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CONTENTS

COVER STORY

Keysight engineers have been creating reliable, insightful products for more than 75 years. The company is continually looking for new ways to help engineers shape the future with innovative products and test solutions. From high performance to extreme value, and real-time bandwidths ranging from 20 MHz to 63 GHz, the company has oscilloscope solutions to meet evolving needs.

Whether it's a super-fast real-time oscilloscope with measurement accuracy, the only capacitive touch screen oscilloscopes, or something a little more basic, Keysight has oscilloscopes in every category. The company is working continually to bring oscilloscopes with breakthrough capabilities that help users solve their toughest measurement challenges. Keysight, like its customers, is working on what's next.

With that in mind, the company has launched the Keysight Technologies Ultimate Scope Program. Users get up to 17 free software applications (including a free integrated function/arbitrary waveform generator and digital voltmeter) in one free application bundle with the purchase of a Keysight 2000 X-, 3000 X-, 3000T X-, 4000 X- or 6000 X-Series oscilloscope. The application software on the oscilloscope improves the user's ability to debug their system.

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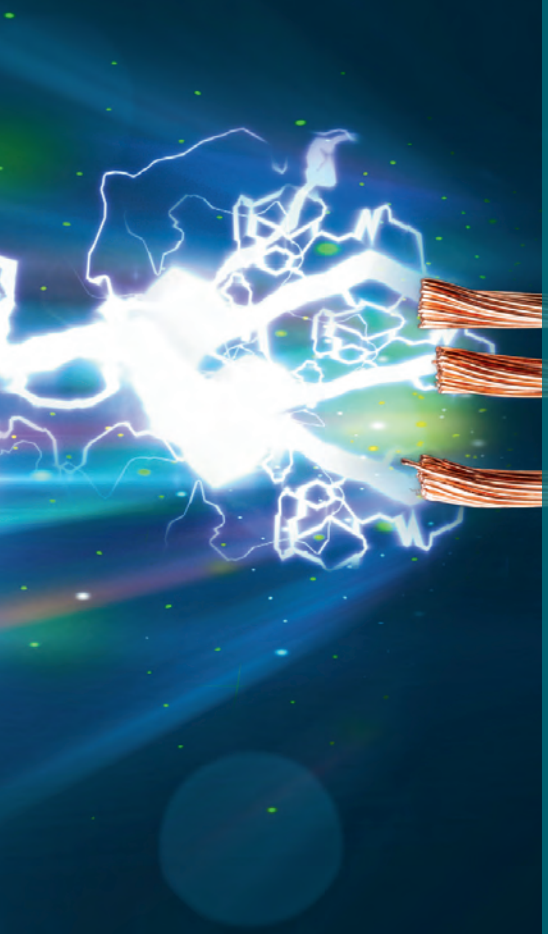
KEYSIGHT TECHNOLOGIES

POWER SUPPLIES 101



Power supplies are essential components of electronic devices. This article details the basics of linear and switching power supplies, along with their benefits.

In the most basic terms, a step-down regulator takes an input voltage and converts it to a lower voltage required by the load. There are two major types of voltage regulators: linear and switching.

A voltage regulator that is placed close to the device or devices for which it is powering is commonly referred to as a point of load regulator. This type of regulator often receives its input from a voltage bus contained on the PCB.

A linear regulator works by absorbing the energy difference between the input and the output while a switching regulator chops the input voltage and then averages the chopped voltage to provide the proper output voltage.

There are several parameters that should be considered when evaluating power supplies for particular applications:

- **Quiescent current:** The amount of current an IC consumes when it is not source current and its inputs are not cycling.
- **Efficiency:** Defined as the ratio of power into a regulator circuit to the output power delivered by the regulator. Power input includes quiescent currents, losses due to parasitic components and power delivered to the load.
- **Equivalent series resistance (ESR):** The resistive component of the capacitors used in a regulator circuit. Attention needs to be paid to the ESR of the capacitors of the output.
- **The loop:** Defined as all the elements affecting the output and stability of a regulator. This includes such blocks as the power stage, error amplifier, modulator and compensation circuits.

Additionally, as illustrated in Figure 1, several other specifications associated with power supplies affect their operation. These include:

- $T_{J\text{-}MAX}$ — The highest allowable temperature the junction in the IC is allowed to achieve.
- T_A — Defined as the ambient temperature of the air in the vicinity of the regulator.
- $R_{THETA\text{-}JA}$ — The thermal resistance from the junction to ambient. This includes the thermal resistance from the junction to case, the case to PCB and PCB to air.
- V_{FB} — The feedback voltage used to set the output voltage. R1 and R2 create a resistor divider to form V_{FB} from V_{OUT}. The error amp works to keep V_{FB} equal to V_{REF}.

Linear regulators are often used because of their ease of use and typically have a very low component count requirement. This type of regulator is equivalent to an adjustable resistor which drops V_{IN} to V_{OUT} and tries to keep V_{OUT} constant. The following is a list of key parameters to look for in a linear regulator:

- Dropout voltage — This is the minimum voltage needed above V_{OUT} to maintain proper regulation.
- Low drop out (LDO) — This is a type of regulator that functions when $V_{DROPOUT}$ is very small.
- Stability region — The area of a linear regulator where the output will remain stable. It is given for different output capacitances and depends on the ESR of the output capacitor.
- $P_{D\text{-}MAX}$ — The maximum power a device can dissipate is defined as the difference of $T_{J\text{-}MAX}$ and $T_{AMBIENT}$ divided by $R_{THETA\text{-}JA}$. It is possible to figure out what the maximum allowable output current is by combining and rearranging the power dissipation equations.

Linear regulators can be classified as either integrated or discrete (as illustrated in Figure 2). An integrated linear regulator has the pass element integrated in the package. A discrete

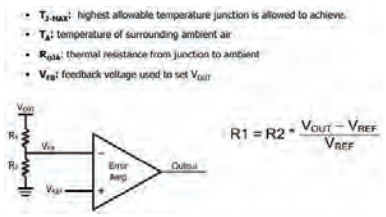


Figure 1: Voltage regulator definitions.

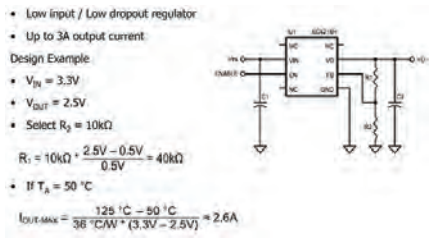


Figure 3: Linear regulator example — Semtech SC4216H.

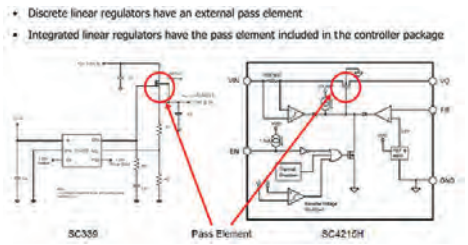


Figure 2: Integrated vs discrete linear regulators.

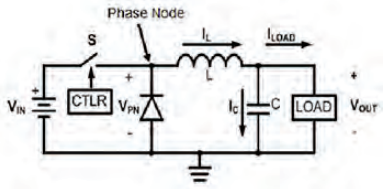


Figure 4: Buck regulator.

solution has an external pass element. Feedback components may or may not be integrated for either a discrete or integrated regulator. Semtech's SC339 is an example of a discrete linear regulator. The Semtech SC4215H is an example of an integrated linear regulator.

In the example shown in Figure 3, the V_{IN} has been defined to be 3.3 V and V_{OUT} has been defined as 2.5 V. We begin by selecting R_2 to be 10 kΩ. From the equation for calculating R_1 and using the value of 0.5 V for V_{REF} from the datasheet, we come up with a value of 40 kΩ needed for R_1. We have defined the $T_{AMBIENT}$ to be 50°C. From the datasheet, we find the value for T_{J-MAX} defined as 125°C and $R_{THETA-JA}$ defined as 36°C/W. With those values, we can calculate the maximum available output current, which is 2.6 A.

The datasheet states 10 µF per amp of output current is needed to prevent the input to the regulator from sagging. To support the full current calculated on the previous slide, a minimum of 26 µF is needed. Due to capacitor tolerances, a minimum of 33 µF capacitor should be chosen. In addition to the bulk cap, a 4.7 µF ceramic is recommended to be placed directly next to the V_{IN} pin of the regulator. For the output, the same rule of 10 µF per amp of output current is recommended. This will lead to the same value of 33 µF being used for the output. It is important to watch the ESR of the output capacitor to ensure the regions of instability are not entered. While a graph is not given for a 33 µF capacitor, we can interpolate between the two graphs given and use a 5 mΩ ESR to maintain stability. It is also recommended to use a 0.1 µF capacitor next to the V_{OUT} pin.

A buck regulator converts a higher V_{IN} to a lower V_{OUT} as shown in Figure 4. The controller opens and closes switch S periodically to connect the phase node between V_{IN} and ground. The waveform seen at the phase node is then filtered through the inductor and capacitor to provide a smooth voltage to the load.

The buck regulator has two different states (as shown in Figure 5) when switch S is closed and when switch S is open. When the switch is closed, V_{IN} charges the inductor and capacitor and supplies the output current. When the switch is open, the magnetic field in the inductor collapses and causes the voltage across the inductor to change polarity. This change in polarity pulls the phase node below ground, forward biasing the diode. This allows current to continue to flow as the inductor sources the current needed by the load.

As mentioned previously, the diode becomes forward biased with the collapsing of the magnetic field of the inductor. This occurs without any reference to a clock and is known as an asynchronous regulator. The VF of the diode used represents a significant portion of losses within an asynchronous regulator, especially as the value of V_F approaches the value of V_{OUT}. By replacing the diode with another MOSFET, the losses in the system can be reduced. This requires a more complex controller to ensure the MOSFETs are not both turned on at the same time. Since the bottom MOSFET is now controlled, the topology is referred to as a synchronous regulator. S_1 is also

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When S is closed, the input source charges the inductor and supplies the output current

When S is opened, the voltage across the inductor changes polarity due to a collapse in the magnetic field, forward biases the diode and supplies the energy to the output

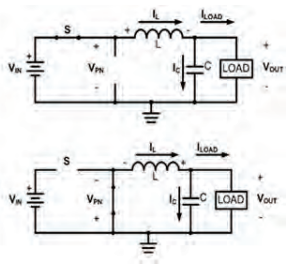

Figure 5: Basic buck regulator states.

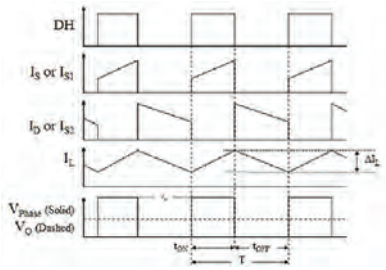

Figure 7: Basic buck regulator waveforms.

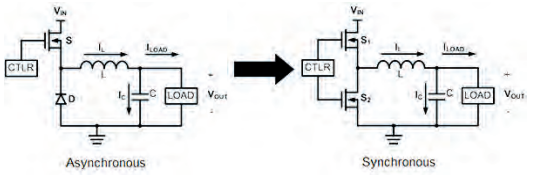

Figure 6: Asynchronous vs synchronous buck regulators.

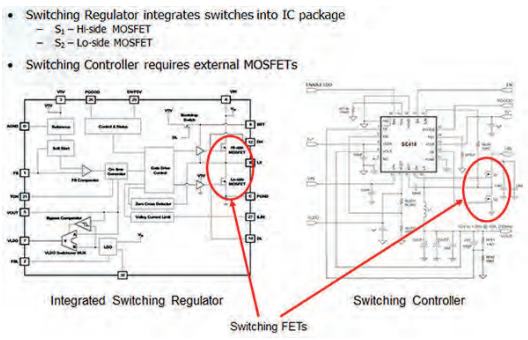

Figure 8: Integrated switching regulator vs switching controller.

$$R1 = R2 * \frac{V_{OUT} - V_{REF}}{V_{REF}}$$

Figure 9: Feedback resistors calculation formula.

known as the top FET or the high-side FET. S_2 is also known as the bottom FET or the low-side FET. The comparison between the asynchronous and synchronous buck regulators is shown in Figure 6.

The waveforms on Figure 7 are associated with a buck regulator. DH is the control signal to the high-side FET. As the controller turns on the high-side FET, current ramps up in the switch. At the same time, current also ramps up in the inductor and the voltage of the phase node hits V_{IN}. When the high-side switch is turned off, current ramps down in both the inductor and the low-side FET and the voltage at the phase node is pulled to ground.

The signal at V_{PHASE} is then filtered to form V_{OUT}.

The amount of time the high-side FET is on is defined as t_{ON}. The amount of time the high-side FET is off is defined as t_{OFF}. The time of t_{ON} plus t_{OFF} is defined as T or total cycle time.

Buck regulators can be further divided into two classes (as depicted in Figure 8): integrated regulators and switching controllers. The integrated switching regulator builds the FETs into the package or in the silicon. The switching controller requires switches to be placed external to the IC.

Voltages other than the fixed options provided can be used so long as a feedback network is added to the design. It is recommended to use the 1 V regulator when requiring voltages other than the standard fixed voltages. Due to the internal compensation, the use of a capacitor across the top side of the feedback network is necessary to maintain stability. The equation for calculating the capacitor was already discussed. V_{OUT} is the desired output voltage and V_{OSTD} is the voltage of Semtech SC189 with no feedback network. The feedback resistors are calculated via the formula found in Figure 9. The VREF to be used in the equation is the V_{OSTD} of the part or 1 V when the SC189A is used.

In summary, the best time to use a linear regulator is when noise in the system cannot be tolerated or when the V_{IN} and V_{OUT} difference is small. The best time to use a switching regulator is when the difference between V_{IN} and V_{OUT} is large. Also, it is best to use a switching regulator when efficiency is important and large currents are involved. Semtech has many options for both linear regulators and switching regulators.

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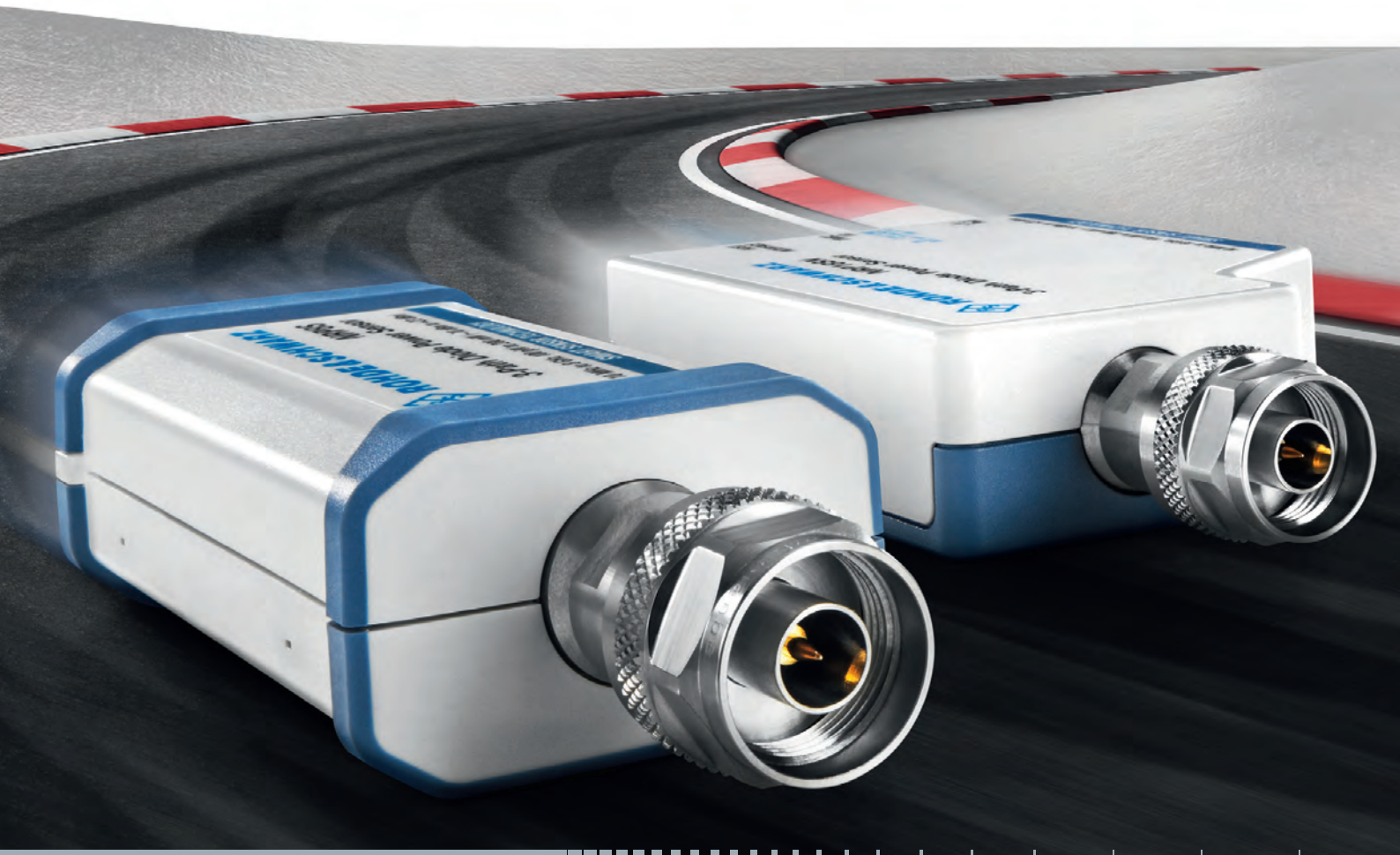

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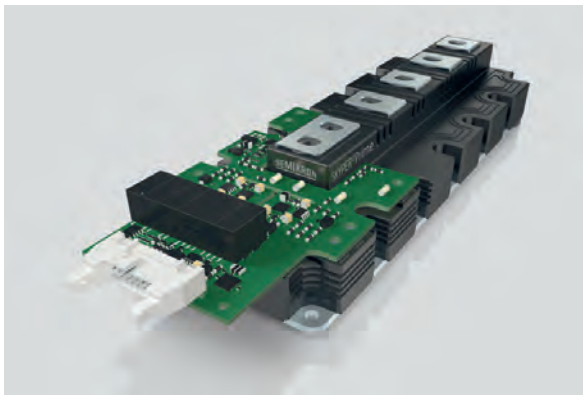

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Users have a broad choice of backhaul options to connect to the internet, depending on the needs of the application. Two card slots in the gateway accept MultiConnect mCard modules, which offer a variety of connectivity options - including traditional wired technologies such as ethernet and serial cable, as well as wireless options such as Semtech's LoRa long-range, low-power technology.

The product offers robust performance even in noisy RF environments, deep penetration into buildings and industrial structures, and an extended battery life. It is suitable for applications such as industrial equipment, IoT devices and asset tracking.

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CPUS WITH UPGRADED FIRMWARE

The Siemens SIMATIC S7-1200 CPU series features upgraded firmware V4.1 that introduces performance improvements, extra features and support for forthcoming failsafe CPUs. The firmware has improved instruction processing for faster execution of PLC programs, while increased work memory makes extra resources available for program and user data.

Features include enhanced motion capabilities such as position control and support for analog or PROFIdrive drives. A PID control block allows temperature control in active heating or cooling systems, as well as interval measurements using high-speed counters. A built-in station web server allows flexible access via IP address.

There is also dynamic copy protection; support for a shared I-Device, allowing connection of multiple controllers and fast data exchange; and enhanced configuration handling that allows modules to be specified and left unconnected without triggering alarms.The firmware also introduces support for the forthcoming failsafe S7-1200 CPUs and signal modules (SM) for implementing safety-related appliances.

