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DECEMBER 2022

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THE EXECUTIVE

FORECAST 2023

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On the cover – December 2022

The Executive Forecast 2023
page 14

Editor's Word



Sidestepping the demographic pyramid

Over recent weeks I've had the pleasure of attending a number of engineering exhibitions and working on the production of over thirty Executive Forecast features across the North American and UK editions of Electronics Sourcing.

Every conversation and interaction offered a unique perspective of what we can expect in 2023, however some trends emerged. Allow me to expand on two.

Firstly, at this phase of the post pandemic reset, the industry is starting to experience, for the first time, what happens when a complex, globalized supply chain comes back online after a shut down. It is true that manufacturers and distributors in every component category are working hard to match supply and demand. However, the problem seems to be sequencing. Not all component types are becoming available at the same pace leading to simultaneous over and under supply across bills-of-materials.

Secondly, it looks like component manufacturers, distributors and OEMs are finding it difficult to secure the staff they desire. There are many reasons for this but I fear a significant variable, operating on a global basis, is demographics.

The rate at which experienced engineers are leaving the industry is accelerating as the baby boom generation retires. However, falling birth rates in many industrialized nations over recent decades mean fewer young people are available to fill the talent pool.

To solve this problem today, the electronics industry needs to make it very clear to young people entering higher education or vocational training that playing a role in 'designing and building our technological future' can be one of the most fulfilling and rewarding lifelong careers anyone could wish for.

Jon Barrett

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Connect Influence. Optimize.

NEWS



Bright solution for automotive lighting

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Bright solution for automotive lighting



Mouser Electronics is now stocking AMS Osram's Synios P3030 KW DSLP31.CE LED. The component is designed to meet the energy efficiency, weight and space-saving qualities for automotive exterior lighting.

This white LED offers a luminous flux/radiant flux of 45 to 71lm and a minimum color rendering index of 90. Forward current is rated at three to 200mA, with a pulsed forward current of 400mA (max.). Forward voltage is 2.6 to 3.5V, with a maximum reverse voltage of 5V.

Incorporating InGaN-on-sapphire chip technology, the LED is designed using a colored-diffused silicone resin with flat square package. The close-to-center chip layout allows for optimal design flexibility, while its small outline dimensions (especially height), provide maximum flexibility to accommodate tight spaces.

Dimensions are 3.0 by 3.0 by 0.65mm. Operating temperature range is -40 to 125°C and the device is tested at 2kV according to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2). The LED is AEC-Q102 qualified.

www.mouser.com

Long-life memory ready to ship

Flip Electronics has signed a franchised distribution partnership agreement with SMARTsemi (a division of Smart Modular Technologies) to distribute its line of DRAM and Flash components. SMARTsemi supplies memory components focused on long-life embedded applications, particularly in medical, industrial robotics, communications, networking, home/gaming and defense.

SMART Modular's senior vice president of strategy and marketing, Alan Marten, said: "We are pleased to offer our devices through Flip Electronics with their emphasis on customer service and support, a critical factor for our legacy and EOL customers."

Flip Electronics' executive vice president, Jeff Ittel, added: "SMARTsemi is the latest addition to our product portfolio of industry-leading manufacturing partners. The long-life cycles of many embedded applications for memory products make SMARTsemi a viable solution for Flip's focus on providing an authorized source for long-term support of parts at the end of their respective life cycles.

"As new technology evolves, not all applications and designs evolve at the same pace. OEMs turn to Flip to source these products and Flip is there to support them as an ECIA-authorized distributor."

flipelectronics.com

Tough capacitors take the heat

Rutronik is expanding its portfolio of Samwha Electronic conductive polymer hybrid aluminum electrolytic capacitors with the YM and YL series. The products feature higher capacitance at operating temperatures up to 125°C, making them suitable for a range of industrial applications.



With the addition of the YM version to the surface-mountable YH series and the radial YL series, Samwha is meeting increased demand for higher value ranges of ripple current and capacitance. The capacitors have a voltage range of 25 to 63V and a capacitance of 47 to 680µF. Tolerance is ±20% at 120Hz (20°C).

In addition, service life is 4,000 hours and the devices can be used over a temperature range from -55 to 125°C.

www.rutronik24.com



Connectivity where space is valuable

Heilind Electronics is stocking Molex's Zero-Hachi 0.80mm pitch wire-to-board connector system. Ideal for slimmer device form factors in consumer and industrial markets, the system is designed for applications such as AR/VR, gaming, mobile devices, home devices and industrial UAVs. The footprint is 40 per cent smaller than other Molex 1.00mm pitch wire-to-board products.

Despite the reduction in size, Heilind states the connector saves space without sacrificing reliability and connectivity. A fitting nail ensures PCB retention and defends against damage when wires are pulled, while the friction lock on the crimp housing provides extra confidence in mating retention.

The system offers a range of circuit sizes (2 to 20 circuits), while dual-point contact design secures electrical connections. Despite its size, the receptacle housing is designed to be easy to grip.

www.heilind.com



1887

Emile Berliner receives the patent for the gramophone.

James Blyth builds the first electricity generating wind turbine.

Herman Hollerith receives a U.S. patent for his punch-card calculator.

Sager opens its first location in Boston, Massachusetts.



All great things begin with a single step – or in Sager’s case a single storefront.

Recognized as the first distributor in the industry, Sager opened for business one hundred thirty-five years ago in downtown Boston, Massachusetts, servicing the growing interest in radio technology.

Under the vision and leadership of Joe Sager, the company established a thriving business that put the needs of its customers first. Since then Sager has grown into a North American distributor of interconnect, power, thermal and electromechanical products and a provider of custom design and manufacturing solutions.

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And after 135 years, Sager still operates just as Joe envisioned – based on a commitment to exceeding expectations and keeping the customer at the center of its business philosophy.

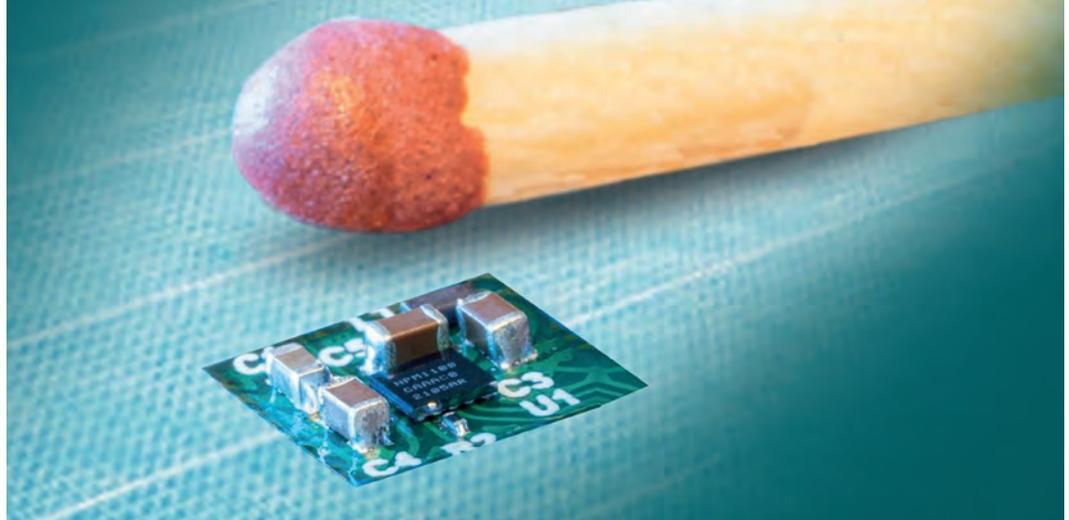
Sager Electronics, a TTI Inc., Berkshire Hathaway Company

www.sager.com | 1.800.724.8370

In Brief

Depth of knowledge

Galco Industrial Electronics has announced that Jim Ricciardelli, former executive vice president of Digi-Key Electronics, has joined the company's Board of Directors. Galco's CEO, Allison Sabia, said: "Jim brings valuable experience and a depth of knowledge to our Board, covering eCommerce, strategic planning, mergers and acquisitions, sales, marketing, and business development." galco.com



Shipping tiny PMICs

Newark is shipping Nordic Semiconductor's new nPM1100 power management chip. The IC is designed to offer a higher efficiency-to-size ratio than other PMICs and a PCB area as low as 23mm². The PMIC suits space-constrained applications including battery charging and power delivery in hand-held, portable, wearable wireless and connected medical devices.

Designers are striving to increase battery life and add functionality without increasing form factor. Adding battery capacity incurs a volume penalty, leaving efficiency gains as the only way to achieve battery life and functionality improvements. Nordic states

the nPM1100 achieves this by combining a small form factor with tight integration and efficient power conversion.

The component is a dedicated PMIC with a dual-mode configurable buck regulator and integrated battery charger. It is designed as a complementary component to Nordic Semiconductor's nRF52 and nRF53 series of SoCs, which enable reliable power delivery and stable operation while maximizing battery life through high efficiency and low quiescent currents.

www.newark.com

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2023

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Technical Marketing
Manager



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AI • By John Denslinger

AI unknowns outweigh knowns



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 explores the growing role of artificial intelligence in business environments and offers an opinion on the recently published Blueprint for an AI Bill of Rights

AI is largely desired for its data analytics, but generally comes with embedded algorithms particularly in customer, employment and productivity software packages often unbeknownst to procurement teams. Likewise, large enterprise platforms updated by outside vendors may introduce additional or modified AI functions likely enhanced by cloud-based machine-learning systems. There can be no doubt, AI is becoming ubiquitous as a super-automated, decision-making tool. Coupled with machine-learning, AI's overall capability is nothing less than scary powerful.

Algorithms are generally thought to be benign, but biases have surfaced in consumer and employment related areas. Just the perception of bias or privacy invasion could cripple a company and its brand. The distinction between benign and bias might be small but an unintended error in judgement could be enormously consequential. Software recipients beware. Executives may find staying on top of algorithmic unknowns an endless task.

So, what constitutes a responsible use of AI in business? Simple question, right? Perhaps the basic assumption might be that every company already has executive level governance with well-defined operational checks and controls in place. Do I dare say, most companies have yet to reach this level of awareness let alone operational competence.

