

ELECTRONICS

MARCH/APRIL 2020

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The European magazine for purchasing professionals

MARCH/APRIL 2020

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OBSOLESCENCE ISSUES
BLOW A GASKET**

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On the cover – March/April 2020

Don't let obsolescence issues blow a gasket

Editor's Word



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Buyers' Guide

All the facts and figures to help you buy

Now wash your hands

People laugh at my level of concern about the potential of viral pandemics to do harm. I have my reasons. One hundred and one years to the month my great uncle died of Spanish influenza. Having survived the horrors of fighting through the trenches of World War I, he wrote to his mother in November 1918 to announce his war was over and he would be heading home in February 1919 once his remaining sapper operations were complete. He never made it. He died in France of Spanish flu that same February.

As a child this story emphasised my parents rather Victorian approach that 'cleanliness is next to godliness'. I realised that no global military conflict can compare with the killing power of bacteria and viruses. It's why I get triggered by people walking out of public bathrooms without washing their hands.

Now stir in the rise in global population, plus lingering poverty, plus poor state governance, plus mass transit and I feel obliged to at least respect the potential of this bug.

As factories in China close and production facilities around the world start to reduce their output as part bins run empty, I wonder how many of those organisations' SWOT analysis paperwork included 'global pandemic' in the Threat Quadrant? Not many I bet.

Remember, if you chose to single source your supply of critical technologies from a distant land, you will one day pay a price. Just because it's a one-hundred-year event doesn't mean it can't be tomorrow.

Jon Barnett

Contact

ELECTRONICS **sourcing** **mmg** PUBLISHING LIMITED

EDITORIAL

Managing Editor: Jon Barrett
jonb@electronics-sourcing.eu
Contributing Editor: Amy Barker
amyb@electronics-sourcing.com
Editorial & Production: Thomas Smart
thomas.smart@electronics-sourcing.com

ADVERTISING

Director of New Business: Charlotte Morgan
charlotte.morgan@electronics-sourcing.co.uk
Advertisement Manager: Emma Poole
emma.poole@electronics-sourcing.com
Marketing Manager: Amy Leary
amy.leary@electronics-sourcing.com

CIRCULATION

Circulation Manager: Vicky Leary
vicky.leary@electronics-sourcing.com
Circulation Account Manager: Liz Poole
liz.poole@electronics-sourcing.com

DESIGN

Graphic Designer: Josh Hilton
josh.hilton@electronics-sourcing.co.uk

PUBLISHER

Mark Leary
mark.leary@electronics-sourcing.com
Office Manager: Denise Pattenden
denise.pattenden@electronics-sourcing.com

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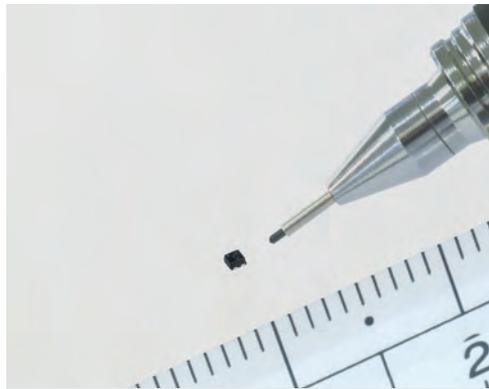
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Easy access to low power semis

Arrow Electronics can now supply ABLIC analogue semiconductors throughout Europe, the Middle East and Africa, providing access to low-power components for automotive and smart appliances.

With its track record of producing analogue semiconductors that function extremely accurately using only a small amount of energy, ABLIC provides a range of voltage regulators, temperature and magnetism sensors, timer and power supply ICs, and specialist components for automotive use. Current focus areas include power management ICs, sensors, timers, and amplifiers.

Vice president of product and supplier marketing in EMEA, Arrow Electronics, Matthias Hutter, commented: "Miniaturised, power-efficient, analogue semiconductor components are at the heart of many smart technologies, from IoT edge nodes to automotive battery protection devices. ABLIC has been developing these products for decades and we are pleased to make this vast experience available to Arrow's customers."

www.arrow.com



Compact supplies deliver on efficiency

Conrad Electronic now offers the TracoPower TBLC series of DIN rail power supplies, designed to meet building automation and industrial requirements.

Global marketing director at Traco Electronic, Florian Haas, said: "In order to cover as many applications as possible, our TBLC DIN rail switched-mode power supply series comprises a total of 15 product versions with outputs from six to 90W. Depending on the model, the power supplies work with AC voltages from 85 to 264V AC, providing DC voltages of five or 12V and output currents of 250mA to 7.5A."

Product manager at Conrad Electronic, Kilian Braun, explained: "The AC/DC power supplies are characterised by their flat housing and low installation depth of 55mm, offering a high power density that allows them to be used in space-restricted applications. The supplies require very little standby power and have improved EMC characteristics as well as meeting the new ECO standby power and efficiency requirements."

The TBLC series also meets safety approvals according to IEC/EN 60335-1 and EN/IEC 60950-1, and is suitable for installation in sub-distribution or distribution housings in offices and homes.

conrad.com

Tiny 3W converters ready to ship

RS Components has announced availability of a new series of encapsulated switch-mode power supplies claimed to offer the smallest 3W AC/DC power solution available. Manufactured by Recom, the versatile RAC03-K series of modules comes with international safety certifications for use in IT equipment and various household devices, as well as being suitable for IoT power designs in home and industrial automation and Industry 4.0 applications.

Designed to offer a high power density, the series comes in a compact footprint and delivers 3W single-output power across the -40 to 60°C operating temperature range and 2W up to 80°C. The series also boasts no-load power consumption of less than 150mW, supporting the EU's Ecodesign Lot 6 power design study for optimised standby-mode and off-mode power losses.

uk.rs-online.com



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In Brief

New office to focus on AI
Imagination Technologies has opened a new design centre in Timisoara, Romania. The centre will focus on intellectual property for artificial intelligence and computer vision. Initially it will focus on software and test activities, expanding in future to system architecture and design. Imagination intends to open further engineering centres in 2020.
www.imgtec.com

Second source for hi-rel connector
Nicomatic and Amphenol Socapex have signed a dual-sourcing agreement, whereby Amphenol Socapex will sell Nicomatic's modular, 1.27mm pitch rectangular EMM connector family under the brand MICRO HDAS. This will benefit buyers in hi-rel industries who require a dual source for this connector. Under the agreement, a selection of EMM series connectors will be integrated into the Amphenol Socapex portfolio.
www.nicomatic.com

E-mech agreement in EMEA
Schurter and TTI have signed an EMEA distribution agreement, extending a long-standing, cooperation in France to include the rest of Europe, Africa and the Middle East. The Schurter portfolio and TTI's specialist passive, electromechanical and discrete strategy are said to be a perfect fit, with the two companies combining to provide the best service to customers.
schurter.com

EMS acquisition fights trade friction
Universal Scientific Industrial is to acquire the European EMS, Asteelflash. Currently serving more than 200 clients, Asteelflash is dedicated to meeting requirements for small batch and diversification. With heightened trade friction on global markets, USI's acquisition of Asteelflash will offer clients a more diverse range of production bases, including cost competitive ones in the Czech Republic and Poland, as well as in France, Germany and the UK.
www.usiglobal.com



Telecoms ICs in stock

Mouser Electronics has announced a global distribution agreement with CML Microcircuits, a specialist in low-power analogue, digital and mixed-signal semiconductors for telecommunications systems. With a product line-up covering all aspects of wireless voice and data system design, devices include RF transceivers, analogue front ends, baseband processing and application-specific microcontrollers.

Purchasers will be interested in the CMX901 and CMX902 three-stage wideband, high-gain, and high-efficiency RF power amplifier ICs. With a high power gain up to 40dB and up to 60 per cent power efficiency, they are ideal for VHF and low UHF radio applications as well as wireless-based industrial internet of things systems.

Mouser is also stocking four series of CML receiver ICs, including the CMX994 direct conversion receiver, which provides the ability to dynamically select power consumption versus performance modes to optimize operating trade-offs.

Other highlights of the new portfolio include CML Microcircuits' wireless packet data modems, which address a range of communications and control applications.

www.mouser.com

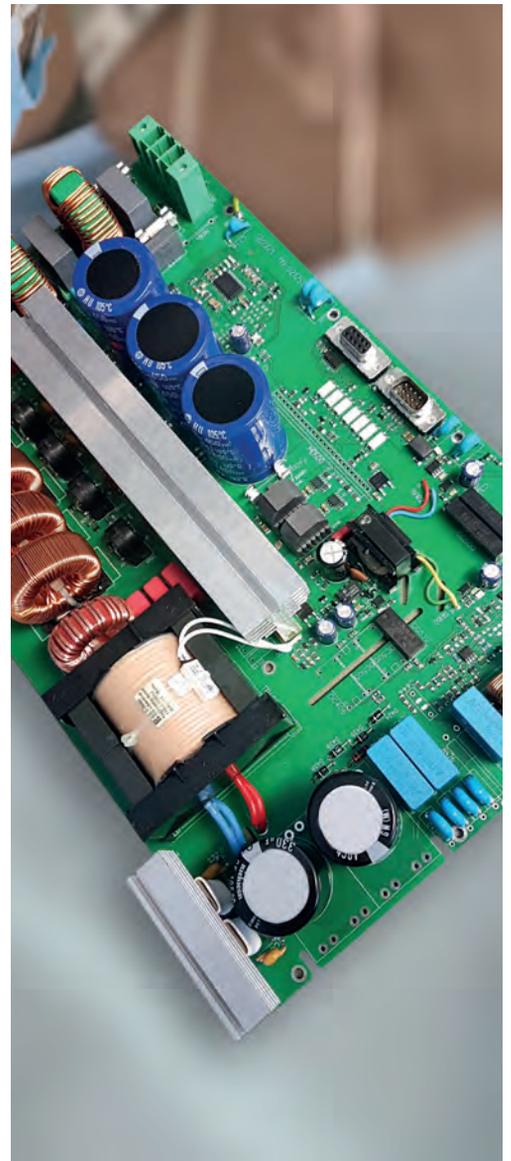


Components achieve automotive approval

Schurter Electronic Components has revealed that its Romanian production site has been certificated according to the International Automotive Task Force 16949:2016 standard. As one of the strictest and most demanding standards, this attests to the production of components at the highest quality level.

With certified production of electrical circuit boards, Schurter can also now offer entire systems manufactured according to IATF. This moves the company from component supplier to complete solution provider, with the improved processes offering benefits for all Schurter customers.

www.schurter.com



Looking to power medical lasers?

Powerbox has released a new power supply solution for high peak load applications in the medical sector. Based on digital control and high energy storage management techniques, the SMM3000A80024C series delivers 2.25kW repetitive peak power to medical lasers with high efficiency.

Commenting, Powerbox chief marketing and communication officer, Patrick Le Fèvre, said: "A good laser device has less than a millisecond pulse width, meaning that it is incredibly fast-firing, requiring the power supply to be able to deliver high energy levels during the pulse, but also able to restore energy for the next pulse. To meet such requirements is a great challenge, though by combining digital power and special PRBX innovations, the PRBX 2.25kW AC/DC capacitor charger SMM3000A80024C effectively meets the requirements of the job and complies with the medical safety standard IEC60601-1 3rd."

The supply complies with medical safety standards and for silent operation it includes a thermo-controlled cooling system.

www.prbx.com



More power products for same day despatch

Farnell has expanded its linecard with an increased range of XP Power products available for same day despatch. Solutions include AC/DC power supplies, DC/DC converters and high voltage DC/DC converters, with products suitable for a range of applications, particularly in the industrial and medical sectors.

XP Power's medically approved power solutions can be used in patient vicinity applications and in laboratory environments. Major features include class II approvals for homecare devices, convection-cooled designs for low-noise patient-area devices and defibrillator-proof DC/DC converters for applied part applications. For industrial power systems, XP products are found in factory automation, automated test equipment, industrial control, test and measurement, instrumentation, hazardous environments, transportation and defence.

