener materials used in its products. Consumers are becoming more conscious about how their purchases affect the environment and showing the environmental benefits of green materials will often lead to higher sales.

The favourable materials used in green electronics are aluminium, borosilicate glass, iron alloy, graphene and biomaterials.

Aluminium is known as the 'green metal' and 'the best eco metal' due to the fact it has a virtually infinite lifespan. It can be recycled repeatedly without losing any quality.

Each tonne of recycled aluminium saves 9 tonnes of CO₂ emissions and prevents having to source new raw metal from the ground, which is an expensive and lengthy process. In contrast, a recycled aluminium can is able to be processed and returned to the shelf in as little as six weeks.

On top of its unparalleled recyclability, aluminium is lightweight with incredible strength. Practically, the average density of aluminium

is between 2.6 to 2.8 g/cm³, yet tensile strength of pure aluminium is around 90 MPa, which can be increased to over 690 MPa in some alloys.

Strength is important for use in electronics, but its resistance to corrosion is arguably a more valuable trait. Pure aluminium also has an electrical conductivity of about 38 million S/m; alloys can have a lower conductivity, but rarely as low as that of iron or steel.

Borosilicate glass is made of the same four components as regular glass but in different percentages. Its strength, durability and resistance to temperature change result in less replacement and, therefore, less waste. Iron isn't so much a 'green' material as it is a 'yellow' one, in the sense that it isn't necessarily good or bad for the environment. The main reason for including iron alloys in this list is their recyclable properties. This is especially pertinent for electronics where recycling is crucial to avoid environmental degradation. Compared with other heavy metals, iron is the most environmentally friendly.

Graphene is one of the strongest materials on Earth. It has several characteristics, including high electron mobility that is 100x faster than silicon, thermal conductivity twice that of diamond, electrical conductivity 13x better than copper and absorption of only 2.3% of reflecting light.

Graphene can be used in a myriad of electronics applications, from faster transistors and bendable phones to improved touch screens and advanced circuitry for computers. Given that it is made from one of the most abundant elements on earth, it is inherently environmentally friendly.



EACH TONNE OF RECYCLED ALUMINIUM SAVES 9 TONNES OF CO₂ EMISSIONS AND PREVENTS HAVING TO SOURCE NEW RAW METAL FROM THE GROUND, WHICH IS AN EXPENSIVE AND LENGTHY PROCESS.

The real issue comes from how it is produced: if it is made using solvents and chemicals, it loses its 'green' status due to toxicity in its upstream production. But if it is made using physical processes, with no related chemical discharge to the surrounding environment, then it can live up to its reputation as the wonder material that it has been dubbed.

As consumer demand continues to grow for more environmentally friendly products, and as the line continues to blur between electronic and organic, 'green' materials will become even more prevalent in electronics production. Whether it's in the form of wearable tech or more ecologically friendly products, we will likely see electronics that are continually better for the environment.

Matmatch
<https://matmatch.com>

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WE THINK
OUTSIDE
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CHIP SCALE PACKAGE LED

The combination of energy efficiency and lighting quality is of key importance to luminaire manufacturers. The high-power LED Osconiq C 2424 from Osram Opto Semiconductors offers a broad colour temperature range from cool to warm white and various colour rendering indices (CRIs), enabling a large variety of different luminaire designs. It is claimed to be the only chip scale package (CSP) LED with an integrated ESD (electrostatic discharge device) that protects the LED from any electrostatic damage.

The product was designed to be compact, while maintaining high brightness and efficiency levels as well as long lifetime and robust performance. It is suitable for high-power applications and is available in three CRIs: 70, 80 and 90. It covers the colour temperature range from 2200 to 6500 K. In addition to numerous design options, luminaire manufacturers benefit from the LED's high brightness and efficiency values; for example, the CRI 70 version achieves 328 lm at 700 mA and a performance of 167 lm/W.

Luminaire manufacturers also benefit from the robust epoxy package of the LED, which provides stability and protects the component from corrosion and external shocks. Other key advantages include the lowest thermal resistance (R_{th}) and good colour over angle performance. The product features Osram's UX:3 chip technology and an integrated ESD, which protects against damage caused by electrostatic voltages up to 8 kV.

The full package measures 2.4 x 2.4 x 0.6 mm; the chip or the light-emitting surface (LES) of the LED is 2.1 x 2.1 mm. Because the package and chip have approximately the same dimensions, it is considered a CSP. This allows the individual LEDs in the luminaire to be placed close together, for particularly homogeneous illumination.

Osram Australia Pty Ltd
www.osram.com.au



HIGH-POWER GaN HEMTs

Teledyne e2v HiRel has added two ruggedised GaN power HEMTs (high electron mobility transistors) to its 650 V, high-power family of products based on GaN Systems technology.

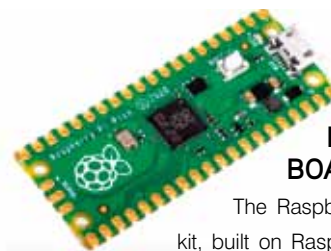
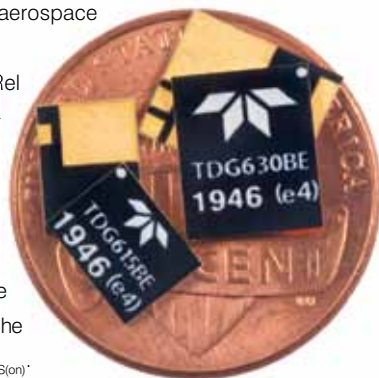
The high-power HEMTs, TDG650E30B and TDG650E15B, deliver low current performance of 30 and 15 A respectively. They are claimed to be the highest voltage GaN power devices on the market for demanding military, avionics and space applications, making them suitable for areas like power supply, motor control and half-bridge topologies.

They come with a bottom-side cooled configuration and feature ultralow FOM Island Technology die, low-inductance GaNPX packaging, high-frequency switching of >100 MHz, fast and controllable fall and rise times, reverse current capability and more. The small-sized packaging of the devices should also benefit users designing for high power density projects.

The HEMTs are both enhancement mode GaN-on-Silicon power transistors that allow for high current, high voltage breakdown and high switching frequency while offering low junction-to-case thermal resistance for high-power applications. They are designed to deliver the efficiency, size and power-density benefits required in critical aerospace and defence power applications.

For power devices, Teledyne e2v HiRel performs qualification and testing including sulfuric test, high altitude simulation, dynamic burn-in, step stress up to 175°C ambient, 9 V gate voltage and full temperature testing. Unlike SiC devices, the GaN HEMTs can easily be implemented in parallel to increase the load current or lower the effective $R_{DS(on)}$.

