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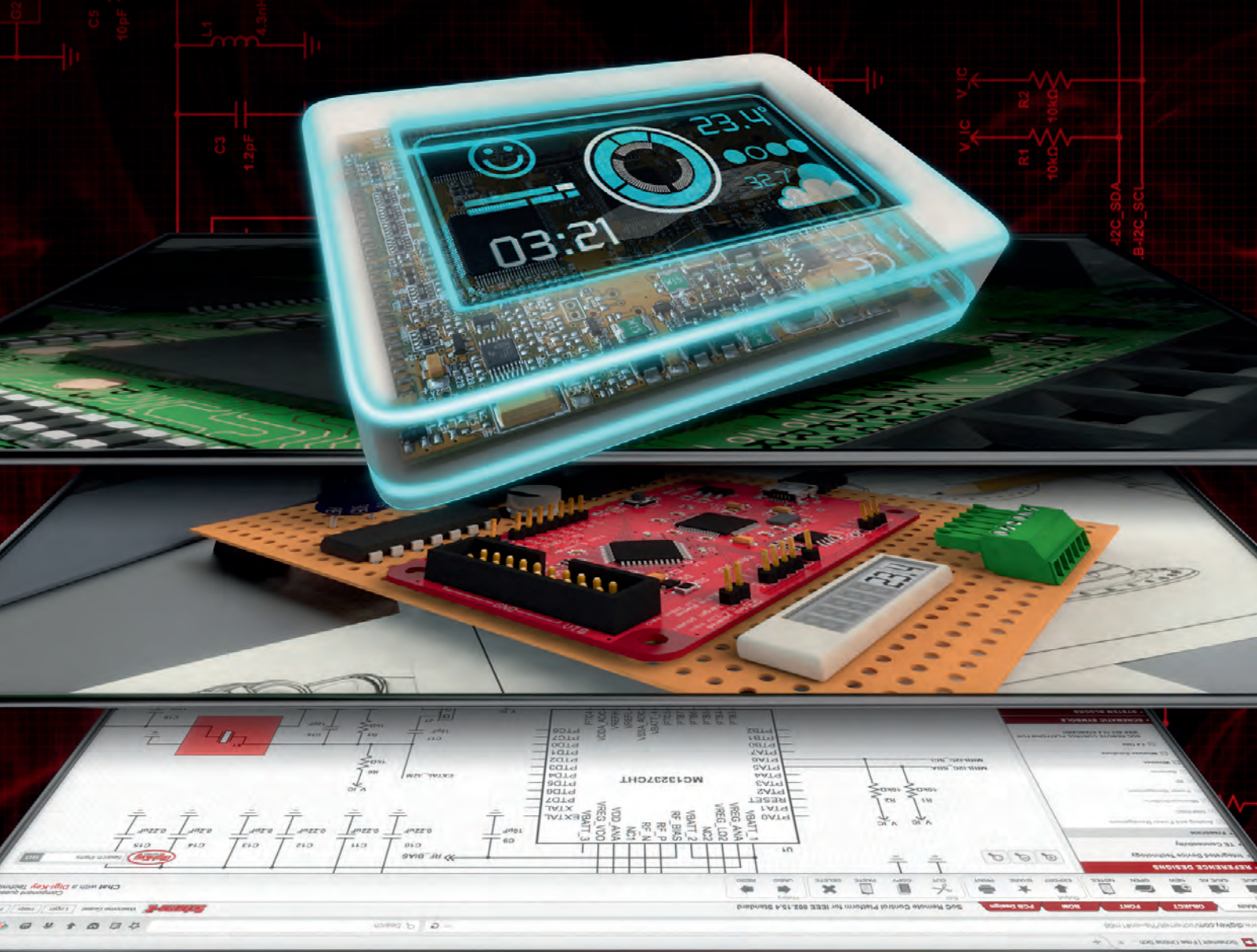


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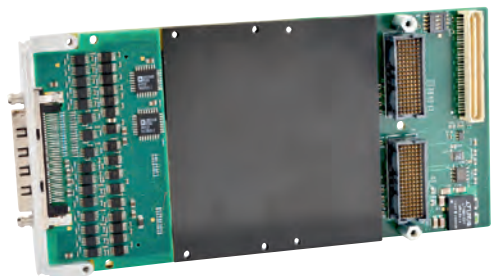
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COVER STORY



The new FAULHABER 2668 ... CR DC motor, available from ERNTEC, is a powerful copper-graphite commutated DC-micromotor. Thanks to a bigger NdFeB magnet and increased copper content in the winding, it supplies a continuous torque of 70 mNm in a compact design, weighing just 189 g with a diameter of 26 mm. Furthermore, it reaches full power rapidly with its high pulse torque.

The copper-graphite brushes of the motor are characterised by their outstanding stability and low wear. The housing is made of coated steel. The motor can be combined with gearheads in a range of fixed ratios, as well as high-resolution optical or magnetic encoders.

High power in a compact design makes the 2668 ... CR ideally suited for many handheld devices. Areas of application include aerospace, robotics, medical technology, in special machinery construction, metering systems and automation solutions.

ERNTEC provides high-efficiency, compact DC motor solutions from FAULHABER for the markets in both Australia and New Zealand.

FAULHABER specialises in the development, production and deployment of high-precision small and miniaturised drive systems, servo components and drive electronics with output power of up to 200 W. The product range includes brushless motors, DC micromotors, linear motors, gearheads, encoders and motion controllers. In addition, FAULHABER offers customer-specific complete solutions for, among others, medical technology, automatic placement machines, precision optics, telecommunication, aerospace and robotics.

ERNTEC Pty Ltd
www.erntec.net

DESIGNING IoT

As Internet of Things (IoT) devices become increasingly popular, designers strive to find a low power, battery-free energy solution to power these devices.

The IoT advocates invite us to imagine a future where even the tiniest devices are smart and connected, designed to make life easier, more comfortable and to contribute to saving the planet's resources. Few, however, will want to imagine a future where tens of billions of remotely installed boxes need to have their batteries changed at regular intervals. Extreme power management using ultralow-power microcontrollers that draw very low sleep current can allow the IoT to run from a small battery for the lifetime of the device. This may be several years, assuming a low duty cycle. An alternative is to design-in an energy harvesting subsystem capable of powering the device and charging a capacitor or small battery to provide backup.

A key objective of IoT applications is to exploit connectivity to gather intelligence or control devices in locations that have been difficult or uneconomical to reach using other technologies. These connected devices can deliver more value to end users and other stakeholders such as service providers. They may be connected using a technology with native IP transport, such as Ethernet or Wi-Fi, or may be aggregated into an internet gateway using any of a wide variety of wired or wireless connections such as RS232, Bluetooth, Bluetooth Smart or a protocol such as ZigBee or another dedicated low-power protocol running on an IEEE 802.15.4 radio. The sensors or actuators could be connected individually in remote locations or may be connected with other nearby devices as part of a mesh network.

In many situations a convenient power supply for the IoT device, such as an AC line or network power like a USB host or Power over Ethernet source, is not available. An independent energy source is needed, such as a primary cell or energy harvesting subsystem. Maintenance-free operation for the intended lifetime of the device is desirable to save the high cost of field-service visits.

If a battery is to be used, the designer must ensure that the total available energy is at least equal to the total energy required by the device throughout its lifetime. When selecting the battery type, factors including cell chemistry influence the discharge

characteristic including peak current delivery. As the battery discharges, the circuit will become inoperable when the battery voltage falls below the minimum operating voltage required by the components. The remaining battery energy then becomes inaccessible, unless extra circuitry, such as a boost converter, is introduced. Lithium cell technologies offer good performance in this respect: lithium thionyl chloride batteries are able to maintain a stable voltage of about 3.6 V until the energy is almost depleted, falling quickly near its end of life to a fully discharged voltage of about 2.2 V. Designers should also take into account the battery's stated maximum discharge current. If the battery is the sole intended power source for the device, it must be able to deliver the peak current required by the load. Alternatively, a short-term storage device having high discharge capability, such as a supercapacitor, may be used to assist the battery at times of peak demand.

An energy harvesting subsystem should be capable of capturing enough ambient energy to cover the device's needs. Because ambient energy such as light or thermal energy is usually not available continuously, energy harvesting may be used in conjunction with an energy-storage device that is at least able to supply backup power to the microcontroller while the sensor is in power-saving mode. A small rechargeable battery such as the Seiko MS412FE 4.8 x 1.2 mm lithium coin cell, which has 1.0 Ah nominal capacity and maximum continuous discharge current of 0.1 mA, could satisfy this requirement. Figure 1 illustrates a charging circuit for the MS battery. The charging voltage, V_c , should be no more than 3.3 V. In this case, a 2 M Ω resistor should be inserted to regulate the charging current. Alternatively, a storage capacitor may be used, but has a faster self-discharge rate than a battery.

Cost and size constraints must also be taken into account when choosing energy harvesting or battery power. Lithium primary cells are available in a variety of sizes and capacities, including standard button and cylindrical form factors. The Tadiran TL-5101 is a half AA-size 3.6 V battery in an axial leaded package that can be soldered directly to the circuit board or power supply leads. This eliminates the cost of a battery

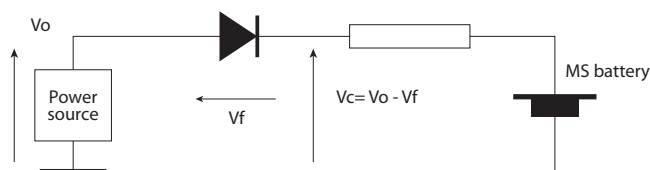


Figure 1: Charging circuit for rechargeable lithium battery.

Low power mode	Consumption	CPU	Flash/EEPROM	RAM	DMA & Peripherals	Clock	LCD	RTC
Sleep	41µA/MHz (Range 1)	No	ON	ON	Active	Any	Available	
	36 µA/MHz (Range 2)							
	35 µA/MHz (Range 3)							
Low power run	8.55µA (Flash OFF, 32 kHz)	Yes	ON or OFF	ON	Active	MSI	Available	
Low power sleep	4.65 µA (peripherals OFF)	No	OFF	ON	Active	MSI	Available	
Stop with RTC	0.82 µA (1.8 V)	No	OFF	ON	Frozen	LSE, LSI	OFF	ON
	1.0 µA (3 V)						OFF	OFF
Stop	415 nA	No	OFF	ON	Frozen	–	OFF	OFF
Standby with RTC	655 nA (3 V)	OFF	OFF	OFF	OFF	LSE	OFF	ON
	845 nA (1.8 V)						OFF	OFF
Standby	290 nA	OFF	OFF	OFF	OFF	–	OFF	OFF

Figure 2: Microcontrollers architected for power-conscious applications such as self- or battery-powered IoT nodes provide multiple power-management modes.

clip and the extra time overhead to insert the battery manually during final assembly.

As far as energy harvesting is concerned, a kit such as the Microchip XLP 16-bit Energy Harvesting Development Kit can help to accelerate design-in.

Microcontrollers for the IoT Age

The growing importance of careful energy management in IoT applications has driven the development of ultralow-power design, taking advantage of flexible microcontroller sleep modes to reduce current draw or deactivate unused circuitry whenever this can achieve a net energy saving. A connected sensor that must periodically capture sensed data, perform a small number of processing actions locally and transmit the result wirelessly to a receiver has a power profile characterised by long periods in sleep mode where power consumption is minimal, with short periods of higher demand as the device is activated to receive, process or transmit data. The application designer's skill lies in ensuring the low level is as low as possible for as long as possible, and the peaks are as low as possible for the briefest possible time.

Microcontrollers such as Microchip XLP devices, STMicroelectronics STM32L lines and Texas Instruments MSP430 devices such as the latest MSP430FG626 have introduced flexible architectures that give designers more control than typical conven-

tional microcontrollers to power down unused peripherals and parts of the CPU core while continuing to support important functionality. Core-independent peripherals, such as a UART capable of receiving and transferring data packets directly into memory without CPU intervention, help to save energy and also save code space. Microchip XLP devices such as the 16-bit PIC24FJ256GB410, which is part of the new PIC24 GB4 series, combine features supporting ultralow-power design with an integrated hardware crypto engine capable of offloading important IoT security tasks from the main processor.

Microcontroller SOS (switch off something)

Whereas conventional microcontrollers usually support only limited power-management modes, usually giving software designers a choice of active, idle or sleep, ultralow-power microcontrollers support more complex power-management schemes. A multitude of power-saving features cover all aspects of the device, such as the clock subsystem, voltage regulator and special low-power peripherals like the integrated op-amps of the MSP430GF6266.

Additional control over the clock and voltage regulator, as in the STM32L0 series, gives designers the flexibility to optimise operating speed and supply voltage dynamically to ensure all operations are performed at the

lowest power consumption possible within any applicable constraints on execution time. The clock controller provides multiple internal sources, controlled by logic, which designers can use to select a low-, medium- or high-speed path to allow peripherals to be operated at a suitable speed depending on whether the PCU is active or static. In addition, multiple gates to peripherals provide a convenient and responsive means of deactivating individual peripherals. Devices such as DACs or GPIOs can be halted while pin states remain valid.

In addition, multiple voltage regulator modes give the choice of Normal, Low-Power or Off to allow multiple Run and Sleep states. Hence, there are Low-Power Run and Low-Power Sleep modes, in addition to normal Run and Sleep modes. There is also an 8 µA Stop mode in which all clocks are stopped except the low-speed clock. In this mode, the RTC and RAM can also be turned off, reducing the current further to 4 µA. The device can exit Stop mode in 3.5 µs, which allows frequent use of Stop to maximise overall power savings. Even more circuitry can be turned off to save energy: the on-chip Flash can be powered down in any operating mode, and the low-power timers and UARTs can be turned off in Stop mode. In addition, there are Standby modes with RTC on or off. Standby turns off the voltage supply to the core, and also the high-speed and medium-speed clocks, reducing current to 0.27 µA. Figure 2 summarises the microcontroller low-power modes.

The core voltage can also be scaled dynamically, allowing a choice of voltage ranges down to 1.2 V to maximise energy savings when the performance demands placed on the core are low. The voltage can be scaled up or down quickly, within about 3 µs, which enables fast response to rapid changes in performance demand.

Conclusion

Billions of smart wireless devices such as remote sensors will be connected to the internet in the coming years. Battery-free operation taking advantage of efficient energy-harvesting technologies offers great environmental credentials. Alternatively, IoT endpoints can be designed to operate maintenance-free for their intended lifetime through a combination of careful battery selection and embedded design leveraging ultralow-power microcontrollers.

Digi-Key Corporation
www.digikey.com

References

STMicroelectronics AN4445 Application Note - www.digikey.com.au/en/pdf/s/stmicroelectronics/st-microelectronics-an4445-application-note

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	Keysight 2000 X-Series	Keysight 3000T X-Series	Keysight 4000 X-Series	Keysight 6000 X-Series
Bandwidth	70 MHz–200 MHz	100 MHz–1 GHz	200 MHz–1.5 GHz	1 GHz–6 GHz
Sample Rate	2 GSa/s	5 GSa/s	5 GSa/s	20 GSa/s
Waveform Update Rate	>100,000 wfms/s	>1,000,000 wfms/s	>1,000,000 wfms/s	>450,000 wfms/s
Display	8.5"	8.5" touch	12.1" touch	12.1" multi-touch
Zone Touch Triggering	N/A	YES	YES	YES
Instrument Integration	Arbitrary waveform generator, digital voltmeter, protocol analyzer, counter, MSO			

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HOT AIR REWORK TOOLS



Soldering equipment supplier Thermaltronics has just released its two latest hot air rework tools.

The TMT-HA200 hot air tool can be used for surface-mount component removal and reflow on packages such as SOIC, QFP, PLCC and other chip components. The handpiece incorporates an auto sleep mode when placed in its holder.

The TMT-HA300 hot air tool uses a large diaphragm pump and features a digital temperature readout as well as a visual air flowmeter.

There is also a large range of tips and nozzles available to cover most component packages.

RMS Parts Pty Ltd
www.rmssparts.com.au



ENCLOSURE FOR WIRED APPLICATIONS

The CONNECT is a versatile and compact plastic enclosure for wired applications. It consists of two enclosure shells that are joined together by means of a concealed locking edge. The enclosure ends are designed in such a way that they are either closed or they can be fitted with cable glands.

Applications include medical technology, security and building services systems, computer peripherals and network technology, data transfer, and measuring and control engineering.

Each side of the enclosure shell has a different shape: one side is convex and the other is flattened with a recessed panel to accommodate membrane keypads or labels. They have identical recesses at both ends for end elements.

To assemble the enclosure, the two shells are simply snapped into each other. Either the front or rear face of the enclosure can be freely selected as the operating surface.

Cable glands and/or end parts are optionally available to complete the enclosure shells. Assembly with cable bushings at each end is also possible if the enclosure is to be used as an interface between several devices.

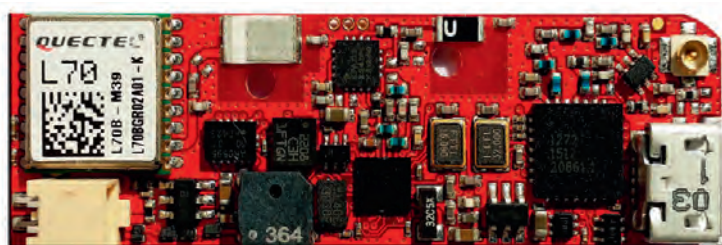
The cable gland kit contains an integrated strain relief device. A holding clamp which has a concealed attachment to the enclosure is available for hanging the enclosure on pipes and on common round profiles. The shell with the flattened face has four attachment domes on the underside for mounting PCBs and built-in components.

