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DEFENDING IP
BY JOHN DENSLINGER
PAGE 18

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Buyers' Guide

All the facts and figures to help you buy

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When distribution lets down design

After many years of hard use our kitchen demanded a refit. I secretly love this type of work. I can dig out the router and aligning doors feeds my engineering OCD. So the decision was made to choose a supplier offering design support, followed by DIY installation.

The design process was swift and pleasing, offering a mix of online CAD and one-to-one advice. That just left the delivery of the parts.

Delivery was set for a Monday. On the Sunday it was rescheduled for Tuesday. On Monday it was rescheduled for Thursday. Then on Thursday, 30 minutes before the delivery was due, it was rescheduled for Saturday week.

By this time the old kitchen had been removed and the electrician cancelled three times. The telephone customer support was apologetic but referred me back to the store. Then the fun really began.

The reason the delivery kept being cancelled was that some line items on the bill of materials were missing and their system would only allow delivery of a complete order. The solution was to cancel the entire first order, and start two new orders, one containing the parts that were in stock and one comprising the missing parts for later delivery. All this was done manually by three people as we watched.

On the Sunday, the initial part-order arrived. Then over following days a succession of couriers brought the remaining parts. Then to our surprise, the following Saturday the company redelivered the entire kitchen for a second time! You guessed it, they had forgotten to process the order cancellation.

Couriers continue to arrive, now delivering duplicate parts we don't need. I have no idea when it will stop. In the end we all laughed it off, felt rather sorry for the couriers, and can now stand back and admire what is a rather dandy new kitchen.

It is, however, a classic case of distribution letting down design.

Jon Barrett

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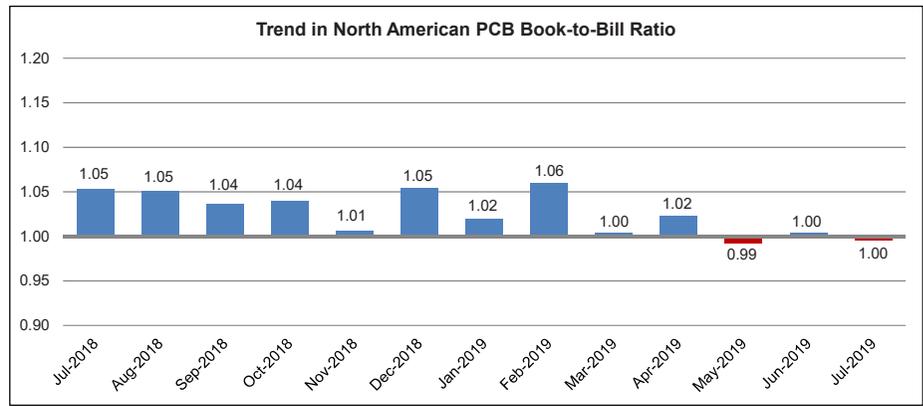
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Note: The January 2019 ratio has been revised since its original publication due to updated data from statistical program participants.



FTZ status avoids supply chain disruption

Global technology solutions provider, Avnet, has secured foreign-trade zone authorization from the United States Bureau of Customs and Border Protection for its McKemy distribution center in Chandler, AZ. The designation, which will increase the company's global logistics flexibility and efficiency, reduces tariff recovery fees for international customers as well as for domestic customers shipping abroad.

With the McKemy Center as an authorized FTZ, Avnet can import products into the United States and store them without incurring a duty tax. Payment of tariffs is delayed until products leave the FTZ for destinations inside the United States.

The 400,000ft² McKemy distribution center can also serve as a duty-free hub for products bound for non-United States destinations. Products can transit through the facility to overseas destinations without incurring the same duties and tariffs as those entering United States commerce, benefiting Avnet's international customers.

Vice president of operations and supply chain at Avnet, Vincent Cellard, explained: "Avnet is focused on mitigating risk, minimizing costs, and avoiding supply chain disruptions that can pose significant challenges for our customers amid complex and changing international trade regulations. Securing FTZ status for McKemy better enables Avnet to navigate these conditions."

avnet.com

PCB purchasing in decline

The IPC has revealed a drop in the sale of printed circuit boards according to the July 2019 findings from its North American PCB statistical program. Shipments were down 5.3 per cent compared to the same month last year and although year-to-date sales growth remained positive, compared to the preceding month, July shipments decreased 23.1 per cent. Bookings were also down 17.8 per cent from the previous month.

Director of market research for the IPC, Sharon Starr, commented: "Sales growth has slowed in recent months and dipped into negative territory in July. The slowdown is reflected in the book-to-bill ratio, which indicates the probability of flattening sales growth in the second half of the year."

www.ipc.org

Need immediate access to wireless antennas?

KP Performance Antennas has now partnered with Winncom Technologies to offer its wireless antenna products to a worldwide customer base. As an authorized stocking distributor of KP Performance Antennas, Winncom can now offer purchasers a range of antennas to address a myriad of wireless networking applications with immediate access to KP's complete solutions covering the tower to the subscriber.

Vice president of sales at KP Performance Antennas, Jason Koshy, said: "By partnering with Winncom we are providing customers with the latest antenna technologies along with Winncom's engineering, logistics and sales support. Winncom's in-depth experience helps position them as the go-to value-added distributor in the wireless industry."

www.kpperformance.com





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In Brief

Hi-rel production expands

AirBorn has begun construction of a new manufacturing facility in Lake City, Pennsylvania, which will double the manufacturer's footprint. This addition to its existing facility, along with new equipment and tooling, will expand AirBorn's capacity to supply highly reliable electronic components to manufacturers of military equipment, commercial airplanes, spacecraft and life-saving medical equipment.
www.airborn.com

Investing in IoT expertise

Avnet has signed an agreement to acquire Witekio, a company with expertise in software and embedded systems supporting internet of things solutions. This will enhance Avnet's end-to-end IoT strategy by adding expertise in embedded software, edge computing and security, specifically from hardware to the cloud. It also underscores Avnet's commitment to reducing the time, cost and complexity of bringing IoT products to market.
www.avnet.com

One stop SoC shop

Silicon IP and chip provider, Rambus, has acquired Northwest Logic, a supplier of memory, PCIe and MIPI digital controllers. This will expand the company's high-speed interface offering, bringing together high-speed design expertise with various physical and digital IP families to offer comprehensive memory and SerDes IP solutions.
rambus.com

Re-reeling service saves time

Würth Elektronik has introduced a worldwide re-reeling service. When customers order small quantities of components, belt sections can now be offered on reel with a leader and trailer of at least 40cm. Customers benefit from labor and time savings and can also process small quantities of components for prototypes and small series immediately and efficiently with SMT pick-and-place machines.
www.we-online.com



Modules set to simplify IoT

Mouser Electronics is now stocking the SAM R30 sub-GHz module from Microchip Technology. It combines an ultra-low-power microcontroller with a sub-GHz radio to provide long-lasting battery life in space-constrained designs like wireless-networked sensors and controls in home automation, smart city, and industrial applications.

Housed in a 12.7 by 11mm package, the module is described as the industry's smallest IEEE 802.15.4-compliant module. Designed for use in unlicensed sub-1GHz frequency bands worldwide, SAM R30 boasts receive sensitivity up to -105dBm and transmit output power up to 8.7dBm. This helps offer twice the connectivity range and better communication through walls and floors than similarly powered devices using the 2.4GHz frequency band.

An ultra-low-power sleep mode of under 800nA also makes the SAM R30 ideal for internet of things sensor applications that require long battery life.

www.mouser.com

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Shift battery production to avoid China tariffs

In response to new tariffs that increase the cost of manufacturing in China, Global Technology Systems has initiated a program to move clients' battery pack and charger manufacturing to its GTS facilities in Taiwan.

GTS president and chief executive officer, Larry Murray, explained: "GTS is equipped to move a customer's tooling and components out of China and, in as little as 30 days, resume production in our secure facilities in Taiwan. We also have the flexibility to manufacture small quantities for new products and almost unlimited quantities for more mature products."

With its 'Get Out of China' initiative, GTS offers OEMs immediate cost savings of up to 25 per cent, along with IP security and low minimum order quantities. Low MOQs can help improve cash flow by reducing battery inventories and investments.

GTS vice president of technology and manufacturing, Danny Rockett, added: "From single-cell assemblies to complex military packs and chargers, GTS can do it all, including in-house testing and certifications. As part of our program, GTS can also analyze a customer's battery packs and cells, providing advice on potential cell and component upgrades for longer run times, longer life and reduced costs."

www.gtspower.com

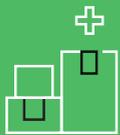
Audio-optimized capacitors offer sound savings

New Yorker Electronics has introduced new audio-optimized film capacitors from Electrocube. Both the 916D series of metallized polypropylene capacitors and the 967D polypropylene and foil audio capacitors are intended for high-end audio applications and are available with tolerances up to ± 20 per cent, voltages from 100 to 600V DC and frequencies up to 100KHz.

Supplied in oval or round format in either an epoxy case or hermetically sealed package, the 916D and 967D capacitors store energy for applications such as AC and pulsing, high surges and high frequency, high current or low ESR. Made in the USA, they are commonly specified by audio engineers because of their high-grade materials and manufacturing processes, says the distributor. Applications for both include audio amplifiers, speakers and musical instruments.

www.newyorkerelectronics.com

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Same-day shipping on switches and relays

Newark is expanding its range of switches and relays, offering same-day shipping on over 25,000 products and on demand access to over 85,000 products, to further help customers reduce time to market. The additions include products from EAO, NKK, Omron, and TE Connectivity supporting industrial applications such as transportation equipment, industrial internet of things and communications solutions.

New products include EAO's series 84 halo illumination pushbuttons and NKK Switches' KP02 series super bright LED illuminated pushbuttons. Other highlights include the Omron IA G2RV industrial slim power relay and the TE Connectivity V23079 signal relay suitable for communications, measurement and control, and medical equipment.

Senior product manager at Newark, Danny Weiss, explained: "Switches and relays are integral components and our customers demand faster shipping so they can speed time to market. We've added new offerings and ensure same-day shipping for tens of thousands of products to help customers bring their ideas to life efficiently."

newark.com

Reed relays ready to ship

Pickering has signed a US distribution deal with Testco ensuring Pickering's range of reed relays for automated test equipment switching and semiconductor test is now supported by the distributor across North America.

Included in the inventory held by Testco for immediate shipment is the 4mm² product family featuring a footprint of four by four millimeters. Pickering's range of high voltage reed relays will also be offered from stock.

Chief executive officer of the Pickering Group, Keith Moore, commented: "We have been impressed by Testco's expertise and its ability to offer creative supply chain solutions including flexible blanket orders, bonded inventory, consolidated shipments, and annual pricing programs."

www.pickeringrelay.com



High voltage, small size resistors in stock

Stackpole's RNV series thru-hole resistors are ideal for applications that require high voltage handling capability, high reliability, and stability. The robust quarter watt size resistors can handle up to 7kV under IEC 60065.14.1 standard testing. They are also designed to withstand 1,000 hours at 40°C, 90 per cent relative humidity with cycled power while experiencing very little resistance shift.

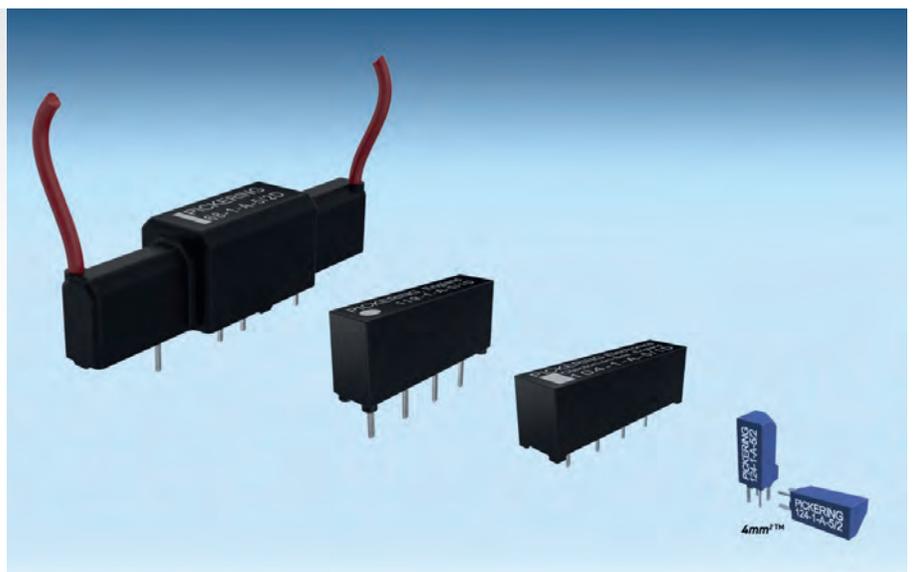
Ideal for industrial electronics, switching power supplies, power inverters, AC adapters, appliances, electronic ballasts, displays and monitors, the RNV series is available in both five and one per cent tolerances, and in standard ammo and tape and reel packaging.

www.seielect.com

Searching for colorful stacklights?

Sager Electronics is now stocking Mallory's JR series of 30mm stacklights complete with sound and light options. Said to be small enough to fit on top of control boxes, or anywhere space is at a premium, the JR series boasts flexible voltage ranges of nine to 16V DC or 24V AC/DC. They are available in one to three stacks in red, yellow and green colors. Seven different sound options are also available. JR series stacklights are made in the US and are cUL approved, NEMA 12 rated and protected to IP52.

www.sager.com



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Not all inventory sites are equal

Senior vice president of the Electronic Components Industry Association, Victor Meijers, explains how the ECIA's search tool differs from other inventory aggregation websites

Back in 2011, when inventory aggregation sites were first becoming a common source for price and availability information on electronic components, none made much distinction between authorized and unauthorized sources. It was up to users to determine if a given source was franchised for a product or not. This left users vulnerable to a host of potential problems, not least inadvertently buying counterfeit products.

In order to provide a better experience, a group of ECIA's authorized distributor members came together to create a site where all listed sources were franchised distributors for the products displayed.

From its inception ECIAauthorized.com was different. Instead of depending on advertising revenue or user subscriptions, funding comes from participating distributors, allowing ECIA to offer use of the site and its various tools as a free service to purchasing professionals and design engineers. This means ECIA can limit participation to only authorized sources while sparing users from superfluous content, creating a clean search experience.

Verified data

ECIA works extensively to verify

that all price and availability data displayed on the site relates only to products for which the distributors are authorized/franchised. Each distributor posting inventory on the site must provide proof of authorization for a product line before their data is displayed. While painstaking, this process provides users with confidence that any products purchased through the site are genuine, fully warrantied by the manufacturer and properly handled throughout their life cycle, which is not what you get when buying from brokers or on the gray market. At the same time, a lot of energy is put into making sure that data is accurate and as current as possible so that users can count on the site to be a trusted source of information.

