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High-speed digital designs, power integrity verification, Wi-Fi 6, IoT, IIoT, and imaging and gallium nitride (GaN) semiconductors utilise frequencies between 2 and 6 GHz that are currently underserved or require costly trade-offs. Testing these new products requires time- and frequency-domain equipment capable of simultaneous analog and digital channels, ideally with software-enabled protocols, standards, built-in test assistance and test team remote collaboration.

Keysight's new Infiniium MXR-Series mixed signal oscilloscope comes with eight analog channels at 6 GHz and 16 simultaneous digital channels. It includes eight instruments in one, including a real-time spectrum analyser (RTSA), oscilloscope, digital voltmeter (DVM), waveform generator, Bode plotter, counter, protocol analyser and logic analyser. It is complemented by an extensive suite of software solutions focused on power integrity, high-speed digital test and verification. Built-in software includes a fault hunter function that speeds root cause identification and resolution of rare or randomly occurring errors.


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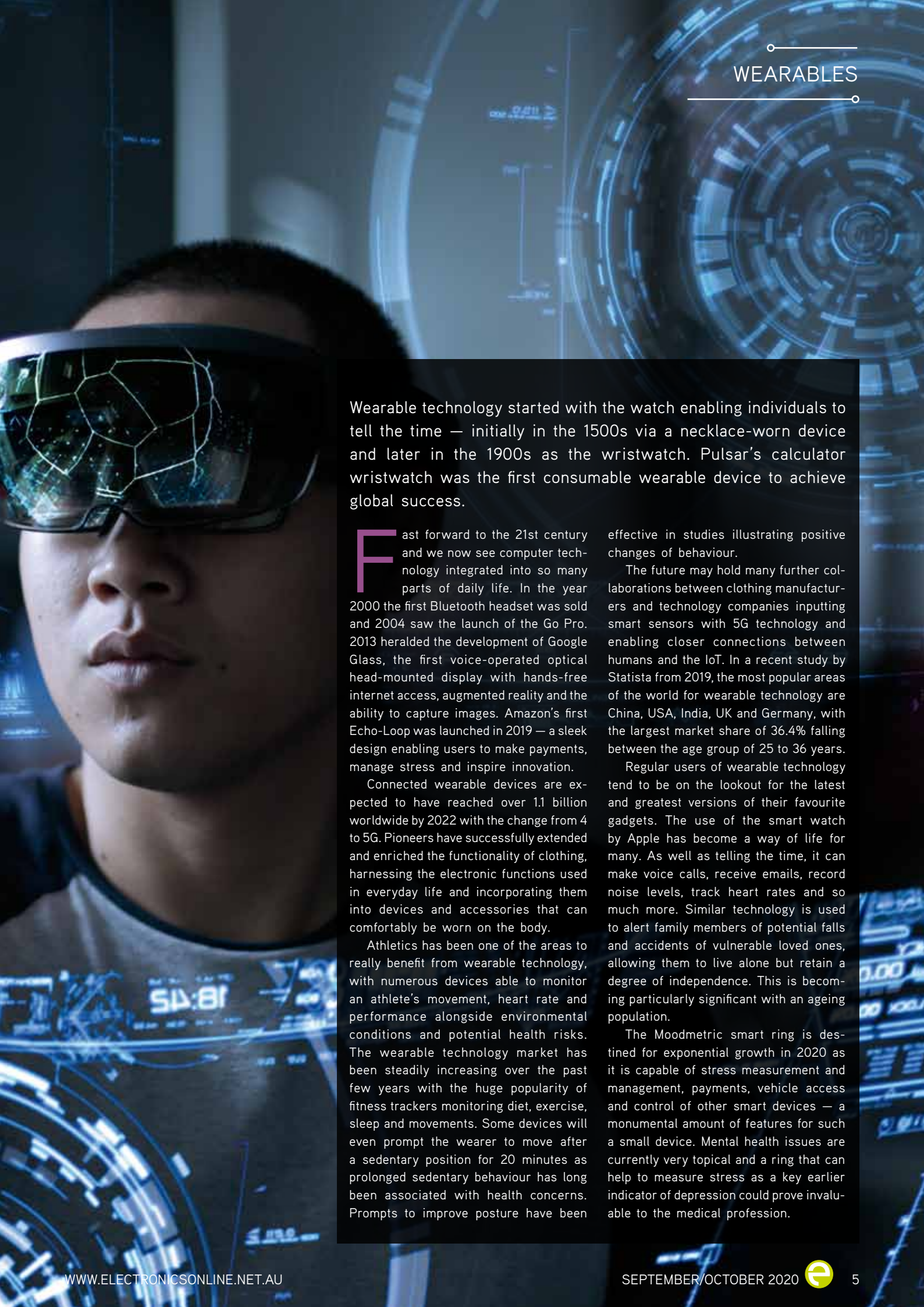


Keysight Technologies Australia Pty Ltd
www.keysight.com



WEARABLE TECHNOLOGY AND THE FUTURE OF ELECTRONICS

Jade Bridges, Global Technical Support Manager



Wearable technology started with the watch enabling individuals to tell the time — initially in the 1500s via a necklace-worn device and later in the 1900s as the wristwatch. Pulsar's calculator wristwatch was the first consumable wearable device to achieve global success.

Fast forward to the 21st century and we now see computer technology integrated into so many parts of daily life. In the year 2000 the first Bluetooth headset was sold and 2004 saw the launch of the Go Pro. 2013 heralded the development of Google Glass, the first voice-operated optical head-mounted display with hands-free internet access, augmented reality and the ability to capture images. Amazon's first Echo-Loop was launched in 2019 — a sleek design enabling users to make payments, manage stress and inspire innovation.

Connected wearable devices are expected to have reached over 1.1 billion worldwide by 2022 with the change from 4 to 5G. Pioneers have successfully extended and enriched the functionality of clothing, harnessing the electronic functions used in everyday life and incorporating them into devices and accessories that can comfortably be worn on the body.

Athletics has been one of the areas to really benefit from wearable technology, with numerous devices able to monitor an athlete's movement, heart rate and performance alongside environmental conditions and potential health risks. The wearable technology market has been steadily increasing over the past few years with the huge popularity of fitness trackers monitoring diet, exercise, sleep and movements. Some devices will even prompt the wearer to move after a sedentary position for 20 minutes as prolonged sedentary behaviour has long been associated with health concerns. Prompts to improve posture have been

effective in studies illustrating positive changes of behaviour.

The future may hold many further collaborations between clothing manufacturers and technology companies inputting smart sensors with 5G technology and enabling closer connections between humans and the IoT. In a recent study by Statista from 2019, the most popular areas of the world for wearable technology are China, USA, India, UK and Germany, with the largest market share of 36.4% falling between the age group of 25 to 36 years.

Regular users of wearable technology tend to be on the lookout for the latest and greatest versions of their favourite gadgets. The use of the smart watch by Apple has become a way of life for many. As well as telling the time, it can make voice calls, receive emails, record noise levels, track heart rates and so much more. Similar technology is used to alert family members of potential falls and accidents of vulnerable loved ones, allowing them to live alone but retain a degree of independence. This is becoming particularly significant with an ageing population.

The Moodmetric smart ring is destined for exponential growth in 2020 as it is capable of stress measurement and management, payments, vehicle access and control of other smart devices — a monumental amount of features for such a small device. Mental health issues are currently very topical and a ring that can help to measure stress as a key earlier indicator of depression could prove invaluable to the medical profession.



THERE ARE TWO HUGE CHALLENGES WHEN DESIGNING A FUNCTIONING WEARABLE DEVICE: WILL THE DEVICE BEHAVE/INTERACT/COLLECT DATA AS REQUIRED AND WILL THE DEVICE CONTINUE TO FUNCTION WHEN EXPOSED TO THE ENVIRONMENTS IN WHICH IT IS DESIGNED TO FUNCTION?

Just considering the medical profession a little further, the options are endless. Just think for a moment about the kind of wearable devices (still in the prototype stage) that could be specifically designed for the prevention of disease and maintenance of good health such as weight control, blood pressure monitoring and monitoring of physical activity. Data gained from the wearable device could have a direct impact on a clinical decision regarding medication, for example.

There are arguments in favour of more wearable tech for these kinds of devices to improve patient care, as the 'big data' that these devices are capable of collecting and utilising with AI could revolutionise the treatment of some extremely serious conditions such as heart diseases, Parkinson's and diabetes. But as the devices are still at prototype phase, there is still a long way to go in terms of patient acceptance, security and confidentiality, ethics and the artificial intelligence (AI) required to cope with the data outputs. 5G will also play a huge part in the volume of data that can be transmitted and communicated to numerous hospital devices at the same time.

Looking into these developments, generally speaking, there are two huge challenges when designing a functioning wearable device: will the device behave/interact/collect data as required and will the device continue to function when exposed to the environments in which it is designed to function? For example, a temperature sensor on a static device will have to withstand the temperatures within that immediate environment and any thermal shock or cycling that may take place. A temperature sensor as part of a wearable device has the added consideration of physical interactions; the device will be moved and worn, may see impact, may be flexed and may be potentially exposed to a number of additional elements, such as water or chemicals, for example. It is therefore imperative that these devices are protected accordingly to ensure reliable performance when utilised in their end-use environments.

Protection for the exposed electronics/components of the wearable device can

be afforded in the form of encapsulation resins or conformal coatings. The variety of potential applications can also generate another challenge: to select the most suitable protection compound. As we have already concluded, the wearable device is likely to collate and transfer data, whether it be direct to another device or system or via a sensor to record changes in information gathered. This connection to other devices may operate via radio waves and therefore any protection compound used must allow RF signals to be transmitted without any interference. In addition to this, the environmental conditions and general use of the device must be considered in order to produce a full picture of its working life.

To enable a better understanding of likely performance and simplify the selection process, it is possible to draw on experience from other industries and technologies. For instance, if we think of a wearable device that can be worn by a swimmer to monitor heart rate and general health when in the pool, it is immediately understood that this device must still work when immersed in water. Any changes in temperature will be minimal but quite rapid and the frequency and length of time the device could be immersed in water is an unknown quantity. It is therefore a sensible assumption that the device will be required to be constantly operational when immersed in water.

This application can be likened to that of a sonar buoy used in marine applications where sensors are utilised for providing vital information about the sea environment. In this case, the device will have to send an RF signal and operate when constantly immersed in salt water — a similar environment to that of the wearable health tracker worn by the swimmer. Trackers used on sea or river dwelling creatures to study habits and behaviour must also receive similar consideration.

As a company, Electrolube effectively utilises and compares the information and knowledge gained from other industries. For example, salt water is generally more corrosive than the water found in a swimming pool and therefore the application experience gained from the sonar buoys

will show the performance of a device protected with a suitable potting compound in a similar but more aggressive environment. This is obviously just one example of many different considerations; the degree of flex and toughness of the device, the operating temperature range and the possibility of any chemicals coming into contact with the device are all possible factors to take into account during the selection process.

Thinking about all of these properties and not forgetting the need to allow connectivity and information transfer, there are many properties such as the dielectric constant, salt mist resistance, shore hardness and elongation at break that can be used to find the optimal product for in-use testing. It is clear that each application of wearable technology will have its own criteria in terms of performance, environment and expected use, and in all cases a reliable and accurate response is required from the device.

Whatever the application, the wearables market is definitely a hot topic and right now technology is shaping our lives more than ever. Home working and home schooling are changing before our very eyes as technologies such as podcasts, videos with flipped classrooms and the myriad of apps, games, AR/VR and simulations available on wearable devices become part of the educational system that the new generation are facing. New concepts and developments will continue in the future, and with the variety of devices possible will come the vast array of requirements which will define the need for a suitable protection medium.

Wearable technology is designed with the intention to make everyday tasks easier and more accessible. It will encourage different methods of interaction and communication, increasing our mobility within the electronic world and further enhancing relationships and collaborations in this field.



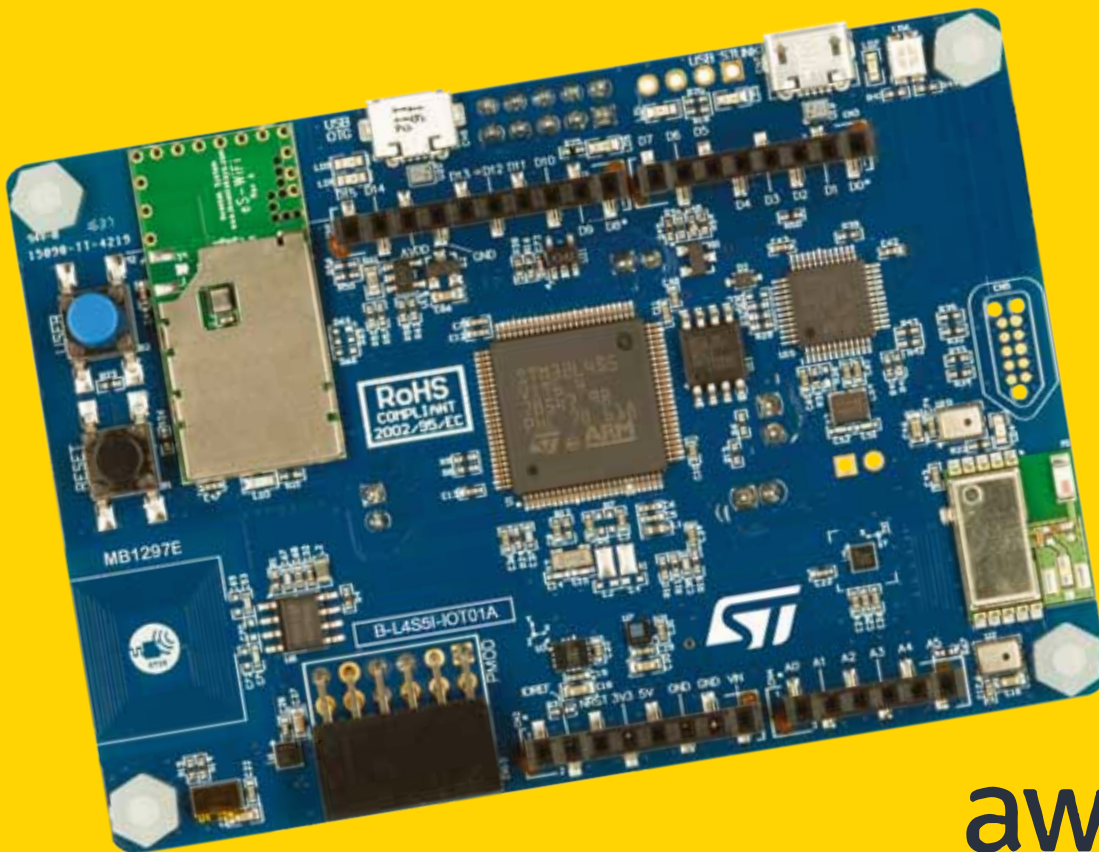
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EXTENDING THE LIFE CYCLE OF LITHIUM-SULFUR BATTERIES

Researchers from The University of Texas at Austin have found a way to stabilise one of the most challenging parts of lithium-sulfur batteries, bringing the technology closer to becoming commercially viable. Their breakthrough has been published in the journal *Joule*.