Robust, UV-stabilised plastic material ASA+PC-FR in off-white is used to manufacture the enclosure. The enclosures offer protection class IP40 and are available in three sizes: 76 x 54 x 22 mm, 116 x 54 x 22 mm and 156 x 54 x 22 mm.

The enclosures can be customised on request. Modification services include CNC milling and drilling, digital or screen printing of legends and logos, special finishes, EMC shielding, keypads and labels.

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www.rolec-okw.com.au

TRACK-AND TRACE MODULE



KCS has extended its TraceME product line with a track-and-trace module based on LoRa technology. The TM-900/N1C1 module is suitable for tracking and tracing a variety of objects, including livestock, and for personal use.

The full-version module is equipped with different technologies for traceability (eg, GPS/Glonass, LoRa, Bluetooth LE, ANT/ANT+ and RF), which can all be combined depending on the application. It is not equipped with GPRS/SMS, therefore eliminating traditional national telecom operational costs.

The combined LoRa and 2.4 GHz RF technology offers tracing of the module over a wide area up to 15–20 km. The rough tracing from 20 km down to 300 m is done by LoRa, while the short-range tracing is done by the company's RF technique, which offers good indoor and outdoor tracing with an accuracy up to 1.5 m.

Multiple onboard sensors (temperature, humidity and acceleration), a buzzer, LEDs, I/O functionality and a push-button enable integration into a variety of custom (M2M) applications (eg, Internet of Things and smart wearable electronics). With a size of 49.6 x 15 mm, a weight of 3.4 g, a battery lifespan of more than 10 years and solar-powered functionality, the module offers several OEM integration possibilities.

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The Blue Power Charger is a world class battery charger with IP65 protection.

This state of the art unit offers water, dust, dirt, oil and chemical protection (IP65) from a completely encapsulated cast aluminium design. As well as being shock proof and ignition protected, the Blue Power Charger's special purpose built design allows for no need of a cooling fan or other moving parts, making it completely silent.

With a Ultra High Efficiency of 95%, the Blue Charger generates 4x less heat and up to 10x more efficient power consumption on a fully charged battery in comparison to the industrial standard.

The Blue Charger comes in a variety of different power outputs to suit a array of applications. With the 12V system available in 5A, 7A, 10A, or 15A and the 24V system available in 5A or 8A, this charger suit applications from small to large.

Charger Guide

Blue Power IP65 Charger

Battery size Ah	12V				24V	
	5 A 20 - 50 Ah	7 A 20 - 50 Ah	10 A 30 - 70 Ah	15 A 50 - 150 Ah	5 A 20 - 50 Ah	8 A 30 - 70 Ah
Your IP65 Charger is	12/5	12/7	12/10	12/15	24/5	24/8
	Recommended	OK	OK	OK		
	Recommended	Recommended	Recommended	Recommended		
	Recommended	Recommended	Recommended	Recommended		
					Recommended	Recommended
	OK	OK	OK	Recommended	OK	Recommended
Recommended	This is the best charger for this type of battery. The battery will be charged in the most efficient way.				OK	
					This charger can be used for this battery. It is possible that it takes longer to charge the battery than using a recommended charger.	

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ENHANCING BATTERIES

WITH HYDROGEN

Lithium-ion batteries operate longer and faster when their electrodes are treated with hydrogen.

The growing demand for energy storage emphasises the urgent need for higher-performance batteries. Several key characteristics of lithium-ion battery performance — capacity, voltage and energy density — are ultimately determined by the binding between lithium ions and the electrode material. Subtle changes in the structure, chemistry and shape of an electrode can significantly affect how strongly lithium ions bond to it.

Through experiments and calculations, the Lawrence Livermore National Laboratory (LLNL) scientists discovered that hydrogen-treated graphene nanofoam electrodes in the LIBs show higher capacity and faster transport. “These findings provide qualitative insights in helping the design of graphene-based materials for high-power electrodes,” said Morris Wang, an LLNL materials scientist and co-author of a paper published in *Nature Scientific Reports*.

Commercial applications of graphene materials for energy storage devices, including lithium-ion batteries and supercapacitors, hinge critically on the ability to produce these materials in large quantities and at low cost. However, the chemical synthesis methods frequently used leave behind significant amounts of atomic hydrogen, whose effect on the electrochemical performance of graphene derivatives is difficult to determine.

Yet Livermore scientists did just that. Their experiments and multiscale calculations reveal that deliberate low-temperature treatment of defect-rich graphene with hydrogen can actually improve rate capacity. Hydrogen interacts with the defects in the graphene

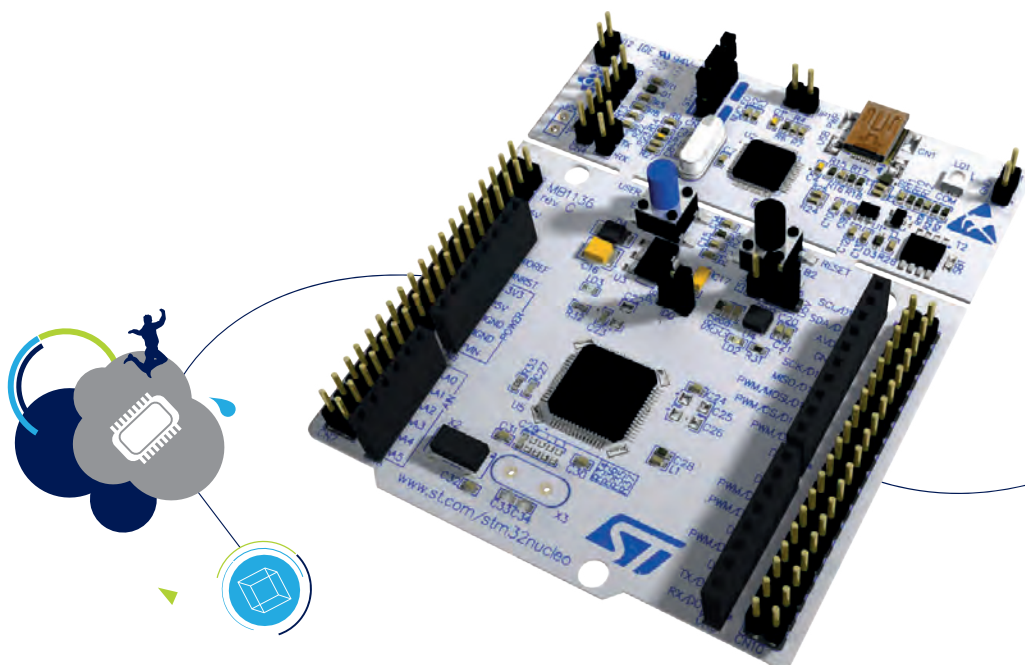
and opens small gaps to facilitate easier lithium penetration, which improves the transport. Additional reversible capacity is provided by enhanced lithium binding near edges, where hydrogen is most likely to bind.

To study the involvement of hydrogen and hydrogenated defects in the lithium storage ability of graphene, the team applied various heat treatment conditions combined with hydrogen exposure and looked into the electrochemical performance of 3D graphene nanofoam (GNF) electrodes, which are comprised chiefly of defective graphene. The team used 3D graphene nanofoams due to their numerous potential applications, including hydrogen storage, catalysis, filtration, insulation, energy sorbents, capacitive desalination, supercapacitors and LIBs.

The binder-free nature of graphene 3D foams makes them ideal for mechanistic studies without the complications caused by additives.

“We found a drastically improved rate capacity in graphene nanofoam electrodes after hydrogen treatment. By combining the experimental results with detailed simulations, we were able to trace the improvements to subtle interactions between defects and dissociated hydrogen. This results in some small changes to the graphene chemistry and morphology that turn out to have a surprisingly huge effect on performance,” said LLNL scientist Brandon Wood, another co-author of the paper.

The research suggests that controlled hydrogen treatment may be used as a strategy for optimising lithium transport and reversible storage in other graphene-based anode materials.



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MICROMOTOR

FAULHABER is expanding its range of drives in the medium power range with the 1727...CXR DC micromotor. A powerful neodymium magnet gives the graphite-commutated motor a high power density with a continuous torque of 4.9 mNm. It generates this power in a housing that is just 17 mm in diameter and 27 mm in length.

The product's compact dimensions and performance data open up a wide range of potential applications. The motor is suitable for hand instruments in dental technology, for tattooing machines or as a high-performance servo drive in automation and robotics. The temperature range in which it can be used is from -30 to +100°C.

As with the other drives of the CXR series, the unit can be combined with encoders and with precision gearheads from a coordinated product range. It can be optionally actuated with the SC 1801 speed controller or the MDC 3002 motion controller for speed control or positioning.

ERNTEC Pty Ltd

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EMI RECEIVERS WITH REAL-TIME SPECTRUM ANALYSIS

Keysight Technologies has announced the availability of real-time spectrum analysis (RTSA) as an upgradeable option for its MXE EMI receiver. The addition of RTSA enables test labs to observe and diagnose transient and wideband emissions during electromagnetic compatibility (EMC) compliance and pre-compliance testing.

With RTSA, engineers can see and understand high-speed transient signals that are difficult to capture with traditional spectrum or signal analysers. This is useful in applications such as radar, automotive and wireless communications that often experience fast-moving, short-duration emissions.

In RTSA mode, the receiver can provide real-time analysis bandwidth up to 85 MHz below 3.6 GHz and up to 40 MHz above 3.6 GHz, ensuring image-free, over-the-air diagnostics that enable fast, easy analysis of emissions. RTSA offers 100% probability of capture for signals with durations greater than 3.7 μ s when viewing with an 85 MHz span.

Frequency mask trigger (FMT) capability is also included with RTSA, allowing users to trigger on signals with durations as short as 17.4 μ s. Time-qualified triggering capability further enhances FMT by simplifying the task of finding pulse outliers or triggering on specific communications bursts.

Keysight Technologies Aust Pty Ltd

www.keysight.com

LOGGING MULTIMETER

The Fluke 289 multimeter is a suitable handheld device for industrial troubleshooting and predictive maintenance.

With graphical display of logged data through TrendCapture, the unit allows for efficient problem-solving of issues related to in-plant automation, power distribution and motor drives. The multimeter's large memory allows for up to 200 h of continuous recording; data can then be interpreted using FlukeView Forms for PC.

The product includes a backlit, 50,000 count, 1/4 VGA display for easy viewing of measurements. On-screen help is one click away with the 'i' button, which provides an in-depth explanation of measurement functions.

Other features include: 0.025% basic DC voltage accuracy; up to 1 MHz frequency (0.1 Hz to 999.99 kHz); safety rating CAT III 1000 V and CAT IV 600 V; and a low pass filter to eliminate electrical noise.

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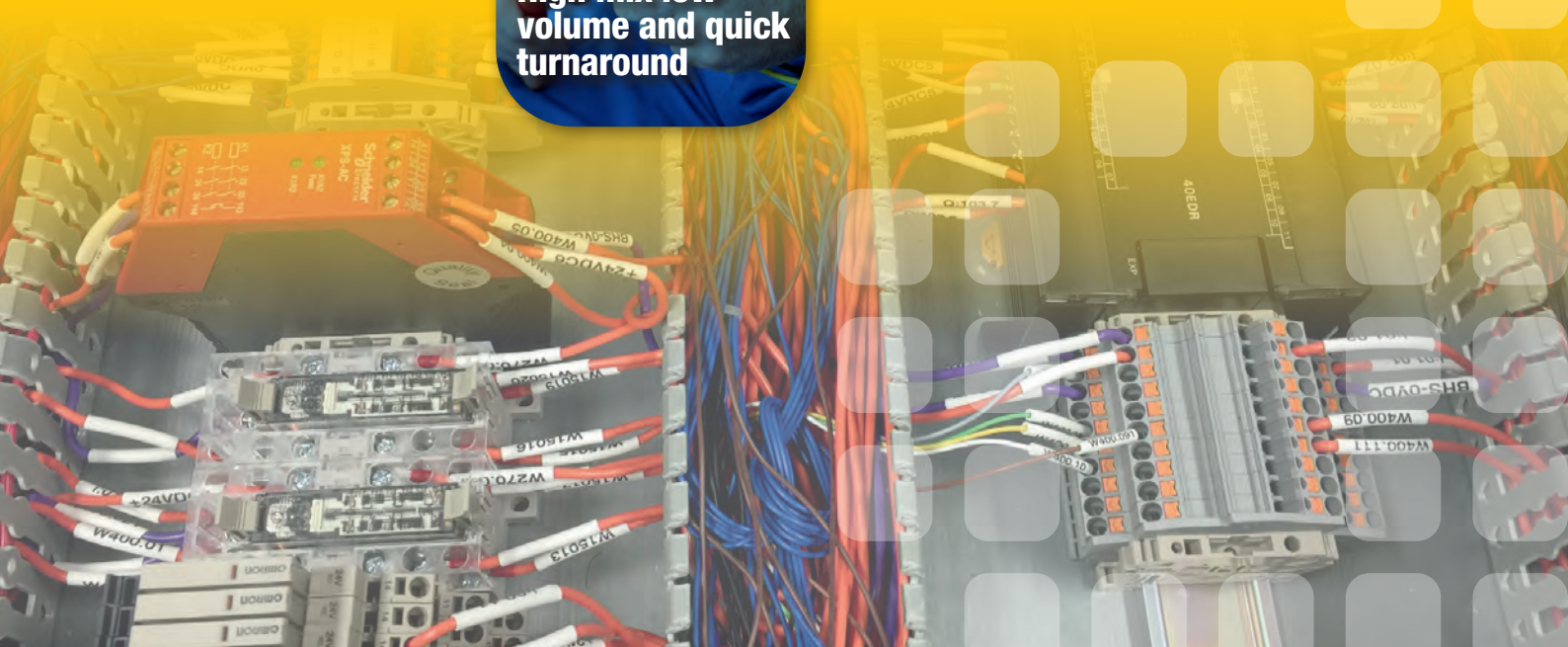
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HIGH-SPEED CONNECTOR DESIGN

Ryan Satrom, Signal Integrity Engineer, Omnetics Connector Corporation

PART 2

Impedance is a critical parameter in determining the performance of high-speed applications.

In Part 1 of this series of articles, we used the analogy of a pipe diameter to relate impedance to electrical performance. Just as optimal fluid flow is achieved with a pipe with a constant diameter, optimal electrical performance through a high-speed path is achieved with a constant impedance at every point along the path. But why is impedance so important?

The importance of impedance

Revisiting the fluid flow analogy

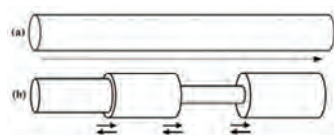


Figure 1

High-speed signals should be viewed as waves. As waves, travelling high-speed electrical signals are analogous to fluid travelling through a pipe. As a wave travels through a pipe, a portion of the wave will reflect back every time the pipe diameter changes. Thus, optimal fluid flow is achieved with a pipe that has a constant diameter (Figure 1a). If the pipe diameter is constantly changing (Figure 1b), large portions of the wave will reflect and the efficiency of the pipe will decrease.

The performance of the pipe is analogous to the performance of a high-speed signal path in a cable/connector assembly, with

the critical parameter in a signal path being impedance instead of diameter.

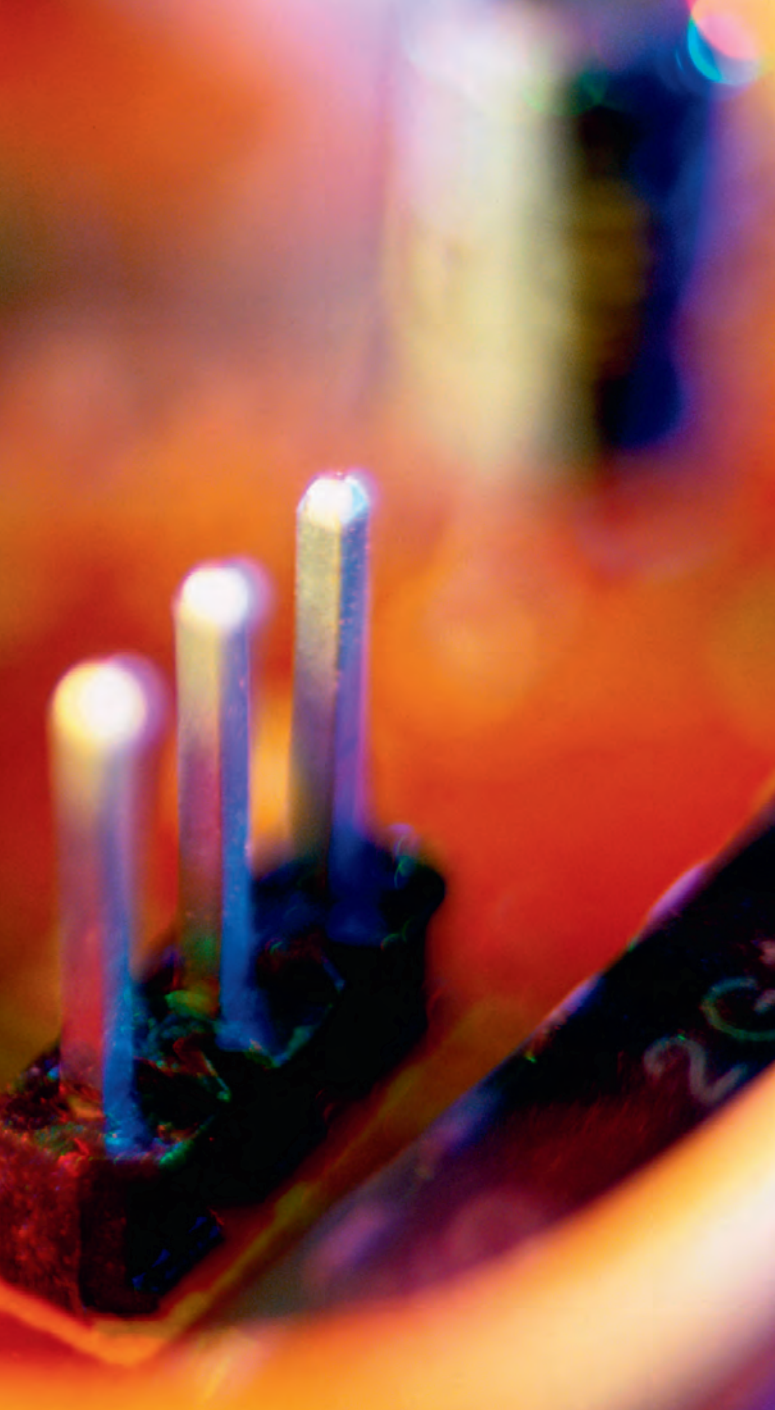
Why is impedance so important?

