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Silicon can harvest energy from heat
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Pros and cons of preapproved wireless modules
FAQs ABOUT
ENCAPSULATION RESINS AND POTTING COMPOUNDS
Extreme environmental conditions are often encountered in the bid to offer protection for PCBs. How do resins offer this protection?

There are a number of different factors that influence the way resins provide protection. The act of encapsulating a component or PCB means that it is surrounded by a layer of resin, which, since it is normally done in a single operation, completely seals a component or an entire PCB from the environment in which it operates.

A two-part resin, when mixed, starts a chemical reaction which results in the resin becoming fully polymerised to provide a homogenous layer. The polymerisation reaction creates a three-dimensional structure which provides a barrier against chemical attack and high humidity, for example, and even physical shocks and the destructive effects of thermal cycling.

Under less extreme conditions, is a resin still the best option or should a coating be considered as an alternative? What pointers will assist a design engineer to make the choice between these two approaches?

This is an interesting point as the protection provided by a coating offers a number of advantages over the application of a resin. However, as always, the choice will depend upon what level of protection the designer requires, as a general rule of thumb, to ensure the highest levels of protection, resins are, on the whole, superior to coatings.

A note of caution here: if weight or volume is a paramount consideration, then a coating is preferred as this is likely to provide adequate protection while ensuring minimal weight/volume increase. On the other hand, if you need to protect your intellectual property and avoid the underlying circuit being copied, then a resin will not only provide excellent protection due to its toughness, chemical resistance and adhesion to the substrate and components, but with pigmented resins, its opacity will ensure that the circuit detail is visually obscured. It is well to remember that some filled resins are also X-ray opaque!

Why are silicone resins appropriate choices for high-temperature applications that also demand protection against harsh environmental conditions?

Silicone resins have the broadest continuous operating temperature range of any of the resin chemistries that we currently offer, so they are a natural choice for both high- and low-temperature applications. They maintain their flexibility over this temperature range with very little signs of degradation over time. Due to their high flexibility, they place very low stresses on delicate components, particularly those with weak and fragile connecting legs.

There is, however, a downside to silicones, particularly the effectiveness of their adhesion to certain substrates. Moreover, their chemical resistance is not as good as that provided by an epoxy resin. Another category of resins — polyurethanes — would be the better choice for applications operating in the -30 to +120°C region as these offer similar levels of flexibility and better adhesion to many substrates — and all for a lower price.

How do resins work to reduce damage to PCBs from vibration?

Due to the crosslinking that takes place during the curing of the resin, a three-dimensional structure is created which can absorb stresses and strains and help to distribute the forces involved over a larger volume. By doing so, the magnitude of the forces acting upon a particular component is considerably reduced compared to that of a non-potted component. The same reasoning applies to both physical and thermal shocks.

In these cases, the thicker the resin layer applied, the greater the level of protection that is provided.

Optically clear resins are ideal for LED applications (for example protection of the LED itself) — why is UV stability so important for these resins?

For LED lighting units — particularly those installed outdoors and in all weathers — UV radiation is a fact of life, and the single greatest source is the Sun. The majority of resins have an aromatic backbone (they contain benzene rings), which will turn yellow when exposed to UV light. They will then start to break down over time as the processes that cause yellowing also result in the formation of free radicals, which leads to the breaking of chemical bonds within the structure.

Resins with an aliphatic backbone do not contain aromatic (benzene) rings, and are less likely to turn yellow and subsequently deteriorate. Free radicals are still formed within aliphatic resins, but at a much lower concentration and they do not have as many sites to attack compared to aromatic resins.

Of course, while being the main source of UV light on Earth, the Sun is not alone in emitting this potentially damaging radiation. Artificial light sources (tungsten, fluorescent, metal halide, for example) all emit certain levels of UV light, which can attack the resin, not to mention the LEDs themselves, which also generate some UV radiation.

Hopefully, the foregoing has been a useful overview of some of the most common enquires we receive from customers and a further insight into the effectiveness of resin chemistries. Do feel free to get in touch with any of your own queries regarding resins.

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Electrolube’s Technical Director for Resins, Alistair Little, discusses his top trending encapsulation resin/potting compound questions.
**SHORTCIRCUITS**

**BLUGLASS OPENS NEW LABS IN WESTERN SYDNEY**

Clean technology company Bluglass has formally opened its new manufacturing laboratories, the Paul Dunnigan Labs, at its facility in Silverwater, Western Sydney.

Bluglass is developing and commercialising a semiconductor technology called remote plasma chemical vapour deposition (RPCVD) — a new approach to the manufacture of group III nitrides, which are essential components used in millions of electronics devices globally. RPCVD is claimed to offer better-performing, lower-cost devices and more environmentally sustainable processes for electronics manufacturers producing LEDs for automotive and overhead lighting, microLEDs for wearables and virtual reality display, and power electronics for efficient power conversion.

Representing an investment of over $6 million in equipment and associated infrastructure, the new labs incorporate two cleanrooms which will house two additional semiconductor deposition systems, expanding the company’s operational and manufacturing capacity. The output from these new facilities will be used in commercial contracts, on collaborations with commercial partners and as part of Bluglass’s continuing development of RPCVD for the manufacture of LEDs, microLEDs, laser diodes, power electronics and other optoelectronic devices.

The first of the new systems, the BLG-300II, is now commissioned and has already started semiconductor wafer growth runs using RPCVD, expanding Bluglass’s operational capacity. Bluglass also aims to commission its largest RPCVD system to date by retrofitting the commercial-scale AIX 2800 G4 in collaboration with global semiconductor equipment leader AIXTRON SE of Germany. The RPCVD G4 system is due to commence operation by the end of 2019 and, together with the BLG-300II, will more than triple RPCVD wafer capacity while also demonstrating the scaling potential of RPCVD.

The labs were named after one of Bluglass’s pioneer hardware engineers, the late Paul Dunnigan, who made invaluable contributions in the development of both the RPCVD hardware and Bluglass’s facility. They were opened by members of Dunnigan’s family and the City of Parramatta Lord Mayor, Councillor Andrew Wilson.

“It is very exciting to be unveiling this major facility expansion,” said Giles Bourne, CEO and Managing Director of Bluglass. “These new systems and infrastructure allow us to expand our revenue-generating epitaxy foundry services, accelerate our RPCVD development for commercial applications and will provide the foundation for our continued negotiations with leading specialist optoelectronics manufacturers around the world.”

**NEW BATTERY DESIGN FOR THE 5G WORLD**

Researchers have created a new formula for battery composition that is claimed to offer 2.5 times more battery life than anything currently on the market, in the same volume as the current market-leading superslim battery.

The formula thus more than doubles the energy a battery can carry without changing the weight — a critical requirement for use in applications such as IoT networks, electric vehicles and drones.

The formula was developed by researchers at Nokia Bell Labs and AMBER, the SFI Centre for Advanced Materials and BioEngineering Research hosted at Trinity College Dublin, as part of the Nokia Bell Labs Distinguished Academic Partners Program.

It was designed to meet the increasing power requirements of connected devices, such as smartphones, drones, electric cars and robots. However, it could also power 4G and 5G network equipment or emergency backup battery systems.

“By packing more energy into a smaller space, this new battery technology will have a profound impact on 5G and the entire networked world,” said Nokia Bell Labs’ Member of Technical Staff, Paul King, who was one of the lead investigators on the project.

The researchers added that the technology could potentially be used to store energy generated by wind and solar renewable technologies, making them more reliable.

A patent has been filed to protect their battery design and help bring it to market.

A study discussing the battery research can be found in *Nature Energy*. 

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FLEXIBLE AND GREEN ELECTRONICS MADE FROM SILK

A research group from the Technical University of Denmark (DTU) is developing a new class of flexible, eco-friendly thin-film electronics, which they call 'fleco-ionics'.

The team utilised cocoons, woven by silkworms, to extract silk—one of the strongest materials in nature, and one that is cheap, readily available and biodegradable. In addition, it is an ionic conductor—a material that can conduct electricity mainly through the passage of ions.

Ionic conductors have been utilised to yield flexible Li-ion batteries, stretchable display devices, transparent touch screens, loudspeakers and actuators, but they still present drawbacks. Notably, most of them have been made of synthetic materials, which are potentially hazardous for humans and the environment. Therefore, research towards eco-friendly alternatives is essential—and silk could be the answer.

“We need to think simple,” said Professor Alireza Dolatshahi-Pirouz, head of the DTU research group. “Why do we want to do old, complicated chemical syntheses that take months and years to optimise when we can be smart and look into nature?”

The team has now transformed this natural polymer into an ionic material with stable performance in both aqueous and chemically active environments, enabling a wide range of applications within the field of flexible and wearable electronics. They have already used it to develop a small motion sensor, made from silk and nano-sized clay.

As explained in the journal Advanced Science, the production process for the sensor is extremely simple, with the two main components simply mixed together in water; the product is thus easy to upscale. It is also low cost ($0.62/unit), maintains its high electrical sensitivity even after 2000 bending cycles and can be recycled again and again. The technology is thus suitable for mass production without compromising the environment.

Applications for the flexible motion sensors vary from pressure-sensitive displays to motion-sensing gloves, with the team already developing their own E-glove equipped with the sensors. Supported by DTU’s Proof of Concept funding, the first prototype of their E-glove should be ready in about 10 months, which could help surgeons to perform better in operations, translate sign language or even help golfers improve their technique.

The scientists are also working on flexible sensing systems that readily conform to the curvatures of the body and can measure motions without any discomfort to the user. This would address a number of drawbacks that current motion capture imaging technologies are suffering, including their limited measuring range, low sensitivity and impractical measuring scenarios.

HEAT-FREE TECHNOLOGY CAN PRINT METAL ON FLOWERS

Researchers from Iowa State University have developed heat-free technology that they claim can print conductive, metallic lines and traces on just about anything—from flowers to gelatin. Their work has been described in the journal Advanced Functional Materials.

Undercooled metal technology, developed by Martin Thuo and his research group, features liquid metal trapped below its melting point in polished, oxide shells, creating particles about 10 millionths of a metre across. When the shells are broken—with mechanical pressure or chemical dissolving—the metal inside flows and solidifies, either creating a heat-free weld or printing conductive, metallic lines and traces on everything from a concrete wall to a leaf.

