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Buyers' Guide

All the facts and figures to help you buy

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ELECTRONICS
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PUBLISHING LTD

EDITORIAL
Managing Editor: Jon Barrett
jon@electronics-sourcing.com
Contributing Editor: Amy Barker
amyb@electronics-sourcing.com
Editorial & Production: Thomas Smart
thomas.smart@electronics-sourcing.com

ADVERTISING
Director of Sales: Charlotte Morgan
charlotte.morgan@electronics-sourcing.com
Advertisement Manager: Emma Poole
emma.poole@electronics-sourcing.com
North American New Business Manager: Glen Sundin
glen.sundin@electronics-sourcing.com

CIRCULATION
Circulation Manager: Vicky Leary
vicky.leary@electronics-sourcing.com
Circulation Account Manager: Liz Poole
liz.poole@electronics-sourcing.com

DESIGN
Graphic Designer: Josh Hilton
josh.hilton@electronics-sourcing.com

PUBLISHER
Mark Leary
mark.leary@electronics-sourcing.com
Office Manager: Denise Pattenden
denise.pattenden@mmgpublishing.co.uk

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Editor's Word



Efficiency: a battle of attrition

As the climate change debate surges around me, I would like to thank one group of people for their contribution to a more sustainable world. These are the employees of the global electronics industry who work tirelessly, some across their entire careers, to steadily improve the efficiency of electronic components and then deliver them to the market.

Over the past 30-years I've never attended a press conference for a new electronic component where the presenter is pleased to announce they had reduced the efficiency of the new device. The opposite is always true.

However, the reason these people don't get more praise is that this is a battle of attrition. Every improvement it typically tiny and thus gains little attention. However, when you add all the efficiency gains, across all the new components, from all corners of the world, across decades of effort, the net results mount up.

Essentially, there is no end in sight for efficiency enhancement. Just as one technology appears to have reached its zenith, a new material or manufacturing process pushes it on again. Nano technology is a classic example of this evolution.

So thank you, continue the good work and keep press releasing your new, ever more efficient, components.

As a closing note I doubt the human race can take sole ownership of the earth's climate using the single lever of carbon dioxide. I fear its more complicated than that and wonder who gets to pull the lever, how far and how fast. All I can do is place my faith in people much cleverer than me.

Jon Barrett

N ES News

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Are you buying North American PCBs?

As a window on the electronics industry, PCBs offer a pretty good gauge of what's going on, which is why the IPC's 2019 Annual Report on the North American PCB Industry makes interesting reading. It shows that the PCB industry in North America has turned a corner, with domestic PCB production growing in 2018 for the first time in five years. North America's PCB market also grew last year by nearly eight per cent, solidifying the turnaround that began in 2017.

Other key findings include the breakdown of vertical markets for PCBs, showing that PCBs for military and aerospace, and medical devices and instrumentation markets make up the lion's share of both rigid PCB and flexible circuit markets in North America.

In addition to estimates of PCB domestic production, the report contains data from IPC's North American PCB statistical program regarding 2018 sales and order growth by board type and company size, vertical market, as well as providing percentages of PCBs with special technologies including RF, metal core and embedded components. For electronics industry purchasers, this could provide useful insight on trends in electronics manufacturing.

The report, priced at \$450 for IPC members and \$900 for non-members, is available for download from IPC's online store.

www.ipc.org

More choice on conical inductors

Gowanda Electronics has expanded its broadband conical product line with new microwave RF conical inductors, the C102 and C182, which are available in surface mount and flying lead configurations.

Developed to address industry trends for ever-increasing performance, the two new series are designed for use in communication applications for bias Ts, broadband chip manufacturing, communication platforms, high frequency, microwave circuitry, RF test set-ups, test instrumentation and transmission amplifiers.

The performance ranges provided by these new wirewound conical components include inductance from 0.47 to 10.7 μ H, DCR ohms from 0.19 to 7.10 and current rating from 150 to 815mA DC. Operating temperature range is -55 to 125°C for all series.

www.gowanda.com



SIL 3 supplies shipping now

Sager Electronics is now stocking Phoenix Contact's Quint 20+ power supply, which is safety integrity level three rated. The Quint 20+ introduces a single SIL 3, conformal coated device with ATEX, IECEx and Class I Division 2 approvals. It features a redundant overvoltage protection circuitry and an integrated mosfet decoupling diode.

www.sager.com

Looking for low pressure sensors?

TTI has announced a North America distribution agreement with manufacturer of ultra-low pressure sensors, All Sensors.

TTI vice president, supplier marketing, Lew LaFornara, commented: "All Sensors' line of pressure sensors is top-notch in quality and design. TTI is pleased to bring this excellent ultra-low pressure technology to the benefit of our customers."

The sensors are particularly well suited for low- and ultra-low pressure applications for flow measurement and control with potential use in medical, military, industrial, and HVAC markets. Common applications include ventilators, spirometry, blood pressure monitoring, building monitoring systems, industrial automation, airspeed, and leak detection.

www.ttiinc.com





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In Brief

TVS diode range expands
 Bourns has expanded its line of discrete transient voltage suppressor diodes with two new series of ESD/EFT surge protection products. Models SMA6J and SMA6L-Q are designed to protect power buses and I/O interfaces in data lines and DC power supplies. Model SMA6L-Q is AEC-Q101 compliant and suits communications, industrial and consumer electronics applications used in harsh environments and require high reliability.
www.bourns.com

Flat rate shipping
 On 1 October RS extended flat-rate shipping for North American customers placing orders for delivery anywhere in the United States, Canada and Mexico for \$9.99, with no minimum order quantity. In addition to the limited-time flat-rate shipping offer, RS has also added Maxim Integrated to its list of supplier partners.
americas.rsdelivers.com

New Jersey gets optical R&D facility
 Molex has opened a new research and development facility in Bridgewater, New Jersey. The building represents a significant investment in the future of optical wavelength solutions for telecommunications networks. The facility features eco-friendly clean rooms and capabilities for designing and prototype manufacturing of optical solutions for the rapidly emerging segment of metro and long-haul telecommunications networks.
www.molex.com

Avnet/Alibaba alliance
 Avnet has launched an Avnet Super Store on Alibaba Group's China-focused B2B purchasing and wholesale marketplace, 1688.com. One of the first products offered through the new Chinese Super Store will be the Alibaba Cloud-enabled Raspberry Pi 3 Model B/B+ computer. Avnet's vice president of digital, Nishant Nishant said: "Through our alliance with Alibaba Cloud, developers in China can accelerate their IoT prototyping on a familiar and versatile platform with built-in cloud connectivity."
avnet.1688.com



Bridging the gap

New Yorker Electronics has released several new products from Lite-On Semiconductor including a new series of SiC Schottky diodes and a range of glass passivated bridge rectifiers ideal for server, telecom, data center, industrial, lighting and home appliance applications.

The NTT series of glass passivated rectifiers features a high forward current capability up to 8.0A in a surface mount package. Uses include fast charging, USB adapters, and general purpose power adapters under 100W.

Other new additions include the Ultra LVF series designed for AC-to-DC full-wave bridge rectification for SMPS, LED lighting, adapter, battery chargers and home appliances, and the LVF and GBJS series, both of which offer low-forward voltage drop. The GBJS can be used in bridgeless technology in desktops or workstations as well as server, telecom and industrial power supply applications.

Finally, New Yorker is also distributing the new Lite-On semi silicon carbide Schottky diodes in the LSC Series. Designed for high thermal cycling performance and low thermal resistance, they are ideal for UPS, EV chargers, server and telecom power.

www.newyorkerelectronics.com



Synthesizers set for high frequency success

Mouser Electronics is now stocking the ADF4371 and ADF4372 microwave wideband synthesizers from Analog Devices. The former claims to deliver one of the highest frequency synthesizers in the industry today, offering a continuous RF output range of 62MHz to 32GHz, while the latter operates at 62MHz to 16GHz.

Both the ADF4371 and ADF4372 consist of a phase-locked loop with fully integrated voltage-controlled oscillators, low-dropout regulators, and tracking filter technology. The devices also boast low jitter of 36fs at 10GHz.

According to Mouser, the two synthesizers offer the bandwidth, small footprint, reliability, low noise, and increased clocking range to complement a range of RF applications such as wireless infrastructure equipment, test equipment and instrumentation, clock generation, and aerospace and defense-based designs. Evaluation boards and an SDP-S controller board are also available from Mouser.

www.mouser.com



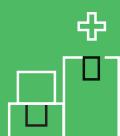
New coax joins high frequency lineup

Cinch Connectivity Solutions has announced an addition to its Johnson SMPM product line with a new coax connector. The SMPM male full detent, solder end launch is designed for very high frequency applications where space limitation and package density are critical.

Said to be 30 per cent smaller than SMP connectors, the SMPM interface also boasts superior performance from DC up to 65GHz and is compatible with all SMPM and GPO connectors. As a straddle mount style, it supports a 0.063in board thickness, with tight tolerance spacing of 0.066in, ensuring a snug fit to the PCB. Johnson SMPM connectors claim to offer high electrical reliability in extreme shock and vibration conditions ensuring high quality data transmission for test and measurement equipment, semiconductor ATE test board, and instrumentation test fixture hardware applications.

belfuse.com/cinch

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Sourcing industrial energy solutions

Newark has broadened its portfolio of passive devices with new supercapacitor modules from Eaton, available for same day shipping. Designed to improve efficiency and reduce costs, this supercapacitor line includes reliable, ultra-high capacitance energy storage devices that are tailored to work with applications for backup power, pulse power and hybrid power systems.

Product manager at Newark, Mike Davis, said: "We're excited to expand our offerings from Eaton to provide our customers with this new series of supercapacitors, enabling greater efficiency and optimization in their designs."

Designed to balance the power density of traditional capacitors with the energy density of batteries, the new supercapacitors feature a double layer construction that offers high capacitance and low ESR. They can be used alone or in combination with batteries to optimize cost.

