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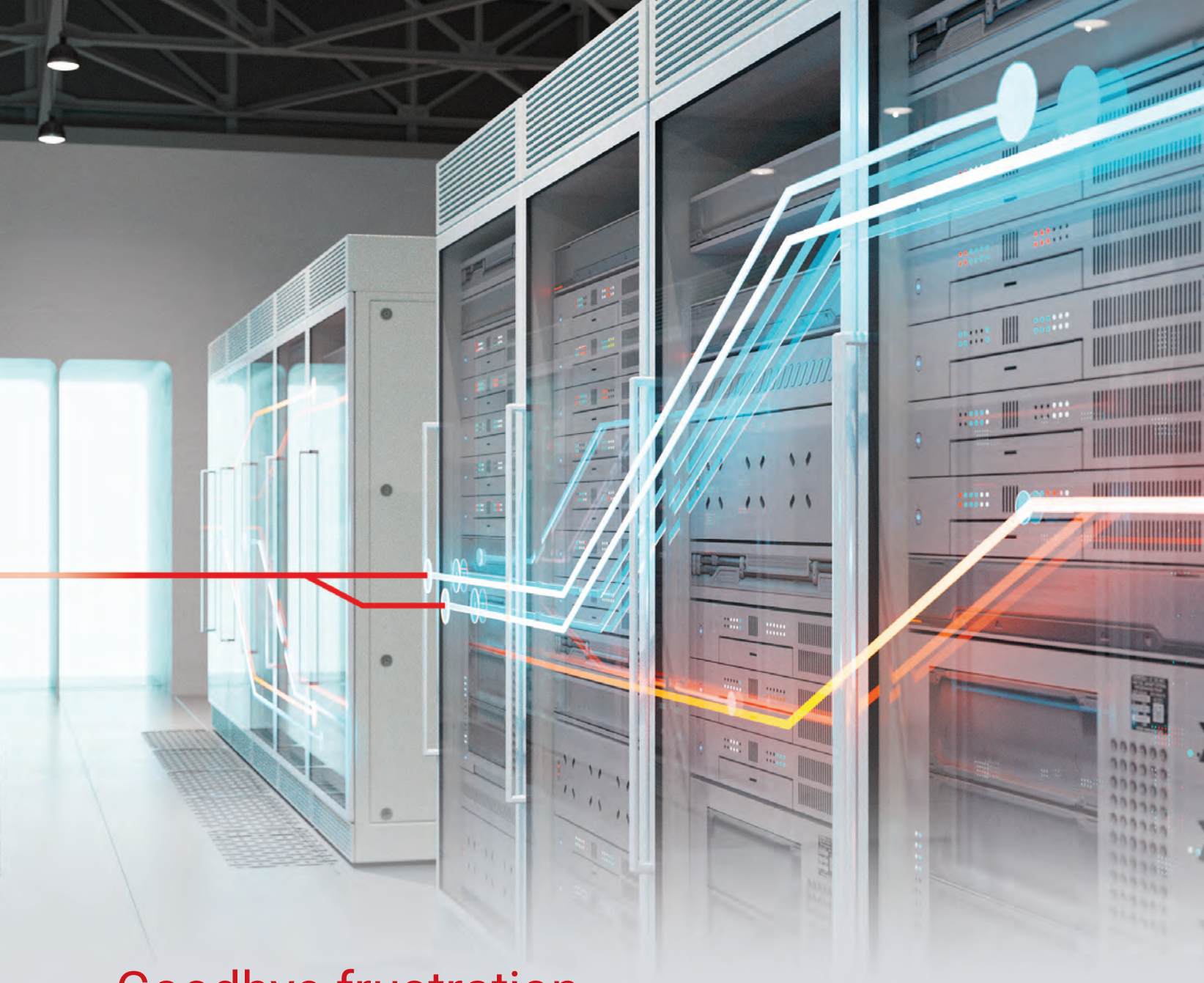
OCTOBER 2023
NORTH AMERICA

STRONG, SECURE GLOBAL SUPPLY CHAINS

PAGE 22



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ECIA MEMBER
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On the cover – October 2023

Strong, secure global supply chains
page 22

Editor's Word

Where to make, where to buy?

On page 30 of this issue, John Denslinger discusses the benefits and limitations of reshoring, nearshoring and friendshoring. It's a topic which has been bubbling under the surface for at least 30-years since the offshoring phenomenon first started gaining pace. So, why has it resurfaced now? The answer is simple, nothing stays the same forever.

All the variables that made offshoring the only solution three decades ago have been, still are and will always be in a state of constant flux. At any point in time the sum of these variables either suggests offshoring is the right or wrong thing to do.

The list of variables is almost endless but obvious contributors include: state aid, demographics, raw material availability, energy costs, legislation, politics, war, intellectual property, economic expansion/recession and the volume/cost of money.

I don't own or operate an engineering OEM that outsources so I don't have real-time access to all these variables. Thus, to get a handle on the situation I've got a much simpler process. Every time I visit an engineering show I ask every stand I visit where its products are made.

My most recent show attendance was to an electric vehicle technology event. In answer to the above question, I was shocked. Every supplier fell into the local or nearshoring category. Some did also deploy offshoring but specifically to support local markets. Their answers did not stop there. In addition to their obvious pride in local manufacturing they were also keen to detail their recent and significant factory investments.

These are not discussions I have had for some time. This seems to be a sea change.

Jon Barrett

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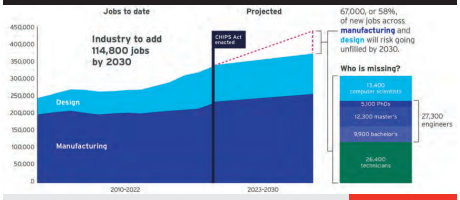
NEWS

Motherboards suit medical and more 04

SEMICONDUCTORS



America faces significant tech worker shortage 08

MEDICAL

Smaller, smarter, safer healthcare technology 18

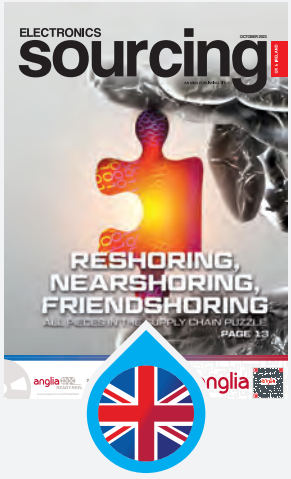
FREQUENCY

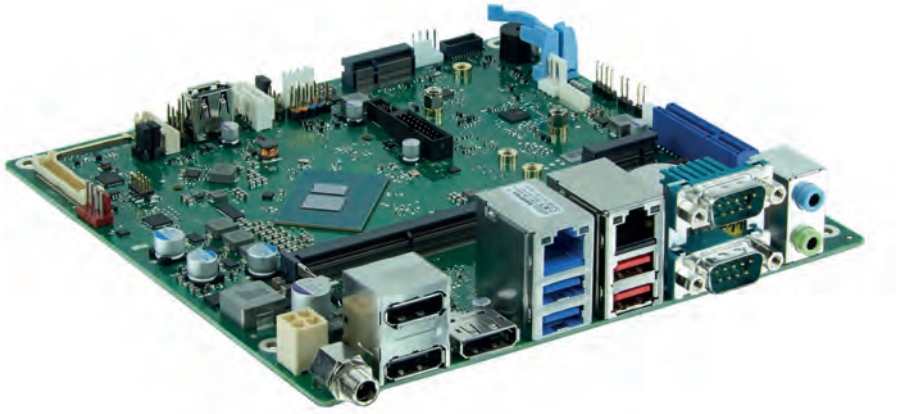
Buyers' guide to frequency control products 26

BUYERS GUIDE

All the facts and figures to help you buy 32

ES News





Motherboards suit medical and more

Kontron is expanding its portfolio of compact, energy-saving, made-in-Germany motherboards with its K3931-N mITX. The boards use Intel's Core i3 and N-series (Alder Lake N) processors in the power range 6W to 15W. The motherboards offer scalability regarding performance, power consumption and cost within one product design.

Applications include casino gaming, digital signature, kiosks, POS/POI, ticketing, industrial and medical.

Equipped with UHD Gen12 graphics, they use efficient cores based on the Xe architecture. In combination with up to 32 execution units, accelerated deep learning inference and media processing for various edge applications are supported by Intel AVX2 and Intel Deep Learning Boost.

With up to three display ports (V1.4a), one embedded display port (V1.4b 4K) and one dual-channel LVDS (24-bit), the boards support a maximum of three independent displays with 4K resolution. In addition to interfaces such as GPIO, four COM ports and four USB 3.2 Gen2, the Alder series has expansion slots for PCIe and two M.2 ports.

www.rutronik24.com

SMT LiDAR lasers ready to ship

Mouser Electronics is now stocking ams Osram's SPL S1L90H 1-channel SMT laser, offering improved performance and easier optical integration for long-distance industrial ranging and LiDAR applications such as drones, robots and building/industrial automation.

The laser is a small aperture, edge-emitting laser (EEL) in a surface-mount package. It is said to feature the highest peak power (65W) and average power in the small package class. The device has a 110µm aperture, enabling a very narrow beam optimized for short-pulsed LiDAR applications.

Featuring ams Osram's multi-junction technology—comprising three vertically stacked emitters in a single laser die—the device is supplied as a 2.3 by 2.0 by 0.69mm QFN package. This technology is designed to offer better target area illumination at long-range distance measurement, 3D optical sensing and simultaneous localization and mapping (SLAM) applications.

The SPL S1L90H's pulsed laser enables a maximum pulse width of 50ns and suits pulses shorter than 2ns.

www.mouser.com

Buying into low cost-of-ownership

Powell Electronics has announced availability of Gigalane's one-piece, second-generation GDBC connectors for complex stack-ups in 5G systems.

The simple one-piece design enables high integration and miniaturization of board-to-board and board-to-module RF interconnections. GDBC series contacts are easy to use during assembly as they require no SMT. The connectors are said to offer the lowest total-cost-of-ownership on the market and suit multiple connections and complex stack ups in 5G systems.

