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DIGITALLY NAVIGATING COMPLEX SUPPLY CHAINS

PAGE 16

On the cover – November 2023

Digitally navigating complex supply chains
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Editor's Word

Preparing for 2024 forecasts

At the time of writing, I'm already waiting for the executive forecast copy to start arriving ahead of the December issues of *Electronics Sourcing UK and North America*. At this stage of the process, I like to play a mind game by trying to second guess the authors' thoughts and then compare my ideas with the final articles.

If I was to write my own executive forecast it would start with reshoring, nearshoring and friend shoring. At present, I'm awash with news about investments in new manufacturing and distribution facilities in the UK, Europe and North America. Likewise, I'm intercepting news about production capacity relocating from China to surrounding regions. It looks like the next rewrite of globalization is underway.

Secondly, I would discuss demographics. A strong manufacturing sector requires people to make things and people to buy things. Slowly but surely, we are running out of both. Populations across the planet are aging while, at the same time, the birthrate continues to decline. I foresee a significant shift in the types of products consumers will demand, how they will be manufactured, where they will be produced and how much they will cost.

Finally, there is digitization. As products and their supply chains become more complex, while the number of people available to manage them diminishes, digitization is currently the only obvious solution. Being a digitization pathfinder can be a risky business. However, coming to the game late could also be a disaster. Thus, I expect 2024 to be a year where the middle ground of distribution learns from the early adopters and starts deployment.

Jon Barrett

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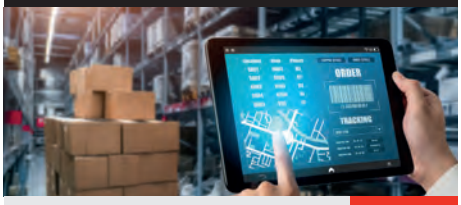
NEWS

SUPPLY CHAIN



OBSOLESCENCE

WHAT'S NEW

BUYERS GUIDE

Exclusively sponsored by DigiKey

Laying the **Groundwork** for a **Bright Future**

by **Dave Doherty,** president, **DigiKey**

The past several years have presented challenges, as well as opportunities, for DigiKey and our customers. When I take a step back and look at our business, specifically the past two years, we've reached new heights, which is in no small part due to our incredible DigiKey suppliers, partners and customers. We've seen 80% growth and surpassed $5 billion in global sales.

While we continue to focus on our core business, we've found new opportunities to partner with our suppliers to offer our customers even more benefits. We're a customer-focused business, so we're always looking ahead and reshaping what service for our customers looks like.

A Seamless Check Out for Customers

Making transactions as seamless as possible for customers is extremely important. Whether a customer is on the DigiKey website or doing additional research directly on a supplier's website when they decide they want to make a purchase, we need to make the checkout process as smooth as possible. We're working with suppliers across our network to ensure no matter where a customer is making a purchase, they have the same user experience. There is a lot of potential here and we're excited to keep expanding in this area.

Premier Search Functionality

For the past couple of years getting parts for electronics was extremely difficult and a pain point for procurement professionals. DigiKey can provide a solution.

Longtime customer, Limor "Ladyada" Fried of Adafruit, recently shared what a difference this has made for her business. "Sometimes parts are completely discontinued, and I have to look at what is new and available on the market because if I'm going to be doing the redesign, which takes so much effort, I might as well get the newest best thing that I know will last me 10 years," Fried shared. "DigiKey's parametric search lets me find the best fitting components. It's helped me do 300 redesigns in the last two years."

As Limor shared, our search function identifies product alternatives extremely well. Whether our customers are looking for an alternative because a product is unavailable, soon to be discontinued or has a lead time longer than they're willing to wait. We've heard from many customers that this has been an extremely useful tool.

What's Next? It's Always a Cycle

In the first half of 2023, DigiKey has added over 175,000 new stocking parts year-to-date, including nearly 40,000 newly introduced product SKUs across our core business. We can look at order history and see signs that design activity is shifting from sourcing old designs to innovating new ones, which we're excited about and is a good sign for the overall industry.

While we've seen an increase in customer count and shipments, we've also seen order size and revenue go down. But at DigiKey that doesn't mean it's time to worry, it's all cyclical and this is the time to work toward what is going to fuel that next stage, the next cycle. We see it as just the beginning.

Learn more at **DigiKey.com.**

DigiKey's Product Distribution Center expansion (PDCe) processes more than **6.5 million orders per year** with an industry-leading breadth and depth of product in stock and available for immediate shipment

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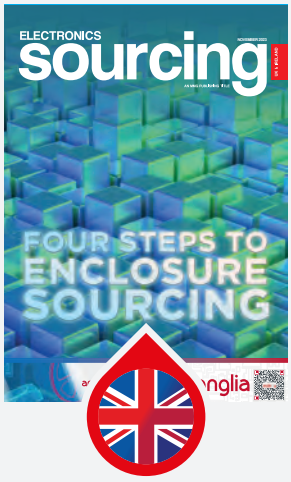
ES News



More Pi supply options

Mouser Electronics is now offering customers the latest Raspberry Pi products. Sourced directly from Raspberry Pi, the entire catalogue of single-board computers, embedded devices and peripherals is available, with full manufacturer traceability/authenticity.

Mouser Electronics' VP of supplier marketing, Andy Kerr, said: "Mouser is excited about this expanded partnership with Raspberry Pi. With their line of industrial-ready products, customers across the globe now have access to an expanded offering of innovative, scalable products that are certified, low-cost, powerful and production ready."

Raspberry Pi's chief commercial officer, Mike Buffham, added: "Mouser's global reach enables us to extend our customer base to offer powerful and easy-to-use products to people of all skill levels. Known for their best-in-class distribution, outstanding service and exceptional customer reach, Mouser is a valued strategic partner for us. We look forward to this expansion opportunity."

Raspberry Pi products now offered by Mouser include: Compute Module 4; RP2040 microcontroller; Pico, Pico H and Pico W; and Camera Module 3.

www.mouser.com

Tiny switches ready to ship

Omron's D2FP ultra-subminiature base switch is now available from Rutronik. The company states these changeover switches are characterized by durability, fast response and reliability. A sharp snap mechanism, clear 'click' and light response (0.59N) ensure a pleasant feel. The optical switches suit applications requiring fast reactions, such as keyboards, controllers and mice for e-sports applications.

The fast, chatter-free response of the optical switches (0.015ms response time) is achieved through contactless operation with sensors. The service life of up to 70 million clicks at a maximum operating frequency of 300 clicks per minute is made possible by the stable structure of the springs produced by Omron.

Minimum output voltage when the button is not pressed is 1.5V. When the button is pushed, it takes 27µs for the output voltage to drop below 0.4V after the LED lights. Accurate mounting is facilitated by integrating the sensors into the switch. The switches measure 12.8 by 5.8 by 6.5mm.

www.rutronik24.com

Transformative transaction in components distribution

WT Microelectronics has entered into an agreement to acquire 100 per cent of Future Electronics' shares.

WT Microelectronics' chairman and CEO, Eric Cheng, said: "Future Electronics has an experienced and deep management team and a very talented employee base and is highly complementary to WT Microelectronics in terms of product offerings, customer coverage, and global footprint. Future's management team, all their employees worldwide and all locations and distribution centers will continue to operate and add value to the organization."

Future Electronics' president, CEO and chairman, Omar Baig, added: "Our two companies share a common culture, driven by a rich entrepreneurial spirit that will empower our talented employees globally. This combination is a great opportunity for WT Microelectronics and Future Electronics to jointly form a world-class industry leader, and allows us to continue our long-term strategic plan to offer the highest level of services to our customers, which we have been doing for the past 55-years."

www.futureelectronics.com

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ES News

In Brief

200mm fabs heading for high
In its *200mm Fab Outlook to 2026 Report*, SEMI announced manufacturers worldwide are projected to increase 200mm fab capacity by 14 per cent from 2023 through 2026, adding 12 new 200mm volume fabs (excluding EPI) as the industry reaches a record high of more than 7.7 million wafers per month. *www.semi.org*

Growing line card
Waldom Electronics has added Kyocera AVX to its manufacturer line card by participating in Waldom's Excess Management Solution. This partnership will provide opportunities to service Kyocera AVX's global authorized distributors in a sustainable manner by providing in-stock inventory at reduced MOQ investments and distribution costs while reducing their risk of excess inventory. *www.waldom.com*

Power inductor capacity boost
Vishay Intertechnology has opened a new manufacturing facility in Gómez Palacio, Durango, Mexico. Initial activity will be mass production of power inductors. Vishay's senior VP, Mike Husman, said: "La Laguna will give us plenty of room to grow and to help us achieve our plan to double our global inductor capacity." *www.vishay.com*

Supply chains look healthy
IPC's August 2023 Global Sentiment of the Electronics Supply Chain Report states that although cost pressures continue to impact the electronics industry, product demand and inventories remain positive. IPC's chief economist, Shawn DuBravac, said: "While backlogs and profit margins are expected to improve, ease of recruitment is likely to remain challenging." *www.ipc.org*

Novel fans now in stock

RS is stocking ebm-papst's DiaForce 120mm diagonal compact fans which are claimed to combine an axial fan's airflow volume with a centrifugal fan's static pressure. This combination is designed to deliver the performance of counter-rotating axial fans with less noise and significant power efficiency improvements to satisfy challenging cooling demands.

Developed to meet the ambitious specifications of an electronics giant looking to cool its next-generation AI servers, ebm-papst's new DiaForce fans deliver up to 50 per cent more air performance than the best single-stage compact axial fans currently on the market while generating six to 12dB(A) less noise. They also offer a significant reduction in power, less mechanical vibration and a smaller, lower-profile footprint.

Applications include server, base station, mass storage and cabinet cooling, plus autonomous/AI technologies and 5G/IoT networks.

Specifications include: 119 by 119 by 86mm dimensions, 400cfm airflow, 395W, 48 per cent overall efficiency, 48VDC nominal voltage, 17,200rpm nominal speed and -4 to 158°F operating temperature range.

us.rs-online.com

Investing in solar product production

Amphenol Industrial Operations is expanding with a new solar product factory opening Q4 2023. The new 58,000ft ² facility will be in Mesa, Arizona. The factory will be focused on manufacturing solar junction boxes, connectors and other interconnect assemblies to support the solar energy industry. Mesa was selected due to its strategic location, favorable business climate and skilled workforce.

Amphenol Industrial Operations' general manager, Mark Cunningham, said: "We are thrilled to expand our operations and support the solar energy industry with new products designed to increase efficiency and reliability, while reducing supply chain risk in the US market."

Martin Pochtaruk, president of Heliene (a North American domestic module manufacturer and Amphenol Industrial Operations customer due to its American focus) said: "Amphenol Industrial Operations' junction boxes are becoming an essential component of Heliene's bill-of-materials for its US-made solar PV modules. Heliene is committed to decarbonizing our supply chain and utilizing more domestically sourced components in our manufacturing."

www.amphenol-industrial.com

North America distribution partnership for TFT and MIP

TTI is now an authorized distributor of Kyocera Display products, offering a variety of TFT and memory-in-pixel (MIP) displays for industrial, medical and e-mobility applications.

TTI Americas' VP of sales, Geoff Imlach, said: "TTI is excited to expand our display technology offering with the addition of Kyocera Display to our extensive customer base. The Kyocera Display brand and its broad product portfolio of TFT and MIP technologies further strengthens our position in the optoelectronics display market segment."

Kyocera Display's distribution manager, Bill Adam, added: "Kyocera Display is excited to partner with TTI as an authorized North American distributor to help us expand our channel and customer base. The combination of TTI's strengths in selling into our core markets and Kyocera Display products will help to accelerate the technology adoption and innovation by making our products more readily available to engineers and designers."

The combination of Kyocera's display range with TTI's broad and deep inventory will provide buyers with greater options in meeting their project needs.

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Component inventory: how much is enough?

Now that the component shortages are generally over and the fears of a downturn are receding, distributors must now recalibrate their stock levels for greater efficiency

The electronics supply chain has been on a roller coaster. In the last several years, the industry has gone from steady to stagnant sales growth, followed by crushing demand as manufacturers recovered from the dampening effects of trade restrictions imposed by many governments in response to the outbreak of the Covid-19 pandemic. Electronic component distributors were caught in the vortex of all these activities with OEMs tasking them to help manage supply chain conditions that were changing at dizzying speed. The tools deployed by distributors, in most cases, were as old as the industry. Adroit management of available inventory combined with nimble efforts to acquire additional stocks became the norm.

Many distributors went further. They agreed to unusual conditions imposed by suppliers. Distributors received stocks shorn of the "return-to-manufacturer" benefits they had long enjoyed. Beyond being stripped of this financial insulation, distributors also paid billions of dollars upfront for components to entice wary semiconductor suppliers to jack up production or add manufacturing capacity. Many OEMs agreed to compensate the distributors for this market stabilizing move but still had a level of financial exposure. The largest distributors were eventually forced to warn investors that this action could hurt earnings if conditions changed, and they were stuck with excess inventory. It was a risk most of the industry's key players felt was necessary to avoid further erosion of confidence. But the market challenges persisted. "Allocation", a dreaded word—for OEMs and electronic manufacturing services (EMS) providers — cropped up during the recent scarcity in addition to pricing pressures and lead times that stretched out as long as 52 weeks for automakers in desperate search for microcontrollers.