One of the first publicly voiced ethics concern occurred in 2015 via an open letter on Artificial Intelligence signed by Steven Hawking, Elon Musk and other notable professionals. It contrasted short-term and long-term benefits versus the unintended consequence of mis-applied AI. In the time since, responsible AI seems commonplace, but as adoption penetrates more deeply into daily society, AI hits upon some touchy areas. Questions of bias, discrimination and inequity have appeared in both business and political circles.

Local, federal, and international bodies have weighed in proposing rules, and in some cases, passed laws regulating use of artificial

intelligence. At the Federal level, FTC, NSF, EEOC and more recently Congress, have looked to strengthening AI safeguards on civil rights, privacy, consumer deception, and discrimination. Not to be outdone, the White House just issued a major document on 4 October called: Blueprint for an AI Bill of Rights. This policy paper identifies five tenets: (1) safe and effective automated systems; (2) algorithmic discrimination protections; (3) data privacy; (4) notice and explanation how AI is used; and (5) opt-out alternatives.

The Blueprint for an AI Bill of Rights has two problems:

- It's a non-binding white paper aimed at how the federal government and its agencies acquire and deploy AI technology
- The blueprint intentionally avoids regulating tech companies who power machine learning and AI deployment

Developers are free to create algorithms that best suit their business intentions obviously giving due consideration to current privacy and discrimination laws. One point is remarkably interesting: the government's opt-out protection requires a human alternative as the remedy. If this tenet were forced on business, it might be costly. Nevertheless, the signal is clear: big-brother oversight is coming and with it more unknowns for executives to oversee.

Companies need data. It's data that fuels prospering ones and AI delivers extraordinary results. But ethics matter more. It's ethics that sustain the mission regardless of whether your company is a buyer, developer or provider of AI technology. Executive governance is an absolute must. Organizations need well-defined operational checks and controls to avoid hints of bias, discrimination and inequity.

It would appear AI unknowns outweigh the knowns at this time.

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THE PERFECT SOURCE

Today's market shortages and lead-times of over 52 weeks make it clear that no one's supply chain is safe. Given major constraints that are being experienced by both design and supply chain departments, many OEMs are realizing that partnering with the right distributor is the missing link in their supply chain. Partnering with a distributor that knows reverse logistics, has global reach, a good reputation, and third-party testing capabilities to ensure that your products meet your end user requirements is needed in order to be successful.

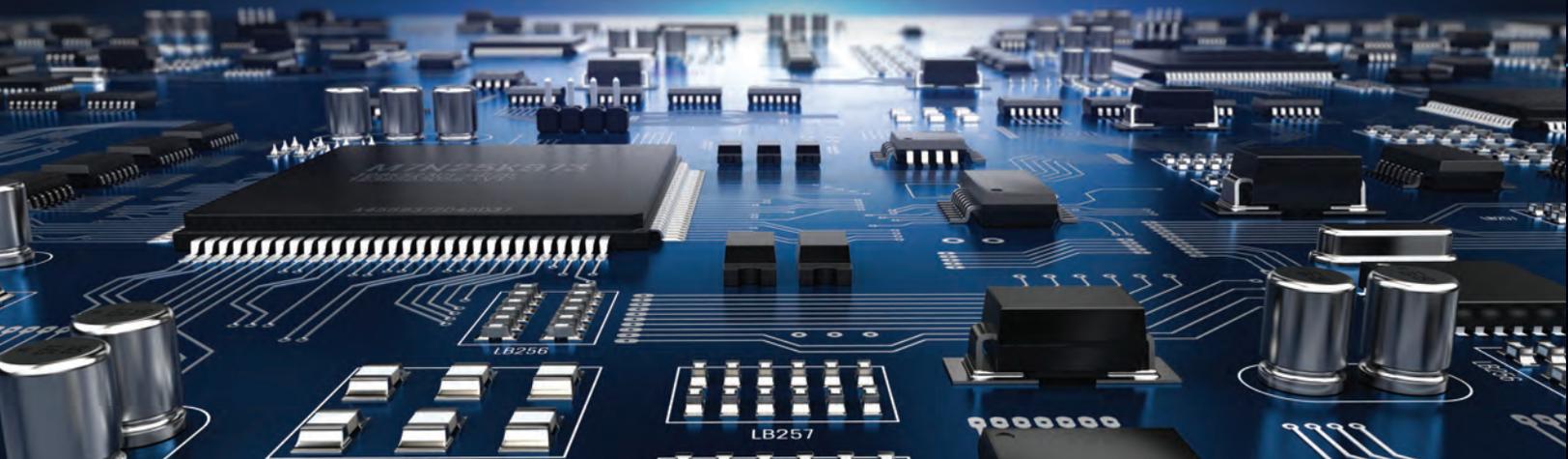
Sourcing from the open market can be daunting with counterfeit parts and sub-standard materials posing as a constant threat to your supply chain. Material procured from the open market that is improperly tested can cause loss of relationships, increased liability,

major delays, and line down situations. Many distributors test material in house or not fully leaving your supply chain exposed. Perfect Parts works with 3rd party fully accredited test labs which are specialized in performing comprehensive testing including those which are for high reliability applications. By utilizing third party laboratories you can rest assured that there is no conflict of interest when testing material for your supply chain.

With an eight-year streak of zero RMAs due to sub-standard materials, Perfect Parts is the only USA distributor that can boast zero RMAs due to a counterfeit or substandard part deliveries. When you work with Perfect Parts you can expect a level of quality that is unrivaled in the electronic component industry. Perfect Parts is a global online distributor of electronic components

that specializes in testing requirements, sourcing, and distribution. With access to over 30 million unique inventory lots from our global network of manufacturers, OEMs, contract manufacturers, authorized channels, and other vetted suppliers you will find everything you need for your builds. With a focus on providing value-added services and advanced web tools, Perfect Parts will change the way you design and procure components for your organization.

www.perfectelectronicparts.com





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Distributors grapple with conflicting supply chain signals

Supply chain complexities have increased throughout the electronics industry, creating opportunities for distributors to help customers navigate the tortuous terrains facing them

After nearly two years of severely constrained supply conditions, electronic manufacturers are finally reporting improvements in the delivery of some components, shortening lead times and reduced pressure on average selling prices across the industry. The situation remains fluid and uneven, though, and restoring the procurement environment to a state of balance is still months away, according to industry executives.

Clearly, conditions are still not optimal in the electronics manufacturing business, or even in the larger global economy where enterprises across multiple industries are reporting weakening sales and either freezing hiring activities or cutting the workforce.

In the electronics sector, many OEMs and electronics manufacturing services (EMS) providers are still struggling with lack of clarity about actual end-customer needs and the ability of suppliers to meet their procurement requirements. Automotive OEMs, for example, remain in a quandary, unable to source sufficient quantities of critical components like microcontrollers. As a result, automakers like Toyota Motor Corp. have been cutting vehicle forecasts for even 2023.

“We have seen a high production plan of 9.7 million units and worked hard with

the suppliers and production sites in order to deliver as many cars as soon as possible to our customers who have been waiting for a long time for their cars to be delivered,” said Masahiro Yamamoto, the chief accounting officer for Toyota, during a call with analysts to discuss the company’s fiscal 2023 second quarter financial performance.

He added: “However, it’s still difficult to predict the future due to risks such as procurement of semiconductors. Therefore, we decided to revise our plan to 9.2 million units, which is down by 500,000 units from the previous forecast. We intend to continue to consider all possible countermeasures and make every effort together with our suppliers and production sites.”

All segments of the economy have been exploring innovative ways to resolve sourcing challenges like the one Toyota faced during its recent quarter but solutions have proved elusive, according to industry executives. As the procurement problem worsened in the electronics industry at the beginning of this year, it pitched OEMs against OEMs, created rifts in the relationship between chip suppliers and some of their top clients, resulted in double-ordering of components and spot hoarding,

“These tremendous changes are occurring concurrently and for the broadly based auto industry. These changes could have a significant impact in the future”



**Kenta Kon, CFO,
Toyota**

which is now showing up in higher inventory levels at distributors and semiconductor vendors.

Avnet Inc., for example, closed its fiscal 2023 first quarter ended October 1 with inventory worth \$4.65 billion, up from \$4.24 billion, in the preceding quarter, and 42 per cent above the year-ago level of \$3.28 billion. Pricing have risen over the last year, accounting for a portion of the increase, but stocks have risen also as companies demanded greater buffer inventories and as distributors ordered more parts to meet demand.

“We are more deeply engaged with our customers and

suppliers than ever before, which enables us to maintain the necessary expertise and capabilities to help them navigate today’s supply chain complexity,” said Phil Gallagher, CEO of Avnet, late in October after announcing the company’s financial results. “With the structural and organizational changes we made to our business over the last two years, we are well positioned to continue serving as control tower for our customers and suppliers. In the quarter, demand remains strong globally in key vertical segments like transportation, industrial, and aerospace and defense. And we have continued to invest in inventory to meet this demand.”



New phase

Component distributors have long been in the vanguard of helping to smoothen out wrinkles in the electronics supply chain. Adding to their traditional procurement functions, the top distributors have beefed up their supply chain management functions in recent years and actively monitor inventory levels across the industry to gain better visibility into actual requirements and production activities.

They monitor demand-supply conditions and provide just-in-time inventory management services that have helped to optimize production operations at OEMs and their contractors. The information gleaned is typically shared with customers and suppliers as well as disseminated via distribution websites to other interested parties.

In one such publication recently, Avnet shared the result of a survey conducted about engineering and procurement activities that confirmed anecdotal reports of a non-linear recovery within the industry. It painted the portrait of an industry struggling with uneven demand-supply conditions, indicative of the early phase of a downturn. The report also confirmed closer working relationships between procurement professionals and engineers, according to Avnet.

"Relationships between engineers and distributors are continuously evolving and cyclical, and right now, we are seeing an increased understanding of the value that distribution, and its associated services, can add in the midst of prolonged uncertainty," said Peggy Carrieres, VP of sales enablement and supplier development at Avnet, in the *Avnet Insight* report. "Engineers and product designers who lean into distribution's design and

supply chain services will not only be prepared to succeed in the current environment, but also be well positioned to navigate any potential future disruptions the industry—and technology—may face."

