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maxon motor has unveiled the first configurable, sterilisable, motor gearhead and encoder combinations. The new absolute and incremental encoder will create many opportunities for advances in medical technology.

Released at the Hannover Fair, maxon motor's new ENX sterilisable encoder is available in two versions: as an incremental (1024 CPT) and an absolute version (4096 CPT). The electronics can be integrated into suitable motors without increasing the motor's length.

The encoder has allowed maxon to create the first sterilisable motion control system with brushless DC motor, gearhead and integrated encoder. The maxon web-based configuration tool allows development engineers to select and customise the combination of components to suit the application. The assembly is then robotically manufactured within 11 working days.

The invention opens many opportunities for demanding dental, medical, surgical and laboratory robotics that require high speed and accurate positioning control. Available with ball bearings or in a ceramic bearing version for extreme speed requirements, various diameters also increase the motor compatibility options. An added bonus of the new electronics is its embedded nature that allows for extremely precise commutation, low vibration and reduction of heat build-up.

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MAKING THE MOST OF MANAGED TEST SYSTEMS

Dr James Truchard, Co-Founder

The media tends to focus on the consumer Internet of Things, but thinking of a test system as an IoT device presents additional opportunities.

On the small scale, test organisations can optimise the performance of their test hardware assets. On a larger scale, the insights from managed test systems can improve yield, quality, productivity, uptime and much more. A great example is how large semiconductor manufacturers use real-time data to optimise their processes, and this trend will only increase as test systems become smarter than the devices they're testing.

As Moore's law continues to influence the performance and complexity of test systems, the need for robust system management capabilities is increasingly apparent. Test managers responsible for maintaining the uptime of a test system are looking for improved management features in their test equipment. Simply defined, manageability comprises the set of features that support the ability to identify and supervise a computing system. Borrowing from a rich heritage established in the information technology (IT) industry, manageability features enhance a test system's ability to perform its primary task (testing and measuring) by ensuring the components of the system are up to date, healthy and meeting performance expectations.

In the same way that IT administrators rely on manageability features to efficiently maintain client and server computing assets in a corporate environment, test engineers and operators will benefit from manageability features when developing, deploying and supporting the operation of test systems.

Elements and operating modes of managed test systems

Managed test systems are composed of the system infrastructure, peripherals and hardware and software elements that manage them, including management consoles and APIs. For example, management console software, such as NI Measurement & Automation Explorer (MAX), can run directly on the test system being managed or be executed remotely via a network on a separate computer. In both cases, the management console issues configuration, calibration, platform monitoring and deployment requests on behalf of the test engineer or operator managing the system, and the managed system fulfils those requests. In addition to vendor-provided management consoles, users can define their own or integrate manageability features directly into test applications using APIs. With these standard elements, manageability features can operate in two distinct modes: in-band and out-of-band.

In-band management uses the primary computing resources, including the system controller's main CPU, network interface and operating system, to manage the system. In addition to running the test application, the system controller runs software to enable manageability features, including management consoles and supporting infrastructure. In this way, in-band management can support a rich set of manageability features while the system is operating in the 'fully on' state. If the system controller is powered



TEST ENGINEERS AND OPERATORS WILL BENEFIT FROM MANAGEABILITY FEATURES WHEN DEVELOPING, DEPLOYING AND SUPPORTING THE OPERATION OF TEST SYSTEMS.

off, unprovisioned or not operating normally because of a failure, out-of-band management is required.

Out-of-band management can be particularly useful for those diagnosing a system that has failed. While rare today, more test equipment is incorporating these features by using dedicated computing resources, including a secondary management processor, network interface and operating system, to manage the test system independently of the system controller's computing resources. For example, if the system controller is unable to boot normally because it has experienced a hard drive failure, out-of-band management can be used to remotely power the system on and execute diagnostics on the hard drive, allowing for remote analysis to determine the cause of the failure. Further, because out-of-band management does not require the use of the system controller's computing resources, the system controller can remain fully dedicated to executing the application. This is particularly important for applications that are sensitive to disruptions in CPU or data bus usage, including real-time and high-throughput measurements.

Trends in managed test systems

As modular instrumentation platforms continue to displace traditional box instruments, the need for asset management capabilities is increasingly important.

Because modular test systems separate the system into components (system controllers, chassis and instruments), the number of assets to be managed naturally increases. By knowing which test assets are being used and how they are being applied, test managers can lower costs by maximising the use of available equipment. In a validation lab, for example, it is critical that the location and operational state of all assets are known so that components not actively being used can be redeployed in other test systems. The same applies to high-volume production test environments, but on a much larger scale.

Increasingly, complex measurement devices are also driving the need for comprehensive manageability support, particularly in platform monitoring and control.

Modern modular instruments, especially RF instruments, offer unprecedented measurement flexibility and speed by taking full advantage of the power and cooling capabilities of the modular platforms that support them. Test system designers can maximise the long-term reliability, usability and measurement accuracy of these systems by selecting platform elements that use monitoring and control features. For example, by monitoring the cooling requirements of the instruments in a chassis, a chassis can optimise its fan speeds to minimise acoustics. This is especially important in an environment where noise must be minimised, such as a validation lab.

Further, measurement accuracy is optimised when an instrument is operating as close as possible to its calibrated temperature. By monitoring the temperature of an instrument, a chassis can precisely control its fans so that the instrument can maintain a steady temperature at or near its calibrated value to ensure the integrity and repeatability of the measurement.

Benefits of a managed test system

Test managers can significantly benefit from improved manageability features, which lower the test system's integration risks by ensuring that issues can be diagnosed and resolved efficiently, especially for large and complex testers and test systems in remote locations. Additional benefits include minimising a test system's 'time to value' by ensuring that initial and subsequent test station deployments can be managed in a fast and repeatable manner. Finally, manageability features lower the total cost of ownership of a test system by enabling the ability to proactively monitor and diagnose problems as well as convert unplanned outages into planned outages. Just as manageability features helped drive the transformation of the IT and telecom industries, they will play an increasing role in test systems in the years to come.

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STEREO PANEL MOUNT JACKS

Seeking to widen its offering of watertight products, Switchcraft has introduced a range of 3.5 mm stereo panel mount jacks available in Locking and Sealed, Flush Mount and Compact Rear Mount versions, suitable for the manufacture of audio products for outdoor, medical devices and instrumentation.

The Locking and Sealed version is available in front and rear mount options, sealed to IP66 when mated. The M6 threaded bush is for use with locking plugs such as the Switchcraft 35HDL Series.

The Flush Mount is available unsealed or sealed and the sealed version is rated IP66 when mated. The front mount design mounts flush with panel.

The Compact Rear Mount has nickel-plated brass housing and contacts.

Both the Locking and Sealed and Flush Mount versions are rated for 5000 mate/unmate cycles, with durable nickel-plated housing and high-quality beryllium copper contacts. All options are 3-conductor open circuit and mate with any standard 3.5 mm stereo plug.

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The Hioki CM3286-01 Cat IV (600 V) auto-ranging, Bluetooth-compatible clamp tester measures leakage current and mains current to 600 A, voltage to 600 V, single- and three-phase balanced power, energy, reactive power, power factor, phase angle, frequency and total harmonic distortion for current and voltage.

The IP54-rated tester clamps up to 46 mm diameter conductors. A dedicated app to acquire measurement data on a smartphone or tablet is available, allowing reports to be automatically created from measurement data in the field. Supported devices include: Android SMART model, iPhone5, 3rd generation iPad and iPad mini.

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ULTRAPORTABLE SPECTRUM ANALYSER UP TO 110 GHz

Anritsu has introduced the Spectrum Master MS2760A family, the world's first ultraportable, millimeter wave (mmWave) spectrum analysers that operate up to 110 GHz, according to the company. They can verify high-frequency designs, including those used in 5G and E-band applications. The MS2760A analysers leverage Anritsu's patented state-of-the-art NLTL Shockline technology to more efficiently advance technology development. In addition to 5G and E-band, the MS2760A significantly improves test procedures and lowers the cost-of-test in other fast-growing mmWave applications, such as 802.11ad/WiGig, satellite communications, electronic warfare and automotive radar.

The MS2760A is truly pocket sized, but claims to have industry-leading dynamic range, sweep speed and amplitude accuracy. Its ultraportable size enables direct connect to almost any DUT, eliminating the need for lossy, expensive cables or antennas.

The MS2760A is available in six versions with frequencies ranging from 9 kHz up to 32, 44, 50, 70, 90 and 110 GHz. It measures only 155 mm high x 84 mm wide x 27 mm deep.

The MS2760A is suitable for use in the lab, on the manufacturing floor and out in the field. It provides benchtop level spectrum analyser performance in the palm of your hand. Anyone making basic spectrum measurements can benefit from the size and affordability.

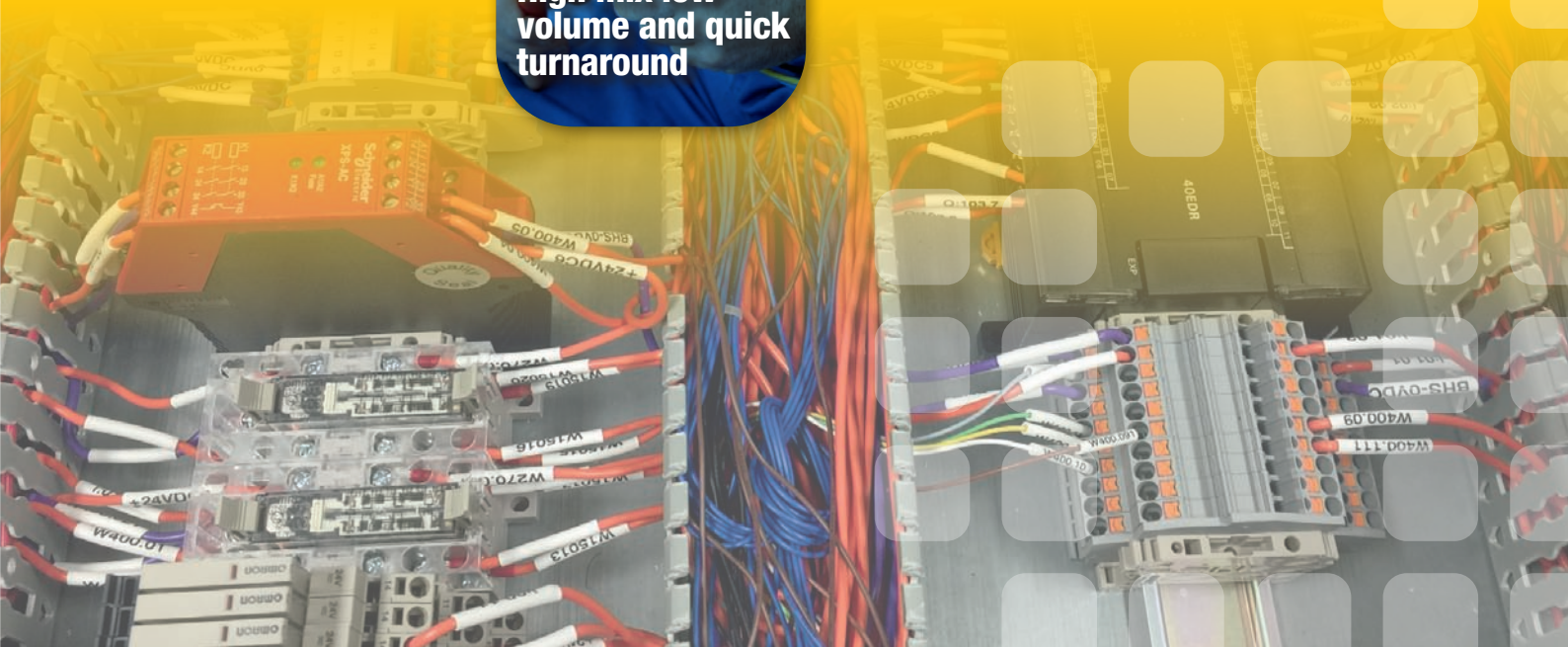
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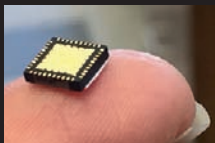


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TINY CHIP TO EXTEND BATTERY LIFE

Researchers at the University of Texas at San Antonio (UTSA) have received



a \$50,000 grant from the National Science Foundation to commercialise a chip that can make lower power electronics, like mobile phones, work more efficiently. With a size of no more than a pin's head, the technology is being developed by Professor Ruyan Guo alongside researcher Shuza Binzaid and graduate student Avadhood Herlekar.

Currently, mobile phone users in desperate need of a charge may put their device on low-power mode and reduce its regular functions in order to extend battery life. The use of the chip means such measures are no longer necessary, keeping a phone working at top functionality with much less power. It also facilitates the use of smaller batteries, since the object itself is so small.

"This chip can be used with anything that runs on a battery," said Binzaid. "It manages power so that the device can last longer."

The chip also tackles the issue of devices heating up after several minutes of use, which is a result of a lot of power being used. "With our device there is less power consumption," noted Guo, "which means the heat will be much less of an issue."

Guo and Binzaid are currently working with marketplace experts in order to determine which industry their chip is best suited to, since it could be used in several different applications. Beyond lower power devices such as phones, the chip could be used in fire sensors, fitness monitors and even medical apparatuses.

"We hope to make a significant leap forward in defibrillators and pacemakers," said Guo. "Invasive surgeries to replace medical devices that are running out of power could become much less frequent."

FEMTOSATELLITE LAUNCHER 3D PRINTED IN SPACE

The winning design of the International Space Station (ISS) Design Challenge, an initiative of Mouser Electronics, has been 3D printed in space.

The ISS Design Challenge gave people a chance to help astronauts aboard the International Space Station with a device that improves their jobs or daily life. The winning design would be digitally transmitted to the ISS, where it would be 3D printed by Made In Space's Additive Manufacturing Facility (AMF) — the first commercially available off-world manufacturing service and the only 3D printer adapted for use in the vacuum of space.

The winner of the competition was Andy Filo, who designed a device that allows astronauts to launch femtosatellites (tiny satellites about the size of a postage stamp and weighing less than 100 g) in zero gravity. Scientists can use femtosatellites in many different missions and applications, including monitoring disasters, studying Earth's environment and even flying in formation to create a giant antenna for deep space analysis.

"It has a microprocessor, it has a number of sensors on it — a magnetometer, a gyroscope, and then we're also using the memory," said Filo. "These are things that can describe asteroids passing by, coronal events from the Sun and cosmic rays from the stars."

The device is now in orbit and may one day be used by astronauts for a variety of missions.



The winning design.

1950s ENERGY CONVERTER REINVENTED WITH GRAPHENE

US researchers have updated the process of thermionic energy conversion for the 21st century, using wonder material graphene as a key part of the technology.

Thermal energy is one of the most abundant, cheap and widely used energy sources in the world, but it is harvested using mechanical heat engines and turbines based on antiquated 19th-century technology. Thermionic energy converters (TEC), on the other hand, can convert heat to electricity more efficiently, without the need for big, expensive equipment, through the phenomenon of thermionic emission.