Specifications include: frequency from DC to 8.5GHz; 50Ω impedance; 5000MΩ insulation resistance; and 750Vrms dielectric withstand voltage. VSWR is 1.12:1 at 3.0GHz, 1.22:1 at 6.0GHz and 1.35:1 at 8.5GHz.

www.powell.com

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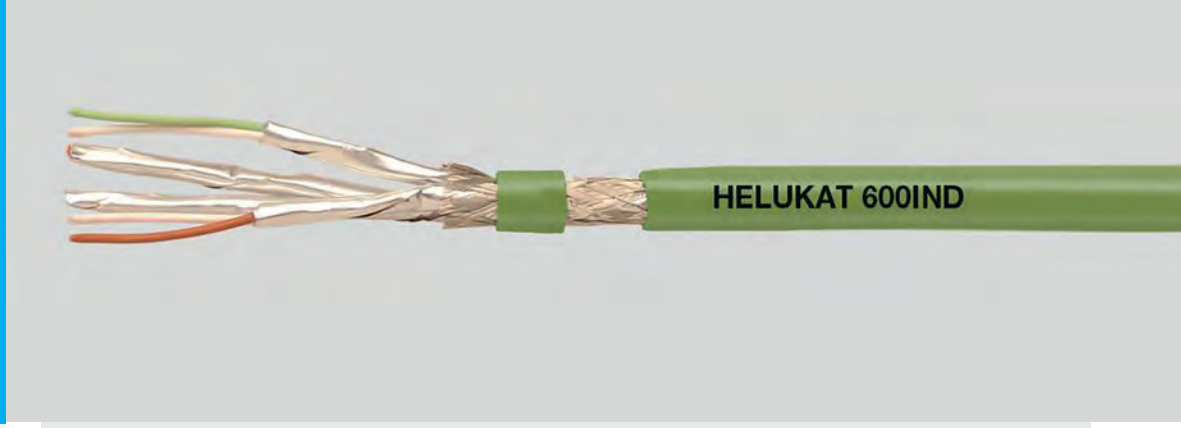
ES News



In Brief

Supporting modular material handling
RS is offering a range of IO-Link solutions to help industrial automation customers in the material handling and packaging industry. The IO-Link portfolio offers solutions from suppliers including Banner Engineering, Phoenix Contact and Norgren, and is backed by support teams experienced in helping customers identify, procure, deploy and maintain IO-Link products.
us.rs-online.com

Simplifying RF development
Trident IoT is a new company focused on simplifying RF development and decreasing time-to-market. The company will directly supply Z-Wave Technology solutions and manufacture proprietary silicon and modules. The company will also offer product design and development consulting for any RF technology, UL and ETL preparation, and US-based Z-Wave device certification.
www.tridentiot.com

Growing linecard
Waldom Electronics has added Yageo to its linecard (including the Yageo, Kemet and Pulse product brands) as its Global Authorized Master Distributor. Yageo is also a participant in Waldom's Excess Inventory Management Solution, providing increased opportunities to expand in-stock inventory and availability of products available at reduced MOQs with same-day shipments.
www.waldom.com

UL746E certification for conformal coatings
Novagard has received UL746E certification on two of its conformal coatings. Novagard's VP of R&D, Robert Duan PhD, said: "We're extremely pleased that 800-505FC UV Alkoxy Dual Cure Sprayable Silicone and 500-210 General Purpose Conformal Coating passed the rigorous testing required to achieve UL746E certification. We are committed to delivering products that meet the highest standards."
www.novagard.com

Boost to sourcing options

In Q1/Q2 2023, DigiKey added 300 suppliers across its DigiKey Marketplace and Fulfilled by DigiKey program.

Suppliers include Alps Alpine, Amphenol LTW, Ambiq Micro, Helukabel and Zettler Magnetics. Long-term suppliers also continue to expand their offerings, adding new products from different divisions. DigiKey states it is expanding in industrial, controls, sensors, motors and products for industrial automation.

DigiKey's vice president, global business development, Mike Slater, said: "DigiKey is focused on adding the newest and most innovative technologies to carry the widest selection for the engineering community. In addition, we are continuously analyzing our supplier mix to fill technology gaps and provide the global engineering community with technologies that are in compliance with regulations in their respective locations."

DigiKey Marketplace is a single source for technology innovation, including bare PCBs, industrial automation, test/measurement, IoT and related technology. Fulfilled by DigiKey brings a 3PL warehouse and on-demand fulfillment/transaction website to market, sell, pick, pack and ship products globally.

www.digikey.com

Understanding panel mount fuse holders

Panel mount fuse holders are used to provide a secure and accessible way of holding fuses. They are typically directly surface mounted to a panel, control box or chassis. The following list introduces common panel mount fuse holder applications.

Industrial control panels to protect electrical circuits controlling machines, motors, etc. Automotive to protect systems such as lighting and wipers. Data center power distribution units to protect circuits against power surges. Audio equipment such as amplifiers and mixers to safeguard circuitry from overloads. Marine and recreational vehicles to safeguard electrical systems. Laboratory equipment, such as test and scientific instruments, often require fuse protection to prevent damage to sensitive components.

Panel mount fuse holders come in different shapes, sizes and configurations to accommodate various fuse types and current ratings. They offer easy fuse replacement and are an essential safety feature in many electrical and electronic systems.

www.fuseholders.com

Shorter resistor lead times

Vishay Intertechnology has opened a new production facility in Las Torres, Ciudad Juárez, Chihuahua, Mexico. The plant lets the company significantly increase the current output of its WSLx family of Power Metal Strip resistor products and reduce lead times for devices in core case sizes to eight weeks.

Vishay's president and CEO, Joel Smejkal, said: "Given the significant rise in automotive, industrial, consumer and aerospace applications for these products, we're committed to expanding our production capacity to meet the rapidly growing demand and provide unparalleled service to our valued customers and distributors."

WSLx resistors offer: very low TCR for increased stability; low resistance values down to 0.1mΩ to reduce power dissipation and improve efficiency; and tight tolerances for more accurate current measurement. Offering power up to 15W in a range of package sizes and configurations, the devices offer superior pulse performance when compared to thick film, thin film and commercial foil devices.

www.vishay.com

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America faces significant tech worker shortage

SIA/Oxford Economics study estimates semiconductor industry risks 67,000 technician, computer scientist and engineering jobs going unfilled by 2030

The Semiconductor Industry Association (SIA), in partnership with Oxford Economics, have released a study finding the US faces a significant shortage of technicians, computer scientists and engineers, with a projected shortfall of 67,000 in the semiconductor industry by 2030 and 1.4 million throughout the broader economy. Titled *Chipping Away: Assessing and Addressing the Labor Market Gap Facing the US Semiconductor Industry* the report also offers recommendations to help close the talent gap.

The study projects the US semiconductor industry's workforce will grow by nearly 115,000 jobs by 2030, from approximately 345,000 jobs today to approximately 460,000 jobs by the end of the decade. To meet this challenge and address the talent gap, the study presents three core recommendations:

- Strengthen support for regional partnerships and programs aimed at growing the pipeline for skilled technicians for semiconductor manufacturing and other advanced manufacturing sectors

- Grow the domestic STEM pipeline for engineers and computer scientists vital to the semiconductor industry and other sectors that are critical to the future economy

- Retain and attract more international advanced degree students within the US economy

Of the total estimated semiconductor technical workforce gap, the study estimates approximately 39 per cent will be technician occupations, 41 per cent in engineering occupations and 20 per cent in computer science. Semiconductors are foundational to virtually all critical technologies of today and the future, so closing the talent gap will be central to the promotion of growth and innovation throughout the economy.

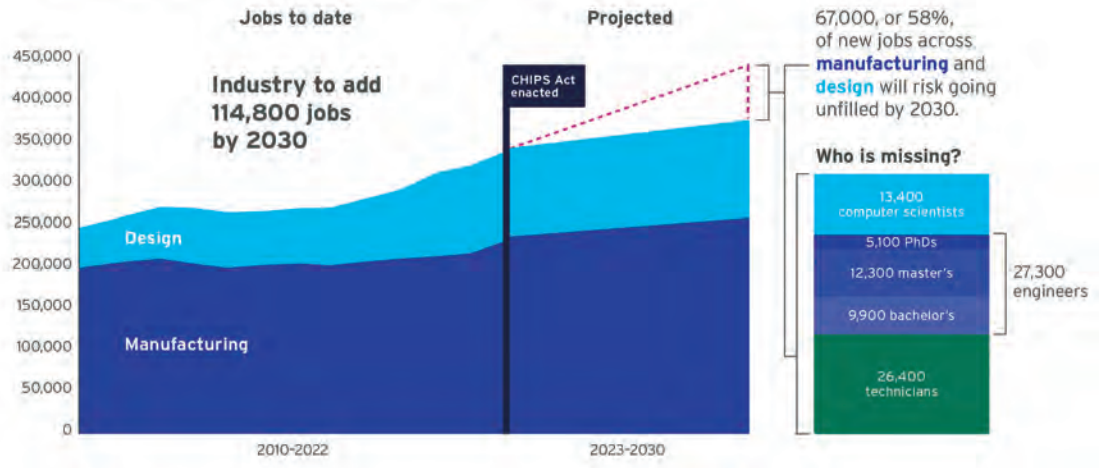
SIA president and CEO, John Neuffer, said: "Along with making historic investments to reinvigorate domestic semiconductor production and innovation, the CHIPS and Science Act anticipated the need to strengthen the semiconductor workforce in America. We look forward to working with government leaders to advance policies that build on our industry's longstanding workforce development efforts, expand the pipeline of STEM graduates in America and retain and attract more of the top engineering students from around the world."

President and CEO of Silicon Labs and SIA board chair, Matt Johnson, added: "Semiconductor workers are the driving force behind growth and innovation in the chip industry and throughout the US economy. Effective government-industry collaboration can overcome the talent shortage facing our industry, build the strongest American tech workforce possible and unleash the full potential of semiconductor innovation."

