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On the cover – May/June 2023

Investigating connectors for harsh environments pg 20

Editor's word



Battle for planet purchasing begins

In the May issue of Electronics Sourcing North America, the bulk of its page count has been dedicated to the Top 50 Americas Authorized Distributors Report 2023, authored by the ECIA's chief analyst, Dale Ford. Throughout the feature, executives comment on a wide range of topics from inventory management and ESG to energy reliability. Reading through the article one word appears more than most: data. Likewise, John Denslinger's article is dedicated exclusively to artificial intelligence.

So it begins, the ultimate clash for purchasing supremacy is about to be fought between human and artificial intelligence. I'm close to this for a number of reasons. Firstly, alarm bells are ringing left, right and centre suggesting services such as ChatGPT are on the verge of obsoleting my role as a writer and editor. Secondly, as a software developer I'm looking to see how AI could benefit the applications I design.

Thirdly, and most importantly for my Electronics Sourcing audience, I've thought for a long time that the end-to-end lengths of some component supply chains are so long and tortuous they are breaching the capabilities of human management.

The electronics industry continues along its cyclical waveform of over and under supply. What matters is the frequency and amplitude of the waveform. As AI starts reaching into the supply chain I expect to see a steady decrease in both measures leading, ultimately, to a straight line sometime over the next 50-years.

Jon Bannett

Contact

FDITORIAI Managing Editor: Jon Barrett jonb@electronics-sourcing.co.uk Contributing Editor: Amy Barker

amyb@electronics-sourcing.co.uk

ADVERTISING Director of Sales: Emma Evernden sinctor of Jack Control of State Control of State Stat william.leary@mmgpublishing.co.uk

PRODUCTION & DESIGN Production & Design Manager: Josh Hilton josh.hilton@electronics-sourcing.co.uk

Junior Creative Artworker: Tom Claydon-Smith tom.claydon-smith@electronics-sourcing.co.uk CIRCULATION

Data and Software Analyst: Thomas Smart thomas.smart@electronics-sourcing.co.uk Circulation Account Manager: Liz Poole liz.poole@electronics-sourcing.co.uk

PURI ISHER

Mark Leary mark.leary@electronics-sourcing.co.uk Director of Operations: Denise Pattenden denise.pattenden@mmgpublishing.co.uk

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NEWS



Unique video and storage add-ons

FLEXIBLE ELECTRONICS



Benefits of additive manufacturing



CHARGING



Powering the e-bike revolution



MEDICAL



Benefits of conducting virtual clinical trials

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Supporting Lithuania

Wurth Elektronik Lietuva has received its official registered company status. Thus, the seven Lithuanian employees of Würth Elektronik form another subsidiary of the manufacturer of electronic and electromechanical components. MD, Zenonas Vaitonis, has represented Würth Elektronik in Lithuania and Latvia since 2017.

The region boasts manufacturers in areas including wireless technology, fleet management systems, power electronics for lasers and building automation. Among other things, Würth Elektronik is known for EMC expertise and products for interference suppression. As practical advice is core to the Baltic branch, Wurth Elektronik Lietuva attaches importance to its partnership with two certified EMC laboratories and several smaller laboratories.

Zenonas Vaitonis said: "We are pleased to now be able to act as our own company in the globally successful Würth Elektronik eiSos Group. There is still room for more colleagues in our beautiful office—the way our growth is developing, I am optimistic that we will soon be able to welcome others here as well."

www.we-online.com

Unique video and storage add-ons

Avnet brings a new DisplayPort and eMMC add-on module which provides features of high-definition video output and rugged, bootable storage to the ZUBoard 1CG.

The Avnet ZUBoard 1CG features the AMD-Xilinx Zynq UltraScale+ ZU1CG device-described as the smallest, lowest power and most cost-optimized member of the Zynq UltraScale+ family. It suits miniaturized, compute-intensive edge applications in industrial and healthcare systems, embedded vision cameras, AV-over-IP 4k and 8k-ready streaming, hand-held test equipment, consumer and medical applications.

Avnet's VP Advanced Applications Group, Jim Beneke, said: "This prototyping module for the ZUBoard 1CG is specially created for designers who are focusing on embedded vision, AI and edge computing applications. This new add-on module will enable cost-effective, highperformance design for applications requiring both high resolution video output and rugged permanent storage-while making the board even easier to use."

The module is available today in the Americas, EMEA, APAC and Japan for \$59 (USD).

www.avnet.com

Mesh network modules now in stock

NeoCortec has signed a new global distribution agreement with Poland-based distributor Transfer Multisort Elektronik which operates from Lodz, Poland with a 18,800m² warehouse and logistics centre.

NeoCortec's business development manager, Cato Skibsted Fagermo, said: "We believe that TME is an ideal new distribution partner for us and they will do well promoting our NeoMesh wireless mesh network modules together with Neocortec's protocol stack with their global customer base."

TME product manager, Pawel Sioda, added: "Neocortec's great products are a perfect addition to our linecard and we are very much looking forward to establishing a very successful business relationship with NeoCortec in the years to come."

NeoCortec's NeoMesh wireless network modules are based on a decentralized mesh of self-governing nodes which are not dependent on a network coordinator. A virtually limitless number of nodes can be added to an existing network. This means that even the largest buildings can be covered with only one network and without any additional infrastructure.

www.neocortec.com

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In Brief

On time

The AD-SYNCHRONA14-EBZ is a self-contained device for evaluation and prototyping applications requiring an accurate frequency and phase-controlled source clock. It is designed around the Analog Devices AD9545 and HMC7044 and simplifies clock distribution and multichannel synchronization in complex systems. The device is intended to be used by trained professionals in a laboratory environment. farnell.com

Collaborate on

electromobility Infineon Technologies and Delta Electronics are expanding their cooperation from industrial to automotive applications. The agreement covers a range of components such as high-voltage and low-voltage discretes and modules plus microcontrollers for EV drivetrain applications such as traction inverters, DC-DC converters and on-board chargers. www.infineon.com

Easy access product data

Stego has relaunched its website, offering user-friendly navigation, a modern design and new features making it easier for customers to satisfy their information and technical data requirements Marketing manager, Daniela Mohr, said: "Our goal was to create a simple and intuitive online platform that gives our customers easy access to our products and their certificates www.stego.de

Find the right fuse

Schurter's fuse selection guide is designed to help engineers feel confident in their ability to find the right fuse to best fit their application requirements. The guide also includes a fuse accessories guide, which identifies the fuse holders designed for use with each fuse series, making the selection process even simpler. schurter.com

Instant access to fast data interconnect

Amphenol CS connectors enable data transfer rates up to 985MB/s with the SD Express and microSD Express card sockets. They support the PCIe Gen 3 interface, plus the NVMe application protocol. Features include: compliance with SD7.0 specifications; pin recognition that ensures better read function when inserting the memory card; and improved protection.