Originally developed in the 1950s for use in space programs, TECs are composed of two electrodes — the emitter and the collector — separated by a small vacuum gap. Unfortunately, the technology faces two obstacles: a high loss of energy at the anode surface, which leads to reduced output voltage, and high electrical barriers against electrons moving in the gap between the collector and the emitter, which results in reduced output current.

Now, researchers at Stanford University have tested a prototype TEC made using a single sheet of graphene instead of tungsten as the collector material. Writing in the journal *Nano Energy*, they revealed that this led to an electronic conversion efficiency of 9.8% at 1000°C, making it 6.7 times more efficient than the previous technology.

According to lead author Dr Hongyuan Yuan, TEC technology is "very exciting", with the efficiency improvements potentially opening up an "enormous market for it".

"TECs could not only help make power stations more efficient, and therefore have a lower environmental impact, but they could be also applied in distributed systems like solar cells," said Dr Yuan. "In the future, we envisage it being possible to generate 1–2 kW of electricity from water boilers, which could partially power your house."

The prototype currently works in a vacuum chamber but not in a normal setting, meaning the technology is not yet ready for use in power stations or people's homes. The researchers are now working on a vacuum-packaged TEC to test the reliability and efficiency of the technology in real applications.



NEW TECHNIQUE TO MEASURE 2D WONDER MATERIALS

A research team led by the University of Warwick has developed a method to measure the electronic structures of stacks of two-dimensional materials, whose features such as flatness, atomic thinness, high conductivity and extreme strength make them highly desirable for use in electronic devices.

Multiple stacked layers of 2D materials — known as heterostructures — create highly efficient optoelectronic devices with ultrafast electrical charge, which can be used in nanocircuits and are stronger than materials used in traditional circuits. Various heterostructures have been created using different 2D materials, while stacking different combinations of 2D materials creates new materials with new properties.

The new technique, created by Dr Neil Wilson, measures the electronic properties of each layer in a stack, allowing researchers to establish the optimal structure for the fastest, most efficient transfer of electrical energy. It uses the photoelectric effect to directly measure the momentum of electrons within each layer and shows how this changes when the layers are combined.

The ability to understand and quantify how 2D material heterostructures work — and to create optimal semiconductor structures — paves the way for the development of highly efficient nanocircuitry and smaller, flexible, more wearable gadgets. Solar power could also be revolutionised with heterostructures, as the atomically thin layers allow for strong absorption and efficient power conversion with a minimal amount of photovoltaic material.

"It is extremely exciting to be able to see, for the first time, how interactions between atomically thin layers change their electronic structure," said Dr Wilson.

The technique has been published in the journal *Science Advances*.

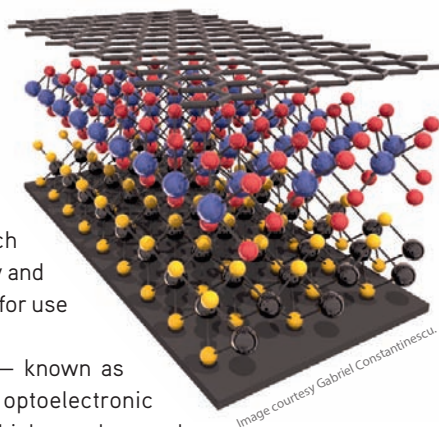


Image courtesy Gabriel Constantinescu.

AUSTRALIA'S BIGGEST E-WASTE RECYCLING PLANT

Metals business Nyrstar is upgrading its smelter in Port Pirie, South Australia, to a multimetals processing and recovery facility that will also provide the technology to process e-waste.



The company will soon accept a wide range of electronic products, such as PCBs, cathode ray tubes, mobile phones and related devices. It will also accept photovoltaic cells from roof solar panels, alkaline batteries and potentially other batteries such as lead acid and nickel cadmium.

"Featuring proven state-of-the-art technology available in Europe, Asia and

North America, the site will be Australia's first e-waste treatment facility, helping to reduce landfill and recover valuable metal to re-use in consumer products," said Bertus de Villiers, Nyrstar vice president, metals refining.

"The treatment rate of e-waste from 2018 is expected to be around 3000 tonnes per annum, increasing to more than 20,000 tonnes per annum as the facility ramps up, with a recovery of 98% of metal content."

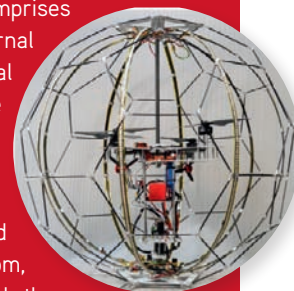
The upgrade marks a milestone for Australian-generated e-waste, which is currently either landfilled or exported. In some cases, it can end up in countries without stringent environmental or health and safety regulations, leading to environmental contamination and hazards for workers recovering e-waste components.

SPHERICAL DRONE DISPLAY DEVELOPED

Telecommunications company NTT DOCOMO has developed what it claims is the world's first spherical drone display — an unmanned aerial vehicle that displays LED images on an omnidirectional spherical screen while in flight.

Equipping a drone with a spherical display has previously proved difficult due to challenges such as the display interfering with the airflow of the drone's propellers, as well as the added weight of the display. DOCOMO solves this issue by using a largely hollow display that is lightweight and allows air to flow through it, yet still achieves the illusion of a solid display.

The device comprises a spherical external frame, an internal LED frame consisting of a series of eight curved LED strips that extend from top to bottom, a drone fitted inside the sphere and legs protruding underneath. During flight, the LED frame spins on its axis in a rapid horizontal motion, forming an afterimage effect to create the illusion of a solid sphere of motionless LEDs.



The highly manoeuvrable drone can be operated virtually anywhere, according to the company, including venues such as concert halls or arenas where it can fly around as part of a performance or deliver messages or event information. The maximum diameter of the spherical frame is about 88 cm and the entire device, including the drone, weighs just 3.4 kg. The display measures 144 pixels high and 136 pixels wide.

DOCOMO aims to commercialise its spherical drone display in the fiscal year ending in March 2019. The company plans to eventually explore potential entertainment and messaging solutions for event venues, including stadiums and concert halls.





HIDDEN PIM SOURCE DISCOVERED IN MOBILE DATA CONNECTIONS

Research by Hughes Electronics and London Southbank University has found that humidity makes a significant contribution to passive intermodulation (PIM) in cellular networks. PIM is a series of resulting signal harmonics and distortions that emerge between two or more interacting signals when transmitted through passive components such as cables and connectors, causing unwanted interference and degradation of wireless communications.

The group found that humidity deposits a layer of salts and other airborne contaminants which interfere with 'clean' signal transit. Though almost impossible to see, the salts, deposited during the evaporation process, are electrically conductive and play havoc with skin effect signal transmission. They instigate surrogate (signal) pathways, causing parallel path and harmonic signals and distortions, which are a root cause of PIM.

To counter the effect, Hughes has designed an intelligent IP68-rated cap for connectors with a humidity indicator. The cap, which protects open connector interfaces from mechanical damage, dust and humidity is transparent, and incorporates a blue indicator that visibly turns to pink when it detects the presence of humidity. It is possible to determine the amount of humidity present by the shade of colour; instructional information is provided with each cap to help the user.

Approved by most major UK networks, the device is economical to deploy and can save companies many wasted man-hours of PIM diagnosis and trial-and-error remedies tracking down sources of PIM they simply cannot see. The screw-on caps are rugged yet lightweight and require no special tools, making them economical to deploy. They are available for industry-standard 7/16 and 4.3/10 connectors.



STRETCHABLE FIBRES CAN DETECT TOUCH

Researchers from North Carolina State University (NC State) have developed elastic, touch-sensitive fibres that can interface with electronic devices. Their work has been published in the journal *Advanced Functional Materials*.

As explained by Michael Dickey, corresponding author on the paper, "Touch is a common way to interact with electronics using keyboards and touch screens. We have created soft and stretchable fibres that can detect touch, as well as strain and twisting."

The new fibres are made of tube-like polymer strands, each of which is only a few hundred microns in diameter, which contain a liquid metal alloy: eutectic gallium and indium (EGaIn). Each fibre consists of three strands: one is completely filled with EGaIn, one is two-thirds filled with EGaIn and one is only one-third filled with EGaIn. The slim tubes are then twisted together into a tight spiral.

The touch-responsive fibre works because of capacitance, or the phenomenon in which electric charge is stored between two conductors separated by an insulator. For example, when your finger (a conductor) touches the screen of your smartphone (an insulator), it changes the capacitance between your finger and the electronic material beneath the screen. The smartphone's technology then interprets that change in capacitance as a command to open an app or to type on the keypad.

Similarly, when your finger touches the elastic fibre, it changes the capacitance between your finger and the EGaIn inside the insulating polymer strands. By moving your finger along the fibre, the capacitance will vary, depending on how many of the strands contain EGaIn at that point in the fibre. This effectively gives you the ability to send different electronic signals depending on which part of the fibre you touch.

"These microscopic fibres may be useful for integrating electronics in new places, including wearable devices," Dickey said.

The researchers also developed a sensor using two polymer strands, both of which are completely filled with EGaIn. Again, the strands are twisted into a tight spiral. Increasing the number of

twists elongates the elastic strands and brings the EGaIn in the two tubes closer together. This changes the capacitance between the two strands.

"We can tell how many times the fibre has been twisted based on the change in capacitance," Dickey said. "That's valuable for use in torsion sensors, which measure how many times, and how quickly, something revolves. The advantage of our sensor is that it is built from elastic materials and can therefore be twisted 100 times more — two orders of magnitude — than existing torsion sensors."



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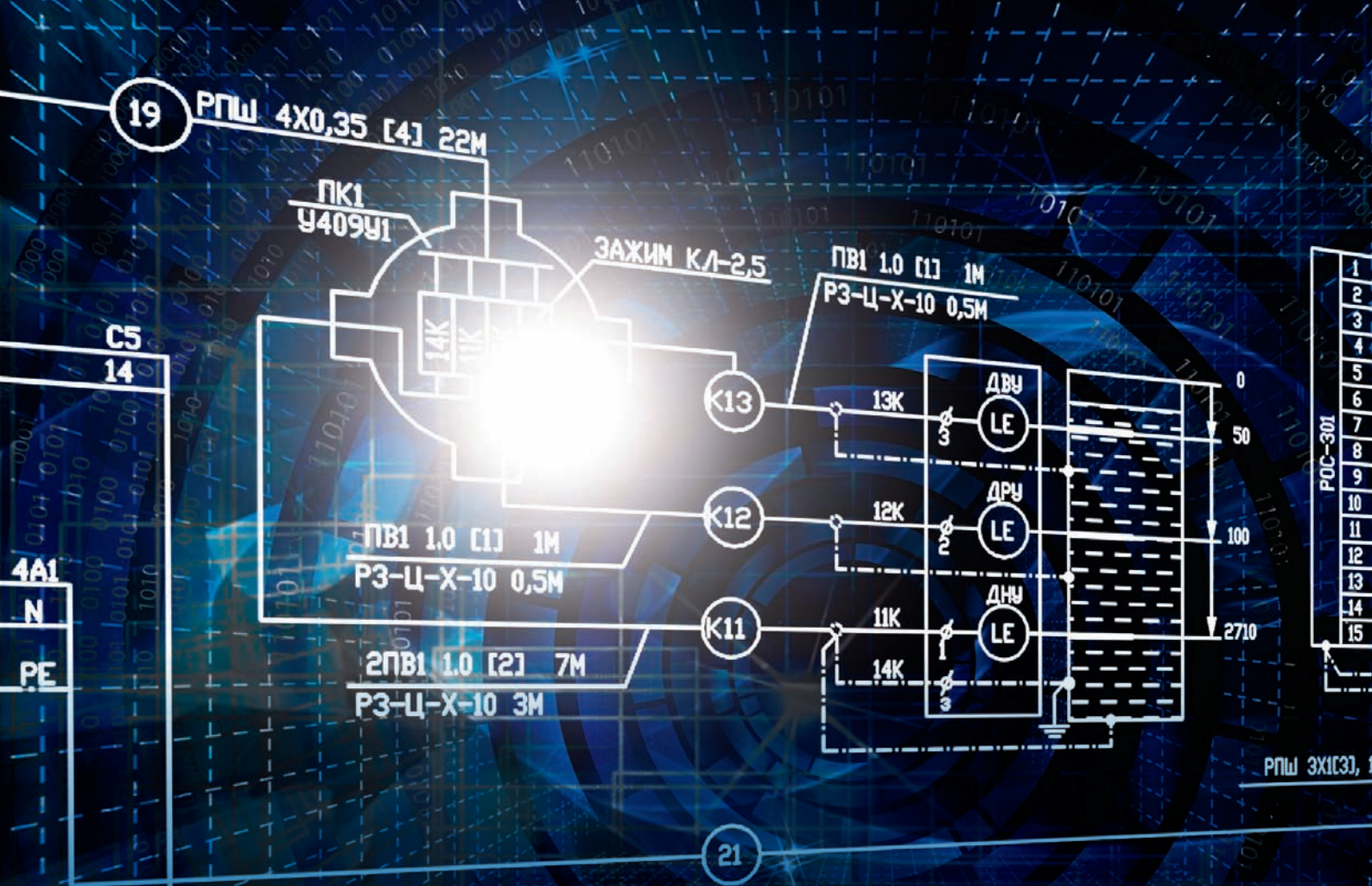


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EXPLORING THE NEXT GENERATION OF WIRELESS R&D

Ken Karnofsky

In 2017 and beyond, the next generation of wireless communications systems is driving a new level of technology integration.

Higher data rates, massive connectivity for systems like the Internet of Things (IoT), lower power consumption and other ambitious goals can only be achieved by combining advanced digital, RF and antenna technologies. Traditionally, each of these components has been designed separately, only to be integrated, tested and debugged after the first hardware prototype is built. The days of this approach, with domain experts working separately, using separate tools, are numbered.

With current technology, the entire signal chain from RF to baseband can be implemented in a single programmable device or module. Consider the expertise required to use, let alone design, one of these devices: RF, digital logic, digital signal processor (DSP), embedded software and system architecture. To integrate it into a complete system, engineers need to know even more: antenna design, propagation and one or more wireless standards.

For example, if an engineer designs baseband algorithms without considering RF impairments, it is unlikely these algorithms will work in the real world. For RF front-end designers, the DSP and digital



Compared with groups still designing in silos, teams taking advantage of earlier design integration report savings as much as 30% in overall development time and 85% in functional verification time, having dramatically fewer design respins and creating defect-free implementations on the first attempt.

A flexible, integrated simulation environment provides critical advantages for wireless system design. Model-Based Design allows engineers to design, model and simulate multidomain wireless systems. Domain experts in each area can use the tool that is best suited to their task, to model RF architectures, digital hardware and complex state machine logic, and then seamlessly connect their own work into the rest of the system.

