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JULY 2019

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On the cover – July 2019

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Buyers' Guide

All the facts and figures to help you buy



Hybrid renewable: why not?

Most months I get the chance to chat with industry friends and colleagues about a range of electronics related subjects. Most times we start with contemporary topics but quickly wander into uncharted territory. So it was during a conversation with industry PR, Nick Foot, who sideswiped me with a simple question I had no answer for: “Why do renewable energy facilities typically employ only a single generation technology, especially offshore”.

I've seen plenty of wind, solar, wave and tidal facilities, but never an offshore 'power station' using multiple generation hardware.

Nick's basic argument was why invest in building an offshore facility (miles in size) including the cabling infrastructure and ongoing maintenance facilities without trying to maximize the energy density using multiple techniques?

An internet investigation uncovered plenty of research documents discussing just such an idea but I couldn't find a single example of what I would describe as a 'hybrid renewable power station'.

Maybe there is a very simple answer in that the optimum conditions for wind, solar, wave and tidal power can never congregate at a single geographic location due to the inherent requirements and limitations of each technique. Alternatively, maybe the providers of such technologies see each other as competitors rather than partners.

I trust some of my readers know more about this than Nick or I and I look forward to their answers.

Jon Barrett

Contact			
EDITORIAL Managing Editor: Jon Barrett jonb@electronics-sourcing.com Contributing Editor: Amy Barker amyb@electronics-sourcing.com Editorial & Production: Thomas Smart thomas.smart@electronics-sourcing.com Editorial & Production Assistant: Ben Kitching ben.kitching@electronics-sourcing.com		CIRCULATION Circulation Manager: Vicky Leary vicky.leary@electronics-sourcing.com Circulation Account Manager: Liz Poole liz.poole@electronics-sourcing.com	
ADVERTISING Director of Sales: Charlotte Morgan charlotte.morgan@electronics-sourcing.com Area Sales Executive: Emma Poole emma.poole@electronics-sourcing.com		DESIGN Graphic Designer: Josh Hilton josh.hilton@electronics-sourcing.com	
		PUBLISHER Mark Leary mark.leary@electronics-sourcing.com Office Manager: Denise Patten denise.patten@mmgpublishing.co.uk	

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Production expands to meet automotive growth

Laser Components is building a new production facility for its detector products in Chandler, Arizona. The 26,000ft² building, which will serve as a central development and production site for all Laser Components detector technologies, should be complete by the spring of 2020. Equipped with production and cleanroom areas, it will provide space for growth in the coming years.

Chief executive officer, Patrick Paul, commented: "We will continue to expand our close ties with Arizona State University. In addition, major players in technologies related to autonomous driving have recently settled in Chandler."

General manager of the Laser Components Detector Group, Dragan Grubisic, added: "The automotive industry is known for its high standards of quality, which is why we are confident that our high-end products make us an attractive partner. With the new facility, we will be able to manufacture the quantities necessary to meet the enormous growth potential of this market."

www.lasercomponents.com

No MOQ on new tunnel diode detectors

Pasternack has introduced a new line of coaxial packaged tunnel diode detectors that are in-stock and available with no minimum order quantity. That makes the detectors ideal for prototype and proof-of-concept applications in aerospace and defense, military and commercial radar, test and measurement, and SATCOM applications.

This offering includes 26 models featuring rugged germanium planar construction and operate over octave and broadband frequencies ranging from 100MHz to 26GHz.

Sniff out new sensor technologies

Sager Electronics has enhanced its line card with patent-pending gas sensing products developed by NevadaNano.

Senior director of business development at NevadaNano, Bob Christensen, noted: "Sager is an excellent partner with which to offer our ground-breaking gas sensors. Sager's position in the marketplace, alongside the industry's first gas sensor capable of detecting multiple combustible gases, is a compelling combination that we are confident will drive demand."

Supplier marketing and product manager for Sager Electronics, Brian Moran, added: "NevadaNano's highly accurate, low power sensors requiring minimal calibration intervals are a great addition to Sager's world class line-up of sensors."

www.sager.com



Product manager, Tim Galla, said: "Our new tunnel diode detector product line is ideal when fast and sensitive power detection capability is needed. We offer a comprehensive selection of broadband high-performance designs that cover a variety of applications, plus detailed datasheets, applications support and immediate, in-stock availability with same-day shipping."

www.pasternack.com



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In Brief

Embedded power acquisition

Advanced Energy Industries is to acquire the Embedded Power business of Artesyn Embedded Technologies, enhancing AE's ability to provide engineered, application-specific power supplies for demanding applications including hyperscale data centers, telecom infrastructure in next generation 5G networks and embedded industrial power. Artesyn EP brings new power technologies, expanded capabilities and increased stability and scale.
www.advancedenergy.com