The current industry cycle is in many ways unique. It emerged from a confluence of factors, including the Covid pandemic, the tech Cold War between the United States and China, other geopolitical disturbances, including the Russia-Ukraine war and amidst weakening global economic conditions. The result is a market marked by numerous imbalances, including component shortages and rising oil prices, all of which make prognostications about the direction of the industry difficult.

The disruptions are even more challenging for companies that are trying to divine the direction of the technology manufacturing supply chain. The supply shortages the industry was grappling with is unraveling but in a highly unusual format where certain segments have completely returned to normal operating conditions while others remain stuck in an unyielding or even worsening condition.

It is a phase that is fraught with problems for components suppliers and OEMs as well as EMS providers faced with uneven supplies, rising inventories, demand opacity, and other sourcing issues. Demand, which appeared robust only a few months ago, has petered out, except in a few sectors, leaving the industry contemplating the possibility of mountainous loads of components booked at the top of the latest upcycle but that are now no longer needed at manufacturers.

The disparity in supply availability is mindboggling. Lead times have eased back completely in some markets,



"We are seeing an increased understanding of the value that distribution, and its associated services, can add in the midst of prolonged uncertainty"

Peggy Carrieres, VP, sales enablement and supplier development, Avnet

including for memory products. In fact, memory manufacturers have more than sufficient supplies to meet customer requirements. They are reporting excess inventories, which has in turn forced down ASPs as OEMs and EMS companies sharply pare down orders.

Toyota, for instance, remains unable to meet customer demand because of the continuing shortage of some components despite its famous JIT manufacturing system and recent efforts to work with semiconductor suppliers and others to assure supply of critical components, according to company executives who said, "it is difficult to predict the future due to rapid changes in the business environment."

The industry must work together to resolve many of these challenges. Auto manufacturers are directly signing procurement agreements with semiconductor suppliers, working in tandem with their tier-1 partners but also collaborating with third-party service providers. Distributors are also being tapped for their expertise in supplier and inventory management by OEMs that have in the

past purchased components directly from manufacturers.

This is because no single player in the production process can solve the current problems, many of which start much earlier in the manufacturing supply chain and sometimes even in the raw material procurement phase.

"These tremendous changes, including the semiconductor procurement situation and other factors, are occurring concurrently and for the broadly based auto industry, these changes could have a significant impact in the future," said Kenta Kon, chief financial officer at Toyota. "We have been constantly discussing with suppliers without drifting away from our focus of enhancing competitiveness over medium and long term. Toyota and each and every one supplier [must] work as one to implement competitive measures to address these things."



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LEAD TIMES BACK TO PRE-PANDEMIC LEVELS

OKW Enclosures' president, Sean Bailey, expects a strong 2023 despite October's lower than expected fall in US inflation and signs of a cooling labor market

Strong growth at OKW Enclosures helped drive a record year for the group. The company celebrated an impressive rise in revenue compared with the previous 12-months and a significant uplift on the three years before that.

I feel very positive about the OEM electronics market and what that will mean for OKW in 2023. Last year was a record for us, regardless

of all the global difficulties caused by Covid-19 and post-pandemic inflation.

OKW always performs well in a challenging economy. This is because designers are more likely to specify standard and customized enclosures and tuning knobs, rather than fully bespoke products which cost more and take longer to manufacture.

Once customers have experienced those benefits, they tend to remain with us because they like our products' performance and quality. This is what happened in 2022 and we expect 2023 to be similar. Interestingly,

although our new products are proving popular, some of our bestselling models last year were older, timeless designs that always sell strongly. We expect that to continue in 2023.

Despite growing demand, lead times at OKW are now back to pre-pandemic levels. That looks set to continue, barring any significant worsening in global geopolitics (notably in Ukraine) or in China's Covid-19 infection rates.

www.okwenclosures.com

OKW's president,
Sean Bailey



GRIT TO OVERCOME OBSTACLES



Digi-Key's VP of global business development,
Mike Slater

Digi-Key's VP of global business development, Mike Slater, believes the long-term outlook for the electronics supply chain is very bright

Over the past two and a half years, Digi-Key has worked hard to offer personal and professional crucial behavioral competencies to overcome significant obstacles. Much of what we did and adjusted to, was not part of the playbook many of us have used in our careers.

While many have continued to see increased sales volume in 2022, I believe 2023 will see a leveling off. Customers have now adapted to their

new way of doing business and will work to get back to something a bit more sustainable. Our suppliers have continued to push for ways to increase supply and many are starting to dig out of the capacity and supply crunch we have seen. It looks like lead times in many product types and categories will begin to decrease, although I do not believe we will see all capacity and supply issues fully resolved.

We believe the long-term outlook for the electronics supply chain is very bright and Digi-Key has significantly increased its capital infrastructure investments in

recent years to match that. We have scaled our capacity to match demand and those investments will continue to scale as business grows. These include: expansion of the Product Distribution Center; more robust and predictive web search functionality; higher inventory levels; and increased warehouse automation. The impact of the recent economic cycles on Digi-Key and the industry has proven we have the resiliency, perseverance and grit to overcome obstacles.

www.digikey.com

SUCCESS AMID SEMICONDUCTOR SUPPLY DISRUPTION

Rochester Electronics' executive vice president, Colin Strother, explains how the company will enable customer success in 2023 in one word: products

The semiconductor industry can be notoriously cyclical. Since the founding of Rochester Electronics in 1981, we recall approximately twenty industry cycles of varying magnitude, each with different causes. They all tend to start and end abruptly.

We expect continued supply chain disruption in 2023. The overall market may decline but shortages are likely to remain in specific categories, with oversupply in others. Our focus for 2023 is, as it has been for over forty years, enabling customer success.

We will continue our digital transformation strategy and add physical resources to existing and new global locations as we strive to meet our customers where they are: online, in electronic B2B transactions, offline, in-person and virtually. How will we ultimately enable customer success? In one word: products.

As an original manufacturer stocking distributor, Rochester has over 15 billion devices in stock encompassing more than 200,000-part numbers, providing the world's most extensive range of end-of-life (EOL) and broadest range of active semiconductors. Our die bank of over 12 billion die allows us to add to our in-stock portfolio with an enormous potential SKU count of licensed manufacturing product solutions.

The tremendous breadth of our offerings provides our customers with the parts they need, when they need them, from an authorized source of supply, in any market. Rochester expects another year of tremendous success by enabling our customers' success.

www.rocelec.com

Rochester Electronics' executive vice president, **Colin Strother**



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FUNDAMENTALS REMAIN SOLID

TTI Americas' president, John Drabik, explains how design engineers are pivoting from chasing parts to the new product developments that will drive future demand

2021 and 2022 have been record-setting years for many in the electronic components industry. However, we are beginning the transitional phase to slower growth in the face of macroeconomic headwinds and inventory rebalancing across the supply chain.

As we enter 2023, I expect demand and lead times for IP&E products to slowly

decrease as supply and true demand begin to align. Cancellations, reschedules, inflation, labor and supply chain disruptions will continue to challenge the industry throughout the first half of 2023.

Despite macroeconomic uncertainties, I expect demand from military/aerospace, industrial and the transportation segments to remain resilient. New design activity will also increase as design engineers pivot from chasing parts to focus on new product development and innovation that will drive future demand for years to come. At TTI, our

focus will remain consistent, we will continue to invest in people and parts.

Yes, 2023 will feel different but be assured the long-term growth fundamentals in the electronics component industry remain solid.

www.tti.com

TTI Americas'
president,
John Drabik



NAVIGATING THE SUPPLY CHAIN MAZE



**Rutronik's VP North
America, Terri Walsh**

Rutronik's VP North America, Terri Walsh, alerts purchasers to the potential impacts of inflation and interest rate rises on the supply chain

The second half of 2022 saw a decline in consumer electronics and personal computing. We expect the decline in those two segments to continue throughout 2023 which should have a positive impact on lead times. However, demand within the automotive and industrial markets continues to be strong as many contract manufacturers and electronic manufacturing services providers are booked through 2023.

Lead times on select products such as high/low voltage power MOSFETs (specifically SiC and GaN MOSFETs), microcontrollers and analog will remain extended through the first half of 2023 as manufacturers bring capacity online in those markets the latter half of 2023.

Inflation and corresponding interest rate increases will have an impact, both at contract and component manufacturers. As interest rates increase, contract manufacturers will look to right-size inventory which will have a negative impact to sales in the channel, particularly the first half of 2023. The increased cost of

capital will also put pressure on CAPEX spending required to expand fabrication capacity.

Look for component manufacturers to optimize their portfolio by obsoleting low demand and legacy components. We expect price increases for raw materials and rare earth. This will have an impact on leading edge passive and e-mech components.

www.rutronik.com

ALIGNING SUPPLY AND DEMAND

Fusion Worldwide's president, Tobey Gonnerman, is keen to emphasize that new manufacturing facilities and fabs are being constructed and will come online in 2023

2022 came with numerous highs and lows for the electronic component supply chain. Shortages continued to impact verticals like the automotive industry but now we're seeing markets like consumer electronics experience weak demand and excess supply. No one can accurately predict what the next year will look like but global economic downturn and inflation concerns are certainly impacting demand forecasts. In accordance with those

projections, lead times are shortening or remaining steady for manufacturers seeing a downturn in demand. Order cancellations are increasing as customers are working to align order backlog to consumer behavior. Most markets, excluding automotive, are undergoing declines in Q4 which are predicted to continue into the first half of 2023.

Product timelines are also being delayed but those projects will inevitably resume and push other commodities towards obsolescence. However, Fusion Worldwide is confident in our ability to navigate these changes and will continue to support our customers via creative sourcing solutions.

That being said, demand is expected to recover in the second half of the year. New manufacturing facilities and fabs are being constructed and will come online in 2023, which will likely improve the overall state of supply. There are still bottlenecks that need to loosen before we can accurately predict the status of lead times, but it seems certain that supply/demand imbalances will persist, just as they always have.

www.fusionww.com

Fusion Worldwide's president, Tobey Gonnerman



PREPARE FOR THE SURGE

XTG's president and TTI's senior VP business development, Michael Knight, sets the scene for a supply chain rollercoaster ride culminating in a 2024 surge

Following the electronic component industry's record-setting 2021, momentum going into 2022 was massive. Many component suppliers set fresh records in the first six months and a continuation of abnormally high book-to-bill ratios. However, in the second half of the year business pace became a bit erratic and exuberance turned into perturbation. News that GDP contracted again in the second quarter (putting the US economy

in a technical recession), the Fed's interest rate increases and predictions of inventory gluts have set the stage for flat-to-down revenue for 2023.

