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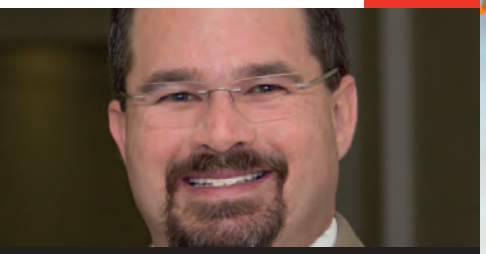

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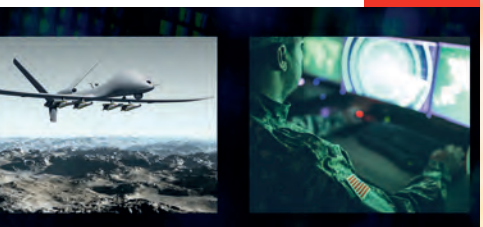

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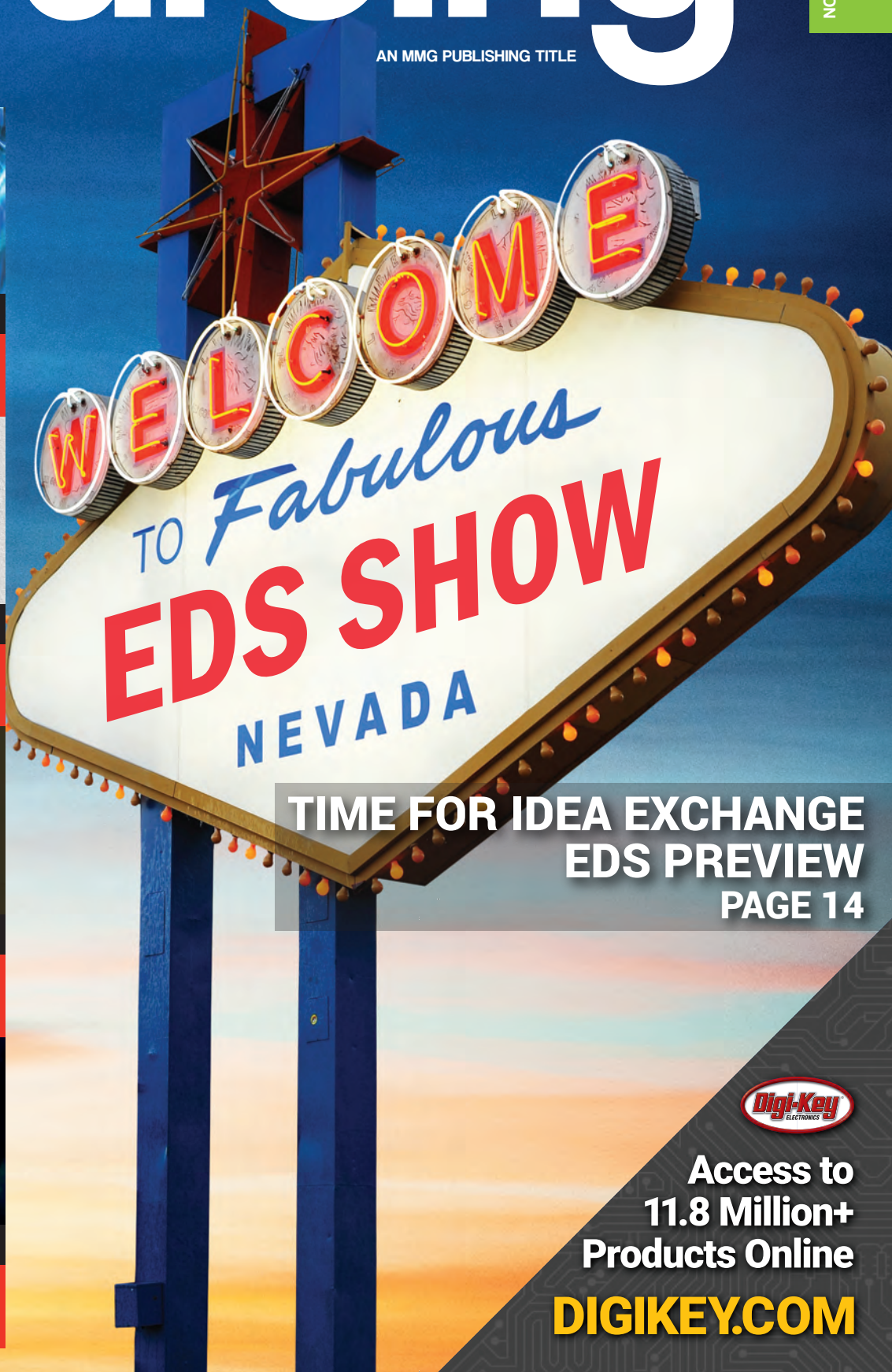

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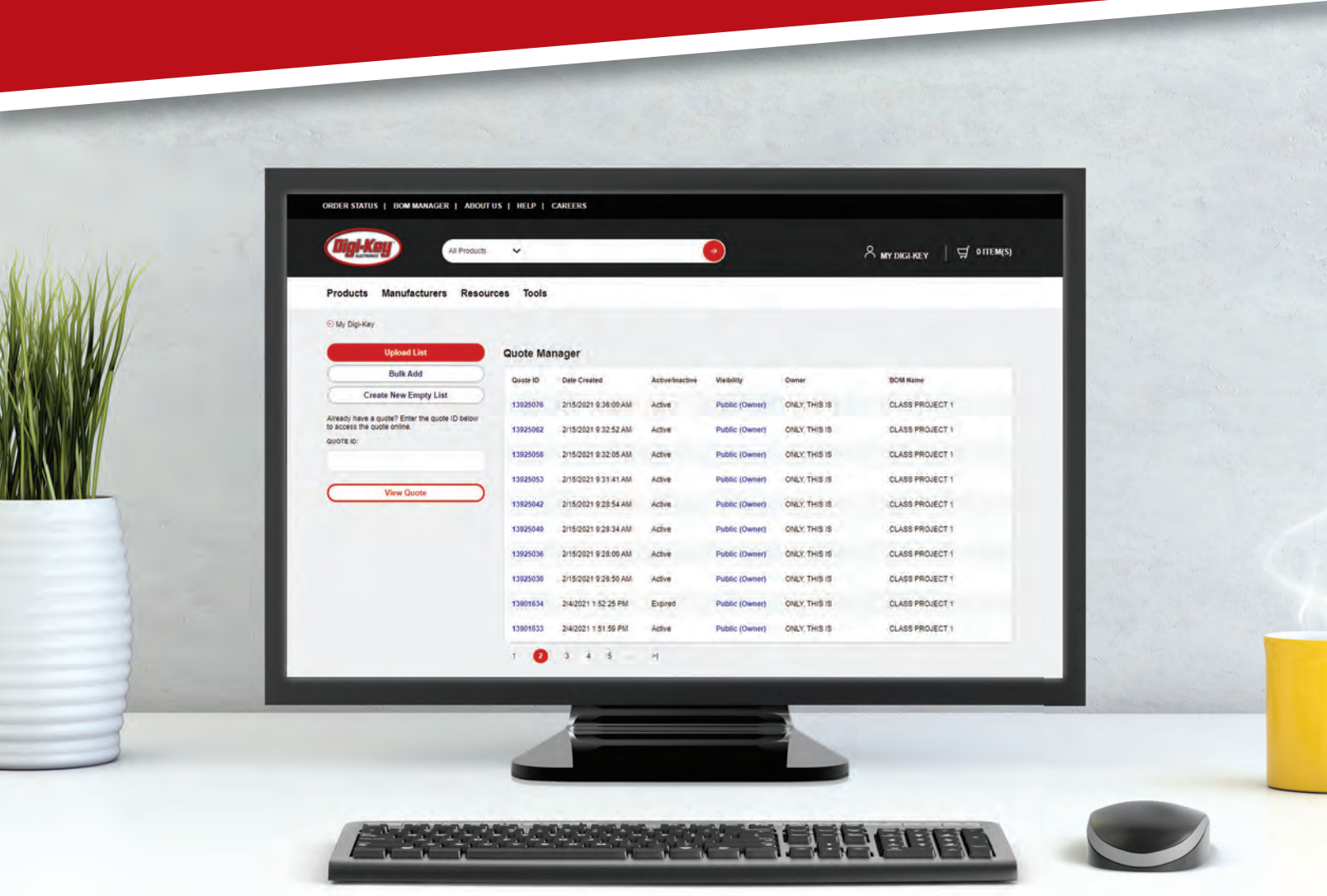

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Editor's Word

What next JIT

I'm no JIT expert but I appreciate that reducing work-in-progress is a sensible goal. However, I've watched JIT in action in some very expensive manufacturing environments and two questions always niggle at the back of my mind.

Firstly, every component in an assembly will have its own individual manufacturing profile. Some will be very quick to make (small pressings etc) while others will take much longer (hand assembled interconnects etc). So, unless one hundred per cent of the disparity is accommodated via production capacity, someone, somewhere in the supply chain is going to have to hold stock.