The CPUs are recommended for new designs. Versatile configurations of analog and 24 V digital inputs and outputs are available. The firmware can also be downloaded for existing S7-1200 CPUs.

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Applications include the calibration of: analog and digital multimeters; thermometers; thermocouples and RTDs; handheld wattmeters; data loggers; current clamps; panel meters; process calibrators; power harmonic analysers; various recorders; and other instruments.

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ELECTRONEX 2015

ElectroneX, Australia's only dedicated trade event for the electronics industry, returns to Melbourne on 9–10 September at Melbourne Park Function Centre. With over 80 exhibitors and top-of-the-line local and international industry experts, this is truly an event not to be missed.

When: 9-10 September
Where: Melbourne Park Function Centre, Melbourne
Website: www.electronex.com.au

This year's event reflects the move towards niche and specialised manufacturing applications in the electronics sector and will also cater for the increasing demand from visitors for contract manufacturing solutions. Last year, the exhibition witnessed a high demand for 3D manufacturing technology and the event organisers expect to attract new exhibitors from this sector.

The event targets electronics design professionals; design, electronic and electrical engineers; along with OEM, scientific, IT and communications professionals and service technicians. ElectroneX is designed to help professionals across an array of industry sectors to learn about the latest technology developments for systems integration and production electronics. The event will be held in conjunction with the SMCBA Electronics Design & Manufacture Conference. Local and international guest speakers will share information critical to successful electronic product and system engineering. The conference will include presentations on: flexible electronics — thin-film solar cells through large-scale printing; control of noise, signal integrity and EMI in high-speed circuits and PCBs; and enabling implementation of advanced technologies. Over 1000 trade visitors are expected to attend the expo and conference over two days.

Kyung-In Synthetic Corporation's Dr Scott Watkins will be presenting on flexible electronics — an emerging area of technology that is based on using new materials, particularly organic-based compounds, as semiconductors in devices such as displays and solar cells. This enables these devices to be lightweight, low-cost and flexible, and they can be manufactured using processes such as roll-to-roll printing.

In his presentation, Watkins will describe how chemistry and physics are at the core of these new technologies and highlight some of the industrially focused research that is being done in this area in Australia. In particular, he will emphasise the work of the Victorian Organic Solar Cell Consortium (VICOSC). VICOSC is a research collaboration between CSIRO, The University of Melbourne, Monash University, BlueScope Steel, Innovia Films and Innovia Security. It is supported by the Victorian State Government and the Australian Government through the Australian Renewable Energy Agency.

Watkins is business development director and technology developer, Melbourne, with Kyung-In Synthetic Corporation (KISCO). He was previously the stream leader for thin-film photovoltaics in CSIRO's Future Manufacturing Flagship and was based in the Division of Materials Science and Engineering, Melbourne, Victoria. Watkins has a PhD in Chemistry from UNSW and has developed research interests which span the synthesis and analysis of new materials through to the fabrication and testing of devices. Between 2000 and 2004, Watkins worked on OLEDs with Cambridge Display Technologies in the UK. Watkins joined CSIRO in 2004 and led projects on both OLEDs and OPVs and coordinated CSIRO's involvement in a number of national and international consortia aimed at developing applications of flexible electronics by linking industry with research.

Rick Hartley of RHartley Enterprises will present on control of noise, signal integrity and EMI in high-speed circuits and PCBs. Knowing how to design circuit boards to contain and control energy (fields) and knowing how to mitigate and control the effects of high-speed devices is key to successful design of low-noise circuits. This two-day workshop is a crisp focus of the issues PCB designers and engineers need to know to prevent signal integrity, EMI, crosstalk and grounding problems in high-speed digital and mixed signal designs.

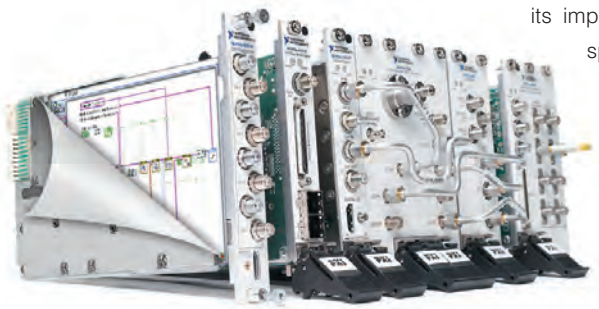
The conference will also include a presentation on enabling implementation of advanced technologies by Dr Denis Barbini. Universal Instruments Corp's Advanced Process Laboratory has developed a data-based seminar focused on providing the attendee with the necessary tools and case studies to implement advanced packaging designs into their assemblies. In this seminar, Barbini will identify the impact of novel technologies in electronics manufacturing. This seminar will provide the attendees information on fine pitch printing, PoP, 01005, LGA/BGA and novel laminate materials.

STAND C27

VECTOR SIGNAL ANALYSER

The NI PXIe-5668R vector signal analyser (VSA) offers 765 MHz of bandwidth with good measurement performance and speed. The high-performance microwave signal analyser meets the challenging requirements of applications such as wireless communications, radiofrequency integrated circuit characterisation, RADAR test and spectrum monitoring and signal intelligence.

The product offers a combination of RF measurement performance, measurement speed and flexibility. With high dynamic range and bandwidth, it is suitable for the measurement requirements of R&D applications. With its implementation as a PXI instrument, the device also features the fast measurement speed required for high-volume manufacturing test.



Finally, the VSA includes a LabVIEW-programmable Xilinx Kintex-7 FPGA. This can be used to customise the instrument's behaviour by adding triggering, signal-processing routines and more.

National Instruments Australia
www.ni.com/oceania

STAND C34

PICK-AND-PLACE MACHINE

The Mechatronics P30 is a desktop automatic pick-and-place machine with dispensing head. Capable of placing up to 1200 CPH and dispensing rate of 1200 dots/h, the product can accommodate up to 40 automatic 8 mm feeders along with 40 manual 8 mm strips and two IC trays while maintaining an A4-size workable PCB area of 200 x 300 mm.

The machine has a placement accuracy of 30 μm and is qualified for placement of standard and fine pitch components including SOIC, PLCC, BGA, μBGA, CSP, QFN and LEDs, targeting the prototyping and low-volume production area. Additional features include a CAN bus smart feeder system; vision-assisted touchless component alignment; automatic fiducial recognition; six-tool automatic nozzle changer; vision inspection of placement and dispensing accuracy; and an internet remote service port.

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APEM, a worldwide recognised brand develops and manufactures a broad range of professional switch products for diversified markets including industrial automation, defence, transport, instrumentation and communications.

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Switch Panels • LED Indicators

Control Devices

Joysticks • Control Grips • Sensors • Encoders • Custom Electronics • Switches

PO Box 7082, Unit 5, 79 Bourke Rd, Alexandria NSW 2015, AUSTRALIA T: +61 2 9330 1700,
F: +61 2 8338 9001, 1800 266 876, **sales@controldevices.net • www.controldevices.net**

STAND C1

CONTRACT MANUFACTURING

Duet Electronics is a niche contract manufacturer servicing Australian and international export markets. The company provides short-run, volume manufacture and prototype services; assistance in design to manufacture; and full turnkey capabilities including end-to-end logistic support and supply chain management.

Duet supplies key products and services to a diverse range of users in a wide range of markets including automotive, defence, aerospace, information technology, telecommunications, security, medical, process control, industrial and commercial power. Its capabilities extend from circuit development to turnkey production with an emphasis on total quality control.

ISO 9000:2008 accreditation and the company's 100% trackability system allow Duet Electronics to provide good accuracy and repeatability. The company will work with its clients to streamline their products to ensure ease of manufacture, thereby lowering production costs.

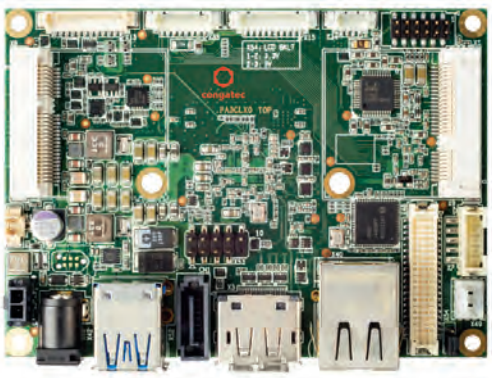
The company is able to offer macromelt moulding for overmoulding of parts, overmoulding connectors, printed circuit boards or use as a casting compound for electronic encapsulation. Its electronic manufacturing services and support are targeted specifically to meet the requirements and budgets of small to medium-sized clients.

Duet Electronics
www.duet.com.au

STAND A1

PICO-ITX SINGLE-BOARD COMPUTER

conga-PA3 is an industrial single-board computer based on the Intel Atom E3800 processor series (code-named Bay Trail). Compact industrial computers, such as those based on the Pico-ITX form factor, can execute tasks reliably and also handle connectivity, from use in the field up to the management level.



The compact design, with a footprint of 70 x 102 mm, makes the SBC versatile. The Intel Atom E3800 processors are also suitable for use in the extended industrial temperature range.

With low power consumption of 5-10 W TDP, single-chip Bay Trail solutions are suitable for passively cooled and enclosed systems that can be used in harsh environments. Typical applications include mechanical engineering, automation, control system and high-performance IoT computers with low power consumption.

The conga-PA3 is a powerful, low-power SBC with embedded qualities. Users receive a robust SBC that is suitable for 24/7 operation in harsh environments. Optional versions for the extended industrial temperature range of -40 to +85°C are also available.

congatec Australia Pty Ltd
www.congatec.com

STAND A23

PC-BASED VECTOR NETWORK ANALYSER

The MegiQ VNA0440 is a compact USB-driven vector network analyser (VNA) manufactured in the Netherlands. The bidirectional, 2-port VNA allows detailed impedance measurements of antennas, components and circuits covering 400 to 4000 MHz, ie, all popular communication bands for GSM-LTE, GPS, ISM, Wi-Fi, Dect, etc.

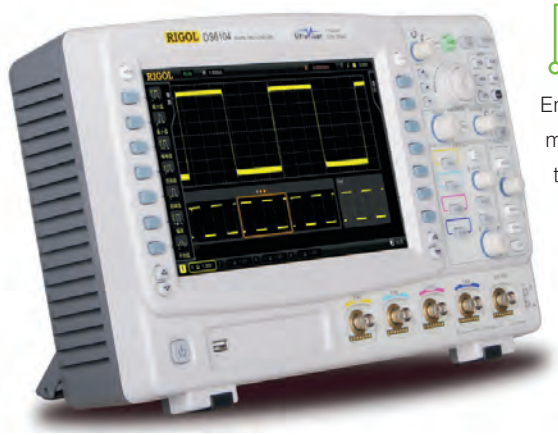
An extra generator output is suitable for characterising 3-port devices, like splitters and hybrids. The internal, programmable bias generator with bias tees allows fully automatic parametric measurements of, eg, amplifier and varactor/PIN circuits.

The VNA and the PC software were developed for RF engineers, with emphasis on use in real life. With the UFL test kit and the RF Sandbox, the user can be up and running within 10 min with a series of life experiments. These are instructive for the novice user and entertaining for the expert.

The UFL kit allows measuring circuits on micro PCBs, like baluns, antennas and amplifiers. Other available kits include WFL, SMA and balanced, including calibration tools.

PC software provides intuitive control, extensive graphing, data export and reporting. Measurements and set-ups can be stored in sessions for easy 'Retrace-and-Compare'. The 'Click-and-Match' feature calculates and simulates matching circuits.

Emona Instruments Pty Ltd
www.emona.com.au



STAND A23

ELECTRONIC TEST AND MEASURING INSTRUMENTS

Emona Instruments has released a number of recent electronic test and measuring instruments, such as the MegiQ USB-driven vector network analyser. The fully bidirectional two-port VNA allows detailed impedance measurements of antennas, components and circuits, covering 400 to 4000 MHz, ie, all popular communication bands for GSM-LTE, GPS, ISM, Wi-Fi, Dect, etc. Other products include the Rigol DSA-875 7.5 GHz spectrum analyser and the Rigol DG-5000 350 MHz arbitrary function generators.

Emona offers a complete range of test and measuring instruments — including oscilloscopes, function generators and counters, data acquisition instruments, multimeters, power supplies and thermal imaging cameras — and a range of products to support manufacturers, including hipot and production testers and harness and cable testers. The company's team of applications engineers provides on-site product demonstrations, while its service and calibration department provides full after-sales technical and calibration support.

Emona Instruments Pty Ltd
www.emona.com.au

STAND E40

COMMUNICATIONS-ENABLED CONVERTERS

Benbro Electronics has announced its range of communications-enabled components. The company's communications protocols include SNMP, with an embedded webpage, Wi-Fi, MODbus, CANbus, Digimesh, 6Lowpan, 3G and LTE, Bluetooth, USB and many more.

The protocols are modular, allowing the end user to choose the basic comms package, then option with the specific protocols that they require. Even custom and proprietary protocols can be catered for.

The initial product to carry this facility is the 300 W Eurocard DC/DC converter range. The range is also available with a full-colour touchscreen for comms control and monitoring.

Benbro will be deploying the comms solution system across the rest of its products, including the 1RU 1500 W converter range. There is even a standalone comms system to allow legacy products to be integrated with existing site comms.

Benbro Electronics Pty Ltd
www.benbro.com.au

STAND A20

STEREO MICROSCOPE

Lynx EVO is a high-productivity stereo microscope without eyepieces, powering the user's productivity through 3D imaging. The product is suitable for inspecting PCBs, quality control of manufactured parts and performing critical checks.

The eyepiece-less optics liberate users from restrictive working practices, offering ease of use and ergonomic performance. The microscope's modular design gives it the flexibility to be tailored to individual user applications.

The 10:1 zoom ratio provides 6-60x magnification, increasing to 120x with supplementary lenses. The integrated HD camera/software (optional) provides seamless image/video capture and annotation capabilities.

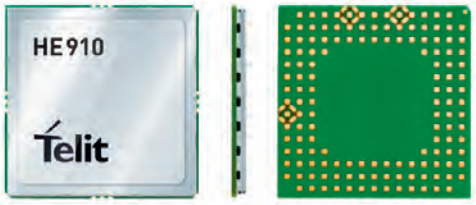
The device has a long working distance for easy sample manipulation and flexible stand options. This makes it suitable for industrial and life science applications.

Hawker Richardson
www.hawkerrichardson.com.au

STAND A16

3G MODULE

Telit's HE910 is a compact, multiband HSPA+ LGA module series with built-in GPS and GSM/EGPRS fallback at 28 x 28 mm. The series is pin-to-pin compatible with LTE, HSPA, GSM/GPRS and CDMA/EVDO xE910 family counterparts. Featuring seven-band HSPA+ data rates of up to 21 Mbps (Cat 14) downlink and 5.7 Mbps (Cat 6) uplink, it is suitable for high-performance global roaming.

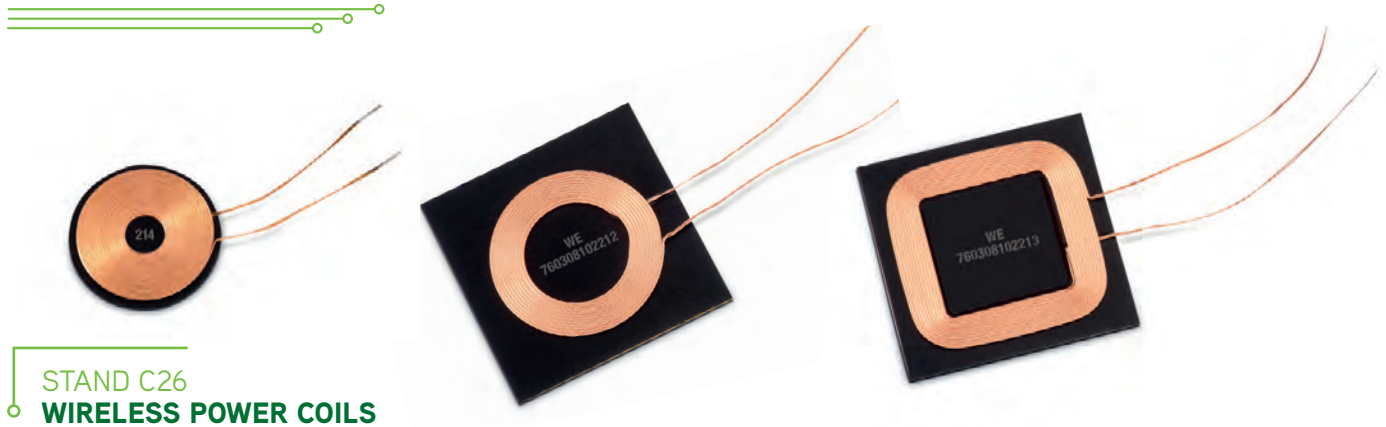


The series is suited to a range of industrial and consumer applications with high data throughput requirements, including asset and fleet tracking, in-car telematics, PDAs, security surveillance, personal navigation devices, e-readers and consumer electronics in general. It is capable of supporting Telit's deviceWISE Application Enablement Platform (AEP).

The deviceWISE AEP, a cloud-based IoT service, simplifies the creation of end-to-end applications for M2M and the Internet of Things. The platform-as-a-service (PaaS) offers a usage-based subscription plan that lets you 'pay-as-you-grow' — from prototyping to basic entry-level solutions and full-scale enterprise-grade deployments across the globe.

The developer-friendly platform reduces the risk, time to market and complexity of deploying solutions for remote monitoring and control, industrial automation, asset tracking and field service operations across operations around the world. By having the deviceWISE APIs embedded in the firmware of HE910, the user's application can easily connect to the cloud using a set of simple AT commands.