The coming year is going to be choppy but not down from 2022. Backlogs are strong, except for those concentrated in personal computers, office equipment and products overextended during the post-Covid recovery. Lead times for microcontrollers and analog and power semis are still impossibly long. Many manufacturers are sold out through 2023. Innovation and new product development are as peppy as ever. Makings of an up year are abundant.

That said, the supply chain is way out of balance and legions of lower-lead-time parts have been accumulating. Rising capital costs have added stress and order pushouts/cancellations are rising. I expect new order rates in 2023 will lag sales for at least a couple of quarters (probably starting Q4 2022), leading to proclamations the crash has arrived. I don't think so. The book-to-bill ratios were not sustainable so a reset was inevitable.

My advice is stay calm, pay extra attention to cash, conserve strength and prepare for a surge late 2023 or early 2024.

www.tti.com

XTG's president and TTI's senior VP business development, Michael Knight





STILL THE ROARING 20S BUT MIXED OUTLOOK FOR 2023

Flip Electronics' president, Bill Bradford, warns about increasing obsolescence driven by product line consolidations, fab efficiency drives and aging fab equipment going offline

By now it is evident the semiconductor cycle has peaked and we are entering a more difficult market in 2023—driven heavily by weakness in PCs and consumer products—and most severely effecting memory devices. Component inventories are building and many lead times will shorten throughout next year, although the mix is still out of balance. This means several product types will remain constrained in 2023, most notably high-performance

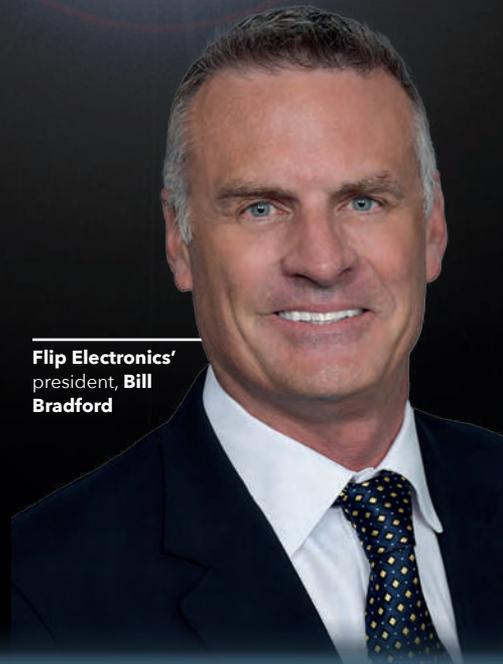
analog, microcontrollers and certain legacy technology nodes that have not sufficiently expanded capacity in this cycle.

As a result, industries continuing to be impacted by constraints include automotive and industrial. Even if the auto market begins to soften due to recessionary pressures, the semiconductor content will increase dramatically with the accelerating shift to electric vehicles. We expect an eventual increase in aerospace and defense spending to replenish supplies and offset global threats. With all the puts and calls, expect to see a 10 per cent contraction of the semiconductor market in 2023 but returning to growth by the following year to keep our

industry on track to be a trillion-dollar industry by decade's end.

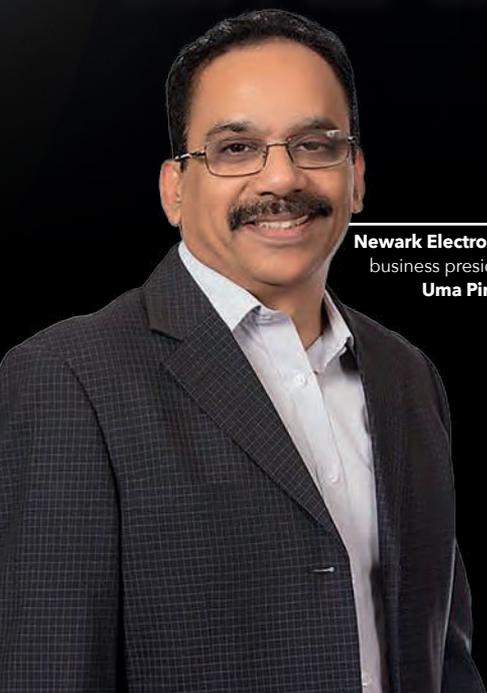
Flip Electronics puts significant focus on solving obsolescence issues and the industry is expected to continue to increase the rate of product discontinuance, driven by: product line consolidations; the drive for fab and backend efficiencies; and aged fab equipment being taken offline to make room for supporting next generation nodes. Working with customers that must support extended product life cycles remains our priority.

www.flipelectronics.com



Flip Electronics'
president, **Bill Bradford**

STABILIZING CHAOTIC SUPPLY CHAINS



Newark Electronics'
business president,
Uma Pingali

Newark Electronics' business president, Uma Pingali, highlights how high-service distributors with wide, adaptive inventories help stabilize chaotic supply chains

In terms of 2023 performance regarding allocation and lead times, the situation will be much better than 2022. Allocations are few and far between and long lead times are subsiding. Customer backorders and book-to-bill ratios have returned to pre-Covid levels. We're seeing inventory buildup at all levels, with certain segments impacted more than others.

Regarding obsolescence, some suppliers will try to trim offerings. Products not sold

in high volumes or profitably, will reach obsolescence sooner. As end-of-life notifications come through, distributors must plan their supply chains, notify customers and work to stabilize their supply chains. This creates distribution opportunities but can pose a significant risk to customers.

Regarding the US economy, some segments will continue to support growth but others will decrease, resulting in an excess supply of inventory. This depends on which segments are rising or declining. We're optimistic that the US economy will experience growth and next year will be lower in terms of inflation, but how low is debatable.

A disruptive supply chain is becoming normal, and inventories are much heavier. We anticipate that the market will be softer and 2023 will be a flatter year for growth, but we will still experience single-digit growth. Newark and other high-service distributors who are wide-breadth and adaptive inventory players will help act as a stabilizing force in an otherwise chaotic supply chain.

www.newark.com



UNIQUE SOLUTIONS FOR COMPLEX DYNAMICS

Smith's VP of global purchasing, Todd Snow, explains how every individual component has a different story to tell in terms of availability, pricing and logistics

Since the Covid-19 pandemic's onset, no two years in the electronics supply chain have been alike. While we expect uncertainties in some pockets and continuous growth in other areas for 2023, it's difficult to predict exactly where things are headed as a whole. In the current electronic component market, each individual part has a different story in terms of availability, pricing and logistics, with this trend likely to be predominant throughout the new year.

From a historical perspective, inflation and other factors tied to the United States' economy will surely be top of mind for many businesses and play strategically into their purchasing decisions. Our latest market intelligence shows slight improvements to allocation direct from manufacturers, lead times and obsolescence issues, but manufacturers are still lagging and having difficulties compared to pre-pandemic conditions. Additionally, we're seeing allocation efforts begin to diversify, softening supply constraints for some industries while still leaving specific parts in other sectors with lead times pushed out to over 52-weeks.

As technology advances worldwide, demand for semiconductors to power new innovations will only continue to grow, which makes us optimistic regarding the market's performance in the year ahead. Utilizing market intelligence and expertise from trusted independent distributors like Smith can help customers navigate the market with unique solutions for complex dynamics. Keeping lines active in the year to come will likely remain a challenge for manufacturers but relying on trustworthy supply chain partnerships can make a key difference in meeting business objectives.

smithweb.com



SMITH's Vice President of Global Marketing, **Todd Snow**

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ENSURING A SECURE SUPPLY CHAIN



Velocity Electronics' president and CEO, **Kristofor Kelly**

Velocity Electronics' president and CEO, Kristofor Kelly, asks business partners to communicate openly and collaboratively as the industry adapts to a changing world

As we approach 2023, what are the major challenges facing our industry? Will lead times contract? Will inflation continue its upward climb? What about obsolescence as OCMs shift into advanced semiconductor technology? How will the world evaluate its relationship with China?

Lead times in certain verticals, particularly automotive, remain constrained. Our industrial business partners have slowed their demand in 4Q22, and consumer chip prices have returned to pre-

pandemic levels. I would expect this trend to continue into 1Q23.

I would expect the world's governing bodies to continue to combat inflation with increased interest rates. Most experts believe inflation will cool by the end of 2023.

Why are semiconductors becoming obsolete faster than in the past? This is partly due to the natural process of semiconductor manufacturers shifting into newer and more cost-efficient alternatives. However, I believe continuous mergers and acquisitions within the semiconductor manufacturing market over the last decade are accelerating this process. These new 'super' companies are streamlining certain product

portfolios to make room for newer more advanced models.

The United States' most recent export restrictions against China is our company's most pressing initiative entering 2023. The export restrictions are unprecedented. Companies will need to re-tool how they operate in and with China. Agility in managing the new restrictions will be paramount to ensuring a secure supply chain. I would encourage each of our internal and external business partners to communicate openly with each other in a collaborative spirit as we adapt to this ever-changing world in which we all share.

velocityelectronics.com

PLANNING HAS NEVER BEEN MORE IMPORTANT

Perfect Parts' VP, Daniel Roca, encourages buyers to plan ahead and partner with supply chain experts to help alleviate constraints and assist as global tensions increase

There is no doubt 2023 still holds a high level of uncertainty when it comes to supply chain stability. Many companies are still heavily impacted by shortages, the resurfacing pandemic, allocation, lead times, inflation, obsolescence and the global economy. There are signs of improvement, however many companies are facing strong demand and requests for improvements along their supply chain channels. Partnering with the right companies can ensure a higher level of success.

Many commodities, like resistors and capacitors, are seeing improvements. However, semiconductor lead-times and shortages remain high and have limited raw material resources, increased costs, and heavy allocation across the globe. As tensions increase in China and Russia, the volatile market is likely to see more constraints. Planning can help alleviate constraints and assist as tensions increase.