Secondly, is it really feasible to build a JIT infrastructure that can accommodate every conceivable unexpected event? I guess it is, provided someone, somewhere, holds stock.

From my own perspective, there was never a better time for JIT than the last 30-years. The steady expansion of globalization, unlimited labor, increasing automation, reducing border controls, stable governments, improving transport infrastructure, digital communications/commerce. Everything favoured the expansion and refinement of JIT.

However, things are changing. All of the above, apart from digital communications/commerce, is being impacted by events beyond any individual's control. From new diseases closing borders, decarbonisation increasing transport costs or shifting politics reducing access to cheaper labor, everything JIT relies on is changing.

There must come a point where the cost of chasing ever tighter JIT becomes more expensive than holding stock. My guess is that the next 30-years will see a strong focus on improving the efficiency of holding and moving industrial stock, just like the consumer sector is doing right now.

Jon Barrett

ES News

View current editions online – www.electronics-sourcing.com

Rising prices

IPC has published its *May 2021 Economic Report* which explains how strong demand coupled with supply chain disruptions has created large imbalances that have driven prices higher across the board. This was first seen with transportation costs early in the pandemic but has now spread to most input costs. The US price for hot-rolled coil steel was around $500 per ton prior to the pandemic. It is now near $1,600.

The price of copper and other commodities are near all-time highs. Prices are expected to remain elevated through at least the first half of next year.

Given tight supply, strong demand and rising prices, expect businesses to look to buy as much as they can, as early as they can. In some instances, shortages have led distributors to allocate supply, which will force businesses to order more than they need or double book. Further out this could lead to a glut.

ipc.org

Fab capacity on pace to meet surging demand

Semi's *200mm Fab Outlook Report* states semiconductor manufacturers worldwide are on track to boost 200mm fab capacity by 950,000 wafers or 17 per cent from 2020 through 2024 to reach a record high of 6.6 million wafers per month. The equipment spending increase reflects, in part, the industry's push to overcome the current chip shortage with 200mm fab utilization continuing at high levels.

Semi president and CEO, Ajit Manocha, said: "The report shows that, during the same period, wafer manufacturers will add 22 new 200mm fabs to help meet growing demand for 5G, automotive and IoT devices that rely on analog, power management and display driver integrated circuits, Mosfets, microcontroller units and sensors."

The report also reveals that foundries will account for more than 50 per cent of fab capacity worldwide this year, followed by analog at 17 per cent and discrete/power at 10 per cent. Regionally, China will lead the world in 200mm capacity with 18 per cent share in 2021, followed by Japan and Taiwan at 16 per cent each.

www.semi.org

Reduced component count

Mouser Electronics is now stocking Analog Devices' ADAQ4003 µModule data acquisition solution. Using system-in-package technology, the device reduces the development cycle by transferring component selection, optimization and layout from the designer to the device.

The component combines a low-noise, fully differential analog-to-digital converter driver; stable reference buffer; and a high-speed 18-bit, 2 MSPS successive approximation register ADC. It also incorporates Analog Devices' iPassives technology, supplying passive components with superior matching and drift characteristics, to minimize temperature dependent error sources.

Supplied in a 7 by 7mm BGA package, it can save up to 75 per cent board space compared with multi-component equivalent solutions, enabling smaller-form-factor instruments without sacrificing performance.

With the integration of multiple common signal-processing and conditioning blocks into a single device, the ADAQ4003 reduces end system component count along with development cycle time for systems such as automatic test equipment, machine automation, process controls, medical instrumentation and digital control loops.

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News

In Brief

Expanding industrial availability
Molex has signed a distribution agreement with Wesco Anixter, a provider of business-to-business distribution, logistics services and supply chain solutions. Molex will offer its industrial electrical, communication and connectivity product lines and industrial automation products through Anixter's North American and European distribution networks, driving progress in the development of fourth-generation manufacturing.
www.molex.com

Opto on the shelf
Sager Electronics is now stocking Molex's OptoHD, OptoDP and OptoUSB assemblies, designed to meet today's data demands in the medical and industrial automation markets. OptoUSB, OptoDP and OptoHD AOC assemblies' lengths are up to 100m, eliminating the need for multiple connection points and reducing the possibility of connectivity failure.
www.sager.com

Fast-track to secure IoT
UL has announced it will recognize PSA Certified as a fast-track for achieving UL's Secure IoT Component Qualification to help demonstrate that components incorporate industry best practices for IoT cybersecurity. This move reduces fragmentation in IoT security standards and will help to support more secure IoT ecosystems.
ul.org

Dedicated start-up solutions
Digi-Key has launched a microsite and help manual dedicated to startups. The site leverages resources, tools and knowledge Digi-Key has amassed in working with thousands of startups. The *Startups Survival Guide* manual is the second edition leveraging Digi-Key's partnership with *Startups Magazine*. Both resources follow the 10-step journey, from ideation and prototyping through production and support.
www.digikey.com

Lowering sensor costs

Heilind Electronics has signed a distribution agreement with Crocus, a supplier of magnetic sensors for the industrial, consumer electronics and IoT markets.

Crocus sensors utilize the manufacturer's patented XtremeSense TMR (tunnel magneto-resistance) technology which enables sensors to be fully integrated over a proprietary CMOS lithography process, simplifying the manufacturing flow, maximizing integration and lowering overall cost.

The company states XtremeSense TMR products offer low noise and stable performance in extreme operating environments, while providing higher sensitivity, lower power consumption and a more compact footprint than other magnetic technologies like Hall, AMR and GMR.

Heilind offers the complete line of Crocus solutions, including contactless field sensors, integrated current/field sensors, angular sensors and digital latches.

www.heilind.com

Guide to thermal management

CUI Devices' Thermal Management Group has published a free, comprehensive ebook on thermal management. As an almost inescapable factor in electronic design, managing heat is often an afterthought during the design phase. With this free-to-download ebook, titled *The Complete Guide to Thermal Management*, readers will gain a better understanding of the fundamental principles of heat transfer and how to manage heat early on.

The ebook begins by looking at the various modes of heat transfer and the most common types of cooling devices used in thermal management. It then delves into dedicated sections on: fan selection and control features; specifying a heat sink; and operating principles of Peltier modules. The ebook also includes links to helpful online calculation tools, a glossary of thermal management related terms and an overview of CUI Devices' thermal management solutions.

www.cuidevices.com

Displays designed for demanding applications

Display Visions' TFT graphic displays with IPS technology are designed to provide stable contrast and all-round viewing angles usually only provided by OLED displays.

Thanks to simple control via SPI interface, the smaller displays from 2in are compatible with all microcontrollers and can replace older displays without issues. Alternatively, they can also be controlled via an RGB interface or 8/16-bit data bus.

The displays are offered in various sizes, from 2in to 4.3in. Even the smallest option has a 320 by 240 pixel resolution and is 2.2mm thick. The screens can be combined with a capacitive, multi-gesture touch surface.

The company also offers 5, 7 and 10.1in IPS displays, providing resolutions of 800 by 480, 1,024 by 600 and 1,280 by 800 pixels.

As standard components, all IPS graphic displays are available from stock. Designed for demanding continuous industrial use, these displays work reliably from -20 to 70°C. Guaranteed service life is at least 50,000 operating hours.

www.displayvisions.us

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Global copper demand drives up PCB prices

Fineline VAR's MD, Clive Wall, reveals the driving forces behind recent fluctuations in PCB pricing and supply

It is no secret the PCB market is turbulent with prices changing almost daily. Driven by a copper shortage it is impacting the PCB supply chain in new ways and there is no end in sight.

The markets draining copper reserves include electric vehicles, smartphones, green energy, telecoms and 5G. These consume huge quantities of copper adding pressure to an already stressed market. Additionally, copper PCB foil is prepared to exacting standards for fine tracks and complex features. Many copper producers prefer to sell to the less demanding energy and battery markets. Copper foil cost is currently increasing at a higher rate than copper as a commodity.

Foil capacity is increasing but not overnight. Two copper foil plants are expanding with deadlines of Q4 2021 and 2023. However, even this will not bridge the gap between supply and demand.

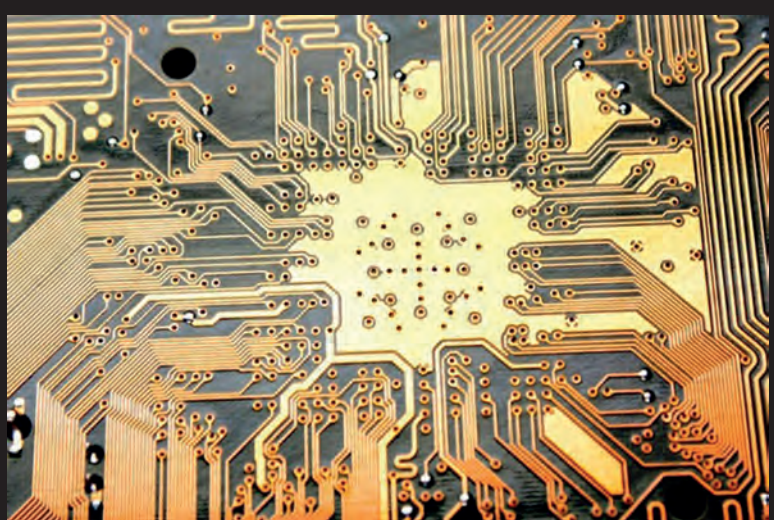
Past pricing wars and production efficiencies have lowered costs year-on-year to the point where 2020 PCB pricing was lower than 2000. Now we are seeing the opposite. Lead-times are extending and global PCB prices are rising rapidly. Costs may subside when the markets stabilise, but it is unlikely they will return to levels enjoyed in recent years.

