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## On the cover – February 2021

Obsolescence management: aerospace leads the way

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## Buyers' Guide

All the facts and figures to help you buy

## Editor's Word



### Plug-and-play comes of age

Thanks to a unique set of circumstances, there is a single day when I judge the accomplishments of the electronics industry over the previous year: Christmas day.

On that day, as if by magic, electronic products appear on the living room floor. The time frame to enable them is immediate. The userbase comprises demanding children. Finally, any form of meaningful technical support is non-existent.

This year the challenge was an app-controlled toy and this is how things went. Connect phone to WiFi: check. Find correct app on store and download: check. Register app using facial recognition: check. Enable Bluetooth on toy: check. Enable Bluetooth on phone: check. Allow app to find toy: check. Allow app to interrogate toy's firmware: check. Automatically update firmware: check. Reboot toy: check. Play with toy: check.

Every single step worked perfectly. I do believe, after 25-years, plug-and-play has come of age. To be honest the concept of plug-and-play always faced an uphill struggle. No sooner were standards decided, technology quickly moved on and the goalposts shifted.

However, in a world of 5G IoT, a flaky handshake at any point along the data chain, regardless of the product, application or environment, is unacceptable.

As today's children grow older, their app-controlled toy cars will become full size autonomous vehicles, a type of technology evolution which will eventually reach into every aspect of everyone's lives.

Expect bill-of-materials to reflect secure, robust, reliable, ergonomic, 5G centric plug-and-play products, starting now.

*Jon Barrett*

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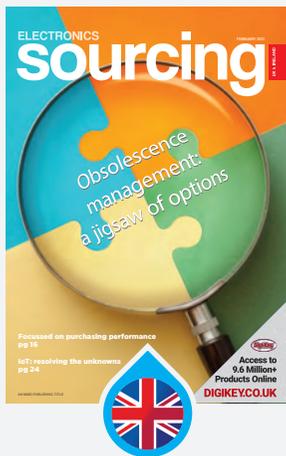


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## Same day for power semiconductors

Mouser has announced a global distribution agreement with SanRex, a manufacturer of power semiconductors. Through the agreement, Mouser customers can now order SanRex power semiconductor products for same-day delivery in most cases.

SanRex three-phase diode modules include compact 1600V diode bridges, incorporating a low-loss, high-surge tolerance chip in a compact dual-inline package. The modules are designed to offer reduced thermal resistance due to an integrated copper heat plate, while dual terminals ensure reliable solderability for large-current applications.

The DKR400CA60 two-in-one fast recovery diode module suits welding machines, plasma cutting machines and plating equipment. The SCE110AB160 thyristor power module is a 110A, 1600V silicon-controlled rectifier module for applications including inverters, servo controllers and power controllers. Both come in a compact Techno Block transfer mould package, which combines transfer moulding with a structure that solders the chip directly without the use of wire bonding, enabling improvements in long-term reliability and miniaturisation.

[www.mouser.com](http://www.mouser.com)

## Reasons for optimism

IPC's December economic outlook report is now available. It includes US and European data on economic growth, employment, Manufacturer's Sentiment (PMI) and end markets for electronics. Details are also provided on industrial production, capacity utilization, PCB production data and North American PCB bookings.

Chief economist, Shawn Dubravac, said: "We enter 2021 at a crossroads. The early months will be dictated by the trajectory of the virus. Expect slower growth in both the US and Europe. But vaccines are now being administered to millions of people. It would take more than four years to reach herd immunity without vaccines. While the exact timing is uncertain, it appears likely that the US and much of Europe can reach herd immunity with the help of vaccines by the back half of 2021.

"In the second half of next year prospects should brighten. Increased immunization should instill confidence and push economies closer to pre-pandemic normalcy. Pent-up demand should help drive economic activity. The US economy should regain its pre-pandemic levels by mid-2021, although the labor market will likely lag behind. European economies are not likely to regain their pre-pandemic levels until the end of 2022 or into 2023. This will be especially true in Southern Europe where countries are more reliant on tourism."

[ipc.org](http://ipc.org)



## Amplifiers suit aerial vehicle market

Pasternack has added four new models to its existing line of bi-directional amplifiers, making a total of six. This portfolio covers VHF/UHF, L, S, C and broadband RF frequency bands that range from 0.225MHz to 5.875MHz. These rugged, mil-grade designs are in compact, environmentally-sealed, SMA-connectorized packages and feature either quick-connect or D-SUB connectors for DC and control functions.

The designs in this line offer sensitive receiver performance with 2.5dB noise figures. Some also incorporate GaN semiconductor technology. Transmit (Tx) output Psat levels range from 8 to 20W that boost performance of data links and transmitters. These models feature manual or auto-sensing transmit/receive (T/R) control with fast switching times of 1 to 2µsec.

Pasternack's product line manager, Tim Galla, said: "Pasternack's new selection of bi-directional amplifiers offers higher frequency capability and GaN technology with higher efficiency, which is ideal for broadband RF telemetry, tactical communication and unmanned aerial vehicle applications."

[www.infinitelectronics.com](http://www.infinitelectronics.com)

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### In Brief

#### EDS 2021 rescheduled

With many experts now expecting the new Covid-19 vaccines to be generally available in the US by June, the EDS board has decided to move the 2021 EDS Leadership Summit (previously scheduled for May 10 to 14) to August 30 through September 2. The Mirage Resort in Las Vegas continues to be the hosting venue.

[www.edssummit.com](http://www.edssummit.com)

#### Sponsoring Women in Electronics

TTI has extended its collective support and sponsorship to Women in Electronics for 2021. TTI's COO, Mike Morton, said: "TTI takes great pride in supporting WE again for the coming year as the organization continues its mission to foster growth and leadership to the many talented, professional women within the field of electronics."

[www.tti.com](http://www.tti.com)

#### IPC J-STD-001 and A-610 recertification

IPC's Validation Services Program has announced that John Deere Electronic Solutions, a manufacturer of custom, integrated electronics components based in Fargo, ND, has become the first OEM company to be recertified a second time to the IPC J-STD-001 and IPC-A-610 Qualified Manufacturers Listing.

[www.ipcvalidation.org](http://www.ipcvalidation.org)

#### ECIA welcomes Avnet

ECIA has welcomed Avnet as a distributor member. ECIA's president and CEO, David Loftus, said: "Avnet is an important leader in the electronics industry and their voice is vital in our mission to bring the key players together to solve business challenges cooperatively. Avnet has a long history with the association and is a strong supporter of our inventory search site, [TrustedParts.com](http://TrustedParts.com)."

[www.avnet.com](http://www.avnet.com)



### Bounce-free switches at your fingertips

Digi-Key has expanded its Marketplace product portfolio to include LogiSwitch, a provider of debounced switches.

Switch bounce is a problem facing anyone designing an electronic system. LogiSwitch's adaptive NoBounce technology eliminates the problem of having switch bounce regardless of the duration of the bounce. The designer does not have to worry about the impact of switch degradation over time, atmospheric and environmental conditions, or software updates recreating switch bounce problems.

LogiSwitch's VisiShield prototype boards and peripherals simplify Arduino breadboard design and eliminate the conventional rat's nest of wiring to simplify design and debugging.

Digi-Key's vice president of global supplier management, David Stein, said: "LogiSwitch's adaptive NoBounce and VisiShield technologies solve switch bounce and design problems for the lifetime of their products and resolve major issues for electronic designers."

LogiSwitch's founder and CEO, Mike Pelkey, added: "Digi-Key reaches our entire customer base and also allows us to reach many new customers. Digi-Key's new Marketplace is ideal for a company of our size, and we look forward to a long and successful relationship between our companies."

[www.digikey.com](http://www.digikey.com)



### Conduction cooled modules now shipping

Sager Electronics is stocking TDK-Lambda's PFH500F conduction cooled 500W AC/DC power modules. The series is a high density and high efficiency AC/DC power module that comes in a 4 by 2.4in brick footprint.

The modules operate from 85 to 265VAC input, suit conduction cooling and can operate from -40 to 100°C baseplate. Read/write programming and communication is offered via a PMBus interface with optional droop mode current share for simplified parallel operation.

The series suits industrial, test, communications, COTS and commercial applications.

[www.sager.com](http://www.sager.com)

### Buying into fiber

Molex has announced the acquisition of Fiberguide Industries, a manufacturer of customized optical fiber solutions based in Caldwell, Idaho. Fiberguide will join Molex's Polymicro business, a Phoenix-based provider of specialty optical fiber and fluidic-based products tailored for medical, industrial and datacom applications.

Polymicro's GM, Jim Clarkin, said: "Our combined capabilities give global customers a full array of products and complete solutions to meet emerging requirements for innovative laser-based optical systems."

Fiberguide's VP of technology, Devinder Saini, added: "Fiberguide contributes more than 40 years of technological innovation to Molex. We share similar cultures and are united in our focus to deliver the most powerful, vertically integrated fiber solutions available."

A portfolio of design capabilities provides customer-centric solutions for industrial monitoring and sensing as well as datacom applications that require reliable performance in extremely harsh environments.

[www.molex.com](http://www.molex.com)

# 50

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Paul Andrews / 1971



Since that small house in Texas, our family has gone global, growing to include nearly 7,000 employees, 133 locations, and 13 distribution centers with more than 2 million square feet of inventory space – stocking over 850,000 component part numbers.