Teledyne e2v Asia Pacific Limited
www.teledyne-e2v.com



MICROCONTROLLER BOARD

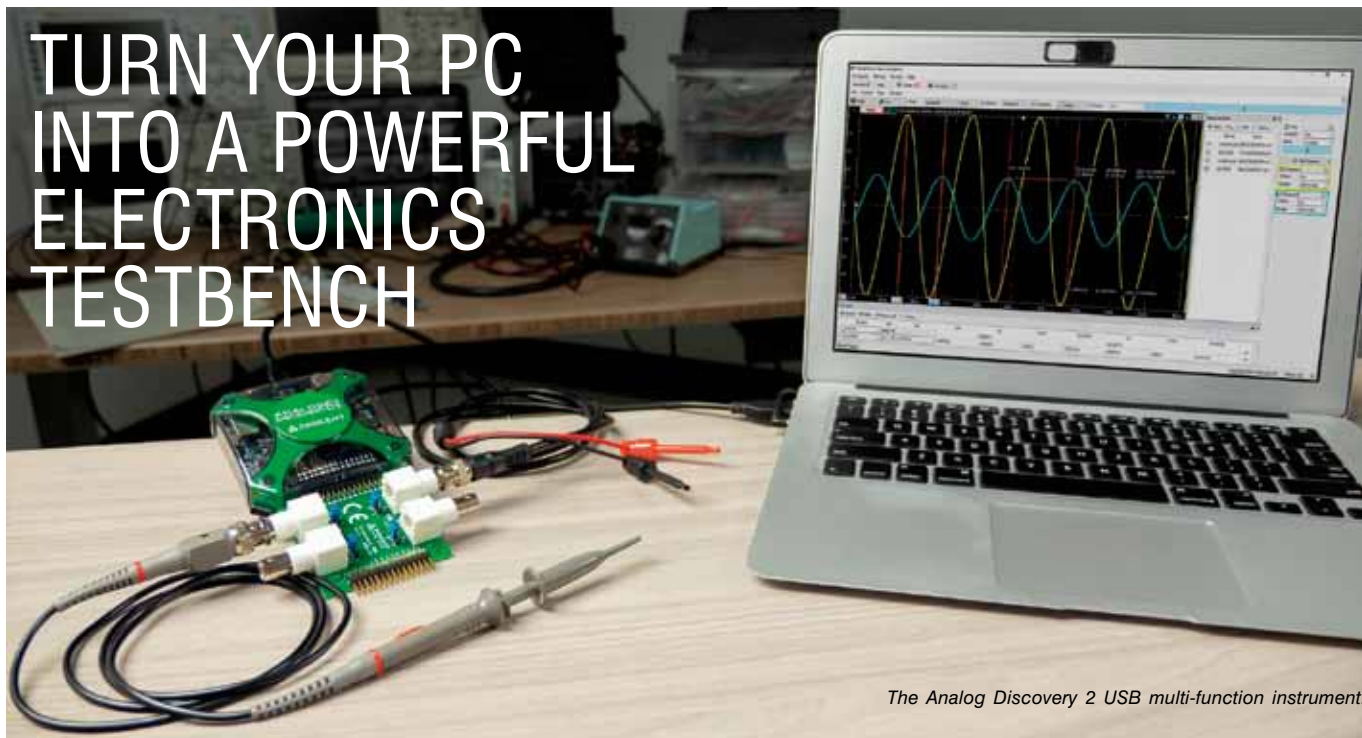
The Raspberry Pi Pico development kit, built on Raspberry Pi-designed silicon, has been designed to bring high performance and ease of use to the microcontroller market. It is a flexible development platform that can also be directly deployed into end products, reducing time to market.

At the heart of the product is the RP2040, a Raspberry Pi-designed microcontroller that offers high performance for integer workloads, a large on-chip memory and a wide range of I/O options, making it a flexible solution for a wide range of microcontroller applications. It features two ARM Cortex-M0+ cores clocked at 133 MHz; 264 kB of on-chip SRAM; 30 multifunction GPIO pins; dedicated hardware for commonly used peripherals alongside a programmable I/O subsystem for extended peripheral support; a four-channel ADC with internal temperature sensor; and built-in USB 1.1 with host and device support.

Professional design engineers who are already comfortable working with Raspberry Pi will appreciate the development board's ease of use. The onboard power supply can generate 3.3 V for the microcontroller and external circuitry. A wide input voltage range, from 1.8 to 5.5 V, gives designers the flexibility to select their preferred power source. Simple drag-and-drop programming is offered via micro-USB.

element14
au.element14.com

TURN YOUR PC INTO A POWERFUL ELECTRONICS TESTBENCH



The Analog Discovery 2 USB multi-function instrument.

The Digilent Analog Discovery 2 is a USB multi-function instrument that allows users to measure, visualize, generate, record, and control mixed-signal circuits of all kinds.

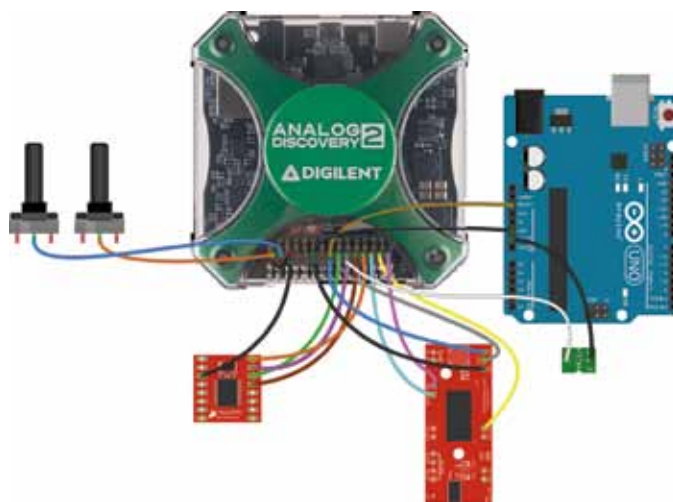
The Analog Discovery 2 is small enough to fit in your pocket but powerful enough to replace a stack of lab equipment. It comes with the FREE multi-instrument software application, WaveForms. The WaveForms seamlessly connects to Analog Discovery 2 with full Windows, Mac OS X, Linux, and Raspberry Pi 4 support. Driven by WaveForms software, Analog Discovery 2 can be configured to work as any one of several traditional instruments including an Oscilloscope, Waveform Generator, Power Supply, Voltmeter, Data Logger, Logic Analyzer, Pattern Generator, Static I/O, Spectrum Analyzer, Network Analyzer, Impedance Analyzer, and Protocol Analyzer.

Test your design with NI LabVIEW

Engineers and developers can use NI LabVIEW Community Edition and Analog Discovery 2 to test analog and digital circuits. The getting started guide presents how to install and use the Digilent WaveForms VIs LabVIEW package, to control Analog Discovery 2. Demos for controlling the Power Supply, the Digital I/O lines, the Waveform Generator, and the Oscilloscope instruments are included.

Debug Motor Control Application with Analog Discovery 2

The WaveForms Software Development Kit (SDK) can be used to create custom tester applications and scripts in Python, C,

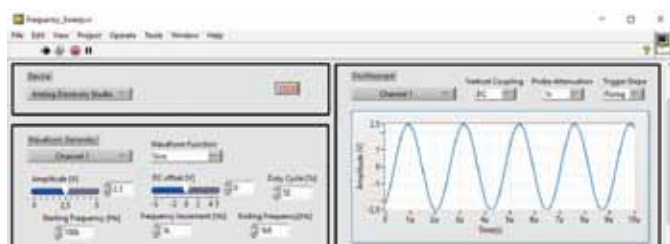


Debug Motor Controllers with Analog Discovery 2.

and additional languages. Digilent provides an example project to demonstrate how to build an automated test to debug motor controllers. In this particular project, multiple motors were used in a system where their functionality directly impacted the safety of the user, so extensive testing was necessary.