Supply chain and logistics are another area of instability. According to Ventec International Group, air freight demand has returned to pre-pandemic levels but capacity is significantly down. This is elevating prices and is expected to continue until passenger flights increase. Sea freight is in high demand, leading to container shortages. Also, Asia/USA routes are more profitable than Asia/Europe. Brexit added congestion and delays through UK ports.

Customers with strong, close partnerships with their PCB suppliers are best placed to navigate further upheaval.

fineline-global.com

> **Past pricing wars and production efficiencies have lowered costs year-on-year**



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Strong demand, limited supply stretch power semiconductor lead times

Power semiconductor manufacturers are adding new capacity, but supply will be tight through 2021

James Carbone

Buyers can expect continued long lead times and higher prices for many power semiconductors through the rest of the year and tight supply could continue into the first three months of 2022.

While some power semiconductor manufacturers are adding capacity, strong demand from automotive and other segments will keep supply tight for months, according to chipmakers and industry analysts. Demand is strong for power MOSFETs, IGBTs, power management ICs, gate drivers and voltage regulators. Robust demand and limited supply mean the power semiconductor market will bounce back after the pandemic shut down production of electronics systems and components in the first half of last year.

Gianfranco DiMarco, technical marketing engineer, power transistor macro-division, automotive and discrete group for STMicroelectronics, said in the first half of 2020 power semiconductor business looked to be heading to the worst decline in five years. However, some end-use markets stabilized in the summer, which triggered a rush to refill inventories. He noted the shutdowns of schools, business and services boosted the demand for portable computers, tablets, gaming devices, 5G smartphones, data-center systems and home appliances. But weakness in automotive in the first half and the lack of commercial and industrial spend impacted the broader market performance for the year.

The overall result was that the power semiconductor market declined about 1.5 per cent in 2020, according to researcher Omdia. Richard Eden, senior principal analyst, power semiconductors for Omdia, said the power semiconductor market, which includes power discretes, power modules and power ICs, fell to $44.5 billion in 2020 from $45.2 billion in 2019.
He noted the power discretes market grew by 1.8 per cent to $15.6 billion from $15.3 billion in 2019 and the power module market grew by 3.5 per cent to $5.9 billion from $5.7 billion in 2019. However, the power IC market fell by 4.9 per cent to $23 billion from $24.2 billion in 2019.
Eden said that power discretes and modules are used more in infrastructure systems for power generation and power distribution while power ICs tend to be used in electronic equipment used in homes and businesses.

However, some segments of the power ICs market fared better than others during the pandemic. For instance, power management ICs (PMICs) were basically flat compared to 2019 when revenue was $13.8 billion, according to Semico Research.

Growth will return

"We think the power management IC business will pick up this year and revenue will exceed the peak of 2018," said Jim Feldhan, Semico president. PMIC revenue topped $14.3 billion in 2018. He said sales will grow 5 per cent to $14.54 billion in 2021.
Eden said he expected the overall power semiconductor market to grow about 5-10 per cent in 2021 and growth "may be even more than 10 per cent."

Robust demand has resulted in higher prices for many power semiconductors, but not all. Feldhan said the average price of power management ICs should actually decline in 2021. He said in 2019 the average price was $0.21. "In 2020 the price dropped to about $.20 and fell to $0.19 at the beginning of this year," he said.

Feldhan said it is unclear why prices would be declining for PMICs. "It's a real quandary. It's kind of a head scratcher. I have not come up with a good scenario on why prices are going down when demand is up and there is tight supply," he said.
Tight supply of power semiconductors will continue through the rest of the year because of healthy demand from

By the Numbers

$0.20
The average price of a power semiconductor in 2020. Source: Semico Research.

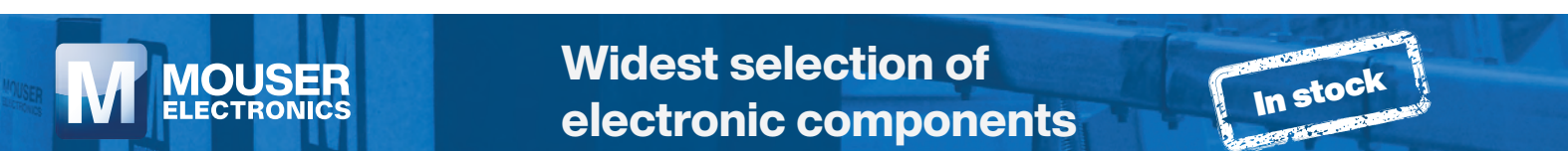
$30.3 billion
The forecasted size of the power integrated circuit market 2024. Source: IC Insights

1.5%
The rate of decline of the global power semiconductor market in 2020. Source: Omdia

$14.54 billion
The forecasted size of the global power management integrated circuit market in 2021. Source: Semico Research

$19.2 billion
The expected size of the worldwide power transistor market in 2021. Source: IC Insights

3.5%
The rate of growth of the power semiconductor module market in 2021. Source: Omdia



five major segments: automotive, industrial, computer and data storage, wireless communications, and consumer electronics.

Auto causes disruption

While power semiconductor demand is strong across multiple customer segments, the automotive industry has caused the most disruption. "Overall vehicle production declined by 5.7 per cent in 2019 and then in 2020 with the pandemic, factories were closed and the people did not need to buy cars so there was less demand" in the first half of the year, said Eden. But in the second half of 2020, vehicle sales grew strongly and the recovery "caught vehicle producers on their back foot," he said. Automakers and their suppliers boosted orders for power semiconductors and other chips causing shortages that continue today.

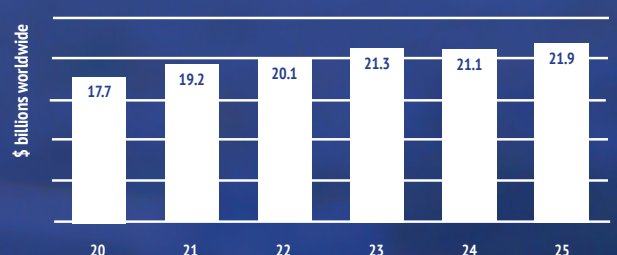
DiMarco said automotive, especially electric vehicles (EVs), will drive semiconductor growth for years. Automotive power transistor applications are forecast to push ahead of communication systems to become the second largest end-use category by 2025 because more EV will be produced and EVs have a much higher power semiconductor content than traditional combustion-engine vehicles, said DiMarco.

Five-G technology will also drive power semiconductor growth. "The rollout of 5G cellular networks in many different countries and new base stations that support this wireless system are expected to strongly contribute to an increase in power transistor demand for the power semiconductors over the next five years," he said. Because of strong demand from automotive, industrial, communications, "we believe the power transistor market will grow in 2021 and continue with significant projected compound annual growth rates through 2025," said DiMarco.

More capacity coming

Durable demand means that power semiconductor companies need to add capacity because lead times have stretched to one year for some products. Eden said in early June that lead times were rising for power MOSFETs, IGBTs, rectifiers and thyristors.

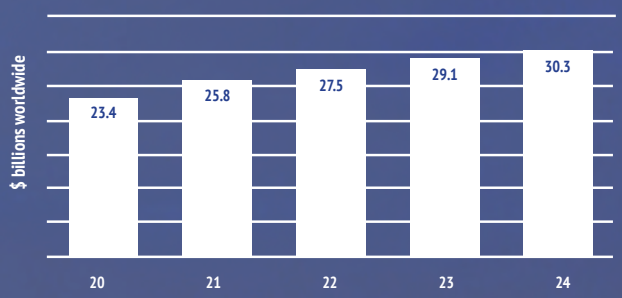
Demand rises for power transistors



Healthy demand from key market segments will result in mostly revenue increases in the power transistor market.
Source: IC Insights

The global market for power integrated circuits will increase to more than $30 billion by 2024.
Source: Omdia

Power IC's to post steady growth



Power semiconductor manufacturers "are being forced to play God deciding which customers they can support and which ones they can't," he said. Chipmakers have to decide if they should "not give quite enough semiconductors to all customers or give the right quantity to some but let down other customers. It's horrible," said Eden. "As suppliers of commodity items, semiconductor companies will always follow the money."

Some power semiconductor manufacturers are adding capacity. For instance, Infineon, the largest power semiconductor manufacturer in the world, expects a new $2 billion fab in Austria to come online later this year. "It can't come online soon enough," said Steve Bakos, senior director of power switching for Infineon Technologies Americas.

Lead times for power semiconductors have stretched to one year for some products. "Depending on the product, technology and package, lead times range from 26 to 52 weeks," said Bakos. He said Infineon has a lot of customers that are "begging to get parts. They have line downs. It is hard. It is not fun. I prefer the old normal steady times when you have to go work hard for orders" said Bakos.