Their target applications include consumer electronics such as notebook PCs, UAVs/drones, game consoles, digital cameras, smartphones, pads and servers, plus automotive applications such as infotainment or recorders.

The SD Express version is a push-push connector with a gold flash contact surface. While the microSD Express is available as a push-pull variant and has gold-plated connectors for corrosion resistance and optimal conduction of the electrical signal.

Both types are backward compatible with the previous legacy version for (micro)SD cards. They also score with a long service life of 5,000 mating cycles. The products conform to RoHS, are lead-free and are manufactured with halogen-free resin.

www.rutronik24.com

One-chip solution for HV USB-C

Mouser Electronics is now stocking Infineon Technologies' EZ-PD PMG1-B1 USB Type-C microcontrollers which provide an integrated, onechip solution for high-voltage USB-C applications requiring a flexible and secure MCU and a reduced bill-of-materials, like power tools, small appliances, E-bikes and more.

The microcontrollers are integrated, singleport USB-C Power Delivery solutions. These high-voltage, programmable USB power delivery systems feature an integrated Arm Cortex (-M0/M0+) processor, 128kB flash, 16kB RAM and 32kB ROM, plus analog and digital peripherals.

The device also features integrated buckboost controllers which offer integrated gate drivers for VBUS NFET on the consumer path for sink applications and hardwarecontrolled protection features on the VBUS.

Support is provided for a wide input voltage range (4 to 24V with 40V tolerance) with programmable switching frequencies (150kHz to 600kHz) in an integrated USB power device solution. The device also features an integrated hardware crypto engine with vector unit. Temperature range is -40 to 105°C.

www.mouser.com

Extended connectivity portfolio

Renesas is acquiring Panthronics to enrich its portfolio of connectivity technology, extending its reach into high-demand near-field communication applications in fintech, IoT, asset tracking, wireless charging and automotive environment.

Renesas' president and CEO, Hidetoshi Shibata, said: "Connectivity has been a priority area of ours, expanding and differentiating the realm of solutions we offer. We see tremendous opportunities for Panthronics' NFC connectivity technology to benefit our customers in growing areas that span across fintech, IoT and automotive spheres."

Headquartered in Graz, Austria, Panthronics has been offering NFC chipsets and software designed to be easy to apply, innovative, small-in-size and highly efficient for payment, IoT and NFC wireless charging. Renesas and Panthronics have been addressing rising demand of NFC as partners since 2018. Acquiring Panthronics' NFC technology will provide Renesas with in-house capability to capture growing and emerging market opportunities for NFC.

www.renesas.com

Simplify your BOM process with Mouser's intelligent FORTE tool

As your design heads towards completion and becomes production-ready, the chore of creating the bill-ofmaterials (BOM) takes hold. A crucial part of any new product development and the key to unlocking future profits, creating the BOM demands diligence. BOMs may potentially include thousands of components, each with individual part numbers, challenging purchasing professionals with an arduous task of obtaining pricing and availability information.

Churning through each component becomes a repetitive task beset with part number and code challenges. For example, parts flagged as no longer suitable for new designs require purchasing professionals to go back to engineering to check alternative part numbers. Even simple part code errors introduced when creating the BOM can take ages to rectify.

So what can you do? Save time, improve order accuracy and increase purchasing confidence with Mouser Electronics' FORTE intelligent BOM tool.

FORTE, the intelligent BOM tool from Mouser FORTE removes the

uncertainty of specifying and purchasing semiconductors and electronic components. With its time-saving import features, you can upload your BOM from a spreadsheet or CSV file or cut and paste it from another document. A clean, easy-to-understand interface enables adding, amending and deleting parts and checking price breaks for multiple quantities without committing to changing the BOM.

FORTE's intelligent part number capabilities can analyse partial part numbers and part descriptions to check for correct part numbers and suggest alternative components. FORTE accesses Mouser's online database of millions of orderable part numbers to recommend alternatives that reduce product lifecycle risks.

FORTE is free to use, and no subscription is required.

Getting started with FORTE It couldn't be easier to start experiencing a more

straightforward way to research and purchase electronic components. To change your BOM experience for the better and discover FORTE's intelligent and time-saving features, you just need to log into your My Mouser account. Once logged in, select whether you wish to upload a spreadsheet document in a Microsoft Excel or CSV file format or paste in part numbers or quantities as illustrated in Figure 1. To start the import process, simply assign each column of your import file to the nominated BOM heading (part number, quantity, etc.). FORTE then processes your BOM file and displays instances where a product match hasn't been found, notifies minimum order quantities, and highlights products with lead times and products at the end of their production life (Figure 2).

Take control of your BOM and start using Mouser's intelligent and comprehensive BOM tool today.

www.mouser.co.uk/bomtool/





Mark Patrick Technical Marketing Manager EMEA Marketing

As Mouser Electronics' Technical Marketing Manager for EMEA, Mark Patrick is responsible for the creation and circulation of technical content within the region – content that is key to Mouser's strategy to support, inform and inspire its engineering audience.

Prior to leading the Technical Marketing team, Patrick was part of the EMEA Supplier Marketing team and played a vital role in establishing and developing relationships with key manufacturing partners.

In addition to a variety of technical and marketing positions, Patrick's previous roles include eight years at Texas Instruments in Applications Support and Technical Sales.

A "hands-on" engineer at heart, with a passion for vintage synthesizers and motorcycles, he thinks nothing of carrying out repairs on either. Patrick holds a first class Honours Degree in Electronics Engineering from Coventry University.

May/June 2023 07

Environmental benefits of additive manufacturing

The VTT Technical Research Centre of Finland introduces a study highlighting how the environmental impact of flexible electronics can be reduced by almost 90 per cent

The VTT Technical Research Centre of Finland has announced the results of a study investigating how changing the manufacturing of electronics can improve their environmental impact. For example, one of the project's most significant findings showed that environmental impact could be reduced by 86 per cent when additive printing methods are used to create flexible electronic components, as reported in detail by LUT University.