In fact, on a monthly basis more than 170,000 actual users perform over four million searches on ECIAauthorized.com. The 75 participating distributors provide data for 22 million unique SKUs from 4,000 component manufacturers. So, information isn't limited to just common or popular parts but includes many of those difficult to find components as well. And with local language and currency available in all regions of the world, today the site is also truly global.

Search. Find. Buy. ECIAauthorized.com



ALWAYS REAL-TIME

Pricing and Availability



Search Over 22M Products

100%

Authorized Sources



75 Industry Leading Distributors



22 THOUSAND

Real Users Per Day



Local Language

Truly global site

Enter a component part number



20 MILLION

Total Searches Per Month



BOM Management Tools
Up to 100 parts at once

Search tools

In addition to inventory data, ECIAauthorized.com offers users a host of features beyond just performing a basic search. There are several BOM management tools, including a bill of materials import/export feature, which allows users to request information for up to 100 part numbers at a time, or 1,000 in the Extended BOM tool. BOMs can be imported and exported in a variety of file formats and search results filtered so the user gets only the data they want. By creating an account, users can save their BOMs for future searches, as well as creating price and stock alerts if the average price of a component fluctuates by a certain percentage, or if a part previously not in stock becomes available.

Lastly, the ECIA API remains a popular tool. By integrating this application programming interface into their ERP system or quoting application, purchasers

can automate the search for price and availability information. Data can then be shared throughout their organization helping them to make purchasing and supply chain decisions more quickly. All with confidence that the information received is accurate and timely and for genuine products from only authorized sources. And it's free, which could well prompt you to start your next search at ECIAauthorized.com.

eciaauthorized.com

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Class-G Amplifier
Decimated Power-Efficiency
Microwave
Bluetooth
Remote Control
FPGA
DDS
Batteries
Betavoltaics
MMW Transceiver
Nanogenerators
AMR
Recycling Radiowaves
Ask Receiver
Transformers
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Distributors see IoT as an important driver for future sales growth

The growth of the Internet of things will mean distributors will see robust demand for sensors, microcontrollers, and wireless modules, as more consumer devices and industrial equipment are connected to the Internet



James Carbone

"You Ain't Seen Nothing Yet" was a song by 1970s Canadian rock group Bachman-Turner Overdrive, but it is also a phrase many distributors say describe the impact that the Internet of Things (IoT) is having on distribution and the overall electronics industry.

Distributors say IoT is already having a positive impact on business, driving sales of sensors, microcontrollers, wireless modules, high-speed connectors and other components. But over the next five years, more devices ranging from home thermostats and appliances to self-driving cars and factory robots will be connected to the Internet and will help drive distribution sales to new heights.

One distributor that is bullish about IoT is Arrow Electronics. "IoT is not a vertical, it is not a technology. IoT is a movement," said Murdoch Fitzgerald, vice president sales and engineering at Arrow. "It's about aggregating more and more technology together across the entire technology stack to be able to influence business outcomes," he said.

Arrow has a global IoT practice within the company. About \$1 billion of Arrow's annual revenue is connected to IoT and involves sales of components, software and services, said Fitzgerald.

"It can be anything from a Wi-Fi or Bluetooth module all the way up to some type of engineering service that we provide, or data connectivity from a mobile

network operator," said Fitzgerald. IoT offers "tremendous potential" for Arrow as more customers develop IoT strategies and "are looking to monetize their data," he said.

"One interesting fact is for every dollar of engineering service within an IoT type of application, there is about a 5X multiplier for hardware," Fitzgerald said. As a result, IoT is helping drive semiconductor sales, including microcontrollers, sensors, wireless modules and other chips. IoT is also having an impact on "passive technology," he said. "Antennas are perfect example. Any type of radio needs an antenna, and an antenna is a passive of technology," said Fitzgerald.

Interconnect is also critical to Internet of Things, especially with industrial IoT. Industrial companies are looking at how they can get greater operational efficiency, reduce cost and improve quality through machine learning, machine vision and video inspection, said Fitzgerald. High-speed connectors are needed to accomplish those goals, he said.

Demand for IoT solutions is coming from established OEMs as well as emerging startups and Arrow services those customers with its components business. "Then we have enterprise computing business. They are working with system integrators and value-added resellers," he said.

More to IoT than Fitbits



Kevin Hess, senior vice president of marketing for Mouser Electronics

"There's obviously been a great deal of IoT growth in consumer, but I think the largest amount of growth will be in industrial and business applications"

A lot of IoT growth has been driven by the consumer market. Products such as smart watches Fitbits and other fitness devices are IoT devices and need sensing, processing and connectivity capability. But many distributors believe over the next several years, industrial and commercial applications will drive IoT applications, resulting in greater component sales.

"There's obviously been a great deal of IoT growth in consumer, but I think the largest amount of growth will be in industrial and business applications," said Kevin Hess, senior vice president of marketing for Mouser Electronics. Hess said it is hard to predict the impact IoT will have on the electronics industry, but IoT is

going to be in a lot of equipment and products. "IoT is going to be part of autonomous vehicles, part of warehouse automation, factory automation, and the smart home and medical."

As IoT become more ubiquitous, component demand will grow and some distributors will have to add product lines for sensors, wireless modules and microcontrollers. However, Hess said that Mouser was not adding suppliers strictly because of IoT.

"We are adding suppliers because of the advances in sensing types of products" and advances with components that require lower power and chips that have the processing strength to power multiple functions, he said.



One distributor that has seen sales of certain components increase because of IoT and has added product lines is Digi-Key, based in Thief River Falls, Minn. Dave Doherty, president and COO, said Digi-Key has added products from established suppliers and related startups because of IoT applications.

“Our sales of sensors have outgrown Digi-Key overall sales. That’s validation that IoT does have a meaningful place in our industry,” he said. Digi-Key is seeing greater demand for MCUs due in part to IoT. However, it’s hard to measure the impact IoT is having on Digi-Key’s MCU business because use of microcontrollers has increased in a wide range of electronics equipment over the last 20 years. “It’s a little harder to distinguish and attribute which of those microcontroller sales are going into IoT,” said Doherty

Digi-Key has added about 118 suppliers over the year and a half. A high percentage of those suppliers are because of IoT, including “additional new sensor guys and connectivity suppliers,” he said.

Long-term impact

IoT will impact distribution in the overall electronics industries for years, said Doherty. IoT applications such as wearable

electronics are in early stages and will continue to grow. IoT will also become more prevalent in industrial, medical and energy-efficiency applications, he said.

Karim Yasmine, senior corporate vice president for Future Electronics, said IoT has helped increase revenue for Future and is more than just a “great buzzword” for the industry. “It has driven excitement” because it is being used in so many applications, including factories, homes and businesses. “There really is no end to how many more things will become smarter and more connected. IoT has a great amount of growth potential,” he said.

To take advantage of that growth, Future is adding more services providers. “You have to continuously add partners on the services side because it’s moving fast and you have to be in touch with who the newcomers are that have a differentiated service,” he said. He said Future is looking at data service providers and device management solutions companies.

“That’s where there are a lot of new partners and we are signing two or three per month of new partners on the services side to remain relevant and have the services level that customers require,” said Yasmine.

Murdoch Fitzgerald, vice president sales and engineering at **Arrow Electronics**

“One interesting fact is for every dollar of engineering service within an IoT type of application, there is about a 5X multiplier for hardware”



He says Future did not have to add new component suppliers because of IoT. “We have a very solid line card and IoT did not require us adding any new lines.”

“Certainly, our line card continues to expand because it’s a necessity, but it’s not a necessity on the semiconductor lines for microcontrollers, wireless modules or sensors. We have a very healthy line card for sensors so we don’t need to buffer that,” said Yasmine.

He said Future’ focus has been to provide value to customers with design services and components. “The end goal is to sell components. I think it’s important that people don’t just talk about IoT at a nebulous high level, but drive down to an application level,” said Yasmine. The idea is to sell sensors, connectivity components and services to the IoT customer base that’s trying to make ‘their products more intelligent and connected,” he said.

The IoT challenge

For some distributors, IoT has great potential, but it is also a challenge. Dan Stewart, vice president of marketing and eCommerce for Allied Electronics, a distributor that focuses on industrial automation, says IoT is an opportunity, but it “seems no one has done a great job of making it simple and easy” for

industrial users of IoT.

He said IoT has been successful in the consumer segment but customers in the industrial segment are “still struggling a little bit with IoT. Distributors and manufacturers have not been able to communicate to customers about how IoT can solve a problem on the factory floor .

“Distributors and manufacturers have to do a better job of coming out with a good message about why a customer needs IoT,” he said. The message needs to be “here’s a way to make your machine run more efficiently. Here’s a way to reduce downtime on your machines. Here’s a way that you as machine builder can build something that is more attractive to your end customer,” he said.

Facing fake ICs head on

Counterfeit integrated circuits are a huge headache for purchasers and distributors alike. Chief executive of Saelig, Alan Lowne, presents a solution capable of checking component validity in seconds

In October 2015, a Massachusetts man was sentenced to 37 months in prison for importing thousands of counterfeit integrated circuits from China and Hong Kong which were resold to US Navy contractors for use in nuclear submarines. He also sold components to hundreds of other independent distributors and brokers in the US and Europe. The counterfeit ICs were marked as originating from thirty-one different IC suppliers, including Motorola, Xilinx and National Semiconductor. This case, and untold similar ones, show that counterfeit components in the supply chain are a significant and growing issue.

Creating fake “lookalike” parts is not difficult. It simply requires finding cheap parts in the same package and painting new marks on them. Unfortunately, the whole manufacturing and supply chain, from assembly house to end-user, is vulnerable and the number of companies that have been duped by fake devices is incalculable.

The impact has been felt by a variety of electronics systems used by consumers, businesses, and military customers. The detection of counterfeit components has therefore become an increasingly important priority, especially for electronics manufacturers and component suppliers.

Common counterfeit techniques

There are several ways counterfeiters produce fake

goods: empty packages can be marked to resemble actual ICs; cheap ICs are remarked to resemble more expensive ICs; ICs with similar characteristics are remarked to resemble more expensive ICs; and ICs can be salvaged from circuit boards.

The most prevalent counterfeiting technique is re-badged product. It is a simple matter to remove the existing mark from a chip package and put on a new logo and part number. Sometimes the chip is only an empty package with no die inside. Sure, the finished system would fail before it left the factory—but this still requires expensive investigation and rework, and with no part available to replace the bad one, could stop production. Worse still, the failure of borderline ICs may not occur until the system is in the field where repairs can cost ten times as much as those caught before they leave the factory.

Counterfeiting can also involve chips gleaned from discarded scrap boards. After remarking, parts are sold to innocent buyers who who assume that the products are genuine.

Finding the fakes

Usually, it is impossible to identify counterfeit components until they are fitted on a PCB when the final tests are made on the final product. Failure requires the costly identification of counterfeit components and removal from all boards in the production line. Complete batches of finished products

may need to be recalled—directly hurting a company’s bottom line.

Technical measures to solve this problem have previously included visual inspection of devices for marking errors and electronically testing or x-raying every incoming batch. Another, more destructive, method is to use a decapsulation system in order to visually inspect IC die samples, immediately losing revenue due to the component’s destruction. Not only is this expensive and time consuming, it requires complex training, skilled operators, and expensive equipment.

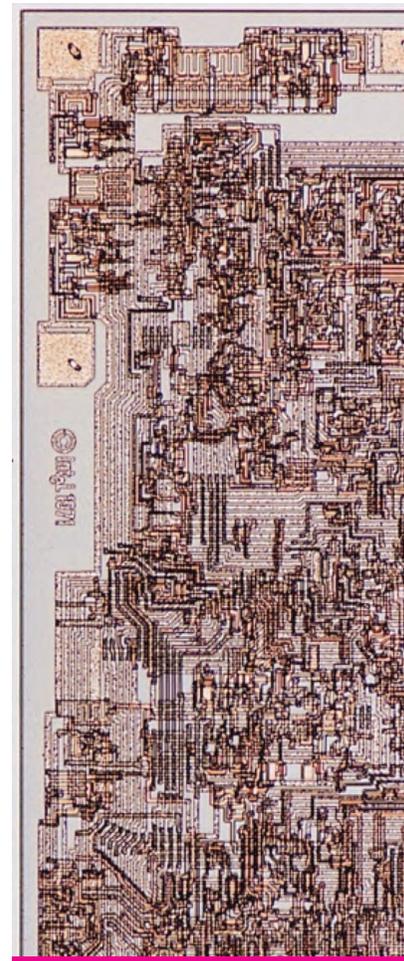
Some distributors advertise screening services to verify components, sometimes with a two-day turnaround, although, in many cases that is still unacceptable. These companies offer techniques such as: x-ray, x-ray fluorescence analysis, decapsulation, heated solvent testing, visual inspection, and solderability testing, resulting in detailed reports. In reality, however, this approach is only viable for military or large volume production runs.

Another approach is to perform a functional test on a sample of the ICs; logic I/O conforming to a truth table is an example. This will detect gross problems, such as an incorrect logical function, or no function at all, but will miss subtle ‘out of tolerance’ issues, which can be tell-tale signs that a component is counterfeit. With older-technology IC families,

different speed variants are available. Conventional testing equipment with this level of speed test capability is extremely expensive.

Simple screening

What the electronics industry really needs is a tool that can verify the identity of received ICs quickly and economically using a statistically significant



The ABI Sentry uses an advanced form of VI testing to determine an IC’s electrical characteristics or ‘signature’



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procedure. Component purchasers require a tool that is suitable for all devices and packages, simple to use by any operator, and capable of producing a fast 'good/suspect/fail' result.

In fact, there is such a commercially available device: the ABI Sentry Counterfeit IC Detector. This PC-driven product uses a complex PinPrint test algorithm to check the validity of parts in seconds. It is designed to be simple to use with minimal training as analysis takes place in the background and the operator only sees a simple 'Good Device', 'Blank Device' or 'Fail Device' message, with the option to produce a detailed report to send to the supplier.

According to its manufacturer, the ABI Sentry benchtop device uses an advanced form of VI testing to determine an IC's electrical characteristics or 'signature'. VI testing applies a voltage waveform between two IC pins and measures how the current drawn changes as the applied voltage varies. This response is directly related to the device characteristic, its internal structure and manufacturing processes.

A vital benefit of the Sentry device's VI Matrix Test is that

it exercises every possible pin combination on the IC under investigation. This provides great insight; more than simple systems that are restricted to testing between pins and ground. The Matrix VI Test can reveal differences between devices with different functionality but similar technology and a relabeled chip with the same input/output pinout would be detected by this test.