Lithium-sulfur batteries have been hailed as the next big step in battery technology, suitable for devices that need lightweight batteries and can run for a long time on a single charge and don't require a large number of charge cycles, such as drones. Both the positive and negative electrodes in lithium-sulfur batteries hold 10 times as much charge capacity as the materials used in lithium-ion batteries, which means they can deliver much more use out of a single charge.

Sulfur is also widely available as a by-product from the oil and gas industry, making the batteries inexpensive to produce, and is more environmentally friendly than the metal oxide materials used in lithium-ion batteries. However, lithium-sulfur batteries don't currently last as long as their lithium-ion counterpart, degrading over time.

Lithium is a reactive element that tends to break down other elements around it. Every cycle of a lithium-sulfur battery — the process of charging and discharging it — can cause mossy, needle-like deposits to form on the lithium-metal anode, the negative electrode of



A glovebox used for testing the batteries.



The batteries were tested in Arumugam Manthiram's laboratory.

the battery. This starts a reaction that can lead to the battery's overall degradation.

The deposits break down the electrolyte that shuttles lithium ions back and forth. This can trap some of the lithium, keeping the electrode from delivering the full power necessary for the ultralong use the technology promises. The reaction can also cause the battery to short-circuit and potentially catch fire.

The researchers found that creating an artificial layer containing tellurium on top of the lithium electrode can make it last four times longer. The artificial layer protects the electrolyte from being degraded and reduces the mossy structures that trap lithium from forming during charges.

"The layer formed on the lithium surface allows it to operate without breaking down the electrolyte, and that makes the battery last much longer," said study co-author Amruth Bhargav. Co-author Sanjay Nanda added, "The stabilising layer is formed by a simple in-situ process

and requires no expensive or complicated pre-treatment or coating procedures on the lithium-metal anode."

Solving the instability of this part of the battery is key to extending its cycle life and bringing about wider adoption, with corresponding author Professor Arumugam Manthiram saying the new method can be applied to other lithium- and sodium-based batteries. The researchers have since filed a provisional patent application for the technology.

Image credit: The University of Texas at Austin.

ELECTRONEX RESCHEDULED TO MAY 2021

Electronex – The Electronics Design and Assembly Expo, which was to be held in November at Rosehill Gardens in Sydney, has been rescheduled to 5-6 May 2021.

Following the recent outbreak of COVID-19 in Victoria, which resulted in tighter border restrictions around Australia,

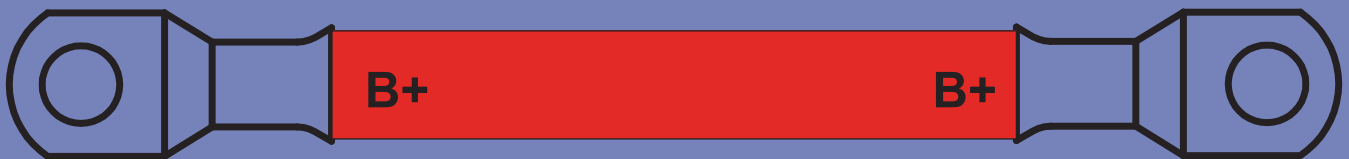
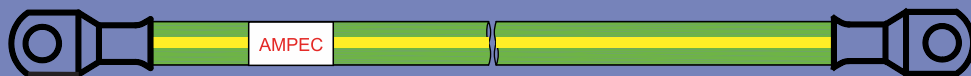
show organiser Australasian Exhibitions & Events (AEE) surveyed exhibitors to determine the impact that this would have on their ability to participate in the expo — with a number of suppliers and company staff normally travelling from interstate for the event. More than 90% of the exhibitors indicated that they would be impacted by the border closures or preferred that the event was postponed to 2021.

AEE Managing Director Noel Gray said, "We were confident that the event would be able to proceed with a COVID-safe plan in place until the state borders were shut due to the Victorian outbreak. As a result of the feedback from our exhibitors, the difficult decision was made to move the expo to May next year, which has been welcomed by the industry. We are committed to the long-term success of Electronex and did not want to compromise the brand and our exhibitors by holding an event that was not a proper representation of the industry."

For enquiries or further information, email ngray@auexhibitions.com.au.



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FAST DATA TRANSFER WITH OLEDs

An international research team has developed a visible light communication (VLC) set-up, capable of a data rate of 2.2 Mbps, by employing a new type of organic light-emitting diode (OLED, pictured).

The project is a collaboration between Newcastle University, University College London, the London Centre for Nanotechnology, the Institute of Organic Chemistry at the Polish Academy of Sciences and Italy's Institute for the Study of Nanostructured Materials – Research National Council (CNR-ISMN). It has been published in the journal *Light: Science & Applications*.

The demand for faster data transmission speeds is driving the popularity of light-emitting devices in VLC systems. LEDs have multiple applications and are used in lighting systems, mobile phones and TV displays. While OLEDs don't offer the same speed as inorganic LEDs and laser diodes do, they are cheaper to produce, recyclable and more sustainable.

Dr Paul Haigh, from Newcastle University's Intelligent Sensing and Communications Group, was part of the research team. He led the development of a real-time transmission of signals that transmit as quickly as possible. He achieved this by using information modulation formats developed in-house, achieving approximately 2.2 Mbps.

"Our team developed highly efficient long wavelength (far-red/near-infrared) polymer LEDs free of heavy metals, which has been a longstanding research challenge in the organic optoelectronics community," Dr Haigh said. "Achieving such high data rates opens up opportunities for the integration of portable, wearable or implantable organic biosensors into visible/nearly (in)visible light communication links."

By extending the OLED's spectral range to 700–1000 nm, the team successfully expanded the bandwidth and achieved what is claimed to be the fastest-ever data speed recorded in real time for solution-based OLEDs — high enough to support an indoor point-to-point link, with a view of IoT applications. The researchers highlighted the possibility of achieving such data rates without computationally complex and power-demanding equalisers.

Together with the absence of toxic heavy metals in the active layer of the OLEDs, the new VLC set-up is promising for the integration of portable, wearable or implantable organic biosensors. In the future the technology may be applied in many different areas, ranging from individual communication-enabled pixels in display technologies right through to under- or through-skin biosensing for active health monitoring and faster care linkage.

NEW ORGANIC MATERIAL TO UNLOCK FASTER ELECTRONIC DEVICES

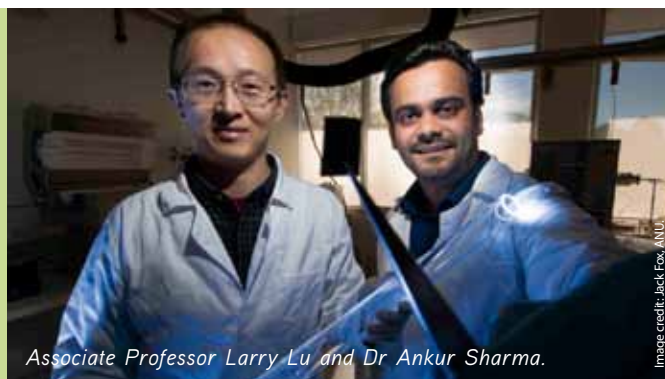
An organic material that is thin, bendable and powerful could be used to create the next generation of mobile phones and other electronic devices, according to a study led by The Australian National University (ANU) and published in the journal *Nature: Light Science & Applications*.

In 2018, the team invented a semiconductor with organic and inorganic materials that could convert electricity into light very efficiently — and was thin and flexible enough to help make devices such as mobile phones bendable. Now they've been able to improve the organic part of the material, allowing them to completely remove the inorganic component.

Lead researchers Dr Ankur Sharma and Associate Professor Larry Lu, both from ANU, say their material will help create the next generation of ultrafast electronic chips, which promise to be much faster than the current electronic chips we use.

"Conventional devices run on electricity — but this material allows us to use light or photons, which travels much faster," Dr Sharma said. "The interesting properties we have observed in this material make it a contender for superfast electronic processors and chips."

Assoc Prof Lu said the researchers observed functions and capabilities in their organic material that were previously unseen, and should help to achieve ultrafast electronic devices. They were



Associate Professor Larry Lu and Dr Ankur Sharma.

Image credit: Jack Fox, ANU

also able to control the growth of their novel organic semiconductor material by stacking one molecule precisely over the other.

"The material is just one carbon atom thick, a hundred times thinner than a human hair, which gives it the flexibility to be bent into any shape. This will lead to its application in flexible electronic devices," Assoc Prof Lu said.

Dr Sharma noted that the removal of the inorganic component means the material is made from "just carbon and hydrogen", which would mean devices could be biodegradable or easily recyclable — thus avoiding the tonnes of e-waste generated by current-generation electronics. And while he acknowledged that actual devices might still be some way off, the new study provides a demonstration of the organic material's immense capabilities.

"We now have the perfect building block to achieve flexible next generation electronics," he said.



The DGIST team prepared lab-scale CZTSSe solar cells.

SUSTAINABLE COMPONENTS FOR SOLAR PANELS

Scientists from Daegu Gyeongbuk Institute of Science and Technology (DGIST) have identified a novel method to create efficient alloy-based solar panels free of toxic metals, publishing their results in the journal *Advanced Energy Materials*.

Most common thin-film solar panels consist of expensive rare-earth elements like indium and gallium, or highly toxic metals like cadmium. Environmentally friendly solar panels consisting of more abundant materials offer attractive alternatives, but are hindered by their low practical efficiency compared to their theoretical potential. DGIST researchers, led by Dr Jin-Kyu Kang and Dr Dae-Hwan Kim, have now discovered a solution to this problem.

"Thin-film solar cells using bronze (Cu-Sn) and brass (Cu-Zn) as base materials are composed of non-toxic earth-abundant materials, and have been studied worldwide because of their low cost, high durability and sustainability," said Dr Kang. However, using these alloys in thin film technology has its own drawbacks.

While the theoretical efficiency of these panels matches the efficiencies of top-market products, they tend to underperform drastically in practice. This is because of the formation of various defects in the materials, such as point defects, surface defects and volume defects, during the annealing (heating and cooling) process. These defects undermine the current flow, resulting in loss of electricity generated.

The scientists wanted to find a way to synthesise the best-quality CZTSSe (copper, zinc, tin, sulfur and selenium) thin films. They played around with the annealing profile, which has a strong effect on the grain size of CZTSSe thin film: the longer the annealing time and higher annealing temperature, the larger the grains and the lesser the electricity loss. However, as the annealing temperature and time increase, there is a change in the properties of the CZTSSe thin film due to decomposition.

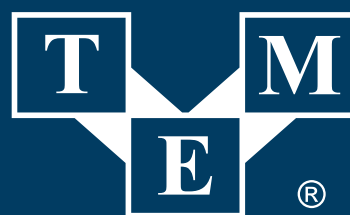
To bypass this issue, the team used a special 'liquid-assisted method', which allowed the grains of CZTSSe to grow at a faster rate. This meant that the grains could grow large even at low temperatures, preventing the change in the properties of the CZTSSe thin film. The scientists thus managed to overcome a significant hurdle in the search for low-cost, environmentally friendly solar energy, with one of their CZTSSe solar cells exhibiting an impressive 12.6% conversion efficiency.

"Our technology has diverse applications, including in electronic devices, household goods, buildings and vehicles," Dr Kim said. "The best part is that CZTS solar cells are free of the current drawbacks of toxic and rare metals. We can install everywhere we want!"

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STAINLESS STEEL INDUSTRIAL ENCLOSURES

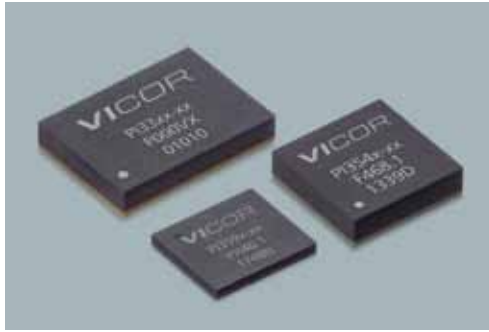
The EJSS family of enclosures from Hammond Electronics is available in 304 or 316 grade stainless steel, supplied in a natural smooth brushed finish. Sealed to IP66, the series is designed for use as an instrument enclosure; an electric, hydraulic or pneumatic control housing; an electrical junction box; or a terminal wiring enclosure.

In applications such as food processing, a formed lip on the enclosure diverts flowing liquids and contaminants away from the seamless poured-in place gasket in the door, enabling it to be hosed down during cleaning. Stainless steel is also a suitable material for installation in areas where corrosion may be a problem.

The EJSS family is available in 22 sizes, ranging from 102 x 102 x 76 mm to 406 x 356 x 254 mm. All but the two smallest sizes are supplied complete with a 1.6 mm-thick internal unpainted galvanised steel panel. The series meets IEC 60529 IP66 for European and CE, UL and NEMA 3R, 4, 4X, 12 and 13 requirements for North American markets.

The body and cover are formed from 1.3 mm stainless steel with smooth, continuously welded seams without knockouts, cutouts or holes. Integral heavy-duty, full-width top and bottom brackets facilitate mounting the enclosure to an external surface. The cover, mounted on a heavy-duty continuous hinge, opens through 180° for good access; a quarter-turn latch prevents casual unauthorised access by requiring a tool for operation. A bonding stud is provided on the door and a grounding stud is fitted to the enclosure.

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ZVS BUCK REGULATORS

Vicor has released the PI3323 and PI3325 ZVS buck regulators, with an extended operating temperature range of -55 to +120°C and an optional

tin-lead 10 x 14 mm SiP BGA package for Mil COTS applications.