Glyn Ltd
www.glyn.co.nz



STAND C26

WIRELESS POWER COILS

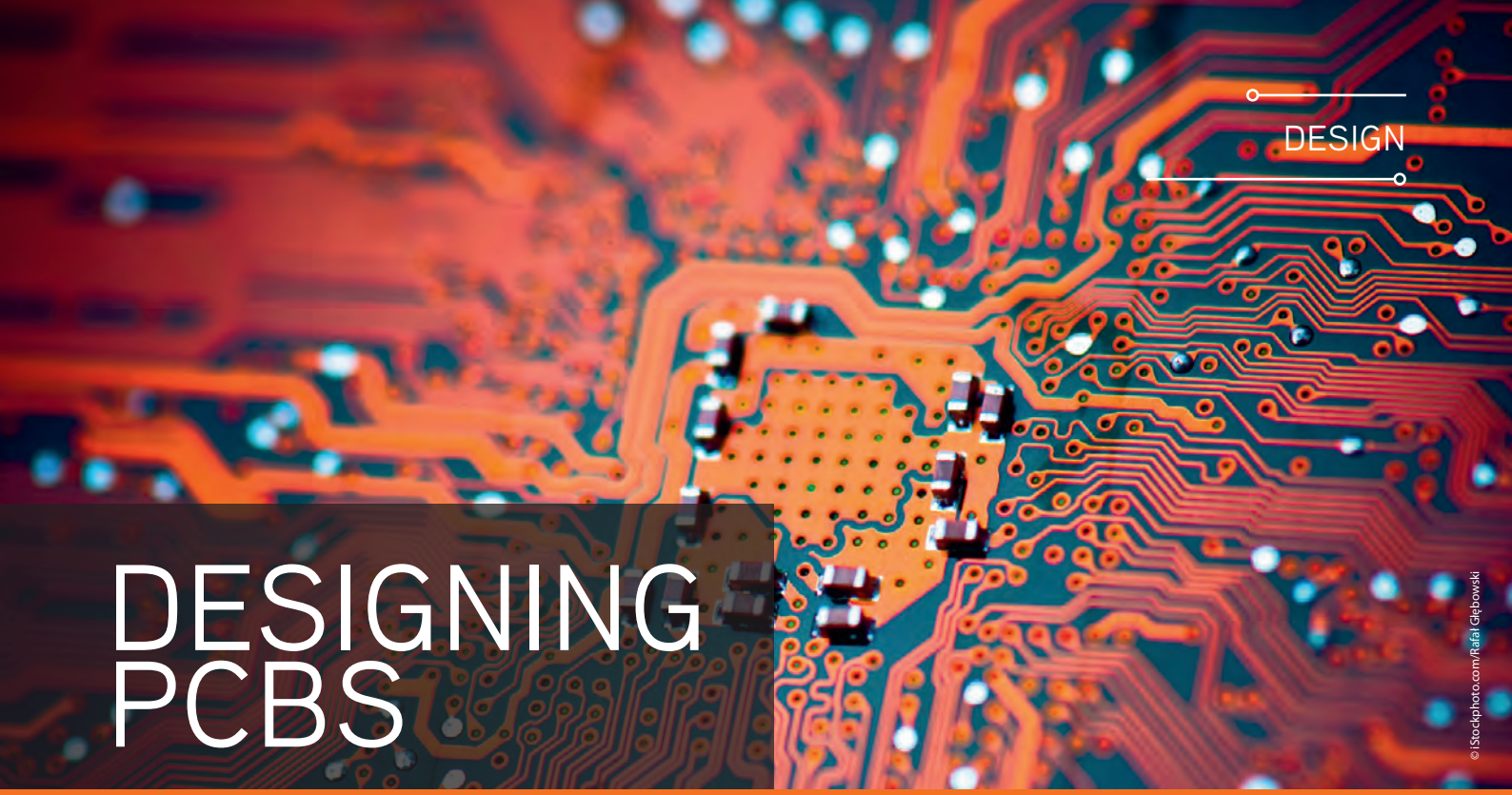
Würth Elektronik eiSos is expanding its portfolio of wireless power-transfer products, offering two transmitter and three receiver coils that are suitable for charging wearables and mobile devices. The coils are adapted to the already existing standard chip sets for the WPC Qi standard, making it easy to use already available designs by exchanging the coils for wearables.

The WE-WPCC 760308102212 and WE-WPCC 760308102213 receiver coils are just 0.64 mm, making them suitable for use in wearables with space for relatively large coil areas (29 x 29 mm) but with strong limitations regarding their height. The broad ferrite projection of the former unit offers good shielding properties.

The inductance value used in the WE-WPCC 760308102213 product makes it a dual-standard receiver. Fitted with the corresponding receiver chip, the coil is capable of responding to transmitters that are compatible with either the WPC Qi standard or the PMA standard.

The WE-WPCC 760308101214 receiver coil is slightly thicker, measuring 0.8 mm with a diameter of 19 mm. The product is suitable for wireless power transfer in devices with only limited space. Used in conjunction with the WE-WPCC 760308101104 und WE-WPCC 760308101105 transmitter coils, it is capable of achieving good power-transfer results.

Wurth Elektronik EiSos
www.weonline.com



DESIGNING PCBS

Designing and manufacturing PCBs is a complex process that involves many steps and considerations. This is the first article in a three-part series on PCB design and manufacturing. This article details the types of PCBs and explains why it's important for designers to understand manufacturers' capabilities.

Printed circuit boards (PCBs) are made from fibreglass material, commonly known as copper clad laminate, with copper tracks in place of wires. Copper tracks are chemically etched — ie, printed — to connect different components on the PCB. Through-hole components are fixed in position by drilling holes and then soldering them on the other side of the PCB. The different types of PCBs that are in common use these days include:

Rigid PCBs

The substrate used to manufacture a PCB is purely rigid in nature and therefore it is called a rigid PCB. Rigid PCBs are mainly divided into 3 categories — single-layer (or single-sided), double-layer (or double-sided) and multilayer PCBs.

Single-layer PCBs — The most basic PCBs have the components mounted on one side of the board and the conductor pattern on the other side. Because there is only a conductor pattern on one side, this type of PCB is called 'single-sided' or 'single-layer'. This type of circuit board is suitable for simple circuits only. Because there is only one side, no wires can cross and they have to be routed around each other.

Double-layer PCBs — Double-sided or double-layer PCBs are better suited to complex circuits as they have twice the area for the conductor pattern compared to single-sided PCBs. Double-sided PCBs have a conductor pattern on both sides of the board. Having two separate conductor patterns requires an electrical connection between them. Such electrical 'bridges' are called 'vias'. A via is simply a hole in the PCB that is filled or plated with metal and touches the conductor pattern on both sides.

Multilayer PCBs — Multilayer PCBs have one or more conductor pattern inside the board to increase the area available for the wiring. This is achieved by gluing (laminating) several double-sided circuit boards together with insulating layers in between. The number of layers is referred to as the number of separate conductor patterns — usually even and including the two outer layers. Most boards have between four and 10 layers, but PCBs with almost 100 layers can be made.

Metal-core PCBs

Advanced electronics demands efficient dissipation of heat away from the components. Thermally conductive dielectric material like aluminium or copper alloy can help achieve this more effectively than standard FR-4 material. The major advantages of metal core PCBs are heat dissipation, thermal expansion and dimensional stability.

Flexible and rigid-flex PCBs

Flexible printed circuits (FPCs) are made with a photolithographic technology. A flex circuit or flex PCB is a patterned arrangement of printed circuitry and components that utilises flexible-based material with or without flexible coverlay.

FPCs offer the same advantages of a printed circuit board: repeatability, reliability and high density, but with the added 'twist' of flexibility and vibration resistance. The most important attribute compelling designers to adopt flex circuit technology is the capability of the flex circuit to assume three-dimensional configurations. Rigid-flexible circuit boards are a combination of rigid and flexible PCBs. Rigid circuits (FR-4 PCB) are connected with single or multiple flex through PTH (via), inside or outside of flex circuit layer.

Manufacturing capability statements

It's crucial for designers to know PCB manufacturers' capabilities. Imagine a situation where you have designed a complex circuit board and sent to the manufacturer for a quote. Instead of receiving a quote, you are asked to make few design changes to suit their manufacturing capability. This unnecessarily lengthens the design process and disturbs the project plan. Below are some tips on understanding manufacturers' capability statements and using that information during the design process.

1. If a manufacturer has a separate capability statement for prototype and production manufacturing, ask for a copy and refer the correct one. It is possible to manufacture small volume PCBs with tighter tolerances so if PCBs are required in small numbers, one may choose their tightest capability statement.
2. Three basic limitations to know about the manufacturer before starting the design process include:
   - Etching limitation (ie, minimum track width/spacing) — For 1 oz standard finish copper thickness PCBs, 0.127-0.152 mm is the minimum track width and spacing requirement for most manufacturers. With special attention, 0.089-0.102 mm can be achieved on small- to medium-volume production. If your design requires thicker copper then minimum track width/spacing can increase up to 0.305-0.330 mm, depending on the required thickness of the copper.
   - Hole size limitation — Most manufacturers accept finish hole sizes from 0.3 mm and higher as standard. Some manufacturers charge extra for 0.25 mm finish holes (standard for QualiEco Circuits). A few manufacturers accept 0.2 mm finish holes by charging extra. In some special cases, a 0.15 mm finish hole size can also be acceptable using mechanical drilling process. Any less than 0.15 mm can be achieved by laser drilling, which is an expensive process.
   - Bonding and drilling limitation (for multilayer PCBs only) — The most important criterion to keep in mind while designing a multilayer PCB is the gap between the edge of the hole and the nearest copper area (track/pad/pour) in inner layers. For multilayer PCBs, drilling is performed after bonding so this criterion is extremely critical for PCB manufacturers.
     It is important to know whether a manufacturer has added plating tolerance while mentioning minimum isolation in their technical capability statement. Most manufacturers need to add approximately 0.1 mm plating tolerance for via holes. Some manufacturers display minimum isolation sizes without adding plating tolerance while some do add them. Unfortunately, there is no specific guideline for displaying this criterion.
3. Another important factor to consider in your design is the minimum copper and solder mask pad size around holes.
   - Copper pad size — Most manufacturers define copper pads around holes as 'annular ring'. There is a minimum annular ring size you need to maintain everywhere in the design.
   - Solder mask pad size — Solder mask is nothing but an opening to prevent solder bridges between adjacent pads and traces during the soldering process.
     The next article in this series will provide insights on PCB design software packages and choosing the right PCB manufacturer.

QualiEco Circuits Pty Ltd
www.qualiecocircuits.com.au

STAND A27

HANDHELD ENCLOSURE

Hammond Electronics is launching the 1553W IP65 sealed version of the stylish, ergonomically designed 1553 hand-held enclosure. Intended for housing any electronics that will be used in environments where dust and water are likely to be present, it features an ergonometric curved shape that fits comfortably into the hand.

The product is initially available in three sizes: 117 x 79 x 25 mm, 117 x 79 x 32 mm and 147 x 90 x 25 mm. All sizes are moulded in UL94-V0 flame-retardant ABS in light grey or black, both over-moulded with grey soft side grips.

The top cover is recessed to allow a membrane keypad to be flush mounted, while PCB standoffs are provided in the top and base. The IP65 environmental sealing is achieved by a rubber gasket in a slot in the base. The top and base are assembled with four screws that locate into brass inserts in the top moulding, facilitating repeated access to the housed electronics.

The fixing positions are outside the gasket, ensuring the integrity of the seal. An integral end panel forms part of the top cover, providing an easy-to-machine area for cable entry, switches and indicators.

Hammond Electronics Pty Ltd
www.hammondmfg.com

STAND C6

SOURCE-MEASURE UNIT AND DIGITAL MULTIMETER

The Model 2460 SourceMeter source-measure unit (SMU) is the next in a series of interactive SMU bench instruments with a capacitive touch screen. The product adds higher current capacity up to 7 ADC and 7 A pulse compared to the 1 A Model 2450 that was launched in August 2013.

The device builds on the design strengths and high precision of the Model 2450 SourceMeter and the original Models 2420, 2425 and 2440 SourceMeters. It combines the functionality of a precision power supply, true high current source, 6½-digit precision multimeter, electronic load and trigger controller in one tightly integrated, half-rack instrument. The product also leverages an intuitive high-resolution touch screen and icon-based control.

The Model 7510 digital multimeter (DMM) meanwhile combines a precision digital multimeter, 5″ graphical touch screen display and high-speed, high-resolution digitiser in a graphical sampling multimeter. The product's pinch/zoom control and settable cursors simplify visualising signals and transients and interacting with data, while on-screen statistics enable measurement analysis without connecting to a PC.

Vicom Australia Pty Ltd
www.vicom.com.au

STAND A1

QSEVEN MODULE

congatec introduces the latest addition to its Qseven family. The conga-QA4 module features the Intel Pentium and Celeron processors based on 14 nm technology and is said to offer increased energy savings and computing power. The optimised Intel Gen8 graphics, with up to 16 EUs (graphics execution units) and 4K (3840 x 2160 pixels) resolution, result in a good visual experience.

The module comes in three different processor versions (Intel code-name Braswell) for high scalability. These range from the entry-level dual-core Intel Celeron N3050 with 1.6/2.08 GHz to the quad-core Intel Pentium N3700 with 1.6/2.4 GHz, each with a power consumption of 4 W for standard applications.

congatec Australia Pty Ltd
www.congatec.com

STAND C23

ISP PROGRAMMING TECHNOLOGY

Algocraft has designed WriteNow! ISP programming technology that allows users to reach the theoretical programming speed for any given device on up to eight devices at once. The technology allows for universal device support, since the majority of ISP protocols are implemented by the same hardware platform. Standard and custom programming algorithms are transferred to the instrument and run at the programmer's full speed.

The compact size and versatile interfacing possibilities of the programmers allow them to be conveniently integrated in an automatic test equipment (ATE) or programming/test fixture. Since binary codes, board parameters and programming flow reside inside the WriteNow! programmer, the programmer can work without a connection to a PC (stand-alone mode). When in stand-alone, a simple 'start' command string can be sent by an ATE or PC to initiate the programming flow. After the programming flow is started, the ATE or PC can switch to other tasks — no external resources are needed to carry out the programming flow.

The programmers enable the ability to custom-program each device with variable data. The data encryption feature, coupled with LAN connectivity, allows manufacturing companies to securely synchronise local data with distant production facilities. A built-in relay barrier allows ISP lines to be disconnected from the target system, thus allowing other operations to be performed by other equipment.

Redback Test Services
www.redbacktest.com.au

STAND A1

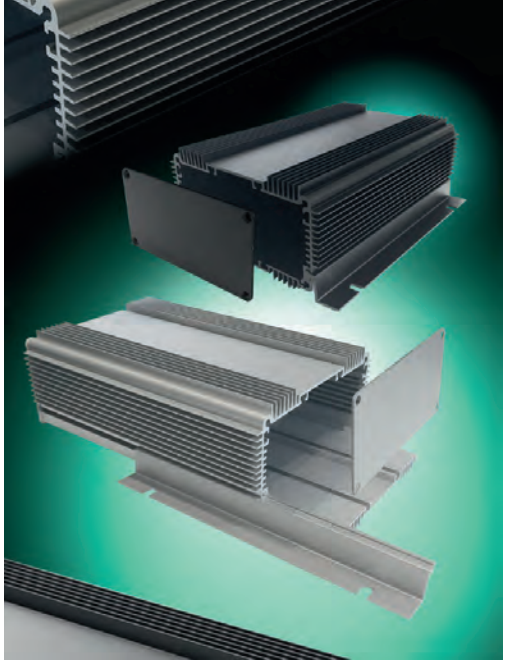
QSEVEN IOT KIT

congatec's Qseven IoT kit is said to make it quick and easy to develop applications for the Internet of Things (IoT). The kit provides a complete starter set for the rapid prototyping of embedded IoT applications.

The kit contains a Qseven computer-on-module (COM) based on the latest Intel Atom processor technology; a compact IoT carrier board; a 7″ LVDS single-touch display with LED backlight; and an extensive set of accessories, including an AC power supply and 802.11 WLAN antenna with IoT Wind River Linux image on a USB stick. The kit enables the development of an IoT demo system in a matter of minutes.

The kit comes with congatec's conga-QA3 Qseven COM based on the Intel Atom E3827 processor (XM cache, 1.6 GHz, XW TDP). A space-saving single-chip processor and low power consumption make the product suitable for fanless designs in applications that require enhanced IoT connectivity. These include M2M and motion control applications for Industry 4.0, gateways, and system and control monitoring in smart home automation.

congatec Australia Pty Ltd
www.congatec.com



STAND A27

ENCLOSURE

The 1455NHD is the latest addition to the 1455 series of extruded aluminium enclosures from Hammond Electronics. The product features six integral heat dissipating fins in the extrusion profile, providing enhanced cooling capability for when high thermal loads are expected from the housed equipment.

Designed to house PCBs and discrete components, the device is sized to accept the 100 x 160 mm single Eurocard, which mounts horizontally into one of seven slots in the body of the enclosure. The removable flat metal end panels secure the PCB into the enclosure and can be easily machined with the required apertures for indicators, switches and connectors. The two-piece body has a removable plate in the base that gives good access to the interior, and both the top and base have large flat areas that give plenty of room for component mounting.

Also extruded into the body are six internal and two external T slots running the length of the enclosure. The external ones accept two removable mounting flanges for easy wall, shelf or bulkhead mounting; the internal ones can be used for mounting components using fixings that slide into the slot. The enclosure is available with a clear or black anodised finish.

Hammond Electronics Pty Ltd
www.hammondmfg.com

STAND A20

HD MICROSCOPE

The Mantis Elite-Cam HD is the latest product in the Mantis stereo microscope range. Combining the ergonomic benefits of eyepiece-less technology and with the imaging power of an HD camera, the instrument is suitable for inspection, reworking and reporting.

The device offers a large field of view and generous working distance to allow for a wide range of inspection, preparation and manipulation tasks. The product's optical technology removes the need for the restrictive eyepieces of a conventional microscope, allowing freedom of head movement, providing good ergonomics and hand–eye coordination and offering the ability to wear prescription or safety glasses, if required.

The product is available with magnifications of up to 20x as well as flexible stand options, including a low-profile bench stand with integral sub-stage illumination.

Hawker Richardson
www.hawkerrichardson.com.au

STAND B32

LASER MARKING WORKSTATION

Amada Miyachi's LMWS (Laser Marking Workstation) is a configurable, compact unit designed for lean manufacturing and offering a wide range of marking capability. Standard options include a rotary stage to tailor the machine to the user's specific process.

The compact workstation has been designed for bench-top operation, so minimal workspace is needed. Integrated with the company's LMF fibre laser markers (10-50 W), the unit has the same GUI and interface for easy transfer from prototype to production phase.

Benefits include: a fast and precise motorised Z-axis for easy focus adjustment (programmable axis optional); easy access to parts and tooling; a large viewing window for easy mark monitoring; F-Theta 100, 160 and 254 mm lens options for marking various parts and sizes; a fume extraction port with flexible tubing; and an optical breadboard with M6 threaded holes for easy mounting.

Kobot Systems
www.kobot.com.au

STAND C12

TEST AND MEASUREMENT EQUIPMENT

Scientific Devices Australia's range of test and measurement equipment includes: the Teledyne LeCroy Model HDO 6104-MS, a true 12-bit digital oscilloscope with high resolution and loaded with functionality and features to meet complex, analytical applications; the ThinkRF spectrum analyser, which has a frequency range to 27 GHz, a small footprint and is PC-based for portability; Transmille's range of multifunction and electrical test equipment calibrators, together with Procal calibration software; Microsemi's range of NTP time servers, carrier time synchronisation and frequency standard equipment; Dataforth MAQ20 data acquisition systems; Stanford research equipment; and APM DC power supplies.

Scientific Devices Australia
www.scientific-devices.com.au

STAND B26

DC/DC CONVERTERS

Mornsun's third (R3) generation of DC/DC converters is said to reduce standby power consumption to as low as 0.12 W and raise light-load efficiency up to 78%. This enables the product to solve temperature rise issues when operating in light-load conditions for long periods.

The converters offer a 4:1 wide input voltage range, 1500/3000 VDC isolation voltage and a wide operating temperature of -40 to +85°C to meet the requirements of many different design applications. Average efficiencies approach 80% at 10-100% load; if the load is lower than 10%, efficiency levels of over 70% can be maintained. The converters meet UL/EN 60950 certification.

The converters feature ultralow no-load consumption, high efficiency in all input ranges, large-capacitive load capability and multiple protections (input undervoltage protection, output overvoltage protection, short circuit protection and overcurrent protection), ensuring smooth operation when used in most applications.

DLPC is the master distributor in Australia and New Zealand for Mornsun Power products, with Fairmont Marketing acting as the company's official distribution partner in Victoria.

Fairmont Marketing
www.fairmontmarketing.com.au

STAND A12

OSCILLOSCOPE

The Keysight 3000T X-Series oscilloscope is the next generation of the InfiniiVision X-Series. With its zone touch triggering, the user can trigger on any signal in just two steps.

The product can isolate a signal in seconds, which is said to make it faster than any competing scope. It is a six-in-one instrument, providing an oscilloscope, MSO, WaveGen function generator, protocol analyser, DVM and counter.