This could have all kinds of applications—from sensors to measure the structural integrity of a building or the growth of crops, to paper-based remote controls that read changes in electrical currents when the paper is curved. Engineers also tested the technology by making electrical contacts for solar cells and by screen printing conductive lines on gelatin—a model for soft biological tissues, including the brain.

An assistant professor of materials science and engineering at Iowa State, Thuo said he launched the project three years ago as a teaching exercise—and once students learned to use a few metal-processing tools, they started solving some of the technical challenges of flexible, metal electronics.

“The students discovered ways of dealing with metal and that blossomed into a million ideas,” Thuo said. “And now we can’t stop.”

Since then the researchers have learned how to effectively bond metal traces to everything from water-repelling rose petals to watery gelatin. Based on what they now know, Thuo said it would be easy for them to print metallic traces on ice cubes or biological tissue.

“This work reports heat-free, ambient fabrication of metallic conductive interconnects and traces on all types of substrates,” the researchers wrote. They said their experiments “highlight the versatility of this approach, allowing a multitude of conductive products to be fabricated without damaging the base material”.

Thuo also serves as an associate of the US Department of Energy’s Ames Laboratory and a co-founder of the Ames start-up SAFl-Tech, which is now commercialising the liquid-metal particles.
AT AMPEC we specialise in manufacturing of custom design cable assemblies as well as turnkey electronic and electric product assemblies.
SHORTCIRCUITS

GALLIUM OXIDE POWER TRANSISTORS SAID TO ACHIEVE RECORD VALUES

Researchers from Germany’s Ferdinand-Braun-Institut (FBH) have made a breakthrough in their development of transistors based on gallium oxide (Γ-Ga2O3), achieving high breakdown voltage combined with high current conductivity.

Powerful electronic components are indispensable for future communications, for the digital transformation of society and for artificial intelligence applications. On a footprint as small as possible, they should offer low energy consumption and achieve ever higher power densities, thus working more efficiently. This is where conventional devices reach their limits.

Scientists all over the world are thus investigating new materials and components that can meet the above requirements — and FBH’s Ga2O3-MOSFETs (metal-oxide-semiconductor field-effect transistors) may just have succeeded.

Writing in the journal IEEE Electron Device Letters, the team recounted how they tackled layer structure and gate topology. The basis was provided by substrates from the Leibniz Institute for Crystal Growth with an optimised epitaxial layer structure. As a result, the defect density could be reduced and electrical properties improved. This leads to lower on-state resistances.

The gate is the central ‘switching point’ of field effect transistors, controlled by the gate-source voltage. Its topology has been further optimised, allowing for high field strengths to be reduced at the gate edge. This in turn leads to higher breakdown voltages.

With a breakdown voltage of 1.8 kV and what is said to be a record power figure of merit of 155 MW/cm², the transistors achieve performance figures close to the theoretical material limit of gallium oxide. At the same time, the breakdown field strengths achieved are significantly higher than those of established wide-bandgap semiconductors such as silicon carbide or gallium nitride.

Pictured: A gallium oxide chip with transistor structures and structures for measurement purposes, manufactured at FBH using projection lithography.

STRAIGHTENING SINGLE-MOLECULE NANOWIRES IMPROVES CONDUCTIVITY

Japanese researchers have created single-molecule nanowires, complete with an insulation layer, up to 10 nm — and found that forcing the ribbon-like chains to be flat significantly improved their conductivity compared with a twisted conformation. Published in The Journal of Physical Chemistry Letters, their findings may allow for a new generation of inexpensive high-tech devices, including smartphone screens and photovoltaics.

Carbon-based polymers, which are long molecular chains made of repeating units, can be found everywhere, from the rubber in the soles of your shoes to the proteins that make up your body. We used to think that these molecules could not conduct electricity, but that all changed with the discovery of conducting polymers — a small subset of carbon-based molecules that can act like tiny wires owing to their alternating single and double chemical bonds, also called conjugated bonds. Since carbon-based conductors are much easier and cheaper to make and customise than conventional electronics, they have seen rapid adoption in OLED TVs, iPhone screens and solar panels.

Now, researchers at Osaka University have synthesised chains of oligothiophene of various lengths, with up to 24 repeat units. This means that single nanowires could be up to 10 nm in length. Insulation of the wires was needed to avoid interwire currents, so that the intrinsic conductivity of a single molecule could be measured accurately.

On the basis of the rules of quantum mechanics, electrons in molecules behave more like spread out waves than localised particles. The overlapping bonds in oligothiophene allow electrons to be entirely spread out over the polymer backbone, so they can easily transverse the molecule to create an electrical current. This charge transport can occur in two very different ways.

“Over short distances electrons rely on their wave-like nature to ‘tunnel’ directly through barriers, but over long distances they hop from site to site to reach their destination,” said Dr Yutaka Ie, first author on the study.

The team found that changing the oligothiophene chain from twisted to flat led to much greater overlap of the conjugated backbone of oligothiophene, which in turn meant a larger overall conductivity. As a result, the crossover from tunnelling to hopping conduction took place with flat chains at shorter chain lengths, compared with those with the twisted conformation.

The researchers believe their work could open a whole new world of devices, with lead author Dr Yoshio Aso stating, “This study demonstrates that our insulated nanowires have the potential to be used in novel ‘single-molecule’ electronics.”
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Consumers and manufacturers are gradually abandoning fiddling with plugs and cables in favour of the convenience of just setting their phones directly on a charging base — but researchers from the University of Warwick have found that use of inductive charging, while highly convenient, risks depleting the life of mobile phones using typical lithium-ion batteries.

Standardisation of charging stations, and inclusion of inductive charging coils in many new smartphones, has led to rapidly increasing adoption of inductive charging technology. In 2017, 15 automobile models announced the inclusion of consoles within vehicles for inductively charging consumer electronic devices, such as smartphones, and many are considering it for charging electric vehicle batteries.

Inductive charging enables a power source to transmit energy across an air gap, without the use of connecting wire, but one of the main issues with this mode of charging is the amount of unwanted and potentially damaging heat that can be generated. There are several sources of heat generation associated with any inductive charging system — in both the charger and the device being charged. This additional heating is made worse by the fact that the device and the charging base are in close physical contact, so any heat generated in one device may be transferred to the other by simple thermal conduction and convection.

In a smartphone, the power receiving coil is close to the back cover of the phone (which is usually electrically non-conductive) and packaging constraints necessitate placement of the phone’s battery and power electronics in close proximity, with limited opportunities to dissipate heat generated in the phone, or shield the phone from heat generated by the charger. It has been well documented that batteries age more quickly when stored at elevated temperatures and that exposure to higher temperatures can thus significantly influence the state-of-health (SoH) of batteries over their useful lifetime.

The rule of thumb (or more technically the Arrhenuis equation) is that for most chemical reactions, the reaction rate doubles with each 10°C rise in temperature. In a battery, the reactions which can occur include the accelerated growth rate of passivating films (a thin inert coating making the surface underneath unreactive) on the cell’s electrodes. This occurs by way of cell redox reactions, which irreversibly increase the internal resistance of the
A lithium-ion battery dwelling above 30°C is typically considered to be at elevated temperature, exposing the battery to risk of a shortened useful life. Guidelines issued by battery manufacturers also specify that the upper operational temperature range of their products should not surpass the 50°F–60°C range to avoid gas generation and catastrophic failure.

These facts led researchers from the Warwick Manufacturing Group (WMG) to carry out experiments comparing the temperature rises in normal battery charging by wire with inductive charging. However, the WMG group was even more interested in inductive charging when the consumer misaligns the phone on the charging base.

To compensate for poor alignment of the phone and the charger, inductive charging systems typically increase the transmitter power and/or adjust their operating frequency, which incurs further efficiency losses and increases heat generation. This misalignment can be a very common occurrence as the actual position of the receiving antenna in the phone is not always intuitive or obvious to the consumer using the phone. The research team therefore also tested phone charging with deliberate misalignment of transmitter and receiver coils.

All three charging methods (wire, aligned inductive and misaligned inductive) were tested with simultaneous charging and thermal imaging over time to generate temperature maps to help quantify the heating effects. Regardless of the mode of charging, the right edge of the phone showed a higher rate of increase in temperature than other areas of the phone and remained higher throughout the charging process. A CT scan of the phone showed that this hotspot is where the motherboard was located.

Other results of the experiments, published in the journal ACS Energy Letters, are as follows:

- In the case of the phone charged with conventional mains power, the maximum average temperature reached within 3 hours of charging did not exceed 27°C.
- For the phone charged by aligned inductive charging, the temperature peaked at 30.5°C but gradually reduced for the latter half of the charging period. This is similar to the maximum average temperature observed during misaligned inductive charging.
- In the case of misaligned inductive charging, the peak temperature was of similar magnitude (30.5°C) but this temperature was reached sooner and persisted for much longer at this level (125 minutes versus 55 minutes for properly aligned charging). Also noteworthy was the fact that the maximum input power to the charging base was greater in the test where the phone was misaligned (11 W) than the well-aligned phone (9.5 W). This is due to the charging system increasing the transmitter power under misalignment in order to maintain target input power to the device.

The maximum average temperature of the charging base while charging under misalignment reached 35.3°C — two degrees higher than the temperature detected when the phone was aligned, which achieved 33°C. This is symptomatic of deterioration in system efficiency, with additional heat generation attributable to power electronics losses and eddy currents.

In conclusion, the research team found that inductive charging, while convenient, will likely lead to a reduction in the life of the mobile phone battery. They do acknowledge, however, that future approaches to inductive charging design can diminish these transfer losses, and thus reduce heating, by using ultrathin coils, higher frequencies and optimised drive electronics to provide chargers and receivers that are compact and more efficient and can be integrated into mobile devices or batteries with minimal change.
Fujitsu Australia has been awarded a contract to upgrade what is claimed to be the nation’s fastest supercomputer, intended to keep Australia at the forefront of the world’s research community.

Named ‘Gadi’, the new machine will be installed at The Australian National University (ANU) in November and be operated by the National Computational Infrastructure (NCI). Gadi means ‘to search for’ in the language of the Ngunnawal, the traditional owners of the Canberra region where ANU is based. Gadi will replace the NCI’s current supercomputer, Raijin, which was also provided by Fujitsu back in 2012.