The high-density and high-efficiency buck regulators have a 14–42 V input voltage range and support nominal outputs of 3.3 and 5 V, adjustable over ranges of 2.2–4 and 4–6.5 V, respectively. The devices offer up to 22 A of continuous operation and up to 96% peak efficiency and are easy to parallel for higher power delivery.

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LINEAR MOTORS

The LM 1483, with a continuous force of 6.2 N and a peak force up to 18.4 N, is the latest in the portfolio of FAULHABER Linear DC-Servomotors, which now provide a performance range with continuous force from 1.02 to 9.2 N and a peak force from 2.74 up to 27.6 N.

As with other models in this family, the LM 1483 combines highly dynamic motion (acceleration up to 220 m/s²) with high precision and repeatability (down to 120 and 40 µm respectively). It measures 14 x 20 x 83 mm with a 6 mm diameter rod and is available with different stroke lengths ranging from 20 to 80 mm. In addition, the stainless steel rod has welded end caps that provide a robust interface to the application.

Using three integrated linear Hall sensors, the -11 version can easily be combined with FAULHABER Motion Controllers (MC 5004 and MC 5005 as well as the FAULHABER MCLM 300x). For sin/cos output, the -12 version is also available.

FAULHABER Linear DC-Servomotors are suitable for small and micro linear motion applications. They combine dynamic performance and robust design typical of a pneumatic system with the silence of a brushless motor. Applications include solutions where highly dynamic positioning is required, with the products enabling long lifetime (millions of cycles) and low maintenance. They are useful in any complex system, such as pick-and-place machines, medical devices, piston pumps, optics and instrumentation.

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FASTER AND FASTER, FURTHER AND FURTHER

When it comes to presenting new electric vehicles, automobile manufacturers are constantly beating each other with increasingly shorter charging times and longer ranges. It is easy to determine that this calculation only works to a limited extent. In addition, this procedure is anything but beneficial for the service life of a vehicle.

More and more cities want to impose a driving ban on diesel vehicles due to stricter air pollution regulations. The pressure on the automotive industry to offer vehicles with the lowest possible emissions is growing. After all, who buys a vehicle they will no longer be allowed to drive into town tomorrow?

So the potential buyers have to be convinced with pithy slogans that the latest electric model can be charged from zero to 100% in just a few minutes and can cover hundreds of kilometres. Unfortunately, it is not that simple. Physics cannot be outwitted with such sayings. Here are a few simple facts.

How long does it take to charge?

The calculation is done quickly. Take the battery capacity of a vehicle in kWh and divide it by the power (kW) of the charging station. This way you get the number of hours for a full charge (0–100%).

The weakest link

When charging, always note that the charging process consists of the mains, the charging station, the charging cable and the charger itself like a chain. The weakest link of such a chain always determines the maximum charging power. If the charger can only cope with 6.6 kW, it won't help if you 'pump' electricity into the batteries with a 22 kW charging station.

At this point, you should say goodbye to the information provided by some manufacturers, who attribute particularly short loading times to their vehicles. Please read the small print! Under which conditions are these loading times realistic — at an external three-phase high-performance charging station or at home?

Charging at home

In practical terms, this results in the following charging times at home for the Nissan LEAF with the 40 kWh battery, which has

been the best-selling electric vehicle for a long time: we need 22 hours at a standard 230 V socket (10 A/1.8 kW) via a charger belonging to the vehicle, which should only be a practicable value for real emergencies. Moreover, it should be remembered that these socket outlets are not designed to withstand such continuous loads.

It makes more sense and is also recommended by the manufacturer to use their own wall box, a separate charging station. However, the installation of such a terminal belongs in the hands of an electrician. In a one-phase network, the lithium-ion battery can be charged with 3.7 kW of power, which still leads to a charging time of 11 hours. So we have to switch to the three-phase grid to get more power. The next call to the electrician is scheduled.

Required charging capacity

If you are in the privileged position of owning a detached house, you can easily get a powerful home charging station. The story is different, however, for apartment owners and tenants who park their vehicles in an underground car park used by several parties. The apartment owner must obtain the consent of the owners corporation, and the tenant needs the permission of the landlord.

Let's take another small example: there is room for 30 cars in a normal underground car park. If a conventional vehicle is replaced by an electrically operated one with a three-phase charging station, this should not cause any problems. The situation is different for three, five or even 10 electric vehicles. The power system for the underground car park was simply not designed for such loads.

It is therefore not only advisable, but also absolutely imperative, to clarify from the outset how many charging stations the reserves of the house's connected load are sufficient for and whether it will be possible at all to boost them later. If several electric cars are attached at the same time, it is best to choose intelligent charging stations that measure the load on the power grid and include it in the respective charging capacity.

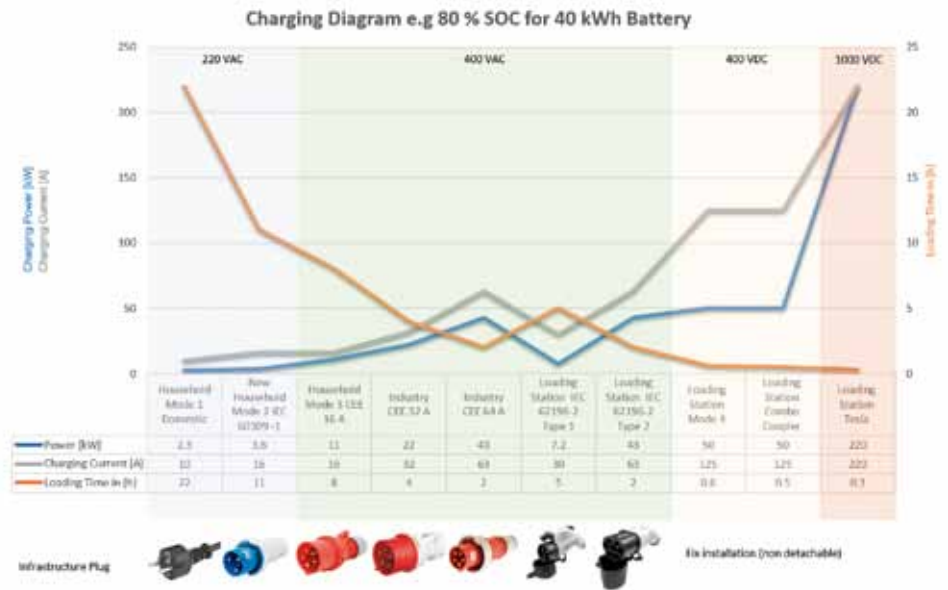


Figure 1.

Fast charging is no good

No matter what the marketing strategists of the automobile manufacturers say, fast charging harms a lithium-ion battery. The IU charging process, which is used for lithium-ion cells, works with constant current (CC) and constant voltage (CV). Like the service life, the charging time also depends on various factors, with higher charging capacities above all on the temperature. Short charging times or high charging currents have a negative effect on the electrode material, shortening the service life and the number of cycles. Gentle charge/discharge massively increases the service life.

Lithium plating

Charging and discharging Li-ion cells at high currents or low temperatures can lead to lithium plating. Lithium ions are preferably deposited on the anode surface instead of between the layers of graphite. This effect leads to significant losses in performance, lifetime and safety. In extreme cases, lithium plating can even lead to a short circuit or, since metallic lithium is highly flammable, to a fire.

Communication/BMS

BMS (battery management systems) are responsible for controlling and monitoring the charging and discharging process of high-performance battery packs. Their main task is to ensure that each individual cell does not exceed or fall short of a defined state of charge (SoC) during both charging and discharging. The SoC value denotes the remaining capacity of a battery in relation to the nominal value. The value is given as a percentage of the fully charged state. For example, 30% means that the battery still has a residual charge of 30% relative to full charge. Depending on the application, the upper and lower limit values for the SoC are 20% to 100% for max power and 30% to 70% for max service life.

Charging systems overview

Unfortunately, there is no standardised method for charging electric vehicles. There are both country- and manufacturer-specific techniques and plug/socket combinations. Figure 1 provides an

overview of the most common systems currently in use with their key specifications.

The large number of different connections and charging standards may seem confusing from a potential consumer's point of view. In everyday life, however, it is less problematic than one might think at first glance. However, what still needs to be simplified, particularly in the case of public charging points, is access authorisation and payment options. For the sake of simplicity, it should be possible to pay by Maestro or credit card, as at a petrol station. This will take some time, but there is no way around it.

IATF 16949: experienced partner

SCHURTER is certified according to IATF 16949 and serves a large number of customers with fuses that have been tested according to AEC-Q200 for various applications (battery management, climate control, engine-related electronics for diesel/petrol engines and many more). Millions and millions of fuses to protect against overcurrent and overtemperature (thermal protection) are in use worldwide. The close networking with international automotive organisations and the industry itself make SCHURTER a competent partner for questions concerning the protection of electronics in automotive engineering. In addition, the company has a competence centre for EMC solutions, which has been developing customised solutions for industrial and medical applications for decades.

Conclusion

The subject of 'charging electric vehicles' is characterised by an uncanny dynamic. It's about a future market worth billions. Mobility for all of us. In Germany alone, more than 800,000 jobs depend on the classic automotive sector. The introduction of electro mobility will change a lot. Accordingly, the manufacturers of electric vehicles are struggling with tough bandages and pithy slogans. One should not always believe everything one is presented with. Much is simple physics.

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www.schurter.sg

BIOMORPHIC BATTERIES

COULD PROVIDE MORE ENERGY FOR ROBOTS

Similar to how biological fat reserves store energy in animals, a new rechargeable zinc battery integrates into the structure of a robot to provide much more energy.

That's according to a new study led by the University of Michigan (U-M) and published in the journal *Science Robotics*. This approach to increasing capacity will be particularly important as robots shrink to the microscale and below — scales at which current standalone batteries are too big and inefficient.

"Robot designs are restricted by the need for batteries that often occupy 20% or more of the available space inside a robot, or account for a similar proportion of the robot's weight," said U-M Professor Nicholas Kotov, who led the new research.

Applications for mobile robots are exploding, from delivery drones and takeaway bots to robotic nurses and warehouse robots. On the micro side, researchers are exploring swarm robots that can self-assemble into larger devices. Multifunctional structural batteries can potentially free up space and reduce weight, but until now they could only supplement the main battery.

"No other structural battery reported is comparable, in terms of energy density, to today's state-of-the-art advanced lithium batteries," Prof Kotov said. "We improved our prior version of structural zinc batteries on 10 different measures, some of which are 100 times better, to make it happen."

The researchers' battery works by passing hydroxide ions between a zinc electrode and the air side through an electrolyte membrane. That membrane is partly a network of aramid nanofibres — the carbon-based fibres found in Kevlar vests — and a new water-based polymer gel. The gel helps shuttle the hydroxide ions between the electrodes.

Made with cheap, abundant and largely non-toxic materials, the battery is designed to be more environmentally friendly than those currently in use. The gel and aramid nanofibres will not catch fire if the battery is damaged, unlike the flammable electrolyte in lithium-ion batteries. The aramid nanofibres could also be upcycled from retired body armour.

To demonstrate their batteries, the researchers experimented with regular-sized and miniaturised toy robots in the shape of a worm and a scorpion. The team replaced their original batteries with zinc-air cells. They wired the cells into the motors and wrapped them around the outsides of the robots.

"Batteries that can do double duty — to store charge and protect the robot's 'organs' — replicate the multifunctionality of fat tissues serving to store energy in living creatures," said Ahmet Emre, a doctoral student in Prof Kotov's lab.

The downside of zinc batteries is that they maintain high capacity for about 100 cycles, rather than the 500 or more that we expect from the lithium-ion batteries in our smartphones. This is because the zinc metal forms spikes that eventually pierce the membrane between the electrodes. The strong aramid nanofibre network between the electrodes is the key to the relatively long cycle life for a zinc battery, while the inexpensive and recyclable materials make the batteries easy to replace.

The combination of energy density and inexpensive materials means the new battery may already double the range of delivery robots. "This is not the limit, however," said Mingqiang Wang, recently a visiting researcher to Prof Kotov's lab. "We estimate that robots could have 72 times more power capacity if their exteriors were replaced with zinc batteries, compared to having a single lithium-ion battery."

Beyond the advantages of the battery's chemistry, Prof Kotov said the design could enable a shift from a single battery to distributed energy storage, using a graph theory approach developed at U-M.

"We don't have a single sac of fat, which would be bulky and require a lot of costly energy transfer," Prof Kotov said. "Distributed energy storage, which is the biological way, is the way to go for highly efficient biomorphic devices."

The university has applied for patent protection and is now seeking commercial partners to bring the technology to market.



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CLEANING SYSTEM

Austin American Technology's (AAT) Mega ION cleaning system is designed for solvent-based applications requiring product cleanliness verification (IPC ROSE testing). It is used for the final clean prior to conformal coating, encapsulation or other sealing operations used to protect electronic modules.

The device is compatible with multiple solvents including but not limited to DI water, water-alcohol mixtures, pure alcohol, evaporative hydrocarbons (like cyclohexane) and commercial solvent blends not requiring a water rinse. ROSE testing allows the system to quantify ionic contamination of the circuit board before or after cleaning. This enables the operator to clean and test the circuit boards within one system.

AAT's regeneration system increases the product's bath life by removing flux, finger soils and other manufacturing soils from the wash solution without heat or condensing coils. This is said to provide a large increase in bath life and to reduce solvent waste. The integrated solvent regeneration typically maintains the solvent purity level at a higher standard than the solvent as received from the vendor, the company claims.

The product operates in a closed-loop environment with wash bath life maintained through the use of an integrated ionic exchange filter system. This is said to provide a fast payback based on solvent and solvent disposal savings, combined with low maintenance downtime and high production uptime.

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USB 1553 AND ARINC APPLIANCE

Alta Data Technologies has released an innovative USB MIL-STD-1553 and ARINC-429 appliance: the USB-MA4. The product connects notebooks, desktops and servers with 1553 and ARINC networks via USB 3.0 SuperSpeed. This is useful as current USB 2.0 interfaces can have serious throughput issues.

About the size of a deck of cards, the product provides 1–2 dual redundant 1553 channels and/or eight ARINC-429 channels. In addition to 1553/ARINC full RX/TX message controls, it can generate or capture (o-scope) raw bus signals for protocol and electrical troubleshooting.