7000  Employees | 13  Distribution Centers

133  Locations

As we move through 2021 and beyond, we will continue to put People, Parts and Peace of Mind at the forefront of our service offering.

Join us in celebrating 50 years of Specialization.



# Distributors rise to the occasion in managing supply chain risk

*Distributors are bearing more of the responsibility of managing risk in the supply chain, as more semiconductors and other components are sold through the channel*



James Carbone

Helping OEMs and electronics manufacturing services providers manage supply chain risk is not a new task for distributors, but that role seems to have become more important and is now an integral part of the distribution business model.

Outsourcing, shorter product lifecycles, increased government regulation, trade wars and tariffs have increased risk in the supply chain. That's in addition to "normal" supply risks caused by supply/demand imbalances which can result in longer lead times, shortages and price increases.

The supply chain has become more complex and as risks have increased, electronics buyers and their companies have become more dependent on distributors to help identify potential new risks and manage and mitigate them. In fact, distributors are in a good position to identify and manage risk because they have a birds eye view of the supply-chain.

They receive purchase orders from customers and often receive forecasts from them. In addition, they often have close relationships with suppliers, and are privy to a lot of market intelligence that can be used to manage risk.

"Minimizing risk in our customer's supply chain is TTI's number one priority," said Jeff Ray, vice president product and supplier marketing for TTI. He said in the past, fluctuating or extending lead times would be the

distributors largest challenge. "Today that challenge seems to be one of the least threatening, at least comparatively," said Ray.

#### Range of risk

He said risk for distributors today ranges from the impact of raw material cost increases to freight challenges, both in the cost and availability of commercial air as well as ocean freight shipments. He noted the freight challenges are less pronounced when products are procured within the same geographic region as they are manufactured.

"Cyber security threats, counterfeit and product obsolescence are also supply chain risks that are on the increase," said Ray. He said buyers should work with suppliers and distributors that are fully compliant with all industry quality regulatory requirements such as: NIST, Anti-Counterfeit and Anti-Corruption to reduce those risks.

Some supply chain risks, like cyber security threats, have increased over the last 10 years while others like product obsolescence and lead time extensions have long been a part of supply chain management, according to Ray.

"I think the supply chain challenges that have presented themselves as a result of outsourcing and less vertically integrated manufacturing have also increased," he said. However, the increase of multi-location component manufacturing footprints and the relocation



**"Minimizing risk in our customer's supply chain is TTI's number one priority"**

**Jeff Ray**, vice president product and supplier marketing for TTI

of these additional sites closer to the point of consumption has aided distributors and customers with supply chain management, said Ray

There are many steps that are taken to identify and reduce risk including market intelligence, systemic controls, as well as institutionalized processes and procedures to protect the supply chain during volatile market conditions, said Ray.

**Guiding lifecycle management** OEMs rely on distribution to guide them with product lifecycle management. "As component manufacturers continue to rationalize their product portfolios, it is critical to have a distributor that will

support bills of materials as products move from production, to NRND (not recommended for new designs), to EOL (end-of-life), to obsolete," said Ray.

He added distributors are uniquely qualified to assist customers with additional and/or alternate sources. The communication of product change notices is a "primary communication vehicle for both the component manufacturer as well as the distributor," he said.

An area where the industry could help customers in this process is to standardize the timelines associated with the migration from standard to product through obsolescence, especially for automotive grade and hi-

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reliability products, according to Ray.

“Too frequently the customer does not receive enough notice from the manufacturer for long running end product applications that require production part approval process (PPAP) or other agency testing approvals,” he said.

Peggy Carrieres, vice president for global sales enablement for Avnet, noted the component industry is cyclical and the supply chain is complex and unique. Supply/demand imbalances are inherent in the market so close relationships with suppliers can help mitigate risk.

“We have strong relationships across many suppliers and can reduce the level of risk through early warning and approved vendor list (AVL) expansion of customers’ bills of materials (BOM) to give options for sourcing,” said Carrieres. Avnet is “uniquely positioned with strong supply chain expertise to manage risk through inventory buffering and robust forecast management capabilities,” she said.

Most buyers and their companies depend on distributors to identify potential risks and help manage them. “The end-to-end ecosystem between supplier and consumer is complex and connected,” said Carrieres. She notes the supply chain is dependent on multiple triggers and depends on the forecasting between customer, distributor and each supplier. However, many forecasts are

not accurate and customers rely on distributors’ supply chain capabilities to buffer forecast variability, anticipate and analyze long term signal changes and adjust proactively to ensure customer lines keep running smoothly, she said.

Dave Doherty, president and chief operating officer for Digi-Key, said that forecasting is getting more accurate than in the past, but it is still an “inexact science” because there is more variability. One reason is suppliers are offering more variations of parts so there are more stock keeping units (SKUs). “It has become more fragmented,” said Doherty. “Forecasting likes the law of big numbers.” It is easier to have an accurate forecast for a broad category of parts than for a specific SKU.

**Black Swan events increase risk**

While there are always risks in the supply chain at any given time, the severity of those risk can change on a dime when a “Black Swan” event such as an earthquake, a tsunami, flooding or other catastrophe occurs in a region where there is a lot of electronics production. Such events often wreak havoc on the supply chain and boost risks exponentially. The latest such event of course is the COVID-19 pandemic.

When the pandemic started to impact North America last March, risk priorities changed for many distributors.



**“We have strong relationships across many suppliers and can reduce the level of risk through early warning and approved vendor list expansion of customers’ bills of materials to give options for sourcing”**

**Peggy Carrieres**, vice president for global sales enablement for Avnet

“Keeping our people safe was the number one priority” when coronavirus hit the United States, said John Hufnagle, vice president, North American sales and engineered solutions at for connector and cable specialist distributor PEI-Genesis. The company focused “heavily on keeping our facilities safe and operational by instituting safe distancing, cleaning and shift policies and working with the local government to identify the business as essential was key,” he said.

Customers were also a priority. “We reached out to our customers to pulse the level of readiness, the need for tailored support and general market conditions early on,” he said. PEI-Genesis was able to help reduce customers’ risk through inventory programs, business reviews and insight on emerging market trends and supplier situations,” said Hufnagle. He added the distributor kept customers at large apprised “with its operational status in all regions.”

In addition to communicating with customers to reduce risk during a particular event, longer term it is also important to make sure staff at a distributor keeps pace with changes in technology. Training, upgrading

of technology internally and externally, staying current with products and enhancing the user experience are all key components of risk mitigation necessary for future success.

Doherty says that while distributors can help OEM and EMS companies reduce risk, not all take advantage of distributors’ capabilities. For instance, Digi-Key and other distributors can assess the risk of a bill of materials to determine if lead times on the BOM have stretched or if some parts have gone end-of-life or will for EOL soon.

“There is no charge for that service. So many distributor partners have information that could be utilized but is not leveraged by many customers today,” he said.

# Combatting counterfeits

*PEI-Genesis' senior VP and European MD, Jonathan Parry, explains why mission-critical industries need to fight the fakes*



A perfect storm best describes the events of the last five-years that led to a global component shortage. Combine the US/China trade war, Brexit, rising copper prices, growing adoption of electric vehicles, record sales of industrial robots and a global pandemic, and you have quite the storm.

A consequence of component shortages is a rise in counterfeiting. Shortages, price hikes and obsolescence are driving some OEMs to take shortcuts. Research firm Havocscope estimates \$169bn of counterfeit parts are in circulation. You don't have to knowingly buy a fake to be affected.

Counterfeit parts include: parts that don't conform to the original design; parts produced by unauthorized contractors; parts that are off-specification; and defective or used parts sold as new. For the user, consequences can range from mild (reduced accuracy in a desktop robot) to life-threatening (an unresponsive aircraft sensor).

PEI-Genesis is a distributor and manufacturer of cables and connectors with facilities in North America, Europe and Asia, supplying the military, industrial, medical, aerospace, transportation and energy sectors.

The company is uniquely placed to break the chain between component shortage and counterfeiting.

PEI-Genesis holds \$90m dollars of global inventory in component form. So, rather than hold finished products that could become obsolete, it can build millions of combinations of products using the parts. Combined with a highly automated manufacturing process that promises a 48-hour lead time and a minimum order quantity of just one, there's no reason for customers to turn to counterfeits.

OEMs should be wary of the grey market. Buy from trusted distributors that have long standing relationships with major brands. For brands like ITT Cannon and Amphenol we must make sure we abide by their stringent quality standards. Customers can audit our manufacturing facilities at any time, and they regularly do, once a week or so.

Over time, this transparency means we've reached a trusted advisor status for many customers, particularly those in the defence sector. In such sectors, price is often a secondary consideration to safety and trusting a supplier to deliver parts that protect people's lives becomes the primary objective.

Supplying cables and connectors into hazardous areas requires cradle to grave traceability. We track supplier shipments from the moment they enter the manufacturing facility to the finished product we send to customers. We inspect deliveries, matching the

shipment to our records, and every person in the process wears an armband to log the movement of parts. This means we can trace a cable or connector back to when and where in the world it was produced, where the components came from and who quality-checked the product.