Gadi will feature 3200 nodes and provide a tenfold increase in speed, thus providing high-end computing services that will power some of Australia’s most crucial research. Researchers from organisations including the CSIRO, Geosciences Australia and the Bureau of Meteorology in particular should benefit from these faster speeds and higher capacity compared to the existing supercomputer.

“NCI plays a pivotal role in the national research landscape, and the supercomputer is the centrepiece of this important work,” said ANU Vice-Chancellor Professor Brian Schmidt.

“The upgrade of this critical infrastructure will see Australia continue to play a leading role in addressing some of our greatest global challenges. This new machine will keep Australian research and the 5000 researchers who use it at the cutting edge. It will help us get smarter with our big data. It will add even more brawn to the considerable brains already tapping into NCI.”

To ensure the best outcome for NCI, Fujitsu has assembled a solution based on its own technology, in conjunction with technology sourced from a number of vendors including Lenovo, Intel, NVIDIA, NetApp, Mellanox Technologies, DDN (Lustre), Altair and APC by Schneider Electric. This robust technology approach is intended to sustain the needs of Australian research for years to come.

The supercomputer will utilise both Fujitsu and Lenovo Neptune innovative direct liquid cooling technologies with warm water, allowing for high-density computing. The system features Fujitsu PRIMErGy CX2570 M5 servers and will include second-generation Intel Xeon Platinum processors, Intel Optane DC persistent memory and NVIDIA V100 GPUs to accelerate deep learning training and inferencing.

The underlying storage subsystems will be provided by high-performance NetApp enterprise-class storage arrays, clustered together in a DDN Lustre parallel file system delivering terabyte-scale data transfer speeds. The interconnect network is architected using Mellanox’s latest generation HDR InfiniBand technology in a Dragonfly+ topology, capable of transferring data at 200 Gbps. Itair’s PBS Works Suite software will optimise job scheduling and workload management.

“Fujitsu is proud to be part of this important initiative, which will play a vital role in the progress of science in Australia,” said Mike Foster, CEO, Fujitsu Australia and New Zealand. “We look forward to renewing and further invigorating our longstanding relationship with ANU and NCI, which includes the commissioning of Raijin and also dates back as far as the 1980s with the commissioning of one of The Australian National University’s first supercomputers.”

The upgrade has been made possible thanks to $70 million in Australian Government funding under the National Collaborative Research Infrastructure Strategy (NCRIS).

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With a display resolution of up to 6½ digits when measuring voltage, current and power, the power supplies are useful for characterising devices that have low power consumption in standby mode and high current in full load operation. In many cases, an additional digital multimeter is no longer necessary.

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RACKMOUNT NETWORK APPLIANCE

iEI Integration’s PUZZLE-A002 1U rackmount network appliance features an AMD R-Series RX-421ND processor and 6x GbE RJ45 ports. Suitable for small companies and global businesses alike, the focus of the unit is to marry low power consumption, hardware-accelerated encryption and international standards of network security.

Useful for compute-intensive workloads and complex algorithm processing, the device features up to 32 GB dual-channel DDR4 RAM, enabling fast multitasking with minimal energy consumption. Additionally, it supports a hardware-accelerated AES-NI engine, for an encryption capability that boosts system performance while ensuring the safety of all sensitive data.

The product comes with 2x PCIe x4 slots for extra computing power, enabling users to achieve tasks requiring higher bandwidth such as virtualisation, media workflows and large quantities of data backup/restoration. It also features 6x 1GbE ports, 1x M.2 A Key slot and 1x mini PCIe slot.

The device supports TPM security chips — internationally standardised security controllers to protect the authenticity and integrity of systems. The chips feature secure cryptographic key storage, support for a variety of encryption algorithms, and robust protection for critical data inbuilt to the user’s machine.

The product can be utilised in unified threat management, as an IDS, as a wireless gateway, for WAN optimisation, as a NGFW (next-gen firewall) or as an application delivery controller.

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Vox Power’s VCCM600 series combines a modular and configurable power supply with fanless architecture. The medical and industrial series delivers a silent 600–750 W of peak power for 5 s in a rugged 4” x 7” package.

Depending on the user’s application, the product can be configured as a conduction, convection or forced air cooled solution. This flexibility allows the unit to be seamlessly integrated across a vast range of applications, making it suitable for standardising the application’s power platform. Its design and heat dissipation techniques allow the unit to be mounted in virtually any orientation, giving system designers more flexibility.

The series is suitable for applications ranging from controlled environments to harsh conditions. Each configured solution can accommodate up to four isolated DC output modules, and each module utilises 100% SMT components.

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METCASE’s TECHNOMET instrument enclosures can now be ordered with handles for portable electronics applications.

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METCASE engineered TECHNOMET to fine tolerances to replicate the high-quality aesthetics and ergonomics usually found only in moulded plastic enclosures. Applications include medical instruments, test and measurement, industrial control, peripherals, interfaces, switchboxes, communications and laboratory equipment.

Diecast metal front and rear bezels fit flush in the case body. Front and rear snap-on trims conceal the fixing screws for the front panel and case. Access to components is fast and easy. A wraparound top cover slides over the base/chassis assembly.

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The product is available in eight standard sizes (75 x 225 x 200 mm to 150 x 350 x 275 mm). Each case offers two options for installing PCBs: four M3 mounting pillars in the base for a single PCB and accessory snap-in anti-vibration guides for multiple slide-in PCBs.

The removable rear panel is recessed to protect switches and connectors. The anodised front panel (accessory) is also recessed to protect displays and keypads. The base and rear panels have ventilation slots for cooling. All panels are fitted with M4 earthing pillars for electrical continuity. All cases are supplied with ABS non-slip case feet.

The product is available in light grey or anthracite grey. Customising options include bespoke sizes; custom front panels; CNC punching, folding, milling, drilling and tapping; fixings and inserts; custom colours and finishes; digital printing of legends and logos.

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**BROADBAND POWER AMPLIFIER MODULE**

The MACOM MAMG-100227-010C0L is a fully matched 10 W power amplifier module based on gallium nitride-on-silicon (GaN-on-Si) technology. Operating in the broadband 225 to 2600 MHz range, the module offers up to 40% power-added efficiency (PAE) and 22 dB power gain.

The module supports up to 36 V operation (28 V typical) in a robust operating temperature range of -40 to +85°C. With flexible top-side and bottom-side mounting configurability and a 14 x 18 mm package, the module supports radio designs with strict size, weight and power (SWaP) specifications. The module features integrated gold-plated copper heatsink and a laminated air cavity package, eliminating the need for PCB space and componentry associated with other PA modules.

The power amplifier module offers design flexibility for a broad selection of radio and communications applications, including military tactical communications and electronic countermeasures, wireless public safety communications and land mobile radio systems.

**FIELD RADIATION MONITOR**

The Narda RadMan Personal RF field radiation monitor provides safe and timely warning of electromagnetic fields directly threatening humans in their presence. As 50% of the maximum permissible exposure limit is exceeded, a warning buzzer sounds. The product is available for rent from TechRentals.

For noisy environments, earphones are included. As an added feature, the monitor also has LEDs displaying field strength measurements of approximately 12.5%, 25%, 50% and 100%.

Features include wide frequency monitoring from 1 MHz to 40 GHz; shaped frequency response matched to national and international standards; simultaneous E and H field monitoring for near field use; and a detachable absorber cap to provide isotropic response for monitoring signals apart from the body, eg, for leak detection.

TechRentals
www.techrentals.com.au

**UPS**

Schneider Electric has extended its uninterruptible power supply Easy UPS 3M product range with the addition of 120, 160 and 200 kVA models. The Easy UPS 3M 120–200 kVA UPSs are easy to install, use and service, providing business continuity for small and medium businesses.

With an optimised footprint design, the UPS range protects critical equipment from power outages, surges and spikes. It also delivers up to 99% efficiency in energy-saving ECO mode. The extension to the range makes it suitable for a wide range of applications, including small and medium businesses, data centres and manufacturing facilities.

All users benefit from the included start-up service designed to ensure the UPS is properly and safely configured for best performance and safety. Schneider Electric’s specialists also provide a complete range of services throughout the entire life cycle. Users can also monitor and manage the UPS status remotely through the EcoStruxure IT cloud-based DCIM software suite when they buy the optional network card.

The product is rugged, with a wide input voltage window and strong overload protection, all in a compact footprint. Designed and tested following rigorous procedures, the UPS rolls into position quickly and installation is simple.

The device provides easy design configuration with the input/output/bypass breaker built in, so there is no need for an external breaker cabinet. It is simple to service and offers front/top access for service and built-in UPS lifecycle management.

The unit offers resiliency against harsh environments with conformal coated printed circuit boards, a replaceable dust filter, operating temperature up to 40°C and strong overload protection. It has a 5” colour touch screen with an aesthetic design, allowing for easy operation.

Schneider Electric IT Australia
www.schneider-electric.com/ups

**Mouser Electronics**
au.mouser.com

**TechRentals**
www.techrentals.com.au
NON-CONTACT, LOW DC CURRENT SENSOR

Non-contact current sensing is usually reserved for large currents, and sensors for this environment are readily found. The elf E10974001 non-contact current sensor is specifically designed for sensing small currents.

The product is useful in situations where users need to monitor current without interrupting the wiring. It is capable of sensing low currents and also has an alarm output with dry relay contacts.

Features include: input range of 0–5 or 0–50 ADC (factory set); output range of 0–5 or 0–10 VDC (factory set); accuracy to 0.25% of the full range; linearity to 0.25% of the full range; resolution to 0.1% of the full input range; and response time of 10 ms.

The product can operate in ambient temperatures of -10 to +55°C. It measures 85 x 80 x 25 mm and weighs 103 g.

Elf Electronics Pty Ltd
www.elfelectronics.com.au

WIRELESS MONITORING PLATFORM

DeltaBlack is the latest member of ETM’s range of 3G and 4G monitoring platforms, based on the previous ETM 9140 model, sharing its architecture and code base.

Designed for general industrial monitoring applications, the DeltaBlack has seven configurable inputs, analog output (4–20 mA, 0–10 V), digital outputs (voltage-free contacts, voltage) and a relay output. The device is also able to send custom SMS alerts to multiple numbers and has the ability to upload data to ETM’s IoT Cloud Dashboard.