Features include: an 8.5″ capacitive touch display and user interface; an update rate of 1,000,000 wfm/s; time/frequency correlation; and six-in-one instrument integration to find the root causes.

Keysight Technologies Aust Pty Ltd
www.keysight.com

STAND B18

PORTABLE MINI JUMP STARTERS

Future Tech Concepts has released a range of portable mini jump starters. Catering for vehicles of all sizes, the jump starters have the built-in multifunctionality of being a power bank for all the user's electronic needs.

The jump starters are a suitable accessory for motoring enthusiasts and campers. They weigh 220 g, making them small enough to fit in the glove box.

The BR-K23 model boasts a capacity of 8000 mAh and can start a 3 L gasoline vehicle up to 20 times, as well as act as a power bank for a mobile phone. A 12 V socket adapter is included, meaning the user can charge on the go.

Future Tech Concepts Pty Ltd
www.ftconcepts.com.au

TEST AND MEASUREMENT

THEN, NOW AND THE FUTURE

Thirty-five years is a long time to witness the extraordinary development in the electronic, computing and the test and measurement industry. In the early days you would enter the service department of a test equipment electronics repair centre filled with cigarette smoke, lined with multiple tables, geared with soldering iron, oscilloscope, generator, spectrum analyser and a multimeter… and disassembled was the state-of-the-art piece of test equipment weighing more than 20 to 30 kg. The equipment would be choked with PCB boards, some of which had wire wrap as the means of providing the signal routing for discrete components such as transistors, resistor, capacitors and ICs — gates, switches, flop flops and drivers.

The CSIR Mk1 was the first computer to be introduced in Australia. In the early 1960s, Olivetti introduced the first commercial personal computer and around the same time, the General Purpose Interface Bus (GPIB) was introduced to automate test equipment systems. With technological advancements, computers have become extremely economical to manufacture. Memory has become abundant and power requirement reduced to lower levels. Test equipment manufacturers have taken advantage of this powerful resource and have introduced computers as a tool for designing and manufacturing test equipment as well as using them as a basic building block for advanced equipment.

Electronic componentry, PCB boards and test equipment are produced by computer-assisted processes and robotics that minimise human intervention and therefore human-induced errors, resulting in remarkable improvement in reliability. In today's disposable world there is less need for servicing equipment. There are less board-level repairs and more complete board replacements. With electronic devices getting smaller and more powerful, the electronics equipment market has changed dramatically in recent years.

The requirement for faster communication speeds to cope with enormous growth in data use; the ability to store mass data; the desire for wireless communications, power and mobility; and the need to store energy from natural resources for sustainability and the conservation of the environment will continue to create the need for new technologies and equipment to test these technologies. The fifth generation of wireless networks will demand the use of higher frequency bands. The 802.11ac standard has introduced many new technologies such as multiuser MIMO (multiple input multiple output) and beamforming, which will require technology advancements and a new wave of test equipment. This, together with the Internet of Things (IoT), will drive the demand for RF and wireless test equipment, general test equipment such as digital oscilloscopes, spectrum analysers and metrology equipment.

In the past 10-15 years, many US and European test and measurement manufacturers have relocated their manufacturing facilities to locations in Asia and South America with an aim of lowering costs. The American and European companies manufacturing in China have trained local engineers on the latest engineering, design and manufacturing techniques. Some of these engineers have moved jobs leading to transfer of knowledge and skills to local companies. Furthermore, there are more local start-ups that are manufacturing test equipment that rival the USA and European manufactured test equipment in functionality, quality and price.

Some test equipment companies have badged Asian brands and marketed the instruments under their own brand, benefiting from their own brand recognition and reputation. In recent times we have seen an increase in high-technology equipment introduced into Australia from Asia, specifically China. These include products such as smartphones, telecommunications infrastructure equipment and test and measurement equipment. The introduction of the English language in Chinese schools has significantly improved their language proficiency and marketing ability and this, along with the transfer of knowledge, has spawned aggressive competitors in the Australian high-technology marketplace.

Labour is expensive in Australia, and shopfront-type companies that supply test equipment with minimal customer service and support are becoming increasingly popular. For some types of test equipment, direct overseas purchases via catalogue companies and online services are convenient and economical. However, there are many factors to consider when purchasing high-technology test equipment directly from overseas suppliers.

Local test equipment companies such as Scientific Devices Australia, which has been in business for 45 years, invest in resources, engineering talent, calibration departments and technical experts that can assure the best instruments are selected and purchased for appropriate applications. Furthermore, they can offer a knowledge base that can assist customers in simple as well as complex measurement techniques, notify of equipment obsolescence, and offer application customisation and other auxiliary services that complement the purchase of equipment.

Mark Lotter is a Director, and National Sales and Marketing Manager at Scientific Devices Australia. This year, he will celebrate 35 years in the test and measurement industry. Mark has held several senior positions at the company and is instrumental in the management of international relations with principle suppliers across many technologies as well as having a customer-focused business ethic. Mark holds a Commerce Degree, majoring in Marketing and Human Resources, as well as a Diploma of Technology (Electronics).

AUSTRALIAN RESEARCHERS DEVELOP ELECTRONIC LONG-TERM MEMORY CELL

Researchers at the MicroNano Research Facility (MNRF) have built the one of the world's first electronic multistate memory cells which mirrors the brain's ability to simultaneously process and store multiple strands of information.

The development brings them closer to imitating key electronic aspects of the human brain - a vital step towards creating a bionic brain - which could help unlock successful treatments for common neurological conditions such as Alzheimer's and Parkinson's diseases.

The discovery was recently published in the materials science journal *Advanced Functional Materials*. Project leader Dr Sharath Sriram, co-leader of the RMIT Functional Materials and Microsystems Research Group, said the development imitates the way the brain uses long-term memory.

"This is the closest we have come to creating a brain-like system with memory that learns and stores analog information and is quick at retrieving this stored information," Dr Sharath said.

"The human brain is an extremely complex analog computer ... its evolution is based on its previous experiences, and up until now this functionality has not been able to be adequately reproduced with digital technology."

The ability to create highly dense and ultrafast analog memory cells paves the way for imitating highly sophisticated biological neural networks, he said.

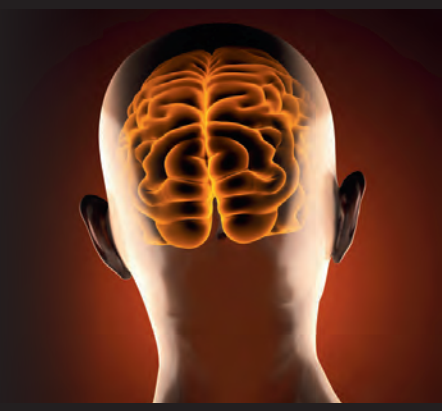
The research builds on RMIT's previous discovery where ultrafast nanoscale memories were developed using a functional oxide material in the form of an ultrathin film - 10,000 times thinner than a human hair.

"This new discovery is significant as it allows the multistate cell to store and process information in the very same way that the brain does," said Dr Hussein Nili, lead author of the study.

"Think of an old camera which could only take pictures in black and white. The same analogy applies here - rather than just black and white memories, we now have memories in full colour with shade, light and texture, it is a major step."

While these new devices are able to store much more information than conventional digital memories (which store just 0s and 1s), it is their brain-like ability to remember and retain previous information that is exciting.

"We have now introduced controlled faults or defects in the oxide material along with the addition of metallic atoms, which unleashes the full potential of the 'memristive' effect - where the memory element's behaviour is dependent on its past experiences," Dr Nili said.



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Nanoscale memories are precursors to the storage components of the complex artificial intelligence network needed to develop a bionic brain. Dr Nili said the research had myriad practical applications including the potential for scientists to replicate the human brain outside of the body.

"If you could replicate a brain outside the body, it would minimise ethical issues involved in treating and experimenting on the brain, which can lead to better understanding of neurological conditions," Dr Nili said.

The research, supported by the Australian Research Council, was conducted in collaboration with the University of California Santa Barbara.

AUSTRALIAN START-UP LOCKS IN A DEAL WITH TESLA

Canberra start-up Reposit Power has locked in a contract that will see Tesla batteries sold with Reposit's technology installed in them.

Reposit Power has developed software - in the form of a computer program and phone app - that allows consumers to determine their energy usage and generation, and how much energy is being generated from solar and how much is being drawn from the grid.

"On one level it's quite a shock when you think of the multibillion-dollar value of Tesla," said ANU alumnus Dr Lachlan Blackhall, chief technology officer and co-founder of Reposit Power.

"But for us what it does is give us some validation in the market that what we're doing is really cutting edge and world class," said Blackhall, who is also an Adjunct Professor at the ANU College of Engineering and Computer Science. The Canberra-based firm is the brainchild of Dr Blackhall and business partner Dean Spaccavento. "We've been working on this since 2011," Dr Blackhall said.

"Being able to demonstrate that with Tesla really was where their interest was garnered, because they saw we have a world-leading capability."

The Tesla agreement adds to an already successful 2015 for Reposit Power, with the business already starting work with West Australian firm Magellan earlier in the year.

"There are a large number of manufacturers all over the world who currently have storage on the cusp of being available or currently available, and the vision for Reposit is our system sits on every single one of them," he said.

Dr Blackhall said if he hadn't come to ANU in 2007 to do his PhD, Reposit Power may never have formed. He still has strong ties with ANU. "I'm an adjunct and still teach. Previously we've built a power lab in the engineering department to demonstrate the technology we've been working on," he said.

QLD START-UP SECURES $3M FUNDING FOR ITS POLYMER TECHNOLOGY

Queensland-based start-up TenasiTech has received $3 million in investor support for its scratch-resistant and environmentally sustainable acrylic glass for use in the computer, electronics and automotive industries.

Co-inventor and chief scientific officer Professor Darren Martin said the world-first invention was significantly more durable than regular acrylic glass and was a fraction of the cost of other hardened acrylic products. "Globally the acrylic glass market is worth almost $6 billion; however, the material's poor scratch resistance is a barrier to its more widespread use as a replacement for traditional glass," Professor Martin said.

"TenasiTech's nanotechnology and ceramic additive increases a product's hardness and scratch resistance, so you could find that cracked or scratched device screens or casings on mobile phones, computers and flat screen TVs or automotive interiors might become a thing of the past.

"The product can be supplied as a concentrate in 5 mm pellet form, and once processed into the acrylic glass can significantly enhance the durability without any loss of impact strength."

The current standard for making an acrylic glass product scratch resistant involves strong solvents and chemicals to apply a 'hard coat', said Professor Martin (pictured), who is a Research Group Leader at UQ's Australian Institute for Bioengineering and Nanotechnology. The University of Queensland start-up company is an entrant in the 2015 Telstra Australian Business Awards.

"This process requires strict environmental monitoring because of the strong solvents and chemicals, and is expensive because the coating must be applied after the plastic has been moulded into shape," he said.

"The technology we've developed is better for the environment in terms of reduced chemical and solvent use and is far more cost effective."

Professor Martin said TenasiTech's ceramic nanoadditive for plastics and rubbers was easy to incorporate into the manufacturing process.

ITP AUSTRALIA RECEIVES ARENA FUNDING FOR LI-ION BATTERY TRIAL

ITP Australia has been awarded a $450,000 grant from the Australian Renewable Energy Agency to conduct independent testing of the performance of six major lithium-ion battery brands, an 'advanced' lead-acid battery and a conventional lead-acid battery.

ITP is building a test facility at the Canberra Institute of Technology to run repeated charge and discharge cycles on each battery type, simulating real-world applications and Australian environmental conditions.

The test will compare the batteries side by side in hot daytime and cool overnight temperatures similar to what they would be expected to face in real-world conditions. Despite recent reductions in the cost of lithium-ion batteries and the potentially significant advantages the technology offers, energy system designers and end users are cautious about transitioning to new battery technologies, especially for remote applications where reliability is critical.

Users and industry will be consulted in order to design a testing regime and data structure that maximises the value of the findings. The regime will broaden the understanding of various storage technologies and how they can best be adopted as they begin to compete with lead-acid batteries on cost and reliability. The results will be shared broadly across the energy industry with investors, power companies and researchers.

TURNING A BASIC ELECTRONICS LAB INTO A LOW-COST COMMUNICATIONS LAB

A NUP/UPNA-Public University of Navarre researcher has developed a solution that allows a basic electronics lab to be transformed into a low-cost, advanced telecommunications one.

NUP/UPNA Professor Antonio López-Martín has connected the basic instrumentation of an electronics lab to a computer and has written some software that allows the measuring data to be acquired and complex, costly instrumentation equipment for communications to be emulated on the computer. That way it is possible to give experimental classes in telecommunications using economical equipment already existing at most universities without any additional expense or additional learning time having to be devoted to the instrumentation.

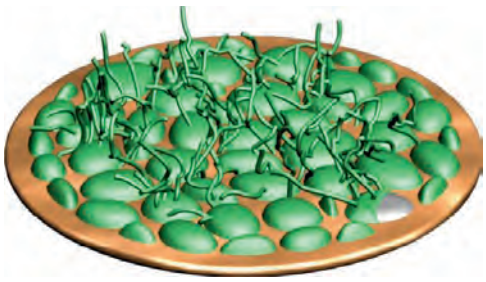
Prof. López-Martín's work has already received the best paper award in the category of 'Innovative Materials, Teaching and Learning Experiences in Engineering Education' at the 6th IEEE Global Education Conference (EDUCON).

"The invention is particularly attractive for universities in developing countries that cannot afford the expensive equipment needed for a degree in telecommunications engineering," said Prof. López-Martín. The work has made a considerable impact on the international community and the software has already been transferred to a research centre in Australia and universities in the United States and Mexico.

This author was previously the first European to receive the award for best paper in *IEEE Transactions on Education*, the journal that is a reference worldwide in engineering education.

PREVENTING DENDRITE FORMATION IN LITHIUM BATTERIES

Adding two chemicals, lithium nitrate and lithium polysulfide, to the electrolyte of a lithium metal battery can prevent the formation of dendrites — 'fingers' of lithium that pierce the barrier between the battery's halves, causing it to short out, overheat and sometimes burst into flame.



Dendrites form when a battery electrode degrades and metal ions become deposited on the electrode's surface. When those deposits elongate until they penetrate the barrier between the two halves of the battery, they can cause electrical shorts, overheating and fires.

In a study published last October, Yi Cui, an associate professor at Stanford University and the Department of Energy's SLAC National Accelerator Laboratory, and his colleagues reported that they had developed a 'smart' lithium-ion battery that senses when dendrites start to puncture the barrier so the battery can be replaced before the situation becomes dangerous.

Cui and his team's latest research addresses battery technologies that haven't reached the market yet, and it takes a different approach: adding chemicals to the electrolyte to prevent dendrite formation. Lithium nitrate has been under investigation for a long time as an additive to improve battery performance. The other compound, lithium polysulfide, has been considered a nuisance: formed when a sulfur electrode degrades, it travels to the lithium metal electrode and wrecks it, Cui said.

In brainstorming sessions, the research team realised their combined effect had not been studied before; together the chemicals could potentially react with lithium metal to form a stable, solid interface between the electrode and the electrolyte.

The researchers assembled coin cell batteries, similar to the ones that power calculators, remote controls and watches, and added various concentrations of the two chemicals to the ether-based electrolyte. Then they ran those batteries through many charge/discharge cycles, took them apart and examined the electrodes with an electron microscope and an X-ray technique that reveals their morphology and chemical composition.

They found that adding both chemicals in just the right amounts stopped lithium dendrite formation; harmless pancake-like deposits grew instead. The lithium metal electrode acquired a stable coating that helped protect it from further degradation and actually improved the battery's performance.

In tests, batteries with both chemicals added operated at 99% efficiency after more than 300 charge-discharge cycles, compared to significantly decreased efficiency after 150 cycles for batteries treated with lithium nitrate alone, said Fiona (Weiyang) Li, a postdoctoral researcher in Cui's lab and first author of the paper.

Yet-Ming Chiang, a professor at the Massachusetts Institute of Technology, collaborated with the team and helped them interpret their results. He said the next step is to see if this approach can prevent dendrite formation in larger-scale cells that are closer to being practical batteries. It may also work for electrodes made of other metals, such as magnesium, calcium or aluminium, that also have potential for storing much more energy than today's batteries.

Image credit: W. Li et al, Nature Communications

NEW BORON COMPOUNDS FOR OLEDS

Scientists at Gothe University have developed a new class of organic luminescent materials through the targeted introduction of boron atoms into their molecular structures. The compounds feature an intensive blue fluorescence and are therefore of interest for use in organic light-emitting diodes (OLEDs).

Carbon in the form of graphite conducts the electrical current in a similar way to a metal. In addition, its two-dimensional shape, the graphene layer, has extremely attractive optical and electronic properties. In graphene, countless benzene rings are fused to form a honeycomb structure. Sections of this structure, so-called nanographenes or polycyclic aromatic hydrocarbons (PAHs), constitute an important basis of organic electronics.

"For a long time, efforts were largely focused on affecting the properties of nanographenes by chemically manipulating their edges. However, in recent years, researchers have been increasingly capable of also modifying the inner structure by embedding foreign atoms in the carbon network. This is where boron assumes crucial significance," said Professor Matthias Wagner of the Institute for Inorganic and Analytical Chemistry at the Goethe University.

A comparison of the new boron-containing nanographenes with the analogous boron-free hydrocarbons verifies the fact that the boron atoms have a decisive impact on two key properties of an OLED luminophore: the fluorescence colour shifts into the highly desirable blue spectral range and the capacity to transport electrons is substantially improved. To date, only limited use could be made of the full potential of boron-containing PAHs, since most of the exponents are sensitive to air and moisture.

"This problem does not occur with our materials, which is important with regard to practical applications," said Valentin Hertz, who synthesised the compounds within the scope of his doctoral dissertation.

Hertz and Wagner anticipate that materials such as the graphene flakes they have developed will be particularly suitable for use in portable electronic devices. As film displays for future generations of smartphones and tablets, even large-scale screens could be rolled up or folded to save space when the devices are not in use.

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LED LIGHTING:

WHY THE CONNECTION COUNTS

Everywhere you turn, you can find LEDs in almost any lighting form factor, and connections are more challenging than a screw-in light bulb. Andrew Bogaczyk* of Phoenix Contact explains how to connect LEDs and why the connection counts.

LEDs continue to dominate the lighting marketplace; everywhere you turn, you can now find LEDs in almost any form factor. LEDs allow designers incredible flexibility when it comes to designing light and fixtures: the beauty of this simple technology is that you now have the ability to create numerous colours and designs.

The challenge comes in how to connect your fixture. Because an LED can be designed to look like anything, connections are no longer as simple as a screw-in light bulb. The connections must be flexible, like the LEDs themselves. We need connectors that can be placed in a variety of locations, and some may need to be wired in the field or in a factory.

There are also different types of PCBs used with LEDs. Some use a rigid or solid board made of FR4 or a metal core; these boards will only allow for processing on the top side of the PCB. Those that want even greater flexibility may choose the flex-strip LED boards, which allow the actual PCB to bend around corners and other structural design elements. Both of these applications require a unique type of connection to ensure maximum reliability.

The real value of LEDs is the lower power consumption and the long-lasting life of the light. Therefore, the connector we place on the fixture must be able to outlast the life of the luminaire itself. The connector will need to handle vibration, ambient temperature, humidity and mechanical security to the board.

Rigid or solid-core boards

The most common type of lighting in a building is probably the light above your head, known as downlighting. The purpose of downlighting is to cast illumination on objects below the luminaire. These fixtures are typically integrated into the ceiling, which is generally flat. A rigid or solid core board works perfectly.