We live in turbulent times and industry faces difficult, but not insurmountable, challenges. Understanding the nature of fakes, choosing carefully where you buy parts and ensuring supply chain traceability is what's required to create an equally perfect storm of countermeasures.

[www.peigenesis.com](http://www.peigenesis.com)



PEI-Genesis' senior VP and European MD, **Jonathan Parry**



**OEMs should be wary of the grey market. Buy from trusted distributors that have long standing relationships with major brands**

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# Managing semiconductor component obsolescence

*Rochester Electronics discusses why it is vital to purchase components from AS6496 compliant authorized sources*

As technology evolves and new semiconductor products increase in demand, the manufacturing volume increases. Naturally, older products are phased out. This is the obsolescence phase of the semiconductor lifecycle.

When an original component manufacturer chooses to discontinue a product, it typically offers an end-of-life purchase, better known as a last-time-buy. Customers can not necessarily fund these purchases or buy enough, nor do they have the storage facilities available to support future requirements.

Most industries will face component obsolescence at some point and with it comes a wide range of challenges and risks. While machine downtime and lost revenue are high on that list, health and public safety rise to the top.

Component obsolescence management becomes a critical factor in high-reliability industries such as medical, defense, energy, transportation, industrial and civil aviation. This practice allows for businesses to safely prepare for end of life. Companies not prepared become vulnerable to counterfeits as well as quality and reliability issues. Even for those companies who proactively prepare, long-term

component storage remains a problem.

There is a common misconception that once the original manufacturer stops producing a component, that unauthorized sources are the only recourse. This is not true. The risk-free option of an authorized after-market supplier such as Rochester Electronics, should always be the first choice.

The risks of counterfeit and poor-quality components from unauthorized sources represent a significant risk to production yield and mean time between failure rates (MTBR) in the field. Inferior or substandard 'testing' by unauthorized third parties provides a false veneer of confidence that authenticity can be tested. In reality, this testing is visual, an x-ray or a poor partial copy of the original manufacturer's test processes. Full tri-temp testing can rarely be offered and the risk of commercial grade components being re-marked as industrial, automotive or military parts has never been more real.

There are also documented quality problems related to foreign chemicals. Cleaning chemicals used to recover, wash and re-mark used components, slowly migrate into the products, shorting and corroding bond wires and



pads alike. Superficial testing will not be guaranteed to find these faults. Recovered components may not only pass these tests, but also survive for a period in-service. However, the ultimate failures will destroy MTBR figures, and result in reduced reliability and damaged reputations.

Buying from an authorized source who partners with the original component manufacturer eliminates these risks.

Fully authorized distributors, like Rochester Electronics, identify themselves as compliant with the SAE aerospace standard, AS6496. Simply stated, they are authorized by the original component manufacturer providing traceable and guaranteed products with no quality or reliability testing required because the parts are sourced from the original component manufacturer.

Those providers who are not, may market themselves as AS6171/4 compliant. This source, though better than no compliance at all, follows standardized inspections and test procedures with minimum training and certification requirements to detect suspect or counterfeit components. This is an indication the parts are not sourced to the supplier from the original component

manufacturer but have passed testing to minimize, not eliminate, risk.

The only way to eliminate these risks is to purchase from a fully authorized source who is AS6496 compliant.

[www.rocelec.com](http://www.rocelec.com)



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# Decade of fighting counterfeits

*Lansdale Semiconductor's president, R Dale Lillard and Electronic Components' president, Rich Nadeau, highlight how 10-years of effort has reduced counterfeiting problems*

Counterfeits began to increase in the 1990s and 2000s, primarily through purchases from brokers and distributors sourcing components on the internet. The largest market was long-life applications where the system outlived the component's life cycle. The aerospace and defense industries have the longest system lives and were targeted by counterfeiters when component supplies dried up.

Counterfeiters also filled the void for popular parts when lead times were long or supply was scarce. Purchase awards were often given per the DFAR to the lowest bidders regardless of the supplier's trustworthiness.

In 2007, industry and government recognized counterfeit problems were growing and formed a representative team initiated by the Aerospace Industry Association. It included industry associations, contractors and government agencies and was set up to establish recommendations to mitigate counterfeits. It formed an Integrated Project Team and reported its recommendations in 2011. Among the

recommendations were:

**1: Implement specification SAE AS5553 in organizations.**

**2: Establish a Government audited Qualified Supplier List of Distributors and Qualified Test Supplier List who follow SAE AS6081 specifications. These distributors and brokers will be trusted suppliers. The Defense Logistics Agency established a new system to audit, qualify and monitor brokers and distributors. This reduced the suppliers capable of selling to the DLA significantly. It required a DLA audit to JEDEC specifications AS9120 and testing requirements AS6081 and AS6171. DLA purchases were focused on QSLD suppliers.**

As a result, when the National Defense Authorization Act of 2012 Section 818 (which worked to minimize purchases of counterfeit components) was passed, purchasing electronic components for defense and aerospace contracts changed dramatically. The law significantly tightened the procurement

rules for components, passing financial responsibility back to the contractors for any costs to mitigate and rework problems associated with counterfeits. In the event a contractor or supplier intentionally purchases counterfeits for government contracts, the individual or company can be fined up to \$15,000,000 and imprisoned for up to 20-years. With the NDAA 2012-818 passed by Congress, purchasing guidelines established by industry and government to mitigate counterfeits became mandatory, not suggestions.

The NDAA revised the Department of Defense Federal Acquisition Regulation to address detection and avoidance of counterfeit electronic parts. It required government departments and department contractors and subcontractors to have a counterfeit mitigation plan. It required them to purchase components primarily from the original manufacturers or their authorized dealers and obtain electronic parts not in production or not currently in stock from trusted suppliers. It established a procedure for qualification of



Lansdale Semiconductor's president **R. Dale Lillard**

trusted suppliers to be audited by department officials. It also utilized the Government Industry Data Exchange Program to communicate about suspect counterfeit components in the supply chain.

Industry and Government procurements of electronic components are now more focused to prevent counterfeits entering the supply chain. They are more concerned about purchasing from original manufacturers and their sales channel, authorized aftermarket manufacturers and trusted QSDL distributors to minimize counterfeits. This has led to a reduction in the problems caused by counterfeits in the supply chain and greater reliability for the systems that use them.

[www.lansdale.com](http://www.lansdale.com)

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# Standards-based obsolescence management

*When managing obsolescence, a last-time-buy isn't always sufficient on its own as one aerospace manufacturer discovered. 4Star Electronics explains there is hope*

An independent distributor was recently called on by an aerospace customer to help solve a dilemma. Production of an avionics assembly needed to be restarted to fulfill a contract. The end customer could only use a specific version of the system and one field programmable gate array was out of stock, out of production with the original component manufacturer for over six years, and in short supply in the secondary or surplus market.

The aerospace OEM didn't think it would find itself in this situation. Years earlier, during the FPGA's last time buy period, it had made a purchase it felt would last for the lifetime of the program. Plenty of inventory to carry through the end of production, with spares for potential service and repair in the field. However, production demand of this specific configuration continued beyond expectations. Forecasted requirements were surpassed, leading to the current situation. Most of the other components in the assembly were still available, either still in production or readily available through distribution sources, but without this specific FPGA, a re-design of the entire assembly would be required, costing several million

dollars and likely delaying the project by two years.

After receiving the requirement for 50 pieces of the FPGA, the distributor followed the principles of AS5553 and AS6081. Authorized sources were looked at, then trusted open market vendors and finally, high risk vendors from around the world. Lots from multiple high-risk sources were brought in for validation and testing. The validation process included external visual inspection, surface and marking analysis, x-rays and decapsulation. In the end, all lots failed due to suspected counterfeit status, except a single lot of nine pieces, which yielded eight parts after one piece was destroyed as part of the testing. The cost of each part, originally around \$200, ballooned to over \$1500 on the open market, even for the used and/or suspect parts.

Once it was determined the lot was authentic, with no prior use or tampering, it was sent to a high-level electrical test lab for full functional testing, at an approximate cost of \$50,000. Luckily for the OEM, all parts in the lot passed electrical testing and were sent to production. The OEM only had eight pieces to work with, at a cost of almost \$10,000 each, but was thrilled that they could postpone a

redesign and satisfy their end customer, if only for a short time. The program manager directed the distributor to continue to try to source more of these parts despite the 250x price increase. At the time of writing, no additional good parts have been found, so the OEM may still be forced to redesign their avionics system, but at least they bought themselves some time for additional planning.

This story points out some key lessons. Planning for obsolescence through life-cycle management whenever possible is an important first step to avoid production issues. Purchasing organizations should develop relationships with obsolescence specialists like independent distributors and test laboratories to ensure they have alternative sources, and sometimes paying thousands of dollars for hundred-dollar parts is better than the alternative.

[www.4starelectronics.com](http://www.4starelectronics.com)





### Connector series expands into Cat 6a

Stewart Connector has expanded its SealJack cable applied connector series to support Cat 6a applications. The series now supports Cat 5e, Cat 6 and Cat 6a performance levels through IP67 plug kits, cable assemblies and cable applied jacks.