When lab spaces are not always available or convenient, the Analog Discovery 2 is a great choice as a supplement to traditional laboratories. With Analog Discovery 2, it is easy for engineers and developers to acquire, visualize, store, analyze, produce, and reuse analog and digital signals.

The Analog Discovery 2 is available via Element14.



Control Analog Discovery 2 in NI LabVIEW.

Digilent Inc
www.digilent.com





INTEGRATED IoT EDGE

Powered by a 9th gen Intel Atom E3940 quad-core processor, the UNO-137 is an industrial-grade IoT edge. Compliant with IEC-61010 safety standards, the device has a rugged design including a wide operating temperature (-40 to +70°C), wide input voltage (10 to 36 VDC), isolated DIO/COM and TPM 2.0 hardware-based security, making it suitable for industrial-grade

equipment and control cabinet applications.

The UNO-137 can be easily integrated with edge software to support various industrial applications. For example, for machine monitoring, the built-in DI/O can be used directly or connected with USB I/O modules. The inclusion of DAQNav software facilitates failure prediction and prevention. The product can also be equipped with an additional fieldbus iDoor module loaded with CO DESYS software to realise real-time, PC-based soft logic control. For remote asset management, the device supports Wi-Fi, LTE and 5G connectivity. The integration of Advantech's WISE-DeviceOn software further enables flexible device management.

To ensure easy deployment for diverse IoT operations, the UNO-137 features a modular design. The base unit has two expansion slots (1 x mPCIe and 1 x M.2) for integrating diverse expansion modules. The device has been optimised for DIN-rail mounting with the provision of a sliding hook that snaps into place as well as a user-friendly release latch that allows quick disassembly. This enables easy installation even in limited-space environments.

Advantech Australia Pty Ltd
www.advantech.net.au

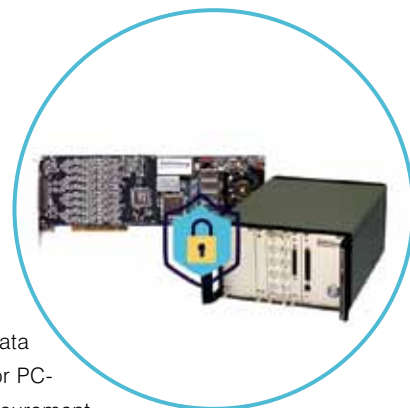
DATA ACQUISITION SOFTWARE

Microstar Laboratories, a maker of data acquisition processor (DAP) systems for PC-based high-performance test and measurement applications, has released the data acquisition software DAPtools 7.00, designed to help users keep up with their data as well as Windows 10 developments. The DAPtools package is available in three versions: Basic, Standard and Professional.

DAPcell software serves as the central hub for DAP activity on each host system, and is included with each DAPtools package. Upgrades to DAPcell in this release mean that it can adapt to the Windows 10 configuration. It works with features like secure boot in recent Windows 10 versions and makes sure that a system works. If the user runs an earlier Windows build, DAPcell understands and runs the software version that is right for the situation.

Different versions of DAPcell run automatically, depending on the Windows version. DAPcell 8.00 runs with Windows 10 and Windows Server 2019. DAPcell 7.41 runs for legacy Windows O/S (Windows 7, Windows 8, Windows XP, Windows 2000). Each version works with the DAP or xDAP onboard operating system, DAPL, to minimise any Windows-related delays.

SciTech Pty Ltd
www.scitech.com.au



SURFACE MOUNTER

Yamaha's YRM20 Premium High Efficiency Modular surface mouter is suitable for flexible, high-speed production. It comes with a user interface that has been designed to enable improved set-up, machine operation and changeovers.

Utilising the company's two newly developed head types, the multipurpose rotary (RM) head, when combined with the high-speed feeder, delivers mounting performance (under optimal conditions) of 115,000 CPH. Together with the one-head solution, this should enable high speed and versatility.

The product provides high mounting accuracy of $\pm 25 \mu\text{m}$ ($\text{Cpk} \geq 1.0$) and supports 0201 (0.25 x 0.125 mm) sized microchip component mounting. Businesses can therefore use the surface mouter to increase their production capacity and efficiency.

Hawker Richardson
www.hawkerrichardson.com.au



HIGH-VOLTAGE CONVERTER IC

The latest addition to the VIPerPlus series, the VIPer31 compact high-voltage converter IC from STMicroelectronics enables robust power-converter solutions that should meet energy-saving eco-design norms, while saving bill-of-materials (BoM) costs.

The product is optimised for commonly used offline AC/DC converter topologies, including isolated and non-isolated flyback, buck and buck-boost converters. The compact, highly integrated IC requires minimal external components, enabling designs to be created using a small-size PCB.

Combining high conversion efficiency with no-load power consumption below 20 mW with a 230 VAC input, the device is suitable for switched-mode power supplies (SMPS) for large or small home appliances, air conditioning, smart-home or -building automation, lighting, metering and motor-control applications. The IC embeds a jittered PWM controller with 30, 60 and 132 kHz options, along with an 800 V avalanche-rugged

MOSFET power section, high-voltage start-up circuit, sense FET, error amplifier for direct feedback, internal supply without auxiliary winding and a clamp-less design.

A wide Vcc supply-voltage range of 4.5 to 30 V makes it easy to power the device. The 24 VDC drain start-up voltage saves further external circuitry and allows an ultrawide AC input-voltage range, which enhances flexibility in both consumer and industrial applications. Over- and undervoltage protection, soft start, short-circuit protection, pulse-skipping protection and thermal shutdown are also built in.

STMicroelectronics Pty Ltd

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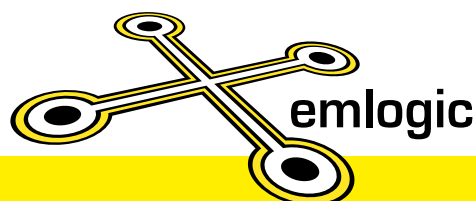
The LPKF ProtoLaser ST desktop laser system enables efficient prototyping of complex digital and analog circuits, RF and microwave circuit boards. The system achieves exact geometries on almost any material and is ideal for structuring single or double sided circuit boards.



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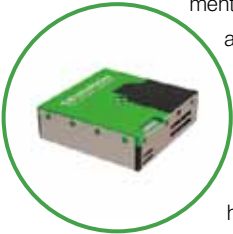
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www.emlogic.com.au

ENVIRONMENTAL SENSORS

Sensirion is a designer and manufacturer of flow and environmental sensors, useful for applications including air purification, indoor air quality monitoring and carbon dioxide detection.



The Sensirion SGP40 indoor air quality sensor is an integrated CMOSens sensor system on a single chip that provides a humidity-compensated indoor air quality signal.

The sensor offers long-term stability in terms of response time and sensitivity, making it useful for applications including kitchen hoods, thermostats and demand-controlled ventilation.