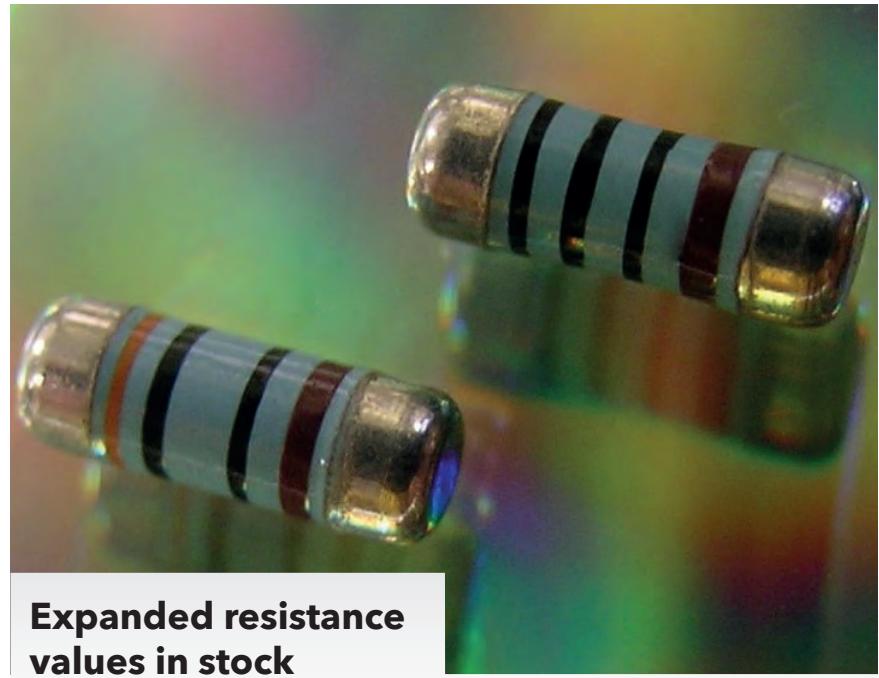
Product manager at Eaton, Nick Stone, added: "Supercapacitors are a unique energy storage technology that helps end users solve common energy storage challenges across a wide variety of applications."

www.newark.com

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Expanded resistance values in stock

Stackpole's new MLFA AEC-Q200 compliant MELFs are now available in an expanded value range of one ohm to 3.4Mohm. The range boasts excellent pulse handling and electrical stability with AEC test proven performance, which ensures increased reliability and stability over standard MELF resistors.

Specifically, the MLFA offers power ratings of 0.3W in the 0102 package size, 0.4W in the 0204, and 1W in the 0207 size. Tolerances down to 0.1 per cent and TCR as low as 15ppm are available for a limited value range.

The MLFA is ideal for applications requiring high pulse handling such as industrial electronics, monitoring and metering, HVAC, precision motor drives, hybrid power controls, and medical electronics.

Pricing depends on resistance value, tolerance, and TCR and ranges from \$0.022 to \$0.15 each in full reel quantities. More than 90 popular resistance values are currently in stock.

www.seiselect.com

Florida warehouse ensures two-day shipping

BigTime Battery has opened a new distribution warehouse in Edgewater, Florida, which will process and ship batteries and chargers to seven neighboring states in the southeast.

Purchasers in the region will now enjoy faster deliveries as Big Time Battery seeks to integrate its existing brands, such as PowerStar, PowerStar H-D and, Banshee, into a more shipping effective proximity. The new 6,000ft² building is in the perfect central Florida location to service millions of customers with two-day shipping and adds to the company's 10,000ft² facility located in Minooka, Illinois.

General manager, Donny Sweeney, stated: "It's part of a history of 14 straight years of steady growth. It just goes along with our product expansion plans and increases our ability to service customers."

Southeast logistics operations manager, Cody Sweeney, commented: "It's a win, win. Everyone knows the southeast region is the fastest growing region of the country. We expect the facility to be fully operational for Q4 2019."

www.bigtimetimebattery.com

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Mil/aero helps drive distributor sales

With increased defense spending, distributors that sell to the defense industry report robust component demand



James Carbone

While sales of semiconductors, passives and connectors have slowed this year compared to 2018, distributors that service defense and aerospace OEMs and their subcontractors say component demand from the mil/aero segment remains strong because of the increase in defense spending in the United States and foreign countries.

"Sales to the defense and aerospace market have increased significantly over the past two years," said Roger Raley, vice president for TTI's military/aerospace segment. TTI's sales to companies that build military aerospace systems and equipment increased 23 per cent in 2018 and were projected to rise more than 20 per cent in 2019.

"Defense spending both to domestic and foreign militaries has increased significantly over the past two years," he said. The Trump administration has increased spending and "our allies overseas also are allocating more of their budgets to defense spending, so it's a great time to be involved in the defense segment," said Raley.

To serve the military/aerospace segment, TTI continues "to invest in resources and expertise to allow us to stay focused on our core markets" including the military/aerospace market. The focused strategy is paying off and TTI is "building stronger, more focused partnerships that allow us to address the critical needs this market requires," said Raley.

TTI, which sells passives, connectors, electromechanical devices and specialized semiconductors, was founded 50 years ago to service military and aerospace manufacturers, Raley noted. "While our customers now include manufacturers involved in all areas of transportation, communication devices and industrial applications, a large percentage of our business continues to be in support of our mil/aero partners," he said.

TTI sells components into a wide range of military equipment including avionics, ground vehicles, aircraft, satellites, missiles, connected warrior applications and unmanned vehicles. "In fact, it would be hard to find a defense application where we don't provide component content," said Raley.

Expanded focus

He added that TTI has always had the broadest and deepest passive inventory in the industry to support the mil/aero segment. "However, over the past few years we really expanded our product focus and supplier relationships to include the broadest and deepest interconnect and electromechanical inventory profile in the industry. Because we're not focused on inventory turns like our larger competitors are, we invest well ahead of our customers' needs to ensure we have product on the shelf when they need it," Raley said.

Doing business with mil/aero customers is different than with commercial customers. "One



Roger Raley, vice president for TTI's military/aerospace segment

"Sales to the defense and aerospace market have increased significantly over the past two years"

reason is the products we sell may be required to operate only once but must operate without fail because lives are very literally on the line," said Raley. "Quality is paramount in all areas, whether it's documentation, counterfeit mitigation or additional inspection." TTI has the proper certifications, processes and expertise in place to ensure the highest reliability for our products, he said.

John Hunter, director of Avnet's defense and aerospace segment, said the defense business is also different than the commercial business because defense requirements are more stringent and there are more enhanced testing requirements, component preparation for

severe environments, and strict documentation control requirements. "In general, the stakes are higher, as battlefields and space deployments are higher risk, which means the technology has to work every time. Lives depend on it," said Hunter.

Avnet has been supplying to the defense and aerospace segment over the past 20 years and has seen growth, especially in recent years because of Department of Defense budget increases, overseas sales, strong commercial avionics, space and satellite markets, and overall increased electronic capability and content.

He said while business to the mil/aero segment has always been



strong, in recent years there has been growth in specific defense initiatives including smart munitions, unarmed air vehicles and satellite communications.

Distributors say there are challenges in supporting the defense market, including the high-mix, low-volume nature of many of many military programs. "This creates a challenge in our customers' ability to forecast," said Raley. TTI offsets this by having the "broadest and deepest IP&E inventory in the industry. We also work with our customers to pipeline inventory well ahead of when they need it," he said.

Another challenge is long lifecycles of defense systems. TTI needs to support defense programs that have lifecycles of 20, 30, 40 years or more, he said. "We work closely with our OEM partners to ensure product availability over the life of a program." When products do become obsolete TTI can offer alternative solutions because of its comprehensive line card.

The counterfeit risk

Hunter added counterfeit parts pose a greater risk in the defense sector than with commercial customers. "By the critical nature of the defense and aerospace customer applications, there is absolutely a greater risk for the segment. This risk is exacerbated

by the longevity of defense and aerospace programs and the costly reluctance to redesign," he said.

To combat the risk, Avnet only sells product from a franchised manufacturer or an authorized distributor, with traceability to the franchised manufacturer, Hunter said.

"Avnet has a robust returned material verification process, which ensures the product being returned is the exact material shipped," he said. The verification process includes, but is not limited to, customer information, quantity, date code, and packing integrity. "This helps ensure the authenticity of the parts and their manufacturer," said Hunter.

Another challenge is managing the use of more commercial off-the-shelf (COTS) components. Hunter said the trend to use more commercial off-the-shelf components in the defense industry has not made it easier for distributors to support the defense and aerospace sectors. "The reality is that the move to COTS has increased the support challenge for distribution as the defense and aerospace customers design in COTS components, then flow down the additional requirements," he said. These customers are not immune from cost down challenges, which

forces them to look for price and efficiency opportunities. As a result, distributors are being pulled into additional support functions such as low dollar procurement activities, quality support, and various value add support functions, he said.

Because of long life cycles and component obsolescence, many defense OEMs purchase components from independent distributors. For instance, independent distributor Smith, based in Houston, Texas, supplies components to customers "across all sectors of the aerospace and defense industry," said Tim McQuade, trading manager, aerospace & defense for Smith. "Our team specializes in sourcing critical, obsolete, and hard-to-find components."

He noted that as defense spending has increased over the past two years Smith has increased its sales to defense contractors and their subcontractors. "Our team sells all types of electronic components to aerospace and defense customers. Memory, LCD panels, and processors are especially popular commodity groups within the industry.

To meet the needs of its defense customers Smith has invested in aerospace-and-defense-specific certifications such as AS6081 and AS9120 at its distribution centers in Houston and Hong Kong, said McQuade. "Offering nitrogen storage capabilities for long-term requirements has also helped us earn more customers," he said. Value-added services, such as specialized testing, offer key supply chain support for EOL parts.

He said that aerospace and defense customers have even greater quality and testing requirements than customers in other industries. Most A&D customers require certification to the AS6081 and AS9120 standards to ensure the proper

mitigation of nonconforming product. These key certifications also outline the sourcing and traceability requirements and processes for distributors, which aerospace and defense customers rely on strongly to help keep their supply chains active."

"Strict date codes and lead times are a few of the aspects that can be challenging to navigate when working with defense customers. Sourcing obsolete components for A&D applications can pose a particularly acute challenge, which makes adherence to the AS6081 and AS9120 standards critical," said McQuade. Maintaining a strict supplier rating and management system is one of Smith's top priorities to ensure the highest-quality parts.

Doing business with defense contractors has become more challenging for independent distributors over the last 10 years because the aerospace and defense industry has tightened its procedures and sourcing policies for distributors to enter its supply chain. "The investment Smith has made in obtaining ISO certifications that are A&D specific, coupled with 35 years of experience and all of the peripheral value-add services we offer, has certainly opened doors for us," said McQuade.

He added overcoming barriers to entry can be quite steep in the A&D industry, but once those are satisfied, "opportunities to partner on a variety of supply chain services exist, and the customers tend to be very loyal."



"By the critical nature of the defense and aerospace customer applications, there is absolutely a greater risk for the segment"

John Hunter, director of Avnet's defense and aerospace segment

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All just a distant memory?