That was between 2020 and mid-2023. A new scenario is playing out today. The frantic search for scarce components is abating. Automotive OEMs have greater visibility into the supply chain and the pressure on suppliers is finally easing. Distributors are also fielding less frenetic calls from OEMs for electronic components. As usual, the departing round of shortages—like a hurricane—is leaving a lot of debris in its wake. Stocks at distributors are higher than they would like, and efforts have intensified to bring the situation under control. However, distributors must first determine the optimal level of inventory they should be carrying, which is a difficult task in an industry where OEMs and contract manufacturers wield their supply chain as a weapon for securing competitive advantages. Will OEMs offer this much needed visibility?

Divergence

A lot is at stake. For everyone. OEMs cannot afford a disillusioned supply base. Historically, gains secured whenever OEMs limit access to information are often quickly lost during times of scarcity when power reverts to suppliers and distributors. Suppliers, too, need the commitments of their distributor partners during the various industry cycles either to help manage and dispose of excess inventories during shortages or to fulfill rampaging demands in times of roaring sales, observers said. With margins already constrained, distributors cannot afford unnecessary additional costs, they noted. Dale Ford, chief analyst at the Electronics Components Industry Association (ECIA), for instance, notes a divergence in sentiments between how distributors and semiconductor manufacturers see the market evolving.

"While distributor scores are relatively close to the overall average, the difference in sentiment reveals a highly divergent view of the world with manufacturers much more positive compared to the others," Ford said, in a report on market conditions. "This renewed divergence in outlook is a possible indicator that the distribution channel is still resolving inventory imbalances while manufacturers benefit from direct sales that are more in line with end market demand."

The divergence Ford highlighted in his report emerged from the different sourcing strategies adopted by OEMs during the shortages. For the first time, many OEMs began talking directly with component manufacturers about their component needs. To avoid allocation, they encouraged suppliers to increase production and prepay for components, bypassing not just distributors but also Tier-1 companies that provide subassembly support services. "Some automakers have started to bypass tier-1 suppliers and directly collaborate with MCU suppliers to shorten the

design process, ensure stable supply, and achieve cost reduction goals," said Andrew Man, chief marketing officer of SAC Group. "In response to increasing demand and different procurement patterns of downstream customers, upstream chip manufacturers have begun consolidating in order to expand product lines and increase chances of winning orders from automakers. Indeed, the entire automotive semiconductor industry supply chain is experiencing drastic change."

Time for change

Distributors were quick to respond. Adopting the OEMs' strategy, distributors finetuned their engagement with suppliers, increasing orders and agreeing to pay ahead for components. By waving some of the rights they used to enjoy, including the possibility of returning unwanted or unsold inventory, the biggest distributors successfully improved their leverage with suppliers. But this move also left them with hefty inventory loads. Take WPG Holdings, Asia's No. 1 component distributor. The company's inventory rose at the end of 2022 to NT$111.74 billion ($3.48 billion), up 65 percent, from NT$67.72 billion, in 2019. During the same 3-year period, revenue rose only 47 percent, to NT$775.23 billion, from NT$527.6 billion.

In response to changes going on in its market and to accommodate demands from its automotive clients, WPG Holdings this year reorganized its supply chain operations, "to promote two integration strategies and optimize cooperation models," according to Andrew Yan, chief marketing officer for the company. WPG said its 4 subsidiaries—WPI Group, SAC Group, AIT Group, and YOSUN Group—were being brought into tighter strategic operations to better serve the diverse needs of its automotive customers.

Inventories have grown across the entire industry and not just at distributors. However, as the main link between suppliers and OEMs, the rise in the value of components held by distributors is of concern across the industry. WT Microelectronics, another leading component distributor based in Taiwan, also reported a surge in inventories during its latest financial year. The company said inventories increased to NT$66.5 billion at the end of 2022, up 45 percent, from NT$45.8 billion at the end of 2019 and before the outbreak of Covid-19. Contrary to WPG Holdings' experience, WT Electronics' revenue (70 percent higher) outgrew inventories during the period, justifying the rise in component stocks.

WT Microelectronics is not done growing, but it is exploring acquisitions this time. Eyeing overseas expansion, higher margins and better supply chain systems, it has offered $3.8 billion for Canada's Future Electronics. The acquisition will give the company its first base outside of Asia-Pacific and help it create inroads into higher margin businesses currently dominated by European and American distributors. "This is transformational for WT Microelectronics and Future Electronics and important for the electronic component ecosystem," said Eric Cheng, chairman and CEO of WT Microelectronics.

Transactions like this will help the industry gain a better understanding of its inventory exposure. As a publicly traded company, WT Microelectronics had always published its financial details, including inventory levels, cash holding, gross profit margins and other operating metrics. As a result, other industry players have had access for years to critical information about the company, helping to add to data in the public sphere for the industry. That had not been the case for Future Electronics. Established in 1968, the company remained private for decades and had not been obliged to publish financial information. The planned acquisition changed this, offering industry observers and analysts critical insights into the company's sales and operating conditions.

"The transaction will enable the combined company to provide seamless cross-border services to customers around the globe, achieve geographic diversification and deliver a full range of product offerings, application engineering expertise, as well as superior logistics management services," WT Microelectronics said, adding it "will further enhance the combined company's strengths in supply chain solutions."

"While distributor scores are relatively close to the overall average, the difference in sentiment reveals a highly divergent view of the world with manufacturers much more positive compared to the others"

Dale Ford, chief analyst, **ECIA**

"This is transformational for WT Microelectronics and Future Electronics and important for the electronic component ecosystem"

Eric Cheng, chairman and CEO, **WT Microelectronics**

A switch for all seasons

Sager Electronics' VP supplier marketing & product management, Craig Sanderson, explores switch applications from industrial to aerospace and more

Switches are ubiquitous, performing a variety of functions including power on/off, human-to-machine interface (HMI), machine-to-machine interface (MMI), navigation and safety. Various types and features suit them to all vertical market segments of the electronics industry.

Switch products are deployed in industrial, instrumentation, medical, communications, transportation, computing, networking and aerospace/defense segments. Primary electromechanical switches are: pushbutton, toggle, rocker, basic/snap-action, limit, tactile, DIP, rotary DIP, rotary, keylock, slide, pressure, reed and thumbwheel/pushwheel.

Typically, industrial applications require a robust switch, often sealed or ruggedized to withstand harsh environments. Popular are pushbutton e-stop switches, limit switches, basic/snap-action, toggle and rocker switches. All types have sealing and heavy duty or ruggedized options.

For instrumentation applications, switches do not normally require harsh industrial protection features. Prevalent switches in instrumentation or test/measurement applications are pushbutton, toggle, rocker, tactile, DIP, rotary DIP, rotary and thumbwheel/pushwheel.

Medical equipment OEMs have moved much of their user interface to touchscreen and sensor interfaces but still employ pushbutton, toggle, tactile, basic/snap-action and rotary switches. Some medical applications require sealed switches, a key feature regarding cleaning and sterilization of patient contact equipment.

Communications and networking applications range from power on-off toggle, rocker, pushbutton switches with some utilizing a hydraulic-magnetic circuit breaker to handle heavy power requirements. Also, board-level pushbutton, toggle, tactile and DIP switches play an important role in controlling PCB configurations. Hand-held communication devices use a form of tactile switches known as navigation devices, letting users scroll and navigate between screens.

Transportation applications include construction, rail, forklifts and heavy-duty vehicles. Here keylock, rocker, toggle, pushbutton and pressure switches are used to control equipment movement, ensure cabin safety and deploy various vehicle features. Pressure switches monitor and adjust oil pressure for engine performance.

Aerospace and defense applications require the most robust, well-engineered switch products. These switches need to perform in harsh environments and withstand shock/vibration, often at high altitudes. Important switch products include toggle, pushbutton and limit switches. They must meet rigorous requirements, with many assigned a QPL part number. MS, Mil or QPL listing is the standard recognized by military and aerospace OEMs and the military to ensure switches and other products meet their quality requirements.

As the electronic component industry evolves, switches are being replaced in some applications by touch screens and sensor products. Certainly, these new technologies provide significant value in terms of measuring data, offer easier user interface and streamline the application. At the same time, they often include an electromechanical switch. Many design and safety engineers will continue to rely on switch products for their applications given their proven performance, cost effective features and ease of use. Sager Electronics' broad electromechanical switch product offering can support any customer application.

www.sager.com

Sager Electronics' VP supplier marketing & product management, **Craig Sanderson**

Many design and safety engineers will continue to rely on switch products for their applications given their proven performance, cost effective features and ease of use

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Untangling uncertainty in today's supply chains

TTI's senior director, supply chain and AIM services, Ben Lasoi, explores complex supply chains and how product access, process optimization and innovation are keys to success

In many ways, global supply chains are back on track following a tumultuous 2020/2021 as companies strive to keep projects going and revenue flowing. However, volatility and uncertainty remain challenging realities.

Issues like global political unrest, worldwide inflation, customer unpredictability, increased expectations, labor shortages, extreme weather, increased technology demands and more are complicating the question buyers are asking: 'where is my stuff?'.

While the pandemic tested supply chain resiliency, it also revealed kinks in the system that needed addressing. Now, 60 per cent of supply chain leaders are investing in customer experience metrics and data analytics to handle the enhanced speed, complexity and demand they're facing. The differentiator in how companies can thrive—and not just survive—with product supply issues is how they maximize these three critical factors.

Product access: When a typical project requires dozens of components—any of which could derail the entire system—the first step in optimizing the supply chain is securing a proven and reliable distributor with a broad and deep inventory of fully authorized parts, free of defects and counterfeits. Superior parts come first.

Quality distributors will have application programming interface technology that allows customers a real-time look at what's in stock, making it possible to access inventory/pricing information and place orders without delay. In addition, bill-of-materials management analytics provides instant inventory assessment on current component availability. Effective supply chain management isn't just about product availability but also the effective use of component information, industry know-how and design/integration expertise that a distributor can provide.

Process optimization: Digitization, inventory optimization and control tower utilization (an integrated, personalized dashboard of key supply chain data, people, processes and technology for greater visibility, control and decision making) are becoming more useful operational tools in this age of immediate and immense data. Concepts like end-to-end visibility and system agility and flexibility are legitimate goals, and the new objective isn't just securing parts but also optimizing inventory levels.

Top distributors will have advanced inventory management tools, tailored to ordering and delivery requirements that result in reduced procurement, logistics and shipping costs, thus lowering total cost of ownership. Other forecasting and performance management tools are available to help make visibility, flexibility and adaptability force multipliers for higher performance.

Progress innovation: What will separate the survivors from the thrivers in supply chain management will be how companies use technology and innovation, areas we're just starting to explore. With performance accelerators like the Internet of Things, predictive analytics and artificial intelligence/machine learning and forecasting, companies will greatly improve overall supply chain visibility and effectiveness.

TTI has mastered these product, process and progress necessities, with over 27 billion units shipped last year with an industry-leading delivery rate. That's how TTI can offer tailored, flexible and dependable supply chain solutions for greater efficiency and performance with reduced costs and downtime regardless of whatever challenges our industry faces.

www.tti.com

TTI's senior director, supply chain and AIM services, **Ben Lasoi**

While the pandemic tested supply chain resiliency, it also revealed kinks in the system that needed addressing

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Digitally navigating complex supply chains

Lytica's chairman and chief strategy officer, Ken Bradley, introduces the concept of digital transformation and details five benefits offered to supply chain managers

Globalization, increased competition, shifting consumer preferences, labor shortages, component shortages, plus the need to be streamlined, efficient and cost-conscious, all increase the complexity of supply chain management. As a result, digital transformation is critical.

While all businesses struggle with supply chain management issues, consumer electronics is perhaps one of the most complex supply chains to manage, thanks to rapid growth within this broad market. Consumer electronics market revenue is projected to reach $602.50 billion by the end of 2023, followed by expected annual growth of 12.07 per cent over the next four years.

For example, consider EV manufacturing volume and all the electronic components (like high voltage applications) needed to create these vehicles. Beyond creating new parts, these components must also meet industry standards as the call for increased regulatory restrictions booms. Then, there is the additional wrinkle of reintroducing mature parts to meet new requirements.

With so many layers of complexity at play, those in consumer electronics require more efficiency and transparency from their supply chain management systems to remain competitive. This is where embracing digital transformation comes in.

Digital transformation is the process of adopting new digital technologies to create or improve products or services and to make operational workflows more efficient and effective. Digital transformation tools let organizations collect and analyze large quantities of data from multiple sources. Users get the best, most up-to-date view of their supply chain, customers and market.