Along with flexible, layered SDK, AltaAPI and AltaView Windows analyser, users can quickly integrate the USB-MA4 for their avionics application. For most applications, the user can port existing Alta applications to the product with little or no code changes.

Metromatics Pty Ltd
www.metromatics.com.au



TOUCH CONTROLLER FAMILY

Microchip Technology announced the extension of its maXTouch portfolio with the MXT288UD touch controller family, containing what are claimed to be the industry's smallest automotive-grade packaged touchscreen controllers. The MXT288UD-AM and MXT144UD-AM devices offer low power mode, weatherproof operation and glove touch detection in multifunction displays, touch pads and smart surfaces for vehicles, motorcycles, e-bikes and car-sharing services.

Secondary touch surfaces can be placed in both the interior of cars and exterior of a motor vehicle, such as handlebars, doors, electronic mirrors, control knobs, the steering wheel, between seats or in an armrest. With the MXT288UD family's 7 x 7 mm automotive-grade VQFN56 package, tier one suppliers should expect to reduce board space by 75% and minimise the overall bill of materials (BoM) for these compact applications — all while exceeding the requirements for good touch performance. The family's low-power wait-for-touch mode consumes less than 50 μ A, remaining responsive for the user, even if the display switches off to save power or to avoid disturbing the driver at night. The system will wake by a touch event anywhere on the touch surface.

The MXT288UD-AM and MXT144UD-AM devices enable detection and tracking of multifinger-thick gloves through a wide variety of overlay materials and thicknesses, like leather, wood or across uneven surfaces — even in the presence of moisture. In car-sharing applications, this touch functionality helps users access a car from the outside by tracking touch coordinates on an exterior display in any environment, like rain, snow or extreme heat. Motorcycles and other motorbike vehicles also benefit from such weatherproof designs. As a turnkey solution, the MXT288UD family provides firmware developed according to Automotive SPICE processes and is AEC-Q100 qualified — making it easy for today's automotive manufacturers to integrate into existing systems at a low risk with fast time to market.

Microchip Technology Australia
www.microchip.com

GNSS RECEIVER MODULE

Septentrio's mosaic-X5 is a high-end GNSS receiver module, suitable for users who need secure positioning in a compact and low-power form factor. It has been designed to bring high-performance positioning to volume applications.

The product features complete multi-frequency, multi-constellation technology and tracks every existing and future signal from all GNSS constellations. Such signal diversity, coupled with anti-jamming and anti-spoofing technology, allows the device to deliver centimetre-level positioning with maximum availability even in challenging industrial environments. This makes it a useful positioning solution for applications such as robotics, automation, telematics and more.

Digi-Key Electronics
www.digikey.com



Proximity sensors encourage social distancing

FlightSense proximity and ranging sensors from semiconductor company STMicroelectronics are helping prevent disease transmission in innovative products developed in response to the global pandemic situation.

Time-of-flight (ToF) sensors transmit photons and then calculate distance to the target based on the time it takes for the reflected photons to be received back by the sensor. Moreover, ranging accuracy is unaffected by surface characteristics of the target, such as clothing colour or skin reflectivity, making FlightSense ToF sensors particularly useful for helping people to maintain social distancing.

Amsterdam-based start-up Aura Aware is now using ST's FlightSense technology in a smart distance-awareness portable device suitable for use at retail counters and check-in desks. The easy-to-set-up device displays a green OK signal that changes to red if a person crosses a safe minimum-distance threshold.

Aura Aware devices integrate ST's VL53L1X compact ToF sensor, which has an operating range of up to 4 m and very

low power consumption. Signal processing built into the sensor simplifies design and provides sophisticated features such as crosstalk compensation that maintains measurement accuracy even if the sensor window becomes obscured by foreign material.

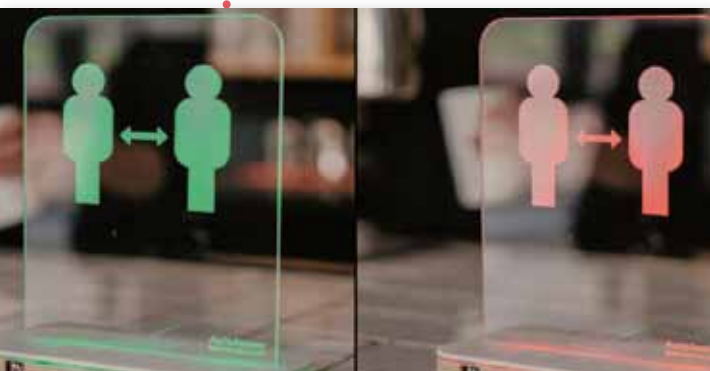
"This innovative device from Aura Aware shows a highly creative use of our FlightSense technology," said David Maucotel, Business Line Director, Imaging, STMicroelectronics.

The sensors can also help users avoid contact with surfaces, including self-service touchscreens, smart faucets and push-button door openers, located in high-traffic areas. The speed and precision of ToF sensing enable FlightSense sensors to manage basic on/off control as well as to detect and interpret gestures like tapping and swiping for smart touchless human-machine interaction.

Another advantage of ST's ToF sensors is their linear response when measuring short distances, which allows them to be used inside dispensing machines to detect the level of hand-sanitising liquid or the number of personal protective items such as face masks.

"ST's ToF sensors can help protect our health in many ways, ensuring both social distancing and touchless interaction with all kinds of products that we use every day," Maucotel concluded.

STMicroelectronics Pty Ltd
www.st.com



PLASTIC SCREWS, NUTS, BOLTS AND WASHERS

Hi-Q Components is a supplier of plastic hardware and electronic components to the electronic, engineering and general industries. The majority of the company's plastic hardware is made of nylon 6/6, which is tough, durable and corrosion resistant in normal temperatures.

For engineering and assembly, Hi-Q has a large range of nylon machine screws, nuts, bolts and washers. These are available mostly in metric with some imperial sizes available. Threaded rod in 1 m lengths is available in M3-M20 sizes. Nylon washers in many sizes are available as flat, self-retaining and insulating. Machine screws are available in many lengths and a range of head styles.

Hi-Q Electronics Ltd
www.hiq.co.nz





MICRO-ATX MOTHERBOARD

The AIMB-506 is an expandable, industrial-grade Micro-ATX motherboard. It provides high computing power and multiple expansion slots via an Intel H310 chipset that supports the latest 9th Gen Intel Core/Pentium/Celeron socket-type processors.

Featuring multiple high-speed I/O including 20 x USB ports, 3 x SATA III, PCIe (x16 and x1), 2 x PCI and an M.2 (B-Key), the AIMB-506 allows users to consolidate legacy and modern peripheral devices on a single motherboard. The product has 16-bit digital programmable I/O, 14 x COM ports (2 x support RS-232/422/485) and a 6 W dual-channel audio amplifier. It also features dual Gigabit Ethernet ports that deliver up to 1000 Mbps of bandwidth for network-intensive applications. These high-speed connectivity capabilities allow the device to support a variety of peripherals and network connections in self-service applications.

The AIMB-506 integrates Intel HD graphics with DX11.1, OpenCL 2.1 and OpenGL 5.0 to deliver enhanced graphics performance. Dual independent displays are supported in clone or extended mode with VGA, DisplayPort 1.2, DVI-D, eDP or LVDS in high 4K2K resolution for DisplayPort 1.2 and eDP ports. This combination of I/O connectivity and excellent graphics performance makes the product suitable for applications in virtual teller machines (VTM), automated teller machines (ATM) and other interactive kiosks.

The motherboard is bundled with a WISE-DeviceOn software package, which offers smart software for IoT applications and facilitates remote management and security. It is suitable for interactive kiosks, cash dispensers and sensor/card readers.

Advantech Australia Pty Ltd
www.advantech.net.au

SWITCHES

SCHURTER has extended its MSM Metal Line series of switches with a 24 mm mounting diameter. The sleek range of switches provides a multitude of options for switching voltages from 30 VDC to 250 VAC and switching currents from 0.1 to 10 A.

The rugged switches feature an IP67 seal protection rating and an impact resistance rating IK07, making them suitable for use in applications exposed to harsh environmental conditions or in applications requiring protection against vandalism. The mechanical action and the high-grade materials offer good tactile feedback.

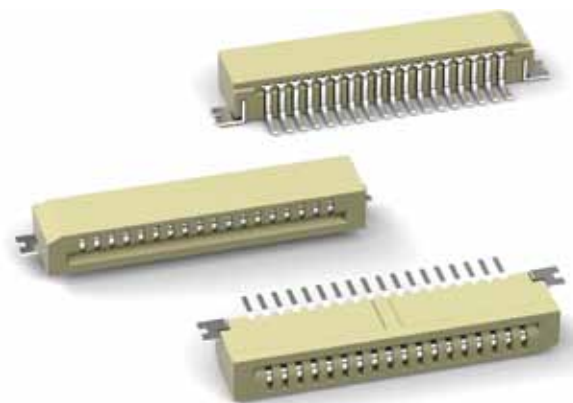
The Metal Line switches are now available in standard 16, 19, 22, 24, 27 and 30 mm diameters over a range of three different technologies: mechanical, capacitive and piezo. They can also be customised to almost any specific requirement, meaning switches are available for a wide range of applications — including indoor and outdoor equipment, industrial, vending and ticketing, POS terminals, public transport, pro audio, food service and processing, and laboratory and medical equipment.

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LIF CONNECTOR

Small and flexible flat-ribbon cables are widely used in LCD screens, board-to-board connections for medical equipment, test and measurement devices, industrial applications, entertainment electronics and more. In many of these applications, it is not important to have a vibration-free interlock for the plug-in connector. For such applications Würth Elektronik offers its easy-to-assemble LIF (low insertion force) connector, the WR-FPC.



Suitable for SMT pick-and-place assembly systems, connectors in the 1 mm grid format are available in a variety of versions, from 4 to 30 pins, in horizontal and vertical plug-in directions. Besides serving as sockets for flat flexible cables, they are also intended for use as connectors for flexible printed circuit boards (hence the designation FPC).

The rated current is 1 A and the operating voltage 125 V. To ensure a high degree of elasticity, low wear and tear and low resistance (30 mΩ), Würth Elektronik has selected phosphor bronze as the material for the contacts. The connectors have an undercoat of nickel to prevent the so-called tin whisker phenomenon.

Würth Electronics Australia Pty
www.we-online.com



MODBUS/TCP TO RTU/ASCII GATEWAY

ICP DAS's tGW-700 is a Modbus TCP to RTU/ASCII gateway that enables a Modbus/TCP host to communicate with serial Modbus RTU/ASCII devices through an Ethernet network and eliminates the cable length limitation of legacy serial communication devices.

The module can be used to create a pair-connection application (as well as serial-bridge or serial-tunnel application) and can route data over TCP/IP between two serial Modbus RTU/ASCII devices. This is useful when connecting mainframe computers, servers or other serial devices that use Modbus RTU/ASCII protocols and do not themselves have Ethernet capability.

The product features a powerful 32-bit MCU to enable efficient handling of network traffic, and also has a built-in web server that provides an intuitive web management interface that allows users to modify the configuration of the module — including the DHCP/Static IP, the gateway/mask settings and the serial port settings.

The module offers true IEEE 802.3af-compliant (classification, Class 1) Power over Ethernet (PoE) functionality using a standard category 5 Ethernet cable to receive power from a PoE switch such as the NS-205PSE. If there is no PoE switch onsite, the module will also accept power input from a DC adapter.

The device is designed for ultralow power consumption and should therefore reduce the costs associated with increasing fuel and electricity prices, especially when many modules are installed.

ICP Electronics Australia Pty Ltd

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INDUSTRY 4.0:

EDGE COMPUTING POWER IS KEY

Up to now, cloud computing has been one of the biggest driving forces behind the growth in digital industrial transformation — particularly expansion of the Industrial Internet of Things (IIoT) — as well as increasingly high levels of automation in a wide and diverse range of industry sectors.

However, today it is clear that using the cloud for data management and storage no longer represents the whole picture. Edge computing used in conjunction with cloud computing — that is, processing data locally then sending it to the cloud — is becoming an increasingly indispensable element of the burgeoning Industry 4.0 concept.

As the number of smart devices increases due to greater IIoT usage, there has been a growing demand for these devices to have the data that they collect processed by units that are 'on the edge' — ie, close to

their users. With this in mind, edge computing is capable of minimising bandwidth usage and increasing response times by enabling data to be stored and managed close to where it's required, making it possible to use edge servers within a much wider selection of applications.

Typical edge devices that many may be familiar with include sensors for controlling lighting, heating and other elements. These applications illustrate the clear benefits to having such sensors as close as possible to the computing power being provided, not least the substantial cost savings that can be achieved by cutting down on the amount of data that has to be transferred across long distances and/or stored in the cloud.

Indeed, there are several potential pitfalls for users who are looking to export data from sensors directly onto the cloud. They can include network latency, poor system integration, high data management costs and vulnerability in terms of IT security. For these reasons, then, it is being acknowledged that local is best and that taking on edge computing can have hugely beneficial impacts on the adoption of otherwise costly Industry 4.0 systems.

Reducing risk and increasing agility

In short, edge computing can reduce risks when connecting devices and sharing data, increase flexibility and agility within organisations, reduce the amount of irrelevant data that is processed and ensure extremely low and predictable latency levels. Finally, in a manufacturing environment, where edge computing can integrate with an enterprise resource planning (ERP) system and deliver data processing in real time, a company can speed up its automation process significantly by keeping things local.

A key cornerstone of this new approach — and therefore an influential factor in the widespread adoption of automation — is having the ability to process data locally via robust, reli-



Figure 1: The Advantech ADAM-4520-EE robust converter is capable of connecting easily to devices.





Figure 2: The HARTING 2095000000300 industrial computer with Ethernet port and 32 GB flash memory is suitable for use in hostile environments.

able, customisable and easy-to-use solutions that can be used in hitherto challenging industrial environments. These solutions include, for example, various types of industrial controllers and communication systems that can help to make the installation and application of Industry 4.0 networks much more feasible to set up and more straightforward to operate.

It is widely understood that Industry 4.0 requires the use of various tools that not only facilitate automa-

tion but also help to process and share data widely and efficiently. In turn, this enables manufacturing processes to be improved and refined and end products made to precise customer specifications.