He said long lead times will likely continue through the end of the year. "Crystal balls get hazy as we get too far out from the six- to nine-month horizon. It does not feel as if demand is going to let up anytime soon," said Bakos. DiMarco said ST is working to increase capacity faster and above the company's initial operating plan in its wafer fabs. "Our current and planned 2021 manufacturing capacity is fully loaded with a confirmed backlog," he said. "We are now planning for 2022 and are working closely with our customers and partners across all end markets and channels to adapt to these unprecedented circumstances."

Worldwide manufacturing capacity, including foundries, "is and will remain saturated and well below global levels of demand for at least the next six months and most likely for all of 2021," said DiMarco.

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Chomerics has launched Therm-a-Gap Gel 75, a 7.5W/m-K single component dispensable thermal interface material designed for high performance applications. It is a single component gel which reduces stress and pressure due to its low compression force, while representing the highest thermal conductivity dispensable available from Parker Chomerics. The company states its flow rate is nearly three times faster than the next closest performing material in the family.

The gel suits high volume, automated production, specifically found in telecommunications equipment, automotive safety electronics modules, power supplies and memory/power modules.

Parker Chomerics' global thermal business unit manager, Brian Mahoney, said: "Gel 75 was formulated to accommodate the future high-power demands of many different markets, including 5G enabled telecom infrastructure, automotive applications and any application that is seeing increased bandwidth demands that generate excessive heat. It is the next evolution in our Therm-a-Gap family of easy to use, reliable, high performance, single component dispensable gels."

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Increased cooling reliability

Laird Thermal Systems has launched the PowerCycling PCX series of thermoelectric coolers designed to meet demanding thermal cycling applications found in molecular diagnostics, PCR and point of care test devices.

Thermal cycling exposes thermoelectric coolers to mechanical stresses as the module contracts and expands from repeated heating and cooling cycles. This can quickly degrade the long-term performance and operational life of a standard thermoelectric cooler. PCX thermoelectric coolers are assembled with next-generation thermoelectric materials and enhanced module construction to provide improved performance and long-life operation in thermal cycling applications.

Laird Thermal Systems' product director, Andrew Dereka, said: "The new PowerCycling PCX Series is an ideal solution for leading PCR OEMs looking to specify a premium thermoelectric cooler in their next generation bench top or point of care PCR machine. The PCX Series is a major advancement to support faster ramp rates, while assuring long life operation in the field to allow our customers to sell more molecular diagnostic consumables."

www.lairdthermal.com

Rising demand for touchscreen enclosures

OKW reports increasing demand for its touchscreen enclosures: wall-mounted Smart-Panel, low-profile handheld Slim-Case, square-plan control center Protec and multifunctional Interface-Terminal.

Smart-Panel houses edge-to-edge touchscreens for building services, electrical installations, smart home and security systems. These enclosures can be fitted to standard flush-mount cavity wall boxes. With no visible fixing screws, they blend seamlessly into modern residential, commercial and industrial environments.

Slim-Case (IP54/65) accommodates touchscreens up to 10cm for a wide range of high-mobility environmental technology and safety engineering applications. Contoured sides, beveled rear panel and optional soft-touch intermediate ring make it comfortable to hold.

Protec (IP65 optional) has an ergonomic sloping front panel and is available in three sizes. This housing can be used on a table-top or wall mounted to suit the specific application. Three versions are offered with recessed, closed or extended rear section for the connections and cables.

Interface-Terminal (IP54 optional) can be ordered as mobile handheld; sloping front table-top or wall mounted; flush-mount for fitting in walls or front panels for harmonious integration in visually sensitive locations such as historic buildings.

www.okwenclosures.com

New fiber enclosures

PolyPhaser has released a new line of fiber terminal boxes, splitter distribution boxes and rack-mount panels, ideal for communications, telecom, cable TV, surveillance and monitoring systems.

The enclosure product line is designed to simplify field installation and address FTTx, fiber distribution networks and growing high-speed voice, video and data applications.

Patch panels and rack-mount fiber enclosures feature space-saving 1U 19in SC and LC patch panels in multimode and single-mode options with D-ring management card. This line also includes 1U, 24 and 48-port rack-mount enclosures.

Wall-mount outdoor fiber enclosures are available with 24, 48 and 72 simplex SC/UPC couplers (pre-installed) and 0.9mm single-mode pigtails (per port). The routing guides on these products limit bend radius and enhance strain-relief control. They feature a waterproof, IP54 design with gasket seal and secure lid latch.

Product line manager, Tinu Oza, said: "This new product line addresses a wide range of installation needs by providing installers with the broad selection of fiber enclosure options."

www.polyphaser.com

Time for idea exchange

With the electronic components industry facing an uncertain business climate and supply-chain challenges, manufacturers, distributors and sales representatives are encouraged to attend the EDS Summit which returns 30 August to 2 September 2021

With a legacy dating back decades, the *EDS Leadership Summit* is a premier annual event for the electronic components industry. It is unique in the conference and trade show business because it functions as both a high-level, meeting-based event and a vibrant marketplace where conversation leads to commerce.

It's called a 'leadership summit' because EDS brings together industry experts and decision-makers from the world's top manufacturers, distributors and sales representatives to share insights, focus resources, make plans and build new business. At the heart of EDS is idea exchange, which takes place at strategic meetings, event functions and informal gatherings throughout the Summit.

All official EDS activities will be held at the Mirage Hotel in Las Vegas. The location of the conference, meeting rooms, suites and guest rooms are carefully organized to minimize time spent getting from meeting-to-meeting. At the time of writing, masks, capacity limits and social distancing are no longer required for most Las Vegas businesses, bringing this year's Summit as close to normal as possible. There are exceptions and delegates can learn more at mgmresorts.com.

Due to pandemic-related scheduling issues, the 2021 SPARK 1.0 Professional Development Program was held virtually earlier in the year and will return to EDS in 2022. The SPARK program introduces talented people into EDS and gives them new competencies to grow their careers.

With over 2,200 members, the EDS LinkedIn group provides a forum where all EDS channel partners—including manufacturers, authorized distributors and sales representatives—can meet and network. Join the discussion by typing 'EDS Summit' into the LinkedIn search box.

The All-Industry Reception will be held on Monday, 30 August. This popular get-together provides an energetic introduction to the week ahead and allows industry colleagues to reconnect in a casual setting. This year, there will be a lot to catch up on.

Above all, EDS is about personal connection, networking and exchanging ideas. This is what makes EDS unique. Taking advantage of all EDS has to offer requires planning. To make effective use of your time, plan on contacting people you want to see well in advance. Every meeting is an opportunity to build your company's brand, so be purposeful, deliver a clear message and always follow up.

The Global Electronic Distributors Association (GEDA) is now the third sponsoring association of EDS, joining the Electronics Representative Association (ERA) and the Electronics Components Industry Association (ECIA).

The resources on EDSSummit.com are designed to make participation as easy and productive as possible. They include: Best Practices, Manual for Logistics and Support Services. You'll also have access to advice from EDS board members, staff and our three supporting associations.

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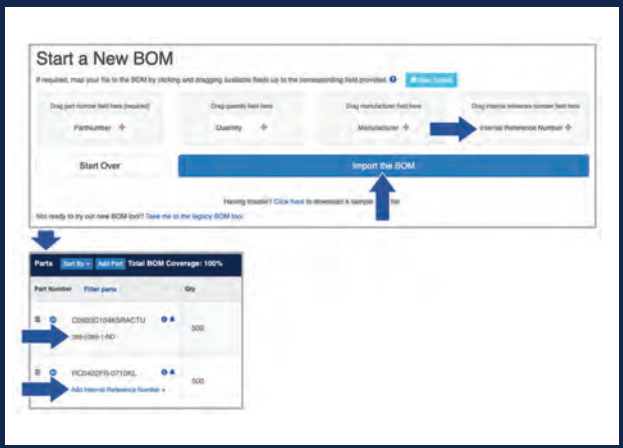

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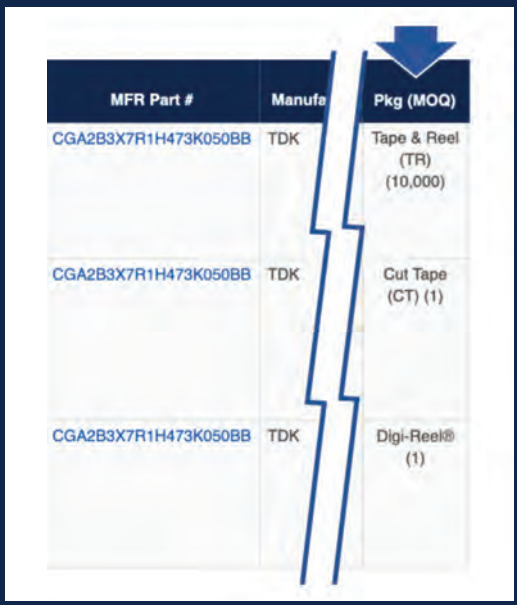

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Unmasking workplace and company culture

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 wonders what post pandemic workplaces will look like given all the data squarely points to hybrid

Workplace • By John Denslinger

A careful look at a CDC demographic shows 62 per cent of the US adult population received at least one vaccine dose as of May 2021 and 50 per cent are now fully vaccinated. CDC guidance suggests vaccinated Americans can forego masks and social distancing: the two biggest impediments to everyday person-to-person interaction. As one would expect, the news generated swift policy changes across the country from state governments to business. America is open again.