Testing against a known device

Sentry is also thought to be the first system capable of using a known good device to obtain a 'gold standard' signature. A known good component is locked into the Sentry's zero insertion force socket, and a test pattern is then applied across all pins. The component's response to this test pattern, or PinPrint, is automatically measured and stored as a benchmark.

Subsequent signatures of incoming, unknown chips are compared with this known good version to check for discrepancies. Sentry uses a combination of electronic parameter settings including voltage, frequency, source resistance and waveform to generate the 'signature' for each pin of the IC being checked. It then compares the unique electrical

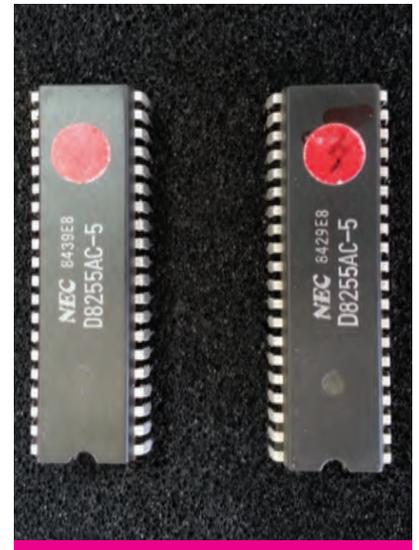
characteristics of known components and with suspect components.

Small variations are likely to indicate that the chips are from different manufacturers, or possibly different batches from the same manufacturer. Larger differences, however, suggest that the chips are faulty or counterfeit. Sentry can quickly detect missing or incorrect dies, lack of bond wires, inaccurate pin outs and pin impedance variations. It can also be customized for each IC type by setting tolerances that define the point at which a tested device is deemed 'bad'.

If no reference devices are available there are two alternatives. Reference data can be exported from other users' machines or libraries and imported into the Sentry's database. Alternatively, though not quite as good, testing can be done across the batch. If there is any variance then the whole batch becomes suspect and should be rejected. A package with no internal die is easily detected with all pins showing the 'null response' of an open circuit.

Supporting traceability

Controlled via USB using PC software, Sentry's device library can be built up by adding specific known good



Chip package markings can be almost identical to the untrained eye



Sentry can quickly detect missing or incorrect dies, lack of bond wires, inaccurate pin outs and pin impedance variations



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devices. Each device can have documents associated with it, such as photos of device markings, data sheets, and other documents to help confirm the integrity of a device.

To build this database, Sentry can analyze the electrical characteristics of ICs with up to 256 pins. Devices with over 256 pins can also be tested by rotating the BGA or QFP to allow all pins to be learned and compared. The equipment is supplied with four 48-pin dual in line zero insertion force sockets; these can be used directly for older DIP components but can also be used to accommodate a variety of additional socket adapters for different package types including DIP, SOIC, BGA, SSOP, or discrete components. The socket adapter can contain multiple IC sockets if required, to allow testing several ICs at the same time or comparing one IC with another. An expansion connector allows custom socket adapters with up to 256 pins to be attached.

Designed in Europe by ABI Electronics, Sentry is ideal for component distributors and suppliers or manufacturer receiving departments that want to conduct sample testing. Detailed reports can be saved to provide quality control traceability. When used effectively, Sentry helps guard against the infiltration of counterfeit devices, identifying bad parts before they are mounted on PCBs, thereby saving time, money and frustration.

Practical counterfeit testing

As parts become increasingly complex, 100 per cent testing becomes burdensome, but testing one or two pieces in every 200 is manageable. Variations arising from a suspect shipment will reveal themselves well before such a test is complete. Nevertheless, if non-destructive testing is required, using a Sentry Counterfeit IC Detector can be the ideal solution.

This practical solution addresses the counterfeit IC issue using a rapidly built dedicated library of component data to cross-check each part tested. With lead-time issues making ICs harder to acquire to meet aggressive manufacturing schedules, identifying any parts that are not 'real' before they enter production can potentially save every manufacturer a great deal of time and money—as well as that intangible but irreplaceable quality—brand reputation.

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Sentry is ideal for component distributors and suppliers or manufacturer receiving departments that want to conduct sample testing



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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

The Americas - IP stealth-wealth transfer

In this article, John Denslinger investigates the cost to company and country when technology-based intellectual property is lost or traded

Tariffs • By John Denslinger

Given an engineering background and lengthy career in hi-tech, I am fascinated by the tariff one-upmanship between the USA and China. It seems every week brings another rate hike threat. Often it's just words. A negotiating head fake meant to tilt the debate in one direction or the other. Don't be duped into thinking the rate juxtaposition is the battle. It's merely the leverage vehicle. The real battle is all about safeguarding intellectual property and the stealth-wealth transfer that results.

No one can doubt China successfully accelerated its economic and technological development through a systematic theft of IP from more advanced trading partners. To be fair, China did: make capital investment cheap and a key priority; created an inexhaustible, well-educated, dexterous workforce; enabled access to foreign markets for its products; and openly solicited overseas companies to manufacture in a low cost/high value environment. There is also no doubt US companies eager to participate in the Chinese economic miracle willingly traded away the crown jewels, their IP. It's unfortunate that so many companies capitulated to this forced technology transfer. They didn't have to, but I sense FOMO (fear of missing out) was too great a risk not to take. China, on the other hand, bears full responsibility for the balance of its ill-gotten gains achieved through coordinated acts of deception: cyber hacking; unlawful infringement on registered patents, trademarks, and copyrights; bonuses for theft of trade secrets; and deep state industrial espionage. Given all this, is it possible to stop this ongoing IP stealth-wealth transfer?

Before tackling that question, allow me to add monetary perspective to the conversation. Imagine the advantage a company would have over its competition if it didn't have to invest in R&D and could readily covet any 'know how' it needed without consequence. Now imagine a country that has done so on a truly enormous scale; a country that

costs the American economy alone somewhere between \$225 billion and \$600 billion annually according to a 2018 US Trade Representative report; a country that readily commercializes new technologies locally then exports its version often under-cutting the same domestic suppliers it stole the technology from in the first place; a country that in less than 40 years became the world's number two economic and military powerhouse.

As for the injured companies, the cost is significant as well. According to Harvard Business Review, intangible assets, which includes IP is 80per cent of the value of S&P 500 companies. Unlawful IP theft is ongoing and irreversible. The consequence to most: lost opportunity, lost competitive advantage, lost sales.

The sad fact remains: the IP stealth-wealth transfer continues today despite the tariff bantering. Until now, no country, including the USA, has ever dared to enforce an economic showdown over the IP issue. While the media focuses exclusively on the tariff battle, ending IP theft as a routine industrial practice is the real goal. I see negotiations difficult and enforcement relentlessly challenging.

Earlier I asked the question: is it possible to stop the IP stealth-wealth transfer? The simple answer might be yes in principle, but highly doubtful in practice and definitely not soon. It seems the tariff pain isn't great enough yet.

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Is outsourcing still the answer?

Strong demand for smart phones and 5G wireless has prompted an increase in contract electronics manufacturing. Although the shift to low cost regions may be over, it seems appetite for outsourcing continues to grow

With the release of its latest annual electronics manufacturing services report, the 'Worldwide Electronics Manufacturing Services Market – 2019 Edition', New Venture Research is highlighting healthy growth in the electronics industry. Notably, the preceding year saw significant expansion for the contract manufacturing market, with a total revenue increase of 15 per cent.

The results are particularly encouraging coming as they do on the back of flat revenue growth from 2013 to 2016. Dramatic expansion in 2017 and 2018, however, has prompted the welcome news of a combined EMS and ODM revenue of nearly \$542 billion; an expansion of \$70.7 billion.

Connectivity drives growth

Strong demand for smart phones has sustained the contract manufacturing market, along with even more powerful demand for the infrastructure networking equipment required to build out the 5G wireless architecture. This has seen a boost in products like enterprise storage systems, enterprise local area networks and servers. Furthermore, the need for cloud computing, social media, and real-time data and video streaming has also been a strong driving factor in demand for advanced switching, routing, and wireless communication hardware.

So how does the industry building all this equipment break down? Overall, the

report looks at 42 electronics manufacturing service providers and 17 original design manufacturers, recording that the industry was once again profitable for the ninth year in a row.

Foxconn accounted for nearly half of all the money made by the EMS industry in 2018, and EMS companies accounted for approximately 80 per cent of the total. Reassuringly, only five EMS companies and one ODM lost money in 2018. Pegatron ranked second in net income for EMS firms, meanwhile Delta Electronics, Quanta Computer and Lite-On ranked highest in earnings for the ODMs.

Plant closures and openings were rare in 2018 as most companies appear to have right-sized their operations or closed facilities due to consolidation. New openings clearly related to new business opportunities, while closures are being driven by economic decisions about company structure.

Outsourcing tomorrow

Looking ahead, communications and computer products will continue to be the segments driving the largest growth in the electronics industry. Fueled by demand for EMS services, the research indicates that the contract manufacturing industry will grow from \$542 billion in 2018 to \$777 billion in 2023; around 7.5 per cent per year.

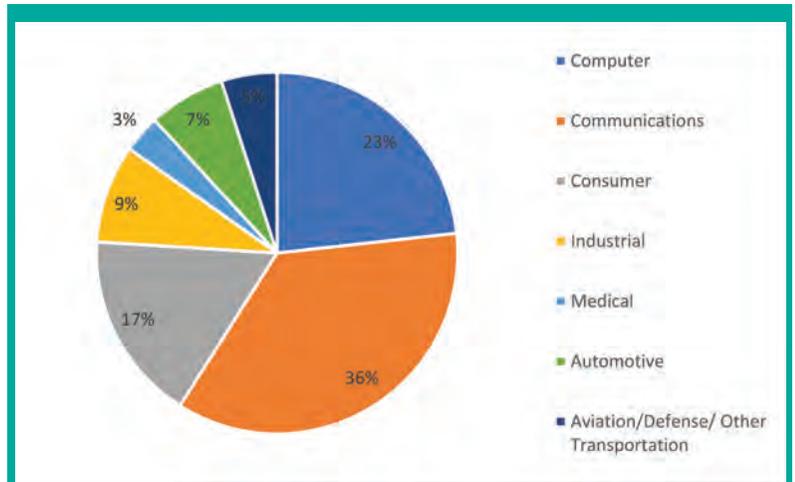
As the report highlights, outsourcing has clearly become a critical element in keeping the electronics

assembly industry expanding and in driving costs down each year, making it a leading factor in stimulating continuous consumer demand and technology deployment. Despite the trend to move price-sensitive manufacturing

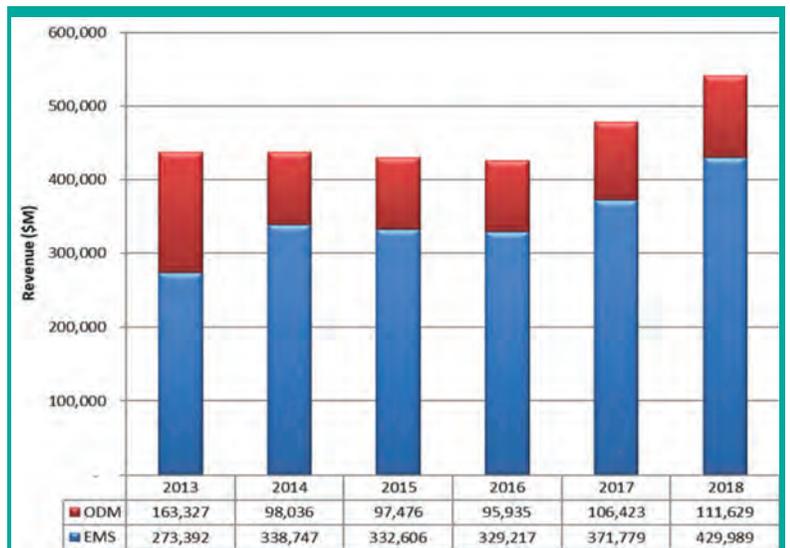
to low-cost regions having come to an end, it seems its impact will continue to shape the industry for all suppliers, at least in the foreseeable future.

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Communications and computer products drive the greatest growth in the electronics industry – a trend that looks set to continue



The electronics industry continues to increase its reliance on contract manufacturers



Devil is in the detail

Recom Power's Bianca Aichinger and product manager at Rutronik, Axel Stangl, explain how choosing the correct power supply involves balancing several interrelated factors that influence efficiency, reliability and operating lifetime

How do you choose a power supply for your project? Simple: find the input mains voltage, the required output voltage and current, and then pick the cheapest supplier that meets the specs. In reality, it's not that simple.

Opt for high efficiency

Most power supplies, for example, specify a conversion efficiency, however, this is often only quoted at the nominal voltage. With global mains supplies varying up to 10 per cent from this value, power supplies can spend a lot of time working at much lower efficiencies than advertised. Take a 'global' power supply, operating at between 85 and 264V AC: the manufacturer may claim an efficiency of more

than 90 per cent at a nominal voltage of 230V AC, but not highlight that it only runs at 70 per cent efficiency at 120V AC.

Even small differences can affect the operating costs of the supply. Compare two devices, with 90 and 92 per cent conversion efficiencies. The difference doesn't seem much, but if you compare the energy losses, at 10 and eight per cent, respectively, you see that the first device is dissipating 25 per cent more heat than the second. This might be enough to necessitate forced cooling, increasing size, complexity and cost.

Reducing heat generation also extends a

system's service life. As a rule of thumb, increasing the temperature of a system by 10°C halves its life expectancy. Increasing a supply's conversion efficiency by a couple of percent could therefore really extend its operating lifetime.

Compare reliability

Reliability is another key issue. The mean time between failure of a supply is derived from a statistical analysis of the average time between failures during the product's useful working life, setting aside early-life and end-of-life failures. In practice, the MTBF for switched-mode power supplies is often quoted as several million hours. ▶

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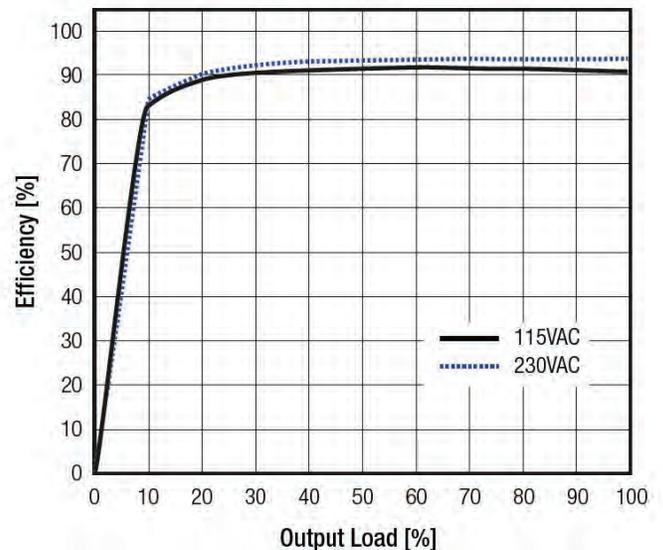
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MTBF figures can, however, be derived using various standards such as MIL HDBK 217F, Bellcore TR-NWT-000332, and SN29500. Each takes a different approach, which can lead to different values, so it is important to use a consistent MTBF measure when making comparisons.

