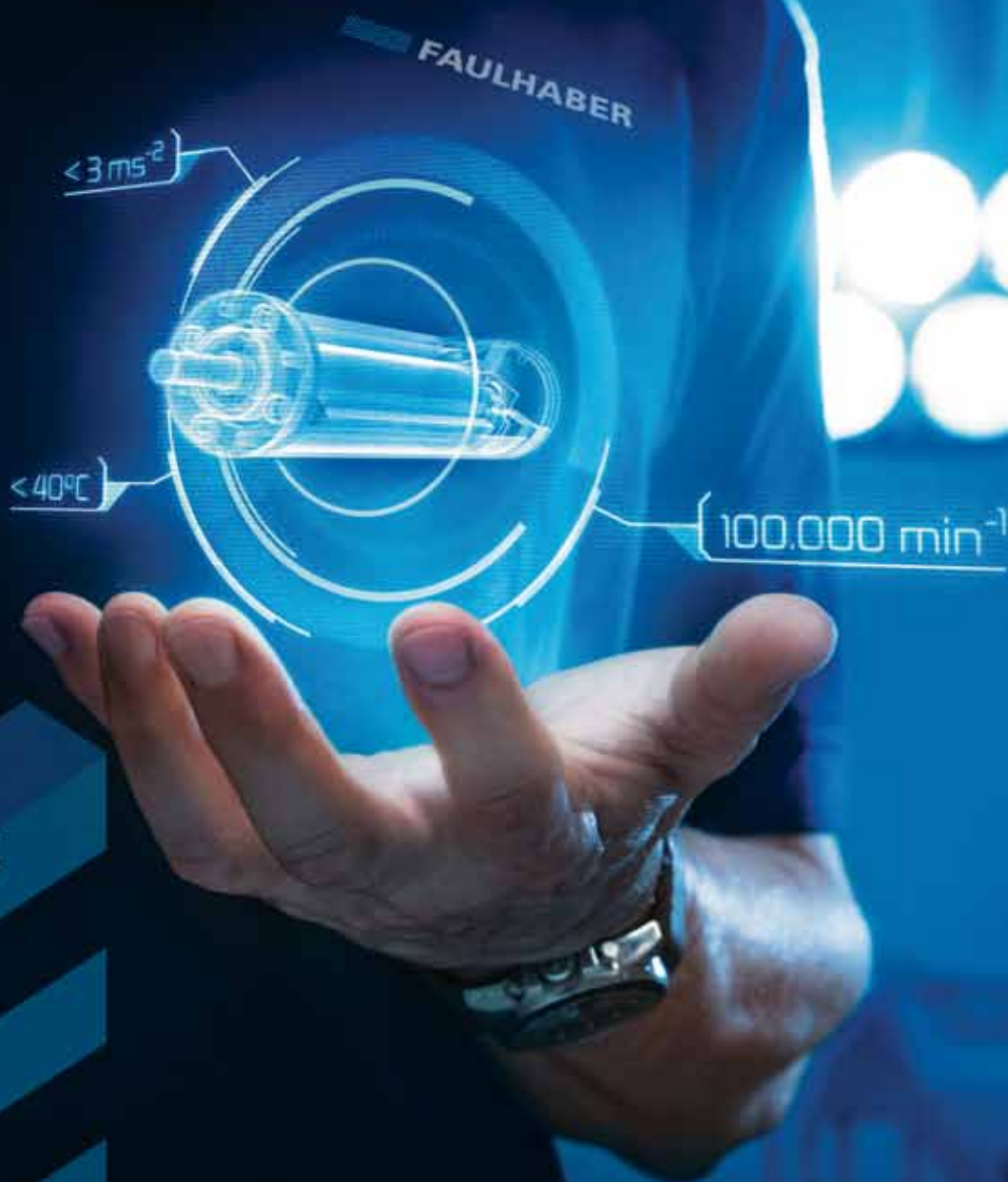


Access to
9 Million+
Products
Online



what's **new** in **electronics**



**MICRO-DRIVES
FOR MEDICAL
APPLICATIONS**

**COMPACT
POWERFUL
RELIABLE
PRECISE**

ERNTEC
ELECTRONICS TECHNOLOGIES



WE THINK
OUTSIDE
THE BOX.

9 MILLION+ PRODUCTS ONLINE | 1,000+ INDUSTRY-LEADING SUPPLIERS | 1.8 MILLION+ PRODUCTS IN STOCK



YOU INNOVATE. WE CAN HELP.



AUSTRALIA
DIGIKEY.COM.AU
1800 285 719

NEW ZEALAND
DIGIKEY.CO.NZ
800 449 837

The World's Largest Selection of Electronic Components Available for Immediate Shipment™

*Australia: A shipping charge of \$24.00 AUD will be billed on all orders of less than \$60.00 AUD. A shipping charge of \$20.00 USD will be billed on all orders of less than \$50.00 USD. All orders are shipped via UPS, Federal Express, or DHL for delivery within 3-4 days (dependent on final destination). No handling fees. All prices are in Australian dollar or United States dollar. New Zealand: A shipping charge of \$26.00 (NZD) will be billed on all orders of less than \$66.00 (NZD). A shipping charge of \$20.00 USD will be billed on all orders of less than \$50.00 USD. All orders are shipped via UPS for delivery within 3-4 days (dependent on final destination). All prices are in New Zealand dollar or United States dollar. Digi-Key is an authorized distributor for all supplier partners. New product added daily. Digi-Key and Digi-Key Electronics are registered trademarks of Digi-Key Electronics in the U.S. and other countries. © 2020 Digi-Key Electronics, 701 Brooks Ave. South, Thief River Falls, MN 56701, USA

ECIA MEMBER
Supporting The Authorized Channel

CONTENTS

- 4 The difference between IoT and M2M communication and design
- 14 Medical equipment power supplies in times of emergency
- 18 Tiny optical cavities could enable a quantum internet
- 22 Photoelectric sensors in practice
- 26 High-efficiency laser created for silicon chips
- 30 The screen printing process
- 32 Safety feature to stop lithium batteries catching on fire
- 34 High-frequency transistors said to achieve record efficiency



READ ONLINE!

Your copy of *What's New in Electronics* is available as an online eMag.
www.electronicsonline.net.au/magazine

SUBSCRIBE FREE

Choose from 11 industry magazines –
FREE for business professionals



www.WFMedia.com.au/subscribe

COVER STORY



Micro-drives (miniature DC-motor assemblies) are integrated into a large array of medical products including ventilators, respirator machines, optical inspection, compact injection systems and laser therapy devices.

Medical products consistently feature precision, high throughput performance and exceptional reliability from all critical components. In view of this, micro-drives for medical applications, particularly portable ones, typically incorporate the following features:

- Compact design
- High efficiency
- Quiet operation with low vibration
- Long operating life
- Non-arcing in normal operation
- High power density — high torque/volume ratio
- High speed
- Precise rotor balance
- Special options for specific applications (eg, autoclavable, special lubricants, adhesive free)

A combination of these features is challenging for a conventional iron armature motor. On the other hand, due to their unique design, coreless micro-drives offer all the above features in a compact package.

Combined with various types of commutation (brushed and brushless) and many complementary components and options, these coreless micro-drives are well suited for medical applications.

Erntec sources high-performance micro-drives from FAULHABER and can customise a solution utilising our design and manufacturing capabilities. Draw on our 30+ years' experience and see if we think outside the box for your next medical application.

ERNTEC Pty Ltd
www.erntec.net

THE DIFFERENCE BETWEEN IoT AND M2M COMMUNICATION AND DESIGN

Rich Miron

Though related, machine-to-machine (M2M) communications and the Internet of Things (IoT) are different, yet are often used synonymously. This leads to misconceptions and confusion about their distinctive characteristics, capabilities, and design and implementation requirements.

This article explains the differences between the two and introduces examples of each approach before elaborating on M2M's uniqueness relative to IoT systems using design solutions from Multi-Tech Systems, FreeWave Technologies and Hirschmann. It also looks at new M2M capabilities such as over-the-air (OTA) updates and multilayered security that boost network functionality and lower barriers to entry. Finally, it instructs designers on choosing the right M2M data plan to lower the data communication cost.

The difference between M2M and IoT

While both M2M and IoT technologies are about data sharing and links that drive data transfer, they are also different: IoT is a network of devices that are connected to the internet, while M2M is a process of communicating among two or more

electronics-enabled systems (or machines or devices) in an automated manner. The machines or devices in M2M point-to-point or point-to-multipoint connections can be sensors, actuators, embedded systems or other connected elements.

Here, it's important to note that M2M has been around before the term IoT was coined and before the emergence of the commercial internet in the mid-1990s. The origin of M2M can be traced back to telemetry applications that emerged after the advent of two-way radio in the early part of the 20th century. However, the launch of GSM, the first digital cellular network, brought a new phase of development to M2M communications in the 1990s.

A decade or so later, the IoT emerged as a primary vehicle for connecting things via open IP-based networks. It was then that the dividing lines between these two unique communication technologies started

to blur. To appreciate this blurring of lines, it's useful to take an example application — in this case, a heart rate sensor — and see how it fits into both the M2M and IoT models.

When a sensor monitoring the heart rate of a patient is connected to an external device or medical-grade server to keep the doctor informed about the patient's health, it could be achieved via an M2M application. If, instead, the heart rate sensor is integrated into an interactive device proximal to the patient that sends alerts to a patient's doctor or family members on their smartphones, it enters IoT territory.

M2M applications employing wired, wireless and cellular connectivity mechanisms include automated reading of utility meters, intelligent connectivity with traffic lights, and surveillance camera-based home security and assisted living. It is at this networking technology crossroads that M2M communication starts to converge with similar IoT designs.

How IoT complements M2M

In a wider context, M2M communication has entered a new phase in the IoT era. As IoT's cousin, M2M can use the same rapidly advancing connectivity technologies and solutions that are associated with the IoT, especially with regard to wireless. Multi-Tech Systems' MTC-H5-B01-US-EU-GB MultiConnect Cell 100 Series cellular modems, supporting both M2M and IoT applications, are a case in point (Figure 1). These cellular modems support GSM through to Cat 4 and Cat-M1 4G networks and are useful for M2M applications such as process automation, emergency services, remote patient monitoring, renewable energy systems and end-of-train system management.

The Cell 100 Series modems offer several interface options, including RS-232 and USB serial interfaces, serving a

broad range of application requirements. The hardware is supported by the MultiTech Connection Manager, a software package that automatically detects USB and serial devices, downloads required drivers and ensures that communication ports are correctly mapped to establish an M2M connection.

As vendors work on low-power IoT solutions using highly integrated connectivity, this is also helping to facilitate compact M2M radios that are available with a variety of voltage inputs and network configurations. A good example is the MM2 Series of 900 MHz RF modules from FreeWave Technologies. These can operate as an end point in both point-to-point and point-to-multipoint network topologies. The RF front-end modules incorporate a gallium arsenide (GaAs) FET and multistage surface acoustic wave (SAW) filtering for a combination of high sensitivity and overload immunity. Data rates are selectable: either 115.2 kbps or 153.6 kbps.

Typical specifications for the MM2 Series for output power, input sensitivity and range are 1 W, -108 decibels referred to 1 milliwatt (dBm) and up to 20 miles, respectively. The range assumes a clear line of sight.

M2M security and reliability

Security and reliability, traits shared by M2M and IoT designs, are even more critical in M2M applications as they usually don't involve any human interaction. In fact, security and reliability are key hurdles in the widespread rollout of M2M networks.

So, in the wired space, Hirschmann's RS20/RS30 industrial DIN rail Ethernet switches allow engineers to configure M2M networks according to reliability needs. The RS20 switches offer 4–25 Fast Ethernet ports to ensure extremely high failure tolerance (Figure 2). Likewise, the company's RS30 switches feature eight to 24 port



Figure 1: The MTC-H5-B01-US-EU-GB cellular modem (left) from Multi-Tech Systems, designed for M2M applications, can also be used for IoT services.

densities with two Gigabit Ethernet ports and eight, 16 or 24 Fast Ethernet ports. Fast Ethernet and Gigabit ports can be individually defined, which provides M2M designers with a choice to pick redundancy protocol and security mechanisms according to specific design requirements.

The support for standards like Media Redundancy Protocol (MRP) and Multiple Spanning Tree Protocol (MSTP) ensures high network availability for reliability conscious M2M applications. Similarly, there are numerous security mechanisms that these industrial Ethernet switches support, including IP and MAC port security, SNMP V3, SSHv2 and 802.1x Multi Client Authentication.

These M2M devices bolster network security by featuring the Secure Shell (SSH) public key authentication and fully encrypted data tunnels. Additionally, at the device level, these M2M routers and bridges offer multilevel encryption capability to protect configuration data.

When it comes to M2M services using cellular connectivity, security and authentication are usually baked into the LTE standards. In regard to physical security, eSIMs soldered directly onto the board make it nearly impossible for anyone to tamper and remove the SIM for misuse.

The SIMs used in M2M applications bring us to the final topic: M2M data plans and pertinent questions regarding their selection and usage.

M2M data plans

M2M designers and users may have many options when it comes to M2M data plans, as all major mobile operators offer data plans and pricing packages for M2M services. However, there are some key criteria under which to evaluate them, including degree of customisation for the application.

Also, some subcarriers specialise in M2M services, and they are often called mobile

virtual network operators (MVNOs). These mobile operators provide remote provisioning and management of M2M connections via over-the-air (OTA) services.

Here, unlike traditional SIMs used in mobile phones, an M2M SIM provided by a specialist operator offers users control over data usage and other features such as activity monitoring and SIM locking. These SIMs can also be provisioned and linked to specific application servers using the tunnelling network features.

It's also important to mention that some M2M specialists also package data plans along with modems and other M2M equipment like gateways, setting up M2M applications as a complete task. These M2M operators are usually carrier agnostic and they build coverage according to M2M application needs.