Given the steady pace of vaccinations, business leaders must now orchestrate the post Covid employee workplace. Will it be a return to the old-school workplace circa 2019? Will it be a continuation of the 2020 new-school thinking: remote forever? Or will it be a hybrid? If hybrid, who, why, where, when, what conditions, and for how long are the likely questions employees will ask. For executives, the decision is extremely consequential to talent retention, morale, flexibility, inclusivity and bottom-line productivity. Good or bad, it will define the company and its culture.

So here are the numbers to digest. According to a March 2021 KPMG article, 45 per cent of CEOs do not expect 'normal' to occur until late 2022. Surprisingly only 30 per cent are considering hybrid working models with most requiring two to three workdays in the office. But the Genie is out of the bottle. Employees may resist if pushed too aggressively to return. Another survey by Gallup reports seven in ten white-collar workers are still working remotely. Forty per cent would like to continue working from home because they prefer it, while another 11 per cent would opt to stay remote citing Covid anxiety.

To be fair, management has legitimate concerns about productivity, worker motivation, spontaneous creativity, employee development, worker dedication and keeping teams engaged in a remote environment. Additionally, how does the company fairly assess and retain its talent pool, safeguard its data and circumvent potential cybersecurity threats? From the employee's perspective, what about long-term isolation from peers, lack of stimulation, a feeling of invisibility to management, timely tech support, and perceived response indifference. Caregiving responsibilities only serve to complicate matters.

The post Covid workplace model will not be an easy decision for any company. Misjudging employee sentiment could be a disaster. A May 2021 survey by Ernst & Young revealed 90 per cent of employees wanted work rule and workplace flexibility as to when and where they work. More than half said they would consider quitting their jobs absent this flexibility. Also, many workers made life-defining choices during the pandemic: where to live. That stat seems confirmed by Accenture plc who found 83 per cent of workers viewed the hybrid workplace as optimal. If not permitted to work remotely, retaining these employees will be problematic.

Office, remote or hybrid? All the data squarely points to hybrid, but that's not the end of the story. The new workplace must still assure the organization can deliver on its mission. While each company promotes a unique culture, the successful ones typically expound the virtues and value of agility, innovation, respect and customer focus. If employees can work from anywhere, achieve assigned goals, realize their own potential, be available when/where needed, and deliver on company values, then the hybrid model works for the long term.

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Partnership guarantees component authenticity

Digi-Key and Rochester Electronics have formed a partnership designed to help purchasers sidestep component shortages with confidence

The Covid-19 pandemic and other factors have placed significant strains on the electronic components supply chain, with shortages rampant throughout the industry. To help resolve these purchasing problems, Digi-Key has partnered its high-inventory buying model with Rochester's in-stock inventory and licensed manufacturing capabilities for end-of-life (EOL) and legacy products.

Rochester Electronics' variety of critical components are available through the Digi-Key Marketplace, supporting purchasers in medical, industrial, aerospace, defense, transportation and more.

Digi-Key's EVP of digital business, Jim Ricciardelli, said: "We launched the Digi-Key Marketplace last summer to give engineers and innovators access to more product lines than ever before, through a one-stop shopping experience that serves the entire ecosystem of technology innovation."

The partnership also guarantees authentic components, at a time when component counterfeiting is on the rise due to shortages and high demand. Rochester boasts partnerships with more than 70 authorized manufacturers and Digi-Key is an authorized distributor for more than 1,800 industry-leading suppliers. Customers can rest assured that the products they order are authentic and come to Digi-Key and Rochester directly from the manufacturer.

Rochester Electronics' channel sales manager, Christa Brooks, added: "It has been a very rewarding experience working with the Digi-Key Marketplace team. We see a high level of customer service from every department we work with and the digital Marketplace portal is user-friendly as well."

www.digikey.com

Protecting against cybercriminals

Microchip explains how its DesignShield helps manufacturers protect their systems against non-authorized agents

To help prevent cybercriminals extract critical program information (CPI) from mission critical systems via FPGAs, Microchip has extended its FPGA family's security with the DesignShield development tool.

Microchip's VP FPGA business unit, Bruce Weyer, said: "Microchip offers a portfolio featuring the latest countermeasures for reducing the risk of cloning, intellectual property theft, reverse engineering or the insertion of malicious Trojan Horses.

"Protecting CPI in deployed systems with our DesignShield tool is essential for national security and economic vibrancy. The tool advances the state of bitstream protection mechanisms and provides another defensive layer in ensuring that deployed systems behave as intended and are safe from counterfeiters and their threat to a developer's design investments and brand reputation."

DesignShield deters reverse-engineering of the bitstream by obscuring its logical equivalent using a combination of logic and routing-based encryption techniques. This improves design security and integrity, reduces system corruption risks and reduces the possibility that custom code, intellectual property or information critical to national security is used by non-authorized agents.

Based on non-volatile flash memory, Microchip states its FPGAs offer inherently better security than SRAM-based alternatives that expose sensitive bitstream data on every power cycle. They also include unique integrated security features that prevent overbuilding and cloning, protect design IP and provide a root of trust, secure data communications and anti-tamper capabilities.

The company's layered approach to security includes licensed, patented differential power analysis (DPA) protection, built-in certified security functions, built-in tamper detectors, and supply chain assurance that the FPGA is authentic.

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As lead times lengthen, counterfeit and fraud risks grow

TTI's VP total quality, Kevin Sink, examines ways that counterfeiters and other criminal elements are taking advantage of uncertainty to prey on manufacturers

Right now we are seeing the ideal growing conditions for fraud and counterfeiting in the electronic components supply chain. Logistical issues; the disruption of supply chains by the Covid-19 pandemic; concerns about raw materials availability: and increased competition for key components among different industries: all these factors have led to the status quo of long lead times and high uncertainty.

In this high-stakes, high-stress environment, larger OEMs and ODMs may have more options than mid-size and smaller manufacturers. Even so, there is no shortage of bad actors who are waiting to take advantage of anyone who falls into their trap.

First, there are the ever-present problems of counterfeit parts: components that are offered as new when they are actually used or refurbished, and components that have been intentionally mislabeled to appear to be higher quality or reliability than they actually are. Those challenges have not gone away.

In addition, manufacturers are being targeted by sophisticated groups that claim to be franchised distributors with parts in stock: in exchange for up-front payment. These organizations build reputable-looking websites and register a wide variety of domain names related to different electronic components. They invest heavily in search engine optimization (SEO) and bid on internet keywords in hopes their site will appear above authorized distributors.

These websites promise on-time delivery but as soon as funds change hands, that's the end. No parts arrive because there were no parts for sale. In many cases funds are quickly transferred away from the destination bank, leaving victims with little or no recourse.

Industry watchers have seen similarly-designed websites with multiple different names (as many as 50 or more variations) that seem to be in the business of selling passives, semiconductors and more. This sort of fraud was common years ago until the legitimate industry of parts escrow services helped prevent it. Buyers urgently searching may not be familiar with such scams or may not know to rely on an escrow service.

A lot has changed in the past two decades. Smartphones and other computing devices, plus the growing electronics content in vehicles, have increased component demand. For example, those who weren't working in our industry during the 2000 tantalum shortage may be caught off-guard.

While major companies with larger staff and more resources may not fall victim to this kind of fraud, smaller manufacturers may be vulnerable: especially those dealing in smaller volumes where every job is a large contributor to the company's overall health.

To those worried about access to electronic components inventory during challenging times, the best advice is do due diligence and build connections with a known authorized distributor. If you're looking for specific components, rely on ECIA's TrustedParts.com search.

While the potential for fraud won't disappear entirely, by working together we can at least help stop counterfeiting and scams from harming manufacturers and customers in the industries we serve.