Recent additions to the XP Power range stocked by Farnell include high voltage DC/DC converters, the FCS family of high reliability 40 and 60W AC/DC power supplies and the DSR series of ultra-thin DIN-Rail power supplies.

Global head of IP&E, Farnell, Simon Meadmore, said: "XP Power is a key supplier for Farnell and is known for its innovation in power supplies, often being the first to set new footprint and efficiency standards and boast products such as the world's smallest 40W AC/DC power supply."

www.farnell.com

Efficient modules ready for rapid delivery

Flex Power Modules has signed an agreement with Digi-Key Electronics to open a new sales channel, expanding its global footprint and accelerating order fulfilment. All Flex Power Modules products will be listed on Digi-Key's website and available for purchase, with many held in stock for immediate same-day despatch.

Vice president and general manager, Flex Power Modules, Marcus Hansson, said: "This agreement offers a new global sales channel for our customers to buy Flex Power Modules products, and, by improving the speed of delivery, it demonstrates our commitment to engineers worldwide."

Vice president of global supplier management at Digi-Key Electronics, David Stein, added: "Engineers demand high efficiency and high power density in a small size, while still being able to check the box on value for money. Flex Power Modules' market-leading products deliver just that."

www.flex.com

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New DC/DC converters, available from TME, provide a wide range of input voltages, increasing efficiency in a whole host of applications—not least photovoltaic products

Every year, manufacturers of photovoltaic modules attempt to create more efficient solar panels using new technologies and new materials. Although in recent years they have succeeded in increasing the performance of PV systems, there is an easier way to improve efficiency. Aimtec's DC/DC AM10/15/40/45/200-NZ converters provide an exceptionally wide range of input voltage from 200 to 1,500V DC with efficiency 1.5 to two percentage points higher than the 1,000V DC converters currently available.

Furthermore, with Aimtec DC/DC converters, you can construct a simple, low-cost and smaller system of the main electrical components involved in solar energy harvesting. These solutions are beneficial because they reduce the time needed to market the product, lower the costs, and at the same time increase the efficiency of the entire system.

Global renewable energy demand

In 2015, following the UN Climate Change Conference held in Paris, an agreement was signed to reduce the global emission of greenhouse gas. It has had a positive impact on the development of ecological renewable energy sources such as photovoltaic panels and wind energy. Strong public support for green renewable energy solutions, lowered production costs and modern performance-boosting technologies are factors that will heighten

demand for PV and wind energy systems.

The use of new converters improves efficiency. Currently, PV systems are designed on the basis of a model using the input voltage of 1,000V DC, which is 33 per cent lower than the 1,500V DC supported by new solutions from Aimtec. Higher voltage systems will increase the efficiency by 1.5 to two percentage points. In light of these findings, the situation has become clear: the next step in the development of photovoltaic installations must be to replace the internal components of the devices in these highly advanced systems.

Efficient energy solutions

The AM10/15/40-800xxS-NZ series of DC/DC converters aims to fill this demand. The converters provide an input voltage range from 200 to 1,500V DC, 4,000V AC isolation and built-in multidimensional protection functions that can be useful for various photovoltaic systems and other applications which require a stable and reliable power supply such as wind turbines.

Designed to stand out from the crowd, Aimtec DC/DC series converters boast a wide input voltage range, with standard output voltage of 5, 12, 15, or 24V. They are perfect for smaller and more compact devices such as inverters and monitoring systems, as well as offering several protections including input under-voltage,

reverse polarity and output overcurrent protection.

This innovative DC/DC converter allows a power module in a solar array to receive an output voltage higher than 1,000V. This is crucial, because the output voltage varies depending on the intensity of sunlight. If the output voltage is too high for a long period of time, this can lead to instability of the operating voltage, cable problems and short circuits, which in turn can cause a failure of the entire system.

The DC/DC converter scheme is based on the flyback topology thanks to the reliable pulse width modulation control system. It also uses two high voltage transistors connected in a series, as well as a power isolation. The high voltage starter is built with Aimtec's patented starter technology and has a number of built-in protections.

To simplify life for purchasers, the new Aimtec converters are complemented by a range of products that can increase the efficiency of PV systems by two percentage points. What is more, best-in-class protections guarantee safe and reliable operation. Aimtec's solution for PV systems therefore delivers huge benefits by simplifying designs, reducing costs and improving overall system performance.

www.tme.eu

Accelerate your EV projects

Featuring new components and technologies for electric vehicles and charging infrastructure Mouser's latest eBook, produced in collaboration with Bourns, is a go-to guide for purchasers

Mouser Electronics, has launched a new eBook in collaboration with Bourns, exploring new components, technologies, and strategies for the design and development of electric vehicles. In *Electrification of the Vehicle*, experts from both Mouser and Bourns provide detailed explanations of concepts and products including shunt resistors, inductor designs for on-board chargers, and the use of inductors and current sense resistors to reduce automotive emissions.

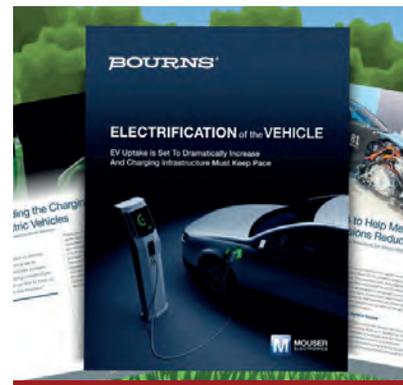
Citing sector surveys and industry projections, *Electrification of the Vehicle* predicts growing adoption of electric vehicles throughout the United States. To keep pace with increasing numbers

of electric vehicles, significant strides must be made in the development of charging infrastructure. The eBook highlights some of the most pressing challenges relating to electric vehicles and charging stations, providing in-depth guides to potential technical solutions and useful products.

The eBook also incorporates detailed information on products such as the Bourns Model CSM2F series of shunt resistors. Available in three footprint sizes, the CSM2F series is designed to deliver accurate current sense measurements in high-energy storage applications. Bourns' useful guide highlights the key elements of each transistor in the series.

In total, the eBook includes key features and ordering information for more than a dozen products from Bourns, including BMS signal transformers and SRN automotive semi-shielded power inductors. Purchasers may also be interested in information on Bourns' complete range of products for electric vehicles, available from Mouser, which includes encoders, magnetics, position sensors, and other automotive solutions.

www.mouser.com



Mouser's EV eBook will help purchasers address the expected uptake in demand for EV charging

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Simplify your BoM with smart power solutions

Clever converters help purchasers address growing demand for dual voltage power in automotive systems, without ramping up the component count, explains Digi-Key Electronics' Rich Miron

The LV148 automotive standard combines the existing automotive 12V system with a secondary 48V bus. The 12V bus will typically continue to provide power to systems such as lighting, infotainment, audio, and ignition while the 48V bus will supply systems like the adjustable suspensions, electric turbos/superchargers, air conditioning compressors, air conditioning compressors, and active chassis along with regenerative braking support.

Implementing this additional 48V supply network will present various challenges. To help alleviate these issues, Linear Technology offers several DC/DC converters that handle bi-directional energy transfer very efficiently. With these converters, either battery could be charged and current could be supplied to the same load when needed.

Unlike many early 12V/48V dual battery DC/DC converter designs that utilize separate power components to step-up and step-down the voltage, Linear Technology's LTC3871 bi-directional DC/DC controller uses the same external power components for stepping down the voltage as it does for stepping it up.

An integrated solution

The LTC3871 is a bi-directional 100V/30V two phase synchronous boost or buck controller. It can provide bi-directional DC/DC control and battery charging between the 12V and 48V system networks. It operates in boost mode from the 12V bus to the 48V bus and in buck mode from the 48V bus to the 12V bus.

This device allows both batteries to simultaneously supply energy when additional power is required. The maximum current delivered to the load is regulated by the on-chip current programming loop. There are four control loops that enable the control of voltage and current on either of the 12V or 48V busses.

Maximize efficiency

To provide more output current without increasing input or output voltage ripple, users can daisy chain multiple LTC3871s and run them out-of-phase. A maximum of twelve phases can be daisy chained to run simultaneously out-of-phase with respect to each other.

The demonstration board for the LTC3871 can be configured in either two or four phases with one or two LTC3871s.

Efficiency curves for the devices are encouraging. Looking at a four-phase demonstration board utilizing two LTC3871 devices, the buck mode curve shows the efficiency as the board steps a 48V input down to 12V at up to 60A, while the boost mode curve shows the efficiency as the board steps a 12V input up to 48V and up to 10A. On both curves, peak efficiencies are around 97 per cent.

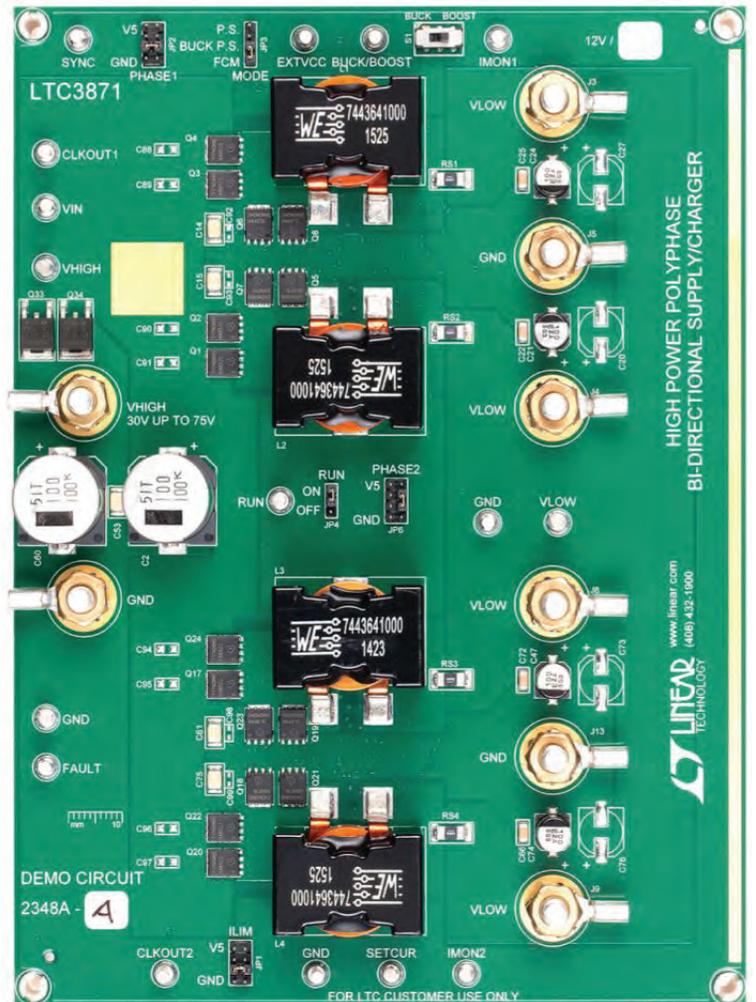
Simpler sourcing

Not only will the LTC3871 bring a new level of performance and enhanced control, it also has the power to simplify dual battery 48V/12V DC/DC automotive systems. By allowing the same external power components to be used

for both step-up and step-down purposes, this clever converter could well cut your component count.

www.digikey.com

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Distributors can help mitigate risk of obsolete parts

Dealing with obsolete parts is a continuing issue for electronics buyers who buy unique parts in industries that have long product life cycles



James Carbone

Component obsolescence has been and probably always will be a challenge for electronics buyers, but tools and services that distributors provide can help reduce the risk that buyers will have to scramble to find a part that goes end of life.

Most distributors keep track of end of life (EOL) notices issued by component manufacturers and send them out to customers. Some distributors will do lifetime buys on behalf of customers and hold the parts in stock until they are needed. Others will scrub bills of materials for customers to identify parts that are obsolete and offer online purchasing tools that identify components that are not recommended for new designs because they soon may go EOL.

Tools and services which can help reduce obsolescence risk may become even more important in the future because of shrinking lifecycles of some semiconductors and long lifecycles of electronics equipment in certain industries. In addition, more products are being designed with the capability to connect to the Internet so more companies that had not purchased electronics in the past are now purchasing components needed to connect their products to the web. Eventually those components will go obsolete and OEMs will need to find alternative parts.