Plastic pallets cut costs

Taking ownership of your own closed loop of plastic pallets can reduce costs says Goplasticpallets.com. Although more expensive than wooden pallets, plastic pallets can reduce costs and aggravation in the long run and generate income by renting pallets to suppliers. Resilient and hygienic, plastic pallets can be used repeatedly for over 10 years, after which they can be recycled.
www.goplasticpallets.com

IPC endorses USMCA pact

IPC hosted its annual US advocacy event, Impact Washington, DC, last month. During the event, executives from electronics companies across the US endorsed the proposed US-Mexico-Canada Trade Agreement, calling on the Trump Administration and Congress to support advanced manufacturing. IPC also released a report looking at the potential impact of the pact, the underlying economics and how specific provisions could affect the industry.
www.ipc.org

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Extra opto options added

Newark has expanded its range by adding Osram Opto Semiconductor products to its global offering. The portfolio, which includes LEDs, infrared emitters, photodiodes, and optical sensors, will provide more choice when looking for high-performance illumination, visualization and sensor solutions.

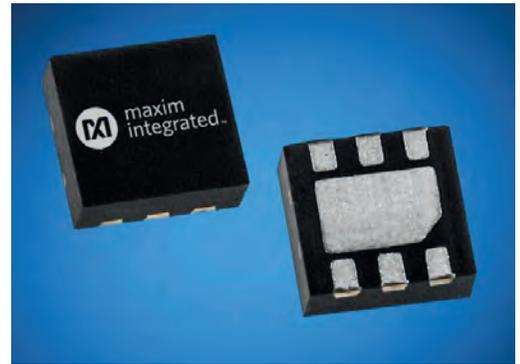
Key products to be stocked include the Osram Black family of infrared LEDs, now with dedicated automotive versions for exterior and interior applications. Other highlights include the SFH 2200 family of small photodiodes, the Topled E1608 family of low-power LEDs, SFH 4776 broadband infrared LEDs for use in near-infrared spectroscopy applications and the Synios P2720 platform consisting of 15 different LED products with different chip sizes, power ratings and colors that can be configured within a single footprint to suit different applications.

www.newark.com

Connectors win on pricing and reliability

New Yorker Electronics and Pinrex Technologies have announced a new franchise distribution agreement for the global distribution of Pinrex connectors, wire harnessing and cable assemblies. Said to offer factory-direct competitive prices, short lead times, high capacity, and strict quality controls, Taiwanese manufacturer, Pinrex, can also provide customizations and OEM/ODM parts.

A common choice in the computer, consumer, and communications industry, Pinrex manufactures a range of wire-to-wire, wire-to-board and board-to-board connectors including



Two new authenticators join security line-up

Mouser Electronics is now stocking two new authenticator products from Maxim Integrated. The authenticators are designed to add an extra layer of protection to applications such as internet of things nodes, device management, secure peripherals, and medical sensors.

The Maxim DS28E39 and DS28E84 DeepCover authenticators provide a core set of cryptographic tools including an asymmetric ECC-P256 hardware engine, a FIPS-compliant true random number generator, and a decrement-only counter. The devices also include onboard non-volatile memory and offer a unique 64-bit ROM identification number, which is used for cryptographic operations.

www.mouser.com

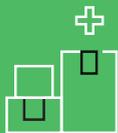


0.3mm FPC Hirose-compatible connectors, SATA Express and specially designed pin and female headers.

New Yorker Electronics president, Barry Slivka, said: "Our new relationship with Pinrex is beneficial to customers because of its pricing, reliability and custom options. New Yorker's broad global resources will allow us to supply highly certified, quality products to customers quickly and consistently."

www.newyorkerelectronics.com

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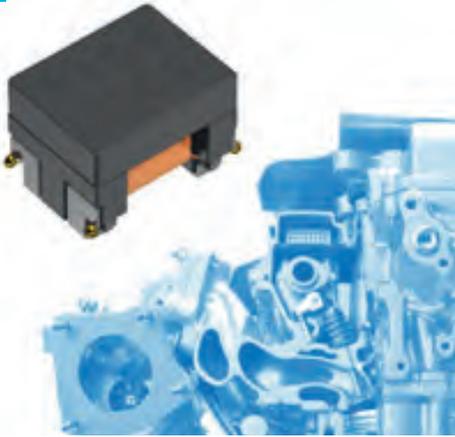
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Ferrite filters are first for automotive

TTI is now stocking common mode chokes from TDK. ACT series common mode ferrite chip filters are ideal for automotive markets, boasting outstanding common mode impedance characteristics and structural reliability compatible with a high-temperature environment of 150°C.