For instance, while a healthcare monitoring service might suffice with single cellular network coverage, a trucking fleet might require more than one mobile network footprint. Also, M2M users should ensure that their service provider is hands-on with troubleshooting capabilities and can perform troubleshooting remotely and in real time.

Data plan tiers

Finally, when it comes to the cost of M2M data transfer, and subsequently the economics of data plans, the nature of the application matters a lot. For example, M2M applications such as wireless point-of-sale (PoS) and parking meters use small data packets sporadically; here, pay-per-use data plans make more sense than per device or fixed data plans.

Also, low-use monthly plans for 50 KB to 3 MB per month can suffice for M2M applications such as automated meter reading, asset and vehicle tracking, and security alarm systems. On the other hand, medium-use M2M plans, ranging from 5 to 150 MB per month, can efficiently serve vending, retail and healthcare applications.



Figure 2: The Hirschmann RS20 Ethernet switch offers four to 25 Fast Ethernet ports to minimise the chance of failure.

On the higher end, there are high-usage plans for digital signage, PLCs for industrial monitoring and control, and smart building management. They span from 300 MB to 4 GB and are typically used for M2M devices that mandate real-time access to remote locations for transferring large files or content streaming.

There are even M2M data plans for extreme use, ranging from 8 to 100 GB, and typically serve devices that require M2M connections 24/7 for streaming high volumes of data. Typically, such M2M applications include backup and redundancy links and video surveillance systems for asset management.

Furthermore, there are M2M data plans that allow users to aggregate data usage across multiple SIMs. So, one M2M device overusing data may be compensated for by another connected device underusing data. Moreover, depending on the application and operator, these data plans provide users with connectivity technologies of their choice: GPRS, 2G, 3G, and LTE 4G data pipes.

Conclusion

A closer look at the intertwined worlds of M2M and IoT communications shows they are distinct in terms of their network architecture and implementation requirements, but that they also share common building blocks like RF modules, modems, switches, routers and gateways. Cellular connectivity and its associated data plans offer yet another common ground between these two networking technologies.

Those commonalities, however, make it even more important to understand the dividing lines between M2M and IoT systems, because it will matter when calibrating industrial automation design needs regarding security, connection availability and reliability, interface options and RF robustness.

Digi-Key Electronics
www.digikey.com

New STM32H7



High performance, Power saving



STM32H7A3, STM32H7B3 and STM32H7B0

- Arm® Cortex®-M7 @ 280 MHz
- Up to 2 MB embedded Flash and 1.4 MB RAM
- Enhanced support for graphics:
 - RGB interface for up to XGA displays
 - Chrom-ART Accelerator™ for more advanced GUI with less CPU load
 - Chrom-GRC™ optimizing support for non-rectangular displays
 - JPEG HW codec
 - Display resolution up to HVGA with 24-bit colours without external SRAM
 - Dual Octo-SPI external memory interface
- Complete graphical solution based on TouchGFX™ technologies
- Power efficiency achieving 120 µA/MHz in Run mode
- Extended security features



SELF-CHARGING BATTERY DEVELOPED

Researchers from the University of Porto and The University of Texas at Austin have developed a new type of battery that combines negative capacitance and negative resistance within the same cell, allowing the cell to self-charge without losing energy — a breakthrough that has important implications for long-term storage and improved output power for batteries.

The battery can be used in extremely low-frequency communications and in devices such as blinking lights, electronic beepers, voltage-controlled oscillators, inverters, switching power supplies, digital converters and function generators, and eventually for technologies related to modern computers. It was made with two different metals as electrodes and a lithium or sodium glass electrolyte between them — a method that was described in the journal *Applied Physics Reviews*.

"The glass electrolyte we developed was lithium-rich, and so I thought that we could make a battery in which the electrolyte would feed both electrodes with lithium ions, on charge and discharge with no need for lithium metal," said researcher Helena Braga from the University of Porto.

The work unifies the theory behind all solid-state devices — such as batteries, capacitors, photovoltaics and transistors — where the different materials in electrical contact exhibit the properties of the combined material instead of those of the individual materials.

"When one of the materials is an insulator or dielectric, such as



© Stock-Adobe.com/au/midrey Popov

an electrolyte, it will locally change its composition to form capacitors that can store energy and align the Fermi levels within the device," Braga said.

In a battery, the open circuit potential difference between electrodes is due to an electrical need to align the Fermi levels, a measure of the energy of the least tightly held electrons within a solid, which is also responsible for the polarity of the electrodes. The chemical reactions come later and are fed by this electrical potential energy stored

in the capacitors.

"Our electrochemical cells, which in principle are simpler than batteries, are all about self-organisation, which is the substance of life," Braga said.

To contribute to a more sustainable world, self-cycling can be stopped or mitigated by not allowing a leap in the Fermi levels or by configuring a negative resistance to happen.

"This can be obtained by having the negative electrode of the same material as the positive ions of the electrolyte," Braga said. "It gives rise to a device that self-charges without self-cycling — increasing the energy stored in it — as opposed to the natural degradation of the electrochemical process that makes the energy stored decrease by dissipation of heat. The latter has applications in all energy storage devices, such as batteries and capacitors, and can substantially improve their autonomy."

AUS SUPERCOMPUTING FACILITIES JOIN THE BATTLE AGAINST COVID-19

Australia's leading supercomputing facilities, the National Computational Infrastructure (NCI Australia) and the Pawsey Supercomputing Centre have joined the fight against COVID-19 through the provision of streamlined, prioritised and expedited access to computation and data resources.

NCI has announced support for three targeted projects with over 40 million units of compute time, which is equivalent to one single computer doing constant calculations for over 4500 years, on the Gadi supercomputer. NCI will also provide storage for major reference datasets (national or international) needed to support the computational and data analysis by multiple projects.

Meanwhile, the Pawsey Supercomputer Centre has provided access for researchers across five projects to over 1100 cores on

the newly deployed Nimbus cloud. Resources being made available at Pawsey include large data stores and the refreshed Nimbus Cloud service. COVID-19 projects will have access to allocations of up to 500 cores, with up to 100 TB of storage available for use during 2020–2021.

"The Australasian Leadership Computing Grants represent a peak merit award for high-performance computing at a scale that is unprecedented within the Australian context, made possible by the federal government NCRIS funding for the new peak facility recently commissioned at NCI," said NCI Director Professor Sean Smith.

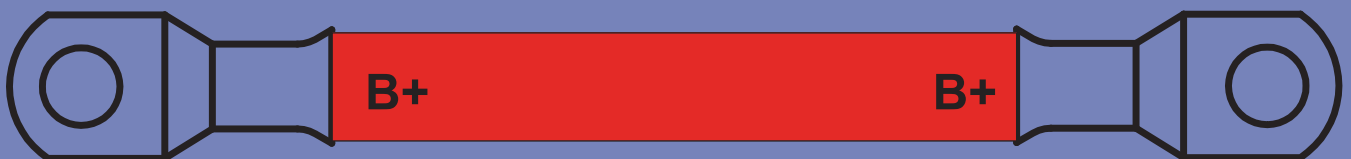
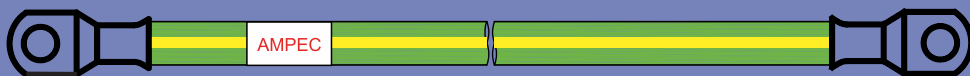
Pawsey Executive Director Mark Stickells added, "Having access to advanced HPC

resources and data expertise at Pawsey and NCI allows Australian researchers to accelerate their science to combat the pandemic and we are proud to contribute our national infrastructure and expertise in this collaborative effort."



NCI's Gadi supercomputer.

Wiring Harness Solutions



Ampec Technologies Pty Ltd
Tel: 02 8741 5000 Email: sales@ampec.com.au

SHORTCIRCUITS

HIGH-FREQUENCY SIGNALS ENABLE TERABITS-PER-SECOND DATA LINKS

Using the same technology that allows high-frequency signals to travel on regular phone lines, US researchers tested sending extremely high-frequency, 200 GHz signals through a pair of copper wires. The result is a link that can move data at rates of terabits per second — significantly faster than currently available channels.

While the technology to disentangle multiple, parallel signals moving through a channel already exists, thanks to signal processing methods developed by the inventor of digital subscriber lines (DSL), questions remained related to the effectiveness of implementing these ideas at higher frequencies. To test the transmission of data at higher frequencies, researchers used experimental measurements and mathematical modelling to characterise the input and output signals in a waveguide, with the results published in the journal *Applied Physics Letters*.

The team used a device with two wires running parallel inside a sheath with a large diameter that facilitates increased mixing of the waveguide modes. These mixtures enable the transmission of parallel noninterfering data channels. Higher frequencies allow larger bandwidth and more data to travel through a channel, if the architecture of the channel is such that the data is not garbled by interference.

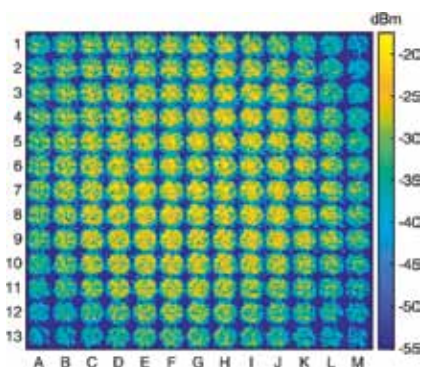
"To confirm and characterise this behaviour, we measured the spatial distribution of energy at the output of the waveguide by mapping the waveguide's output port, showing where the energy is located," said Brown University's Daniel Mittleman, corresponding author on the study.

The researchers created a 13 x 13 mm grid for the output of each possible input condition, resulting in a 169 x 169 channel matrix that provides a complete characterisation of the waveguide channel. The results demonstrate a superposition of waveguide modes in the channel and allow estimation of data rates.

"It is exciting to show that a waveguide can support a data rate of 10 terabits per second, even if only over a short range — that's well beyond what anybody has previously envisioned," Mittleman said. "Our work demonstrates the feasibility of this approach to high-rate data transmission, which can be further exploited when the sources and detectors reach the appropriate level of maturity."

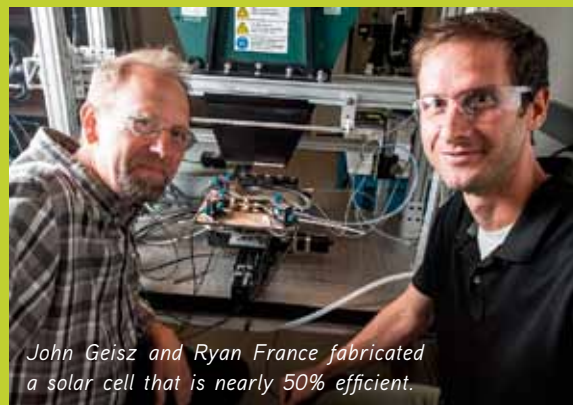
The researchers intend to further investigate ohmic losses — a function of the resistance of each of the cell components and caused

by the metal hardware of the waveguide, which dictate the limit on the length of the channel. Their work could be used in applications that require large amounts of data to move quickly over short distances, such as between racks in a data centre or for chip-to-chip communication.



A 13 x 13 mm measurement for each of the 169 possible locations of the signal input location of the waveguide. These measurements reveal multiple maxima in each 13 x 13 spot, confirming a superposition of modes in the signal propagating through the waveguide. Image courtesy of the study authors.

SIX-JUNCTION SOLAR CELL SETS WORLD RECORDS FOR EFFICIENCY



John Geisz and Ryan France fabricated a solar cell that is nearly 50% efficient.

Image credit: Dennis Schroeder, NREL.

Scientists at the US National Renewable Energy Laboratory (NREL) have fabricated a six-junction solar cell that now holds the world record for the highest solar conversion efficiency at 47.1%, as measured under concentrated illumination. A variation of the same cell also set the efficiency record under one-sun illumination at 39.2%.

As described in the journal *Nature Energy*, the researchers constructing the device relied on III-V materials — so called because of their position on the periodic table — that have a wide range of light absorption properties. Each of the cell's six junctions (the photoactive layers) is specially designed to capture light from a specific part of the solar spectrum. The device contains about 140 total layers of various III-V materials to support the performance of these junctions, yet is three times narrower than a human hair.

Due to their highly efficient nature and the cost associated with making them, III-V solar cells are most often used to power satellites, which prize III-V's high performance. On Earth, however, the six-junction solar cell is well suited for use in concentrator photovoltaics, said study co-author Ryan France.

"One way to reduce cost is to reduce the required area, and you can do that by using a mirror to capture the light and focus the light down to a point," France said. "Then you can get away with a hundredth or even a thousandth of the material, compared to a flat-plate silicon cell. You use a lot less semiconductor material by concentrating the light. An additional advantage is that the efficiency goes up as you concentrate the light."

France described the potential for the solar cell to exceed 50% efficiency as "actually very achievable", but acknowledged that 100% efficiency cannot be reached due to the fundamental limits imposed by thermodynamics. Lead author John Geisz added that the main hurdle to topping 50% efficiency is to reduce the resistive barriers inside the cell that impede the flow of current.

Geisz added that NREL is also heavily engaged in reducing the cost of III-V solar cells, enabling new markets for these highly efficient devices that demonstrate "the extraordinary potential of multijunction solar cells".



SUPERCAPACITORS MADE OF THE WORLD'S SMELLIEST FRUIT

Researchers from the University of Sydney have found a way to use jackfruit and durian — the latter considered the world's smelliest fruit — to create energy stores for rapid electricity charging. Turning fruit waste into supercapacitors could substantially reduce the cost of energy storage and charge devices such as mobile phones, tablets, laptops and even electric cars much faster than batteries.