The following five examples illustrate tangible benefits to supply chain teams embracing digital transformation.

1) Digital transformation offers organizations the simplification of focus through the power of data and analytics. By using digital tools to gain access to data, like component pricing or consumer trends, organizations can identify areas for improvement, restructuring or resource allocation.

2) Automation of repetitive tasks. Supply chain management issues can become unnecessarily

tedious or error-prone, due to a manual approach. By adopting digital tools, organizations can automate routine tasks like data entry, order management and inventory management. This reduces the chances for inconsistencies/ errors and saves time and resources better spent on larger business objectives.

3) Modern digital tools are invaluable for monitoring market changes and tracking real-time price and availability trends. This type of data ensures decision-making processes on pricing or product offerings are always based on data, not instinct, and helps circumvent product shortage issues.

4) Effectively managing supplier relationships. Digital supplier relationship management platforms can provide data on supplier performance, reliability and responsiveness, all critical information when selecting and managing suppliers.

5) Ability to successfully and rapidly redesign and reuse new components. With the right digital transformation tools, users can more easily create prototypes, develop new products and introduce or retrofit components to meet new environmental regulations.

Digital transformation is vital for improving business operations-specific strategies including time-to-market, time-to-cost and quality enhancement. With digital transformation, organizations can harness the power of data and analytics to enhance product quality and pricing while slashing waste. Digital transformation helps improve resource allocation and operations, ensuring organizations operate as competitively as possible.

To navigate supply chain management successfully, digital transformation is vital to improving efficiency and efficacy. Embracing the power of digital tools, data and analytics helps organizations streamline supply chain management and workflows, respond nimbly to shifting market and customer trends, and operate at maximal efficiency in the crowded global marketplace.

For companies ready to embrace digital transformation there are three key elements to focus on: tools, vendors and partners for supply. However, companies must refrain from attempting to shoulder the entire burden themselves. Instead, they should actively seek capable partners in their digital transformation journey.

Most electronic products share standard core components from reference designs set out by the manufacturers. Many electronic products share common supply, manufacturing and logistics business models. As a result, they often face similar challenges and effective digital transformation solutions have likely already been successfully deployed in similar contexts.

The best digital transformation tools provide data collection, analysis and interpretation that delivers supply chain transparency to help organizations avoid product shortages, work with the best vendors/suppliers and perform at their peak.

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> **Digital transformation is the process of adopting new digital technologies to create or improve products or services and to make operational workflows more efficient and effective**

Avoiding obsolescence issues

In this article, Mouser explains why component obsolescence is an increasing headache for buyers and how sourcing the latest technology helps sidestep the issue

Few things are more frustrating to buyers and engineers than a delay caused by obsolete components or components not recommended for new design (NRND). The number of components reaching obsolescence has increased over time, with reasons including more advanced manufacturing capabilities, greater feature integration and pressure to adapt to quickly changing consumer tastes.

Constant demand for new products tends to shorten product life cycles. This often translates into components becoming obsolete at a faster pace. In 1970, the average life cycle of a semiconductor was expected to be 30-years. Today, that number has reduced to under 10-years.

Identifying product lifecycle and NRND products are two examples of value-added services from high service distributors. For example, Mouser gives suggestions for component alternatives, along with the risk level assessment for those potential replacements.

Having the most advanced technology to develop cost-efficient prototypes limits costly redesigns, manufacturing delays or even a project's termination. It also helps designers deliver more product features/capabilities, plus longer lifecycles.

Mouser's customers can be confident they are working with the most advanced, genuine electronics available and can subscribe to receive product notifications. The company offers real-time product availability through its website and customer service representatives.

Mouser's Purchasing Resource Library features articles and videos designed to help buyers make informed purchasing decisions. The library contains instructional videos developed in partnership with leading manufacturers. It also features articles addressing trending topics, such as vehicle charging infrastructure, chip shortages and supply chain challenges.

The company's website also offers links to services and tools including the FORTE intelligent BOM tool, Price and Availability Assistant and API hub.

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ASICs protect against obsolescence

Swindon Silicon Systems' director of sales, Richard Mount, explains how application specific ICs, or ASICs, offer a solution to component obsolescence

An ASIC is a bespoke chip designed precisely for its destined application. Taking a custom design approach means an ASIC can offer many benefits over a standard IC, including improved performance and reduced power consumption.

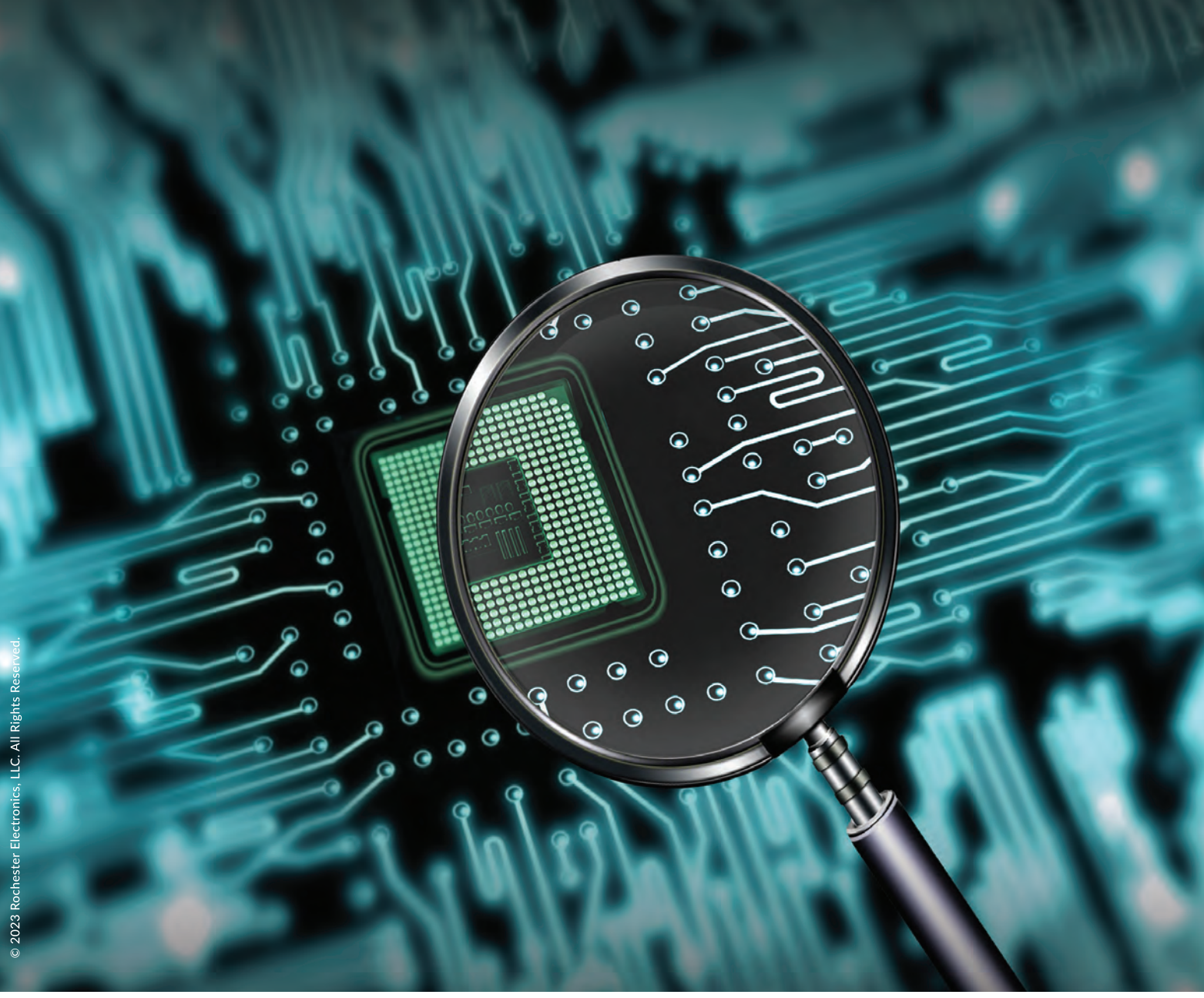
In the case of a chip becoming obsolete, an experienced ASIC designer can replicate the functions of the old chip onto an ASIC. This may be completed on a similar silicon process or more modern process with higher speeds, depending on the obsolete part's age and when it was first designed. This offers an ideal route for manufacturers with products still early in their lifecycle, plus those in critical sectors that need a high-quality, guaranteed chip supply over a prolonged period. With the ability to replicate the design and performance, it's possible for the new chip to offer all the benefits of ASIC design while fulfilling the requirements of the original IC.

Where obsolescence notification is short notice, the time taken for ASIC design and development can be a concern. This can be approached in a two-stage process where a last-time-buy (LTB) is purchased along with the commencement of a replacement ASIC development. If the original schematics are available, this could possibly simplify and shorten the design phase. ASIC engineers can also use existing circuit-block IP as part of their design, streamlining the process and shortening the timeframe between specification and production, thus reducing the LTB requirements and subsequent cost.

ASICs are designed with non-obsolescence in mind. The two main components that typically can become obsolete are the silicon process and packaging. With the latter, it's typically easy to find an alternative and the change can be made with a potential requalification process completed by the ASIC supplier and customer. However, the silicon process requires more thought. An experienced ASIC designer can advise on the right choice. The primary factor is choosing a silicon process that meets the performance criteria while also matching the end product's availability

Continues on page 22 >

With the ability to replicate the design and performance, it's possible for the new chip to offer all the benefits of ASIC design while fulfilling the requirements of the original IC



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requirements, ultimately satisfying performance, maturity and longevity needs.

In the unlikely case that process obsolescence comes sooner than calculated, the ASIC supplier will typically receive around two years' notice from the foundry, giving the supplier and manufacturer time to find a solution. This could include porting the design onto a new silicon process. This occurrence is rarely seen in the ASIC world.

As in the case of standard ICs, purchasing an LTB of fully packaged chips is an option. However, it is also possible to purchase an LTB of wafers instead. These can be stored in dry nitrogen cupboards for up to 30-years, allowing the ASIC supplier to fulfil orders as and when required. Cost is another advantage, with the commercial outlay of an LTB supply of wafers often much lower than complete chips.

Regardless of the route, it is crucial customers are involved early in the decision-making process. This ensures a complete non-obsolescence plan from the start of the ASIC design process. It also means manufacturers face significantly lower risks of being left without supply or unexpectedly needing to fund an LTB outlay of chips over the product lifetime.

Component obsolescence is not ideal for any manufacturer but solutions are available. By turning to custom IC design, producers are offered a replacement chip in a time of need and a chip designed to last a lifetime.

With over 50-years' experience in the design and supply of ASIC solutions for the automotive and industrial sectors, Swindon Silicon Systems has the technical expertise to offer a solution for ASIC applications.

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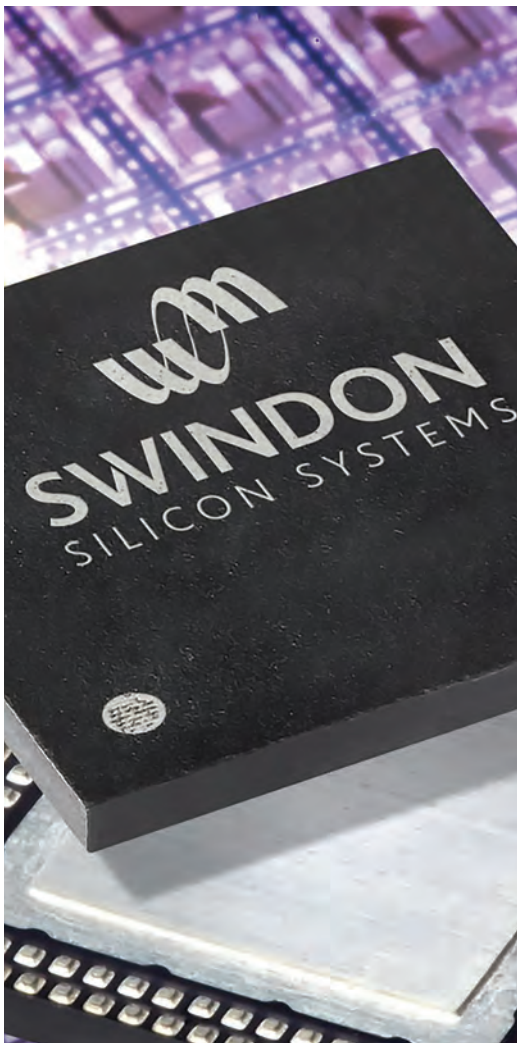

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Avoiding obsolescence pitfalls

4 Star Electronics encourages purchasing professionals to develop and deploy a proactive and strategic approach to avoid the pitfalls of component obsolescence

Sourcing obsolete electronic components is a significant challenge that can disrupt production, increase costs and jeopardize product quality. Obsolete components can be hard to find, leading to long lead times or even the inability to source required parts. As components become obsolete, the supply diminishes over time. It's not uncommon to find the last remaining available stock has been depleted, leaving buyers with no source of replacement parts.