The series is designed to offer versatility and reliable performance when designing products for rugged applications. It features Stewart Connector's RJ45 modular plugs and jacks along with an IP67 bayonet locking shell designed to provide reliable connectivity in harsh environments. Cat 6a applications include military communications, marine equipment, medical devices, industrial and other harsh out-of-office environments.

[belfuse.com](http://belfuse.com)



### VCO suits satellite communications

Crystek's CVCO55CC-1500-1500 voltage-controlled oscillator operates at 1500MHz with a control voltage range of 0.5V to 4.5V. It features a typical phase noise of -125 dBc/Hz @ 10kHz offset and is said to have excellent linearity. Output power is typically 0dBm.

Engineered and manufactured in the USA, the device is packaged in an industry-standard 0.5 by 0.5in. SMD package. Input voltage is 5V, with a max current consumption of 36mA. Pulling and pushing are minimized to 1MHz pk-pk and 1MHz/V, respectively. Second harmonic suppression is -20dBc typical.

The device suits applications such as digital radio equipment, fixed wireless access, satellite communications systems and base stations.

[www.crystek.com](http://www.crystek.com)



### Image sensor ups low light performance

OmniVision Technologies has announced its OV40A, a 40MP, 1.0-micron pixel image sensor. Designed to provide super high gain and denoise technologies for low light performance, this sensor also offers multiple high dynamic range options. Additionally, it supports 1080p slow-motion and high-speed video captures at 240fps with phase-detection autofocus.

OmniVision's senior technical marketing manager, James Liu, said: "TSR estimates there will be 855 million image sensors with 40MP or higher resolution shipped to smartphone manufacturers in 2021, which presents a huge opportunity for

this new image sensor. The OV40A's unique combination of features is bringing flagship-level performance to the main, wide, ultrawide and video cameras in this fast-growing market segment."

The OV40A integrates an on-chip, 4-cell color filter array and hardware remosaic, which provides 40MP Bayer output in real time. For low light conditions, this sensor can use near-pixel binning to output a 10MP image, as well as 4K2K and 1080p video, with four times the sensitivity, yielding 2.0-micron pixel-equivalent low-light performance.

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### Color-coded enclosures

Color-coded trims are now available as an option on Rolec's starCASE enclosures. Designed to be elegant and tough, these IP66 rated cases can be installed on walls, machines and bulkheads. Applications include monitoring systems, IIoT, HVAC controllers, safety equipment, factory automation, security systems and test equipment.

The trims, which cover the lid and mounting screws, are now optionally available in red, blue or anthracite, in addition to standard light gray. They are fitted with non-detachable hinges to stop them from being dropped or lost. Separate screw channels mean the case can be mounted 'lid closed' to protect the seal and electronics.

The lid is recessed to accommodate a membrane keypad, product label or front plate. Integrated flexible support straps ensure the lid remains attached to the base when the unit is open. Inside, there are screw bosses for the installation of PCBs, mounting plates and terminal rails.

[www.rolec-usa.com](http://www.rolec-usa.com)

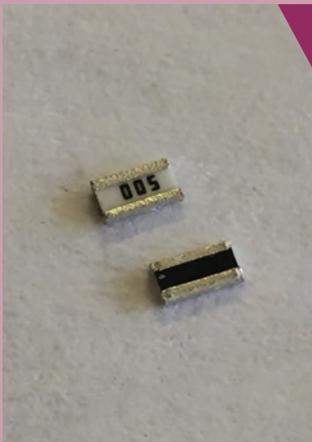
### Flood illuminator reduces costs

AMS states its new TARA2000-AUT flood illuminators for automotive applications are the industry's first to be qualified to AEC-Q102 and ISO 26262. The products suit optical in-cabin sensing systems based on 2D NIR imaging or 3D time-of-flight sensing which support the next generation of assisted and autonomous driving technologies in vehicles.

In driver monitoring systems, which track whether the driver is alert and attentive, high optical power distributed over the whole field of illumination means a single TARA2000-AUT illuminator can replace multiple lower-power emitters. This offers automotive OEMs savings in space, component count and cost.

AMS's in-cabin sensing segment manager, Firat Sarialtun, said: "Technical evaluation of the optical characteristics of the TARA2000-AUT shows that its high optical power uniformly distributed over the whole FOI gives a high signal-to-noise ratio and provides high image quality, so minimizing the number of illuminators needed for the scene."

[ams.com](http://ams.com)



### Wide terminal thick film chips in stock

Industrial and commercial power electronics demand robust resistor performance. When high stability and low thermal resistance are important, standard chip resistors may not be the best solution.

Chip resistors with reverse geometry provide terminations on the long sides of the chip, as opposed to the short side terminal for standard chips. Wide terminations offer a significant benefit in current handling and thermal resistance, which contributes to lower PCB temperatures for a given chip size and power rating. Stackpole's RMCW0612 size thick film

wide termination chip resistors are now in stock in a range of popular values in one and five per cent tolerances.

The RMCW is available in resistance values from 1ohm to 10Mohm. Applications include power management, battery charging, motor controls, industrial machinery and appliances.

Pricing varies with tolerance and resistance value and ranges from \$0.016 to \$0.115 each in full reel quantities.

[www.seielect.com](http://www.seielect.com)



### Medical benefits from compact power

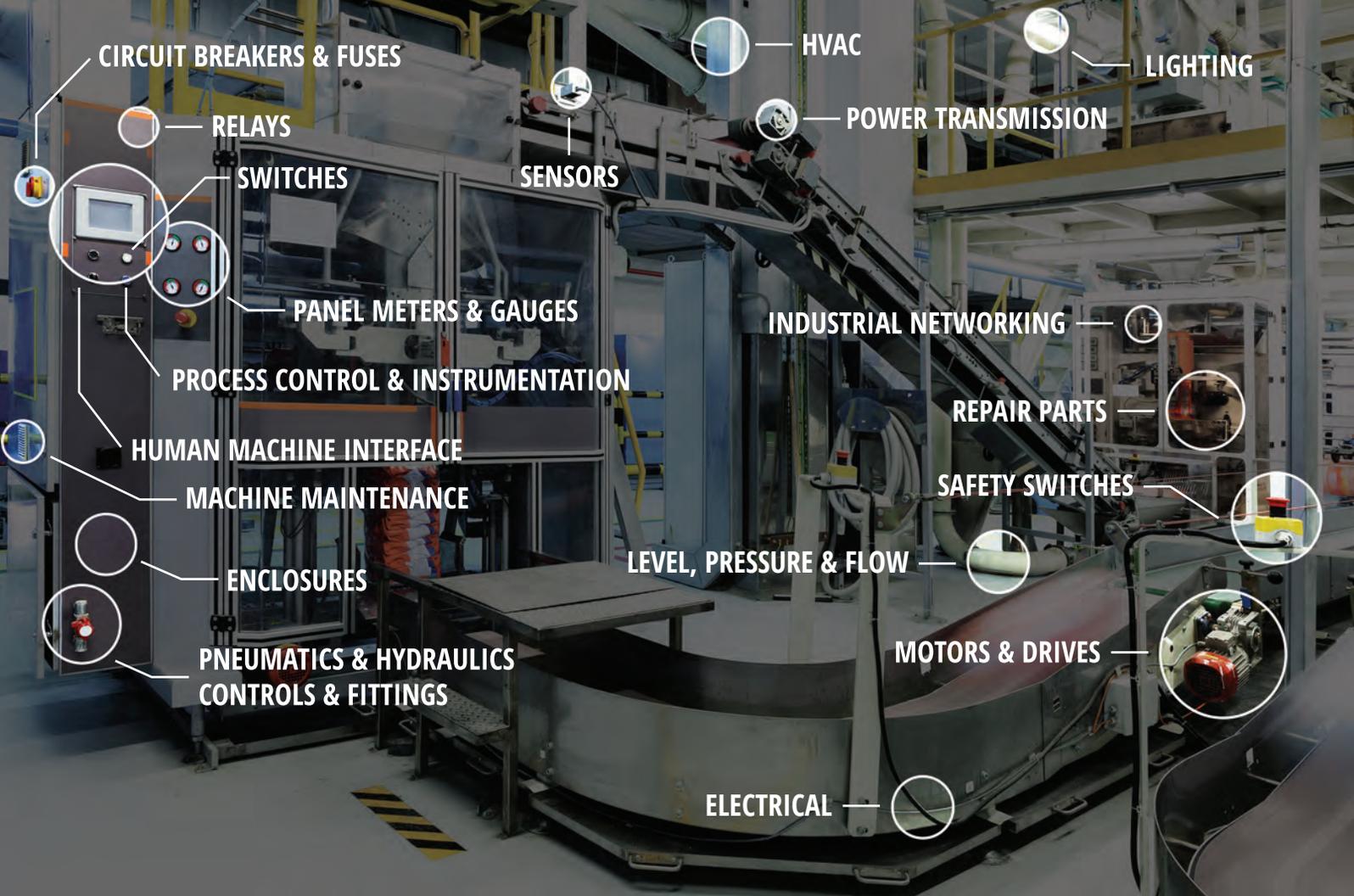
CUI has announced two new 120W AC/DC external power supply series, expanding its existing 60601 certified medical power supply family. The footprint is 35 per cent smaller than its non-medical counterpart, providing a lighter and less cumbersome adapter that can power a wide range of medical and dental devices.