Associate Professor Vincent Gomes explained how he and his team converted the fruits' waste portions (biomass) into supercapacitors that can be used to store electricity. "Supercapacitors are like energy reservoirs that dole out energy smoothly. They can quickly store large amounts of energy within a small battery-sized device and then supply energy to charge electronic devices ... within a few seconds."

He explained, "Using a non-toxic and non-hazardous green engineering method that used heating in water and freeze drying of the fruits' biomass, the durian and jackfruit were transformed into stable carbon aerogels — an extremely light and porous synthetic material used for a range of applications.



"Carbon aerogels make great supercapacitors because they are highly porous," he said, with durian waste selected "based on the excellent template nature provides for making porous aerogels".

"We then used the fruit-derived aerogels to make electrodes which we tested for their energy storage properties, which we found to be exceptional."

The results of the study, as published in the *Journal of Energy Storage*, found that "the durian and jackfruit supercapacitors perform much better than the materials currently in use and are comparable, if not better, than the expensive and exotic graphene-based materials", Assoc Prof Gomes said.

"Current supercapacitors are made from activated carbon ... [and] are nowhere near as efficient as the ones prepared during this project."

The project also provides an ideal use for durian waste, which Assoc Prof Gomes described as "a zero-cost substance that the community wants to get rid of urgently due to its repulsive, nauseous smell ... [It] is a sustainable source that can transform the waste into a product to substantially reduce the cost of energy storage."



Easy, Effective Embedded Security

Everything You Need to Make Security Simple and Scalable

With new security threats on the rise, it is imperative to properly secure your embedded products.

Microchip's comprehensive ecosystem of hardware, software and tools make it easy to implement effective protection for your embedded application.

With Microchip support, implementing security into your design no longer needs to be time consuming or complex. Microchip gets you started with our 32-bit MCU security portfolio with integrated

hardware-based security features. When combined with our award-winning development ecosystem, you'll be rewarded with shorter development time, fewer required development resources and a secure solution without the need to employ your own security experts.

With our broad portfolio of scalable security solutions, from simple security building blocks to fully hardened security solutions with secure elements, Microchip has the solution for your design needs.



Contact Information

Microchip Technology Australia Email: aust_nz.inquiry@microchip.com Phone: +61 (2) 9868-6733

microchip.com/embeddedsecurity-32bitmcus

The Microchip name and logo and the Microchip logo are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries. All other trademarks are the property of their registered owners. © 2020 Microchip Technology Inc. All rights reserved.





INERTIAL MEASUREMENT UNITS

STMicroelectronics is extending the benefits of its motion-detection machine-learning core (MLC) technologies into industrial and high-end consumer applications with the ISM330DHCX and LSM6DSRX 6-axis iNEMO inertial measurement units (IMU). The MLC performs basic AI pre-processing of motion data using about 0.001 times the power a typical microcontroller (MCU) would consume to complete the same task. As a result, IMUs featuring this IP can offload the host MCU — a capability that is said to enable longer battery runtime, lower maintenance, and reduced size and weight in context-aware and motion-sensing devices.

The LSM6DSRX and ISM330DHCX are suitable for high-end consumer and industrial applications such as augmented/virtual reality, drone flight controls, dead-reckoning navigation systems, disk-antenna positioning systems, fleet management, container-tracking devices and dynamic inclinometers for industrial vehicles. The consumer-grade LSM6DSRX contains a 3-axis accelerometer and a 3-axis digital gyroscope with extended full-scale angular-rate range up to ± 4000 dps and good performance in temperature and time. The industrial-grade ISM330DHCX comes with 10-year product-longevity assurance and is specified from -40 to 105°C, with embedded temperature compensation for stability.

In each device, the MLC interacts with integrated finite-state machine (FSM) logic, which can run simple repetitive algorithms like counting steps, hits or rotations at lower power than is said to be possible in a microcontroller. The FSM signals to the main controller after detecting a preset number of events or after a defined time has elapsed.

STMicroelectronics Pty Ltd
www.st.com



PLASTIC CABLE TIES AND CABLE MANAGEMENT COMPONENTS

Cable ties, cable tie mounts and cable management components form part of the large range of plastic fixings and fastenings available at Hi-Q Electronics, trading as Hi-Q Components.

Standard strap-type cable ties are available from 75 mm long and 2.4 mm wide to 1500 mm long and 9 mm wide.

Many sizes are also available in weather-resistant black nylon for outdoor use.

Where special cable ties are required, there is a large range of special ties available including HVAC duct straps, heavy duty for hydraulic hoses, releasable, screw mount, marker, push mount, hanking and beaded ties.

Standard releasable cable ties are now available in longer and wider sizes, up to 590 mm long and 12.8 mm wide. Other cable ties now available are double head, security and chassis ties.

To complement the cable tie range, Hi-Q Components stocks many cable tie mounts. These include quick and easy self-adhesive tie mounts, and push and lock clip mounts for through hole panel mounting. For securing heavy wire bundles, screw-mounted saddle-type mounts are particularly suitable.

For other cable management applications, Hi-Q has various cable clips, clamps and saddles to secure cables, tubing, wire bundles and flat wire. As well as the standard 'P' clips there are releasable and adjustable cable clips and clamps, which can be through-hole panel clip mounted, adhesive mounted and nailed.

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

SMD CERAMIC FUSE

With the UMT-W, SCHURTER launches a pulse-proof SMD ceramic fuse with super time-lag tripping characteristics, which is particularly suitable as a fail-safe device in demanding applications.

The cuboid shaped (5.3 x 16 mm), compact SMD fuse is available in five rated currents from 5 to 20 A and reaches rated voltages of up to 125 V AC and DC with a breaking capacity of up to 1000 A. It features a slow and precisely defined melting characteristic claimed to be unique for SMD fuses.

The product is recommended wherever high inrush currents flow (eg, motor control systems). It is particularly suitable for applications with long cables (eg, avionics), which are often primarily protected by an electronic fuse. If this monitoring fails, or does not perform its task correctly, the UMT-W takes over as a fail-safe device and transfers the system to a safe, current-less state. Due to the melting times with precise min/max corridor at 4xIn, robust and selective safety concepts can be implemented on top of the electronic fuse.



The fuse is a COTS+ product, having undergone extended fuse qualification tests (eg, AEC-Q200) and highly controlled manufacturing processes, which are available to all SCHURTER customers. The company also offers visual inspection according to MIL-PRF 55342, different types of up-screenings (burn-in) and detailed test reports on request.

SCHURTER (S) PTE LTD
www.schurter.sg

ENCLOSURES

MFB's SoHo 210 range of enclosures offers a useful solution for removing desk clutter. The simple enclosures provide a vertical storage solution for equipment that could otherwise take up unnecessary desk space. Simply drop one under a desk to house modems, switches, routers and other peripheral devices.

The enclosures can be supplied unassembled or assembled with common MFB accessories including shelving and power distribution boards. They are available in a range of heights and depths and a range of powder coat colour finishes.

MFB Products Pty Ltd
www.mfb.com.au





SINGLE-MODE OTDR

The Viavi MTS-4000 Single-Mode OTDR is a highly integrated optical test platform with module bays which

have been designed for the installation, turn-up and maintenance of fibre-optic networks. It is available to rent from TechRentals.

It has a multi-touch screen that is highly intuitive and easy to use, enabling fast testing. The simple device requires minimal training for engineers, technicians, installers and contractors. The device certifies the fibre physical layer of FTTx/PON, access, metro and enterprise networks.

The optical test platform supports optimum operation within the platform or through the cloud with its VIAVI StrataSync (a centralised cloud-based asset, configuration, test data and workflow management). The unit also has a 9" high-visibility touchscreen along with essential tools integrated such as an optical microscope.

TechRentals

www.techrentals.com.au



DC-DC CONVERTER

Vicor has announced the DCM5614 — an isolated, regulated 270–28 V DC-DC converter with an output power rating of 1300 W in a 5.6 x 1.4 x 0.3" VIA package. Providing power density of 451 W/in³ at a weight of 178 g, the product supports airborne, shipboard and UAV systems where power density, weight and efficiency are critical.

With 96% efficiency, power dissipation is reduced, and the innovative planar and thermally adept VIA package enables multiple cooling strategies for enhanced thermal performance. Modules can also be easily paralleled for increased power or stacked for increased output voltage.

Vicor Corporation

www.vicorpower.com

TRANSFER MULTISORT ELEKTRONIK

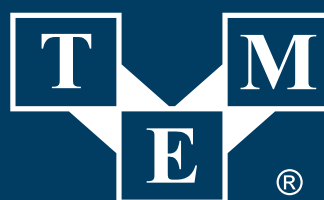
GLOBAL DISTRIBUTOR OF ELECTRONIC COMPONENTS

SCHMALZ

THE LEADER IN VACUUM TECHNOLOGY



CHECK
OUR OFFER



Electronic Components



NO PRODUCTS
IN STOCK?
CHECK TME'S
OFFER!

Transfer Multisort Elektronik

Transfer Multisort Elektronik Sp. z o.o.
Ustronna 41, 93-350 Łódź, Poland
tel. +48 42 645 54 44, export@tme.eu

tme.eu

facebook.com/TME.eu

instagram.com/tme.eu

youtube.com/TMElectroniComponent



MEDICAL EQUIPMENT POWER SUPPLIES IN TIMES OF EMERGENCY

When demand for the supply of modular power supplies for medical equipment is high, the necessary certifications should not be overlooked so that patient and operator safety is maintained. This article summarises the product specifications that should be considered.

The outbreak of COVID-19 in January 2020 has disrupted the world economy, with some technology companies, particularly in China, temporarily closing their doors to avoid the infection risks associated with workers travelling and gathering together. Many have restarted their businesses as the risk at the outbreak epicentre diminishes, but supply chains for electronic components have been disrupted, with a knock-on effect around the world. Stock markets have suffered huge losses as companies, from phone manufacturers to airlines, see their profits at risk, but with hope for a rebound after some pause in the continuous demand for consumer goods and industrial output.

Medical equipment demand surges during medical emergencies

While we can all delay our next tech purchase or holiday and wait for stocks to recover, there is a more pressing problem: governments globally have been taking emergency action to contain the disease and make facilities available for screening, isolation and treatment of patients — and this requires medical equipment. We have seen the

amazing speed at which China has built new hospitals — from empty lot to finished building within 10 days — with thousands of workers and masses of heavy construction equipment having achieved what seemed impossible.

Each new bed and theatre though needs a suite of diagnostic and therapeutic equipment to treat the patient effectively; screening points around the world at airports and other transport hubs need huge extra numbers of portable personal temperature monitors; even beds themselves today are expected to be 'smart' with patient status monitoring and motorised position adjustments. Medical equipment suppliers have been rushing to fulfil new orders to meet the demand, pulling in deliveries of necessary components, but this is the very supply chain that has been disrupted by the virus outbreak. Buyers have therefore, in some cases, had to look for equivalent parts from a wider supplier base.

Certified medical equipment manufacturers are well aware of the necessity to maintain their product quality and safety and cannot cut corners, but in times of emergency it is worthwhile restating the requirements for one of the most safety-critical items in medical applications — the power supply.



Medical applications require medical-grade power supplies

Medical equipment can be powered from an AC mains or increasingly from an internal battery, and protection against electric shock is vital in both cases. It is often the case that domestic, commercial, industrial, IT and medical-grade AC/DC power supplies are available in a common form factor, for economy in manufacturing. Outwardly they can look identical and headline performance specifications for input and output ratings can be the same, with most categories of end-equipment possibly functioning as expected with a power supply intended for another category. The difference is in safety specifications however; medical-grade power supplies have particular characteristics that match the sensitive healthcare environment where monitoring equipment may be directly applied to the body of a patient, who may already be weak and susceptible to further injury.

Categories of medical environment must be identified

The latest medical standards for safety consider different healthcare environments: Type B (body), where equipment has no direct connection to the patient, such as lighting in operating theatres or analysis equipment in laboratories; Type BF (body float), where the equipment has direct patient connection such as with incubators, beds with electronic controls or ultrasonic diagnostic equipment; and Type CF (cardiac

float), where there is direct connection to the patient's heart such as in defibrillators. For Type B applications an AC/DC power supply must be certified for 2 x MOOP, or 'Two Measures of Operator Protection'. For Type BF and CF, the certification is 2 x MOPP (Two Measures of Patient Protection), with a further very stringent limit to mains leakage current in the CF case.

Power supplies meeting these requirements have very specific insulation systems, with minimum creepage and clearance distances between live and output connections and controlled maximum mains leakage current — the current that could flow from the AC supply to the output or casing of the equipment and on to an operator or patient under normal or single fault conditions. The fourth and latest edition of the medical safety standard ES/IEC/EN 60601-1 also has more stringent EMC requirements compared with its predecessor and other application environments. In some cases, the power supply output may need guaranteed isolation from ground and there are further considerations if there are other connections to the power supply or end-equipment such as communications links.

DC/DC converters may need medical certification as well

It may not be obvious, but in medical applications, DC/DC converters with low input and output voltages may also need safety certification. Often, a DC/DC is used to add a level of safety isolation to a lower grade AC/DC to achieve a higher overall grade. This can enable a lower cost 2 x MOOP AC/DC to be used in a 2 x MOPP application, as long as the DC/DC has the required insulation grade and creepage/clearance. DC/DCs in battery-powered equipment may also form a safety barrier when the equipment is being charged from AC mains or when a communications link is connected, to a grounded laptop for example. In this case the DC/DC is preventing lethal current flow from other faulty equipment through the patient and through the battery-powered equipment and on to ground through the laptop. Modular DC/DCs are often advertised with high test-voltage levels, perhaps 3 kVDC, but this is not necessarily sufficient and may only be a measure of immunity to transients, not safety isolation. For medical applications, the DC/DC must have the correct, certified, 1 x or 2 x MOOP or MOPP according to the equipment configuration, connections and environment. Unlike AC/DCs which can be expected to be rated for measures of protection for typical highest AC mains voltages, perhaps 250 VAC, DC/DCs can be offered with MOPs for lower system voltages, which may not be sufficient in the application. Close examination of the data sheet is necessary.