"Obsolescence has always been a problem especially in industries that have long lifecycles," said Tom Treichel, senior director of assigned accounts for Digi-Key. "The longer your products are out there, the more of a chance a supplier will end of life one of the components in your products." Communications, medical and industrial OEMs have products with long lifecycles and are impacted by component obsolescence. "Certainly, military and aerospace have longer lifecycles," he said.

Rob Picken, global director at Converge, an Arrow company, said historically, "Aerospace and defense industries were the most heavily impacted by obsolescence" because life cycles of the systems built by OEMs in those industries can be excess of 30 years which cause challenges for any manufacturer to support. "Also, any changes to a design or a bill of material need to be submitted for approval, usually to the ultimate end customer and if approved, those redesigns needed to go through time-consuming recertification," he said.

Hi-rel parts go obsolete

Picken says that obsolescence is a challenge for any industry that requires high reliability parts because such parts may have a limited market. He notes that a component manufacturer producing a standard part may



"Historically, aerospace and defense industries were the most heavily impacted by obsolescence"

Rob Picken, global director at **Converge**, an Arrow company

technically be able to produce 1,000 variants of size, tolerance, voltage and other variables. However, OEM customers for high reliability parts may only want to use components at "the very edges of the component's operating capabilities, and usually with rugged or non-standard physical properties—massive operating temperature ranges, or radiation hardening for example," said Picken.

"This makes these parts low profitability for suppliers, and that means they are at risk of discontinuance during any merger activity," he said.

Picken points out that recent mergers in the electronics supply base have led to "product line rationalisation, or in simple terms, obsolescence." A component manufacturer that acquires another parts maker often will discontinue some product lines of the acquired company if there is an overlap. However, consolidation is not the only reason. Environmental laws and regulations, such as the Restriction of Hazardous Substances (RoHS) directive and Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) law resulted in greater component obsolescence.





However, obsolescence often occurs simply because after a certain amount of time, certain components are no longer purchased in the same volumes as in the past. "It comes down to the usage of the parts," said Treichel. At some point usage of a component declines and the manufacturer determines it no longer makes sense to make the part even if there is still some demand for the component in some products, he said.

When designing a new product, "an engineer wants to use the latest and greatest technology and new parts" not older parts with less functionality even if there is still some demand for the part in certain products Treichel said.

Semiconductors are more often affected by component obsolescence. John Hunter, director of defense and aerospace for Avnet, said the more unique the component is, the more challenging it is to replace. "Field programmable gate arrays (FPGA) and microprocessors lead the way in complexity with RF analog devices following close behind. These complex devices also tend to be cost drivers which exasperates the EOL challenge," he said.



John Hunter, director of defense and aerospace for Avnet

However, passive components are also impacted by obsolescence. In recent years passives manufacturers have stopped making components in larger case sizes. One example is multilayer ceramic capacitors. Some capacitor manufacturers have opted to build MLCCs in small case sizes such as 0201 and the 01005 and ceased production of capacitors in larger sizes such as 1206 and 1812 because smaller case size parts are more widely used and more profitable.

Keeping up with EOL notices

Whether a part is an FPGA or ceramic capacitor, buyers are challenged in keeping up with end-of-life notices that are issued by manufacturers. Each year, manufacturers send out 3,000 to 5,000 EOL notices and each notice may have dozens of discontinued parts.

Distributors receive those notices and send out EOL information to customers that have purchased the soon-to-be obsolete parts. "We will notify the customer that a product is going end-of-life and give them some of the details when the last-time buy is," said Treichel. That gives the customer an opportunity to make a decision."

"Our notification process will provide alternatives if the supplier has suggested replacements"

"Obsolescence has always been a problem especially in industries that have long lifecycles"

Tom Treichel, senior director of assigned accounts for Digi-Key



The customer may decide to redesign a product that uses an alternative to the EOL part. Or the customer may want to do a lifetime buy or find a similar part from a different manufacturer.

Treichel said that any customer that bought a part from Digi-Key in the previous two years will be notified if the component goes EOL. "Even if a customer has not bought from us, they can go to our site and punch in the part number and we will tell them if it is obsolete or not suggested for new designs and show them some alternatives," he said.

He said Digi-Key has quoting tools that identify EOL parts. "We don't scrub bills of materials (BOMs), but our online quoting tools allow customers to upload their BOMs and the tools will tell them what the lifecycle of the product is and if the part is not recommended for new designs. That will give them an early warning," said Treichel.

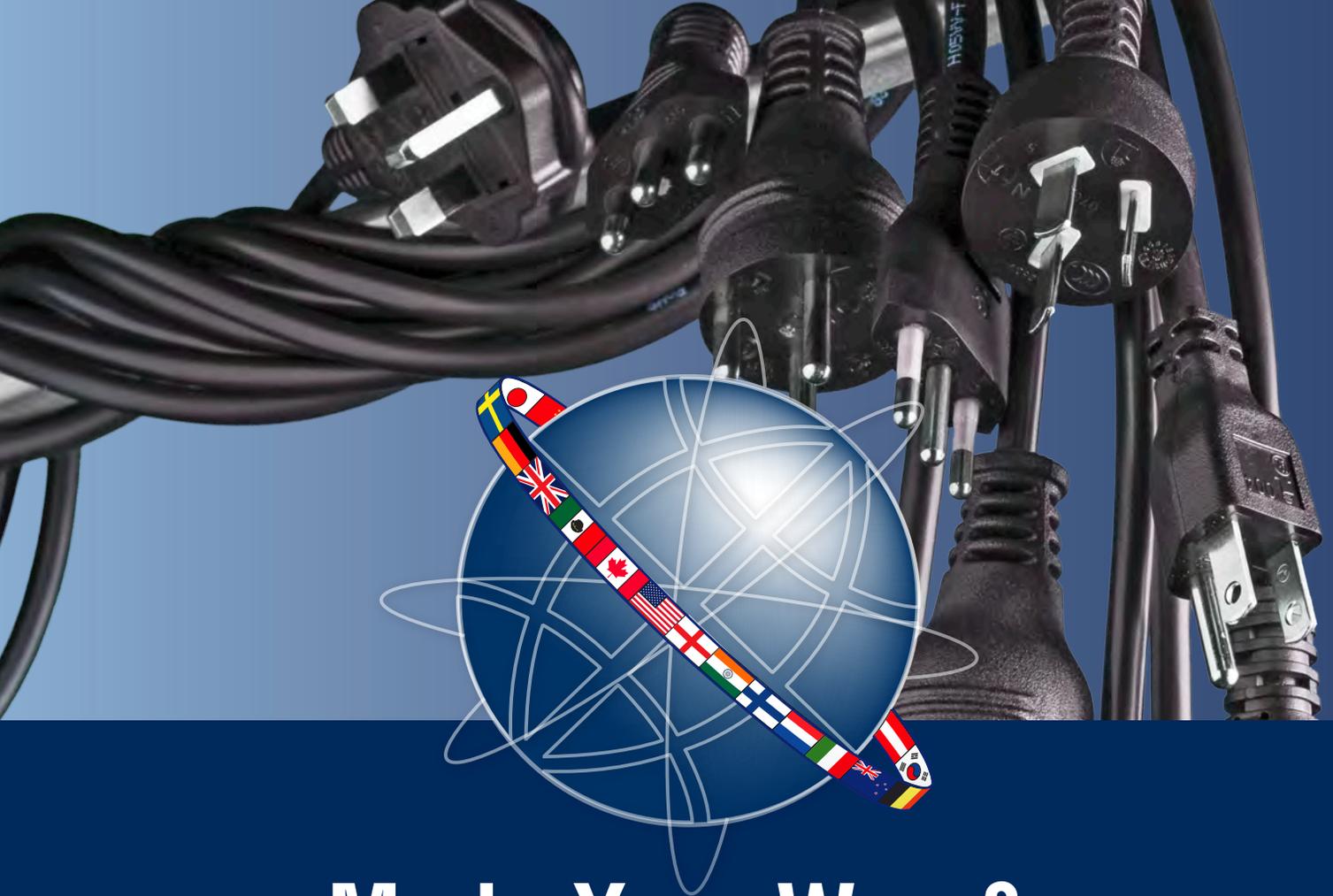
Of course, Digi-Key is not the only distributor that assists customers in managing EOL notices. For example, with Avnet's "Digital Portal", customers can sign up to receive EOL and product change notices for parts they purchase from Avnet, said Hunter. Avnet also has an internal "Light the

Target" process, in which "Avnet's sales team send EOL notifications to our customers on parts they currently buy from Avnet," he said.

"Our notification process will provide alternatives if the supplier has suggested replacements," said Hunter. "Additionally, our sales team will help our customers review options to support their EOL challenge. He added Avnet can also provide customers with a BOM analysis upon request using a SupplyFrame tool.

Avnet also supports customer last time buy requirements. "We work each opportunity to minimize the financial impact while ensuring continuity of supply, and our team will support efforts to locate EOL parts in support of our customers request," said Hunter.





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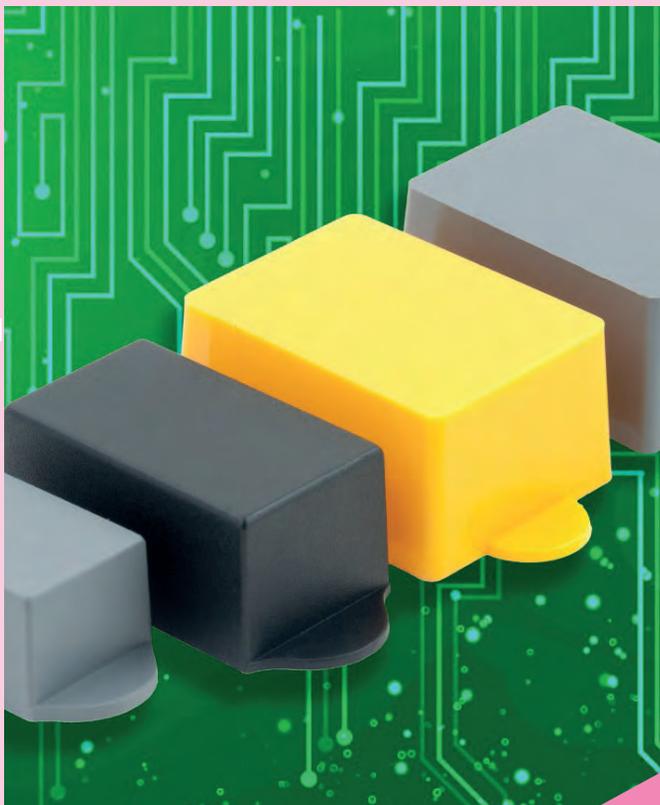
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Specify protection for small electronics

BCL Enclosures' potting boxes can be specified to protect small electronic circuits in all kinds of applications from consumer products to harsh automotive environments.

The GPL range is designed for permanent encapsulation of electronic circuits and is manufactured in lightweight yet robust ABS. The range features fixing lugs for secure attachment to a variety of surfaces, with three models available: measuring 36 by 24 by 19mm for the GPL05; 50 by 30 by 24mm for the GPL1 and 55 by 42 by 27mm for the GPL2. The potting boxes can also be punched or drilled as required.

Moulded in black ABS, the PB range of potting boxes is designed to provide a low-cost solution for protecting delicate electronics. This series features models ranging in size from 11 by 11 by 9mm in the PB109, right up to the PB106, which measures 100 by 60 by 25mm. Again, these boxes can be easily drilled or punched by the customer.

www.bclenclosures.com



Extreme reliability straight off the shelf

Spelsberg GRP enclosures have been utilised as part of an Air Spectrum dust suppression system installed at the face of the UK's deepest mine. This sees the enclosures operating over a kilometre under the North Sea, eight miles from dry land in Boulby Mine, which is part of a polyhalite mining operation run by Cleveland Potash.