The impedance of the path is critical because any time the path impedance deviates from the system impedance, a portion of the signal will reflect back to the source and therefore will not reach its destination. The magnitude of the reflection, or discontinuity, will be dictated by two variables:

1. The physical length of the impedance mismatch, and
2. How far the impedance differs from the specified system impedance.

In order to understand this better, we will look at four examples. In these examples, we will assume a system impedance of 100 Ω and a cable with a connector on each end:

- Example 1: 100 Ω connectors with 100 Ω cable. Performance: Excellent. The impedance is matched through the entire path.
- Example 2: 70 Ω connectors with 100 Ω cable. Performance: Good. The length of the impedance mismatch (only through the length of the connector) is small enough that it doesn't have a significant impact on the performance.
- Example 3: 100 Ω connectors with 70 Ω cable. Performance: Poor. The length of the impedance mismatch (through the entire cable) is large, which yields poor performance.



- Example 4: 40 Ω connectors with 100 Ω cable. Performance: Poor. Although the length of the impedance mismatch is small, the magnitude of the mismatch is large enough to yield poor performance.

Impedance and data rate

Of course, impedance isn't always important. For low-speed signals (less than 100 Mbps/MHz), the impedance of the connectors and the cable is not likely to be an issue. However, as speeds increase, the impedance becomes more important. As a general rule, the impedance of the cables is important for signals above 100 Mbps/MHz, and the impedance of the connector becomes important for signals above 1 Gbps/GHz.

Determining cable and connector impedance

As data transfer rates continue to increase, the impedance of the cable and the connector become increasingly important. In order to ensure that designs adequately address this, we must understand the factors that impact impedance and what can be done to optimise our designs.

Calculating impedance

Unfortunately, impedance is very difficult to calculate. In fact, it is nearly impossible to calculate without a high-powered electro-

magnetic field solver. Due to this complexity, it is often helpful to simply understand the implications of specific design changes on impedance. This can help us make the necessary design changes to increase or decrease the impedance of our current design.

The impedance of any path is determined by the cross-sectional geometry at any point in the path. For any path where the cross-section changes, the impedance will have some variation. In most cable/connector assemblies, this occurs in the connector. It is relatively easy to keep the cross-section of a shielded, twisted pair cable constant. However, it is very difficult, if not impossible, to keep the cross-section constant as the path transitions from the cable to pins to a circuit board.

Equation for impedance

$$Z = \sqrt{L/C}$$

Figure 2

Impedance (Z) is proportional to inductance (L) and inversely proportional to capacitance (C) (see Figure 2). In order to understand this equation, it is necessary to have a general understanding of inductance and capacitance.

Inductance is the ability to store magnetic charge, and it is determined by the size of the circuit loop. The loop size is determined by the size of the conductors (length/width) as well as the distance between the conductors. Inductance increases as the length of the loop increases and decreases as the width of the loop increases.

Capacitance is the ability to store electric charge. Capacitance increases as the size of the conductors increases and decreases as spacing between conductors increases. Capacitance is also proportional to the dielectric constant, a material constant of the insulating plastic that is typically provided on the datasheet of the insulator.

Impedance in cables and connectors

Several design parameters impact impedance. As the spacing between conductors increases, the inductance increases and the capacitance decreases. Both of these factors will cause the impedance to increase. For cables, the impedance increases as spacing between wires increases. In connectors, the impedance increases as the spacing between the pins increases.

As the diameter of the signal conductors increases, the inductance decreases and the capacitance increases. These both cause the impedance to decrease.

The dielectric constant of the insulating material also impacts impedance. However, since dielectric constant only affects capacitance, not inductance, the impact of dielectric constant on impedance is less profound than diameter and spacing. Impedance has an inverse relationship with dielectric constant: as the dielectric constant of the insulating material increases, impedance decreases.

Finally, impedance has no relationship to length. Since length increases inductance and capacitance with the same proportion, length has no impact on impedance. This is why impedance is a function of cross-sectional geometry and can be determined at any point along a path.

Conclusion

Impedance is an important parameter for all high-speed designs. It is critical that designs are optimised to provide a matched impedance throughout the entire path.

Clarke & Severn Electronics
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SINGLE- AND DUAL-PORT SERIAL DEVICE SERVERS

Vlinx VESR900 Series industrial ethernet serial servers allow users to monitor and control serial devices from any point on their ethernet LAN/WAN. The easy-to-use Vlinx Manager software provides remote access to device servers and serial ports directly from the user's desktop computer or laptop. Configure devices, upgrade firmware and monitor activity using the Vlinx built-in web server.

The series includes single- and dual-port models with support for RS232 and RS422/485 protocols. Virtual com port drivers can be installed on workstations, allowing applications to access the remote com ports as if they were directly connected to a local com port. In Direct IP mode, serial data can be sent directly to the device server's IP address. Paired mode is also available, allowing data to be sent directly from one device server to another via the network.

The device servers provide both DB9 serial connectors and screw terminal blocks for cable termination. The servers also feature an additional copper RJ45 port that allows the user to connect another ethernet device or PC workstation. This pass-through port functions like an unmanaged ethernet switch.

If the device server loses connectivity, a manual reboot is not needed to restore communications. The device server will attempt to reconnect every 5 s until the connection is re-established. This heartbeat connectivity signal ensures the series is always online.

The device servers are ultracompact, measuring only 17 x 11 x 4 cm. Optional DIN rail mounting brackets are available.

Interworld Electronics and Computer Industries

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TERMINAL BUSHINGS

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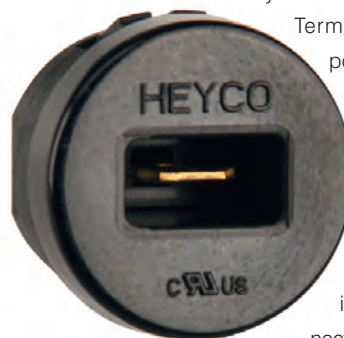
or detachable shrouds.

The non-polarised versions feature 6.4 mm internal brass male terminals to mate with standard 6.4 mm female Quick-Connects. The polarised versions feature 6.4 and 4.7 mm internal brass male terminals to mate with standard 6.4 and 4.7 mm female Quick-Connects.

The terminal bushings are made from polycarbonate, have a 94 V-0 flammability rating and have a temperature range of 0 to 130°C. Typical applications include data processing, vending machines, motors, power supplies and controls.

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INTEGRATED BROADBAND ROUTER FOR M2M

Built for M2M networks, the COR IBR600 is a compact router designed for critical business and enterprise applications needing 24/7 connectivity. The device ensures maximum uptime and is suitable for installations such as ATMs, kiosks, surveillance, vehicles, etc.

The product provides instant network connectivity and can be deployed as a primary connection solution where wired internet is not available. It can also be used to support and complement traditional wired data networks like DSL or cable. The unit has failover/failback so that, when configured, the router detects network failures and seamlessly switches over to another active connected data source.

The router supports both wireless and wired internet connections (two ethernet ports for either LAN/LAN or WAN/LAN) and the Wi-Fi offers wireless 2x2 MIMO 'N' Wi-Fi (802.11 b/g/n). It is certified for shock and vibration in accordance with MIL STD 810G and SAE J1455, so the user can be confident in the device's ability to survive challenging environments.

Providing secure VPN functionality, the product allows for secure access to company networks for enterprise applications and provides a secure way to transmit sensitive data to and from a remote site. It can be used with Cradlepoint's Enterprise Cloud Manager to easily centrally manage the distributed locations within the user's enterprise network.

M2M Connectivity

www.m2mconnectivity.com.au

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The Key to Realizing IoT Applications



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TAILOR-MADE DRIVERS FOR CHIP-ON-BOARD LEDs

The RCOB LED driver series from RECOM has been developed to meet the requirements of COB (chip-on-board) LEDs. The driver series includes 11 models with output voltages between 25 and 44 VDC and constant output currents of 350 to 1050 mA, thus offering a suitable driver for virtually any application.

The drivers come with active PFC (>0.95) and achieve efficiencies of up to 90%. Due to their compact and flat design (106 x 67 x 22 mm), the drivers can be integrated into any type of lighting system. The fact that the inputs and outputs are located on the same side of the driver makes installation even easier. The drivers of version RCOB-A come with a 1 to 10 V input and can be dimmed from 0 to 100%.

As the driver series has been designed for the European market, its input voltage is 230 VAC (198 to 264 VAC). The permissible operating temperature range is -20 to +50°C. Safety features protect the devices against short circuits, overload, overvoltage and overtemperature. The LED drivers come with a 3-year warranty.

RECOM Asia Pte Ltd
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2.5" PICO-ITX SBC

Advantech has launched the MIO-3260 — a 2.5" MI/O-ultra form factor (Pico-ITX) SBC with Intel Celeron Quad Core N2930/Atom Dual Core E3825 processor. The unit supports DDR3L memory, up to 8 GB, and its fanless design and low power consumption (4.47 to 9.73 W) offer good power savings. All I/O functions come from internal connectors.

The product can be used in two ways: either design a simple carrier board with selected I/O to replace all the cabling or use it stand-alone with flexible cabling via the correct connector type. It is suitable for slim, cableless or ruggedness designs, including panel PC and outdoor applications, industrial control, medical portable devices, POS, home automation and more.

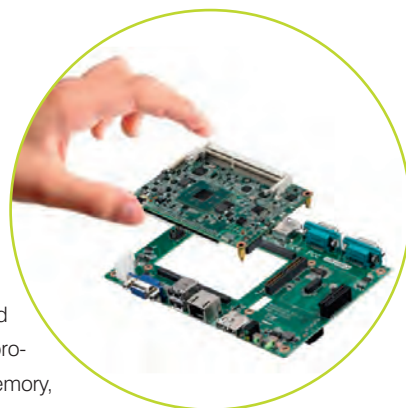
The light and ultraslim SBC's total height with heatsink is only 25.8 mm, so it easily meets size requirements for slim chassis applications. It shortens complicated set-up procedures and offers enhanced stability and durability. The fanless thermal solution is dust-free and noiseless, with 24/7 operation. It has a temperature range of -40 to 85°C and offers low maintenance and long life cycle support till 2020.

The product delivers good CPU performance. The graphics are based on Gen 7 Intel Graphics Architecture with support for DirectX 11, Open GL 4.0 and OpenGL 1.2; and the device has full HD video playback, video transcoding and encoding functionality. The SBC retains a 5/12 Vsb power supply for power exchange processing, which offers a higher throughput yet consumes less power, and can integrate existing data without sacrificing software compatibility.

By connecting with two 64-pin expansion connectors, system integrators can use a carrier board to support the necessary I/O interfaces. With no cabling, the unit delivers many I/O interface options. It is suitable for IoT applications and expedites clients' carrier board development.

The product includes Advantech's exclusive SUSIAccess Remote Management Software, which provides real-time synchronised hardware and software monitoring and maintenance for complete protection.

Advantech Australia Pty Ltd
www.advantech.net.au



REMOVABLE JUMPER LINKS

Harwin has introduced Removable Jumper Links and matching SMT clips to the EZ-BoardWare range. They are available in vertical and horizontal configurations for maximum assembly flexibility.

The products provide a simple way of connecting adjacent PCBs. They enable fast and easy jumper link removal for maintenance and make it easy to replace defective PCBs without disturbing neighbouring modules.

The jumper links are suitable for LED lighting, compact PCB designs and communication systems. Connecting bars are available in 15 and 23 mm lengths and are packed in tape and reel for automated assembly.

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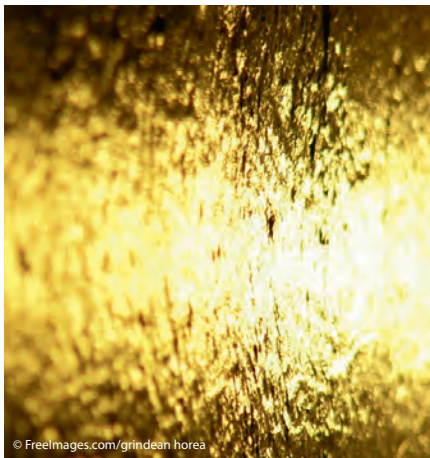
Researchers at Vanderbilt University have used iron pyrite, commonly known as fool's gold, to produce batteries that charge quickly and work for dozens of cycles.

The research team, headed by Assistant Professor of Mechanical Engineering Cary Pint and led by graduate student Anna Douglas, became interested in iron pyrite because it is one of the most abundant materials in the Earth's surface. It is produced in raw form as a by-product of coal production and is so cheap that it is used in lithium batteries that are bought in the store and thrown away after a single use.

Despite all their promise, researchers have had trouble getting nanoparticles to improve battery performance.

"Researchers have demonstrated that nanoscale materials can significantly improve batteries, but there is a limit," Pint said.

"When the particles get very small, generally meaning below 10 nanometres (40 to 50 atoms wide), the nanoparticles begin to chemically react with the electrolytes and so can only charge and discharge a few times. So this size regime is forbidden in commercial lithium-ion batteries."



Aided by Douglas' expertise in synthesising nanoparticles, the team set out to explore this 'ultrasmall' regime. They did so by adding millions of iron-pyrite quantum dots of different sizes to standard lithium button batteries like those that are used to power watches, automobile key remotes and LED flashlights. They got the most bang for their buck when they added ultrasmall nanocrystals that were about 4.5 nanometres in size. These substantially improved both the batteries' cycling and rate capabilities.

The researchers discovered that they got this result because iron pyrite has a unique way of changing form into an iron and a lithium-sulfur (or sodium-sulfur) compound to store energy. "This is a different mechanism from how commercial lithium-ion batteries store charge, where lithium inserts into a material during charging and is extracted while discharging — all the while leaving the material that stores the lithium mostly unchanged," Douglas explained.

"Instead of just inserting lithium or sodium ions in or out of the nanoparticles, storage in iron pyrite requires the diffusion of iron atoms as well. Unfortunately, iron diffuses slowly, requiring that the size be smaller than the iron diffusion length — something that is only possible with ultrasmall nanoparticles."

A key observation of the team's study was that these ultrasmall nanoparticles are equipped with dimensions that allow the iron to move to the surface while the sodium or lithium reacts with the sulfurs in the iron pyrite. They demonstrated that this isn't the case for larger particles, where the inability of the iron to move through the iron pyrite materials limits their storage capability.

AUSTRALIAN ENGINEER TO HEAD GLOBAL ENGINEERING BODY

Australian engineer Dr Marlene Kanga AM has been elected to the position of president-elect of the World Federation of Engineering Organizations.

Engineers Australia CEO Stephen Durkin welcomed the appointment, saying, "Dr Kanga has been an outstanding advocate for the engineering profession in this country. As a former national president of Engineers Australia, Dr Kanga has a strong history of service to the engineering profession and we are proud to have such an eminent engineer representing Australia on the international stage.

"Dr Kanga will formally take the role of president of this international organisation in December 2017 for a two-year term. During her term, Engineers Australia will be celebrating its centenary and hosting the World Engineers Convention in Melbourne in November 2019. This will make Engineers Australia a focus of the engineering world.

"The World Federation of Engineering Organizations operates under the auspices of UNESCO and is the voice of the engineering profession at an international level, addressing global issues such as education standards, international mobility, sustainable engineering practices and solutions to mitigate the impacts of climate change and natural disasters. It represents 90 national and 10 international and regional institutions and some 20 million engineers. Dr Kanga's election is a clear recognition of her leadership at an international level.

"Dr Kanga has been a strong campaigner for the critical role of innovation in our national economy and other issues that challenge our profession and our national economy.

"Dr Kanga's election comes at a time when Australian engineers and engineering firms are expanding their global influence. Having such an eminent engineer take the message of Australian engineering to the international community is an outstanding achievement."





SMART CHIP ANALYSES BATTERY HEALTH

Scientists have developed a smart chip that can tell how healthy a battery is.

Developed by Professor Rachid Yazami, of the Energy Research Institute @ Nanyang Technological University (NTU Singapore) (ERI@N), this smart chip is small enough to be embedded in almost all batteries — from the small batteries in mobile devices to the huge power packs found in electric vehicles and advanced aeroplanes.

“Although the risk of a battery failing and catching fire is very low, with the billions of lithium-ion batteries being produced yearly, even a one-in-a-million chance would mean over a thousand failures,” explained Professor Yazami, who holds more than 50 patents and has authored more than 200 scientific papers, book chapters and reports on batteries.

