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Start 2020 with your eyes on the prize

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ecia Connect. Influence. Optimize.

Editor's Word

Connectors: give them the respect they deserve

I've taken to binge-watching YouTube videos. My latest excursion is a channel called DiagnoseDan. Dan diagnoses faulty cars and fixes them. What makes this interesting and useful is that Dan tends to be the customers' last hope after other dealerships and independent specialists have given up. As an engineer, watching Dan's diagnostic process is fascinating. The rule is always expect the unexpected.

The reason that I'm writing about Dan is that too often, what appears to be a faulty assembly (circuit board assembly, module, motor etc) turns out to be nothing more than a broken connector or wire. If it's not a connector or wire, it's probably a sensor.

To me this is fascinating given that one of the first engineering articles I wrote, some 30-years ago, was about automotive reliability, with the data suggesting that at the time 90 per cent of vehicle vaults were related to wiring and connectors. Somethings never seem to change.

So, as a buyer, may I suggest you give the lines on the bill-of-materials which list connectors and wiring the respect they deserve. This is even more important given that connectors are now just as likely to be carrying signals as power.

Not all connectors and wires are created equally so take care when the thought of switching to a cheaper product looks appealing. Don't take my word for it, watch Dan at work and make your own mind up.

Jon Barrett

N ES News

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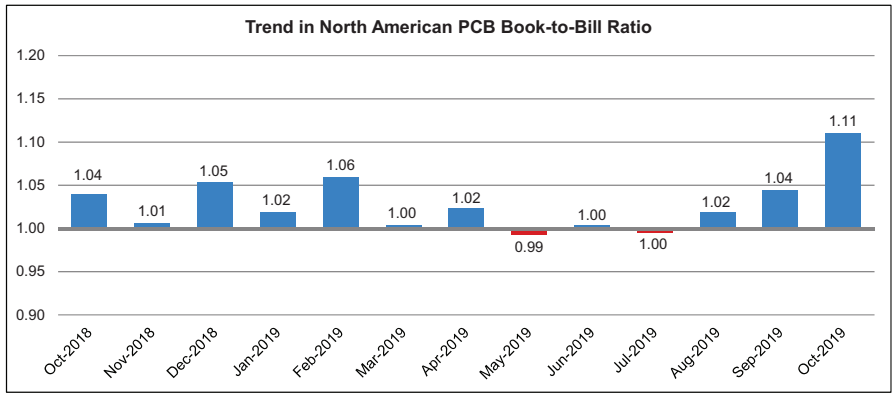

Note: The January 2019 ratio has been revised since its original publication due to updated data from statistical program participants.

Tough cables ready for rapid shipping

ShowMeCables is now offering a new line of commercial-grade Category 5e M12 cable assemblies manufactured by L-com. Designed to provide secure connections for industrial networking, the new M12 Ethernet cables are built to endure harsh environments.

With an IP68 rating and outdoor FR-TPE jacket, L-com Cat5e M12 cables are ideal for wet and corrosive environments and can be used in industrial applications, factory automation, or in fieldbus networks. Assemblies feature locking threads on either end to create a tight seal. A variety of industries will benefit including manufacturing automation, transportation, agriculture, robotics and alternative energy.

Product manager, Blake Woods, explained: "Customers are really going to enjoy the high flex capabilities of this cable while not having to compromise on durability or dependability."

ShowMeCables carries four variations of the L-com Category 5e M12 four position IP68 D-coded cables, including male to male, male to female, male to RJ45, and female to RJ45. Cables are offered in multiple lengths and are available for same day shipping.

www.showmecables.com

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Receive the weekly electronics e-newsletter for Electronics Purchasing Professionals

Register now to receive your free industry news, components releases, announcements and developments within the global electronics supply chain. Register for free at **www.electronics-sourcing.com/newsletter**

PCB purchasing looks positive

IPC has announced the latest findings from its North American printed circuit board statistical program, revealing that sales and orders in October 2019 continued to outpace the previous year. The book-to-bill ratio rose to 1.11.

Total North American PCB shipments were up 6.2 per cent compared to the same month last year, however compared to the preceding month, October shipments decreased 8.9 per cent. PCB bookings were also up 2.2 per cent year-over-year and increased 9.6 per cent from the previous month.

IPC's director of market research, Sharon Starr, commented: "Business for the North American PCB industry continues to outpace last year's performance. The spike in the book-to-bill ratio to a 19-month high reflects the last three months' recovery in bookings. These results lay the groundwork for continued sales growth in the next two quarters."

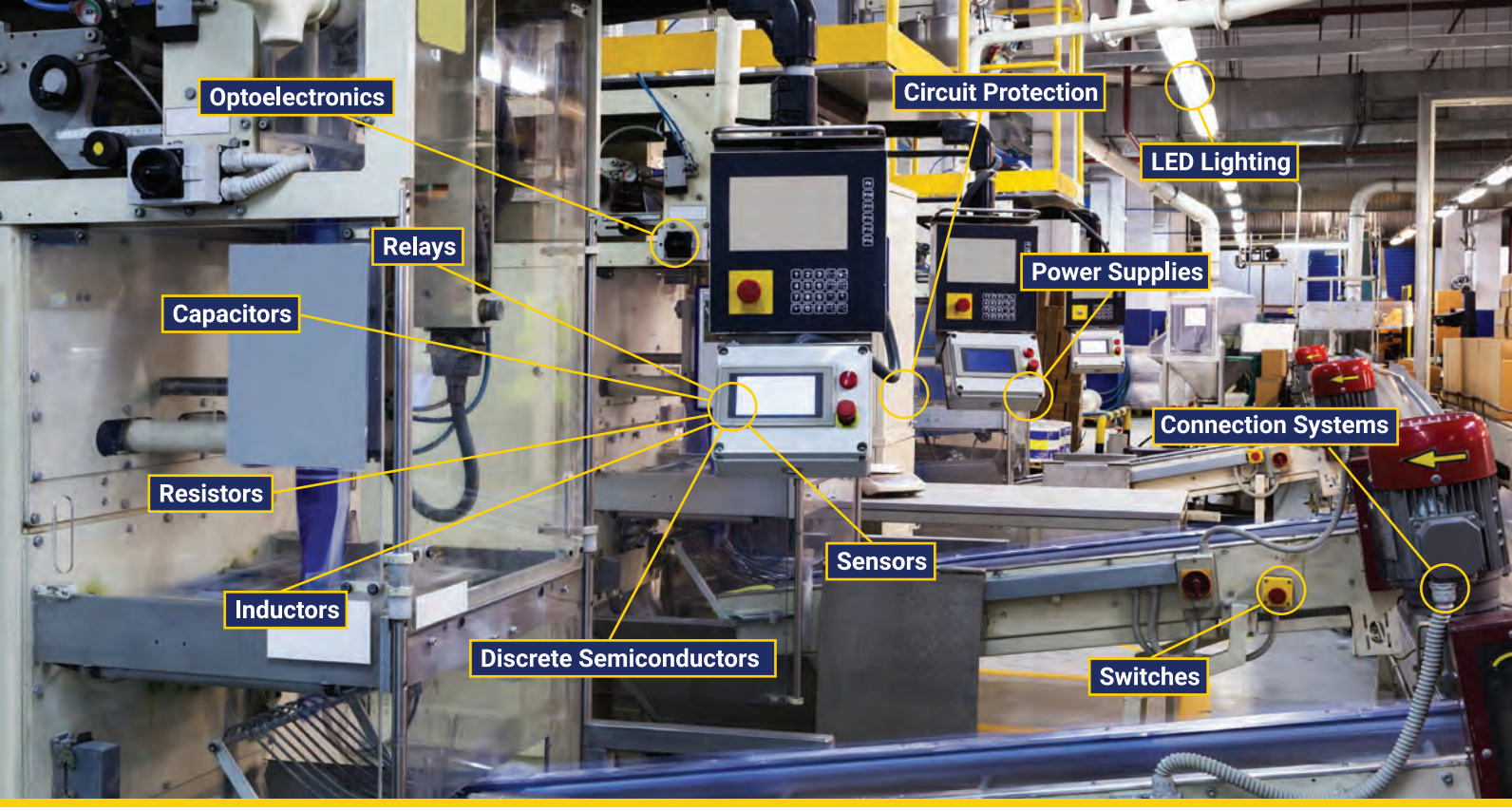
www.ipc.org

New source for 5G surge protection

Cinch Connectivity Solutions, a Bel group company, has announced availability of a commercial grade surge arrester as part of a new product series suitable for 5G network protection. The new Midwest Microwave surge arrester is available through distributors, Digi-Key and Mouser.

Power surges or indirect lightning strikes can create problems by causing network downtime, with the potential for significant revenue losses. The Midwest Microwave surge arrester protects radio frequency and microwave systems from surges without sacrificing RF performance. The device features a tri-alloy plated brass construction, providing multi-strike lightning capability. Potential applications include cellular base stations, public safety systems, Wi-Fi networks, active antenna systems, 5G networks and GPS systems.

www.belfuse.com



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N ES News

In Brief

Webinar unpacks eco regulation
The Electronic Components Industry Association recently hosted a webinar to inform members about regulatory legislation that will impact the industry's global supply chain. This is the first in a series addressing compliance issues and legislation including: the circular economy; RoHS; REACH; Prop 65; persistent organic pollutants; conflict minerals; packaging; Basel Convention; and batteries.
www.ecianow.org

FPGAs to hit $13 billion by 2026
Global Market Insights has released its latest research regarding the FPGA market, revealing rapid growth in China as companies in this region invest heavily in artificial intelligence. Overall, FPGA market revenue is expected to reach $13 billion by 2026. Other sectors driving growth include innovation in wireless communication and automotive OEMs opting for FPGAs to help implement efficient safety systems.
www.gminsights.com

Software simplifies substance data
GreenSoft Technology has released a software solution for component manufacturers to track material substance data and respond to customer data requests. The GreenData Manager with Component Disclosure Module automates the management of parts data and data updates for manufacturers dealing with changing regulations such as EU RoHS, EU REACH, and California Proposition 65.
www.greensofttech.com

Committed to aerospace quality
Global independent distributor, NewPower Worldwide, has achieved International Aerospace Quality Group certification to AS9120 and AS6081. Demonstrating the company's commitment to quality, the standards ensure streamlined documentation, improved audit and surveillance efficiency, and enhanced supplier performance.
www.newpowerww.com

A smart solution for next-gen lighting

Mouser Electronics is now stocking a new automotive-qualified microcontroller complete with ISELED communication for next generation smart LED lighting in automotive and industrial applications.

The S32K ISELED-enabled microcontrollers from NXP Semiconductors combine 32-bit Arm Cortex-based processing power with access to the ISELED ecosystem to offer a complete hardware and software solution that enables dynamic sequences and light parameters. The ISELED protocol helps avoid expensive external processes and ensures well-balanced light parameters with tighter calibration and greater processing control for RGB LEDs.