To make such a concept work in the real world, special interfaces and devices are required. These include communication cards compatible with various bus types, industrial modules, connection leads and modern interfaces in the form of efficient and lightweight panel computers. Indeed, converters and industrial modules are now essential elements in the move towards Industry 4.0.

One of the solutions available to make this possible is based around a range of edge-based industrial controllers from Brainboxes. These units are capable of two-way transmission, where components communicate with a department of engineers who are able to interpret the data. This kind of transmission requires communication cards compatible with various types of buses. One example is Brainboxes' PCI Express (PCIe) bus supported by the IX-100 card. Compatible with Windows, Linux and other operating systems, which makes it easier to integrate with existing set-ups, the IX-100 also features overvoltage protection and measures just 120 x 76 x 18 mm. Finally, the plug-and-play card provides one industry-standard 9-pin RS-232 serial COM port in a single PCIe slot.



Figure 3: The industrial gigabit ANTAIRA LNP-0500G-24 PoE switch has a metal housing and five access ports.

Robust and easy to connect

To use advanced communications technology in an IIoT environment, it is important to use robust converters and in/out modules that are capable of connecting easily to devices. For example, the ADAM-4520-EE isolated RS-232 to RS-422/RS-485 converter from Advantech (Figure 1), supplied in a durable ABS enclosure, is one such module that measures 70 x 122 x 30 mm and has power consumption of 1.2 W @ 24 VDC.

Also worthy of consideration when using industrial computers in hostile environments is the need to have efficient flash memories and a choice of operating systems. For example, the HARTING 2095000000300 (Figure 2) industrial computer with Ethernet port and 32 GB flash memory has an IP67 rating which provides protection against dirt and humidity. Measuring 132 x 86 x 35 mm, this unit has 1 GB RAM memory capacity and uses Power over Ethernet or 12 VDC/24 VDC. The modular hardware and software design allows users, development engineers and system integrators to create integrated industry projects quickly and efficiently.

Because Industry 4.0 requires all devices to be connected to the same network, being able to power them all from a single source is vital. Power over Ethernet technology makes this possible, using the same network cable that transfers data across devices in the network. This set-up can help to provide substantial reductions in the cost of electrical installations, as shown with the industrial gigabit ANTAIRA LNP-0500G-24 PoE switch (Figure 3) which has a metal housing, five access ports and a built-in voltage booster. Manufactured by ANTAIRA Technologies, a USA-based maker of industrial communication solutions, the product is suitable for applications that demand a high-power PoE power source in harsh environments. These include security surveillance, traffic monitoring systems, oil/gas and mining applications, facilities management for power/utility, water/wastewater treatment plants and automated production lines in smart factories.

Conclusion

It's clear that embracing solely cloud computing technology when bringing IIoT into an environment of automation where data is shared locally is no longer sufficient if costs are to be kept to a minimum and companies are to become as productive and efficient as possible. A combination of cloud computing and edge computing is now the recognised optimum solution and there are many robust and easy-to-use devices and products on the market to turn this into reality. Whatever the industry sector, and no matter how demanding the environment, edge computing is now an essential factor when making the move towards Industry 4.0.

Transfer Multisort Elektronik
www.tme.eu





LIQUID ATOMISING SPRAY NOZZLES

EXAIR's 1/4 NPT FullStream liquid atomising spray nozzles provide a full cone spray pattern for pressurised liquids. They are applied to solve cooling, cleaning, washing, rinsing and dust suppression applications for industry.

Their tangential flow design is vaneless, which creates wide open internal features to resist clogging while producing a uniform

distribution in a round pattern with medium to large droplets. Their right-angle design is compact and operates up to 100 psig liquid pressure. The stainless steel construction of the liquid atomising nozzles adds to their durability and corrosion resistance.

The cone nozzles work well with liquids containing particulate. The liquid is supplied into the body of the nozzle, creating a swirling action within a vortex chamber. This vortex produces the spray pattern when the machined nozzle breaks the liquid surface tension as it exits the orifice.

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MINI-RACK RANGE

METCASE has added 5U as a standard height to its TECHNOMET 19" range of mini-racks for tabletop instrumentation. They are now available in all heights from 3U to 6U.

The mini-racks are designed for mounting standard 19" subracks, chassis and front panels. Applications include test and measurement equipment, networking and communications devices, sound and studio systems, laboratory instruments, industrial computers and control systems.



The elegant enclosures consist of two diecast aluminium front and rear bezels, the case body with internal chassis and a removable rear panel. Four snap-on cover trims create a flush-fitting cohesive design with no visible fixing screws.

The front and rear bezels include standard 19" panel mounts with caged nut apertures for fixing the equipment. The four standard case sizes (3U, 4U, 5U and 6U) are all 400 mm deep. Custom heights and depths can be supplied on request.

The rear and base panels are ventilated to aid cooling. Inside there are two subrack/chassis support rails. All case panels are fitted with M4 threaded pillars for earth connections. ABS side handles are recessed for easy portability. Moulded ABS non-slip feet are also included.

TECHNOMET 19" is available in two standard colours: anthracite (RAL 7016) and light grey (RAL 7035). Custom colours are available on request. Accessories include (unvented and vented) 19" front panels and M6 caged nuts and fixing screws.

METCASE can supply the enclosures fully customised. Services include: custom front panels; CNC punching, folding, milling, drilling and tapping; fixings and inserts; painting and finishing; and digital printing of legends and logos.

ROLEC OKW Australia New Zealand P/L

www.metcase.com.au



PFC CONTROLLER

STMicroelectronics is extending its range of digital power-supply controllers with the STNRGPF02 for two-channel interleaved boost-PFC topologies. Typical applications include industrial motors, air conditioners, domestic and commercial appliances, cellular base-stations, telecom infrastructure, data centre equipment and uninterruptible power supplies (UPS).

The controller is said to bring the advantages of digital power to applications from 600 W to 6 kW, including greater flexibility and faster design cycles compared with typical analog approaches. At the same time, system integration is claimed to be greater than other digital solutions that require a separate DSP or microcontroller.

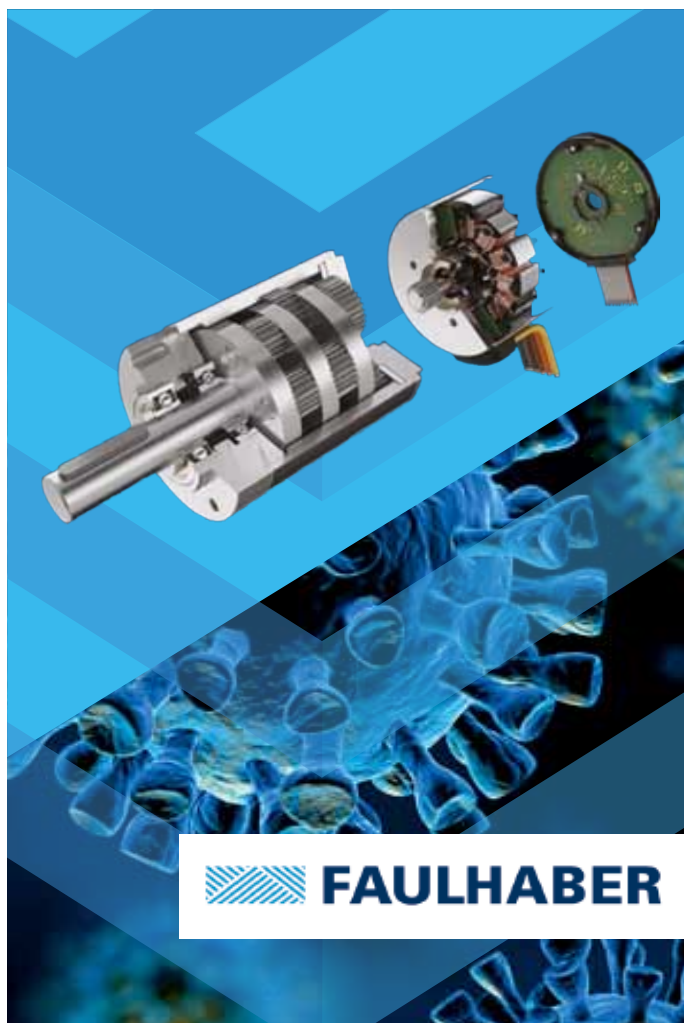
The product operates in continuous-conduction mode (CCM) at fixed frequency with average current-mode control. An optimised blend of analog and digital control combines a hardware analog Proportional-Integral (PI) compensator in the inner current loop and a digital PI controller in the outer voltage loop, ensuring fast response. Cascaded control for the voltage and current loops regulates the output voltage by acting on the total average inductor current.

Designed for mechanical inrush-current control using an external relay or triac, the controller supports programmable phase shedding, load feed forward and burst mode to maximise energy efficiency. Built-in protection features include programmable fast-acting thermal and over-current protection (OCP), over-voltage protection (OVP) and soft-start management. PFC Fault and PFC OK status indicators are also provided.

The device is easily configured using eDesignSuite by inputting the converter specifications and running the configurator. The tool generates a full schematic, bill of materials (BOM) and binary object code as firmware ready to download via the IC's serial communication port, which reduces the typical power-supply design cycle. The serial port also allows monitoring of the PFC parameters.

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RISE TO THE CHALLENGE

COVID has the world on edge but many developers are meeting the challenge of managing and researching the virus.

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WE THINK
OUTSIDE
THE BOX.

NEW DESIGN ENABLES BRIGHTER LEDs

The fin LED pixel design includes the glowing zinc oxide fin (purple), isolating dielectric material (green) and metal contact (yellow atop green). The microscopic fins, which the research team arranged into comb-like arrays, show an increase in brightness of 100 to 1000 times over conventional submicron-sized LED designs.

A new design for light-emitting diodes (LEDs), developed by US scientists led by the National Institute of Standards and Technology (NIST), may hold the key to overcoming a longstanding limitation in the light sources' efficiency.

The concept, demonstrated with microscopic LEDs in the lab, achieves a dramatic increase in brightness as well as the ability to create laser light — all characteristics that could make it valuable in a range of large-scale and miniaturised applications. It has been described in the journal *Science Advances*.

LEDs have existed for decades, but even modern LEDs have a limitation that frustrates their designers. Up to a point, feeding an LED more electricity makes it shine more brightly — but soon the brightness drops off, making the LED highly inefficient. Called an 'efficiency droop' by the industry, the issue stands in the way of LEDs being used in a number of promising applications, from communications technology to killing viruses.

The NIST team, which included scientists from the University of Maryland, Rensselaer Polytechnic Institute and the IBM Thomas J. Watson Research Center, did not initially set out to solve the problem of the efficiency droop. Their main goal was to create a microscopic LED for use in very small applications, such as lab-on-a-chip technology.

The team experimented with a whole new design for the part of the LED that shines, using familiar materials but changing their shape. Unlike the flat, planar design used in conventional LEDs, the researchers built a light source out of zinc oxide strands they refer to as fins (each fin is only about 5 μm in length, stretching about a tenth of the way across an average human hair's breadth). Their fin array looks like a tiny comb that can extend to areas as large as 1 cm or more.

"We saw an opportunity in fins, as I thought their elongated shape and large side facets might be able to receive more electrical

current," said NIST's Babak Nikoobakht, who conceived the new design. "At first we just wanted to measure how much the new design could take. We started increasing the current and figured we'd drive it until it burned out, but it just kept getting brighter."

The novel design shone brilliantly in wavelengths straddling the border between violet and ultraviolet, generating about 100 to 1000 times as much power as typical tiny LEDs do. Nikoobakht characterises the result as a significant fundamental discovery.

"A typical LED of less than a square micrometre in area shines with about 22 nW of power, but this one can produce up to 20 μW ," he said. "It suggests the design can overcome efficiency droop in LEDs for making brighter light sources."

The team made another surprising discovery as they increased the current. While the LED shone in a range of wavelengths at first, its comparatively broad emission eventually narrowed to two wavelengths of intense violet colour. The explanation grew clear: the tiny LED had become a tiny laser.

"Converting an LED into a laser takes a large effort," Nikoobakht said. "It usually requires coupling an LED to a resonance cavity that lets the light bounce around to make a laser. It appears that the fin design can do the whole job on its own, without needing to add another cavity."

A tiny laser would be critical for chip-scale applications not only for chemical sensing, but also in next-generation handheld communications products, high-definition displays and disinfection.

"It's got a lot of potential for being an important building block," Nikoobakht said. "While this isn't the smallest laser people have made, it's a very bright one. The absence of efficiency droop could make it useful."

VIRTUAL CONFIGURATION TOOL FOR EMERGENCY STOP SWITCHES

EAO's Digital Product Selector (DPS) is an interactive and intuitive virtual configuration tool, enabling engineers and designers to easily configure products online to their specific needs. It is now available for customers looking to obtain emergency stop switches from Digi-Key Electronics.

The tool offers an engaging user experience for users to select emergency stop switches and configure them to their needs based on 3D photorealistic selections, as well as parametric input. Users can view 360° images, mounting depths, dimensional representations, illumination previews and panel-mounted views. Users can also download files such as data sheets designed for specific configuration, CAD drawings, installation videos and certifications.

The tool has been designed to take the guesswork out of configuring emergency stop switches. From switch function to IP ratings and unlocking features, it allows users to quickly and intuitively select their switch and accessories. It gives users access to over 130 parts, which can be configured in more than 2000 different combinations. Once a customer has selected a configured emergency stop switch to meet their specific needs, they may add it to their cart and purchase it through Digi-Key's website.

The tool supports a variety of industries, including machinery and industrial automation, food and beverage, packaging systems, process automation, lifting and moving, specialty vehicles, transportation, medical equipment, industrial X-ray machines, compressors, printing equipment, EV charging stations and more.

Digi-Key Electronics

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LPKF

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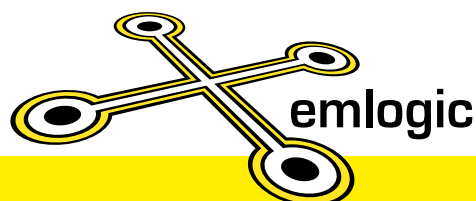
The LPKF ProtoLaser ST desktop laser system enables efficient prototyping of complex digital and analog circuits, RF and microwave circuit boards. The system achieves exact geometries on almost any material and is ideal for structuring single or double sided circuit boards.