Certified power supplies are available

When selecting a medical-grade AC/DC or DC/DC power supply, the decision should be taken with care, despite the urgency. Austria-based manufacturer RECOM has a wide selection of medically certified AC/DC and DC/DC converter products and can advise on their compatibility with any particular application. RECOM has an extensive worldwide distribution network with high inventory levels to meet potential surges in demand and does not anticipate major effects on delivery times or product availability due to events such as the COVID-19 virus outbreak. As of March 2020, RECOM is in full production with good component stocks in its main manufacturing site in Taiwan, with sites in Italy and China fully operational.

RECOM Power GmbH
www.recom-power.com



RIBBON FUSION SPLICER AND CLEAVER

The Fujikura 70R+ ribbon fusion splicer and cleaver is a fast and ruggedised ribbon fusion splicer with a splice time of 11 s, sleeve shrink time of approximately 29 s and heat time of 18 s. It is available to rent from TechRentals.

The unit offers speed, ease of use and optical performance by incorporating fully automated features such as wind cover and heater operation. Its long battery life can provide up to 110 splice/heat cycles and 1500 splices per set with its extended electrode performance.

The Fujikura 70R+ has a large 4.73" colour screen for optimal visibility and offers onboard instructional videos and tutorials for users who might need assistance of any kind. The device also offers Bluetooth capability, a fibre holder and a transit case with work table.

TechRentals

www.techrentals.com.au



INGRESS PROTECTION TESTING

Ingress Protection is the rating of the degree of protection provided by an enclosure with respect to foreign object ingress. The foreign object may be dust or accidental, or even intentional, contact with water.

The IP Code is formulated from a possible combination of IP tests to provide the full IP rating code. The IP Codes that are shown on many products are defined by International Protection Marking, often called Ingress Protection Marking. Many electrical, industrial and consumer products require IP testing as it is often mandatory by regulation or by contract condition. It has also become increasingly common for marketing claims. Examples include waterproof mobile phones, sports watches and outside equipment enclosures.

EMC Technologies is accredited to test and issue for IP and can issue accredited NATA or A2LA accredited test reports to IEC 60529 or AS 60529 — degree of protection provided by enclosure (IP Code testing) up to IP6X (dust) and IPX8 (water).

Enclosure Protection testing involves assessing ability of the product or its enclosure to provide protection against: ingress of water (drip, spray, jet or immersion); ingress of dust; solid foreign objects; access to hazardous parts; and mechanical impact.

EMC Technologies

www.emctech.com.au



EMBEDDED IoT SOLUTIONS FOR RAPID PROTOTYPING

Due to the fragmented nature of the Internet of Things (IoT) marketplace, increasing project complexity and costs, Microchip Technology says that today's developers face more challenges in design decisions than ever before. To address these challenges, the company has announced its cloud-agnostic, turnkey, full-stack embedded development solutions.

From small PIC and AVR microcontrollers (MCUs) for sensors and actuator devices, to sophisticated 32-bit MCU and microprocessor (MPU) gateway solutions for edge computing, the company is now making it possible for developers to connect to any major core and any major cloud, using Wi-Fi, Bluetooth or narrowband 5G technologies — all while maintaining a strong security foundation through the support of its Trust Platform for the CryptoAuthentication family.

The PIC-IoT WA and AVR-IoT WA development boards feature a companion custom-built rapid prototyping tool developed in collaboration with Amazon Web Services (AWS), helping designers natively connect IoT sensor nodes to the AWS IoT Core service via Wi-Fi.

Based on the latest wireless system on module (SOM), the ATSAMA5D27-WLSOM1 is a gateway solution running AWS IoT Greengrass. It integrates the SAMA5D2 MPU, WILC3000 Wi-Fi and Bluetooth combo module fully powered by the MCP16502 high-performance power management IC (PMIC).

The SAM-IoT WG connects the Google Cloud IoT Core with Microchip's 32-bit SAM-D21 Arm Cortex M0+ range of microcontrollers.

The Azure IoT SAM MCU-based IoT development platform integrates the Azure IoT device SDK and Azure IoT services with Microchip's MPLAB X development tools ecosystem.

The PIC-BLE and AVR-BLE boards for sensor node devices connect to mobile devices for industrial, consumer and security applications and the cloud via gateways featuring Bluetooth Low Energy (BLE).

The LTE-M/NB-IoT development kit features Monarch chip-based modules by Sequans, enabling coverage of IoT nodes and leveraging the latest low-power, 5G cellular technology.

Microchip Technology Hong Kong

www.microchip.com

BREAKOUT BOARDS FOR RASPBERRY PI

Pimoroni has released a variety of breakout boards designed to enable additional functionalities for Raspberry Pi and Arduino boards. The breakout boards offer useful functions such as audio output, sensors and motor control.

The PIM476 1.3" SPI colour LCD breakout board offers a crisp and bright display with good viewing in-plane switching (IPS) angles. The board runs up to 50 fps, is compatible with all models of Raspberry Pi and Arduino, and features reverse polarity protection.

The PIM480 SGP30 sensor breakout board is based on the Sensirion multipixel gas sensor SGP, which measures total volatile organic compounds (TVOC) and equivalent carbon dioxide (eCO₂) in indoor environments. The sensor board features reverse polarity protection, minimal drift through time and Raspberry Pi-compatible pinout.

The PIM479 DRV8830 breakout board is an H-bridge DC motor driver with a configurable current limit of 0.2 or 1 A. The breakout board — which incorporates a Texas Instruments DRV8830 brushed DC motor driver — is bidirectional and speed-controllable, and incorporates four different I²C addresses that can be used simultaneously.

Mouser Electronics

au.mouser.com



LASER SCANNER

The high-performing scanCONTROL laser profile scanners from Micro Epsilon are said to feature good accuracy and measuring rates. They are also compact and can be easily integrated in industrial environment and applications in areas where space is limited.

Bestech Australia announces the release of the high-resolution scanCONTROL 30xx/BL laser scanner for dynamic measurement applications that require a system with high resolution. The laser scanner is primarily used for process automation tasks, but can also be applied in production, process monitoring and quality control. It includes a High Dynamic Range (HDR) feature which offers additional exposure and control features for generating measurements on challenging surfaces.

The scanner is available with a measuring range of 25 and 50 mm along the laser line with a capability to measure up to 5.5 million points per second and generate up to 2048 measuring points per profile. This translates to a fine X-axis resolution of 12 μm , which is suitable for measuring heterogenous surfaces. The sensor also offers a high measuring speed of 10 kHz for dynamic and high-speed measurement applications.

The output values from the scanCONTROL 30xx/BL are available via the EtherNET or RS422 interface. As the product is designed for industrial measurement tasks, it is also available with the optional gateway to enable integration with other popular industrial communication interfaces such as ProfiNET, EtherCAT or Ethernet/IP industrial control systems.

The scanCONTROL 30xx/BL is also available with blue laser technology. The blue laser diode generates short-wavelength laser light which hardly penetrates the objects. This provides advantages in some measurement applications particularly when used in measuring organic materials or objects with shiny, reflective and highly polished surfaces. Some examples include wood or semi-transparent objects such as adhesive beads or plastic objects. The laser scanner also sharply projects blue laser line on the surface which is reflected back onto the sensor elements. This configuration should ensure stable and precise measurement results.

Bestech Australia Pty Ltd

www.bestech.com.au



NEXT GENERATION SMART SERIES PICK & PLACE MACHINE

NeoDen S1 is the next generation of NeoDen Smart Series Pick and place machines, it offers technologically advanced, low cost solutions for low to medium volume SMT placement applications.

It features fully modular design, four heads, 58 feeder slots, flying vision, auto conveyor and electronic all-in-one feeders, users can move from prototype into mass production on the same machine. Easy operation to ensure high-efficiency.



Call us today: **+612 9687 1880**

Embedded Logic Solutions Pty Ltd ABN 44 109 776 098

✉ sales@emlogic.com.au



www.emlogic.com.au



TINY OPTICAL CAVITIES COULD ENABLE A QUANTUM INTERNET

Quantum engineers from the California Institute of Technology (Caltech) have shown that atoms held in optical cavities — tiny boxes to hold light — could be foundational to the creation of a quantum internet. Their work has been published in the journal *Nature*.

Quantum computers promise to revolutionise information technology, with the very nature of their hardware meaning they will be able to solve problems beyond the reach of classical computers. Scientists are also working on how to connect multiple quantum computers to share data and work together, creating a 'quantum internet' that would open the door to several applications — including solving computations that are too large to be handled by a single machine and establishing secure communications using quantum cryptography.

In order to work, a quantum network needs to be able to transmit information between two points without altering the quantum properties of the information being transmitted. The idea is to use one of the fundamental quantum properties of matter, which is entanglement. This is where the information of quantum objects remains dependent on each other, even if separated by an arbitrary distance.

One current model works like this: a single atom or ion acts as a quantum bit (or qubit) storing information via one of its properties, such as the direction of its angular momentum, known as 'spin'. To read that information and transmit it elsewhere, the atom is excited with a pulse of light, causing it to emit a photon whose spin is entangled with the spin of the atom. The photon can then transmit the information entangled with the atom over a long distance via fibre-optic cable.

Doing that is harder than it sounds, however. Finding atoms that you can control and measure that also aren't too sensitive to magnetic or electric field fluctuations that cause errors, or decoherence, is challenging.

"Solid-state emitters that interact well with light often fall victim to decoherence; that is, they stop storing information in a way that's useful from the perspective of quantum engineering," said Caltech's Dr Jon Kindem, lead author of the paper.

Meanwhile, atoms of rare-earth elements, which have properties that make the elements useful as qubits, tend to interact poorly with light. To overcome this challenge, researchers led by Caltech's Professor Andrei Faraon constructed a nanophotonic cavity about 10 μm in length, sculpted from a piece of crystal. The crystal was

© Stock-Adobe.com/au/Boketstore

made in such a way that light inside it would bounce around in predictable patterns.

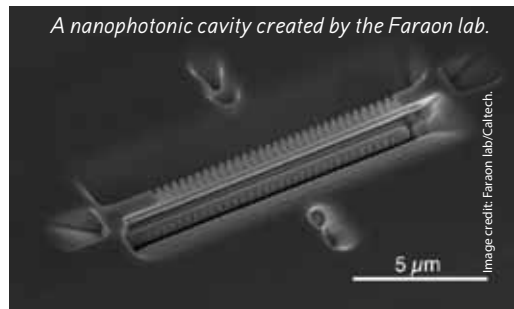
A charged atom, or ion, of the rare-earth element ytterbium was then placed at the centre of the cavity where it could receive a beam of photons. The optical cavity allows for light to bounce back and forth down the beam multiple times until it is finally absorbed by the ion. By doing this, the researchers were able to control and measure a stable form of quantum information in a solid.

"This ticks most of the boxes," said Prof Faraon, describing ytterbium as "a rare-earth ion that absorbs and emits photons in exactly the way we'd need to create a quantum network".

"This could form the backbone technology for the quantum internet," he said.

The team showed that the cavity modifies the environment of the ion such that whenever it emits a photon, more than 99% of the time that photon remains in the cavity, where scientists can efficiently collect and detect that photon to measure the state of the ion. This results in an increase in the rate at which the ion can emit photons, improving the overall effectiveness of the system.

In addition, the ytterbium atoms store information for 30 ms. That's long enough for light to transport that information nearly



6000 km — about the distance from Sydney to Jakarta and enough time to cross continental Europe, Asia, Australia or the US.

Study co-author Dr John Bartholomew, who worked on the project at Caltech, added, "These rare-earth atoms have great appeal for quantum technologies but several challenges had to be overcome to

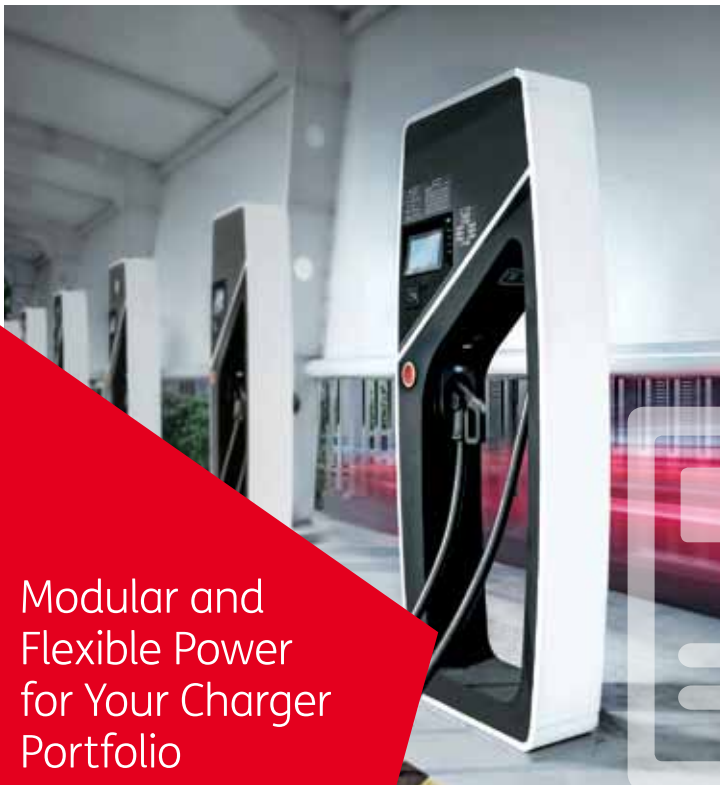
get things working at the single atom level. I've worked on overcoming these challenges since starting my PhD at The Australian National University 12 years ago.

"I saw the nanophotonic cavities pioneered at Caltech as the best shot for making this breakthrough."