Devices include a production license and a dedicated driver to run the ISELED serial communication protocol. Furthermore, each microcontroller can serve as a single external master controller within the ISELED ecosystem due to its robust feature set and superior performance processing capabilities.

www.mouser.com

New range makes savings easier to source

Newark has launched a new collection of over 60,000 affordable components, tools and test equipment under its the brand, Multicomp Pro. The range brings together products from Multicomp, Duratool, Tenma, Pro-Power, Pro-Elec and Pro-Signal, making it easier to identify high-value alternatives, while assuring production-grade quality. Customers can benefit from reduced upfront costs and product-lifetime savings.

Items from the new Multicomp Pro brand are ideal for design and development labs, service facilities and educational establishments where budgets might be restricted. Original equipment manufacturers and contract electronics manufacturers can also benefit.

Managing director of CPC and global head of private label at Newark, Chris Haworth, said: "Our new Multicomp Pro brand focusses on the very best private label products, carefully selected from leading global brands, giving customers access to quality products with incredible value, and average savings of 30 per cent compared to branded alternatives."

www.newark.com

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In touch with sensor demand

Sager Electronics is now stocking Omron's W7ED capacitance-type touch sensor, said to be ideal for low power applications requiring clean environments and an easily integrated solution. The sensor boasts a flexible and long-lasting design for any application requiring human capacitance touch sensing, providing a long operating life and high reliability due to its low-profile design and lack of moving parts. Measuring 15 by 15 by 5.5mm, Omron's W7ED series features a touch electrode design and a capacitance-type conductive technology able to detect changes from a light touch.

www.sager.com

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New source for MLCC capacitors

Stackpole Electronics has released its CML series MLCC capacitors, designed to offer a wide capacitance range from 0.1pF up to 100µF in voltage ratings from 10 to 100V.

Purchasers can choose the C0G dielectric for exceptional stability and accuracy and no aging effects, X7R and X5R for broad capacitance range and higher capacitance capability, and Y5V for cost effective high capacitance solutions with the best volumetric efficiency.

This ensures the CML is suitable for various applications where small size, low cost, and ease of manufacture are critical. They can be used in feedback circuits, for smoothing, by-pass, coupling and decoupling applications, as well as lower bulk capacitance requirements.

Pricing for the CML varies with dielectric, size, capacitance, and voltage with many popular size, capacitance, and voltage combinations currently in stock. Lead times are currently 12 weeks.

www.seielect.com

Need a secure supply of MLCCs?

Rutronik is working with its long-standing partner, Yageo, to secure a long-term, supply of MLCC products in response to the continued shortage of ceramic capacitors. The company has established a corresponding range of stocked products for this purpose.

Yageo will continue to guarantee a stable supply of MLCC across all sizes and capacities and further expand its manufacturing capacity. The company says it will not abandon larger manufacturing sizes, which will continue to play a key role in the supply chain ecosystem.

Director product marketing passive components at Rutronik, Stefan Sutalo, commented: "Securing our customers' supply of high-quality MLCC components from our partner is one of our top priorities. This is why we have established a corresponding range of stocked products and can therefore meet the various requirements."

www.rutronik.com

Delivering 5G solutions with in-stock availability

Pasternack has announced a comprehensive portfolio of 5G radio frequency solutions serving the urgent needs of engineers and technicians around the world with high-grade RF components and cable assemblies shipped same day to support 5G innovation, testing and deployments.

The 'RF components for the next generation' suite is comprised of thousands of active, passive, interconnect and antenna products supporting global sub-6GHz and millimeter wave frequency band applications. These components are essential building blocks in 5G deployments and are powering 5G application development and testing for enhanced mobile broadband, mission-critical communications and emerging internet of things applications.

In addition to a broad selection of ready-to-ship 5G RF components, Pasternack provides application-engineering-level support and immediate online access to datasheets, CAD drawings, pricing and inventory.

Vice president of product management, Gabriel Guglielmi, said: "We are seeing an increased need for RF components especially in 5G test and prototype environments, where expedient delivery of parts is a requirement,"

www.pasternack.com

Distributors expect a return to sales growth in 2020

Increased demand for components from industrial and defense and aerospace OEMs and their contractors, coupled with deployment of 5G networks will create greater demand for semiconductors, passives and other components in 2020

James Carbone

Distributors are cautiously optimistic that they will post single-digit sales increases in 2020 because high inventory levels in 2019 have been mostly worked off and component demand will increase after being sluggish last year.

Distributors say that component demand from industrial, transportation and defense and aerospace OEMs and their contract manufacturers will drive demand in 2020. In addition, the deployment of 5G technology is under way and will contribute to component demand for at least the next five years and most likely longer.

However, some distribution executives say that while component demand will rise in 2020, it could be impeded by slower economic growth in the U.S., China and Europe. Some executives say that a recession is possible, although not likely.

"Next year (2020), there is going to be a dichotomy, said Michael Knight, president, TTI Semiconductor Group. "On one hand there are a lot of things that will put energy into the market. On the other hand, there is this growing pessimism and fear that were going to slip into a recession, maybe a global recession. But I don't think the U.S. is going to go into a recession," he said.

Some distributors say while there will be sales growth in 2020, it likely won't occur in the first quarter and may not happen until the second half of the year. Knight said the first half of the year would be "bumpy. I think the second half of the year will be better than the first and we will start seeing nice momentum build going towards 2021," he said.

Chris Stansbury, chief financial officer for Arrow Electronics, said "sales growth won't return until the second quarter or even beyond. Inventories have largely come down, but there's still more to come out although it is not a large amount," he said.

He said Arrow's business last year was "off across the board but we have done better than the market overall. That's most pronounced in Asia because we continue to take share from regional distributors," said Stansbury. He added while 2019 was an off year for Arrow, the distributor previously had 25 straight quarters of growth in Europe, Middle East, and Africa (EMEA) but that ended in the third quarter of last year.

Some distributors are not sure when business will get better. "No one knows exactly when the market will return to more favorable dynamics," said Alex Iuorio, senior vice president of supplier development for Avnet Electronics Marketing Americas. "What we do know is that macro data, including the U.S. Purchasing Managers Index, or PMI, hit a 10-year low in September, and is now showing signs of improving. The most recent PMI data shows that in the U.S. the November PMI is at a seven-month high amid a stronger upturn in new orders," he said.

"I think the second half of the year will be better than the first and we will start seeing nice momentum build going towards 2021"

Michael Knight, president of **TTI Semiconductor Group**

He added as "we look towards the new year and beyond that to a new decade, we're seeing mid- to long-term opportunities in retail and health care, and positive trends in defense and aerospace." However, with other industries such as industrial and automotive," we still see lingering impact from recent regional slowing such as that in EMEA. "But a new decade promises new opportunity across all of Avnet's key industries and geographies, said Iuorio.

A significant impact

One opportunity will be 5G technology. Stansbury said 5G will have a significant impact on business because it will make industrial IoT "easier to access." He said Arrow has a lot of engineering capability and works with small and medium size customers on industrial IoT solutions.

"If you look at 5G deployment, it is obviously slow. I think there are also questions right now given the issues with Huawei." The Chinese company builds

telecommunications equipment including 5G networks and smart phones. The U.S. has said that Huawei's infrastructure equipment may allow China to conduct surveillance on the U.S. and there have been calls for the U.S. to prevent the use of products made by Huawei. In 2018, the United States passed a defense funding bill that barred the federal government from doing business with Huawei because of security concerns.

Nevertheless, 5G technology will drive sales as networks and new 5G smart phones are built. However, there will be much more to 5G technology than smart phones. Len Jelinek, director and chief analyst at IHS Markit Technology, said IoT is a "technology platform that will enable a lot of things beyond handsets." For instance, the low latency and low power of 5G will enable a lot more IoT applications to be developed because a lot of data can be transmitted very quickly.

"It should enable some better form of autonomous driving," said Jelinek. "My belief is 5G will definitely be an enabler and will really benefit" the component industry, not just in the short term, but for five years.

Knight agrees. He said 5G will result in strong, steady growth for a long time. "I think 5G will be the story for the 2020s. As 5G comes into play there will be many other technologies applications that get enabled by that low latency such as telemedicine, telesurgery, vehicle communications, and autonomous driving" which will drive component demand, said Knight.

That will be welcome news to all distributors, including small- volume distributors that specialize in design and new product introduction such as Mouser Electronics. Kevin Hess, senior vice president of marketing for Mouser, said the distributor is expecting high single-digit growth in 2020. He noted that Mouser has increased its number of customers and has seen a rise in the number of component orders. IoT applications, 5G and new emerging artificial intelligence applications should contribute to sales growth over the next several years.

Mouser has expanded its warehouse adding more inventory and will be well-positioned to meet component demand, he said. Extra inventory may be needed because the electronics industry often grows four times

Chris Stansbury, Arrow chief financial officer

"Inventories have largely come down, but there's still more to come out"

GDP, according to Pete Shopp, senior vice president of business operations for Mouser. "If GDP is 2 per cent that means electronics should grow 8 per cent and if we do a couple things right, we will be at 12 per cent," he said. That should be our long-term average,"' he said.

Solving trade issues

Shopp said if trade issues with China can be resolved and the problem of Brexit can be settled, it should lead to more economic growth and have a positive impact on the electronics industry. Shopp said that the planned exit of the UK from the European Union and the trade war and tariffs with China have contributed to lower GDP.

GDP has been reduced by 1 per because of Brexit and the tariffs, said Shopp. So, If these issues are resolved it will boost overall economic growth which should mean greater sales growth for many distributors because large and medium-sized distributors sell globally and not just in North America. Hess notes that North and South America used to account for more than 50 per cent of Mouser's business. "Now it's about 36 or 37 per cent. Europe is about 26 or 27 per cent's and Asia the rest," he said. Mouser's business in Europe and Asia has grown at a faster rate than the Americas with the exception of 2019. "Asia was down a little bit and Europe was relatively flat," he said.

Don Akery, president of TTI Americas, said the distributor was expecting mid-single-digit growth in 2020. "We have seen a few weeks where the bookings have been surprisingly strong," he said in late October.

"Five to seven percent growth is where we expect it to be next year. Mil-aerospace is a big part of our business," said Akery. And that's going to be in the double digits again although the commercial air piece of it may slow down due in part to the Boeing 737 MAX being grounded.

Not all certifications are equal

Product marketing specialist for industrial field connectors at Phoenix Contact USA, Dean W. Smith, explores the UL standards buyers need to be aware of when purchasing power cables and connectors

Power cabling and connectors are a vast subject, covering different levels of power transmission that can feel infinite in their variation. The connectors for these cables reflect this in the wide variety of styles and form factors that are in use today. With all this variation, along with the extreme risks associated with power, it is extremely important that we ensure the vessels used to transmit this power are as safe as they are reliable.