Senior scientist and senior project manager at VTT, Liisa Hakola, said: "Traditionally, metal electronics parts are etched out of copper sheets in a process called PCB etching. The process removes unwanted copper from a printed circuit board, so only the required circuit remains while the rest of the sheet isn't used.

"We found that flexible metal electronics parts can instead be printed onto bio-based substrates, like paper or bioplastic. The process requires less energy and avoids the use of harmful chemicals while drastically reducing material waste and increasing the use of renewable materials. This change in the manufacturing process is the single largest factor in potentially reducing the climate impact of flexible electronics."

In printed electronics, there are additional challenges that still need to be resolved. Silver has a high environmental impact and is commonly used for printed electronics. The project found that silver can be replaced with more abundant and less valuable alternatives, such as copper or carbon-based materials. This provides further reduction to the environmental footprint of flexible electronics. In addition, end-of-life management and longevity of product usability, (better durability and decreased energy consumption) are also key factors in creating more sustainable electronics.

The flexible electronics market is expected to grow to \$45.88 billion by 2026. By 2030, global electronic waste will reach 74 billion kg, with only 20 per cent collected or recycled properly. The electronics industry is currently facing major challenges with the availability of crucial materials combined with increasing pressure to cut its environmental footprint and move toward circularity.

In March 2022, the European Commission published its Sustainable Products Initiative, which aims to ensure that all products placed on the EU market become more sustainable. Thereby, the initiative also includes electronics, and so manufacturers are met with increasing pressure to meet new sustainability requirements in the years to come.

Research Team Leader at VTT, Maria Smolander, added: "At VTT, our goal is to set a new standard for sustainability in the electronics industry and offer solutions that increase circularity at every stage of the electronics life cycle. Implementing these new manufacturing methods on a mass scale is a challenge that the industry will inevitably need to tackle in the coming decade in order to keep up with increasingly strict regulations and demands from consumers."





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Innovations in circuit protection

TTI's director of sales and engineering, Pat Denton, discusses some new circuit protection technologies that have evolved over recent years

Metal oxide varistors (MOVs) are a ceramic protection device that have existed for years. Gas discharge tubes (GDTs) have also been around for a while. One MOV drawback is wear, as the device is constantly biased in the circuit. Design innovations have significantly miniaturized GDTs in low-profile packages, letting engineers marry the GDT and MOV into one device. The GDT isolates the MOV from circuit bias, extending the MOV's life and making the overall end product longer lasting.

Extremely low capacitance

diodes: Semiconductor devices inherently exhibit capacitance which can be detrimental to high-speed data signals. As data lines moved from dial-up modems to much faster protocols, protection diodes were initially ignored because their relatively high capacitance degraded signal integrity. Advances in semiconductor chip design let manufacturers shrink the chips or die while maintaining surge capability, which lowered the capacitance. Additionally, manufacturers found if they put two die in series in the same package, capacitance would effectively be halved. Combining the two techniques let designers lower capacitance of diodes and diode array to acceptable levels for high-speed data line protection.

High-speed Mosfet-based

protection devices: While Mosfets are not typically used for circuit protection, silicon design engineers have discovered ways to do just that. Modern day ICs with millions of tiny internal circuits are extremely susceptible to variances in voltage levels which can damage the device. New devices based on Mosfet technology operate in nanoseconds and redirect any over-voltage or overcurrent events away from the IC. Additionally, the turn-on window of the devices is much more precise than other technologies, affording superior protection of sensitive ICs.

eFuses: Wire-in-air fuses have been around since the 1800s. With advances in design and production techniques, fuses are still a staple of protection in electronic design. Unlike conventional fuses, the silicon-based eFuse IC has a highspeed current interruption function that turns the circuit off when excessive current flows. In addition, the eFuse is resettable and is not destroyed by a single overcurrent event. It can also incorporate various protection functions such as overvoltage protection.

High-speed fuses and electric

vehicle fuses: Because these fuses protect power semiconductors,

they are sometimes referred to as semiconductor fuses. Highspeed fuses provide protection for semiconductor devices such as diodes, SCRs and IGBTs as well as providing protection in harsh DC traction applications. High-speed fuses are available as high as 4,000Vdc and 10,000A. Highspeed fuses don't have intentional time-delay features that other fuses may exhibit. Typical equipment using power semiconductor devices includes inverters, rectifiers, electric vehicle battery management systems, locomotive traction drives, industrial motor drives, battery chargers and more. Electric vehicle high-speed fuses can provide circuit protection solutions for battery and drive inverter protection as well as DC charging and shortcircuit back-up protection.

tti.com



SPONSORED BY **BULLETON** More power for electromobility

mproving the monitoring and control of indoor air quality, where the most relevant contributor is carbon dioxide (CO2), is central to reducing environmental impacts, safeguarding occupants' health and wellbeing, and meeting legislative guidance. To be both practical and effective, technological solutions must not significantly increase operational expenses, or add too greatly to the building's carbon footprint.

Infineon's XENSIV[™] PAS CO2 sensor module combined with EBV's evaluation shield offers a simple and cost-efficient way of incorporating highly accurate and reliable CO2 monitoring into your platform of choice.

Benefits of Infineon's XENSIV[™] PAS CO2 sensing

Infineon's XENSIV™ uses photo-acoustic spectroscopy (PAS), which provides a streamlined and energy efficient way for accurately determining air quality. This sensing technique uses infrared (IR) light that is 'tuned' to measure a specific airborne gas compound. Excitation generated by short flashes of IR light results in a sudden expansion of the target gas. The sound that this expansion causes is then picked up by a high-performance MEMS microphone, enabling the concentration of the target gas to be quantified.

The PAS approach used by the Infineon XENSIV™ possesses

several key benefits over other forms of CO2 sensor:

- Greater compactness and more attractive pricing than gas sensing devices using non-dispersive infrared sensor (NDIR) technology.
- Rapid responsiveness and better accuracy than electrochemical (EC) and metal oxide (MOX) gas sensors.
- Not prone to drift over time, so additional calibration work is not necessary.