Senior economist and lead researcher at Oxford Economics, Dan Martin, concluded: "Our analysis showcases the critical high-skilled roles across the semiconductor sector and the likely skill shortages the industry will face, if proactive talent development measures are not taken. The CHIPS Act set the stage for US long-run investment and increased global competitiveness in semiconductor design and production. Moving forward, tens of thousands of new post-secondary-trained workers will need to fill the roles created as the industry increases their productive capacity in the US."

www.semiconductors.org

FIG. 1: Historical semiconductor workforce and projected 2023-2030 gap



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AI in the electronics supply chain: a done deal?

Experts believe artificial intelligence will play a catalyst role in the evolution of the electronics supply chain. Adoption may be slow at first, though, but surprisingly, components distributors are already leading the charge with technical information and services

Purchasing and procurement, two of the stodgiest and yet fundamentally critical elements of the electronics component distribution business, are getting primed for an incredible makeover, courtesy of artificial intelligence. The breakout introduction of ChatGPT last year, coupled with the introduction of many variants of the application by enterprises seeking to leverage the advantages of AI, has sparked interest within the distribution world. Researchers say distributors, suppliers and their customers can benefit from the productivity gains other segments of the economy are squeezing from the deployment of AI applications. "AI has been a field of academic study since the 1950s, but only recently has it found concrete applications within procurement functions," said Sievo, a data analytics and procurement services provider, in a report. "AI is transforming procurement. AI is automating or improving many time-consuming tasks or giving procurement experts additional insights based on extremely complex and large sets of data."

The range of functions where distributors can inject AI is as wide as the broad breadth of services provided by the top industry players. In addition to their traditional role of serving as a middleman between OEMs and electronics manufacturing services (EMS) providers, on one side, and component suppliers, on the other side, distributors offer numerous other support services that could be optimized with the use of artificial intelligence, according to Sievo. These services, as detailed by the top publicly owned distributors in their filings with the Securities and Exchange Commission, stretch from design and engineering support to "demand-creation" and other value-added services. Distributors also enhance their value to customers with supply chain management programs, including warehousing, procurement of scarce components, stocking, regulatory compliance, new product innovation as well as import and export services support.

Supporting the tens of thousands of customers that a typical distributor sells components and services to can be daunting. Most distributors, including mid-tier players like Mouser and Digi-Key, have thousands of employees on their payrolls in addition to being present in dozens of countries globally. Their services are often provided in local languages and currencies, further complicating operations and raising demands on enterprise resource planning (ERP) systems, noted observers. With the digitalization of economies globally, distributors seeking to maintain operations at the highest efficiency level—to reduce or eliminate IT downtime—have had to invest heavily in ERP systems. Mouser Electronics, for example, has nearly 4,000 employees at 27 locations worldwide and supports more than 1,200 suppliers. The company said it ships products to more than 650,000 customers and stocks more than one million products, shipping from a one-million sq. ft. warehouse in Dallas.

Continuously adding new products and services is typical for the distribution world. Observers said companies in the segment are rolling out AI applications to help them stay on top of their growing roster of suppliers, customers, products and services. In addition to building out their own AI support infrastructure, distributors are also stepping in to assist engineers trying to make sense of the technology and its relevance to their professional operations. To support its engineering customers, for example, Mouser in July announced the rollout of its Artificial Intelligence hub, aimed at providing faster product information. The company said in a statement that it is offering engineers free educational content on AI technology via eBooks, blogs and articles. This is in addition to the information already available on Mouser's website, said Kevin Hess, head of marketing at the distributor. "Our AI resource page is specifically designed to help engineers stay abreast of the latest developments in this fast and ever-evolving field," Hess said. "We are committed to providing engineers with an unparalleled selection of products and content resources to help them learn more about this topic and other subjects at the forefront of today's technology."

Data hubs

Distributors aggregate a lot of data about their ecosystem. They collect information about suppliers, products, supply availability, sales and market conditions, OEM and end-customers, pricing, sourcing and supply chain management. In fact, due to the huge number of customers served by most distributors and their regular direct contact with all segments of the market, distributors can be regarded as the single most-extensive source of information about the electronics manufacturing industry. Finding a way to share this information—and with the right parties—without violating engagement conditions with customers can be complex. In addition to the data gleaned from OEM orders, for example, distributors can also have access to the component requirements of the customer's immediate rivals.

"Procurement gathers data on clients, spend, transactions, pricing, suppliers, and contracts from RFPs, POs, spend reviews, contract management, e-catalogues, SRM systems, and expense reports, among others," the Sourcing Industry Group (SIG), a purchasing trade association, said in a recent research report. "Similarly, every stage of the supply chain has incoming and outgoing data that affects the entire product journey, from upstream inventory planning to downstream demand management. The data can be hugely variable in its speed of delivery, structure and flow, with volumes fluctuating hourly to seasonally. It is also hugely complex, coming from many sources; consolidating,

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cleansing and finding patterns requires resource. This is where predictive analytics comes in—to make sense of it all."

Being able to pool all these data into a digestible and accessible form for all players in the market without disclosing proprietary information is a valuable service that distributors can provide in an industry prone to erratic demand-supply swings and inaccurate forecasts. This is one area where access to AI tools can help to optimize pricing and product availability predictions, they said. "AI-powered methodologies can sift through immense amounts of external data to identify opportunities and provide benchmarks and recommendations for improving performance," said Sievo, in the report cited above. "Let's take, for example, the task of benchmarking your performance to those of others. Say, you are mainly using internal data as well as a static historical data set to benchmark your performance. This way you may get an accurate picture but are still missing out on some key observations. A whole new level of insight comes into play when external data, such as market reports and stock prices, enter the field."

There are numerous other advantages the entire electronics industry can derive from the efficient deployment of artificial intelligence tools, according to Sievo. Using AI applications, supply chain partners, working in unison and sharing critical data, can improve the sources and type of information they capture about market conditions, increase their anomaly detection rate, and better manage supplier and customer contracts, the company said. AI can also be used for supplier risk management, accounts payable automation, purchase analysis and classification, trend analysis, accounts receivable management, product end-of-life management, employee training and regulatory compliance. The availability of AI tools will not eliminate procurement challenges, however. Distributors will still need to be methodical in introducing AI and not dive in first at the deep end, Sievo said. "To start with AI, don't look for miraculous new solutions to change the way you run your procurement operations," the procurement data analysis firm warned. "Don't think of AI as magical new technology. Instead, think of AI from the business process point of view. Consider the challenging but boring business operations that already take time and resources to manage. The most immediate value of AI will not come from new applications, but from embedding technology into existing processes—for example, improving your existing spend analysis or contract management processes."

Early days

Not everyone in the electronics supply chain is racing to add AI tools to their offerings or even introduce it within their own services. Purchasing market analysts said the terrain can be slippery although they encourage players in the supply chain to get involved, starting with efforts to assess their operations and enlisting the assistance of experts to determine how, when and in which areas to use AI services. For example, SIG said in its report that AI would have a transformative impact on the procurement function but also noted that it is too early to determine fully how companies could best leverage the technology innovation. "Procurement and supply chains, along with the wealth of data they generate, are both ripe to leverage the efficiencies and insights afforded by AI, and in some cases already are," the SIG said, in a whitepaper. "However, the level of ambition, capabilities and change required to benefit from the technology can appear challenging."

Despite the obvious challenges—of cost, use cases determination and implementation efficiency—the manufacturing economy is likely to benefit greatly from the digitalization of key operations, the SIG noted, basing its conclusion on a survey. It identified high-tech, telecom, manufacturing and financial services sectors as the likeliest early adopters of AI tools for productivity gains. Many of these economic sectors have focused their adoption of AI and digitalization on supplier compliance and supply chain risk management. These early adopters want to enhance their forecasting and analytical capabilities, the SIG determined. "The ability of automation to produce high-impact results across key measurables that matter for businesses—profitability, agility and driving positive customer experiences—is undeniable," the SIG report noted. "Smart automation" initiatives, combining both AI and RPA capabilities, will improve decision-making and enhance productivity and cost savings. Traditional technology suites are facing incremental challenges to deliver upon procurement's more recent expectations, making smart automation a priority. Encouraging results from early implementations of automation solutions are expected to move the needle from boardroom chatter to actual adoption."

If the SIG findings prove correct, how fast can the electronics supply chain deploy AI applications in critical operational areas? Do not expect a hasty or accelerated deployment of AI in the supply chain, whether within distribution or in the larger electronics supply chain. Distributors, especially, have had rough experiences with IT tools in the past and are likely to be cautious in rolling out these tools without first determining the cost-to-benefit ratios. Distribution being a low-margin business, it is more likely that enterprises in the sector would find uses for AI where they can automate functions to further reduce costs and improve productivity. Such areas include contract analysis, human resource and sourcing management, information sharing and data analysis, invoicing and purchase order generation, fraud detection and other risk management activities, according to Dariusz Rafal Pielach, a procurement, sourcing and data analysis expert.

"In today's fast-paced and highly competitive business environment, procurement teams face enormous pressure to deliver cost savings, manage risks, and account for factors previously unheard of, such as ESG (environmental, social and governance) considerations," Pielach said, in a LinkedIn post. "However, traditional procurement methods are often reactive and lack the agility needed to keep up with changing market dynamics. This is where artificial intelligence can make a significant difference. By harnessing the power of AI, procurement teams can transition from reactive to proactive procurement, making informed decisions based on data-driven insights."

"We are committed to providing engineers with an unparalleled selection of products and content resources to help them learn more about this topic and other subjects at the forefront of today's technology."

Kevin Hess, senior VP of marketing, **Mouser Electronics**

Authorized distributor

MOUSER ELECTRONICS

Railway sector benefits from dual output DCDC converters

Bel Fuse has expanded its RCM converter series with the RCM300 dual output DCDC converter for railway and transportation systems. The converters deliver 300W at +24/-24V, while the two input voltage ranges cover all common railway batteries. The company states the two outputs are independently regulated, allowing tight and constant regulation even at extreme cross loads.

The converters are designed for chassis mounting and exhibit a closed housing. Applications include railway traction and auxiliary converters, plus railway power over ethernet (PoE) environments.

The converters have a five-year warranty and comply with EN50155, EN50121-3-2 and AREMA electrical standards; EN45545 and NFPA130 fire and smoke standards; and IEC/EN 62368-1 and UL/CSA 62368-1 safety standards.