When a component reaches end-of-life, they typically become scarce, which drives up prices. If sources are limited, some sellers may take advantage and unreasonably inflate prices.

Another significant risk when sourcing obsolete electronic parts is counterfeit components which can be substandard, unreliable or even dangerous. It's imperative that buyers have good sources of supply or a comprehensive plan to counteract this.

It is also important to appreciate that obsolete components may have been sitting on shelves for years with their quality deteriorating over time due to moisture, temperature fluctuations and handling.

Solutions to these issues start with establishing a dedicated obsolescence management team comprising experts in the electronics industry, market trends and component lifecycles. The team can monitor components' lifecycles—from introduction through maturity and into obsolescence—identifying potential issues in advance. Market intelligence tools and services provide insights into industry trends, emerging technologies and components' overall lifecycle. Some tools provide real-time status updates of component inventory.

Buyers should also maintain an inventory of critical components at risk of obsolescence. Buffer stock helps mitigate the impact of sudden obsolescence announcements. Holding excess inventory—and the costs associated with that—can be tricky but is essential for ensuring the right parts are available when needed.

By building strong relationships with component manufacturers and their authorized distributors, buyers can gain insight into their product roadmaps and plans. This information can help anticipate potential obsolescence issues.

Single sourcing critical components is risky. Work on diversifying the supplier base by engaging with a specialist independent distributor who can help procure material from the open market when other options are unavailable. Many independent distributors have processes in place for bill-of-materials and lifecycle analysis, plus vendor management, kitting and full purchasing outsourcing. The top tier independent distributors provide validated material and support counterfeit avoidance initiatives through in-house inspection and test, typically based on the Independent Distributors of Electronics Association's IDEA-STD-1010 visual inspection standard or the SAE's AS6081 and AS671 aerospace standards for counterfeit electronic parts. If advanced testing techniques—such as full functional electrical testing—are required, independent distributors have relationships with established test labs to meet validation requirements.

Prioritize testing and reliability assessment of components in the inventory to help ensure components meet quality and performance standards and have not deteriorated over time.

Regularly perform risk assessments to help review and refine obsolescence management strategies to adapt and improve processes to better respond to changing conditions.

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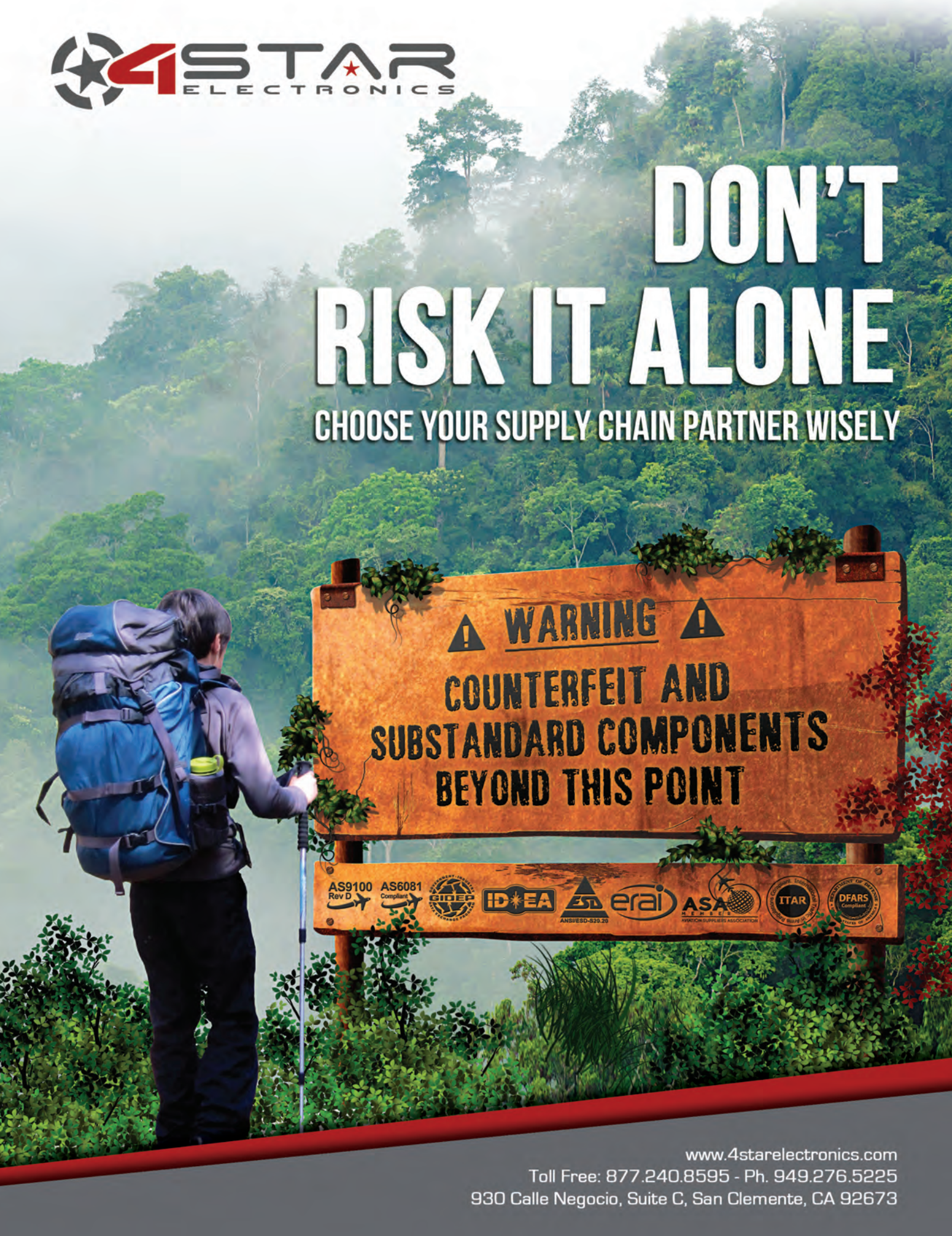
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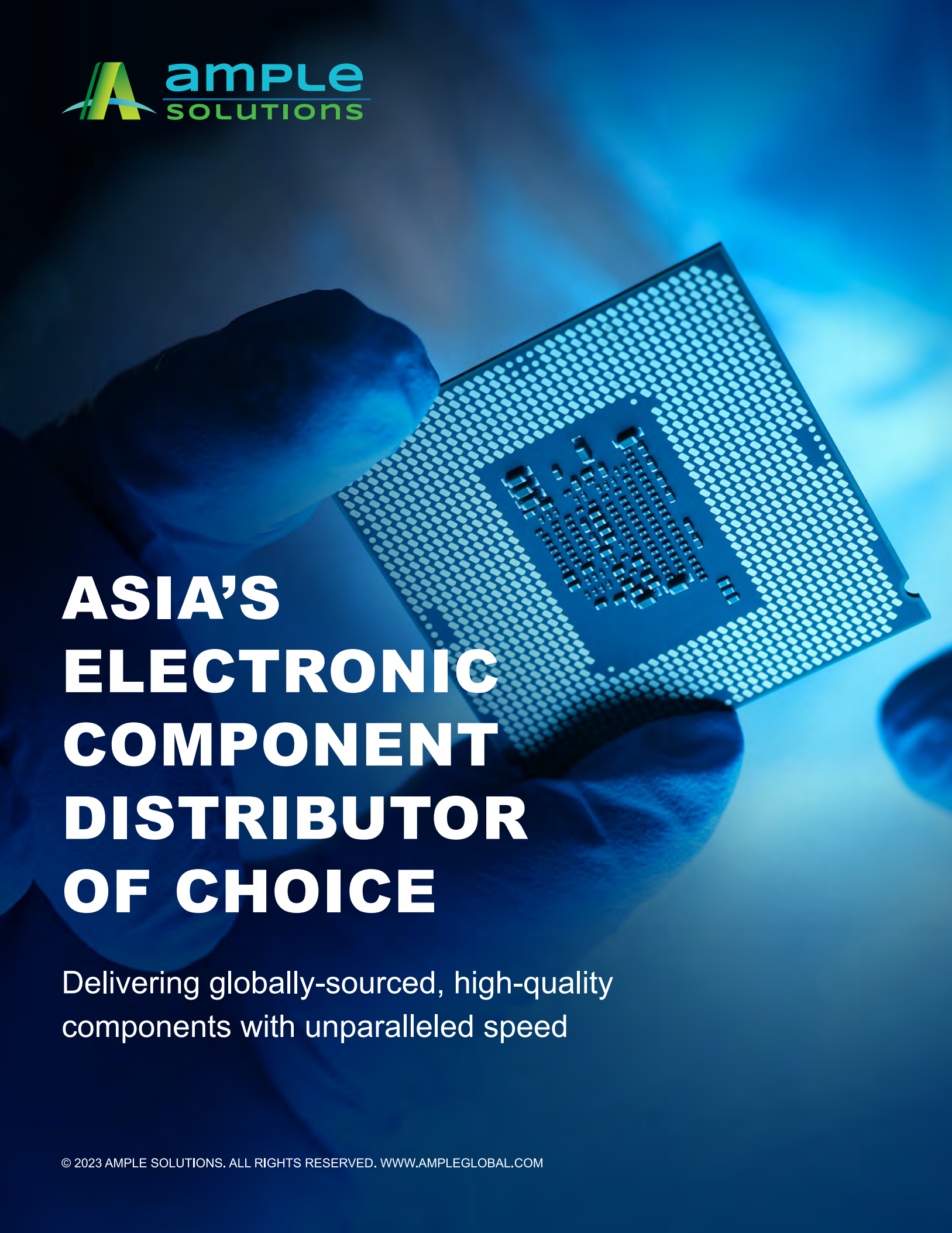

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When fighting counterfeiting, vigilance never goes out of style

Flip Electronics' VP of quality and warehouse operations, Gary Beckstedt, explores counterfeiting data, trends and best-practice prevention strategies

Flip Electronics' VP of quality and warehouse operations, **Gary Beckstedt**

Wherever necessity and scarcity collide, there is money to be made. Wherever there is money to be made, counterfeiters and other opportunists can be found circling the waters. The electronic component industry is no stranger to this phenomenon. Counterfeit electronic components have been the bane of technology manufacturers' existence for decades, but when supply is threatened, production deadlines loom and customer deliveries are at stake, it can be tempting to risk an unsanctioned vendor. It is a risk—unauthorized parts are rarely, if ever, in step with original manufacturers' quality standards.

More than one trillion semiconductors—$574 billion worth—are sold worldwide each year, led by logic, memory and analog ICs. Policing can be a daunting task, especially on a global scale. Though the numbers aren't definitive—not all counterfeits are found, nor are they reported when they are—the ERAI noted a 35 per cent increase in reported counterfeit and nonconforming parts from 2021 to 2022, despite global semiconductor sales remaining essentially flat. Its buyer beware when purchasing components in the grey market.

Even for the most diligent, counterfeits can sneak into the supply chain. The only way to be assured of the highest quality components is to deal directly with original manufacturers or their authorized and franchised distributors. A rigorous approach to sourcing and due diligence once parts arrive can help keep sham components out of finished goods. So can staying abreast of counterfeiters' latest tools of the trade. The following are some of the prevalent trends.

Increased counterfeiting sophistication alongside the rise of authentication technologies.

Counterfeiting isn't a mom-and-pop game anymore, nor is it simply stripping old parts from e-waste for resale. Counterfeiters' latest techniques are more nuanced and sophisticated. They may use processes closely mimicking genuine components, from flawless finishes to unimpeachable paper trails. In turn, this is accelerating demand for authentication and anti-counterfeiting technologies such as blockchain, RFID and unique serialization to track and verify components throughout

the supply chain. However, counterfeiters can be quite skilled, so anytime a new detection or prevention methodology is introduced, it's a fair bet they're working on ways to offset it. Component buyers must remain hypervigilant and component manufacturers' R&D investment should go beyond the parts themselves to protecting the parts.

Business as usual despite the re-homing of semiconductor manufacturing. It's long been a trend to offshore various aspects of production to lower-cost labor markets. However, the effort to build or maintain dominance in the semiconductor field among ever-present geopolitical tensions and materials scarcity is prompting a rethink. The Covid-19 supply chain debacle provided a stark reminder of the dangers of manufacturing in outlying locales. While efforts to shore up supply chains and rehome manufacturing are accelerating, they won't happen overnight. Neither those making or consuming components can let future promises blind them to present realities. Millions more counterfeit parts have entered the market since the CHIPS and Science Act was signed into law in August 2022. Onshoring manufacturing will provide greater quality control, for now it's business as usual for counterfeiters.