Special thanks to ERAI's Kristal Snider who contributed information for this article.

tti.com

TTI's VP total quality, **Kevin Sink**

> **Right now we are seeing the ideal growing conditions for fraud and counterfeiting in the electronic components supply chain**

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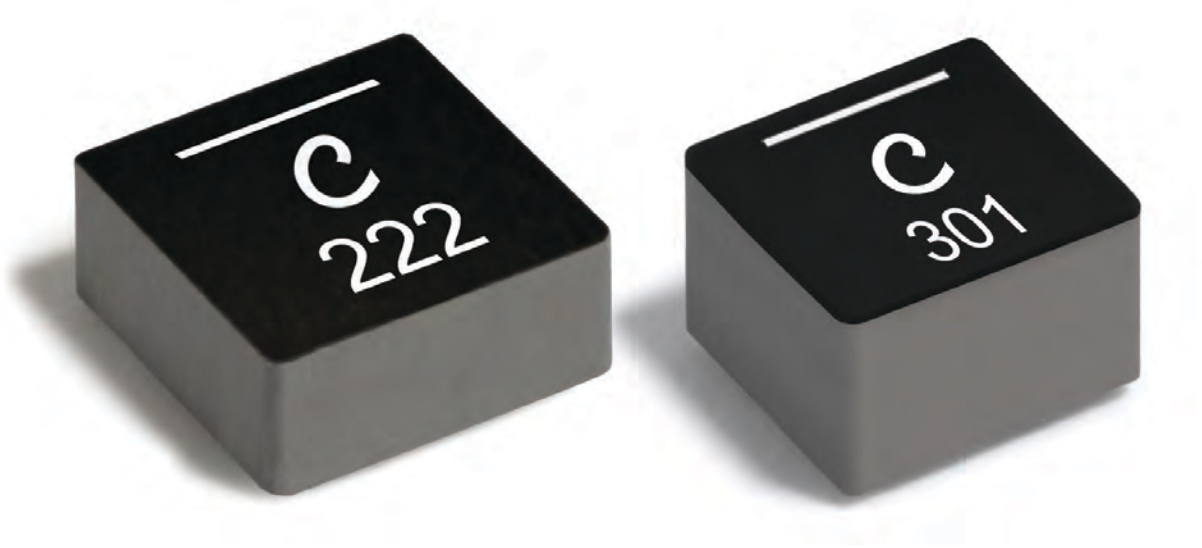

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Mitigate obsolescence across embedded computing

Aitech USA's general manager, Pratish Shah, explains how military COTS products increased the likelihood of supply continuity and reliability

In military, defense and aerospace industries, where programs can take years and millions of dollars to develop, test and qualify, obsolescence is a valid concern. Embedded systems aren't like the latest cell phones, easily discarded when the next upgrade comes along. They comprise rugged products that take time and money to create and effort to qualify for use in a military program. The components must be available for years, even decades, as programs move from low-rate initial production (LRIP) to full production cycles.

The lifecycle of COTS products needs to be managed according to a well-defined and forward-looking program. At Aitech, for example, the COTSLifecycle+ program is divided into three distinct program phases: Active, Supported and Extended Support, each providing product availability for at least four years. The combined lifecycle ensures a minimum COTS product lifetime of 12-years from product introduction.

Employing total program and lifecycle support services ensures that products designed-in today will meet the functional, environmental and operating requirements of specifications tomorrow (Fig 1).

Electronics systems have always consisted of both active and passive components. In time, these components are replaced by the next generation of more technically advanced components, resulting in the obsolescence of the earlier devices. This is a natural progression, but by implementing a structured approach that plans for the future and looks towards the next electronics evolution, you can effectively guard against and properly plan for obsolescence on your terms.

More than ever before, common hardware standards are providing military and defense organizations with streamlined system development and communication, further helping to reduce obsolescence. Technology shifts are happening at an unprecedented pace and embedded systems and components critical to modern warfare need to keep up with these advancements.

In the past few months, we have witnessed a rapid change in the global

> **Electronics systems have always consisted of both active and passive components**

Fig 1 - Long-term program planning, like Aitech's COTSLifecycle+, needs to start early

Long-term program planning, like Aitech's COTSLifecycle+, needs to start early

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component market. Component lead times are rapidly increasing, due to the global macroeconomic situation. This impacts the lead time for all types of products that use these components. Widely used COTS components, though, are less likely to be affected, due to the wide use of those commonly used components. By choosing military COTS products, you leverage economies of scale and benefit from an increased likelihood in continuity and reliability of supplies.

Development of open standards ensure that we are building to a common platform that will deliver practical applications like communications, C5ISR, SINGINT, EW and more, used on air, ground and sea platforms. Companies like Aitech have been working with open standards for several decades to support the common mission of developing products that help the military build equipment, while managing obsolescence. The communities established within open standards organizations, like PICMG, VITA and SOSA (The Open Group Sensor Open Systems Architecture), all work towards the common goal of lengthening the operational life of a system, while incorporating innovative technology upgrades (Fig 2).

No matter how one looks at it, component obsolescence typically means added costs—in many instances unplanned and unbudgeted—that translate into program delays and cost overruns. The burden to ensure longevity of these highly integrated, rugged embedded systems is shared across the supply chain and relies on collaboration across the partner network: from the actual parts availability through to design resources and upgrades.

The need for warfighters to access the most advanced technology built to the highest standards and reliability is not ever going to change. While system designers may not be able to eliminate all the factors affecting obsolescence, being cognizant of them will optimize time to market, while managing costs.

www.aitechsystems.com

> **Component lead times are rapidly increasing, due to the global macroeconomic situation**

Fig 2 - Open standards-based products offer obsolescence management via integration across different manufacturers

Business booms for high-service distributors

An increase in design engineering activity and tight supply of chips and other components is resulting in skyrocketing sales for high-service distributors

James Carbone

High-service electronics distributors have weathered the coronavirus pandemic with some reporting a 50 per cent increase in sales during the first five months of 2021.

Most high-service distributors focus on design and sell small quantities of parts to engineers designing new products. Design activity has increased significantly in the first half of 2021. However, high-service distributors also report they are seeing strong sales from buyers at OEMs and electronics manufacturing services (EMS) providers who are looking for shortage components or parts needed for small production runs.

"OEM and EMS providers needing parts for shortages and short production runs have always been part of our business," said Uma Pingali, business president for Newark. "But that business is now growing at a greater clip because of supply chain disruptions" caused by the pandemic, he said.

RS Components is also seeing increased business because of tight supply. "There is an opportunistic part of the market related to the surge of business," said Chris Beeson, group senior vice president-electronics for RS Components. "Large OEMs in automotive have supply chains that are so fine-tuned, when there is any type of volatility in the markets, those supply chain programs get tested. Right now, some of them have obviously not fared well," he said

Buyers in automotive and other industries have been reaching out to small-volume, catalog distributors because they have available inventories of a wide breadth of parts including some of those that are in short supply.

"I'd be lying to say that allocations and long lead times have not helped our business," said Mark Burr-Lonnon, senior vice president global service and sales for Mouser Electronics.

"They absolutely have." He said Mouser has been increasing its inventory dramatically over the last 10 years.

Sales surpass 50 per cent

That strategy has proven to be advantageous to Mouser. So far this year through May Mouser's sales to OEMs are up 51 per cent. EMS business has increased 47 per cent and its MRO business is up 40 per cent, said Burr-Lonnon. If sales continue at the same run rate Mouser's sales will reach $3 billion in 2021, up from $2 billion, he said.

The scenario is similar for other high service distributors. Beeson said RS's sales were up 50 per cent "in many areas of our products portfolio. Even when I look at a two-year comparison going back to 2019, we would still see the business cycle growing about 25 per cent," he said. He added RS is also growing its customer count and is adding suppliers.

At Digi-Key sales through May were up 50 per cent, said Jim Ricciardelli, executive vice president of digital business for Digi-Key. The high-service distributor had recorded $3.1 billion in sales three years ago and finished 2020 just under $3 billion, he said.

"At the current run rate, we will go over $4 billion in revenue," he said. "A lot of it has to do with tight supply. Because we have available inventory, a lot of OEMs and EMS companies are coming to us," said Ricciardelli. "We have a deep selection of parts," he said. "Any time an EMS provider or an OEM has high-mix, low-volume opportunity they know Digi-Key will have the stock available to sell."

Customer count is rising

Another reason for sales growth is an increase in customers

"Mouser has more than 1,200 brands so it is almost hard to find a brand that we don't stock"

Mark Burr-Lonnon, senior vice president **global service and sales** for **Mouser Electronics**

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using high-service distributors. "Right now, we are approaching 800,000 customers around the world. The number of customers grew 22 per cent last year," said Ricciardelli. Engineers appreciate the wide breadth of products that Digi-Key offers, he said.

"An engineer does not want to go to a lot of different sites to buy different components," said Ricciardelli. If an engineer needs to buy 100 components for an NPI project, he or she prefers a one-stop shop. "That's where the breadth of product becomes important," said Ricciardelli. "They can get the capacitors, the resistors, controllers and sensors all in one place in the quantities that they want," he said.

Breadth of product is a differentiator for high-service distributors over large-volume distributors. "The number of stock keeping units (SKUs) for a high-service distributor is probably 15-20X the number of SKUs that are kept in inventory at any point compared to any other distributor," said Pingali of Newark. "The sheer breadth of volume of products and offerings is perhaps reaching 1 million SKUs and beyond" for Newark, he said.

High-service distributors are continuing to try to build inventory by adding products from new component manufacturers or buying more from current suppliers. "Having breadth of inventory is "the big thing" for Mouser, "said Burr-Lonnon. "We spend a lot of time growing that breadth with all suppliers." He said Mouser has more than $800 million of available inventory and about 25 per cent of its stock is new products, which are components that had been introduced within the last two years.

Niche brands added

He said Mouser has more than 1,200 brands "so it is almost hard to find a brand that we don't stock." He said because Mouser already carries most of the larger, well-known brands, it is now adding small "nichy" brands at a rate of about 10 per month.

Burr-Lonnon said Mouser needs to have that inventory because it services about 100,000 customers worldwide. Large volume distributors only have about 30,000 customers, he estimates.