The Infineon XENSIV™ PAS CO2 sensor module is supplied in a compact surface-mount unit. It exhibits strong CO2 measurement accuracy (±3%) and has a measurement range of 0ppm to 10,000ppm CO2 concentrations. Measuring just 14mm x 13.8mm x 7.5mm, it is the world's smallest PAS sensor module, which gives it a huge advantage in terms of system integration.

Ease of integration

The EBV supporting evaluation shield makes it easy for customers to incorporate the Infineon XENSIV[™] into their air quality monitoring solutions. To further enhance measurement accuracy, the CO2 sensor is accompanied by a pressure and a temperature sensor (also provided by Infineon). A step-up DC/DC converter allows 12V (needed for the IR emitter) and 3.3V (for the rest of the circuitry) supply. UART, I2C and PWM communication interfaces are all included. The

highly portable library (coming from Infineon) makes it compatible with a wide variety of different microcontroller/ microprocessor platforms. Numerous wireless connectivity protocols can be selected from Wi-Fi through to cellular IoT (CAT-M and NB-IoT).

This shield can be used either as a standalone evaluation unit or attached to an Arduino for conducting evaluation work on the customer's microcontroller/ microprocessor platform of choice. Alternatively, the break-away board can be employed for integration with other hardware.

Connectivity options

Access to the Avnet IoTConnect[™] cloud platform enables customers to go beyond closed-loop implementation and apply cloud connectivity services to their CO2 measurement strategy. This allows management and analysis of acquired data, so that underlying trends can be identified and strategic changes made. Detailed dashboards on the CO2 levels across all the buildings within an organisation are straightforward to construct, and these can be referred to by any relevant stakeholder.

Samples of the EBV-IoT - Infineon XENSIV™ PAS CO2 sensor evaluation shield are now available. For more information, visit: www.ebv.com

UROS MALI, DIRECTOR SEGMENT SMART SENSING & CONNECTIVITY, EBV ELEKTRONIK

Is older technology still needed?

Central Semiconductor's director of marketing and sales operations, Tom Donofrio, explains distribution can be a vital resource to extend older technology component lifecycles

The term 'older technology' is often associated with obsolete devices baring less than desirable specification for use in applications no longer appropriate for modern designs. Of course, this is not always true. While newer technologies are successfully replacing workhorse devices, the benefits of the older, standard products are still relevant. Case in point: silicon. New designs are now using wide bandgap (WBG) devices to perform the same function that silicon devices have for years. Even with an aggressive bill-of-materials, WBG products have become suitable replacements as pricing moves closer to parity.

So, where does the older technology still fit? These devices primarily find themselves sustaining existing products to prevent costly redesigns or for ongoing repairs of still-valuable electronics. However, considering the increasing move to WBG devices, the ability or desire for manufacturers to continue supporting older lines has moved to a diminishing support role. This pivot has increased the cost of maintaining older device production, which can reduce the consistency of specifications.

Countless end product manufacturers still require previous generation devices for their designs. As older components grow increasingly difficult to source, consider the following strategies to maintain the required supply of diminishing source devices:

• If possible, arrange a long-term production

program with a manufacturer. Often, this can be arranged through a preferred distributor

- If possible, secure a bond inventory with a distributor to ensure long-term supply
- Consolidate required long-term volume to one or two manufacturers to incentivize them to continue to support the end products
- Share forecasts to help suppliers plan these devices properly and ensure adequate supply
- Ask the current supplier for a product roadmap and life cycle report

A paramount

recommendation is plan for the future. In instances where manufacturers must discontinue an older technology device, end product designers and purchasers must be prepared to migrate. To avoid holdups or line down situations it is essential to work closely with component manufacturers. Ask them for their newest releases and roadmaps.

With a better understanding of device lifecycles across the BoM, discover when replacements will be available for evaluation and, if necessary, qualification. In some cases, these processes can take months. Making these inquiries seems obvious but design teams can neglect to ask these questions up front. Then, sustaining the existing end product line is in jeopardy because of the apparent 'sudden discontinuation' of a required device, while

the replacement is months away. Avoid shortages by communicating with the component manufacturer and securing required stock until the replacement is available.

Distribution works mainly off existing item numbers with price and delivery. If a quote is required and the part number is not showing, the initial reaction is no bid. As components become more challenging to source, some distributors have added diminishing source teams. Their job is to find suppliers known for extending life cycles or resurrecting older technology products-often a challenging and timeconsuming process.

The immense gratitude I have experienced from customers when bailed out of line-down situations demonstrates the power in maintaining older technology and successfully finding devices. Even if a source no longer exists, customers appreciate the above and beyond effort by the distributor and suppliers.

Distribution can be a vital resource to extend older technology component lifecycles and, when required, help source newer technology replacements increasingly found in mainstream designs. To ensure a constant flow of end products and avoid redesigns, seek out distributors and suppliers maintaining older technology device lines and ensure regular communication about requirements.

When an essential device is finally discontinued and a redesign is required, consider pursuing wide bandgap technology. The



Central Semiconductor's director of marketing and sales operations, **Tom Donofrio**

cost to manufacture WBG technologies has become more competitive as pricing moves toward commodity, making it an appealing path. Ultimately, Moore's Law holds true—at least in the tenant where technology improves, while costs reduce.

www.centralsemi.com

Distribution can be a vital resource to extend older technology component lifecycles



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Powering the e-bike revolution

Spelsberg UK's MD, Chris Lloyd, argues that a lack of charging points shouldn't be a factor that puts the brakes on e-bike take up

Rapid increase in the popularity of e-bikes is a sign of the benefit for their users. Employers and venues welcoming e-bike riders can also capitalise, not least through a contribution to their sustainability commitments. This is a key factor behind support for electric bikes, and now that easy charging infrastructure is available, the barriers to optimal e-bike take up are being removed.

Using the United Kingdom as an example, this year, 165,000 e-bikes are likely to be sold in the UK and that figure is expected to rise fast. With a forecasted growth rate of over 10.5 per cent, the UK e-bike market value in 2027 is set to reach nearly £400m. While the Covid lockdown saw a stimulus in exercise and cycling take up, the Department for Transport's (DfT) figures says the general increase in cycling is continuing.