Options include an output ORing FET for redundant operation, interruption time of 10ms (class S2), shutdown input and an output voltage monitor controlling a relay.

www.belfuse.com

Reed sensors are world's smallest

Littelfuse has released the world's smallest subminiature flange mount reed sensors, designated 59155 and 59156. Stated benefits include compact size, contactless activation and customization options.

Measuring 0.500 by 0.354 by 0.118in with normally open contacts, the sensors can switch 120VAC/170VDC at 10W. The case design allows M2 screw or adhesive mounting. Wires can exit left or right.

Applications include: small/major appliances; security/access control; factory automation; process equipment; proximity/limit sensing; and other IoT proximity sensing applications. The new reed sensors provide a customizable, space-saving design to meet different installation requirements. Contactless activation prevents exposure to humidity or dust, improving end equipment's lifetime.

Littelfuse's global market manager, Ryan Sheahen, said: "We understand the challenges that come with limited space in many applications, which is why we developed one of the world's smallest reed sensors. This extends our leadership in offering one of the broadest and most comprehensive portfolio of magnetic sensing solutions to meet our customers' needs."

www.littelfuse.com

Ultra-compact capacitor snaps into place

TDK Corporation has introduced the EPCOS B43657 aluminum electrolytic capacitor series with snap-in terminals. Specifications include: a >2000h service life at a maximum operating temperature of 105°C; rated voltage range from 450 to 475VDC; and capacitance values from 120µF to 1250µF. An important performance feature is ripple current capability up to 8.54A (120Hz, 60°C). The AlCap Tool can be used to calculate lifetime under application-specific conditions.

Case sizes range from 22 by 25mm to 35 by 60mm (D x H). Thanks to their reliability, these RoHS-compatible capacitors suit high-end switched-mode power supplies; industrial/telecommunications power applications; UPS systems; photovoltaic inverters; and frequency converters.

www.tdk-electronics.tdk.com

Aluminum enclosures tackle harsh environments

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From **Prototype** to **Product** – Electronic Components Come **Full Circle**

by **Missy Hall,** vice president of new market development at **DigiKey**

As a longtime leader in distributing electronic components, DigiKey works with our customers to reach their customers. Historically, companies making the widgets, or components, for a machine or piece of technology weren't the same ones selling the final product. DigiKey is changing the game and supporting customers at key touchpoints of the technology lifecycle, including sales. We've always had the components to build products, but now we're selling the finished product too.

The Changing Customer Landscape

Until a few years ago, DigiKey had focused on what went into a product versus selling the finished product. This full circle approach isn't something that had been done in the technology/electronic component industry and DigiKey saw the potential to be a partner that could enable designs through the sale of components, but also provide an online marketplace to sell the customer's finished products.

In 2019, DigiKey launched an online marketplace to create a repository for engineers, technicians and general consumers across all industries to fulfill electronics and technology product needs in one place. By expanding its product offerings, DigiKey could offer semi-finished and finished products such as single board computers, plug and play sensors, industrial robots and consumer tooling. It now has over 2 million products available.

Since the launch in 2019, more than 40,000 new customers have used DigiKey's Marketplace to make a purchase, resulting in more than $25 million in sales. These initial results showcase the desire of DigiKey customers to not only buy traditional components, but to also utilize this growing sales platform for their finished products.

For customers and consumers, DigiKey's easy to use website and ordering process is no longer strictly used for B2B (business-to-business), but now being used as a B2C (business-to-consumer) marketplace, selling products for both business and personal use.

Full Circle Products

Many of the finished products on the DigiKey Marketplace likely had one or more components originally sourced from DigiKey. For example, a reel of LEDs shipped to a business customer could come back through the DigiKey website as a shop light fixture and be sold via Marketplace. Sometimes products can even enter and pass through DigiKey's doors multiple times in evolved forms.

Due to changing customer needs and interest, DigiKey continues to push into new areas of technology. Marketplace offerings go beyond components and related products and now includes Internet of Things (IoT) solutions, alternative energy, bare PCBs, tools to aid in industrial automation and more – selling virtually anything related to technology innovation.

Being able to serve our customers in a new way for us, and frankly the industry, is exciting for DigiKey. Now we're not only a partner for their upstream process, but we can also be a sales chain partner for the finished product's journey to the end customer.

Learn more at **www.digikey.com**

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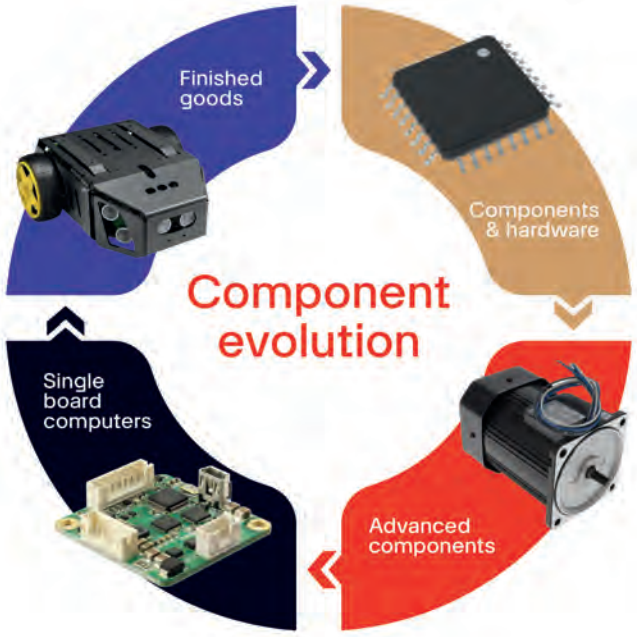

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Swiftly, AI wends its way through the electronics design world

Artificial intelligence is the new and favored lubricant helping OEMs and chipmakers accelerate design work and raise engineering productivity

Many months after ChatGPT made a huge splash in the world of internet search engines, auguring in a new era of accelerated computing and multimodal large language model (LLM), electronics engineers are waking up to the intrusion of a new set of applications that is proving both supportive and disruptive to their business operations. For many technology manufacturers, finding a way to quickly harness the strengths and promises of artificial intelligence in their design activities has become critically urgent. Design and software engineers, many of whom assisted in the development of AI tools and applications, have glommed onto GPT4—the next iteration of ChatGPT—and other AI applications and are proving to be among the earliest and most avid users of the technology. In fact, so quickly have engineers adopted AI in their vocation that some educational institutions have begun offering courses designed to produce a new class of potential employees dubbed AI engineers.

Carnegie Mellon University, for example, is in a race to establish a field of study it termed Artificial Intelligence Engineering, which it described "as an emergent discipline focused on developing tools, systems, and processes to enable the application of artificial intelligence in real-world contexts." Carnegie Mellon's Software Engineering Institute, which is funded in part by the US Department of Defense, has begun soliciting partnerships from enterprises and other agencies to create the first AI engineering discipline at the university. "The need for an engineering discipline to guide the development and deployment of AI capabilities is urgent," SEI said, in a statement on its website. "The rise in availability of computing power and massive datasets have led to the creation of new AI, models, and algorithms encompassing thousands of variables and capable of making rapid and impactful decisions. Too often, though, these capabilities work only in controlled environments and are difficult to replicate, verify, and validate in the real world."

The emerging field of AI engineering builds on the existing foundation of machine learning (ML), itself still evolving area that design engineers were just beginning to get comfortable with and which requires the leveraging of data and algorithms for developing solutions and building systems. AI is the canopy under which ML resides, alongside other components that include computer vision, natural language processing, perception and data science, robotics and inferencing or automated reasoning. Industry observers said software engineers especially are well positioned to benefit from the productivity gains and innovative edge other sectors of the economy are securing from generative AI. In a recent report, McKinsey & Co. analysts concluded that software developers "can expect groundbreaking time savings with generative AI" but warned that it would take more than the simple tools currently available for engineers to benefit from the strengths of the technology. In other words, everyone hoping to fully exploit AI in the electronics industry must add new functional skills. "For developers to effectively use the technology to augment their daily work, they will likely need a combination of training and coaching," said McKinsey analysts Begum Karaci Deniz, Chandra Gnanasambandam, Martin Harryson, Alharith Hussin and Shivam Srivastava, in a report. "Initial training should include best practices and hands-on exercises for inputting natural-language prompts into the tools, often called prompt engineering."

The authors identified areas where they suggest developers use AI for basic productivity improvements. These include expediting manual and repetitive work in completing routine works such as developing coding statements and documenting code functionalities; jump-starting the first draft of new code; accelerating updates to existing code and; increasing developers' ability to tackle new challenges. Beyond these basic functions, developers can also leverage AI for more complex tasks but doing this successfully would require that they upgrade their skills and develop a better understanding of the advantages and limitations of the tools. "Generative AI technology can do a lot, but our research suggests that the tools are only as good as the skills of the engineers using them," the McKinsey researchers said. "Deploying new use cases requires a careful evaluation of tooling, as a flurry of new generative AI tools are coming to market and different tools excel in different areas," they added.

Semiconductor applications

AI has long roots in the semiconductor industry. Companies like Nvidia Corp. began working on AI applications more than 10 years ago, partnering with a range of companies across all segments of the economy to bring the technology to fruition. Nvidia's products—both AI chips and software—today dominate the AI market. Other companies are working hard to establish a presence in the segment or broaden their market share. Advanced Micro Devices Inc. is putting up a fight while its microprocessor rival Intel Corp. has also entered the market. The chip sector initially focused on using machine vision applications—a key component of AI—for system-on-chip (SoCs) developments. Nowadays, "AI capabilities within SoCs are becoming pervasive," according to Ron Lowman, designware IP strategic marketing manager at EDA tools developer Synopsys. "Semiconductor leaders, industry giants, and hundreds of startups are focused on driving AI capabilities into scores of new SoCs and chiplets in industries across the spectrum, from cloud server farms to home assistants in every kitchen and more," Lowman said, in a whitepaper.