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TINY DEVICE SERVER

ICP DAS's tDS-732i tiny device server is a serial-to-Ethernet device server that is designed to add Ethernet and internet connectivity to any RS-232 device, and to eliminate the cable length limitation of legacy serial communication. It can be easily used for remote controlling of serial devices through an Ethernet network.

By using the VxComm driver/utility, the built-in COM port can be virtualised to a standard PC COM port in Windows. Most serial devices do not have network ports; tDS-732i allows those devices to connect to the network. Therefore, users can transparently access or monitor serial devices over the internet/Ethernet without software modification.

The product offers true IEEE 802.3af-compliant (classification, Class 1) Power over Ethernet (PoE) functionality using a standard category 5 Ethernet cable to receive power from a PoE switch such as the NS-205PSE. The series also accepts power input from a DC adapter. Additionally, it features 3000 VDC isolation and ± 4 kV ESD protection that diverts the potentially damaging charge away from sensitive circuits to protect the modules and equipment from the sudden and momentary electric current.

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

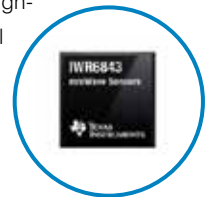
mmWAVE SENSORS FOR INDUSTRIAL RADAR SYSTEMS

The IWR6x mmWave sensors, from Texas Instruments (TI), allow engineers to integrate mmWave technology into a broad range of factory automation, radar, robotics and building automation designs.

The integrated single-chip frequency-modulated continuous-wave (FMCW) radar sensors are built on TI's 45 nm RFCMOS process. They offer ultrahigh-resolution sensing and can detect objects, humans and subtle motions, including breathing and typing.

The 60–64 GHz sensors offer up to 4 GHz of ultrawide bandwidth, claimed to detect objects up to 16 times more accurately than 24 GHz narrowband solutions. The system incorporates a C674x DSP for advanced signal processing.

The sensors feature application-specific algorithms, scalable software and several reference designs, allowing developers to quickly begin creating high-performance sensor solutions. They are optimised for use in industrial settings, supporting key applications such as motion detection, robotics, people counting, vital sign monitoring and safety guarding. The sensors are also suitable for low-power, self-monitored industrial radar systems.



Mouser Electronics
au.mouser.com



SINGLE-PHASE EMC BLOCK FILTERS

SCHURTER completes its portfolio of single-phase EMC filters with its FMBB EP series of ultracompact filters with high-performing attenuation. The double-stage filter family is claimed to be more powerful than typical filters, meeting the space constraints and performance requirements of today's electronic devices.

The filters are said to feature high-quality components, including right-sized film capacitors, chokes with permeable cores and a steel housing that is

completely closed and spot-welded at the bottom. The series provides high common-mode attenuation at low frequency, as well as common-mode and differential-mode attenuation over a wide frequency range, thus resulting in good broadband attenuation.

The filters are particularly suitable for use in applications confronted with stubborn electromagnetic interference, such as any equipment with fast semiconductor processing speeds at high switching frequencies, which are typically integrated into larger scale operations where exposure to other noise-generating devices exists. These operations include datacom, medical, industrial, and test and measurement, for example.

The filters are designed for rated currents ranging from 1 to 36 A at an ambient temperature of 40°C up to 250 V. Standard versions can be used over a temperature range from -40 to 100°C, with manufacturer-recommended deratings at higher temperatures. Variations in leakage currents are available for different applications (the standard version is 0.9 to 3.8 mA; for medical technology it is ≤ 5 or ≤ 80 μ A).

The filter is easily installed to a chassis using the screw flange on both ends. Wires can be quick-connected or threaded to 6.3 x 0.8 terminals. The series is ENEC and cURus approved.

SCHURTER (S) PTE LTD
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REGENERATIVE POWER SUPPLIES

Keysight Technologies is expanding its RP7900 Series with two bidirectional, regenerative DC power supplies providing integrated safety features that protect people and devices under test (DUT).

The series is part of Keysight's HEV/EV Power Converter Test Solutions, which enable customers to deploy high-voltage, high-power solutions that meet the fast-paced, high-growth demands of the hybrid-electric/electric vehicle (HEV/EV) market. The regenerative design of the latest models enables the energy normally

consumed to be returned to the grid cleanly, saving costs associated with energy consumption and cooling.

The power supplies — 20 kW and up to 2000 V per instrument — feature a two-quadrant, bidirectional sourcing and sinking capability that allows for seamless, uninterrupted transitions between sourcing and sinking current, without changing the power supply's output characteristics or introducing any disruptive behaviour. An autoranging output characteristic should meanwhile improve flexibility over rectangular, or traditional, output characteristic power supplies due to an expanded power curve, which delivers more voltage and current combinations in one power supply.

Keysight Technologies Australia Pty Ltd
www.keysight.com

PROGRAMMABLE STEPPER MOTOR CONTROLLER/DRIVER

Capable of up to 10 A peak and up to 64 V, Kremford's Hyperdrive10 High Power Stepper Motor Controller can drive medium through to the very largest stepper motors.

Statically and dynamically configurable with a complete set of Modbus registers for all motor parameters, the product provides precision control for every aspect of the motor's motion profile. Among others, these include step-defined movement profiles, timed and step defined runs, acceleration and deceleration rates, micro-stepping, individual power settings for the four motion states, and the ability to switch to full-step at a given speed for maximum high-speed torque.

Motion control includes four isolated and configurable control inputs and two switchable outputs. An isolated RS485 interface and USB access provide for both static and dynamic control. Programming is standard Modbus, allowing convenient HMI or PLC control.

Configurations include a number of built-in modes, allowing a simple standalone step/direction mode through to connecting up to seven controllers operating on the same RS485 bus and acting together in a master/slave configuration for acceleration and speed control where multiple motors on the same machine must remain synchronised at all times through complex speed profiles.

Most motor and operational parameters can be set and/or changed via Modbus commands. Most set-up type parameters are saved to memory and thus will survive power cycling. The controller responds directly to Modbus packets over duplex RS485 and to simple encapsulated Modbus packets over USB.

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THE EMERGENCE OF THE VIRTUAL SUPPLY CHAIN IN A COVID-19 WORLD

What happens when supply chains are required to adapt, and what will electronics distribution look like post COVID-19?

Mark Burr-Lonnon, Senior Vice President of Global Service & EMEA and APAC Business at Mouser Electronics, shared his thoughts in a panel discussion as part of All About Circuits' 2020 Industry Tech Days Virtual Conference.

What is the role of distributors, manufacturers and semiconductor companies in an engineer's design process?

I think what's key, from our standpoint, is bringing the latest technology to an engineer. Engineers have to build lots of new products, and the essence of our industry is all about how we help new designs and how we move things forward. All of us have a role to play, but everyone does play a different role — even if you take it back to how a stocking policy works. We put a lot of stock in place for a design engineer to make sure there really is a wide range of parts, from a wide range of manufacturers, with the latest technology. That really helps the engineers with new designs to take things forward, rather than being focused only on the supply chain.

The supply chain distributor stocks very differently — they're stocking a much more limited range of parts for things which go in volume. So when a manufacturer brings out something brand new, those people are unlikely to stock it, because there's no demand for it. But as an NPI distributor, we jump on that and say,

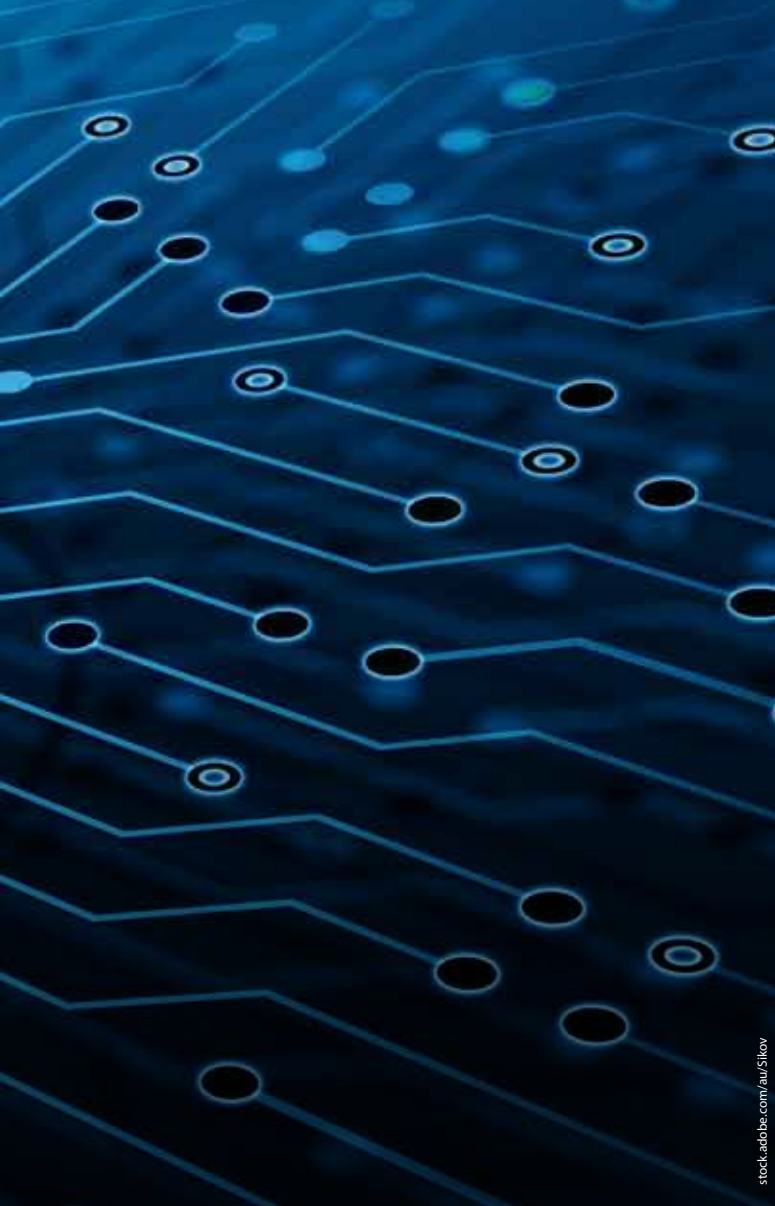
"The only way to take this new technology to engineers, and to help the manufacturers get new customers, is to roll those parts out through our model."

Where and how do distributors think their products will be bought and sold in future?

The importance of inventory has always been a big thing in distribution, but it's been quite bizarre that a few distributors have started to stock less inventory as we've gone through time. If you think about it, the amount of inventory that we're now putting in place and shipping around the world is really helping drive a lot of that engineering buying. You know, the longest it takes to get to Europe now is 2–3 days. And a lot of the local distributors are just not stocking the inventory. We're able to stock it on a global basis — so if you're a local distributor in Spain, for instance, you're going to be stocking a really narrow list of parts for that Spanish market, whereas we're stocking it for every market in the world, which means everybody has availability of every manufacturer that we have. We've got over 850 manufacturers, so if someone's trying to build a bill of materials, you can get almost everything in one place at one time, and in most places in the world you can get it anywhere from the next day to three days. It's very efficient, and we've got some great logistics partners who help us do that.

Since everybody's been shut down, have you seen any differences in order values per purchase?

We certainly saw in the April/May/June timeframe a huge increase in medical customers coming to us who probably hadn't come to



stock.adobe.com/au/5kov

us before. But overall, we've not seen too much difference. We've seen more engineers continuing to build, whether they're at home or not, and if you look at most factories, they are working. It's like our distribution centre — our distribution centre employees are working onsite, but some of our office staff are not in the office. Lots of production lines are working, but lots of the buyers are at home. So from an engineering standpoint, we're seeing more parts being shipped out now than we saw last year.

Is there a science you can use to predict the effects of what's going on, or is it more about being nimble and responsive?

A lot of it comes down to inventory. If you have inventory, lots of these problems go away. If you can't supply the parts, it doesn't matter what's happening — that's a problem. So the big thing for us is to make sure we get the simple things right. Now we don't have the logistics side in our hands, it's all third-party providers, but even through the pandemic they've done a great job for us, even getting into places like India, which was on a total lockdown. We never knew how much product used to go on commercial aircraft, but it's still getting there, and we've had very few people saying shipments are late. It's just a system that works, with a lot of inventory moving around every day.

What will distribution look like post-pandemic? Is it predominantly going to be e-commerce?

We'd started to see a lot more online shopping before COVID-19, and I think that's going to continue. COVID-19 didn't require us

to totally change our model. I feel sorry for some other guys out there — I was talking to one distributor who said he had 2000 field people. We have zero, so we're not having to worry about what we do with thousands of salespeople. We can continue to lay more inventory, we can continue to bring in more NPIs, we can continue to add things to the website to make it easier for the design engineer to find technology on there. Because the engineering community is pretty smart — they can make good designs out of information that's provided on websites.

How do you want engineers to be using your company?

I think the way the world has changed for the engineer, they have a lot less time. What they want to do is remain anonymous, because if they buy from a manufacturer direct, or they buy an engineering quantity from a volume distributor, suddenly they've got people crawling over their front door trying to come in and talk — not during COVID-19 of course, but in normal times. If those engineers buy from us, it's anonymous. They can just get on, they do their next design, and the whole process is a lot easier. So that's a real value that's been added, and it sounds like a crazy value to add, but time is a big thing. It's not all about components — it's really about content. Because engineers don't always start with the parts that they want. They start with, "I need to make this. Which parts do I need?" And then go off and look at websites and start to pull it all together.

What effect has COVID-19 had on global supply chains, and what is your forecast for the remainder of the year?

It has had an impact for sure, and it's affected different parts of the world at different times as we've gone through the year, but I think our industry has come out of it better than most. I think we're pretty robust, and there are lots of people still making parts even when countries are relatively closed down. The production people are on the frontline working, and the warehouse people are in the warehouse picking parts. So I think we've got through it pretty well, to be honest.

Just to give a couple of numbers, we get 370,000 people a day who are coming to visit our website, and that's 1.8 million page views. So there's a lot of people out there looking at information, and other distributors will have similar numbers. It's that type of ilk, of engineers and purchasing people sitting at home, looking for data, looking for parts, going onto websites, and I think as we go through the rest of the year it's going to get slightly better, and next year I think will be a good year for the industry unless COVID-19 stays a lot longer.