Performance of original chip design manufacturers, original equipment manufacturers and contract manufacturers will be impacted by their ability to partner and bridge supply chain gaps for semiconductors, other critical shortages and pricing. Due

to rising costs overseas, many are realizing they don't have as many supply chain solutions as previously thought. Perfect Parts is an expert in bridging those gaps.

Despite all the constraints, we have seen many positive improvements in material allocations with appropriate focus in bridging the gaps for original chip design manufacturers, original equipment manufacturers and contact manufacturers customers. Many clients are securing products through 2024 to ensure success and get ahead of soaring product costs, high allocation, and raw material resources. Planning has never been more important.

www.perfectelectronicparts.com



Perfect Parts' VP, **Daniel Roca**



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INVENTORY IS THE DIFFERENTIATOR

Mouser Electronics' senior VP of global service, Mark Burr-Lonnon, is proud buyers see the company as a well-resourced, authorized distributor with the widest selection of products

The global economy has endured challenging times of late and the resulting impacts of the pandemic are ongoing as inflationary pressures ripple through all industries. Despite higher prices and ongoing supply chain instabilities, the outlook for the electronic components industry shows steady demand in 2023, particularly in the data, communication and transportation sectors. Key technology drivers, such as 5G,

IoT, AI and electric vehicles, will continue to accelerate consumption and demand in 2023 and beyond.

At Mouser, our inventory position continues to help set us apart. We experienced a record year in 2022, due in large part to semiconductor shortages. This continues to send customers our way, as they know we are a well-resourced, authorized distributor with the world's widest selection of products.

We've broken ground on a major expansion at our Global Distribution Center and anticipate continued growth in 2023 as supply chains improve across the semiconductor,

interconnect, passive and electromechanical product categories. Two focus areas for us are engineering tools and new product introductions and we expect upward momentum in these areas as well.

Inventory and selection are key, especially in times of shortages and allocation. Over the last two years, Mouser has added over 140 new manufacturers to our lineup and we are stocking the industry's widest product selection. We will continue to invest in inventory, new products and our e-commerce site to serve our growing customer base of engineers and buyers.

mouser.com

Mouser Electronics' senior VP of global service, **Mark Burr-Lonnon**



VALUE IN INDEPENDENT PARTNERS



Freedom USA's CEO, **Carl Depaolo**

Freedom USA's CEO, Carl Depaolo, is confident the customer relationships made and maintained through the shortage will last decades

The past two years have taught a humbling lesson. In my 36-year distribution career it's the most lead time pressure I've ever seen. What to expect next? As supply eases, expect to pay the price for double and triple ordering. Will there be an inventory glut in 2023? Seems likely. As we prepare for this change, relationships and customer service are the keys to success.

What have we all learned from this mess? Options are limited once you pass the top five or six franchised distributors and there is

genuine value in having great independent partners. If you are not a billion dollar plus manufacturer, you're likely not getting the services you should. Long and short term schedules, lead time buys and bonded inventory are some of what Freedom offers customers to offset the lack of services they experience daily. Manufacturers deserve more.

During this shortage, manufacturers had to get creative. These brave folk took a huge leap to meet their customers' demands. They are realizing the value of an independent that puts relationships ahead of giant profits. In 2021 (and so far in 2022), Freedom's gross margins haven't changed more than a point or so

from '19 and '20. Where we could have made margin, we made friends. While the dollar cannot be ignored, the relationships we've made and maintained through the shortage will last decades.

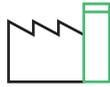
Expect more disruption on a smaller scale. The coming year will be interesting to watch with the market correcting throughout 2023: it's starting already.

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TECHNOLOGY INDUSTRY TO OUTPACE GDP

Avnet's regional president, Dayna Badhorn, encourages purchasing professionals to deploy digital tools and automation to help ease the impact of rising prices

While many areas are running more smoothly compared to a year ago, we're still preparing for a continued imbalance in component availability and pricing heading into 2023. For example, our recent Avnet Insights survey of design engineers found that over a quarter are still preparing for even longer lead times. To address this continuing challenge, we've worked to extend our pipelines and create a

clearer allocation view that reaches a full quarter or more into the future. Helping our customers design in the latest technologies also helps with both availability and pricing pressures as a lot of CAPEX is being spent in newer technologies.

Price pressures have not totally eased and 29 per cent of engineers are still preparing for continuously increasing prices according to the latest Avnet Insights survey. They can help ease the impact of rising prices by implementing more efficient practices into their supply chain, such as deploying more digital tools and automation.

When it comes to the US economy, the balance between the tech industry and broader economic picture is shifting. While tech has grown largely in lockstep with the economy in the past decade, the predicted slowdown combined with new demand drivers such as clean technology and electric vehicles are shifting the technology economy ahead. That means we could see the technology industry grow at a greater pace than GDP and this trend could begin to materialize in 2023.

www.avnet.com

Avnet's regional president,
Dayna Badhorn



WHAT COMES AROUND GOES AROUND



ECCO's president,
Bernard Gizzi

ECCO's president, Bernard Gizzi, is confident the electronic component procurement community will soon be back to more balanced material planning and availability

The phrase 'what comes around goes around' offers insight into 2023's component supply chain. I say that with full confidence that contrary to those who said 'this cycle will be different'—given factors such as electrification, IoT, aerospace, post-pandemic pent up travel demand, logistics chaos, infrastructure investment and geo-political influences to name a few—there will be a change in our industry's record profits and revenues. This will

start with the global and US economies beginning to feel the effects of monetary pricing and government's efforts at mitigating runaway inflation.

In fact, Northern Trusts' USA capital advisers released their forecast sighting slower growth for most market segments due to slower than expected transitions to renewable energy sources, a prolonged war in Ukraine, restructuring of global monetary debt and further nationalistic tendencies of governments who have been burned by relying on political adversaries for resources.

So, how does this affect our industry? It allows the procurement community to

get back to a more balanced aspect to material planning and availability. Allocation will persist but buyers can take a minute to breathe, think and plan vs the reactionary environment of the past 18-months.

Lead times will normalize and pricing will stabilize and likely decrease (for IP&E commodities and specific active commodity categories). All of this can drive competition and eventually M&A activity which could lead to the closure of production lines/facilities and lead to spotty product constraints: oh boy there we go again, what comes around, goes around.

eccoconnectors.com



INDEPENDENTS BECOME INDISPENSABLE



NewPower's CEO,
Carleton Dufoe

NewPower's CEO, Carleton Dufoe, describes how independent distributors are providing real-time insights into global supply, coupled with an unparalleled ability to execute

The electronic components industry has been in a state of consolidation, with larger manufacturers buying smaller manufacturers, suppliers buying suppliers, and distributors buying distributors. The consolidation had helped distributors broaden their service offerings to keep up with the demands of the status quo economy. However, those service models were not designed to deal with

the current shortage market, which has been exacerbated by the explosion in demand for electronic components.

When the world's smartest supply chain experts turned to their distribution partners for help, they quickly learned those partners weren't built to help solve the real-time inventory problems they were facing. The next alternative was independent distribution.

Once investigated, it was evident independent distribution filled the gaps. People have blamed the 'broker' for the industry's shortfalls for years. However, in today's marketplace, the independent distributor is

essential to almost everyone's supply chain operations. They provide real-time insights into global supply coupled with an unparalleled ability to execute.

Founded in 2014, NewPower prioritized technology as its primary differentiator with its Empower® trading platform providing real-time data to thousands of customers daily. With 13 global offices, NewPower is positioned to execute locally, in real-time, with no problem too big or too small.

www.newpowerww.com

YEAR OF CORRECTION



IBS Electronics' CEO,
Rob Tavi

IBS Electronics' CEO, Rob Tavi, sees a correction beginning in Q3 2022 and taking one to two-years to see improvements in the supply chain, lead times and prices

The electronics supply chain has experienced record growth in the last two-years and accelerated the global economy into a technological revolution, fueled by excessive fiscal spending ignited by the pandemic to stimulate the economy after the global shutdowns in 2020.

Global supply chain disruption, raw materials, labor and geopolitics have pushed global inflation to record numbers affecting the economy. As fiscal spending programs are being cut and interest rates rise, we are headed straight

into a cyclical and global recession that will directly affect the electronics industry.

2023 will be the year of correction in the electronics industry, with allocation, lead times and price deflation that sent the sector skyrocketing in prior years. Today's data shows the correction beginning in Q3 2022 and will take about one to two-years to improve the supply chain, lead times and prices, especially in the semiconductor and power-driven products used in advanced industrial infrastructure, EVs and cloud computing.

Manufacturers' and distributors' investments in technology, engineering and digital transformation over the last two years will show how they will handle the cyclical slowdown.

Digitally maturing companies innovate at a far higher rate than their competitors and employees of digitally maturing companies have more latitude to innovate. That will be the separator in this decade's electronics and supply chain industry of improving efficiency and output and communicating in real-time to their customers and partners.

The future is bright for the electronics industry, but how you adapt to implement software and technology will be the separator to long-term growth and success.

www.ibselectronics.com



BOOKEND OF A FOUR YEAR CYCLE

Sager Electronics' senior vice president marketing, Faris Aruri, encourages industry to extend its planning out at least a decade where the direction is decidedly up

Demand has reached historic heights and is growing across markets including industrial, automation, robotics, medical, 5G and EV. It is important to note that business cycles rarely last one year. While US business closes out the year and moves with a clean slate to the next, the underlying drivers have no connection to the calendar.

We find ourselves in a four-year cycle no one has seen

before. The pandemic's 2020 start led to an economic shutdown for at least two and a half quarters and a somewhat flat year. That shutdown left us unprepared for a drastic increase in demand, with the supply chain crisis dominating 2021/2022 and leading to 20 per cent annual growth and ever-rising backlogs.

The next dominoes to fall were inflation and a federal reserve determined to slow the economy at almost any cost. Next year will likely closeout this four-year period. We should see cost, transportation, material shortages and labor all settle. The upward demand for electronics will battle

against adjustments to an unsustainable order trend, high inventory levels and an economic slowdown.

The uneven growth numbers we find troublesome now will average 10 to 12 per cent annually when smoothed across the four years, a result most would take and run with.