Mining at this extreme depth under the sea presents several challenges including equipment reliability, access, ventilation and dust. As polyhalite is mined at the face, the auger produces large amounts of airborne dust, presenting safety risks to miners and equipment. To ensure that dust is suitably controlled, Cleveland Potash approached dust control specialist, Air Spectrum, to deliver a solution.

Operations and engineering manager at Air Spectrum, Matt Edmonds, explained: "Our dust suppression system constitutes a series of 12 air and water atomising nozzles that spray above the auger as it mines. The reliability of the system is paramount, as mining cannot continue without it. Therefore, we knew that when choosing an enclosure for the system, we needed an optimum solution."

In conjunction with Air Spectrum, Spelsberg selected a highly durable glass reinforced polymer enclosure measuring over a metre high. Available with an ingress rating of IP68, the enclosure was ideal for resisting dust and moisture off the shelf; especially important as it was installed within 10m of the face.

Matt Edmonds continued: "The enclosure offered a good IP rating, increased durability, correct specification and the right size to accommodate everything we needed. Overall, it ticked all the boxes, while also offering value. We've tried other enclosures in this application, but Spelsberg offered a high level of technical proficiency right out of the box, which is what we need for these specialised systems."

Area sales manager at Spelsberg, Chris Smith, concluded: "We hold a lot of stock in the UK ready for rapid delivery. In this case, we could take a specialised GRP enclosure straight off the shelf and deliver it to Air Spectrum on a reduced lead time."

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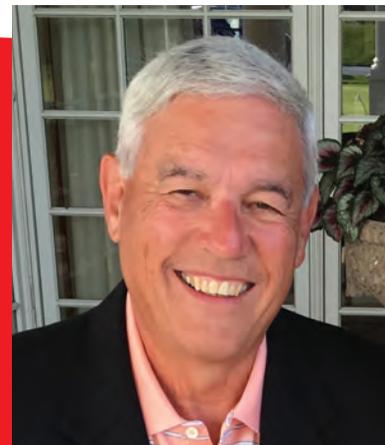
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USMCA ushers in new trade era



John Denslinger is a former executive VP Murata, president SyChip Wireless, and president/CEO ECIA, the industry's trade association. His career spans 40 years in electronics

John Denslinger presents the pros, cons and obligations of a new era of international trade

International trade • By John Denslinger

For too long, politicians and well-intentioned bureaucrats steadfastly championed the status quo when it came to international trading agreements. Despite overwhelming evidence of predatory trading practices and lopsided trade imbalances, meaningful change seemed all but impossible. Only after the imposition of (or mere threat of) economy-killing tariffs did the reality of a broken, global trading system finally get the attention of world leaders.

One can certainly argue the pros and cons of tariffs. Globalists and nationalists will have distinct opinions. Nevertheless, tariffs forced nations to discuss and ultimately amend outdated trade policies. USMCA is the first of these new agreements to be ratified by Congress and signed by the President. As such, it is the catalyst ushering in a new era of trade with several more deals in the works: China Phase 1, Japan, UK, South Korea and eventually the EU to name the majors.

USMCA is important not because it was the first re-negotiated agreement, but because it governs \$1.2 trillion of economic trade among US, Mexico and Canada, one of the world's largest trading blocs. It's likely much of the framework for this agreement will serve as the template for other bilateral negotiations.

So, what's new in USMCA? Pharma and farming aside, the agreements include: vital automotive industry protections; labour rate increases; labour rights provisions; IP protections; some environmental advancements; and streamlined dispute resolutions. Unchanged from NAFTA but included in USMCA are: currency manipulation protections; regulatory cooperation; digital trade; investment protections; and continuation of the sunset clause. In my opinion, USMCA appears to foster incremental enhancements to the 1994 NAFTA agreement rather than breaking new ground. That being the case, adoption should not

disrupt established supply chains, cost models and existing legal structures.

One area of particular note. If you are a small or medium-sized enterprise (SME), USMCA offers specific support for the first time in a US trading agreement. There is a whole chapter dedicated to fostering growth of SME that: establishes a SME Dialogue with admission open to any and all stakeholders; cuts excessive border-related red tape; offers digital trade provisions for e-commerce exports; invites small business participation in both US & Mexican government procurement opportunities; sets affordable IP protections; allows for cross border trade in services that eliminates a need of foreign offices; and establishes good regulatory practices giving particular attention to small business impact.

As I said earlier, USMCA ushers in a new era of trade. Now it's up to your legal, logistics and procurement teams to verify compliance. Understand the new rules of origin and changed customs laws, confirm that your contractual support for import-export operations qualifies under the new regs, review labour and employment agreements if your company has a physical presence in Mexico, and validate automotive content. The latter is critically important. It may require major realignment of your supply chains and raw material sourcing.

USMCA is the first of the new trade agreements reshaping international economics. Jay Timmons NAM President and CEO recently commented: "This agreement strengthens trade and restores needed certainty to our industry." Certainty is key. Let's hope the global goal of free and fair trade absent tariffs is realised sooner than later.

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Is your BOM ready to fly?

With drone use expected to take off in various sectors, buyers are looking for smaller, lighter components. TTI is helping to meet these constraints with a robust new interconnect solution from Harwin

The environments in which drones operate are often demanding, with difficult environmental conditions, high degrees of vibration and potentially heavy shocks. There are also size and weight considerations that need to be factored in. Ensuring the successful operation of drones means that while miniaturisation is important, the constituent electronic components also need to exhibit the highest levels of robustness.

Reductions in component size and weight are of obvious benefit for drones that are themselves constrained by these parameters. Their small and lightweight construction naturally limits the payload they can carry. By designing in smaller, lighter components, drones can use these savings on more payload, as well as covering greater range before needing to be recharged.

Compact yet rugged

Harwin's high reliability connector and cabling solutions combine compactness with a rugged but lightweight construction.

This enables the necessary power and data to be assured without adding any unwanted bulk to the design.

The Datamate J-Tek range, for example, provides a secure and robust connection under extreme conditions, including vibration, shock and high operating temperatures. A jackscrew design provides maximum strain relief and enables the connector to perform in the demanding environments affecting drones and other aerospace applications. The four-finger beryllium copper contact is gold plated and capable of achieving 3A per contact.

To address the need for improved size, weight and power in aerospace applications, Harwin has also introduced a new female T-Contact to the Datamate range. It utilises a proprietary six-finger design machined from a single piece of beryllium copper. For use with the existing Datamate J-Tek housings, the T-Contact raises current capacity on the 2.0mm pitch connector range to up to 8.5A per contact.

The increased number of contact points also enhances Datamate's vibration resistance to 40g for six hours. Heavier gold plating improves overall durability to 1,000 mating operations.

Reducing weight

In order to keep the weight of wire harnessing down, the Datamate Mix-Tek family can accommodate power, signal and RF contacts inside the same compact housing. The Mix-Tek range offers 3A, 20A or 40A contact options as well as multi-port 50 ohm coax contacts capable of frequencies up to 6GHz. Drones and their supporting infrastructure require shielding to ensure resistance against electromagnetic interference. To this end, Harwin's Datamate range offers rugged aluminium alloy backshells with electroless plating compatible with both J-Tek and Mix-Tek configurations.

The availability of compact, lightweight and rugged connectors that support design flexibility will help push the boundaries of drone capabilities. Drones are

finding new applications all over the world in a variety of sectors and no matter how related legislature develops, it seems likely that this technology will play an increasingly important role in the commercial and industrial landscape. Their adoption is limited only by the confines of human imagination.

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Medical equipment demands careful connector selection

Connectors for medical equipment are often tasked with meeting tough demands including steam sterilisation at elevated temperatures. ODU helps purchasers specify tailored solutions at minimal cost

Medical electronics currently counts as one of the fastest expanding sectors. Its growth is providing innovation stimuli, creating new areas of use, and increasing demand for connector systems designed to match their specific needs.

Connectors used on medical equipment must fulfil special requirements, for example, there is often need for autoclavability. This process of steam sterilisation at 134°C necessitates great care in the selection of connector and cable materials, usually leading to connectors requiring over-moulding.

Break-away solutions

As a low-cost alternative to autoclaving, ODU has developed break-away plugs for both the ODU Medi-Snap and ODU Mini-Med connector ranges at viable economic costs. Both feature

mechanical coding and offer multi-contact options and custom cables. They are ETO sterilisable, DEHP free, wipe-disinfectable and 0.9 per cent NaCl resistant.

To support customers with diverse medical application requirements, ODU can also provide custom solutions. For instance, the company developed a hermaphrodite design for an inhalation device used specially for the treatment of new-borns. The ODU connector assembly provides an interface between the control-unit and the nebuliser.

Another solution was engineered for a mobile defibrillator. This uses three versions of the ODU Min-Snap PC connector with push-pull locking: a high-voltage shock transmission of up to 2.3kV and 15ms to the reusable paddles; a high-voltage shock impulse to the defibrillation

electrodes, or for a four-core ECG cable; and an SpO₂ oxygen saturation sensor interface.

Supporting rapid innovation

To support ever-faster medical equipment innovation, suppliers need to offer not only a wide range of standard products, but a fast and responsive approach when only a customer-specific solution will neatly solve the problem.

At ODU all technologies are under one roof, from design and development to volume production of connectors, cable assemblies and mechanical sub-assemblies. As ODU explains, this makes it possible to offer high quality products at economic prices.

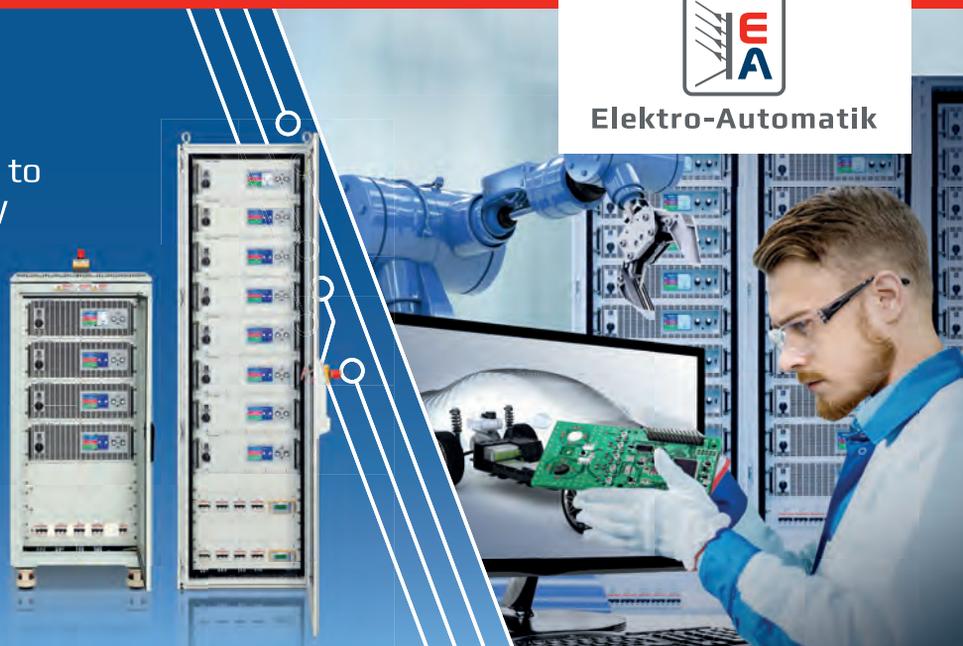
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Elektro-Automatik

Make confident buying decisions

Mouser Electronics aims to take service excellence to the next level by providing purchasers with in-depth availability information—even flagging when components are unsuitable for new designs

In the world of electronic components, where technical development is in a constant state of flux, it's reassuring to know that Mouser goes to great lengths to identify products that are 'not recommended for new designs'. Consequently, design engineers and buyers can be confident they're always working with the most advanced electronics available and can even subscribe to receive these product notifications online. This is just one of the ways Mouser, a new product introduction NPI distributor focused on the latest products from over 800 manufacturers, fosters speed to market for all of its customers.