Narrowing our focus, cabling and connectors that only carry power up to 16A can be used to power a host of different equipment such as AC and DC motors, servos, and lighting fixtures. Because connections for these devices must be reliable and safe, third-party certifications are used on a regular basis to ensure that the cabling and connectors selected are up to the task.

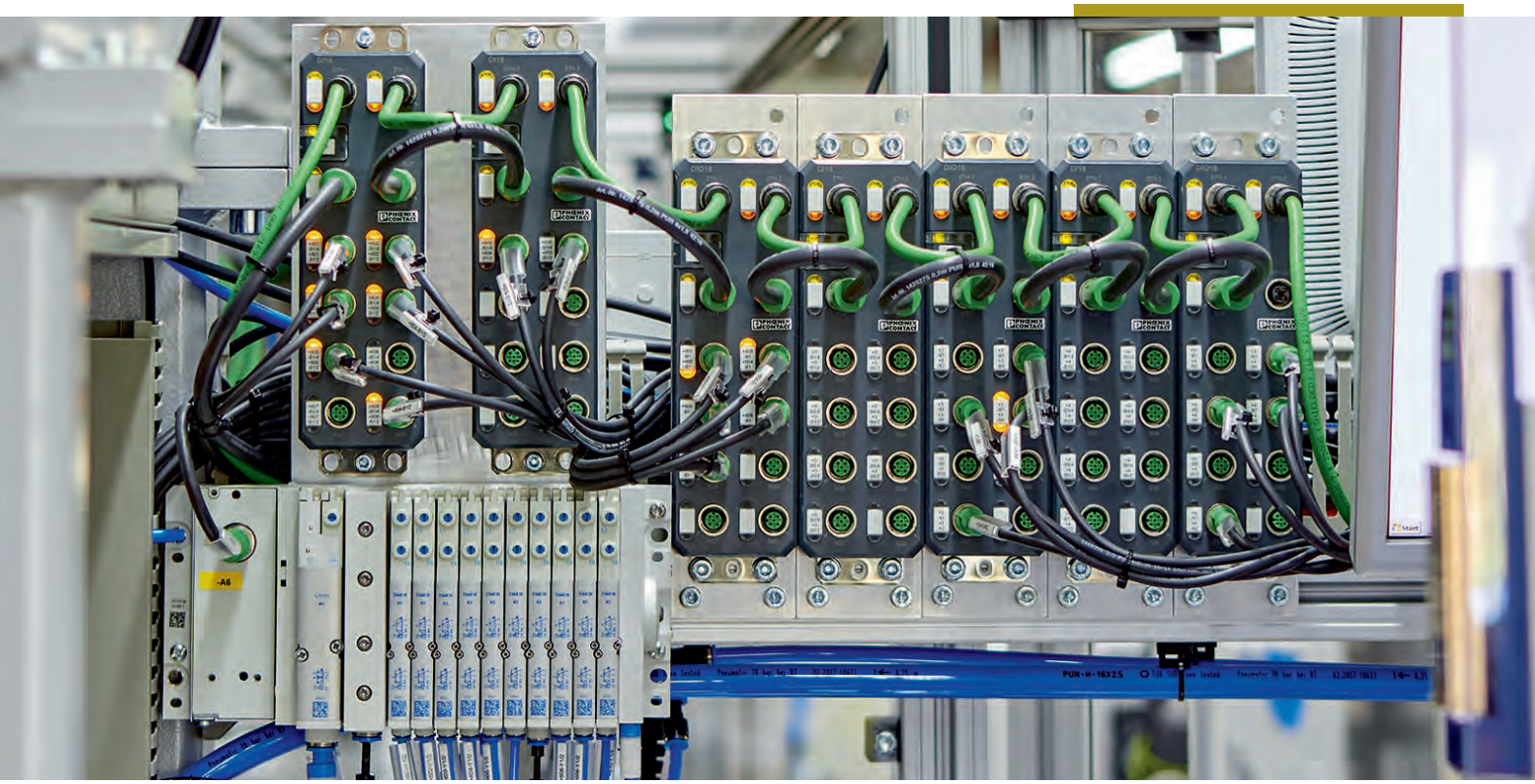
In the United States, Underwriters Laboratories is the primary third-party organization trusted to certify that electrical products are safe for use. That applies not only to electrical characteristics, but also to the environmental protection the connection affords. You will find the UL mark of certification on electrical products across the spectrum. Manufacturers that wish to submit their products for certification so that they can be used in these types of applications will generally have three different UL specifications to reference.

UL 1977: Simple certification

UL 1977 is probably one of the more common test specifications used for electrical connectors. It allows testing products that could be rated to transmit 1,000A of current or 600V AC or DC. It does, however, require that the OEM purchasing the connector is also the installer. Assembly of the connection after it leaves the OEM voids the UL certification.

This specification also does not account for any environmental ratings for the connectors alone. To achieve

> **With the risks associated with power, it is extremely important that we ensure the vessels used to transmit this power are as safe as they are reliable**



Recent standards make M12 connectors acceptable for power transmission as well as signals and data

UL certification with regards to environmental protection, the connector must be evaluated in its installed condition. That means an additional submission request to UL beyond that which an OEM would normally need to perform. Obviously, products need to be installed properly and checked for safety, but this can be achieved in a more efficient manner by using products approved under alternative test specifications.

UL 2238: Test environmental protection

UL 2238 is used mostly for data, signal, and control transmissions, but will also account for power as well with a 60A, 600V AC or DC limitation. Bear in mind, however, that because the standard wasn't written with power as its focus, it does not specify the most stringent requirements.

On the other hand, this specification does account for many of the issues with UL 1977. The most significant is that it allows for the direct testing of environmental protection. While it sub-contracts out the work to UL 50E, a product can be listed with UL Environmental Type Ratings included, without an additional review of the connector in its final application.

Another advantage of UL 2238 over UL 1977 is that it allows for connector installation at the OEM or in the field. This makes it much easier for end users to install UL certified products from multiple OEMs. Another bonus is that the requirements under UL 2238 line the connector up for use in NFPA 70 (Article 725) environments. While UL testing and certifications focus mainly on electrical cabinets and individual components, NFPA looks more at the overall site for safety. Knowing that UL 2238 already defines testing that coincides with NFPA 70 makes the final installation that smoother.

UL 2237: Specify transmission safety

UL 2237 is, ultimately, the most comprehensive standard for power requirements. It has all the advantages of UL 2238, but goes a few steps further, as its test standards address power transmission safety more thoroughly.

For one, there is no current limit, and the voltage limit is 1,000V AC or DC. Second, UL 2337 requires a short-circuit current rating and must meet a 5kA minimum rating. This is optional under UL 2238, but most suppliers do not opt in for that additional testing. It also addresses not only the requirements for NFPA 70, but also NFPA 79 environments.

The most noticeable difference between UL 2237 and UL 2238 is in the final current rating that a connector can achieve. As an example, we can look at 7/8in form-factor cordsets and connectors. Most were initially certified under UL 2238, allowing for nearly 25A in some configurations. As those connectors are re-tested under UL 2237, suppliers are finding that 15A becomes the upper limit. This is going to prove troublesome for the future of 7/8in connectors. There is a new M12 form factor now available in the market that can achieve a 16A rating under UL 2237. Since M12 is about half the size of a 7/8in connector, it will be difficult to justify the extra space required by 7/8in for the privilege of running less power.

Understand your application

As you look for power connectors for different applications, remember that while UL certification is often required, not all certifications are equal. When addressing power needs, be sure to confirm that the product you choose includes UL 2237, so the installation will ultimately be as safe and easy to implement as possible.

www.phoenixcontact.com

The shape of things to come

Gabe Osorio, sales engineer with TTI's Transportation business unit, looks at how electrification will shape the connectors we buy for next generation industrial vehicles

Sales engineer with **TTI's** Transportation business unit, **Gabe Osorio**

While electric cars and mass transit are reducing fossil fuel use, the electrification of shipping, agriculture and industrial vehicles and equipment are also priorities for further reducing our overall carbon footprint.

One of the biggest challenges in electrification is creating the connectors needed to transmit power through the next generation of electric commercial vehicles, farm equipment and construction equipment. The industry is working hard on new innovations in connector technology to help achieve these goals.

As the new year begins, the biggest areas of focus for connector manufacturers are increased amperage and output, as well as finding the right shielding and safety features to meet harsh-environment requirements while still reliably delivering power where it's needed.

Sourcing the right materials

Today's commercially available connector technologies can't support the loads that future applications will require. Let's start with the problem of higher amperage. While an electric passenger vehicle may need 400A, a combine harvester requires a much higher power output than a car, not only to move, but to perform its tasks. In fact, the equipment used in mining or construction can easily require 800A and higher because of the density of materials they need to move, not to mention the weight of the machine itself.

When it comes to electrification in heavy industries, the components specified will have to be tougher and more powerful than those found in any electric passenger vehicle, or even an electric over-the-road truck.

The first attempts at designing connectors to handle these larger loads have resulted in parts similar to those used in electric rail applications: connectors larger than a laptop computer, designed to pull the kind of power that an electric harvester or earth-mover will need. To make those designs workable long-term, however, will require scaling them down and finding the right materials to deal with the three other major needs of heavy-duty EV connectors: heat dissipation, durability and safety.

Any connector that handles 800A or more has to be able to let the energy pass through

Construction equipment is exposed to weather, mud, dust, and harsh chemicals that can damage connectors

while maintaining its integrity despite the heat created from passing so much power through the connection. Some manufacturers currently offer connectors that can meet the need, but there are other considerations that current-gen connectors will have to evolve to address.

One of those is heat shielding, a challenge that's requiring designers to think differently in terms of materials. How do you create a connector housing that dissipates heat quickly and effectively? A lot is being done to identify different plastic formulations that can be used, as well as different combinations of materials.

The difficulty of balancing metal with other materials isn't just a question of cost, but of weight: in order to run more efficiently, new electric vehicle and equipment designs are focused on reducing weight while also increasing power. Connector suppliers are aware of this balancing act as well.

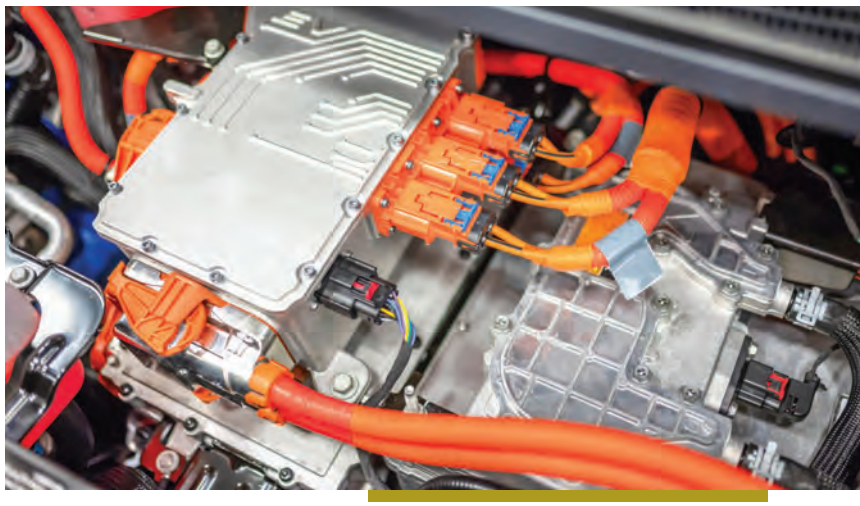
To add another layer of complexity, these new, high-amperage connectors must also have adequate EMI shielding and protection from dust, moisture or contaminants. Manufacturers are experimenting with new alloys of lighter metals as well as composites that can reduce both weight and electromagnetic 'noise.'