Managing director at Nexus Industrial Memory, Michael Barrett, reflects on the rise and, in some cases, fall of commercial removable memory device formats

Removable flash memory devices have been around for more than two decades. Uses include the transfer or storage of files, a means of implementing software or firmware upgrades and user authentication. Devices are available in different form factors, the most familiar being the Secure Digital SD memory card and the USB stick.

Commercial memory evolution

Prior to the advent of SD in 1999, the MultiMediaCard was a prevalent format. Launched in 1997, it was created mainly for use in digital cameras, mobile phones and PDAs. MMC had an identical outline to SD but was thicker at 2.1mm compared to 1.4mm. This meant SD cards could be used in MMC receptacles but not vice versa.

The MMC was not to last, however and it was not just this physical difference that marked its demise. SD's ability to carry Secure Digital Music Initiative software, intended to combat music piracy, also helped it gain traction.

The SD form factor then evolved over the years.

The first derivative was the Mini-SD which, at two-thirds the size of the standard SD, was an ideal solution for mobile phones and cameras. However, the introduction of the significantly smaller Micro-SD in 2005 signalled the end for the Mini-SD and production of these cards ceased in 2008.

SD and Micro-SD are now well established but both have been through iterations. The original, known as Secure Digital Standard Capacity, carrying 1MB to 2GB, was followed by larger-capacity versions called Secure Digital High Capacity, carrying two to 32GB, and Secure Digital eXtended Capacity from 32GB to 2TB. A fourth version, the Secure Digital Ultra Capacity, from two to 128TB, is due for release soon.

In most cases these iterations involved changes to the read mechanism, with products designed to take smaller capacity cards unable read higher capacity ones without a firmware upgrade.

The other commercial stalwart is of course USB, which has also been through a few iterations regarding speed. As for the form factor, there are different types of connector, and the trend is towards smaller. For example, with the popularity of cloud-based storage and wireless connectivity, Apple has, for some years, not included USB Type-A receptacles on its MacBooks, but mass-produced USB sticks are still geared for Type A.

Industrial memory trends

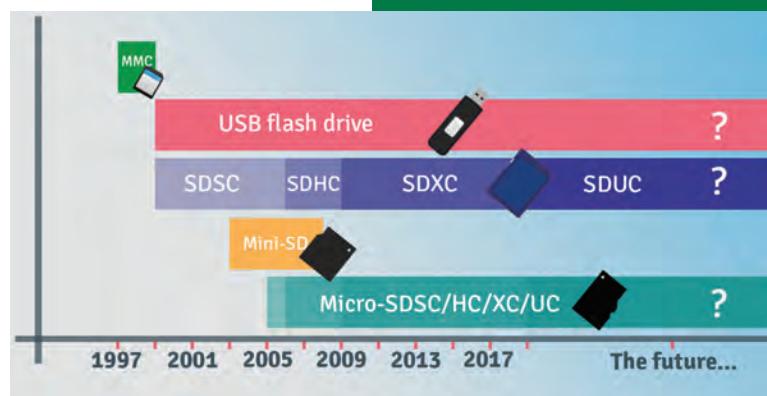
Leaving aside commercially available removable memory device formats, there are industrial formats which pre-date even MMC. Such devices are ideal for products that must be future-proofed against obsolescence, and are therefore popular in the

defence, transportation and renewable energy sectors. Long-term availability is just one advantage. Industrial devices are also more rugged and are rated for far more connect/disconnect cycles than, say, USB.

Furthermore, industrial form factor devices provide an added degree of security. If a device were to be lost, a corresponding receptacle would be needed to interface with it. Likewise, if an end product is fitted with a bespoke receptacle, this safeguards against someone trying to introduce malware via USB stick.

www.nexusindustrialmemory.com

Removable memory device formats have changed over the years, with new versions still emerging





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Weighing up the alternatives

In the past decade, some major capacitor OEMs have ceased production or discontinued products, leaving purchasers in a tight spot. Marketing manager at API Capacitors, Anastasia Love, provides a guide to alternative sources

Q Why would someone need obsolete, discontinued or replacement parts?

Often, it's to refurbish or maintain older equipment or machinery. The problem is that equipment originally manufactured 10, 20 or 50 years ago will typically include components that have been discontinued.

Similarly, a part in a piece of equipment may have reached the end of its life or experienced a failure. In situations like this, end users may seek to buy a one-off part rather than placing a batch order, which would typically be the only type of order an original manufacturer will accept.

Although you may be safe if the required item is a legacy part, certain parts, for example diodes or

fuses, are much easier to replace than an item such as a high voltage capacitor. Trying to find an exact replacement part can present obstacles including strict minimum order quantities and unknown specifications for discontinued items.

Q Where can I find electrical components that have been discontinued?

If you are in doubt about the availability of an item, call the original equipment manufacturer or a trusted distributor. Bear in mind, however, that the original manufacturer may not be too helpful when it comes to an obsolete part. An OEM will always try to sell a new part, rather than help you keep an obsolete part in your equipment design. You may just have to trawl the manufacturer's archive of old

specifications and provide this to an alternative source manufacturer.

If a part is no longer available to buy through its original manufacturer, an alternative manufacturer may be able to match the design and produce an interchangeable part to fit the equipment that needs servicing.

Alternatively, in some instances it may be possible to source obsolete components from a distributor, often with a large mark up. If capacitors are stored correct to manufacturer's instructions, most types will not age, however if you are sourcing electrolytic capacitors from a distributor with an inventory of old stock, be aware there is a shelf life on this component type.



“ ”

If a part is no longer available to buy through its original manufacturer, an alternative manufacturer may be able to match the design

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Learn more @ coilcraft.com

Obsolescence



Is it possible to manufacture a direct replacement?

Some independent capacitor manufacturers can manufacture interchangeable parts to replace discontinued OEM capacitors. Typically, capacitors can be manufactured and designed to order as per application requirements, which means a solution can be provided for almost any spare or replacement capacitor request.



What information do I need to provide to my alternative source?

With the design or specification for the original part, your alternative source will be able to manufacture the part to your requirement with no problems.

If the original design or full specification is not available, it may still be possible to design an equivalent part, if you can provide details of the following:

- product and capacitor application
- required capacitance and tolerance
- any temperature or humidity requirements
- whether the capacitor will be subject to any high current discharge
- the physical part measurements or size
- the rated voltage
- the actual working voltage which will be applied to the part

While some purchasers may not have these technical details, your engineering department will certainly know the conditions under which the part will need to perform.

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Johanson Technology has developed a line of small, highly reliable integrated passive components for RF systems. Components operate over several bands from 300MHz to 10GHz covering cellular, DECT, WLAN, Bluetooth, 802.11 a, b and g, and GPS applications.

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same functionality as 10 to 40 individual components in a single, low profile package with a total thickness of 0.35 to 1.0mm.

IPCs are available for almost any type of passive circuit, including low and high pass filters, diplexers, triplexers, impedance matched baluns, balun-filters, band pass filters, couplers and other custom signal conditioning circuits.

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Put an end to obsolescence anxiety

Obsolescence is a reality in today's high-tech supply chain. Executive vice president of Flip Electronics, Jeff Ittel, explains how to put a stop to the stress associated with end-of-life notifications

Looking back on 30-plus years in the industry, it is interesting to reflect on just how much change has occurred. The industry was exciting during the early years of my career, but everything seemed so simple then. Semiconductors were primarily used for building computers and related products. Original equipment manufacturers typically designed, procured, and manufactured their products in one location.

Fast-forward to today and it looks like a completely different world. Semiconductors have become faster, smaller, and more complex at an ever-increasing pace. All of this has contributed to a much more complex supply chain. Today, semiconductors are pervasive in every aspect of our lives, in the smartphones, tablets, appliances, automobiles, and security systems that we use every day.

With semiconductor components just about everywhere we turn, semiconductor manufacturers

constantly have to develop new chips to win new designs. This is particularly true in the fast-paced internet of things marketplace, where almost all products can include some type of semiconductor content.

The price of innovation

Constant innovation also means that older parts are phased out of production to make way for newer devices. When an original component manufacturer decides to end-of-life a product or product line, a chain of events takes place. While this is usually a well-designed process from the OCM's point of view, it can be a challenging one for everyone else involved in the supply chain.

Here's a brief overview of how the EOL process works. Once the OCM has decided which products will be discontinued, and when, its sales team and distributors will communicate this to current users. Customers are notified of last order dates and last ship dates and must quickly work out how this

affects their forecasts, revenue plans, product life cycle, and future support plans.

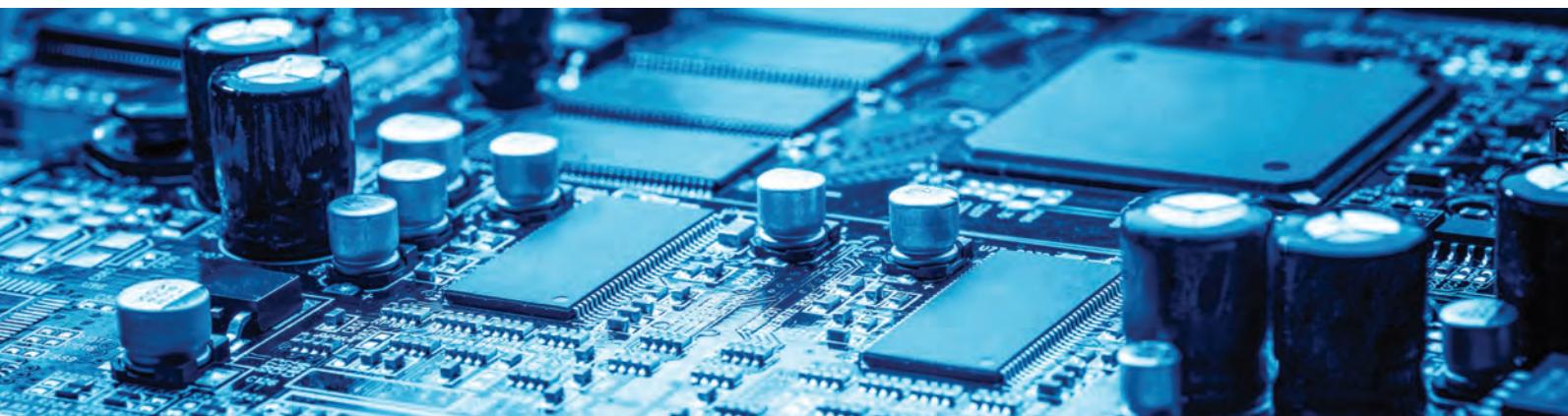
It is key to remember that many products have planned production and life cycles far longer than the individual components that go into the end-product. Component purchasers will therefore need to establish what inventories are on hand, including all regions and contract manufacturing partners, looking at current demand and forecasts for all products that contain EOL components on the bill of materials.