Multiple factors are driving the increase. Fuel costs have risen and with 71 per cent of all UK car journeys under five miles, cycling is a viable alternative to save significant cost. While riding a bike can be an extremely enjoyable way to travel, electric power can enhance this further. E-bikes delivering from 250W and upwards can enable speeds far in excess of 20mph, making cycling inherently easier, especially up hill. There's also rider choice over how much assisted power to draw on, meaning that e-bikes can also provide vital exercise.

The UK government is actively encouraging cycling and e-bike use in particular to reduce emissions and contribute to net zero, as well as lowering congestion and improving public health. This ambition has been met with a £2Bn





Charging

Coilcraft

funding package, including initiatives such as the DfT's national e-cycle programme, launched this year as a pilot scheme to provide short and long-term loans of electric bikes. Plans like these have also been deployed regionally, such as Islington's 500 e-bikes, half a million pounds investment in Bristol, and more than a million pounds spent by the Welsh government.

The private sector too has good incentive to encourage cycling and e-bikes as a viable commuting option. Firstly, reducing car journeys and CO2e footprint contributes to a business' own sustainability agenda, including employee wellbeing.

Enabling this transition is also a matter of infrastructure. Just like electric cars, e-bikes require charging and a battery charge can take the rider between 25 and 100 miles, depending on its capacity and how it's used. Charging points need to be in place, whether that's places of work, municipal areas or locations such as shops, gyms, hotels and restaurants to optimise e-bike take up.

Fortunately, the infrastructure required for e-bike charging is relatively low cost to install, easy/ universal to use and requires just a relatively small footprint. Spelsberg's e-bike charging station comes with a choice of all the major charging systems, including four charging points and with cables provided so riders don't have to carry their own. Including a safety switchoff function and high-level protection, each station is encased in a durable enclosure that prevents ingress from dust and water.

The transition to e-bikes sounds encouraging, but at outset, some building owners or facilities managers don't know where to begin regarding establishing a supply, and where and how to install it. While in many respects the process is similar to providing electric car charging points, Spelsberg's engineering team takes a building manager through each step in sequence, providing assistance from planning through to installation and onward management. These insights have also proved valuable for facilities managers

experienced in electric car charging point installation.

Even while electricity costs rise, to charge a typical 500W e-bike battery we're still talking a matter of pence and a value far lower than using a car or public transport. The transition to increased e-bike use is already taking place. However, a lack of charging points shouldn't be the factor that puts the brakes on e-bike take up.

"

Fuel costs have risen and with 71 per cent of all UK car journeys under five miles, cycling is a viable alternative to save significant cost



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Best Practices for Getting Started with APIs

by Nathan Pray, manager, digital technology office – B2B, and Stephane Ratelet, director, business development/digital solutions - EMEA, at Digi-Key Electronics



The supply chain challenges everyone experienced over the past three years have taught the electronic components industry many lessons that we won't soon forget. One of the key takeaways: now more than ever, speed and access to real-time information and data are critical as product availability can change on a dime. APIs can help procurement professionals and engineers ensure they have up-to-date information and pricing about the components they need and that's why Digi-Key developed the most advanced, complete suite of real-time APIs, completely free of charge to customers.

Digi-Key's API solutions provide a digital platform with a competitive advantage to customers. By streamlining the purchasing process, APIs enable procurement, engineering and design teams to all receive critical real-time information on products they need at lightning speed through automated machine-tomachine connections. Customers using Digi-Key's API solutions save time and bring products to market faster and more efficiently, boosting revenue.

Before getting started selecting and using APIs, it's important to:

- Determine the process(es) you want to digitalize and select the API solution(s) that addresses those processes. For example, a quoting process alone represents a major timesaver. Also consider where you want processes to be in 5-10 years and what the future could look like.
- Think about the pain points in your process and select an API to reduce or eliminate the top pain points. For example, frequent changes in status and lead time in the supply

chain are common frustrations. Digi-Key's Order Support APIs provides real-time data on status, lead time and more in one place, saving time and resources required to manually check on these critical details for each product.

- 3. Assess your internal capabilities to determine if your development team can deploy an API. If not, Digi-Key collaborates with exceptional integration partners to provide customers with cost-effective and fast options to connect to Digi-Key's API solutions with less development investment.
- 4. Start with one API solution and scale up as your team feels comfortable adding more. Digi-Key's APIs are flexible and can be implemented in smaller pieces to avoid feeling daunting. Once you implement one API, others are easy to add.

Digi-Key's APIs allow customers to connect directly to Digi-Key systems to access automated, real-time product search, price and availability, quoting and ordering, barcoding, product change notifications and more.

Digi-Key further provides an ROI calculator that estimates how much you can save in one year by implementing Digi-Key's price and availability and ordering APIs. Customers have seen an average of \$50,000 to \$100,000 per year in reducing spending on manual tasks to shift resources to more strategic tasks by implementing API solutions.

For more information about Digi-Key's API solutions, visit *www.digikey.com/API* to download a free eBook on implementing API solutions and use the ROI calculator to see the return on investment that implementing APIs can deliver.



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Benefits of conducting virtual clinical trials

Avnet Silica explains how harnessing IoT to conduct virtual trials will help clinical research organizations (CROs) adopt a more patient-centric approach and deliver the following benefits

Cost reduction: It isn't uncommon for clinical trials to last years and for costs to reach several billion Euro. Using IoT to conduct virtual trials could dramatically reduce the timing from years to months or, in some cases, even less than a day.

Improved participation:

Finding and retaining participants can be problematic. Drug companies tend to be large organizations located in or close to urbanized areas. This limits the catchment area for participants, with those not close to the facility much less likely to participate in clinical trials. IoT will provide easier access to a more diverse range of participants. This will alleviate the issue of finding patients for trials during each phase of drug development.

Better data capture:

Data entry is often carried out manually, which can introduce errors. IoT was built to capture real-world data and handle complex data sets. Also, IoT doesn't know what is real and what is virtual, so it has no preconceptions of the different domains. A virtual trial could be as simple as capturing data from a patient in a facility, to monitoring vital statistics halfway across the world.

Data can be collected by a trained member of staff or a wearable sensor. The smart connected device will capture patient data and send it securely to the CRO. This is already happening using devices such as smartphones and smartwatches. Also, patients are increasingly using home-based medical devices connected to the internet to monitor their own blood sugar levels, heart health, weight, sleep patterns and more. This data is shared with medical professionals who may be many miles away. The same technology is applicable to virtual clinical trials, making it easier to conduct trials for CROs and participants.