At a minimum, housings won't eliminate EMI but can reduce it, especially housings using aluminum alloy. New developments in hybrid-vehicle cables and cable shielding, as well as new coating materials, may yield results from a noise-reduction standpoint.

Addressing environmental challenges

Another important factor becomes clear when you consider the places future electric vehicles and equipment will work. Some applications, such as mining, involve contained spaces and flammable gasses. Others contain flammable chemicals and potentially explosive dust. In those environments, any arc or spark from a connector could cause a deadly explosion or fire. The high voltage connectors used in such applications must be sufficiently insulated for those environments, with terminal shielding and sealing that meets much higher safety standards than those used in today's most-common EVs.

Construction equipment is constantly exposed to weather, mud, dust, and harsh chemicals—many of which are corrosive and all of which can foul connectors. Electrified construction equipment needs connectors, battery packs and inverters that withstand the kind of high-pressure spray cleaning that diesel-powered equipment can endure.



New, high-amperage connectors must also have adequate EMI shielding and protection from dust, moisture or contaminants

Instead of pulling industrial machinery away to a charging station, equipment and vehicles could be designed with battery packs that can be switched out on the spot for longer operation. But when workers are dealing with such a massive amount of energy, enough to perhaps kill a person instantly, how do you design connectors that allow for rapid serviceability while maintaining the necessary safety margins?

Manufacturers are meeting the challenges of materials selection, connector design and packaging. The amount of testing and evaluation that is required means these innovations are still making their way to market. At TTI, we're working with suppliers whose connectors can deliver 500A, but there's still a market need for higher-voltage and higher-amperage connectors that address other future requirements.

Even so, those solutions are coming—and who's to say that a breakthrough in engineering labs in early 2020 couldn't rewrite the book on HV equipment and vehicles much sooner than we expect?

www.ttiinc.com

Buyers face critical supply chain challenges as the new year begins

Constrained supply, diminishing sources of supply and higher than normal lead times for some components will be some key issues for buyers in 2020

James Carbone, contributing editor for **Electronics Sourcing**

Many OEM and electronics manufacturing services (EMS) providers buyers may feel that the purported ancient Chinese curse of "may you live in interesting times" applies to them as the new year begins.

While the semiconductor industry suffered double-digit revenue decline in 2019, the EMS industry grew its sales 10 to 13 per cent in 2019, the third consecutive year of double-digit growth for the industry, according to New Venture Research (NVR). (See story page 18) While EMS providers hope that healthy sales growth will continue in 2020, buyers will face a plethora of interesting supply chain challenges and risk management issues, including the trade war with China, continuing supply base consolidation and constrained supply for some parts.

EMS buyers must also deal with rising raw material costs, the continuing problem of counterfeit parts, and plan for the possibility that a natural disaster could stop production of key components as it did with the 2011 earthquake and tsunami in Japan and severe flooding in Thailand.

It is often the responsibility of EMS buyers to work with their OEM customers to mitigate such risks or manage those risks on behalf of OEMs.

"A key part of the service we provide to our customers is to help manage and mitigate risk throughout the supply chain, said Graham Scott, vice president of global procurement for EMS provider Jabil Circuit. "We have a systematic process to address and manage risk from geopolitical uncertainty to natural disasters to ensure continuity of supply."

One uncertainty involves component lead times. While shortages of multilayer ceramic capacitors and other components have eased compared to 2018, lead times for many capacitors, resistors and discretes "are longer than the historical norms," according to Scott. There are several reasons including continuing supply base consolidation which has reduced the number of suppliers and could potentially impact pricing in 2020 and beyond, he said.

Rising labor costs and reduced labor-force growth in China and other traditional low-labor cost countries have contributed to supply constraints which will likely persist. For instance, China's average annual wages rose by nearly 63 percent between 2011 and 2016, according to China's National Bureau of Statistics. The impact of China's one-child-per-family policy has been a slowdown in population growth and a decline in the size of the workforce, which has driven up wages and labor costs for the electronics industry and other businesses.

China's workforce will continue to decline, according to the Chinese government. In 2017, China had an available workforce of 900 million people but the figure will drop by 200 million by 2030, the government predicted.

Over the long term, electronics buyers must develop strategies to minimize the effect of rising labor costs. A partner that has extensive global partnerships and manufacturing footprint will be essential to attain this, according to Scott.

Higher labor costs can impact component prices and so can rising demand for certain components from smart phone and portable equipment manufacturers. Increasing demand could contribute to tight supply in 2020.

> **Higher labor costs can impact component prices and so can rising demand for certain components from smart phone and portable equipment manufacturers**

Dealing with shortages

Another key challenge for electronics purchasers is component shortages. While electronics purchasers historically have had to deal with component shortages caused by a spike in demand and/or lack of investment

by suppliers in new capacity, more shortages are occurring because of technological transitions by component manufacturers.

Increasingly, component manufacturers of critical components are transitioning production from lower margin mature components to higher functioning, higher price components. As a result, memory ICs, discretes and some passive components that are still widely used in electronics equipment that have long product lifecycles are becoming increasingly harder to find.

One example is multilayer ceramic capacitors (MLCCs). MLCC manufacturers have boosted production of capacitors in small case sizes such as 0201 and 01005. Such parts are used in smart phones, notebook computers, handheld video games among other products. At the same time, some capacitor manufacturers have ceased to make capacitors in larger case sizes such as 0603 or 1203. Larger case size parts are used in systems that have long product lifecycles such as industrial, medical and communications equipment.

While capacitor manufacturers may increase capacity overall, the increase tends to be for parts in smaller case sizes. Because capacitor suppliers are being more selective in the capacity investments that they make, buyers should be aware of the type of customer a component manufacturer supports.

Buyers need to work with suppliers on visibility issues to help suppliers plan and fulfill their component needs. In addition, with more mature parts going end of life, buyers need to develop strategies that guarantee continuity of supply if a supplier decides to stop producing a needed part, according to Scott.

Trade war continues

One issue that buyers will continue to have to deal with in 2020 is the trade war and tariffs. "Rising tariffs are putting a painful squeeze on many U.S. electronics manufacturers," said Shawn DuBravac, chief economist for trade association IPC. "Many are facing supply-chain disruptions and steeper costs from the tariffs that have been imposed to date, and the impacts will grow as the trade war drags on," he said.

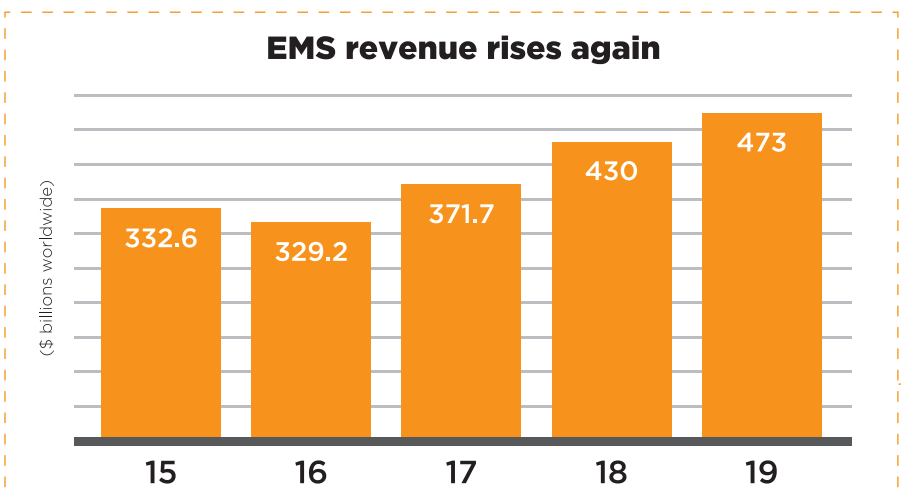
Randall Sherman, president of New Venture Research, added tariffs have become a significant headache and is causing redistribution of sourcing away from China." The findings of a recent IPC survey of the impact of tariffs on electronics manufacturers concur with that assessment.

Fifty-one percent of electronics companies responding to the IPC survey said they are now sourcing from countries other than China as a result of increased tariffs on Chinese imports. That means EMS buyers must work with OEM customers to find and qualify new sources of components and other production materials.

The survey also found 86 per cent of U.S. electronics compnaies are troubled by the higher tariffs imposed by the United States and China on each other's imports and some are investing less in the United States and hiring fewer workers as a result. More than a third of companies report they cannot increase their prices to cover the cost of higher import tariffs due to various factors.

About 69 per cent of companies report lower

> **Buyers need to work with suppliers on visibility issues to help suppliers plan and fulfill their component needs**



Electronics manufacturing services revenue increased by more than 10 percent in 2019.
Source: New Venture Research

profit margins as a result of increased tariffs, 21 per cent report they are reducing investment in the United States and 13 per cent say they are cutting back on hiring and/or reducing headcount, the IPC survey said.

Besides tariffs, many EMS buyers are challenged by a shrinking supply base caused by mergers and acquisitions. Buyers are feeling the impact of consolidation that has reduced the number of suppliers in the electronic components market, which has decreased parts availability. The bad news for buyers is M&A activity is continuing. In 2019 Infineon acquired Cypress Semiconductor, NXP bought Marvell's Wi-Fi connectivity portfolio, ON Semiconductor purchased Quantenna and Nvidia acquired Mellanox. More consolidation is likely in 2020.

Consolidation in the supply base will continue to reduce the industry's investments into new production, leading to further supply constraints as demand starts to return to normal levels, said Scott. Due to this increased risk, it's critical for buyers to understand the supply base and its strategic/technology direction, he said. With the increasing consolidation of supply, buyers need to make sure they have few, if any single sources for parts, which would mean qualifying new suppliers.

Another supply chain issue buyers must deal with is rising labor costs. OEM buyers involved in outsourcing decisions must review their supply chains and assess emerging geographies where costs are lower. OEMs need to balance the risk and cost of moving production and supply chains to places like Indonesia, India, Mexico and new regions of China, said Scott.