Mouser as a high-service distributor has a broader customer base in terms of volume. "We are happy to deal with everybody from the guy who wants to buy one piece" to companies that want to buy larger volumes of parts, he said. "We don't shoo anyone away." Large volume distributors have a "huge amount of inventory on the big runners because they are trying to look after a limited number of customers," said Burr-Lonnon.

Burr-Lonnon said besides breadth of inventory, Mouser also has 27 locations around the world which provide local service to customers, which is an integral part of Mouser's high-service model. "Having local people talk to local people from a service standpoint, not a sales standpoint, is important," he said.

The need for new technology

Also key to the high-service distribution model is introducing components that use new technology. "What we do is bring in new technology and the latest parts to the market quicker than anyone else," said Burr-Lonnon. "When you do that, you become the source for the engineer for the latest parts," he said.

Besides introducing parts based on new technology and having a wide breadth of inventory, flexibility is another characteristic of the high-service distributor. "If an engineer wants five pieces or 12 pieces, we can deal with that," said Ricciardelli. Volume distributors may not want to cut the tape on a reel of 500 parts, but high service distributors will deliver smaller quantities engineers are looking for, he said.

While RS and its sister company Allied Electronics and Automation are high-service distributors, their business models are a little different from other high-service distributors. RS and Allied, which are owned by Electrocomponents, serve the needs of engineers for NPI, but they also sell electrical equipment, industrial parts and MRO products.

"I would say 25 per cent of our business would be electronic components," said Beeson. "Industrial has a larger percentage and we have a major play in MRO and the indirect spend," he said.

Chris Beeson, group senior **vice president - electronics for RS Components**

"There is an opportunistic part of the market related to the surge of business"

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Obsolescence rises as chipmakers focus on high-profit parts

In addition, more longer lifecycle systems could result in even more parts going EOL

Component obsolescence is not a new issue for the electronics supply chain but it is a continuing one and it could be getting worse as component manufacturers in some cases are opting to discontinue older products even if there is still healthy demand for them.

"It used to be when a component went end-of-life, it was because no one wanted the part anymore. It was obsolete," said Steve Calabria, founder and CEO of PC Components, an independent distributor based in Seaside Park, N.J. But now EOL notices are being issued for products even if the products are still being used "by numerous customers who have many active and mature designs that need these products," he said.

Manufacturers are not making as much money on the older products as they could so they are switching the lines "over to high-volume, high-demand stuff," said Calabria. Automotive, mobile device and IOT markets as well as other new markets "are using electronic components in extremely high volumes which is causing havoc to the system," he said.

Original component manufacturers (OCMs) are struggling to develop the capacity needed to produce high-demand, high-profit components, according to Calabria. Manufacturers have three options. They can invest and build new fabs and manufacturing facilities, outsource to foundries, or stop making mature, less profitable products and use the "existing space, equipment, and personnel to produce components which are generating higher revenue," he said. Many component manufacturers are choosing the third option.

Recent product change and end-of-life notices confirm this. For instance, component manufacturer Murata said it would discontinue making capacitors in 0403 and larger case sizes in order to increase capacity for other components for the automotive and consumer markets, said Calabria. TDK also discontinued MLCC and radial ceramic capacitors which were in wide use. "Consolidation of low demand product lines allows the OCM to dedicate lines to high-volume, high-profit parts," he said. However, it causes major problems to OEMs and contract manufacturers who now need to design in alternate sources for the discontinued parts, said Calabria.

Large case sizes go EOL

Often products in larger case sizes are targets for discontinuation. "The reality is most high-volume, high-demand parts are getting smaller in size, which is resulting in EOL for parts of larger sizes, said Calabria.

In some cases, component manufacturers site raw materials or contract assembly issues as the reason they are discontinuing a part. For instance, KOA issued a product obsolescence notice (PON) in May for RN73 resistors with a last time buy date of September 2022, said Calabria. The PON states the series is being discontinued due to raw material availability issues.

Texas Instruments said it was discontinuing the LM3S microcontroller because its assembly contractor stopped supporting the part, according to Calabria.

Acquisitions have been another major source of discontinuation of active products. Some examples include Intel discontinuing the Altera series EPC2, Cyclone, and Stratix after Intel acquired Altera. ON Semiconductor discontinued many of the Fairchild 74VHC devices after Fairchild was purchased by On Semiconductor. Renesas acquired Intersil then discontinued ISL28, ISL63, ISL68, and X9268 series.

Calabria said many of these parts were discontinued by the acquiring company to avoid having two parts which have similar functionality. However, there are many challenges associated with using an "alternate part in an existing design, even when the alternate is believed to be a better part," said Calabria.

The alternate part is not a drop-in replacement, he said. "There's always evaluation, testing, reliability studies and process documentation that

Consolidation of low demand product lines allows the OCM to dedicate lines to high-volume, high-profit parts

Steve Calabria, founder and CEO of **PC Components**

need to be performed to determine whether that part can be used," said Calabria. He added in most cases a component engineer would prefer a buyer "locate the part that was designed-in, rather than to use an alternate."

COVID-19 has had an impact on component obsolescence, according to Todd Snow, vice president of purchasing for independent distributor Smith, based in Houston. "While pre-Covid saw many manufacturers starting to focus their attention to the newer products, the manufacturing capacity and customer reluctance to transition away from the legacy designs was not as prevalent as it is now," he said.

Focus on higher margin parts

Snow said restrictions caused by the pandemic and limited work schedules resulted in many manufacturers prioritizing their manufacturing efforts on the newer technologies and product releases because those parts are more profitable. "Legacy products, which may not have all of the improved features and functions of new product releases, do not provide the same margins as the newer 'sexier' products," said Snow.

He added there is an increase in product change notices from multiple component manufacturers. "This has been seen across multiple commodities including memory and discretes."

While more mature parts are being discontinued, demand for EOL parts is rising, said Snow. "Smith is seeing increases in demand from our customers in many industry segments and EOL parts are proving to be a challenge for many customers," he said.

In such cases buyers often turn to independent distributors or authorized distributors that specialize in obsolete parts. One such authorized distributor is Rochester Electronics, based in Newburyport, Mass. Rochester is authorized for more than 70 semiconductor manufacturers. It is an original manufacturer stocking distributor and has more than 15 billion devices in stock that include 200,000 part numbers.

Rochester has the world's most extensive range of end-of-life (EOL) semiconductors and broadest range of active semiconductors, according to the distributor. Besides stocking obsolete parts, Rochester, which was founded in 1981, is also a licensed semiconductor manufacturer. It has made over 20,000 device types. With over 12 billion die in stock, Rochester can manufacture over 70,000 device types. Rochester's manufacturing services including design, wafer processing, assembly, test and IP archiving.

Focus on obsolescence

Another authorized distributor that specializes in end-of-life parts is Flip Electronics, based in Roswell, Georgia. Flip's business is similar to Rochester. "We focus on obsolescence 100 per cent," said Jeff Ittel, executive vice president. "We take an authorized approach to focus on end-of-life and obsolescence inventory," said Ittel. "Our approach is to partner with some suppliers and work closely with them," he said.

Flip's business group understands what capabilities a supplier may have concerning a part going end-of-life and know "what the supplier could produce, what extra die and finished goods they have. We buy that in bulk from them," said Ittel.

He said Flip searches for obsolete inventory. "We don't take as much product in on a consignment business as Rochester. We are little bit more proactive," he said. Flip has an "astute team" that knows what parts buyers are looking for," said Ittel. "We use that information to try to find product and make buys."

Many of Flip's customers are in the defense

industry and other industries that have long product lifecycles. "Defense is a big segment for us," said Ittel. Defense has a lot of old programs that get revived. Contracts are re-upped or awarded," said Ittel. Many of these programs have 20 to 30-year or even longer lifecycles.

"We have been involved in some programs with the Navy in which about 40 ships had to be retrofitted," he said. The Navy did not want to do a redesign which might have cost $40-$50 million but the retrofitting required some obsolete parts, said Ittel.

Flip also does business with medical OEM buyers. Medical has some of the same challenges as defense. "There are 10 to 20-year lifecycles," noted Ittel. "It has an approval cycle with the Food and Drug Administration (FDA).

Obsolescence is becoming more of an issue with industrial because the chips used in industrial are used in so many different products and use mature or trailing edge technologies.

Little EOL warning

No matter what the industry, managing obsolete parts is a challenge for buyers because often there is little warning before an EOL notice is issued. Some companies try to be proactive in managing obsolescence. Larger companies in an industry that has recurring obsolescence issues such as aerospace, may have committees that include purchasing from all the companies sites. Committee members work to understand the markets to identify potential obsolescence issues.

Electronics manufacturing services providers Sanmina uses several strategies to mitigate component obsolescence. "We are constantly refining the bill of materials with the OEM customer to ensure that they select components that have a long lifespan whenever possible," said Pierre Brossier, director, regional supply chain for Sanmina.

Sanmina's overall strategy for managing EOL parts is to have "more qualified vendors available at the start of a new product design," he said. If there are multiple approved vendors, risk is reduced because of the flexibility to switch from one vendor to another in some scenarios, said Brossier. However, with microprocessors and other custom specific electronic components, there is only one source and so the "risk is higher for a full product redesign if some parts go EOL," he said.