The SPS30 particulate matter sensor is an optical sensor that combines laser scattering with Sensirion's contamination-resistant technology. Built for a lifetime of more than eight years, the sensor enables measurements for HVAC equipment, air conditioners and Internet of Things (IoT) devices.

The STC31 is a chip-sized gas concentration sensor, offering high-range CO₂ measurements for high-volume production. The sensor is based on a thermal conductivity measurement principle, which results in good repeatability and long-term stability.

The SFA30 formaldehyde sensor module is based on the company's electrochemical technology and provides good formaldehyde sensing performance with low cross-sensitivity to other volatile organic compounds. The sensor module is designed for simple integration into air purifiers, indoor air quality monitors and demand-controlled ventilation systems.

Mouser Electronics
au.mouser.com



LIQUID NOZZLE FOR COOLING, WASHING AND RINSING

EXAIR's 3/8" FullStream Liquid Atomizing Spray Nozzle provides a full cone spray pattern for pressurised liquids. The versatile nozzle is suitable for cooling, cleaning, washing, rinsing and dust suppression applications for industry. With a vaneless, tangential flow design, it has wide open internal features to resist clogging while simultaneously producing uniform distribution in a round pattern with medium-to-large droplets. The compact, right-angle design operates at up to 250 PSIG liquid pressure, and functions seamlessly with liquids containing particulate.

The liquid is supplied directly into the body of the nozzle, creating a swirling action within a vortex chamber. This vortex produces the desired spray pattern when the machined nozzle breaks the liquid surface tension, and exits the orifice in a round, controlled spray angle. Stainless steel construction provides durability and corrosion resistance, with operating temperatures up to 427°C. Nozzles are CE compliant, and are also available in 1/4" with a variety of flow rates.

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HIGH-DENSITY, MULTI-CIRCUIT POWER METERS

Schneider Electric has announced its PowerLogic HDPM6000 range of high-density power meters, enabling custom solutions for cost and network management in critical facilities. Leveraging the latest in IoT-enabled technology, including MODBUS, SNMP and BACnet TCP/IP, the meters should enable users to manage power consumption, optimise uptime and allocate energy costs.

Designed for new construction or retrofit installations, the switchboard or busway multi-circuit meters meet a wide array of power applications. Suitable for data centres, hospitals or industrial facilities with critical power needs, the meters are versatile and equipped with features that facilitate simple installation. They provide building operators and facility managers with valuable power quality data at the branch circuit level that can be easily integrated with EcoStruxure edge control software or other third-party management systems.

The meters are modular and scalable to meet the needs of expanding electrical networks, including simplified installation to reduce wiring errors. They have the ability to monitor up to 192 circuits and to identify increased risks in branch circuits to detect potential issues (THDv, THD, and waveform capture per circuit). They also enable data logging with onboard memory, to meet the needs of robust code compliance applications.


The switchboard and busway monitoring solution offers configuration and monitoring via the embedded webpage or optional HMI touch screen and easy integration with EcoStruxure Power applications via Power Monitoring Expert or Power SCADA Operation. Cybersecurity helps to minimise vulnerabilities to critical power assets and systems and reinforce security strategies.

The product's user-friendly web interface allows easy commissioning and configuration on branch circuits, and it easily adapts to changes in distributed architectures and scales to future requirements. Adding to its versatility, the meter's form factor enables installation in existing panels with limited space. With monitoring of up to 192 circuits to identify increased harmonics and help prevent potential failures, it is suitable for high-density metering applications.

Schneider Electric


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PRECISION MOTION CONTROL ENABLES AUTOMATION

Adam Kimmel*

The world of automation exists in four dimensions: height, width, depth, and time. When the equipment must place an object in an exact location precisely, it requires motion control — the control of position, speed, and acceleration. Fabricating objects for specialized applications leverages the precision and reliability of motion control more than most other disciplines.

When digital information transforms into precise physical motion, previously infeasible use cases suddenly become possible. This improvement delivered Industry 4.0 to applications such as advanced robotics, Internet of Things (IoT) and Industrial Internet of Things (IIoT), battery-powered medical devices, additive manufacturing, and prosthetics. Each of these applications requires high precision in the control of the manufacturing equipment. As a result, turning digital information into physical motion and accurate part placement for these applications requires more than just transferring data into movement.

In the following, we'll discuss precision motion control, review medical and industrial automation applications needs, and highlight high-performance Trinamic product recommendations in each area.

Precision motion control

Precision motion control uses stepper motors to guide the active machine components' position. Open-loop systems employ a stepper motor, which converts the electric control signal into a precise rotational position for the shaft. For higher-precision uses, engineers incorporate a check feature to measure the shaft's position. The measurement device sends dimensional data back

to the controller to compare with the setpoint, allowing variance correction. The two-way communication is termed closed-loop.

CNC machining is one of the most well-known applications that benefit from advanced-precision motion control, but 3D printing and desktop manufacturing also benefit from tighter tolerances. Inspection equipment that feeds information back to the controller, pick and place machines, and automated assembly lines are three of the other segments that benefit from high-precision motion control.

With precision motion control, labs run more smoothly, and warehouses experience additional increases in operational efficiency. Simultaneously, this control improves product cost elements driven by inefficiencies, such as:

- Heat loss and power consumption
- Resonance
- Audible noise
- Diagnostics without sensors
- Battery life

The Trinamic Motion Control Architecture consists of functional building blocks. The motor controller (or motion controller) receives commands over a selected interface in a defined protocol. The tasks are translated into signals for the motor control and driver part. For ease of integration into the application's firmware, the



Figure 1: The TMC5160 combines a flexible ramp generator for automatic target positioning with industries' most advanced stepper motor driver. (Source: Mouser Electronics)

code exports in Trinamic's format or C. Read on to learn about Trinamic's recommended products for medical and industrial automation applications.

High-precision applications

Trinamic developed products that address the performance issues in medical and industrial automation.

Medical

Medical devices, such as pumps and ophthalmic devices, need precise control at low speeds. Applications ranging from tissue analysis to blood centrifugation and liquid handling provide opportunities for a solution to low-speed, minimal-vibration precision. Trinamic technology provides current loops that are nearly perfect sine waves to address excessive vibration. The smooth curves limit vibrations that would hinder tolerances. Inefficient current conversion in the motor leads to temperature rise in the component, creating a system failure or automatic shutoff event. Furthermore, tweaking the acceleration profile can allow system operators to improve precision and smooth out machine component movements.

Below are Trinamic product recommendations ideal for the respective medical applications:

- Tissue analysis: TMC2209 (ultra-silent motor driver integrated circuit for 2-phase stepper motors)
- Blood centrifugation: TMC262 (integrated stepper motor)
- Liquid handling: TMC5160 (high-power stepper motor controller)

Ensuring precise, low-speed, smooth operation is the key to motion control in medical device automation. With a range of solutions from sophisticated chips to smart motors, Trinamic's motion control solutions are customizable and flexible to applications in this space.

Industrial

Productivity and throughput drive product development for industrial applications. As motion control improves, Trinamic's

advanced diagnostics and interconnected drives enable an intelligent factory. The technology is robust enough to apply to standalone applications to networks by creating building blocks that system designers can use to build the most efficient, customized solution for their needs.