These features make the chokes ideal for applications where the electronic control unit is located inside the engine room, which has become mainstream for industrial communications signal lines

such as the CAN protocol in automotive applications.

TTI is also stocking the TDK ACM and ADM series ferrite chip filters for common mode chokes and differential mode inductors commonly found in power line applications. The series is perfectly suited to the strict requirements of automotive applications.

www.ttiinc.com

New facility supports supply chain optimization

CDM Electronics has opened a new 9,000ft² manufacturing and distribution center in Turnersville, NJ. The location functions as a manufacturing facility for value-added cable assemblies including RF, military and power cable assemblies, plus box builds. It also supports warehousing and order fulfillment for over 90,000 RF interconnect products, and 365,000 feet of low-loss and specialty coaxial cable. The location is ISO certified and staffed by technicians certified to IPC/WHMA-620 and J-STD-001 standards.

Configured from the ground up, the company states the facility employs the latest manufacturing, warehousing, inventory management, materials handling and storage systems to help OEMs speed time to market. It also houses onsite testing.

Convertible manufacturing cells can be reconfigured within an hour to accommodate an array of builds. To expedite shipping, the new location features unique storage systems designed to promote fast and easy deployment of coaxial cable bulk spools.

www.cdmelectronics.com

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Connectors stocked and ready to ship

GCT Managing Director, Laurence Hill, explained: "Digi-Key is one of the first places engineers look to source products and it's great to be part of the extensive library of components it has to offer. Our customers have also expressed their preference to acquire our connectors through Digi-Key and I'm delighted to announce this is now possible."

Core GCT product lines such as USB, SIM and memory card connectors are now currently in stock at Digi-Key. This includes leading-edge and unique products such as the SIM8060 hinged nano SIM connector with card detection

and the USB4085 Power focused Type-C connector engineered to be a real alternative to MicroUSB for charging applications.

Digi-Key's VP global supplier management, David Stein, added: "We are happy to announce our partnership with GCT and offer their standard and custom interconnect products to our global customer base. Their wide range of PCB interconnect products and experience working with custom designs will be of great benefit to the customers we serve."

www.digikey.com

Rainbow of terminal blocks

CUI's Interconnect Group today announced the addition of terminal block connectors to its existing line of connector products. Featuring up to 24 pole counts, the terminal blocks come available in pluggable, screw type and screwless configurations with 2.54, 3.50, 3.81, 5.00, 5.08, and 7.62mm pitches. These terminal block models also offer horizontal, vertical, 45deg and 180deg orientations, making them ideal for lighting systems, commercial building equipment, industrial controls and any wire-to-board application requiring quick wire termination in the field.

Accommodating 28 up to 10 AWG wires, all terminal block series include blue, green, orange, yellow, gray and black options, along with an additional white option for the push button on the screwless versions. The terminal blocks carry UL current ratings

from two to 30A and IEC current ratings from five to 32A, as well as UL voltage ratings of 150 and 300Vdc and IEC voltage ratings from 130 to 630Vdc. With operating temperature ranges from 40 up to 105°C, all models further comply with RoHS and the UL94V-0 flammability rating.

The connectors are available immediately with prices starting at \$0.16 per unit at 1,000 pieces through distribution.

www.cui.com





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Same-day shipping on hi-rel cable

Fairview Microwave has released a new series of high-reliability, temperature conditioned RF cable assemblies available with same-day shipping. Designed to cover operating frequencies to 18GHz with VSWR as low as 1.35:1, the low loss cables are ideal for military electronics, avionics, SATCOM, electronic countermeasure and other mission critical applications.

Consisting of 128 configurations, the range is built from three different cable types, totaling more than 1,400 parts. Cable assemblies are constructed using thermally pre-conditioned, triple-shielded coaxial cable and captivated stainless steel connectors, which are then assembled using J-STD soldering processes and WHMA-A-620 workmanship criteria. This, along with acceptance testing, combines to create a highly reliable cable assembly, ideal for applications where the cost of failure is high and performance over time is paramount. These commercial off-the-shelf cables are 100 per cent tested and come complete with material lot traceability and test reporting.

www.fairviewmicrowave.com

Rugged memory is ready for action

Smart Modular Technologies has added to its Smart Rugged offering with a 32GB industrial grade SO-DIMM. This small form factor memory is ideal for rugged computing applications in the defense and other similar segments exposed to extreme operating environments.