Bobbing and weaving through advanced testing, screening and tracking efforts. The savvier the counterfeiter, the more aware they are of companies' countermeasures. It's easy for counterfeiters to forge traceability documents/certificates. If a counterfeiter is good, x-ray inspection and basic functional testing will only get buyers so far regarding recovered and reused parts. The fact many chips are designed for long life and multiple use cases can keep them recirculating through illicit channels for years. AI-powered track-and-trace is becoming an anti-counterfeit weapon of choice to help maintain a transparent supply chain and verify components' authenticity. Full-functional testing—100 per cent fault test coverage to the manufacturer's specs per AS6171 standards—is the best way to ensure performance, especially when provenance is questioned. However, counterfeiters understand the cost of implementing such measures—and many companies don't unless it's legislated. It's like playing the odds at the casino: never bet against the house.

No one is safe from counterfeiting, not those on technology's cutting edge nor those trying to find a reliable source for end-of-life or obsolete components. ERAI found 62 per cent of parts reported as counterfeit in 2022 were classified as 'active' while just 33 per cent were classified as 'obsolete' or 'not for new design'. No matter how meticulous a counterfeiter is, re-marking and recovery processes, along with poor handling and storage, can damage components.

Collaboration between organizations, industry associations and government agencies has been increasing to share information about counterfeit threats and prevention strategies. Governments are getting on board with stricter regulations requiring companies to act. Organizations have focused on training employees to identify and report counterfeit components: crucial in preventing counterfeits entering the production process. Buying electronic components from authorized sources is the surest way to reduce risks of obtaining counterfeit parts. When fighting counterfeiting, vigilance never goes out of style.

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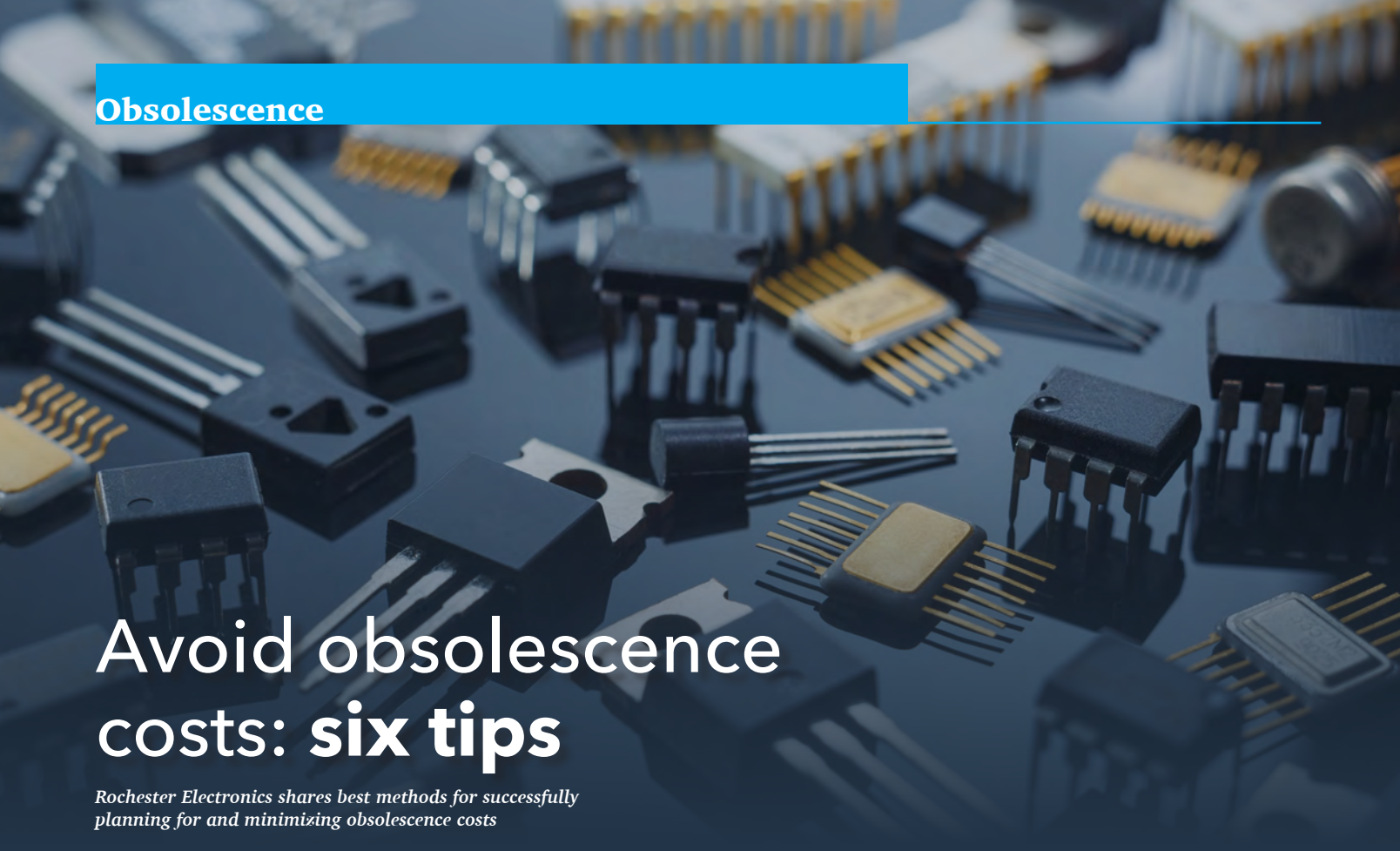
The only way to be assured of the highest quality components is to deal directly with original manufacturers or their authorized and franchised distributors



Avoid obsolescence costs: **six tips**

Rochester Electronics shares best methods for successfully planning for and minimizing obsolescence costs

1) Obsolescence management begins at design and product definition phases

There are stories of products being launched with obsolete components, a particularly relevant issue for customers with lengthy development and qualification cycles. Choosing the right component technology and supplier can dramatically impact long-term availability. Lowest cost sources may not be the best long-term supply choice.

Key questions:

- What is the component's lifecycle status across the application's lifetime?
- Are the design's key components comprehensively documented?
- Can the true design files be retained and archived during the design phase, offering a chance of rebuilding if the unexpected happens?
- Does the design contain proprietary intellectual property?

2) Understanding the total costs of obsolescence

It is important to understand and model costs and risks associated with obsolescence.

Key questions:

- Does the project plan need to include anticipated product refresh or redesign during its life? If yes, how will it be funded?
- How will the business account for capital locked down in long-term component sourcing?
- What will the component obsolescence impact be on after-sales service commitments?
- What effect would a shortened product lifecycle have on customers and end-users?

3) Planning for obsolescence and resource management

If equipment has long qualification, production or in-service lives, OEMs will face component obsolescence. Best-in-class organizations devote skilled multi-disciplined workers to obsolescence management. Preventative planning can reduce or eliminate cost and risk.

4) Identify important Product Discontinuation Notices (PDNs) and monitor them

Proactively monitoring component lifecycles is crucial to anticipating problems before they occur. Excellent commercial tools are available which track a component's lifecycle, lead-times and specification changes. Alerts can be triggered when PDNs are issued.

Key questions:

- Will sub-tier suppliers share their BOMs?
- Do sub-tier suppliers have adequate obsolescence management processes in place?

While many component manufacturers offer proactive component lifecycle management as a service, others are completely reactive. PDN notifications are typically only aimed at the direct purchasers over the previous two-years.

5) Last-time-buy: what to forecast?

Forecasting is not an exact science and forecasts are likely to be inaccurate. It is difficult to anticipate product needs years in advance or possible market disruptions. Underestimating risks prematurely terminating a product. Overestimating ties up unnecessary capital in stock and excessive storage costs. If a future redesign is planned to limit LTB costs, the design, requalification and opportunity costs of using engineering resources need to be factored in.

6) Purchase from 100 per cent authorized sources

There is a misconception when a component is discontinued, that unauthorized or grey market sources are the only option. The risk-free option of an authorized after-market supplier should always be the first choice.

The risks of counterfeit and poor-quality components from unauthorized sources represent a significant risk to production yields and mean time between failure rates (MTBR) in the field. Inferior or substandard testing by unauthorized third parties provides a false veneer of confidence that authenticity can be tested. This mimicry of testing is a visual, x-ray or poor partial copy of the original manufacturer's test processes. Full tri-temp testing is rarely offered and the risk of commercial-grade components being re-marked as industrial, automotive or military is always possible.

Unauthorized component risks include:
• Poor handling: resulting in ESD damage and device destruction.
• Poor storage: excessive heat, cold or moisture during any part of its storage life.

Risks include external lead corrosion, failed solderability, moisture ingress and/or a catastrophic device failure.

• Fake documentation that mimics the original specification or lies about performed tests.

• Recovered, re-marked or repackaged components masquerading as another product.

There are also documented quality problems related to foreign chemicals. Cleaning chemicals used to recover, wash and re-mark used components, slowly migrate into the products, shorting and corroding bond wires and pads. Superficial testing is not guaranteed to find these faults. Recovered components may pass these tests and also survive for a period in service. However, their inevitable failures will destroy MTBR figures, resulting in reduced reliability and damaged reputations.

Original component manufacturers (OCMs) do not provide guarantees for products purchased through unauthorized channels.

Fully authorized distributors, like Rochester Electronics, are compliant with the SAE Aerospace Standard, AS6496. Simply stated, they are authorized by the OCM to provide traceable and guaranteed products with no quality or reliability testing required because the parts are sourced from the OCM.

Providers who are not fully authorized may market themselves as AS6171/4-compliant. While better than no compliance at all, if AS6171/* testing is offered in isolation, this potentially indicates the parts were not sourced directly from the OCM but have only passed AS6171 testing. This merely minimizes but does not eliminate risk.

As a licensed semiconductor manufacturer, Rochester also offers on-going solutions using information and technology transferred directly to Rochester from the OCM. All the resulting product is 100 per cent certified, licensed guaranteed.

Expect and plan for the unexpected. It is important to have partners who can support businesses during unforeseen or unplanned component discontinuations, completely risk-free whenever they occur.

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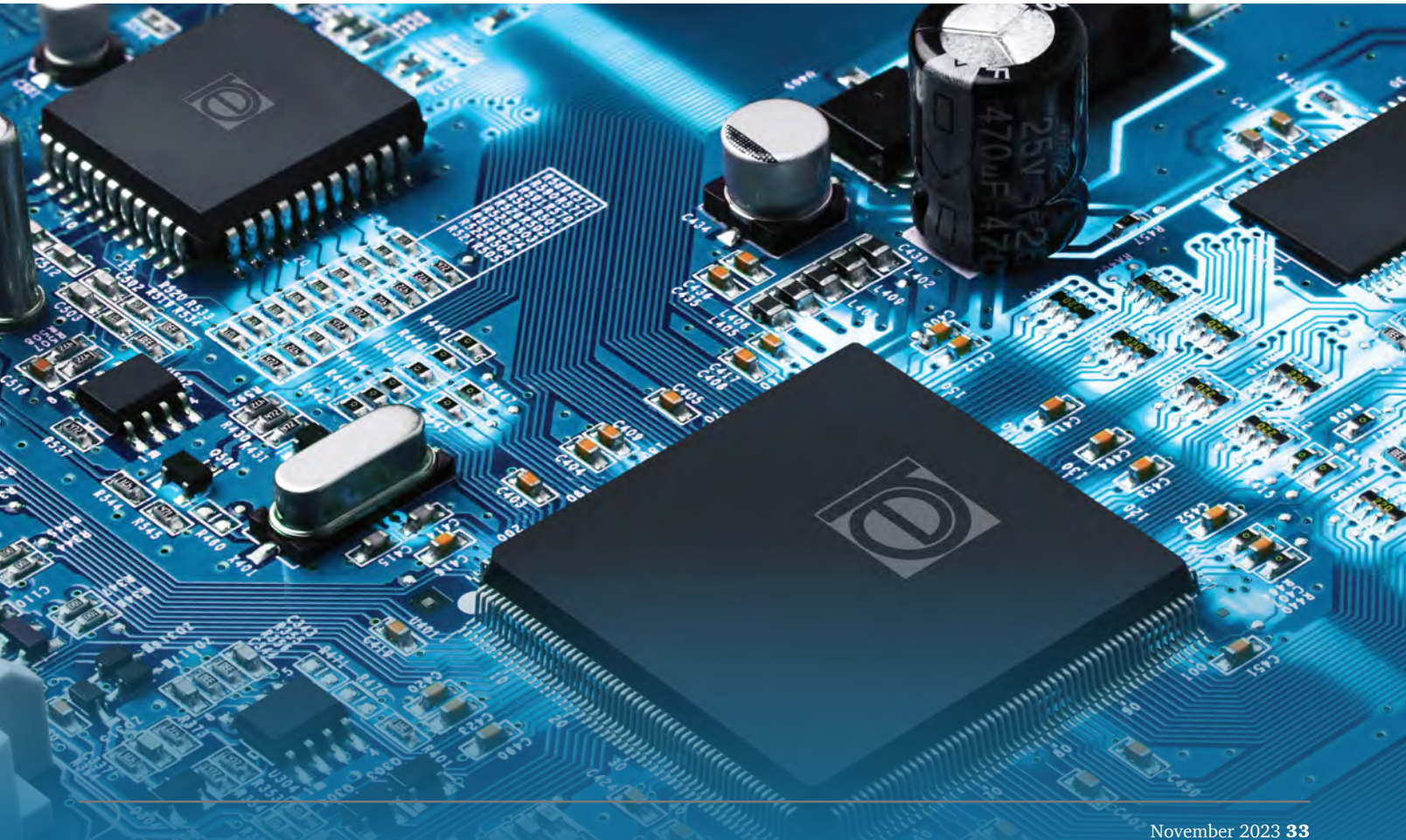


Unveiling the steps of custom battery and charger manufacturing

Accutronics' technical marketing manager, Neil Oliver, provides a step-by-step guide to custom batteries and chargers, from understanding customer needs to obtaining certifications

Every custom battery or charger order begins with an enquiry and ends with volume production. However, many tasks happen in-between to ensure the final product meets the quality, performance and safety requirements of each customer.