They will also need to consider any future designs that may incorporate these parts and new product design plans in order to phase out products. There may well be commitments on other devices that go into these products that could create a financial impact, and there may also be an impact of inventory buildup from last time buys.

Finally, purchasers will want to assess the time and cost associated with certifications



Flip Electronics executive vice president,
Jeff Ittel



Obsolescence

and regulatory approvals for redesigns, as well as weighing up redesign costs versus increased inventory costs.

Understand EOL challenges

For a large OEM with multiple devices, products, designs, and manufacturing sites, you can understand how EOL and obsolescence planning can easily get out of hand, not to mention at potentially great costs. Having a process in place to deal with obsolescence is vital for any supply chain, but even with the best-laid plans, there will be challenges to overcome.

Understandably, most OCMs' and distributors' sales teams are working on new design wins for upcoming OEM products so facilitating EOL communications is not always a priority. And when the EOL message does arrive, purchasing departments have to go through considerable analysis and approval processes internally, which often creates a situation where decisions are being made at the last minute.

At the OCM, someone in the factory is making a final decision about when and how large the final product run will be for the component. Chances are there will be an inventory imbalance somewhere.

This inventory imbalance, coupled with unforeseen continued demand, creates a whole market of resellers that are often referred to as the 'gray market'. Dealing in the gray market cannot always be avoided, however, quality concerns including older date codes, counterfeit issues, traceability problems, lack of certificates of conformance, voided warranty, and packaging issues are all serious risks and considerations that procurers must evaluate.

Plan, prepare, review

Bearing these challenges in mind, an ongoing process for the planning, review, and execution on EOL components is essential. Simply being prepared helps a company navigate through most of these issues. Beyond the process outlined already, I recommend partnering with a company that specializes in EOL supply chain issues. At Flip Electronics, our sole focus is on the gap caused by obsolescence and EOL issues. Through visibility, knowledge, and expertise, Flip has developed solutions that can help avoid costly product shortage and line down scenarios.

Flip is constantly monitoring and analyzing demand trends across the industry. With visibility across multiple

customers and inventory sites, we have the ability to understand potential shortages. This insight helps Flip to anticipate future demand and procure products that will be used across many different OEMs and contract manufacturers. For example, Flip successfully got an OCM to restart a product line for an 'additional run' and placed a lifetime buy on a device that three different OEMs required. Individually, none of them had the demand to meet the minimum volume needed to start up a line but Flip was able to coordinate their demand.

In this way, Flip helps customers avoid the gray markets completely by building fully 'authorized' relationships with semiconductor manufacturers. We have partnerships with these manufacturers on obsolete and EOL components. These partnerships allow a lot of product that would otherwise be set aside, scrapped, and destroyed to remain available to customers who may not have had enough inventory to support lifetime production demands.

Flip offers customers all the benefits that come with factory-direct procurement, including traceability and manufacturer quality



For a large OEM with multiple devices, products, designs, and manufacturing sites, EOL and obsolescence planning can be complicated

standards plus one extra element that factories cannot provide—and that is convenience.

Many companies don't understand obsolescence and how it truly affects the supply chain but obsolescence doesn't have to be a painful process. With the right partner, it can even become an opportunity.

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Get proactive

Short component lifecycles cause havoc for high reliability products with their long manufacturing lifespan. Proactive obsolescence management is essential, explains 4 Star Electronics

Component obsolescence is an issue for any company that designs or manufactures electronic equipment but is especially problematic in high-reliability applications such as those found in military, aerospace, or specialized industrial manufacturing.

This is primarily caused by the rapid development of commercial electronic components and subsequent replacement of popular parts by their manufacturers. As high-reliability applications have increasingly utilized commercial parts, these short lifecycles create havoc in planning for long-term manufacturing and product support. Thus, it's crucial to develop an effective proactive obsolescence management program.

Supply chain evaluation

Effective obsolescence or diminishing manufacturing sources and material shortages programs can reduce costs and reactive actions by evaluating the supply chain. It's important to address obsolescence at all stages of product development: design, introduction, growth, maturity, decline, and phase-out.

During the design phase, component engineers should ideally use components that have multiple sources. That way, if one supplier ends production or experiences production interruptions, then another supplier may be a backup option. Another way to future-proof work is to use parts that have multiple options, such as speed, temperature, or tolerance ratings, that may be easier to source in the future.

During production, continual evaluation of all the components on your bill of materials is essential. You should consider future requirements for your product as well as current availability of all the material required to produce or repair the product. Forecast obsolescence dates and lifecycles of critical items, scheduling end-of-life material purchases with a view to stocking additional material with impending obsolescence. Evaluate design alternatives when the component supply becomes critical and align with specialized end-of-life distributors to handle unforeseen circumstances.

When your application begins its phase-out, you still need to ensure an uninterrupted

supply of components until the end-of-support date has passed.

Enlist specialist suppliers

Best practice in component procurement always includes maintaining a relationship with the original component manufacturer and a variety of its authorized distributors, to ensure a smooth supply of active components, but challenging times of rapid obsolescence may require additional resources.

Buyers need to know who the authorized end-of-life distributors are for the components on their bill of materials. This includes aftermarket manufacturers that can build continuation product based on OCM die or fully recreate components with authorization from the OCM. It also includes distributors specifically authorized by OCMs to warehouse end-of-life product with full certification and traceability.

Lastly, component buyers should have strong relationships with a small number of independent distributors that can provide excess material from the open market to bridge supply

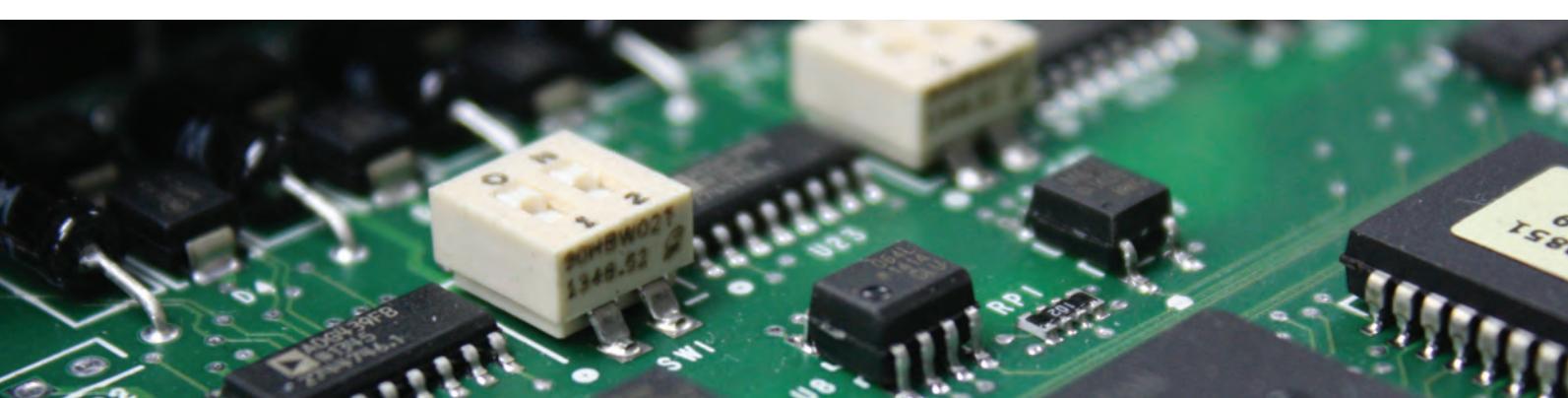
gaps and support obsolete parts. Top tier independent distributors have sophisticated processes in place for bill of material and lifecycle analysis, vendor management, kitting, and full purchasing outsourcing; effectively acting as purchasing departments for customers.

Quality independent distributors will have invested heavily in counterfeit mitigation tools and processes to ensure that parts supplied are new and original as specified by the original manufacturer, through detailed inspections and tests.

Think long-term

Taking the time to proactively develop and implement an obsolescence management program will aid in long term project success. Having a thorough understanding of component lifecycles through the use of tools and data, focusing on critical solutions, and aligning with specialist suppliers to ensure a supply of parts when dealing with unforeseen circumstances are the keys to undertaking this difficult challenge.

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Could you customize without compromise?

The best way to find out whether a customized standard enclosure could save you time and money is to ask a specialist enclosures manufacturer, says OKW

Thanks to various new manufacturing technologies, there's a tantalizing array of opportunities when looking to specify custom electronics enclosures. But with infinite possibilities available, it can be tricky for purchasers to establish whether specifying a customized standard enclosure could save time and money, or if a fully bespoke case is a more effective solution. Either way, partnering with a specialist enclosures manufacturer, rather than a distributor, is the best way forward, says OKW. That's because only an enclosure manufacturer can offer a single source solution with direct access to engineering advice.

Single-source expertise

Lots of suppliers promise customization expertise, and they all offer machining, but only a specialist manufacturer can offer CNC machining, plus other technologies, under one roof. That's especially true for plastic enclosures because the choice is so large. Custom colors are just the start; digital photo-quality decor foils enable customers to wrap enclosures in any graphics, while lacquering offers a range of finishes and textures. Special materials such as high gloss ASA or ASA+PC-FR improve the strength and UV stability of enclosures and can make them easier to keep clean in demanding applications such as healthcare where RFI/EMI shielding and tamperproof fixing screws are also a must.

The hottest new technology

for plastic enclosures is laser marking, which turns dark and light plastics gray to create precise, waterproof and smudge-proof legends and logos. Laser marking is suitable for ABS, ASA+PC, ASA+PC-FR, polycarbonate, polyamide and aluminum. It makes adding sequential numbers, barcodes and QR codes fast and easy.

OKW Enclosures vice president of marketing, Robert Cox, explained: "The arrival of digital printing was a huge step forward because the set-up costs were so much lower than for screen or tampo printing. This was an important factor in helping to make customization viable for lower volumes. Now laser marking offers all the advantages of digital printing—but with higher levels of resilience."

Customizing small quantities

Enclosures manufactured from folded aluminum offer even greater opportunities for customization in small batches since no mold is needed. This ensures tooling costs are much lower than for plastic. Consequently, OKW's metal enclosures division, Metcase, now offers a cost effective prototyping service. And although it is quicker and easier to create a fully bespoke enclosure from metal than it is from plastic, there are still significant time and cost savings to be gained by modifying a standard metal 19in rack case or instrument enclosure.



CNC machining, custom front panels, fixings and inserts are fundamental services for any metal enclosures manufacturer. What sets manufacturers like Metcase apart, however, is its ability to offer a choice of custom paint colors, anodizing, finishing, anti-corrosion finishing and RFI/EMI shielding all on one site. Digital printing is key too, with the capacity to handle larger print areas up to 23.62 by 16.53in in 1,800 by 1800dpi quality.