In order to span this set of tasks, the software must operate at three levels: low-level functions (eg, modulation, mapping, pre-coding) with open interfaces; mid-level functions that process a complete link (physical channels and signals) in one step; and high-level signal generation functions and apps. And it should offer hardware-agnostic testing interfaces, so the generated signals and the test bench can be used for simulation and test hardware independent of a specific manufacturer.

The tools capable of supporting the work of the multifunctional wireless engineer are already on the market. They are particularly useful for advanced research and design problems, such as modelling multiantenna (MIMO) systems found in LTE and WLAN systems and 5G proposals, including antenna arrays, propagation patterns and beamforming.

MathWorks Australia
www.mathworks.com.au

These teams are adopting tools that help them integrate the multiple engineering disciplines into a coherent workflow. They use an integrated software environment, like the one provided by MATLAB and Simulink, that enables Model-Based Design and encompasses algorithm design, system simulation, over-the-air testing, prototyping and implementation. The improved workflow

Semiconductor solutions for the Nintendo Switch

Semiconductor solutions from STMicroelectronics, including motion sensors, touch-screen controller IC, STM32 microcontrollers and NFC controller ICs, have been selected for the Nintendo Switch, Nintendo's latest gaming device.

The gaming system consists of a console, two Joy-Con detachable controllers, a Joy-Con charging grip and a dock. Several ST products contribute to the device by enabling the intuitive user interface as well as through the NFC-connectivity function that enhances gameplay.



ST's 6-axis inertial sensors are embedded in the main console and in the controllers of Nintendo Switch, responding to players' motions to control the games. The inertial sensor comprises a 6-axis IMU (inertial measurement unit) in an ultrasmall footprint (2.5 x 3 x 0.6 mm). The sensor enables increased accuracy and resolution with low noise performance, and also operates on very little power to keep players playing.

The capacitive touch-screen controller IC from ST is mounted in the main console and features highly sensitive touch detection and low power consumption. Combining an analog front-end and a digital signal processor based on a microcontroller core, the controller IC enables multitouch and a fast report rate. The touch-screen controller IC supports many types of capacitive touch-panel materials and structures, and can be configured based on the particular touch sensitivity required by consumers.

Three STM32 32-bit microcontrollers offer the right balance of processing capability, low power consumption, embedded memory and package size. A high-performance STM32 MCU in a small package is embedded in the Joy-Con controller to manage the IR motion camera and the NFC function. In addition, a low-power STM32 MCU is embedded in the Joy-Con charging grip that attaches the controllers to meet battery-life constraints while performing signal-processing functions. Another STM32 MCU is embedded in the dock of the main console for power management functions.

The ST NFC controller IC in the Joy-Con controller and the Nintendo Switch Pro controller enable contactless communication using near-field communication technology with Nintendo's amiibo accessories. The communication allows adding and customising characters in supported games, as well as a way to deliver bonus content in such games. ST's low power-consumption NFC controller ICs embed NFC Forum-compliant firmware and software protocol stacks, and provide high contactless performance for a good user experience.

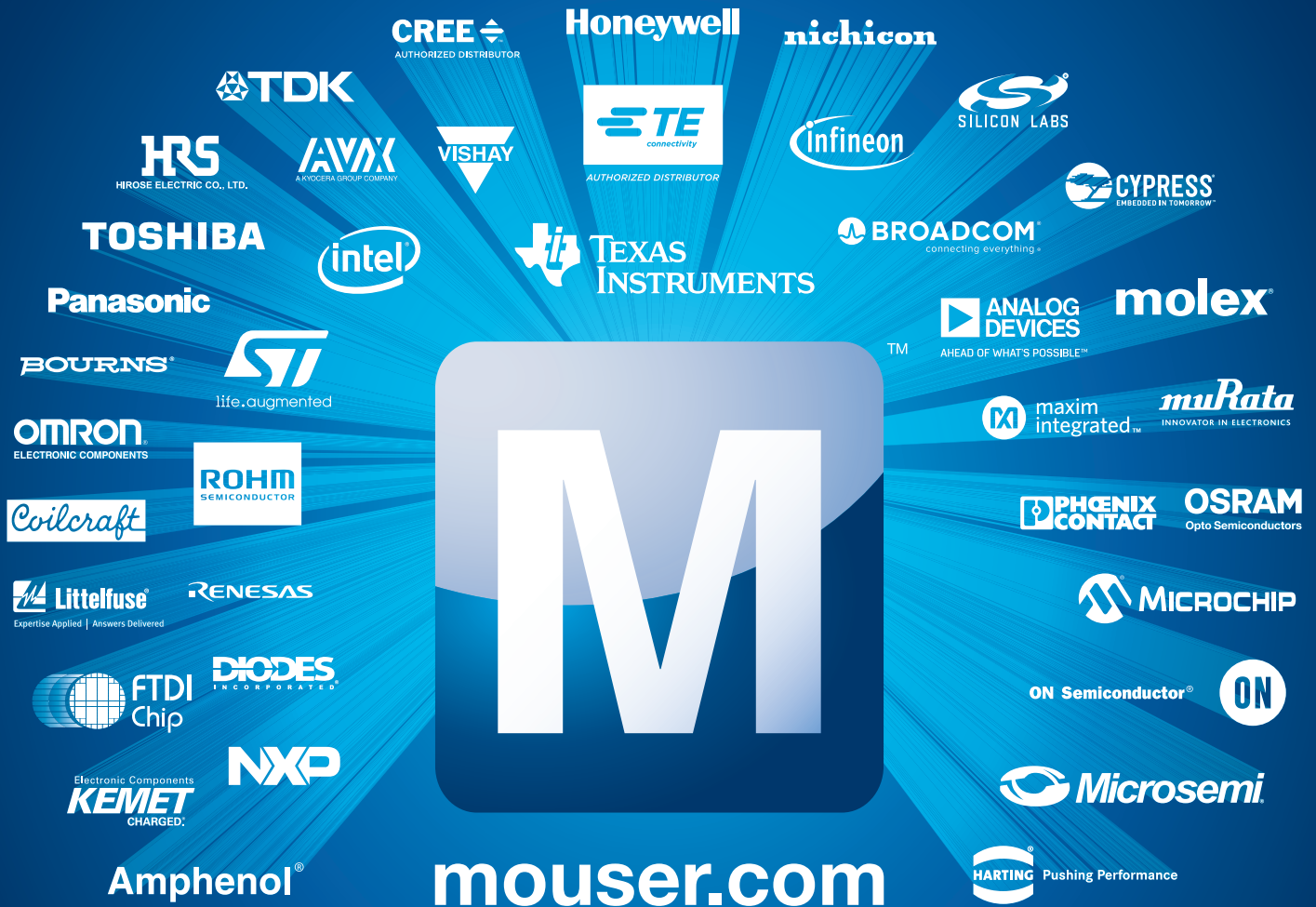
"Since Nintendo's launch of Wii in 2006, ST has strengthened its close relationship with Nintendo by delivering advanced semiconductors while expanding our product portfolio to best fit new gaming applications," said Marco Cassis, executive vice president and president of Asia Pacific Region, STMicroelectronics. "We are delighted to have contributed to Nintendo Switch,

which is an innovative gaming device that offers a unique user experience through an exciting new approach, with our broad expertise in sensing, processing and connectivity."

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1 W DC/DC CONVERTERS

RECOM's R1SX series has a nearly 20% lower profile than the industry standard due to its inverted transformer design, the company says. The 1 W DC/DC converters are suitable for bus isolation and a wide range of industrial automation control equipment.

The R1SX series, an open-frame SMD converter, leverages fully automated manufacturing techniques to deliver stable performance and consistent high quality. The modules are available with 3.3 or 5 V inputs, offer a single unregulated 3.3 or 5 V output and can reach up to 78% efficiency. There is no minimum load required and the quiescent consumption is less than 150 mW.

RECOM says the converters can drive up to 2200 μ F of high capacitive load, which is 40 times higher than the competition. With up to 3 kVDC (/H option) of isolation, it makes them suitable for isolating data transfer lines in industrial communication protocols (eg, CAN bus). The modules operate at a wide temperature range from -40 to +100°C at full load and have industry standard pinouts that are compatible with the R1S series but at half of its height.

Class A EMC compliance can be reached without external inductors, and Class B EMC compliance can be met with one additional inductor. The series is fully certified to IEC/UL/EN62368-1 and UL60950-1.

RECOM Power GmbH
www.recom-power.com

BRUSHLESS DC SERVOMOTOR

FAULHABER has extended the powerful BP4 product family with the Brushless DC-Servomotor 2264...BP4. As well as having a good ratio of torque to size and weight, the miniature drive comes with integrated sensors and a wide speed range.

The 4-pole motor achieves a torque of 59 mNm with a weight of just 140 g and a diameter of 22 mm. Furthermore, the product reaches up to 34,500 rpm. The reason for the high performance is the innovative segment winding of the coil, which was developed for the brushless DC motors of the BP4 family. Due to the overlapping, nested, individually wound segments, an especially large amount of copper can be accommodated in the coil. The high winding symmetry with minimal losses and appropriately high efficiency is a desirable side effect.

There is also room for a resilient shaft with a diameter of 4 mm and suitable bearings due to the compact coil. With its low inertia, the motor is suitable for dynamic start/stop operation. The unit is also overload-resistant. It operates without wear-prone mechanical commutation and, as a result, has a service life longer than standard DC micromotors, according to the company. It can be used at temperatures of between -40 and +125°C.

Optionally integrated analog Hall sensors can replace an encoder in the majority of applications and determine the position of the output shaft precisely. Compatible optical and magnetic encoders are also available for high-precision applications.

Among other things, the motor is suitable for industrial automation and the handpieces of electric tools, eg, electric pruning shears and screwdrivers, motorised instruments for surgery, grippers and robots, and also for aerospace or for active prosthetics.

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SPLICING CONNECTORS

WAGO's 221 series COMPACT splicing connectors are suitable for all wire types. The series is 40% smaller and even more user-friendly than its predecessor, the 222 Series.

The connectors allow solid, stranded and fine-stranded wires to be connected faster and in less space, according to the company. This is not just made possible by their compact design, but also by their 100% transparent housing, easy handling and two test ports.

Due to its compact dimensions, the connector offers safe, fast installation in space-restricted areas. Approvals like ENEC or UL allow it to be used in worldwide applications.

The series is available in 2-, 3- and 5-wire point connectors that accommodate fine-stranded wires from 0.14 to 4 mm² and solid and stranded wires from 0.2 to 4 mm. Ratings up to 32 A/450 V and a maximum continuous operating temperature of 105°C allow the connectors to be used at ambient temperatures up to 85°C, making them suitable for small and large loads.

WAGO Pty Ltd

www.wago.com.au

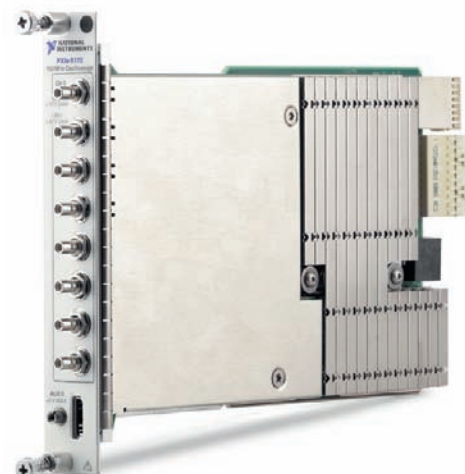
8-CHANNEL OSCILLOSCOPE

NI's PXIe-5172 is a highly flexible oscilloscope, with 100 MHz, 250 MS/s and eight channels. It has an input voltage range of up to 80 V peak to peak with ± 20 VDC offset.

The product includes a user-programmable FPGA and offers support for external sample and reference clocks. Engineers can use LabVIEW to customise the oscilloscope's firmware, such as adding inline signal processing or advanced triggering.

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ROHDE & SCHWARZ

PROGRAMMABLE AUTOMATION CONTROLLERS

ICP DAS has released its XP 8331-CE6 and 8731-CE6 series of embedded compact PCs. The products are Windows CE 6.0-based programmable automation controllers (PACs) that come equipped with an x86 CPU (1 GHz, dual-core), a VGA connector for video output, 2x USB 2.0 port, 2x Ethernet ports and 4x serial ports and 1/3/7 I/O slots for high-performance parallel I/O modules and serial I/O modules.

The series come with expandable I/O ports, three for the XP-8331-CE6 and seven for the XP-8731-CE6. These ports allow the products' capabilities to include functionality like motion control, frequency input, PWM output, memory, counter input and more.

The benefits of running Windows CE 6.0 on XPAC include hard real-time capability, small core size, fast boot speed, interrupt handling at a deeper level and achievable deterministic control. The XPAC is also capable of running PC-based control software such as Visual Basic .NET, Visual C#, etc. The series offers features of both traditional PLCs and Windows-capable PCs.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



SPECTRUM ANALYSER

Rohde & Schwarz introduces the R&S FPC1000, an entry-class spectrum analyser with good quality and innovative features. It features a flexible keycode upgrade concept; solid RF performance; a large, high-resolution display; and integrated Wi-Fi for wireless remote control via mobile apps.

Engineered in Germany and designed to the same quality standards as high-end Rohde & Schwarz instruments, the product provides solid RF performance and a future-ready, software-upgradeable feature set. It has the largest high-resolution display in its class, according to the company, plus remote control options via smart wireless mobile apps or PC software. These characteristics make it excel in basic research, production, service and educational applications that require spectrum analysis.

The device is said to offer the best measurement resolution in its class, with 1 Hz RBW and a 10.1" display that is 26% larger with 2.6 times higher display resolution. This high measurement and display resolution allows signals to be measured in razor-sharp detail.

Rohde & Schwarz (Australia) Pty Ltd

www.rohde-schwarz.com.au

CORD CONNECTOR

Switchcraft's Tini-QG (Mini-XLR) cord connectors are now available in a right-angle version with male and female options of three, four, five and six poles. This follows requests for a compact solution where space is limited or awkward, such as equipment positioned in low or high places.

The right-angled plug provides a convenient connection and eliminates strain on the cable. The handle can be rotated during assembly to allow for four different cable orientations.

The TARA series mates with the existing TA, TB, TRA and TY Tini-QG ranges and are easy to assemble with chuck-style strain relief. The standard product fits cable up to 3.8 mm diameter — larger options accept cables up to 5.3 mm diameter. High-quality flex relief offers maximum durability and silver-plated or optional gold-plated contacts are available.

The product is suitable for audio, broadcast, medical, instrumentation and communication applications where robustness and space saving is important.

Clarke & Severn Electronics

www.clarke.com.au



ARBITRARY WAVEFORM GENERATORS

NI has announced a family of PXI arbitrary waveform generators with up to two channels and 80 MHz of analog bandwidth in a single slot. The PXIe-5413, PXIe-5423 and PXIe-5433 arbitrary waveform generators deliver -92 dB of spurious-free dynamic range and 435 fs integrated system jitter while providing precise waveform adjustment when used with a dedicated standard waveform generation engine.