The SDM120-U is available with a C14 inlet, while the SDM120-UD comes with a C8 inlet. Both series meet the current average efficiency and no-load power specifications mandated by the

US Department of Energy (DoE) under the Level VI standard, as well as the European Union's (EU) Ecodesign 2019/1782 and CoC Tier 2 directives for external power supplies.

These compact adapters are certified to the medical 60601-1 edition 3.1 safety standards for MOPP applications and 4th edition EMC requirements, making them suitable for medical, dental and home healthcare applications.

[cui.com](http://cui.com)



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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

# IoT: resolving the unknowns

*In this article, John Denslinger sees the expansion of existing IoT applications, plus the introduction of new connected technologies, as a fundamental driving force over coming years*

IoT • By John Denslinger

**F**orecasting several years out is often futile. Results are rarely accurate and frequently altered by disruptive technologies unknown at the time. Somehow, that doesn't stop us from planning the future for many new technologies like IoT.

I admit a certain fascination with IoT. It stems from a white paper released in 2011 by Cisco projecting 50B connected devices by 2020. At the time, that caught my attention. The application was ubiquitous. It would require components, connectivity and engagement across every market segment. The opportunity for growth would be great.

The road to adoption was anything but smooth. It's a great case study. Just five years ago, consultants everywhere were pushing huge growth in connected devices. Collectively, the projections varied widely as one might expect. The low-end forecast hovered around 25B (Gartner, McKinsey, Harper Research and others) and the high end at 30B+ (Statista, BI Intelligence). As a group, they missed and missed by a lot. The actual figure for 2020 is just a little over 20B. That means these forecasters over-estimated market adoption between 25 to 50 per cent. In a way, the forecast miss is the lesser story largely because billions were connected. Also, those billions will continue as the outlook remains at double digit CAGR affirmed by the latest consensus forecast of 64B to 75B connected devices by 2025. Whether adoption reaches that amount or not, it will be spectacular growth by any measure.

To be fair to our forecasters, the unknowns constricted 2020 growth. First, as IoT implementations occurred, companies acquired a deeper understanding of the networking complexities and from that grew greater concern for security, connectivity, data collection, data sharing, reliability and privacy issues. Secondly, the ecosystem for IoT was, and still is, under constant refinement as newer technology is introduced offering better performance, lower cost and solutions to many of the attribute concerns mentioned above. Lastly, enter the regulators. Around the globe, guidance initiatives and protective measures were instituted in response to national security and individual privacy concerns.

On a positive note, IoT is still in its infancy. There is an explosion of new ecosystem enablers and next-generation market drivers that will enhance IoT adoption. Think of the enablers as technology conduits. When applied to IoT, the performance of the entire ecosystem is elevated. Consider these five following technologies: AI driving faster decision making and unbiased control logic via algorithms; blockchains offering verifiable security for every digital transaction; nanotechnology pushing componentry to micro-scale levels with greater integration capabilities; VR augmenting control through vision; and lastly sensors, the underpinning of the IoT network. Sensors are the eyes and ears of the grid. Each is becoming smaller, more efficient, less costly, more secure, and easier to mesh into any system set up.

As for next-generation market drivers, 5G and eSIM alone is expected to generate nearly 37B connections by 2025 according to Juniper Research. Add to that figure key emerging technologies such as autonomous vehicles, smart homes, healthcare wearables, smart cities, and smart agriculture. Plus, there still is substantial application expansion available in current markets such as EV, fitness, factory automation, consumer electronics, warehousing, and enterprise.

So much more is now known about IoT and its deployment. Solutions to every problem are many and readily available. The market opportunities are real. It would seem then that resolving the unknowns most assuredly paves the way to meeting the 2025 IoT growth forecast.

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# The buyer's market for high-brightness LEDs will continue in 2021

*While demand for high-brightness LEDs will grow this year, availability will remain high and prices will decline because of overcapacity*



James Carbone

Oversupply, overall weaker demand from key customer segments and declining prices resulted in a 10 per cent decline in the high-brightness LED (HB-LED) market in 2020 as total LED revenue fell from \$13.1 billion in 2019 to \$11.8 billion in 2020.

HB-LEDs represent about 92.4 per cent of the total LED market which declined from \$14.2 billion in 2019 to \$12.7 billion in 2020, according to market researcher IC Insights.

"Most of the semiconductor segments have seen growth this year in 2020," said Ron Lineback, senior market analyst for IC Insights. However, the LED segment was "probably hit the hardest in 2020 during the pandemic as sales fell 10 per cent. In comparison to the overall semiconductor market grew 5.1 per cent last year, according

to World Semiconductor Trade Statistics (WSTS).

Paul Scheidt, product marketing manager for LED manufacturer Cree, said that LED revenue has actually decreased the past two years by double-digit percentages. "There was a 10-15 per cent drop in 2019 due to the US-China tariff/trade war and a massive slowdown in automobile demand," he said. There was another 10 per cent drop in 2020 mainly due to COVID-19 and "mostly impacting just the lighting and video screen sectors," he said.

The good news for Cree and other LED manufacturers is over the next few years there will be a "mild recovery, mainly driven by the ongoing adoption of LEDs into automobile forward lighting and higher resolution LED video screens," said Scheidt. He said, automotive

and all LED applications, are "returning to more normal levels of growth and adoption. However, we are now starting from a much lower baseline than anticipated a few years ago. A return to 2019 revenue levels will take years," he said.

IC Insights says the worldwide high-brightness LED market will post 6 per cent revenue growth in 2021 as automotive, interior and exterior lighting and other key segments recover and HB-LED sales will reach \$12.6 billion while the overall LED market grows to \$13.5 billion.

Scheidt said the three applications that will drive LED growth over the next few years are automotive forward lighting and video screens "as well as more niche non-visible applications, including UV-C LEDs for sterilization applications

and IR LEDs for mobile phone facial recognition. He added the "LED-ification" of lighting is pretty much done, so there really are no major growth drivers in that sector on the horizon.

There have been a lot of efforts to create a "killer app" for commercial lighting, such as IOT/connected applications or human-centric solutions. "But the reality of COVID-19 is that people spend a lot less time in commercial spaces than they used to. There just isn't the demand for higher technology lighting for spaces that aren't being used right now," said Scheidt.

**Oversupply, lower tags likely**  
The good news for buyers is that there will continue to be oversupply and prices for LEDs should fall about 6 per cent in 2021, the same price decline as 2020, the researcher said.

## By the Numbers Source: IC Insights



6%

The expected growth rate for high brightness LEDs in 2021.



5.9%

The forecasted compound annual growth rate for the global LED market through 2025.



233.9 billion

The number of LED units that are expected to ship this year.



-6%

The forecasted percentage decline in the average selling price of an LED 2021.



\$13.5 billion

The forecasted size of the worldwide LED market in 2021.



\$17 billion

The forecasted size of the worldwide LED market in 2025.



The biggest customer segments for HB-LEDs include interior and exterior lighting, cell phones, television and computer screens and automotive, according to IC Insights. LED demand from those segments is expected to increase especially in the second half of the year as the overall economy improves as the impact of COVID-19 lessens due to vaccinations against the virus.

Unit growth will grow 13 per cent in 2021 increasing from 206.3 billion in 2020, to nearly 234 billion this year, said IC Insights. It will be a welcome reversal of fortune for LED manufacturers as unit shipments declined 4 per cent in 2020 and 8 per cent in 2019.

COVID-19 was one reason that unit shipments and sales revenue declined in 2020, but it wasn't the only one. "The LED industry has been in major overcapacity for many years," said Scheidt. The drops in demand in 2019 and 2020 "didn't do anything to change that situation. We've seen some delays with some of our material suppliers due to COVID-19 related production disruptions but that is starting to settle out now," he said

Overcapacity has made it harder for LED manufacturers to grow sales, said Lineback. Also contributing to declining demand was a weak economy in 2019 and 2020.

Another reason for oversupply was the move to 150 wafers from smaller size silicon disks.

Some LED manufacturers also moved to 200mm wafers. Larger wafers mean more LED chips can be produced per wafer which boosts supply and reduces cost for manufacturers. However, because of tepid demand, it also resulted in declining prices, which means less revenue for manufacturers. Because of oversupply, it is unlikely more LED manufacturers will transition production to 200mm wafers.

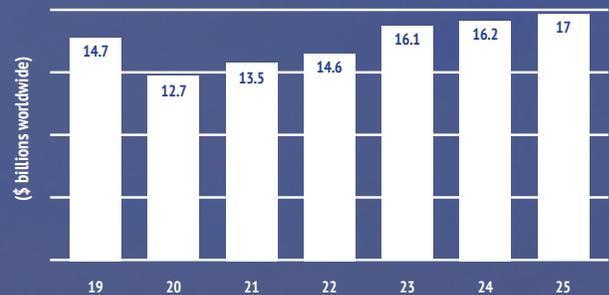
"LED makers have been talking about 200mm wafer production since early last decade, but with the glut on the market, few have made the move," said Lineback.