The module responds to increased demand for ruggedised mobile computing devices in the field. To achieve this level of reliability, the Smart Rugged 32GB SO-DIMM undergoes a rigorous industrial grade test process that includes a cold boot at -40°C, ramping up to 85°C ambient operation. The modules are also tested at a high utilization rate while being subjected to this industrial grade temperature range. Customized test boards expose the memory modules to temperature variations while running at high speed to ensure that all cells in the DRAM components are fully stressed through the entire temperature cycle. Weak modules are then removed, ensuring reliability in the field.

Modules operate at DDR4-2666 speed grade and are offered in error correcting code and non-ECC configurations.

www.smartm.com



Bringing Li-ion battery benefits to defense buyers

Saft has launched a new 56V lithium-ion battery in its Xcelion range. Offering a higher voltage than its predecessors, the new variant continues to offer a high-capacity, low-weight alternative to traditional lead-acid batteries, enabling widespread adoption of Li-ion technology in military applications such as ground vehicles or other defense applications using 48V power.

According to Saft, the Xcelion 56V offers higher capacity, a longer life cycle, longer calendar life, lighter weight and smart battery capabilities compared to standard lead-acid batteries. The 41Ah Li-ion battery is an off-the-shelf solution with a nominal voltage of 52.8V and is only half the weight of lead-acid batteries of similar size.

Various safety features are incorporated in the Xcelion 56V, which features an abuse-tolerant Super-Phosphate Li-ion technology and a battery management system.

www.saftbatteries.com



Robust data connectors target defense

TTI is now able to supply ITT Cannon's MDM and MDV Micro Series connectors for data, power and signal transmission. Optimized to save space and weight in demanding applications such as space vehicles or defense systems, these rugged, moisture-sealed connectors are designed to be comparable with MIL-DTL-83513-style connectors.

The series is available in eight shell sizes, accommodating nine to one hundred contacts, either copper alloy or gold plated, in positions 9, 15, 21, 25, 31, 27, 51 and 100. Wire sizes are AWG24 to AWG32. Interconnects feature the Cannon micro twist pin contact system, which reverses the traditional pin and socket arrangement and ensures that the pins will mate even under misalignment conditions. The series is said to be highly robust and can withstand 500 mating cycles. Available configurations include Micro-D Metal; coaxial/power, PCB, surface mount, micro strip, hermetic, filter, center jackscrew and circular connectors.

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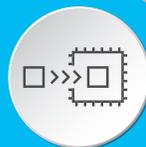


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Connectivity: a heads-up on the defense avionics challenge

Next generation defense avionics demand greater functionality, higher data speeds, miniaturization and ruggedization. Astute Electronics asks whether the connectors specified are up to the job

There are enormous challenges on mil/aero avionics, both environmental and technological. From scorching deserts to cryogenic atmospheres and lightning storms, through sandstorms and dust clouds to explosions, shocks and extreme vibration, these systems must be fully ruggedized to operate without interference.

As if surviving some of the toughest field conditions on the planet and beyond isn't enough, defense avionics is now demanding smaller and lighter components that can be mounted in higher densities, consume less power, generate less heat and are standardized for maximum interoperability and service life.

The latest military aircraft are also driven by unprecedented levels of data. Virtually everything on board is now

directly controlled by, or has a related dependency on, electronics. Complex electronic systems throughout aircraft, satellites and spacecraft are required to control engine management, communications, navigation and the multitude of systems that perform individual functions, including information displays, weapons guidance, fuel systems, and flight recorders a truly dizzying array.

Security presents a further hazard. Electronics are typically the most sensitive pieces of equipment on board and may need added protection against disruption from cyber-attacks and electronic countermeasures, ranging from radar jamming and deception to a devastating electromagnetic pulse attack.

The role of connectors is

critical to the integrity and operability of these systems. Naturally, these stringent demands translate into big challenges for connector makers to ensure that their interconnect products provide highly reliable and fast connections over extended use and in harsh conditions. As a franchised distributor, Astute Electronics not only offers a variety of connectors designed for the defense and aerospace industry but works closely with manufacturers in what is actually a highly complex area.

Cockpit evolution

Any pilot who's been flying for several decades will have witnessed a gradual but dramatic evolution in cockpit design, as data-driven avionics systems have steadily taken over various functions. Pilots are no longer faced with a sea of circular dials and are now much more



Stringent demands translate into big challenges for connector makers to ensure that their interconnect products provide highly reliable and fast connections over extended use and in harsh conditions



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likely to use a small number of multi-function displays (MFD).