With a fractional resampling architecture for arbitrary waveform generation, similar dynamic range and jitter performance is available independent of user sample rate. Users also benefit from high-speed waveform streaming capabilities and multiple-instrument synchronisation.

Other features include: up to two independently controlled output channels; maximum ± 12 V and minimum ± 7.75 mV output ranges; and options for 20, 40 and 80 MHz in a single PXI slot.

National Instruments Aust Pty Ltd

www.ni.com



MOTOR CONTROL SOFTWARE PLUG-IN

The Microchip motorBench Development Suite motor control software plug-in has autotuning and self-commissioning capability.

It is a graphical user interface (GUI)-based tool with automatic tuning of feedback control gains and offline accurate measurement of critical motor parameters such as resistance, inductances and the back electromagnetic force (EMF) constant.

This plug-in collects all the information relevant to the motor control system and automatically tunes the control algorithm gains. The software then uses this information to generate MPLAB X IDE project code ready to run on the dsPIC33EP family of digital signal controllers (DSCs).

The generated code can then be reviewed and edited as needed and flashed as motor control firmware.

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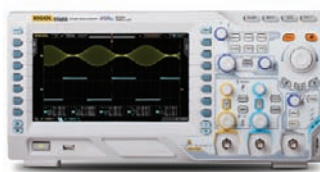
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GRAPHENE 'COPY MACHINE' TO PRODUCE CHEAPER WAFERS

MIT engineers have developed a technique that could vastly reduce the overall cost of wafer technology for the semiconductor industry, enabling devices made from more exotic, higher-performing materials than conventional silicon.

In 2016, the semiconductor industry spent about \$7.2 billion on wafers that serve as the substrates for microelectronics components, which can be turned into transistors, light-emitting diodes and other electronic and photonic devices. Unfortunately, once a wafer's crystalline pattern is transferred in conventional semiconductor manufacturing, it is so strongly bonded to the semiconductor that it is almost impossible to separate without damaging both layers.

"You end up having to sacrifice the wafer — it becomes part of the device," said Jeehwan Kim, an associate professor at MIT.

Looking to avoid this, Kim and his team hit on the idea of using a graphene sheet as a sort of 'copy machine' to transfer intricate crystalline patterns from an underlying semiconductor wafer to a top layer of identical material. Kim explained that graphene had ideal properties for this task due to the fact that it is robust and ultrathin, with slippery, Teflon-like properties. It could therefore be used by manufacturers as an intermediate layer, said Kim, allowing them to copy and paste a wafer, separate a copied film from the wafer and re-use the wafer many times over.

Testing their theory in the journal *Nature*, the engineers detailed how they placed a single sheet of graphene onto an expensive wafer, before growing semiconducting material over the graphene layer. The graphene was thin enough to appear electrically invisible, allowing the top layer to see through the

graphene to the underlying crystalline wafer, imprinting its patterns without being influenced by the graphene. And because the graphene did not stick to other materials easily, the engineers could simply peel the top semiconducting layer from the wafer after its structures had been imprinted.

The team found that their technique, which they term "remote epitaxy", was successful in copying and peeling off layers of semiconductors from the same semiconductor wafers. They had success in applying their technique to exotic wafer and semiconducting materials, including indium phosphide, gallium arsenide and gallium phosphide — materials that are 50 to 100 times more expensive than silicon.

Kim said the technique makes it possible for manufacturers to re-use wafers of silicon and higher performing materials "conceptually, ad infinitum". In addition, it opens opportunities for exploring more exotic semiconductor materials.

"The industry has been stuck on silicon, and even though we've known about better performing semiconductors, we haven't been able to use them, because of their cost," he said. "This gives the industry freedom in choosing semiconductor materials by performance and not cost."

The technique may also advance the field of flexible electronics, with Kim explaining that the wafers are typically inflexible — a trait they tend to pass on to the devices they are fused to. With the peel-off technique, LEDs and solar cells can be made



Image courtesy Jose-Luis Olivares/MIT under CC BY-NC-ND 3.0

A nickel film peel-off from a silicon wafer demonstrates the concept of using a 2D-material-based transfer process for wafers.



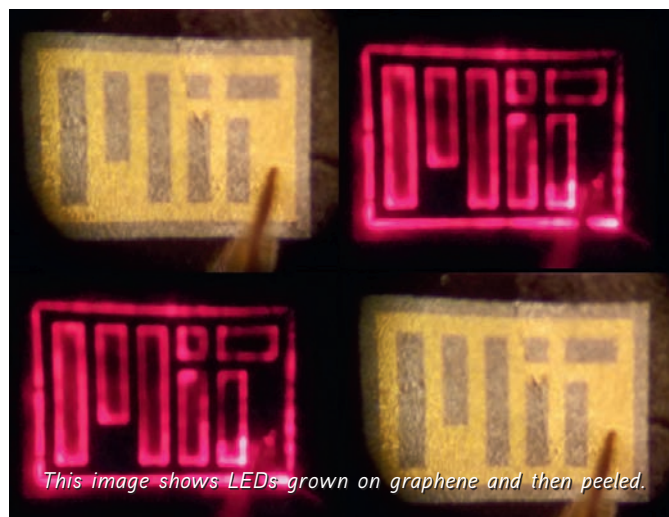
BECAUSE THE GRAPHENE DID NOT STICK TO OTHER MATERIALS EASILY, THE ENGINEERS COULD SIMPLY PEEL THE TOP SEMICONDUCTING LAYER FROM THE WATER AFTER ITS STRUCTURES HAD BEEN IMPRINTED.

to bend and twist, he said — in fact, the group demonstrated this possibility by fabricating a flexible LED display patterned in the MIT logo.

“Let’s say you want to install solar cells on your car, which is not completely flat — the body has curves,” Kim said. “Can you coat your semiconductor on top of it? It’s impossible now, because it sticks to the thick wafer. Now we can peel off, bend, and you can do conformal coating on cars and even clothing.”

The researchers are now planning to design a re-usable “mother wafer” with regions made from different exotic materials. Using graphene as an intermediary, they hope to create multifunctional, high-performance devices. They are also investigating mixing and matching various semiconductors and stacking them up as a multimaterial structure.

“You don’t have to worry about the cost of the wafer,” said Kim. “Let us give you the copy machine. You can grow your semiconductor device, peel it off and re-use the wafer.”



This image shows LEDs grown on graphene and then peeled.

Image courtesy of the researchers under CC BY-NC-ND 3.0

STG AND VOLTAGE MEASUREMENT MODULE

IPETRONIK's X-LINK device series has been extended by a fast 6-channel measurement module for RLDA and STG applications. The Mx-STG2 6 supports TEDS (transducer electronic data sheet) sensors just like the Mx-SENS2 8, Mx-SENS2 4 and Sx-STG do.

Compared to CAN-based devices, users benefit from a faster LAN connection. The XCP on Ethernet architecture supports a high number of devices, covering more than 100 channels within a system. Moreover, channel data rates up to 100 kS/s enable RLDA applications that would commonly request high-dynamic measurements. The software integration is ensured by the IPEmotion Plug-In IPETRONIK-X V02.04 and the IPEaddon INCA V05.07 supporting ETAS INCA 7.1 and INCA 7.2.

Features include: six fast analog signal inputs for voltage/STG; six dual sensor excitations (up to ± 5 V, ± 45 mA); selectable internal resistors for bridge completion; measurement data output via XCP on Ethernet or CAN; complete galvanic isolation (inputs, CAN, Ethernet, power supply); tool-less module-to-module connection; and ruggedised and compact modules for harsh environments.

IPETRONIK measurement channels and data loggers operate continuously under harsh climatic conditions and in long-term testing, providing dependable data acquisition for drivetrain, engine cooling, HVAC and more.

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PLANETARY GEARHEADS

FAULHABER introduces the 26/1R and 32/3R Series planetary gearheads. With diameters of 26 and 32 mm, the products build on the previous 26/1 and 32/3 gearheads while maintaining the same geometry to ensure mechanical compatibility with their predecessors.

The output power available for impulsive cycle operation has been more than doubled compared to the previous generation. Such performance improvements were made possible through deep design analysis, extensive testing and meticulous validation.

The 26/1R and 32/R achieve continuous input speed of up to 9000 and 8000 rpm, respectively, resulting in a 100% increase. In intermittent operation conditions, the input speed can reach up to 10,000 and 9000 rpm to exploit DC or brushless motor capability. Maximum output torque has also been enhanced to exhibit up to 4 Nm and up to 8 Nm in continuous operation.

The gearheads are available with one to five stages, and the span of the 13 possible reduction gear ratios ranges from 3.7:1 to 1526:1. The output shaft has no axial play due to the preloaded ball bearing. The units are able to operate in the typical temperature range conditions of -10 to +125°C and options are also available for lower temperatures like -45 to +100°C. The products can be combined with many motors using various technologies like DC motors, brushless motors and stepper motors with diameters from 23 up to 35 mm.

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GPU COMPUTING PLATFORM

Neosys Technology's Nuvo-5095GC is a compact GPU computing platform. It features an Intel 6th Generation Core processor to exhibit good computing performance for emerging high-end requirements, while its fanless design provides a wide temperature range of -25 to +60°C.

The unit is based on the Intel Skylake platform, which supports 35/65 W 6th-Gen Core processors and up to 32 GB DDR4 memory. It offers a large range of I/O functions that include USB 3.0 ports, COM ports and GbE ports, so it can connect many external devices. This is packed into a compact form factor, with a 240 x 225 x 110 mm footprint.

The embedded PC incorporates a full-sized modern GPU into its smaller form factor unit. This allows the product to target emerging applications of CUDA computing such as autopilot, deep learning and virtual reality. It also features Neosys's cassette technology and innovative thermal design that will help dissipate the heat that is generated from the nVidia GPU. This enables the unit to operate the GPU at 100% load while still operating at +60°.

Backplane Systems Technology Pty Ltd

www.backplane.com.au



SOLVING MILLIMETRE WAVE TEST CHALLENGES

Millimetre wave (mmWave) frequencies have traditionally been dedicated to military applications, with some commercial use for point-to-point microwave links. Octave bandwidth waveguide was the preferred transmission line as mmWave capable coaxial cables and connectors were not available.

That has changed during the past decade, with technology improvements in semiconductors, components, cables and connectors. As mmWave frequencies are now being used for commercial and consumer electronics, design engineers must be aware of the issues encountered using coax cables within a test system. Reducing test equipment size and using fewer interconnections will yield improved measurement accuracy.

Several market segments are adopting mmWave frequencies, each with its own design and test considerations. These include 5G, Automotive Radar, 60 GHz Wi-Fi (WiGig), Point-to-Point Links & Security/Defence applications.

Higher frequency transmission, however, comes with challenges such as higher propagation loss, measurement repeatability and field testing. The loss of a signal propagating at RF and microwave frequencies is proportional to the frequency and distance. At mmWave frequencies, there is additional attenuation from components of the Earth's atmosphere, such as oxygen. The additional loss presents a testing challenge. Test equipment needs higher output power or improved sensitivity for accurate measurements at these bands.

At 70 GHz, the diameter of the coaxial centre connector is just 0.5 mm. A centre pin diameter is the same size. Connector dimensions are approaching the limits of machine shops, and scratches and dust particles on the connector interface affect the impedance match at mmWave frequencies. mmWave connections require significantly more care than at lower frequencies. Connector interfaces should be inspected with a microscope and cleaned before each use.

Spectrum analysers are often used to measure the path loss of a proposed wireless link. The setup comprises a test source with antenna and spectrum analyser with antenna, placed at realistic locations. At lower frequencies, a bench instrument on a cart with the antenna elevated on a pole and fed with a coaxial cable is used. At mmWave frequencies, a similar approach with a long cable run results in significant loss. For example, at 70 GHz, a 3 m cable has more than 20 dB loss, reducing measurement range and accuracy. Also, the loss and phase characteristics of cables vary with temperature, which adds to the uncertainty. To address this, a portable spectrum analyser

can be connected directly to the antenna and elevated above the control PC, using a USB extender cable to interface with the analyser.

Reducing the number of connections in a test system reduces measurement error and the possible points of failure, including dust or dirt affecting the return loss of a connection. It also minimises the chance for imperfections that cause test system impedance to vary from 50 Ω . Each connection in the system (male to female connector pair) will add uncertainty, and mmWave connectors and cables are particularly sensitive. They must be handled carefully to ensure accurate measurements.

Advances in mmWave testing over the years are also enabling more accurate measurements at these frequencies. The introductions of the 40 GHz K connector in 1983, the 70 GHz V connector in 1989 and the 110 GHz W connector in 1997 are examples of such innovations.

Test equipment has also progressed to meet the market need: VNAs are now available to 145 GHz, as well as spectrum analysers in ultra-portable form factors. Some VNAs have very small mmWave frequency extension modules that enable full frequency coverage for on-wafer measurement systems. Using nonlinear transmission line (NLTL) technology allows the probe's tips to be mounted directly to the modules, enhancing measurement and calibration stability. A handheld spectrum analyser using this same technology is slightly bigger than a smartphone and provides performance similar to a benchtop instrument in a much smaller and more affordable design. The small size allows direct connection to almost any DUT.

In the past decade, technology improvements in semiconductors, components, cables, connectors and test equipment have helped make it possible for mmWave frequencies to be used for low cost commercial and consumer electronics products and systems. The continuing evolution of test instruments will significantly reduce mmWave measurement challenges and improve measurement performance and accuracy.

For further information please contact au-sales@anritsu.com.

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MICROATX MOTHERBOARD

Advantech introduces AIMB-505, a vertical domain microATX motherboard based on the Intel H110 chipset supporting the latest 6th generation Intel Core I/Pentium/Celeron processors.

Providing high computing and graphic performance and rich expansion capability, the platform is suitable for applications in self-service, kiosks, control centres, automatic device centres and more. Bundled with Advantech's WISE-PaaS/RMM software suite, which offers remote management and security features, the smart software boosts IoT applications from the edge to the cloud.

The motherboard is equipped with multiple high-speed I/O with reliable connectivity ports, including 8 x USB 3.0, 6 x USB 2.0, 3 x SATAIII, PCIe x16, 2 x PCIe x1, 1 x PCI and 1 x MiniPCIe (F/S x 1) supporting mSATA. It also supports 8-bit digital programmable I/O, 10 x COM (2 x RS-232/422/485) and a 6 W audio amplifier. It also comes with dual Gigabit Ethernet ports (Realtek 8111G) delivering up to 1000 Mbps of bandwidth for network-intensive applications. This high-speed connectivity is packed into a microATX form factor.

The AIMB-505 uses a special USB power on/off switch design, where each of the two ports can be powered on or off by GPIO. Users can use an SW API like WISE-PaaS/RMM to control the USB power on/off devices separately. This design lets USB devices operate more flexibly for special applications.

The motherboard offers one external USB controller for two independent USB 3.0 ports on board to help users separate USB ports for admin and non-admin use. This ensures USB devices will not crash or run at lower speeds due to bandwidth limitations. The unit also has a voltage regulator, which can be revised depending on the project.