Faster response times:

IoT provides instant and continuous access to live data, plus a secure infrastructure that supports remote screening and patient verification. This means that smart triggers and alerts can be used to provide faster response times. It also enables drugs and other supplies to be delivered direct to the patient's home.

Reduced risk: Data

captured remotely can be preconditioned for advanced technologies such as artificial intelligence (AI), enabling medical experts to leverage technology, data and their preferred analytics in a more integrated way to support risk-based monitoring (RBM). By identifying risks that could affect the quality of any data gathered, RBM can improve the quality of the study, provide greater patient safety and add transparency to the trial.

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By **Alastair Worth**, Director IoT Services, **Avnet Silica**





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Investigating connectors for harsh environments

In this article, ECCO helps buyers better understand the types of connectors and related considerations required for applications where water and environmental exposure exist

When thinking about wet interconnect applications in marine, transportation, industrial, defense and energy industry environments, OEMs need to decide if the connection needs to be waterproof, water resistant or simply well sealed. Waterproof connectors join electrical circuits with an extremely tight seal. Such connectors can create a waterproof seal using a silicone or rubberized O-ring or gasket.

IP67 = Solids Rating (First Number)

IP67 = Liquids Rating (Second Number)

Fig 1: IP rating code structure (Source: CUI Devices)

Waterproof connectors have a high IP rating, including dust and water submersion resistance, plus protection from highpressure water flow. IP protection levels are based on exposure to dust, short/ long-term liquid immersion and exposure to hightemperature water or steam.

IP ratings have two digits: the first digit (0 to 6) represents the solids rating, while the second digit (0 to 8 and 9k) is the liquids rating. Most waterproof connectors are rated either IP67 or IP68, which means they are dust-tight and protected against 30min submersion in water at 1m or 1.5m, respectively.

Exposed external connectors are a common entry point for water and dust. Determining an application's intended use at an early stage is important, so that exposed connectors are selected with an IP rating that meets a system's minimum requirements.

The most prevalent need for IP rated connectors can be found on devices with external ports such as an audio, USB or DC power jack. A proper IP rating will protect internal circuitry from water or dust ingress when no plug or external equipment is connected. In other instances, such as industrial cable-to-cable connections, a connector and plug combination that is fully sealed when mated may be required. A fully sealed connection can prevent dust and moisture from disrupting signals or damaging components exposed to high-pressure water or even full immersion.

It is important to clarify that plugs and connectors with individual IP ratings do not automatically create an IP rated connection. Unless a design integrates an additional sealing mechanism like the screw terminal interface in Fig 3, they are still susceptible to dust and moisture ingress at the connection interface (Fig 4). If the interface was not properly sealed, it could disrupt signals or cause damage to internal circuitry.

CUI offers a range of IP67 rated connectors including USB receptacles, 3.5mm audio jacks and DC power jacks to give OEMs additional flexibility in rugged applications. Implementing a customshaped gasket or O-ring to

Protection Level	Solids Rating (First Number)	Liquids Rating (Second Number)
0 or X	Not rated for protection against contact or ingress (or no rating supplied).	Not rated (or no rating supplied) for protection against ingress of this type.
1	Protection against solid objects larger than 50mm (e.g. accidental contact with any large surface of the body, but not deliberate body contact).	Protection against vertically dripping water. No harmful effects when the item is upright.
2	Protection against solid objects larger than 12mm (e.g. accidental finger contact).	Protection against vertically dripping water. No harmful effects when tilted up to 15° from normal position.
3	Protection against solid objects larger than 2.5mm (e.g. tools).	Protection against water sprayed directly at any angle up to 60° off vertical.
4	Protection against solid objects larger than 1mm (e.g. small objects such as nails, screws, insects).	Protection against splashing water from any direction. No harmful effects when tested for at least 10 minutes with an oscillating spray (limited ingress permitted).
5	Dust protected: partial protection against dust and other particulates (permitted ingress will not compromise the performance of internal components).	Protection against low-pressure jets. No harmful effects when water projected in jets from 6.3mm nozzle, from any direction.
6	Dust tight: full protection against dust and other particulates.	Protection against powerful water jets. No harmful effects when water projected in jets from 12.5mm nozzle, from any direction.
7	N/A	Protection against full immersion at up to 1 meter depth for up to 30 minutes. Limited ingress permitted with no harmful effects.
8	N/A	Protection against immersion beyond 1 meter. Equipment is suitable for continuous immersion in water. The manufacturer may specify conditions.

provide effective sealing, these connectors achieve dust tight protection and full immersion up to 1m in an unconnected state.

Connectors permanently sealed by glass fusion prevent transmission of air, moisture and other gases Fig 2: IP rating classifications (Source: CUI Devices)

into electronic equipment used in downhole and other well completion applications. Hermeticity is expressed as the rate of leakage volume of helium per second and glass-tometal seal technology

Harsh environments



Fig 3: Plug and connector cable with locking and sealing interface (Source: CUI Devices)



achieves hermeticity ratings (up to 1x10-¹⁰ CC He/s). High temperature vitreous glass is used to provide a robust hermetic seal between metal conductors and metal connector shells. Glenair specializes in the design and manufacture of glass hermetic connectors and can integrate the technology into virtually any connector package or series.

Designed for use in geophysical and other hostile marine and oilpatch applications, Glenair's Series 22 Geo-Marine connectors, cables and bulkhead feed-thrus offer highdensity insert arrangements and advanced environmental sealing. Specialized corrosionresistant materials increase system integrity and lower system cost. Standard mated stainless-steel plugs and receptacles deliver a hydrostatic pressure sealing capability of up to 5,000psi (345bar) and are available in either glass-sealed hermetic or with rigid dielectric environmental insulators.

Customized HTHP connectors can be engineered with Inconel body/pin materials or other exotics. Other features include: single-start, stub-acme threads for quick coupling and superior resistance to thread fouling and binding due to dirt and other foreign matter; a castellated and knurled plug coupling ring which provides easy mating and unmating, even with arctic gloves; and plug shell leading edge configuration which assures key-keyway alignment and engagement prior to mating of the plug coupling ring threads.