The application of AI in the semiconductor industry has broadened beyond initial machine vision to product design and tools development. While AI chips are going into many segments of the economy, engineers within the electronics market are also applying it in telecommunication design programs and other connectivity solutions. They

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are being utilized in cellular infrastructure development and optimized to aid the functions of self-organizing networks where machine learning algorithms are deployed for data analysis. As far as chips being designed for AI applications, there are "two different types of semiconductors," said Synopsys' Lowman. "There are stand-alone accelerators that connect in some fashion to an apps processor and there are application processors that are adding neural network hardware acceleration on-device."

He added: "As AI capabilities enter new markets, the IP selected for integration is providing the critical components of an AI SoC. But beyond the IP, designers are finding a clear advantage in leveraging AI expertise, services, and tools to ensure the design is delivered on time, with a high level of quality and value to the end customer for new and innovative applications."

More than ChatGPT

For the engineering community, AI goes beyond ChatGPT or its commercialized variant, GPT-4. Each company uses AI in different ways, depending on the solutions for which the tools are being applied. Companies like General Electric, for instance, have deployed AI tools for a wide range of applications, including for building design, manufacturing and product design, infrastructure design, synthetic data for automation and even materials discovery to "identify and test new materials," according to Statista. GE "uses AI algorithms to predict maintenance needs for industrial equipment, helping to optimize maintenance schedules and reduce unplanned downtime," the data aggregator said, in a report.

GE began exploring opportunities in AI long before the unveiling of ChatGPT. Early in 2016, the company acquired Bit Stew Systems and Wise.io, two AI startups that GE said would help build its presence in machine learning for power plants, software development and aircraft engines. One year later, the company said it was investing in AI technology for electricity grids that could help slash costs by as much as $200 billion globally. That same year, the company struck an agreement with Nvidia to add what the partners called "sophisticated artificial intelligence" to GE's 500,000 imaging devices with the objective of accelerating data processing speed and time. The plan was to leverage deep learning solutions to "design more sophisticated neural networks for healthcare and medical applications," they said. Since then, GE has increased its application of AI in other business segments. It has been incorporating AI into equipment developed for the US military, electrical systems, industrial, and research.

Other global electronics manufacturers are also using AI to broaden their design and research activities. The group includes Japanese OEMs like Mitsubishi and Hitachi as well as Korean giant Samsung Electronics. At Hitachi, AI applications are being offered to the banking industry for accelerating the analysis of financial information, helping to save on time and labor, the company said. The same services are also available for other data-intensive exercises, including "corporate reports, municipal registration, and medical records," according to Yasushi Miyata, a member of Hitachi's Research and Development division. AI must be taught to identify different formats to be effective in such scenarios, Miyata noted in a research paper. "AI can help organizations save time completing certain tasks," Miyata added. "Banks, for example, can use AI to scan through a plethora of financial statements and annual reports when researching loans and investments. AI helps them find key information and store it in their knowledge base for further analysis. Banks encounter problems, however, when these statements and reports come in different formats. This is when automation tends to fall short of its full potential. In such cases, AI needs the ability to identify different formats as well as have the domain knowledge to decide what is important."

AI applications for engineers

While engineers like Miyata are helping customers with AI solutions, they are also avidly exploring artificial intelligence application usage for their own jobs. Engineers use different types of applications for AI-related applications, some of them programming interfaces that have been in long use, including Python, TensorFlow, an open-source platform for machine learning, and Google AI platform. Others include applications from Amazon Web Services, which has a range of development, training and deployment tools for machine learning services. IBM Watson and Microsoft Copilot are also frequently used by engineers.

Concerned about data authentication and reliability, many engineers gravitate towards established AI service providers although smaller companies are also making some headway in offering machine learning services. The tier-2 companies can match their bigger rivals in niche applications such as manufacturing defect identification and specialized data processing, observers said. Still, the engineering business is not likely to be the top beneficiary of artificial intelligence applications, according to researchers. That distinction belongs to banking, followed by insurance, according to Statista. In third place are software and platforms developers. Capital markets, energy, communications and media, retail and health round up the Top-8 heaviest users of AI, the company said. The broad-based acceptance and ongoing deployment of AI across all segments of the economy explains why consulting firm Accenture has decided to invest $3 billion over the next several years in its data and AI business with the goal of helping customers benefit from the promises of the technology innovation.

"There is unprecedented interest in all areas of AI, and the substantial investment we are making in our Data & AI practice will help our clients move from interest to action to value, and in a responsible way with clear business cases," said Julie Sweet, chair and CEO of Accenture, in a statement. "Companies that build a strong foundation of AI by adopting and scaling it now, will be better positioned to reinvent, compete and achieve new levels of performance."

Julie Sweet, chair and CEO of **Accenture**

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Prescription for smaller, smarter, safer healthcare technology

TTI director of supplier marketing, Scott Stemley, explains how healthcare equipment and services are undergoing a major check-up

The daily global volume of healthcare data is phenomenal. Now measured in zettabytes, it accounts for more than 25 per cent of all information created. It's not only the amount of data that's changing healthcare, but also how fast and efficiently it's collected, communicated and analyzed.

As a result, medical technology is expected to experience robust growth—as much as $432 billion globally by 2025. The connected device segment alone may increase more than 25 per cent by 2024. The result is higher quality, lower cost, more responsive, less intrusive medical care. To accommodate this, new, innovative electronic components are emerging. The following areas are seeing the most change:

Size and weight: Small and light is the new normal, replacing previously bulky, heavy and cumbersome equipment. Leaving more room for design and less weight for convenience and maneuverability, the move to miniaturized components is reflected in demand for SWaP features, which optimize size, weight and power capabilities. Patients and practitioners now expect devices to be accurate, small, sleek, fast and well connected.

Speed, reliability and durability: Today's components are designed with an emphasis on speed, reliability and durability. 5G speeds have arrived along with next generation WiFi and Bluetooth. Precision sensors are performing at near-perfect rates and robust, durable components are excelling in extreme and critical conditions where failure is not an option.

Comfort and ease: Another key medical technology trend is 'wearable', taking advantage of size, weight, customization and speed optimization. Rooted in the trend of human-centered technology, wearable devices introduce a new healthcare mindset that stresses comfort, discreetness, instant monitoring and care that is more preventive, proactive and personal. Additionally, miniaturization offers reductions in complex invasive procedures which decreases recovery times.

Interoperability: Many advances center around interconnectivity—where machines are sharing information with other machines in an Internet of Medical Things. For example, some watches use a single lead ECG that alerts users of abnormal heart rhythms. Advantages include: real-time monitoring,

TTI director of supplier marketing, **Scott Stemley**

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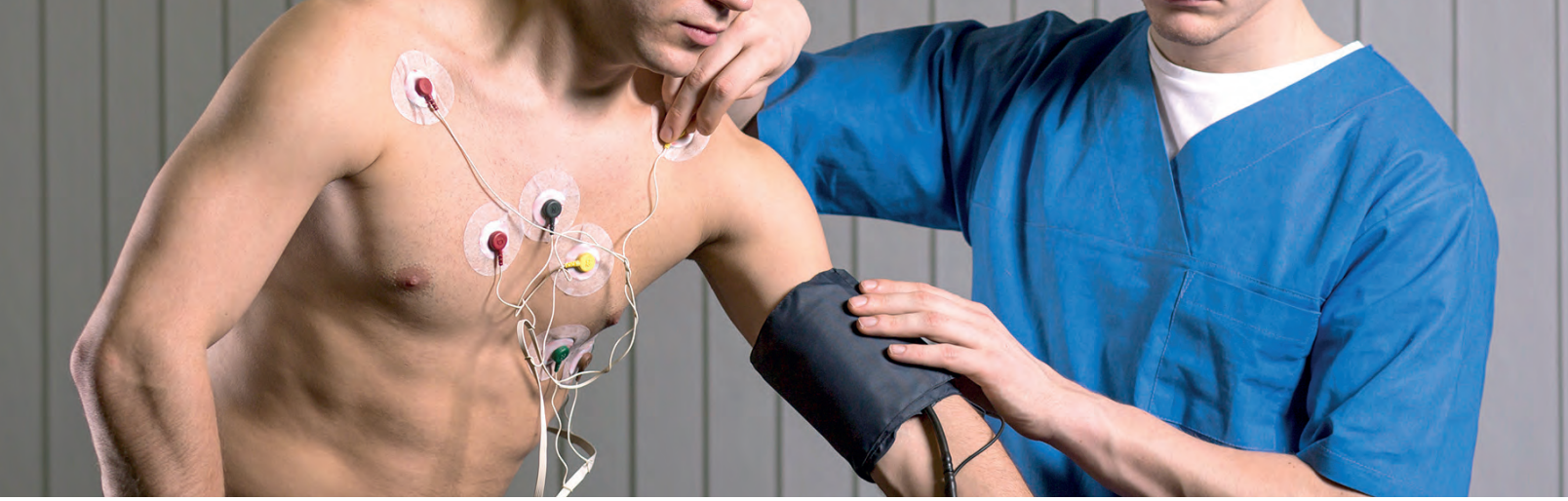

remote diagnoses and wider access to services previously unavailable.

Breadth and multifunctionality: Enhanced speed, efficiency and reliability expands the depth and range of care. Patients are offered more care options and the degree and complexity of those options are constantly improving. New areas of care include 3D visualization and robotics. Devices with multiple functions are also emerging, like the ability to monitor EKG, oxygen saturation, skin temperature variation, stress and heart rate levels.

In this new age of healthcare possibilities, manufacturers require component suppliers with high quality parts, design experience and the ability to deliver products when they need them. TTI's specialty is a deep, wide inventory of quality available parts, expert design specialists with years of experience and a customer-first mentality to help them diagnose and execute critical operations as successfully as possible.

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> **In this new age of healthcare possibilities, manufacturers require component suppliers with high quality parts, design experience and the ability to deliver products when they need them**

Stay medically informed

Manufacturers of medical products can now benefit from Mouser's new resource page offering products, articles and design guides

With support from its global partners, Mouser's resource portfolio is designed to help manufacturers find tools, information and materials, while highlighting trending medical topics like next-generation medical devices for brain-computer interfaces and the evolution of medical wearables. Content includes features about medical 3D printing, the role of AI/ML within healthcare, digital therapeutics, power management in medical devices and more.