Used properly, MTBF figures can help buyers compare device reliabilities but they can't help to predict life expectancies. This takes extensive testing. One way to start is to do a 96-hour accelerated stress test at 85°C and 95 per cent relative humidity. Checking datasheet parameters before and after this test offers insight into service lifetimes, since it's regarded as equivalent to operating the device under test at ambient temperatures, 24/7, for 7¼ years.

Another important factor to consider is efficiency at low loads. Some switched-mode power supplies only achieve their best efficiency close to their nominal output, offering lower efficiency at lesser loads. Well-designed power supplies, on the other hand, offer constant high efficiency, even at medium and low loads.

Look for long service life

To address these issues, Recom has developed a series of DIN rail power supplies with long service lives using components with operating temperature ranges greater than the values specified for the finished supplies. REDIN products offer a nominal conversion efficiency of 93 per cent, which minimises heat generation so the supplies can be used at operating temperatures of -25 to 70°C without active cooling. They also have a power factor of

more than 0.95 and active power factor correction.

Buying the right supply means balancing several critical factors that can affect the utility, reliability and operating lifetime of the end-product. Alternatively, you can rely on a manufacturer that already takes these factors into account. Then you're done.

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Company Profile

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For more than 70 years OKW has pioneered the development of ergonomic enclosures and tuning knobs. The company expanded to North America 25 years ago and continues to grow rapidly.

As a manufacturer (rather than a distributor), OKW is able to offer high levels of technical expertise. This helps engineers to source enclosures quickly and cost effectively – enabling them to specify superior housings and reduce time to market.

Regular investment in new technology has enabled OKW to manufacture customized electronic enclosures in much smaller volumes – opening up a wealth of design possibilities previously not available.

OKW Enclosures President Sean Bailey said: “Our customers deal directly with us – rather than via a middleman.

“This not only saves you time and money, it also ensures that nothing from the specification brief is

ever ‘lost in translation’. And our engineers can alert you to a whole host of possibilities – enhancing your products,” he added.

Unparalleled customisation solutions and a huge range of standard enclosures mean that no two OKW customers’ cases need ever look the same. Each elegant, modern case is designed with discretion – so it will showcase the product but never ‘overpower’ it.

“Put simply, our standard enclosures don’t look ‘standard’. This makes it much easier to ensure each housing looks like a one-off created specifically for your electronics,” said Mr Bailey.

For the last few decades OKW has been best known for its huge range of innovative plastic enclosures (and it still is).

But recently the company made another massive leap forward with the launch of highly advanced aluminum enclosures. They combine finely finished extruded aluminum with high performance plastics and advanced technical features – completely rewriting the enclosures rulebook.

New SMART-TERMINAL is OKW’s latest aluminum offering. These

sophisticated desktop and wall mount control enclosures are big enough to house touchscreens and large-volume electronics assemblies in style.

But OKW also continues to innovate in plastic – choosing UV-stable ASA+PC-FR for its brand new PROTEC range of wall mount and desktop housings for security, building control, IoT/IIoT, Smart Factory, Industry 4.0 and medical technology.

ASA is also the plastic of choice for OKW’s BODY-CASE wearable enclosures – wristwatch-style cases that fit an 18 mm standard strap. They can also be clipped to a belt or suspended from a lanyard or wrist strap.

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The basics of buying wire and cable

Wiring and cabling can be found everywhere from consumer applications to industrial equipment. Here, president of Memory Protection Devices, Tom Blaha, helps purchasers as they address performance and cost efficiency queries

When sourcing wire and cable products, purchasers will find a wide range of wire and cable products with variable characteristics, including: size or gauge measured in AWG or KCMIL; physical strength; radiation resistance; weight; electrical properties; chemical/oil/moisture resistance; flexibility; temperature rating; durability; sunlight resistance; flame resistance; and finally cost and availability. Prioritizing these characteristics will help determine the ideal solution, as trade-offs are often required.

What is wire?

A wire is a single conductor, usually copper or aluminum, while cable is defined as two or more insulated wires wrapped in one jacket. Multiple conductors not separated by an insulation layer are typically classified as a single conductor.

There are three types of cable: signal; power; and control. Signal cables are rated for low power, low current for applications such as TV cable, electronic cable, fiber optic cable, data cable, electromagnetic wire, low voltage power, and communications. Signal cables are usually shielded and carry data modulated power ranging from four to 20mA DC current.

Analog signal transmission typically consists of two-wire signal leads or three-wire signal leads. Where precision and accuracy are required, a

third signal lead, or shield, is necessary. In the three-wire configuration, the shield is grounded at the signal source to reduce common-mode noise. Four types of signal cables are used to carry analog signals: plain pair, twisted pair, co-axial, and shielded-pair. These cables are normally single pair cable with a cross-sectional area ranging from 0.5 up to 1.5mm².

Power or control cables come in larger gauges and typically deliver 24V DC or 110/230V AC unshielded to heavy-duty applications including mining, energy, transportation, infrastructure, or industrial machines. Control cable is usually insulated and sheathed with PVC and paired with a circuit protection device.

Understanding electricity

Electricity is measured in volts, amps and watts. Volts represent the amount of electrical force delivered, with the specific voltage determining insulation thickness requirements. Amps represent the quantity of energy delivered, with conductor size determined by the required amperage. Watts measure total energy using the formula: watts = volts x amps.

Different applications are UL-rated for a specific voltage and current. Low voltage or low tension LT cable can be used up to 1000V while high voltage or high tension HT cable is used between 1000V and 11KV. Super tension or

ST cable is suitable for use from 11 to 33kV and extra high voltage or EHT cable from 33 to 66kV. Finally, for applications above 66kV, specify extra super voltage or EST cable.

Common cable choices

Wire and cable are integral to many electronics applications from circuit prototyping and wire harnessing to Ethernet connectivity and high voltage power transmission. Electronic devices primarily use copper wire, which is considered an excellent conductor and relatively inexpensive, ensuring it is popularly used for transmitting both AC and DC current. Tinning can be used to alter the properties of wire as can annealing, a process where wire is heated to 700°F, then cooled to make it more flexible.

Popular wire products used in electronics include solid hook-up wire which comprises a single strand of insulated copper wire. While not very flexible, this is often used as magnet wire in transformers and motors or for prototyping on a breadboard. Stranded hook-up wire is more flexible making it ideal for use in tight spaces. It consists of a bundle of thin copper wires twisted or braided together to extend the life of the wire in high-vibration applications.

Another commonly specified product is coaxial cable. Coax combines a solid copper core with a tubular insulating layer surrounded by a tubular conducting shield and a plastic jacket. It is commonly



Network cable can be used for high speed data transmission and is typically available in twisted pairs to cancel out EMI



Coax combines a solid copper core with a tubular insulating layer surrounded by a tubular conducting shield and a plastic jacket

used to transmit radio frequency signals that require protection from electromagnetic interference.

Network cable includes coaxial, as well as CAT3, CAT 5, CAT6, CAT 7 and fiber optic cable. It can be used for high speed data transmission and is typically available in twisted pairs to cancel out EMI. Finally, various types of computer cable are commonly available including ribbon, socket ribbon, male to female ribbon, USB data sync, ATX, extension cables, power charging cables, and more. A common requirement for these applications is the need for flexibility.

Products sold in the US usually carry Underwriters Laboratory registration, including: UL1007; UL1569; UL1423; UL94V; and ULVW-1. Other notable US approvals include MIL-C for military-grade cables and components, and CL2 / CL3 for audio cables and speaker wire.

Specifying jackets and insulation

Purchasers will be aware that jackets and insulation also offer many variables, including: wall thickness; electrical variables such as capacitance, insulation resistance, and dielectric strength; physical characteristics such as abrasion resistance or deformation; chemical/environmental resistance; long-term reliability; flexibility; radiation resistance; and smoke and flame resistance.

Designed to help prevent shorting, insulation is a non-conductive material applied over conductors to provide electrical isolation between conductors. Jackets are applied over conductor insulation or a cable core to enhance its mechanical, chemical, or electrical properties. Versions include thermosetting; thermoplastic; fluoropolymer; elastomer; and rubber. Armoring and shielding provides even greater protection.

Finally, any wire and cable products used in electronic assemblies need to be properly terminated and tested to ensure that a reliable electrical connection has been achieved. Through careful consideration of all these factors, purchasers will be better equipped to select, specify and buy the optimum cable for their application.

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Stranded hook-up wire is more flexible making it ideal for use in tight spaces



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Getting the timing right

Electronics Sourcing North America asked vice president of global technical sales and marketing at ECS, David Meaney, what purchasers should prioritize when sourcing frequency control products

Q What should buyers look out for when sourcing frequency related products?

When selecting and buying frequency control products or power inductors for a new or existing design, look for a brand that is well known and respected in the industry. Most modern applications will require several clocks in the design and a good FCP manufacturer should offer a wide array of products to choose from including crystals, oscillators, voltage controlled oscillators, temperature compensated oscillators, oven controlled oscillators, as well as resonators and filters.

The product is only part of the equation, however, and manufacturers should also offer engineering and technical resources to support customers' design efforts. A regional sales manager should be available to help with part numbers, pricing and delivery, plus a local manufacturer

representative to provide real time support, and a strong sales channel with product held at major distributors.

Q What are the differences between crystals and oscillators?

A crystal is a specifically cut and formed piece of quartz that will resonate at a pre-determined frequency when a voltage is applied. This is known as the Piezo-electric effect. These formed crystal blanks are connected to electrodes and placed in a hermetically sealed package. To form an oscillator circuit, the crystal will need to be controlled by external capacitors and resistors. This is cost effective but less precise than other timing methods.

An oscillator is self-contained and doesn't need outside components to generate a stable clock. Starting with the crystal blank that has been cut and formed to resonate at the desired frequency,

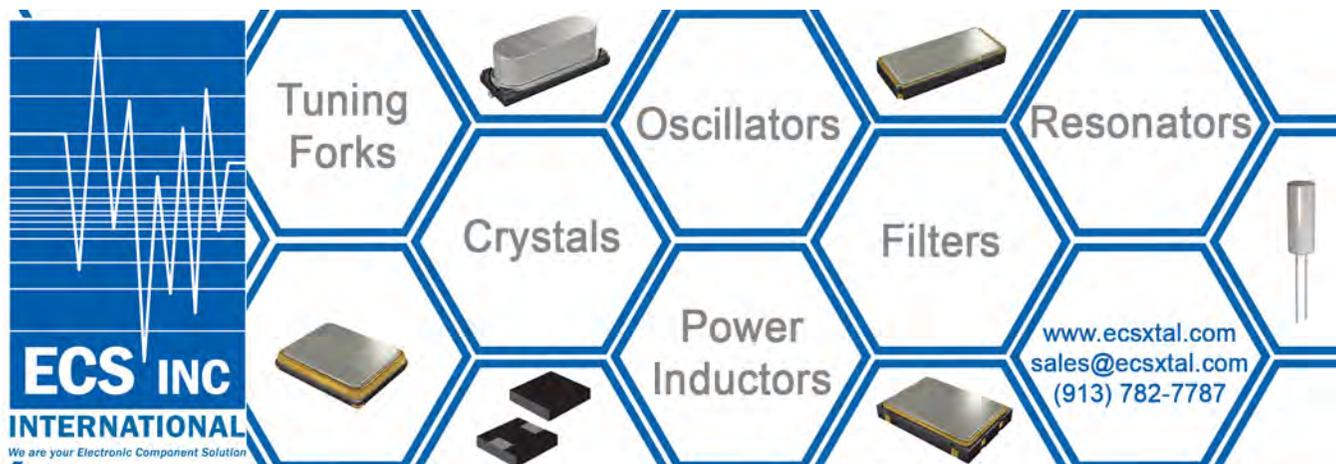
or a harmonic thereof, the manufacturer adds a capacitor to clean up power supply noise. Next, an output buffer IC is added to take the incoming sinusoidal wave and convert it to a square wave. It may also multiply or divide the frequency to achieve the desired frequency of operation.

Q Are counterfeits a problem in the supply chain?

In this market there is always a risk that people with nefarious intentions will attempt to duplicate or counterfeit product. Their goal is to use the good name of a reputable FCP manufacturer to supply cheap knock-offs at a discount price. The issue of counterfeit components can result in unnecessary inspection and testing, lost revenue, and field product failures. Purchasers are therefore encouraged to use an authorized distributor channel for components as this guarantees the highest



Vice president global technical sales and marketing at ECS, David Meaney





quality products and technical support.

Q How are lead times holding up?

When managing the supply chain, it is vital to understand how and where products are used and keep an eye on product inventory trends. Since we follow these market indicators, we can keep our lead times for products we don't stock at well below 10 weeks. We also offer our customers 'just in time' delivery by keeping significant amounts of product in our distribution sales channel.

Q How do you see frequency products developing in the future?

Frequency control trends are always changing. Through the 1990s and early 2000s we saw a technology boom. The widespread use of communications equipment, faster computers, and the internet were really pushing

the need for high speed stable clocks. Today products are compact, portable, battery powered, and connected to the internet. Connectivity is expected and can be critical for those that depend on the internet of things for medical and safety needs. Demand for performance has not changed, but we must also focus on designing products that have a small form factor and use less power.

In the future, systems will still require stable quartz-based clocks to make them run smooth. Expect to see embedded FCP products as part of system on a chip components, wireless clocking modules, and products that are capable of multi-function operation. The future is unknown but for certain, there will be a need for quality timing products of some sort.

Q Aside from cost, what are the three most frequent questions from procurement professionals?

Purchasers looking to build partnerships tend to focus on three areas. Corporate details such as where we are headquartered and how long we've been in business are essential. Our HQ is in Lenexa, KS and we've been operating for 39 years.

Other questions center on our products asking what additional products we manufacture and what our product roadmap looks like. As ever we're focused on making our products smaller, tighter, and faster. Many also ask whether we offer technical and engineering support, to which the answer is yes.

Lastly, buyers want to know about our supply chain, such as whether we sell through authorized distribution channels, which we do, and which distributors are franchised for our products. A full list is on our website, but it's also possible to buy direct from us.

ecsxtal.com



Purchasers looking to build partnerships tend to focus on corporate, product and supply chain details

Why custom isn't always costly

Resolving component shortage issues can involve custom test solutions, innovative design adaptations and serious troubleshooting. With the right skills it can also be cost-effective says general manager of Winslow Adaptics, Josh Mancey

Q What purchasing trends are you seeing in the test and development markets?