Catering for extremes

Purchasers looking to specify industrial electronics enclosures for challenging environments such as factories, marine/offshore and the petrochemical sector may require the assistance of a specialized enclosure manufacturer such as Rolec, which is now selling direct in North America. Customizing standard IP-rated enclosures is the best option because

Plastic enclosures are ideal for digital printing or laser marking



Enclosures manufactured from folded aluminum offer even greater opportunities for customization in small batches since no mold is needed



most are diecast aluminum or polyester, which can have high initial tooling costs. Stainless steel enclosures offer high impact resistance and are manufactured from sheet metal but need edging and welding to make them watertight. Again, customizing a standard housing is often the most cost-effective route.

When it comes to specifying human machine interface and command enclosures for Industry 4.0, smart factories and IoT/IIoT applications, Rolec claims to have taken customization to the next level. It manufactures custom panel enclosures to any desired plan size up to 31.49 by 31.49in. Standard customizable options—along with dedicated housings for B&R, Beckhoff and Siemens displays—make the process even easier. Mount these enclosures on Rolec's customizable modular suspension arms and the range of options is even greater.

Whatever purchasers' requirements, employing a specialist enclosures partner can pay dividends, particularly one capable of playing a key role early in the design process. A true partner will be able to provide a full outsourcing solution, offering not just a PCB-ready custom enclosure, but also installation and assembly, touchscreens or membrane keypads, plus a wealth of timely expertise.

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Don't go it alone with IoT

Partnering with an IoT technology specialist can speed time to market and create secure solutions that optimize the customer experience, says Microchip Technology's strategic partner manager, Sneha Murali

The internet of things is constantly evolving, with latest advances promising smarter cities and driverless cars. Yet fulfilling this vision requires vendors to understand multiple, complex technologies, all of which are changing rapidly.

The fact is, no company can create an IoT solution alone, and increasingly vendors must form strategic partnerships that give access to complementary technologies. Unfortunately, today's IoT partner ecosystem is fragmented, making it easy to forge weak alliances that lead to solutions which deliver a poor customer experience. On the other hand, an effective partnership will speed time to market for solutions that not only optimize the customer experience but also protect users against growing cyber security threats and offer the scalability to support growth and changing requirements.

Plugging technology gaps

When looking to source IoT

solutions, most OEMs will be trying to overcome technology and feature gaps in their solution. Reducing time to market is the main goal, with the right partner providing resources and expertise to accelerate solution development.

Vendors that join the partner program of a large technology provider may also be able to use the organization's sales channels to break into the market and gain greater visibility. In contrast, a partnership with a smaller provider can be a prolonged, tedious and costly venture that may ultimately limit the vendor's growth opportunities. Careful partner choice will provide complementary technology assets that are critical for developing solutions that combine connectivity, scalability and security.

End-to-end solutions

Given a choice between working with one or multiple suppliers, it's always wise to

choose the former. Complex business needs are best solved with a complete end-to-end solution from a single partner who offers all necessary elements including the IoT platform, application, architecture, security, connectivity, product/UX analytics and enterprise cloud solution.

This type of partner also offers a palette of services and can provide efficient and timely support across a solution's many iterations from ideation to launch. Without this level of support, a solution's delivery schedule and the quality of its user experience may both be jeopardized.

Connectivity

Consumers are confused by the myriad of IoT solutions available. This makes connectivity an important product feature since, to a large extent, it determines whether a product is easy to set up and use, and will continue to operate reliably.



Vendors that join the partner program of a large technology provider may also be able to use the organization's sales channels to break into the market and gain greater visibility

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First and foremost, a vendor needs to understand which connectivity standard best suits its solution before locking in a partnership. Any solution that is used to run a business must deliver the same high quality of service to every customer, but today's IoT connectivity technology options usually force a trade-off between bandwidth, power, consumption and range. This means vendors must have access, through their partner, to a variety of connectivity services that can be flexibly priced to meet specific customer needs.

Scalability

This is a make-or-break feature for any IoT solution. It is easy to build a prototype in beta but a vendor's ability to scale the solution without compromising security or functionality relies heavily on a good technology partner and its services.

As an organization grows, its system, network and process requirements are accelerated. Data migration, latency,

connection time, scaling infrastructures and meeting service level agreements are crucial. These organizations need a vendor that enables them to manage different plans at scale and can accommodate their growth. Most would also rather pay as they go rather than overpay and underuse.

On the flipside, customers do not want to limit their expansion. They don't want to feel stuck with a boxed hardware and software solution that cannot be adapted for future needs. They also want a vendor that is transparent with cost plans and gives them a heads up when they are likely to hit their budget ceiling. The right technology partner enables vendors to navigate all these challenging customer dynamics and expectations.

Security

Security threats are accelerating as cyber attacks proliferate throughout the rapidly expanding internet of things. It is therefore

critical that security be considered from the start of the development process. The more things are connected in the IoT, the more attack surfaces there are for hackers to access to private information.

Every organization needs to evaluate its vulnerability to attack. Choose a partner that prioritizes security with a multi-layered security strategy that spans the device, network, systems and data. The right partner should be talking about appropriate solutions for user authentication, access control mechanisms and adaptive authentication. They will also advise on the best approach for protecting the unprecedented amounts of user data today's solutions gather.

While strengthening security can increase costs, it will pay off in the long run through improved credibility, greater customer loyalty and potentially higher revenues. Not investing may ultimately

be more costly should there be a breach that leads to lost customers and diminished trust and credibility. Security is often the best place to start an IoT technology partnership.

Prepared for growth?

There are tremendous opportunities ahead for those targeting the rapidly growing market for connected IoT solutions. Choosing the right partner, however, is essential. This will facilitate a solution that can scale to meet changing needs, as well as delivering the multi-layered security that is critical for defending against hackers and safeguarding the huge volumes of private information that today's IoT solutions generate. Rather than go at it alone, partnering with a large technology provider delivers the end-to-end solutions and large service offering needed to support both current and future customer requirements.

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Need a hand with your IoT solution?

Partnering with a large technology provider can provide the connectivity, scalability and security required



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A case for cyber securing our industry

This month John Denslinger argues for an 'operational alliance' within which electronics companies collaborate to cyber-secure the industry



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

Cyber security • By John Denslinger

Is the electronic component supply chain secure from cyber threats? That question came to mind as I read a recent article published in the *Harvard Business Review*. The author, Daniel Dobrygowski, head of governance & policy for the World Economic Forum Centre for Cybersecurity, is obviously a person with deep understanding of the digitally connected world. His article proceeds to highlight the hi-tech industry forming its own cybersecurity alliances and pacts. My immediate reaction: why isn't our government taking the lead? It would seem the consequences of cyber-attacks are of national interest. Our personal safety and critical infrastructure are at risk. So are institutional, financial and legal systems. Each is a ready target for bad actors. The reality is most western governments are still more focused on developing offensive capabilities than building responsive counter cyber measures to protect us and our businesses.

Let's face it, the future digital network will only increase in complexity and entice increasingly destructive cyber-attacks. Anyone familiar with our industry understands me completely when I say our companies tend to be fiercely competitive and keenly individualistic. That being the case, is it really possible to form meaningful alliances to tackle cybersecurity issues? If so, what kind of alliance makes the most sense?

To answer that question, let's draw from Mr Dobrygowski's experience and discuss two possibilities that might be appropriate for our industry:

Operational alliances—a small-group structure focused on intelligence and related technical data sharing. Information is exchanged freely to raise collective awareness of cybersecurity issues and speed adoption of counter security technologies.

Normative alliances—a structure of very large-platform companies targeting solutions to cybersecurity vulnerabilities with the intent

of creating a more secure, global digital environment for customers, institutions as well as nations.

To be clear, the global digital network transformed our industry and made us more productive. B2B, B2C and C2B eCommerce transactions take place 24/7/365. Uploads/downloads between business and customer systems is commonplace and the frequency continues to accelerate. Business is global. Speed is critical. Privacy is paramount. So too is reliability of transferred data sets. In the digital network, we are vulnerable. The next cyber target making headline news might be one of our own! If that happens, you know customers will demand counter-measures from every company and their supply chains.

With so much at stake, our industry should strongly consider banding together for the greater good. Protection from government cyber efforts can't be counted on. The industry must safeguard itself. IT solutions of one company may quickly recognize cyber threats, hacks and breaches. Another company may have developed state-of-the-art cybersecurity tools. Another may be capable of tracking digital footprints and identifying threat sources. And still another, the speed and resources to prevent cyber intrusions before any damage is done. What if we could share what we know and armed the industry with the best cyber safeguards? I think customers would value the concept greatly as it better protects them and their supply chain more comprehensively.

In my view, the Operational Alliance appears to be a good fit for our industry. ECIA might be the perfect forum to host such an alliance. It's about time we collaborate and cyber-secure our industry.



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Switched on buyers opt for certification

Sourcing switches for use in hazardous or explosive environments brings serious safety concerns. Here Schurter explains the ATEX/IECx certification that underpins safe switch specification

Products in Schurter Electronics' Metal Line switch range are more than just mechanical switches. In order to offer switches capable of operating in the harshest of environments, Schurter makes use of different component technologies.

The PSE EX family, for example, is certified according to ATEX and IECEx regulations and its application is consistent with device group II, which covers areas other than mining. As a piezo switch, it can be used in hazardous environments with ATEX / IECEx certification due to the PSE EX certification. The fact that piezo technology has no moving parts allows for a fully sealed switch, ensuring it is ideally placed to deal with the rigors of the toughest industries.

Explosive atmospheres

The PSE EX family is approved for use in potentially explosive atmospheres containing air and gases. Further application areas also include industrial sectors such as mills, where solids are found in their smallest form as dust, which may be prone to self-ignition.

Flammable substances such as gases, vapours or mist released into the environment during production,

transportation or storage, can ignite and pose serious consequences for people and property. The same is true for dust, which, in conjunction with air, can create an explosive atmosphere.

To ensure security in these environments, the Device Directives 94/9/EC features guidelines for the protection

of personnel and devices working in such hazardous areas. This is achieved by eliminating all possible sources of fire and ignition in the products and systems used in these areas.

Approval markings

The approval marking is Ex II 2 GD according to ATEX



Switches for hazardous use have a label with the particulars of the certification



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To ensure security in hazardous environments, the Device Directives 94/9/EC features guidelines for the protection of personnel and devices

regulations, and Ex ib IIC T6 T5 Gb and Ex ib IIIC T85°C T100°C Db according to IEC regulations, for gases and dust.