Mouser's latest installment of the Empowering Innovation Together (EIT) series also unveils the transformative potential of digital therapeutics, examining the bridge between technology and medical devices to find how these parts and components can work together to provide a more personalized and accessible means of healthcare.

The medical industry is evolving and technology is a crucial aspect in changing traditional methods. Digital therapeutics offers the potential to reach more patients, monitor conditions in real-time and reduce the financial barriers to accessing medical care. To support this shift, Mouser and its supplier partners have collaborated to share their collective expertise and promote a more comprehensive method of personal health.

The latest EIT series installment includes a new podcast episode from The Tech Between Us, plus a second episode from In Between The Tech, featuring guests from the Digital Medicine Society and Freespira. Each episode breaks down the meaning of digital therapeutics and the cutting-edge solutions it can potentially provide. Listeners gain a comprehensive understanding of the technical hardware/software aspects of engineering design, plus current industry challenges.

Regarding parts, Mouser stocks semiconductors and electronic components for medical applications, offering parts from suppliers including Molex, Omron and TE Connectivity. The following are other examples.

Analog Devices' ADPD4200 sensor front end is equipped with twelve-time slots that enable twelve separate measurements per sampling period. This sensor includes control circuitry with flexible LED signaling and synchronous detection. It has multiple wearable health and fitness applications including home patient monitoring.

The ams OSRAM's AS7050 medical and health sensor lets users detect bio signals such as photoplethysmogram, electrocardiogram and galvanic skin resistance. These features offer flexibility for several LED and photodiode arrangements in different uses. Applications include optical sensor platforms, heart rate and ECG monitoring, smart devices and earbuds.

Texas Instruments' SimpleLink microcontrollers are designed for connected smart devices in medical applications, providing low-power wireless connectivity to wearable blood analyzers, heart-rate monitors, sleep monitors and e-stethoscopes.

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Perfect Parts explores the benefits of diversity in a market currently characterized by volatility, long lead-times, product allocation, material shortages and IC delays

Locating an alternative for a part stopping a prototype/production run is critical in the race to find a design solution. Product availability is a deciding factor when selecting a replacement or alternate product acting as a quick drop-in replacement. If a product under review is scarce, it's probably not going to offer immediate relief for supply chain constraints. Engineers can benefit from knowing the market on a part prior to selecting and prototyping it into a build. Verifying a part is accessible through reliable sources is critical to ensuring it is readily available at an appropriate cost.

Perfect Parts helps bridge that gap with access to over twenty million parts in its supply chain. The company has a broad range of components to select from and tests its material to ensure a high level of product assurance with strict test policies. Staff can help customers select and gain knowledge about drop-in replacements, possible similar parts and market inventories or lack of.

Perfect Parts Corporation is a disabled owned, women owned, small, disadvantaged, minority business. Services include crossing parts, locating alternates, testing components, plus kitting, distribution, reverse logistics and other supply chain solutions. The team carries a range of knowledge across multiple areas and disciplines that offers a different perspective to address the semiconductor industry's challenges.

Diversity suppliers offer benefits to clients' supply chains including access to federal and state funding, cost savings, alternate channels for products, new services, alternate perspectives, plus improvement of a company's agility and resiliency to disruptions. As a diverse supplier, Perfect Parts is agile and resilient to market changes and disruptions. The company's ability to bridge supply chain gaps sets it apart from other large suppliers that do not utilize a deep look into the overall market risk of the supply base.

Resilient supply chain operations that are conscientious of strategic supply chain sources, create buffers, engineering solutions and assurance tend to mitigate disruptions and bridge market gaps better than competitors. Working with diverse suppliers can open doors to a new group within the supply chain.

No two market situations are the same regarding shortages, suppliers and disruptions, so working with a supplier that understands diverse sourcing and strategy can bring cost savings at a higher ratio to OEMs, ODMs, OCMs and CMs. Perfect Parts' team carries a wide range of knowledge across multiple areas and disciplines, helping bring a different perspective to address challenges. Understanding supply chain risks helps reduce semiconductor volatility and supports a stronger, more secure, global supply chain.

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> **Perfect Parts helps bridge that gap with access to over twenty million parts in its supply chain**

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Accelerating charging infrastructure

TTI's director, TBU marketing, Americas, Gabe Osorio, explains how the company is tracking EV charging growth to ensure the right parts are ready when needed

The evolution of electric vehicles is racing ahead and it's hard to keep pace with developments. EVs are seeing significant price reductions, with Ford's F-150 Lightning by $10k and most Tesla sticker prices decreasing too. The first Tesla Cybertruck rolled off the production line in July and US EV sales are expected to surpass one million in 2023.

Although some EV start-ups and special purpose acquisition companies (SPACS) that appeared during the pandemic are running out of money or filed for bankruptcy and are being acquired by established OEMs, the march toward an all-electric automotive society continues. The big bump in the road is charging technology. Supply can't support demand and range anxiety is a reality.

Infrastructure is growing

The Infrastructure Bill Congress passed earlier this year is seeing real progress. The $7.5b investment in EV charging means the government is taking this seriously and expansion is coming. Things have been moving in the right direction with 17,000 current Tesla superchargers, 126,000 Level 2 charging ports and 20,000 Level 3 charging ports. Charging ports increased more in 2022 than the preceding three-years combined.

However, we're a long way from broadscale EV consumer adoptions and relieving consumers' charging-issue concerns. For the US to be ready for full adoption (considered 40 per cent of new vehicles in 2030), it is estimated we need over quadruple the amount of available charging ports with a target of 2.13 million Level 2 chargers, in addition to in-home chargers, by 2030.

Roadblocks

Broader adoption will require localized infrastructure planning, buy-in and execution down to municipality level. Naturally, the biggest concern is funding. The cost to launch is extreme when

TTI's director, TBU marketing, Americas, **Gabe Osorio**

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the economy is stagnating and consumer confidence is stressed. The recent infrastructure legislation Washington passed is a good start but only a start.

Additionally, according to federal funding legislation, US built charging stations require more than 50 per cent of the products to be sourced by North American Free Trade Agreement (NAFTA) members. This has left suppliers scrambling to set up local production, which is about one to two years away. The government will play an additional role as they legislate requirements, like adding charging stations to housing, retail and publicly owned resources.

NACS adoption

A hot topic in EV charging is the major automotive OEMs adopting the Tesla North American Charging Standard (NACS). Companies were previously developing their own designs and technology but the Tesla standard is more ergonomic, efficient, well designed and powerful. It also adds to the overall availability of charging networks. GM was the first to announce, followed by Ford, Aptera, Rivian, Volvo, Polestar, Mercedes, Nissan and the list will grow.

Tesla open-sourced this standard in late 2022. Once GM announced it would be adopting, other OEMs started falling in line and caught the coupler and inlet manufacturers off guard. Manufacturers are now rushing to design, test and bring to market options for NACS offerings—which is about three to six months away from the first ones arriving with many more in the next year.

TTI is excited about EV charging technology—from power and efficiency to communications and safety. As we make the transition to a net-zero-emissions world, we are positioned to deliver the broadest and deepest inventory of quality components that put EVs on the road and running well.

We also pride ourselves in having seasoned and expert specialists who know technology and market trends to equip customers with the best products, help them integrate designs for optimal performance and ensure designers get the right parts, at the right place, at the right time.

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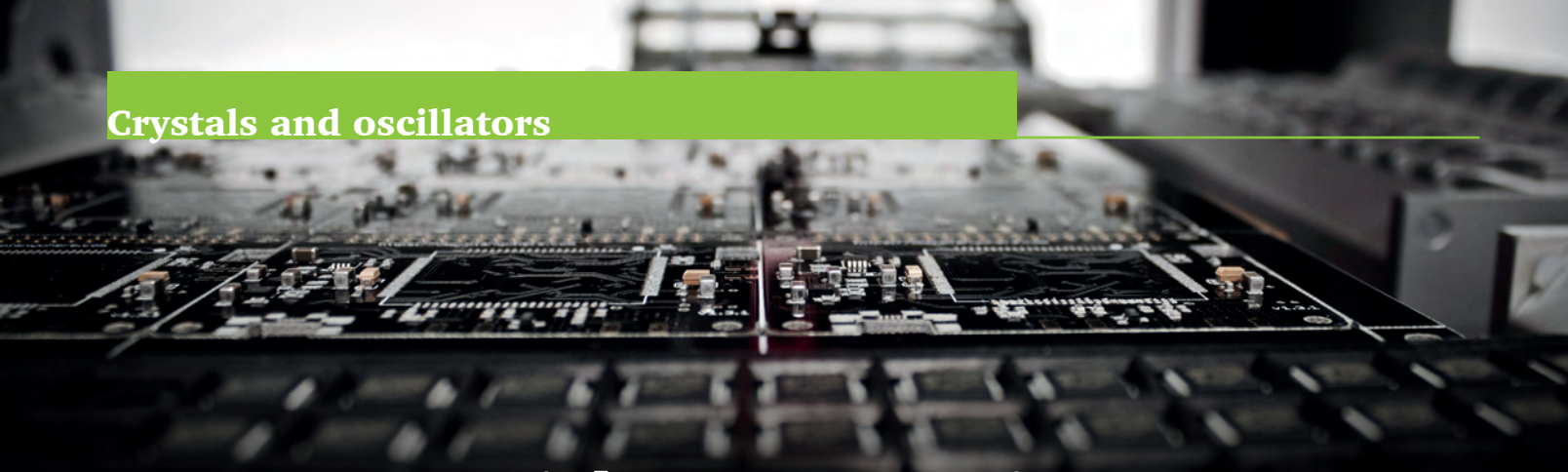

Buyers' guide to sourcing frequency control products

In this article, ECS emphasizes the benefits of directing frequency control product sourcing requirements to reputable manufacturers and their authorized distribution partners

Frequency control products (FCP) are used to generate timing signals to ensure all processes happen in an orderly and error-free manner. When designing systems, the performance versus cost conundrum must be solved as not all budgets can support a $40 OCXO. So how do manufacturers find the right FCP that meets their application's design requirements within budget?