Demand for machined test sockets is increasing. The desire for smaller, fine-pitch, high-speed devices has significantly increased the choice in package types available to system designers. Due to high front-end tooling costs, it's becoming less viable for test socket manufacturers to provide a commercial, off the shelf test socket solution to meet demand and as a result the trend is towards machined test sockets.

Manufacturer consolidation and the inevitable obsolescence caused by newer technologies has created a surge in the requirement for legacy lines. Often these devices have been stored for some time and are not sourced from manufacturers' stock. When a COTS solution for test, emulation or prototyping isn't available a machined socket is often the only answer.

Q Doesn't custom mean expensive?

Cost will always be relative to the environment and the application, but custom doesn't always speak expensive. Very often it's the cost of not engaging with a

specialist manufacturer that becomes prohibitive. It's crucial that your test socket is robust and reliable, and that the results you see are from the device under test, not the test socket.

Q Is it possible to reduce test costs?

You may want to consider whether it's necessary to access all signals in a single test procedure. In practise it's feasible to reduce the pin count of a high density test socket for a high count BGA package to 25 or 50 per cent of the I/Os. This requires the user to write their test programme accordingly and to rotate the package in the socket to complete the test. Whilst

slowing the test process, this can introduce a significant hardware cost saving that could be beneficial during counterfeit or post storage testing.

Custom machining will also facilitate the addition of multiple test cavities in a single clamshell design to increase test throughput. As an example, the Gate Driver



General manager, **Winslow Adaptics**,
Josh Mancey





When a COTS solution for test, emulation or prototyping isn't available a machined socket is often the only answer

LMG1205YFXR for Texas Instruments is a DSBGA12 measuring just 1.9 by 1.75mm. A single test socket can include 25 test cavities for this type of package providing cost benefits of up to 80 per cent. Sockets can be manufactured with both surface mount and through board interconnect.

Q How about leadtimes?

Often when a test socket is required, it's required urgently. Manufacturers who specialise in machined test sockets operate with design and piece part standardisation. This facilitates typical leadtimes of 20 working days, however this can be significantly improved when required. COTS production test sockets often have a five to eight week leadtime from the manufacturer.

Q Does size and form matter?

In a word, no. A mil-aero company had a number of obsolete Actel A1010 FPGAs that had been in storage for future use. The devices required full functional testing at -55 to 125°C prior to release for production. The package still had tie bars attached to the package leads which were therefore unformed. Machining a socket meant this could be accommodated with ease.

Q What information is needed from the customer?

The device part number or datasheet, test environment and test quantity. If the device is attached to a circuit board so, for example, an in-circuit test is required, then some detail of the position of neighbouring components is required.

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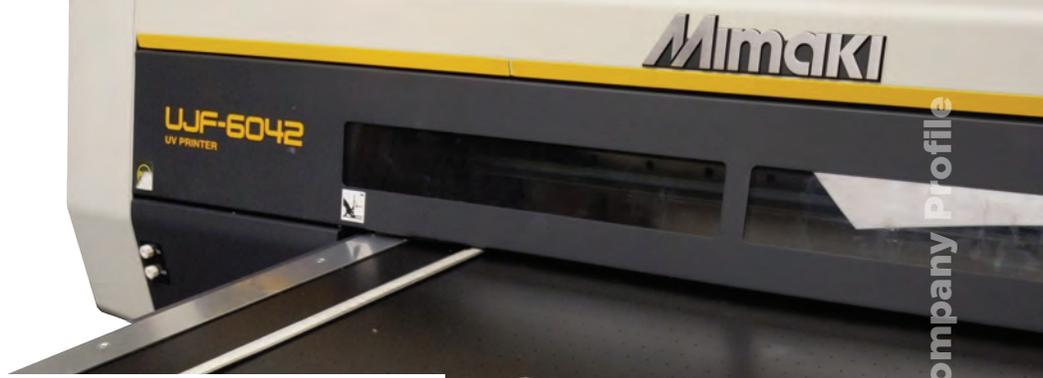
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Providing Ready-To-Use Class-Leading Metal Enclosures



METCASE is the metal enclosures division of OKW Enclosures, Inc – specializing in class-leading 19” rack cases and desktop/portable instrument housings.

Over three decades METCASE has grown into a key innovator in the metal electronic enclosures market, challenging the status quo with its advanced standard and custom metal enclosures.

Innovation and customization have been key drivers in the METCASE success story. Its strong investment in cutting edge CNC punching, forming and machining centres, along with modern painting facilities and digital printing technology, has made customization available in much smaller batches.

Most customers now specify the enclosures fully finished and ready for their PCBs; the online specification process is so easy:

- exploded view videos show all the technical benefits of each model
- customization services such as punching, fixings/inserts, finishing can be added at a click – as if they were products
- customers can download 3D models to see how their components will look in their finished enclosure.

METCASE also offers a highly cost

effective prototyping service. For a fixed fee, its design engineers will develop an instrument enclosure or 19” rack case from scratch – giving a fully finished prototype and a follow-on 10-piece production batch.

METCASE Vice President Marketing Robert Cox said: “This service is incredibly popular because it gives customers access to our specialist design engineers for a cost effective fixed fee.

“Not only does it make prototyping costs much more predictable, it’s also a great option for lower volume orders such as 20 to 50 units.”

METCASE’s most advanced instrument enclosure is TECHNOMET. It’s a game-changer. Flush-fit bezels create a modern, cohesive design with no visible fixings. The optional tilt/swivel carrying handle doubles as an adjustable desk stand to create the perfect viewing angle.

Mr Cox said: “We wanted to create a metal enclosure that had the curves and fit quality of a molded plastic enclosure. It was quite a challenge – especially the sloping front version – but well worth it. We’ve had fantastic feedback.”

METCASE’s most popular 19” rack case is COMBIMET. Its smart design made it a bestseller in a matter of months. Advanced design means customers get the best of both

worlds: METCASE’s most versatile range of 19” enclosures is also its most cost effective.

This success has led to rapid expansion of the COMBIMET range. Versions include extra deep (24”) cases for server racks, new smooth top cases (which offer enhanced aesthetics and easier access) and open top cases – all available as standard, ready to ship.

For more information, view the METCASE website:

www.metcaseusa.com

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3000 Old Pond Road,
Bridgeville, PA 15017
USA

Contact: Robert Cox, Vice President Marketing, OKW Enclosures, Inc.
Toll free: 800 965 9872
Phone: 412 220 9244
Email: sales@metcaseusa.com



Smart support underpins IoT growth

President of TTI Semiconductor Group, Michael Knight, explains how the company has enhanced its offering with the acquisition of Symmetry and the creation of a high-tech application engineering support service

Q It's two years since TTI acquired Symmetry. What have been the biggest challenges to date?

Acquiring Symmetry was the start of the TTI Semiconductor Group and as such it blazed a new path within the TTI family of companies. Symmetry's path into the mix has been very smooth. Its first full year as a TTI company saw sales grow more than 50 per cent. What challenges there are, have been associated with fast growth, namely, attracting additional talented team members, especially in the area of technical sales, and navigating rapidly evolving technology in the wireless IoT space.

Q Has Symmetry altered in any way to fall under the TTI umbrella?

By design, the company is standalone from the other TTI companies and as such has not changed its focus, controls or business processes. There is growing collaboration with other TTI companies, TTI and Mouser in particular, where customer application and component supply chain needs suggest that we can bring increased value to the customer through inter-company coordination.

Q What developments or changes have you imposed over the last two years?

The biggest change has been leaving profits in the business to nourish growth,

plus forward investing in additional people and inventory. These are the key ingredients upon which a distributor is built. Since the acquisition, inventory has increased almost five-fold, reaching a point where more space was needed. This led to our carving out a place for Symmetry in a TTI warehouse in Texas, and the transference of all stock to that space in mid 2018. The Symmetry inventory remains in their complete control but now resides in a warehouse that is a free trade zone, ITAR and DFAR compliant, with cross-trained non-Symmetry warehouse workers on hand that can jump in and help during peak activity.

Q Have you added any new franchises during this period?

The line card as acquired was perfect for Symmetry's core wireless and video focus and as such there was no fine tuning involved. Where some additions were made, and are to be made, are in component areas that are synergistic to the internet of things stack, namely, sensors, antennas, batteries and cloud connectivity. The goal is to be a total solution provider for any company working on making their end product 'smarter'. Smarter means more capable of gathering and using data and connected to the internet. This happens to describe a great many of TTI's customers, hence the excellent opportunity for collaboration.

Q Have you introduced any new or updated services at Symmetry?

Symmetry is just launching a new way of providing application engineering support that is more time effective for customers and cost effective for the business. This Virtual Application Engineering service equips Symmetry application engineers with high end video and audio streaming equipment so they can interact on-demand with a customer engineer. The connection set-up is quick and can be done through Wi-Fi or even a mobile phone hotspot. The video and audio are crisp and clear, and once a project is started, the customer engineer can plug in with the Symmetry VAE on an ad hoc basis using the camera and microphone in their computer or mobile phone. With this system, a VAE can review circuit designs, firmware, and even assemblies, make notes and annotate as if on a whiteboard, demonstrate devices on equipment in their lab, and pull up and share documents.

VAE 1.0 isn't fancy, but it is effective. Using the latest software, web services and portable video conferencing equipment, we are able to replicate an in-person meeting between application and customer engineers. As things like virtual reality and smart glasses mainstream, subsequent versions will incorporate those technologies to make the interactions even more life-like. In this way, Symmetry VAE's can



Michael Knight, president of the TTI Semiconductor Group and senior vice president of corporate business development

“
The goal is to be a total solution provider for any company working on making their end product 'smarter'
”

Mouser Electronics By the Numbers

- Over 1 million parts in inventory.
- Over 2,500 employees worldwide.
- 24-Hour Operation.
- Authorized distributor for more than 750 manufacturers.
- 27 Global Offices.
- 21 Website Languages.
- 63 Country Website Subdomains (xx.mouser.com).
- Mouser accepts 27 currencies online.
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- On Time Shipping Arrival: 99%+ Success Rate.
- Orders are processed in as little as 15 minutes.
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deliver on-demand support that isn't dependent on travel time. Trials conducted with customers were extremely positive and other companies in the TTI semiconductor group will likely follow suit.

Q Do you tap into TTI, Mouser or Sager inventories, or is Symmetry inventory separate?

Symmetry suppliers mostly also work with Mouser, but with only one or two exceptions, they are not found on TTI or Sager's line cards. Where we do have franchise commonality, it is easy to provide inventory assistance as needed between companies, but this is a rare occurrence as TTI companies don't skimp on stocking behind their customers. This means that they rarely find themselves short of parts.

Q Where do you see the biggest growth for semiconductors in North America?

Last year, North America semiconductor growth was widespread and obvious. This year, forecasts for market value have gotten negative as the months have ticked by but much of that is related to the dramatic fall in memory pricing. Many segments will finish 2019 with year on year growth on a unit basis.

In fact, I see near and long-term growth for the semiconductor market driven by the growth of electronic content in literally everything. This is especially true for developing end market applications like 5G communications, the electrification of transportation and green

energy production and for general purpose technology applications like internet of things. To fully appreciate how rapid and pervasive electronics deployment is, one only needs to note that both Pampers and Huggies have recently launched sensor and Bluetooth enabled diapers for infants.

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Symmetry suppliers mostly also work with Mouser, but with only one or two exceptions, they are not found on TTI or Sager's line cards



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Sager Electronics began in 1887 as a single storefront in downtown Boston that serviced the growing interest in radio technology.

Under the vision and leadership of Joe Sager, the company rapidly established a statewide distribution system for home radios and related components. Despite the onset of the Great Depression, Sager continued to grow by bringing new electrical products to Massachusetts' consumers.

FROM RETAILER TO DISTRIBUTOR

At the onset of WWII, Sager reacted to the critical demand for electronic components. The company refocused its operations to supply electromechanical components to the U.S. military.

This transition positioned us to emerge as the leading regional electronic component distributor at the beginning of the consumer electronics market in the 1950s and 60s.

FROM REGIONAL TO NATIONAL PROMINENCE

Anticipating the explosive growth in electronics, in 1977, we relocated our headquarters to more spacious facilities in Hingham, MA and began building a national network and infrastructure. This included the prudent acquisition of smaller regional distributors and the creation of regional support facilities to service our expanding network of customers and suppliers.

In 2012, Sager Electronics was acquired by TTI Inc., a Berkshire Hathaway Inc. company. As a wholly owned subsidiary of TTI Inc., Sager continues to operate independently and has made a number of acquisitions to support its business. In June 2014, Sager acquired PowerGate LLC, a premier North American power specialist distributor. This acquisition preceded Sager's 2015 purchase of Norvell Electronics, a North American power products distributor with extensive design and value-add capabilities. Sager acquired Power Solutions Unlimited Inc. in 2017, and this

year completed the acquisition of Technical Power Systems, a battery value-add solutions provider.

Today Sager services our customers via headquarters and a state-of-the-art 100,000 SF distribution center in Middleborough, MA, a 40,000 SF distribution Center in Carrollton, TX, a national network of field account representatives and power system sales engineers, strategically located service centers across North America, and two value-add facilities: a Power Solutions Center in Carrollton, TX and a Battery Solutions Center in Lisle, IL.

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It was decided early on in Dove's formative years that it would be a distributor that focused on selling crystals & oscillators (frequency control products).

It wasn't easy early on and there were lots of detractors, but as we hung on, adding suppliers & people – we knew we had something special. Now in its 36th year with over 35 valued suppliers Dove is truly the **"Crystal & Oscillator Specialist"**.

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Large Scale Oscillator Programming: Dove is very proud of its Oscillator Programming Center. This capability



Dove CEO, Matt Waite

enables us to keep large amounts of unprogrammed oscillators on hand that can be immediately programmed to a customer's requirements. Orders as high as 10,000 pieces can be potentially shipped the same day ordered. Dove has been programming oscillators in volume for over 20 years. We have upgraded equipment on order right now to handle next generation products.





Prices continue to erode for 32-bit microcontrollers

Falling prices will contribute to market decline for 32-bit MCUs this year, but the market will rebound in 2020 and continue to grow for years



James Carbone

Semiconductor buyers can expect continued price erosion for 32-bit microcontrollers but declines over the next two years will be less than in the past.

Weaker demand, higher inventory levels and falling prices mean the 32-bit MCU market will decline this year but bounce back in 2020 as inventories are worked off and demand increases, especially from the automotive and industrial segments, according to industry analysts.

The worldwide 32-bit MCU market will fall from \$9.8 billion in 2018 to \$9 billion in 2019 because of weaker demand and high inventory levels, according to researcher Databeans, based in Reno, Nev. The 32-bit MCU market had grown in recent years because of robust demand from industrial and automotive applications and because more OEMs are opting to use 32-bit MCUs rather than 16-bit devices because prices have declined sharply for 32-bit microcontrollers.