Mouser Electronics' vice president of Americas sales and service, Coby Kleinjan, explained: "Having the newest, most advanced technology to develop cost-efficient prototypes limits costly redesigns, manufacturing delays or even the termination of a project. It also leads to a design edge in delivering more product features and capabilities as well as longer lifecycles. That's why we work closely with all our manufacturer partners to provide the fastest and easiest access to the industry's newest components."

Fresh ideas

Few things are more frustrating than a design delay because of obsolete products, so Mouser strives to deliver tomorrow's products today. Each transaction is about more than a sale; it's about building relationships, which is why Mouser aims to provide options to help buyers easily find what they

want. This support assists purchasers to navigate the many new products available, with Mouser claiming to launch more new products than any other global distributor, with its website updated continually, every day.

To this end, customer service and technical support representatives are available weekdays from 7am to 8pm CST to assist with all types of requests, including price quotes, order placement and order status, real-time product availability, technical support and more.

Playing a central role is the company's website, mouser.com, which features more than 800 manufacturers and access to more than four million orderable part numbers. For added service, buyers can also order and communicate with Mouser representatives via phone, email, fax and live chat.

Informed decisions

For buyers who need to know real-time inventory, Mouser offers real-time product availability through its website and customer service representatives, providing the most accurate product information to make confident buying decisions. Mouser clearly identifies end-of-life, obsolete and not recommended for new design products to avoid the use of older components in new designs, providing a speed-to-market advantage for customers.

Identifying product lifecycle and NRND products are examples of Mouser's commitment to value-added services beyond simple

component supply. The global distributor also gives suggestions for component alternatives, along with the risk level for those potential replacements. In addition, Mouser delivers easy and rapid access to essential technical data and application resources—such as product datasheets, application design notes,



Mouser Electronics' vice president of Americas sales and service, Coby Kleinjan



Mouser can suggest component alternatives, along with the risk level for those potential replacements

white papers, videos, and other solution-based content—to give buyers and design engineers a technological edge.

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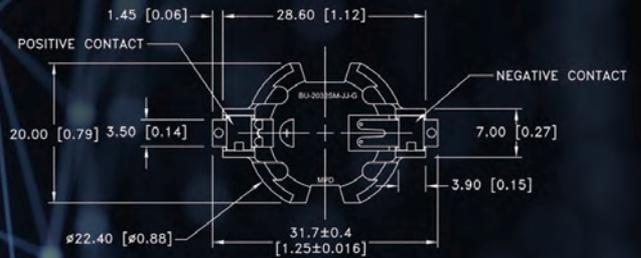


Mouser claims to launch more new products than any other global distributor, with its website updated continually, every day

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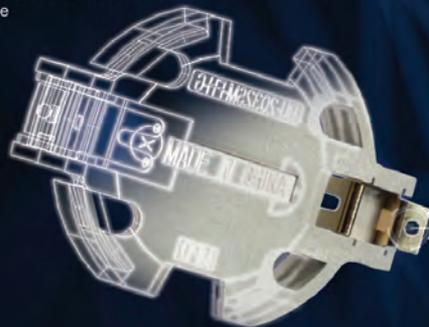
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Buyers can expect stable prices and steady lead times for power management ICs

Demand and revenue for power management ICs declined last year, but the PMIC market will bounce back in 2020 as sales grow 7 per cent



James Carbone

The worldwide power management integrated circuit (PMIC) market will return to growth in 2020 after declining about 4.5 per cent last year because of weaker demand, high inventory levels and lower prices.

Last year, power management IC revenue declined to \$13.6 billion from \$14.3 billion in 2018, according to Semico Research. "There was lower demand in 2019. PMIC unit shipments fell from 69 billion in 2018 to 60.6 billion units in 2019," said Jim Feldhan, Semico president. Some of the decline was due to high inventory levels and some of it was "just because of weakness in the overall market," he said. While the PMIC market declined in 2019, it did not fall as much as the overall semiconductor market which decreased about 12 per cent.

One reason the power management IC market declined last year was smart phone shipments fell 2.3 per cent in 2019, according to researcher IDC. Mobile phones are a big driver of PMIC demand. Automotive is also a driver of PMICs and worldwide vehicle sales fell about 4 per cent, according Fitch Ratings, a credit ratings agency.

"We had a bit of decline in PMICs in automotive," said Kevin Anderson, senior analyst, power semiconductors for researcher IHS Markit. Automotive PMIC business declined about 5 per cent in 2019, he said. While electronics content, including power management ICs, in automobiles is increasing, "vehicles sales were down enough to offset the growth in electronics content," said Anderson.

With weaker PMIC demand, inventory levels grew. "In Q3 and Q4 of 2018 there was a buildup of inventory, especially with some OEMs in China," said Anderson. Inventory continued to build into 2019 and there was a continued decline in demand in the first half of the year.

Normal lead times reached

However, by early 2020 high levels of inventory "dissipated and now are down to normal levels. Lead times are normal," said Anderson. "Factory utilization is somewhere in the mid-80s in general so the industry is poised to handle an upturn," if it occurs in 2020, he said.

In fact, many industry analysts forecast that PMIC demand will increase in 2020. Power management IC revenue will grow about 7 per cent in 2020 to

\$14.6 billion and will outperform the overall semiconductor market, according to Feldhan.

"Supply should be in balance in 2020 and that is one reason why our forecast is looking at about 7 per cent growth," he said. With high inventory levels being worked off, supply and demand are in balance. "We are starting to see some customers restock," said Feldhan.

The good news for buyers is that while PMIC demand will increase, prices will remain stable in 2020 after declining last year. Demand will rise across the board. PMICs are used in everything from cell phones and other portable electronics equipment to automobiles, including electric and hybrid vehicles, as well as industrial equipment and defense and aerospace systems.

By the Numbers



4.5%

The rate of decline for the worldwide power management IC market in 2019. Source: Semico



60.6 billion

The number of power management ICs that shipped in 2019. Source: Semico



\$13.6 billion

The size of the power management IC market in 2019. Source: Semico



5%

The rate that the automotive PMIC market declined in 2019. Source: IHS Markit



7%

The forecasted growth rate of global power management IC revenue in 2020. Source: Semico



\$14.6 billion

The forecasted size of the worldwide power management IC market in 2020. Source: Semico.



Power management ICs include AC/DC converters, linear and switching regulators, voltage references, rectifiers, thyristors and battery charging and management chips.

Switching regulators are the largest PMIC category, said Feldhan. "You find those in just about everything," he said. "They are used in most equipment for switching power off and on. Last year switching regulator revenue totaled \$5.6 billion, while total PMIC market was \$13.6 billion.

About 21 billion switching regulator units shipped in 2019, compared to 60.6 billion total PMICs that shipped. Switching regulators have higher average prices than most PMICs.

The average price for power management integrated circuit was 20.7 cents but switching regulator ASP is about 30.6 cents, said Feldhan. The second largest PMIC category is linear regulators which cost on average about 9.1 cents per device.

Battery charging management ICs have the highest ASP at about 35 cents. Last year about 6.2 billion battery charging management ICs shipped and revenue totaled about \$2.2 billion, said Feldhan.

In 2020, mobile phones will help drive demand for battery charging

management ICs and switching and linear regulators as mobile phone users upgrade to 5G handsets. However, that may not occur until the second half of the year, according to Anderson.

5G automotive will drive demand

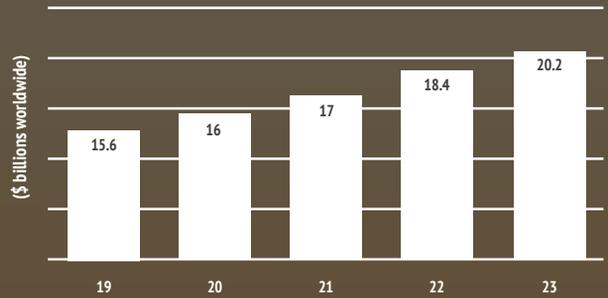
Prasanna Obala Bhuvanesh, product line marketing manager for Microchip's analog power and interface business unit, said key growth segments for PMICs this year and beyond will be 5G and automotive, particularly, powering at the "edge" for enhancing both smart and secure features of all connected consumer, industrial and automotive applications. These could range from IoT to Industry 4.0 to V2X, he said.

In fact, automotive will drive PMIC demand for five years, said Anderson. More power ICs will be needed for the advanced driver assistance systems (ADAS) and infotainment systems, he said.

Ali Husain, senior manager, corporate strategy and marketing for ON Semiconductor, said that autonomous driving will also increase demand for PMICs. "Automotive PMICs, especially for image sensors and other subsystems involved in autonomous driving, will be a very important growth area for PMICs in the next several years," he said.

The worldwide power management integrated circuit market will rise through 2023 driven by multiple end customer segments. *Source: IC Insights*

Power management IC market to post steady growth



Feldhan said that electric vehicles will also help drive the PMIC usage as electric car makers switch from silicon-based chips to silicon carbide (SiC) semiconductors.

Feldhan said the trend towards silicon carbide chips by EV manufacturers such as Tesla will result in greater need for power management ICs. SiC MOSFETs and IGBTs are being used in some EVs instead of silicon ICs because SiC chips can handle voltages up to 1200V and can operate more efficiently at high temperatures. They also have greater energy efficiency than silicon semiconductors.

Those characteristics make SiC semiconductors ideal for applications such as on-board chargers and inverters used within plug-in hybrid and full electric vehicles (EVs). Use of SiC semiconductors in such applications require more sophisticated power management and require more PMICs. "SiC is certainly a growing area that needs more sophisticated electronics and that will certainly help the power management ICs segment as well," said Feldhan.

Consumer electronics will also be a driver for PMICs. "We are talking about things like wearable electronics" such as smart

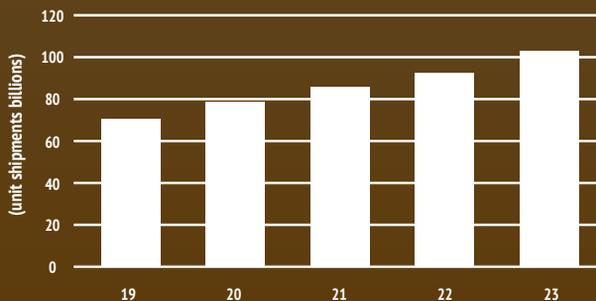
watches and fitness devices, as well as smart speakers, home automation applications said Anderson. He added industrial IoT is going to help drive growth as well.

Other markets that are expected to grow in 2020 and could drive PMIC demand include data centers and edge computing, according to Bhuvanesh. "If any or all these markets grow as anticipated, then demand for power management ICs will grow as well. If one or more of these markets were to grow very rapidly, then it could possibly strain supply and potentially push out lead times throughout the industry," he said.

With edge computing, computation and data storage is done closer to the devices where data is being gathered rather than a central location. This reduces latency and companies can reduce cost by having processing done locally and not in the cloud.

Ali said the "trend of increasing electric power, intelligence and connectivity in all industries will increase demand for PMICs steadily through the next decade."

PMIC shipments move upward



Smart phones, automobiles and portable electronics equipment will need more power management ICs over the next three years. *Source: IC Insights*



Creating the industrial connectors you need next

As the HARTING Technology Group celebrates its 75th birthday, it continues to focus on innovative industrial connectivity, delivering the products set to feature on your BoM in the year ahead

2020 marks 75 years of the HARTING Technology Group and the 40th anniversary of HARTING UK. During this time, the company has consistently delivered cutting edge products and technological developments across a range of industries, thanks to its robust, reliable and innovative solutions. As we enter a new decade, this pioneering, forward-thinking spirit remains a key aspect of the HARTING approach.

For example, HARTING's T1 Industrial recently won the award for *Passive and Electromechanical Product of the Year* at the Elektra Awards. Industry recognition for establishing this new standard highlights the immense potential of the new technology, which can supply both data and power across a single pair of wires in an IEC 63171-6 industrial interface for single pair Ethernet.