He noted in 2012, Toshiba announced it was ready to ramp LED production on 200mm GaN-on-silicon wafers in an existing mature IC fab. But the company pulled out of LEDs about four years later because of huge losses in a new restructuring plan, said Lineback. He added that Samsung researchers have talked about continuous improvement in 200mm GaN-on-Si HB-LEDs, but "it is still a small percentage of its output."

"You hear of several companies promising 300mm production of LEDs, or at least "roadmaps to 300mm from 200mm LED-making wafers, but these are not in volume manufacturing plants," said Lineback. "Most of these companies are looking to license their technology," said Lineback. He estimates that less than 10 per cent of LEDs are made with 200 mm wafers today.

*The worldwide LED market will post 5.9 per cent compound annual growth rate through 2025 when sales will reach \$17 billion. Source: IC Insights*

## LED market will brighten



### Competition from China

There is likely to be a continuation of excess LED supply due in part to Chinese companies who have gone into the LED business and their production yields are improving. Major LED manufacturers such as MLS and NationStar have increased capacity, he said.

With supply increasing, prices will continue to drop and revenue will rise but will be muted even if unit shipments increase. "We'll have 6 per cent drop in the prices in 2021. Price erosion is quite as bad as it has been over the last five years," said Lineback.

Despite falling prices in 2021 the longer-term outlook for high-brightness LEDs will improve. The forecasted compound annual growth rate through 2025 for LED revenue is expected to be 5.9 percent, while unit CAGR will be 9.9 per cent, said IC Insights. From 2015 to 2020 LED CAGR was -2.2 percent while unit CAGR was 3.2 percent.

However, while there will be an increase in LED demand over

the next five years it will remain a competitive market at least through 2021. It should still be a buyer's market in 2021, because of oversupply and competition from Chinese LED manufacturers as they try to grow market share.

Capacity will remain high at least through the year although there has been some consolidation among LED manufacturers. For instance, Cree sold its LED business to Smart Global Holdings and the deal is expected to be final in the first quarter of this year. In addition, OSRAM was sold to ASM for \$5 billion last year. More consolidation could occur as manufacturers continue to struggle to grow sales and improve profitability.

# An important year ahead for EV charging technology

*Transportation sales engineer at TTI, Gabe Osorio, examines the EV charging infrastructure and what manufacturers in this space should expect in 2021*

This should be a milestone year for electric vehicles, with Ford, Rivian, Lordstown Motors and others bringing new models to market. Though passenger EV charging may be more visible to the everyday consumer, larger-scale EV infrastructure rollouts are taking place now to support work trucks within freight yards and docks. For instance, all-electric Class 8 trucks from Daimler are moving containers from warehouses to the Long Beach Shipyard. Similar installations are planned for other parts of the United States and elsewhere.

When municipalities, and the contractors that service them, begin electrifying their Class 4 to Class 6 fleets (trucks used for garbage, recycling, street maintenance, etc.) we will see a larger wave of equipment selection and infrastructure construction, allowing those vehicles to operate by day and recharge at night.

For now, the status quo is a hodgepodge network of different manufacturers, each creating EV charging stations in the US, Europe and China. It remains to be seen how decisions by Tesla and Rivian to focus on proprietary charging systems

will impact their supply chains, or the choices made by other vehicle manufacturers.

From an electronics manufacturing standpoint, the future is going to be driven by the commercial vehicle and freight carrier side of electrification. Yet, questions remain around what types of connectors, chargers and methods will be widely adopted.

For OEMs who want to design charging station infrastructure, there's no single guideline to necessarily follow. One or more accepted standards will eventually emerge out of this Wild West of competing visions.

Right now, three groups are working to standardize charging infrastructure: CharIN EV, SAE and Electrify America. The Combined Charging System or CCS Type 1 seems most likely to prevail among different charging interface standards for North America, with DC fast-charging options (including liquid-cooled) on the road map for release in 2021.

Tesla's proprietary Supercharger system is also being widely deployed, though it remains to be seen

how much this will impact charging outside of the passenger vehicle space.

For now, we can expect to see a period of multiple standards and interfaces as different stakeholders work to control the customer experience and maintain a profit stream. We're most likely to see a standardization happening first in the interface itself, most likely around CCS Type 1. This should remain constant and available across multiple charging networks being built across the US, with controller programming software being the main concern for interoperability.

Vehicle OEMs need to stay focused on how charging infrastructure is being built and proliferated and which compatible downstream electronic components can be used: including logic and controllers, filters, HV fusing, contactors, timers, interconnects and more.

Any constraints on components used in BEVs, whether in the vehicles themselves or in charging infrastructure, will impact rates of adoption and the selection of a charging standard.



TTI transportation sales engineer,  
Gabe Osorio



**The future is going to be driven by the commercial vehicle and freight carrier side of electrification**



Choose partners who are participating in developing these standards, or that have a reputation behind supporting the standards that exist today

Also, wireless charging technology may impact passenger vehicles, mass transport, OTR trucking and service vehicles, especially if manufacturers quickly focus on one standard and implement it widely, with government or private industry support.

The biggest question for buyers at OEMs in transportation and EV charging to consider is whether your company is participating in the discussion. Is your company a member of a group debating the future of EV charging infrastructure? If not, should you be?

The good news is that organizations working to create future standards have high-performing, well-respected suppliers involved in the process. This means it's vital to choose the right suppliers to partner with today, not only for charging infrastructure designs but the components that will go into them.

Stay informed on new charging standards being agreed to and rolled out by the consortia mentioned here. Follow charging interface trends: the push is there for manufacturers to provide products that can deliver concentrated high power in shorter periods of time.

Also, follow the progress that commercial vehicle owners are making in charging and electrifying their fleets. By the end of 2021, most will have millions of miles of road experience and testing from which to draw learning and experience.

Do your due diligence and choose partners who are participating in developing these standards, or that have a reputation behind supporting the standards that exist today. Looking back from the end of this decade, we may find that 2021 was the critical point when the standards of tomorrow were determined.

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# Contact sourcing considerations

*In this article, PEI-Genesis unpicks the growing problem of EV connector standardization and compatibility*

For most electrical devices, users don't have to worry about compatibility, because standardized connectors and a nationwide standard mains voltage keep everything simple. For EVs, a reliable grid solves the issues with frequency and voltage, but the connector conundrum remains.

Furthermore, the problem is complicated by EV manufacturers taking advantage of several charging options: Mode 1 for slow charging from typical home outlets, Mode 2 for faster charging from specially designed home outlets, Mode 3 for commercial street-side charging points and Mode 4 for rapid, direct current charging.

Currently there are four common EV connectors around: Type 1, Type 2, CHAdeMO and CCS.

Type 1 connectors, officially SAE J1772, were among the first used on EVs. These five-pin connectors supply single-phase AC power at between three and seven kilowatts and are mostly found in Asian markets. These have been largely supplanted by Type 2 connectors in the west.

The Type 2 connector, known as SAE J3068 and colloquially

as mennekes after the original manufacturer, features an additional two pins and can carry either three-phase AC or high current DC depending on the configuration. In Europe, Tesla uses a modified version of the Type 2 connector that only fits Tesla EVs.

CHAdeMO connectors provide purely DC power at high currents and voltages. Finally, CCS, or Combined Charging System connector, is simply a Type 1 or 2 connector with an additional two DC pins for rapid DC charging.

CCS seems to have emerged victorious as the de facto standard, because it allows for flexible AC charging from home grids or any commercial charging station, excluding Tesla superchargers, but it also provides high current, high voltage DC to EVs with that charging capability.

It's clear the ideal EV connector must be ergonomic, space efficient, safe and able to provide both AC and DC power. CCS connectors already combine all these design features, so problem solved? Not quite.

They fulfil the customer requirements but from an electrical engineering perspective there's more to be done. For instance, high

voltages and currents form the perfect environment for arcing between the contacts. The pilot signal helps mitigate this as any loss of continuity stops the charging but this doesn't fully prevent resistive heating or contact damage.

A second of high voltage arc between contacts could score and scorch them. This damage exacerbates the problem, eventually leading to sudden connector failure. If this damage occurs on a charging station it means replacing the connector. However, if the damage occurs onboard the EV people could be stranded.

Regarding the contact design, extra effort can pay dividends. An example is Amphenol's Radsok connector range which uses hyperbolic geometry to provide robust, high-density contacts mating. Instead of passively mating, these connectors push against the respective contact to ensure a complete and reliable connection.

While it seems like CCS might have solved the EV charging conundrum, more consideration of the subtleties means an ideal, future-proof design could be just around the corner.

[www.peigenesis.com](http://www.peigenesis.com)



**Currently there are four common EV connectors around: Type 1, Type 2, CHAdeMO and CCS**

# Constrained supply challenges buyers

*Buyers qualify new suppliers, share long-range forecasts and look to distributors for help in sourcing parts that are in short supply*

By most accounts, supply of semiconductors and other components will be constrained through the first half of 2021 and buyers at OEMs and electronics manufacturing services providers are employing strategies and tactics to make sure their companies get all the parts needed to keep production lines running.

While most buyers like to have a limited number of suppliers, some are qualifying new suppliers for commodities and finding alternative parts for shortage components in an effort to maintain the supply for hard-to-find chips and passives. Others are buying parts from more authorized distributors and taking advantage of inventory programs that hold inventory of needed parts on behalf of customers until the components are needed for production.