The good news for MCU manufacturers is that the 32-bit MCU market will rebound in 2020 to \$10.2 billion and continuing positive growth through 2024 when the market will reach \$14.5 billion and will have a compound annual growth rate of 10 per cent, the researcher said.

"In 2017 we saw some really good growth in units," said Jim Feldhan, president of Semico Research, based in Phoenix, Ariz. Unit shipments increased 39 per cent to 12 billion units that year. Unit shipments slowed in 2018, but still grew 12 per cent to 14.1 billion. However, in 2019, 32-bit unit shipments will fall 10 per cent to 12.6 billion, he said.

"We saw some inventory build last year," and sales of 32-bit MCUs in the first quarter of 2019 were terrible," he said. However, "the inventory burn is just about over and the market will return to growth," said Feldhan. In 2020, 32-bit MCU shipments will reach 14.3 billion and continue to grow for several more years.

"We will have a good recovery year in 2021 and have almost a 25 per cent growth in unit shipments to 17 billion," he said. Positive growth will continue in 2022 when shipments will total 19.7 billion and then grow to 21.3 billion in 2023, according to Feldhan.

Demand grows from automotive

One reason for strong unit demand growth in the 32-bit MCU market is automotive. Automotive uses 8- and 16-bit MCUs, but 32-bit MCUs represent the largest portion of the auto MCU market. For instance, in the first six months of 2019, about \$2.1 billion of 32-bit MCUs were shipped to the automotive industry, compared to \$750 million of 8- and 16-bit MCUs, said Feldhan.

In fact, automotive accounts for 39 per cent of all microcontroller sales across all industries, according to researcher IC Insights. Thirty-two bit MCUs are used in a wide range of equipment.

"They are everywhere in computer peripherals, industrial applications, real-time operating systems, factory equipment, small office PBX systems. The list goes on," said Feldhan.

Many applications that have used 8-bit and 16-bit MCUs have transitioned to 32-bit devices because of price erosion for 32-bit microcontrollers. Thirty-two-bit MCUs now account for 59 per cent of the overall microcontroller market, while 16-bit represents 23 per cent and 4/8-bit MCUs account for 17 per cent, according to IC Insights.

Prices for 32-bit devices have been declining for years. On average, 32-bit MCUs were selling for about twice the amount of the average price for all microcontrollers in 2012, \$1.76 for 32-bit versus \$0.88 for total MCUs, according to IC Insights. In 2018, the average price for 32-bit MCUs was just \$0.09 higher than the ASP for all MCUs, and by 2022, the difference is forecast to shrink to \$0.05 as the price

By the Numbers



59%

The percentage of microcontrollers sold in 2018 that were 32-bit devices. Source: IC Insights



\$9.8 billion

the size of the worldwide 32-bit microcontroller market in 2018. Source: Databeans



10%

The amount of unit shipments of 32-bit microcontrollers will decline in 2019. Source: Semico Research



13%

The compound annual growth rate of 32-bit microcontrollers sold to the automotive industry through 2024. Source: Databeans



\$14.5 billion

The forecasted size of the worldwide 32-bit microcontroller market in 2024. Source: Databeans



will be \$0.60 for 32-bit versus an average of \$0.55 for total MCUs. In some cases, new 32-bit MCUs are being priced below the cost of 8-bit microcontrollers, the researcher said.

Because of the sharp price declines suppliers are aggressively promoting more powerful designs that are cost competitive with 8-bit and 16-bit devices, which have typically been used in consumer products and other high-volume systems, according to IC Insights.

"We have seen pretty substantial price degradation with 32-bit devices and we will continue to see that this year," said Feldhan. That trend will like continue for years although the price declines won't be as dramatic, he said. Still, lower prices will mean more equipment will transition to 32-bit MCUs, which provide "twice the compute power of 16-bit," said Feldhan. "That's important for anything connected to the Internet," because 32-bit offers security that 16-bit MCUs can't provide.

Price declines have also made 32-bit MCUs more attractive to the automotive industry, which need them for advanced driver assistance systems (ADAS), engine

and transmission control, chassis and safety and entertainment and infotainment systems in vehicles .

Automotive MCUs are dominated by 32-bit designs and represent nearly three quarters of the market segment's revenue, according to IC Insights. Infotainment including entertainment and information systems, such as those retrieving digital maps, identifying locations, and other data from the Internet and satellite transmissions, is expected to account for 8 per cent, or about \$530 million, of automotive MCU sales this year, the researcher said. Microcontrollers used throughout the rest of vehicles will generate 92 per cent, or \$5.89 billion, of the revenue this year.

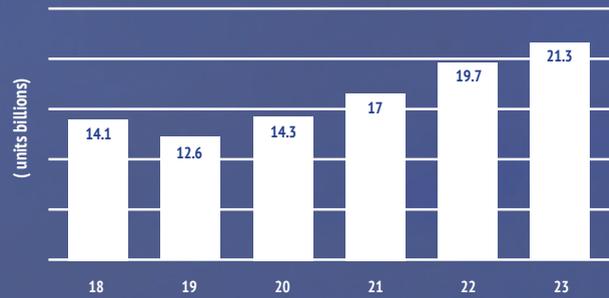
32-bit MCUs are required
"There are many more 32-bit MCUs being used in vehicles than there were five years ago," said Susie Inouye, research director and founder of Databeans. She said they are needed because vehicles are designed with more "sophisticated communication" systems that require 32-bit chips.

Bill Stewart, director of safety/ ADAS at Infineon Technologies Americas Corp., said Infineon's 32-bit MCUs are used in automotive

Shipments of 32-bit microcontrollers will increase from 12.6 billion in 2019 to 21.3 billion in 2023.

Source: Semico Research

Unit shipments of 32-bit MCUs will rise



and overall transportation applications. "We do not see just one or two applications leading the adoption of 32-bit MCUs in automotive," he said. Stewart said Infineon's AURIX family of MCUs are used in mass market automotive, off-highway applications such as construction and agricultural vehicles, buses and trains, avionics systems and drones.

"The MCUs also cover a wide array of applications in the vehicle," he said. He added as customer applications become more complex and OEMs adopt security and functional safety, most vehicles will fully transition to 32-bit.

Use of 32-bit MCUs by automakers and their suppliers will grow for years. The 32-bit automotive MCU market will grow from about \$2.7 billion in 2019 to nearly \$5.2 billion in 2023, Inouye said. Thirty-two-bit automotive MCUs will have a compound annual growth rate of 13 per cent, the highest rate of growth of any segment. In fact, automotive is the second largest market for 32-bit MCUs.

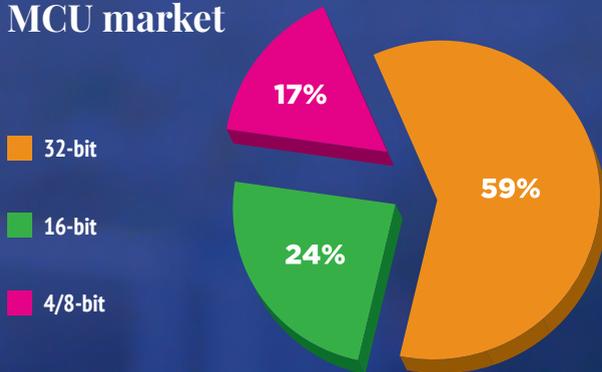
The industrial market is the biggest with sales of about \$5.1 billion in 2019, which will grow to \$8 billion and 2023 a

compound annual growth rate of 9 per cent, said Inouye.

Stewart said there will be strong growth in the 32-bit MCU segment because of automotive and industrial applications. "We see the adoption of 32-bit in automotive and industrial applications for multiple reasons: performance, software size and support for over-the-air updates, ethernet/connectivity, security and functional safety," he said. IoT and cloud services application such as AWS and AliOS are also using 32-bit devices, he said.

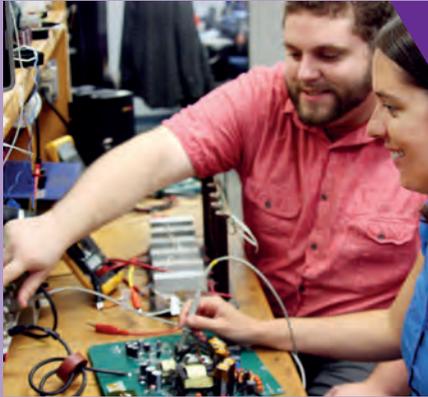
There could be some consolidation in the MCU market as MCU demand grows because of the need by some companies for IP. Stewart noted there are key features which enable the success of a 32-bit product family. "For example, having the right IP to support security, functional safety and robust designs for high temperature operation and embedded flash endurance are critical. Companies either have this IP in-house or will need to decide how they can obtain it," he said.

32-bit dominates MCU market



Prices have declined for 32-bit microcontrollers and they are now the largest part of the global microcontroller market. Source: IC Insights

Medical Products



Custom converters specified for hospital use

Bear Power Supplies has won the contract to design a 500W medical power supply tailored specifically for hospital use. The custom AC/DC converter will have a universal input for worldwide use and feature four different low-leakage-current outputs, including CF-rated outputs.

President of Bear Power Supplies, Michael Allen, said: "The leakage current specification for this design is an order of magnitude lower than a typical power supply. We won

this business based on our proven ability to deliver medical power supplies that meet this specification."

Once Bear has completed work on the open-frame custom medical power supply, it will be certified to IEC 60601 standards and integrated into the customer's equipment. Production is expected to start by the end of the year.

www.bearpwr.com



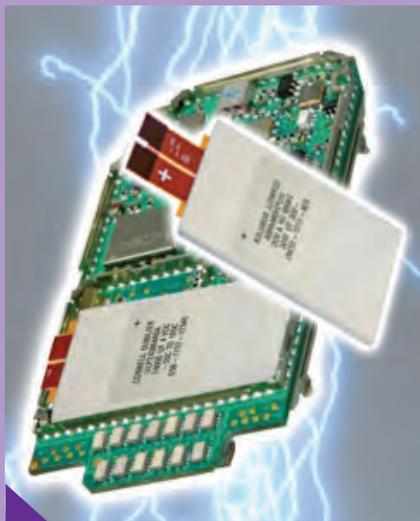
Low power performance is perfect for portable medical devices

Mouser Electronics is now stocking NXP Semiconductors' i.MX 7ULP applications processors designed to support ultra-low-power performance and rich graphics in applications such as portable medical devices and wearable electronics.

Based on Arm Cortex-A7 and Cortex-M4 cores with separate isolated domains, the processors include both 3D and 2D graphics processing units. The cores enable the device to run a rich operating system like Linux on the Cortex-A7 and a real-time operating system like FreeRTOS on the Cortex-M4.

The processors provide 32KB of L1 cache instruction memory, 32KB of L1 cache data memory, and 256KB of L2 cache, as well as 512KB of SRAM. Furthermore, the processors also support up to 32-bit LPDDR2/LPDDR3 memory interfaces, GPIO, I2C, SPI, UART, and USB interface types. Further benefits are listed as a deep sleep suspend power consumption of just 50µW in optimized configurations with low leakage and operating voltage scalability.

www.mouser.com



Cut your capacitor count

New Yorker Electronics has announced a new ultra-low-profile aluminum electrolytic capacitor from Cornell Dubilier Electronics designed for bulk capacitance and low board profiles in applications such as portable instruments and medical monitors.

With an energy density of over 0.4J/cc, the ULP enables the use of a single component instead of an array of surface mount capacitors. This is said to save space, weight and cost while improving circuit reliability and achieving high capacitance on the board.

Due to its light weight, the ULP is ideal for use in portable devices in applications where height, board space, weight and reliability are critical. Package heights of 2.2 and 3.2mm are available. Capacitance values range from 500 to 24,000µF and the capacitor is rated at 10g for vibration withstand.

www.newyorkerelectronics.com



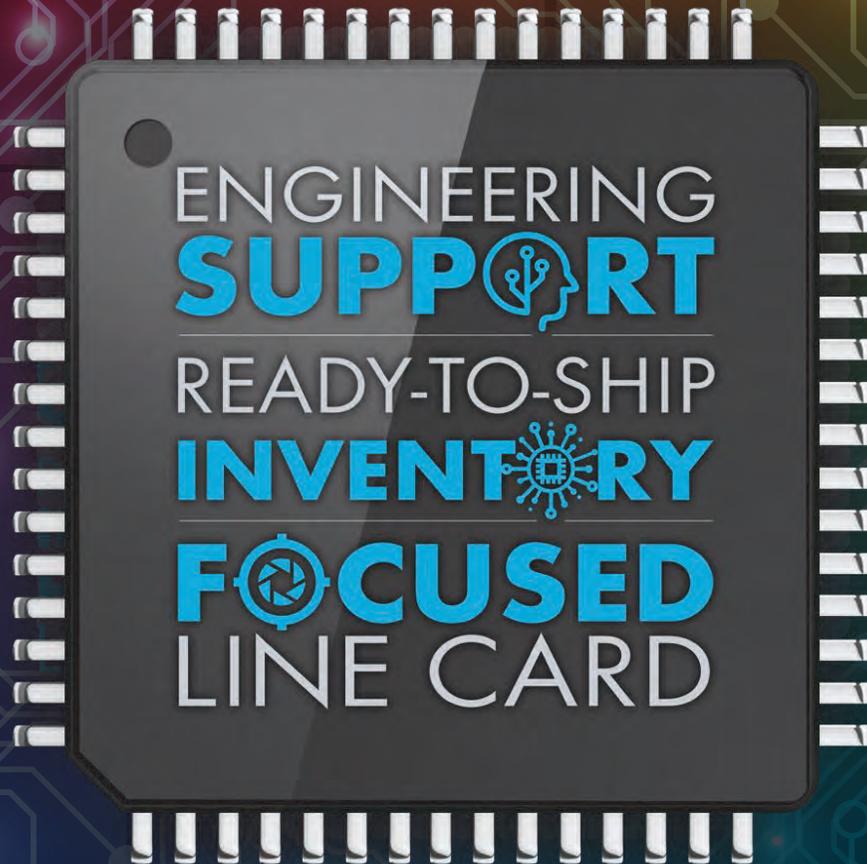
Empowering patient safety

Bel Power Solutions has introduced a new enclosed power supply, the MBE1000 series, which is ideal for medical applications and available in a variety of single output voltages.

Featuring a universal AC input range of 85 to 264V AC, the series offers up to 1,000W of output power with an integrated fan, in a 127 by 241.5 by 41mm footprint. High efficiency and high-power density are said to be hallmarks of the range, ensuring minimal power loss for higher reliability and easier thermal management.

The MBE1000 series is designed and approved to the latest EN/IEC 60601-1 medical standards, providing two times MOPP isolation for Class I and Class II applications. Potential uses therefore include diagnostic, drug pump, dialysis, home health care, monitoring and imaging, as well as therapy and surgical devices.