This trend has been driven by the demands of military aviation. Third generation fighter aircraft such as the F-4 Phantom used mechanical gauges to present information to the pilot. In the 1970s, the fourth generation fighter began to take over. At the same time, the increased use of electronic warfare was demanding the introduction of new and complicated systems. In aircraft like the F-16 Fighting Falcon and the F-18 Hornet, it was imperative to find ways for these new capabilities to be controlled by a single pilot, which simply could not be achieved with conventional dials.

Thus, the multi-function display was born. By condensing a huge amount of information into a simple, easily understood picture, the MFD enabled pilots to spend more time concentrating on their role of flying the aircraft rather than managing electronic systems.

At the same time, the head-up display (HUD) was reaching maturity. This is a device which takes the same combined information that might be shown on an MFD, and projects it onto a glass screen in the direct eye-line of the pilot. Suddenly, pilots could fly their aircraft with their 'heads up,' looking out of the aircraft, instead of 'heads down,' managing a huge array of dials, switches and controls.

You can imagine that, behind the screens, a huge amount of computing power was required to gather, combine and then present this information instantly to the pilot, and you would be correct.

Multi-function displays

If we look forward to the present day, the MFD has become a standard tool, not just for fighter pilots but in commercial and even in general aviation. The latest Boeing airliners are fitted with a HUD for each pilot, and the latest Cessna aircraft designed for private pilots are fitted with full-color, programmable multi-function displays. Head-up displays are even available for cars now, showing just how far this technology has spread.

Continues on page 14 ►



MIL-DTL-38999 still seems to be the 'go-to' connector for many military and aerospace projects, which is incredible considering that the standard is well over 40 years old

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Fast. Advancements in technology should never take you by surprise. In the military and aerospace industry, if you're not on top of things, they're on top of you. To stay out front, you need a partner who's plugged into the industry - one who can react quickly to your needs, sometimes before even you know what those needs are.

Focused. It's Falcon's focus on the military and aerospace industry that has allowed us to forge long-term relationships with suppliers who are equally dedicated. Falcon's line card showcases superior, high-reliability product lines from the industry's top manufacturers - all with long-term Mil-Aero strategies - reducing the possibility of obsolescence.

It's Falcon's focus on our customer that enables us to become a dedicated partner. Whether managing individual inventory requirements, providing sophisticated levels of support, or supplying leading-edge technologies to meet rugged environmental demands, Falcon is committed to your success.

Falcon. Falcon Electronics is a Certified Small Disadvantaged Distributor of state-of-the-art semiconductor components, dedicated to the military and aerospace industry. Our suppliers have confidence in us. Our customers trust us. And Falcon is proud to be considered an ally of both.



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The F-18 Hornet head up display includes a multi-function display combining inputs from multiple sources - every connection must be faultless

The problem of connectivity remains, however. These fantastic displays combine inputs from sources such as engine management systems, information on speed, altitude and attitude, and the latest GPS navigation systems. Each of these connections must perform without fault in an environment that is subject to vibration, acceleration and extremes of temperature. Failure could have life-threatening consequences.

Cockpit displays have come a long way in 50 years, and purchasing professionals need to be aware of the challenges that the latest technologies present. High data speeds, miniaturization and improved functionality make new and interesting demands of the connectivity and infrastructure in the next generation of aviation electronics.

Sourcing for the future

Those tasked with sourcing connectors for next generation defense avionics will be relieved to hear that the latest connectors are ready and able to take up the high-speed application challenge of the mil/aero and space markets. Demands include the ability to reliably transmit and receive 10Gbps and beyond with a stable

characteristic impedance of 100 ohms and compliance to all MIL-STD-202 requirements for shock and vibration.

Circular connectors have long been valued for their robustness and superior performance in the military and aerospace industries, but many are bulky and heavy. The MIL-DTL-38999 connector, for instance, is very familiar. It still seems to be the 'go-to' connector for many military and aerospace projects, which is incredible considering that the D38999 standard is well over 40 years old. For those specifying into the current generation of miniaturized systems, however, the size of the interface connector can be a real stumbling block.

Fortunately, the D38999 connector is no longer the only option. The 2M connector from Amphenol takes the most useful features of D38999 connectors, such as high contact density, mechanical reliability and robustness, and incorporates them into a significantly smaller physical package. This translates into a connector that offers the same performance as a D38999 type but can offer a weight and space saving of up to 50 per cent.

Astute Electronics' MIL spec connectors include popular MIL-spec series D38999, M26482 and 5015; micro-miniature circular connectors such as Amphenol 2M; D-sub and micro-Ds, including M23408; as well as connector accessories such as backshells and ID solutions. Many products also meet approvals and ratings outside of MIL-spec, such as UL and ATEX. You'll find these connectors deployed in a range of mil-aero applications including drones/UAVs and helicopters, military comms and more.