Working with distributors

To manage supply chain risks, EMS providers often work closely with key component manufacturers to identify potential risks and develop strategies to address them. Electronics distributors are often part of material sourcing and risk management strategies of EMS companies.

Distributors often provide inventory flexibility for EMS providers. "Since distributors typically have multiple customers for commodity items, they can shift inventory to meet customer needs," said Scott. "In addition, they can bond inventory within their warehouses to support our customer's requirements." Distributors can help EMS companies manage component obsolescence. Many have humidity-controlled facilities to store last-time buy inventory.

Distributors often support supply chain models such as consignment and vendor managed inventory (VMI) programs and distributors can manage some of the "more focused component lines," said Scott.

Many distributors have large customer bases and strong relationships with component manufacturers. "In cases where Jabil has limited transactions with a supplier, distribution plays a role in establishing a Jabil relationship with that component manufacturer," he said.

EMS providers often use distributor value added services such as parts programming, custom marking, and kitting, which are helpful in new product introduction production ramp phases.

EMS industry posts double-digit sales growth

The electronics manufacturing services (EMS) industry posted a third straight year of double-digit growth in 2019 as revenue increased from about $430 billion in 2018 to $473 billion in 2019, according to New Venture Research.

"There has been a good recovery in computers mainly as replacement sales of end-of-life products," which is helping the EMS industry to grow, said Randall Sherman, founder and president of NVR. He said telecom industry has continued its strong growth "as a result of 5G phones, routers, modems and other network gear being deployed." Communications and computer products will continue to be the segments driving the largest growth in the electronics industry. Those segments will continue to be strong for years because cloud computing, social media platforms, and real-time data and video streaming means more computer and wireless indication hard will be may needed.

Fifth-generation cell phone technology will be an important driver to the EMS industry, but it is unclear when 5G will have a big impact on EMS business. "It's not a question of whether it's going to happen or not. It's just a question of timing," said Revathi Advaithi chief executive officer & director of EMS provider Flex. The rollout of 5G so far has been "spotty," he said. "Europe and Asia have been slow. North America has ramped up a little bit faster. When it does happen, we're well-positioned I would say with all the major 5G providers," said Advaithi.

Sherman said the consumer market has been surprisingly good in North America with devices for the smart home and next generation gaming devices. The transportation industries have been steady with automotive adopting driver safety assistance technologies, according to Sherman.

One reason for EMS growth is OEMs that are dependent on EMS providers more than ever. "EMS providers have become the true partner of their OEM customers in all aspects of manufacturing. Most are investing in design services and prototyping that is being driven by 3D manufacturing technologies," said Sherman.

Is your finger on the pulse?

Purchasers keen to stay abreast of supply chain trends should check out the latest IPC 'Pulse of the Electronics Industry' survey in which electronics manufacturers report slowing growth and cautious optimism

Electronics manufacturing growth has a less optimistic outlook than in previous quarters

Electronics manufacturing growth is slowing worldwide with a less optimistic outlook than in previous quarters, although the industry is still generally positive, according to results of the IPC's fourth-quarter 2019 *'Pulse of the Electronics Industry'* survey. Based on responses from 82 companies that make up a representative sample of the industry, global third-quarter 2019 sales growth was at its lowest level since mid-2017, with predicted sales growth for the current quarter down further.

Current-state scores for Europe and the Americas turned negative this quarter. Sales, orders and profit margins are moving in a positive direction on balance, while labor and material costs, ease of recruiting, inventories and order backlogs are having a negative impact.

That said, the industry's expected direction in the next six months remained generally optimistic with all business indicators looking positive. Among the industry segments, PCB fabricators are the most optimistic about the next six months. Overall, the industry expects its health to remain generally good through the first quarter of 2020 despite some slowing.

Looking to the next 12 months, the business outlook is positive in all regions except Asia where the uncertainty of US-China trade relations is contributing to a lackluster 12-month outlook. Generally, respondents ranked economic uncertainty as the leading concern in terms of impact on future business growth. Asked about trends that are increasing costs, respondents predominantly cited the tight labor market and trade conflicts.

Looking to the future, the internet of things and smart systems are seen as the number one growth driver, followed closely by 5G/high-speed communications. Defense and aerospace topped the list of growing vertical markets with medical device and LED lighting also cited.

www.ipc.org

The keys to effective HMI

Human machine interface systems are the critical link between user and machine. EAO offers a useful list of factors to consider before you decide which interface products to specify

Whether it's a simple two-button panel or an extensive software-based system, a well-designed HMI system should allow the user to perform necessary actions while providing noticeable feedback and essential system information. Every decision, from the layout to control element selection, style, and color, must be focused on providing functionality and interactivity for the user, increasing ease-of-use and improving productivity.

Determine operational requirements

Factors such as user environment, operating temperature, humidity, dust or vibration, are all pivotal considerations when determining material and functionality choices for HMI.

As safety should always be the top priority, it's also vital to understand who will be operating the HMI. What is their role? Are they expert or novice users? Will they be operating with or without gloves? These are just some of the many questions to ask.

Select control elements

After determining the application, functional requirements and operator needs, you're ready to select the control elements. For basic alphanumeric or graphical displays, LCD and LED non-touch displays are an ideal choice.

Touch displays are better suited for HMI systems requiring increased interactivity, however, it's important to remember your key operational requirements when selecting a touch display. For example, resistive touchscreens, which are operated by a finger or stylus are popular in industrial applications due to their high resistance to moisture, dust, oil and cleaning agents. Infrared touchscreens, which register when a finger or object breaks an infrared light beam, are an ideal option for workers wearing gloves.

Yet, touch displays also run the risk of a 'false trigger'. Unwanted reactions, which can be caused by anything from moisture to electrical interference, are one of the biggest safety and productivity concerns for HMI systems. As a result, touch displays are not suitable for all applications.

Specify tactile controls

In scenarios where touch displays are not suitable, particularly where the HMI is not in the operator's direct line of sight, tactile control elements and electromechanical devices provide an alternative. Devices such as pushbuttons, emergency stops, selector switches and optical and acoustic signaling devices offer intuitive use, reliability and safety.

When selecting electromechanical devices, it's important to consider the materials used and how the devices are installed, as well as their compatibility with any other systems.

HMI design is not a one size fits all approach. Mixed technology solutions combine touch screens with tactile elements to provide benefits such as intuitive operation, discrete pushbuttons, illumination and softkeys.

Think about safety

When specifying an HMI, you must consider all available safety mechanisms and select the most effective one. For example, emergency stop switches are covered by strict regulations and are actuated via a manual action, while keylock switches require some sort of prior authentication before being activated.

Standards are immensely important as both general and industry-specific requirements can dictate features, functional attributes and even the placement or color of components.

Remember, a poor HMI system can alienate users or even encourage them to circumnavigate the system, resulting in poor or unsafe system performance. HMIs should therefore create an optimal user experience with a mix of design and layout considerations, such as style, color, and tactile response coupled with ergonomic and intuitive operation. Working with a knowledgeable HMI and mixed technology solutions expert such as EAO is the best way to specify an HMI system that satisfies unique requirements.

eao.com

HMIs enable the efficient operation and monitoring of essential processes

Every decision, from the layout to control element selection, style, and color, must be focused on providing functionality and interactivity for the user, increasing ease-of-use and improving productivity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Ready for a double squeeze?

Managing director of marketing at Rutronik, Markus Krieg, believes the US China trade war could impact component availability while 5G growth may see lead times increase again

How do you envisage the NA electronic component industry will perform in 2020?

We are currently in a downturn phase for the semiconductor industry but also for passive components in North America. The World Semiconductor Trade Statistics figures show that the North American market is showing the deepest downturn in a global comparison. It is difficult to say when we will have passed the low point, but we do not expect a significant recovery until the end of Q2 2020.

What trends or shifts have you identified and predict will continue into next year?

The trade war between the US and China will leave clear marks. If the dispute becomes tougher, the components industry in North America will be one of the victims. With a world market share of over 40 per cent in the semiconductor market, China is the most important trading partner of the US semiconductor industry. If there are further trade blockades, many high-tech jobs will be at stake. The longer the dispute lasts, the more regions will isolate themselves so, ultimately there are no winners in this fight.

How will lead times perform in 2020?

We currently expect stable lead times for the first quarter of 2020. Investment in the start of 5G production will significantly influence component supply. We expect a shortage of MLCCs in particular, potentially by the end of Q2 2020. The new 5G infrastructure in China will provide significant growth. Smaller markets will probably have to take a back seat in terms of supply. In addition to base stations, 5G infrastructure could also include the IoT infrastructure or the traffic control infrastructure in China. New digital business models will be growth drivers contributing to fab capacity utilization.

What advice would you give to purchasing professionals for 2020?

We recommend timely planning in procurement and continuous observation of lead times. After all, it doesn't matter which component is missing to halt PCB production. Only regular contact with sales team brings secure information.

www.rutronik.com

Cracking down on counterfeits

Taking a tough stance on counterfeiting is second nature for distributor, Mouser. With its anti-counterfeit strategy certified to aerospace standards, the company supports purchasers in all sectors to mitigate inventory risk

Authorized global distributor, Mouser Electronics, is rightly proud of its accreditation to AS6496. This is the aerospace industry's exacting standard for anti-counterfeit measures in authorized electronic component distribution—with Mouser enthusiastically claiming its position as the first to receive certification.

The standard sets requirements for the avoidance, detection, mitigation and disposition of counterfeit products in the authorized distribution supply chain. Recognized internationally, the standard requires authorized distributors to have a counterfeit mitigation policy and a counterfeit electronics parts control plan in place. Purchasers looking to reduce the risk of counterfeit electronic parts entering the supply chain can therefore accomplish this by using distributors accredited to AS6496.

Vice president of quality at Mouser, Chuck Amsden, explained: "By becoming accredited to AS6496, Mouser demonstrates that we are committed to providing customers with only authorized, genuine components. From sales to shipping, Mouser is dedicated to providing customers with the right product, on time, every time. Our mission is to be the source most preferred by engineers and buyers to design, prototype, test and manufacture electronics."

Rigorous processes

Despite growing concerns over counterfeit parts entering the supply chain, Mouser customers can order with confidence, knowing that Mouser has rigorous processes in place to prevent counterfeit products from entering its inventory. Over 800 semiconductor and electronic component manufacturers count on Mouser to help them introduce their products into the global marketplace. Purchasers, Mouser states, can expect 100 per cent certified, genuine products that are fully traceable from each manufacturer.

Mouser received the AS6496 accreditation in fall 2018 from the Performance Review Institute, as part of the Counterfeit Avoidance Accreditation Program. The CAAP audit was based on AC7403 audit criteria created jointly by PRI, the Electronic Components Industry Association and aerospace OEM representatives.

CAAP is a cooperative industry effort to mitigate the risk of introducing counterfeit parts into the supply chain, supporting compliance throughout the aviation, space, and defense industries. The program was established to enable organizations like Mouser that purchase components and assemblies to demonstrate that they have systems in place to identify counterfeit products, and to minimize the risks associated with them. CAAP accreditation reassures purchasers of the organizations' vigilance and ability to act appropriately.