While some are already planning for a downturn next year, we must realize the horizon is much longer and we should be planning for the next 10-years where the direction is decidedly up.

www.sager.com

Sager Electronics'
senior vice president
marketing, **Faris Aruri**



TALE OF TWO DIFFERENT HALVES

Future Electronics' VP strategic supplier development, Karim Yasmine, recommends ensuring accurate long-term requirements are in place with sources of supply

We have experienced two of the strongest back-to-back growth years in documented history. As we head into the final quarter of 2022, the long-awaited correction has begun. Yet many technologies remain at extended lead times, giving the purchasing community mixed signals. We see expedites for 'golden screw' requirements daily, followed by a slew of cancellations and backlog adjustments as end customers rationalize

their supply requirements and start to even-out the bubble that the industry has carried for over two-years.

As we head into 2023, most companies are challenged to forecast 2023 requirements but the end demand and overall supply situation remains murky. 2023 may be a tale of two very different halves. A first half driven by a backlog correction, reduced growth and lead time recovery, with a second half buoyant with strong end demand and a potential return to business health. That could also mean a return to extended lead times so keep your long-term backlog visible to your supply chain partner.

More flexibility is expected on key supply chain programs and long-term agreements. Also, major foundries have publicly stated capacity availability, so stay tuned.

The most important recommendation to purchasing executives heading into the new year is to ensure accurate long-term requirements are in place with your source of supply. It is also key that the EMS backlog matches the aggregate of the requirements from the OEM as we have seen imbalance here throughout the cycle.

www.futureelectronics.com



Future Electronics'
VP strategic supplier
development, **Karim
Yasmine**

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Top tips for buying relays

Hongfa America's director of sales and marketing, John Clayton, shares advice and tips for relay buyers, with communicating forecasts, lead times and end-of-life timings as priorities

What are current relay lead times?

Current relay manufacturing lead times range from eight to 44-weeks, with the majority of standard automotive, plug-in type and general-purpose relays having around a 10-week lead time. For specialty automotive relays and modules, including solid state relays, the lead time can be more than one year. With that said, lead times for relays have been decreasing to normal levels and procurement professionals should have an easier job of getting what they need in 2023. The moral is to prepare and order in advance, so as not to affect sales.

How can buyers avoid common relay purchasing mistakes?

There are three common mistakes buyers can improve on. First, the buyer should always try to create a positive partnership with their suppliers. Providing accurate forecasts, communicating lead time changes and end-of-life timings are important for suppliers and buyers as market demands change. In times of product shortages, good relationships with suppliers can assure a continuous supply of material.

Secondly, while buyers are charged with finding the most competitively

priced components, there is often the expectation that suppliers can reduce prices each year. Unfortunately, year-on-year component discounts are not always achievable and annual supplier price-cut requests for two to four-years after production starts are not actually the smartest long-term strategy.

These cost savings, typically from two to five per cent annually, are sometimes added to the piece price at the start of the program to level the playing field for the supplier. Unfortunately, buyers are often graded and/or rewarded on their year-on-year cost-cutting, which may not be in anyone's best interest from a time and quality standpoint. Manufacturers should look at the entire relationship with suppliers and the positive impact it can have on their bottom line.

Lastly, and possibly most importantly, engineers sometimes misunderstand the technical and quality differences between relay manufacturers and a component's impact on their finished product. Too often components are chosen based on a tenth of a penny difference in price, which later may cost thousands in addressing quality complaints, returns and poor ratings by customers, resellers and channel partners. This negative press is often irreversible and can have an impact for

years. It is not worth the fraction of a cent difference.

What advice would you give to buyers sourcing relays in the supply chain?

Our first tip is to honor the supplier's lead time requirement and provide forecast information that reaches as far into the future as possible. We suggest providing a rolling six-month forecast at minimum, preferably 12-months. Share as much program life information as possible and be sure to notify the supplier when the product's end of program life is near. Don't be afraid to sign long-term agreements and consider safety stock agreements as a buffer for sudden and/or unexpected surges in market demand. Appreciate the manufacturer that provides the best overall value: component price, timely delivery, few or no quality complaints and ease of doing business are most important.

www.hongfa.com



Hongfa America's director of sales and marketing, **John Clayton**



Lead times for relays have been decreasing to normal levels and procurement professionals should have an easier job of getting what they need in 2023

DON'T LET OBSOLESCENCE KEEP YOU GROUNDED



AUTHORIZED DISTRIBUTION



Tips and tools to quickly find alternatives

Digi-Key Electronics' digital product owner, Cody Walseth, introduces purchasing professionals to the company's tools and services designed to help them source alternative parts

Rapid changes in electronic components and availability have always been a challenge for our industry, especially for procurement professionals. However, with shortages and supply chain constraints over the past two years, purchasing pros have a more difficult job than ever. The good news is there are strategies and easy-to-use tools available to help navigate comparing components that will ultimately save time and ensure the right parts are in hand when needed.

Design with flexibility and understand tolerances

In the current environment, engineers are encouraged to create designs with components that can be sourced from multiple suppliers. Of course, they can't do that for every part, but there are often ways to

reconfigure a design to accommodate different part numbers. Having a bill-of-materials for parts with multiple manufacturers provides some insurance in the event stock is not available. In some cases, engineers are redesigning end products to use parts that are in stock; or starting the design by searching the Digi-Key website for in-stock product and designing their product around available inventory.

From the purchasing side, it's important to know if varying part tolerances are acceptable. For example, with capacitors, the tolerance for voltage may be wider than with a diode. Understanding the parameters are key and will be helpful in making purchasing decisions or in circling back to engineers with suggested substitutes.

Online tools to compare components quickly, conveniently

Digi-Key is working with customers and supplier partners to provide tools and technical support to offer alternate solutions when a specific component is out of stock, has a long lead time or is obsolete.

Earlier this year, the company introduced a robust cross-reference tool that automatically pulls a list of potential alternatives from its database of nearly 50 million part number cross-references. When a customer tries to order a part number from the website that is out of stock or obsolete, Digi-Key automatically presents potential alternatives via the cross-reference tool so customers can quickly and easily evaluate those parts.

If a design's bill-of-materials is available, it can be uploaded into



Digi-Key Electronics'
digital product owner, **Cody Walseth**



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myLists, Digi-Key's parts list management platform, which will indicate if any parts are out of stock, obsolete or not recommended for new designs. myLists tools are designed to be easy to use, save time and provide a better user experience with easier collaboration between purchasing and engineering, as lists can be shared with others in the organization without interrupting workflow.

Along with self-serve online tools, customers can find archived resources and interact with a team of technicians on Digi-Key's TechForum. The technical support team is available to review part inquiries and help customers find a substitute or alternative. These types of questions and answers are then archived and easily searchable in the future.

Digi-Key's sales and technical support teams are available via online chat, email and phone to answer questions about part substitutes and alternatives to replace out-of-stock components in their designs or to

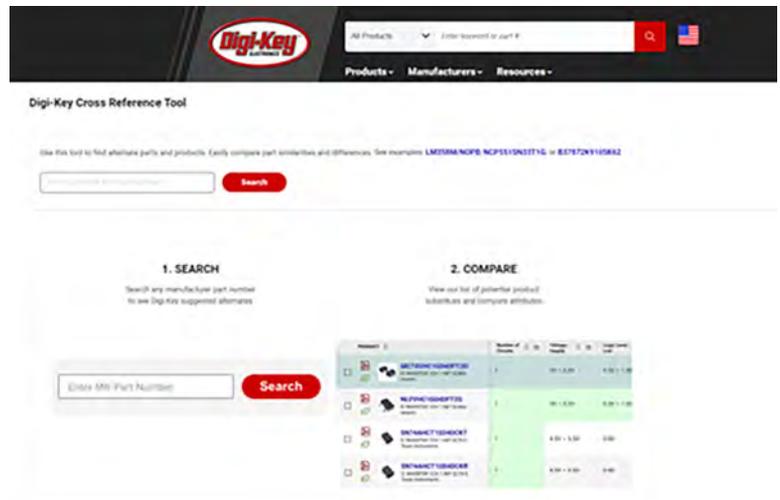
qualify multiple options in their designs.

Communication is critical

In this line of business and the current market, there truly isn't such a thing as overcommunication—simply getting on the phone, making that individual connection and keeping all parties in the loop.

The Digi-Key team excels at staying in close contact with supplier partners to provide as much visibility as possible into the products in highest demand. In some cases, Digi-Key is already placing orders out to mid-to-late 2023 to ensure inventory is pipelined accordingly.

In addition to that close human connection, investments are also being made in technologies that help connect us more automatically and electronically with suppliers, such as Advance Shipping Notifications (ASNs) which provide real-time, automated updates to Digi-Key's system about when product will be shipping. This provides



Cross Reference Tool

the most up-to-date information from supplier partners to customers.

Digi-Key understands customers are busy, making speed and ease the key to finding replacement parts. The company is evolving and improving tools and solutions to provide customers accurate information about component comparisons as fast as possible so they can keep their projects moving and generate revenue as soon as possible.

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Engineers are encouraged to create designs with components that can be sourced from multiple suppliers



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Rob Tavi
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Understanding obsolescence, mitigating risk

Obso Global director, Leroy Spence, outlines key factors to consider when planning for obsolescence and how a third-party provider can help

When new electronic components are brought to market, it is not uncommon for older technologies to be phased out. This can present problems for plant and equipment managers tasked with keeping assets performing reliably.

However, when discussing the challenges of obsolescence, it is important to note that 'obsolete' does not mean equipment has reached its end of life. It simply defines the part as no longer supported by the manufacturer, so alternative sources that can provide a part of equal quality and design need to be considered instead.

Key to managing obsolescence is a plan which considers every aspect of the plant and its impact on productivity. This should include an audit of the installed base of machinery and equipment, identifying the risk by area, line and machine.

The second stage is to understand the equipment lifecycle. Spare parts do not reach obsolescence at

pre-determined intervals and their availability cannot necessarily be predicted, so it is important to understand the equipment life cycle. This can help build an accurate profile of which parts are current and readily available, which are due to become obsolete and which are already obsolete.

Rather than waiting for a part to fail, this method helps operators stay in control, minimising the potential for expensive downtime, reducing the time-consuming search for parts and freeing up resource for more productive tasks.