The initial step is thoroughly understanding the customer's requirements and expectations. This involves close communication and collaboration to gather the necessary information, including desired battery/charger specifications, performance criteria, intended applications and specific industry standards/regulations. A detailed technical specification is then authored. This document serves as a comprehensive guide for all involved, describing what is (and is not) required from the product. It includes electrical ratings, environmental considerations, mechanical constraints, and regulatory requirements.

The battery then goes through a detailed electrical and mechanical design phase, involving blocking out the internal structure, circuitry and mechanical components. The design phase may also include purchasing initial design proving components and conducting bench testing to validate expected performance.

The battery/charger housing design is also evaluated using rapid prototyping techniques to fabricate the casing quickly and cost-effectively. This involves 3D printing (or similar technologies) and helps show if components fit available space.

After fabricating the case, a batch of batteries/chargers are assembled and tested in an internal laboratory following a test plan created on the technical specification. This helps identify any potential issues in the design or assembly process. Results are documented in a validation report, which assesses whether the batteries meet the specifications.

After prototype validation, the manufacturing process moves towards hard tooling. This step involves the production of required components, which could include injection-molded plastics, formed metal parts, printed circuit board assemblies, light pipes, packaging, labels and membrane panels. Tool trials are conducted to ensure the components' quality and precision.

With the production-tooled components ready, a low volume of non-qualified batteries/chargers is built. These batteries/chargers are assembled using the finalized components, but they are not yet tested to external regulatory standards (if required).

Results are documented in a validation report, which assesses whether the batteries meet the specifications

Most of this batch is sent to the customer for approval, with the manufacturer retaining the balance for reference or analysis. Batteries over 100Wh are subject to more costly and complex shipping regulations.

To enable volume production, production jigs, fixtures, test equipment and software are designed and built where necessary. These help the efficient assembly and testing of custom batteries/chargers in a larger-scale production environment. Careful consideration is given to accuracy, repeatability and reliability during manufacturing.

In preparation for regulatory qualification testing and certification, components are purchased, and batteries/chargers are assembled. Alongside assembly, paperwork and documentation are created to meet the regulatory bodies' requirements. Documents include compliance reports, safety assessments and supporting materials mandated by the specific certification tests.

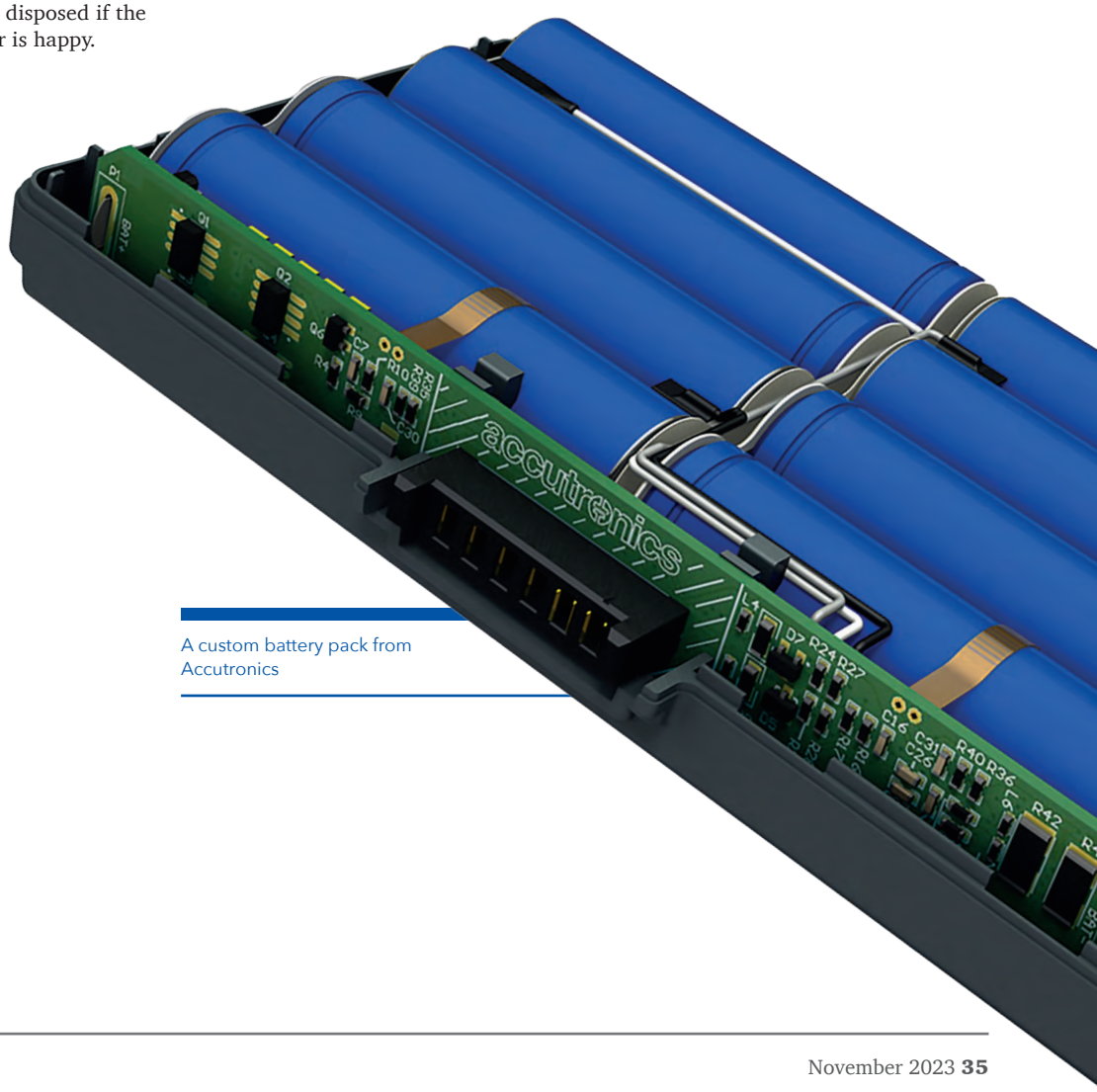
Fully assembled batteries and their documentation are shipped to an external test house specializing in certification testing. Batteries are often tested to UN 38.3 for transportation, plus IEC 62133-2:2017, UL 62133-2 or UL 2054 for safety. Other tests can include electromagnetic compatibility (EMC), ingress protection, environmental, plus validations for RoHS, REACH, and waste electrical and electronic equipment (WEEE) regulations, among others.

Once the custom batteries/chargers successfully pass the regulatory qualification testing and certification, production documentation is generated. This includes detailed instructions, specifications and quality control procedures to guide operators during volume production. Operators are then trained to ensure they have a thorough understanding of the manufacturing process. A small new product introduction (NPI) batch is built, part of which is sent to the customer for final approval. The remaining NPI batch is either retained at the manufacturing facility in case of further amends or safely disposed if the customer is happy.

As the process moves through each stage, from initial requirements to NPI batch, the cost to the manufacturer and customer increases. Therefore, it is important both parties sign-off each stage and is also the reason why prototypes are shipped to the customer before the finished product. When everyone is satisfied, the project is signed off and volume production begins (to agreed levels/dates). Accutronics' custom batteries and chargers are manufactured at one of three ISO 9001 and ISO 13485 certified facilities in the UK or USA.

www.accutronics.com

Accutronics'
technical marketing manager,
Neil Oliver



A custom battery pack from Accutronics

Medical converter offers extended temperature range

CUI has released the PTP15 series 15W, five-pin DIP isolated DCDC converter, specialized for medical instrumentation and home medical supplies.

Offering 4,000VAC isolation or 5,600VDC isolation with a 2:1 input voltage range, the series is compliant with the IEC/EN 60601-1 and EN 55011 Class A safety standards without external components. Housed in an industry standard 2 by 1in, encapsulated, board mountable package, the converter can be used in temperatures from -40 to 100°C and features output over current, short circuit and overvoltage protections.

Though specialized for medical, the PTP15 series also suits low-power consumer electronics and industrial equipment requiring high-isolation voltage. The converter is available immediately.

www.cui.com

Poke-home portfolio expands

Kyocera AVX has released its new 9296-11X series STRIPT vertical poke-home through-board contacts for 12 to 18AWG wire. This brings the portfolio total to 10 series, two of which—this series and 9296-000 contacts—can now support larger wire gauges and higher current ratings. Applications include machine controls, building controls, LED lighting and home appliances.

Kyocera AVX's product marketing manager, Perrin Hardee, said: "This new series supports the simple and reliable termination of plated and unplated solid and stranded 12 to 18AWG wires without soldering and achieves robust connections rated for up to 20A and proven to withstand the hazards of harsh industrial environments. It also offers immediate cost savings, space savings and design flexibility that can be crucial for achieving desired device functionality with densely populated PCBs."

The new series are packaged on tape and reel for automated SMT placement and currently available with an eight-week lead time.

www.kyocera-avx.com

Growing SiC Schottky barrier diode family

Bourns has expanded its 650 and 1,200V silicon carbide (SiC) Schottky barrier diode (SBD) product family with 10 new models. They address increasing power density requirements in transportation, renewable energy and industrial systems. Bourns states the line delivers the peak forward surge, low forward drop, reduced thermal resistance and low power loss capabilities demanded by today's high frequency and high current applications. These capabilities also help designers develop smaller and cost-efficient power electronics.

As power conversion solutions for DC-DC and AC-DC converters, switched-mode power supplies, photovoltaic inverters, motor drives and other rectification applications, the new models feature currents ranging from five to 10A, with no reverse recovery current to reduce EMI. This lets them lower energy losses and further increase efficiency, switching performance and reliability.

The devices are available in multiple forward voltage, current and package options that include TO220-2, TO247-3, TO252, TO263 and TO247-2. Available now, the models are RoHS compliant, halogen free, Pb free and their epoxy potting compound is flame retardant to UL 94V-0.

www.bourns.com

DC to 65GHz sets industry standard

Fairview Microwave has rolled out its VITA 67 mini-SMP (SMPM) cable assemblies. They are designed to address needs in industries including aerospace, defense, ground communication systems, radar systems and avionics.

The company states a standout feature is their DC to 65GHz frequency range, setting a new industry standard for signal transmission. The assemblies also boast a blind mate/push-on design, ensuring optimal connectivity even in high-density RF environments. Their push-on and snap-on mating styles promise quick installation, saving time and reducing potential for errors.

What's more, customers can opt for a custom configuration with a choice of connectors, including 1.85, 2.4 and 2.92mm, plus SMA. The products suit motherboard applications.

Particularly advantageous for phase array systems and avionics applications, the cable assemblies have been designed with the future of RF signal transmission in mind.

Fairview Microwave's product line manager, Kevin Hietpas, said: "We continue our commitment to innovation, ensuring our customers have access to the most advanced and efficient products on the market."

www.fairviewmicrowave.com

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Specifying the right IIoT enclosures

OKW Enclosures' VP of marketing, Robert Cox, walks buyers through the requirements of IIoT enclosure applications and products meeting these needs

Data is the lifeblood of the industrial internet of things (IIoT), playing a critical role in real-time monitoring, process optimization, predictive maintenance, quality control, energy efficiency, supply chain management, safety and compliance. Vast amounts of precious data must be managed on robust networks, so demand for IIoT network hardware is surging as companies vie to seize the opportunities offered by Industry 4.0.

Last year the global IIoT market was valued at $101.45 billion—with a compound annual growth rate (CAGR) of 20.5 per cent from 2022 to 2030, report analysts at Coherent Market Insights. Little wonder electronics designers are swiftly developing new solutions for manufacturers keen to capitalize on IIoT.

This has driven demand for specialist enclosures for IIoT electronics. Smart factory technology has opened new possibilities for manufacturers of plastic enclosures—advanced thermoplastics are making inroads into industrial markets traditionally dominated by diecast aluminum housings.

In the past, ABS was the 'go to' plastic for many enclosures, being resistant to impact and chemicals. However, ABS does not cope well with UV rays. So, more enclosures are now being molded from UV-stable ASA or blends such as ASA+PC-FR. However, there is still a place for ABS in industrial electronics, especially when blended with stronger plastics such as polycarbonate.