The team's current focus is on creating the building blocks of a quantum network, with Prof Faraon saying they hope to scale up their experiments and connect two quantum bits. Meanwhile, Dr Bartholomew now leads the Quantum Integration Laboratory at The University of Sydney Nano Institute and hopes to build on the university's demonstrated strengths in photonics and quantum technologies.

"The next big steps are to increase the performance and scale of this hardware and I can't wait to tackle these challenges at the University of Sydney by designing new materials and building integrated devices," Dr Bartholomew said.

SEMIKRON
innovation+service



Modular and
Flexible Power
for Your Charger
Portfolio

PowerCell

50kW rated power

500V_{DC} or 1000V_{DC} Isolated output

Scalable for high power charging

CANopen communication protocol

Easy integration and maintenance –
all connections at the front

Parallel operation for high power charging

Integrated transformer for safe galvanic isolation



50kW
charging unit

www.semikron.com

Phone + 61 385 615 600 · sales.skaus@semikron.com



DIGITAL 3D INSPECTION SYSTEM

The DRV-Z1 is a 3D digital viewer from Vision Engineering that can be utilised for a wide range of inspection tasks. With real-time remote sharing capability, operators can share 3D images with colleagues, suppliers or customers anywhere in the world.

The 3D image is designed to project out of the viewer like the user is wearing a virtual reality headset. Operators can continue to wear their prescription eyewear and utilise the device to see their component parts in full resolution, in three dimensions and with 360° views.

Designed to be utilised for a diverse range of applications, the product allows users to inspect components with zoom functionality with up to 186x magnification. It has been designed with ergonomic features such as hand-to-eye coordination and freedom of head movement, as well as advantages such as a large field-of-view and depth perception.

The unit has the capability to share the image in real time to a paired DRV, whether it's in another department or another continent. This is particularly beneficial for OEMs in Australia and New Zealand, where time and distance are pivotal to businesses.

Hawker Richardson

www.hawkerrichardson.com.au

EMC EMR SAR SAFETY

Accredited testing and global product approvals since 1992

EMC Technologies Pty Ltd

Melbourne Telephone: +61 3 9365 1000

Sydney Telephone: +61 2 9624 2777

Bayswater Telephone: +61 3 9761 5888

Auckland (NZ) Telephone: +64 9 360 0862



Global Product Certifications
EMC-EMF-Safety Approvals

www.emctech.com.au



STERILISABLE MOTORS

FAULHABER developed the sterilisable 2057...BA family of motors especially for medical applications. In the sensor-free variant, the drives can withstand more than 1500 autoclave cycles. They are optimised for high speeds of up to 65,000 rpm, as are required in, eg, the handpieces of dental equipment.

The motors are fitted in a moisture-resistant, stainless steel housing. During the development process, they were thoroughly tested for resistance to the loads experienced during autoclaving. These tests indicated that the standard motor can typically withstand 1000 cycles in the autoclave undamaged. For the sensor-free variant, this value is 1500 cycles.

Autoclavable motors are frequently used in the handpieces of dental or surgical handheld instruments, which generally require very high speeds. Further applications for this motor type are found in other areas of medical care, such as in ventilators.

The motors are characterised by high power values in relation to their volume, making them useful for tight installation situations. Their low weight also makes them suitable for use in the handpieces with which doctors and dentists perform delicate tasks, often over several hours.

ERNTEC Pty Ltd

www.erntec.net

DEEP CUSTOM ENCLOSURES

COMBIMET is METCASE's 19" rack case range, with applications including networking and communications, industrial computers, sound and studio electronics, laboratory instruments and control systems. The 28" (711.2 mm) deep custom COMBIMET is METCASE's deepest 19" rack case, designed to fit 1000 mm deep racks.

Standard COMBIMET enclosures have removable top, base and rear panels, offering full access to the PCBs. The top and base can be specified as either vented or unvented. Other features include ergonomic front panel handles and mounting holes for PCBs and chassis. M4 earth studs on all components ensure electrical continuity.

The 28" deep custom COMBIMET cases are available in all heights from 1U to 6U and in any colour. Cases are supplied fully assembled.

All COMBIMET rack cases can be supplied fully customised. Services include CNC punching, folding, milling, drilling and tapping, fixings and inserts, painting and finishing, and digital printing of legends and logos.

**ROLEC OKW Australia
New Zealand P/L**

www.metcas.com.au



ULTRALOW-PROFILE ALUMINIUM ELECTROLYTIC CAPACITORS

Traditionally, capacitors with large capacitance require a certain volume to accommodate electrodes and dielectric materials. However, due to advances in material science and engineering, designers can now achieve higher energy density with a single component, rather than multiple discrete capacitors with a lower overall MTBF (mean time between failure).

CDE (Cornell Dubilier Electronics) has introduced ultralow-profile electrolytic capacitors as thin as 1 mm with capacitance up to 20,000 μF (9 VDC @ 85°C or 6.3 VDC @ 125°C). With a surface area of 177 cm^2 , the capacitor can withstand 54 A RMS ripple current (at 20 kHz with external thermal management) and is especially suited to power-demanding operations.

The part is designed to operate in a wide temperature range (-55 to +125°C) and high altitude (>3000 m) and to withstand shock, vibration and moisture (tested according to MIL-STD-202). Furthermore, the shape, size and capacitance can be customised to fit specific end-product design requirements.

If higher voltage is required, different product series at up to 3 mm thickness are available to offer 1500 μF (63 VDC at 85°C) to 24,000 μF (4 VDC at 85°C). Mating is achieved via FPC leads with ZIF connectors to satisfy low-profile applications and to reduce PCB footprint compared to an array of SMT capacitors.

Designers can therefore think slim and are not limited by the traditional boxy style. This should extend the marketability and practicality of their end products across categories including consumer, industrial and other demanding segments.

Ampec Technologies Pty Ltd

www.ampec.com.au

ANALOG FRONT-END

Analog Devices' AD7124-8 fully integrated analog front-end (AFE) is designed to offer a combination of low power and low noise, suitable for high-precision measurement applications and power-saving portable devices.

Manufacturing processes require precise temperature measurement technologies. The AD7124-8 features a low-noise, 24-bit sigma delta analog-to-digital converter (ADC) and can be configured to have eight differential inputs or 15 single-ended or pseudo differential inputs.

Said to enable the highest system channel density versus comparable products, the product allows designers to reduce PCB footprint or apply the space savings to expand monitoring and connectivity functions within the same board area. The on-chip low gain stage ensures that signals of small amplitude can be interfaced directly to the ADC. In addition, the level of integration and flexibility of the ADCs should simplify the design architecture and help to shorten the design cycle for measurement applications.

Mouser Electronics

au.mouser.com



INDUSTRIAL TOUCH CONTROL MONITORS

Purpose-built for industrial and IoT applications, the FPM-200 series are true-flat LCD monitors that feature an IP66-rated front panel for protection from water and dust ingress. This ensures the monitors can withstand rigorous cleaning using high-pressure water jets, making them suitable for industrial environments with harsh operating conditions.

Featuring a WXGA/full HD TFT LED LCD widescreen display with 10-point multi-touch control, the displays support two-handed operation for more intuitive input and improved efficiency. Multi-touch functionality also enables additional control features such as swipe and zoom gestures, predefined motion triggers and two-point key confirmation, which can increase operational safety and boost productivity. With a 16:9 widescreen aspect ratio, the FPM-200 series provides a 40% increased viewing area compared to traditional 4:3 aspect ratio displays, enhancing the overall visualisation of information.

The monitors can support various mount options, including panel, desktop and VESA mounting, to ensure easy deployment in diverse industrial environments.

Advantech Australia Pty Ltd

www.advantech.net.au





HAMMOND MANUFACTURING
tel: 08 8240 2244
oz-info@hammondmfg.com

Standard and modified diecast aluminium, metal and plastic enclosures



www.hammondmfg.com

PHOTOELECTRIC SENSORS IN PRACTICE

DETECTING AND DISCRIMINATING THE DIRECTION OF MOTION

Jacek Bogusz

There are two types of sensors most commonly used in various industrial automation applications: photoelectric and inductive (proximity). They both have advantages and disadvantages which determine their use.

For instance, an inductive sensor is capable of detecting metallic objects behind an opaque, nonmetallic barrier, while a photoelectric sensor does not have such ability, because it needs to 'see' an object within a certain light range. On the other hand, if we use laser light in such a sensor, its detection range can be high, even up to several dozen metres. Inductive sensors do not reach such a detection range.

A photoelectric sensor operates by measuring the intensity of a light beam emitted by a transmitter as the light beam reaches a light-sensitive component of a receiver. Depending on the intended use of the sensor, different kinds of light are employed and the beam is modulated. Infrared light, invisible for the human eye, is used most commonly. Thanks to that, detection can be carried out without distracting attention, but the solution also has some disadvantages, which are known to anybody who ever installed a sensor meant to prevent a gate from closing when there is a vehicle standing in it. That is why laser pointers are used as additional accessories during such installation works to facilitate mutual positioning of the transmitter and receiver.

A lot of photoelectric sensors are equipped with LEDs for signalling the working status, including proper cooperation between the transmitter and receiver. Observation of the LEDs and their colours helps to mount the sensors in the right way, determine the output status or check if a response to an object is proper, which is particularly important during sensitivity adjustment.

Almost any electronic technician, automation engineer or integrator (these are specialists who use photoelectric sensors most often) will easily evaluate the criteria set by the target application and choose the

right kind of a sensor. Important selection criteria include the sensor operating environment, ambient temperature, mechanical resistance (all the factors will affect the choice of the housing material, its IP rating and mounting method), the kind of light in the environment, intended use of the sensors, the required detection range, available supply voltage and output type. The sensor reaction time can be very important in some applications, although it will not be expected from wide-range sensors. The kind of detected object or objects is an extremely significant criterion. Some sensors react even when there is thin, transparent film between the transmitter and receiver in the light beam path. Other ones require nearly full opaqueness of the object, while yet another group includes sensors equipped with a sensitivity adjustment potentiometer, which allows highly accurate setting of their triggering threshold.

It is worth paying attention to the brand when choosing a sensor. Industrial applications or devices in which the sensor has to be reliable not only for users' safety but also for the comfort of application use should be based on proven products from renowned producers. For instance, when we get a Panasonic sensor we can assume that the sensor's quality was checked in a solid way and so they will operate stably and reliably.

Let us see how a sensor can be used in practice, in combination with any PLC. Although the sample program was developed for Siemens LOGO! v8, owing to the clarity of FBD language, it can be easily adapted to use on any platform.

If one photoelectric sensor is available, determination of an object motion direction can be very difficult. In order to do so, the light beam should be modulated and the Doppler effect used, or the time



© Stock-Adobe.com/au/leptong

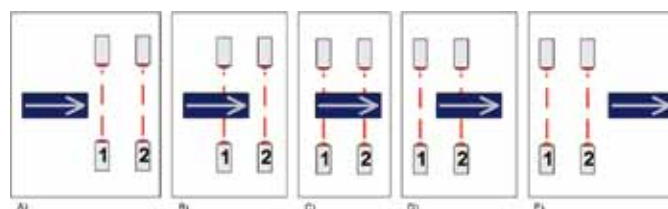


Figure 1: Principle of motion direction sensor. A) Standby — the object approaches the sensors from the left, B) Sensor 1 active, C) Sensors 1 and 2 active, D) Sensor 2 active, E) Standby mode.

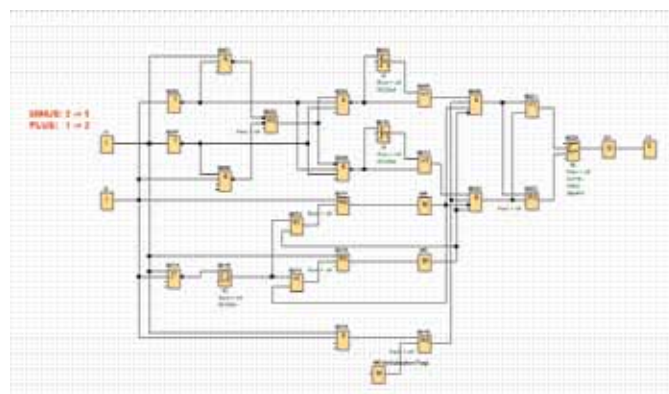


Figure 2: Sample program in FBD language for LOGO! v8 sensor.

between series of pulses sent towards the object should be measured. The methods are quite difficult for practical implementation and fairly expensive, and not everybody is able to handle them. It is much easier to place the sensors one next to another and check their activation sequence.

Figure 1 shows the operation principle for this solution. If we use two sensors, marked as 1 and 2, the activation of 1 and then 2 can suggest motion to the right, while if the sensors are activated in a reverse order it suggests motion to the left.

Still, for the algorithm to be reliable and possible to use not only for discriminating the motion direction but also, eg, for counting objects, some restrictions need to be introduced. First and foremost, quite obviously, an object must move in front of the sensors to activate them. Secondly, the maximum distance between the sensors must not be greater than the smallest dimensions of the object. This way our sensors will be activated in a sequence, eg:

both inactive → "1" activated → "1" and "2" activated → "2" activated → both inactive.

Thirdly, incidental motions of the object checked between the sensors should not result in an incorrect operation of the system. Not all logic errors can be eliminated because it is a program, but it needs to be thoroughly checked with a simulator or model system, testing the algorithm in various situations which can occur in practice.

Figure 2 shows a sample program in the FBD language, developed in the free LOGO! Soft Comfort environment. If we used LOGO! controller, voltage representing the logic '1' should be applied to its outputs I1 and I2. If it was LOGO! 24RC, the voltage range would amount to 18–24 VDC. If we use a version supplied with 230 VAC,

the logic '1' is represented by much higher voltage but then we have to pay attention to the sensor output parameters and type!