There are frequency control suppliers with experienced and knowledgeable staff ready to help customers sift through choices and make decisions. Ideally, customers explain what they want to accomplish within a rough budget with the supplier responding with options for components that are in stock or can be built. This type of service is the best source of application information for crystals and oscillators.

As a rule of thumb, products in stock and continuously re-stocked are a good choice. Such components typically have many users and are readily available from multiple sources. Manufacturers should explore whether their design can be modified to use such standard products.

A little engineering upfront will likely save dollars and engineering hours later. If a custom timing device is required, a manufacturing partner should help make the best decisions based on the specifications, including package sizes, frequency, tolerance, stability and operating temperature ranges. These specifications help identify a low-cost, long-life FCP component.

Over recent years, the electronic component industry has gone through uncharted times due to the pandemic and subsequent supply chain issues. Accurate forecasting and a close eye on the market are imperative today. Many manufacturers ignore these warnings and soon discover there is no component too small or too inexpensive that can't derail their manufacturing schedule or, worse case, future. The best sourcing advice is prudent planning and always purchasing FCP from reputable manufacturers using authorized distribution partners. This should ensure product longevity, quality-of-service and overall satisfaction.

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> **Manufacturers should explore whether their design can be modified to use such standard products**

DX from a supply chain management viewpoint

In this article, Murata employees Koyama, Kishino and Umeda explain the transformation of the company's supply chain and benefits of DX

The term supply chain covers everything from the procurement of materials and components used to manufacture products to the delivery of finished products to customers. In a manufacturing business that handles enormous quantities of products and materials every day, working to improve efficiency is essential. Murata's supply chain moves enormous quantities of goods—around 13,000 tons monthly.

What does Murata's supply chain look like?

Koyama: "Murata operates 50 production facilities and 57 sales bases globally. Our factories across the world ship a total of 25,000 items per day. In addition to the route from factory to customer via a commercial warehouse, goods flow through other routes, such as those bringing raw materials from suppliers to factories and routes between factories. This involves many logistics companies implementing transport by air, sea and truck. Total monthly distribution volume is around 13,000 tons."

Kishino: "In the Monozukuri Group, Koyama handles distribution operations such as exports and imports, while I work on business improvement in the supply chain area by promoting the planning, building and deployment of necessary systems."

Umeda: "My job involves company-wide DX promotion, building organizations and training personnel to build a next-generation digital infrastructure. I work with my two colleagues on the common goal of creating a next-generation supply chain infrastructure. Moving forward, while engaging in ongoing discussions with business divisions, function divisions and local staff, we hope to promote efforts to boost competitive value through supply chain transformation."

What sorts of issues affect Murata's supply chain?

Koyama: "One distribution related issue is that data is divided among various processes and is not linked together. Even when processes were linked, each location maintained its own database. This meant we had to obtain information from separate logistics companies to check the status of outgoing shipments. Getting an overall situational view and tracing progress required obtaining and consolidating data from multiple computing environments, so the work was time-consuming. These issues were brought into sharp relief by the typhoon in September 2018."

Typhoon Jebi caused widespread power outages in the Kinki and Tokai regions, plus flooding of the runways at Kansai International Airport.

Koyama: "Kansai International Airport was Murata's main export/import hub and we were scrambling to find alternative routes. Customers were asking 'where is my shipment?' and 'when will my order arrive?' It took us quite some time to assess the situation and provide answers. This really made us aware of the importance of linking up dispersed and divided data to manage the supply chain overall."

Kishino: "Because of that typhoon I started thinking that building a system to keep track of where shipments were in a timely manner would also strengthen our ability to deal with events such as natural disasters and pandemics."

So, supply chain transformation was necessary for business continuity planning in case of emergencies?

Koyama: "Business continuity planning was only one trigger. Recent years have seen a

growing need for business improvement in distribution and enhanced flexibility due to geopolitical risks affecting exports/imports such as pandemics, regional conflicts, increase in electronic commerce and difficulty retaining personnel. More than anything, I really feel we must transform distribution data management to supply products to customers stably and reliably."

Kishino: "Regarding managing data as Monozukuri becomes more globalized, we are seeing more customers wanting to trace products at the individual package (reel, etc) level. To meet these needs, it is essential to accumulate data across the distribution process—from shipment from the factory, to transport and shipment from the commercial warehouse—and build an end-to-end system that links this data and allows us to utilize it."

What does the system for the tracking database and shipment trackers involve?

Kishino: "The tracking database (for future release) accumulates and utilizes data at individual package level for all distribution stages, from factory shipment to commercial warehouse shipment. Shipment trackers manage data while goods are being transported by logistics companies and, by linking these systems with tracking databases, we can achieve end-to-end traceability."

What advantages will the system bring when fully implemented?

Kishino: "First, we will be able to boost response speed to quality issues/complaints, plus improve service for regular customers. Also, by linking data for various packaging levels—outer packing boxes, assembly packing boxes, pallets—data can be utilized and tracing performed at any packaging level. This will boost productivity by reducing the reception and stocking workload at commercial warehouse and regular customers' facilities.

Were any difficulties encountered building the system?

Kishino: "We had to impose additional tasks on the commercial warehouses to implement tracing at individual package level. We gained understanding of the commercial warehouses by painstakingly explaining the goals and value of our efforts to strengthen traceability. When promoting these efforts, I really felt the importance of shared goals and gaining understanding and cooperation through extensive discussions. Many times during discussions I thought 'maybe linking this data will also make it possible to do such and such'. I became aware of insights that might be useful in solving other issues and realized there is much hidden potential for providing value."

Umeda: "As Kishino says, linking a wide variety of data has a lot of hidden potential. On the other hand, as digitization proceeds, some processes and tasks may become harder to visualize, and the problem of some tasks becoming specific to a limited number of people is emerging. To combat this, we first need to visualize processes and tasks. I think it is important our digital society makes possible stronger communication and ties between individuals."

Koyama: "Through this project, I have come to realize that improvements arise from connections between people. I hope we can disseminate a wide variety of information to build a new supply chain and, at the same time, a chain linking people with other people."

Umeda: "As what we can achieve by creating links between data in different places broadens, we must make judgments covering a wider area. In response, I think it is important we establish clear judgment criteria—setting guidelines, for example—and train personnel capable of making sound judgments."

What developments do you anticipate moving forward?

Kishino: "We are currently working with the MLCC and Battery Divisions to build and deploy a new production plan creation system. Under this system, production plans that individual factories located across the world previously created using their own individual methods will be replaced by optimized production plans created in a timely manner for related factories, linked by business unit, to enable rapid decision-making. Moving forward, the flow of goods and materials as part of the manufacturing process, procurement activities and provision of distribution resources will be linked in production plans. By linking all aspects of Murata's supply chain, the aim is to achieve advances through an enhanced ability to adapt to changes alongside better integration of activities."

Umeda: "Bottlenecks in the value chain can have a negative impact on the process of planning, developing and designing products. For this reason, I think it is important to maintain close coordination between the supply chain and engineering chain. Furthermore, I want to create and provide value through Murata's value chain activities, including the demand chain, which is the customers' product development process."

Kishino: "If we can create links with customers' data and processes, Murata can keep track of product

Koyama, general manager, **Murata, Monozukuri Group**

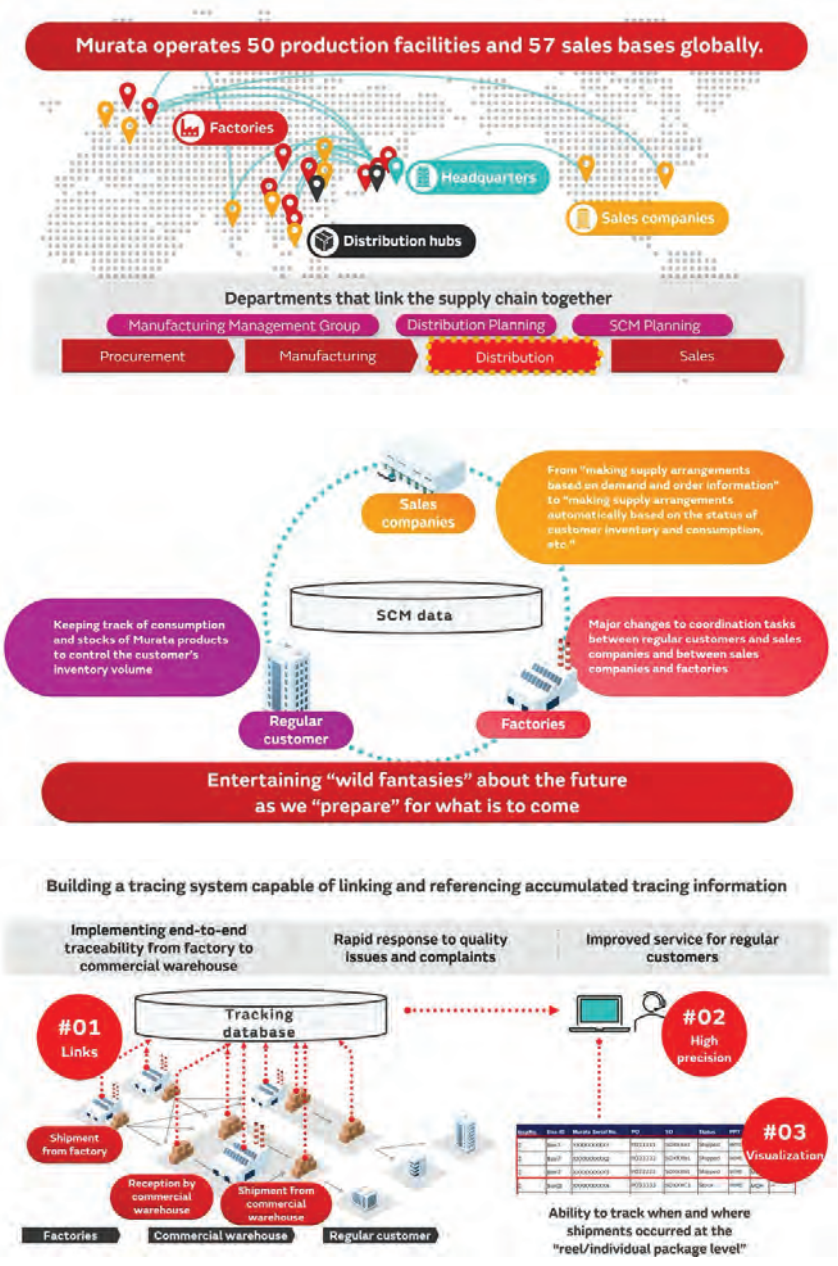
Kishino (Monozukuri Group)

Umeda (Business Engineering & Information System Group)

consumption and inventory volumes. We may eventually find a point where product provision is arranged automatically, based on customers' inventory and consumption status. If this becomes reality, we may see big changes in tasks that presently take considerable time, such as coordinating delivery schedules with customers and coordination between commercial warehouses and factories. The hurdles we must cross are high, but supply chain transformation has enormous hidden potential for innovation."

www.murata.com

"I hope we can disseminate a wide variety of information to build a new supply chain and, at the same time, a chain linking people with other people



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Reshoring, nearshoring, or friendshoring?