The other (maybe more important) reason rigid boards are used is their ability to drive heat away from the LEDs. The biggest drain on LED life is heat. With proper design, the solid board, with a good heat sink on its back, can drive away heat.

Solid boards make great sense for LEDs, but when it comes to connecting power, there are some challenges. The first option is to directly solder wire to the PCB. Soldering requires someone who knows how to really step in and solder correctly. The challenge is that due to the small size of the fixtures, the soldering pads on the PCB may be too close together, and you don't want the wires to short from one position to the next.

There is also a concern about vibration and its effects on the solder joint. A crack in the solder joint could lead to excess resistance and cause the device to fail or, in a worst case, cause a fire. Soldering wires to the board also means eliminating the chance to repair later. If something goes wrong on the PCB, you will need to clip the wires and throw the module away.

Traditionally, connectors have been thru-hole components. The solder pins would go through the PCB, and a wave solder process would be used to secure the connectors to the PCB. With the proliferation of solid boards in lighting, these thru-hole connectors can no longer be used. The connector now must be mounted and soldered to the top side of the board through surface-mount technology (SMT).

SMT is more commonly used for other components on the board, such as ICs, but not commonly used for connectors. Connector manufacturers must create something that is field-wireable, but also mechanically secure enough to handle the force of wiring a connector. One good way to prevent the product from delaminating from the board is to utilise anchors on the side of the connector. Anchors supply no electrical contact and ensure these connectors are secure while taking stress off the electrically necessary solder joints.

Connector options for rigid boards

Once you've decided to connectorise your application, you must choose the style of connection you need - fixed or pluggable. A fixed connection means a one-piece connector that solders to the board and accepts the wire all in one block. Typically with this type of connector, you terminate the wire once and you're done. The wiring on the PCB is easy to access. Most fixed connectors are available so that wire entry can be horizontal, angled or vertical to the PCB.

Pluggable connectors are great when you need to troubleshoot your boards, swap modules or have a difficult-to-access wiring interface. With pluggable connections, you have two pieces - a plug connected to the wire and a header soldered to the PCB. Pluggable connectors also give you a lot of options when it comes to orientation of wire coming to the PCB. Header (board-mount side) can be mounted to the PCB horizontally or vertically. A few manufacturers also have a thru-board design that allows the plug to connect on the bottom side of the board, moving the connector mass below the PCB and away from the LEDs. The plug would then be wired and connected to the header.

Some manufacturers also allow you to use the same connector family to do board-to-board connections. When you have LED modules that you want to stack end to end, you can do it securely with a connector on each board and slide the modules together. There is a connector series that allows this to be done without the use of wires. Use an 'inverted' header (a header with plug-mating interface) with a standard header, and you can slide the connectors into each other without the need to wire the boards together.

Flex boards

LED lighting designers are getting more creative because of the flexibility LEDs offer. One of these options is the ability to use the flex-strip LEDs to allow lighting to wrap around almost anything. Many consumers are using these in their homes because of the simplicity of installation. Buy a kit, unwind the reel of LEDs, peel the adhesive off the back of the strip, stick the strip wherever you want and simply plug the strip into an outlet.

PLUGGABLE CONNECTORS ARE GREAT WHEN YOU NEED TO TROUBLESHOOT YOUR BOARDS, SWAP MODULES OR HAVE A DIFFICULT-TO-ACCESS WIRING INTERFACE.

But what happens if you are designing something beyond the at-home application? You'll need more than a standard reel of 16.4 feet, which is inexpensive and meant for light use. There is little concern if the product breaks, because the cost of the product is not high. When designing a product for a professional installation, however, you want everything to work all the time, as well as to look aesthetically pleasing.

The flexibility of these strips is actually a challenge. Combining circuitry and flexing was not always successful in the past. Engineers have created a valuable product with these flexible LEDs. The flexibility, however, makes it very difficult to find a connector that will do the job consistently. Directly soldering a wire is an option, but if any flex happens at the solder joint, the solder could crack and create significant resistance on the electrical connection.

There are a number of connectors available on the market that improve this process a bit by connecting with the solder pads without the solder. These connectors often have a pigtail of loose wires coming out of the backside of the flex-strip connector to allow for connections to power or RGB control. Connectors can be a great option here, but many of the connectors secure to the board with a pressure fit to the flex strip. This connection may not be enough to secure the connector to the board if the flex strip has any movement. To maintain a secure connection, there are connectors that have a locking pin that pierces through the flexible PCB. The pin does not damage any circuitry and ensures that the strip and the connector stay connected.

What's next for LEDs and connectors?

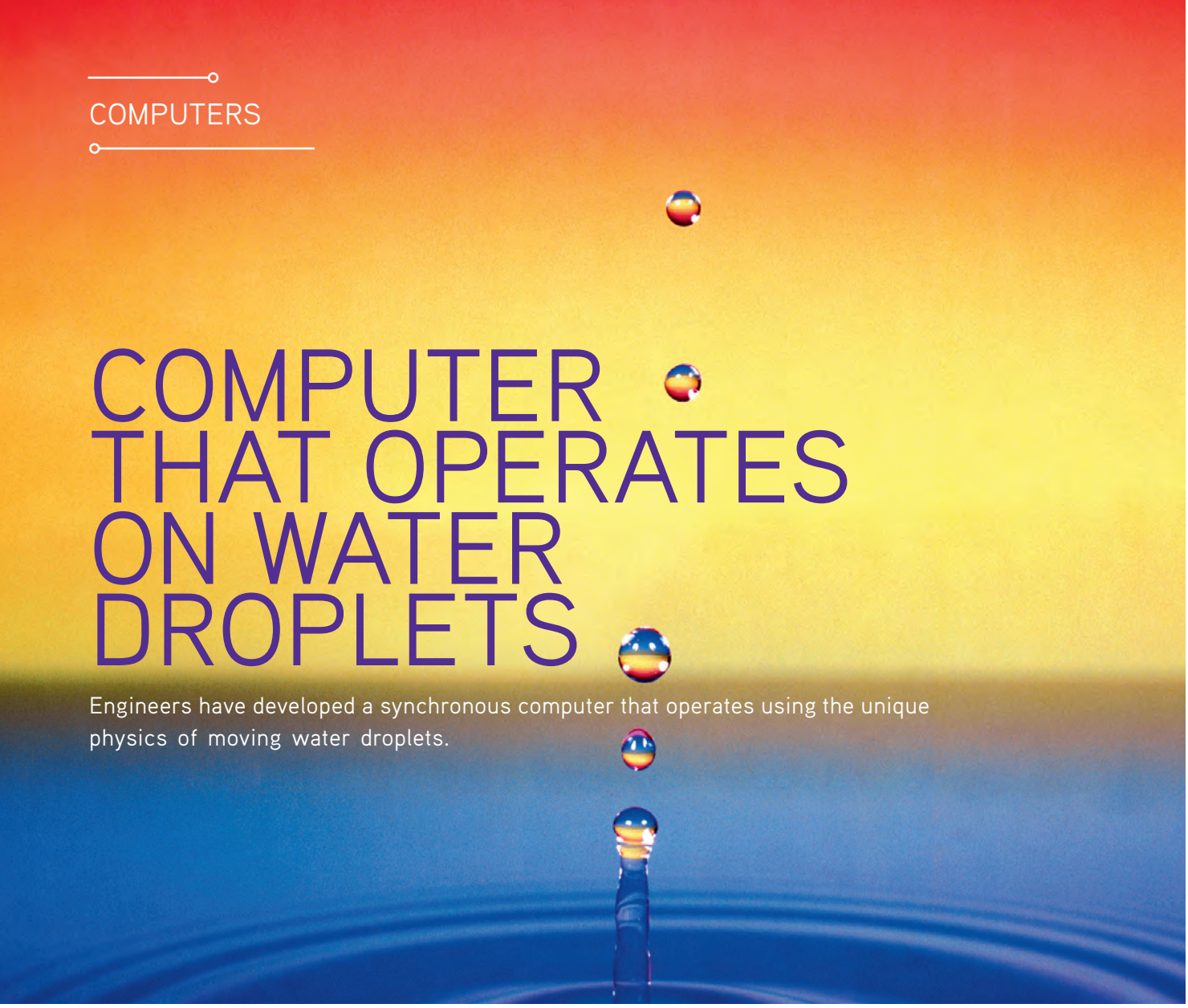
The LED lighting industry is moving forward fast and furious, and it seems that every year something new comes to the market. Connector manufacturers have to evolve with the market as well. A great connector introduced three years ago may be all but obsolete today, due to the incredibly high pace of technological advancements.

What is next for LEDs and what will they require of connector manufacturers? As buildings and facilities get smarter and more connected, will we see a need for more data connections to every light? As renewable energies continue their proliferation at business sites, will we begin to see a DC electrical system in the ceiling put in place for lighting? As LED lighting continues to evolve, will we ever get away from the Edison light bulb concept?

Some of these trends may be coming soon and some might be further off in the distance. One thing we do know is that LED lighting technology is constantly evolving. The connector industry is doing its best to keep up with new innovative connectors, allowing lighting engineers to create truly unique designs.

**Andrew Bogaczyk is a product marketing specialist, device connection technology, at Phoenix Contact USA Inc.*
For more information, please contact Robin Pearce, Bishop & Associates, via email at rpearce@bishopinc.com.

Bishop & Associates
www.connectorindustry.com



COMPUTER THAT OPERATES ON WATER DROPLETS

Engineers have developed a synchronous computer that operates using the unique physics of moving water droplets.

Computers and water typically don't mix, but in a Stanford bioengineer's lab, the two are one and the same. The computer is nearly a decade in the making, incubated from an idea that struck Manu Prakash, an assistant professor of bioengineering at Stanford, when he was a graduate student. The work combines his expertise in manipulating droplet fluid dynamics with a fundamental element of computer science — an operating clock.

Because of its universal nature, the droplet computer can theoretically perform any operation that a conventional electronic computer can crunch, although at significantly slower rates. Prakash and his colleagues, however, have a more ambitious application in mind. "We already have digital computers to process information. Our goal is not to compete with electronic computers or to operate word processors on this. Our goal is to build a completely new class of computers that can precisely control and manipulate physical matter. Imagine if when you run a set of computations that not only information is processed but physical matter is algorithmically manipulated as well. We have just made this possible at the mesoscale," said Prakash.

The ability to precisely control droplets using fluidic computation could have a number of applications in high-throughput biology and chemistry, and possibly new applications in scalable digital manufacturing.

Computer clocks are responsible for nearly every modern convenience. Smartphones, DVRs, airplanes, the internet — without a clock, none of these could operate without frequent and serious complications. Nearly every computer program requires several simultaneous operations, each conducted in a perfect step-by-step manner. A clock makes sure that these operations start and stop at the same times, thus ensuring that the information synchronises.

The results are dire if a clock isn't present. It's like soldiers marching in formation: if one person falls dramatically out of time, it won't be long before the whole group falls apart. The same is true if multiple simultaneous computer operations run without a clock to synchronise them, Prakash explained.

A magnetic clock

Developing a clock for a fluid-based computer required some creative thinking. It needed to be easy to manipulate and also able to influence multiple droplets at a time. The system needed to be scalable so that in the future, a large number of droplets could communicate amongst each other without skipping a beat. Prakash realised that a rotating magnetic field might do the trick.

Prakash and graduate student Georgios 'Yorgos' Katsikis built arrays of tiny iron bars on glass slides that look something like a Pac-Man maze. They laid a blank glass slide on top and sandwiched a layer of oil in between. Then they carefully injected into the mix individual water droplets that had been infused with tiny magnetic nanoparticles.

Next, they turned on the magnetic field. Every time the field flips, the polarity of the bars reverses, drawing the magnetised droplets in a new, predetermined direction, like slot cars on a track. Every rotation of the field counts as one clock cycle, like a second hand making a full circle on a clock face, and every drop marches exactly one step forward with each cycle.

Stanford Assistant Professor Manu Prakash, left, and graduate students Jim Cybulski and Georgios Katsikis developed the water drop computer.

A camera records the interactions between individual droplets, allowing observation of computation as it occurs in real time. The presence or absence of a droplet represents the 1s and 0s of binary code, and the clock ensures that all the droplets move in perfect synchrony, thus the system can run virtually forever without any errors.

"Following these rules, we've demonstrated that we can make all the universal logic gates used in electronics, simply by changing the layout of the bars on the chip," said Katsikis. "The actual design space in our platform is incredibly rich. Give us any Boolean logic circuit in the world and we can build it with these little magnetic droplets moving around."

The results have been published in *Nature Physics*. The current paper describes the fundamental operating regime of the system and demonstrates building blocks for synchronous logic gates, feedback and cascadability — hallmarks of scalable computation. A simple-state machine including 1-bit memory storage (known as 'flip-flop') is also demonstrated using the above basic building blocks.

Manipulating matter

The current chips are about half the size of a postage stamp, and the droplets are smaller than poppy seeds, but Katsikis said that the physics of the system suggests it can be made even smaller. Combined with the fact that the magnetic field can control millions of droplets simultaneously, this makes the system exceptionally scalable.

"We can keep making it smaller and smaller so that it can do more operations per time, so that it can work with smaller droplet sizes and do more ... operations on a chip," said graduate student and co-author Jim Cybulski. "That lends itself very well to a variety of applications."

Prakash said the most immediate application might involve turning the computer into a high-throughput chemistry and biology laboratory. Instead of running reactions in bulk test tubes, each droplet can carry some chemicals and become its own test tube, and the droplet computer offers unprecedented control over these interactions.

From the perspective of basic science, part of why the work is so exciting, Prakash said, is that it opens up a new way of thinking of computation in the physical world. Although the physics of computation has been previously applied to understand the limits of computation, the physical aspects of bits of information have never been exploited as a new way to manipulate matter at the mesoscale (10 microns to 1 millimetre).

Because the system is extremely robust and the team has uncovered universal design rules, Prakash plans to make a design tool for these droplet circuits available to the public.

FANLESS EMBEDDED BOX PC

Sintrones' SBOX-2600 Series is a rugged and compact industrial computer. The ultraslim embedded box system features a 4th generation Intel Celeron 2980U up to Core i7 4650U, which helps to reduce power consumption with space efficiency. The processor is said to provide the PC with higher performance when compared with Atom E3845. It also provides to support 4K2K resolution displays and optional RAID 0, 1, 5 for storage solutions.

The fanless embedded system is capable of noiseless operation and offers good performance with a wide operating temperature. This allows the system to withstand extreme working conditions and harsh environments within -30 to +60°C.

The series is designed with 9-32 VDC power input to avoid damage of electric components caused by incorrect charging current and thus ensures overcurrent protection, overvoltage protection and reverse polarity protection. This enhances the security level and helps the embedded box PC to meet the needs of various applications.

The series is suitable for industrial controllers, panel systems and industrial automation. Its powerful performance, dual display output and compact size make the product especially suitable for digital signage and interactive kiosks.

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FANLESS INDUSTRIAL PANEL PC

IEI Integration's flat-bezel industrial panel PC with expansion slot, the PPC-5152-D525-E, is based on the Intel Atom D525 1.8 GHz dual-core processor. It is suitable for industrial, commercial and hospitality applications.

The fanless panel PC can support up to 4 GB DDR3 SO-DIMM. It features a robust, ultraslim, aluminium front bezel and 5-wire resistive touch screen.

The product provides a flexible expansion interface with two PCI slots or one PCI slot + one PCIe slot. The LCD panel PC features multi I/O like 2x RJ45 gigabit LAN ports, 2x USB3.0, 2x USB2.0, 2x RS232, 1x RS232 or RS422/485, 2x RS422/485 (RJ45 connector) and 1x VGA connector.

The PC meets the IP64 environmental rating, providing resistance to dust and liquid ingress, and can be used in wide operating temperatures from -20 to +50°C. It supports one 2.5″ SATA HDD/SSD and a CF Type II socket for data storage.

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www.icp-australia.com.au

PHASE NOISE ANALYSER AND VCO TESTER

The FSWP phase noise analyser and VCO tester from Rohde & Schwarz enables ultrasensitive and ultrafast phase noise measurements. It also allows users to easily measure pulsed sources and residual phase noise of RF components. The instrument can be upgraded to a signal and spectrum analyser.

The phase noise tester is said to enable users to measure the spectral purity of signal sources such as generators, synthesisers and voltage-controlled oscillators (VCOs) more quickly than with other products. The instrument covers a frequency range up to 50 GHz and offers a good dynamic range. The low phase noise of its local oscillator, coupled with cross-correlation, makes it possible to easily measure signal sources that in the past required complex test set-ups or could not be measured at all.

Due to its fully digital signal processing, the product performs complex measurements at the push of a button and features intuitive touch-screen operation. It can quickly and easily measure the phase noise of pulsed sources, as well as residual phase noise, under pulsed conditions. The device is therefore suitable for aerospace, defence and automotive applications, eg, for manufacturers of radar components and synthesisers. Its additional voltage sources also make the product suited to measuring VCOs in research and development and, due to its high measurement speed, in production.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com

HANDHELD ENCLOSURES WITH INTEGRATED CABLE GLANDS

Integrated cable glands are now available on OKW's SMART-CASE range of handheld enclosures. They help to protect the cable as well as further enhancing the aesthetics of the range.

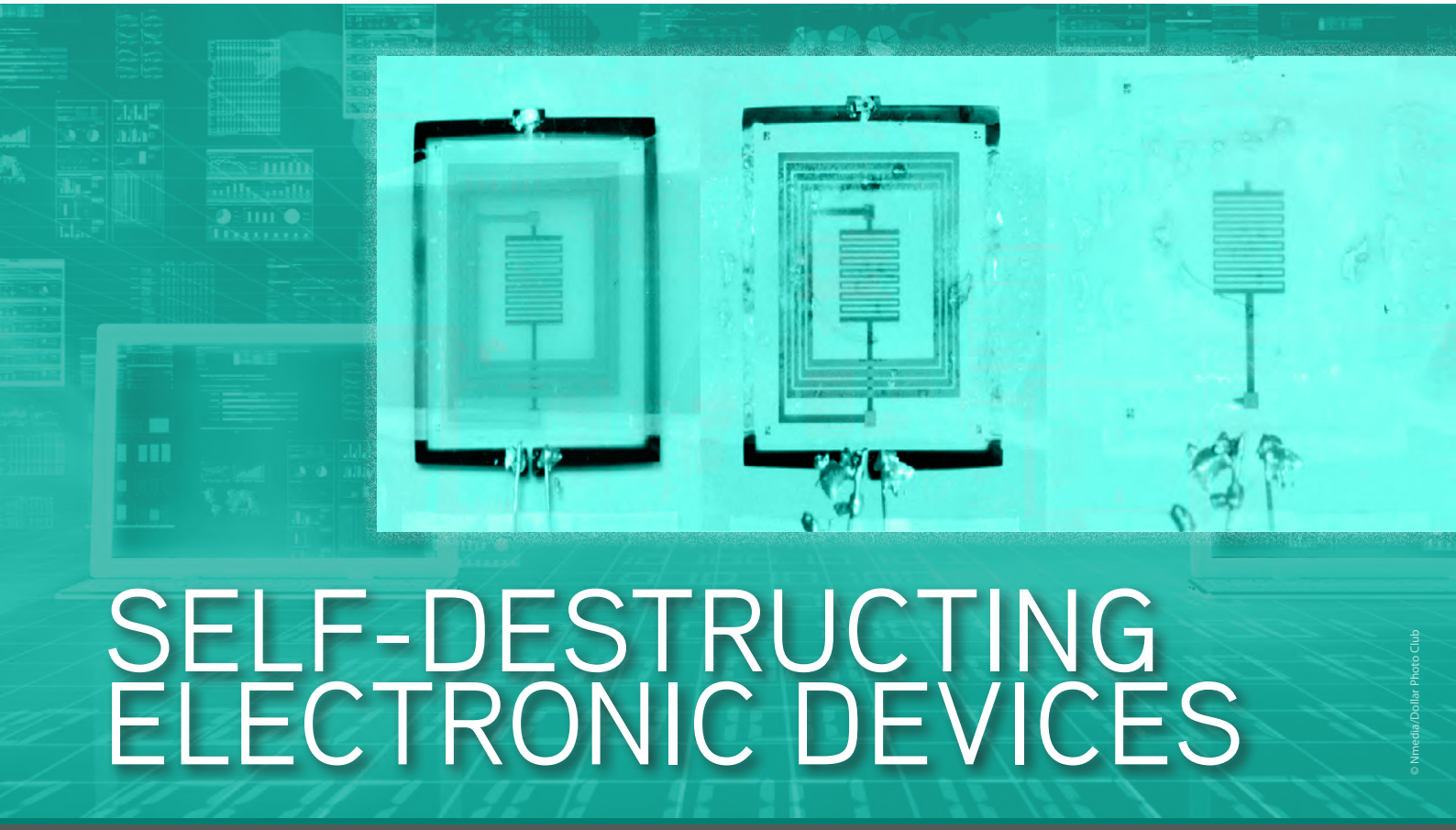
Integrated cable glands can be specified for three of the four models (M, L, XL). The glands are available for cable sizes 3.4-4.2, 4.2-5 and 5-5.9 mm and come in either grey or black to match the housings' colours of off-white and black.