A third stage is to consider an alternative to the obvious 'like-for-like' parts replacement. While no reputable supply partner would advocate the use of pirate parts or cheap imports, there are often numerous plug-and-play alternatives or a migration path available that will return the equipment to its original performance.

The final phase is regularly monitoring spare parts and

components throughout their service life. Routine, proactive maintenance will always help prolong equipment longevity and help prioritise energy performance. In this way, operators can help lower ownership costs over the lifetime of the equipment.

Once a comprehensive obsolescence management plan is in place, operators should consider forming a partnership with a reputable, third-party supply.

Such a supplier will focus on minimising production downtime during parts upgrade or replacement, with an emphasis on maintaining existing equipment parameters. This may mean the first option is not an immediate like-for-like replacement but to consider reverse engineering a part or finding an upgraded alternative which may require minimal programming.

A third-party supplier can also assist with inventory management, especially when

holding large volumes of spare parts on-site is impractical or where the cost of upfront purchase is prohibitive.

In conclusion, managing the product lifecycle requires operators to understand current and future risk and put steps in place to mitigate—creating a long-term strategy that includes replacement parts and an adequate stock of critical spares.

Obso Global has launched an obsolescence management guide (available to download) which guides operators through key steps when implementing an action plan and provides recommendations for outsourcing obsolescence management to a supply partner.

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Buyers' guide to sensor evolution

Sager Electronics' VP supplier marketing and product management, Craig Sanderson, explains how new sensors can reduce costs by combining multiple technologies in one device

Original equipment manufacturers (OEMs) are expanding sensor usage. Over the past decade, sensors have become a mainstream method for improving the effectiveness and utility of equipment and products. Proliferation of sensors in our personal lives via mobile devices, home security, automobiles, appliances, etc, is paving the way for a similar expansion in OEM applications.

Growing sensor use is impacting engineering and procurement. For engineering, sensor technology defines the capability, features and differentiation of equipment, while adding an element of safety in many applications. Procurement management is concerned with unit and total cost.

Cost is improved as sensors become more feature-rich. OEMs can reduce costs by combining multiple sensor technologies in a single device. A reduction in BoM size, handling, procurement, inspection, assembly and manufacturing costs are made possible by sensor developments.

In most applications, new generation sensors offer similar feature-rich specifications at a significantly lower cost. For example, Honeywell's MicroForce sensors are feature rich, in smaller form-factor packaging, at a cost that wasn't available in the past.

Another area that continues to affect sensor use in customer applications is safety. This significantly impacts the



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

total cost in applications where safety requirements are critical such as: heating, ventilating, air conditioning and refrigeration (HVAC-R); and electric vehicle charging.

In HVAC-R the elimination of global warming chemicals has been mandated for several years but is only now impacting equipment manufacturers as they replace refrigerants containing these ozone-depleting chemicals. The newly approved refrigerants contain gases, the use of which in an HVAC-R system by itself is a clean process. However, these refrigerants are mildly flammable (A2L), causing concerns around leaks. The need for a safety device to ensure a leak or escape of refrigerant is detected is a proven and cost-effective measure to ensure compliance and safety.

Gas sensors exist but their technology may not be as reliable as the newest digital technologies. One such sensor is in advanced stages of development by Sensata. Due for release in Q2 2023, Sensata's 1GDT2 Resonix sensor addresses the critical safety needs for the HVAC-R refrigerant mandate and offers cost enhancing features that will appeal to procurement.

With the world moving from internal combustion engines to electric

vehicles, charging the battery systems is a critical need. These charging stations require a sensor device to ensure the safety of the vehicle, user and location. What types of sensors are targeted for these EV chargers? Current transducers and sensors are being used in all three types of EV charging: AC destination chargers, DC destination chargers and DC fast chargers.

LEM offers current sensors that address charging requirements. Their

CDSR and CDT sensors detect leakage current for safety and efficiency. LEM also offers a plug-and-play meter coupled with a sensor unit to provide a single purchase order solution rather than the cost of all of the associated components, manufacturing, etc.

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Time-tested strategies all buyers should be using right now

By **David Stein**, vice president of global supplier management, and **Margaret Cunha**, senior director of supply chain solutions at **Digi-Key Electronics**



Prourement professionals and buyers have dealt with a litany of challenges in recent months as the global pandemic, labor shortages, logistics bottlenecks and supply chain shortages all impacted usual processes.

The good news is that there are time-tested strategies that buyers can be using now to tackle their current challenges and prepare for the future. Here's how you can prepare for what's coming in 2023.

Avoiding the "golden screw" issue

If the part you need is already out of stock and hard to find, consider ordering a similar product from the same family, how much you need right now and how much you'll need over the next 12-24 months. Will your usage increase by 10%, or will it go up by 50%? The answer will reveal your potential shortage over the coming months so you can plan ahead accordingly. There is an assumption from our

industry that many are waiting for the "golden screw." Meaning that from an inventory standpoint, customers have procured some material, but they're still waiting for those one or two critical components to finish production and start generating revenue.

You want to avoid this golden screw issue, where you have all the other parts on your bill of materials (BOM) except one. It's the biggest challenge distributors are facing right now.

If this does happen, it's time to pull your engineering and design teams into the conversation and start talking about slight design tweaks or form-fit-function alternatives that you can get your hands on faster. Where possible try to have at least a couple part options that can be used on each line of your BOM – allowing flexibility on your approved vendor listing (AVL).

Looking ahead

Although we might see some of the market softening in 2023, a lot of purchasing professionals are very bullish about what they're seeing and what their future is, because they don't see their demand going down or customers backing away. Over the past 6-8 months we have seen a rejuvenation from companies stressing the focus on new designs. The amount of engineering activity is extremely strong – companies now have the engineering resources at their disposal to focus on the products and designs of tomorrow.

Utilizing myLists, on the Digi-key website, is a strong option to vet any component alternatives and check the life cycle of the components that are being designed in. Kicking off a new product introduction (NPI) with an obsolete component can be very costly at production launch and

another reason to make sure you are designing with the right products and the maximum amount of flexibility.

To help buyers work to meet their current needs, address any challenges and plan for the future, Digi-Key provides a full suite of online tools, including the new strategic procurement e-book you can find at: www.digikey.com/morethanparts.





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Semiconductor raw materials draw attention on IC sales optimism

The widening use of semiconductors across the global economy is forcing companies and investors to pay closer attention to the availability and sourcing of the raw materials used in chip production

This is the semiconductor decade. Notwithstanding expectations for a double-digit revenue decline in 2023, semiconductor sales are projected to hit or exceed one trillion dollars by 2030, rising from \$556 billion in 2021, and making chipmakers the darling of investors for the immediate future.

Chips have become so ubiquitous that the shortages of some IC components over the last couple of years and the effects of pandemic-related actions hurt sales in many industries, including automotive and industrial equipment, leading to a reduction in global economic growth forecasts.

It's no wonder, therefore, that the raw materials used in fabricating chips have similarly become hot commodities. Semiconductor industry executives and government officials alike have begun showing greater interest in the sourcing, extraction and processing of the raw materials used in chip production, including silicon, germanium and gallium arsenide.

The industry is also widening research into alternative components that offer better technology advantages and that can be more easily sourced at cheaper costs. As governments globally warily watch the supply chain to assure security of supplies following the recent shortages of chip components, interest in the location and control of the sourcing environment for semiconductor raw materials

has also increased. Western governments, for example, are expressing greater concern about the role of regions seen as politically unstable in the electronics supply chain.

In line with the expected strength in demand for semiconductors over the next years, researchers are projecting solid growth for semiconductor raw materials through the rest of the decade. Demand for all semiconductor raw materials is forecast to jump 50 per cent between 2021 and 2030, rising to \$87.4 billion, from \$58.3 billion, according to Precedence Research. It attributed the increase to widening demand for electronic equipment especially in the communication field, including data center, IoT and the digitization of many segments of the economy.

"Increasing demand for mobile phones and other wireless devices are driving the growth of the semiconductor materials market," said Precedence, in a research report. "The deployment of 5G technologies, robust investments in cloud services and data centers and the increased digitization of developed as well as developing economies will contribute to the growth of the semiconductor materials market. There's an increased demand for miniaturization of various electronics [and] this demand is creating more opportunities for the growth of the semiconductor materials industry."

The geopolitical rivalry between the US and China that ensnared

semiconductor suppliers and chip equipment makers in recent years is slowly catching up with raw material suppliers too although it has not been as intense. Supplies of raw materials for chip production is more widespread but China, as in other manufacturing sectors, is also a major supplier. Other countries involved in the supply of semiconductor raw materials include Japan and South Korea.

The Asia Pacific region leads in the production of semiconductor raw materials, in part due to the strong role Taiwan, Korea and China play in IC production. Japan is also strong in the sector and has leading manufacturers like Hitachi High-Technologies, Tokyo Ohka and Mitsui High-Tech operating in the segment.

Other countries are pushing for greater participation of their local enterprises in the sector. India, for example, wants to become more independent in silicon production and has been encouraging Indian businesses to get involved. American enterprises, which once yielded the leading role in the supply of semiconductors, are reviewing their participation in the procurement of raw materials with the support of the US government.

The concerns are not misplaced. Silicon, which is more widely used in the production of semiconductors, is readily available but many in the industry believe it is approaching certain technology limits and would be eventually replaced. However, sourcing

the alternatives can be difficult and expensive. Also, the market for some of the alternatives is dominated by China, which has in the past prioritized domestic consumption, according to observers. China has also in the past weaponized the supply chain, punishing Japan in 2010 over a fishing dispute by restricting the supply of rare earth elements or materials (REEs) to the country.

"While some semiconductor materials are both cheap and abundant—silicon being the most obvious example—the REE used in the production of high-k dielectrics and chemical-mechanical polishing can be costly," said the IEEE, in a report. "Several factors contribute to REE value. The processes required to separate REEs from the rock in which they are found are both difficult and costly, requiring thousands of stages to extract and purify the finished material. China is one of the few nations to focus on REE mining and refining, resulting in the nation producing 85 per cent of the world's supply of tungsten and molybdenum."