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

This month, John Denslinger explores the benefits and limitations of reshoring, nearshoring and friendshoring, with a focus on the semiconductor ecosystem

China's economic grip on the world's supply chains ended with the pandemic shutdowns. The pandemic may have been the catalyst, but punitive tariffs, geo-political uneasiness and protectionist measures supported by hundreds of billions of Fed dollars in economic hand-outs helped usher in a new age of strategic sourcing. Across every industry it's quite evident manufacturers have decidedly pivoted from sole source, low-cost status quo to one that delivers diversification and resilience.

From a manufacturing perspective, offshoring appears to be dead. A new vocabulary has replaced it: reshoring, nearshoring and friendshoring. Each has unique deliverables and risks.

Reshoring

Reshoring is by far the most talked about of the three and basically brings business operations, manufacturing and sourcing functions back to the home country. A company trades the benefit of domestic location, flexibility, security, improved quality control, reduced logistical costs and proximity to local market against potentially higher labor and operating costs. It should be noted that smart companies mitigate these operational expenses by introducing robotics and AI tools during transition. Despite the apparent advantages, two issues still stand out:

1. There is a skilled worker shortage, with 82 per cent of US manufacturing companies saying they are experiencing a labor shortage according to a 2023 *Career Advancement in Manufacturing Report*. Competition for scarce talent likely drives up recruitment, training and retention expenses.

2. Reshoring requires significant initial capital investment. New facilities, state-of-the-art equipment and automation technology are expensive. If your business happens to be semiconductor or EV related, Federal subsidies may make the decision quite easy.

Nearshoring

Nearshoring relocates a business' operations to a neighboring country within the same region or continent. In this case, the company gets many of the advantages of reshoring but maintains much of the offshore benefit of lower labor costs. A good example is the proximity of Mexico to the US. While initial investment may be similar to reshoring, ample labor is generally available. Nearshoring still requires some outsourcing and reliance on local suppliers but the complexity is considerably less than the offshoring model. If a company is just looking for geographic proximity, real-time collaboration and better supply chain visibility at a lower cost, nearshoring seems a satisfactory solution.

Friendshoring

Only the government could invent this word. The definition seems loosely translated as locating manufacturing in countries with shared values, 'friends' so to speak. Who qualifies as a friend is somewhat undefined, but this trust-based relationship seems to hinge on a trading pact between nations. Friendshoring might be a workable solution for some such as the semiconductor industry. Questions remain though. Is a partner country in an unstable part of the world? Are there shipping bottlenecks and added inventory costs? What are the ESG compliance requirements? Is the ongoing regulatory environment favorable to business?

In the short-term semiconductor is ripe for friendshoring. Currently, 74 per cent of semi design is US based; 41 per cent of global equipment processing is US based; 57 per cent of global material processing is done in Taiwan, South Korea and Japan; 56 per cent of manufacturing capacity is concentrated in Taiwan, South Korea and Japan; and 38 per cent of global semi assembly is done in China (Deloitte article dated March 2022).

All these governments have committed funds to subsidize semiconductor production on home soil. It's not likely any country can possess the critical mass to dominate the complete semi supply line. America might find friendshoring adequately provides the security it seeks: design (US and EU), equipment (US, EU and Japan), materials (South Korea, Japan, US and EU), wafer fab (Taiwan, Japan, South Korea, US and EU) and assembly (India). There seems to be plenty of countries with shared values to make friendshoring work.

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Dove Electronic Components, Inc.	25	Rolec Enclosures Inc	19
eBOM	21	Sager Electronics	05
ECIA Trusted Parts	15	TTI Electronics	07
ECS, Inc International	26	Transfer Multisort Elektronik (TME)	31
Fusion	09	Win-Source Electronics	21
Memory Protection Devices, Inc.	20		

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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	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	Pack and Hold
Cinch	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cinch Connectivity/Bel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cinch Connectivity Solutions		+1 507 833 8822	belfuse.com/cinch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eaton	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,744	N/A	$0	27%	50	1,000+	Y
ERNI Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Glenair	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Harting	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,160	N/A	$0	51%	50	1,000+	Y
Harwin	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Hirose Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ITT Cannon	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ITT Cannon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
JAE Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,02	N/A	$0	100%	N/A	N/A	Y
JST	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
KYOCERA AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
KYOCERA AVX	Digi-Key	800-344-4539	www.digikey.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
LEMO	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Mill-Max	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	85,634	N/A	$0	89%	50	1,000+	Y
Neutrik	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,563	N/A	$0	100%	50	1,000+	Y
NorComp	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	30,044	N/A	$0	77%	50	1,000+	Y
Radiall	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Samtec	Mouser Electronics	800-346-6873	www.mouser.com	Y	123,613	N/A	$0	69%	50	1,000+	Y
Stewart Connector		+ 1 717 235 7512	belfuse.com/stewart-connector	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Switchcraft Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	300	N/A	$0	55%	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	123,613	N/A	$0	69%	50	1,000+	Y
OBSOLESCENCE / HARD TO FIND											
	Lansdale	602-438-0123	lansdale.com	Y							
	Lantek Corp.	973-579-8100	www.lantekcorp.com	M	186,000	$22M	$0	75.00%	5	62	Y
	Rochester Electronics	978-462-9332	www.rocelec.com	Y		N/A	$250		10	400+	Y
OPTO ELECTRONICS											
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cree LED	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	$0	99%	50	1,000+	Y
Finisar	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ams OSRAM	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	$0	99%	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
PASSIVES											
ABRACON	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	$0	78%	50	1,000+	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	$0	71%	50	1,000+	Y
Coilcraft	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	$0	98%	50	1,000+	Y
Fair-Rite	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
KEMET	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	$0	66%	50	1,000+	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	$0	58%	50	1,000+	Y
KYOCERA AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
KYOCERA AVX	Digi-Key	800-344-4539	www.digikey.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	$0	99%	50	1,000+	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	$0	84%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	$0	55%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	$0	100%	50	1,000+	Y
Signal Transformer		+1 516 239 5777	belfuse.com/signal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	$0	98%	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	$0	100%	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	$0	100%	50	1,000+	Y
TT Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
United Chemi-Con (UCC)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	102,917	N/A	$0	64%	50	1,000+	Y
Wurth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	$0	99%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	$0	100%	50	1,000+	Y
POWER & BATTERIES											
Artesyn Embedded Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
B&K Precision	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bel Power Solutions		+1 866 513 2839	belfuse.com/power-solutions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	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	Pack and Hold
Cincon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cosel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
CUI Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Delta Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
MEAN WELL	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phihong	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
RECOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Schaffner	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
SL Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TDK Lambda	Mouser Electronics	800-346-6873	www.mouser.com	Y	405	N/A	$0	80%	N/A	N/A	Y
TRACO Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vicor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
XP Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
SENSORS											
ams OSRAM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Analog Devices Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bosch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Honeywell	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,059	N/A	$0	64%	50	1,000+	Y
KYOCERA AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
KYOCERA AVX	Digi-Key	800-344-4539	www.digikey.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Melexis	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
onsemi	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,915	N/A	$0	59%	50	1,000+	Y
Renesas	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,915	N/A	$0	59%	50	1,000+	Y
Sensirion	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
STMicroelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	914	N/A	$0	65%	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	914	N/A	$0	65%	50	1,000+	Y
SWITCHES & KEYBOARDS											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TEST & MEASUREMENT											
B&K Precision	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Fluke	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,008	N/A	$0	94%	50	1,000+	Y
Keysight	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Lascar Electronics		814-835-0621	www.lascarelectronics.com	Y	130	$602,000	$0	100%	10	175	Y
Tektronix	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Teledyne LeCroy	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96%	50	1,000+	Y
THERMAL MANAGEMENT											
Materials Direct	Materials Direct	01908 222 211	www.materials-direct.com	N/A	N/A	£1,000,000	£0	N/A	5	55	Y
ebm-papst	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96%	50	1,000+	Y
Sanyo Denki	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96%	50	1,000+	Y
CUI Devices	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96%	50	1,000+	Y
Universal Science	Universal Science	01908 222 211	www.universal-science.com	N/A	N/A	£1,000,000	£0	N/A	5	55	Y
WIRELESS SOLUTIONS											
KYOCERA AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y
KYOCERA AVX	Digi-Key	800-344-4539	www.digikey.com	Y	N/A	N/A	$0	N/A	50+	1,000+	Y

Contract Manufacturers Buyers' Guide

Manufacturer	Telephone	Website	Turnover	Location	Employees	Number of Surface Mount Lines	Approvals	BGA Capacity	Lead Free Manufacturer	Prototyping	Design Capability	Full Turnkey	Cables and Harnessing
Alan Anderson Manufacturing Ltd	+44 (0) 333 322 7222	www.aa-manufacturing.co.uk	£21m	Hertfordshire UK	40	2	ISO9001:2015 , IPC-A-610	Y	Y	Y	Y	Y	Y
Pektron	1-248-677-4838	www.pektron.com	$66m	Michigan & UK	350	8	ISO9001, ISO14001, TS16949, BEAB, VCA, TUV, UL	Y	Y	Y	Y	Y	Y

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