The AIMB-505 supports dual independent displays, either in clone mode or extended mode, using VGA, DVI, DisplayPort1.2, eDP(LVDS) with high 4K2K resolution for Displayport1.2 and eDP ports. With stunning graphics and imaging, it is suitable for digital signage applications.

Advantech Australia Pty Ltd
www.advantech.net.au

BLACK LED PANEL LAMP

Marl's Black LED Panel Lamp, designated the CEDark Night Series, is now available fitted in a ruggedised aluminium housing to suit a standard one-panel aperture. Integral circuitry can suit any AC/DC voltage input over a range from 2 to 28 V.

The device is suitable for small to medium-sized environments which facilitate a dramatic optical effect. When the lamp is energised, a volumetric area of up to 3 m³ is plunged into darkness.

Applications include a range of horticultural and photographic applications, including industrial-scale mushroom farming and traditional film development.

Aerospace & Defence Products

www.aerospacedefenceproducts.com.au



REGULATED SIP8 DC/DC CONVERTERS

RECOM's regulated DC/DC converters RSE (2 W) and RSOE (1 W) series were developed for a variety of industrial, transport, test and measurement applications which require onboard 5 V power supplies. The converters operate at extreme temperatures from -40°C up to +80°C at full load.

The fully upgraded DC/DC converters are offered with nominal 2:1 input voltages of 5 and 24 V and with 5 V output voltage. Tight output regulation protects against any sudden change in input voltage and keeps interference levels low and output voltage stable.

The converters are pin-compatible with the RSO, RS, RS3 and RS6 series for an easy upgrade on existing circuit boards. They are packaged in an industry-standard SIP8 housing measuring a compact 21.8 x 9.2 x 11.1 mm and have an I/O isolation of 2 kVDC.

The products reach efficiencies up to 80% at full load. At low loads, common converters fail to produce high efficiency rates; however, the RSE and RSOE series converters still reach 70% efficiency at 30% load and can even maintain full functionality down to 0% load.

They are overcurrent as well as short-circuit protected, with rapid start-up times less than 500 μs. Industrial Class A EMC levels are met with a pi-filter. All modules are certified to UL62368-1 with a CB report.

RECOM Power GmbH

www.recom-power.com



TIME-OF-FLIGHT RANGING SENSOR

STMicroelectronics has released its third-generation laser-ranging sensor based on its FlightSense technology.

The VL53L1 sensor benefits from silicon- and module-level architectures, adding optical lenses to the module.

This boosts core performance while introducing features including multitarget detection, cover-glass crosstalk immunity at long distance and programmable multizone scanning. These advances are suitable for robotics, user detection, drones, IoT and wearable applications.

With a form factor of 4.9 x 2.5 x 1.56 mm, the sensor module integrates a new lens system, a 940 nm VCSEL (vertical-cavity surface-emitting laser) invisible-light source, a processing core and a SPAD (single-photon avalanche diode) photon detector. The optical lens system increases the photon detection rate to boost the module's ranging performance. The embedded microcontroller manages the complete ranging function and runs the innovative digital algorithms to minimise host-processing overhead and system power consumption, maximising battery life for mobile applications.

The product performs a full measurement operation in as little as 5 ms for high-speed applications. For autofocus applications in smartphones, the sensor detects objects twice as fast as earlier devices. The unit has doubled the maximum ranging distance of sensors to beyond 4.5 m.

The high-performance design architecture can detect multiple targets within the scene and allows manufacturers to subdivide the SPAD sensing matrix into custom-defined zones. These small zones can then provide spatial ranging information that can be used for dual-camera computation in stereoscopy as well as simple depth-map use cases.

ST's algorithms and direct time-of-flight architecture are immune to crosstalk at long distances, making the product compatible with a large selection of cover-glass materials and design artwork. The I²C-based module comes with a full package of software drivers and documentation for quick and simple integration.

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BECAUSE FEMTOSECOND PULSES ARE FAST ENOUGH TO INTERCEPT AN ELECTRON BETWEEN BEING PUT INTO AN EXCITED STATE AND COMING DOWN FROM THAT STATE, THEY CAN POTENTIALLY BE USED FOR QUANTUM COMPUTATIONS USING ELECTRONS IN EXCITED STATES AS QUBITS.

German and US researchers have demonstrated extremely short and configurable pulses of light, in a method that moves electrons faster and more efficiently than electrical currents — with reliable effects on their quantum states.

The researchers showed that they could control the peaks within the laser pulses and also twist the light. Their study has been published in the journal *Nature Photonics*. Electrons moving through a semiconductor in a computer occasionally run into other electrons, releasing energy in the form of heat. But the concept of lightwave electronics proposes that electrons could be guided by ultrafast laser pulses. While high speed in a car makes it more likely that a driver will crash into something, high speed for an electron can make the travel time so short that it is statistically unlikely to hit anything.

"In the past few years, we and other groups have found that the oscillating electric field of ultrashort laser pulses can actually move electrons back and forth in solids," said Professor Rupert Huber from the University of Regensburg, who led the recent experiment. "Everybody was immediately excited because one may be able to exploit this principle to build future computers that work at unprecedented clock rates — 10 to 100,000 times faster than state-of-the-art electronics."

But first, Professor Rupert Huber and his team needed to be able to control electrons in a semiconductor. This required them to mobilise groups of electrons inside a semiconductor crystal using terahertz radiation — the part of the electromagnetic spectrum between microwaves and infrared light.

The researchers shone laser pulses into a crystal of the semiconductor gallium selenide. These pulses were very short at less than 100 femtoseconds, or 100 quadrillionths of a second. Each pulse popped electrons in the semiconductor into a higher energy level — which meant that they were free to move around — and carried them onward. The different orientations of the semiconductor crystal with respect to the pulses meant that electrons moved in different directions through the crystal — for instance, they could run along atomic bonds or in between them.

"The different energy landscapes can be viewed as a flat and straight street for electrons in one crystal direction, but for others, it may look more like an inclined plane to the side," said Fabian Langer, a doctoral student at Regensburg. "This means that the electrons may no longer move in the direction of the laser field but perform their own motion dictated by the microscopic environment."

When the electrons emitted light as they came down from the higher energy level, their different journeys were reflected in the pulses. They emitted much shorter pulses than the electromagnetic radiation going in. These bursts of light were just a few femtoseconds long.

Inside a crystal, they are quick enough to take snapshots of other electrons as they move among the atoms, and they could also



A semiconductor crystal has shown an unprecedented capacity to shape ultrashort laser pulses.

be used to read and write information to electrons. For that, the researchers would need to be able to control these pulses — and the crystal provided a range of tools.

"There are fast oscillations like fingers within a pulse," said Professor Mackillo Kira from the University of Michigan, whose group worked with researchers at the Philipp University of Marburg to interpret Huber's experiment. "We can move the position of the fingers really easily by turning the crystal."

The crystal could also twist the outgoing light waves or not, depending on its orientation to the incoming laser pulses.

Because femtosecond pulses are fast enough to intercept an electron between being put into an excited state and coming down from that state, they can potentially be used for quantum computations using electrons in excited states as qubits.

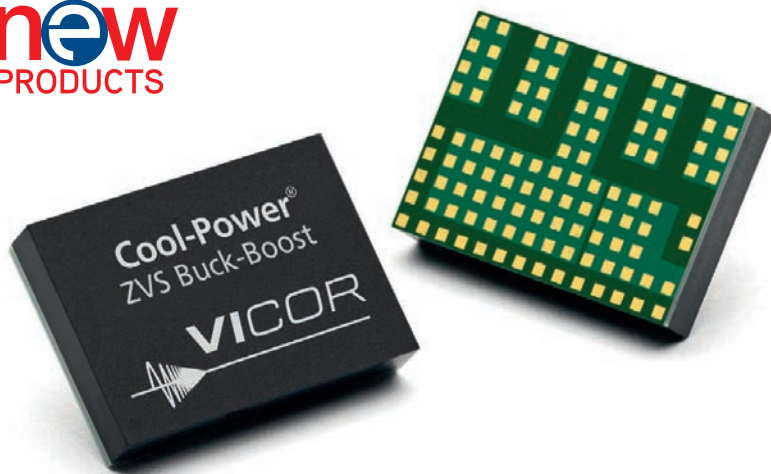
"For example, here we managed to launch one electron simultaneously via two excitation pathways, which is not classically possible," said Professor Kira. "That is the quantum world. In the quantum world, weird things happen."

An electron is small enough that it behaves like a wave as well as a particle — and when it is in an excited state, its wavelength changes. Because the electron was in two excited states at once, those two waves interfered with one another and left a fingerprint in the femtosecond pulse that the electron emitted.

"This genuine quantum effect could be seen in the femtosecond pulses as new, controllable, oscillation frequencies and directions," Professor Kira said. "This is of course fundamental physics. With the same ideas you might optimise chemical reactions. You might get new ways of storing information or transmitting information securely through quantum cryptography."

Professor Huber is particularly interested in stroboscopic slow-motion cameras to reveal some of the fastest processes in nature, such as electrons moving around within atoms.

"Our crystalline solids make for fantastic light sources in this field — with unprecedented possibilities for pulse shaping," he said.



BUCK-BOOST REGULATOR

Delivering up to 140 W of power and up to 8 A of output current, at up to 96% efficiency, Vicor's PI3740 Cool-Power ZVS buck-boost regulator features an input operating voltage range of 8–60 VDC and a regulated output voltage range of 10–50 VDC. Incorporating high-frequency zero-voltage switching (ZVS) technology, the product is suitable for demanding, automotive, industrial, test automation, LED lighting and battery charging.

The regulator meets its performance specifications 'out of the box' across the full breadth of its operating voltage ranges without the need for special circuit customisations. Wide operating voltage ranges can enable a reduction in both the number of regulators and the number of power supply designs that must be designed, configured, manufactured, inventoried and maintained. The PI3740 converter, for example, can be used in a range of applications that would otherwise require the use of several different alternative regulators having narrower operating voltage ranges.

The product fully integrates its controller, power switches and support circuitry within a high-density, thermally adept, 10 x 14 x 2.5 mm SiP. It also features seamless transitioning between Buck mode (input voltage is greater than output voltage) and Boost mode (input voltage is less than output voltage), making it suitable for applications in which the regulator input voltage varies above and below the output voltage.

Other features include: high-frequency (1 MHz) operation; parallel options; constant-voltage and constant-current operating modes; overvoltage, overtemperature and overcurrent protection; -40 to 115°C temperature range; and an integrated current sense amplifier and integrated general-purpose amplifier.

Vicor Corporation
www.vicorpower.com

MULTICORE HPEC MODULE

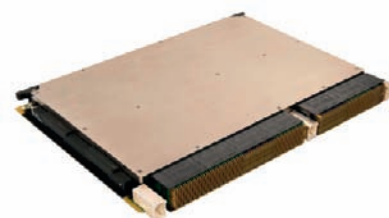
The 6U OpenVPX CHAMP-XD2M rugged Intel Xeon D multicore HPEC module is designed for use in high memory capacity, compute-intensive industrial, aerospace and defence applications.

It is available in a range of rugged configurations to deliver optimal performance in the harshest of deployed environments, including air-cooled and conduction-cooled variants.

It combines the high core count and floating-point performance of the Xeon D processor with a massive 128 GB.

The product also features a substantial bandwidth and a 16-core Intel Xeon D processor. It has a peak performance of 870 GFLOPS.

Unitronix Pty Ltd
www.unitronix.com.au



INDUSTRIAL-GRADE MONITORS

IEI Integration's LCD Kit-F Series industrial-grade monitors are available in 12.1, 15, 17 and 19" sized open-framed display screens. The wide operating temperature of -20 to +60°C makes them suitable for outdoor or semi-outdoor applications.

The series has a slim design and only measures 42 mm in depth. Flexible mounting options allow the LCD kits to be either panel, rear or VESA mounted.

The series can be touch-screen bonded or separated. The air-bonding method is suitable for both resistive- or capacitive-type touch screens.

Both VGA and DVI-D ports are provided to offer both an analog and digital interface option. Resistive and projective capacitive touch-screen technologies are available, as well as a default 12 VDC or optional 6–36 VDC power input option.

The series has been designed for system manufacturers, integrators or value-added resellers that want to provide the performance and quality of an LCD display. The open front panel can be combined with any front bezel design and makes installation easy and efficient, making it suitable for various embedded markets.

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



OSCILLOSCOPES

The Keysight Technologies InfiniiVision 1000 X-Series oscilloscopes have 50 to 100 MHz models and deliver professional-level functionality with software analysis and 6-in-1 instrument integration.

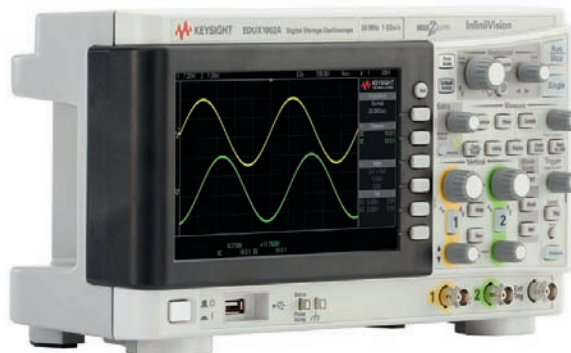
The product uses MegaZoom IV custom ASIC technology, which enables 50,000 wfps update rate. This makes it easier to see random and infrequent glitches and anomalies. The product also has a high sampling rate of up to 2 GSa/s and comes standard with two probes. The oscilloscopes use segmented memory capability to maximise memory depth while helping the scope test faster.

The oscilloscopes are suitable for new users and students. The industry-standard front panel is easy to use and features built-in help so new users can quickly analyse signals to deliver results. The educator's resource kit comes standard. The kit includes built-in training signals, a comprehensive oscilloscope lab guide written specifically for undergraduate students and an oscilloscope fundamentals slide set for professors and lab assistants.

In addition to being an oscilloscope, the product is also a serial protocol analyser, digital voltmeter and frequency counter. The EDUX1002G and DSOX1102G models include a frequency response analyser and WaveGen function generator. Bode plot fundamentals are easy to teach with the built-in WaveGen and frequency response analysis.

The product provides professional-quality measurement and software analysis capability. The scope features 24 typical oscilloscope measurements to quickly analyse signals and determine signal parameters. Additional signal analysis is provided by the gated FFT function, which allows users to correlate time and frequency domain phenomenon on a single screen. Mask limit testing is also available to help users easily detect signal errors. The product supports decoding and analysis of a wide range of popular embedded and automotive serial bus applications, which include I2C, SPI, UART/RS232, CAN and LIN.

Keysight Technologies Australia Pty Ltd
www.keysight.com

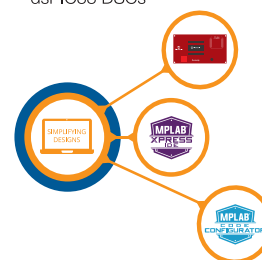


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PSTN TO 3G MODEM/ETHERNET CONVERTER

The MultiConnect AEW analog-to-Ethernet/wireless converter is a convenient turnkey solution that allows legacy equipment with built-in analog modems to connect to the cellular packet data network.