To support buyers tasked with sourcing in this challenging environment, Astute Electronics works closely with franchised manufacturers to provide technical support and ensure access to a huge range of connectors designed for the aviation and aerospace industry. From technical workshops and seminars to customization and design-in advice, Astute aims to provide a solution, as well as providing much needed logistical and stock-holding support, all of which can help purchasers attack this complex sourcing challenge with confidence.

www.astute.global



Circular connectors have long been valued for their robustness and superior performance in the military and aerospace industries but many are bulky and heavy

30 YEARS

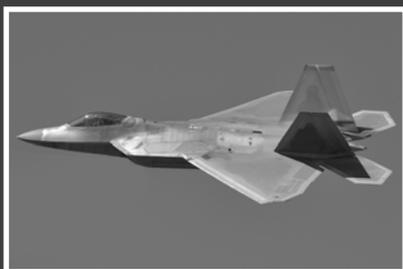
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Five statistics that will change your buying behaviour

Strategic choices about how and where electronics are manufactured have a significant impact on purchasing. Mentor Graphics presents five key facts that will make you rethink purchasing for PCB assembly

Manufacturing is an old process, yet new consumer buying patterns are increasingly putting pressure on factories to become more flexible. Innovations such as Industry 4.0 attempt to meet these market-force requirements with technology solutions, but in reality, the problem surpasses manufacturing and includes the whole business process, which has become entrenched in bad habits.

Here, we expose some of the shocking statistics in manufacturing, as well as highlighting the opportunities they present for agile companies and progressive purchasers.

1. 95% of manufacturing businesses focus on optimising just 1% of their total business cost

Looking at the latest technology products built today in China, the labour contribution to the final product retail cost can be as little as one per cent. Why then, are companies so concerned with this, to the detriment of quality, flexibility, and risk?

Historically, when factories existed close to the market, labour represented most of the fixed cost of operation. Consequently, there was a move toward off-shoring manufacturing, but once all the major companies had

followed this pattern, the once competitive edge of lower cost labour was lost. Now companies are fighting to reduce the last one per cent that labour contributes to the final price of fashionable high-tech products.

Unfortunately, during this process other cost contributors have been ignored. For example, if we look at a quality LED lightbulb, we find that it is available online with free shipping from a small Chinese supplier for around one fifth of its in-store retail price. We can assume that the lower figure represents a fair price for the manufactured product, with a reasonable profit for the manufacturer, some profit for the Chinese sales company, and of course the real cost of postage.

Consumers can pay the higher price and have the bulb today or wait three to six weeks for the product to be delivered from China, saving 80 per cent of the cost. For many, it will be worth the wait. If customers are willing to buy goods on-line from China despite the wait and risks involved, wouldn't it be better if the factory was based close to home, using the same model as the Chinese sales company and shipping directly to customers?

An on-shore factory with direct shipping could have a far higher degree of success with a simple warehouse

inside the factory, although of course, the factory would need to be flexible to respond to more random shopping requests while still remaining productive. The labour cost in such an on-shore factory could be five to ten times that of the corresponding Chinese factory, but this will still be small compared to the cost saving from distribution.

2. SMT operations often run at as little as 20% absolute productivity

The important word here is 'absolute.' In high-volume manufacturing, when production lines were dedicated to a specific product and lines ran at full capacity, absolute productivity could be as high as 85 to 95 per cent.

Today, however, very few SMT operations operate in this way. With rapid technology evolution and multiple product variants, each with a limited lifecycle, consumer items have only a small window to attract premium pricing, after which there is rapid price depreciation.

The effect of this on the factory is a need to not only produce a high mix of products but also to cope with sudden changes in demand. These factors are the key cause of the low productivity currently seen in many SMT operations.

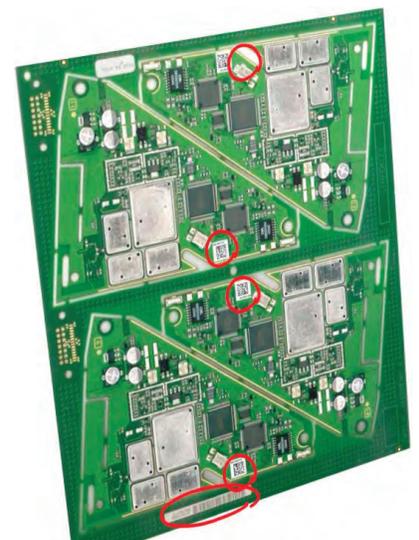
Factors such as changeover



Collecting data directly from equipment helps to account accurately for usage and spoilage



Looking at the latest technology products built today in China, the labour contribution to the final product retail cost can be as little as one per cent



time, line balance losses, engineering setup time, maintenance, and new product introduction time can all be used to boost the headline number. The reality is that many 'unavoidable' losses are effectively ignored, even though they may actually be avoidable. As product mix and demand volatility continue to increase, attention on these issues will be essential.