The enclosures can be specified for all types of remote control applications, either wireless or with a cable connection. They are suitable for a wide range of sectors, including medical/wellness, social care, industry and household applications.

SMART-CASE is manufactured from ABS or PMMA (for infrared applications). The protection rating is IP40 for size XS, IP41 for size M and IP65 (with optional sealing kit) for sizes L and XL. Features include ergonomic design for comfort plus a wide recess for mounting a membrane keypad.

OKW offers a wide range of accessories, including battery contacts (AA, AAA and 9 V), sealing kits, belt clips, key ring, ring eyelet, hand strap, lanyard, wall holders, bed clamps, desk station and the 4-K in-vehicle holding system. Customisation services include bespoke colours, CNC milling and drilling, EMC shielding and silk screen, and tampo printing of legends and logos.

ROLEC OKW Australia New Zealand Pty Ltd
www.rolec-okw.com.au



SELF-DESTRUCTING ELECTRONIC DEVICES

University of Illinois researchers have developed heat-triggered self-destructing electronic devices, a step towards greatly reducing electronic waste and boosting sustainability in device manufacturing.

The researchers have also developed a radio-controlled trigger that could remotely activate self-destruction on demand.

"We have demonstrated electronics that are there when you need them and gone when you don't need them anymore," said Aerospace Engineering Professor Scott R White, who led the research.

"This is a way of creating sustainability in the materials that are used in modern-day electronics. This was our first attempt to use an environmental stimulus to trigger destruction."

The heat-triggered devices use magnesium circuits printed on very thin, flexible materials. The researchers trap microscopic droplets of a weak acid in wax and coat the devices with the wax. When the devices are heated, the wax melts, releasing the acid. The acid dissolves the device quickly and completely.

To remotely trigger the reaction, researchers embedded a radiofrequency receiver and an inductive heating coil in the device. The user can send a signal to cause the coil to heat up, which melts the wax and dissolves the device.

The findings have been published in the journal *Advanced Materials*. White's group teamed up with John A Rogers, a Swanlund chair in materials science and engineering and director of the Frederick Seitz Materials Laboratory at Illinois. Rogers' group pioneered transient devices that dissolve in water, with applications for biomedical implants. Together, the two multidisciplinary research groups have tackled the problem of using other triggers to break down devices, including ultraviolet light, heat and mechanical stress.

The goal is to find ways to disintegrate the devices so that manufacturers can recycle costly materials from used or obsolete devices or so that the devices could break down in a landfill.

"This work demonstrates the extent to which clever chemistries can qualitatively expand the breadth of mechanisms in transience, and therefore the range of potential applications," Rogers said.

The researchers can control how fast the device degrades by tuning the thickness of the wax, the concentration of the acid and the temperature. They can design a device to self-destruct within 20 seconds to a couple of minutes after heat is applied.

The devices also can degrade in steps by encasing different parts in waxes with different melting temperatures. This gives more precise control over which parts of a device are operative, creating possibilities for sophisticated devices that can sense something in the environment and respond to it.

White's group has long been concerned with device sustainability and has pioneered methods of self-healing to extend the life of materials.

"We took our ideas in terms of materials regeneration and flipped it 180°," White said. "If you can't keep using something, whether it's obsolete or just doesn't work anymore, we'd like to be able to bring it back to the building blocks of the material so you can recycle them when you're done, or if you can't recycle it, have it dissolve away and not sit around in landfills."

White and Rogers are both affiliated with the Beckman Institute for Advanced Science and Technology at the U. of I. The Defense Advanced Research Project Agency and the National Science Foundation supported this work.

ENCLOSURES FOR IPAD AIR TABLETS

OKW has added two iPad Air front panels to its Interface-Terminal multifunction electronic enclosures range, enabling the tablets to be securely mounted to walls or desks or in a robust, handheld enclosure to help prevent damage or even theft.

Both front panels have been designed to fit the Type I Interface-Terminal housing. They provide a tamper-resistant, IP40-rated housing and mounting solution for the viewing and operation of an iPad Air in communal locations such as museums, offices, factories, public buildings, laboratories and healthcare facilities.

The modular design gives engineers the choice of either mounting the iPad flat on a wall or desk or inclining it at an angle of 20° for more comfortable viewing and operation. Robust handheld units can also be configured.

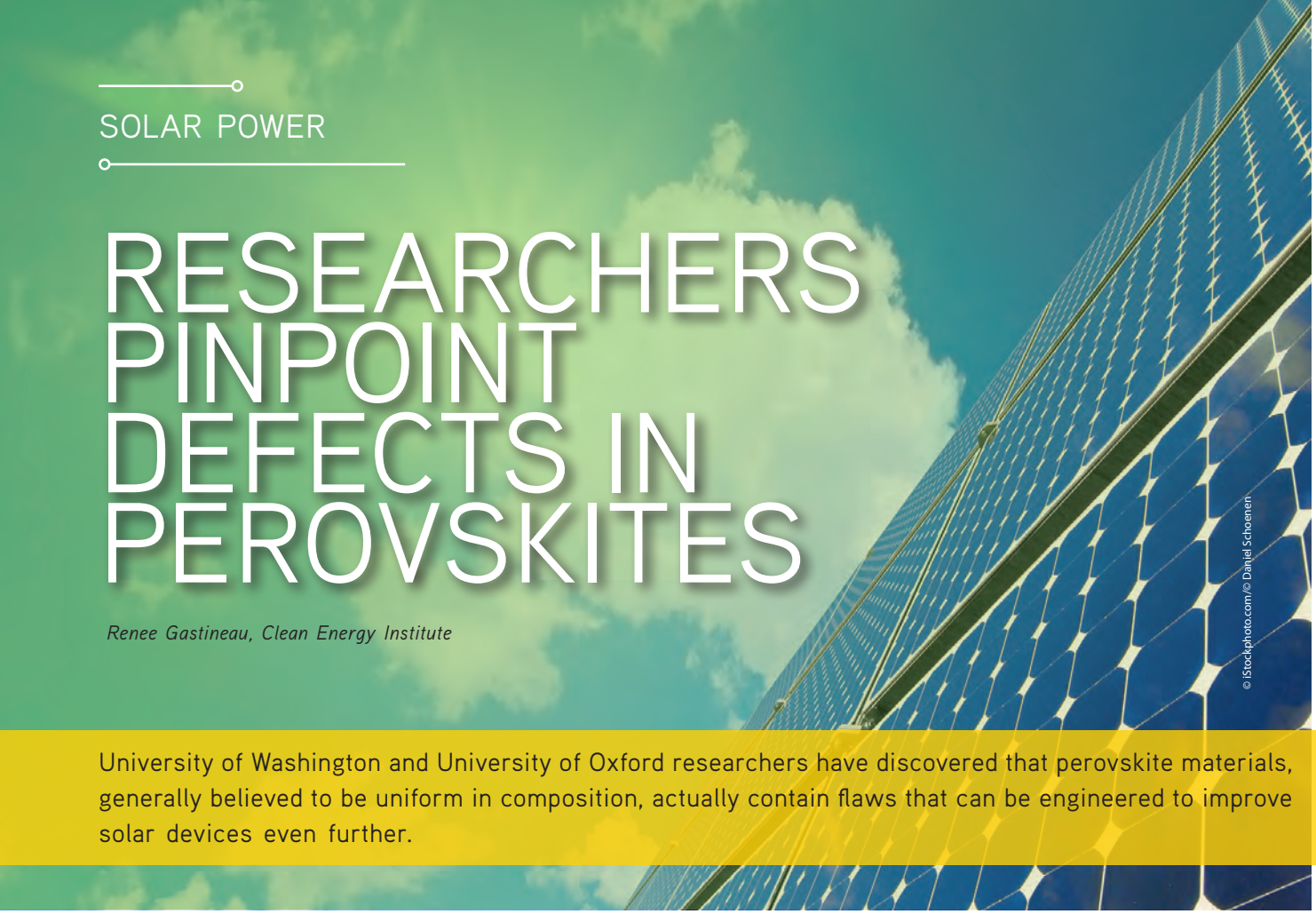
The front panels are available in matt anodised aluminium or ABS. The plastic panel is rated UL 94 HB. Its standard colour is off-white but custom colours can be specified. Both panels are supplied with two attachment strips and assembly kits.

Interface-Terminal's innovative modular format enables designers to specify high-quality, ergonomic standard enclosures that can be used as handheld units then transferred to vehicle-based mounting points or clipped into desk stations. They can also be wall mounted. All OKW enclosures can be customised with CNC milling and drilling, printing or engraving of legends and logos, bespoke colours, special finishes and assembly of components.

ROLEC OKW Australia New Zealand Pty Ltd
www.rolec-okw.com.au

RESEARCHERS PINPOINT DEFECTS IN PEROVSKITES

Renee Gastineau, Clean Energy Institute



University of Washington and University of Oxford researchers have discovered that perovskite materials, generally believed to be uniform in composition, actually contain flaws that can be engineered to improve solar devices even further.

"Perovskites are the fastest-growing class of photovoltaic material over the past four years," said lead author Dane deQuilettes, a UW doctoral student working with David Ginger, professor of chemistry and associate director of the UW Clean Energy Institute.

"In that short amount of time, the ability of these materials to convert sunlight directly into electricity is approaching that of today's silicon-based solar cells, rivalling technology that took 50 years to develop," deQuilettes said. "But we also suspect there is room for improvement."

The research team used high-powered imaging techniques to find defects in the perovskite films that limit the movement of charges and, therefore, limit the efficiency of the devices. Perovskite solar cells have so far have achieved efficiencies of roughly 20%, compared to about 25% for silicon-based solar cells.

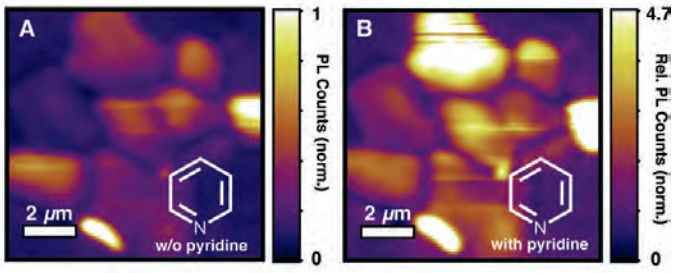
In a collaboration made possible by the Clean Energy Institute, the team used a technique called confocal optical microscopy, which is more often used in biology, and applied it to semiconductor technology. They used fluorescent images and correlated them with electron microscopy images to find 'dark' or poorly performing regions of the perovskite material at intersections of the crystals. In addition, they discovered that they could 'turn on' some of the dark areas by using a simple chemical treatment.

The images offered several surprises but also will lead to accelerated improvements in the materials' uniformity, stability and efficiency, according to corresponding author Ginger, the Alvin L. and Verla R. Kwiram Endowed Professor of Chemistry and Washington Research Foundation Distinguished Scholar.

"Surprisingly, this result shows that even what are being called good or highly efficient perovskite films today still are 'bad' compared to what they could be. This provides a clear target for future researchers seeking to improve and grow the materials," Ginger said.

The imaging technique developed by the UW team also offers an easy way to identify previously undiscovered flaws in perovskite materials and to pinpoint areas where their composition can be chemically altered to boost performance, Ginger said.

deQuilettes, who spearheaded the project as a Clean Energy Institute graduate fellow, estimates there are more than a thousand laboratories around the world currently researching the semiconducting properties of perovskite materials. Yet there is more work to be done to understand how to consistently make a material that is stable, has uniform brightness and can stand up to moisture without degrading. The UW research offers new ways for people to think strategically about how to improve the materials and how to extend their applications to high-performance light-emitting devices such as LEDs and lasers.

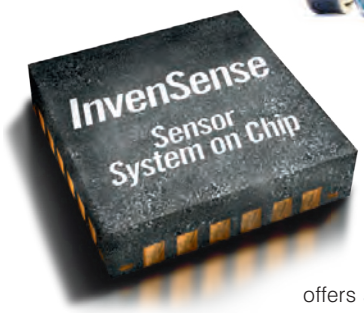


The quality of the perovskite materials for electronic device applications improved after chemical treatment, remediating the 'dark' areas. Image courtesy of University of Washington.

"There are so many of us focusing on perovskites, so hopefully this technique will offer some new direction and steer us toward the places we can look to optimise their energy-capturing and emitting potential," deQuilettes said.

Co-authors of the study are Sarah M Vorpahl, Hirokazu Nagaoka and Mark E Ziffer of the UW and Samuel D Stranks, Giles E Eperon and Henry J Snaith at Oxford.

Funding for the research was provided by the state of Washington through the UW Clean Energy Institute.



6-AXIS MOTION SENSOR FOR WRIST-WORN DEVICES

The MPU-6555 is InvenSense's 6-axis (3-axis gyroscope + 3-axis accelerometer) activity detection device, working in conjunction with its Automatic Activity Recognition library (AAR) in a 3 x 3 x 0.9 mm (24-pin QFN) package. The product is suitable for Smart Watch, Smart Band and Fitness Tracker applications.

The unit uses data calculated on the on-chip DMP (digital motion processor) to recognise new activities typically within 10 s and with 95% accuracy for true positives. The AAR library offers a pedometer that benefits from the awareness of knowing which activities will require steps and which will not, as well as elevation tracking. The library is optimised to recognise the user's 'persistent' activity, making it useful for cataloguing the user's daily fitness level.

The product also features a 512 B FIFO that can lower the traffic on the serial bus interface and reduce power consumption. With its dedicated I²C sensor bus, the device directly accepts inputs from external I²C devices. It is also designed to interface with multiple non-inertial digital sensors, such as pressure sensors, on its auxiliary I²C port.

The gyroscope has a programmable full-scale range of ±250, ±500, ±1000 and ±2000 degrees/s and low rate noise at 0.01 dps/√Hz. The accelerometer has a user-programmable accelerometer full-scale range of ±2, ±4, ±8 and ±16 g. Factory-calibrated initial sensitivity of both sensors reduces production-line calibration requirements. Other features include on-chip 16-bit ADCs, programmable digital filters, a precision clock with 1% drift from -40 to 85°C, an embedded temperature sensor and programmable interrupts.

Glyn Ltd
www.glyn.co.nz

GET CHARGED UP FOR TAITRONICS 2015

Lauren Davis

Electronics enthusiasts from all over the world will soon be swarming to Taitronics 2015 — the 41st Taipei International Electronics Show. The annual event is organised by the Taiwan External Trade Development Council (TAITRA), founded in 1970 to help promote foreign trade.

To be held from 6-9 October at the Taipei Nangang Exhibition Center, Taiwan, the exhibition last year attracted over 45,000 attendees from 90 different countries. This year's show promises to be just as exciting, with over 350 exhibitors already signed up to showcase their latest and most innovative products in the following categories:

- Active and passive components
- Electronic components and parts
- Meters and instruments
- LED lighting and applications
- Cells, batteries and power supplies
- Industrial process and automation equipment
- Smart living and consumer electronics
- Broadband products and cloud tech
- Semiconductors (new)
- Electrical energy (new)

Green energy

In order to enhance environmental awareness and lead smart mobile trends, the year's exhibition theme is 'Green Electronics, Smart Living'. Clean technology will thus play a significant role for several exhibitors, with lighting company OmniTronix set to showcase its extensive LED range.

The company concentrates on producing high-quality products with first-class technical properties, operating under the understanding that the rising popularity of LEDs does not necessarily translate to a rise in quality. As a result, OmniTronix ensures that its products have achieved ENEC — a European Mark for electrical products that demonstrates compliance with European standards. The company's range includes electronic ballasts, emergency light insert units, electronic converters for metal halide lamps, LED drivers, electronic transformers for low-voltage halogen lamps, dimmers and complex light-controlling units.

Resistor manufacturer TY-OHM Electronics has similarly become prominent in the clean tech space, with increasing demand for its SMD power chip resistors in Europe as the popularity of green energy increases (in fact, the company has a high demand for all its products, with a production capacity of over 150 million pieces per month). All TY-OHM resistors are RoHS compliant and halogen free, and can be designed according to customers' specifications. The company also complies with ISO-14001 Environmental Management System requirements in order to improve its environmental performance.

KS Terminals (KST), a producer of automotive connectors, electrical terminals, tools and machines, is also looking towards a green energy future. Its EV connector VCPGS2A/VCSS2A, for example, is a charging gun for pure and hybrid electric vehicles. The product has recently passed the 5000 N driveover test and been certified by TUV. The company's other green energy solutions include PV cables, PV connectors and junction boxes.

Test and measurement

Electrical safety testing expert Chroma produces a range of LED and EV testing devices, as well as power, battery and video/LCM testing equipment. The company is particularly proud of its solar

Where: Taipei Nangang Exhibition Center, Hall 1, No.1, Jingmao 2nd Rd, Nangang District, Taipei, Taiwan
When: 6-9 October
Registration: www.taitronics.tw

array simulator, which replicates various sun/cloud conditions for PV inverter testing and thus serves as a more accurate alternative to real solar arrays in unreliable weather conditions. Taitronics will see the company exhibit its Model 63200A and 63600 electronic loads, its Model 66203/66204 power meter and its Model 61800 regenerative grid simulator.

GW Instek will meanwhile be displaying its wide range of high-precision electronic test and measurement instruments. New in 2015 is the APS-7000 Series programmable AC power source — a series which comprises nine test and measurement functions and provides a user interface similar to that of an AC power meter. The company has additionally released the PSW-Series programmable switching DC power supply — a series of 15 models which allow for the flexible and efficient configuration of voltage and current within the rated power range.

Of course, testing is a vital part of any company's operations, and the exhibitors are no exception. With a particular focus on the automotive market, KST places a high level of importance on quality assurance (QA) — as such, all its products go through extensive electrical, mechanical and environmental testing, in order to simulate driving conditions. This includes tests for chemicals, salt spray, high-pressure water spray, ozone ageing, rain, temperature, humidity, dust, extreme weather and ageing.