With the temperature class extended from T4 to T5 and T6, the permissible power dissipation of the PSE EX was limited accordingly, such that the piezo switch is intrinsically safe according to EN60079-11.

In addition, the flammability group was increased from IIB to IIC, and IIIC respectively. This extension will allow the use of the PSE EX in atmospheres with further types of gases, combustible dust, ignitable fibres and filings.

Typical applications include oil and gas exploration rigs, petrochemical facilities, transportation and storage environments for combustible materials, paint mixing devices, grain mills, wood processing and chemical plants.

To meet the needs of these diverse applications, the PSE EX standard models are available with mounting diameters of 16, 19 and 22mm with pin connectors and housing colours in red, green or natural aluminium. Other colours, housing diameters and connection versions are available on request. Installation instructions are included in the packaging according to the ATEX directives and for maximum safety, switches for hazardous use have a label with the particulars of the certification and an identification number.

www.schurter.com

Piezo technology has no moving parts allowing for a fully sealed switch



Switch products

Quality feedback for automotive switch

C&K has launched a new tactile switch designed for automotive interior and openings applications. Housed in a compact 6.2 by 6.2 by 4.9mm package, the KSC XA switch is said to be smaller than competitor products, while still delivering the required sound and haptic feedback for applications such as steering wheel or gear shift paddles.

Operating life is up to 1,000,000 cycles, delivering reliability for automotive applications. The switch is housed in an extended cage, is fully sealed, and compatible with potting, which is often used in opening applications. An IP67 rating for resistance to dust and moisture enables it to withstand extreme environmental conditions and exposure to water.

Global product manager, tact switches at C&K, Jérôme Smolinski, said: "Automotive customers know that the sound and haptics of a switch can strongly influence drivers' and passengers' perceptions of the car's quality. The KSC XA switch delivers the right sound and haptics and excellent reliability, in a compact package – all at a lower cost than competitive products."

www.ckswitches.com

Specify any legend with laser engraving

EAO can now supply its Series 82 pushbutton switches with laser engraving and a low minimum order quantity. This permanent and precise marking technique allows for complex icons, logos, legends and detailed graphics. Customers can submit unique designs or select from EAO's ISO library of industry accepted legends such as the 'power on/standby' symbol. Additionally, EAO can add any industry accepted cable or connector to the pushbutton.

Engineered to offer strength and versatility, the Series 82 pushbutton can withstand harsh, industrial environments. It features an all-metal front, IK10 shock protection and IP67 sealing, ensuring it is both durable and rugged. Extreme temperature fluctuations from -22 to 158°F, or even humidity up to 85 per cent, will not affect its reliability, says EAO.

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Microprocessor market will bounce back despite slow PC growth

MPU demand will rebound in 2020 resulting in higher tags for processors used in computers and a return to sales growth



James Carbone

Weaker demand and oversupply will result in the global microprocessor market declining about 2 per cent in 2019 as revenue falls from \$54.1 billion in 2018 to \$53.25 billion in 2019, according to researcher Gartner Inc.

However, the MPU market will bounce back in 2020 when sales climb to \$54.5 billion and continue to grow steadily through 2023 when revenue reaches \$58.6 billion, the researcher said. Unit shipments will also rebound. Processor unit shipments in 2019 will fall to 486.9 million from 491.9 million in 2018. Shipments will rise to 500 million in 2020 and grow to 531 million in 2023, Gartner said.

Part of the decline in MPU revenue in 2019 is due to a weak PC market, which has been slowing for years. Despite slow growth in PCs, the MPU market had been growing steadily until 2018 because of strong demand for microprocessors used in servers for data centers run by

hyperscale cloud providers such as Google, Amazon, Microsoft, Facebook and Alibaba and others, said Alan Priestley, research vice president for Gartner Inc.

"They account for a huge volume of product. What happened in the second half of 2018 and the first half of 2019, the hyperscalers' slowed down their consumption" of servers impacting demand for microprocessors, he said.

"It looks like in the second half of this year server demand is coming back but for the total year, the microprocessor market will be down compared to 2018," said Priestley.

He noted the MPU market is comprised of the computer segment, which includes servers, desktops, mobile computers, and the embedded market, which includes microprocessors used in other types of electronics equipment.

"The embedded market is a lot smaller part of the market," said

Priestly. In 2018, the embedded market totaled about \$5 billion compared to \$49 billion for the computer market, according to Gartner.

"The embedded market is more fragmented and is much more affected" by economic conditions, said Priestly. As a result, the embedded MPU business has slowed because of declining economic growth worldwide.

The server market is more affected by the large cloud computing providers, which had been increasing purchases of servers, resulting in robust demand for MPUs and is not as dependent as much on strong overall economic growth.

Mixed pricing scenario

Buyers who purchase microprocessors for embedded applications can expect modest price declines through 2023. For instance, the average price for an MPU used in an embedded system will drop from \$23.70 in 2018 to \$22.00 in 2019 and

to \$21.50 in 2021. However, the average price for an MPU used in servers and PCs will rise from \$174.80 in 2018 to \$176.35 in 2019, then increase steadily through 2023 when the average price will be \$194.17.

MPU tags vary depending on the application performance level. For instance, the highest end Intel Xeon microprocessor for servers has a list price of more than \$17,000, while a low-end Celeron processor lists for \$42.

"The difference between these processors is core count," said Priestly. Microprocessors used in high-end servers have 28 cores while low-end Celeron MPUs have two cores. The higher the number of cores, the greater the workload the processor can handle. "Some workloads need a lot of cores and some don't," he said.

The average price for server microprocessors will increase because server manufacturers will use more powerful, higher-

By the Numbers



\$54.1 billion

*The size of the global microprocessor market in 2018.
Source: Gartner*



\$176.35

The expected average selling price of a server microprocessor in 2019.



486.9 million

The number of microprocessors that are expected to ship in 2019. Source: Gartner



\$58.6 billion

The forecast size of the worldwide microprocessor market in 2023. Source: Gartner



1%

*The expected growth rate of servers in 2019.
Source: IHS Markit*



performance microprocessors in systems. Such MPUs have higher prices and drive up the MPU average price. In fact, the long-term strategy of MPU makers Intel and AMD is to produce more processors in the mid-range and high-end, according to Shane Rau, research vice president, computing semiconductors for researcher IDC.

"That has had a positive effect to raise average prices," he said. However, with demand being weaker than last year there has been some competition between Intel and AMD and "I've seen some pricing competition in the midrange and high-end," said Rau. "In the second quarter, I noticed a notable sequential decline in processor ASP," he said. However, it will likely be a short-term trend once microprocessor demand picks up.

Demand for MPUs will rise because server demand will increase next year. Server shipments will likely end 2019 rising about 1 per cent after growing 7.9 per cent last year. IHS Markit forecasts 8 per cent growth in server shipments in 2020.

Rau noted that microprocessors designed to be used in servers are used in other types of electronics equipment as well.

About 70 per cent of processors are actually used in servers, while the remaining 30 percent are used in other data center systems including storage, workstations and networking systems among others, he said.

More servers to ship

He said server processor revenue will decline 1.5 per cent this year to \$19.6 billion but will grow 2.9 per cent in 2020 to \$20.15 billion.

"Demand in 2019 was weak compared to 2018," he said. In 2018, server processors grew 25 per cent because of robust demand by server manufacturers. But the very end of last year we noticed a significant slowdown in demand for server class components, including processors. That trend continued in the first half of 2019," he said.

Enterprise OEMs and cloud service providers reduced their purchases of servers. Some companies were waiting for new server processors, such as Intel's Cascade Lake Xeon processors and AMD's new version of its Epyc processors.

There was expected to be a "significant increase in demand in the fourth quarter," said Rau. That demand will carry over into 2020 and continue for several years. Rau expects server revenue to

The global microprocessor market will dip in 2019 but rebound and post steady growth through 2023. Source: Gartner Inc.

MPU market will bounce back



rise between 2.7 per cent and 4.1 per cent per year through 2023.

Also driving microprocessor demand over the next five years will be the growth of connected devices in Internet of things applications including the rollout of 5G technology, smart cards, artificial intelligence and machine learning techniques, said Vlad Galabov, principal analyst, data center compute and cloud research for IHS Markit. As a result, while the MPU market will decline in 2019, it will bounce back in 2020 and post a compound annual growth rate of 4.4 per cent through 2023, Galabov said.

The PC market will not be as much of a factor in MPU growth. "We expect a downward, sloping curve for the long run because the PC market is mature. People are doing more and more computing on their smart phones," said Galabov.

Growth for application-specific MPUs

One segment of the MPU market that will contribute to microprocessor growth will be application-specific microprocessors. Revenue in the segment totaled about \$1.3 billion, "so it's quite small compared to the overall MPU market," said Galabov. However, the segment will

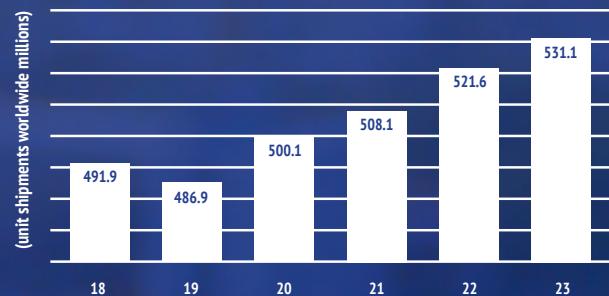
grow over the next five years. The compound annual growth rate for application-specific microprocessors will be 12.9 per cent," said Galabov. They will expand beyond videogame consoles and will be used in automotive systems as well.

One unknown factor that could impact microprocessor sales, as well as sales of other semiconductors, is the ongoing trade dispute with China. Intel says rising trade tensions between the U.S. and China have led to increased tariffs and trade restrictions which have an impact on some of the chipmaker's products.

"The U.S. has previously imposed, and continues to impose, restrictions on the export of U.S.-regulated products and technology to certain Chinese technology companies, which have included, and continue to include, certain of our customers," Intel said in a financial filing. "These restrictions have reduced Intel's sales and continuing or future restrictions could adversely affect our financial results," the company said.

The restriction could result in some companies developing or adopt technologies that compete with Intel's products, the company said.

Processor unit shipments will rise



Unit demand shipments of microprocessors will fall in 2019 but increase in 2020 as demand from server manufacturers rises. Source: Gartner Inc.

Chipmakers' spending plans key to forecasting supply and price trends

Large investments by semiconductor suppliers often mean buyers can expect lower prices and short lead times for many chips

Many strategic semiconductor buyers spend a great deal of time trying to determine if prices and lead times for the crucial integrated circuits and discrete semiconductors that their companies need for production will increase or decline over the next 18 to 24 months.