All ANZ 4G/LTE and 3G frequencies are supported, and the unit comes in a DIN rail mounting case, with a 6–36 VDC supply. Preconfigured for the most common sensor types, the unit has a wide operating temperature range and LED status indications.

SIM and data plans are available.

ETM Pacific Pty Ltd
www.etmiot.com.au

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A two-qubit gate is the central building block of any quantum computer. The UNSW team’s version of the gate is said to be the fastest that’s ever been demonstrated in silicon, completing an operation in 0.8 ns — around 200 times faster than other existing spin-based two-qubit gates.

The group approached the two-qubit gate as an operation between two electron spins, comparable to the role that classical logic gates play in conventional electronics. The team was able to build the gate by placing two atom qubits closer together than ever before, and then — in real time — controllably observing and measuring their spin states.

The team’s approach to quantum computing requires not only the placement of individual atom qubits in silicon but all the associated circuitry to initialise, control and read out the qubits at the nanoscale — a concept that requires such precision it was long thought to be impossible. But with this major milestone, the team is now positioned to translate their technology into scalable processors.

“Atom qubits hold the world record for the longest coherence times of a qubit in silicon with the highest fidelities,” said Prof Simmons, Director of the Centre for Excellence for Quantum Computation and Communication Technology (CQC²T) and founder of Silicon Quantum Computing.

“Using our unique fabrication technologies, we have already demonstrated the ability to read and initialise single electron spins on atom qubits in silicon with very high accuracy. We’ve also demonstrated that our atomic-scale circuitry has the lowest electrical noise of any system yet devised to connect to a semiconductor qubit.

“Optimising every aspect of the device design with atomic precision has now allowed us to build a really fast, highly accurate two-qubit gate, which is the fundamental building block of a scalable, silicon-based quantum computer.”

Using a scanning tunnelling microscope to precision-place and encapsulate phosphorus atoms in silicon, the team first had to work out the optimal distance between two qubits to enable the crucial operation. As explained by CQC²T’s Dr Sam Gorman, lead co-author on the study, “Our fabrication technique allows us to place the qubits exactly where we want them. This allows us to engineer our two-qubit gate to be as fast as possible.

“Not only have we brought the qubits closer together since our last breakthrough, but we have learnt to control every aspect of the device design with sub-nanometre precision to maintain the high fidelities.”

The team was then able to measure how the qubits’ states evolved in real time. Most excitingly, the researchers showed how to control the interaction strength between two electrons on the nanosecond timescale.

“Importantly, we were able to bring the qubits’ electrons closer or further apart, effectively turning on and off the interaction between them — a prerequisite for a quantum gate,” said lead co-author Dr Yu He.

“The tight confinement of the qubits’ electrons, unique to our approach, and the inherently low noise in our system enabled us to demonstrate the fastest two-qubit gate in silicon to date.

“The quantum gate we demonstrated, the so-called SWAP gate, is also ideally suited to shuttle quantum information between qubits and, when combined with a single-qubit gate, allows you to run any quantum algorithm.”

Prof Simmons said the breakthrough is a “massive advance” and the culmination of two decades’ worth of work.

“To be able to control nature at its very smallest level so that we can create interactions between two atoms but also individually talk to each one without disturbing the other is incredible,” she said. “A lot of people thought this would not be possible.

“The promise has always been that if we could control the qubit world at this scale, they would be fast, and they sure are!”

UNSW Science Dean Professor Emma Johnston AO added that the paper shows just how groundbreaking Prof Simmons’ research is.

“This was one of Michelle’s team’s final milestones to demonstrate that they can actually make a quantum computer using atom qubits,” she said. “Their next major goal is building a 10-qubit quantum integrated circuit — and we hope they reach that within 3–4 years.”
The Assun Motors (DC brushless coreless motors) can be combined with control electronics, gearboxes, brakes and encoders in a modular system to provide a flexible, adaptable, market-orientated solution.

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- Diameter size of 16mm to 45mm
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FANLESS EMBEDDED BOX PC

The ARK-1000 series are lower power consumption, fanless embedded box PCs that offer sufficient storage and expansion capability for easy implementation. With their ultrasmall size and lightweight design, the computers are suitable for space-limited applications.

Part of the ARK-1000 series, the ARK-1220L features an Intel Atom E3940 Quad Core SoC with turbo burst up to 1.8 GHz. It has a DIN rail mounting system with essential I/O ports on the front-side bezel and supports dual HDMI display up to 4K resolution. The ARK-1220L also features a 2.5" SATA III SSD, a full-size mSATA, a full-size mPCIe slot with SIM holder and an M.2 2230 E key for Wi-Fi.

With an extended operating temperature from -30 to +70°C and a wide-range power input from 12 to 28 V, the ARK-1220L is suitable for a wide range of industrial applications.

Advantech Australia Pty Ltd
www.advantech.net.au

HANDHELD SPECTRUM ANALYSES

Ceyear 4024 series spectrum analysers (seven models from 9 kHz to 44 GHz) have many advantages, including wide frequency range, high performance, various functions and easy operation. The series has good DANL of -163 dBm @ 1 Hz RBW, low phase noise and high sweep speed. Measurement functions include those of a spectrum analyser, interference analyser, AM/FM/PM analyser, power meter, channel scanner, etc, as well as intelligent measurement functions of channel power, occupied bandwidth, adjacent-channel power, tuning and listen, emission mask, carrier-to-noise ratio, etc.

The series adopts the integrated design of an 8.4” LCD and capacitive touch screen, which offers good display definition and operator convenience. It is handheld, compact and light with a flexible power supply, making it suitable for field work. The series can be used for signal and equipment testing in the fields of aerospace, microwave and satellite communication, radio communication, radar monitoring, electronic countermeasures and reconnaissance, and precision guidance.

Fuseco Power Solutions Pty Ltd
www.fuseco.com.au

IoT EDGE CONTROLLER

ICP-DAS’s WISE-2241M (Web Inside, Smart Engine) offers a user-friendly and intuitive website interface that allows users to implement IF-THEN-ELSE control logic in controllers with just a few clicks; no programming is required. With the built-in IF-THEN-ELSE logic engine, WISE can execute automation logic in a stable and efficient way. It also provides mathematical operation, schedule and email alarm messaging functions.

The product supports I/O module connection, I/O data logging and IoT platform integration, and allows connection to XV-board, DCON I/O and Modbus TCP/RTU slave modules. The wide range of selection options enables flexibility in I/O module integration to meet the requirements of various applications.

The controller provides the MQTT client and can directly connect to the major public IoT cloud platforms, such as Microsoft Azure or IBM Bluemix, and MQTT Broker. It also provides CGI command functions to integrate with an IP camera for access control applications.

With I/O module connection, intelligent logic control, data logging and various communication protocols supported (SNMP, MQTT and Modbus TCP/RTU), the product can help IT/MIS/MES/SCADA systems to manage field-side I/O modules and sensors efficiently in applications such as unmanned facility room monitoring, intelligent factories and environment monitoring.

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

Renesas Electronics’ fourth-generation lithium-ion battery management IC, the ISL78714, provides cell voltage and temperature monitoring along with cell balancing and extensive system diagnostics to protect 14-cell Li-ion battery packs while maximising driving time and range for hybrid and electric vehicles (HEV/MHEV/PHEV/BEV). It offers a combination of battery pack monitoring, fast data acquisition and fault checking features.

The feature-rich device monitors and balances up to 14 series connected cells with ±2 mV accuracy across automotive temperature ranges, letting system designers make informed decisions based on absolute voltage levels. It includes a precision 14-bit analog-to-digital converter and associated data acquisition circuitry. The device also offers up to six external temperature inputs (two available from GPIOs) and includes fault detection and diagnostics for all key internal functions.

The product is designed to meet the stringent performance requirements of battery pack systems for all EV variants, including HEV/PHEV, with safety features enabling automotive manufacturers to achieve the ISO 26262 automotive safety integrity level (ASIL D). In addition, it monitors and reads back over/undervoltage, temperature, open wire conditions and fault status for 112 cells in less than 10 ms, or 70 cells in 6.5 ms.

Multiple devices can be connected together via a daisy chain that supports systems up to 420 cells (30 ICs) that provide transient and EMC/EMI immunity, said to exceed automotive requirements. The daisy-chain architecture uses capacitive or transformer isolation, or a combination of both, with twisted pair wiring to stack multiple battery packs together while protecting against hot plug and high voltage transients. A watchdog timer automatically shuts down a daisy-chained IC if communication is lost with the master MCU.

Renesas Electronics
www.renesas.com

Scalable Dual- and Single-Core dsPIC33C Family

The dsPIC33C Digital Signal Controller (DSC) family includes over 75 devices, including both single- and dual-core options to meet a wide range of program memory and I/O requirements in motor control, digital power conversion and other high-performance control applications. The dsPIC33C devices include a fully featured set of functional safety hardware to ease ASIL-T3 and ASIL-C certifications. The robust set of control and communication peripherals, including CAN FD, along with the new support for 150°C operation, enable a new set of real-time control applications.

Key Features
- Delivers the processing power of a digital signal processor with the simplicity of a microcontroller
- Simple migration from 32 KB to 512 KB Flash and from 28 to 80 pins
- Simplifies functional safety certification in safety-critical automotive or industrial applications

Contact information
Microchip Technology Australia  Email: aust_inquiry@microchip.com  Phone: +61 (2) 9868-6733
microchip.com/dsPIC33CFamily
THREE-PHASE GATE DRIVER

The STMicroelectronics STDRIVE601 three-phase gate driver for 600 V N-channel power MOSFETs and IGBTs provides ruggedness against negative voltage spikes down to -100 V and responds to logic inputs in 85 ns.

Featuring smart-shutdown circuitry for fast-acting protection, the product turns off the gate-driver outputs immediately after detecting overload or short-circuit, for a period determined using an external capacitor and resistor. Designers can set the required duration, using large C-R values if needed, without affecting the shutdown reaction time. An active-low fault indicator pin is provided.

The device replaces three half-bridge drivers to ease PCB layout and optimise the performance of three-phase motor drives for equipment such as home appliances, industrial sewing machines, and industrial drives and fans.