Silicon war

Concerns about the security of the semiconductor supply chain has increased in recent years especially after severe shortages hit many economic segments starting in 2021. The exposure of the Western economy to supply chain problems originating outside their regions and concerns about China's lock on the production of chips and materials triggered actions that have since led to a



further widening of the gulf between East and West.

The US Chips Act—designed to foster an increase in local semiconductor production—and a similar legislation in the European Union, emerged from Western worries about the security of the supply chain. In addition to offering billions of dollars to support local IC production, the US government has increased its oversight of the sector and added restrictions on the supply of advanced semiconductor manufacturing equipment to China.

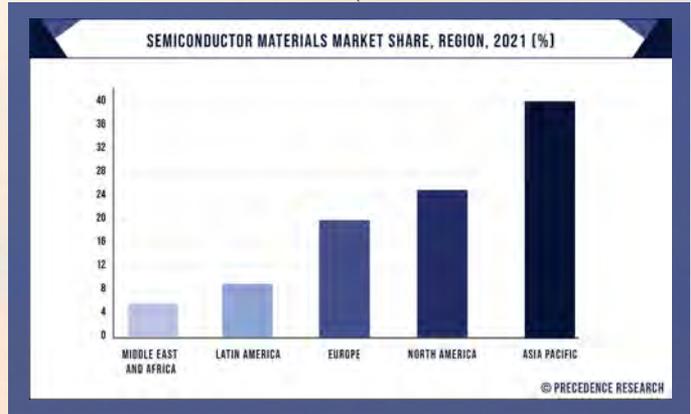
The Chips Act and the National Critical Capabilities Defense Act, which tracks overseas investment by American enterprises, are two of the major steps taken in recent years by the US government to protect the country's information and technology supply chains, according to the Commerce Department. In a statement earlier this year, the Department noted that it had identified areas of the economy that should be protected against dangers inherent in the foreign

domination of the electronics industry supply chain.

“The assessment of the current ICT supply chains conditions revealed several risks that threaten to disrupt the broader ICT industry,” said the Commerce Dept, in the report. “These risks, including a lack of domestic production capacity for many product categories, overreliance on single-source and region suppliers, limited use of robust cybersecurity practices, and underinvestment in the domestic workforce threaten to continue to disrupt the ICT industry and the broader economy if left unaddressed.”

Companies like Advanced Micro Devices and Nvidia have been impacted by the new regulatory environment. In October, the two companies said they received communication from the government regarding a ban on the export of their advanced chips to China. The directive impacted high-end server chips from Nvidia used in cloud and data center applications. Western governments are also placing tighter restrictions on the acquisition of

Semiconductor Materials Market Share By Region 2021
Source: Precedence Research



semiconductor enterprises by Chinese companies. Germany, for example, recently blocked the acquisition of two chip manufacturers by Chinese investors due to national security concerns.

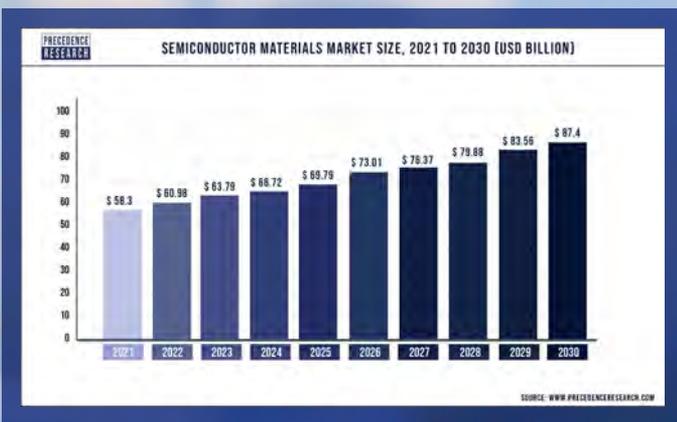
Innovations

Similar objections to the transfer of leading-edge innovations to China are expected to crop up in the semiconductor materials market as suppliers explore innovative solutions, according to industry observers.

Silicon, for instance, is the most widely used raw material in the production of semiconductors but innovative products and potential replacements are already being developed. These include high-power gallium nitride, graphene and pyrite, which is cheaper and widely available and can be used to replace cadmium telluride in solar cells.

“While the most important material in semiconductor manufacture for most of

the late twentieth and early twenty-first centuries, silicon is reaching the limit of its usefulness,” the IEEE said, in its report. “Demands for ever-smaller, faster integrated circuits have pushed the material's efficiency about as far as it can go, with industry experts fearing silicon will soon reach the limits of Moore's Law. Research into new materials is ongoing, with some materials holding great promise for the future.”



Semiconductor Materials Market Size 2021 to 2030
Source: Precedence Research



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TOP 5 WAYS TO REDUCE RISK IN YOUR SUPPLY CHAIN

In the past two years, Murphy's Law has all but replaced Moore's Law as the defining dictum that characterizes the semiconductor industry. When it comes to supply chains, everything that could go wrong has indeed gone wrong.

Whether it be geopolitical tensions, line halts, natural resource shortages or unpredictable demand due to economic volatility, supply chains have taken damage at every turn. To ensure that your supply chain is both fortified and flexible enough to withstand the next disruption, here are the top five ways to reduce risk in your supply chain.

1. Forecasting

Forecasting is fundamental to reducing risk. When done effectively, it can reveal hidden market factors that may negatively affect your supply chain. These factors are often fluid, such as supply, demand, and geopolitical situations. Therefore, keeping a watchful eye on these variables is key.

By analyzing your company's data around past supply, as well as a comprehensive map of your supply chain logistics, you can determine if one or more of your channels lie downstream from potential threats. Whether they're economic or geographical, identifying vulnerabilities allows you to either pivot preemptively, or put contingencies in place.

Forecasting is just the first step in managing risk. The next is determining the proper course of action.

2. Buffer Stock

If you spot a potential risk to the supply of a critical component, purchasing buffer stock is a strategy that may be worth considering. Acquiring just one to two months of extra inventory can be a good way to brace for an incoming shortage.

However, this course of action is heavily contingent on the accuracy of your market forecasting. A misguided purchase of buffer stock could leave you with an excess, potentially forcing you to lower prices.

3. Obsolescence Management

Not all risks are unpredictable. Component obsolescence is an internal threat, making it a controllable risk that can be navigated smoothly with diligent monitoring.

Obsolescence management starts with keeping track of the end-of-life (EOL) notices and last-time-buy (LTB) dates for all components within your supply chain. Letting just one of these transitions fall through the cracks will lead to immediate shortages.

Once you've identified a component's upcoming obsolescence, you can either find cross-compatible alternatives to plug-and-play, or look to R&D to accommodate plans for the next generation of parts from the manufacturer.

The more complex your supply chain is, the more vulnerable you are to obsolescence. Managing obsolescence well in advance is key to reducing internal risk.

4. Quality Control Process

Having a supply chain quality control process is imperative. Regardless of your industry, orders for electronic components should always be vetted. A lapse in quality can often require massive corrective action with direct impacts to your supply chain, such as scrapping inventory.

5. Supplier Relationships

Choosing the right supplier network to partner with is the most substantial step you can take in managing risk throughout your supply chain. A good supplier will often have offerings that extend far beyond supplying inventory.

Since they operate upstream from your main operations, where supply chain disruptions typically stem, a supplier can provide invaluable market insight that equips your forecasting. Moreover, finding one with a comprehensive quality control process will not only reduce risk, but also poses a more cost-efficient alternative to paying for in-house QC.

Partnerships with such a supplier should be seen as an investment that stands to pay dividends many times over to reduce risk in your supply chain in the short- and long-term.

Managing Risk Is an Ongoing Process

Risk management is a delicate balance of proactivity and reactivity. Documented processes and fail-safes are designed to keep you readily positioned to deal with most risks, but with threats appearing unexpectedly, being well informed on supply chain best practices equips you to handle surprises as effectively as possible.

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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

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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/A)	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											
Abrakon 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

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/A)	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
Würth	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
BE Power Solutions		+1 866 513 2839	belfuse.com/power-solutions	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						
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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
Lasca 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
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

RUTRONIK SYSTEM SOLUTIONS

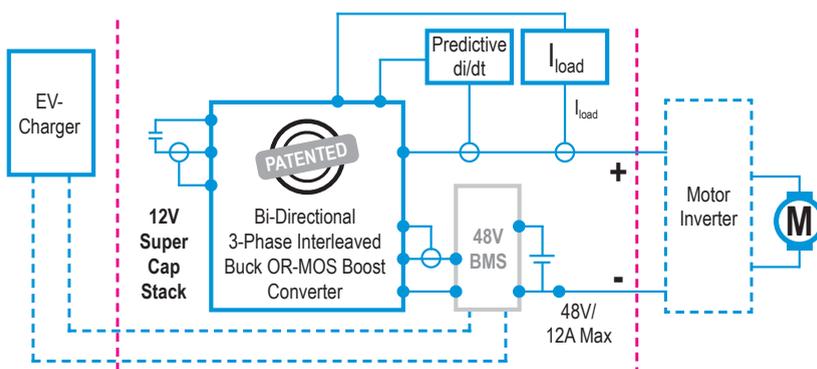


Patented innovation by Rutronik

HESS – HYBRID ENERGY STORAGE SYSTEM LONGER & MORE POWER!

At Rutronik, we stand for **Innovation & Value in E-Mobility** solutions tailored to your business, delivering **more power and performance** while caring for the environment through **more efficiency**. Many of today's existing battery powered applications require to provide enough energy even during high-power consumption times, called "peaks", which immediately and negatively effects battery- health and lifetime performance of the system.

In the face of this challenge, we developed a brand-new, innovative solution - **the "HESS"**. The HESS (Hybrid Energy Storage Solution) offers a significant benefit to nearly double the battery health and lifetime performance by reversing these peaks and allowing the **full energy** flow independent of the batteries current state of charge.



BENEFITS OF HESS

HESS is available to customers with a complete bill of materials (BoM) and license for production implementation. Nearly all components, from the semiconductors to the supercapacitors and Li-ion battery cells are available from Rutronik's wide range of franchised manufacturers. In addition, Rutronik provides customized solutions for HESS technology to enable added value with respect to protection and lifetime of the battery packs.

www.rutronik.com/electronic-components/innovation-and-future-dna

All information are subject to change without notice