Learning the capital expenditure (capex) plans of key chip suppliers and the current capital spending trends in the overall semiconductor industry can give buyers insight into future changes coming in supply, lead times and prices and help them develop strategies to manage those changes.

Big increases in capital spending often occur when component shortages occur and chipmakers determine that the shortages are likely to continue for a while. Semiconductor manufacturers then add more production lines, upgrade existing ones with new equipment to boost production or build entire new fabs.

In recent years, many chipmakers have been transitioning from 200mm wafers to 300mm wafers because they can produce more usable chips on larger wafers, thereby increasing capacity and supply.

Inevitably what happens

is chipmakers add too much capacity, resulting in oversupply, short lead times and falling prices. When that occurs, suppliers reduce capex even if demand continues to be strong. Eventually, the declines in capex result in tight supply, longer lead times, and in some cases shortages, as well as higher prices. Then suppliers increase capital spending and a new cycle begins.

Good supply times

In 2019 buyers are enjoying oversupply conditions that resulted from heavy investment in new capacity by chipmakers in 2017 and 2018. The good news is buyers can expect ample supply will continue for another year or more because of large investments in new equipment, production lines and fabs by semiconductor integrated device manufacturers (IDMs) and foundries over the past three years.

Semiconductor capital spending increased sharply from \$67.8 billion in 2016 to \$95.6 billion dollars in 2017. Investment in new fabs and equipment continued to grow in 2018 when capex reached a record \$109.5 billion, according to researcher IC Insights. As frequently happens during periods of capital spending growth, too much capacity was added

for the amount of demand in the market, resulting in oversupply and falling prices for some chips.

As a result, chipmakers are now cutting back on capital expenditures (capex). In 2019, total semiconductor capital expenditures are forecast to slip 8 per cent to \$97.8 billion and 11 per cent to \$87.3 billion in 2021, according to IC Insights. The capex cutbacks will likely mean tighter supply, longer lead times and potentially higher prices in late 2021 and 2022, but in 2020 chip supply will be ample as capacity will continue to rise because of investment made in 2017 and 2018.

For instance, DRAM capacity is expected to increase 1 per cent and be followed by a 3 per cent rise in 2020, the researcher said. It's expected that 3D NAND capacity growth will increase by 4 per cent and jump by double digits in 2020. Installed capacity for MPU is expected to increase by 3 per cent in both 2019 and 2020. Optoelectronics, (primarily image sensors) capacity will increase by 9 per cent in both 2019 and 2020, according to IC Insights.

"Currently the industry has a little too much capacity available," said Brian Matas, vice president of research for

IC Insights. "The spending we've seen over the past two, maybe three, years has resulted in the industry not only meeting, but exceeding demand."

He said the industry will be "in good shape from a capacity standpoint" for at least another 18 months before supply-demand equilibrium is achieved. "Across all IC products, it should be a buyer's market throughout 2020 although there is a slight chance of some tightening of supplies for leading-edge memory and/or server processors in the second half of next year," said Matas. Later in 2020, suppliers will need to consider raising their capex budgets again, he said.

Earmarking investment

Semiconductor companies typically earmark a certain percentage of their sales for capital expenditures in order to increase capacity. Capital spending as a percentage of sales was 19-21 per cent since 2010. "For 2017-2019F, we have capex as a percent of sales at 21 per cent all three years," said Matas. However, the percentage varies widely by supplier and IC type.

Typically, the big three DRAM suppliers, the big five flash suppliers, and the top four foundries, make the most capital expenditures. Memory





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IC manufacturers Samsung, SK Hynix and Micron invest in new equipment to make the next generation of ICs that are typically designed using smaller process geometries than the previous generations, according to Matas.

Newer designs often mean the chips use less power, provide more performance, and basically offer more bang for the buck. They also are physically smaller, which is what system OEMs want to place into their new boxes. These new devices bring higher profits, he noted.

In recent years memory suppliers have focused on 3D memory chips and have had to upgrade to new equipment including new lithography and etching equipment that can make the deep aspect-ratio cells associated with 3D memory, Matas said. Moreover, using smaller process nodes requires more mask steps and more cleanroom space for new equipment.

Making 3D devices requires more mask layers, requires a larger footprint within the fab. That means existing fabs need to be retrofitted or memory suppliers have to build new

fabs for 3D NAND or DRAM devices, he said.

Foundries, which build chips for multiple semiconductor companies, also need to invest a lot to keep up with design technology advances as more IDMs decide to outsource production of semiconductors because of soaring manufacturing costs. As a result, foundries must be prepared for the steady growth of their services, especially for leading-edge processes since many of their customers want their devices made using the smallest possible process nodes, according to Matas.

While the top five non-foundry suppliers—Samsung, Intel, SK Hynix, Micron, Toshiba/WD—collectively spent 26.6 per cent of sales on capex in 2018, the percent of sales on capex by the “big four” foundries has been “through the roof since 2010,” said Matas. The big four include TSMC, UMC, GlobalFoundries and SMIC.

TSMC’s capex as a per cent of its sales averaged 40 per cent per year since 2010. However, with oversupply, TSMC will cut back on its capital expenditures in 2019 to about 33 per cent of sales. The

foundry average will be about 32 per cent sales in 2019, IC insights said. The overall semiconductor industry average as a percentage of sales will be about 22 per cent, the researcher said.

Memory makers invest the most

Capex as a percentage of sales is highest for foundries, but memory IC manufacturers overall account for the largest percentage of semiconductor capex investment. Memory is forecast to represent 43 per cent of total semiconductor industry capital spending this year, down from 49 per cent in 2018, according to IC Insights.

Samsung, SK Hynix, and Micron have added capacity for both DRAM and NAND flash, while Intel, Toshiba Memory/Western Digital/SanDisk, and XMC/Yangtze River Storage Technology all boosted 3D NAND flash capacity over the last year and a half. However, this year DRAM and NAND flash memory markets have entered a period of overcapacity and prices per bit have weakened, resulting in a cut back in capital spending to 2019, the researcher said.

Capex for DRAM and flash is expected to drop 19 per cent in 2019 and 21 per cent in 2020. Total memory capital spending is expected to be \$41.6 billion in 2019, a decline of \$10.4 billion from last year, IC Insights said.

The cutbacks in spending are an attempt by memory IC manufacturers to stop price erosion. How far memory prices continue to fall will be determined in large part by how much memory suppliers cut capital expenditures and if the lower prices result in additional demand. Increased demand could result in the cessation of price declines.

Capital expenditures by memory IC manufacturers and other IDMs and foundries are often used to equip new fabs or to upgrade existing ones with high-end machines used for advanced lithography ($\leq 10\text{nm}$) and 3D process technology for 3D NAND, 3D DRAM, said Matas. Such equipment is expensive and constitutes a “good share of the total amount of capex spending over the past few years,” he said.

TSMC, Samsung and, to a lesser extent Intel, SK Hynix and Micron are the primary

Semiconductor capex will bounce back



Capital spending by semiconductor manufacturers will decline this year and next increase again beginning in 2021. Source: IC Insights

buyers of this equipment and will likely be among the very few that will continue to allocate big money for high-end equipment purchases, said Matas. Other chipmakers are allocating money to upgrade to 300mm wafer manufacturing and/or to move their particular process nodes to the next generation on their roadmaps. For many, this means moving to <22nm process nodes, according to Matas.

Equipment investment falls

Because of cutbacks in capital spending, global sales of semiconductor manufacturing by original equipment manufacturers are projected to drop 18.4 per cent to \$52.7 billion in 2019 from last year's historic high of \$64.5 billion, according to trade association SEMI.

Wafer processing equipment sales will fall 19.1 per cent in 2019 to \$42.2 billion and other front-end segment, consisting of fab facilities equipment, wafer manufacturing, and mask/reticle equipment, is expected to decline 4.2 percent to \$2.6 billion this year, the association said. The assembly and packaging equipment

segment will plummet 22.6 percent to \$3.1 billion in 2019. Semiconductor test equipment will drop 16.4 per cent to \$4.7 billion this year, said SEMI.

The decline will be short lived as sales are expected to increase 11.6 per cent in 2020 to \$58.8 billion on the strength of spending by memory IC manufacturers and by increased purchasers of equipment by fabs in China. China's chip equipment capital spending will rise from \$11.6 billion in 2019 to \$14.5 billion in 2020, according to SEMI. Semiconductor equipment spending in Korea will increase from \$9.22 billion in 2019 to \$11.75 in 2020. While equipment sales in Japan will rise \$9 billion in 2020 from \$6.14 billion in 2019. The new equipment is needed because chipmakers will increase the number of semiconductor production lines over the next four years from about 136 in 2019 to 172 in 2023, the association said.

Much of the spending will be for 300mm fab equipment, as more chip production transitions from 8-inch wafers to 12-inch wafers. Such a transition means that

chipmakers will increase supply as they can produce more chips on 300mm wafers than with 200mm wafers. The transition helps reduce the cost of production and lower prices for semiconductor buyers in addition to increasing semiconductor supply.

Like semiconductor equipment, shipments of silicon wafers will also decline in 2019 but bounce back in 2020, said SEMI.

"Silicon shipment volumes are expected to decline this year as the industry works through accumulated inventory and weaker demand," said Clark Tseng, director of Industry Research and Statistics at SEMI. "The industry is expected to stabilize in 2020 and regain growth momentum in 2021 and 2022."

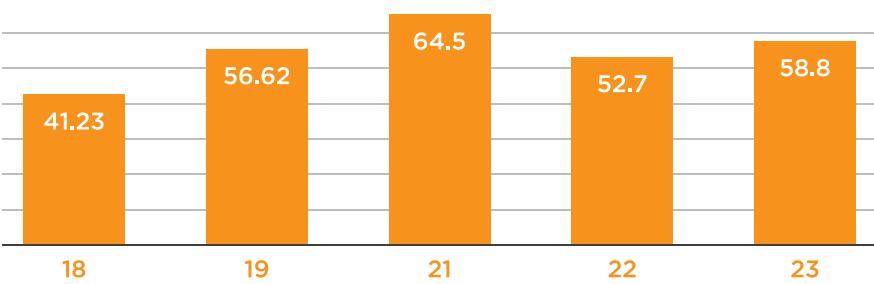
Shipments of polished and epitaxial silicon shipments will total 11,757 million square inches in 2019 and rise to 11,977 million square inches in 2020, according to SEMI. Wafer shipments will increase to 12,390 million square inches in 2021, and 12,785 million square inches in 2022.