“This poses a serious risk for electric vehicles and even in advanced aeroplanes, as usually big battery packs have hundreds of cells or more bundled together to power the vehicle or aircraft. If there is a chemical fire caused by a single failed battery, it could cause fires in nearby batteries, leading to an explosion.”

Embedded in the smart chip is a proprietary algorithm developed by Professor Yazami that is based on electrochemical thermodynamics measurements (ETM) technology.

Current lithium-ion batteries have a chip in them which only shows voltage and temperature readings. Today’s battery chips are unable to detect symptoms of a malfunction and can also show only the estimated amount of charge the battery is holding.

In comparison, Professor Yazami’s patented algorithm is able to analyse both the state of health and the state of charge through a three-dimensional chart. On a monitor screen, it looks similar to a ski route down a mountain.

Drawing on the analogy of a fingerprint, he said: “The ‘ski route’ of a brand new battery looks different from those of a degraded or faulty battery — just like how two fingerprints will look quite different.

“In addition to knowing the degradation of batteries, our technology can also tell the exact state of charge of the battery, and thus optimise the charging so the battery can be maintained in its best condition while being charged faster,” added Professor Yazami, the director of Battery Programmes at ERI@N.

“My vision for the future is that every battery will have this chip, which will in turn reduce the risk of battery fires in electronic devices and electric vehicles while extending their life span.”

Worldwide annual production of portable battery cells has been predicted to grow from 13 billion in 2014 to over 35 billion by 2025, according to a report by Avicenne Energy.

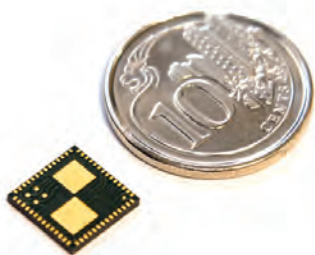
The smart chip took Professor Yazami more than five years to develop and is now marketed by his start-up, KVI. Working together with Professor Yazami on developing the smart chip platform at ERI@N is research scientist Sohaib El Outmani.

KVI is now being incubated by NTU’s commercialisation arm, NTUitive. KVI is developing the chip into a series of products, including battery packs for recharging mobile devices, charge gauge for electric vehicles and a smart chip for every battery.

The start-up company has an exclusive licence on Professor Yazami’s ETM technology, which is based on his research done at NTU Singapore, the California Institute of Technology (Caltech) and the French National Centre for Scientific Research (CNRS).

His research incorporates two other factors: entropy, a measure of disorder or randomness of a system; and enthalpy, which is the sum of internal energy of a system.

It is expected that the technology will be made available for licensing by chipmakers and battery manufacturers before the end of 2016.



AUSTRALIAN ELECTRONICS RESEARCHER AMONG WORLD’S BEST

UNSW Scientia Professor Michelle Simmons has been named a fellow of the American Association for the Advancement of Science (AAAS) for her groundbreaking research developing atomic-scale electronics. Professor Simmons’ team is now the only group in the world that can make electronic devices in silicon at the level of individual atoms.

Simmons is an ARC Laureate Fellow and director of the ARC Centre of Excellence for Quantum Computation and Communication Technology at UNSW. She leads a team of 180 researchers developing a radical, uniquely powerful quantum computing technology that aims to interface with completely secure communication systems.

As a consequence of both Simmons’ leadership of the centre and her own research program, Australian researchers are now at the international forefront of classical and quantum computing technologies in silicon. Her research has important implications for the semiconductor industry and is anticipated to be transformational in the field of quantum computation.





UNSW RESEARCHER MAKES NANOMEDICINE BREAKTHROUGH



Image credit: Quentin Jones

Associate Professor
Cyrille Boyer.

A UNSW researcher has used near-infrared light to create polymers — a discovery with significant implications for nanomedicine.

Polymers make up the human body's DNA and proteins, while synthetic polymers are used to manufacture everything from paints and plastics to textiles and glue.

UNSW Associate Professor Boyer, who is deputy director of the Australian Centre for Nanomedicine, is looking for more sustainable ways to produce these essential molecules, particularly for use in medical applications. For the first time, he has been able to use a low-energy form of light known as near-infrared to drive the polymerisation process, a breakthrough Professor Boyer said would open new horizons for materials science and medicine.

All objects with a temperature emit infrared radiation, and Associate Professor Boyer's work focuses on a part of the spectrum called near-infrared — a kind of energy harvested by bacteria living in deep-sea vents where light is scarce.

These bacteria use a specialised kind of chlorophyll to harness the near-infrared light, which is emitted from superheated waters erupting from the vents.

Associate Professor Boyer and PhD candidate Siva Shanmugam were able to mimic this process in the laboratory and use the energy produced to build polymers, with an exquisite degree of control over initiating and stopping the process and the length of the chains produced.

Unlike visible light, near-infrared can penetrate objects including human tissue while using a fraction of the energy, making it much safer than ultraviolet (UV) light for biological use.

UV light damages DNA and can cause cancer and mutations, making it toxic for humans, but Associate Professor Boyer said the safety profile of near-infrared light meant it could be used within the body to regenerate tissue or control bleeding during surgery.

Such polymerisation could also be done within the body, he said, paving the way for new joint replacement cements that could be triggered to set with near-infrared light rather than setting within moments of being applied.

The next phase of his research will focus on in vitro studies using live material, with the aim of encapsulating living cells in polymeric gels.

"Using a system like near-infrared will allow you to be more friendly for the materials and also biofriendly for humans," he said.

TUNABLE FILTER FOR FASTER INTERNET

Canadian researchers have designed a new tunable filter with the widest tuning span ever demonstrated on a silicon chip that could help provide the low-cost flexibility needed for the next generation of high-speed optical networks.

The device's performance is claimed to be comparable to the best benchtop systems, but at a fraction of the size and cost. The filter's tuning span, which is a measure of how well the device can adjust to fluctuating data demands, is the widest ever demonstrated on a silicon chip. Additionally, the device has an unlimited free-spectral range, meaning it can operate over any range of frequencies, and shows excellent performance metrics in other standard measures of filter quality, including very low insertion loss and in-band ripples, low crosstalk and small delay variation.

"The most exciting aspect is that these recordbreaking results were achieved on the silicon photonic platform," said Wei Shi, Assistant Professor, Université Laval in Québec, Canada. "This indicates that the filter can be readily integrated with other well-developed components for a novel integrated system. It's like finding the missing piece in a puzzle," Shi said.

The optical spectrum is a limited resource — as internet traffic has increased dramatically, bandwidth has become more precious. To maximise the power and cost efficiency of communication, optical networks must be able to flexibly allocate bandwidth, giving each customer only what they need at any given time.

"Compared to traditional networks where optical resource allocations are predetermined and fixed, flexible networks enable orders-of-magnitude higher data volumes per optical carrier and throughout the entire spectrum," Shi said.

Flexible networks require tunable filters. Filters isolate a specific communication channel from all the others and tunable filters give a network controller the freedom to select the frequency and bandwidth for each channel and change them on the fly.

The tunable filter that Shi and his colleagues designed and tested has a tuning span of 670 GHz, much greater than the approximately 100 GHz span other silicon-based filters have achieved. The researchers believe that with further modification their device's tuning span can be even further extended, to 1 THz.

The device works by using periodic nanostructures, 10,000 times smaller than the width of a human hair, to separate the different frequencies of light from each other. The filter tuning is achieved with micro-heaters in the silicon chip that control the local temperature, which in turns affects the nanostructures and the frequencies they separate.

The device also has a compact footprint and is built on a CMOS-compatible nanophotonic integrated platform. CMOS is the technology used by the computer industry to make integrated circuits, and because the techniques are so well optimised, CMOS-compatible chips are potentially very low cost.



LIQUID-TIGHT CORDGRIPS

Heyco-Tite Multi-Hole Break-Thru Liquid Tight Cordgrips offer the flexibility to use fewer of the available holes while still providing a liquid-tight seal around the conductors. For easy installation of conductors, external dimples indicate the presence of an underlying through channel.

The IP68-rated cordgrips are approved for NEMA 4, 4X, 6 and 6P applications and provide a wide range of conductor through-hole size and number configurations. No O-ring is required because the integral sealing ring ensures a good seal at the clearance or threaded mounting hole location.

The cord grips are made from Nylon 6/6 with a TPE sealing gland. Typical applications include industrial equipment, automotive, machinery, electronic equipment, telecommunications and solar.

NPA Pty Ltd

www.npa.com.au

FIELD-STRENGTH METER AND PROBE

The Narda NBM-520 'E' Field Strength Meter, together with the Probe EF1891, provides a non-ionising radiation survey system with wide frequency coverage of electric fields. It is available to rent from TechRentals.



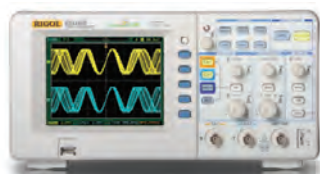
Designed for easy one-handed operation, the meter is suitable for general RF safety, service work on transmitting and radar equipment, mobile antennas, broadcasting and satellite communication systems. The unit also suits operating diathermy equipment and other medical instruments producing short-wave radiation.

Features include: easy four-button operation; automatic probe type recognition; audible alarm function (threshold adjustable by PC software); and auto-zeroing (time interval adjustable by PC software).

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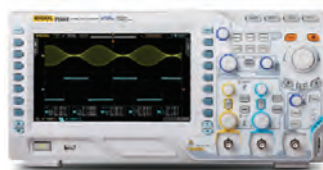
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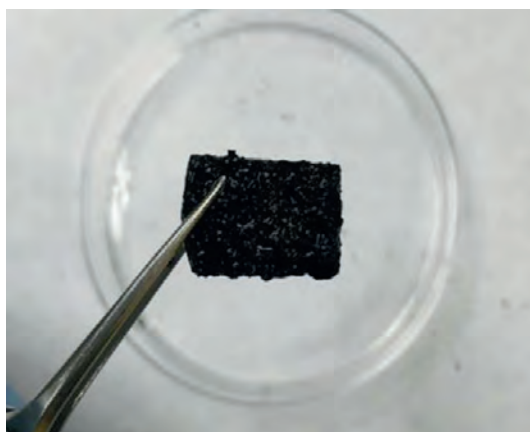
Although technology is moving towards lighter, flexible, foldable and rollable electronics, the existing circuits that power them are not built to flex freely and repeatedly self-repair cracks or breaks that can happen from normal wear and tear.

Until now, self-healing materials have relied on application of external stimuli such as light or heat to activate repair. The 'super-gel' material, developed by researchers in the Cockrell School of Engineering at The University of Texas, has high conductivity and strong mechanical and electrical self-healing properties.

"In the last decade, the self-healing concept has been popularised by people working on different applications, but this is the first time it has been done without external stimuli," said mechanical engineering assistant professor Guihua Yu, who developed the gel.

"There's no need for heat or light to fix the crack or break in a circuit or battery, which is often required by previously developed self-healing materials."

Yu and his team created the self-healing gel by combining two gels: a self-assembling metal-ligand gel that provides self-healing properties and a polymer hydrogel that is a conductor. A paper on



Self-repaired supergel supports its own weight after being sliced in half.

the synthesis of their hydrogel appears in the November issue of *Nano Letters*.

In this latest paper, the researchers describe how they used a disc-shaped liquid crystal molecule to enhance the conductivity, biocompatibility and permeability of their polymer hydrogel.

They were able to achieve about 10 times the conductivity of other polymer hydrogels used in bioelectronics and conventional rechargeable batteries. The nanostructures that make up the gel are the smallest structures capable of providing efficient charge and energy transport.

To construct the self-healing electronic circuit, Yu believes the self-healing gel would not replace the typical metal

conductors that transport electricity, but it could be used as a soft joint, joining other parts of the circuit.

"This gel can be applied at the circuit's junction points because that's often where you see the breakage," he said. "One day, you could glue or paste the gel to these junctions so that the circuits could be more robust and harder to break."

Yu's team is also looking into other applications, including medical applications and energy storage, where the gel holds tremendous potential to be used within batteries to better store electrical charge.

Yu's research has received funding from the National Science Foundation, the American Chemical Society, the Welch Foundation and 3M.



TOUCH PANEL PC SERIES

IEI Integration's latest IoT solution, the 12", 15" and 17" IOVU all-in-one terminal series, has been released to satisfy the increasing demand for Android panel PCs. Supporting a wide range of operating temperatures from -20 to 60°C and providing safety and flexibility in power management, the series is a powerful solution for maximising efficiencies in smart retail, industrial automation and warehousing.

The series is equipped with Power over Ethernet (PoE) technology. This technology features a system that safely transfers electrical power through data transmission in an ethernet network and simplifies deployment by using the common ethernet cabling infrastructure. PoE is said to reduce downtime and cost, and is easy to maintain and upgrade. Furthermore, the front panel is fitted with a projected capacitive touchscreen in 12", 15" or 17" sizes to provide responsive and easy-to-use interaction.

The IP65-compliant aluminium front panel makes the PC suitable for applications in harsh environments. Powered by the Freescale i.MX6 Cortex-A9 quad-core 1 GHz processor with the free-licensed Android 4.2.2 operating system, the series enables high-performance computing. Through Wi-Fi and Bluetooth connectivity, the series can provide real-time data access.

The series is designed with multiple I/O interfaces, such as one CAN 2.0, two USB 2.0 and four GPIO, to meet a variety of demands. Its features are aimed at creating user-friendly experiences.

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TIMING ANTENNAS



The TW3150/TW3152 Timing Antennas, from Tallysman's GNSS antenna range, are high-gain, high-rejection antennas designed for timing applications in high-density cell/telecommunications tower applications where high levels of near-out-of-band interfering signals can be expected.

The antennas feature a 50 dB LNA gain to handle long cable runs often associated with installation on telecommunications towers. Covering GPS L1 and SBAS (WAAS, EGNOS and MSAS) frequency bands, the antennas employ Tallysman's Accutenna technology to provide good cross-polarisation rejection and enhanced multipath rejection.

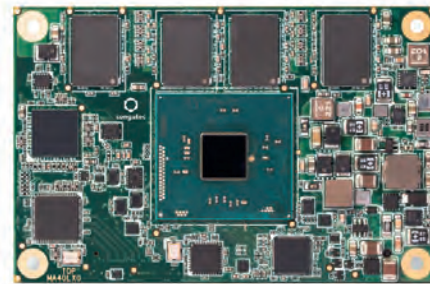
The TW3150 features a four-stage, dual-filtered LNA, while the TW3152 includes an additional SAW pre-filter to provide good rejection of close out-of-band signals and additional protection against saturation by high-level sub-harmonic and L-Band signals. This provides better than 80 dB of signal rejection above 1610 MHz and below 1545 MHz.

The antennas' housing has a permanent mount, IP67 and MIL-STD-801F Section 509.4 compliant metal base and a plastic radome with an extended temperature range. The housing is specifically designed to withstand challenging environmental conditions.

The antennas are REACH and ROHS compliant and there are two options available for mounting an L-bracket or a pipe mount.

M2M Connectivity

www.m2mconnectivity.com.au



COMPUTER MODULE

congatec extends its portfolio of credit card-sized computer modules by integrating the 14 nm Intel Pentium and Celeron processors on COM Express Mini modules. The conga-MA4 module is said to offer an increase in performance over the previous modules, with heat dissipation lowered to an SDP (scenario design power) of 4 W. This enables compact, passively cooled system designs.

Windows 10 support makes the COM Express Mini modules suitable for system designs with state-of-the-art operating systems. The modules also make it easy to connect two 4k screens due to Intel Gen 8 graphics with up to 16 execution units.

The high level of computing and graphics performance is complemented by a full set of COM Express Type 10-compliant interfaces. This makes the modules suitable for graphics-intensive, low-power applications requiring a small footprint, such as banking, vending and POS terminals. Additional uses could include medical imaging, compact diagnostic workstations, IoT-connected industrial controls and compact and robust box PCs and thin clients.

Users will benefit from the high level of standardisation and scalability of the COM Express modules combined with congatec's documentation, industry-grade driver implementations and customary personal integration support. The company supports its products with long-term availability of at least seven years.

congatec Australia Pty Ltd

www.congatec.com



DC MOTOR

The 2668 ... CR DC motor from FAULHABER is said to offer considerably more power than comparable drives and to be the most powerful copper-graphite commutated DC micromotor on the market in its size class.

Due to a big NdFeB magnet and a high copper content in the winding, the product supplies a rated torque of 70 mNm. As a result, it weighs just 189 g with a diameter of 26 mm. Furthermore, it reaches full power quickly due to its high-pulse torque. The unit is therefore well suited to professional high-performance tools such as pruning shears or motorised screwdrivers.

The copper-graphite brushes of the motor are characterised by their good stability and low wear. The housing is made of coated steel and the motor can be combined with high-resolution optical or magnetic encoders. As well as handheld devices, it is also suitable for applications such as in aerospace, robotics, medical technology, special machinery construction, metering systems and automation solutions.

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SING TO YOUR DATA

FOR FASTER COMPUTING

A team from the Universities of Sheffield and Leeds may have found the solution to faster computing: sound. Certain types of soundwaves can move data quickly using minimal power.

The world's 2.7 zettabytes of data are mostly held on hard disk drives; magnetic disks that work like miniaturised record players, with the data read by sensors that scan over the disk's surface as it spins. But because this involves moving parts, there are limits on how fast it can operate.

For computers to run faster, we need to create 'solid-state' drives that eliminate the need for moving parts — essentially making the data move, not the device on which it's stored. Flash-based solid-state disk drives have achieved this and store information electrically rather than magnetically. However, while they operate much faster than normal hard disks, they last much less time before becoming unreliable, are much more expensive and still run much slower than other parts of a modern computer, limiting total speed.