As mentioned, the voltage from the contacts should be supplied to inputs I1 (from sensor 1) and I2 (from sensor 2). The program is written in such a way that the motion direction from I1 to I2 results in generating an impulse at B020 gate output, while from I2 to I1 at B006 gate output.

In order to demonstrate the usability of the sample application, a bidirectional counter (B023) and a logic system (B021 — XOR gate, B022 — RS flip-flop) were connected to both gate outputs. The task of a logic system is to set the counting direction input, if positive pulses come (from gate B020) and zeroing when negative ones reach it (from gate B006), and establishing a clock-based cycle supplied to the counting input. Owing to the setting and zeroing of the counting direction input, the counter counts up (input set) or down (input zeroed).

The output of the Up/Down Counter unit in LOGO! is set and zeroed according to the conditions set in the counter properties window. If we enter '1' in the 'On' field, while we leave '0' in the 'Off' field, the output will be set when the counter status is higher than 0 and zeroed when it is 0. If we run the Output functional unit to the output, eg, Q1, the output transmitter 1 of LOGO! 24RC controller will close the contacts when the counter status exceeds 0. This way we can quickly and easily construct a device which will automatically switch on and off the light and count the persons entering and leaving a room. The light should turn on when somebody enters the room and turn off when everybody has left.

Transfer Multisort Elektronik
www.tme.eu



FILTERED POWER ENTRY MODULE WITH GROUND CHOKES

SCHURTER has extended its power entry module series C20F with versions including a ground line choke, designed for suppressing high-frequency interference on the ground conductor. Additionally, the latest variants have a bigger X-capacitor to enable better symmetrical attenuation.

The C20F filter series combines an IEC C20 appliance inlet with a high-quality mains filter. The particularly wide metal flange makes contact with the housing surface over a large area, thus enabling optimum filtering and shielding.

The appliance inlet filters are now equipped with a ground choke. The line filters have a second choke on the earth conductor in addition to the current-compensated choke on the pole and neutral conductor. The ground choke is located between the device plug and the filter output. Placing it directly at the mains input ensures that possible high-frequency interference currents on the earth conductor cannot bypass the filter via the housing. Medical filters in particular (no Y-capacitors) benefit from improved asymmetrical attenuation in the higher frequency range due to the ground choke.

The filter series is available as a standard or medical version and is used in devices that require particularly high noise immunity. These include IT or telecom systems according to IEC 92368-1 and medical devices according to IEC 60601-1. The series is compatible with V-Lock device connection cables.

The series is certified for currents up to 16 A/250 VAC according to IEC standard and 20 A according to UL/CSA standard at 125/250 VAC. It provides ENEC, CQC and cURus approvals.

SCHURTER (S) PTE LTD
www.schurter.sg



INDUSTRIAL ETHERNET SWITCH

ICP DAS's NSM-210C is an 8-port 10/100 Base copper and 2 gigabit fibre-optic/copper combo port Industrial Ethernet switch, supporting auto negotiation, Auto MDI/MDI-X, high speed (100 Mbps) and high-distance transmissions.

In addition, the product supports dual power and provides a wide 12–48 VDC power range to fit all the common power standards found in industrial automation, without external power converters. The operating temperature of the switch is -25 to +75°C, for use in rugged environments.

The switch has dimensions of only 51 x 154 x 118 mm and is available with an optional DIN-rail or wall mounting kit.

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

VENTILATOR SYSTEM REFERENCE DESIGN

Renesas Electronics has introduced an open-source ventilator system reference design that can be used to swiftly design ready-to-assemble boards for medical ventilators. Many regions are experiencing a critical shortage of ventilators as COVID-19 infections continue to rise and hospital demand exceeds supply.

The company's engineers have followed several open-source ventilator designs, including the Medtronic PB560, to come up with an easy-to-assemble, three-board ventilator design. It controls the tidal volume and mixture of gas delivered to the patient while monitoring the patient's status. The ventilator is portable and can be used with or without gas tanks. In addition, a humidifier can be connected to the ventilator's intake path to soothe the patient's breathing, making it more comfortable to be connected for long durations.

The reference design uses 20 Renesas ICs, consisting of microcontroller (MCU), power and analog ICs that address many of the ventilator's signal chain electrical functions. The system design implements a sensor board and a motor control board,

and features Bluetooth connectivity that allows medical professionals to monitor several patients simultaneously via a tablet or other mobile device. Each board has an MCU to control its specific task while monitoring the status of the connecting board. The ventilator solution also provides a system of checks and balances to enable regulatory approval and provide patient safety.



The ventilator solution also provides a system of checks and balances to enable regulatory approval and provide patient safety.

Renesas Electronics
www.renesas.com

USB-C CONTROLLER

The STUSB4500L from STMicroelectronics is a small-footprint addition to the company's USB-C controller IC family designed and certified for pure 5 V sink-only applications. All mandatory features to use the USB-C connector as a 5 V universal power plug are integrated, allowing designers to implement USB-C charging solutions quickly and easily without studying the standard or writing code.

USB-C is rapidly becoming established as a replacement for Micro-B or Mini-B plugs, for both power and data connections, as it offers the advantages of reversible orientation and robustness — up to 10,000 connect/disconnect cycles. ST's USB-C controller IC is a standalone, plug-and-play interface product, targeting low-voltage applications such as Bluetooth speakers, computer accessories, Wi-Fi access points, point-of-sale equipment, LED lighting and USB dongles. It can also be used for powering equipment such as single-board computers and hardware development kits.

The controller IC runs without additional code and requires no external support from the microcontroller, which eases adoption of the USB-C connector standard by saving time-consuming design work. It is auto-powered via V_{BUS} from the connected source and does not need to be supplied from a local battery or onboard power. Zero leakage current prevents draining the battery when not charging. Input overvoltage protection prevents low-voltage equipment being damaged if it is incorrectly connected, eg, to a 20 V source from a USB PD AC adapter rather than the required 5 V supply.

Further features include 'dead-battery' support to ensure correct identification by the source when the battery is fully discharged, true cold-socket implementation which keeps the V_{BUS} switch open by default until safe 5 V input power is supplied, source power-budget identification and error-recovery support to ensure correct restarting when a fault is triggered.



STMicroelectronics Pty Ltd

www.st.com



Technomelt Low Pressure Moulding THE SMART SOLUTION FOR ELECTRONICS ENCAPSULATION.

We stand together (but 1.5m apart) to help you continue manufacturing!

Strain Relief



Angled Connector



In-line PCBA



Think of others, keep your distance.



Connection Cable

Strain Relief Seal



PCBA

Tarapath

lowpressuremoulding.com.au

Ph: 03 9269 6200

karl.b@tarapath.com.au

HIGH-EFFICIENCY LASER CREATED FOR SILICON CHIPS

Transistors in computer chips work electrically, but data can be transmitted more quickly by using light. For this reason, researchers have long been looking for a way to integrate lasers directly in silicon chips.

Scientists from Germany's Forschungszentrum Jülich, working with the French Centre de Nanosciences et de Nanotechnologies (C2N), STMicroelectronics and CEA-Leti, have now developed a compatible semiconductor laser made of germanium and tin, whose efficiency is comparable with conventional GaAs semiconductor lasers on Si. Their work has been described in the journal *Nature Photonics*.

Optical data transfer permits much higher data rates and ranges than current electronic processes while also using less energy. Computation and data centres, therefore, already default to optical fibre whenever cables exceed a length of about one metre. In future, optic solutions will be in demand for shorter and shorter distances due to increasing requirements, for example, board to board or chip to chip data transfer. This applies particularly to artificial intelligence (AI) systems where large data volumes must be transferred within a large network in order to train the chip and the algorithms.

"The most crucial missing component is a cheap laser, which is necessary to achieve high data rates," said Prof Detlev Grützmacher, Director at Forschungszentrum Jülich's Peter Grünberg Institute Semiconductor Nanoelectronics (PGI-9). "An electrically pumped laser compatible with the silicon-based CMOS technology

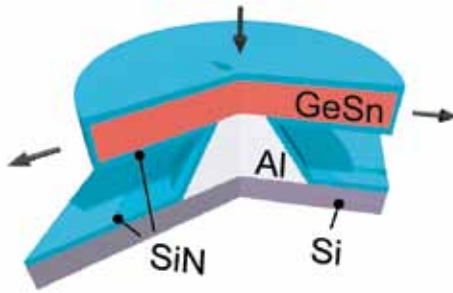
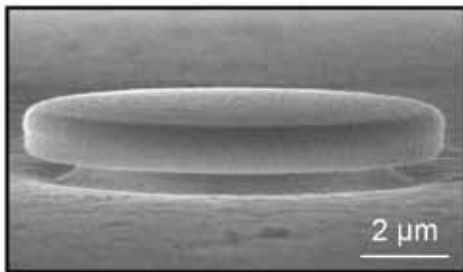
would be ideal. Such a laser could then simply be shaped during the chip manufacturing process since the entire chip production is ultimately based on this technology."

But there's one problem: pure silicon is an 'indirect semiconductor', and therefore unsuitable as a laser material. Different materials are currently used for manufacturing lasers. Generally, III-V compound semiconductors are used instead.

"Their crystal lattice, however, has a completely different structure than that of silicon, which is a group IV element," Prof Grützmacher said. "Laser components are currently manufactured externally and must be integrated subsequently, which makes the technology expensive."

In contrast, the new laser can be manufactured during the CMOS production process. It is based on germanium and tin, two group IV elements like silicon. Back in 2015, Jülich researchers showed that laser emission can be obtained in a GeSn system. The decisive factor in this is the high tin content: back then, it amounted to 12%, which is far above the solubility limit of 1%.

"Pure germanium is, by its nature, an indirect semiconductor like silicon," said Dr Dan Buca, working group leader at PGI-9. "The high concentration of tin is what turns it into a direct semiconductor for a laser source."



Scanning electron microscopy images: the germanium-tin layer is only a few micrometres thick and is applied to a 'stressor layer' made of silicon nitride and an aluminium base for improved heat dissipation (left) and then coated with silicon nitride (right). Orienting the germanium-tin compound along the wider atomic distances in the crystal lattice of the silicon nitride leads to stresses in the embedded material, which ultimately cause optical amplification.

The patented epitaxial growth process developed by Jülich is used by several research groups all over the world. By further increasing the tin concentration, lasers have already been made that work not only at low temperatures but also at 0°C.

"A high tin content, however, decreases the laser efficiency," said PGI-9's Nils von den Driesch. "The laser then requires a relatively high pumping power. At 12–14% tin, we already need 100–300 kW/cm². We thus tried to reduce the concentration of tin and compensate this by additionally stressing the material, which considerably improves the optical properties."

For the new laser, the researchers reduced the tin content to approximately 5% — and simultaneously decreased the necessary pumping power to 0.8 kW/cm². This produces so little waste heat that this laser is the first group IV semiconductor laser that can be operated not only in a pulsed

regime but also in a continuous working regime, ie, as a 'continuous-wave laser'.

"These values demonstrate that a germanium-tin laser is technologically feasible and that its efficiency matches that of conventional III-V semiconductor lasers grown on Si," Prof Grützmacher said. "This also brings [us] much closer to an electrical pumped laser for industrial-application that works at room temperature."

The new laser is currently limited to optical excitation and low temperatures of about -140°C — but with improvements, it could be useful not only for optical data transfer but also for a variety of other applications, since there are hardly any cheap alternatives for the corresponding wavelengths in the infrared range of 2–4 µm. Potential applications range from infrared and night-vision systems all the way to gas sensors for monitoring the environment in climate research or even breath gases analyses for medical diagnosis.

FUSECO

PROGRAMMABLE COMBINED AC/DC ELECTRONIC LOAD



ITECH

- Power rating: 1800 W, 3600 W, 5400 W
- Frequency range: 45 Hz~450 Hz
- Voltage range: 15 V- 260 Vrms, 50V- 420 Vrms
- Current range: 20 Arms, 40 Arms, 60 Arms
- Oscilloscope function supporting display of voltage and current waveform
- Be able to measure Vrms, Vpk, Vdc, Irms, Ipk, Idc, W, VA, VAR, CF, PF and FREQ
- 7" LCD screen
- Measures THD(V) up to 50th Harmonic
- AC electronic load: CC/CR/CP mode
- DC electronic load: CC/CR/CP/CV mode
- External 0~10V analog control input, voltage and current analog monitoring function
- RS232, GPIB, LAN and USB communication interfaces and external USB flash disk interface

www.fuseco.com.au - sales@fuseco.com.au - (03) 9555 3722

FLANGED EXTRUDED ALUMINIUM ENCLOSURES

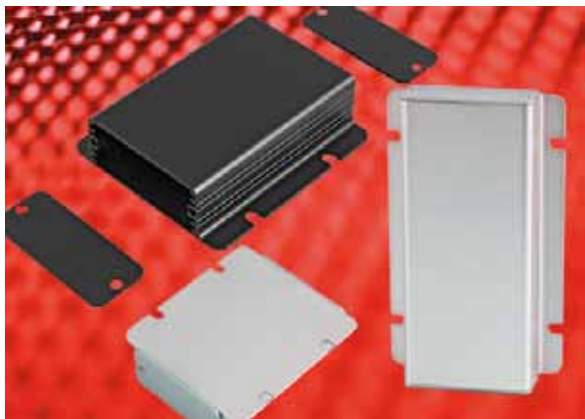
The 1455F flanged extruded aluminium enclosures from Hammond Electronics add a further variant to the 1455 family, with an extrusion that features a flat base with integral mounting flanges. The flanges, which extend beyond the body of the unit, have four notches to accept securing screws for mounting the units to a flat surface such as a wall, bulkhead or machine.

Two sizes, 80 x 54 x 23 mm and 120 x 54 x 23 mm, are initially available in clear and black anodised finish; additional sizes will be released over the coming months. The overall width is 77 mm, including the two mounting flanges. Both the launch sizes are designed to accept 50 mm-wide, 1.6 mm-thick PCBs with lengths of either 80 or 120 mm.