Mark Burr-Lennon

To view the full panel discussion, visit <https://www.allaboutcircuits.com/tech-days/summer2020/mouser-electronics-and-digi-key-electronics/webinars/keynote-panel-emergence-of-the-virtual-supply-chain-covid-19-world/>.



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UPS

The Easy UPS 3L is the latest addition to Schneider Electric's Easy UPS three-phase uninterruptible power supply range, extending the medium range to 500 and 600 kVA (400 V) for external batteries. Available in all regions that support 400 V except China and Japan, the device is designed to simplify and streamline configuration and service, delivering high availability and predictability to medium and large commercial buildings, data centres and light industrial UPS applications.

The product offers resiliency against harsh environments, with conformal coated printed circuit boards, a replaceable dust filter, an operating temperature of up to 40°C and strong overload protection. With its compact footprint, highly available parallel and redundant design, and robust electrical specifications, it protects critical equipment in a wide range of environments from damage due to power outages, surges and spikes.

The UPS includes a wide battery voltage window and accommodates a variety of battery configurations including battery banks. It also comes with a full range of options and accessories, making it easy to integrate into different environments. It is up to 96% efficient to bring predictability to utility costs.

With a flexible, fault-tolerant design and an optimised footprint, the UPS is easy to configure, easy to use and easy to service. Users benefit from Schneider's global service set-up, with local networks of service specialists that provide a complete range of services throughout the entire Easy UPS 3L life cycle. The start-up service is included to ensure the device is properly and safely configured for best performance.

Schneider Electric

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3D SENSING EMITTER MODULE

Osram's Bidos PLPVCDC 940_P_L01 intelligent emitter module for 3D sensing allows smartphones to take high-quality images and videos with staggered depth of field. In portrait shots the person's face remains in focus, while the background becomes blurred. Besides optimising image content, the module can also be used for 3D object recognition or augmented reality apps.

The module features a black package, a 3 W infrared VCSEL with a wavelength of 940 nm, a matching optical system, an integrated intelligent microcontroller for driving the VCSEL and a photodiode. Together, the individual components have a footprint of 3.6 x 5.46 mm. The efficiency of Osram's VCSEL technology ensures low power consumption, and therefore facilitates not only energy management but also the integration of the component into the end device. High optical power enables the acquisition of depth information by time-of-flight (ToF) technology at a distance of up to 7 m.

In addition to optimising image content, users can also use the depth information for other functions in the smartphone, including 3D object recognition and augmented reality applications like games and interior design. Special safety mechanisms have also been integrated in the module, so that if the photodiode registers a change in the incidence of light — for example, if the optics are damaged after a fall — the current supply to the VCSEL is interrupted.

Osram Australia Pty Ltd
www.osram.com.au



RUGGED EMBEDDED COMPUTER

Acromag's ARCX-4000 embedded computer is a customisable-off-the-shelf (COTS), SWaP-optimised deployable solution. The small form factor mission computer is designed for rugged and MIL-AERO applications. It uses the Acromag COM Express Type 6 product platform.

Typical applications include military/aerospace deployable systems such as vetronics, C4ISR and payload management, as well as command and control for drones and robotics. It can be used as a portable data acquisition system in an aircraft by adding a 1553 interface board to a dual unit, or add a FPGA and high-speed graphics card for high-speed video transfer. For multi-sensor monitoring on mobile applications, simply add a CAN bus interface.

Intel's fourth generation of multicore processors provides capabilities for floating-point-intensive computations, media, graphics and security. Power efficiency reduces heat and allows small, light designs with portability. Programmable power limits allow the user to 'dial down' the maximum power consumption of the CPU in systems where heat and/or power is a concern.

The product is designed and tested to meet IP67 ratings for sealed protection from dust and limited immersion. Thick circuit boards and thermal management allow the computer to operate under hostile conditions. The computer can withstand extended temperatures and has been shock and vibration tested to MIL-STD-810 specifications.

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Perseverance rover heading to Mars

On 30 July 2020, an Atlas V rocket launched NASA's new Perseverance rover on its way to Mars, where it will be searching for signs of previous life on the planet. Its most important job is to take multiple soil samples, seal them in containers and deposit them on the surface of Mars so that a future mission can return them to Earth.



Image credit: NASA/JPL-Caltech © maxon Group.

maxon motor's precision brushed and brushless motors will be onboard for various mission-critical tasks, with several such motors employed to handle the samples inside the rover. For example, the company's DC motors are installed in the robotic arm, which moves the samples from station to station. DC motors will also be used for sealing and depositing the sample containers.

NASA's Jet Propulsion Laboratory (JPL) is carrying out the mission, and asked maxon to produce 10 DC motor drive systems for the rover. As with almost all previous Mars missions, these DC motors are modified for the highly specialised purpose and based on standard products from maxon's catalogue. For the first time NASA is using brushless DC motors, including nine EC 32 flat motors and one EC 20 flat motor in combination with a GP 22 UP planetary gearbox.

Working closely with JPL specialists, maxon engineers developed the drives over several years and tested them thoroughly to achieve high standards of quality. This is because space missions place high demands on DC motor systems — including vibrations during the rocket launch, vacuum during the journey, impacts on landing and the harsh conditions on the surface of Mars, where temperatures fluctuate between -125 and +20°C and dust penetrates everywhere.

"We've learned a lot from this exciting project," said Robin Phillips, Head of maxon's Space Lab. "We now have very broad expertise in space applications and have established quality assurance processes that meet the expectations of the industry. Customers from other industries such as the medical sector, where requirements are often similar, can also benefit from this know-how."

The Perseverance rover is expected to land on Mars on 18 February 2021 — but it won't be alone. A solar-powered drone helicopter called Ingenuity will be attached to the underside of the rover. Weighing 1.8 kg, it will perform several short flights — the first ever on the Red Planet — and take aerial images. The main aim of this experiment is to test the concept for further drones of this kind.

maxon has six brushed DCX motors with a diameter of 10 mm controlling the tilt of the helicopter's rotor blades and the direction of flight. The DC motors are very light, dynamic and energy efficient. These properties are crucial, because flying on Mars is not easy. The atmosphere is extremely thin, roughly comparable to the conditions on Earth at an altitude of 30 km.

The drone helicopter has flown in a simulated test environment in the JPL laboratory, but whether it will lift off on Mars remains to be seen.

"We hope that everything goes well and that we'll soon see our drives in action on Mars," said maxon CEO Eugen Elmiger. "We're all keeping our fingers crossed."

maxon motor Australia Pty Ltd
www.maxonmotor.com.au



Images credit: maxon.



SCHOTTKY DIODES

STMicroelectronics has launched 26 new Schottky diodes in low-profile SMA and SMB Flat packages, covering voltage ratings from 25 to 200 V and current ratings from 1 to 5 A.

The 1 mm-high devices are said to have 50% lower profile than diodes in standard SMA and SMB packages, enabling designers to increase power density and save space. SMA and SMB footprint compatibility allows easy drop-in replacement. In addition, the Schottky diodes are said to have higher current ratings than standard alternatives of the same footprint, allowing migration of existing circuits that contain SMC diodes to ST's smaller SMB Flat devices, and similarly from SMB to SMA Flat.

The Schottky diodes offer designers choices from the 30 V/1 A STPS130AFN and STPS1L30AFN in SMA Flat to the 200 V/4 A STPS4S200UFN and 100 V/5 A STPS5H100UFN in SMB Flat. With their inherently low forward voltage, the devices deliver high energy efficiency for industrial and consumer applications such as power supplies and auxiliary supplies, chargers, digital signage, game consoles, set-top boxes, e-bikes, computer peripherals, servers, telecom cards and 5G repeaters. All units have specified avalanche characteristics and feature a notched lead suitable for wave soldering and reflow.

STMicroelectronics Pty Ltd
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HIGH-PERFORMANCE GATEWAYS

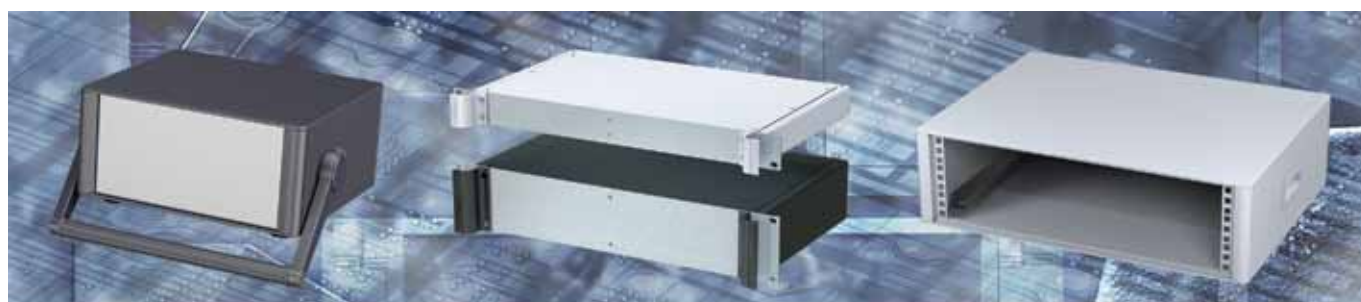
HMS Networks has announced its second-generation Anybus Communicator — a high-performing gateway for connecting devices and machines to industrial networks. The gateway family is suitable for serial to fieldbus and industrial Ethernet connectivity, with millions of devices and machines today relying on the gateways for network connectivity in a wide variety of industrial application areas. Anybus Communicator for EtherNet/IP is now available and versions covering Modbus TCP, PROFINET and PROFIBUS are coming soon.

The second-generation devices are modern, high-performing gateways that are powered by the Anybus NP40 industrial network processor used in all HMS's embedded solutions. Depending on use case, data cycle times are up to 10 times faster than with the first generation. Users can also benefit from increased data exchange support as up to 1448 B can be transferred from the connected PLC to the gateway, as well as from the gateway to the PLC.

An Ethernet configuration port and web interface enable the user to monitor and diagnose network traffic. The user can immediately see the status of the industrial network connection and serial connection, as well as individual serial node status. Communication logs are provided for further user analysis.

The gateways are packaged in an attractive slim housing for straightforward DIN-rail mounting. They carry all relevant industrial certifications, such as CE and UL markings, and a temperature range of -25 to +70°C is supported to ensure that the devices stay operational in demanding industrial conditions. Furthermore, in order to meet current and future security challenges, all products are equipped with a security chip.

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REAL-TIME SPECTRUM ANALYSER

Anritsu introduces IQ capture and IQ streaming options for its Field Master Pro MS2090A that are designed to make the real-time spectrum analyser (RTSA) the first handheld analyser to capture 110 MHz of IQ data. When combining the latest features with wide bandwidth, long memory and fast transfer speeds, the MS2090A can conduct comprehensive spectrum analysis in a variety of general-purpose applications, including military intelligence and government regulations.

With 110 MHz bandwidth and a 200 MSps sample rate, the product is said to capture and stream twice as much data as any other handheld analyser. Additionally, having IQ capture and streaming in RTSA mode allows for the capture and/or streaming of data without pausing the sweep, so users can monitor the spectrum visually while the capture is being conducted. The result is more information is acquired on spectrum surrounding bands of interest.

Of particular benefit for intelligence and government applications, the MS2090A RTSA can stream data to Bird Technology's IQC5000B dual-channel RF record and playback system. The turnkey solution enables 110 MHz of bandwidth to be streamed



at 16-bit format and up to 15 TB of data to be stored. Powerful post-processing analysis, including evaluating data in various domains, replaying data as spectrum with full-time resolution and smart algorithms to search

for signals, can be performed. Data can also be streamed to a USB 3.0 drive or PC over Ethernet.

For 5G applications, the 110 MHz of capture bandwidth allows mobile operators to gather data on a full 5G NR signal in a single sweep. It can also post process the data to locate any anomalies that will adversely affect network performance.

Anritsu Pty Ltd

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MODULES

The Laird Connectivity BL653 Series modules deliver Bluetooth 5.1 connectivity, long range, multi-wireless capabilities and an extended temperature range up to 105°C.

Powered by the compact Nordic nRF52833 system-on-chip (SoC), the modules capitalise on the SoC's 64 MHz Arm Cortex-M4 with FPU, high output power of up to +8 dBm and -95 dBm sensitivity in 1 Mbps. Featuring a comprehensive range of configurable interfaces, they provide support for NFC and 802.15.4 communication (Thread and Zigbee) for a range of Internet of Things (IoT) applications in industrial settings and other harsh environments.

The modules offer Bluetooth 5.1 features such as direction finding with angle of arrival (AoA) and angle of departure (AoD), as well as long-range (Coded PHY) and 2M PHY support for data rates of 2 Mbps, 1 Mbps and 125 Kbps. The small 15 x 10 x 2.2 mm modules also support flexibility in application design, enabling developers to choose between Laird Connectivity's smartBASIC, simple AT command set, Nordic SDK or Zephyr RTOS. The module family includes integrated PCB trace antenna options for overall design simplicity or Trace Pad variants for connecting a range of pre-certified internal and external antenna options.

The series includes modular FCC, IC, CE, RCM, MIC and Bluetooth SIG approvals, which extend to an OEM's design with no new testing for the fastest route to production. Design engineers can take advantage of the fully featured BL653 development kit, available with either an internal antenna or a range of pre-certified external FlexPIFA antennas, which provides the necessary tools to begin Bluetooth Low Energy development.

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WHAT IS ACCELERATED AGEING TESTING

AND WHY MIGHT I WISH TO CONSIDER IT?

Accelerated ageing testing uses a combination of accelerated stresses to expose product flaws in the design and manufacturing of a product. This serves to improve product reliability and reduce field failures and warranty expenses. Accelerated ageing tests are conducted in environmental chambers, with elevated temperature accelerating effective time often in combination with all shakers for creating all-axis vibration.

Accelerated age testing can be separated into highly accelerated life testing (HALT) and highly accelerated stress screening (HASS). Both techniques use stresses far beyond the normal operating condition of a product with the goal to identify problems and eliminate them and thus produce a more reliable product. Each category of testing artificially increases stress on the product or component to identify the impact that time, temperature, humidity, corrosion and vibration will have on the product or component.

HALT testing occurs first: it is used at the time of product development or when new suppliers, components or manufacturing processes are introduced. Typically, HALT is not a qualification test; the goal of HALT is to quickly promote failures and then determine their root causes. Once the causes of failure are identified, the failed components are repaired or replaced and the stress limits of the testing expanded. The product development team is searching for the weak link in the product design, the goal being to find the weak link in the product,

TEST AND MEASUREMENT

eliminate it and then move on to the next weak link. HALT testing has, on many occasions, provided substantial (5–1000 times) MTBF gains and enabled the development of far more reliable products.