Exacting quality control

In addition to AS6496, Mouser is also registered to AS9100D/ISO 9001:2015 and ANSI/ESD S20.20-2014, the industry's gold standards for quality, control, and electrostatic discharge protection. This quality management system adds additional aviation, space and defense industry requirements, including procedures and processes for the prevention of counterfeit parts. Registration to these standards demonstrates a focus on traceability, risk management, process control and documentation.

Mouser Electronics strives to empower innovation among engineers and buyers alike by delivering advanced technologies. In addition to stocking the latest components, the company's website offers advanced search methods to help locate inventory quickly. Data sheets, supplier-specific reference designs, application notes, technical design information, and engineering tools are all online, further encouraging customers to buy with confidence.

www.mouser.com

By becoming accredited to AS6496, Mouser demonstrates that we are committed to providing customers with only authorized, genuine components

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An eye on 2020

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

To start the year, John Denslinger peers into his crystal ball to see how the triple impacts of 5G, IoT and the Cloud will drive growth in 2020

Future gazing • By John Denslinger

Usually 2020 indicates one has excellent eyesight: the natural ability to see far and near with equal clarity. Isn't foresight a wonderful gift? If only we had similar vision forecasting the coming year.

2019 might best be described as a year of retrenchment. Previous growth markets softened, new applications grabbed little attention, lead times remained extended, inventories stymied, and the book-to-bill stayed mostly negative throughout the year. Perhaps the biggest drag was the stalling out of 4G smart phone production and the demand fall-off left in its wake. 2020 looks to be another story.

For the record, I don't profess to have 2020 vision, especially the ability to see far into the second half with absolute clarity. My forecast is merely reading market conditions, applying typical component cycle trends, assessing the health of the global economy, and looking for potential roadblocks to progress. For the moment, let's assume suppliers invested in the appropriate technology, expanded their production capacity to meet increasing demand, and perhaps the greatest unknown, our industry avoids those tangential risks that hinder growth (more on this point later).

As for market conditions, look for three main drivers according to Dale Ford, chief analyst at ECIA: 5G, IoT, and 'the Cloud'. He describes it as the 'forces coming together'. I see it as a symbiotic relationship. The build out of every future infrastructure will incorporate, by necessity, all three technologies for seamless communications. Notice 5G captures most of the media headlines, but the ramp in component demand will likely not occur until late in the year. That means IoT will initially lead the way entering 2020. The demand for sensors of all types, wireless connectivity, gateways, microcontrollers, antennas, and energy enabling devices will be great. Closely following will be the Cloud. It too will resume a major growth role in 2020 as more data centers are needed to handle massive amounts of data captured via IoT and transmitted through 5G communication networks. Processors, power management and sensors will be sought in volume. And coming back to 5G, while it may be slow coming, it will soon become the industry's tsunami. As production ramps, global demand for all components will be enormous. It may make the 4G component shortage of 2017-18 look small.

Adding further credence to this positive growth projection is semiconductors. According to Dale Ford, semis are about to start a new annualized growth cycle around mid-2020 typical of its four year trend history. That seems to fit the market conditions just described above assuring an upward path is likely.

As for the global economy, significant infrastructure build-outs will accelerate. Each will ultimately deploy all three technologies. The key deliverable driving the investment: leadership…. countries and companies seeking to establish dominant global, competitive advantages.

Lastly, I spoke of potential roadblocks and tangential risks that may stymie growth. Among those concerns are: expanded trade barriers; anti-competitive regulatory measures; cybersecurity intrusions; and disparate rules governing a free internet. Any one of these risks could negate the growth and benefit of 5G. Let's hope wiser heads prevail.

By now you might surmise 2020 should be a growth year and you would be right. But given the soft lead-in from 2019, 2020 Q1 will be flat with gradual acceleration starting mid-Q2.

eBOM.com

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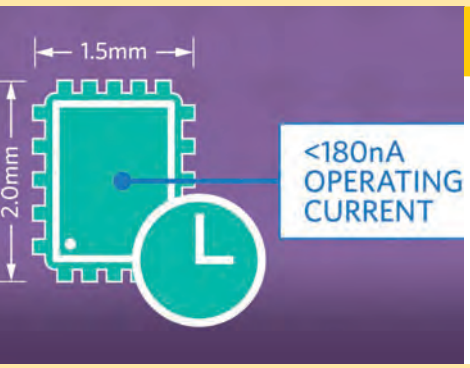


Tiny RTC extends battery life in wearables

Maxim's MAX31341B nanoPower real-time clock is ideal for space-constrained systems such as wearables, medical monitors, point-of-sale equipment and portable terminals. Designed to extend battery life, as well as saving power and space, the new nanoPower RTC is said to be more than 35 per cent smaller than the tiniest RTC alternatives available.

According to Maxim, the MAX31341B achieves these savings by offloading the central microcontroller from timekeeping. This allows for greater energy savings during sleep cycles and extension of battery runtime. The device, which operates at less than 180nA, is available in a wafer-level package measuring 2.0 by 1.5mm.

www.maximintegrated.com

Perfect timing for aerospace buyers

SiTime has unveiled its Endura MEMS timing solutions for aerospace and defense applications such as field and satellite communications, precision GNSS, avionics, and space. The Endura products are engineered to perform in harsh conditions such as severe shock, vibration, and extreme temperature, which are routine in these applications. The devices also offer maximum choice with five million possible part numbers created from 17 programmable products.

Executive vice president of marketing, Piyush Sevalia, explained: "When exposed to high levels of shock, vibration and extreme temperatures, legacy timing components have been prone to failure, degrading system performance and reliability. To solve these problems, SiTime created an oscillator system of silicon MEMS, analog circuits, compensation algorithms and advanced packaging, which is designed to outperform other available timing solution in harsh environments.

"As an example, Endura precision TCXOs deliver four parts per trillion per g of acceleration sensitivity, which is 50 times better than legacy quartz-based solutions. With such performance, we believe that Endura will transform the oscillator landscape in aerospace and defense."

SiTime's portfolio of commercial off-the-shelf Endura products spans six oscillator types and 17 products. All devices offer programmable options with some offering specialized programmable features. This provides purchasers with a large selection and the ability to configure each device to specific application requirements.

www.sitime.com

Behind the scenes

From order placement right through to delivery, ESNA takes a look at a day in the life of an electronic component

You probably know the little thrill you get when the mail man hands you an eagerly awaited parcel containing a product you ordered online. In B2B business the thrill might be a bit smaller and the parcel a bit bigger, but on time shipment is even more important, otherwise a whole production line may come to a halt.

Most people only have a vague idea of the underlying processes that lead to a successful delivery of electronic components. As a broadline distributor, Rutronik needs to cope with a variety of different shipment volumes and product quantities. Depending on the order, some tasks may vary, but in general, the majority of customer orders are handled in a similar way.

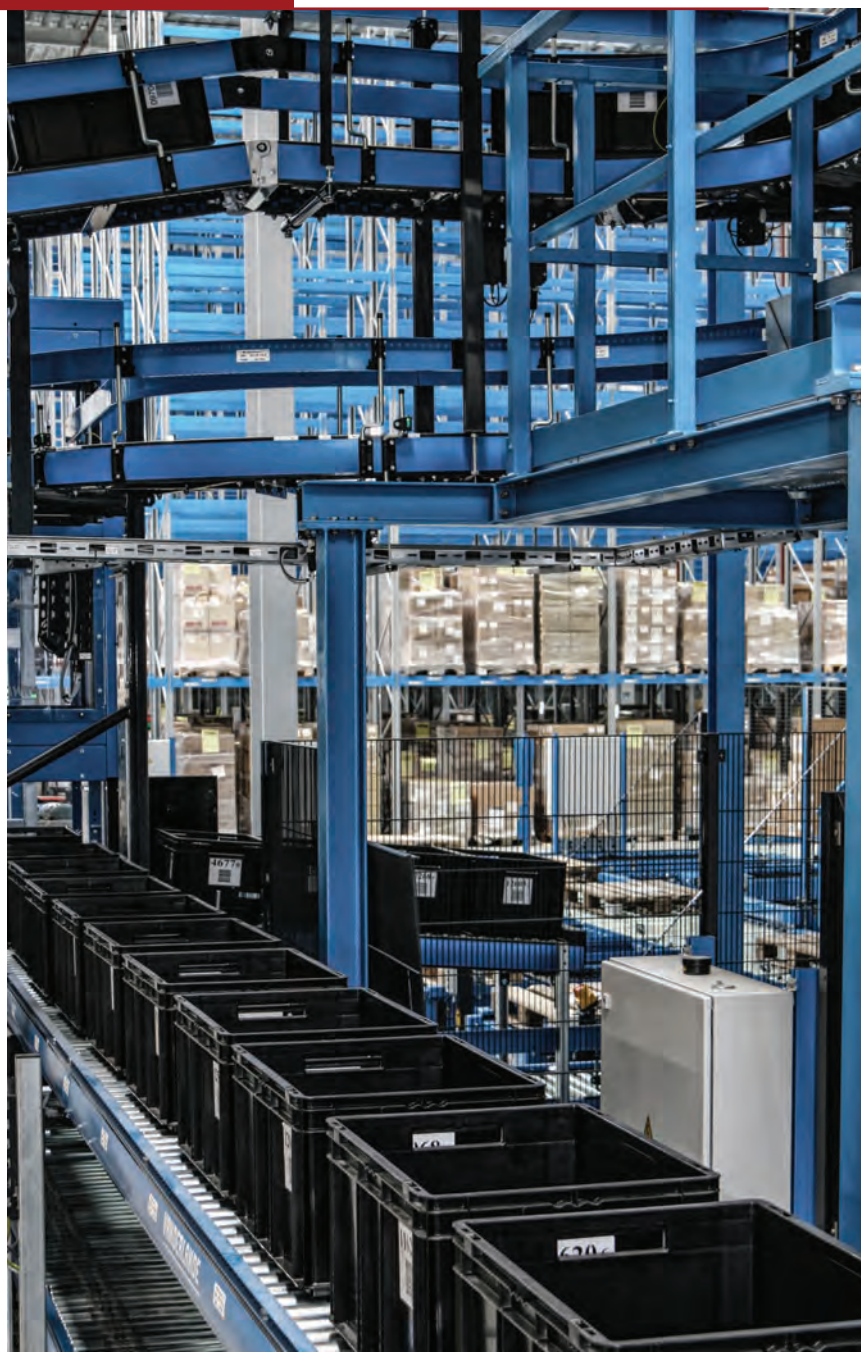
An order is placed

Well, firstly, an order is not just an order. To offer customer-specific solutions, there are three different types of logistics systems available: a delivery plan system, a Kanban system, and a consignment warehouse. These consist of standardized elements but can be adjusted to fit individual requirements.