Creating a magnetic solid-state drive could overcome all of these problems. One solution being developed is 'racetrack memory', which uses tiny magnetic wires — each one hundreds of times thinner than a human hair — down which magnetic 'bits' of data run like racing cars around a track.

Existing research into racetrack memory has focused on using magnetic fields or electric currents to move the data bits down the wires. However, both these options create heat and reduce

power efficiency, which will limit battery life and increase energy bills and CO₂ emissions.

Dr Tom Hayward from the University of Sheffield and Professor John Cunningham from the University of Leeds have together come up with a completely new solution: passing soundwaves across the surface on which the wires are fixed. They also found that the direction of data flow depends on the pitch of the sound generated — in effect, they 'sang' to the data to move it.

The sound used is in the form of surface acoustic waves — the same as the most destructive wave that can emanate from an earthquake. Although already harnessed for use in electronics and other areas of engineering, this is the first time surface acoustic waves have been applied to a data storage system.

"The key advantage of surface acoustic waves in this application is their ability to travel up to several centimetres without decaying — which, at the nanoscale, is a huge distance. Because of this, we think a single soundwave could be used to 'sing' to large numbers of nanowires simultaneously, enabling us to move a lot of data using very little power. We're now aiming to create prototype devices in which this concept can be fully tested," said Dr Hayward, from Sheffield's Faculty of Engineering.



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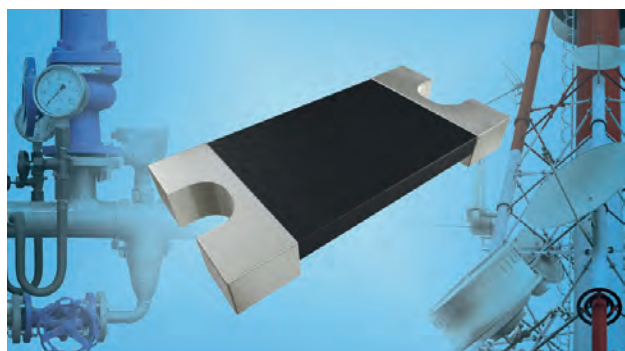
SEALED MINI XLR CONNECTORS

The Sealed Tini-QG line of mini XLR connectors, from Switchcraft, are waterproof to IP66 when mated and available as cable end, cable to cable and panel mount.

The connectors feature an easy-to-operate, intuitive, push-button latch with an updated moulded handle design. The front-mount panel sits flush, protecting the connector from physical impact. The product is rated to withstand a minimum of 5000 insertions/withdrawals cycles in the 3–5 pin versions (2000 cycles for 6–8 pins).

The sealed devices meet harsh environment connector requirements and are suitable for applications ranging from medical instruments to audio connectors in wireless bodypacks and outdoor equipment. They can be mated with unsealed mini XLRs (IP rating does not apply).

Clarke & Severn Electronics
www.clarke.com.au



CURRENT SENSE RESISTOR

Vishay Intertechnology has announced a surface-mount Power Metal Strip current sense resistor featuring a Kelvin 4-terminal connection that reduces TCR down to 35 ppm and enables tight tolerances down to 0.1%. The Vishay Dale WSK1206 combines tight tolerance and low TCR with low resistance values down to 0.01Ω in the compact 1206 case size.

With its 4-terminal construction, the device reduces system errors while eliminating the need for system calibration. The construction incorporates a solid metal nickel-chrome or manganese-copper resistive element with low TCR (<20 ppm/°C). This results in a pulse-tolerant, tight tolerance resistor in the 1206 package size that maintains the good electrical characteristics of the Power Metal Strip construction. The device's low resistance value minimises excess power dissipation, while its tight tolerance and low TCR reduce measurement error and eliminate the need for calibration during manufacturing or in the field.

The product is suitable for current sensing, voltage division and pulse applications in power management for mobile phones; DC/DC converters for servers, VRMs for laptops and Li-ion battery safety and management; industrial instrumentation; and automotive electronic control such as engine, transmission, antilock brakes, audio and climate controls.

RS Components Pty Ltd
www.rsaustralia.com

MINI-ITX MOTHERBOARDS

congatec is extending its industrial-grade Thin Mini-ITX motherboard portfolio to include graphics-rich conga-IA4 boards with 14 nm Intel Pentium and Celeron processors and full Windows 10 support. The Thin Mini-ITX boards are said to offer increased computing and graphics performance, as well as support for up to three 4k displays.

The power requirement has been lowered to 3 W SDP (scenario design power), which enables energy-saving, fanless system designs. With their construction height of just 20 mm, the motherboards allow for flat system designs and can even be integrated into slim panel PCs.

The industrial-grade motherboards are designed for deployment in applications where conventional motherboards do not suffice in terms of robustness, interference resistance, 24/7 operation and long-term availability. Applications of the boards include cash register

systems, scales and vending machines, gaming and digital signage applications as well as industrial HMI's, panel PCs and thin clients in manufacturing, logistics and clinical environments.

congatec Australia Pty Ltd
www.congatec.com





RUGGED FANLESS PC

Neosys Technology's fanless embedded computer, the Nuvo-5000 series, features the Intel 6th Generation Core i7/i5/i3 processor. It supports LGA1151 socket-type CPUs to offer greater flexibility for CPU selection.

In addition to general I/O interfaces, such as up to six Gigabit Ethernet ports, eight USB ports and VGA/DVI/DP triple display outputs, the product integrates Neosys' expansion cassette for easy accommodation of an

off-the-shelf PCI/PCIe card. It also incorporates the company's MezIO interface to deliver incomparable versatility for a range of applications.

The MezIO interface provides computer signals, power rails and control signals via a high-speed connector and is mechanically reliable. By installing either a standard or customised MezIO module, the Nuvo-5000 turns from a general embedded controller into an application platform with specific I/O functions.

Benefited by Neosys' fanless architecture, the PC presents thermal reliability, even with an LGA-type CPU. It supports wide-temperature operating from -25°C (cold boot) to +70°C (100% loading).

The series has been designed for: machine vision platforms with multiple GigE/PoE ports; in-vehicle fanless PCs; surveillance/video analytics computer systems; wide-temperature and rugged applications; and ultracompact fanless controllers.

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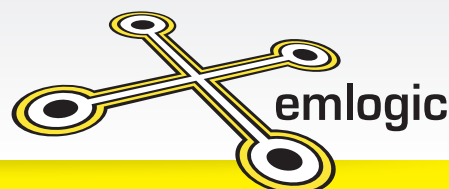
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TRANSPARENT CONDUCTORS

Flexible, transparent electrical conductors with record-high performance can now be made by spreading polymers on a clear surface with a tiny blade, like a knife spreading butter on toast.

The technique has already been used to make patterned electrodes for touch sensors and organic solar cells, and with further development could be a tool for manufacturing transparent conductors on a large scale.

Researchers from Stanford University and the Department of Energy's SLAC National Accelerator Laboratory achieved record-high conductivity by tuning the coating process. "That shows there's a lot of room for achieving high performance through controlling the assembly and structure of materials at the molecular scale," said Zhenan Bao, a Stanford professor and member of SIMES, the Stanford Institute for Materials and Energy Sciences at SLAC, who led the study.

Clear conductors for flexible gadgets

Bao's group developed this 'solution shearing' technique in close collaboration with Michael Toney and Stefan Mannsfeld, staff scientists at SLAC's Stanford Synchrotron Radiation Lightsource (SSRL), whose teams used X-rays to look at the structures and properties of the finished films.

Transparent conductors are used where it's important to get light in or out of a device, such as in solar cells, electromagnetic shielding, antistatic layers and lighting displays. Today, these conductors are mostly made with indium tin oxide, or ITO. But ITO is expensive to work with, and it isn't compatible with the flexible displays being developed for a new generation of TV screens, computers and other electronics. In this study, the researchers turned to PEDOT:PSS, a conductive blend of two polymers that turns transparent as it dries. It's also much cheaper and more flexible than ITO.

Tuning the process

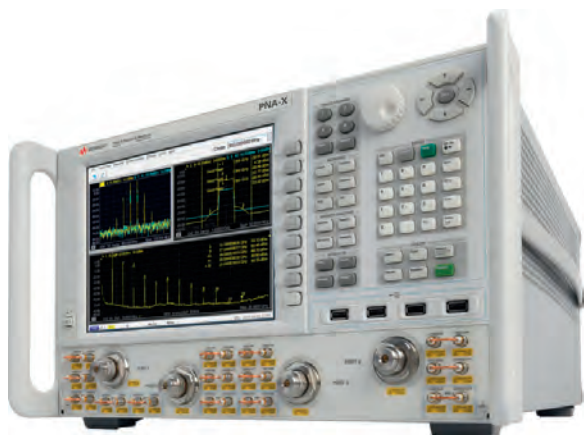
A matchbook-sized silicon blade spread a thin layer of PEDOT:PSS on various surfaces — including glass, silicon and PET, a clear polyester resin used in beverage containers — at speeds up to 6 metres per minute. By varying the speed and adjusting the temperature of this process, the researchers were able to produce see-through films of

various thickness and conductivity, and also get the PEDOT and PSS polymers to separate into layers, which increased the film's conductivity even more. The best films they made beat the existing conductivity record for PEDOT:PSS.

Next they used the method to create working electrodes: first they printed electronic circuit patterns on a glass surface with a chip manufacturing technique called photolithography. Then they spread the polymer mix over the surface with the blade. The conductive polymers stuck to the patterned areas but not to the bare glass, creating circuits where electrical currents can travel. The resulting electrodes were tested and found to work in solar cells and touch sensors.

"Solution shearing is still an experimental technique, but it's becoming more common as a way to deposit these polymeric materials," said Sean Andrews, a postdoctoral researcher who carried out the bulk of the experiments with former postdoc Brian Worfolk, now a scientist with Phillips 66. "We're looking for ways to increase the performance of these films with methods that can be scaled up for industrial manufacturing." He said the team continues to carry out X-ray studies to find out exactly why spreading the polymers with a blade — which stretches them out along one direction and arranges the molecules in different ways as they dry — makes them more conductive, so they can control and take advantage of the process to make even better transparent conductors.

In earlier studies, the research team used variations of the technique to test better ways to manufacture high-quality semiconductors and solar cells. Their solution shearing apparatus was set up with funding from a SLAC Laboratory Directed Research and Development grant. The research was also supported by the DOE's Energy Efficiency and Renewable Energy (EERE) BRIDGE program, which aims to significantly lower the cost of solar energy systems; the Stanford Global Climate and Energy Program; Stanford's Tomkat Center for Sustainable Energy; and the National Science Foundation. Parts of the study were carried out at SSRL, which is a DOE Office of Science User Facility.



VECTOR NETWORK ANALYSER WITH SPECTRUM ANALYSER

Keysight Technologies has announced the addition of a high-performance spectrum analyser to its PNA and PNA-X series microwave vector network analysers (VNAs). Incorporating this functionality into a VNA simplifies system connections and saves time by putting high-speed spurious measurements in the instrument used to characterise S-parameters, compression and distortion in satellite equipment, defence electronics and commercial wireless devices.

With the spectrum analyser capability, the VNA can perform fast spurious searches across a broad frequency band, improving test throughput by as much as 500 times compared to existing approaches. Measurement results are said to be comparable to those obtained with fast, sophisticated standalone spectrum or signal analysers.

The VNA can also perform simultaneous spectrum measurements on all test ports. This capability reduces design cycle time by enabling one-connection characterisation of mixers, converters, amplifiers, modules or subsystems. Example measurements include LO, RF and IF feedthrough; harmonics; intermodulation products; and other higher order mixing products.

In-fixture and on-wafer measurements gain the benefits of VNA calibration and de-embedding, which correct receiver-response errors and also remove cable and fixture effects. The resulting improvement in test accuracy makes it possible to achieve narrower test margins and tighter device specifications.

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SMART LIVING

Xavier Baraton*

By 2030 the global population is expected to grow to more than eight billion people, with more than 60% living in cities. In addition, changing demographics of people living longer than 65 years will nearly double.

The challenge is to maintain people's quality of life while maintaining (or improving) a city's competitiveness, while also addressing the challenges of an ageing population, scarce resources and climate change. With smart systems in smart cities, we can do more with less.

The smart city is built on awareness and (some elements of) real-time control of all of the critical functions and infrastructure of the city. The citizens of the city and their 'smart things' are key actors in enabling the smart city to do more with less.

Today we are entering a new era in which the 'smart home' will continue to provide access to an ever-increasing range of entertainment, information and communication services while also playing a far greater role in many other aspects of our lives, including in health and wellness, domestic security and, particularly important, the need to use energy more efficiently, both to minimise energy costs and to contribute to the worldwide need to develop a sustainable energy strategy to address climate change.

Many factors are enabling this breakthrough in smart homes. One key factor is the very high level of performance that is possible with today's 'home gateways', which have evolved from the simple STB to highly sophisticated 'electronic front doors' that

connect the home to a virtually unlimited pipeline of entertainment and information services with the ability to stream this multimedia content to multiple devices located anywhere in the home.

Smart home

Another major factor is the significant improvements that have been made in the price/power/performance trade-offs, in all the major semiconductor components such as sensors, microcontrollers, wireless transceivers and power transistors needed for smarter homes, and in the circuit topologies that can best exploit these advances. Moreover, the advances made by STMicroelectronics and other key technology providers have been complemented by the success of numerous consortia and partnerships in developing reliable, cost-effective international standards, such as the communications protocols used for smart metering and home automation.

Monitoring the smart home

In the future, smart homes will be more energy efficient and safer because of a network of monitors and image-sensor cameras distributed around the home. Self-powered nodes will easily be positioned around the home for tasks such as temperature, CO (carbon

In a real-world example, smart metering company Meterlinq recently launched an open-standard smart-metering gateway built on ST's MCU and RF technologies. Meterlinq's remote reading and remote management system, based on ST's ultralow-power micro-controllers, handles the communication between smart meters in households and the neighbourhood data concentrator, which relays the information to the utility-provider control centre. This is the result of collaboration and ecosystem development between ST, gas meter manufacturers, system integrators, data management companies and utility companies.

The most promising renewable energy source today is solar power. Maximising energy harvesting and conversion efficiency is critical to making solar energy competitive with fossil-fuel generation methods. Innovative technologies from ST in solar-power converters that improve efficiency include the proprietary MDmesh and STripFET VII DeepGATE power transistors, which ensure ultralow-loss performance; and silicon carbide (SiC) Schottky diodes for minimising switching losses and improving thermal performance in solar-power systems, where every fractional-percentage efficiency improvement is valuable.

In fact, ST's trials using the company's latest 1200 V silicon carbide diodes have shown a 2% increase in overall inverter yield, even when operating at high load and high frequency. Over the intended lifetime of inverters used in installations such as residential photovoltaic systems and high-power solar farms, this improvement can effectively save many megawatt-hours of valuable energy.

The building network uses the smart meter as the link between the external network of energy sources and the internal demand. Optimised energy management, based on dynamic energy tariffs related to peak- and real-time power consumption, will result in valuable energy saving while minimising inconvenience to the final user. ST has a range of solutions that enable smarter building management. For example, power line communications products permit the use of existing wiring to connect smart systems in the building while intelligent programmable lighting solutions combined with sensors and RF connectivity enable optimised lighting management responsive to external lighting conditions and room occupancy.

ST has a range of solutions that can be used to create smart systems comprising sensing, processing, connectivity and energy management. This connectedness could enable, for example, garbage containers to automatically trigger collection when necessary, ultimately avoiding overfilled containers and also improving garbage fleet management.

Smart meters allow power generators to match consumption more efficiently and give users more control over their usage, providing real-time consumption, quality and outage information, and more flexible tariff schemes and billing.

Smart metering consists of an electronic power meter supplemented by, among other features, full remote control, diagnostics, power peak and consumption analysis, antitampering mechanisms, fault alert and time-variable tariffs. Using power line communication (PLC) technology to connect the meter to the service provider offers

SMART CITIES



Smart factory

With manufacturing consuming more than 40% of global energy, making factories as energy efficient as possible is a goal everywhere. Globally, multiple efforts are underway — all of them complementary. Meanwhile, industrial automation and manufacturing are going through the fourth phase of major change (after lean manufacturing in the '70s, outsourcing in the '90s and automation in the 2000s).

This phase, digitisation, is driven by four enablers, and ST has a hand in most of them. First are the advances in human-machine interaction, such as touch interfaces and augmented-reality systems, driven by progress in sensing technologies. Second is the rise in computing power and the ease and speed of connectivity, leading to an explosion in data volumes and the development of advanced robotics and 3D printing, among others. Finally, the emergence of large-scale analytics and business intelligence is opening new levels of understanding and productivity.

One key program is Industry 4.0. With its origins in Europe, it seeks to bring the advances of the computer revolution to the machines and processes developed in the industrial revolution. A similar undertaking is the Smart Manufacturing Leadership Coalition, which had its origins in the United States.

As with the smart grid, these initiatives aim to bring intelligence and inter-communication to factory devices; they envision a day when, for example, factory machines could predict their own failures and automatically trigger pre-emptive maintenance, or when a supply chain can be so closely monitored that factory output would change automatically in response to changes in demand.

Smart mobility

According to new research from Gartner, by 2020 there will be a quarter of a billion connected vehicles on the road globally. Already, the number of connected cars coming onto the market is rising rapidly, with the likes of BMW, Ford, Mercedes and Tesla — in fact, most of the world's leading car manufacturers — already offering some form of wireless online connection in their latest vehicles.