All outputs can sink 350 mA and source 200 mA, with gate-driving voltage range of 9–20 V, for driving N-channel power MOSFETs or IGBTs. Matched delays between the low- and high-side sections eliminate cycle distortion and allow high-frequency operation, while interlocking and deadtime insertion are featured to prevent cross conduction.

Fabricated in ST’s BCD6S offline process, the product operates from a logic supply voltage up to 21 V and high-side bootstrap voltage up to 600 V. Bootstrap diodes are integrated, and under-voltage lockout (UVLO) on each of the low-side and high-side driving sections prevents the power switches from operating in low-efficiency or dangerous conditions.

STMicroelectronics Pty Ltd
www.st.com

FULLY AUTOMATED PCB PROTOTYPING

Electronics developers prefer to create their printed circuit boards directly in the laboratory — a process that becomes fast and easy with circuit board plotters from LPKF Laser & Electronics.

Including the LPKF ProtoMat S64 and the LPKF ProtoMat S104 — a special system for HF applications — the range of fully automated machines ensures the production of fine structures up to 100 µm. Automatic tool change, camera-controlled fiducial recognition and integrated milling width control keep operating time to a minimum.

For the etch-free process, neither special knowledge nor special laboratory equipment is required. Due to digital control via easy-to-use software, the layout can be flexibly adapted at any time. The user has control of every process step, the ideas remain in-house and no coordination with external service providers is necessary.

The LPKF ProtoMat S104 sensor-controlled material and copper thickness measurements are carried out automatically and enable the exact determination of the required milling depth. The milling width adjustment also automatically ensures a constant width of the milling contours.

Due to the vacuum table and the high-performance spindle, which operates at up to 100,000 rpm, the LPKF ProtoMat S104 is also suitable for HF applications and thin laminates as well as substrates with sensitive surfaces. The system software also takes into account the special requirements of RF materials.

Embedded Logic Solutions Pty Ltd
www.emlogic.com.au

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THREE-PHASE MAINS FILTER
FMAD NEO is the name of SCHURTER’s latest single-stage filter family for
three-phase systems with a neutral line. Compact with high performance, the
filter series is suitable for use in today’s portable industrial machines, as it is
designed to occupy less floor space in manufacturing plants. A wide temperature
range extends its capabilities for use in many critical applications.

Three-phase control cabinets almost always have severe space constraints.
SCHURTER addresses this problem with an almost cubed filter design that is
said to be more compact than older generations, making optimum use of available space in the cabinet
housing. Designed with high-quality components, the filter attenuation remains high relative to its more
compact dimensions.

The filter family is also suitable for devices with high EMC loads. Typical areas of application include
converters for photovoltaic systems, battery storage units or charging stations for electric vehicles. The high-
performance filters are also useful for modern frequency inverters for motor control.

The filter series has screw terminals for safe wire terminations. A full metal flange is said to ensure a good
earth ground connection upon screw mounting to the chassis. Six fixing holes are provided for the mounting
itself, which allows both symmetrical and asymmetrical mounting.

The standard versions can be used over a wide temperature range from -40 to 100°C. The filters are designed
for currents from 16 to 230 A at an ambient temperature of 50°C. They are ENEC and cURus approved and
recommended for applications up to 520 VAC. The standard versions are designed for industrial applications
with leakage currents <13 mA. Special versions for leakage-critical applications of <3 mA are also available.

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THE FUTURE OF PORTABLE POWER

Steven Keeping*

Smartphones represent the peak of portable electronic design, boasting computing power and memory capacity that matches the spec of desktop PCs from only a few years ago. But today’s smartphones have an Achilles heel: their batteries, which have struggled to maintain an energy density (Wh/kg) improvement of around 7% per year.

The original iPhone had a 620 MHz 32-bit processor with 128 MB RAM, 16 GB Flash and a 5.18 Wh battery, while today’s iPhone 6S sports a dual-core, 1.8 GHz, 64-bit processor, 2 GB RAM, 128 GB Flash and a 6.55 Wh cell. The electronics represent a dramatic leap in performance compared with the first model, while the battery energy density has improved by only around 26% in eight years.

According to Apple’s specs, the lithium-ion (Li-ion) battery in the iPhone 6S has a capacity of 1715 mAh and is capable of around 11 hours of internet browsing or video playback. It’s impressive, but not enough to stop travellers diving for the charger at the first sight of an airport terminal mains socket. So is a big leap in Li-ion battery technology around the corner, or does the technology represent only a waypoint on the journey to a power source offering far more time between recharges?
Developing the Li-ion battery

Lithium-based batteries are successful because they combine high capacity with low weight, resulting in more energy per kilogram than any other metal. During charging, lithium ions are energised and move from the LiCoO₂ to the carbon. When the battery is in use the ions move back the other way, causing liberated electrons to travel in the opposite direction around the circuit to power the load.

However, a key weakness of Li-ion batteries is their fragility. Each time ions are shifted, some react with the electrodes and remain embedded in the material. Eventually the supply of free ions is depleted and the battery fails. Each charging cycle also causes some volumetric expansion of the electrodes, which stresses the structure and causes microscopic damage, diminishing its ability to ‘store’ ions. Consequently, Li-ion batteries can only be recharged a limited number of times. Moreover, overcharging can ‘force’ so many ions into the electrode that disintegration of the material can occur. It’s important to properly manage the charging and discharge rate of Li-ion batteries in portable devices using a power management IC.

Early versions of Li-ion batteries employed a liquid electrolyte to separate the electrodes, later using a porous separator soaked in an electrolytic gel. This allowed the batteries to have a sandwich construction, leading to the thin designs common to today’s mobile handsets. Further development led to lithium polymer (Li-poly) cells that used a solid polymer as the separator. One downside of Li-poly batteries is that the ions travel more slowly through the solid polymer than liquid electrolyte, so charging takes longer.

Building a better battery

Scientists are now focused on enhancing Li-ion battery characteristics such as energy density, self-discharge rate, peak demand and pulse performance, charging time and tolerance to deep discharge, together with improving device safety. Developments have primarily targeted two areas: alternative materials for positive electrodes, negative electrodes and electrolytes — with a view to packing more lithium ions into the electrodes, making it easier for the ions to move in and out — and overcoming safety challenges.

Positive electrode materials nearing commercialisation include lithium nickel manganese cobalt oxide (LiNiₓMnᵧCo₁₋ₓO₂), which has an energy density ~20% greater than LiCoO₂ but at higher cost, and lithium nickel cobalt aluminium oxide (LiNiₓCoₐAl₁₋ₐO₂), which has an energy density ~35% greater than LiCoO₂. Experimental negative electrode materials include lithium titanate (Li₄Ti₅O₁₂, which has low energy density but higher recharge cycles), hard carbon (greater storage capacity), tin/cobalt (energy density) and silicon/carbon or pure silicon (energy density).

There are also several initiatives for improving the mobility of the ions. One example from the University of Illinois at Chicago (UIC) replaces the thin, almost two-dimensional, positive and negative graphite electrodes of a conventional Li-ion battery with three-dimensional porous nickel structures. LiMnO₂ and nickel tin (NiSn) are plated onto the structures to form the positive and negative electrodes. The result is electrodes that can hold many more lithium ions than a conventional device with greater freedom of movement. The university claims this battery would be 30 times smaller than a device of the same capacity and could be charged 1000 times quicker.

UIC is also doing some pioneering work replacing lithium ions (which carry a +1 charge) with magnesium ions (which have a +2 charge). The result could be a battery with a higher energy density than Li-ion cells that can withstand more recharging cycles.

Researchers have also looked to employ nanoscale (10 nm) materials to improve the mobility of lithium ions through electrodes and electrolytes. For example, scientists at Pohang University have built a prototype battery from pumpkin-shaped molecules organised in a honeycomb-like structure which can be used as a solid electrolyte. The molecules have a thin channel (75 nm in diameter) running through them which enables lithium ions to diffuse more freely than in a conventional electrolyte. In tests, the porous electrolyte demonstrated lithium ion conductivity of three times that of conventional commercial solid electrolytes.

Another example of nanomaterials at work comes from Massachusetts Institute of Technology (MIT). Researchers Byoungwoo
Technology can be shrunk for use in portable products like smartphones. The hope is that sulfur can ‘host’ two lithium ions compared to the 0.5 to 0.7 for conventional intercalation materials — resulting in superior energy density.

**Beyond the battery**

Other power sources include supercapacitors and fuel cells. A supercapacitor is a high-capacity capacitor that bridges the gap between electrolytic capacitors and rechargeable batteries. Supercapacitors offer higher energy storage and power density than conventional capacitors, making them excellent for burst or pulse load applications like an LED flash, power amplifiers or certain audio circuits. Supercapacitors can also provide power for devices that draw little current over a long time.

However, supercapacitors have a low voltage range of 2.5 to 2.7 V, compared to 3.5 to 3.7 V for Li-ion batteries. To achieve higher voltages, several supercapacitors are connected in series, which increases complexity by demanding careful voltage balancing. Moreover, the voltage of a supercapacitor decreases on a linear scale from full to zero, which results in some stored energy remaining in the device once the voltage drops below a usable threshold. A second drawback is the supercapacitor’s low energy density. Compared with the Li-ion battery’s 200 Wh/kg, supercapacitors can struggle to exceed 10 Wh/kg, so a bank of supercapacitors will take up more space than an equivalent Li-ion battery.

Fuel cells, meanwhile, have long been used as a method of converting the chemical energy of fuel into electricity, and are considered a good option for electric vehicles. However, due to their size portable fuel cells are inappropriate for mobile electronic products at this time.

Li-ion batteries lie at the heart of the most portable consumer electronic devices — but while providing satisfactory service, consumers crave longer life from their batteries, stimulating ongoing research. Some of that research promises to yield lithium-based batteries with double the runtime of existing cells — but even that might not be enough to satisfy the demands of consumer products, so expect to see alternative technologies enter the fray in the near future.

*Steven Keeping is a contributing writer for Mouser Electronics and gained a BEng (Hons) degree at Brighton University, UK. He is based in Sydney.*

Camtek’s Cavity/Bore Hole Pan Tilt Camera is an underwater vertical camera for fast and clear visual inspections. It is designed to enable the quick discovery of suspect objects, defects, cracks and blockages in pipes, walls, drain, cavities, water tanks, reticulation, bore holes, pylons, air ducts and ventilation systems. It is available to rent from TechRentals.