Protection and safety

SFI Electronics will be showcasing its overvoltage protection components, which protect against transient pulse types such as ESD, surge and load dump. Its products include chip surge protection devices, smartphone overvoltage protection devices and network protection devices. The company boasts the use of nanotechnology to develop its multilayer SMD varistors, which is said to bring a higher overvoltage capability to the components.

EXCEL CELL ELECTRONIC (ECE) will exhibit its array of electro-mechanical components, with products including switches, terminal blocks, connectors, relays for home appliances and electronic control modules. Following its purchase of Goodsky in 2005, the company has released relays which are both fire retardant and halogen free — features which are particularly important to ECE clients operating in the home appliance sector. If one of the company's relays happens to short circuit, the resulting high temperature will cause it to melt — rather than burst into flames.

Power supply provider Mean Well will promote its RST-1000 10,000 W AC-DC Power Supply — claimed to be the highest power unit in the industry — which includes short circuit, overload, over-voltage, fan alarm and overtemperature protection. The company will also showcase its GST Level VI Power Adaptors, which are able to work for 24 consecutive hours without getting hot. Mean Well prides itself on having power supplies which comply with international safety certification. If a customer returns a faulty product, the company will repair it and keep a record of the return, in order to ensure that model isn't constantly developing the same faults.

Innovation

Particularly inventive companies will be recognised at Taitronics 2015 with the annual Technology Innovation Awards, which every year honour the outstanding R&D work of electronics manufacturers. SFI Electronics last year won the Gold Innovation Award for its CSPD (Chip Surge Protection Device), a kind of surface-mount surge voltage protector. The device is claimed by the company to have better nonlinear ohm, with higher withstanding peak current, compared to conventional products.

GW Instek also won a Gold Award for its GDS-300/200 Series compact oscilloscopes, with 200/100/70 MHz bandwidth selection and a 1 GSa/s sample rate. Other features include a built-in engineering calculator, SMD resistance coding, colour-coding information and attenuator calculation software.

Also in 2014, a Quality Award was presented to Mean Well for its 600 W waterproof power supply HLG-600/HEP-600. The HEP-600 is an industrial AC/DC power supply capable of operating under humid, dusty, oily and high-vibration environments. Applications for the product include outdoor telecoms equipment, outdoor electronic boards, petroleum-related facilities and EV charging stations.

It won't be surprising to learn that the Taitronics exhibitors invest a substantial amount of resources in R&D, with many designing their own manufacturing equipment as well as their own products. For example, Chroma employs 39% of its staff, and spends 15% of its revenue, in the field of R&D. ECE, meanwhile, devotes 70-80% of its engineers and 5% of its annual revenue to the design of its products and production equipment.

The show is open to the public, and overseas attendees can pre-register online for free entry. For more information on the show, including assistance and subsidy opportunities, contact Taiwan Trade Centre, Sydney on 61-2-9231 5959 or visit https://www.taitronics.tw/.

new PRODUCTS

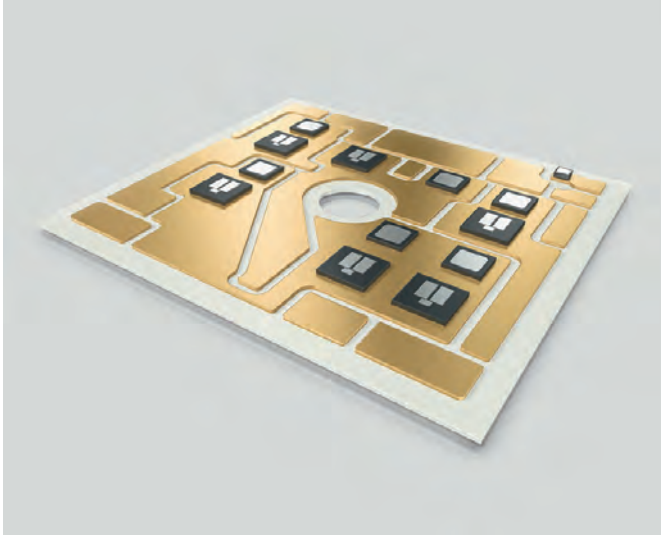
4-20 mA JOYSTICK

Control Devices has developed a 4-20 mA joystick controller featuring single- and dual-axis outputs, transient protection and redundant outputs.

The output can be configured as full swing 4-12-20 or 4-20 mA per quadrant. There are several output options available and the basic joystick comes with MOSFET directional switches.

The joystick can be delivered with handles with single or multiple switching options and can include the company's capacitive sensing handle for person-present sensing. A number of connecting options are offered, including flying lead or M12, and the base of the joystick is fully enclosed in a metal canister.

Control Devices Australia
www.controldevices.net



SILICON CARBIDE POWER MODULES

SEMIKRON offers full silicon carbide power modules in MiniSKiiP, SEMITOP and SEMITRANS housings, as well as hybrid silicon carbide modules in SEMITRANS and SkiM63/93 packages. SiC MOSFETs enable high output power and power densities to be reached, in combination with high switching frequencies, low losses and good efficiency.

Through the increase in switching frequency, passive filter components can be reduced drastically. Power losses are reduced at the same time, which leads to smaller heat sinks and less cooling effort in general. Both benefits result in a decrease in system cost.

The full silicon carbide power modules are available from 20 to 540 A in 1200 V, with or without an anti-parallel, free-wheeling Schottky diode. The hybrid silicon carbide power modules are available from 8 to 450 A in 1200 V.

Covered topologies are six-packs in the classic configuration but are also available with a split output to enable flexible adaption to the user's application. Further half bridges and boost converters, including a bypass diode, are available.

Semikron Pty Ltd
www.semikron.com

EMBEDDED CONTROLLER

The AEC-6402 ultracompact embedded controller, from Aaeon, is a fanless embedded computer measuring 20 mm thick with a good amount of processing power. It is suitable for computing applications where space constraints are a major issue.

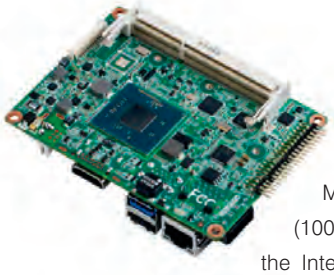
The device uses an energy-efficient Intel Atom N2600 1.60 GHz processor and Intel NM10 Chipset with up to 2 GB of DDR3 1066 SDRAM. It provides a 12 VDC power input, two USB 2.0 ports, two Gigabit Ethernet ports, one CAN Bus port and two RS232/422/485 serial ports. RJ45 connectors are used for all ethernet and serial connections.

Measuring 136 x 79.6 x 20 mm, the solid brushed aluminium enclosure is rugged, vibration resistant and lightweight. With appropriate airflow, the device can operate in temperatures ranging from 0 to 50°C. DIN-rail and VESA mounting options allow the product to be installed in almost any location.

The unit supports half-size mini-SATA solid-state drives for data storage and a mini HDMI link for high-definition multimedia output. An optional wireless network module is also available. System integrators working with factory/machine automation, digital signage, home automation, in-vehicle computing, environment monitoring and surveillance will appreciate the controller's compact and efficient design.

http://www.ieci.com.au/products/product_page2.asp?Product_ID=7654&Class=35&PCat=337&Title=AEC-6402

Interworld Electronics and Computer Industries
www.ieci.com.au



SINGLE-BOARD COMPUTER

Advantech has announced the MIO-2263 SBC in a 2.5″ Pico-ITX (100 x 72 mm) form factor. Based on the Intel Atom processor E3800 product family, the system-on-chip (SoC) is designed for intelligent systems with quad core computing and high graphics and media performance. It offers low maintenance and a long life cycle.

The SBC is designed for wide temperature ranges of -40 to 85°C. The product incorporates built-in Intel AES New Instructions to enhance security and enable fast data encryption and decryption. It has a low thermal design power range (6 to 10 W) and comes equipped with a flexible multiple I/O interface (MIOe expansion slot) which can extend additional functions easily, even in a tiny space.

With its ultraslim size, fanless design and improved media and graphics performance, the product is suitable for graphics, imaging and video-intensive applications for embedded intelligent systems in the medical, automation, military and transportation and industries. These may include image processing, digital signage with secure delivery, interactive clients with high I/O connectivity, industrial control systems and portable devices.

Advantech Australia Pty Ltd
www.advantech.net.au

AC/DC CURRENT PROBE

The Fluke 80i-110s provides high-accuracy measurements for a wide range of applications involving electric, electronic and automotive circuits. It is available to rent from TechRentals.

Common uses include: work safety in industrial and commercial power distribution systems; measuring DC currents in an uninterruptible power supply (UPS) that uses a battery backup system; and leakage currents from discharging car batteries.

The design of the current probe means it can be used around adjustable speed motor drives and ignition systems without noise distortion. It also pairs well with oscilloscopes for accurate waveform measurements, and its narrow jaw profile makes it easily manoeuvrable in small spaces.

Other features include: shielding for high noise immunity; 600 Vrms rating; a measurement range of 50 mA to 100 A; and a band frequency response from DC to 100 kHz.

TechRentals
www.techrentals.com.au

Image courtesy of 24M

START-UP REINVENTS LITHIUM-ION BATTERY MANUFACTURING PROCESS

David L Chandler, MIT News Office

A new manufacturing approach for lithium-ion batteries is said to significantly reduce the manufacturing cost.

The new battery design, developed by researchers at MIT and at spinoff company 24M, is a hybrid between flow batteries and conventional solid ones — in this version, while the electrode material does not flow, it is composed of a similar semisolid, colloidal suspension of particles.

The approach is based on a concept developed five years ago by Yet-Ming Chiang, the Kyocera Professor of Ceramics at MIT and colleagues including W Craig Carter, the POSCO Professor of Materials Science and Engineering. In this so-called 'flow battery', the electrodes are suspensions of tiny particles carried by a liquid and pumped through various compartments of the battery.

This approach greatly simplifies manufacturing, and also makes batteries that are flexible and resistant to damage, said Chiang, who is senior author of a paper in the *Journal of Power Sources* analysing the trade-offs involved in choosing between solid and flow-type batteries, depending on their particular applications and chemical components.

This analysis demonstrates that while a flow-battery system is appropriate for battery chemistries with a low energy density (those that can only store a limited amount of energy for a given weight), for high-energy-density devices such as lithium-ion batteries, the extra complexity and components of a flow system would add unnecessary extra cost.

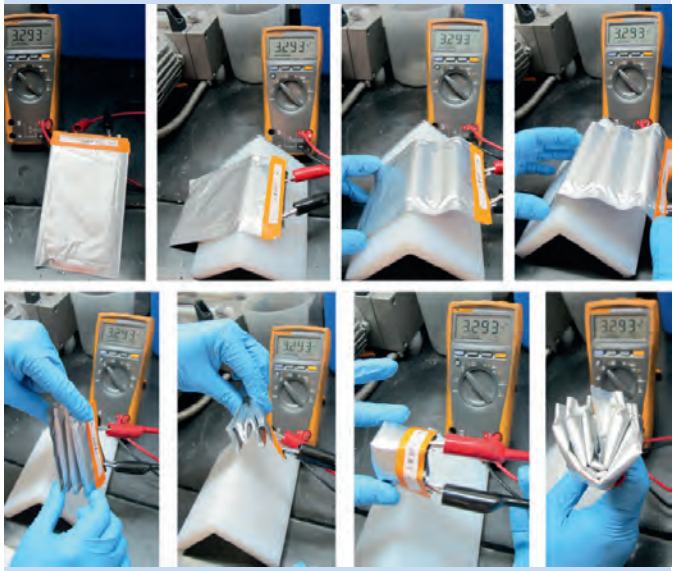
Almost immediately after publishing the earlier research on the flow battery, Chiang said, "We realised that a better way to make use of this flowable electrode technology was to reinvent the [lithium-ion] manufacturing process."

Instead of the standard method of applying liquid coatings to a roll of backing material, and then having to wait for that material to dry before it can move to the next manufacturing step, the new process keeps the electrode material in a liquid state and requires no drying stage at all. Using fewer, thicker electrodes, the system reduces the conventional battery architecture's number of distinct layers, as well as the amount of non-functional material in the structure, by 80%.

Having the electrode in the form of tiny suspended particles instead of consolidated slabs greatly reduces the path length for charged particles as they move through the material — a property known as 'tortuosity'. A less tortuous path makes it possible to use thicker electrodes, which, in turn, simplifies production and lowers cost.

In addition to streamlining manufacturing enough to cut battery costs by half, Chiang said, the new system produces a battery that is more flexible and resilient. While conventional lithium-ion batteries are composed of brittle electrodes that can crack under stress, the new formulation produces battery cells that can be bent, folded or even penetrated by bullets without failing. This should improve both safety and durability, he said.

The company has so far made about 10,000 batteries on its prototype assembly lines, most of which are undergoing testing by three industrial partners, including an oil company in Thailand and Japanese



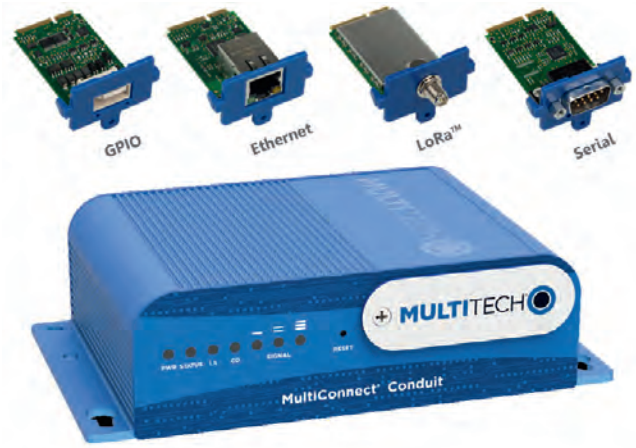
Unlike conventional, solid lithium-ion batteries, the new semisolid cells are flexible enough to be bent and folded multiple times without affecting their performance, as shown by the constant voltage readings in this test. Courtesy of 24M.

heavy-equipment manufacturer IHI Corp. The process has received eight patents and has 75 additional patents under review; 24M has raised $50 million in financing from venture capital firms and a US Department of Energy grant.

The company is initially focusing on grid-scale installations, used to help smooth out power loads and provide backup for renewable energy sources that produce intermittent output, such as wind and solar power. But Chiang said the technology is also well suited to applications where weight and volume are limited, such as in electric vehicles.

Another advantage of this approach, Chiang said, is that factories using the method can be scaled up by simply adding identical units. With traditional lithium-ion production, plants must be built at large scale from the beginning in order to keep down unit costs, so they require much larger initial capital expenditures. By 2020, Chiang estimates that 24M will be able to produce batteries for less than $100 per kWh of capacity.

In addition to Chiang, the Power Sources paper was co-authored by graduate student Brandon Hopkins, mechanical engineering professor Alexander Slocum and Kyle Smith of the University of Illinois at Urbana-Champaign. The work was supported by the US Department of Energy's Center for Energy Storage Research, based at Argonne National Laboratory in Illinois.



PROGRAMMABLE LORA GATEWAY FOR THE IOT

The MultiConnect Conduit MTCDT is a programmable industrial-grade IoT gateway embedded with a cellular LTE/3G option for Semtech LoRa-based wireless sensor networks. The product also features the Linux development platform and Node-RED development platform option.

The device is a configurable, manageable and scalable communication gateway for realising IoT applications. It is not a limited gateway for cellular connection, as developers could embed ethernet, Wi-Fi, Bluetooth, CAN, GPS or other technologies into the two accessories slots. By inserting two LoRa cards inside the gateway, developers could extend the LoRa infrastructure network for their applications.

LoRa technology is said to enable 10 times greater range than competing systems and the capacity to connect tens of thousands of nodes to a single gateway in a star architecture while maintaining low power consumption for multiyear battery operation. This combination of benefits enables IoT applications for smart cities, smart environments and other M2M applications.

Elecom Electronics Supply
www.elecomes.com

CONNECTOR FOR MEDICAL APPLICATIONS

The ODU MEDI-SNAP is a push-pull circular connector with a plastic housing for medical applications. The push-pull system is said to ensure reliable contact, colour coding makes the connector visually recognisable and the plastic housing material means the product remains economically efficient.

The connector has high chemical resistance, simple assembly, a light weight, 2000 mating cycles and designs that can be autoclaved and sterilised. It is used to monitor physical data, such as blood oxygen content, in applications such as intensive care and sports medicine, dental treatment devices, respiratory humidifiers and portable patient monitors.

ODU offers users the opportunity to create their own push-pull solutions. Simply select the number of contacts required in a plug or receptacle housing and then choose the cable OD for the cable collet and the colour of the front or back nut.

Clarke & Severn Electronics
www.clarke.com.au

THERMOCOUPLE INPUT MODULE

The Artila Electronics RIO-2018 is a web-enabled thermocouple input module. Powered by an ARM Cortex M3 processor and FreeRTOS operating system, the product features three thermocouple input channels, one 10/100 Mbps ethernet port, two isolated digital input channels and one relay output.

The unit is equipped with a MAXIM MAX31855 cold junction compensation thermocouple converter and an industrial-grade OMEGA connector is utilised to ensure a seamless signal connection. The converter resolves temperature to 0.25°C and allows readings as high as +1800°C and as low as -270°C. Open thermocouple fault detection is also built into the converter. The isolated digital input and relay output can be assigned to monitor external events and trigger alarms.

The product supports Modbus TCP industrial protocol, which makes it easy to integrate it into the user's automation project. For those people who want to develop their application software using the device, the Linux library AIOLib is available and features programmer-friendly APIs.

Micromax Specialists in Automation Pty Ltd
www.micromaxsa.com.au

PCI EXPRESS DIGITISER

ADLINK Technology has announced its high-speed PCI Express digitiser, the PCIe-9814, featuring four simultaneously sampled 80 MS/s input channels with 12-bit resolution, 40 MHz bandwidth and up to 1 GB DDR3 onboard memory. The product delivers high dynamic performance in 76 dB SFDR, 64 dB SNR and -75 dB THD, with up to 640 MBps data streaming and maximum optimisation for radar testing, power management monitoring and non-destructive testing.

The unit's 80 MS/s sampling and 40 MHz signal bandwidth meet the requirements of medium frequency (0.1 to 30 mHz) radar signal reception from IF radar receivers. The device provides external digital trigger input for synchronous trigger radar signalling and three extra synchronous digital inputs receive radar sync pulse signals or GPS IRIG-B code. This supports radar signal markers or synchronous time stamping.

The product's FPGA-based, 31-order FIR digital filter supports noise reduction when signal content is 20 MHz or less. Noise effects are reduced and signal visibility increased by rejecting out-of-band and background noise and unexpected high-frequency signals, all with no extra programming demands. The digital filter performs faster than on the host, with no host CPU bandwidth occupied.

The digitiser supports Windows 8 and Windows 7 operating systems and is fully compatible with third-party software. ADLINK's measurement APIs allow easy conversion of basic voltage/time measurement results with no need for extra programming.

ADLINK Technology Inc
www.adlinktech.com

SUPERCAPACITORS

CAP-XX has launched its Thinline series of single-cell supercapacitors. At 0.6 mm thick, the series was developed to address the size, weight and cost challenges of designing thin, sometimes disposable electronic devices for the Internet of Things (IoT).

To reduce thickness and manufacturing costs, CAP-XX increased the power and energy density in its electrode materials to deliver equivalent performance in about half the volume, and eliminated the folded edges and copper terminals that contribute to thickness in its standard supercapacitors. The Thinline supercapacitors benefit from a nanotechnology construction that stores electrical charge in engineered carbon electrodes on aluminium foil, to minimise resistance and maximise capacitance.