3D printing, robotics, and factory automation are three applications that require precision automation. Trinamic products that serve these use cases are:

- 3D printing: TMC2209 (ultra-silent motor driver integrated circuit for 2-phase stepper motors)
- Robotics: TMC5160 (high-power stepper motor controller) (Figure 1)
- Factory Automation: TMC262 (integrated stepper motor)

The products above address significant challenges with industrial applications. 3D printing is notoriously loud, disrupting activities happening near the operation. TMC2209 smooths the sine waves and enables quiet part fabrication at higher dimensional accuracy. The TMC5160 is similarly soft and rapidly produces high-accuracy robotic components. It is highly integrated and scalable, maximizing operational efficiency to drive throughput without wasted energy or time. The TMC262 can drive to a gate current of 40 mA, ideal for laboratory and factory automation applications.

Conclusion

Precision control transformed two crucial macro industries — medical and industrial automation. Precision motion control is the enabler for both. It improves vibration performance, energy efficiency, noise, and smoothness of motion and significantly reduces the tolerance of automatic movement to enhance its precision.

Industrial automation is propelling Industry 4.0 forward, bringing smart manufacturing technology into the market. Adding precision motion control can unlock 3D printing, CNC machining, pick and place machines, inspection, quality, test equipment, automated assembly lines and conveyors, and collaborative robots. To aid in supply chain and operations, automated guide vehicles (AGVs) and autonomous mobile robots (AMRs) improve productivity and increase product velocity, approaching a just-in-time product flow state.

**Adam Kimmel has nearly 20 years as a practicing engineer, R&D manager, and engineering content writer. He creates white papers, website copy, case studies, and blog posts in vertical markets including automotive, industrial/manufacturing, technology, and electronics. Adam has degrees in chemical and mechanical engineering and is the founder and principal at ASK Consulting Solutions, LLC, an engineering and technology content writing firm.*

Mouser Electronics
au.mouser.com





INFRARED LASER SOURCE FOR ENVIRONMENTAL RECOGNITION

Würth Elektronik has launched its own infrared laser, extending its comprehensive portfolio of infrared emitters. Made from high-quality materials, the WL-VCSL Vertical Cavity Surface Emitting Laser has a high efficiency of 35% and almost 2 W of radiant power. Designed to emit short, high-energy pulses, the IR laser is suitable for 3D environmental recognition solutions, for example in industrial automation or LiDAR.

The laser's robust housing measures 3.5 x 3.5 x 1.8 mm and features a thermally conductive ceramic substrate, gold-plated contacts and a high-quality quartz diffuser, all of which enable a homogeneous radiation pattern. Two variants are available: 60° x 45° and 110° x 85° beam angles.

With a wavelength of 940 nm, the laser is aimed at applications in which precision is essential. The possible areas of use range from 3D recognition, LiDAR and distance measurement (time of flight), to solutions in industrial automation and robotics, through to applications in the field of biometric recognition.

The company plans to make a tested reference design available for pulsating controls free of charge.

Würth Electronics Australia Pty
www.we-online.com



MINIATURE CELLULAR MODULE

u-blox has announced the ALEX-R5 — a miniature cellular module that integrates low-power wide-area (LPWA) connectivity and global navigation satellite system (GNSS) technology into an ultrasmall (14 x 14 mm) system-in-package (SiP) form factor.

The module futureproofs IoT devices and solutions by enabling users to upgrade the software in deployed devices for compatibility with 5G networks, offering a seamless transition to the next generation of cellular technology. It is based on the u-blox UBX-R5 LTE-M/NB-IoT chipset platform with out-of-the-box Secure Cloud functionality and the M8 GNSS chip for location accuracy. Its tiny dimensions make it suitable for size-constrained applications such as asset tracking, wearables and health care.

The module features 23 dBm cellular transmission power, which means that end devices operate effectively in all signal conditions — even at cell edges, underground or in other challenging scenarios. A dedicated GNSS antenna interface enables fully independent, simultaneous operation of the M8 GNSS chip, matching the performance of a standalone u-blox M8 module. u-blox IoT Location-as-a-Service with CellLocate and AssistNow (online, offline and autonomous) further enhances positioning performance.

The product is optimised for power-sensitive and battery-dependent applications, addressing common pain points of size-constrained applications such as wearables and connected medical devices. It achieves this by leveraging the lower-power modes of the UBX-R5 and UBX-M8 chipsets and giving users options to further balance power consumption and performance using GNSS Super-E mode.


Rugged SiP construction makes the device suitable for harsh environments, where moisture or vibration would be a concern for conventional modules. It is rated at moisture sensitivity level 3 (MSL 3), offering reduced handling and device production complexity.

u-blox can provide lifetime support for the entire platform, down to the chipset level. Secure Cloud functionality supporting IoT-Security-as-a-Service based on an internal, hardware-based secure element enables a lightweight pre-shared key management system specifically designed for LPWA devices.

u-blox Singapore Pte Ltd
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COMPUTER-ON-MODULE

The SOM-6883 is a COMe Compact Type 6 module with 11th Gen Intel Core processors. Adopting up to 96 GPUs and dual video decoder boxes with Intel Iris Xe graphics, it was designed to be the first COMe Compact module that supports up to four ports independent 4K displays or two ports 8K HDR outputs.

Featuring AI Acceleration with Intel's Deep Learning Boost engine, VNNI, the SOM-6883 can improve efficiency and increase the inferencing performance. Enabling high-speed data transmission capability with wide bandwidth of 2.5G LAN, PCIe Gen 4 and NVMe SSD, the product transfers massive data between AIoT applications. The 2.5G LAN equipped with TSN (time-sensitive networking) is useful for automation or edge applications in need of low latency.

The SOM-6883 supports IB-ECC memory for error correct function and features a TPM2.0 chip to prevent cyber threats, an 8.5–20 V wide range power input and a -40 to +85°C operating temperature. It also supports BIOS storage protection and security boot, BIOS power-management and WISE-DeviceOn for remote hardware monitoring/over-the-air software updates to prevent system malfunction.

With its onboard NVMe SSD and TPM2.0, IB-ECC memory, wide-range power inputs and wide operating temperatures, the device is suitable for mission-critical, medical, machine learning, high-end test equipment and defence applications.