By emulating the traditional dial-up PSTN network and using integrated or external cellular modems, the converter gives life to devices currently using traditional analog dial-up communications.

The product offers configurable WAN (cellular or Ethernet) and features a browser-based set-up wizard. It supports analog modem connections from 300 baud to 33.6 Kbps with error correction and data compression.

Offering outbound and inbound calling, the converter supports packet data and PPP pass-through modes. LEDs offer visual monitoring of power, signal strength and phone line status. An RJ-11 port provides dial tone and DTMF detection.

Other features include SSL encryption/open VPN. There is no RS232 port for use with an external modem.

The product is suitable for ATMs, home healthcare monitors, security systems, credit card/POS terminals and kiosks looking to upgrade to a cellular network without a redesign. It is certified in North America, European Union and Australia/New Zealand.

Elecom Electronics Supply

www.elecomes.com



HIGH-VOLTAGE LED PANEL INDICATOR

The man machine interface is crucial to equipment monitoring and control. Effective indication is especially important when high-voltage supplies are present within the host system.

The redesigned and upgraded 671 Series is available in six voltage ranges, from 24 to 440 AC/DC. Historically, this type of product has not been available in LED because of the difficulty in achieving an appropriate intensity level.

Some of the features include the on/off contrast ratio, intensity, colour and consistency throughout the colour range, making the product suitable for red/green on/off status with additional colour options of blue, white and yellow.

Sealed to IP67, rugged mechanical construction and assembly makes the range suitable for demanding industrial applications where high-voltage status indication is required, including power generation, water treatment and petrochemical plants, mining and portable generation systems, marine and even fairground attraction control systems.

Aerospace & Defence Products

www.aerospacedefenceproducts.com.au



CONNECTOR

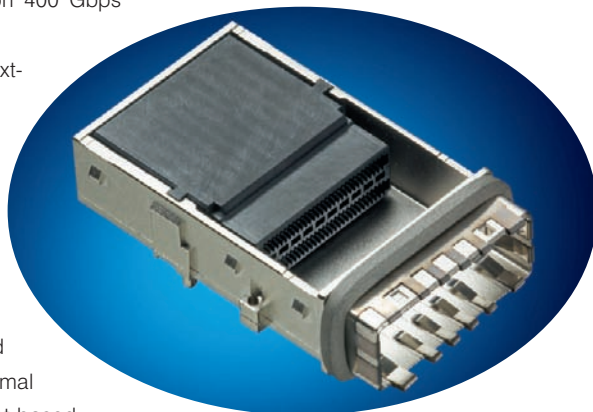
The Molex zCD Interconnect System connector is designed for next-generation 400 Gbps Ethernet applications.

The product enables 4.4 TBps with 11 modules on a line card to support next-generation 400 Gigabit Ethernet. The short-body passive connector accepts both passive and active copper cables. The compact form factor is constructed on a straight, back-route footprint with a 0.75 mm pitch. The small pitch eliminates footprint side-routing, and the overall design of the connector provides industry-leading port-count density with close placement along the panel.

The connector comes equipped with an elastomeric gasket for superior electromagnetic interference (EMI) containment and suppression, a press-fit connector design to ensure a robust and simple board termination, and good thermal management that accepts a broad range of customer-specified thermal modules and heat sinks. The connector is suitable for a wide variety of Ethernet-based applications requiring 400 Gbps interfaces.

Mouser Electronics

www.mouser.com



DC/DC CONVERTER

The Mornsun QAx1 series DC/DC converter is specialised for IGBT drivers. The product integrates driving ICs features and provides +15/-8.0 VDC asymmetrical output voltage, which reduces driving consumption. With output current up to 120 mA, it meets a wider power requirement of IGBT.

This series also features high efficiency up to 81%, operating temperature of -40 to +105°, ultralow isolation capacitance (6PF), max capacitive load (1000 μ F), ultraminiature SIP package, no-load operation allowed and 3000 VAC isolation. 12, 15 and 24 VDC input voltages are available.

Mornsun products are distributed in ANZ by DLPC and in Victoria by Fairmont Marketing.

DLPC Pty Ltd

www.dlpc.com.au



UNIVERSAL DIAGNOSTIC SYSTEM

The ABI BoardMaster 8000 PLUS universal diagnostic system is a self-contained and easy-to-use test and fault-finding system, for almost any kind of PCB.

Offering a full range of measurement instruments and a variety of test methods, the product can test analog, digital and passive components quickly, identifying faults, marginal operation or even fake components.

Whether conducting routine maintenance or repairing mission-critical systems with minimum downtime constraints, the product offers broad fault scenarios to quickly identify faults or marginal operation in almost any PCB with a minimum of repair training and board information.

With a comprehensive component library included, the product can tackle old or obsolete PCBs without schematic diagrams or functional documentation.

Bench repairs can be carried out standalone, with or without power to the board. Generation of electrical schematics, from a PCB on hand, is also possible using the reverse engineering unit.

**Embedded Logic Solutions
Pty Ltd**

www.emlogic.com.au

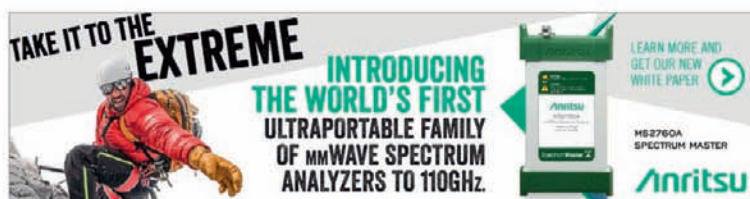
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ENCLOSURE RANGE

With the EVOTEC enclosure range, OKW Gehäusesysteme offers a modern desktop application. With their robust construction and attractive, ergonomic design, the enclosures are suitable for tough working environments. In addition, different operating fronts offer enormous scope for design.

The enclosure consists of a high top part and a flat bottom part, including an assembly kit. It is screwed together from below using corrosion-resistant, stainless steel Torx screws. The enclosures are made of the UV-resistant, flame-resistant material ASA+PC-FR in off-white. Thanks to an optionally available seal, the product achieves the protection class IP65.

Depending on the usage and intended purpose, the user can choose between different top parts. The Size 200 features dimensions of 200 x 124 x 45 mm and a flat top part, while desktop versions include a control and indicator panel ergonomically inclined at 12°. This design makes it particularly pleasant to work with, and operating data can be recorded quickly. The desk versions are available with and without a recessed surface for membrane keypads or decor foils.

Due to its height, the product has a large interface panel on the rear of the top part, suitable for D-sub connectors, round plugs etc. The flat surfaces are particularly practical, allowing the enclosure to be used in a wide variety of ways. For a stable position on the desktop, the enclosure has non-slip rubber feet that can be mounted on the bottom part. The standard range of accessories includes self-tapping screws for installing PCBs.

The enclosure range can be modified directly in-house according to individual customer specifications. Possible options are, eg, special colouring in accordance with customers' CI guidelines, a functional EMC aluminium coating on the inside of the enclosure, machining processes for interfaces, individual lettering and printing, the production and fitting of digital printed foils, and much more. Applications include measurement and control technology, medical and laboratory technology, and environmental technology.

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MICROPROCESSOR

BASED ON A 2D SEMICONDUCTOR

Researchers at TU Wien have developed a microprocessor based on atomically thin materials, in a breakthrough which could contribute to the evolution of traditional processors as well as new applications in the field of flexible electronics.

While silicon has always been used in the production of microprocessors, it is beginning to approach its physical limits. 2D materials such as molybdenum disulfide are now showing promise as potential replacements, offering the advantage of extreme versatility due to the fact that they are made up of just one or a few layers of atoms.

But although research into individual transistors made of 2D materials has been underway since the discovery of graphene back in 2004, success in creating complex structures has been limited — to date, it has only been possible to produce individual digital components using a few transistors. In order to achieve a microprocessor that operates independently, much more complex circuits are required.

Researchers at TU Wien's Photonics Institute have now managed to achieve this for the first time, creating a 1-bit microprocessor consisting of 115 transistors over a surface area of around 0.6 mm² that can run simple programs. Their work has been published in the journal *Nature Communications*.

"Although this does of course seem modest when compared to the industry standards based on silicon, this is still a major breakthrough within this field of research," Stefan Wachter, a doctoral student in the research group, said. "Now that we have a proof of concept, in principle there is no reason that further developments can't be made."

As explained by team leader Thomas Mueller, it was not just the choice of material that resulted in the success of the research project. "We also gave careful consideration to the dimensions of the individual transistors," he said. "The exact relationships between the transistor geometries within a basic circuit component are a critical factor in being able to create and cascade more complex units."

The researchers acknowledged that much more powerful and complex circuits, with thousands or even millions of transistors, will be required for this technology to have a practical application.

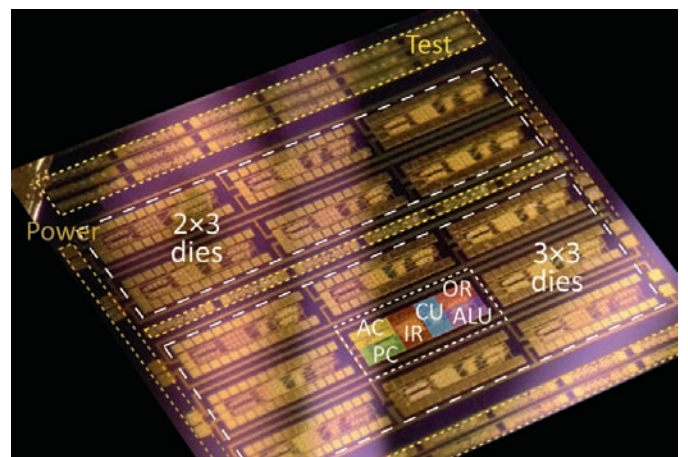


Image courtesy Stefan Wachter

Overview of the entire chip. AC = Accumulator, internal buffer; PC = Program Counter, points at the next instruction to be executed; IR = Instruction Register, used to buffer data- and instruction-bits received from the external memory; CU = Control Unit, orchestrates the other units according to the instruction to be executed; OR = Output Register, memory used to buffer output-data; ALU = Arithmetic Logic Unit, does the actual calculations.

And as the team's circuits were made "more or less by hand in the lab", Mueller said, "such complex designs are of course pretty much beyond our capability" — for now, at least.

However, the researchers are convinced that industrial methods could open up new fields of application for this technology over the next few years. One such example might be flexible electronics, which are required for medical sensors and flexible displays. In this case, 2D materials are much more suitable than the silicon traditionally used owing to their greater mechanical flexibility.

FLEXIBLE, ORGANIC AND BIODEGRADABLE

ELECTRONICS BASED ON HUMAN SKIN



© Stock-Adobe.com/au/johoo

US researchers have developed a semiconductor that is as flexible as skin and easily degradable, offering diverse medical and environmental applications without adding to the mounting pile of global electronic waste. Their breakthrough has been published in *Proceedings of the National Academy of Sciences*.

For some time now, Stanford engineer Zhenan Bao and her team have been seeking to develop electronic devices that mimic the function of human skin. She noted that skin is stretchable, self-healable and also biodegradable — an attractive list of characteristics for electronics.

“We have achieved the first two, so the biodegradability was something we wanted to tackle,” she said.

Bao had previously created a stretchable electrode modelled on human skin — a material that could bend and twist in a way that could allow it to interface with the skin or brain, but couldn’t degrade. That limited its application for implantable devices and unfortunately contributed to waste.

Creating a robust material that is both a good electrical conductor and biodegradable was a challenge, said Bao, considering traditional polymer chemistry. Eventually, the team found that by tweaking the chemical structure of the flexible material it would break apart under mild stressors.

“We came up with an idea of making these molecules using a special type of chemical linkage that can retain the ability for the electron to smoothly transport along the molecule,” Bao said. “But also this chemical bond is sensitive to weak acid — even weaker than pure vinegar.”

The result was a flexible, conductive plastic material that could carry an electronic signal but break down without requiring extreme

measures. As noted by Ting Lei, lead author on the study, “This is the first example of a semiconductive polymer that can decompose.”

In addition to the polymer, the team developed a new type of electrical component and a substrate material that attaches to the entire electronic component, flexing and moulding to rough and smooth surfaces alike. They crafted their component from iron — an environmentally friendly product that is non-toxic to humans — while the substrate was created from cellulose — the same substance that makes up paper. These cellulose fibres were then altered so the ‘paper’ is transparent and flexible while still breaking down easily.

The combination of a biodegradable conductive polymer and substrate makes the electronic device useful in a plethora of settings — from wearable electronics to large-scale environmental surveys with sensor dusts.

“We envision these soft patches that are very thin and conformable to the skin that can measure blood pressure, glucose value, sweat content,” said Bao, suggesting that a person could wear a specifically designed patch for a day or week, then download the data. She added that this short-term use of disposable electronics would be a good fit for a degradable, flexible design.

The components could also be used in places where surveys cover large areas in remote locations, with Lei suggesting they may be dropped by plane over a forest to survey the landscape.



THE COMBINATION OF A BIODEGRADABLE CONDUCTIVE POLYMER AND SUBSTRATE MAKES THE ELECTRONIC DEVICE USEFUL IN A PLETHORA OF SETTINGS — FROM WEARABLE ELECTRONICS TO LARGE-SCALE ENVIRONMENTAL SURVEYS WITH SENSORS DUSTS.

"It's a very large area and very hard for people to spread the sensors," he said. "Also, if you spread the sensors, it's very hard to gather them back. You don't want to contaminate the environment, so we need something that can be decomposed."

Furthermore, the biodegradable substrate, polymers and iron electrodes make the entire component compatible with insertion into the human body, with the polymer breaking down to product concentrations lower than the published acceptable levels found in drinking water. And while Bao said more studies will need to be done before implants are a regular occurrence, she is ultimately hopeful that biodegradable electronics will play an important role in the future of e-waste management.



Image courtesy Bao lab.

The flexible semiconductor can adhere to smooth or rough surfaces and biodegrade to non-toxic products.

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MINIATURE IEPE TRIAXIAL ACCELEROMETER

Dytran Instruments has announced the release of the Series 3493A ultraminiature, low-noise, IEPE triaxial accelerometer.

The series is characterised by its miniature size (0.76 x 0.61 x 0.66 cm), allowing it to be mounted in spaces that are inaccessible to other types of triaxial accelerometers. It utilises a J-FET amplifier, demonstrating what is said to be a lower noise floor (and therefore better resolution) than MOSFET-based IEPE devices. An improved signal-to-noise ratio makes it suitable for applications where low vibration amplitudes are being measured and maximum resolution is required.

In each of the three orthogonal axes, the instrument generates a voltage proportional to vibration by stressing a 'planar shear' type, self-generating crystal element structure inside the sensor housing. The product has low mass and high crystal stiffness, which allows the accelerometer to have a resonant frequency greater than 30 kHz. As a result, it can be used to measure high-frequency vibration with little error.