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Semi sales up and down

Recent research reveals worldwide semiconductor sales totaled a record \$573.5 billion in 2022, but sales slowed significantly during the second half of the year

The Semiconductor Industry Association (SIA) has announced global semiconductor industry sales totaled \$573.5 billion in 2022, the highest-ever annual total and an increase of 3.2 per cent compared to 2021. However, sales slowed during the second half of the year. Fourth-quarter sales of \$130.2 billion were 14.7 per cent less than 2021's Q4 total and 7.7 per cent lower than Q3 2022.

Global sales for December 2022 were \$43.4 billion, a decrease of 4.4 per cent compared to November 2022. Monthly sales are compiled by the World Semiconductor Trade Statistics (WSTS) organization and represent a three-month moving average.

SIA president and CEO, John Neuffer, said: "The global semiconductor market experienced significant ups and downs in 2022, with record-high sales early in the year followed by a cyclical downturn taking hold later in the year. Despite shortterm fluctuations in sales due to market cyclicality and macroeconomic conditions, the long-term outlook for the semiconductor market remains incredibly strong, due to the ever-increasing role of chips in making the world smarter, more efficient and better connected."

On a regional basis, sales into the Americas market saw the largest increase (16.0 per cent) in 2022. China remained the largest individual market for semiconductors, with sales totaling \$180.3 billion in 2022, a decrease of 6.3 per cent compared to 2021. Annual sales also increased in 2022 in Europe (12.7 per cent) and Japan (10.0 per cent). Sales for the month of December 2022 decreased compared to November 2022 across all regions: Europe -0.7 per cent, Japan -0.8 per cent, Asia Pacific/ All Other -3.5 per cent, China -5.7 per cent and the Americas -6.5 per cent.

Several semiconductor product segments stood out in 2022. Analog, a type of

Worldwide Semiconductor Revenues

Year-to-Year Percent Change



semiconductor commonly used in vehicles, consumer goods and computers, had the highest annual growth rate of 7.5 per cent, reaching \$89 billion in 2022 sales. Logic (\$176 billion in 2022 sales) and memory (\$130 billion) were the largest semiconductor categories by sales. Sales of automotive ICs grew by 29.2 per cent year-over-year to a record total of \$34.1 billion.

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The global semiconductor market experienced significant ups and downs in 2022



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TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	41,850	N/A	0€	N/A	50	2,500+	Y
Wurth Elektronik	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,650	N/A	0€	N/A	50	2,500+	Y
		OBSO	LESCENCE/H	IARD	D TO	FIND						
Cyclops electronics		+32 2 209 29 89	www.halfin.com	EU		20,000+		€ 100				
Rochester Electronics		+44 1480408400	www.rocelec.com	EU	Y	130,000 +	N/A	\$250	N/A	50+	600+	Y
		(OPT <u>O ELECT</u>	RON	ICS.							
Broadcom Limited	Mouser Electronics	0049 (<u>0)89 520 462 110</u>	www.mouser.com	EU	Y	2,300	N/A	0€	N/A	50	2,500+	
Cree, Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		3,800	N/A	0€	N/A	50	2,500+	
Intel	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU			N/A	0€	N/A		2,500+	
Osram Opto Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		1,300	N/A	0€	N/A	50	2,500+	
Rochester Electronics		+44 1480408400	www.rocelec.com	EU		1000 +	N/A	\$25 <u>0</u>	N/A	50+	600+	
Toshiba	Mouser Electronics	0049 (<u>0)89 520 462 110</u>	www.mouser.com	EU		450	N/A	0€	N/A	50	2,500+	
Vishay	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		2,350	N/A	0€	N/A	50	2,500+	

Buyers' Guide	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
			PASSIV	ΈS								
AVX	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	17850	N/A	0€	N/A	50	2,500+	Y
Bourns	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	15,100	N/A	0€	N/A	50	2,500+	Y
Coilcraft	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,750	N/A	0€	N/A	50	2,500+	Y
EPCOS / TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,450	N/A	0€	N/A	50	2,500+	Y
KEMET	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	23,650	N/A	0€	N/A	50	2,500+	Y
Kemet	RS Components	08457 201201	www.rs-components.com	EU	Y	N/A	£161m	0€	N/A	50+	2,500	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	18700	N/A	0€	N/A	50	2,500+	Y
Ohmite	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	6,550	N/A	0€	N/A	50	2,500+	Y
Panasonic	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	25,450	N/A	0€	N/A	50	2,500+	Y
Taiyo Yuden	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,100	N/A	0€	N/A	50	2,500+	Y
TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	13,050	N/A	0€	N/A	50	2,500+	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	11,500	N/A	0€	N/A	50	2,500+	Y
TT Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,050	N/A	0€	N/A	50	2,500+	Y
Vishay	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	43850	N/A	0€	N/A	50	2,500+	Y
Würth Elektronik	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	6,750	N/A	0€	N/A	50	2,500+	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	21,450	N/A	0€	N/A	50	2,500+	Y
		F	OWER & BA	TTE	RIES							
RECOM Power GmbH	Various Distributor	+43 7612 88 325 700	www.recom-power.com					0€	100%		560	
Sanyo Electronic Industries Co., Ltd.	Sanyo Electronic Industries Co., Ltd.	+81 36699 8080	www.eta.co.jp	JP		1,000	€3000k	20€	90%	10	100	
Bel Power Solutions	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		600	N/A	0€	N/A		2,500+	
CUI Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		2,200	N/A	0€	N/A	50	2,500+	
MEAN WELL	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		4,400	N/A	0€	N/A	50	2,500+	
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		1500	N/A	0€	N/A	50	2,500+	
RECOM	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		3,150	N/A	0€	N/A	50	2,500+	
TDK-Lambda	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		1,900	N/A	0€	N/A	50	2,500+	
TRACO Power	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		4,000	N/A	0€	N/A	50	2,500+	
Vicor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		2.300	N/A	0€	N/A	50	2.500+	
XP Power	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		2.200	N/A	0€	N/A	50	2.500+	
			SENSO	RS								
ams	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	150	N/A	0€	N/A	50	2,500+	Y
Analog Devices Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0€	N/A	50	2,500+	Y
Bosch	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	25	N/A	0€	N/A	50	2,500+	Y
Honeywell	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0€	N/A	50	2,500+	Y
Maxim Integrated	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	350	N/A	0€	N/A	50	2,500+	Y
NXP	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0€	N/A	50	2,500+	Y
Sensirion	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	80	N/A	0€	N/A	50	2,500+	Y
STMicroelectronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	75	N/A	0€	N/A	50	2.500+	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	650	N/A	0€	N/A	50	2.500+	Y
Texas Instruments	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	850	N/A	0€	N/A	50	2.500+	Y
		SW	ITCHES & KE	ΞΥΒ	DARD	S						
Apem	Mouser Electronics	0049 (0)89 520 462 110		EU		2,850		0€			2,500+	
C&K Switches	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		5,550	N/A	0€	N/A	50	2,500+	
CHERRY	RS Components	08457 201201	www.rs-components.com	EU		600		0€			3,500+	
E-Switch	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU		2,350	N/A	0€	N/A	50	2,500+	
EAO	Mousor Electropics	0040 (0)90 520 462 440	Manan monitor com	EU		1 900	NL/A	0.6	NL/A	F.0.	2 500.	