Each order is channeled via the main logistics hub in Germany but gets processed in the warehouse location closest to the recipient. This helps ensure a globally uniform standard of service.

Delivery plan system

This is pretty much your basic ordering process and is suitable to all available components at Rutronik. Based on expected production figures, the customer forwards their desired bill of materials to Rutronik at fixed intervals. The BOMs are then subject to warehouse operations and »



» get picked, packed and sent out to the customer in the desired time frame.

Consignment warehouse
A consignment warehouse is ideal for manufacturing lines that can face short-term fluctuations and need a high degree of independence from delivery schedules.

But what does that mean in a practical way? A consignment warehouse is designed to work like a Rutronik warehouse at the customer's premises. The client provides the storage space and Rutronik provides the stock. The customer is then free to take out parts according to production capacity, which results in greater flexibility than a delivery plan system. The fulfillment schedule can be based on a forecast, much like the delivery plan system, or on a component consumption report that states the withdrawn quantities and part numbers.

Kanban system
This system combines the previous two systems. The so-called Kanban containers are defined in the run-up with a certain filling quantity of components and are tagged with an individual identification code. This code contains all necessary information of the container's contents including part numbers, quantity and location. The codes are listed on a Kanban card. In case a container is empty, this card will be forwarded to Rutronik electronically, which then starts the delivery process and the container will be re-filled.

Parts enter the warehouse
A fully functioning warehouse is comparable to a well-oiled machine. Many different parts are working together to guarantee a smooth operation. With a warehouse, this begins before the actual incoming shipment even arrives. Due to logistic tracking, it is possible to know well in advance which shipment contains which parts, in what quantity, and what package size. This means that every component is already booked into the logistic system, before it even reaches the warehouse. This accelerates the process of labeling and storage and guarantees full traceability of components during their whole journey. It's even possible to know before hand, if a shipment contains parts that are urgently required by a customer and need to be handled as a priority. »

To offer customer-specific solutions, there are three different types of logistics systems available

» After the parts have been received, each package unit is inspected visually, and is then individually marked with a label that contains all necessary information, such as Rutronik's part number, and the supplier number, before storage. By doing so, full traceability of each part is ensured, and we can intervene in a part transaction at any given time.

After the customer has chosen their preferred logistics solution, everything is ready for the first order, which starts a variety of internal processes at Rutronik.

Components are picked

Picking describes the actual removal of the component from the warehouse shelf. The customer's order is forwarded to a picker together with the exact location of the goods. This minimizes the time spent looking for specific components inside the warehouse, which, at 22 billion articles readily available, can take quite some time. The individual orders that need to be picked are not chosen randomly. An algorithm that takes numerous parameters into consideration prioritizes the order of sequence, so each shipment arrives at the customer on time.

The picked items are placed in a container, called a 'tote' that is then forwarded for shipping on a conveyor belt. Each tote has an ID-tag, so every order can be tracked individually during the ordering process.

When a tote reaches the shipping area, a complex infrastructure of conveyor belts direct it automatically to the packing station with the least traffic. This also ensures an absolute minimum of transit time for the shipment inside the warehouse.

Items are packed for shipping

During packing, items are handled according to customer specific needs. Components that are sensitive to humidity are stored within a special packing inside the warehouse and get checked multiple times during picking and packing. It's also possible to have the goods marked with customer specific labels or have a second outbound inspection, in addition to the mandatory inbound inspection.

By offering additional services like these, processing time at the customer's premises can be minimized. This way, each shipment reaches its destination exactly the way the customer wants it to be and can be processed immediately.

www.rutronik.com

> **Each tote has an ID-tag, so every order can be tracked individually during the ordering process**

Semiconductor industry will recover in 2020

While the semiconductor industry will post single-digit growth in 2020, buying conditions will favor semiconductor purchasers as there will be ample capacity to meet demand

James Carbone

Buyers can expect plentiful supply, normal lead times and price declines for most integrated circuits and discretes in 2020, despite stronger chip demand and lower inventory levels compared to 2019.

While many semiconductor manufacturers have cut back on capital expenditures, there's still ample capacity for manufacturing expansion that occurred in 2018. The capacity that was added resulted in semiconductor inventory levels growing last year as shortages of some memory ICs and discretes were mostly eliminated.

Inventory levels fell back half in the second half of 2019, but there still is some excess inventory that has yet to be worked off. As a result, unless there is a huge spike of demand that continues for months, there should be more than enough supply to meet demand, especially in the first half of 2020, according to analysts. Prices for many chips should decline and lead times should not be a problem in 2020. Chip buyers can expect price erosion for memory ICs, analog chips, sensors, optoelectronics and discretes in 2020.

High inventory levels, declining demand and lower prices resulted in worldwide semiconductor revenue falling 12.8 per cent to $409 billion in 2019, according to World Semiconductor Trade Statistics (WSTS).

Much of the semiconductor revenue decline was due to falling sales for memory ICs and by a steep drop of chip prices in 2019, according to researcher IC Insights. For instance, the average DRAM price fell 44 per cent in 2019, resulting in a 37 per cent decline of DRAM revenue. By comparison, the average integrated circuit price fell 10 per cent, the researcher said.

The steep decline in semiconductor revenue in 2019 was due to a kind of perfect storm of events. First, demand for end products was weak, said Len Jelinek, director and chief analyst for researcher IHS Markit. "Handsets were saturated, everyone has a PC, car sales declined" and data centers eased back on purchases of servers, he said.

Weak end equipment demand came after two years of increased capital spending and capacity expansion by chipmakers. Semiconductor fabs were optimized "and running at high volumes as end market demand slowed down," he said. "Inventories increased to high levels not only for the chip guys but through the channel," he said. As a result, chipmakers reduced prices hoping to stimulate demand. "Well, it did not work because there were only so many handsets and so many PCs and so many servers" to be built, said Jelinek.

Demand will bounce back

The good news for semiconductor companies is sales growth will return in 2020 and revenue should increase almost 6 per cent from $409 billion in 2019 to $433 billion in 2020, WSTS said. Semiconductor revenue will rise 6.3 per cent in 2021.

While semiconductor demand and sales revenue will increase, it probably won't happen until the second half of the year, according to Jim Feldhan, president of Semico Research. He said declining chip industry sales will "bottom out in the March/April time frame and then things will improve, but it won't be a V-shaped recovery to start. It will be slow because we think the overall economy is going to be sluggish in 2020," he said. Feldhan forecasts about 3 per cent revenue growth for semiconductors and 8.7 per cent growth in unit shipments in 2020.

While all categories of integrated circuits declined in 2019, the trend will reverse in 2020. Analog chip sales declined 7.9 per cent in 2019, but will rise 5.3 per cent 2020, said WSTS. Memory IC revenue fell 33 per cent in 2019, but sales will increase

By the Numbers

$408.9 billion
The size of the global semiconductor market in 2019. Source: WSTS

33%
The rate of decline of the total memory market in 2019. Source: WSTS

$68.3 billion
The forecasted size of the industrial semiconductor market in 2023. Source: IHS Markit

8.7%
The expected rate of growth of semiconductor unit shipments in 2020. Source: Semico Research

$460.2 billion
The total value of the global semiconductor market in 2021. Source: Semiconductor industry Association

4.1 per cent in 2020. Logic sales dropped 4.3 per cent but will rise 6.5 per cent this year. Discrete semiconductors suffered just a .6 per cent decline in 2018 and will increase 3.8 per cent in 2020, according to WSTS.

The only two semiconductor categories that posted sales growth in 2019 and will rise again in 2020 were sensors and optoelectronics. Optoelectronics sales grew 7.9 per cent in 2019 and will post a 12.5 per cent increase in 2020. Sensor sales increased 2 per cent 2019 and revenue will rise 5.4 per cent in 2020, according to WSTS.

Analysts say sales growth for chipmakers will increase in 2020 because inventory levels will be lower than 2019, and demand will increase from key customers segments.

"The key drivers for the semiconductor industry will be 5G, servers, and automotive," said Jelinek, "The largest and most significant driver especially in the short-term will be the transition to 5G" because it will be an enabling technology, he said. "The smartphone will be the immediate beneficiary of 5G technology and will receive the most attention, but as 5G networks become deployed they will serve as enabling platforms for future growth across multiple market segments," he said.

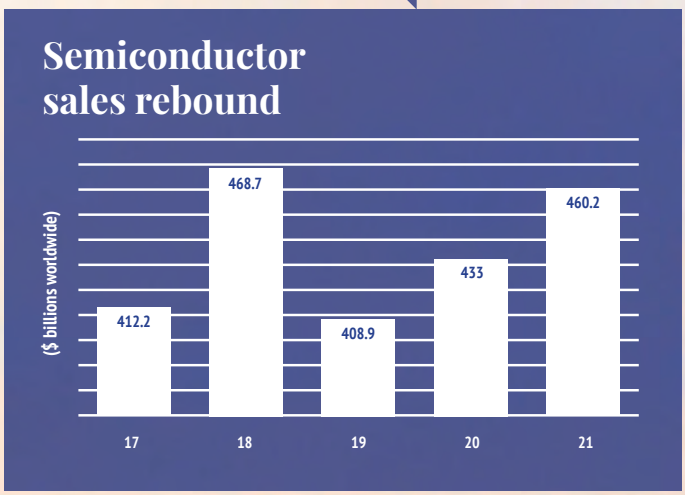
Wait until 2021

Some industry analysts say 5G will have a positive impact on the semiconductor industry, but 5G won't affect the industry too much in 2020. "It certainly will give sensors and discretes a little boost next year, but we're still early in the rollout of systems that can take advantage of the higher speeds and near instant transmissions of data through the network," said Rob Lineback, senior market analyst for IC Insights. He said 4G LTE will continue to be the dominant cellular generation for several more years.

Feldhan said that 5G infrastructure is being built "but it has not gotten the momentum to have a major impact in the market this year." There's a lot of 5G development and 5G networks are being built and there are a few 5G phones on the market today and we will see more coming out in 2020.

Feldhan noted that there are some 5G networks in large metropolitan areas. "It is a chicken or an egg thing. Service providers are starting to build 5G networks, but they don't want to do a whole buildout when there aren't really that many phones out there," he said. The real impact of 5G will start in 2021 and continue through 2023.