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Cool advice on fan purchasing

When buying fan products, focusing on overall operating cost rather than the initial sticker price typically yields a better cooling solution, explains Orion Fans' vice president of marketing, David Luna

Many physical and mechanical considerations go into the purchase of an electronics fan, however, when competing fan designs are comparable, it typically boils down to costs. Taking the following factors into consideration will simplify the buying experience and ensure a suitable thermal management solution.

Operating life

First, identify how long the fan is expected to operate in the application. Cooling fans are susceptible to failure because constant operation puts the motors under stress. Generally, larger slower turning fans last longer than smaller high-speed types, but usually fan failure is a gradual wear and tear process, not an abrupt one. As fans age, they gradually begin to slow down due to increased internal resistance reducing the airflow rate into the electrical cabinet. Less airflow increases the chance of sensitive electronic components overheating.

Fan motors containing ball bearings are more efficient and last longer than ordinary sleeve bearings. Although sleeve bearing fans can maintain a comparable life span when mounted in vertical positions, when mounted in any other position, the operating life significantly decreases. Motors exposed to operating temperatures above 90°F and equipped with ball bearings can provide a reasonable service life of 65,000 hours. At these temperatures, a sleeve-bearing fan will quickly fail due to loss of lubrication.

Sealed sleeve fans are another option, costing around 30 to 50 per cent less than ball bearing fans. They are ideal for lower heat applications that require lower fan speeds and have space for vertical mounting. Selecting the right fan for the right application can lower maintenance and repair costs, as well as associated costs from off-line equipment.

Environmental factors

Metal fans, including aluminum, steel and stainless steel, offer higher heat protection compared to plastic fans and blades, however, plastic fans are less expensive and weigh less. A common misconception is that blade material has an impact on air flow, however, it is blade speed, shape and diameter that determine air flow.

Fans subject to harsh environments, including excessive amounts of heat and dirt, fail at a higher rate compared to those operating in normal conditions. A dirty air filter can damage the fan motor by blocking airflow, causing the internal motor temperature to rise. A fan motor operating above the ideal design temperature will cause the bearing to rapidly lose its lubricating properties, overheat and fail. Harsh environment AC, DC and EC fans and accessories are therefore designed and tested to perform in tough conditions and protect against dust, moisture, salt fog, salt spray, temperature changes and humidity.

Smart choices

DC fans with smart thermal controls optimize fan performance, reducing energy consumption by as much 30 per cent, while reducing noise levels, as fans only operate at full speed when needed. Smart fan control options can also include tachometer output, airflow monitors, locked rotor alarm, pulse width modulation input, and constant speed controls. These options allow users to better monitor end-product operating temperatures and the fan's airflow, ensuring fans are operating properly and maintaining optimal operating conditions.

Choosing the right fan accessories can also reduce power consumption, maintenance and long-term operating cost. Selecting fans and fan accessories designed to reduce cost is

a priority for all purchasing professionals, but remember, focusing on overall operating cost versus the initial sticker price typically yields a better cooling solution. Finally, bear in mind that fans and accessories produced by the same company can optimize performance and fit and reduce lead times, while purchasing and accessorizing fans and blowers from one source simplifies the supply chain.

orionfans.com



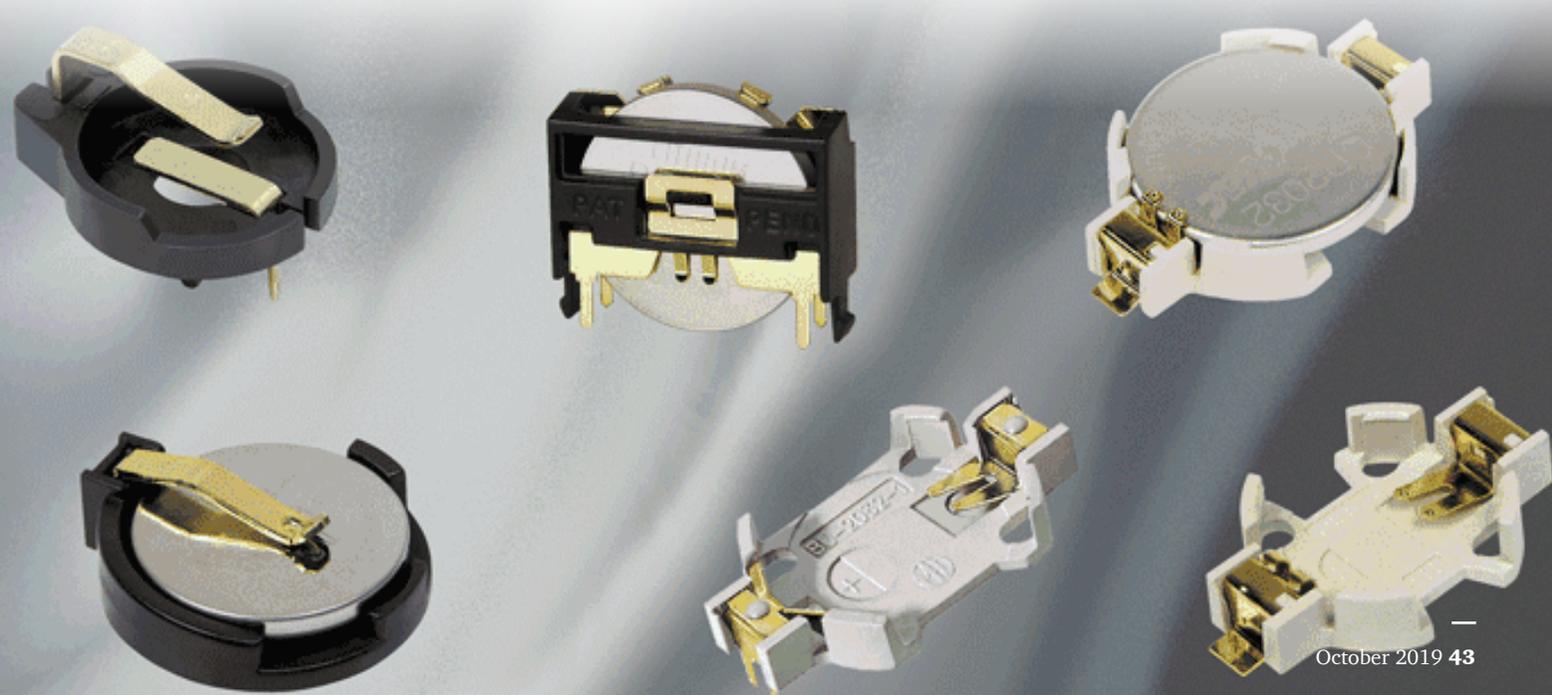
Selecting appropriate fan motor bearings can lower maintenance and repair costs

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www.memoryprotectiondevices.com



Obsolescence: on the flip side

Specialty distributor, Flip Electronics, provides welcome support when components are deemed end of life. ESNA spoke to president and chief executive officer, Jason Murphy, to find out how the company can help

Q Flip Electronics is relatively new. Why did the company form?

End of life and obsolescence of semiconductor products challenge the supply chain at every step. Most procurers exhaust their franchise distributor's OEMs and then are forced to look at the 'gray' market when components become obsolete. Many issues can arise when purchasing from a non-authorized, non-traceable source, such as date code challenges, counterfeit and quality assurances. Flip Electronics was formed to solve the problem of getting franchise stock for EOL and obsolete components.

Q What makes Flip Electronics unique compared to other distributors?

Most distributors focus on new design wins and supply chain programs; however, Flip's focus is on those tough-to-get parts that may have been discontinued and are not marketed actively anymore. These parts are just as critical to getting products built as today's newest technologies. Flip fills the gap between traditional franchise distribution and the 'gray' market, supplying established 'authorized' lines from original component manufacturers. Component manufacturers benefit by supplying customers they were previously unable to service. Our customers benefit by avoiding the 'gray' market.

Q Can you illustrate how Flip has ensured production line continuation in extreme situations?

Oftentimes, Flip sees demand requests from several companies for similar devices or product lines that have been obsoleted. Last year, Flip used this information to restart a product line. Flip made the up-front investment, including non-recurring engineering charges, and was able to service and support several mil-aero customers. These customers could not have made this investment based solely on their individual usages.

Q Do you have an overseas presence?

Most of our business is based in North America; however, we are servicing supply chain challenges both in EMEA and APAC as well. In today's marketplace, many customers have multi-region manufacturing strategies and Flip is equipped to deliver wherever this product is needed.

Q Does Flip Electronics specialize in preventative obsolescence management or providing options at the latter stages?

Our clients engage with us in both stages. It is very difficult for companies to accurately forecast how much product they should buy in the event of an EOL

notification. Semiconductor manufacturers oftentimes have excess product that they want to clear from their factories. Flip invests in this type of product and understands the markets that this product is supporting. In the latter stages, Flip can invest in product runs that an individual customer cannot.

Q What certifications or trade association memberships do you hold?

We take a methodical approach to quality. Currently, Flip is ISO 9001:2015 certified and AS9120:2016 certified. Also, our quality management system is ANSI/ESD-S20.20-2014 certified. We're also an ECIA member.

Q What supply chain bumps in the road could impact readers in late 2019 / 2020?

Currently, there is a surplus of product and ample availability in most semiconductor technologies, but this is always subject to change. Many people are closely watching the various trade talks between the United States and China, as well as Korea and Japan. Significant changes in trade relations can affect supply dynamics. Additionally, there continues to be a lot of consolidation in the industry. Every time this happens, product lines get trimmed and pruned, impacting supply chain stability.

Q Finally, what advice would you give to ESNA readers facing obsolescence and EOL situations?

Understand your BOM and the potential product challenges that may arise. Always avoid the 'gray' market to ensure quality and original components. Partner with a company like Flip Electronics that specializes in this market and is fully 'authorized' to distribute products that are being targeted for discontinuation or EOL.

www.flipelectronics.com



President and chief executive officer of Flip Electronics, Jason Murphy



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Product availability is one of the distinguishing features of Digi-Key from other electronic component distributors. They stock over 1 million products at its distribution center in Thief River Falls, MN. New products are added every day, in a continuous effort to offer the full range of electronic components required by the customer. Whether semiconductor, passive, interconnect, electromechanical, wireless or lighting components,

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Digi-Key's main channel strategy remains providing the broadest selection of electronic components in stock and available for immediate shipment, anywhere in the world. The company is committed to offering the newest emerging technologies from supplier partners and being an industry leader in NPI.

Digi-Key is currently on-track with the construction on a 93,000-square-meter Product Distribution Center expansion that will allow the company to expand inventory even further to meet current and future demands of customers. It will also allow for searching out new and innovative technologies and products from new and existing electronic component suppliers, allowing Digi-Key to continue being a one-stop-shop for customers in all industries.

The company offers a vast selection of online resources including a range of EDA and design tools, DK IoT Studio, reference design library,

product selectors, parametric search, on-demand multimedia library, a comprehensive article library, and community forums, among others. Digi-Key also offers numerous Supply Chain solutions such as API solutions, bonded inventory, and just-in-time shipping, as well as a newly updated BOM manager. The website is updated regularly with new features in response to customer feedback and industry needs.

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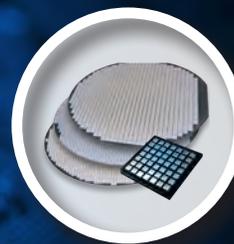
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Shortages are over but buyers face other supply chain issues

Tariffs, the trade war with China and dealing with excess inventories of components are some of the issues electronics buyers are grappling with

Most buyers are rejoicing over the fact that shortages of multilayer ceramic capacitors (MLCCs), chip resistors and power transistors, which plagued the industry last year are over.

Many parts had lead times of 40 weeks or more and some were on allocation. Buyers had to search far and wide to find shortage parts on the open market and pay high, if not exorbitant, prices for them. “Last year was one of the biggest shortage years in history,” said Paul Romano, chief operating officer for independent distributor Fusion Worldwide, based in Boston. “Now a lot of that is abated and supply conditions are not the same as they were last year.”

For instance, standard-grade, small-size MLCC lead times are less than 30 weeks. Metal oxide semiconductor field emitting transistor (MOSFET) lead times are in the 22- to 26- week range after being 40+ weeks last year. Resistor lead times from several manufacturers have shrunk to about 20 weeks after being on allocation last year, according to electronics manufacturing services provider Vexos. Lead times for discretes are normal, about 12 to 16 weeks.

The good news for buyers is that lead times will stay

the same or shrink because of oversupply in the supply chain, which as of September, had not been worked off. The bad news is though despite greatly improved supply conditions, there are still short-term spot shortages of some parts. In addition, buyers this year are dealing with other supply chain issues including tariffs, trade wars and excess inventories.

Spot shortages seen

While it appears to be a buyer’s market for many parts, independent distributors say there are still spot shortages of some components. “We always see spot shortages and it drives a fair amount of activity,” said Romano. Such shortages can occur if a company had an unexpected spike in demand for its products and did not order enough parts from component manufacturers or distributors or didn’t have inventory on hand to meet demand.

“We still see some minor issues with MLCCs in larger case sizes.” Larger case size MLCCs are very low-margin parts and “there was never a significant amount of investment in expansion” in them. Some suppliers are producing fewer of them in favor of higher margin capacitors in small sizes, which are in high demand. Lead times have also stretched

for some relays and CMOS image sensors, said Romano. Those are generally used in surveillance cameras and other devices. “There’s been a huge growth in that market because of smart phones,” he said.

Memory IC buyers may face some longer lead times for NAND. A fab jointly run by Toshiba Memory and Western Digital suffered a power outage in June, which reduced production of NAND flash wafers. Western Digital said the outage would likely reduce the company’s life production by about half for the third quarter.

Some Intel microprocessors are also in short supply as Intel has tried to transition customers to its newer MPUs. However, demand has remained strong for its older Skylake processors resulting in shortages.

“The transition from Skylake to Cascade Lake Xeon processors has played a part in the current shortage, which, from our view, is not entirely uncommon when generational migrations occur,” said Todd Burke, vice president of business development for independent distributor Smith, based in Houston.

“We’re still seeing significant open-market demand for



Paul Romano, chief operating officer for independent distributor **Fusion Worldwide**



Last year was one of the biggest shortage years in history. Now a lot of that is abated and supply conditions are not the same as they were last year

many processors.” He said there has been high demand across the board for Intel CPUs used in desktops, mobile computers, and servers.

Tight supply will return

While shortages of components have eased many in the supply chain say it’s only a matter of time until tight supply returns. “There are a number of things that will have an impact on the electronics market, including artificial intelligence, the continued digitization of transportation, and 5G,” said Romano. Such trends will result in robust demand for electronic components.

Fifth generation cell phone technology will “necessitate the replacement of a lot of gear,” which will result in higher demand for semiconductors, passives and other components.