Of course, many buyers are also returning to non-franchised, independent distributors, whose businesses thrive during component shortages because they either have the parts in stock or know where they can be sourced. While historically many buyers have been suspicious of independent distributors over quality and counterfeit concerns, some independent distributors have

enhanced quality systems and screening processes in an effort to eliminate substandard or counterfeit parts from their inventories.

One part of having a strategic relationship with supplier is to provide long-term forecasts of component demand, especially when demand is rising and there's a possibility of shortages. Some electronics industry executives have said that no forecast beyond 30 days can be accurate. However, forecasting techniques and tools have improved and forecasting demand has gotten better. Some suppliers say any forecast is better than no forecast, especially if it is updated frequently.

"We need to make sure we are providing our supply base with enough forecast to enable them to manage their supply chain," said Graham Scott, vice president of procurement for EMS provider Jabil Inc., based in St. Petersburg, Fla. "We really need to be providing them with as much as 12-months' worth of forecast."

## Forecast sharing

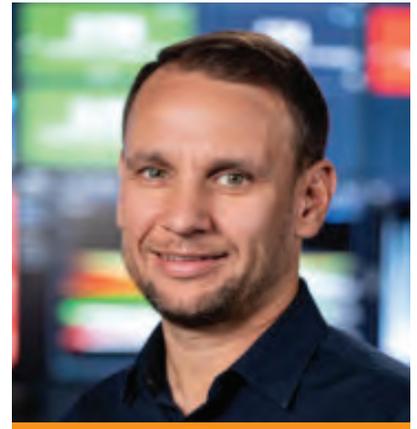
He said it is also important that Jabil's customers share their long-term forecasts with the EMS provider because it impacts Jabil's semiconductor forecasts to chipmakers and

passives manufacturers. "We share that information with our suppliers as quickly as possible," he said. "The more visibility we give to suppliers, the better chance we have of ensuring the products our customers require can be built on time."

Such forecasting sharing is always important, but more so when demand is increasing and there is not enough component production capacity to go around. Scott says that was the case in 2020 when COVID-19 slowed or shut down production at many electronics manufacturers. However, component demand is bouncing back in early 2021 and demand is starting to outstrip supply for some parts.

In fact, Jabil saw some of the industries that "lagged because of the virus started to bounce back" in the second half of last year. "We saw automotive, industrial, the consumer markets all come back with strong demand," said Scott. In addition, more 5G smart phones are starting to ship which is adding to component demand.

As a result, "we are faced with many constraints right now with semiconductors made on 8-inch wafers," said Scott. Fabs using 8-inch wafers are struggling to keep up with demand. "They are running



**We need to make sure we are providing our supply base with enough forecast to enable them to manage their supply chain**

**Graham Scott**, vice president of procurement for EMS provider **Jabil Inc.**

at 100 per cent capacity,” said Scott. With 12-inch fabs, there’s a “little bit more leeway there but they are constrained, too, and that’s leading to a lack of flexibility in the markets,” he said.

Lack of flexibility means a wide range of components were constrained in the first quarter, including microcontrollers from NXP and STMicroelectronics, NXP transceivers, Maxim discretes, Realtek digital audio converters and various chips from ON Semiconductor and Infineon.

“Resurgent demand, combined with tight capacity at fabs and shortages of raw materials like wafers and substrates” is making it challenging for semiconductor manufacturers to produce all the parts for all customers, said Luke LeSaffre, director of sales-Americas for independent distributor Fusion Americas.

“The volume and size of requirements we have received are strong but the amount of product available to support is not very high,” he said. “We are entering this market from a period when activity levels were low, as compared to 2018 when that market was the culmination of many years of strong demand building over time,” said LeSaffre. He added the pervasiveness of shortages is “leading to more line stoppages.”

### Keep suppliers close

Some electronics purchasers say the key to managing shortages and to prevent line shutdowns is to make sure your company has close strategic relationships with critical suppliers before shortages occur. After shortages hit, it may be too late.

The best approach to combatting potential impact of shortages is to “have a consistent nurturing of strategic relationships with your key suppliers,” according to Jamey Mann, director of global purchasing at electronics manufacturing services (EMS) provider Kimball Electronics, based in Jasper, Ind. “A shortage driven market is not the time to try to begin a strategic relationship. This should be ongoing,” he said.

When a company has close relationships with key suppliers, there is going to be ongoing communication with those suppliers and market indicators will be monitored and shared. “This allows us to make strategic decisions of when to flex order horizons and supply programs to enable mitigation of near and long-term impacts,” he said.

It may not absolutely guarantee supply but having established, strategically placed relationships, coupled with “open and honest communications with suppliers and customers, delivers confidence that the supply chain will sustain our operational support of our customer,” said Mann.

### Relationships are essential

Shabnam Shaghafi, vice president of supply chain for EMS provider Benchmark Electronics, based in Tempe, Ariz., said that “developing strategic relationships with key suppliers is an essential part of our business.”

“Maintaining regular and frequent information sharing has helped us to secure supply with minimal disruptions to production,” she said. Benchmark’s strategic partners “offer excellent service. Through collaboration and

communication with our suppliers, and customers as needed, we have been able to secure supply and overcome challenges in a constrained market,” she said.

The relationships Benchmark has had with key suppliers is helping it weather the impact to last October’s fire at Asahi Kasei Microsystems factory in Japan, which knocked out production of DAC and ADC chips and other materials for at least six months.

When production of parts is disrupted by a catastrophic event, Benchmark minimizes the impact by implementing “various proactive measures to help us overcome supply assurance issues.” For instance, Benchmark has a “robust and diversified supply base where we can easily identify backup/alternative suppliers in many cases,” said Shaghafi. “Additionally, we are able to bridge supply gaps by nimbly evaluating critical components of the supply chain and offering alternative solutions to our customers,” she said.

If an alternative requires redesign, Benchmark can offer rapid solutions to customers for their “evaluation of overall compatibility and product performance to ensure form, fit, and function of the product.”

Judy Kile, senior manager, GE Healthcare Sourcing, based in Chicago, says it is not common to re-design a board specifically for shortages due to the stringent quality requirements and time required for a re-design.” She said GEHC buyers proactively work to have multiple sources identified for a commodity. “In the case where there is a form, fit, functional equivalent, we have processes in place to cross functionally



**Maintaining regular and frequent information sharing has helped us to secure supply with minimal disruptions to production**

**Shabnam Shaghafi**, vice president of supply chain for EMS provider **Benchmark Electronics**

evaluate and quickly add to a BOM,” said Kile.

Identifying alternate components is also important to Kimball and its customers. “We work diligently to identify and suggest alternate components for our customers to qualify in order to de-risk the supply,” said Mann. He noted Kimball’s customers own the designs of the products Kimball builds, so it is their decision “to make as to which suggestions are acceptable in their designs.” He notes Kimball builds highly reliable, durable assemblies for its OEMs, “so in most cases there are regulatory compliance hurdles to clear before alternates can be consumed in their products.”

#### Working with distributors

Most OEMs and EMS providers work with distributors to help manage shortages. “We have several programs in place with our key strategic distributors to secure supply and support our customer requirements,” said Shaghafi. Catalog distributors offer “us some leverage and the ability to purchase larger volumes to fill supply gaps as needed,” she said.

Catalog distributors are also important to Kimball Electronics. “Key distributors in this area of focus have expanded their abilities to more than just supplying engineering volumes” said Mann. “Both gap and everyday demand fulfillment from these partners bolsters our ability to cover the needs of our customers.”

Mann added that it has strategic relationships with several distribution partners that are “instrumental in maintaining continuity of supply” at Kimball. “These partners and their ability to manage supply are a key

component of our supply chain strategy,” he said.

Kimball also uses a “strategic set of independent distributors for shortage components and end-of-life parts,” said Mann. “They must continue to meet our stringent requirements of part authentication as part of our anti-counterfeit processes,” he said.

Benchmark also uses independent distributors for hard-to-find parts despite the risk, said Shaghafi.

Non-franchised distributors “can be helpful in circumstances of small and niche needs. Their flexibility and ability to navigate through unique sourcing channels offers sufficient opportunities to bridge immediate or small and short-term needs,” she said.

However, that flexibility comes with risk. She said Benchmark needs to “assure a chain of custody, material viability, and accurate labeling associated with counterfeiting or adulterated material.” The EMS provider requires suppliers to provide documents with every shipment. Shaghafi added Benchmark has a “rigorous qualification process for non-franchised distributors.”

She said Benchmark has close relationships with a few independent distributors and we “audit their systems periodically, and address many of our risk elements proactively.”

Medical OEM GEHC also uses a small list of approved independent distributors that have been qualified through a “robust internal process,” according to Kile. Independent distributors must meet GEHC’s stringent quality, testing and traceability

requirements. “Each of the distributors stand 100 per cent behind the products they deliver for us. They have been extremely helpful with shortages, particularly over the past 10 months,” said Kile.

Scott said during times of shortages it is important to stay close to suppliers. “We need to understand what is driving the market” which suppliers, including component manufacturers and distributors, can help with. In addition, suppliers can provide information concerning new regulations and the “impact they can have on our supply base,” said Scott.