There are two removable aluminium end panels, which are flat for easy machining for I/O components. The PCB mounts into horizontal slots in the body of the enclosure; four alternative vertical positions are available.

The 1455F is the latest addition to the 1455 family, which now extends to the 29-strong standard 1455, ranging in size from 60 x 45 x 25 mm to 220 x 165 x 52 mm. Other standard variants include the IP65 sealed 1457, the screened 1457-EMI version and the 1455HD thermally efficient units.

Hammond Electronics Pty Ltd
www.hammondmfg.com



SERVER-GRADE MOTHERBOARD

The AIMB-586 is an industrial-grade Micro-ATX motherboard based on the Intel Q370/C246/H310 chipset supporting 8th generation Intel Core I/Pentium/Celeron and E3 Xeon processors.

Providing high computing and graphic performance with high expandability, the motherboard is a suitable platform for multiple applications in medical, test and measurement equipment, surveillance, robot AGV, robot controllers and more. It comes bundled with Advantech's WISE-PaaS/RMM software package which provides remote device management and system recovery powered by Acronis as well as system protection powered by McAfee, allowing users to easily monitor, configure, control and even recover multiple systems through a single console from any remote site.

Equipped with high-speed I/O including 4 x USB 3.1, 2 x USB 3.0, 8 x USB 2.0, 6 x SATAIII (C246 sku up to 8 x SATAIII) and 2 x M.2 (M-Key x 1; E-Key x 1), the AIMB-586 supports NVMe storage and Wi-Fi modules. It provides flexibility with both ATX and 12 V DC-in power sources, ensuring the device is compliant with ATX PSUs and power adapters. Moreover, it offers four Gigabit Ethernet ports and Intel iAMT 12.0 and vPro is supported (Q370/C246 PCH with selected CPU), making it suitable for network and security-related applications.

Featuring Intel HD Graphics with DX11.1, OpenCL2.1 and OpenGL5.0, the AIMB-586 is designed to deliver enhanced graphics performance. It also supports three independent displays, either in clone mode or extended mode using HDMI, DisplayPort1.2, eDP and LVDS (option) with high 4K2K resolution.

Advantech Australia Pty Ltd
www.advantech.net.au

We Stock 1000's of Plastic Parts for Industry

- Nylon Fasteners
- Screws & Nuts
- Washers & Spacers
- Rivets & Clips
- PCB Hardware
- Caps & Plugs
- Knobs & Handles
- Hole Pugs & Bushes
- LED Mounts & Light Pipes
- Cable Ties & Mounts



Available from Hi-Q Electronics Limited

sales@hiq.co.nz

NZ 0800 800 293

www.hiq.co.nz

Hi-Q
components



DATA LOGGER MODULE

The ICP DAS DL-300-WF-IP65 series is a gas detector monitoring module with Wi-Fi, Ethernet and RS-485 interfaces. It provides a WLAN connection that complies with the IEEE802.11b/g/n standards. With 802.11 network infrastructure, the module offers an easy way to incorporate wireless connectivity into monitoring and control systems.

The data logger device can be used to record CO, CO₂, HCHO, TVOC, NH₃, H₂S, temperature,

humidity and dewpoint information, including date and time stamps, and is able to store up to 450,000 downloadable records. Real-time data can be accessed from the data logger from anywhere and at any time using the free Windows software, the iOS App or the Android App, as long as it is connected to the same local network as the data logger. Support is provided for common industrial protocols such as DCON, Modbus RTU and Modbus TCP.

The product also supports the emerging machine-to-machine (M2M)/IoT (Internet of Things) connectivity protocol — MQTT. The data logger can be connected via widely used communication interfaces including RS-485, Ethernet, PoE and Wi-Fi, meaning the device can be integrated into existing HMI or SCADA systems and can be easily maintained in a distributed control system.

The IP65 version of the device is designed for industrial applications in harsh environments that require IP65 grade protection. The rugged RJ-45 is designed to ensure tight, robust connections and ongoing operation, even for applications that are subject to high vibration and shock.

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

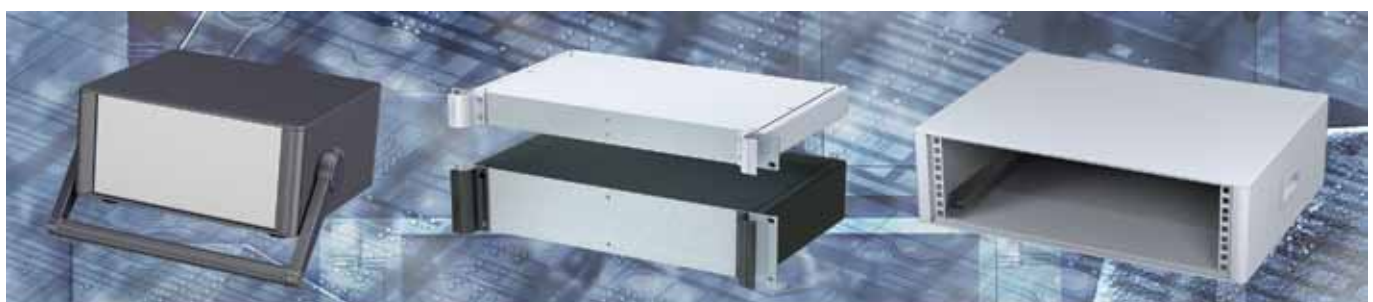
CORDLESS FASTENING TOOLS

The CellCore cordless range from Cleco Tools offers smart assembly solutions that are lightweight, ergonomic and durable for tough environments. CellCore fastening tools perform tightening with good precision and traceability. Designed specifically for critical joint fastening, error-proofing applications and data recording, users can connect up to 10 cordless tools to one MPro Controller.

With intelligence and digital technology, the cordless tools are designed to increase uptime with up to approximately 500K cycles in between maintenance. The tools come with a large user interface allowing for easy on-the-tool programming, without the need for a controller. They are versatile and easy to use.

Other features include: colour work-light on the tools for secondary okay/not okay visual feedback; a 'Stay Alive' function that prevents reboot during battery change, gaining time and efficiency and forward and backward compatibility with Cleco's Global Controller and Cordless platforms.

Hawker Richardson
www.hawker-richardson.com.au



ADVANCED ELECTRONIC ENCLOSURES

Modern and versatile aluminium 19" enclosures and instrument cases for today's OEM electronics equipment.

- 19" rack mount cases: 1U, 2U, 3U, 4U, 5U and 6U
- Desktop and portable instrument enclosures
- Highly functional and ergonomic designs
- Full in-house customisation to your requirements
- Download 2D/3D drawings from our website.

Ask for your own fully customised version!



METCASE ENCLOSURES
Phone: +61 2 4722 3388
Email: sales@metcase.com.au

METcase
www.metcase.com.au

THE SCREEN PRINTING PROCESS

CHALLENGES AND CONSIDERATIONS 101

With the demand for printed circuit board manufacturers to build smaller boards with increased capability, coupled with challenges facing SMT such as the shortage in surface mount devices, it is no surprise that everyone is feeling the pressure to ensure their quality is second to none. Decreasing aperture size to accommodate smaller, finer pitch components requires greater accuracy, and the high demand for some electronic components means it's critical that waste is kept to a minimum.

Focusing on some of the main challenges during the production of the printed circuit board, including the screen printing process, we explore how to overcome some key obstacles and how to introduce best practice into your processes to ensure you benefit from continual improvement.

Contact between the PCB and stencil

It sounds obvious, but it's surprising how many issues there are ensuring there is good contact between the PCB and the stencil. There are a few variables which can have an effect on the contact, including the aperture size and shape, cleanliness and maintenance of equipment, as well as the thickness of the aluminium frames.

- **Aperture variables:** Some apertures have a narrow pitch and this can often lead to the solder paste spilling out of the aperture, causing a blur from one aperture to the next. Equally, in minute apertures, adhesion can often be problematic because the lack of solder doesn't reach the pad.
- **Cleaning and maintenance:** Ensuring daily cleaning and maintenance is carried out can be critical to alignment. Over time, the stencil plate and the PCB can become misaligned, where they are no longer parallel to one another.
- **Aluminium stencil box frames:** These are available in different wall thickness from 1.5 to 3.5 mm. It can be tempting to keep the costs down and purchase the thinner walled frames, because it impacts the price. However, using thinner frames can also affect contact because they can distort with use. Although purchasing thinner walled frames can be tempting, in reality it's a false economy.

It's worth noting that ASM has designed a VectorGuard system to help counterbalance the issues noted above. The DEK VectorGuard utilises a solid, high-tension frame for fine pitch applications. Designed with compressed air, the VectorGuard clamping increases tension by up to 45%, providing greater transfer efficiency.

Despite all of the potential variables that can affect the contact, there are functions that can help overcome some of the issues, such as stencil vacuuming. Even if the plate is showing signs of distortion, utilising the vacuuming functionality on the conveyor holds the stencil down, which stabilises the printing. It also helps to prevent any movement caused by the squeegee during the printing process.

Not all systems offer stencil vacuum functionality, and if they do it is often an optional extra. One solution that does offer vacuum functionality as standard is the Yamaha YCP10 Stencil Printer.

Filling the apertures with solder paste

Filling apertures with solder paste can be a challenge. It's easy to assume that following the data from the Gerber File should lead to a perfectly printed board; however, there are quite a few variables between the beginning and the end of the process that can cause a range of imperfections to occur. Temperature and consistency of the paste, ambient temperature and humidity, squeegee pressure and separation speed can all affect the quality of the paste and overall alignment.

- **Temperature:** As paste is thixotropic and can therefore change its viscosity under stress (such as a change in temperature), it is essential that the temperature is kept constant, ensuring



the viscosity remains stable. The viscosity of the paste will dictate the pressure and speed required to create the board. If this changes, and the pressure and speed are kept the same, imperfections such as misalignment issues will occur.

- **Pressure:** It's important to get the squeegee pressure right, to prevent stencil deformation patterns. Most pastes work well with a pressure of 0.45–0.57 kg/in force, but if you prefer to be cautious, then set the squeegee initially low and start testing until you get a clean wipe.
- **Speed:** As the squeegee speed decreases and slows, the printing volume gradually increases, improving the fill of apertures. However, reducing the attack angle can also have significant advantages. As the attack angle is key to the volume, reducing the angle to 65 degrees (depending on aperture size) can increase the volume of solder in the aperture.

Adjusting the angle of attack isn't always that easy to achieve. This is because there are only a few solutions that provide the capability for engineers to adjust the angle of attack. One of the solutions that allows such adjustment is the Yamaha YCP10 Stencil Printer.

Optimising adhesion through design

Ensuring the solder paste is touching the lands is critical in the design phase. Stencil aperture size should typically be reduced by 10%. This is particularly the case where apertures may prove problematic (size or shape). Etching conditions also need to be considered and in some cases it might be wise to test incremental reduction in percentage until ideal adhesion occurs. If there isn't

enough land size in relation to the aperture, especially on minute apertures, then there will be a high probability that some detachment defects will occur.

Other variables that need to be considered in the design process are listed below.

- **Stencil thickness:** The ratio of the stencil thickness (or lateral area) in relation to the bottom area increases the chance of detachment occurring. Although there are 'ideal' ratios between the two area dimensions, the shape of the aperture can also affect this ratio value.
- **The shape of the apertures:** The 'ideal' ratio for a circle is no more than 1:7, and less than 2:0 for square. The corner of the squares can be problematic, and so ensuring the ratios are correct, and the speed is right, should minimise friction. However, if these ratios are any larger, the stencil thickness should be re-evaluated. Most solder paste suppliers suggest fast and constant is best to achieve good detachment.
- **Surface characteristics:** This is another variable of the stencil that can have an effect on detachment. Both the texture of the aperture wall surface (rough or smooth) and its repellency can change the effectiveness of detachment. For example, the additive process tends to provide a smoother wall finish and lasered, tends to leave a rough or textured finish. The smoother finish often provides better detachment, but using the additive process is usually more costly compared with laser, so it depends on what you are trying to achieve.

Although features of the aperture (such as the shape and surface characteristics) can cause issues with adhesion, there are features available with some systems that can encourage the solder into the aperture. The vibrating squeegee available with the E by DEK Stencil Printer is a feature that helps to manipulate the solder into the aperture. The Paste Height Monitor is also another feature of the E printer, which can ensure the optimum quantity of solder by measuring the solder height utilising a calibrated laser.

This in turn will change your approach to everything discussed above. For this reason, all of the material you are working with and all of the tools you're using needs to be considered holistically, to enable you to achieve the best results.

Best practice

Taking everything above into consideration, we have listed the main considerations below, which can be utilised as a checklist. There is no winning formula, because every aspect from the design (including aperture size and shape) to the thickness of the aluminium frame needs to be considered. Some factors can be counterbalanced with tools and functions on your equipment, such as the stencil vacuuming function, helping you to achieve the best results.

1. Ensure cleaning and maintenance is carried out regularly.
2. Invest in aluminium stencil frames with a good wall thickness.
3. Utilise vacuum functionality to counterbalance any potential distortions.
4. Test the speed, pressure and angle of the solder from the squeegee to obtain the right configuration for your design.
5. Ensure the stencil aperture to land size is reduced by 10% as a starting point.
6. The stencil thickness needs to be 1:7 ratio for circle apertures and less than 2:0 for square apertures.
7. Consider the characteristics of the stencil including its texture and repellency.

Hawker Richardson
www.hawker-richardson.com.au



Image courtesy of David Baillor/UC San Diego Jacobs School of Engineering under CC BY 2.0

UC San Diego nanoengineers developed a safety feature that prevents lithium metal batteries from rapidly overheating and catching fire in case of an internal short circuit.