Buyers' Guide	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	
Honeywell	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU	Y	4,700	N/A	0€	N/A	50	2,500+	Y	
NKK Switches	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU		4,000		0€			2,500+	Y	
Omron	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU		4,700	N/A	0€	N/A	50	2,500+	Y	
Panasonic	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU		550		0€			2,500+	Y	
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU		1,350	N/A	0€	N/A	50	2,500+	Y	
	TERMNINAL BLOCKS												
Molex	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU	Y	1,850	N/A	0€	N/A	50	2,500+	Y	
Phoenix Contact	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU	Y	13,550	N/A	0€	N/A	50	2,500+	Y	
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU	Y	1,750	N/A	0€	N/A	50	2,500+	Y	
						-							
				ANAGE		250		0.0			2 5 0 0	N	
Bergquist Company	Mouser Electronics	0049 (0)89 520 462 11	J www.mouser.com	EU		250	N/A	0€ 06	N/A	50	2,500+	Y	
ohm papet	Mouser Electronics	0049 (0)89 520 462 110	D www.mouser.com	EU		1 450	N/A	U€ 0€	N/A	50	2,500+	Y V	
Materials Direct	Materials Direct	+44 (0)1908 222 211	www.mousei.com	com Ell	Ν/Δ	1,430 N/Δ	£1 000 000	0 € 0 €	N/A		55	v	
Sanvo Denki	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	FII	Y	1 450	N/A	0 € 0 €	N/A	50	2 500+	γ	
Universal Science	Universal Science	+44 (0)1908 222 211	www.universal-science.	com EU	N/A	N/A	£1,000,000	0 €	N/A	5	55	Ŷ	
		TRAN	ISFORMER	S & INI	DUCT	ORS							
Bourns	Mouser Electronics	0049 (0)89 520 462 11	0 www.mouser.com	EU	Y	4,900	N/A	0€	N/A	50	2,500+	Y	
Coilcraft	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU	Y	5,500	N/A	0€	N/A	50	2,500+	Y	
EPCOS / TDK	Mouser Electronics	0049 (0)89 520 462 11	0 www.mouser.com	EU	Y	1,300	N/A	0€	N/A	50	2,500+	Y	
Murata	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU	Y	6,900	N/A	0€	N/A	50	2,500+	Y	
TDK	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU	Y	4,050	N/A	0€	N/A	50	2,500+	Y	
Vishay	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU	Y	1,200	N/A	0€	N/A	50	2,500+	Y	
WURTH ELEKTRONIK	Mouser Electronics	0049 (0)89 520 462 110	J www.mouser.com	EU	¥	5,400	N/A	U€	N/A	50	2,500+	Y	
		٧		SOLUT	IONS								
DIGI	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU				0€	N/A		2,500+	Y	
Espressif	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU		30	N/A	0€	N/A	50	2,500+	Y	
Laird Connectivity	Mouser Electronics	0049 (0)89 520 462 11	0 www.mouser.com	EU				0€			2,500+	Y	
Lantronix	Mouser Electronics	0049 (0)89 520 462 11) www.mouser.com	EU		25	N/A	0€	N/A	50	2,500+	Y	
Microchip	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU		150		0€			2,500+	Y	
Murata	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU		30	N/A	0€	N/A	50	2,500+	Y	
Silicon Laboratories	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU		150		0€			2,500+	Y	
Texas Instruments	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU		20	N/A	0€	N/A	50	2,500+	Y	
u-blox	Mouser Electronics	0049 (0)89 520 462 110) www.mouser.com	EU	Y	10	N/A	0€	N/A	50	2,500+	Y	
PCB Buyers' G	uide	vice Provided Broket Manufacture or Kepair)						ume - Iall, Medium, Large	uble-sided Iti-layer L0/10-20-20-30	tal PCBs xi / Flexi-Rigid	solescence Solutions	difications stotyping	
Manufacturer	Telephone	Website ଅଞ୍ଜି 	Location		Appro	ovals		Sn	g <u>7</u> 4	ž ž	8	ž č	
Elvia PCB Group	+33 233 763 200 ww	w.gepcb.com M/B F	France, Tunisia, China AS91	00, PRI-NADCAP	ISO-TS1694	9, ESA, UL, ISO	9001, ISO14001	S/M/L	Y 1-30	Y F, F/	R Y	Y Y	
Graphic Plc	00441363 774874 www	<i>i.</i> graphic.plc.uk M	UK/China AS910	D, NADCAP, ISO 9001, A	ISO14001,OHSAS	5 18001, Mil 31032	, Mil 55110, Mil 50884	S/M/L	N 4-10	Y Y	N	Y Y	
Contract Man	ufacturers Buy	ers' Guide						ployees	mber of Surface unt Lines A Capacity	ad Free nufacturer	sign Capability	ll Turnkey oles and rnessing	
Manufacturer	Telephone We	ebsite Turnover	Location		Appr	ovals		Ë	Nu Mo BG,	Pro Ma	Ë Ö	호한 토	
Alan Anderson Manufacturing Ltd	+44 (0) 333 322 7222 www.aa-i	manufacturing.co.uk £21m	Hertfordshire UK		509001:201	5, IPC-A-610		40	2 Y	Y Y	(Y	Y Y	
AWS ELECTIONICS GROUP	+44 (U)1/82 /552UU WWW.aWS	electronicsgroup.com £40m	UK & SLOVAKIA	AS9100,ISO900	, 15485, 14001, TS	торай, INC-4-010 С	.idss 5, NADUAP	430	11 Y	Y Y	r Y	т Ү	

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