He said when Sanmina buyers work on EOL issues, they help an OEM customer find an alternate source for a part that may not have been available at the time of the design. Sanmina will also do a last-time buy for the component.

"We work with the customer to determine the number of components required to last the entire lifetime of the product and then purchase them in volume," said Brossier. This approach may require some retesting of components "if they have been in storage for some time but it's very manageable," he said.

"Another effective solution is to request that a vendor build and store wafers on our behalf, instead of a complete component that is ready to use," said Brossier. This ensures the highest level of quality when "we are ready to produce a new component down the road," said Brossier. However, customers tend to prefer lifetime buy orders for complete components, he said.

Obsolescence may worsen

Brossier said the problem of obsolescence parts may become more acute in the future because more products with long lifecycles are being built. "Today, we are seeing more OEMs, such as automakers, develop products that have a longer life span, so there's a higher probability that some parts will become obsolete over time," he said.

While Sanmina is a large global EMS provider, obsolescence is also a problem for buyers at smaller companies. Purchasers at smaller OEMs and EMS providers also need to be proactive in managing component obsolescence.

"Buyers need to keep their bills of material fresh, stay on top of it work with distributors that can analyze their bill of materials and give suggestions" about parts that are at risk and offer possible alternatives, said Ittel.

He noted that no one knows when a part is going to go end of life "until you see that EOL notice come out. What we will do is we will look at bills of materials from our customers and try to identify potential problem areas," said Ittel.

He added when an EOL notice is issued for a part, buyers may make a buy to cover their next year's production. But supply problems with EOL parts often occur two or three years after an EOL notice is issued.

"We take an authorized approach to focus on end-of-life and obsolescence inventory"

Jeff Ittel, executive vice president of **Flip Electronics**

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ACOUSTIC COMPONENTS											
BeStar Electronics Ind. Co. Ltd.	BeStar Technologies Inc.	520-439-9204	www.bestartech.com	Y	N/A	$250,000	N/A	100.00%	50	900	Y
CABLE & WIRING											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23235	N/A	$0	0.46	50	1,000+	Y
Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	$0	93.00%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	$0	97%	50	1,000+	Y
Molex	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
CIRCUIT PROTECTION											
Bel Fuse	Bel Fuse	+1 201 432 0463	belfuse.com/circuit-protection	Y	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	68.00%	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
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
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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	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,390	N/A	$0	99.00%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	$0	84.00%	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
Electronic Assembly	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	100.00%	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
Newhaven Display	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,690	N/A	$0	100.00%	50	1,000+	Y
VCC	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
ELECTROMECHANICAL											
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C&K Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	27,230	N/A	$0	90.00%	50	1,000+	Y
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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
IXYS	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

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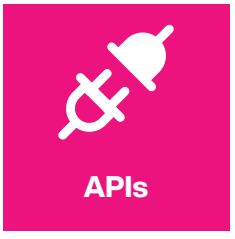

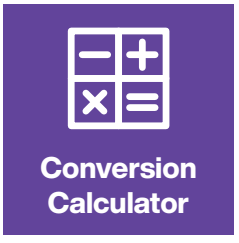

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Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
PUI Audio	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Schneider Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	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
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METCASE Enclosures	OKW Enclosures, Inc.	(800) 965-9872	www.metcaseusa.com		322	$45,000	$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		2450	$110,000	$0	N/A	10	20	Y
ROLEC Gehäuse-Systeme GmbH	ROLEC Enclosures Inc	(888) 658-5774	www.rolec-usa.com		1960	$35,000	$0	N/A	4	6	Y
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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
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Qorvo	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
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ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	$0	96.00%	50	1,000+	Y
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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
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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
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Bud Industries	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	$0	80.00%	50	1,000+	Y
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New Age Enclosures	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
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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	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Silicon Labs	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
Cree, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cypress Semiconductor Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	$0	81.00%	50	1,000+	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	Mouser Electronics	800-346-6873	www.mouser.com	Y	94	N/A	$0	100%	50	1,000+	Y
IDT (Integrated Device Technology)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	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
IXYS	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
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
Microsemi	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	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
ON Semiconductor	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
SanDisk	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	100.00%	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	96.00%	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

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
PASSIVES *(Continued)*											
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	$0	100.00%	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	64.00%	50	1,000+	Y
Wurth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	$0	99.00%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	$0	100.00%	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
Bel Power Solutions	Bel Fuse	Power & Batteries	belfuse.com/power-solutions	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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
Mornsun	+1-978-567-9610/+1-978-293-3923		www.mornsunamerica.com		N/A	N/A	$0	100%	N/A	2000+	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
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	80.00%	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
TRACO Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
REED SWITCHES											
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	$200	100.00%	15	275	N
SENSORS											
ams	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 Sensing and Control	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,059	N/A	$0	64.00%	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
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,379	N/A	$0	45.00%	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
ON Semiconductor	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	59.00%	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	65.00%	50	1,000+	Y
SWITCHES & KEYBOARDS											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TEST & MEASUREMENT											
B&K Precision	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Fluke	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,008	N/A	$0	94.00%	50	1,000+	Y
Keysight	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Lascar Electronics		814-835-0621	www.lascarelectronics.com	Y	130	$602,000	$0	100%	10	175	Y
Tektronix	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Teledyne LeCroy	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96.00%	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

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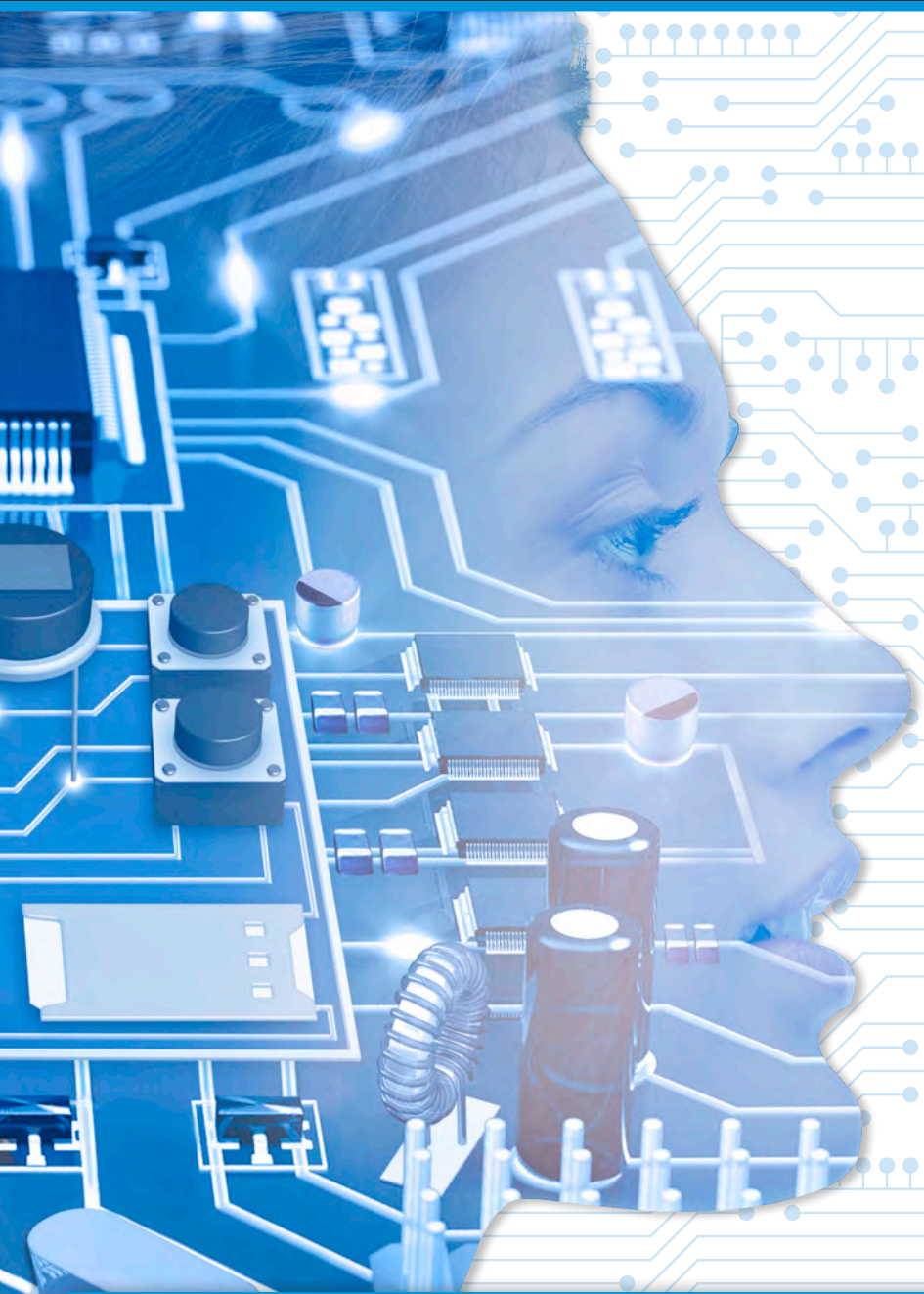

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