The series supports power requirements in IoT devices including wireless communication (Bluetooth, Bluetooth Smart, Zigbee, Z-Wave, Ant, active RFID), electronic paper and OLED displays, haptic or tactile feedback, vibration alerts, GPS acquisition and injection or inhalation system delivery. It works with thin-film, solid-state and other low-power batteries such as coin cells/button cells and energy harvesting modules (solar, vibration/kinetic, RF and other ambient energy sources), as well as inductive/wireless and cable/cradle fast-charging systems.

Cap-XX Pty Ltd
www.cap-xx.com

POWER SUPPLIES IN INDUSTRIAL PLANTS

Bianca Aichinger, Product Marketing Manager

DIN rail power supplies play a central role in industrial plants but often attract little attention, despite the fact that power supply failures can bring production to a halt, causing huge costs.

Industrial plant owners and operators expect power supplies to meet technical standards and work for several years without causing trouble. As purchasing departments increasingly look to cut costs, manufacturers face the challenge of offering top-quality products at competitive prices. Unfortunately, some manufacturers might resort to cutting corners by compromising on design and the choice of components. Plant operators are therefore advised to choose power supplies that guarantee trouble-free operation over the entire service life of the plant. Opting for cheap modules bears the risk of high costs down the line, should production come to a halt due to a faulty power supply. That is why the general trend in DIN rail power supplies designed for industrial applications is towards greater reliability and extended warranty.

MTBF and design lifetime

A first indication regarding the reliability of a power supply is normally given by the mean time between failures (MTBF) value specified in the datasheet. MTBF is, however, a calculated, and therefore purely theoretical, value. It is determined with reference to official databases such as MIL HDBK 217F and additional MTBF specifications of the individual components contained in the device. The MTBF value therefore gives some indication of the quality of the built-in components but does not tell us a lot about the reliability of the power supply itself.

A much more useful specification is the design lifetime. This value can be determined in high acceleration lifetime tests (HALT) and is generally determined by the service life of the 'weakest link' in the overall system. With HALT, devices are exposed to vibration, extreme humidity and fast temperature cycles, at levels that are significantly beyond those expected during normal operation. These tests are generally performed during the prototyping phase in order to identify and eliminate weaknesses in the design.

By testing a large number of samples from a series batch, manufacturers are able to make accurate predictions regarding the average lifetime of the module. Such tests are, however, not yet common practice in the industry, and only a few manufacturers actually publish their results.

Electrolytic capacitors

In many cases, the service life of a module is limited by the lifetime of the electrolytic capacitor, or e-cap. It would, however, be unfair to see e-caps as generally flawed components. When correctly specified and operated within the specifications, they tend to work reliably for long periods of time. One of the primary causes behind the premature failure of e-caps is the evaporation of the electrolyte. This happens obviously most quickly at elevated temperatures.

Designers of power supplies must therefore ensure that the electrolytic capacitors are positioned as far away as possible from heat sinks, transformers and hot semiconductors. In addition, ripple current caused by rapid charging and discharging cycles must be minimised. In conjunction with the equivalent series resistance of

the e-cap, such currents cause the part to become hot. The lower the ripple current, the lower the power dissipation inside the electrolytic capacitor. Driven by a desire to produce ever smaller and cheaper power supplies, these clear design rules are often ignored. As a result, the operating temperature in the power supply might be constantly elevated. Given that many control cabinets provide minimum air circulation, the part is bound to fail.

For the design of its new REDIN series, RECOM substituted electrolytic capacitors for standard capacitors wherever possible. Where this was not an option for technical reasons, expensive long-life e-caps approved for operating temperatures of up to +105°C were used.

Optimised thermal design

Air circulation in control cabinets is often very poor. It is therefore important that DIN rail power supplies be optimised for uniform heat distribution inside the device. To locate potential hot spots inside the power supply at the prototype stage, RECOM uses thermal imaging. This is, however, not an easy undertaking, as thermal optimisation of the device can often only be achieved by altering its circuits. To obtain good EMC properties, the distances between switching transistors and filters should be kept as short as possible. Furthermore, each millimetre of additional wiring affects the efficiency of the power supply, which again results in higher self-heating effects inside the module.

With a width of 41 mm, RECOM's new 45 W (REDIN45) and 60 W (REDIN60) power supplies with outputs of 12 or 24 VDC are compact, despite their curved housing. In control cabinets of limited depth, the devices can be installed at a 90° angle. Optimised for long service life, the power supplies can be operated at full performance level at temperatures between -20 and +50°C. With 87% efficiency and very low no-load consumption (<0.5 W), energy consumption and heat generation are reduced to a minimum. The REDIN power supplies come with a number of safety features as standard and are protected against overcurrent, overtemperature, overvoltage and short circuits. The modules of the REDIN series provide a constant and stable DC output voltage indicated by a DC OK indicator light. The integrated status relay even allows for remote monitoring. The output voltage can be accurately adjusted by means of a potentiometer mounted on the front panel. Operational safety is further enhanced by a mains failure bridging time of 50 ms under full load. As these convection-cooled modules are certified according to a number of international safety standards (EN/UL60950 and UL508) and cater to input voltages from 85 to 264 VAC, they can be installed anywhere in the world.

RECOM Asia Pte Ltd
www.recomasia.com

FIBRE-BASED ELECTRONIC DEVICES

David L Chandler

Photo credit: Jose-Luis Olivares/MIT

A new approach developed by MIT researchers could lead to a completely new way of making high-quality, fibre-based electronic devices.

The idea grew out of a long-term research effort to develop multifunctional fibres that incorporate different materials into a single long functional strand. Until now, those long strands could only be created by arranging the materials in a large block or cylinder called a preform, which is then heated and stretched to create a thin fibre that is drastically smaller in diameter, but retains the same composition.

Now, for the first time, fibres created through this method can have a composition that's completely different from that of the starting materials - an advance that senior author Yoel Fink refers to as a kind of 'alchemy', turning inexpensive and abundant materials into high-value ones. The new findings are described in a paper in the journal *Nature Communications* co-authored by graduate student Chong Hou, and six others at MIT and in Singapore.

The fibres are made from aluminium metal and silica glass, abundant low-cost materials, which are commonly used to make windows and window frames. The aluminium metal and silica glass react chemically as they are heated and drawn, producing a fibre with a core of pure, crystalline silicon - the raw material of computer chips and solar cells - and a coating of silica.

The initial discovery was a complete surprise: in experiments designed to test the possibility of incorporating metal wires inside fibres, Hou tried a variety of metals, including silver, copper and aluminium - and in the latter case, the result was not what they expected.

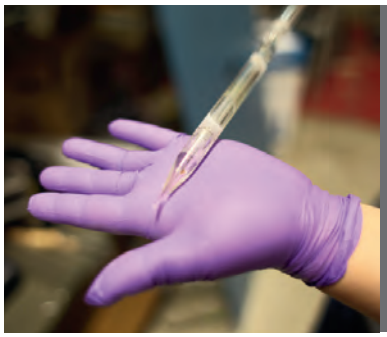
"When I looked at the fibre, instead of a shiny metallic core, I observed a dark substance; I really didn't know what happened," said Hou, who is the lead author of the paper. On analysis, the researchers found that the core had turned to silicon - in fact, very pure, crystalline silicon.

"My initial reaction might have been to discard the sample altogether," Fink said, after seeing that the experiment 'failed' to produce the expected result. Instead, Hou began to examine the specimen and apply rigorous analysis, soon realising that the mundane result he expected was replaced by a surprising one - which is how this discovery came about.

It turned out that the chemical reaction in the fibre was a well-known one: at the high temperatures used for drawing the fibre, about 2200°C, the pure aluminium core reacted with the silica, a form of silicon oxide. The reaction left behind pure silicon, concentrated in the core of the fibre, and aluminium oxide, which deposited a very thin layer of aluminium between the core and the silica cladding.

Now, Hou said, "We can use this to get electrical devices, like solar cells or transistors, or any silicon-based semiconductor devices, that could be built inside the fibre." Many teams have tried to create such devices within fibres, he said, but so far all of the methods tried have required starting with expensive, high-purity silicon.

"Now we can use an inexpensive metal," Hou said. "It gives us a new approach to generating a silicon-core fibre."



Hou holds a leftover silica preform after it has been used. The tapering tip shows how the preform is stretched to make long strands of fibre while in the furnace. Photo: Jose-Luis Olivares/MIT

Fink, who is a professor of materials science and electrical engineering and head of MIT's Research Laboratory of Electronics, said this represents "the first time that a fibre is drawn which is radically different from its preform. ... It opens new opportunities in fibre materials and fibre devices through value-added processing.

"We want to use this technique to generate not only silicon inside, but also other materials," Hou said. In addition, the team is working to produce specific structures, such as an electrical junction inside the material as it is drawn. "We could put other metals in there, like gold or copper, and make a real electrical circuit," he said.

Fink added that this is "a new way of thinking about fibres, and it could be a way of getting fibres to do a lot more than they ever have". As mobile devices continue to grow into an ever-larger segment of the electronics business, for example, this technology could open up new possibilities for electronics - including solar cells and microchips - to be incorporated into fibres and woven into clothing or accessories.

"Optical fibres are central to modern communications and information technologies, yet the materials and processes employed in their realisation have changed little in 40 years," said John Ballato, director of the Center for Optical Materials Science and Engineering Technologies at Clemson University in South Carolina, who was not involved in this research. He said, "Of particular importance here is that the starting and ending core composition are entirely different. Previous work focused on chemical reactions and interactions between core and clad phases, but never such a wholesale materials transformation."

Henry Du, a professor of chemical engineering and materials science at Stevens Institute of Technology in Hoboken, NJ, who also was not associated with this research, said, "This work is simply beautiful." He added that "This new strategy will enable the fabrication of new classes of functional fibres that would otherwise be difficult, if not impossible, using the traditional approach." Besides Hou, the work included Xiaoting Jia, Xin Zhao and John Joannopoulos at MIT; Lei Wei at the Nanyang Technical University in Singapore; and Swee-Ching Tan at the National University of Singapore. The work was supported by the National Science Foundation and by the U.S. Army Research Laboratory and the U.S. Army Research Office through MIT's Institute for Soldier Nanotechnologies.

XMC MODULES

Acromag's XMC-7K family of XMC mezzanine modules are enhanced with the Xilinx Kintex -7 FPGA for low power consumption and good processing performance. The re-configurable FPGA is made possible via a direct download into the Flash configuration memory over the PCIe bus or the JTAG port.

An 8-lane, high-speed serial interface on the rear P15 connector for PCI Express Gen 1/2 (standard), serial rapid I/O, 10 Gigabit Ethernet and Xilinx Aurora implementations are supported. Rear I/O provides 4- or 8-lane high-speed serial interface on the P16 XMC port. Select I/O or LVDS pairs plus global clock pairs direct to FPGA via the rear P4 or P16 port.

The FPGA serves as a co-processor applying custom logic and algorithms to streams of remote sensor data. Typical applications include hardware simulation, communications, in-circuit diagnostics, military servers, signal intelligence and image processing.

Migration to a standard protocol running on a well-defined medium such as Gigabit Ethernet, serial rapid I/O or Aurora allows IP cores to be developed that can be easily supported for the long term. Build options include the choice of a Xilinx XC7K325T or XC7K410T FPGA device.

Options include plug-in I/O, dual SFP+ ports or conduction-cooled for extended temperature. An engineering design kit provides the user with basic information required to develop a custom program. Software support packages are available for VxWorks 32-bit, Windows 32-bit DLL and Linux.

Metromatics Pty Ltd
www.metromatics.com.au

SIC MOSFET-BASED POWER MODULES

Vincotech's latest 1200 V SiC MOSFET-based power modules, available in two versions, are designed specifically for solar, UPS and battery management applications.

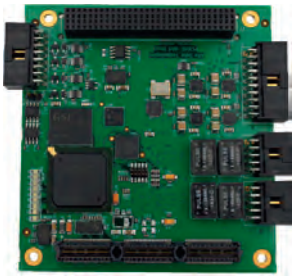
The first version is a flow3xPHASE 0 SiC three-phase inverter module with 3x BUCK/BOOST and split output topology. The second version is the flow3xBOOST 0 SiC with three-channel boost circuits. The three circuits are not connected, giving design engineers the flexibility to use them as individual circuits or to attach shunt resistors for current sensing. The flow3xPHASE 0 SiC configuration may be used as a bidirectional DC-to-AC three-phase inverter or a three-channel bidirectional DC-to-DC inverter.

Both versions feature the latest generation of SiC MOSFET switches designed for ultrafast switching frequencies >100 kHz. They are able to achieve >99% peak efficiency at fPWM of 64 kHz. Equipped with integrated DC capacitors, the SiC modules provide ultralow inductance.

Additional features include: three-phase inverters with split output for better switching behaviour (reduced turn on energy and cross-conduction suppression); three-channel boosters; SiC Power MOSFETs and Schottky diodes; temperature sensors.

Wireless Components
www.wirelesscomponents.com.au

INTERFACE CARD FOR PC/104-*PLUS* SYSTEMS



Alta Data Technologies announces the release of the PC104P-MA4 interface card for PC/104-***Plus*** systems. The product combines MIL-STD-1553 and ARINC interface channels on a single card, providing a small footprint and low power for PC/104-based systems. The card can have one or two 1553 channels (dual or full function BC, mRT and BM modes) and eight ARINC-429 channels (four RX/TX and four RX channels).

The card's signal capture and signal generation capabilities provide good data controls and an advanced test capability. It is claimed that the FPGA protocol engine and software architecture allow Alta to implement and deliver the product with more features than other legacy products.

The application programming interface (AltaAPI) provides a common, abstracted and layered development environment that is portable across the entire product line. Users can be up and running in a short time using any of the 100+ example program templates. The device can be combined with MIL-STD-1553 support, real-time ethernet 1553 and ARINC converter products (ENET2-1553 and ENET-A429).

Metromatics Pty Ltd
www.metromatics.com.au

DEVELOPMENT BOARD

Texas Instruments' C2000 Piccolo LaunchPad, LAUNCHXL-F28069M, is a full development board for Piccolo F2806x devices and InstaSPIN technology. The product is based on the Piccolo TMS320F28069M, with features such as 256 KB of onboard flash, 12-bit ADC, I²C, SPI, UART, CAN, dual Encoder support and InstaSPIN libraries in on-chip, execute-only ROM memory.

Board hardware features include an integrated isolated XDS100v2 JTAG emulator for easy programming and debugging. The product works with various BoosterPacks but is specifically designed for the BOOSTXL-DRV8301. Besides JTAG emulation, the USB interface provides a UART serial connection from the F2806x device to the host PC.

Users can download an unrestricted version of Code Composer Studio IDE version 6 to write, download and debug applications on the board. The debugger is unobtrusive and allows the user to run an application at full speed, with hardware breakpoints and single stepping available, while consuming no extra hardware resources.

element14
au.element14.com

OPEN-FRAME PANEL PC

Axiomtek has announced the FDK172-834, an open-frame panel computer featuring the Intel Celeron processor J1900 quad core 2.0 GHz. Equipped with a 17″ TFT large-size LCD, with a resolution of up to 1280 x 1024 pixels, the flexible PC is designed with an open-frame bezel for easy customisation.

The industrial panel PC is designed for immediate integration and can be deployed in indoor self-service kiosks, HMI automation, signage and many other applications. It provides a wide voltage power supply range from 12-36 VDC, with overcurrent protection for increased system reliability. It is compatible with all versions of Windows 7 and 8, including the Embedded Standard. Its slim thickness of 65 mm means it can fit into custom-made, space-constricting enclosures.

The unit provides four RS232/422/485 serial ports configurable by BIOS settings. For Wi-Fi and 3G connection, the open-frame panel system incorporates a dual PCI Express Mini Card slot for expansion capability. The PC supports a convenient side-access CompactFlash and one 2.5″ SATA HDD bracket for a storage device. The panel system's I/O connectivity includes four COM ports, one 10/100/1000 Mbps ethernet port, VGA port, two USB 3.0 ports, two USB 2.0 ports and audio (line-out).

Adept Total Turnkey Solutions
www.turnkey-solutions.com.au

PANEL-MOUNT CONNECTOR

Switchcraft has introduced an additional connector to its EH Series of audio, video and data connectors. The product is a female/female DIN 1.0/2.3 coupler panel mount which is compatible with the Switchcraft QGPK Series of rack panels and WP Series wall plates. It is available in nickel-plated or black-finish EH flange.

The series is an extensive line of panel-mount connectors used to create custom I/O solutions quickly and easily for A/V, pro audio, broadcast, mobile production and post-production installations. All connectors fit into a standard XLR panel cut-out.

Clarke & Severn Electronics
www.clarke.com.au

the GRUMPY page

Mike Smyth, specialist technical writer

You could be forgiven for thinking that electronics have made the 20th and 21st centuries much more bearable in all sorts of ways. Electronics have most certainly taken over our lives.

Everywhere the little electrons are busy for the most part making our lives easier and more comfortable.

Medicine has made brilliant use of the technology from X-rays to scanners to monitoring patients and making possible such devices as heart pacemakers. And now we are on the threshold of robotic surgery that allows procedures to be carried out remotely.

Warehousing and stock control has become much more sophisticated and cost effective with the advent of RFID systems, not to mention the driverless forklifts that can find a stock item among thousands in far less time than a man in a brown coat.

Industry has benefited with tools such as laser cutters that bring previously untold accuracy to some machining tasks. Computer-controlled machines make slide rules and calipers almost redundant.

At home there is the car at whose heart is a computer, while the kitchen fairly bristles with electronics from the oven to the microwave, to the scales, coffee machine, food processor and the toaster that senses the approach of black toast. Elsewhere in the home is the television, linked to a PVR, and an ambitious hi-fi system, complete with half a dozen remotes. Now, the most active exercise is scrabbling among the cushions for the elusive remote.

Then we have the marvels of the desktop or portable computer and its wireless link to the outside world through the internet. In fact, the list of friendly electronics goes on and on.

But are all sort of electronics necessarily good for us? Is it a coincidence that with the widespread adoption of electronic gadgetry, the number of overweight and obese people has climbed almost vertically? Electronics have taken away the exercise we did not know we were taking. We no longer need to leap up when we think the toast is burning. We no longer have to shuffle across the room to change the television channel or set up the PVR. We no longer have to beat the washing on a wash board of corrugated aluminium. And we no longer have to beat the living daylights out of a pudding in the kitchen with a fork or whisk.

We no longer have to crank the car, which was always a good source of exercise depending on the car. Lifts and escalators have taken over from staircases that are now largely ornamental and serve only as an emergency escape route in case of fire. Not many people are to be seen leaping stairs two at a time to reach an upper level.

Instead we spend hundreds of thousands of dollars on subscribing to the plethora of gyms and keep-fit establishments that have sprung up like a fungus in a damp sneaker. There is scarcely a high street in the land that does not sport a large window through which lycra-clad males and females, mounted on expensive machinery, can be seen intently pedalling, rowing or running the excess weight away.

Now, I'm not suggesting for one moment that physically changing the TV channels and turning the washing machine into a potted palm holder is the answer to our overweight problem. What I am suggesting is that we have taken on a mindset where electronics and all their conveniences are our first line of thought and that anything physical has become an anathema when the electrons can do the work.

And if you link this with the excessive food many of us consume, then it is not surprising that the tubbies are taking over the world, in spite of the gyms.

Sluggish we may have become, but the pudgy hands still reach out for the second helping and then part with money to slim it down.

We can't entirely blame electronics, but we should perhaps learn to harness the excesses.

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