The camera has a Sony HD image sensor housed in a waterproof casing (8 bar, 80 m) with 360/180° pan tilt capability and 120° FOV with LED lighting. The camera head has a diameter of 50 mm and length of 150 mm, and is attached to 100 m soft cable specifically designed for vertical deployment.

Further features include a 20 cm colour LCD monitor with video output, file playback and video capture (MEG4). It can be powered via mains or onboard battery, and the unit features a text overlay function with built-in keyboard.

**TechRentals**

TOUCH PANELS

WAGO Touch Panels 600 enable users to operate, monitor, visualise and diagnose in the manufacturing, building and processing industries. Underneath a contemporary design, the touch panels feature powerful equipment, allowing users to complement their machinery with a high-tech screen and high-quality visualisations.

High-performance Cortex A9 multicore processors provide fast operating speeds due to parallel execution of calculation operations. Practical features such as an energy-saving standby function, integrated sensors for automatic brightness adjustment and an easy-to-mount design make installation and operation simple.

All panels are equipped with the future-ready Linux operating system. When configuring with e!COCKPIT, WAGO’s engineering software, visualisations are created based on modern technologies such as HTML5.

Three versions are available that are tailored for use as a Web Panel, Visu Panel or Control Panel. Through the use of a library, WAGO’s Control Panels become IoT touch controllers that send data from the field level to the cloud. The SSH and SSL/TLS encryption methods are integrated by default for establishing secure HTTPS and FTPS connections.

Depending on the application, the panels are available with resistive touch screens for standard applications in the control cabinet, capacitive multitouch panels with glass surfaces and panels with marine approvals for use in shipbuilding.

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FANLESS EMBEDDED SYSTEM

The EPC-U2117 system uses the latest Intel Atom E3900 processor technology to give a 30% CPU performance enhancement and a 45% graphic performance boost, according to manufacturer Advantech. It is designed with dual-display output, multiple I/O and a wide-range 12–24 VDC power input.

Compatible with Microsoft Windows 10 IoT Enterprise and Linux OS, the EPC-U2117 also features Advantech’s WISE-PaaS DeviceOn intelligent software. This software offers remote management, system monitoring for better device performance, security and predictive maintenance. Furthermore, WISE-PaaS supports BIOS/FW OTA to upgrade the system and devices with the latest firmware to keep everything running at peak performance.

The EPC-U2117 integrates two expansion slots, including one M.2 for Wi-Fi or GPU module and one full-size Mini PCIe for 3G/LTE connection or mSATA storage. It also reserves four antenna apertures to support wireless connection.

With a wide operating temperature range from -20 to +60°C, the palm-sized system is suitable for harsh, outdoor environments as well as limited-space applications such as outdoor vending machines, passenger information systems, digital signage, smart kiosks and more.

Advantech Australia Pty Ltd
www.advantech.net.au

PCB SPACERS AND SUPPORTS

Hi-Q Components’ printed circuit board hardware includes nylon 6/6 PCB spacers, including self-retaining, threaded and standard clearance spacers. Sizes range from 2–23 mmID in a wide range of different lengths.

Available with metric and imperial threads, the threaded spacers are a versatile option that is easy to remove. The male and female thread configurations are suitable for quickly securing PCBs.

Hi-Q nylon 6/6 PCB supports are also stocked in a large range of sizes with a variety of different mounting options, including screw mount, slide mount, rivet mount, adhesive mount and double end types.

The company’s adhesive mount PCB supports are particularly useful as no panel hole is required. The adhesive mount PCB supports range includes different sizes and styles, including an edge support type to solve awkward mounting problems.

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

AC MOTORS WITH DUAL WORM GEARHEADS

The SD motor series from Parvalux offers 240 VAC solutions, with the ability to mount multiple gearheads in the orientation to appropriately suit the application.

Combinations of inline planetary gearheads and right-angle worm gearboxes are said to offer flexibility of the shaft orientation for tight space constraints, as well as large variations in reduction ratio. This increases the versatility of AC motors running in a fixed speed application, the company claims.

The motors are available in single- and three-phase variations. The power range is from 315 to 8 W and selection can be made between die cast zinc alloy or cast iron. Breaks, sensors, IEC flanges and foot mounts are all possible.

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

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maxon motor Australia Pty Ltd
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Hammond MFG.

Standard and modified diecast aluminium, metal and plastic enclosures

www.hammondmfg.com
CLOCK BUFFERS

Four 20-output differential clock buffers that exceed PCIe Gen 5 jitter standards for next-generation data centre applications are now available from Microchip Technology.

The ZL40292 (85Ω termination) and ZL40293 (100Ω termination) are specifically designed to meet the DB2000Q specification while the ZL40294 (85Ω termination) and ZL40295 (100Ω termination) are designed to meet the DB2000QL industry standard. All are suitable for next-generation servers, data centres, storage devices and other PCIe applications. The devices also meet PCIe Gen 1, 2, 3 and 4 specifications.

Each buffer complements chipsets where distributed clocks are required across several peripheral components, such as central processing units (CPUs), field programmable gate arrays (FPGAs) and physical layers (PHYs) in data centre servers and storage devices, along with many other PCIe applications. The devices’ low additive jitter of ~20 fs exceeds the DB2000Q/QL specification of 80 fs. This provides designers with large margins to meet tight timing budgets while achieving increasing data rates. The devices will minimise jitter when distributing clocks to up to 20 outputs, thereby maintaining the integrity and quality of the clock signal through the buffer.

The buffers are said to achieve low power dissipation and contribute savings to power budgets by using low-power high-speed current steering logic (LP-HCSL). Compared to standard HCSL, LP-HCSL consumes one-third of the power, leading to a decrease in power consumption. This feature should give users the ability to drive longer traces on their board, improving signal routing while reducing components and board space. The ZL40292, for example, can eliminate up to 80 termination resistors (four per output) compared to traditional HCSL buffers.

The ZL40292 and ZL40293 are available now in 72-pin 10 x 10 mm QFN packages. The ZL40294 and ZL40295 are available in 80-pin 6 x 6 QFN packages.

Microchip Technology Australia
www.microchip.com
Described in the journal *Nature Electronics*, this ‘wireless body sensor network’ is said to allow devices to transmit data with a 1000 times stronger signal than conventional technologies, meaning the battery life of all devices is improved. Wireless networks of these wearable devices on a body could have future applications in health monitoring, medical interventions and human-machine interfaces.

Over the past decade, a major trend in electronics has been the development of sensors, displays and smart devices which are seamlessly integrated onto the human body. Most of these wearable devices are singularly connected to a user’s smartphone and transmit all data via radio waves like Bluetooth and Wi-Fi. These waves radiate outwards in all directions, meaning that most of the energy is lost to the surrounding area. This method of connectivity thus reduces the efficiency of the wearable technology, as most of its battery life is consumed in attempting the connection.

Assistant Professor John Ho and his team from the Institute for Health Innovation & Technology (NUS iHealthtech) and NUS Engineering wanted to confine the signals between the sensors closer to the body to improve efficiency. Their solution was to enhance regular clothing with conductive textiles known as metamaterials. Rather than sending waves into surrounding space, these metamaterials are able to create ‘surface waves’, which can glide wirelessly around the body on the clothes. This means that the energy of the signal between devices is held close to the body rather than spread in all directions. Hence, the wearable electronics use much less power than normal, and the devices can detect much weaker signals.

“This innovation allows for the perfect transmission of data between devices at power levels that are 1000 times reduced,” said Asst Prof Ho. “Or, alternatively, these metamaterial textiles could boost the received signal by 1000 times, which could give you dramatically higher data rates for the same power.”

In fact, the signal between devices is so strong that it is possible to wirelessly transmit power from a smartphone to the device itself, opening the door for battery-free wearable devices. Crucially, this signal boost does not require any changes to either the smartphone or the Bluetooth device — the metamaterial works with any existing wireless device in the designed frequency band.

This inventive way of networking devices is also said to provide more privacy than conventional methods. Currently, radio waves transmit signals several metres outwards from the person wearing the device, meaning that personal and sensitive information could be vulnerable to potential eavesdroppers. By confining the wireless communication signal to within 10 cm of the body, Asst Prof Ho and his team have created a network which should be more secure.
The metamaterial textile design consists of a comb-shaped strip of metamaterial on top of the clothing with an unpatterned conductor layer underneath. These strips can then be arranged on clothing in any pattern necessary to connect all areas of the body. The metamaterial itself is said to be cost-effective, in the range of a few dollars per metre, and can be bought readily in rolls.

“We started with a specific metamaterial that was both flat and could support surface waves,” Asst Prof Ho said. “We had to redesign the structure so that it could work at the frequencies used for Bluetooth and Wi-Fi, perform well even when close to the human body and could be mass produced by cutting sheets of conductive textile.”

The team’s particular design was created with the aid of a computer model to ensure successful communication in the radiofrequency range and to optimise overall efficacy. The smart clothing is then fabricated by laser-cutting the conductive metamaterial and attaching the strips with fabric adhesive.

Once made, the ‘smart’ clothes are highly robust. They can be folded and bent with minimal loss to the signal strength, and the conductive strips can even be cut or torn, without inhibiting the wireless capabilities. The garments can also be washed, dried and ironed, just like normal clothing.

The team has a first-year provisional patent on the metamaterial textile design and is now talking to potential partners to commercialise this technology, with Asst Prof Ho hoping to test the ‘smart’ textiles as specialised athletic clothing and for hospital patients to monitor performances and health. Potential applications could range from measuring a patient’s vital signs without inhibiting their freedom of motion to adjusting the volume in an athlete’s wireless headphones with a single hand motion.

“We envision that endowing athletic wear, medical clothing and other apparel with such advanced electromagnetic capabilities can enhance our ability to perceive and interact with the world around us,” Asst Prof Ho said.
FRONT-END MODULE FOR WI-FI 5 DESIGNS
The QPF4219 front-end module (FEM) from Qorvo is designed for Internet of Things (IoT) systems based on Wi-Fi 5 (802.11ac). The 2.4 GHz FEM offers a compact form factor and integrated matching to minimise layout area in applications such as wireless routers, residential gateways and access points.