OKW Enclosures' VP of marketing, Robert Cox, said: "There's no doubt that Industry 4.0 has accelerated the pace of innovation in enclosure design. Creating specialized standard enclosures for IIoT reduces the amount of customization required. This means the enclosures can be manufactured and shipped faster to meet rising demand for Industry 4.0 electronics.

"And although many new enclosure models

OKW's new Mini-Data-Box exemplifies specialized 'go-anywhere' enclosures for IIoT

OKW's tough new sealed Solid-Box for larger indoor/outdoor IIoT equipment

have been designed with IIoT in mind, they're versatile enough for lots of other applications too."

Plastic enclosures for IIoT applications must be strong and well protected from dust or water ingress. A rating of IP65, IP66 or IP67 is recommended. However, durability and good ingress protection are just the start.

The sheer number of sensors involved in IIoT makes fast installation a priority. Models such as OKW's Mini-Data-Box can be specified with (or without) flanges allowing housings to be cable tied or screwed in place quickly and easily. Easytec enclosures are also flanged, while a curved recess at the rear adds stability when mounting on poles or rails.

Small handheld or wearable enclosures can also be excellent for IIoT sensor duties, particularly in smart logistics. Award-winning Minitec was originally designed for personal electronics, offering a range of standard choices based on size, shape and color. At the heart of the design are different intermediate rings offering various carrying and mounting options, making it simple to attach Minitec to objects requiring tracking.

Many IIoT enclosures feature smart, modern contours that enhance their aesthetics, an important consideration in today's futuristic factories. As standard enclosures, they must be attractive but also discreet and understated.

That ethos is exemplified by housings such as wall-mounted Smart-Panel. These ASA+PC-FR flush-mount enclosures fit standard cavity wall boxes, blending seamlessly into modern industrial settings. Screwless assembly ensures rapid installation.

However, many IIoT applications require larger plastic enclosures such as the new Solid-Box. These IP66/IP67 housings have an IK08 impact rating, plus design touches usually reserved for diecast housings. These include 'lid closed' installation to stop dust and water ingress when the enclosures are being fitted in challenging locations. Deep side recesses protect connectors and interfaces, while hinges secure the lid when open.

www.okwenclosures.com

"Although many new enclosure models have been designed with IIoT in mind, they're versatile enough for lots of other applications too

For some chipmakers, there was no downturn

The recent semiconductor market downturn was mild to severe for some companies, but a few suppliers breezed through without a scratch. Some even grew strongly through the downturn. What's the secret?

The initial outlook for 2023 was grim. By the time forecasters began finalizing their projections for 2023 late in 2022, the conclusion was that another semiconductor downturn was brewing. Chip suppliers, mainly unsure of the direction of the global economy, braced for the worst and started freezing non-critical expenses. The sales predictions were dire despite solid average selling prices, steady orders and swollen book-to-bill ratios. In 2023, semiconductor revenues will sink a whopping 22 percent, stressed one of the industry's most reliable forecasters.

UK-based Future Horizons, headed by industry veteran Malcolm Penn, is reputedly one of the industry's most accurate forecasters. His company called for the largest drop in annual semiconductor sales in years. With a sterling record behind him, even skeptics were hesitant to say Future Horizons might be a few percentage points off this time. The forecast from Future Horizons was for a 22 percent semiconductor sales plunge.

Other forecasters, including the World Semiconductor Trade Statistics (WSTS) and industry trade body, the Semiconductor Industry Association (SIA), also believed the market was headed for "a double-digit dip in global chip sales for 2023, followed by a strong rebound in 2024," as George Scalise, president of the SIA said, in a June statement.

Sorry everyone, it's beginning to look like the prognosticators were wrong. Chip sales bounced back strongly in the three months ended June 30, throwing a wrench in the forecast and renewing hopes for continued growth towards a $1 trillion market by 2030. Even Penn, notorious for sticking by his numbers, is massaging the figures. He now sees 2023 chip industry revenue dropping only 10 percent from the prior year versus his company's earlier 22 percent decline forecast. Future Horizons' bearish forecast is even less frightening. The company said the worst-case scenario for 2023 semiconductor sales was a decline of 11.5 percent from the prior year.

"It typically takes about 8 to 10 quarters for the [market] correction to play out," said Penn, during a presentation of his company's latest forecast update. "We were totally convinced that this year would be negative, and we didn't think it was going to be just a small negative."

The market played through to type in the first quarter.

Sales dropped closer to Future Horizons' bullish forecast for a decline in the range of 8 percent vs. the "more likely" 10 percent drop projected. The second quarter took everyone by surprise, however. Penn's initial forecast at the beginning of the year was for sales to decline 6 percent in the second quarter. The opposite happened. Chip sales rose 6 percent, instead, breaking initial projections for the year.

Outliers

A few companies were operating at a different level. Companies like Infineon Technologies and fellow European chipmaker STMicroelectronics could barely keep supplies on their shelves. Sales kept surging through the downturn that everyone else was experiencing. At power IC supplier, Infineon, March quarter revenue jumped 25 percent, to €4.1 billion, from €3.2 billion, in the comparable year-ago quarter. "Infineon is performing very well. We are seeing strong growth in our businesses relating to electromobility, renewable energy generation and energy infrastructure. These are precisely the key applications we are serving in terms of decarbonization," said Jochen Hanebeck, CEO of Infineon, in a statement announcing the fiscal 2023 second quarter results. "We are therefore revising our expectations for revenue and profitability in the current fiscal year upwards."

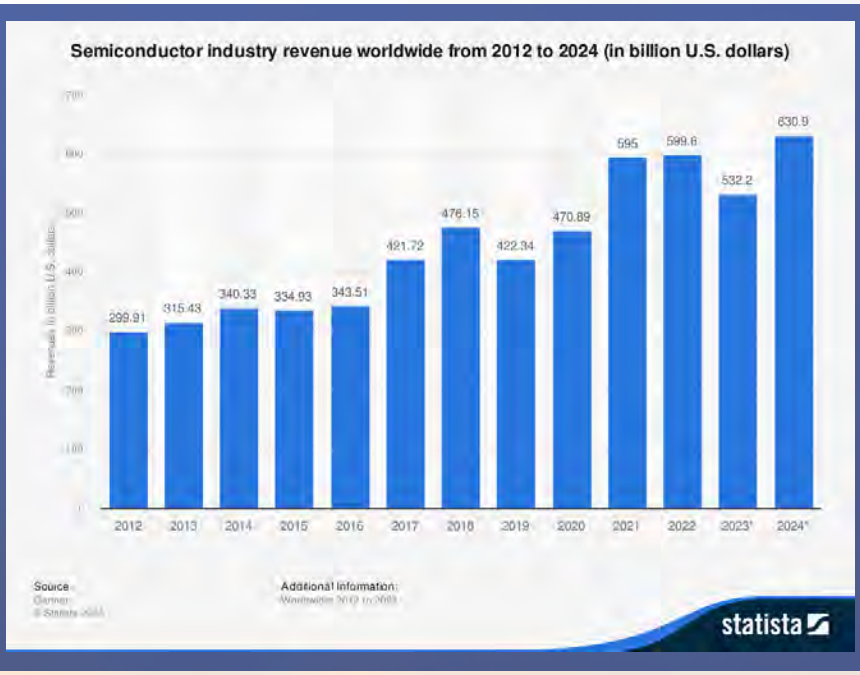
The upward revision of Infineon's fiscal 2023 revenue projection had become necessary. Munich-based Infineon was zipping through its initially conservative revenue forecasts. Revenue in the 3 months ended June (the company's fiscal 2023 third quarter) was 13 percent higher than in the fiscal 2022 comparable period. This sets Infineon on course for record revenue for fiscal 2023, according to analysts' consensus estimate.

Forecasters on average now expect Infineon's revenue to reach €16.3 billion, in the fiscal year ending September 30, up 14 percent, from the €14.2 billion reported for the immediately preceding fiscal year. A slowdown in 2024 is not in sight either. Infineon's fiscal 2024 sales are expected to strengthen over the current fiscal year, rising to €17.2 billion.

Geneva-based STMicroelectronics is in the same camp as other downturn-defying chip enterprises. In the first quarter, the company's revenue rose 19.8 percent, to $4.3 billion, from $3.6 billion, in the first quarter of 2022. It continued growing in the second quarter with sales rising 13 percent, year-over-year. The positive direction is seen continuing through the third quarter and the rest of the year, according to Jean-Marc Chery, president and CEO of STMicroelectronics. The momentum is beginning to slow, however.

Structural growth drivers

The semiconductor companies that are defying the industrywide revenue slowdown projected for 2023 operate in recession-proof market segments, including automotive, energy and industrial. ST's Chery, for instance, acknowledged the positive contributions to sales that his company received from these market segments, noting in a statement that "revenue performance continued to be driven by growth in Automotive and Industrial, partially offset by lower revenues in Personal Electronics." Infineon's Hanebeck



Semiconductor industry revenue worldwide from 2012 to 2024 (Source: Statista)

puts it best in a statement where he highlighted the impact of what he termed "structural growth drivers" or certain markets that continued to power growth through the industry and which his company and some of its competitors had focused upon in previous years. Demand for components used in the segments, which included automotive and energy, happened to have expanded strongly over the last couple of years, he added. This contrasts with high volume but struggling sections such as consumer electronics, PCs, and smartphones, noted Hanebeck.

"We are seeing strong growth in our businesses relating to electromobility, renewable energy generation and energy infrastructure. These are precisely the key applications we are serving in terms of decarbonization"

Jochen Hanebeck, president and CEO, **Infineon Technologies**

Infineon is performing well in this challenging market environment thanks to its persistent focus on structural growth drivers for the digital transformation and the transition to a green economy.

Silicon carbide (SiC) vendor Wolfspeed Inc. is another company that happens to be better insulated against a market downturn. SiC has become a highly sought product in the automotive market and in the general energy sector, putting companies like Wolfspeed, On Semiconductor and other suppliers of the components in a rare group that was able to continue expanding sales through the market depression. After a slight sales slump in 2020, for example, On Semiconductor has grown strongly over the last two years.

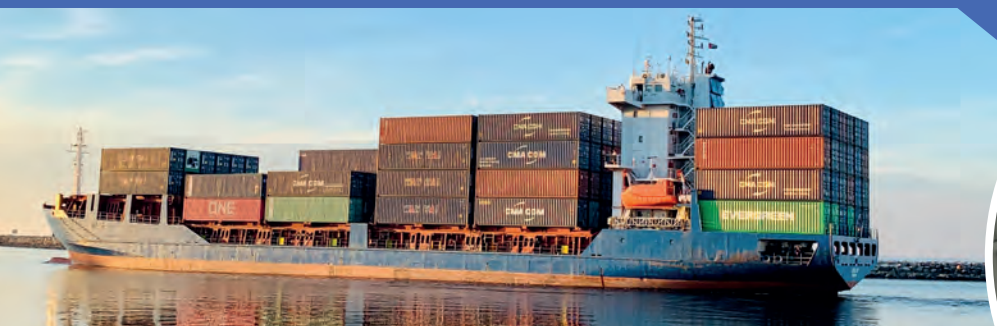
Slowing down

No company can completely defy the cyclical laws of the semiconductor industry. Not even the world's biggest and most resilient companies.

In the market, sales rise and fall regularly and all players eventually succumb to these inevitable dynamics, according to Future Horizons' Penn. Even companies in the automotive and energy sectors are experiencing the pressures of a slowing market. Having ridden successfully through the downturn, companies that enjoyed some insulation through the downcycle may not continue to grow at a double- digit pace, but they will not be as severely pressured as the rest of the market, said Penn.

The shockproof market strategy does not always work, too. Taiwan Semiconductor Manufacturing Co. Ltd. (TSMC), the world's No. 1 foundry, is one of the most shockproof companies in the chip world. It grew steadily over the years till sales reached a peak of $73.7 billion in 2022. For 2023, though, analysts see TSMC's revenue slipping in what looks like a delayed downcycle.

Analysts on average expect TSMC to report revenue of $66.4 billion in 2023, down 12.5 percent. By 2024, TSMC would be back in full swing again with projected revenue of $81.2 billion, up more than 22 percent from the prior year. That would be another sign the market had returned to growth, leaving behind the history of a downturn that impacted many, but which a few semiconductor vendors dodged.



Ocean transit by John Denslinger

Navigating the trade **tide shift** in ocean transit

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

John Denslinger dives deep into the ocean of trade transit, revealing that growth on the Gulf and East Coast is likely to exceed that of the West Coast in the coming decade

Eighty per cent of global trade is moved by ocean shipping. That's an incredible figure made possible by a sprawling network of ports, massive container ships and two vital canals. Ocean routes and transit times have remained predictable for years. America's ports once shared the same consistency, but the 'trade tide' is changing that.