The product is packaged in a titanium case and weighs only 0.9 g. Models are available in two sensitivities (5 and 10 mV/g) and are installed using adhesives or mounting wax. The series features an integral multiconductor, shielded cable design terminated with a 4-pin, ¼-28 threaded connector designed to mate with several models of extension cables for connection to IEPE power sources.

Typical uses include the following test applications: shock and vibration testing of small lightweight specimens (such as printed circuit boards); product response testing; modal and structural analysis; general-purpose triaxial vibration testing; and more.

Metromatics Pty Ltd

www.metromatics.com.au



DEFIBRILLATION PROTECTION DEVICE

The Maxim MAX30034 defibrillation protection device protects against defibrillation pulses and electrostatic discharge (ESD). It simplifies design, provides >75% space savings and trims the bill of materials while improving performance.

ECG input amplifiers must withstand high-voltage pulses for cardiac resuscitation. These pulses can easily damage the sensitive electronic circuitry which captures the millivolt level heart signals. Preventing this damage has required a three-layer, multicomponent approach combining a per-channel gas-discharge tube (GDT) and/or transient-voltage suppression (TVS) device, as well as ESD-protection diodes. Further, leakage current (a critical parameter) is relatively high, at about 1–2 nA.

The defibrillation protection device uses topology from an advanced semiconductor process to absorb and harmlessly redirect these high-energy pulses away from sensitive circuitry. This small and robust device needs only two external pairs of resistors for each channel to provide design simplicity, smaller overall size and lower leakage current.

The product replaces the primary-level GDTs and/or TVSs, as well as secondary-level ESD diodes which are designed for mandated circuit protection. The device can withstand over 100,000 defibrillation pulses without failure and still maintain a leakage current under 10 pA.

A single, tiny IC and two external resistor pairs per channel are all that is needed. Leakage current is 100 x less than GDT/TVS-based approaches even after 100,000 5 kV pulses. The product replaces complicated primary, secondary and ESD protection solutions for >75% space savings; 3 x 5 mm µMAX package (0 to 70°C operating temperature range).

Avnet Electronics Marketing

www.em.avnetasia.com



DIGITAL MULTIPHASE CONTROLLERS

STMicroelectronics' PM6773 and PM6776 step-down controllers meet demands for energy-efficient power delivery in servers and data centres using low-voltage, high-current microprocessors, ASICs and field-programmable devices. In particular, the ICs are designed to power Intel Skylake CPUs and DDR4 memories, extending ST's family of digital step-down controllers for Intel VR13 platforms.

The VR13 Serial Voltage ID (SVID) compliant ICs are 12 V-input, dual-channel, multiphase 3+1 (PM6773) and 6+1 (PM6776) devices. They are PMBus-programmable and feature embedded non-volatile memory (NVM) for storing configuration data. The PMBus communication interface also allows reporting of voltage, current, power, temperature and fault status. In addition, both devices include a valuable black-box recorder function.

The controllers use ST's high-performance Voltage-Controlled Constant-On-Time (STVCOT) digital-control-loop technology, which enables fast transient response and low output capacitance, as well as variable-frequency diode emulations (VFDE) and dynamic phase management (DPM) to ensure high efficiency over all load conditions. Protection against load overcurrent, under- and over-voltage and feedback disconnections is also built in.

Engineers can accelerate the design of the VR13 voltage regulator for Skylake using the PM677x devices with ST's software tools to program and monitor all key parameters, including control-loop response, load-line and switching frequency.

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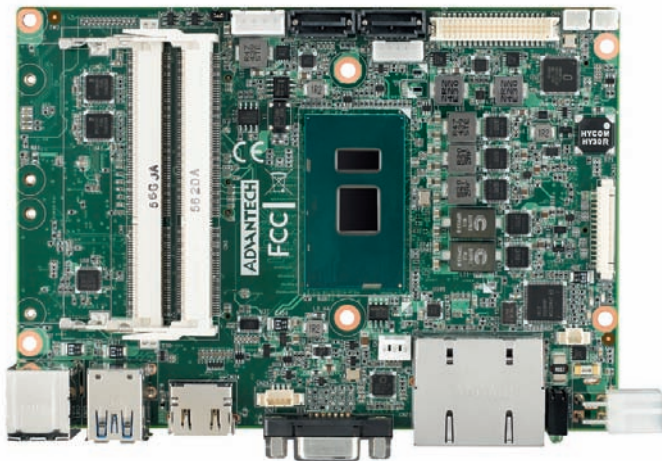
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FANLESS SBC FOR PERFORMANCE-INTENSIVE EMBEDDED SYSTEMS

Advantech announces the MIO-5272 SBC in a 3.5" MI/O Extension (146 x 102 mm) form factor, based on Intel 6th generation Core i7/i5/i3/Celeron processors with triple independent display capability. With an optimised thermal solution, fanless design has been made possible on this compact, high-performance platform under wide temperature environments (-40 to 85°C).



The product comes with Advantech's iManager and WISE-PaaS/RMM integrated to monitor and control system operation remotely and effectively. These tools provide a smart software framework for the embedded customer, helping to speed up time-to-value for IoT and intelligent system design.

The computer adapts the latest microarchitecture with 64-bit, multicore processors built on 14 nm process technology. It delivers improvements in CPU processing, graphics, security capabilities and I/O flexibility. In terms of overall performance, it is said to offer a >30% improvement in processor arithmetic (GOPS) and more than double in graphics performance, compared to the previous version.

The product supports dual memory channels, which expands total memory size from 8 to 16 GB and increases memory bandwidth. With 2 mini PCIe expansion slots, the unit can not only serve applications that require 3G/4G Lite modules and ruggedised mSATA

storage, but it can also serve the requirements for Wi-Fi and Bluetooth modules.

The device enhances security protection and meets the TPM (Trusted Platform Module) 2.0 standard for security protection. It not only facilitates seamless integration and permits high-efficiency network use, but also incorporates the MIOe unified connector which can extend additional interfaces, integrating DisplayPort, PCIe x1, LPC, SMBus, USB 2.0/USB 3.0, audio line-out and power.

The benefits of fanless design include longer MTBF, dust-free, noiseless, zero fan maintenance and 24/7 operation. The MIO-5272 thermal solution is suitable for medical, automation, military or transportation applications, while the unit's compact 24 mm height makes it suitable for IoT and embedded systems.

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MULTICHANNEL FUNCTION GENERATOR

The GW Instek MFG-2000 series multichannel function generator includes MFG-21XX entry-level models and MFG-22XX advanced models.

The output channels of MFG-21XX models include one single-channel 10/20/30/60 MHz ARB generator; one 25 MHz pulse generator ; one 160 or 320 MHz RF signal generator (MFG-2160 MF/MFG-2160 MR) and one power amplifier (MFG-2120 MA only); MFG-22XX models include one 30/60 MHz dual performance ARB generator; one 25 MHz pulse generator; one 160 or 320 MHz RF signal generator (MFG-2260 MFA/MFG-2260 MRA); and one power amplifier (MFG-2260 MFA/MFG-2260 MRA only).

The series has up to five simultaneous output channels (MFG-2260 MFA/MFG-2260 MRA), including CH1 and CH2 equivalent performance dual-channel arbitrary function generator with the maximum 60 MHz for both channels; RF signal generator, a standard AFG which produces the maximum 320 MHz sine wave and various modulation RF signals; pulse generator, whose frequency reaches 25 MHz; and power amplifier, which is suitable for audio range.

The series outputs sine, square and triangle. The series features true point-by-point output arbitrary waveform characteristics of 200 MHz sample rate, 100 MHz waveform repetition rate, 14-bit resolution, and 16 k point memory depth. Some models provide various modulation methods such as AM/FM/PM/FSK/PWM, sweep, burst, trigger, 150 MHz frequency counter. Synchronised dual-channel models provide correlated functions, including synchronisation, delay, sum and coupling.

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MONOCRYSTALLINE SOLAR PANELS

The Powertech high-performance monocrystalline solar panels are smaller, thinner, efficient and more affordable than the previous model range.

The manufacturing process for this range uses 36 pieces of 156 x 156 mm A-grade solar cells cut into defined sizes with four grid lines, providing good performance under low light environments.

Incorporating a durable anodised aluminium frame and 3.2 mm low iron tempered anti-reflective glass, each panel is designed to withstand harsh environmental conditions. With a hydrophobic effect to resist dirt and dust, there is improved light absorption which prevents any needless power loss.

The junction box and bypass diodes stop the panel from overheating and suffering from the 'hot spot effect'.

The range is easy to install, with minimal ongoing maintenance and compatibility with industry-standard inverters and mounting systems.

The range is available in 7 sizes from 5, 10, 20, 40, 80, 120 and 150 W. It is covered by a 25-year limited warranty for defects in construction and manufacturing for a period of 5 years, and that the electrical output will remain above 80% of its original rated output for a period of 25 years.

Soanar Limited

www.soanar.com

CLASS INVERTER KIT

The Renesas 100 kW class inverter kit is designed for high-power 100 kW class motors in mid- to large-sized hybrid electric vehicles (HEVs).

This includes SUVs and mid- to small-sized electric vehicles (EVs).

The kit includes software that maximises the HEV/EV motor performance and hardware components such as microcontrollers (MCUs), insulated gate bipolar transistor (IGBT) and fast recovery diode (FRD), and other power semiconductor devices.

The kit enables system developers to reduce development time for various development steps: from specifications analysis to hardware/software development and motor characteristic adjustments.

Key features of the class inverter include a small design class of 3.9 L and reduced inverter system weight, enabling mounting in even smaller spaces; shortens development period by more than 50% with software that allows quick evaluation in actual cars; and higher fuel and electric power efficiency with devices optimised for HEV/EV applications.

According to the company, the product reduces the inverter's power loss by approximately 10%. This enables increased motor efficiency, which ultimately contributes to increased fuel and electric power efficiency of the inverter system.

Renesas Electronics

www.renesas.com



POWER IGBTs

The Vincotech VINco E3 power IGBTs are designed for motion control, solar and UPS applications.

The product features SLC (SoLiD Cover) technology in an industry-standard low-profile package. It enables engineers to design mid-power inverters with higher output current, higher power density and improved reliability for motion control, industrial drives, solar power, UPS and other mid-power applications.

The insulated metal baseplate combines an electrically insulating resin layer with direct-bonded top- and bottom-side copper layers. It replaces the substrate solder layer and separate baseplate to achieve high thermal cycling capability, reduced thermal resistance, and high power density and low stray inductance. Direct potting resin distributes the mechanical stress more uniformly than silicone gel for improved power cycling capability.

Wireless Components

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AIR CANNON

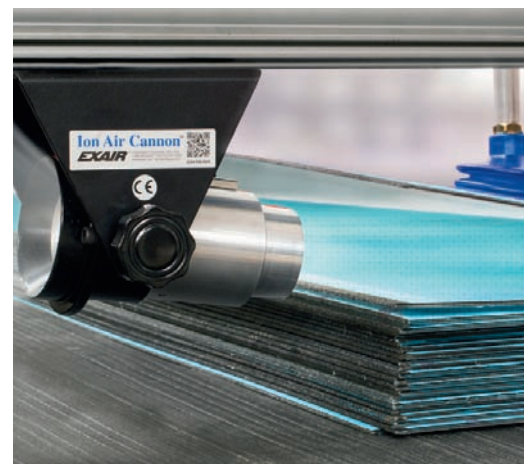
EXAIR's Ion Air Cannon eliminates static electricity and cleans at distances up to 4.6 m, with no moving parts. It is suitable for benchtops, machine mounting and those hard-to-reach spaces that require a concentrated flow of static-eliminating ions.

The product has undergone independent laboratory tests to certify it meets the safety, health and environmental standards of the USA, the European Union and Canada that are required to attain the CE and UL marks. It is also RoHS compliant. Design features include a metal-armoured high-voltage cable to protect against abrasion and cuts, a replaceable emitter point, an integrated ground connection and electromagnetic shielding.

The device incorporates EXAIR's Super Air Amplifier that minimises compressed air use by inducing surrounding airflow at a ratio of 22:1. The amplified airflow carries the ions to the target, making it possible for the product to eliminate static charges in less than half a second. Air volume and velocity are controllable from a 'breeze' to a 'blast' to gently wipe or forcefully blow away contaminants.

The product comes with a sturdy stand that incorporates a swivel adjustment for directing the airflow. A hose or tube can be easily connected to the air intake to draw air from another area. The electrical ion source is shockless and there is no radioactive element. Applications include bag opening, sheet separation, cleaning moulded parts, pre-paint dust removal, package cleaning and container neutralisation.

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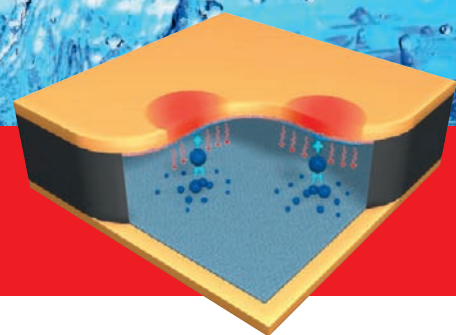
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JUMPING DROPLETS

COOL MOBILE HOTSPOTS

US researchers have reported a technique designed to address mobile hotspots, which come about through electronic devices' inability to evenly dissipate the waste heat they produce.



While a few options for hotspot cooling do exist, they don't work well for mobile hotspots, which move according to ever-changing computing tasks or power-amplification demands.

"Thermoelectric cooling, for example, is best for a fixed hotspot location," said Chuan-Hua Chen. "And electrowetting requires external power input."

The new technique was discovered by Chen's group at Duke University, who found that when two water droplets merge together on a water-repellent (superhydrophobic) surface, the merged droplet spontaneously jumps perpendicular to that surface. They further established that the out-of-plane jumping motion is driven by surface energy initially stored on the droplets and released upon drop coalescence. This effect, which they demonstrated in a vapour chamber, can locally cool hotspots.

The jumping droplet vapour chamber consists of two parallel plates: a superhydrophobic surface and a sponge-like (superhydrophilic) surface. As explained by Chen, "When a hotspot appears on the superhydrophilic surface saturated with water, it drives the working fluid to vaporise. The water vapour condenses on the opposing superhydrophobic surface and rejects the waste heat.

"As condensate droplets grow and merge, the coalescence-induced jumping motion returns the working fluid back to the superhydrophilic surface. This 'jumping return' enables continuous operation of the vapour chamber to dissipate heat."

The main advantage of the jumping droplet technique, published in the journal *Applied Physics Letters*, is "its mechanism to perpendicularly return the working fluid to the hotspots", said Chen. "And because jumping droplets are driven by intrinsic surface energy, the technique is independent of external forces and gravitational orientation."