Facilitating tomorrow's IIoT

Up until now, industrial Ethernet has only been able to reach the control level before it needs to switch to BUS systems via gateways. SPE, via the T1, allows equipment to connect via end-

to-end IP-based communications right up into the field level. As a result, Ethernet interfaces can now be integrated onto simple sensors, cameras, reading/ID devices or similar equipment.

Experts have suggested that SPE will be one of the key technologies that significantly shapes the success of the industrial internet of things. The factory of the future will require high data streams and the industrial sector needs connectivity that adapts itself to ever-growing demands. This is most effectively achieved via standards that are developed and advanced through partnerships in an open ecosystem. The T1 Industrial brings Ethernet from the cloud to every sensor, thus enabling the IIoT.

Innovative aspects of the T1 Industrial include the space-saving and weight reduction benefits attained by the move to a single pair of wires. This means the compact T1 can be easily incorporated into smaller devices. Furthermore, by reducing the amount of copper wiring required, the T1 delivers weight

savings of 1.6kg for every 100m of cable used, along with cost savings.

There is immense potential in this new technology. As sensors, actuators, and network nodes can be networked and supplied with power via the T1, there are numerous applications in automation technology, robotics, machinery, and plant manufacturing, as well as in building automation and transportation markets.

Future-proofing Ethernet delivery

HARTING has also created a space-saving, future-proof Ethernet delivery solution to replace the traditional RJ45. The ix Industrial is a robust connector which is standardised to comply with IEC 61076-3-124. It boasts a 70 per cent smaller PCB jack, enabling manufacturers to use it in much smaller devices and a high current-carrying capacity that supports both existing and future Power over Ethernet applications.

Just as in the past 75 years, HARTING has once again

recognised the future requirements of industry and driven the development of innovative connectivity, this time with solution packages for the cloud and IIoT. As an enabler of IIoT, HARTING is transforming a technology trend into a real application solution.

To learn more about single pair Ethernet, download HARTING's free e-book, which explains the functionality of SPE and why it is perfect for IIoT and Industry 4.0.

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- Qualified to AEC-Q200 Grade 1 (–40°C to +125°C)

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Harsh environments

Rugged converters ready to hit the rails

Traco Power has announced a new series of 10W DC/DC converters in a one by one inch metal package, qualified for rugged industrial and railway applications and certified to EN 50155 and EN 61373 standards. THN 10WIR series converters offer ultra-wide 4:1 input ranges of nine to 36, 18 to 78 and 36 to 160V DC with single and dual outputs ranging from 3.3 to 24V DC.

Converters in the range are designed for high reliability in harsh environments, with efficiencies up to 90 per cent and a full load operating temperature range from -40 to 80°C without derating. Units also

boast resistance against electromagnetic interference, shock/vibration and thermal shock.

All models are safety approved to IEC/EN/UL 62368-1 with CB Report and EN 50155 certified for harsh environments, as well as being further qualified for fire behaviour of components per EN 45545-2.

Products are in stock and available through the Traco Power distribution network with manufacturing lead times of 12 to 14 weeks.

www.tracopower.us



Smart defence purchasers streamline energy costs

Saft has extended its Xcelion range with the Xcelion 56V-LEV battery, a more economical option for low-current, 48V continuous cycling applications, particularly in the defence industry.

The latest product offers a more streamlined design for applications that require continuous cycling and don't need the cranking power required of vehicle applications addressed by the Xcelion 6T. The product has potential for use in uninterruptible power supply applications for military, defence ground stations, electric mobility and back-up power storage.

President and CEO of Saft America and executive vice president of Saft's space and defence division, Annie Sennet, said: "Our customers requested this more streamlined, affordable option in our Xcelion line, and we are proud to deliver this excellent product in response. The Xcelion 56V-LEV battery retains Saft's usual high quality and high safety standards, which are critical for use in the defence industry—the safety of soldiers is paramount."

The Xcelion 56V-LEV uses abuse-tolerant Super-Phosphate Li-ion technology and features a battery management system, which provides information about the battery state of health, state of charge, and other functions.

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Electronics supply base consolidation is changing

More mergers and acquisitions are occurring because suppliers want to add products or technologies that they don't currently have to reach out to new customer segments

Last November, many electronics component buyers were troubled by the news that passives powerhouse Yageo would acquire Kemet, another leading manufacturer of resistors, capacitors and other components.

The planned acquisition, which is expected to close later in 2020, would be good news for Yageo because it would make the company a \$3 billion per year passives behemoth. However, it appears to be bad news for passive component buyers, who would have one less supplier to choose from which would mean less competition and potentially higher prices.

Some buyers fear it could also mean more component obsolescence because if consolidating companies have overlapping product lines,

one of the lines will likely be eliminated.

Buyers are concerned the Yageo-Kemet merger will cut down on parts availability because there could be less investment in new capacity by the consolidated company. They point out that while component manufacturers added capacity in 2016 it was not enough to meet demand in 2017 and 2018 which resulted in shortages of multilayer ceramic capacitors (MLCCs), chip resistors, power semiconductors and other discretes.

If investment in new capacity is not increased by Yageo and other component manufacturers, another round of shortages of capacitors, resistors and discretes is likely because component demand will increase over the next several years. They point out major trends such as

such as development of more Internet of Things devices, continued growth of wireless technologies going into vehicles, industrial equipment, autonomous electric and hybrid vehicles and strong growth of cloud computing will drive component demand to new heights.

Yageo said the acquisition will make would make the company a one-stop shop that provides buyers with a wider choice of polymer, tantalum, ceramic, film and electrolytic capacitors, chip resistors, sensors, actuators and other components. The combined company would be better able to partner with long-standing customers worldwide through its combined 42 manufacturing plants and 14 research and development centers.

Industry analysts say Yageo's planned acquisition of Kemet



Manufacturers added capacity in 2016 but it was not enough to meet demand in 2017 and 2018 which resulted in shortages

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is a recent example of the type of consolidation that has traditionally occurred in the electronics supply base over the years i.e. one supplier acquiring another to boost overall revenue, eliminate a competitor, and reduce cost by consolidating operations. Other examples in recent years include ON Semiconductor buying Fairchild, Infineon acquiring International Rectifier and Microchip buying Microsemi. Such acquisitions occurred frequently over the past 10 years.

However, in recent years, more mergers and acquisitions are occurring because one supplier wants to add products or technologies that it currently does not have and to branch out to customer segments it does not serve. "In the M&A activity we have seen recently, one company acquires another company although the two companies don't have product overlap," said Kevin Anderson, senior analyst, power semiconductors for researcher IHS Markit. "They do it for reasons of diversifying their customer base or their market space. A good example is Infineon is in the process of buying Cypress," he said. Cypress has a differentiated portfolio of microcontrollers as well as software and connectivity components while Infineon products include power semiconductors, sensors and security solutions. "Those two companies basically have zero overlap in the markets that they serve," said Anderson.

There have been many other mergers involving companies that don't have overlapping product lines. For instance, in 2015, the microprocessor market leader Intel acquired Altera, which builds field programmable gate arrays, semiconductors that Intel did not previously make. In 2019 there were seven major mergers and many of them involved companies that looked to expand their

product portfolios and reach new markets. For instance, graphics processor maker Nvidia bought Mellanox which makes adapters, switches and cables for high performance computers, while ON Semiconductor acquired Wi-Fi solutions supplier Quantenna Communications.

In some recent mergers and acquisitions, one company will buy a product division of another company, not the whole company. "A good example of that is NXP buying the Bluetooth radio business of Marvell," said Anderson. "We're seeing those kinds of transactions."

A sharper focus

Rob Lineback, senior market analyst for researcher IC Insights said some consolidation is due to companies wanting to "sharpen their focus on growth market applications, like the Internet of Things or machine-learning and artificial intelligence."

In some cases, the acquiring company starts a whole new company with the division that it acquired. One example is NXP selling its standard products group for \$2.75 billion to Chinese investment companies which then used the group to create Nexperia in the Netherlands. Nexperia now is selling more power transistors than it was when the operation was part of NXP, said Lineback.

In other cases, consolidation may occur because a semiconductor company just wants to get out the chip business. A recent example is Panasonic. Last November, Panasonic announced it was quitting the semiconductor business and selling its assets including the company's chip and product development units and its manufacturing facilities to Nuvoton Technology, a subsidiary of Winbond Electronics, based in Taiwan for \$250 million.

In fact, Panasonic has been divesting its semiconductor

business for years. In 2014, it sold a 51 per cent stake in its chip manufacturing assets including a 300mm fab and two 200mm fabs to TowerJazz. UTAC bought its assembly/test facilities. It also sold its diode and transistor business to Rohm Semiconductor last year.

Anderson says that consolidation has probably resulted in less competition in some product areas. However, he notes that 20 years ago there were probably 15 or more memory IC manufacturers and now there are five, but there's still healthy competition and the remain five have aggressively invested in new technology and capacity.

Less volatility

In fact, consolidation has had a positive impact on the semiconductor industry, according to some industry analysts. "If you look 20 years ago, the boom/bust cycles of semiconductors were more extreme than they are today. We still have peaks and valleys, but they aren't as severe," said Anderson. That is due in part to consolidation.

If there are 15 companies "chasing the same business versus five," it leads to oversupply. Those suppliers compete by overproducing and lowering prices to gain market share. However, when demand eases, revenue for chipmakers plummets. Chipmakers scale back on capital expenditures and when demand recovers, shortages result. Now with fewer suppliers "the market is more mature and there is more discipline" and less volatility in the industry, he said.

Less volatility is good for electronics purchasers because it can reduce the frequency of shortages and the duration, so buyers don't have to scramble on the open market to find parts and pay higher prices for them.



The risk of counterfeit parts is also reduced. During times of shortages, incidences of buyers purchasing counterfeit parts increases because counterfeiters will flood the market with bogus parts.

While the industry may be mature and there are now fewer suppliers of memory chips, power transistors and other components than there were 20 years ago, it does not mean that consolidation is over. In 2019, there were more than 30 semiconductor acquisition agreements with a combined value of \$31.7 billion, a 22 per cent increase from \$25.9 billion in 2018, according to IC Insights. In addition, seven of the acquisition agreements totaled \$1 billion or more.

The average annual value of semiconductor industry mergers between 2015 and 2019 was more than 4x the average from 2010-2014. Prior to 2015, total value of acquisitions in a year were less than \$17 billion. From 2015-2019, total value of acquisitions was more than \$25 billion annually and that trend may continue for several more years, IC Insights said.

Many of the agreements involved companies that are developing or producing chips for high-growth products involving machine-learning and artificial intelligence, autonomous vehicles, human recognition, computer vision, virtual/augmented reality, and high-speed wireless connections to the Internet of Things, said Lineback.

The value of the acquisitions in 2019 was the third highest in semiconductor industry history. The record was set in 2015 when chip companies spent \$100.7 billion on mergers and acquisitions. The second highest was \$59.8 billion in 2016, according to IC Insights.

No records expected

However, it is unlikely there will be a new record

amount of dollars spent for acquisitions over the next several years because “the low hanging fruit with M&A has been plucked and companies that remain tend to be in better shape and more difficult to pick up because another supplier would have to pay a pretty high premium. It’s hard to find real bargains out there,” said Lineback. Smaller acquisitions are likely such as Diodes Inc., a manufacturer of discretes, logic, and other chips, acquiring Lite-On Semiconductor of Taiwan for \$425 million. The company also manufactures discretes and analog semiconductors. The deal is expected to close April.

Buyers concerned that there are fewer choices in the supply base and less competition may take heart in fact that there are new semiconductor companies being formed and venture capitalists are looking to invest in new chip companies, according to industry analysts.

For instance, China is trying to “bootstrap their local semiconductor business. There are a bunch of startup companies, although they are small,” said Lineback.

More venture capitalists are also looking to invest in new semiconductor companies, according to Anderson. That is a change. “Over the last three or four years, you could not get a VC interested. But now VCs are looking at investing. The whole artificial intelligence thing is really driving a lot of that,” he said.

The Internet of Things is also driving venture capitalist interest. “There is a lot of VC development interest on the sensors side,” according to Anderson.