Many of these issues can be addressed, even in a high-mix and high-volatility scenario, for example, by using software tools to create common material feeder setups that adapt dynamically to customer-demand patterns, and optimising work-order sequences.

3. 75% of raw materials in an SMT factory need not be there

The adoption of lean material logistics is an essential part of providing flexibility in SMT production. By enhancing the accuracy and control of enterprise resource planning tools, especially for work in progress on the shop floor, lean material logistics can reduce the amount of buffer stocks in the factory.

Since SMT materials are supplied on bulk carriers, such as reels, many more materials are issued to production than are actually needed. In a high-mix environment, it can be that most materials issued will not be immediately consumed by the targeted work-order. There can also be spoilage during the placement operation, both through the machine and manual operations. The amount of materials left unused after executing a work-order is therefore unknown.

Periodical stock checks often reveal the need to write-off significant amounts of materials, potentially at

great cost. Furthermore, accumulated inventory inaccuracy brings unexpected internal material shortages, which in turn leads to the habit of instructing material requirement planning to over-order materials, creating a bloated warehouse inventory.

Introducing lean material management can eliminate 95 per cent of the material WIP on the shop floor because materials are issued only when needed and are returned to the warehouse when no longer required.

Collecting data directly from each SMT machine helps to account accurately for usage and spoilage. With material inventory accuracy maintained, internal material shortages are eliminated. MRP can then maintain buffer stock levels more accurately, according to real business needs. As a result, warehouse inventory can be reduced by as much as 75 per cent without risk of production shortages.

4. 30% of products leaving the factory were never tested

There are several different categories of product defect, from untestable defects to defects that pass tests in the factory, only to fail once the product has been in use for a while.

With a firm grip on the statistical situation, however, the emphasis moves away from test towards the manufacturing processes themselves. Manufacturing defects are most often caused by variations in the production process, some with a simple cause-and-effect, others as a result of two or more factors working together.

First, check each process to ensure that the setup and operational guidance was correct. Today's process

preparation tools can create SMT programs, test and automated inspection data, as well as operation standards for manual processes, from a single product model. Next, ensure that all production operations are carried out as specified and that any variances are highlighted and eliminated. For most SMT operations, test and repair processes are the third and final step.

The most neglected tool, however, is the application of traceability data within manufacturing. If traceability data is accurate, complete, and timely, then information about defects is already available and could be used to identify potential risks before they leave the factory. Analysis of traceability data can, for instance, highlight PCBs that were printed with solder paste but left too long before placement, increasing the risk of poor solderability.

It's impractical to think that every possible deviation from the normal operation of a production line can be addressed as it happens, but complete, accurate, and timely traceability data could be the ultimate quality tool, acting in a far more effective way than regular test processes.

5. 80% of factory management know these statistics, but feel powerless

In many cases, there is a different management process relating to the business of a product compared to the business of manufacturing. In an OEM company, manufacturing is usually treated as a non-profit operation, with factories working to a budget. This creates a barrier that can prevent investment in product performance-related issues. Using EMS services can make this barrier even larger.



Inventory turns will double as warehouse space halves



The adoption of lean material logistics is an essential part of providing flexibility in SMT production

Going forward, it's clear that with volatile patterns of customer demand and an increasing number of product variants, there is an inevitable need for extreme manufacturing flexibility. Considering the complete needs of the business and analysing all costs, of which manufacturing is only a part, it's clear that the operation and location of manufacturing processes need to be reassessed.

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Distributors see increasing opportunities with automotive and transportation OEMs

Some distributors are focusing on automotive customers because high-tech safety and infotainment systems, rising shipments of electric vehicles and development of connected cars and driver-less vehicles are boosting electronic component demand



James Carbone

Most semiconductor, passive components and connector manufacturers say that automotive continues to be a growing segment for sales despite the fact that car and light truck shipments are expected to decline this year and be sluggish through 2023.

Automotive is also proving to be a burgeoning segment for electronics distributors, many of which sell components to tier 1 automotive suppliers for new product introduction as well as to tier 2, 3 and 4 automotive suppliers building electronic systems and subsystems for automakers.