A typical HALT testing program would progress through the following steps:

- Cold thermal step stress
- Hot thermal step stress
- Rapid thermal shock stress
- Vibration step stress
- Combined thermal and vibration stress

Once product design has been completed, HASS testing can further be used to aggressively create stress on the product in order to detect product defects in manufacturing production screens. The accelerated stresses of the HASS program shorten the time to failure of defective units and therefore shorten the corrective action time and the number of units built with similar flaws.

The types of stresses used for both HALT and HASS are very similar, although the test procedures can vary. Both testing categories use rapid temperature cycling, often combined with all-axis vibration testing and electrical loading. Other tests performed may include accelerated corrosion testing, UV testing and humidity testing.

There are a number of mathematical models which can be used to predict the impact of lifetime under varying stress conditions, the most popular use the Arrhenius mathematical model. This mathematical model helps predict the amount of time required for tests to be performed at elevated temperatures in order to compress the amount of testing time necessary to produce a failure in a product or component. Testing at multiple temperatures can provide a quantifiable acceleration factor. The Arrhenius equation's use is extensive in accelerated ageing tests and looks at the reaction rate of components.

Accelerated ageing can be used with a wide variety of products, from printed circuit boards to power supplies, medical devices, automotive parts, consumer electronics and a wide variety of other devices. The following are the main steps in the HALT/HASS process: **Precipitation** creates a defect which was previously undetectable, for instance a poor solder joint. The stresses used may be vibration combined with thermal cycling and perhaps electrical overstress. Precipitation is usually achieved in HALT testing.

Detection involves actually determining that a fault exists. This often can be a challenge and various techniques are used to detect a detectable fault.

Failure analysis determines why the failure occurred. In the case of the solder joint, for example, why did it fail?



Corrective action requires changes to the design or manufacturing processes so that the failure will not occur again. If a manufacturer performs HALT testing and discovers weaknesses and then dismisses them as due to overstress conditions, they need to be sure that the faults would not have eventually occurred in the field at lower stress levels.

Verification of corrective action needs to be performed to determine that the fix to resolve the failure actually works. The fix could be ineffective or there could be other problems causing the anomaly that are not yet fixed or the fix could produce other faults that weren't present in the initial testing.

Record keeping is the final step in the process, so that techniques learnt to resolve the fault are not forgotten and can be used in future product design.

Simultech distributes the Weiss Technik range of accelerated ageing test chambers, which enable the control of temperature and humidity and can be incorporated into ageing tests for performing failure-rate data and reliability analysis. The company provides sales, service, installation, commissioning, training, rental and basic on-site testing for customers across Australia and New Zealand.

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DIN RAIL ENCLOSURES

Hammond Electronics has announced its 1597DIN family of UL94-V0 flame-retardant plastic enclosures for mounting to standard IEC/EN 60715 35 mm DIN rails for applications such as industrial control equipment, automation, equipment management and monitoring, HVAC controllers and distributed IoT equipment.

The family consists initially of four sizes in 2-, 4-, 6- and 9-module widths. All sizes have two mounting positions for the terminal blocks, maximising I/O availability and giving headroom for future expansion if required.

There are two horizontal PCB mounting slots in the body and two stand-offs in the base for component or PCB mounting.

Plain, vented, knockout and slotted terminal covers are supplied separately and can be mixed and matched in the bodies as required. Primarily designed to accept PCBs is a slimline 22.5 mm wide, 118 mm deep and 90 mm high polycarbonate control box with ventilated sides and a shaped front panel.

All units feature simple no-tool snap together assembly and correspondingly easy disassembly for access to the internal components or PCB when required. The bodies are ventilated on the top and bottom faces and feature a recess in the front panel for mounting identification labels or other graphics.

The bases are moulded in dark grey PPO (polyphenylene oxide) with a polystyrene DIN rail mounting clip and the main enclosure body is RAL 7035 light grey polycarbonate.

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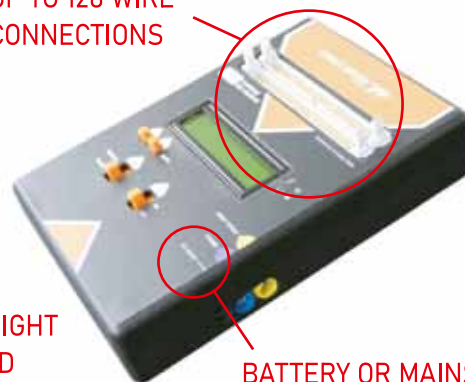
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OPTICAL DATA TRANSMISSION RECORD BROKEN



The chip is only 5 x 9 mm in size — even smaller than a Hong Kong 20 cent coin.

Image credit: City University of Hong Kong.

An international research team claims to have broken the spectral efficiency world record for optical data transmission with a single integrated photonic chip, with a transmission speed capable of downloading 1000 high-definition movies in less than a second.

At the core of the technological breakthrough is a novel chip developed by Dr Chu Sai-tak, an expert in integrated optical circuits and components from City University of Hong Kong (CityU). He collaborated on the project with researchers from Hong Kong, China, Canada and Australia, with the results published in the journal *Nature Communications*.

An integrated photonic chip

Dr Chu explained that the key component inside the chip is a micro-ring resonator, which can generate an optical frequency response called a 'micro-comb'. A single micro-comb could replace dozens of parallel laser sources with different wavelengths. In other words, with the micro-ring resonator in it, an integrated photonic chip can already provide enough signal carriers for ultrahigh-speed optical data transmission.

What makes this chip special is that it can generate a special class of micro-comb called a 'soliton crystal'. Dr Chu explained that a 'soliton' is a solitary wave that behaves like a particle and can be transmitted in optical fibres while maintaining its shape, amplitude and speed for a long time even after it interacts with another soliton. Soliton signals generated by the micro-ring resonators are highly stable, which is crucial for long-distance and high-speed optical signal transmission. "The word 'crystal' in the name refers to the crystal-like shape of the optical frequency mode generated," he added.

Fabricated chips were screened and tested in CityU's laboratory to ensure that soliton crystals could be generated. Only tested chips would be sent to the collaborators for installation in optical devices as a laser source for the high-speed optical data transmission experiment. Current technology means that each laser source could only emit a single transmission signal of a specific wavelength; therefore, 80 parallel laser sources are required to generate 80 laser beams with different wavelengths.

"But using our integrated chip, only one laser source is required," Dr Chu said. "When the laser passes through the chip that consists of a micro-ring resonator, followed with some adjustment, soliton crystals will be generated after adjustment. As a result, 80 different wavelengths will be generated. And the pulses of soliton crystals are very stable, suitable for long-distance optical data transmission."

Fast and stable signal transmission

The research team conducted the data transmission trials not just in a laboratory, but also in a field trial over a 75 km single-mode fibre network connecting Melbourne's RMIT and Monash Universities. Experiment results were said to achieve a new world record of spectral efficiency (the rate at which information can be transmitted per second over a given bandwidth), which was 3.7 times higher than existing records held by similar technologies with a single chip source. Spectral efficiency only dropped a little after 75 km of signal transmission, indicating that signal transmission was stable.

The team's technology achieved an outstanding speed of 44.2 Tbps (equivalent to 5525 Gbps), about a 50% increase compared to the existing record. Internet speed as fast as 44.2 Tbps means downloading 1000 high-definition movies in less than a second is possible.

"The C-band fibre we used for the field trial is commonly used in the market," Dr Chu noted. "If optical fibres of wider bandwidths were used, we believe the data transmission speed would be even faster, probably two to three times faster."

The technology can also be applied to multicore fibres, which consist of many optical fibres to provide multiple transmission pathways and could enhance the speed of data transmission even further. In addition to optical-fibre telecommunications, micro-comb technology could also be applied to fields such as spectroscopy, metrology, sensors and measurement in quantum mechanics.



3D PROFILE SENSORS

Matrox Imaging announces the Matrox Altiz series of integrated high-fidelity 3D profile sensors, featuring a dual-camera single-laser design. The fully integrated 3D profile sensors have been optimally designed to lessen scanning gaps. Simultaneous viewing of the laser line by the product's two opposed optical sensors should therefore reduce optical occlusions — frequently encountered at critical surface junctures — caused by the laser line being obstructed from the view of a single image sensor because of a surface's orientation.

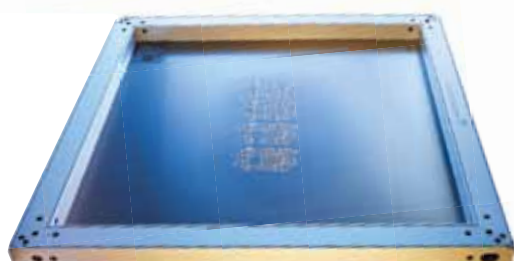
Unlike common 3D profile sensors — equipped with a single laser and single optical sensor — the Matrox Altiz features a dual optical-sensor design and data-fusion capability, said to offer higher 3D reproduction fidelity through the ability to combat occlusion and outlier data. The product delivers high levels of control over spurious data, providing robust reproductions of a 3D object or scene — whether mounted on the end of a robot arm or fixed to a gantry overlooking a conveyor. Data is represented as individual profiles, a depth map or a point cloud.

The integrated image sensors can work in either a synchronised or alternate fashion. In synchronised mode, the 3D profile sensor achieves maximum reproduction quality and robustness. Configured in alternate mode, the scanning rate is almost twice that of the synchronised configuration while still providing key defence against occlusion.

The profile sensors output 3D data over a standard GigE Vision interface with standard GenICam extensions; this means users are not locked into a specific proprietary interface, ensuring interoperability moving forward with commercial and custom acquisition, processing and analysis software. The device interoperates seamlessly machine vision software and is suitable for inspection tasks, delivering two powerful cameras within a single compact enclosure. An IP67 rating ensures its performance in tight spaces and harsh industrial environments.

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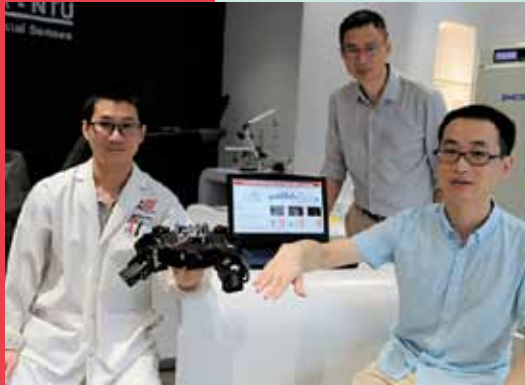
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AI SYSTEM

FOR PRECISE RECOGNITION OF HAND GESTURES

Scientists from Nanyang Technological University, Singapore (NTU) and the University of Technology Sydney (UTS) have developed an artificial intelligence system that recognises hand gestures by combining skin-like electronics with computer vision.



The recognition of human hand gestures by AI systems has been a valuable development over the last decade and has been adopted in high-precision surgical robots, health monitoring equipment and gaming systems. AI gesture recognition systems that were initially visual-only have been improved upon by integrating inputs from wearable sensors that re-create the skin's sensing (or somatosensory) ability — an approach known as 'data fusion'.

However, gesture recognition precision is still hampered by the low quality of data arriving from wearable sensors, typically due to their bulkiness and poor contact with the user, and the effects of visually blocked objects and poor lighting. Further challenges arise from the integration of visual and sensory data as they represent mismatched datasets that must be processed separately and then merged at the end, which is inefficient and leads to slower response times.

To tackle these challenges, the NTU-UTS team created a data fusion system that uses skin-like stretchable strain sensors, made from single-walled carbon nanotubes, and an AI approach that resembles the way that the skin senses and vision are handled together in the brain. Their work has been described in the journal *Nature Electronics*.

The scientists developed their bioinspired AI system by combining three neural network approaches in one system: a convolutional neural network, which is a machine learning method for early visual processing; a multilayer neural network for early somatosensory information processing; and a sparse neural network to fuse the visual and somatosensory information together. The result is a system that is claimed to recognise human gestures more accurately and efficiently than existing methods.

"Our data fusion architecture has its own unique bioinspired features which includes a manmade system resembling the somatosensory-visual fusion hierarchy in the brain," said NTU's Professor Chen Xiaodong, lead author of the study. "We believe such features make our architecture unique to existing approaches."

"Compared to rigid wearable sensors that do not form an intimate enough contact with the user for accurate data collection, our innovation uses stretchable strain sensors that comfortably attach onto the human skin. This allows for high-quality signal acquisition, which is vital to high-precision recognition tasks."

As a proof of concept, the team tested their bioinspired AI system using a robot controlled through hand gestures and guided it through a maze. Results showed that hand gesture recognition powered by the bioinspired AI system was able to guide the robot through the maze with zero errors, compared to six recognition errors made by a visual-based recognition system.

High accuracy was also maintained when the new AI system was tested under poor conditions including noise and unfavourable lighting. The AI system worked effectively in the dark, achieving a recognition accuracy of over 96.7%.

"The secret behind the high accuracy in our architecture lies in the fact that the visual and somatosensory information can interact and complement each other at an early stage before carrying out complex interpretation," said NTU's Dr Wang Ming, first author of the study. "As a result, the system can rationally collect coherent information with less redundant data and less perceptual ambiguity, resulting in better accuracy."

The research team is now looking to build a VR and AR system for use in areas where high-precision recognition and control are desired, such as entertainment technologies and rehabilitation in the home.



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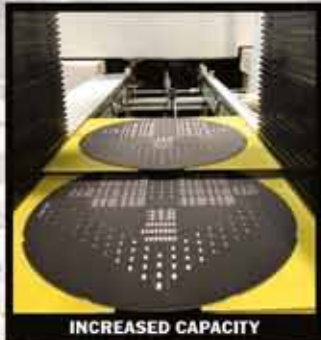
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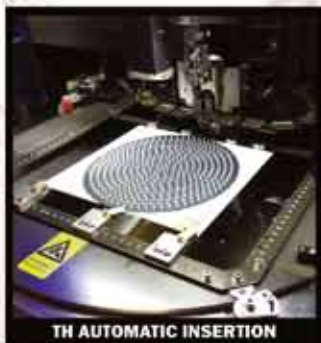
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