Offering a simple and compelling upward-migration path from existing parts, ST's automotive MCUs enable improved vehicle performance and economy, with no compromises in security, while facilitating development with a powerful ecosystem and delivering savings by promoting hardware and software re-use. At the forefront of industrialising technologies that are essential to autonomous driving, ST is among the leaders in SoCs for advanced driver assistance systems (ADAS), which raise driving safety by detecting obstacles around the vehicle including other vehicles and pedestrians, as well as traffic signs and lane markings, to automatically operate brakes or control speed and following distance.



TODAY, THANKS TO THE EVER-INCREASING PERVASION OF MICROELECTRONICS TECHNOLOGY, THE TRADITIONAL MEDICAL ELECTRONICS MARKET HAS BEEN TRANSFORMED INTO THE BROADER AND FAST-GROWING HEALTH AND WELLNESS MARKET, IN WHICH PEOPLE ARE TAKING MORE AND MORE RESPONSIBILITY FOR THEIR PERSONAL HEALTH AND FITNESS.

In April 2015, ST announced new members in its multicore microcontroller (MCU) family aimed at making cars safer. These devices are the first to be launched with ST's in-house 40 nm embedded Flash process. The automotive MCUs combine compliance with stringent automotive safety standards, encryption for security and increased memory size for the storage of vital programs and data, strengthening ST's product line of fault-tolerant microcontrollers for demanding applications throughout the car. These mission-critical applications include engine management, transmission, antilock braking, electric power steering, active suspension and ADAS.

MEMS sensors are inside many automotive products. Within ST's AMS product group, the Custom MEMS division develops the sensors that enable applications that help us navigate and make our cars safer. ST was also recently recognised by IHS, a global source of information and analytics, as the leader in automotive sensors for navigation and telematics, as well as the fastest growing automotive-sensor supplier worldwide.

Smart health care

Semiconductors have been used in medical equipment for over four decades but, until recently, this represented just a small part of the industrial electronics sector, mainly dedicated to equipment for use in hospitals and clinics. Today, thanks to the ever-increasing pervasion of microelectronics technology, the traditional medical electronics market has been transformed into the broader and fast-growing health and wellness market, in which people are taking more and more responsibility for their personal health and fitness.

ST is a manufacturing partner for some of the world's most important healthcare equipment manufacturers; flexible development partner for companies with new ideas; as a broad-range supplier able to offer complete hardware and software solutions for the fast proof-of-concept, prototyping, industrialisation and commercialisation scenarios; and a major technology innovator in fields as diverse as microfluidics, ultralow-power design and motion sensing.

STMicroelectronics Pty Ltd
www.st.com



**Xavier Baraton is currently heading the Strategic Business developments for Smart City and Consumer Robotics segments within the Greater China and South Asia region of STMicroelectronics. He is based in Hong Kong.*



TRIAC-DIMMABLE, CONSTANT-CURRENT LED DRIVER

Phihong has announced a series of 10 W TRIAC-dimmable, constant-current LED drivers for residential lighting applications.

The PDA010N Series LED drivers provide energy-efficient, flicker- and shimmer-free performance for a range of residential LED fixtures, including indoor and outdoor fixtures, downlights and architectural lighting. The series is also compatible with leading-edge, trailing-edge and smart dimmer technologies.

Rated for 10 W output power, the LED drivers are available with three constant current outputs (350, 700 and 1000 mA), and are designed to operate using 108–132 VAC and ≤ 0.25 A input power to deliver 78% efficiency at 120 VAC with power factor correction of ≥ 0.9 and total harmonic distortion (THD) of less than 20%.

The LED drivers are waterproof and dustproof per IP67; feature overvoltage, overcurrent, overload, and short-circuit protection; and are certified to UL8750 Class 2 per UL1310 safety specifications. Exhibiting high performance and energy efficiency standards, the series is approved for use in Energy Star products and qualifies for a variety of state energy department and utility company rebates.

The LED drivers measure 80 x 78 x 25.4 mm and weigh 165 g. Operating temperatures for the series span 0 to +85°C.

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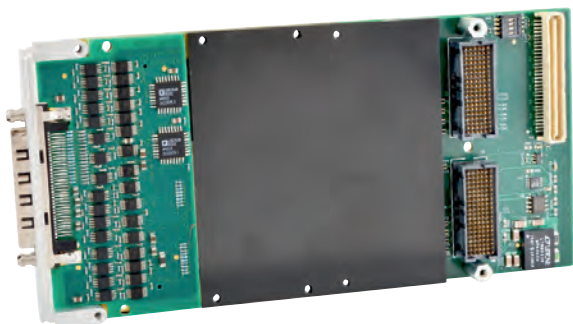
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TR1445



XMC MEZZANINE MODULE AND FPGA

Acromag's XMC-7A200 is an XMC mezzanine module enhanced with a Xilinx Artix-7 FPGA for low power consumption and 128 M x 16-bit Quad DDR3 SDRAM processing performance.

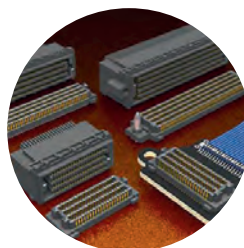
The rear I/O provides an eight-lane, high-speed serial interface on the P16 XMC port. Select I/O or LVDS pairs, plus global clock pairs, direct to FPGA via rear P4 or P16 port. The FPGA module serves as a co-processor, applying custom logic and algorithms to streams of remote sensor data.

The module can be reconfigured via a direct download into the Flash configuration memory over the PCIe bus or the JTAG port. A four-lane, high-speed serial interface on the rear P15 connector supports PCI Express Gen 1/2 (standard), Serial RapidI/O and Xilinx Aurora implementations.

The XMC-7A will provide users with good functionality and a balanced mix of I/O, all based on Xilinx's latest Vivado development package. Typical applications include hardware simulation, communications, in-circuit diagnostics, military servers, signal intelligence and image processing.

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RIGHT-ANGLE PITCH SOCKET ARRAY

Samtec's right-angle SEARAY

0.80 mm pitch socket array is suitable for micro backplane applications, with up to 50% board space savings compared to 1.27 mm pitch SEARAY interconnects. The open pin field design allows for maximum grounding and routing flexibility with up to 500 total Edge Rate contacts.

The ultrahigh-density right-angle socket array (SEAF8-RA Series) features a choice of eight or 10 rows, up to 50 contacts per row and high-speed performance of 28+ Gbps. Optional guide post holes are available for blind mating. Individual high-power modules with press fit tails (UBPT/UBPS Series) are an add-on option for greater system flexibility. Additionally, the mating micro coax cable assembly (ESCA Series) features 34 AWG micro ribbon coax cable, a signal-to-ground ratio of 4:1 and optional screw downs.

Samtec's Edge Rate contact system increases cycle life and minimises the effects of broadside coupling, which decreases cross-talk for good signal integrity performance and impedance control. The rugged contact system is also less prone to damage when 'zippered' during unmating. Lead-free solder charge terminations simplify IR reflow termination and improve solder joint reliability.


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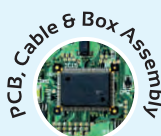
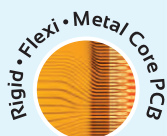
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CLUSTERING

KEY TO ELECTRONICS INDUSTRY GROWTH

Dr Ronald Grill, Managing Director, Technology Management

Industry clusters have long been used to facilitate economic growth. New research shows how the electronics industry in Adelaide and in Christchurch is using a cluster-based approach to seize growth opportunities.

Aggregation of industry-related businesses in geographic proximity is not new. The phenomenon was reported during the Industrial Revolution in places described as 'industrial districts'. In 1990, Harvard Professor Michael Porter introduced the term 'cluster' to describe the 20th-century iteration of this natural aggregation process. Porter defined clusters as "geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions in a particular field that compete but also cooperate".

So how have electronics firms evolved unaided over decades into dense and highly productive 'industry clusters'? Electronics industry professionals communicate on common interests with others in local firms, and when this leads to collaboration a cluster can begin to form. Collaboration between businesses and local education, research and support organisations provides a channel for the interchange of information, goods and services. Repeat localised business reduces transaction costs and increases productivity. Specialisation allows local businesses to outsource

non-core tasks to trusted local companies. These relationships lead to a high level of firm-to-firm interdependence. A developed cluster provides significant advantages to its participants — these benefits aren't available to businesses that are isolated. Start-ups thrive in a cluster environment and the establishment of specialised firms can further extend cluster capability. However, it takes decades to develop successful clusters.

Recent research provides additional understanding of the widely studied electronics clusters in Austin, Texas; Cambridge, UK; and Silicon Valley, California. As a part of this research project, electronics clusters in Ireland, Scotland and Singapore were also studied. The study, involving 18 cities around the world, also included the relatively unknown electronics clusters in Adelaide, South Australia and Christchurch in New Zealand. So far, only limited research has been done on the Australasian clusters, and their origin, structure and value to the regional communities and governments is not well understood.

The research found that the most successful and highest density electronics clusters developed unplanned in small and relatively

remote second-tier regions. Adelaide, Austin, Cambridge and Christchurch are small cities that are relatively distant from major cities, and while Silicon Valley's population has now reached 1.8 million, it was once a small and isolated horticultural community with a population of 290,000 (in 1950).

Electronics industry professionals in smaller cities are isolated from major markets and they tend to network with people from their school, university and community organisations. These prior relationships establish initial trust and a 'known and trusted' local colleague is often preferred to a lesser-known collaborator in a distant city. Cluster firms typically operate within unwritten, tacitly agreed behavioural norms and this encourages collaboration. Negative feedback loops also operate in industry clusters – which means cluster participants must 'play by the rules' since unfavourable reports circulate rapidly in small communities.

Electronics clusters have developed in very few small and relatively isolated global regions, indicating that small city size and remoteness alone are not sufficient to initiate a cluster. In each city — Adelaide, Austin, Cambridge, Christchurch and Silicon Valley — a unique factor was responsible for the formation of clusters. Austin's electronics cluster was developed by academics who started a surveillance company for the technology they had developed at the University of Texas, Austin. The Cambridge electronics cluster started with a spinout established by academics for measurement technologies developed at the University of Cambridge. The origin of the Silicon Valley cluster is related to the establishment of Hewlett Packard to manufacture a new audio oscillator developed by the company's founders at Stanford University.

While Adelaide and Christchurch have good research universities, the electronics clusters in these two cities did not emerge from educational institutions. The origin of the Christchurch cluster was closely related to the establishment of two-way radio manufacturer Tait Electronics. This firm was started in 1954 by Angus (later Sir Angus) Tait, following his return from military service in the UK where he developed defence electronic systems while on secondment from the New Zealand Army.

The electronics cluster in Adelaide started with the relationships among the defence research laboratories, now Defence Science and Technology Organisation (DSTO). This is Australia's principal defence research centre with 1000 scientists, engineers and technologists. DSTO is Adelaide's enduring dividend from the 1947 joint UK and Australian Government's establishment of the Woomera Rocket Range and, importantly, the Adelaide-based laboratories that designed and custom-built the measurement and guidance systems for rocket weapon testing. DSTO specialises in electronics, communications, computing and surveillance systems. Former DSTO staff and employees of the adjacent defence contractor companies are employed in many Adelaide electronics cluster firms and have spawned many Adelaide start-ups in the defence and non-defence electronics sectors. Adelaide, with less than 6% of Australia's population, controls more than one-third of the Australian electronics industry. Christchurch, with less than 8% of New Zealand's population, also has over one-third of New Zealand's electronics industry.

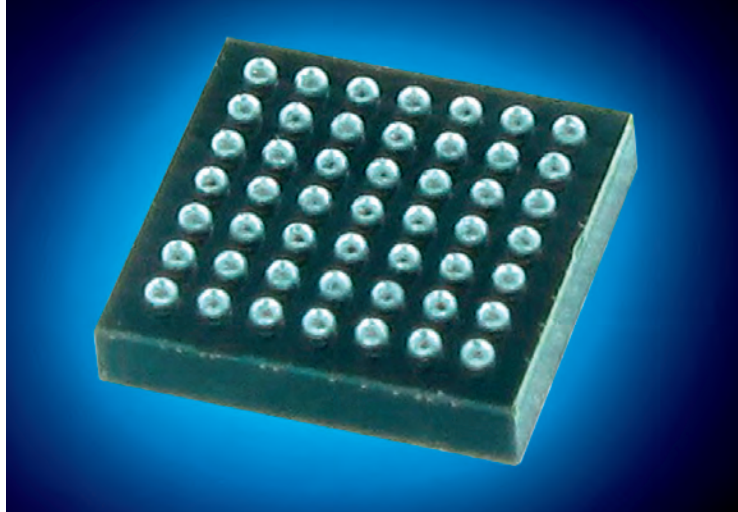
A common theme in electronics clusters, and particularly the clusters in Adelaide and Christchurch, is the design and production of a small volume of high-complexity, intellectual property-based, high value-added, customisable products for commercial, industrial and professional applications. Copying is both difficult and unrewarding for complex, low-volume products. Electronics businesses in the Adelaide 'cluster' offer a range of niche services in an 'open innovation' environment with minimal firm-to-firm competition.



A COMMON THEME IN ELECTRONICS CLUSTERS, AND PARTICULARLY THE CLUSTERS IN ADELAIDE AND CHRISTCHURCH, IS THE DESIGN AND PRODUCTION OF A SMALL VOLUME OF HIGH-COMPLEXITY, INTELLECTUAL PROPERTY-BASED, HIGH VALUE-ADDED, CUSTOMISABLE PRODUCTS.

Decades of global research show that there are significant benefits of clusters. Cluster firms benefit from skilled labour pools and their employees have alternative employment options. Skilled-labour mobility within clusters speeds up collective learning and new concepts disperse quickly in small and isolated clusters. Clusters typically use the same technical and business service providers and component/equipment suppliers. Educational institutions and industry bodies reinforce knowledge sharing and positively influence collaboration. Inter-firm contracting requires trust and over time this develops a high level of firm-to-firm interdependence. Firm-to-firm interdependence is significantly higher in the Adelaide electronics cluster compared with firms in larger cities where factors including distance and travel time limit face-to-face contact, restricting the development of trust, collaboration and firm-to-firm interdependence.

Small population size and isolation from major cities have led to the development of dense electronics industry clusters in a number of global regions. These self-organised and highly productive clusters are widely researched and understood in the EU and USA but are still relatively unrecognised in Australasia. The Adelaide and Christchurch electronics clusters will be major contributors to the transition of their regional economies from industrial economy to knowledge economy.



NFC CONTROLLER

The NXP PN7120 NFC controller provides a plug-and-play, full NFC solution for easy integration into any OS environment. The product helps create innovative 13.56 MHz NFC solutions and enables fast exploration of applications and use cases for the Internet of Things (IoT), including a variety of appliances and consumer electronics such as

home network gateways and routers, set-top boxes (STBs), audio devices, printers and gaming consoles.

The controller features full NFC forum compliance with small form-factor antennas, ultralow-power consumption in polling loop mode and an efficient integrated power management unit (PMU) that allows direct supply from a battery at 2.3 to 5.5 V. It combines a contactless NFC front-end with an embedded 32-bit ARM Cortex-M0 microcontroller to support NFC card emulation, reader/writer and peer-to-peer modes.

The product embeds the microcontroller core with integrated firmware supporting the NFC controller interface (NCI) 1.0 and I²C-bus communication. It includes integrated non-volatile memory to store data and executable code for customisation. Through its drivers and software, the device is optimised for Linux and Android operating systems and is easy to integrate into any other embedded operating system.

Mouser Electronics

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HALF-BRIDGE MODULE

Vincotech, a supplier of module-based products for power electronics, has announced its flowPHASE 0 family featuring NTC, a high-voltage half-bridge topology aimed at upgrading applications. The module is designed for charger, SMPS, solar or ESS applications rated from 5 to 20 kW.

The speedy modules featuring NTCs not only deliver high power density, they also facilitate and enhance the engineering effort. Low- and high-speed versions are available to satisfy the requirements of different applications. High-speed versions can serve to attain switching frequencies up to 50 kHz.

IGBT chip technologies from various silicon manufacturers, alongside full current fast and efficient diodes, are on board to keep conduction and switching losses low. The modules ship with an integrated thermistor for temperature monitoring and Al₂O₃ ceramic or AlN DCB substrates for high thermal performance.

The family comes in compact flow 0 housings 12 or 17 mm in height. Press-fit pins and phase-change material are available on request.

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CONNECTORS FOR MODULAR MANUFACTURING

As industrial systems become increasingly modular, rising demand is evident not only for flexible plug-in connections for power and signal transfer, but also for data communication. HARTING has developed the Han-Modular series to meet these demands.

Standard industrial connectors are designed for 500 mating cycles. The Han-Modular series extends beyond these capabilities and contains an increasing number of modules that have been designed for at least 10,000 mating cycles. Two shielded data modules have joined the group.

The Han Megabit HMC module, suitable for transferring up to Megabit Ethernet Cat 5e, is a good option for applications that call for reliable data transfer and a high level of robustness. The Han Gigabit HMC module enables data transfer according to Gigabit Ethernet Cat 6A. Due to the shielding, the two modules are especially suitable for transferring sensitive (bus) signals.

The Han-Modular Switch US4 features four ethernet ports and allows data exchange based on Ethernet/IP and PROFINET protocols. The switch saves space because it can be integrated into a connector with the Han-Modular hinged frame without further measures. As a result, the module is suitable for applications in which Han-Modular is already being tasked to supply machine elements with power and signals.

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THE RISING THREAT OF

COUNTERFEITS

Joe Longo, Electronics industry specialist, Loftware Inc

As the volume of counterfeit components increases in the marketplace, new solutions are needed to improve electronics supply chain integrity and stability.