To be competitive requires investment and America's gateways have invested heavily in port automation, harbor dredging for larger ships and improved intermodal connections for managing more cargo with greater efficiency. On the surface, it all looks incredibly smooth and seamless, but there's plenty of importer, exporter and shipper anxiety. The yearlong labor slowdown and strike at US West Coast ports took its toll, but as of July, it's finally over. Workers there voted to accept a six-year contract restoring stability. Also, after a two-week strike, Canadian workers ratified their four-year contract in August. The West Coast ports now seem open for normal business once more.

But ocean transit is far from normal. It appears a new normal has surfaced. The consequence of prolonged labor unrest, changing manufacturing strategies and geopolitical tensions shifted millions of container shipments from the West Coast to Gulf and East Coast ports. Manufacturers seeking supply chain resilience are likely to retain these new gateways. Likewise, as Southeast Asia and India replace China manufacturing, routing through the Suez Canal to East Coast ports becomes increasingly convenient and cost effective. These facts imply much of traffic gains at Gulf and East Coast ports may be permanent.

According to S&P Global's Journal of Commerce, the West Coast's share of Asia imports dropped from 71 per cent in 2013 to 56 per cent in the first half of 2023, while East Coast and Gulf share grew from 29 to 44 per cent. As for new growth, technology will definitely add substantial new market share at Savannah and Charleston ports as the southeastern states become production epicenters for EV and batteries. Both ports are well-equipped to oversee increased Asian trade with modern terminals, rapid processing systems, and integrated intermodal hubs offering unrivaled train and trucking options to the continent's interior.

The US remains the largest importer of goods and second largest exporter in the world. That position is unlikely to change, so route and port optimization is a must. Asia traffic to West Coast ports is open waters. Asia traffic destined for Gulf and East Coast ports must pass through the Suez or Panama canals. Neither is risk-free anymore. Both can bottleneck, but the reasons differ. The Suez has been plagued by intermittent blockages, ships running aground and collisions. Most are resolved quickly but the Ever Given's six-day blockage brought global trade to its knees queuing hundreds of vessels. Piracy along the Somalia coast was another concern, but abated quickly after US, EU and UK naval presence. As for Panama, it's drought…lack of fresh water. Mainly fed by rainfall, Lake Gatún serves as the lock's reservoir. With precipitation 30 to 50 per cent below normal, canal operators imposed transit restrictions limiting both ship weight and number of daily ship crossings. Expect these restrictions to continue for at least 10 more months.

Indeed, West Coast port stability has returned, but its long tenure as the dominant gateway to US appears less certain. US population and technology centers are shifting southward. Supply chains are leaving China for southeastern Asia and India. Supply resilience and risk avoidance supersede cost. All signs suggest trade growth on the Gulf and East Coast will exceed that of the West Coast in the coming decade. It's the new trade tide normal.

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PCBs critical to strong US electronics ecosystem

Radford University assistant professor of management, Zachary A Collier PhD, underlines the importance of investing in a trusted and secure PCB supply chain

Artificial intelligence (AI) is being adopted incredibly quickly and is forecasted to contribute over $15 trillion to the world economy by 2030. Companies are competing for dominance, but competition isn't only between companies. On the international stage, nations including the US and China are strategically vying for technological leadership in AI, making the technology itself—and the supply chains supporting it—imperative for economic and national security.

Enabling AI applications are powerful and specialized chips known as graphics processing units (GPUs) which carry out the large-scale computations necessary for AI. These GPUs are in short supply and companies like Microsoft have warned certain services may experience disruptions if they cannot acquire enough chips.

GPUs alone cannot run a complex AI program. A GPU needs a printed circuit board (PCB) so it can receive power and communicate with other components. The problem is the US no longer produces much of the global PCB share. According to the Printed Circuit Board Association of America, the US fell from producing around 26 per cent of the world's PCBs in 2000 to only about four per cent today. Meanwhile, China's share has skyrocketed from around eight to 54 per cent in the same time period.

Dependence on foreign PCB suppliers leaves the US supply chain vulnerable. With China controlling such a large share of the PCB market, one troubling scenario is that the supply to the US could be cut off completely, with dire implications across the entire economy—energy, healthcare, finance and other critical infrastructure sectors. Other concerns include covert insertion of malicious components onto the PCB, altering the impacted system's performance and compromising its security. An example of this was reported in 2018 when a tiny chip was secretly installed onto circuit boards, providing for unauthorized access to the networks that included the altered systems.

Responding to the strategic importance of semiconductors, over a year ago President Biden signed the CHIPS and Science Act into law, providing $52 billion in incentives for semiconductor manufacturing, R&D and workforce development. Since then, multiple companies have announced their intention to build or expand new facilities, totaling over $210 billion in private investment and potentially creating over 44,000 new jobs.

Bipartisan legislation has been introduced called the Protecting Circuit Boards and Substrates Act of 2023, which mirrors many of the provisions found in the CHIPS Act. It includes $3 billion in incentives for construction of PCB factories, R&D and workforce development initiatives and proposes a 25 per cent tax credit for those who purchase American made PCBs.

While the ultimate fate of the proposed legislation is unknown, it is clear that a trusted, secure electronics supply chain should consider the entire end-to-end flow, including PCBs. A supply chain is only as strong as its weakest link. While substantial progress is being made to strengthen the nation's electronics supply chain, demand for AI and other digitally enabled services will continue to increase. To meet this growing demand, more work must be done to ensure we develop a stable, trustworthy supply of components to enable the products we use today and that will power the technologies of tomorrow.

www.radford.edu

Radford University assistant professor of management, **Zachary A Collier, PhD**

Multiple companies have announced their intention to build or expand new facilities, totaling over $210 billion in private investment and potentially creating over 44,000 new jobs

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MARCH	Enclosures, Power Supplies & Batteries, Semiconductors	Aerospace
APRIL	Connectors, Apps, Development Kits, Embedded Systems	Industry Trends
MAY	Cable & Wire, EMS, Harsh Environments, Programming	Top 50 NA Distributors Report
JUNE	Power & Batteries, Logistics, Obsolescence, PCBs	Transport

Making sense of evolving service requirements

SigmaTron International's Allen Abell explains how EMS providers are playing the lead role in helping OEMs manage increasingly complex compliance regulations

Outsourcing electronics manufacturing used to focus on identifying the best partner in a location providing cost or proximity advantage. Today, manufacturing expertise is only part of that equation.

Electronics manufacturing services (EMS) providers are now expected to provide a complete solution that may include product development assistance, multi-region manufacturing support and post-manufacturing logistics support. The supply chain management element equation has expanded to include serving as a conduit for increasing compliance reporting requirements. Growing interest in environmental, social and governance (ESG) practices has expanded the breadth of audits and increased the range of metrics EMS companies must measure.

Regarding outsourcing strategy, it is important to analyze whether projects require an EMS provider capable of delivering a more complex compliance solution, particularly if the project's annualized volumes range from 50,000 to 500,000.

Understanding compliance reporting complexity is critical. Some well-established requirements such as the Conflict Minerals reporting requirement of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, CA Prop 65, RoHS, REACH and SCIP reporting are well-served by supplier disclosures, third-party databases and reporting templates. However, initiatives expanding due diligence on sources or actual elimination of raw materials or chemical substances are ongoing. Where OEMs have started proactively tracking substances and expect support from their EMS provider, internal EMS resources are often required. The following are some initiatives.

The Extended Minerals Reporting Template (EMRT) created by the Responsible Business Alliance (RBA) focuses on cobalt and natural mica supply chains. While not required by any regulatory body, it is designed to support due diligence in accordance with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas by expanding the list of conflict minerals monitored.

The Toxic Substances Control Act (TSCA) as amended by the Frank R Lautenberg Chemical Safety for the 21st Century Act, has resulted in the US EPA beginning a safety review of a list of 90 chemicals developed in 2014. Under the legislation, the US EPA must now have at least 20 of these chemicals under safety review evaluation at any time. If it is determined a chemical presents an unreasonable risk, EPA must mitigate that risk within two years.

Various US states are restricting use of per- and polyfluoroalkyl substances, known as PFAS or forever plastics. The European Chemical Agency (ECHA) is also proposing a universal ban on PFAS within the EU by 2026. The list of PFAS has not been fully established and some don't have Chemical Abstracts Service (CAS) numbers. This complicates PFAS reporting.

SigmaTron International uses proprietary software, third-party databases and an internal Compliance and Sustainability Center team to address customers' reporting requirements. The Center is in its Taiwan International Purchasing Office which coordinates disclosure statements as new suppliers are added. The team also supports customer-driven ESG audits, as needed. A specialized team addresses reporting requirements not well covered in third-party databases. The team also provides feedback to help design out problematic materials.

www.sigmatronintl.com

SigmaTron International's corporate director of quality and compliance, **Allen Abell**

> **The supply chain management element equation has expanded to include serving as a conduit for increasing compliance reporting requirements**

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Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	$0	93%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	$0	97%	50	1,000+	Y
Molex	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molex	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
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Bel Fuse		+1 201 432 0463	belfuse.com/circuit-protection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,462	N/A	$0	68%	50	1,000+	Y
Eaton	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	3,487	N/A	$0	100%	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	28,790	N/A	$0	67%	50	1,000+	Y
Schurter	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	31,445	N/A	$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
BIVAR	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
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	12,390	N/A	$0	99%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	$0	84%	50	1,000+	Y
Displaytech	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Hantronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Kingbright Company, LLC	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	$0	100%	50	1,000+	Y
Lumileds	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Luminus	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Newhaven Display	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	1,690	N/A	$0	100%	50	1,000+	Y
Tianma	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ELECTROMECHANICAL											
ALPS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Apem, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,326	N/A	$0	83%	50	1,000+	Y
E-Switch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Grayhill	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	N/A	N/A	$0	N/A	50	1,000+	Y
Keystone Electronics	Mouser Electronics	800-346-6873	www.mouser.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
Nidec	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
NKK Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	13,976	N/A	$0	86%	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y

Advert Index

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
Panasonic	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
PUI Audio	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Schneider Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Sensata	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
Teledyne Relays	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ENCLOSURES											
Bud	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bud Industries	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	$0	80%	50	1,000+	Y
Hammond Manufacturing	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,839	N/A	$0	82%	50	1,000+	Y
METCASE Enclosures	OKW Enclosures, Inc.	(800) 965-9872	www.metcaseusa.com		322	N/A	$0	N/A	10	20	Y
New Age Enclosures	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
OKW Gehäusesysteme GmbH	OKW Enclosures, Inc.	(800) 965-9872	www.okwenclosures.com		2,450	N/A	$0	N/A	10	20	Y
ROLEC Gehäuse-Systeme GmbH	ROLEC Enclosures Inc	(888) 658-5774	www.rolec-usa.com		1,960	N/A	$0	N/A	4	6	Y
FREQUENCY MANAGEMENT											
Abracon Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,780	N/A	$0	100%	50	1,000+	Y
CTS Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,889	N/A	$0	100%	50	1,000+	Y
ECS Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,070	N/A	$0	100%	50	1,000+	Y
Epson Toyocom	Mouser Electronics	800-346-6873	www.mouser.com	Y	178	N/A	$0	100%	50	1,000+	Y
IQD Frequency Products	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
SiTime	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ICs & SEMICONDUCTORS											
Analog Devices, Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,749	N/A	$0	95%	50	1,000+	Y
Broadcom Limited	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Central Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Central Semiconductor Corp.	Future Electronics	(800) 675-1619	www.futureelectronics.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
Digi International	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Diodes Incorporated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
FTDI Chip	Mouser Electronics	800-346-6873	www.mouser.com	Y	94	N/A	$0	100%	50	1,000+	Y
Infineon	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,580	N/A	$0	63%	50	1,000+	Y
Intel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ISSI	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Lattice	Mouser Electronics	800-346-6873	www.mouser.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
MACOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Maxim Integrated	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	5,800	N/A	$0	100%	50	1,000+	Y
Monolithic Power Systems (MPS)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Nexperia	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	7,205	N/A	$0	100%	50	1,000+	Y
onsemi	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,486	N/A	$0	96%	50	1,000+	Y
Power Integrations	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Qorvo	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Renesas Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	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
Silicon Laboratories Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,141	N/A	$0	100%	50	1,000+	Y
Skyworks	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	$0	96%	50	1,000+	Y
Swissbit	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	29,676	N/A	$0	94%	50	1,000+	Y
Toshiba	Mouser Electronics	800-346-6873	www.mouser.com	Y	800	N/A	N/A	N/A	N/A	N/A	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	53,781	N/A	$0	77%	50	1,000+	Y
Wolfspeed	Mouser Electronics	800-346-6873	www.mouser.com	Y	53,781	N/A	$0	77%	50	1,000+	Y
INTERCONNECTION											
Bel		+1 858 676 9650	belfuse.com/magnetic-solutions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	$0	46%	50	1,000+	Y
Aero Conesys	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	165,853	N/A	$0	31%	50	1,000+	Y
Anderson Power Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Aptive (Delphi)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bel Magnetic Solutions		+1 858 676 9650	belfuse.com/magnetic-solutions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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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