Burke noted the rollout of 5G is starting across Europe, Asia and North America. As a result, “we expect to see an overall increase in demand for the active and passive components needed not only in handsets, but also in the cellular infrastructure equipment including core network equipment, base stations, and antenna arrays,” he said.

He said that initially supply will be impacted by the buildout of 5G networks, then there will be an increase in demand for smart phone components as people upgrade their phones to take advantage of 5G capabilities.

“We’re not seeing tight supply for specific 5G components yet,” said Burke. “The industry is still scaling, and manufacturers at the OEM

and CM levels still have a lot of inventory on their shelves,” he said. However, there should be an increase in overall demand beginning in late 2019 and early 2020 for components used in 5G applications, according to Burke.

Automotive will also continue to have an impact on electronics supply. In fact, some buyers blame automotive for causing some of the shortages of MLCCs, chip resistors and MOSFETs last year and in 2017. More sophisticated electronics systems are being designed into more vehicle models, resulting in higher demand for many components. Vehicle sales have been flat to down in recent years but if they should increase by a few percentage points, it could likely result in tighter supply, and shortages.

Automotive demand grows

While the auto industry often buys directly from component manufacturers or their authorized distributors, independent distributors say they recently have seen an increase in demand from the automotive segment.

“We saw a lot more opportunity in automotive reaching out to us,” said Carleton Dufoe, CEO and founder of independent distributor NewPower Worldwide, based in Nashua, NH. “We did not know a lot of them in the past. But we had people from the auto industry coming to us,” he said. “It’s one of the higher performing segments for us. So, we’re seeing more and more activity in that space.” Automotive customers “know what they want, they

know what they need. It’s no nonsense. They need authentic product and it needs to be automotive grade and traceable to the manufacturer,” said Dufoe.

While buyers may have to plan for increased demand caused by 5G networks, new handsets and rising demand from automotive, they also have other concerns, including tariffs, and the trade war between the U.S. and China and its potential impact on supply. So far there has not been a big impact on the component business because of the trade kerfuffle, according to Burke.

“The semiconductor industry is coming off a record-breaking revenue year. The U.S.-China trade issue hasn’t impacted the component business as much as market cycles have,” he said.

However, the tariff dispute is causing a lot of ambiguity, uncertainty and cautiousness in the electronic components industry. “Lots of changes have occurred with parts being added to the tariff list and then some taken off,” said Burke.

“We’re also seeing some OEMs and CMs, to avoid the tariffs, move U.S.-bound projects out of China to manufacturing clusters in other countries, such as Taiwan, Vietnam, and Mexico,” he said.

Dufoe said that tariffs are a challenge, but don’t seem to be dampening business to any great degree except for very large global companies that may be moving “hundreds of millions of dollars of product globally.”



Todd Burke, vice president of business development for **Smith**



We expect to see an overall increase in demand for the active and passive components needed not only in 5G handsets, but also in the cellular infrastructure equipment including core network equipment, base stations, and antenna arrays

Dealing with tariffs

Ron Bishop, president of connector industry research firm Bishop & Associates, said the tariffs are also causing some connector manufacturers and other electronics manufacturers to move manufacturing to other regions. "I think the tariffs are hitting China big-time. There are a lot of people pulling production out of China. Some of it is moving back here (to the U.S.) or to Singapore, Hong Kong" or other countries, he said.

The tariffs may impact future investment in China from companies in the U.S. and Europe, according to Bishop. "I don't think you'll see a huge investment in China from American or European companies that once existed," he said.

He also noted that China used to be the fastest growing region for connectors. However, in the first seven months of 2019, connector sales were down 8.3 per cent in China, while the North American market was up 2.8 percent. "China is the worst region of the world in connectors. It is something we have not seen in probably 15 to 20 years," he said.

While it is unknown how long the tariffs and trade dispute will continue, there are "ways around tariffs," said Burke. "We have warehouses strategically located in Amsterdam and Hong Kong from which that product can be shipped. Our global team of procurement specialists can also help qualify other manufacturers to stay in line with pricing objectives." In fact, some buyers are also qualifying component manufacturers in other

regions for parts to avoid the tariffs.

Buyers have other concerns this year besides tariffs. Last year and in 2017, many buyers double and triple ordered parts because of the shortages to make sure their companies had enough components to keeping production lines humming. As it turned out, all those parts were not needed and some electronics companies have large stockpiles of components.

One example is MLCCs. "With MLCCs everyone was going crazy," said Dufoe. "A lot of people bought a lot more than they needed, but now customers have oversupply. Some are trying to burn through those inventories, while others are trying to resell the parts. Customers are asking us can we sell parts to someone? Can we scrap them? What's the solution?" said Dufoe.

Large companies with more than \$1 billion sales often aren't overly concerned about the excess parts and will write them off or scrap them, said Dufoe. Smaller companies feel they need to consume the parts or sell them to recoup some revenue.

Recouping revenue from parts can be difficult in a buyer's market especially with low-cost components. "A lot of these parts cost below a penny a piece, said Dufoe. However, buyers may have purchased them on the open market for three, four, five cents or 10 cents.

"How much can you recoup if the component manufacturer is now selling that part by the millions for \$.007 a piece?

How much savings are you going to make?" he said. The company may be better off holding the parts and consuming them or scrapping it.

"We are seeing a lot of those discussions," said Dufoe. "We're trying to help customers with MLCCs and see what's possible for them to get for the parts. However, if a company has \$5 million of parts on their books, the components may be worth only \$900,000 with today's pricing," he said.



Carleton Dufoe, CEO and founder of independent distributor **New Power Worldwide**

We saw a lot more opportunity in automotive. We're seeing more and more activity in that space



Robust ROLEC Enclosures For Industrial Electronics

Company Profile



ROLEC's North American subsidiary may be only two years old but the industrial enclosures manufacturer has a history of innovation dating back half a century.

Its revolutionary designs have transformed the world of sealed enclosures, bringing modern aesthetics and advanced technical features to a previously conservative market.

ROLEC's IP-rated enclosures and suspension arms have been available in North America for many years. But the new subsidiary means customers can deal directly with ROLEC engineers able to offer expert factory know-how.

Customers can specify fully customized PCB-ready enclosures manufactured from diecast aluminum, stainless steel, GRP or high performance thermoplastics. All that remains is the final assembly - and ROLEC also offers that as a custom service.

ROLEC Sales Manager Rob Macek said: "Advanced technical features - such as 'lid closed' installation - mean our enclosures are more than capable of withstanding extremely challenging industrial environments."

He added: "It is now easier than ever to specify customized industrial enclosures. Our services include CNC machining, laser processing, engraving and RFI/EMI shielding."

Key models are:

- aluCASE (IP 66/67/69K) - diecast aluminum boxes with separate channels for the concealed fixing and lid screws, enabling 'lid closed' installation to safeguard the electronics. Features also include lid retaining straps, optional external hinges and a key lock. Available in 29 sizes.
- technoCASE (IP 66/67) - halogen-free ABS enclosures with snap-on covers to hide the lid screws. Users can combine two lids to create a shallow enclosure or two bases to create a deeper case. Choose from 25 sizes.
- aluDISC (IP 66/67/69K) - the world's first round diecast aluminum enclosure for industrial electronics. Features include 'lid closed' installation, lid retaining straps and an optional transparent cover (IP 65).

Three stainless steel enclosures - inoCASE (IP 66/67), inoCASE MINI (IP 66/67) and inoBOX (IP 66) - are available in A2 and A4 steel. All three provide high levels of protection,

along with technical features that maximise interior space.

Increasing demand for IoT/IIoT, Industry 4.0 and Smart Factory solutions has led ROLEC to extend its range of HMI/panel enclosures. Newer made-to-measure models such as profiPANEL and multiPANEL supplement an already wide range of command enclosures. Standard HMI enclosures fit displays by manufacturers including B&R, Beckhoff and Siemens.

They can be fitted to ROLEC's seven suspension arms. Most advanced are the profiPLUS 50 and 70 arms which feature patented 'one screw adjustment' to speed up installation times.

For more information, view the ROLEC website:
www.rolec-usa.com

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Abele Business Park,
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USA

Contact: Sales Manager Rob Macek
Toll free: (888) 658-5774
Phone: (412) 220-9026
Fax: (412) 220-6056
Email: sales@rolec-usa.com



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
ACOUSTIC COMPONENTS											
BeStar Electronics Ind. Co. Ltd.	BeStar Technologies Inc.	520-439-9204	www.bestartech.com	Y	N/A	\$250,000	N/A	100.00%	50	900	Y
CABLE & WIRING											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23235	N/A	\$0	0.46	50	1,000+	Y
Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	\$0	93.00%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	\$0	97%	50	1,000+	Y
Molex	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
CIRCUIT PROTECTION											
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
DISPLAYS & LEDs											
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Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,390	N/A	\$0	99.00%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	\$0	84.00%	50	1,000+	Y
Displaytech	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Electronic Assembly	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kingbright Company, LLC	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	\$0	100.00%	50	1,000+	Y
Lumileds	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Newhaven Display	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,690	N/A	\$0	100.00%	50	1,000+	Y
VCC	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ELECTROMECHANICAL											
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
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Grayhill	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y

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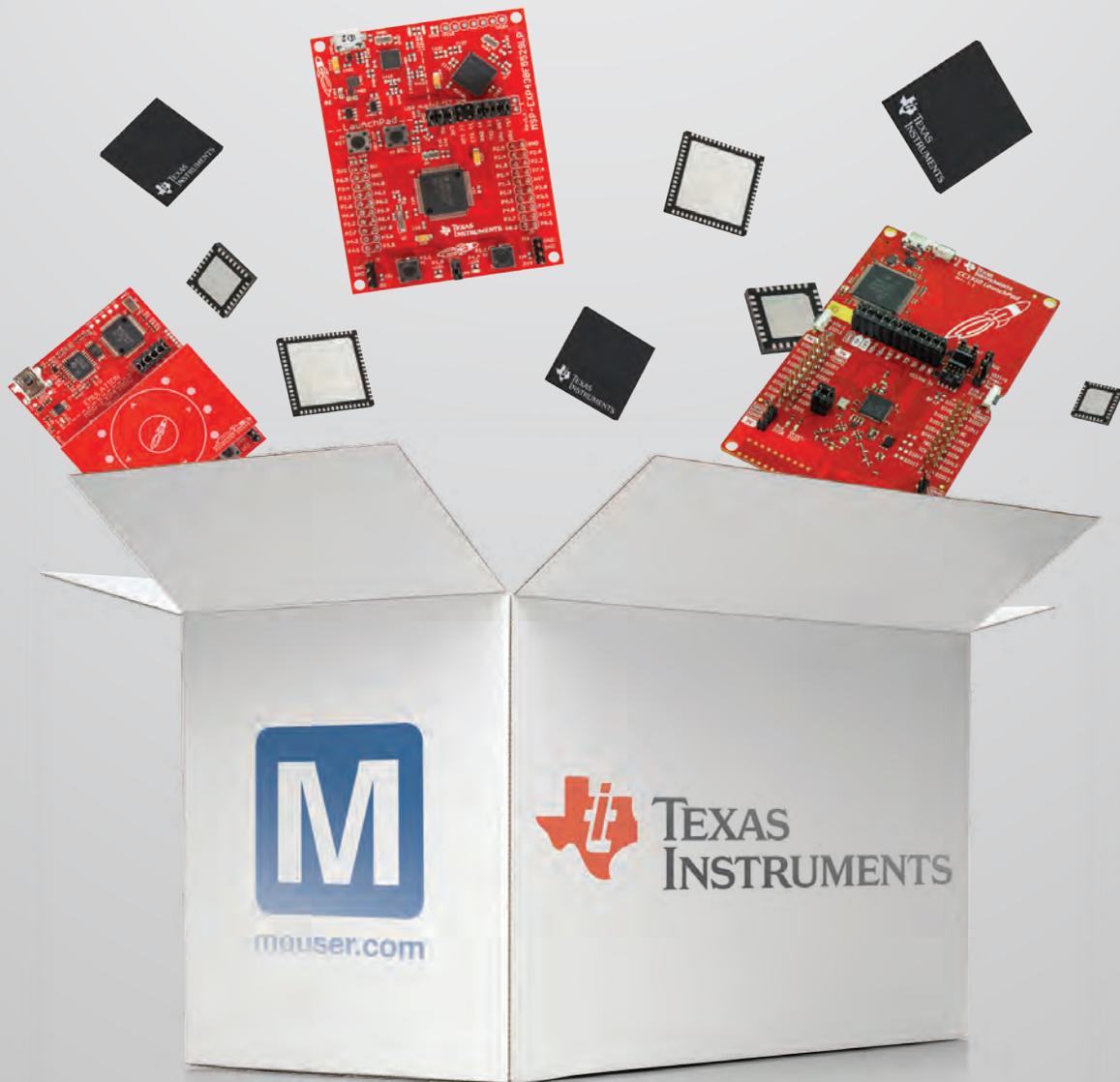
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Panasonic	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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PUI Audio	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Schneider Electric	Mouser 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
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Central Semiconductor Corp.	Future Electronics	(800) 675-1619	www.futureelectronics.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
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
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Intel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	\$0	96.00%	50	1,000+	Y
Swissbit	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	53,781	N/A	\$0	77%	50	1,000+	Y
INTERCONNECTION											
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Amphenol	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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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
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
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Harting	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,160	N/A	\$0	51.00%	50	1,000+	Y
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ITT Cannon	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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JST	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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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
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	Chip 1 Exchange USA, Inc.	949-589-5400	www.chip1.com	Y	850,000	N/A	\$0	85%	20	150	Y
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OPTO ELECTRONICS											
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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
PASSIVES											
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
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Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	\$0	71%	50	1,000+	Y
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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

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
PASSIVES (Continued)											
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	\$0	98.00%	50	1,000+	Y
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
POWER & BATTERIES											
Artesyn Embedded Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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
REED SWITCHES											
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	\$200	100.00%	15	275	N
SENSORS											
ams	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Analog Devices Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Bosch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Honeywell Sensing and Control	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,059	N/A	\$0	64.00%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,379	N/A	\$0	45.00%	50	1,000+	Y
Melexis	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,915	N/A	\$0	59.00%	50	1,000+	Y
Sensirion	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
STMicroelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	914	N/A	\$0	65.00%	50	1,000+	Y
SWITCHES & KEYBOARDS											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TEST & MEASUREMENT											
B&K Precision	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Fluke	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,008	N/A	\$0	94.00%	50	1,000+	Y
Keysight	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Lascar Electronics		814-835-0621	www.lascarelectronics.com	Y	130	\$602,000	\$0	100%	10	175	Y
Tektronix	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Teledyne LeCroy	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	\$0	96.00%	50	1,000+	Y

Contract Manufacturers Buyers' Guide

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



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