As a serious challenge to today's global electronics supply chain, counterfeiting and grey market diversion of electronics components threaten the integrity of products for manufacturers. Counterfeits and obsolete electronic components contribute to dangerous business exposure for manufacturers' customers and compromise health and safety of consumers. Clearly, new solutions are needed to improve the electronics supply chain's integrity and stability.

Enterprise labelling as a first line of defence

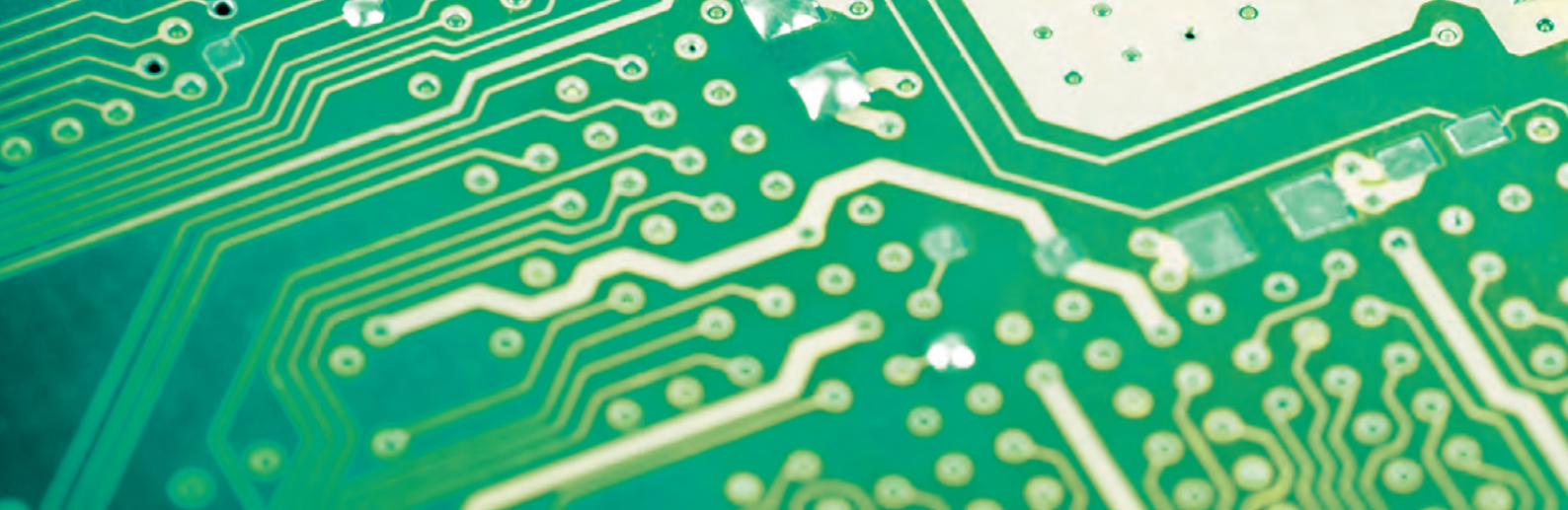
Serialisation technology provides a means by which products can be uniquely identified with a serial number at the unit item level as opposed to lot or batch levels. The individual item, such as a circuit board, battery, etc, is assigned a unique serial number that is embedded in a 1D or 2D barcode or other type of tag, including RFID tags, human-readable numbers, holograms and other covert identification methodologies. Although unit item serialisation is one of the most powerful anti-counterfeiting and anti-diversion measures available

today, many manufacturers lack standardised, automated, enterprise-wide labelling solutions as a foundation on which serialisation can be implemented efficiently and cost-effectively.

This is because many large electronics organisations and their suppliers and distributors still rely on a mishmash of third-party and home-grown barcode labelling systems. Serialisation technology cannot be applied consistently or affordably throughout a non-standardised labelling environment.

However, enterprise-wide labelling strategies can provide the first line of defence in today's complex high-technology electronics distribution environment. Enterprise labelling offers a dynamic and data-driven approach for the creation of complex 1D and 2D barcode labels. It provides a platform for standardisation, automation, scalability and efficient maintenance while allowing businesses to react quickly to evolving customer, regional and regulatory requirements and ensuring consistency across a global supply chain.

Enterprise-wide (or organisationally aligned) labelling solutions that increase visibility and collaboration across the entire supply chain



can better enable electronics manufacturers, suppliers and vendors to meet performance and scalability requirements with power and flexibility. Then, when a company is ready to add unit item serialisation technology as an additional powerful deterrent to counterfeiting and diversion, unique product identifier serial numbers can be integrated with minimal disruption and effort. Now is the time for all responsible electronics supply chain stakeholders to look to enterprise labelling solutions as the best rapid-response strategy to one of the most critical supply chain challenges today.

Counterfeits jeopardise lives and cost billions

Examining the electronics global supply chain landscape, the critical nature of the problem of counterfeits and obsolete products is sobering.

The public has heard rumours about the serious problem of counterfeit electronics for many years, but the magnitude and complexity of the challenges have only come into sharp focus over the last 10 years and in the last five years in particular. For aerospace, military and other high-tech industries, the discovery of counterfeits has ignited intense debate over how to lessen the alarming risks involved. Without a doubt, counterfeits or obsolete components can, sooner or later, fail to perform under critical circumstances. There are a number of factors which have contributed to the difficulty in understanding what to do about obsolete and counterfeit electronics, not the least of which has been the lack of visibility of components as they travel through the supply chain.

Many experts insist that the high prevalence of electronic counterfeits has arisen as a by-product of the grey market, which is the unauthorised sale of new, branded products diverted from mainstream distribution channels. Some estimates state that up to 8% of total market revenue for electronics components is diverted through the grey market. For the semiconductor industry alone, which earned almost \$336 billion in 2014, the grey market could account for up to \$26.8 billion.

The grey market has spawned a fraudulent and unreliable distribution system based on a marketplace clamouring for price discounts and high availability for more and more technology products. Counterfeits have crept into the grey distribution networks through rogue component design houses fronting as manufacturers, which then sell those products to independent distributors, who in turn ask the design firms to buy their products of choice from an authorised manufacturer. After distributors obtain these products illegally, components enter the grey market, are sold at sharp discounts over the internet, and are often offered alongside counterfeit components, making it difficult to know which products are authentic and which are not.

The 'underground' supply chain also handles obsolete parts found in e-waste and used in remanufacturing. These obsolete parts have made their way into the hands of buyers who believe they are getting brand new products.

In this way, counterfeit and obsolete electronics have been discovered in missile guidance systems and hundred-million-dollar

aircraft, causing serious security problems for the US Department of Defense and its contractors. Who made these counterfeits, and are they programmed with malicious software from terrorist organisations designed to divert flights, radars or missile controls? What about tampering with commercial aircraft electronic components?

What happens when an obsolete component fails? Certainly lives can be at risk.

There is, understandably, very little information about the sources of counterfeits. When investigative organisations divulge details of their findings, they are often obliged to protect their sources. Counterfeiters shut down and reopen regularly, mushrooming in multiple locations because they hear about sting operations through the media.

So it is easy for manufacturers and suppliers to become discouraged with the risky grey market and counterfeiting environment today. What can be done about it? The US Department of Defense finalised a new ruling in May 2014 to detect and avoid counterfeit electronics as an amendment to the 2012 National Defense Authorization Act, but many manufacturers are still not clear about who is responsible for which part of the ruling. The DOD has placed more of the responsibility on contractors to identify counterfeits, putting them in charge of the legitimacy of the supply chain to include their subcontractors and suppliers. The question is, how to meet that mandate?

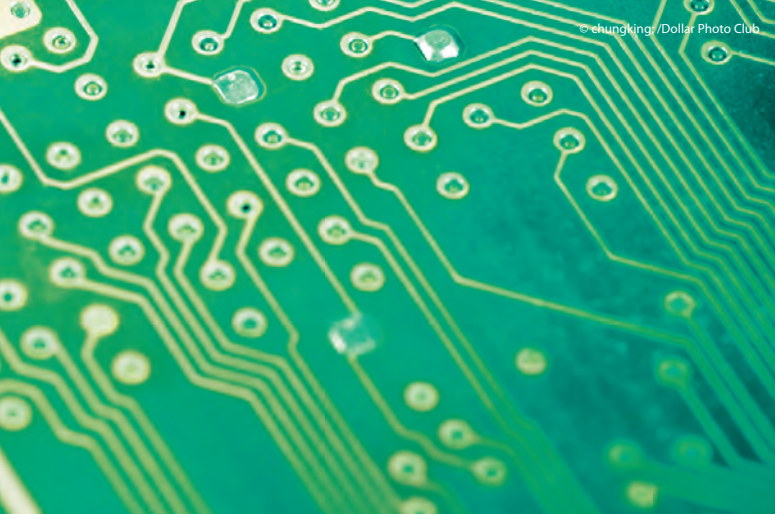
What about the commercial supply chain?

And while the military detects a good percentage of counterfeit parts coming into their sphere of purchases, the commercial side is still wide open. Counterfeiters view the commercial supply chain as much more attractive. The commercial market is much larger and more diversified, the level of testing is lower and product life cycles are much shorter. This gives counterfeit parts more time to hide and counterfeiters more time to sell their wares.

The notion of a commercial supply chain laden with counterfeit parts is truly sobering. Counterfeit parts have been found in servers, routers, storage hardware and other electronics systems. These systems enable communications, transportation, power and critical infrastructure to run our daily lives.

For example, here is a list of some of the electronic products under FDA jurisdiction: television receivers; computer monitors; X-ray machines (including medical, research, industrial, and educational); electron microscopes; black light sources; welding equipment; alarm systems; microwave ovens (devices that generate microwave power); all lasers (including low-power lasers such as DVD and CD readers/writers/players) and other light-emitting devices (infrared and ultraviolet); ultrasonic instrument cleaners; ultrasound machines; ranging and detection equipment such as laser levels.

Unfortunately, most solutions today only detect counterfeit components after they enter the supply chain, not before they enter the supply chain. Unethical suppliers need to be identified and shut down because they manage to stay in business today, and even proliferate, because there are no consequences for their actions. Better technologies are needed to track parts as they move through the



supply chain, so that data can be shared with the industry at large to discredit unethical suppliers.

In addition to the important question of authenticity, today's electronics product labelling requires a variety of complex information with data integrated from a large number of data sources. The real estate on a single label is populated with data from a variety of repositories, including varied governmental labelling regulations and standards for new and existing markets, requirements for multiple languages, complex barcode data and more. But many large companies are not managing this level of complexity with a reliable labelling strategy sophisticated enough to cover all these needs. It is understandable, then, that an attempt to serialise at the unit item level is putting the cart before the horse for many organisations.

Also, for affordable and effectively manageable security measures to be implemented in the supply chain, the ability to allow approved electronics supply chain suppliers and distributors to participate through a streamlined labelling solution is required. This secure access by authorised supply chain participants is the first line of defence against counterfeiting and diversion.

Standardisation of barcode labelling solutions with approved suppliers and distributors can greatly diminish the likelihood of obsolete or counterfeit components making their way into the supply chain. Enterprise labelling solutions allow for secure access by approved suppliers and partners, and offer many other benefits to manufacturers. Enterprise labelling prevents mislabelling through automation while offering support for regulatory data, multiple languages and customer-specific labelling requirements. In the end, labelling consistency and reliability are exponentially improved.

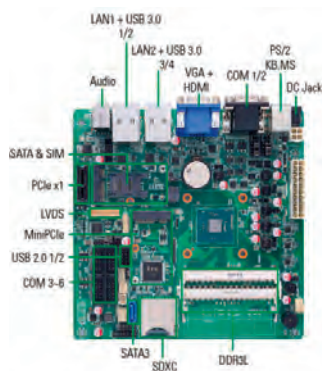
With serialisation technology added to enterprise labeling solutions, an unprecedented degree of security in tracking electronics components can save billions of dollars and prevent other human and environmental disasters.

The complexity of today's labelling requirements points to the fact that without the solid foundation of a good labelling strategy, customer dissatisfaction, returned shipments, counterfeits and loss of business can accumulate, leading to significant erosion of revenue and profitability. Most importantly, the dangers of counterfeiting and diversion can include a negative impact on human health or even contribute to loss of life.

The electronics industry is in an exciting phase of rapid expansion and change, and outdated labelling solutions are unable to keep pace with these dynamics. Fortunately, enterprise labelling is one immediate way the electronics industry can take charge in response to this changing environment, be more responsive to the critical nature of the current labelling challenges and improve the stability of global supply chains while concurrently stemming the dangerous rising tide of counterfeits.

Loftware Inc.
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new
PRODUCTS



MINI-ITX MOTHERBOARD

Axiomtek has announced the MANO300, a low-power, high-performance Mini-ITX motherboard built with the latest Intel Celeron processor N3150 SoC with integrated Intel Gen 8 graphics supporting up to 4K resolution. The product offers good processing and graphics for intensive multimedia and high computing base applications.

Two SO-DIMM sockets are provided to support up to 8 GB of DDR3L-1333 memory. The 12 V single-voltage DC power jack or ATX power makes the power input selection flexible for different automation and embedded industries. The fanless cooling system design and compact form factor are suitable for space-limited applications as well as harsh environments.

One SATA-600 and one mSATA interface are both available for storage options. More I/O features include two USB 2.0 ports, four USB 3.0 ports, two RS232/422/485 ports, four RS232 ports (one with 5 V/12 V power select), two gigabit LAN ports, SDXC, VGA, HDMI, LVDS, PS/2 KB/MS and 8-channel digital I/O. The mainboard runs well with Windows 7 and 8 operating systems.

With one PCIe x1 slot and one PCI Express Mini Card interface, the industrial motherboard MANO300 can fulfil different industrial and embedded application needs, including solutions in health care, in-vehicle infotainment, kiosk, digital entertainment, digital signage and POS.

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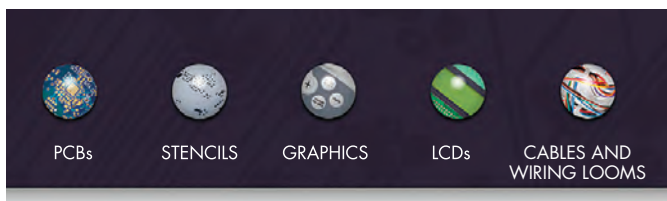
The PIE 541 Frequency Calibrator with Totalizer is a portable, precision calibrating tool for the testing and diagnosing of frequency devices at any location. Offering an accuracy of $\pm 0.005\%$ of range, the calibrator can be used for devices with frequencies from 1 cycle/h to 20 kHz. It can read a wide range of signal frequencies and waveforms from 50 mV to 120 V peak.

The product calibrates, tests and diagnoses turbine meters, frequency counters, vibration systems, tachometers, flowmeters, vortex shedders, integrators and other frequency devices. It can be used to calibrate positive displacement flowmeters, watt-hour meters or slow-rated integrators with frequencies as low as one count per hour and magnetic pickups with square wave outputs.

As a waveform source, the output can be specified as a sine or square wave with amplitudes from 100 mV to 12 V pk-pk, simulating signals from vibration pickups, variable speed drives, etc. It also functions as a totaliser for inputs or outputs from 1 to 99,999 in 1 to 100 min.

The product has a gate-time LED which flashes with received pulses, indicating when the proper input adjustment level has been met. When calibrating, the product eliminates the need for a stopwatch since it automatically stops when the preselected number of pulses has been sent to the totaliser.

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IoT WIRELESS I/O MODULES

Advantech has combined the core functions of data acquisition, processing and publishing into a single I/O module to meet the needs of a wide range of industries, such as environmental monitoring, machine monitoring and smart cities. The company claims the 2.4G WISE-4000 IoT wireless I/O module will improve the way that data is gathered from remote or difficult-to-wire locations.

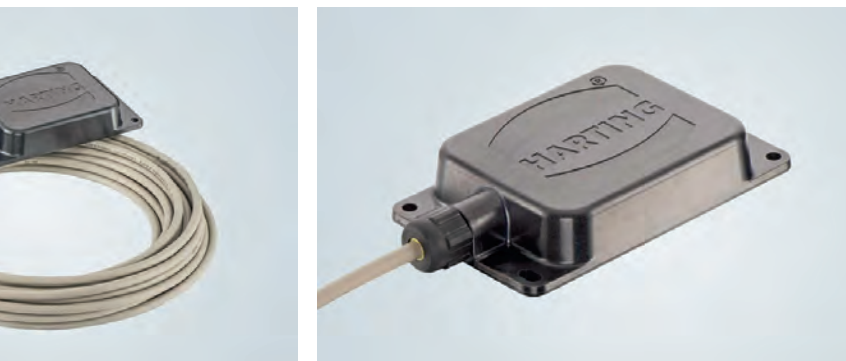
The WISE-4000 series ethernet I/O modules can be used without needing to go through a gateway to provide the information. Deployment is easy as a limitless number of I/O modules can be used to gather the information from any third-party sensors and connect to an existing network.

With an integrated HTML5 interface, the module can be configured and accessed from any mobile device using a standard web browser and without needing to go through an access point. The series uses RESTful API, meaning system integrators can adjust the configurator to meet their specific needs and reduce the amount of effort required to acquire big data.

The module's data logger can send time-stamped information to a Dropbox account or a private cloud. It can also buffer the device's data so that in the event of network failure no data is lost. Other features include: three levels of security (WPA2, SSL and three levels of user login); interchangeable antennas for flexibility; and external DIP switches so the factory settings can be easily reapplied.