The FEM integrates a 2.4 GHz power amplifier (PA), regulator, single-pole double-throw (SPDT) switch, low-noise amplifier (LNA) with bypass mode and voltage power detector into a single device. The device focuses performance on optimising the PA for a 5 V supply voltage by conserving power consumption while maintaining high linear output power and good throughput.

The product maximises receive (Rx) sensitivity through a 1.9 dB noise figure performance that is consistent over a variety of conditions. It also includes integrated die-level filtering for second and third harmonics as well as 5 GHz rejection for dual-band dual-concurrent (DBDC) operation.

Mouser Electronics
au.mouser.com

PUSH-BUTTON
The IX Series push-button, from APEM, is the latest addition to the I series, combining the qualities of the IP and IA series with a backlit switch. The series also features a flexible elastomer membrane actuator, with no space between the actuator and 12 mm compact bushing, ensuring an IP69K panel sealing for an ultra-waterproof feature. This provides good resistance to frost, sand and other contaminants.

The ultrathin design offers an ergonomic advantage with a tight matrix mounting. The product is also customisable, with a choice of nine different actuator colours, illuminated markings with five different LED colours and many different symbols. Illumination can also be limited to just the symbol or the entire membrane actuator.

The series is recommended for harsh environments and all key markets of material handling, agriculture machinery, defence and more.

Control Devices Australia
www.controldevices.com.au

HIGH-VOLTAGE CONVERTER
The STMicroelectronics VIPer26K high-voltage converter integrates a 1050 V avalanche-rugged N-channel power MOSFET that enables offline power supplies to combine a wide input-voltage range with the advantages of a simplified design.

The high voltage rating of the MOSFET eliminates the need for conventional stacked FETs and associated passive components to achieve similar voltage capability, according to the company, and smaller external snubber components can be adopted. Drain current-limit protection is built in and the MOSFET includes a senseFET connection for overtemperature protection.

With high-voltage start-up circuitry, a built-in error amplifier and current-mode PWM controller all integrated on-chip, the product can support all common switched-mode power supply topologies, including isolated flyback with secondary-side or primary-side regulation, non-isolated flyback with resistive feedback, buck and buck-boost converters.

The high MOSFET breakdown voltage, together with a complete set of integrated features and minimal external circuitry, are said to let designers save on board space. These features are particularly useful in applications such as power supplies for one- and three-phase smart energy meters, three-phase industrial systems, air conditioners and LED lighting.

Additional benefits include internally fixed switching of frequency of 60 kHz and jittered ±4 kHz, combined with control of the MOSFET gate current during turn-on and turn-off to minimise switching-noise emissions. High power-conversion efficiency and no-load consumption less than 30 mW help achieve high energy ratings and stringent eco-design approvals, according to the company.

STMicroelectronics Pty Ltd
www.st.com
THERMAL IMAGING CAMERA FOR SMARTPHONES

The FLIR ONE Pro is a thermal imaging camera solution that can be used to quickly identify heat spots, water leaks or damage, as well as to measure temperature. Suitable for almost all industries and applications, the product converts a user’s smartphone into a high-resolution thermography sensor, with the ability to measure temperatures up to 400°C while providing measurement and reporting tools.

The FLIR ONE Pro includes a OneFit connector, which allows an Apple or Android mobile phone with protective case to connect to the product using the adjustable connector. This allows users to use their mobile phone to test and measure, without compromising damage protection.

VividIR image processing technology allows users to detect problems with precision, while providing customers with documented fixes and solutions. With 160 x 120 thermal resolution the device creates sharp, easy-to-understand images.

The FLIR ONE app enables users to access professional problem-solving and advanced functionalities. The app also allows the use of an Apple or Android smart watch to see around corners and awkward spaces. Other app functionality includes multiple real-time spot meters and regions of interest, real-time thermal tips and tricks, and reporting through FLIR Tools.

With a compact pocket design, the product provides a lightweight, portable thermal sensor solution for quick diagnosis.

IPD Group Limited
www.ipd.com.au

BI-DIRECTIONAL PROGRAMMABLE DC POWER SUPPLY

- Bi-directional source and regenerative sink
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- High power density up to 18kW in compact 3U rack space
- Bi-directional power transfer, seamless switch between sourcing and sinking
- High regenerative efficiency up to 95%
- Standard Built-in USB/CAN/LAN/digital IO communication interface, optional GPIB/analog & RS232
- Full protections: support OVP, ±OCP, ±OPP, OTP, power down protection, anti-islanding protection
- Built-in function generator, support arbitrary-waveform generation
- Adjustable output impedance
- Support multiple working modes, rising and falling time can be adjustable
A physicist from The University of Texas at Dallas has teamed with semiconductor company Texas Instruments to design a better way for electronics to convert waste heat into re-usable energy, demonstrating that silicon’s ability to harvest energy from heat can be greatly increased while remaining mass-producible.

In the journal *Nature Electronics*, the findings could greatly influence how circuits are cooled in electronics, as well as provide a method of powering the sensors used in the growing Internet of Things.

“Sensors go everywhere now — they can’t be constantly plugged in, so they must consume very little power,” said Dr Mark Lee, corresponding author on the study. “Without a reliable light source for photovoltaic energy, you’re left needing some kind of battery — one that shouldn’t have to be replaced.”

Dr Lee wanted to explore the concept of thermoelectric generation, whereby a difference in temperature is converted into electrical energy. He explained, “In a general sense, waste heat is everywhere: the heat your car engine generates, for example. That heat normally dissipates. If you have a steady temperature difference — even a small one — then you can harvest some heat into electricity to run your electronics.”

Sensors embedded beneath a traffic intersection provide an example of convenient thermoelectric power. Dr Lee explained, “The heat from tyres’ friction and from sunlight can be harvested because the material beneath the road is colder. So no-one has to dig that up to change a battery.”

The primary hurdles for widespread thermoelectric harvesting have been efficiency and cost, with Dr Lee noting, “Thermoelectric generation has been expensive, both in terms of cost per device and cost per watt of energy generated. The best materials are fairly exotic — they’re either rare or toxic — and they aren’t easily made compatible with basic semiconductor technology.”

Silicon, upon which so much technology relies, is the second-most abundant element in Earth’s crust. It has been known since the 1950s to be a poor thermoelectric material in its bulk, crystalline form. But in 2008, new research indicated that silicon performed much better as a nanowire — a filament-like shape with two of its three dimensions less than 100 nm. For comparison, a sheet of paper is about 100,000 nm thick.

“In the decade since those experiments, however, efforts to make a useful silicon thermoelectric generator haven’t succeeded,” Dr Lee said.

One barrier is that a silicon nanowire is too small to be compatible with chip-manufacturing processes. To overcome this, Dr Lee and his team relied on ‘nanoblades’ — only 80 nm thick but more than eight times that in width. While that is still much thinner than a sheet of paper, it’s compatible with chip-manufacturing rules.

Dr Lee acknowledged that the nanoblade shape loses some thermoelectric ability relative to the nanowire. “However, using many at once can generate about as much power as the best exotic materials, with the same area and temperature difference,” he said.

Study co-author Hal Edwards, a TI Fellow at Texas Instruments, designed and supervised fabrication of the prototype devices, with Dr Lee’s analysis having identified key metrics in which the low-cost silicon technology competes favourably with more exotic compound semiconductors. One key realisation was that some previous attempts failed because too much material was used.

“When you use too much silicon, the temperature differential that feeds the generation drops,” Dr Lee said. “Too much waste heat is used and, as that hot-to-cold margin drops, you can’t generate as much thermoelectric power.

“There is a sweet spot that, with our nanoblades, we’re much closer to finding than anyone else. The change in the form of silicon studied changed the game.”

Dr Lee said the advanced silicon-processing technology at Texas Instruments allows for efficient, inexpensive manufacturing of a huge number of the devices.

“You can live with a 40% reduction in thermoelectric ability relative to exotic materials because your cost per watt generated plummeted,” he said. “The marginal cost is a factor of 100 lower.”

Lead author Dr Gangyi Hu, who finished his doctorate in physics at UT Dallas in May, produced the computer modelling to determine the number of nanoblades per unit area that will produce the most energy without reducing the temperature difference. He revealed, “We optimised the configuration of our devices to place them among the most efficient thermoelectric generators in the world. Because it’s silicon, it remains low cost, easy to install, maintenance-free, long-lasting and potentially biodegradable.”

Dr Lee said the work was also novel because the team used an automated industrial manufacturing line to fabricate the silicon integrated-circuit thermoelectric generators.

“We want to integrate this technology with a microprocessor, with a sensor on the same chip, with an amplifier or radio, and so on,” he said. “Our work was done in the context of that full set of rules that govern everything that goes into mass-producing chips. Over at Texas Instruments, that’s the difference between a technology they can use and one they can’t.”
IN-VEHICLE HMI
iBASE Technology’s BYTEM-123-PC is based on the quad-core Intel Atom processor E3845 and EN50155 certified for railway applications.

The in-vehicle HMI provides high computing performance and low power consumption, silently operating at temperatures from -40 to +75°C. Meeting EN50155 standards, the unit supports input voltages including 24 V (default) as well as 72 and 110 V (options).

The front panel provides IP65 protection to make it dust-proof and providing the ability to wash down the screen, while the whole unit has an IP54 rating. To enhance functionality and performance, iBASE has included a two-finger multitouch screen to enable greater control of the user interface.

The product supports a range of I/O and expansion capabilities. This includes support for M12 connectors for power input and 10/100M Ethernet communication, two USB 3.0, one USB 2.0 and Gigabit Ethernet controllers for system and software installation or maintenance. The system also supports VESA mounting and an optional rack-mounting kit for fitting into different kinds of installations.

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

MULTIFUNCTION MOTOR TESTER
The Megger Baker MTR105 handheld motor tester is designed and built for performing multifunctional tests on motors, all in one device. Features include an insulation resistance tester, a DLRO (digital low resistance ohmmeter), a voltmeter, a motor rotation tester, an LCR meter, a low resistance ohmmeter, temperature measurement, environmental protection and safety ratings.

The device features a guard terminal to eliminate any surface leakage current, which is said to ensure correct results. It is encased in rubber overmoulding, which combines tough shock-absorbing outer protection with good grip in a strong modified ABS housing. It also includes detachable test leads with interchangeable clips and probes for different applications.