Silicon shipment volumes are expected to decline this year as the industry works through accumulated inventory and weaker demand

(\$ billions worldwide)

Chip equipment demand will resume growth in 2020



While the global market for semiconductor equipment will drop in 2019, it will recover in 2019 and continue to rise through 2023. Source: SEMI

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N)	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.eccocomponents.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	Mouse Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	31,445	N/A	\$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
BiVAR	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	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
E-Switch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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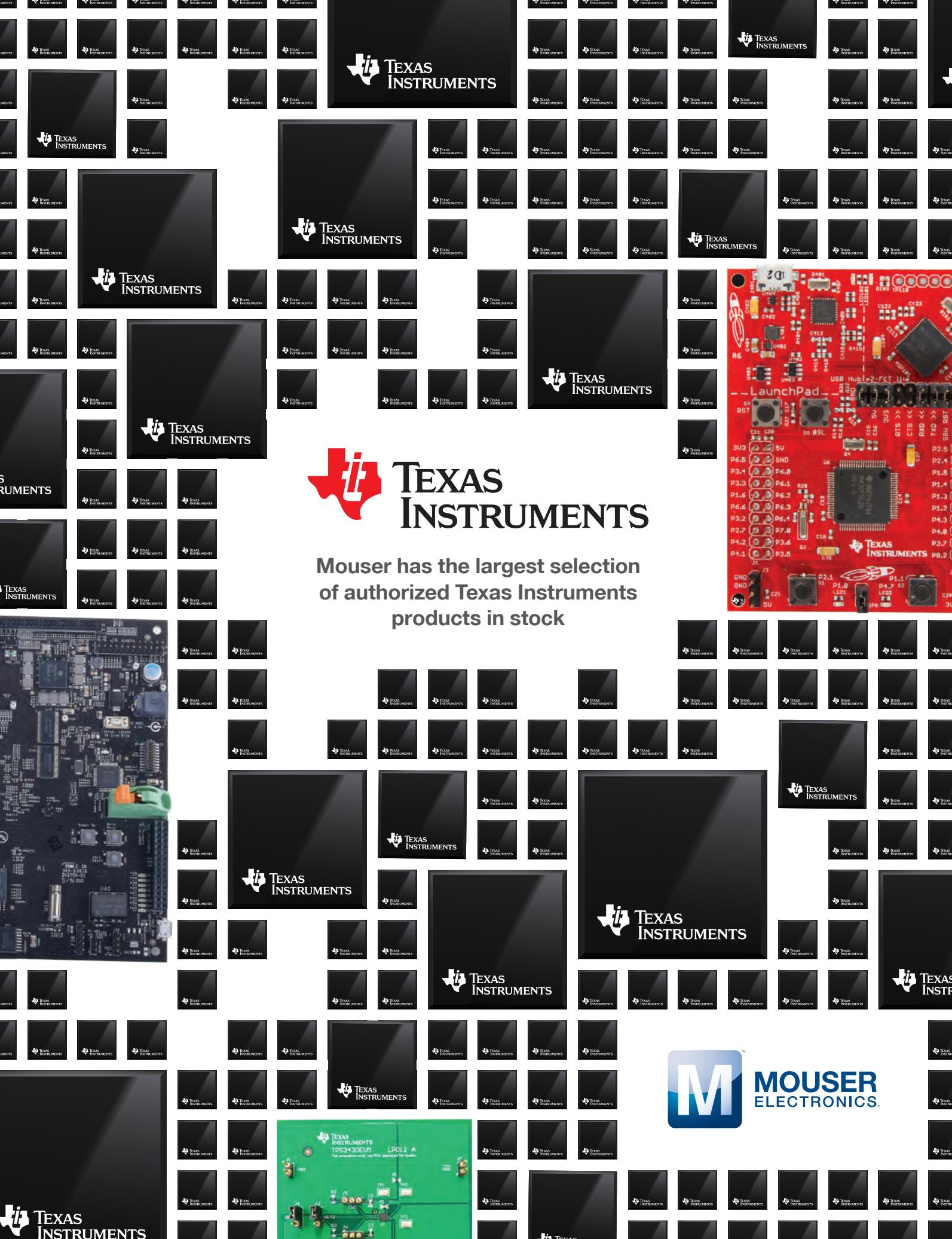
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Honeywell	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Keystone Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NKK Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	13,976	N/A	\$0	86.00%	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Panasonic	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
PUI Audio	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Schneider Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Sensata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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Teledyne Relays	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ENCLOSURES											
Bud	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bud Industries	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	\$0	80.00%	50	1,000+	Y
Hammond Manufacturing	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,839	N/A	\$0	82%	50	1,000+	Y
New Age Enclosures	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
FREQUENCY MANAGEMENT											
Abracor Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,780	N/A	\$0	100%	50	1,000+	Y
CTS Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,889	N/A	\$0	100%	50	1,000+	Y
ECS Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,070	N/A	\$0	100%	50	1,000+	Y
Epson Toyocom	Mouser Electronics	800-346-6873	www.mouser.com	Y	178	N/A	\$0	100%	50	1,000+	Y
IQD Frequency Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kyocera	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Labs	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ICs & SEMICONDUCTORS											
Analog Devices, Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,749	N/A	\$0	95%	50	1,000+	Y
Broadcom Limited	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Central Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Central Semiconductor Corp.	Future Electronics	(800) 675-1619	www.futureelectronics.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
Cree, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cypress Semiconductor Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	\$0	81.00%	50	1,000+	Y
Digi International	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Diodes Incorporated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
FTDI	Mouser Electronics	800-346-6873	www.mouser.com	Y	94	N/A	\$0	100%	50	1,000+	Y
IDT (Integrated Device Technology)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Infineon	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,580	N/A	\$0	63%	50	1,000+	Y
Intel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ISSI	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Lattice	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
MACOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	5,800	N/A	\$0	100%	50	1,000+	Y
Microsemi	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Monolithic Power Systems (MPS)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Nexperia	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,205	N/A	\$0	100%	50	1,000+	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,486	N/A	\$0	96%	50	1,000+	Y
Power Integrations	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Qorvo	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Renesas Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
SanDisk	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Laboratories Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,141	N/A	\$0	100.00%	50	1,000+	Y
Skyworks	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	\$0	96.00%	50	1,000+	Y
Swissbit	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	29,676	N/A	\$0	94%	50	1,000+	Y

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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
ICs & SEMICONDUCTORS (Continued)											
Toshiba	Mouser Electronics	800-346-6873	www.mouser.com	Y	800	N/A	N/A	N/A	N/A	N/A	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	53,781	N/A	\$0	77%	50	1,000+	Y
INTERCONNECTION											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	\$0	46.00%	50	1,000+	Y
Aero Conesys	ECCO	773-767-2200	www.ecconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	ECCO	773-767-2200	www.ecconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	165,853	N/A	\$0	31%	50	1,000+	Y
Anderson Power Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Aptive (Delphi)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cinch	ECCO	773-767-2200	www.ecconnectors.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
Glenair	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Harting	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,160	N/A	\$0	51.00%	50	1,000+	Y
Harwin	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Hirose Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ITT Cannon	ECCO	773-767-2200	www.ecconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ITT Cannon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
JAE Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,02	N/A	\$0	100%	N/A	N/A	Y
JST	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
LEMO	LEMO	800-444-5366	www.lemo.com	M	N/A	N/A	N/A	N/A	N/A	1,500	N/A
LEMO	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Mill-Max	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	85,634	N/A	\$0	89%	50	1,000+	Y
Neutrik	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,563	N/A	\$0	100%	50	1,000+	Y
NorComp	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	30,044	N/A	\$0	77.00%	50	1,000+	Y
Radiall	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Souriau	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,744	N/A	\$0	27%	50	1,000+	Y
Switchcraft Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	300	N/A	\$0	55%	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	123,613	N/A	\$0	69%	50	1,000+	Y
OBSOLESCENCE / HARD TO FIND											
America II Electronics	800-767-2637	www.americaII.com	M	1,900	\$1B	\$0	75.00%	59	550+	Y	
Lantek Corp.	973-579-8100	www.lantekcorp.com	M	186,000	\$22M	\$0	75.00%	5	62	Y	
Chip 1 Exchange USA, Inc.	949-589-5400	www.chip1.com	Y	850,000	N/A	\$0	85%	20	150		
Rochester Electronics	978-462-9332	www.rocelec.com	Y		N/A	\$250		10	400+	Y	
OPTO ELECTRONICS											
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	\$0	99.00%	50	1,000+	Y
Finisar	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	\$0	99%	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	\$0	78%	50	1,000+	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	\$0	71%	50	1,000+	Y
Coilcraft	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	\$0	98.00%	50	1,000+	Y
Fair-Rite	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kemet	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	\$0	66%	50	1,000+	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	\$0	58%	50	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	\$0	99%	50	1,000+	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	\$0	84.00%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	\$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	\$0	100.00%	50	1,000+	Y

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
Wurth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	\$0	99.00%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	\$0	100.00%	50	1,000+	Y
POWER & BATTERIES											
Artesyn Embedded Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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				\$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
Pektron	1-248-677-4838	www.pektron.com	\$66m	Michigan & UK	350	8	ISO9001, ISO14001, TS16949, BEAB, VCA, TUV, UL	Y	Y	Y	Full Turnkey Cables and Harnessing

ebQM.com

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Latest electronic components

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Choose from over 17 categories

Latest free samples

The screenshot displays the ebQM.com homepage. At the top, there's a navigation bar with links like 'Virtual Trade Show', 'Part Sources', 'eBQM Magazine', 'eBQM TV', 'Events', 'Webinars', 'Advertiser', 'Contact Us', and 'About Us'. Below the navigation is a search bar. The main content area features several product categories: 'In Stock & On Time' (Digi-Key logo), 'Sensible 2.0 next Generation of Industrialization of IoT Solution' (with a small image of a circuit board), 'Microchip MIC23650 : 6A Step-Down Converter with HyperLight Load™ and Output Voltage Select' (with a small image of a component), 'FMAD NEO: 3-Phase Mains Filter plus Neutral' (with a small image of a power unit), 'Power Integrations Releases Gallium Nitride-Based InnoSwitch3 AC-DC Converter ICs' (with a small image of a power adapter), 'Small ABS boxes with lid 200 series' (with a small image of a plastic box), 'L-com Debuts New Wall-Mount Cabinets and Racks to Address LAN Connectivity Applications' (with a small image of a cabinet), and 'Motion Sensors, Inc. Implements Optical Control Component Counter' (with a small image of a person standing next to a machine). To the right, there's a sidebar with a 'Whitepaper: Heightening the Security of IoT Networks' section and a 'Click Here for the Latest Free Samples' button. Orange arrows point from the surrounding text boxes to specific features on the site.



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