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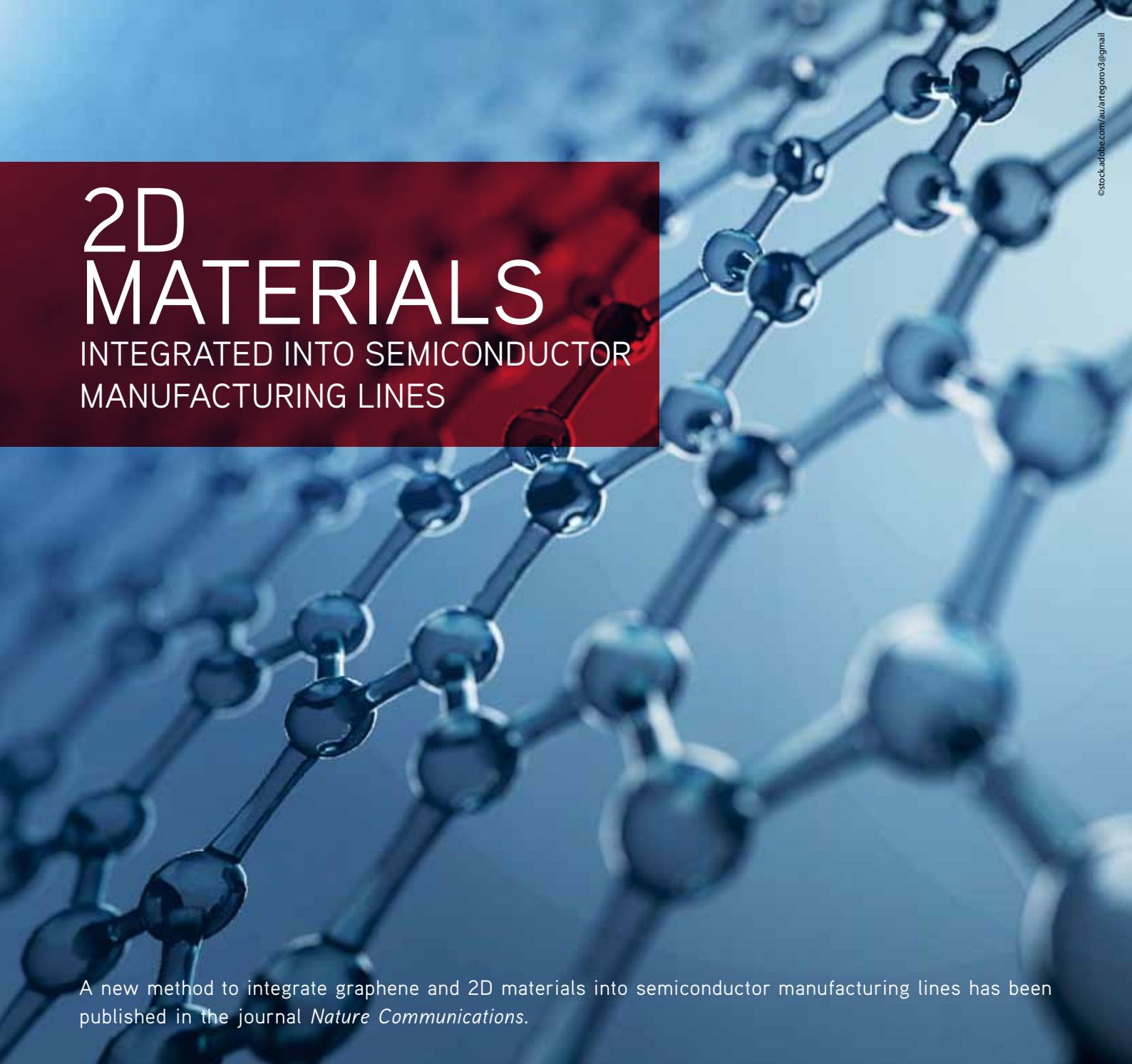
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2D MATERIALS

INTEGRATED INTO SEMICONDUCTOR
MANUFACTURING LINES

A new method to integrate graphene and 2D materials into semiconductor manufacturing lines has been published in the journal *Nature Communications*.

The technique was created by researchers from Graphene Flagship partners RWTH Aachen University, Universität der Bundeswehr München and research institute AMO, in collaboration with Graphene Flagship Associate Member KTH Royal Institute of Technology and measurement company Protemics.

Two-dimensional (2D) materials have a huge potential for providing devices with much smaller size and extended functionalities with respect to what can be achieved with today's silicon technologies. But to exploit this potential we must be able to integrate 2D materials into semiconductor manufacturing lines — a notoriously difficult step, as the integration of 2D materials with silicon or with a substrate with integrated electronics presents a number of challenges.

"There's always this critical step of transferring from a special growth substrate to the final substrate on which you build sensors or components," said Arne Quellmalz, a researcher at KTH and lead author of the paper. "You might want to combine a graphene photodetector for optical on-chip communication with silicon read-out electronics, but the growth temperatures

of those materials is too high, so you cannot do this directly on the device substrate."

So far, most of the experimental methods for transferring 2D materials from their growth substrate to the desired electronics are either non-compatible with high-volume manufacturing or lead to a significant degradation of the 2D material and of its electronic properties. The beauty of the solution proposed by Quellmalz and co-workers is that it lies in the existing toolkits of semiconductor manufacturing: to use a standard dielectric material called bisbenzocyclobutene (BCB), along with conventional wafer bonding equipment.

"We basically glue the two wafers together with a resin made of BCB," Quellmalz said. "We heat the resin until it becomes viscous, like honey, and press the 2D material against it." At room temperature, the resin becomes solid and forms a stable connection between the 2D material and the wafer.

"To stack materials, we repeat the steps of heating and pressing. The resin becomes viscous again and behaves like a cushion, or a waterbed, which supports the layer stack and adapts to the surface of the new 2D material."

The researchers demonstrated the transfer of graphene and molybdenum disulfide (MoS_2), as a representative for transition metal dichalcogenides, and stacked graphene with hexagonal boron nitride (hBN) and MoS_2 to heterostructures. All transferred layers and heterostructures were reportedly of high quality; that is, they featured uniform coverage over up to 100 mm-sized silicon wafers and exhibited little strain in the transferred 2D materials.

"Our transfer method is in principle applicable to any 2D material, independent of the size and the type of growth substrate," said Professor Max Lemme, from AMO and RWTH Aachen University. "And, since it relies only on tools and methods that are already common in the semiconductor industry, it could substantially accelerate the appearance on the market of a new generation of devices where 2D materials are integrated on top of conventional integrated circuits or microsystems."

"This work is an important step towards this goal and, although many further challenges remain, the range of potential applications is large: from photonics, to sensing, to neuromorphic computing. The integration of 2D materials could be a real game changer for the European high-tech industry."

The European Commission recently launched a €20 million project to bridge the gap between lab-scale manufacturing and large-volume production of electronic devices based on two-dimensional materials: the 2D Experimental Pilot Line (2D-EPL). According to the technical leader of the project, Cedric Huyghebaert, "This paper is a good example of the work that we carry out in the 2D-EPL project."



Graphene Flagship researchers report a new method to integrate graphene and 2D materials into semiconductor manufacturing lines. Image credit: A Quellmalz, KTH.

"One of our urgent tasks at the moment is to develop tool kits and design manuals for manufacturing devices based on 2D materials that are compatible with the standards of semiconductor industry," Huyghebaert said. "The next step will be to demonstrate the potential of these processes for producing innovative sensors and optoelectronic devices on a pilot line."



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iEi's IMBA-C2460 ATX motherboard supports 14 nm LGA1151 Intel 8th/9th Generation Xeon E, Core i9/i7/i5/i3, Celeron and Pentium processors with the Intel C246 Chipset. Furthermore, the product features dual-channel ECC supported memory of up to 64 GB for optimal functionality.