The unit comes with a full graphic display and rotary dial control. It can save test results for up to 256 motors and offers a USB storage option. It can be operated on rechargeable batteries.

The product is IP54 rated, which makes it capable of providing protection against moisture and dust ingress — including the battery and fuse compartment. It is also CAT III rated 600 V (up to 3000 m), which should make it safe to use.

Megger Limited
www.megger.com

ENCLOSURES AND TUNING KNOBS FOR TODAY’S ELECTRONICS EQUIPMENT!

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EVENTS FOR CRITICAL COMMUNICATIONS USERS AND INDUSTRY

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For more information or to register visit www.melbourne.comms-connect.com.au
Various technologies are available on the market for bringing an automated guided vehicle (AGV) to its destination.

Let us first of all say: many roads lead to Rome. There is no right way and no wrong way. Decisive is always the application itself – that means the question of where and how the given AGV is used.

There are different processes and technologies for navigating an AGV from point A to point B. The various possibilities range from contour navigation (natural navigation) to laser radar, optical or inductive guidance to grid navigation. Which technology is used depends above all on the specific application.

The price of the AGV itself can also be used as a rough guideline. The costs for the navigation technology should not exceed 5% of the AGV price. For example: for a €10,000 AGV, contour navigation and laser radar do not come into question as their cost lies above the threshold of €500.

Another decisive criterion for one or the other variant is whether the given AGV is a drive-under vehicle or a platform vehicle. Drive-under vehicles are those that move under the load to be transported and lift it up. Their design makes them unsuitable for, e.g., laser radar, fundamentally excluding this process for such AGVs. Platform vehicles are those onto which the load is pushed and that transport their cargo on the vehicle.

Against this background, the individual navigation possibilities are considered in detail below with regard to their possible fields of application.

**Contour navigation (natural navigation)**

Contour navigation is also referred to as ‘natural navigation’. These are the most technically complex as well as the most expensive types of navigation systems. They are unmatched in terms of flexibility.
and accuracy. Should it be necessary to change the transportation path on short notice, this can be performed for contour navigation very easily and quickly at the click of a mouse in the higher-level software, the so-called fleet management. Because the sensor on the AGV is usually mounted close to the floor, this navigation variant is suitable for automatic high-lift trucks and tractors as well as for the drive-under or platform vehicles described above. For this type of navigation, neither further tools — such as reflectors or optical or magnetic traces — nor markings or codes are required.

Laser radar
Navigation by means of laser radar is similar in flexibility to contour navigation. This navigation variant does, however, always require an additional optical connection of the sensor to the reflectors. Each sensor must therefore be mounted high enough on the AGV that it always has a clear view of the reflectors. If the connection to the reflectors is interrupted, eg, when entering a shelf aisle, the AGV must switch to another type of navigation. This makes it more difficult to change to another room if necessary, limiting the flexibility.

Optical and inductive guidance
Optical and inductive guidance are usually very simple systems that follow a predefined trace. As a result, they are very limited in terms of flexibility. On the other hand, however, they represent a very cost-optimised solution. Because the sensor on the AGV is mounted only a short distance from the floor, such a form of navigation is independent of the selected vehicle type.

Grid navigation
With the so-called grid navigation, information is embedded in a specified grid on or in the surface that is travelled, eg, 2D codes or transponders. With the help of the information ascertained while travelling over the individual grid points — with a 2D code these are, eg, the code information and reading angle — the AGV can navigate between the individual grid points and thereby reach any specified point within the grid. This type of navigation is suitable above all for clean surfaces and surfaces not subject to heavy loading.

A general evaluation and recommendation for the suitable navigation variant can only be determined in combination with the function of the AGV within the given application. At the present time, however, there is a clear trend towards contour navigation with integrated safety function.

**CONFORMAL COATING SERVICE**
Hetech can extend the life of a product by providing high-quality conformal coating services, using its conformal coating machine. Coating services including anti-static coating, corrosion-resistant coating, abrasion-resistant coating, high-temperature coating, chemical-resistant coating and conformal.

The coating consists of a non-conductive compound that covers all surfaces except those required for electrical or thermal connections. It is clearly visible as a clear, shiny, paint-like material. Some coatings are hard, while others have a slightly rubbery texture. Most coatings include a marker that appears bright greenish-blue under a blacklight (UV). This marker enables easy inspection of the coating thoroughness.

Unlike other conformal coating services, Hetech’s machine is custom-programmed specifically for the user’s product by its highly trained technicians. This provides a coating that is even with no pooling, ensuring high protection for electronics.

Hetech
www.hetech.com.au

**AIR WIPE**
EXAIR’s 3/8” Standard Air Wipe produces a 360° airstream that can blow off, dry, clean or cool the material passing through it. The split design can be clamped around continuously moving material such as wire, cable, pipe, hose and extruded shapes.

The product ejects a small amount of compressed air through a thin slotted nozzle that pulls in high volumes of surrounding room air. The airflow uniformly ejects from the 360° of its inner diameter. Coupling brackets that hold each half of the air wipe together can be latched together or removed quickly. Additional shims can be installed if more blowoff force is required. Air velocity can be varied with a pressure regulator and instant on/off control provides precision blowoff. Air consumption is 11.1 SCFM at 80 PSIG and the sound level is low at 82 dBA.

The air wipes are CE compliant and available in aluminium in diameters from 3/8” (13 mm) up to 11” (279 mm). Applications include wiping wire, drying inks, cooling hot extruded shapes and blowoff of water, plating, coatings and dust.

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

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Optical guidance with Leuze electronic’s OGS 600.
MIXED SIGNAL OSCILLOSCOPES
The 4 Series MSO oscilloscopes, from Tektronix, feature an intuitive touchscreen user interface incorporating touch interactions similar to phones and tablets, a large, high-resolution display and modern industrial design. 12-bit ADCs provide 16 times the vertical resolution of traditional 8-bit ADCs, enabling users to capture signals of interest while minimising the effects of unwanted noise.

The MSO has been built to meet a diverse range of application requirements alongside enhanced user experience. Typical applications include embedded design and IoT, power design, education, manufacturing, test and troubleshooting, and service installation and maintenance.

The 13.3” (1920 x 1080 HD resolution) capacitive touch display features a stacked display mode, automatically adding and removing additional horizontal waveform ‘slices’ (additional graticules) as waveforms are created and removed. Bandwidths range from 200 MHz to 1.5 GHz.

The product offers six input channels, avoiding the introduction of a second scope for complex applications such as embedded systems or power supply design. Innovative Flex-Channel technology enables any input channel to be converted from an analog to eight digital channels simply by connecting a logic probe.

Other features include an optional spectrum view, arbitrary function generator, power measurement and analysis, and Serial Bus Decode, Triggering and Search. Bandwidth and options are all field upgradeable.

element14
au.element14.com

SKIVED FIN HEAT SINKS
The SKV Series skived fin heat sinks, from Wakefield-Vette, are designed to support the latest trends in renewable energy, industrial electrification and transportation.

The copper and aluminium skived fin heat sinks offer an alternative to extruded heat sinks for applications that require a thin fin density that cannot be achieved with extrusion technology. Skived heat sinks typically have 0.5 mm-thick fins.

Skived heat sinks are produced using a series of sharp knives that pass over the copper or aluminium material, producing a thin curl of metal which is then bent vertically to form the fin. Skived fins are produced from a bar of material that is approximately 5 m in length and then cut to size as required by the final application. The final heat sink can be machined using normal fabrication techniques.

Features of the series include: plastic push pins for easy insertion and integrity of the PCB; no interface between fins and base; minimal tooling cost for non-standards; and good thermal performance. Off-the-shelf as well as custom solutions are available.

Wireless Components
www.wirelesscomponents.com.au

HANDHELD MICROWAVE ANALYSER
Keysight Technologies has announced the next generation of the company’s multipurpose, handheld microwave analyser, the FieldFox B-series, which delivers measurement precision and bandwidth up to 100 MHz for wideband, real-time spectrum analysis to enable 5G testing in the field.

Designed to withstand tough working conditions, the rugged, durable and portable FieldFox B handheld analysers provide 100 MHz bandwidth in real time for cellular base-station testing. They are PRF 28800F compliant to withstand explosive impact and wet weather conditions and offer 10 dB improvement in displayed average noise level (DANL) for measuring low noise signals and detecting weak interferers.

The product handles routine maintenance and in-depth troubleshooting with precision, including multiple measurement applications to meet specific measurement needs. A task-driven user interface for each operation mode helps save time and space in the field. Users can easily transport measurements from the field to the lab for further analysis with the 89600 VSA software.

Keysight Technologies Australia Pty Ltd
www.keysight.com
Pros and Cons of Preapproved Wireless Modules

Judicious selection of a preapproved module can give you the following benefits:

- Reduced testing costs
- Elimination of the certification process and associated fees
- Much faster time to market, since complex testing and lengthy certification processes are avoided.

The design engineer must be mindful that not all preapproved modules are the same and that the module’s type of approval might result in restrictions on its use and the need for further testing or certification. For example, the selection of a wireless module that has ‘limited modular approval’ will require more testing and additional certifications than a product using a module that has a ‘single modular approval’.

Other common restrictions include:
- A limit on the gain of the antenna
- Restrictions on the trace design of the antenna
- Rules for the co-location of other transmitters
- A minimum separation distance of the user from the antenna.

The USA (FCC), Canada (ISED) and Japan (MIC) have similar rules on the use of preapproved wireless modules. In contrast, Europe’s Radio Equipment Directive (RED) 2014/53/EU permits a self-declaration approval process which does not require product certification or regulator involvement; however, the RED requirement for more extensive immunity testing makes using CE marked preapproved wireless modules a more expensive process than testing for North America.

The regulator in Australia, the Australian Communications and Media Authority (ACMA), requires product compliance under various labelling notices and labelling with Regulatory Compliance Mark (RCM). It is important to note that wireless modules are considered to be components under the ACMA regulations and hence they should not be labelled with the RCM.

The original test reports provided by the module manufacturer can be used to reduce the amount of testing on the composite product.

Conclusion

The selection of wireless module for your design is fraught with risk. Careful consideration of all factors will provide benefits in reduced testing and certification fees, reduced chance of test failure and greatly reduced time to market.

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