Commodity managers sourcing parts must factor in new technologies and components that are being introduced when they make sourcing solutions to avoid the risk of shortages. Supply of parts made with new technologies is often limited.

“We have to make sure we are using the appropriate supply base for a new technology,” said Scott. “We need to make sure commodity management get involved with those conversations to ensure that we have a supply chain that’s going to be robust enough for a product launch,” he said.



**GEHC has a small list of approved independent distributors that have been qualified through a robust internal process**

Judy Kile, senior manager, **GE Healthcare Sourcing**

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
<b>ACOUSTIC COMPONENTS</b>											
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
<b>CABLE &amp; WIRING</b>											
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
<b>CIRCUIT PROTECTION</b>											
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
<b>DISPLAYS &amp; LEDs</b>											
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
<b>ELECTROMECHANICAL</b>											
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	83.00%	50	1,000+	Y
C&K Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	27,230	N/A	\$0	90.00%	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
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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# Increase your engineering and buying confidence

The image features a man and a woman standing in the center, surrounded by a large, circular arrangement of logos for various electronic component manufacturers. The logos are arranged in a ring around the couple, with some overlapping. The logos include:

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- cinch CONNECTIVITY SOLUTIONS
- TDK
- VISHAY
- TE CONNECTIVITY
- infineon
- nichicon
- HRS HIROSE ELECTRIC CO., LTD.
- AVX A KYOCERA GROUP COMPANY
- TEXAS INSTRUMENTS
- BROADCOM
- SILICON LABS
- TOSHIBA
- molex
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- Panasonic
- intel
- maxim integrated
- muRata INNOVATOR IN ELECTRONICS
- BOURNS
- OMRON
- ST life.augmented
- NXP
- Amphenol
- Littelfuse Expertise Applied | Answers Delivered
- Microsemi
- RENESAS
- KEMET
- CREE AUTHORIZED DISTRIBUTOR
- Coilcraft
- OSRAM Opto Semiconductors
- PHENIX CONTACT INSPIRING INNOVATIONS
- CYPRESS EMBEDDED IN TOMORROW™
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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
<b>ELECTROMECHANICAL (Continued)</b>											
NKK Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	13,976	N/A	\$0	86.00%	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
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
<b>ENCLOSURES</b>											
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	80.00%	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
New Age Enclosures	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
<b>FREQUENCY MANAGEMENT</b>											
Abracorp 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	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
<b>ICs &amp; SEMICONDUCTORS</b>											
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

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
<b>INTERCONNECTION</b>											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	\$0	46.00%	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
Apptive (Delphi)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Bel Magnetic Solutions	Bel Fuse	+1 858 676 9650	belfuse.com/magnetic-solutions	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	Bel Fuse	+1 507 833 8822	+1 507 833 8822	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ERNI Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
FCI	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,394	N/A	\$0	73.00%	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	51.00%	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
LEMO	LEMO	800-444-5366	www.lemo.com	M	N/A	N/A	N/A	N/A	N/A	1,500	N/A
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	77.00%	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
Souriau	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,744	N/A	\$0	27%	50	1,000+	Y
Stewart Connector	Bel Fuse	+ 1 717 235 7512	belfuse.com/stewart-connector	Y	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
<b>OBSOLESCENCE / HARD TO FIND</b>											
	Chip 1 Exchange USA, Inc.	949-589-5400	www.chip1.com/es	Y	850,000	N/A	\$0	85%	20	150	
	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
<b>OPTO ELECTRONICS</b>											
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	582	N/A	\$0	99.00%	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
Osram Opto Semiconductors	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
<b>PASSIVES</b>											
ABRACON	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	42,454	N/A	\$0	72%	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	98.00%	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
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	84.00%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	\$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	\$0	100.00%	50	1,000+	Y
Signal Transformer	Bel Fuse	+1 516 239 5777	belfuse.com/signal	Y	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	98.00%	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
<b>PASSIVES (Continued)</b>											
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
Würth	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
<b>POWER &amp; BATTERIES</b>											
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	\$0	100%	N/A	2000+	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
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
<b>REED SWITCHES</b>											
HSI Sensing	HSI Sensing	405-224-4046	www.hsising.com	M	75	N/A	\$200	100.00%	15	275	N
<b>SENSORS</b>											
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
<b>SWITCHES &amp; KEYBOARDS</b>											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>TEST &amp; MEASUREMENT</b>											
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

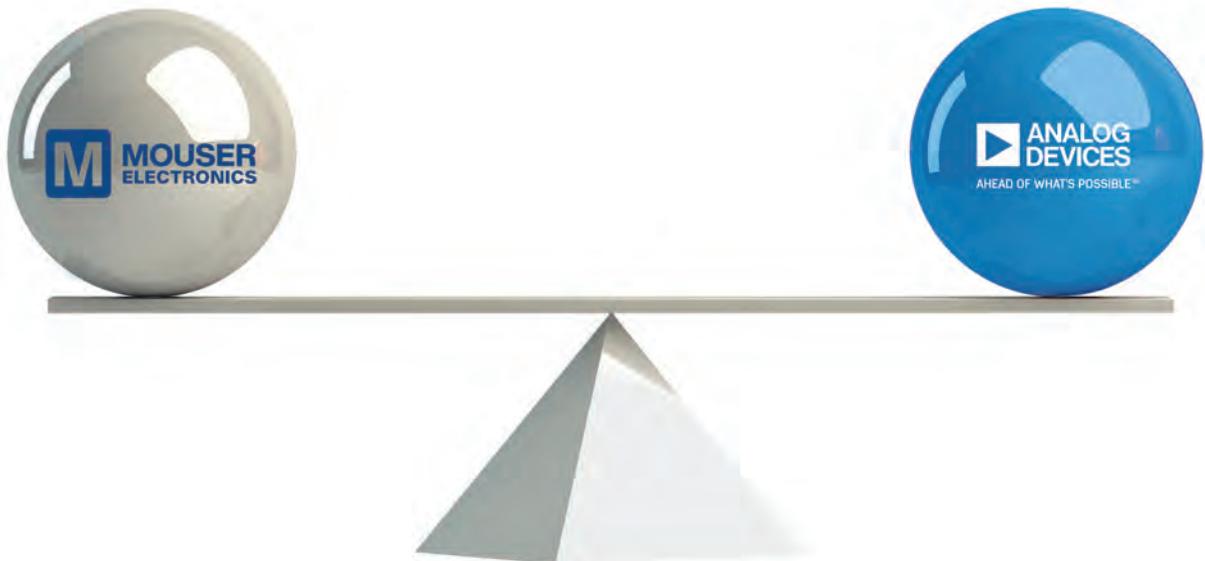
Manufacturer	Telephone	Website	Turnover	Location	Employees	Number of Surface Mount Lines	Approvals	BGA Capacity	Lead-Free Manufacturer	Prototyping	Design Capability	Full Turnkey	Cables and Harnessing
Pektron	1-248-677-4838	www.pektron.com	\$66m	Michigan & UK	350	8	ISO9001, ISO14001, TS16949, BEAB, VCA, TUV, UL	Y	Y	Y	Y	Y	Y

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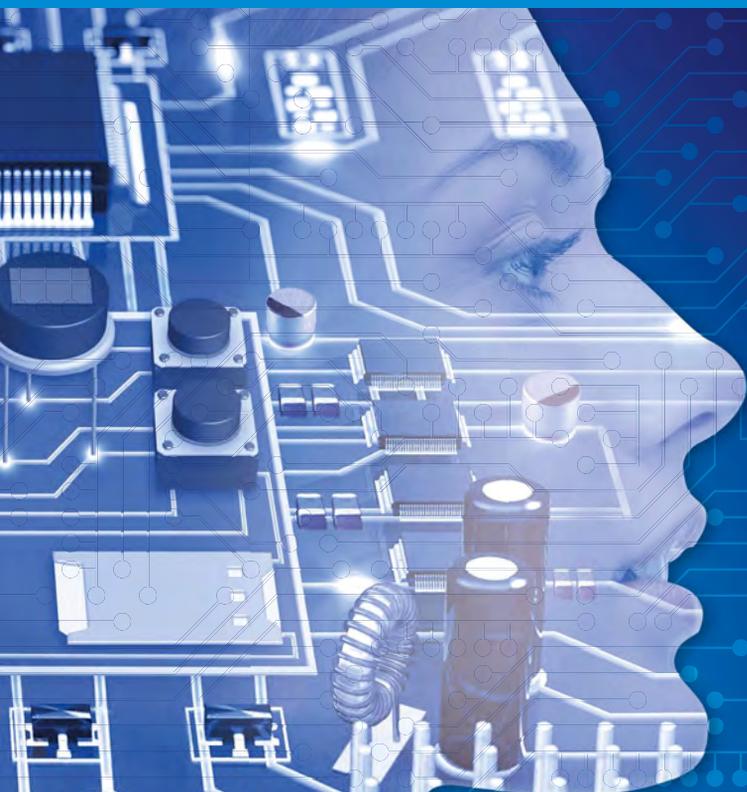
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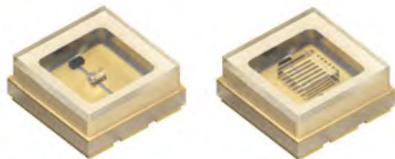


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