© Stock.AdoBe.com/au/melvidoe

SAFETY FEATURE TO STOP LITHIUM BATTERIES CATCHING ON FIRE

Nanoengineers at the University of California San Diego (UC San Diego) have developed a safety feature that prevents lithium metal batteries from rapidly heating up and catching fire in case of an internal short circuit.

The team made a tweak to the part of the battery called the separator, which serves as a barrier between the anode and cathode, so that it slows down the flow of energy (and thus heat) that builds up inside the battery when it short circuits. Their work has been published in the journal *Advanced Materials*.

"We're not trying to stop battery failure from happening," said PhD student Matthew Gonzalez, first author on the study. "We're making it much safer so that when it does fail, the battery doesn't catastrophically catch on fire or explode."

Lithium metal batteries fail because of the growth of needle-like structures called dendrites on the anode after repeated charging. Over time, dendrites grow long enough to pierce through the separator and create a bridge between the anode and cathode, causing an internal short circuit. When that happens, the flow of electrons between the two electrodes gets out of control, causing the battery to instantly overheat and stop working.

The separator that the UC San Diego team developed essentially softens this blow. One side is covered by a thin, partially conductive web of carbon nanotubes that intercepts any dendrites that form. When a dendrite punctures the separator and hits this web, electrons now have a pathway through which they can slowly drain out rather than rush straight towards the cathode all at once.

Gonzalez compared the new battery separator to a spillway at a dam, saying, "When a dam starts to fail, a spillway is opened up to let some of the water trickle out in a controlled fashion so that when the dam does break and spill out, there's

not a lot of water left to cause a flood. That's the idea with our separator. We are draining out the charge much, much slower and prevent[ing] a 'flood' of electrons to the cathode. When a dendrite gets intercepted by the separator's conductive layer, the battery can begin to self-discharge so that when the battery does short, there's not enough energy left to be dangerous."

Other battery research efforts focus on building separators out of materials that are strong enough to block dendrites from breaking through. But a problem with this approach is that it just prolongs the inevitable, Gonzalez said. These separators still need to have pores that let ions flow through in order for the battery to work. As a consequence, when the dendrites eventually make it through, the short circuit will be even worse.

Rather than block dendrites, the UC San Diego team sought to mitigate their effects. In tests, lithium metal batteries equipped with the new separator showed signs of gradual failure over 20 to 30 cycles. Meanwhile, batteries with a normal (and slightly thicker) separator experienced abrupt failure in a single cycle.

"In a real use case scenario, you wouldn't have any advance warning that the battery is going to fail. It could be fine one second, then catch on fire or short out completely the next. It's unpredictable," Gonzalez said. "But with our separator, you would get advance warning that the battery is getting a little bit worse, a little bit worse, a little bit worse, each time you charge it."

While this study focused on lithium metal batteries, the researchers say the separator can also work in lithium ion and other battery chemistries. The team is now working on optimising the separator for commercial use.

Getting your products to market fast with Compliance Folder Management

Keeping your products compliant can be a complex process. The Australian government has many different laws for electrical devices to be sold on the Australian market.

An easy solution to getting electronics to market fast is to use Compliance Folder Management services. A team of specialists in Australian regulations, who are experienced with electrical equipment, will manage the entire process from start to finish.

We work closely with clients to audit and maintain their documentation so they can sell — or continue to sell — products with minimal disruptions. We've even done testing on behalf of the Australian government's Check Testing Program.



Our services

Before you're on the Australian market

- conduct testing on your electrical devices
- review existing test reports and advise you on the next steps
- organise any other testing required
- apply for certification, if required
- act as an agent for international suppliers and regulators
- register products on your behalf on the EESS database

When you're on the Australian market

- update your documents if there are any product changes so you can continue selling in Australia
- manage a product recall process and minimise impact on your business
- audit documentation so you remain compliant

Contact us for a quote.

Phone: 9645 5933
Email: comtest@comtest.com.au
Website: comtestlabs.com.au

HIGH-FREQUENCY TRANSISTORS

SAID TO ACHIEVE RECORD EFFICIENCY

Researchers at the Fraunhofer Institute for Applied Solid State Physics IAF have significantly increased the output power of their high-frequency transistors for the frequency range from 1 to 2 GHz, doubling the operating voltage of the devices from 50 to 100 V and thus achieving a power-added efficiency of 77.3%.

The team's technology allows the development of highly efficient amplifiers with even higher power, as required for applications in the fields of plasma generation, industrial heating, communications and radar technologies. Their results were presented at the IEEE International Electron Devices Meeting (IEDM) in San Francisco in December 2019.

The power density of transistors is one of the most important criteria for their use in high-power applications in the GHz range. It determines the size of amplifier modules and thus the system complexity — both of which are decisive for the manufacturing costs and the required use of resources.

There are several ways to increase the power density of transistors, with the Fraunhofer researchers choosing to increase the operating voltage. By scaling the transistor design vertically and laterally, they succeeded in realising high-frequency transistors suitable for applications at an operating voltage of 100 V. These devices, based on the semiconductor gallium nitride (GaN), are characterised by significantly increased power density at frequencies in the GHz range.

Measurements showed a power density of more than 17 W/mm and a power-added efficiency (PAE) of 77.3% at a frequency of 1 GHz — believed to be the highest PAE achieved for 100 V operation in this frequency range ever reported. Tests have also shown that the technology delivers a power density in excess of 20 W/mm at 125 V.

"Increasing the operating voltage from 50 to 100 V enables higher power densities," said Fraunhofer IAF's Sebastian Krause, one of the main developers of the technology. "This means that a system can deliver more power on the same area than what is possible with commercially available 50 V or 65 V technologies."

On the one hand, this enables systems of the same size with higher output power. On the other hand, it is possible to create more compact and lighter systems delivering the same power, since less chip area is required to achieve the desired power level.

"By doubling the operating voltage to 100 V, the transistor exhibits a four times higher output impedance for a given power," said Krause. This allows the implementation of smaller and therefore less lossy matching networks, which in turn results in higher energy efficiency of the overall system.

"The long-term goal of our development is operation through 10 GHz," Krause said. This would be of particular interest for high-performance applications such as particle accelerators, mobile phone amplifiers, pulse- and continuous-wave radar, and amplifiers for plasma generators. These systems require high output power levels while maintaining a preferably small footprint — exactly what the 100 V technology can deliver.

Another large industrial field of application is power generators for microwave heating. For a long time, tube-based components (eg, travelling wave tubes) have dominated electronic systems with high output power. However, development is moving towards power semiconductors. The Fraunhofer scientists believe that the GaN-based 100 V technology can provide an efficient alternative for increasing the power of microwave generators.

"In this field, industry usually works at higher frequencies, but vacuum components, eg, magnetrons or klystrons, are predominantly used to date," Krause commented. "Here, we are working on providing a semiconductor-based alternative. Semiconductors are much more compact and more lightweight, which enables arrangements such as phased arrays."



Westwick-Farrow Media
A.B.N. 22 152 305 336

www.wfmedia.com.au

Head Office
Unit 7, 6-8 Byfield Street, North Ryde
Locked Bag 2226, North Ryde BC NSW 1670
Ph: +61 2 9168 2500

Editor
Lauren Davis
wnie@wfmedia.com.au

Publishing Director/MD Geoff Hird

Art Director/Production Manager
Julie Wright

Art/Production
Veronica King, Colleen Sam

Circulation Dianna Alberry, Sue Lavery
circulation@wfmedia.com.au

Copy Control Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

Group Sales Manager
Nicola Fender-Fox – 0414 703 780
nfender-fox@wfmedia.com.au

Account Manager
Sandra Romanin – 0414 558 464
sromanin@wfmedia.com.au

Asia
Tim Thompson – 0421 623 958
tthompson@wfmedia.com.au



Contact the editor

If you have any queries regarding our privacy policy please email privacy@westwick-farrow.com.au

Subscriptions: For unregistered readers, price on application.

To register, visit
www.electronicsonline.net.au/subscribe

Printed and bound by Dynamite Printing
Print Post Approved PP100007394
ISSN No. 0728-3873

All material published in this magazine is published in good faith and every care is taken to accurately relay information provided to us. Readers are advised by the publishers to ensure that all necessary safety devices and precautions are installed and safe working procedures adopted before the use of any equipment found or purchased through the information we provide. Further, all performance criteria was provided by the representative company concerned and any dispute should be referred to them. Information indicating that products are made in Australia or New Zealand is supplied by the source company. Westwick-Farrow Pty Ltd does not quantify the amount of local content or the accuracy of the statement made by the source.



Products featured



LED INDICATORS



- New Q Series with RGB LED options**
- 7 different colours
 - Energy efficient
- QS series:**
- Snap-in LED indicator
 - Coloured diffused lens
- QRM-NV series: (Night vision)**
- Ø8mm diameter
 - NVG compatible filters
- See website for more options.

EMERGENCY STOPS



- New EC Series:**
- Compact e-stop with an integrated connector for easy mounting
 - Available with solder lugs or connector
- ES Series:**
- Heavy-duty, metal casing
- More E-Stop series available:**
- Ø16, 19, 22, 28, 34 mm panel mount
 - E-stop control box options

ANTI-VANDAL SWITCHES



- AV Series:**
- Ø16, 19, 22, 24, 30 mm mount
 - Security pushbutton switches
 - Robust and durable
 - Illuminated ring optional
- PBA Series**
- Piezo options
 - ATEX version available
 - Easy to clean metal surface

ULTRA-WATERPROOF PUSHBUTTON



- IX Series:**
- IP69K Panel sealing with flexible elastomer membrane actuator
 - Resistance to frost, sand and other contaminants
 - 9 different actuator colours
 - 5 different LED colours
 - Many different marking symbols

ROCKER SWITCHES



- KR Series:**
- Panel mount power rocker switch
 - Laser etching for direct marking
- 2600 Series:**
- Panel mount power rocker switch
 - 3 Shapes: plain, V or concave
 - SPDT and DPDT models
- TR Series:**
- PCB mounting rocker switch
 - Subminiature
 - Single or double pole
- See website for more options.

TOGGLE SWITCHES



- 12000X778 Series**
- Military grade - MIL approved
 - Double shell case
 - Pinned lever for protection
 - IP67 robust sealing
- 3500 Series**
- 1 or 2 pole configuration
 - Designed for outdoor applications
 - Front panel sealing to IP67
 - IP69K by silicone membrane
- See website for more options.

THUMBWHEELS



- HR Series:**
- Proportional thumbwheel
 - Friction hold option available
 - 11 detents along the travel or 1 detent at centre
 - EMI/RFI Shielding
- TW Series:**
- Contactless Hall-effect technology
 - Voltage output range available
 - Spring return to centre
 - Choice of 4 wheel colours

PUSHBUTTONS



- APEM pushbutton range:**
- Momentary and latching options
 - Plastic and metal
 - Panel, PCB and snap-in mounting
 - Illuminated or non-illuminated
 - Ø4 to 44 mm mounting range
 - ATEX version available
 - Many terminal options
- See website for more options.

KEYPADS & SWITCH PANELS



- KP6 Series:**
- CANbus keypad
 - Electromagnetism proof
 - Many customisation options: Markings, illumination, backlighting phantom markings
- PQ Series:**
- Stainless steel with flush keys
 - 4, 12 or 16 key configurations
 - LED backlighting
- See website for more options.

MINIATURE JOYSTICKS



- TS Series thumbstick:**
- LED backlighting option
 - Contactless hall-effect technology
 - Total current draw no greater than 16mA
 - Suitable for wireless applications
- FR Series:**
- 3-position thumbstick
 - Contactless hall-effect technology
 - Submersible to 1m as per IP67
 - Redundant outputs available

MEC - HIGH PERFORMANCE TACT SWITCH



- Multimec, Rockermec, Controlmec, Ilumec, Ultramec and Unimec:**
- Tactile feedback
 - Huge array of caps
 - Illumination option available
 - Many legend options
 - Different shapes & sizes to select
- See website for more options.

AIR, PRESSURE & VACUUM SWITCHES



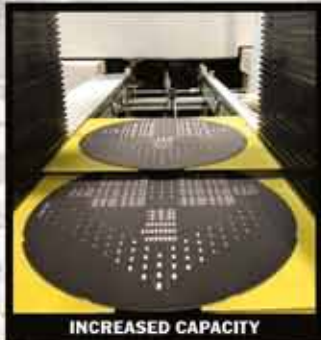
- HPS-500-G:**
- Single pole and single throw
 - Normally open
 - Pressure, vacuum and differential switching to very high sensitivity
- 6861 to 6869 Series:**
- General purpose airswitch
 - Mid-sized switch
 - Variety of contact and connection options
- See website for more options.

VIEW ALL OUR PRODUCTS HERE: WWW.CONTROLDEVICES.COM.AU

Unit 17, 69 O'Riordan Street ALEXANDRIA NSW 2015
02 9330 1700 sales@controldevices.net



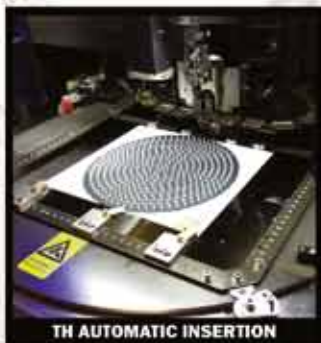
FULLY AUTOMATED SMT LINES



INCREASED CAPACITY



INLINE SELECTIVE SOLDERING



TH AUTOMATIC INSERTION



on-track
TECHNOLOGY

Avoid supply chains disruption

Quicker local turnaround times

Have more control in your manufacturing

Competitive local pricing

Get full traceability in your production

Support local electronic industries

Manufacture in Australia



Global Mark com.au®

12 Works Place
Milperra NSW 2214 Australia
Tel: +61 (2) 9700 7000
Web: www.on-track.com.au

Raymond Pang | Sales Manager
Email: raymond@on-track.com.au
Mobile: +61 (0) 416 116 256