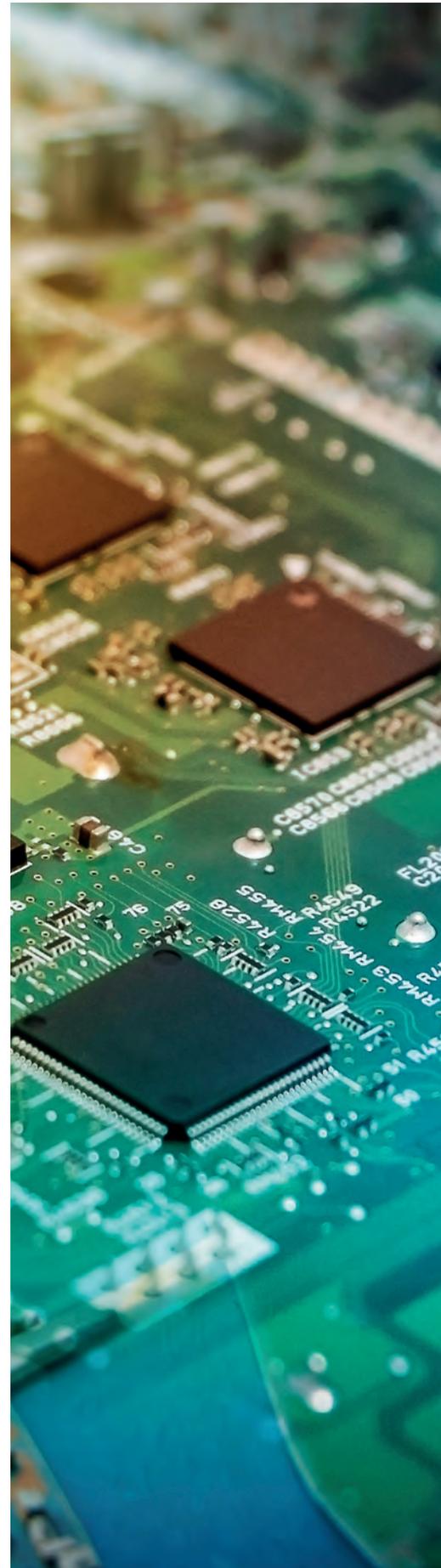
Assess the risk

Analysts say while mergers and acquisitions can pose challenges for buyers, further consolidation is inevitable and buyers need to assess

which of their suppliers are at risk of being acquired and determine what the impact would be. For instance, a purchaser that has placed a relatively large amount of business with a smaller supplier may be important to that supplier. The supplier may offer discounts and be more responsive to special requests and offer better customer service. If that supplier is acquired by a larger company, the buyer’s company may not receive discounts and responsiveness from the larger supplier.

Assessing the vulnerability of a supplier to acquisition may be especially important for buyers purchasing more mature parts that have a limited supply base. If a supplier for such parts is acquired by another, the acquiring company may decide to discontinue producing the older parts because demand for them is limited and margins are low.

A buyer may need to qualify new suppliers for older parts or do a lifetime buy, find substitute parts and work with the company’s engineers to change a product design to use more readily available components.



Why wireless IoT will change your BoM

If you're purchasing for IoT applications, then cellular connectivity solutions are probably on your shopping list. Rutronik's product sales manager wireless, Sarah Brucker, explains everything you need to know about today's go-to technologies

The internet of things is becoming the new normal with a staggering 1.3 billion devices already connected to wide area networks at the end of 2018. From smart metering through to logistics and maintenance, IoT devices are taking centre stage in virtually every domain of our lives. At the heart of this transformation lies connectivity, which is facilitated by cellular technology.

The needs of a typical IoT device can, however, be very different to those of a mobile phone. To meet these needs, two simplified versions of Long-Term Evolution, one of the most popular standards for mobile wireless communications, have been developed: NB-IoT or Narrowband IoT, sometimes referred to as NB1, and LTE-M1, also known as M1.

Simpler and designed to transmit smaller data packets, these standards have the advantage of using less power and occupy a smaller frequency spectrum. Here are four things purchasers should know about these standards, which are currently opening up unprecedented opportunities for IoT devices.

1. They run on existing LTE networks

One of the biggest advantages of LTE-M and NB-IoT is that, as they are derived from LTE standards, they run on the existing LTE network infrastructure. This gives access to data transmission that is both robust and secure and, as the LTE network expands, allows mobile devices to roam globally in the same

way a smartphone can. The infrastructure is provided by mobile network operators meaning that coverage in all regions is already excellent – and improving.

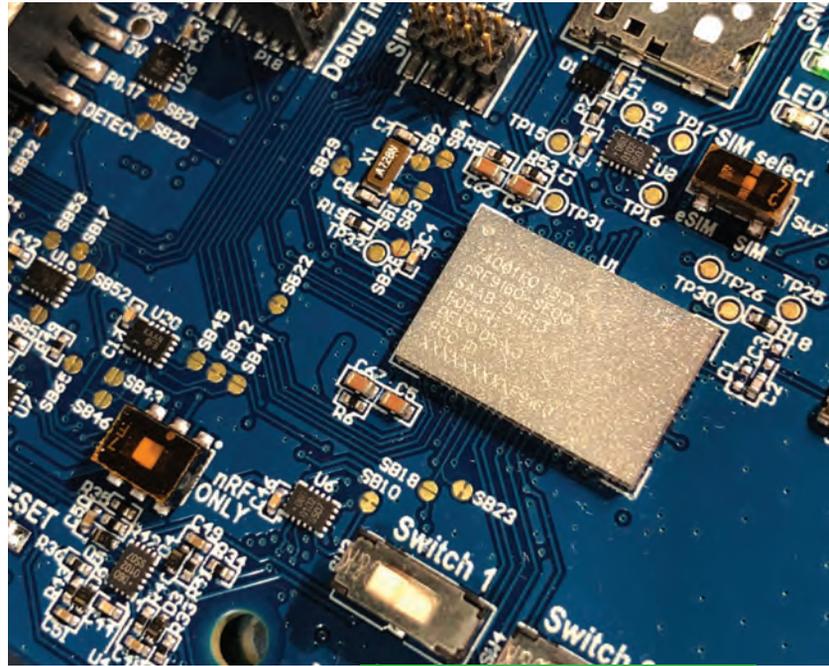
2. They allow cloud access from remote places

The IoT often requires small packets of data to be transmitted on an occasional basis. For example, it is not necessary for an ambient temperature sensor or a soil pH sensor to transmit frequently as the parameters being measured don't change that quickly. The challenge is that the sensing nodes are often placed in out-of-the-way places such as remote fields, inside building infrastructure such as air ducts, or within remotely-located cabinets. This is where NB1 and M1 come in.

The connectivity and range of sensing capabilities now allow engineers to imagine applications that would not have been possible before in areas including smart metering, infrastructure, agriculture, forestry, transport, logistics and maintenance. Utility companies can now receive metering information directly without the cost and inconvenience of meter readers while maintenance companies can monitor machines remotely and schedule predictive maintenance accordingly.

3. There is already a good choice of supporting technologies

Looking for technology to support NB1 and M1? Nordic Semiconductor has



Today's wireless standards allow cloud access from remote places

been involved in low-power wireless for some time. Its latest product, the nRF91 series, is a multi-mode system-in-package based on an ARM Cortex M33 microcontroller for NB-IoT and LTE-M. It searches for NB-IoT and/or LTE-M networks automatically and can switch easily between the two. ARM TrustZone and ARM CryptoCell provide security for storage while data transmission is encrypted and protected.

The SiP is available with assisted GPS and, even with this feature, is available in a tiny 10 by 16 by 1.2mm package. Its footprint is one-fifth of the volume of comparable NB-IoT and LTE-M modules coupled with a GNSS module, which makes this product ideal for space-constrained IoT applications. The capable M33 processor allows data to be processed locally at the



One of the biggest advantages of LTE-M and NB-IoT is that, as they are derived from LTE standards, they run on the existing LTE network infrastructure.

edge, keeping data traffic to a minimum and reducing energy consumption.

Nordic Semiconductor also provides the nRF91-SDK software development kit with a full suite of common stacks. To further simplify sourcing, the SiP is fully integrated with all necessary passive components included and allows for the connection of peripherals including LEDs, switches, relays and sensors.

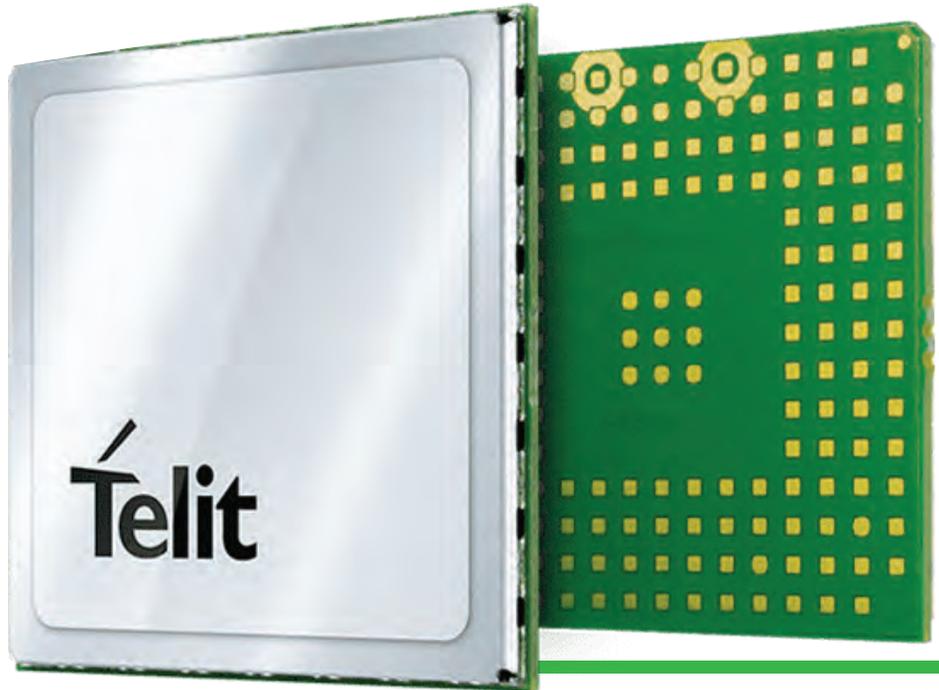
4. SIM cards are no longer needed

Until recently, it was a requirement to have a physical SIM card and SIM card holder to send or receive cellular data. ‘Embedded-SIM’ solutions including the new integrated universal integrated circuit card not only save PCB space and remove the need for a SIM card holder, they also make it unnecessary to swap SIM cards when changing providers as they can be controlled and updated remotely.