The motherboard accommodates triple independent displays (VGA, HDMI and DP++), dual GbE LAN, HD Audio and 6x SATA 6 Gbps ports with RAID 0/1/5/10 for optimal operation. In terms of external I/O interfaces, the product supports 2x USB 2.0 and 2x USB 3.2 Gen 2, 2x USB 3.2 Gen 1, 1x RS-232 and 1x PS/2 port for a legacy keyboard or mouse.



The device is constructed in an effective manner to withstand tough conditions. It has an operating temperature of -20 to +60°C, supported by 1x CPU fan connector and 2x system fan connectors. It holds safety and EMC certifications, as it is CE/FCC compliant. The multifaceted motherboard is therefore suitable when carrying out industrial, medical, transportation, military or other commercial activities requiring long-term product availability.

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FLOW METERS/CONTROLLERS WITH ETHERNET POWERLINK

Bronkhorst is a versatile supplier of digital flow and pressure meters and controllers, available in both IP40 and IP65 versions. The company has now added POWERLINK as its 10th onboard fieldbus interface option.

Ethernet POWERLINK (EPL) is a patent-free, manufacturer-independent and completely software-based communication system that delivers real-time performance. Since the fieldbus is based on Ethernet communication, it can be applied with standard Ethernet cabling and support an unlimited number of nodes.

With Bronkhorst's 'multi-bus' concept, the company offers users an extensive choice of 10 fieldbus interface options. The wide range of digital metering and control devices is suitable for many different applications, including the food, beverage and chemical industries; gas and fluid analysis equipment; glass and tool coating processes; testing fuel cells for the automotive industry; and in machinery used to produce electronic chips, LED lights and solar cells.

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Engineered to be effective, stable and predictable, the product has been designed to enable ongoing production and assembly operations.

Kyzen
www.kyzen.com

EXTRUDED ALUMINIUM ENCLOSURES

Hammond has introduced additional standard sizes to the 1455U family, available in three standard sizes of 160, 220 and 280 x 191 x 66 mm, in clear and black anodised finish and with aluminium and plastic removable end panels. The family now consists of 32 separate sizes, ranging from 60 x 45 x 25 to 280 x 191 x 66 mm.

There are 15 slot positions for mounting single or multiple PCBs directly into the body. Black, red, yellow, translucent red and translucent blue plastic end panels complete with bezel can be mixed and matched for colour coding. Optional flanged aluminium end panels

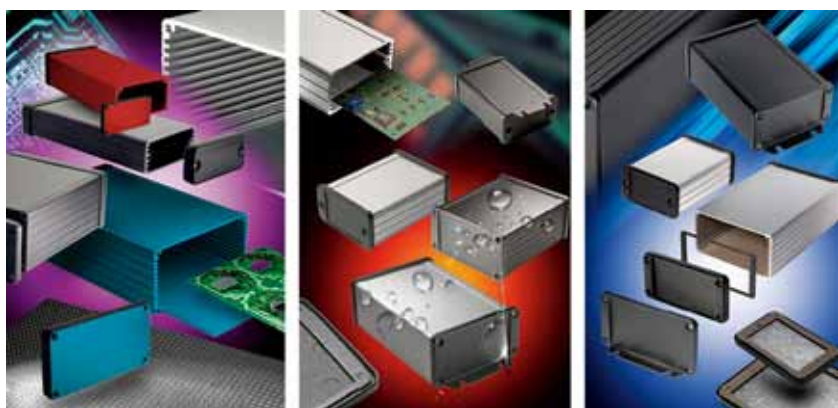
that enable the unit to be mounted directly to a shelf or wall are also available as an optional accessory to replace the flat panels.

The 1457 IP65 sealed and 1457-EMI screened versions complete the range of options in the new sizes. The 1457U and 1457U-EMI are available in three standard lengths, with clear anodised or black powder-coated bodies and clear or black die-cast aluminium end panels. The 1457 IP65 features a self-adhesive gasket and O rings for the securing screws; the 1457-EMI has a nickel/copper conductive closed foam gasket to preserve continuity between the body and the end panel to give enhanced screening for use in electrically noisy environments.

The enclosures are primarily designed to house PCBs, mounted horizontally into internal slots in the body of the case; they can also be used to house any small electronic, electrical or pneumatic components. All sizes of the 1455 are supplied complete with fixings and self-adhesive rubber feet.

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18 TB HARD DISK DRIVES

Toshiba Electronic Devices & Storage has announced its 18 TB MG09 Series HDDs. The series features the company's third-generation, 9-disk helium-sealed design and innovative Flux Control – Microwave Assisted Magnetic Recording (FC-MAMR) technology to advance conventional magnetic recording (CMR) density to 2 TB per disk, achieving a total capacity of 18 TB.

With 12.5% more capacity than prior 16 TB models, the drives are compatible with a wide range of applications and operating systems. They are adapted to mixed random and sequential read and write workloads in both cloud-scale and traditional data centre use cases. The HDD features 7200 rpm performance, a 550 TB per year workload rating and a choice of SATA and SAS interfaces — all in a power-efficient, helium-sealed, industry-standard, 3.5" form factor.

With its power efficiency and 18 TB capacity, the series is designed to help cloud-scale infrastructure advance storage density to reduce capex and improve TCO. As data growth continues at an explosive pace, 18 TB drives with FC-MAMR technology should help cloud-scale service providers and storage solution designers achieve higher storage densities for cloud, hybrid-cloud and on-premises rack-scale storage.

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



PORTABLE PXE EXPRESS CHASSIS

ADLINK Technology has introduced the PXES-2314T PXE Express chassis with versatile, high-bandwidth Thunderbolt 3 interfaces. Unlike traditional PXE Express systems, which are usually large and require complex set-up, the product is a compact test and measurement platform that offers the performance and flexibility of PXE Express but in a portable system, requiring only the small PXES-2314T chassis, a notebook PC with Thunderbolt 3 ports and desired peripheral modules.

The product features two Thunderbolt 3 ports for host PC connections, which use USB Type-C connectors and support USB power delivery up to 60 W and system bandwidth of 40 Gbps. The chassis offers four PXE Express Hybrid slots: two PXle Hybrid slots up to PCIe Gen2 x1 and two PXle Hybrid slots up to PCIe Gen3 x4. It measures 207.9 x 148.4 x 220.5 mm, providing a compact system that delivers high performance but saves space, whether on a benchtop or the factory floor.

Targeted use cases for the 4-slot system include performing mobile quality control testing in the production line without sacrificing feature functions or high performance. R&D tests and experiments can be performed flexibly, without requiring investments in older, more cumbersome PXle systems. The portable device also supports use cases that focus on field troubleshooting, hands-on demos and training for an array of applications in a range of environments.

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TEMPORARY TATTOOS

FEATURE LIGHT-EMITTING TECHNOLOGY

Scientists at University College London (UCL) and the Italian Institute of Technology (IIT) have created a temporary tattoo with light-emitting technology used in TV and smartphone screens, paving the way for a new type of 'smart tattoo' with a range of potential uses. Their work has been published in the journal *Advanced Electronic Materials*.

The technology, which uses organic light-emitting diodes (OLEDs), is applied in the same way as water transfer tattoos. That is, the OLEDs are fabricated onto temporary tattoo paper and transferred to a new surface by being pressed onto it and dabbed with water. Among the advantages of OLEDs are that they can be used on flexible, bendy surfaces, and that they can be made from liquid solvents. This means they are printable.