Another advantage is that the jumping droplet technique cools mobile hotspots without any active power input, similarly to flat-plate heat pipes, which remove heat through horizontal spreading. This method is much more effective than high thermal conductiv-

The top plate is a superhydrophilic evaporator covered with a water-filled wick, while the bottom plate is a superhydrophobic condenser on which the condensate droplets jump upon coalescence. The jumping mechanism returns the condensate droplets to the evaporator, providing a way to address mobile hotspots as they occur. Illustration by Craig Fennel, eGrafX, and Chuan-Hua Chen, Duke University.

ity copper or even diamond heat sinks, but still lacks a vertical mechanism to dissipate heat.

"Our technique not only retains the high effectiveness of flat-plate heat pipes for in-plane heat spreading, but also provides a much better capability for out-of-plane heat transport because of the perpendicular jumping mechanism," Chen said.

The combination of horizontal and vertical spreading is ideal for heat dissipation, with Chen analogising, "To avoid flooding, it's useful to spread the rain horizontally over a large area. But if the ground becomes soaked and water has no vertical pathway to escape, flooding is inevitable. Our jumping droplet technology addresses this technological void with a vertical heat spreading mechanism, opening the door to outperforming the best solid heat spreaders in all directions."

Because the performance of computers and power electronics depends so heavily on their ability to dispose of heat waste, the new method could enable faster computing and longer lifetimes for electronics. Going forward, the researchers are looking at material choices to best exploit their new technique.

"It's technically challenging to design a jumping droplet vapour chamber with materials of opposite wettability that are compatible with high-temperature vapour," said Chen. "We'll fine-tune material choices so that our system can stably work at higher temperature with more effective heat dissipation. We've already demonstrated a cooling performance comparable to copper, but I see a pathway to significantly exceed this industrial standard once we sort out the material issue."

INTELLIGENT NETWORK INTERFACE CARD

The Artesyn SharpSwitch PCIE-9205 PCI Express intelligent network interface card eliminates the need for a costly external load balancer in wireless, communications, broadcast and streaming media applications.

It is suitable for low-power, dense computing applications due to the Intel Xeon D series processor and Intel Ethernet multihost controller (code name Red Rock Canyon), which provides dual 100 G Ethernet interfaces and a 100 G switch.

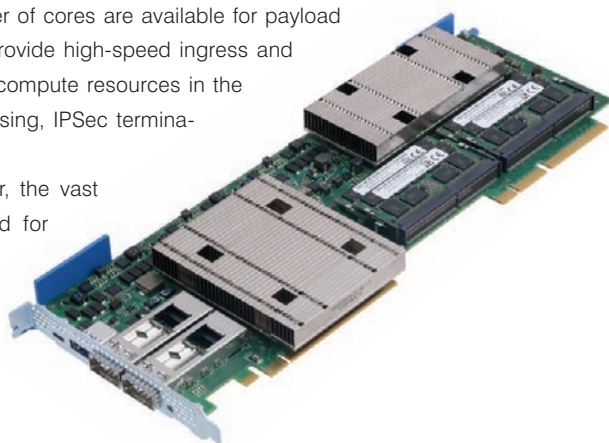
The product uses Open vSwitch offload to ensure the maximum number of cores are available for payload processing in NFV applications. The SharpSwitch card can be used to provide high-speed ingress and egress while doing Open vSwitch offload, allowing a high percentage of compute resources in the system to be used for application processing, such as baseband processing, IPSec termination or voice and video transcoding.

By using the SharpSwitch PCIE-9205 as an Open vSwitch accelerator, the vast majority of the available processor cycles in the system can be used for payload VMs.

The product is optimised to work in MaxCore PCIe platforms which leverage PCIe cards to create very low latency and low OpEx systems for applications such as vRAN, mini-CRAN, video transcode, VoLTE and security gateways.

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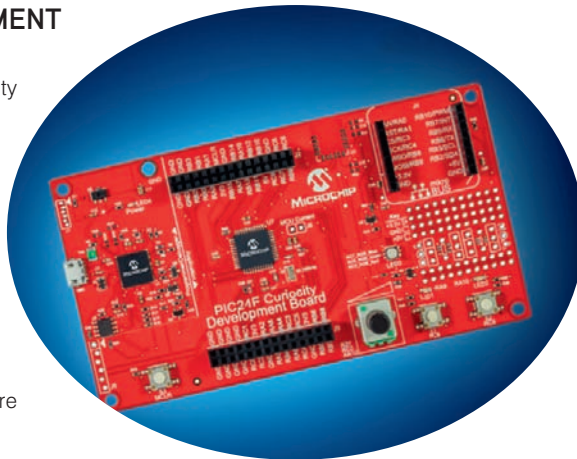
CURIOSITY DEVELOPMENT BOARD

The Microchip PIC24F curiosity development board is a fully integrated 16-bit development platform for first-time users, designers and those requiring a feature-rich rapid prototyping board. The product includes an integrated programmer/debugger and requires no additional hardware to get started.

The product is a suitable platform for harnessing the power of 16-bit eXtreme low power (XLP) PIC24F microcontrollers. The onboard PIC24FJ128GA microcontroller offers an integrated cryptographic engine, ISO 7816 support and I²S support. The board's layout and external connections offer unparalleled access to the core independent peripherals (CIPs), which enable developers to integrate various system functions onto a single microcontroller, simplifying the design and keeping system power consumption and BOM costs low. To simplify programming, the board supports the MPLAB X integrated development environment (IDE), MPLAB Xpress cloud-based IDE, XC16 compiler and MPLAB code configurator.

The product comes with several options for the user interface including physical switches, LEDs and an onboard potentiometer. Users can expand functionality through MikroElektronika mikroBUS click boards, and can add Bluetooth low energy communication with the BM71 module. Out of the box or with expansion boards, the product provides the freedom to develop for a variety of applications, including Internet of Things (IoT), peripheral testing, robotics development and proof-of-concept designs.

Mouser Electronics
www.mouser.com



SIGFOX-READY DEVELOPMENT KIT

For users looking to get started with Sigfox, the Xkit — available from Glyn, in partnership with local Sigfox operator Thinextra — has a full suite of features and accessories to empower anyone to set up an IoT solution, even with little hardware experience. Suitable for start-ups, design houses, universities and schools, the kit has everything required to utilise the globally available Sigfox network.

The kit includes Thinextra Shield with the following embedded on board: temperature, pressure, light, shock and 3D accelerometer sensors; two LEDs; and one push-button. It also features an Arduino Uno R3 board clone (already plugged into the shield); an external male SMA antenna (8.5 cm) for good connectivity; a USB cable (to plug into a Raspberry Pi or PC or use to re-flash the Arduino board); a battery holder (so kit works independently of any computer); and one year's connectivity to the Sigfox global network.

The Thinextra Shield can be used with an Arduino Uno R3 board or equivalent (included), an ST Microelectronics Nucleo development board or a Freescale development board. Using its USB port, the shield can also be plugged into a Raspberry Pi, PC or Mac computer.

Glyn Ltd
www.glyn.com.au

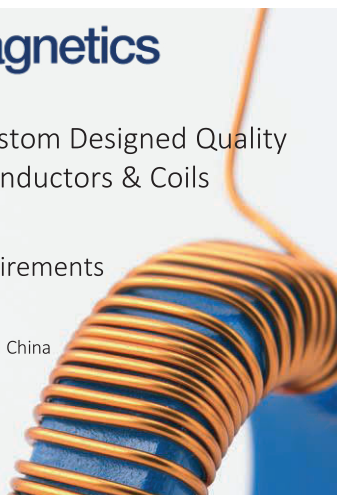
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HARDWARE CRYPTOGRAPHY-ENABLED MICROCONTROLLER

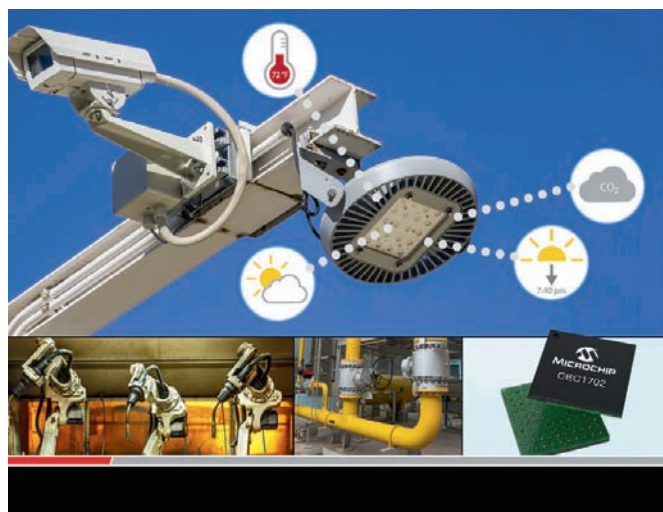
The Microchip CEC1702 hardware cryptography-enabled microcontroller addresses the increasing need for security measures, such as secure boot, driven by the continual growth of Internet of Things (IoT) applications.

The product is a full-featured ARM Cortex-M4-based microcontroller with a complete hardware cryptography-enabled system in a single package. This low-power, but powerful, programmable 32-bit microcontroller offers easy-to-use encryption, authentication, private and public key capabilities and allows customer programming flexibility to minimise customer risk.

The device's hardware cryptographic cipher suite reduces compute time by orders of magnitude over software solutions and provides 20x-50x performance improvement for PKE acceleration as well as 100x improvement for encryption/decryption. This robust hardware-based feature set results in applications that can run security measures quickly, effectively and with significantly lower cost and power consumption.

The product delivers a multidimensional defence against attacks, including pre-boot authentication of system firmware; firmware update authentication; authentication of system critical commands; and protection of secrets with encryption.

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Protecting an underwater lighting unit

Electrochemicals manufacturer Electrolube was recently approached by a company in Australia for assistance with a particularly unusual application: the customer needed protection for an underwater LED lighting unit.

The encapsulation resin needed to be light blue for aesthetic purposes and had to be able to withstand water temperatures from 5–40°C, as well as being flame retardant. The customer specifically asked for a sample of a very flexible encapsulation resin that could resist attack from constant immersion in pool water. Critically, this could be salt water or fresh water.

Electrolube's encapsulation resin was to replace the customer's existing epoxy resin from a different supplier, which was causing problems with slight deformation of the base unit due to the exotherm. The desired resin needed to be highly resistant to both salt and fresh water immersion. Water naturally corrodes most metals due to electrochemical oxidation; however, when a salt water medium is used, the rate of oxidation is significantly increased due to the presence of dissolved sodium and chlorine ions.

Electrolube's technical support team swung into action to resolve the problem as quickly as possible and offered two possible solutions: polyurethane resins UR5118 and UR5097. After further testing, UR5118 was discounted and the first production batch of UR5097 resin material was manufactured and shipped to Australia. Mike Woods, Electrolube's Australia and New Zealand manager, together with Electrolube's global business technical director for the Resins Division, Alistair Little, later visited the customer and discovered that there were a couple of issues with the material.

The first issue to overcome was the material had sedimented over time and was increasingly more difficult to reincorporate back into the resin mix. The second was

that there was a slight bleed of resin through the gap between the resin and the LED unit. With a bit of lateral thinking, the logical solution was to increase the thixotropic nature of the resin, which would help to slow down the rate of sedimentation to an acceptable level and prevent the resin bleeding through the gap.

Following two weeks' laboratory work, where a number of different options were tested, Electrolube's R&D team produced a material that had sufficient thixotropy to slow down the sedimentation and prevent flow through the gap. The resin material was also still very easy to mix and pour into the unit; in fact, the increase in the mix viscosity of modified resin was only slightly higher than the original resin and the colour of UR5097 was altered to the desired colour shade, matching against an RAL standard. This produced a completely bespoke solution that effectively resolved the customer's issues.

Importantly for this application, the resin is designed to withstand both fresh- and saltwater ingress and prevent the transmission of metal ions that could attack any metal present. The polymer used in the resin is also highly resistant to the transmission of water, even at various pressure differences experienced due to the depth of the water.

"We are delighted with the outcome of this particular application challenge," said Electrolube's managing director, Ron Jakeman. "At Electrolube, we are perfectly set up to solve issues for customers quickly and reliably with our international distribution, state-of-the-art in-house testing facilities and global manufacturing sites ready to deal with any challenges.

"We believe the proven quality of our products and easy product application processes, combined with our knowledge of the needs of LED manufacturers, helped assure the success of this project."

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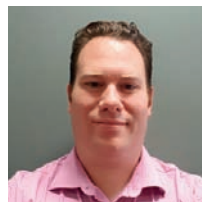
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STAR WARS

SUPERLASER COMES TO LIFE

Researchers at Macquarie University have proven a method for multiplying laser power using diamond, suggesting that the superlaser from film franchise *Star Wars* may not remain in the realm of science fiction for much longer.

The superlaser in *Star Wars* — the primary weapon of the Death Star battle stations — was powered by eight kyber crystals. Laser beams generated from these crystals were focused and combined into a single blast, which was capable of destroying an entire planet at full output.

Similarly, the Macquarie University researchers demonstrate a concept where the power of multiple laser beams is transferred into a single intense output beam that can be directed to the intended target. Their study has been published in the journal *Laser and Photonics Reviews*.

"This discovery is technologically important as laser researchers are struggling with increasing power beyond a certain level due to the large challenges in handling the large heat build-up, and combining beams from multiple lasers is one of the most promising ways to substantially raise the power barrier," said lead experimentalist Dr Aaron McKay.

The key to the high-powered beam is placing an ultrapure diamond crystal at the point of convergence. The beam-combining is achieved in diamond by harnessing a cooperative effect of the crystal that causes intense light beams to transfer their power into a selected direction while avoiding the beam distortion problems of single-laser technologies. The process also changes the colour of the laser beam.

"The particular wavelength of the directed energy beam is critical to the efficient transmission through the atmosphere and to reduce the eye hazard for people, or indeed animals, who may be in the vicinity of the beam," said study co-author Associate Professor Rich Mildren.

Although other materials have exhibited the same type of beam-combining properties, the choice of diamond is essential for high power. The power-transfer effect at the heart of the device, called Raman scattering, is particularly strong in diamond. Diamond is also outstanding for its ability to rapidly dissipate waste heat.

The new laser development has real-world and high-stakes applications, with high-power lasers seen as a key tool in areas such as defence. Associate Professor Mildren added that such a laser may also be useful in space applications, including powering space vehicles and tackling the growing space junk problem that threatens satellites.



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Complete Flexibility with Greater Security

The Individually Configurable Industrial Management Switches reliably network all ETHERNET nodes and ensure continuous access to machines and systems. The network ranges of redundancy protocols enable the creation of redundant network structures with a short recovery time of less than 20 ms. This guarantees secure communication, even when connections are faulty. Every WAGO switch also features a redundant power supply for uninterruptible data communication (transmission rate up to 1 GBit/s). This value-add feature contributes to secure operation of machines and systems.

Industrial Management Switches also support up-to-date security functions, such as "Mac Limitation," "Port Security," and authentication per IEEE 802.1x. Furthermore, "IGMP Snooping broadcast and bandwidth limitation enables additional data flow control.

For further information visit
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