One supplier of these iUICC embeddedSIM solutions is Telit. Its simWISE 2G wireless modules cover both LTE-M and NB-IoT,

with one example being the ME910C1 combi-module, which covers both standards. Telit’s simWISE modules are complemented by an IoT cloud platform that allows development of fully customisable cloud solutions.

www.rutronik.com



Embedded-SIM solutions save PCB space and remove the need for a SIM card holder

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Harwin	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0 €	79%	50	1,500+	Y
Hirose Electric	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	6,100	N/A	0 €	99%	50	1,500+	Y
Hirose Electric Europe B.V.		0031-(0)2 655 7460	www.hirose.com/eu	EU	Y	50,000	N/A	0 €	N/A	N/A	4,190	Y
ITT Cannon	PEI Genesis	+44 8716060	www.peigenesis.com	EU	Y	N/A	£1.3m	10 €	N/A	N/A	85	Y
JAE Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,200	N/A	0 €	32%	50	1,500+	Y
Kycon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	99%	50	1,500+	Y
LEMO	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,900	N/A	0 €	65%	50	1,500+	Y
Molex	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	16,900	N/A	0 €	75%	50	1,500+	Y
Neutrik	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	86%	50	1,500+	Y
ODU		+49 8631 6156-0	www.odu.de	EU, USA, ASIA			N/A	0 €	N/A	50	1,650	
Phoenix Contact	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	12,000	N/A	0 €	99%	50	1,500+	Y
Switchcraft	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0 €	69%	50	1,500+	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	30,900	N/A	0 €	40%	50	1,500+	Y
OBSOLESCENCE / HARD TO FIND												
	Chip 1 Exchange	949-589-5400	www.chip1.com		Y	850,000	N/A	\$0	85%	20	150	
OPTO ELECTRONICS												
Avago Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	8,200	N/A	0 €	89%	50	1,500+	Y
Cree, Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	22,500	N/A	0 €	74%	50	1,500+	Y
Dialight	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	9,800	N/A	0 €	99%	50	1,500+	Y
Kingbright	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,100	N/A	0 €	100%	50	1,500+	Y
Lumileds	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €	99%	50	1,500+	Y
Newhaven Display	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	65%	50	1,500+	Y
Osram Opto Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,800	N/A	0 €	99%	50	1,500+	Y
VCC	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,000	N/A	0 €	92%	50	1,500+	Y
Vishay	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,100	N/A	0 €	99%	50	1,500+	Y
PASSIVES												
AVX	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	70,700	N/A	0 €	58.00%	50	1,500+	Y
Bourns	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	49,500	N/A	0 €	98%	50	1,500+	Y

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Location	Franchised Distributor	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Buffer Stock Facility
Coilcraft	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	10,400	N/A	0 €	98%	50	1,500+	Y
Cornell Dubilier	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	33,000	N/A	0 €	65.00%	50	1,500+	Y
EPCOS / TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	31,000	N/A	0 €	74%	50	1,500+	Y
Fair-Rite	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	94%	50	1,500+	Y
Kemet	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	135,800	N/A	0 €	93%	50	1,500+	Y
Kemet	RS Components	08457 201201	www.rs-components.com	EU	Y	N/A	£161m	0 €	N/A	50+	2,500	Y
KOA Speer	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	107,900	N/A	0 €	82%	50	1,500+	Y
Laird Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,800	N/A	0 €	50%	50	1,500+	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	67,300	N/A	0 €	99%	50	1,500+	Y
Nichicon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	21,600	N/A	0 €	47%	50	1,500+	Y
Ohmite	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	17,300	N/A	0 €	99%	50	1,500+	Y
Panasonic	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	67,900	N/A	0 €	69%	50	1,500+	Y
Taiyo Yuden	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	6,400	N/A	0 €	82%	50	1,500+	Y
TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	25,300	N/A	0 €	85%	50	1,500+	Y
TT Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	32,800	N/A	0 €	55%	50	1,500+	Y
United Chemi-Con (UCC)	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	13,900	N/A	0 €	99.00%	50	1,500+	Y
Vishay	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	119,800	N/A	0 €	76%	50	1,500+	Y
Würth Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,500	N/A	0 €	63%	50	1,500+	Y
Würth Elektronik	Würth Elektronik	+49 (0) 7942 945 0	www.we-online.com	EU	Y	N/A	N/A	0 €	100%	250	4,000	Y
Yageo	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	45,300	N/A	0 €	99.00%	50	1,500+	Y
POWER & BATTERIES												
Bel Power Solutions	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,400	N/A	0 €	94%	50	1,500+	Y
Cincon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,500	N/A	0 €	60%	50	1,500+	Y
Cosel	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	11,800	N/A	0 €	99%	50	1,500+	Y
CUI Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,900	N/A	0 €	100%	50	1,500+	Y
Mean Well	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,500	N/A	0 €	75%	50	1,500+	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,200	N/A	0 €	93%	50	1,500+	Y
RECOM	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	23,300	N/A	0 €	92%	50	1,500+	Y
Sanyo Electronic Industries Co., Ltd.	Sanyo Electronic Industries Co., Ltd.	+81 36699 8080	www.eta.co.jp	JP	N	1,000	€3000k	20 €	90%	10	100	Y
Schaffner	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	900	N/A	0 €	98%	50	1,500+	Y
SL Power	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,100	N/A	0 €	87%	50	1,500+	Y
TDK-Lambda	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,600	N/A	0 €	99%	50	1,500+	Y
TRACO Power	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,400	N/A	0 €	95%	50	1,500+	Y
SENSORS												
All Sensors	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,300	N/A	0 €	70%	50	1,500+	Y
ams	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	77%	50	1,500+	Y
Analog Devices Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	78%	50	1,500+	Y
Bosch	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	94%	50	1,500+	Y
Freescale Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	66%	50	1,500+	Y
Honeywell	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	15,500	N/A	0 €	80%	50	1,500+	Y
Maxim Integrated	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	900	N/A	0 €		50	1,500+	Y
Melexis	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €		50	1,500+	Y
Omron	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,700	N/A	0 €		50	1,500+	Y
Sensirion	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €		50	1,500+	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €		50	1,500+	Y
SWITCHES & KEYBOARDS												
ALPS	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	70%	50	1,500+	Y
Apem	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	96%	50	1,500+	Y

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Location	Franchised Distributor	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Buffer Stock Facility
C&K Components	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,500	N/A	0 €	84%	50	1,500+	Y
Carling Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0 €	87%	50	1,500+	Y
CHERRY	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	200	N/A	0 €	77%	50	1,500+	Y
CHERRY	RS Components	08457 201201	www.rs-components.com	EU	Y	600	N/A	0 €	N/A	50+	3,500+	Y
E-Switch	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	94%	50	1,500+	Y
Grayhill	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	84%	50	1,500+	Y
Honeywell	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	98%	50	1,500+	Y
NKK Switches	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €	94%	50	1,500+	Y
Omron	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	900	N/A	0 €	68%	50	1,500+	Y
Rubbertech 2000	Rubbertech 2000	+44 1594 826019	www.rubbertech2000.co.uk	EU	N/A	N/A	£40k	100 €	N/A	N/A	25	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	98%	50	1,500+	Y
THERMAL MANAGEMENT												
ADDA	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	800	N/A	0 €	59%	50	1,500+	Y
Delta Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	28%	50	1,500+	Y
ebm-papst	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0 €	99%	50	1,500+	Y
Sanyo Denki	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,900	N/A	0 €		50	1,500+	Y
WIRELESS												
Anaren	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	86%	50	1,500+	Y
B&B Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	87%	50	1,500+	Y
Bluegiga Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	93%	50	1,500+	Y
Digi International	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	200	N/A	0 €	92%	50	1,500+	Y
Laird Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	76%	50	1,500+	Y
Linx Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	99%	50	1,500+	Y
Microchip	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	85%	50	1,500+	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	100%	50	1,500+	Y
Panasonic	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	91%	50	1,500+	Y
Redpine Signals	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	94%	50	1,500+	Y
RF Digital	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	100%	50	1,500+	Y
Texas Instruments	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	75%	50	1,500+	Y
Wi2Wi	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	36%	50	1,500+	Y

PCB Buyers' Guide

Manufacturer	Telephone	Website	Service Provided (i.e. Boiler Manufacture &/or Repair)	Location	Approvals	Volume - Small, Medium, Large	Double-sided	Multi-layer 4-10/10-20-30	Metal PCBs	Flexi / Flexi-Rigid	Obsolescence Solutions	Modifications	Prototyping
Elvia PCB Group	+33 233 765 200	www.gepcb.com	M/B	France, Tunisia, China	AS9100, PRI-NADCAP, ISO-TS16949, ESA, UL, ISO9001, ISO14001	S/M/L	Y	1-30	Y	F, F/R	Y	Y	Y
Graphic Plc	00441363 774874	www.graphic.plc.uk	M	UK/China	AS9100, NADCAP, ISO 9001, AISI14001, OHSAS 18001, MIL 31032, MIL 55110, MIL 50884	S/M/L	N	4-10	Y	Y	N	Y	Y

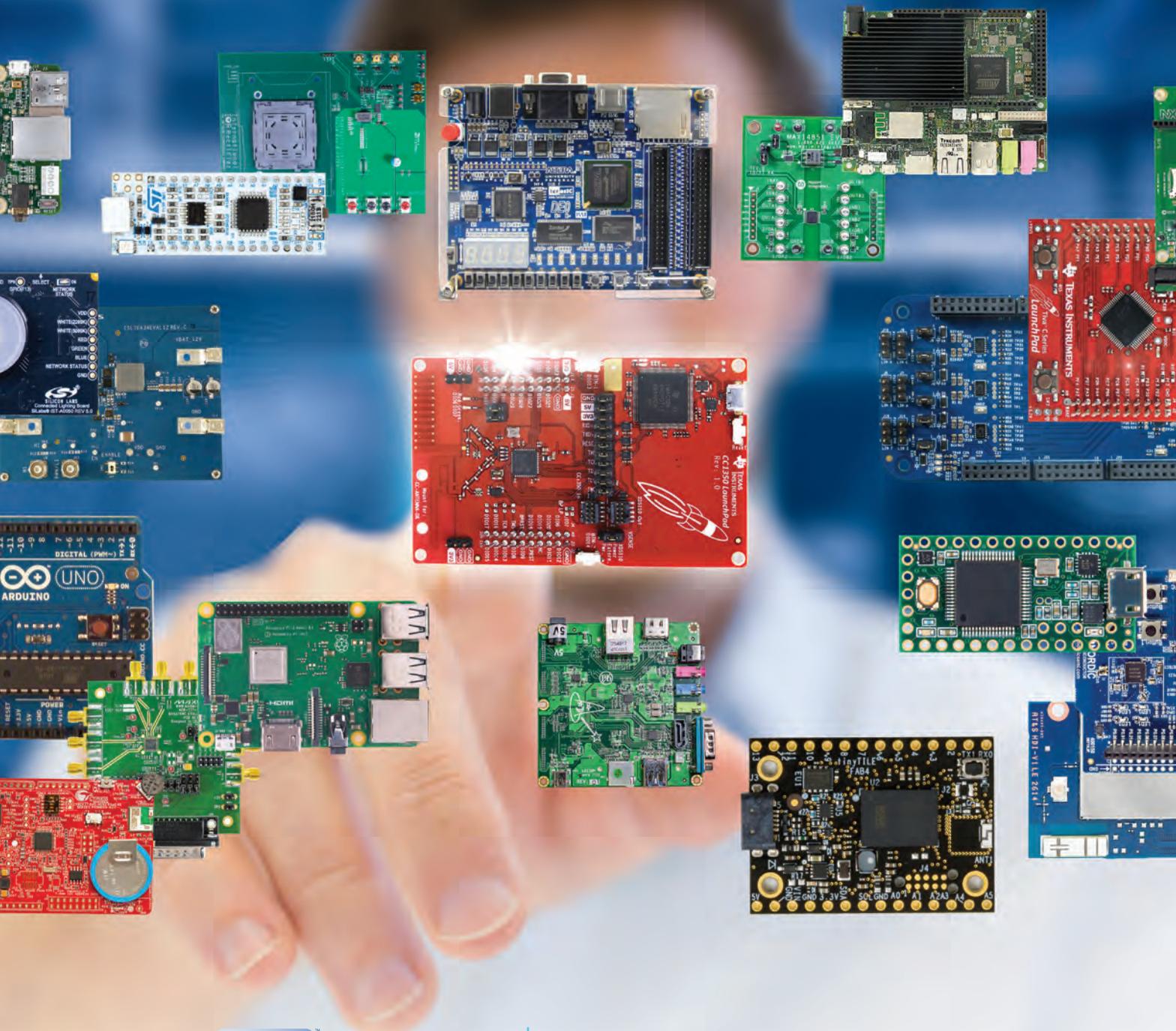
Contract Manufacturers Buyers' Guide

Manufacturer	Telephone	Website	Turnover	Location	Approvals	Employees	Number of Surface Mount Lines	BGA Capacity	Lead Free Manufacturer	Prototyping	Design Capability	Full Turnkey	Cables and Harnessing
AWS Electronics Group	+44 (0)1782 753200	www.awselectronicsgroup.com	£40m	UK & Slovakia	AS9100, ISO9001, 13485, 14001, TS16949, IPC-A-610 Class 3, NADCAP	430	11	Y	Y	Y	Y	Y	Y

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