The OLED device the researchers developed is 2.3 μm thick in total — about a third of the length of a single red blood cell. It consists of an electroluminescent polymer (a polymer that emits light when an electric field is applied) in between electrodes. The light-emitting polymer is 76 nm thick and was created using a technique called spin coating, where the polymer is applied to a substrate which is spun at high speed, producing an extremely thin and even layer. An insulating layer is placed in between the electrodes and the commercial tattoo paper.

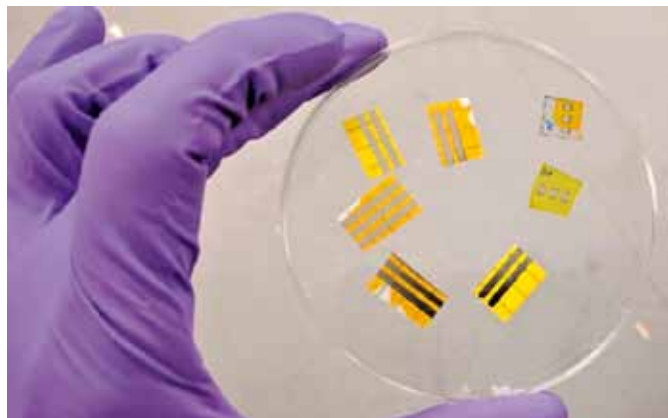
"At the Italian Institute of Technology we have previously pioneered electrodes that we have tattooed onto people's skin that can be used to perform diagnostic tests such as electrocardiograms," noted IIT researcher Dr Virgilio Mattoli, senior author on the paper. "The advantage of this technology is that it is low cost, easy to apply and use, and washes off easily with soap and water."

Once they had built the technology, the team applied the tattooable OLEDs, which emitted green light, onto a pane of glass, a plastic bottle, an orange and paper packaging. The researchers say it could be combined with other tattoo electronics to, for instance, emit light when we need to get out of the sun to avoid sunburn. OLEDs could also be tattooed on packaging or fruit to signal when a product has passed its expiry date, or used for fashion.

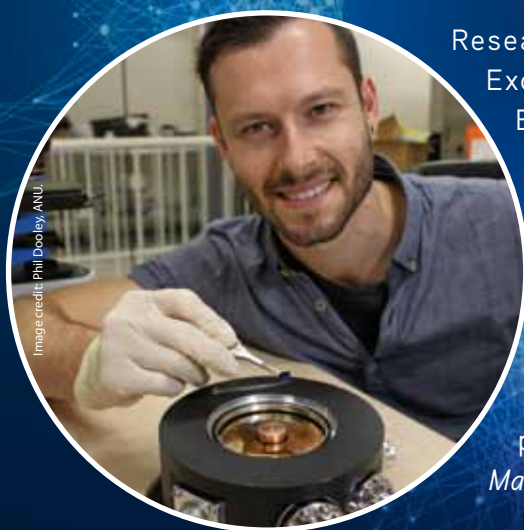
"The tattooable OLEDs that we have demonstrated for the first time can be made at scale and very cheaply," said UCL's Professor Franco Cacialli, senior author on the paper. "They can be combined with other forms of tattoo electronics for a very wide range of possible uses. These could be for fashion — for instance, providing glowing tattoos and light-emitting fingernails. In sports, they could be combined with a sweat sensor to signal dehydration.

"In health care they could emit light when there is a change in a patient's condition — or, if the tattoo was turned the other way into the skin, they could potentially be combined with light-sensitive therapies to target cancer cells, for instance.

"Our proof-of-concept study is the first step. Future challenges will include encapsulating the OLEDs as much as possible to stop them from degrading quickly through contact with air, as well as integrating the device with a battery or supercapacitor."



SCIENTISTS CREATE 'ARMOUR' FOR QUANTUM TECHNOLOGY



Researchers at the ARC Centre of Excellence in Future Low-Energy Electronics Technologies (FLEET) have led the development of so-called 'body armour' for extremely fragile quantum systems, which will make them robust enough to be used as the basis for a new generation of low-energy electronics. Their work has been published in the journal *Advanced Materials*.

Serving as lead author on the study was Matthias Wurdack, a PhD student at the Australian National University (ANU) and FLEET. He explained that protection is crucial for thin materials such as graphene, which are only a single atom thick — essentially two-dimensional — and so are easily damaged by conventional layering technology.

With this in mind, the team created a protective layer by exposing to air a droplet of liquid gallium, which immediately formed a perfectly even layer of gallium oxide on its surface just 3 nm thick. By squashing the droplet on top of the 2D material with a glass slide, the gallium oxide layer can be transferred from the liquid gallium onto the material's entire surface, up to centimetres in scale.

"The protective coating basically works like a body armour for the atomically thin material; it shields against high-energy particles, which would cause a large degree of harm to it, while fully maintaining its optoelectronic properties and its functionality," Wurdack said.

Because this ultrathin gallium oxide is an insulating amorphous glass, it conserves the optoelectronic properties of the underlying 2D semiconductor. The gallium oxide glass can also enhance these properties at cryogenic temperatures and protects well against other materials deposited on top. This allows the fabrication of sophisticated, layered nanoscale electronic and optical devices, such as light emitting diodes, lasers and transistors.

"We've generated a nice alternative to existing technology that can be scaled for industry applications," Wurdack said.

The work also promises lower-energy alternatives for electronics and optoelectronics, by harnessing the superior performance of 2D semiconducting materials such as tungsten disulfide, which was used in this study. As explained by team leader Professor Elena Ostrovskaya, also from ANU and FLEET, "Two-dimensional materials have extraordinary properties, such as extremely low resistance or highly efficient interactions with light.

"Because of these properties, they could have a big role in the fight against climate change."

Using 2D materials to make more efficient devices will have advantages beyond reduced carbon emissions, with Wurdack saying, "2D technology could also enable super-efficient sensors on spacecraft or processors in Internet of Things devices that are less limited by battery life."

Wurdack said he and his team "hope to find industry partners to work with us to develop a protective layer printer based on this technology that can go into any lab, like a lithography machine".

"It would be exciting to see fundamental research like this find its way into industry," he said.



Westwick-Farrow Media

A.B.N. 22 152 305 336

www.wfmedia.com.au

Head Office

Unit 7, 6-8 Byfield Street, North Ryde
Locked Bag 2226, North Ryde BC NSW 1670
Ph: +61 2 9168 2500

Editor

Lauren Davis
wnie@wfmedia.com.au

Publishing Director/MD Geoff Hird

Art Director/Production Manager
Julie Wright

Art/Production

Veronica King, Colleen Sam

Circulation Dianna Alberry, Sue Lavery
circulation@wfmedia.com.au

Copy Control Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

Group Sales Manager

Nicola Fender-Fox – 0414 703 780
nfender-fox@wfmedia.com.au

Account Manager

Sandra Romanin – 0414 558 464
sromanin@wfmedia.com.au

Asia

Tim Thompson - 0421 623 958
tthompson@wfmedia.com.au

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