After declining 12.8 per cent in 2019, semiconductor revenue will bounce back growing nearly 6 per cent in 2020. *Source: WSTS*



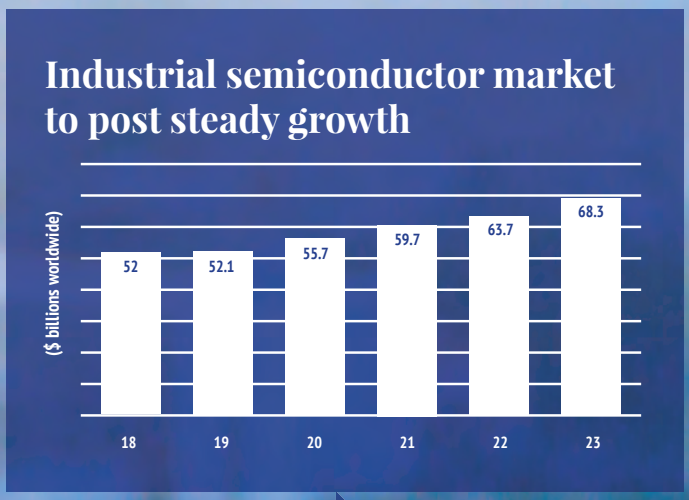
Automotive will continue to be a driver for semiconductors in 2020 and beyond because of the proliferation of infotainment, advanced driver assistance systems (ADAS) and the development of the autonomous vehicle. However, automotive only represents about 9 per cent of all semiconductor sales. The segment will grow as a percentage of sales, but it will remain relatively small compared to other segments.

Semiconductor sales to automotive totaled about $42 billion in 2019, according to IHS Markit. However, computer and storage semiconductor sales totaled $145 billion, while wireless communication accounted for $119 billion of chip sales.

Jelinek notes automotive uses a lot of mature semiconductors such as MOSFETs, and "those cost about $.25-$.30, so you are not talking about $75-$100 chips."

However, as more vehicles are equipped with infotainment systems, more advanced electronics and displays will be used so. "There is tremendous opportunity for growth," for semiconductors sold to the auto industry, said Jelinek. "But is it enough to swing the dial in the total semiconductor industry," asked Jelinek. "No, it isn't," he said. However, it will be a growing segment for semiconductor companies that focus on the automotive industry and for companies that are supplying ICs for infotainment, and ADAS systems.

Increased demand from 5G and automotive applications and other customer segments will result in less price erosion in 2020. DRAM tags will fall about 8 per cent, while NAND flash will increase 2 per cent. Prices for optoelectronics will decline 2.7 per cent, sensor tags will drop 3.9 per cent and the average price for discretes will decline 3.5 per cent, according to IC Insights.



Internet of Things and 5G technology will help drive the industrial semiconductor market for the next several years. Source: IHS Markit

Built in shunt simplifies fuse sourcing

Schurter has added a new variant to its RTS thermal fuse range, which is now available with an integrated shunt.

Developed to protect integrated power semiconductors from overheating, this reflowable thermal switch can be soldered on conventional reflow soldering machines with profiles up to 260°C, prior to mechanical activation.

The new overtemperature protection device comes in the same dimensions and maximum breaking capacity as its predecessor despite its additional shunt functionality. With a 6.6 by 8.8mm footprint, it can handle operating currents of up to 130A and rated voltages of up to 60V DC.

Featuring an integrated resistance with low temperature dependence, the new device enables precise current measurement and additional, non-thermal circuit protection. This makes it ideal for protection against thermal runaway in power semiconductors; an increasingly common phenomenon due the trend towards increasing power density and miniaturization of electronic circuits.

schurter.com

New source for TÜV-certified fuse adapters

Phoenix Contact's photovoltaic string protection fuses have now been certified by the TÜV Rheinland test institute in accordance with demanding PfG 2380/02.14 tests.

The subcomponents have been tested in accordance with IEC 62852 for connectors and IEC 60269-6 for fuse-links and their safe triggering has been confirmed. This means users can be assured that, under the conditions described in the standards, photovoltaic systems are reliably protected against residual currents.

Fuse adapters in the Sunclix family are equipped with Littelfuse fuse-links for 3.5 to 30A and are rated for voltages up to 1,500V. The protective elements are designed to provide IP68 protection and are particularly suited for safe field cabling between PV panels and inverters.

www.phoenixcontact.co.uk

Sensor enclosures available in two plan sizes and heights

OKW has launched EASYTEC, a new range of flanged plastic enclosures for modern sensor electronics, which can be mounted quickly and easily on poles, tubes or flat surfaces.

These IP-rated products are designed to survive industrial environments both indoors and outdoors. Applications include IoT/IIoT, sensor systems, security and monitoring, IT, control, environmental, medical and laboratory technology.

The flat base has a curved recess that makes the enclosure easy to mount on poles. Integrated mounting flanges have holes for pan head screws and apertures for cable ties. The top section is soft contoured for optimum ergonomics.

Internal screw pillars in the top and base mean each enclosure can accommodate two PCBs. The housings are assembled using tamperproof stainless steel Torx screws, perfect for medical electronics.

Four sizes range from 3.98 by 1.97 by 0.87in to 4.76 by 2.44 by 1.22in. They are molded from UV-stable ASA+PC-FR. The standard color is off-white (RAL 9002). Prices start at $17. Options and accessories include IP65 seals, 2.5 by 6mm self-tapping screws (for PCBs) and a Torx T8 screwdriver.

www.okwenclosures.com

One device for accurate AC measurement

LEM's new Rogowski coils measure current up to 300,000A AC with accuracy class 0.5. The ARU range achieves IEC 61869-10 class 0.5 without the need for additional components such as resistors or potentiometers to calibrate the coil.

According to LEM, the range benefits from a patented coil clasp that eliminates inaccuracy caused by sensitivity to the position of the conductor inside the loop. This provides a robust 'twist and click' closure.

Unlike LEM's ART Rogowski coils, the ARU range can be installed outdoors as the models are compliant with UV, water, dust and ice resistance standards. The range is also ruggedised for durability in extreme environments including an operating temperature range of -40 to 80°C. An internal shield protects against external fields, improving accuracy and optimising performance for small current measurements.

Designed to offer ease of installation, as well as being thinner and more flexible than split-core current transformers, the ARU can be mounted quickly by simply clipping on to the cable to be measured. ARU coils complete LEM's AC current measurement portfolio, supporting future distribution network applications and solutions for measuring electrical parameters in the Smart Grid.

www.lem.com

GaN FET ready for volume roll-out

Nexperia has announced its entry into the gallium nitride field effect transistor market with the introduction of the 650V GAN063-650WSA, a robust device with a gate-source voltage of ±20V and a temperature range of -55 to 175°C. The device features a low RDS(on) and fast switching to deliver high efficiency.

High performance applications include xEV, datacentres, telecom infrastructure, industrial automation and high-end power supplies. Nexperia's GaN-on-silicon process is robust, boasts proven quality and reliability and is highly scalable as wafers can be processed in existing silicon fabrication facilities. More, this device is available in the industry-standard TO-247, providing GaN performance in a familiar package.

General manager of Nexperia MOS business group, Toni Versluijs, said: "Our GaN technology is ready for volume production, and with scalability to meet high volume applications. The automotive sector is a key focus and one which is forecast to grow significantly for two decades as electric vehicles replace those powered by traditional internal combustion engines in personal and public transport."

www.nexperia.com

Power connectors upgrade minimizes assembly time

Emerson has enhanced the Appleton200A Powertite series of pin-and-sleeve plugs, receptacles and connectors with new features designed to provide faster and easier field assembly, greater environmental protection and improved worker safety. Capable of supplying reliable power to heavy-duty electrical equipment, fixed or portable, the series is said to be the next generation of power connection solutions designed to excel in wet, corrosive areas such as shipping docks and ports, land-based drilling rigs, sewage pump and lift stations, backup power generation and cellular relay stations.

With the upgrade, the series is claimed to offer the fastest field-assembly time in the industry. It reduces complexity by limiting the total number of components requiring interaction, therefore cutting field assembly time and decreasing the number of hand tools needed for both installation and field maintenance. The addition of nested Allen slots inside the terminal block allow the terminals to be wired and fastened without disassembly, and funnel-type terminals prevent copper conductors from fraying and requiring repair during insertion.

www.emerson.com

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ACOUSTIC COMPONENTS											
BeStar Electronics Ind. Co. Ltd.	BeStar Technologies Inc.	520-439-9204	www.bestartech.com	Y	N/A	$250,000	N/A	100.00%	50	900	Y
CABLE & WIRING											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23235	N/A	$0	0.46	50	1,000+	Y
Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	$0	93.00%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	$0	97%	50	1,000+	Y
Molex	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
CIRCUIT PROTECTION											
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,462	N/A	$0	68.00%	50	1,000+	Y
Eaton	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,487	N/A	$0	100%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	28,790	N/A	$0	67%	50	1,000+	Y
Schurter	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	31,445	N/A	$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
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
Grayhill	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Honeywell	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Keystone Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
NKK Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	13,976	N/A	$0	86.00%	50	1,000+	Y

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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ELECTROMECHANICAL *(Continued)*											
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Panasonic	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
PUI Audio	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Schneider Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Sensata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Teledyne Relays	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
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											
Abracon 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
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

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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
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.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	165,853	N/A	$0	31%	50	1,000+	Y
Anderson Power Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Aptive (Delphi)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cinch	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cinch Connectivity/Bel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ERNI Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
FCI	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,394	N/A	$0	73.00%	50	1,000+	Y
Glenair	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Harting	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,160	N/A	$0	51.00%	50	1,000+	Y
Harwin	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Hirose Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ITT Cannon	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ITT Cannon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
JAE Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,02	N/A	$0	100%	N/A	N/A	Y
JST	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
LEMO	LEMO	800-444-5366	www.lemo.com	M	N/A	N/A	N/A	N/A	N/A	1,500	N/A
LEMO	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Mill-Max	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	85,634	N/A	$0	89%	50	1,000+	Y
Neutrik	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,563	N/A	$0	100%	50	1,000+	Y
NorComp	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	30,044	N/A	$0	77.00%	50	1,000+	Y
Radiall	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Souriau	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,744	N/A	$0	27%	50	1,000+	Y
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
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

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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
PASSIVES *(Continued)*											
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			N/A	$0	100%	N/A	2000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phihong	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
RECOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Schaffner	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TDK Lambda	Mouser Electronics	800-346-6873	www.mouser.com	Y	405	N/A	$0	80.00%	N/A	N/A	Y
TRACO Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vicor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
REED SWITCHES											
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	$200	100.00%	15	275	N
SENSORS											
ams	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Analog Devices Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bosch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Honeywell Sensing and Control	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,059	N/A	$0	64.00%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,379	N/A	$0	45.00%	50	1,000+	Y
Melexis	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,915	N/A	$0	59.00%	50	1,000+	Y
Sensirion	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
STMicroelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	914	N/A	$0	65.00%	50	1,000+	Y
SWITCHES & KEYBOARDS											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TEST & MEASUREMENT											
B&K Precision	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Fluke	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,008	N/A	$0	94.00%	50	1,000+	Y
Keysight	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Lascar Electronics		814-835-0621	www.lascarelectronics.com	Y	130	$602,000	$0	100%	10	175	Y
Tektronix	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Teledyne LeCroy	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96.00%	50	1,000+	Y

Contract Manufacturers Buyers' Guide

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