Advantech Australia Pty Ltd
www.advantech.net.au





CONDITION MONITORING OF RAPIDLY MOVING PARTS

The Embedded Transponder Base (ETB), from HARTING, is a wireless device that can identify and monitor the condition of an object from a distance of several metres. It was previously possible to poll four discrete conditions; now, the latest model will acquire analog measurements independently of the fieldbus and provider and transfer them without wires or batteries.

Industry 4.0 means networking a wide range of components, facilities and IT systems. Rapidly moving objects and rotating objects could be difficult to monitor, as the sensor had to either feature a cable or a battery. The HARTING ETB is now filling this gap and transforming even rapidly moving components into Industry 4.0 components.

Axles, tools and transport systems receive a unique ID, as in the past. The system measures the current environmental conditions, such as temperature. This enables precise condition monitoring, which can then be directly used to optimise the process. It is easy to connect other sensors and switches to the product, enabling additional applications in the condition monitoring area.

HARTING Pty Ltd

www.harting.com.au

SPDT SWITCH

The PE42822 is an absorptive 50 Ω SPDT RF protection switch designed for use in high-power and high-performance wireless infrastructure and small cell applications, supporting frequencies up to 3800 MHz.

The switch features high linearity, which remains invariant across the full supply range, as well as good isolation and fast switching time. In addition, no external blocking capacitors are required if 0 VDC is present on the RF ports.

The product is manufactured on Peregrine's UltraCMOS process, a variation of silicon-on-insulator (SOI) technology on a sapphire substrate. The company's HaRP technology enhancements deliver high linearity and good harmonics performance. It is an innovative feature of the UltraCMOS process, offering the performance of GaAs with the economy and integration of conventional CMOS.

Additional key features include: single-event peak power handling of 46.1 dBm LTE; input IP3 of 65 dBm; input IP2 of 120 dBm; extended operating temperature of 105°C; 1.8/3.3 V TTL compatible control; ESD performance of 3 kV HBM on RF pins to ground.

Wireless Components

www.wirelesscomponents.com.au

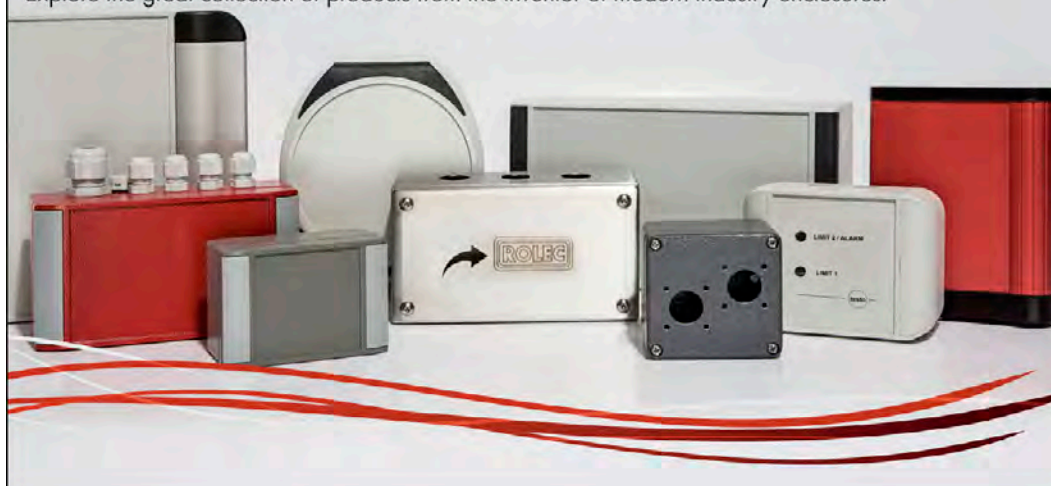


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FANLESS BOX PC



Axiomtek has launched the rBOX510-6COM(ATEX/C1D2), a DIN-rail fanless embedded system certified with ATEX and C1D2 for use in hazardous environments where ignitable concentrations of flammable gases, vapours or liquids might exist. The product supports the dual-core Intel Atom processor E3827 1.75 GHz with the onboard 4 GB DDR3L system memory.

The heavy-duty PC adopts an IP30-rated aluminium and steel enclosure and can perform in wide temperatures ranging from -40 to +70°C. To prevent ESD and overvoltage, the box PC is equipped with four isolated RS232/422/485 ports, two isolated 10/100/1000 Mbps ethernet ports and one isolated DIO (8-IN/8-OUT) port.

The product meets many safety requirements to provide high operational stability, such as Heavy Industrial CE, FCC Part 18, UL/cUL60950-1, IEC60068 and EN50121-4. In addition to the fanless and wide-temperature design, the unit can also handle vibration and shock (5 G_{rms}) as well as operation in high humidity.

The PC comes with a smart remote monitoring and management software package, the AXView 2.0, featuring SNMP, MQTT, MODBUS, SNMP Trap and email support for secured Internet of Things management. The software also contains a variety of easy-to-use management utilities, agent services and libraries which are suitable for IoT and M2M applications.

Braetec Pty Ltd

www.braetec.com.au



EMBEDDED BOX PCs

ADLINK Technology has introduced an industrial PC product line with specialised features for retail and gaming applications.

The line is being launched with

two integrated box PC models — including the necessary interfaces for most common peripheral devices as well as intelligent API middleware, simplifying application development.

The ADi-SA1X and ADi-SA2X integrated box PCs are based on AMD and Intel processors and offer state-of-the-art graphic performance and an onboard GPU option. They support up to eight independent displays and are equipped with external field-removable storage, Wi-Fi, two GbE ports, four USB 3.0 and three USB 2.0 ports, 4x DP on board, 1x PCIe x16 Gen3, 1x PCIe x1 Gen2, 2x Mini PCIe slots, 4x RS232 + 1x RS485/RS422 and 7.1 channel audio. In addition, they deliver multiple hardware and software security options suitable for retail, vending and gaming applications that are designed to meet GLI standards.

ADLINK Technology Inc

www.adlinktech.com

DEVELOPMENT KIT

Imagination Technologies has launched a development kit called Creator Ci40 on Kickstarter. The Ci40 microcomputer has been designed for smart home, IoT and other connected devices (drones, robots, etc), but it also has the hardware requirements for it to be used as a high-speed wireless router.

The microcomputer packs a powerful dual-core chip that has been optimised for IoT and networking applications. It also includes a custom-built chip called cXT200 that delivers high performance but also includes a balanced feature set aimed at low power consumption. The board runs not only Linux but also Brillo, the operating system from Google.

The product includes a full wireless connectivity package: 802.11ac 2x2 Wi-Fi, Bluetooth (Classic and Low Energy) and 802.15.4. The latter represents the foundation for many IoT standards, including the Thread protocol, ZigBee and 6LoWPAN.

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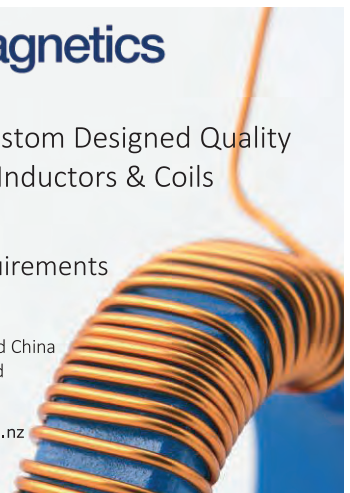
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CONNECTING CARS

TO OUR DIGITAL LIVES

Automotive manufacturer Continental is working on in-car apps that will connect drivers with their homes as well as with other personal devices such as smartphones, tablets, laptops and wearables.

Continental's in-vehicle developer app framework will make the connected car a powerful extension of the driver's smart home and connected lifestyle. The platform allows for the delivery of rich media content, clever home to connected car services, and social media services that deliver the in-vehicle app framework through Continental cloud-based services.

Continental, in cooperation with Dallas, Texas-based Vinli, has developed a dedicated in-car dash interface, Car Port, that enables drivers to interact using real-time vehicle data with IoT (Internet of Everything) devices and other drivers creating a seamless connection to digital life outside the car.

"What we are doing is creating the standard for an in-vehicle application platform, and any interested parties such as car manufacturers, application developers and smart home suppliers are very welcome to join us on our route to bringing all aspects of drivers' lives to their cars," said Seval Oz, CEO at Continental Intelligent Transportation Systems.

More predictive CleverHome applications by ITS are coming along to transform the vehicle into a smart personal device or another room in the house. These applications include controlling smart home features such as room temperature based on the car's navigation information and driver's daily driving habits. When the car 'knows' that it is heading home, it could instruct the heating or cooling system as well as other smart home sensors to trigger the desired room temperature or settings automatically.

Work is also underway at Continental on several autonomous — and thus driverless — driving features, particularly with a view to implementing convenient parking systems.

Challenges of automated driving

Continental is developing the necessary components and systems for automated driving worldwide — in the USA as well as in Japan, China and Germany. The company's engineers are tack-



ling six key challenges: sensor technology, cluster connectivity, human-machine dialogue, system architecture, reliability and the acceptance of automated driving, said Dr Elmar Degenhart, chairman of the Continental Executive Board, describing the company's automated driving work packages.

Sensor technology: Zero accidents are no longer a utopia. Advanced driver assistance systems with sensors can record the area around the vehicle just as well as humans, if not better. Rear-view mirrors can be replaced by camera systems, which not only increase safety, but also reduce CO₂ emissions from cars and commercial vehicles. For the sensor fusion, and ultimately for evaluating the sensor data, Continental is researching the use of artificial intelligence. On the theme of 'safety through learning', Continental has launched a research project with the Technical University of Darmstadt called PRORETA 4, which explores self-learning systems and artificial intelligence.

"In the future, we will be installing sensors in the tyres, which will enable the car to detect the condition of the road's surface.

"Tyres will therefore become a key part of our sensor network in the car," added Degenhart.

"Continental is also working on a unique anticipatory driving system that will be able to learn."

Cluster connectivity: The internet will become the car's sixth sense. Continental is working on a powerful backend that will provide highly accurate traffic information. The basis for this will be the sensor data shared by road users coupled with the traffic backend computer. Sharing data increases the sensors' range enables the vehicle to 'see around corners'.

Dialog between human and machine: What is the strategy if the vehicle arrives at an exit to a freeway in fully automated mode and the driver is supposed to take control again? In its interactive 3D cinema, Continental will be unveiling a cockpit for the interaction between vehicle and driver — an important answer to the question of control.

System architecture: Future system architectures for automated driving will have to securely manage the huge amount of data that is to be processed in the car. One gigabyte of sensor data per minute has to be processed in real time. Increasing sensor output

FUTURE SYSTEM ARCHITECTURES FOR AUTOMATED DRIVING WILL HAVE TO SECURELY MANAGE THE HUGE AMOUNT OF DATA THAT IS TO BE PROCESSED IN THE CAR.

and the resultant increase in the volume of data require a powerful and reliable electronics architecture.

Reliability: At present, advanced driver assistance systems function as a fallback for the driver. With automated driving, in the event of a malfunction, the vehicle must be able to continue safely on its way or to come to a controlled, safe stop. Specially configured brake systems are already being tested in fleets. Protection against attempts at manipulation must also be considered. Processes that will recognise such attempts and protect the vehicle systems are currently in development.

Acceptance: As Continental sees it, automated driving will be accepted if people trust the technology. Trust evolves from the intelligent dialogue between the driver and the vehicle. The developers of today's advanced driver assistance and driver information systems are taking this into account and laying the groundwork for the acceptance of tomorrow's solutions.

Connected driving

Connected cars can use their sensors to collect a large amount of information on changing events — such as traffic jams, accidents, traffic lights, warning signs and road conditions — and share this with other road users via the internet. If you use a 'cluster' of interconnected vehicles and collate and analyse the data they have collected in the traffic backend computer, you will have an up-to-date extremely accurate image of the traffic network and traffic flow. This information can then be used by other vehicles and their advanced driver assistance systems or other features.

"The more a vehicle knows about the route ahead, the better it can adapt and configure its features accordingly. Being connected means it can learn to look ahead," said Degenhart.

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LOW-POWER AC/DC MODULES

RECOM has launched its latest generation of low-power AC/DC modules, the RAC02-SE/277 and RAC03-SE/277 series, with rated outputs of 2 and 3 W respectively. The modules can be used in an extended operating temperature range from -40 to +85°C.

The compact modules have a height of only 18 mm. They accommodate a wide input power range of 85–305 VAC (120–430 VDC) and are available with output voltages of 3.3, 5, 12 and 24 VDC.

When idle, the modules consume maximum 35 mW and are therefore particularly suitable for the supply of sensors and standby equipment. The insulation strength between the input and output is 3 kVAC/min. The modules are available in DIP packages with standard pinout or wired.

Due to the integrated input filter, the modules conform to the requirements of EN55022 Class B. They can thus be operated without the need for additional external components and are short-circuit-proof with automatic restart after fault elimination. The modules are certified according to IEC/EN/UL 60950.

RECOM Asia Pte Ltd
www.recomasia.com



CONTROLLER

Rockwell Automation has expanded its Allen-Bradley ControlLogix family of controllers to enable faster system performance and support the growing use of smart devices in manufacturing and industrial operations.

The ControlLogix 5580 controller is said to provide up to 45% more application capacity and includes an embedded 1 GB ethernet port to support high-performance communications,

I/O and applications with up to 256 axes of motion.

The device's additional capacity cuts the amount of control and communications hardware required, reducing system complexity, costs and required panel space. The product selection process is easier because users can now select the appropriate model using the total number of ethernet nodes required. A single controller can support up to 300 ethernet nodes.

The unit also supports enhanced security as part of a defence-in-depth approach to help protect facilities, assets and intellectual property. The controller incorporates advanced security technologies and software features, such as digitally signed and encrypted firmware, change detection and audit logging.

Engineers can use the Rockwell Software Studio 5000 design software to configure the product and develop all elements of their control system. Data can be defined once and then easily accessed and re-used across the entire Studio 5000 environment to speed system development and commissioning.

Rockwell Automation Australia
www.rockwellautomation.com.au

UNIVERSAL INPUT REFERENCE DESIGN

Industrial automation engineers can now achieve accurate measurements for their system designs with the MAXREFDES67# analog front end (AFE) universal input Micro PLC reference design from Maxim Integrated.

As high-resolution systems move to higher bit counts, they become more sensitive to noise, making such systems difficult to build and maintain accuracy. The 24-bit AFE reference design overcomes this challenge. Capable of accepting four different signals, the universal analog input requires no jumpers and is 100% software configurable.

Advantages include: effective resolution up to 22.3 bits, with temperature error as low as $\pm 0.1\%$ across a range of -40 to 150°C; a Beyond-the-Rails signal chain, which reduces board space and component count; and universal input, which accepts four different signals — voltage, current, resistance temperature detector (RTD) and thermocouple (TC).

To meet Industry 4.0 requirements, Maxim partnered with Wurth Electronics Midcom to customise a power isolation transformer that is energy efficient and compact enough to fit in Maxim's credit-card-sized Micro PLC form factor.

Avnet Electronics Marketing
www.em.avnetasia.com



3D-PRINTED ELECTRONICS

Advances in software, materials and equipment have made it possible to cheaply 'print' custom designs, including diverse products such as airplane engines and action figures.

Researchers from the Naval Research Laboratory in Washington DC have demonstrated that a combination of two technologies — one to create a thin film and the second to 'cut' designs out of the film — could be a potentially powerful tool to create custom electronic components.

Eric Breckenfeld, a National Research Council Fellow at the Naval Research Laboratory, said the lower equipment costs associated with additive manufacturing mean the technology is a great fit for rapid prototyping and can be used by small labs and start-up companies with limited funds.

One additive manufacturing technique that is gaining traction is called laser-induced forward transfer, or LIFT. In LIFT, a laser beam passes over a thin film of ink or paste. The ink absorbs the laser energy, which vaporises a thin layer of solvent. The vaporised solvent gas rapidly expands and the ink or paste is ejected from the film at very high speeds. One advantage of LIFT is that it can transfer high-viscosity inks and pastes.

"LIFT can transfer pastes that are almost solid, like the consistency of toothpaste," Breckenfeld said. "An ink jet printer couldn't handle toothpaste."

LIFT was first developed in the 1980s as a way to eject molten droplets from thin copper films. Naval Research Lab scientists later developed the technique to print fluids and nano-powder suspensions. The team continues to push the technique to new materials, turning most recently to inks containing the transition-metal oxide vanadium dioxide.

Vanadium dioxide undergoes a sharp semiconductor-to-metal phase transition near room temperature, making it an attractive material for a wide range of applications, including chemical sensors, ultrafast electrical and optical switches, and coatings that change colour with temperature.

To turn vanadium dioxide into a thin film compatible with LIFT, Breckenfeld and his colleagues turned to another newly developed technology, called polymer assisted deposition (PAD). The technique works by dissolving metal salts in a solution containing polymers. The metal ions bind to the polymer, forming a stable structure. The solution is placed on a spinning disk that spreads it into a thin film. The film is later cured in an oven to decompose the polymer.

Breckenfeld and his colleagues explored a variety of solvents and heating steps to optimise the growth of vanadium dioxide films on glass and crystalline substrates. They then experimented using LIFT to print patterns with the PAD solutions. In order for LIFT to work, the thin film materials must absorb the wavelength of light of the LIFT laser. The researchers had to modify the vanadium dioxide PAD solutions to catch the energy of the laser light.

So far, the team has successfully printed simple patterns. Breckenfeld said the results show that LIFT and PAD technologies combined could directly print a wide range of commercially attractive electronic materials. The researchers plan to extend their own experiments to new materials soon.



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