Distributors point out that their business is not just with large auto companies and their supply chains, but also with transportation OEMs that design and build agricultural and construction vehicles, mass transit systems, all-terrain vehicles, and golf carts among other off-road vehicles.

Distributors' business with transportation OEMs is robust because many of the electronics-rich safety, convenience, and infotainment systems being designed into cars and light trucks are also being designed into off-road vehicles. As a result, component demand from transportation and automotive OEMs and their contract manufacturers is growing.

For instance, a new report from connector industry research firm Bishop and Associates says that connector sales to automotive will grow from \$15.7 billion in 2018 to \$21.3 billion in 2024, a compound annual growth rate of 5.8 per cent. That strong growth will occur although car sales are expected to decline in 2019 and 2021. In 2018, motorists in the U.S. bought about 17.2 million new automobiles and light trucks, according to researcher Statista.

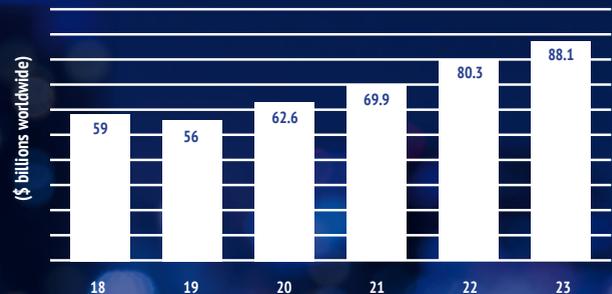
However, car sales in the U.S. will drop to 16.8 million and continue to decline in 2020 and 2021 before increasing to 16.8 million in 2022 and 17.3 million in 2023, the researcher said.

Automotive's appetite for semiconductors will grow and automotive will represent a higher percentage of semiconductor sales. Semico Research Corp. says that in 2018, automotive represented 12.5 per cent of semiconductor sales. By 2023, that percentage will grow to 16.7 per cent, the researcher said. In addition, chip sales to automotive will rise from \$59.2 billion in 2018 to \$88.1 billion in 2023, said Semico.

A strategic segment

With electronics demand by automotive and transportation companies rising, distributors are focusing more resources on the segment. "Automotive

Demand for auto chips will rise



Sales of semiconductors for automotive applications will decline in 2019 but will rebound and reach \$88.1 billion in 2023.
Source: Semico Research

is a strategic vertical for us," said Murdoch Fitzgerald, vice president sales and engineering at Arrow Electronics. "I have a dedicated team that services transportation," he said. Arrow provides supply chain global logistics and engineering services to transportation in automotive customers, said Fitzgerald. Its transportation customers include a wide range of customers ranging from tier 1 automotive companies as well as tier 2 through tier 5 OEMs.

With transportation customers, "we service companies like John

Deere and Caterpillar, anything with wheels, we are servicing them," said Fitzgerald.

Fitzgerald said while unit shipments of vehicles is expected to decline this year, electronics content in vehicles is increasing because more are being equipped with Advanced Driving Assistance Systems (ADAS). Such systems have features such as adaptive cruise control, collision avoidance, pedestrian crash avoidance, mitigation lane departure warning and automatic lane centering among others.



“Electrification” of vehicles is also driving component demand as more vehicles being shipped are electric vehicles (EVs) or hybrids. EV sales increased 81 per cent in 2018 as 361,307 EVs were sold in 2019, according to tracking site Inside EDVs.

“We are working with a lot of the next new wave of automotive customers that could be the next Tesla out there,” said Fitzgerald. “It’s a pretty exciting prospect for us,” he said. Besides EV and hybrids, EV charge stations will help drive Arrow’s transportation business.

Innovation adoption

Innovations being made in automotive are being adopted by off-road transportation vehicles. Dave Doherty, president and chief operating officer for Digi-Key, said the Thief River Falls, Minn. distributor is involved with tier 1 automotive OEMs with new product introduction “whether it is safety, convenience or infotainment systems.”

He added that Digi-Key also sells components for production when supply is tight as it was in 2017 and 2018 in part because of strong demand for semiconductors and passives from automotive OEMs and their suppliers.

“I don’t think tier 1 automotive is unique from other tier 1 customers in other spaces such as networking, EMS etc.,” said Doherty. Digi-Key’s business model is not aimed at large volume production needs of

OEMs and EMS providers, but the distributor is a “highly trusted source of supply,” he said. “When shortages occur due to long lead times and/or unforecast demand, we do see tier 1 customers across all of these spaces purchasing product through our digital model to manage potential disruptions to their supply chain,” said Doherty.

He said that Digi-Key is careful in balancing the needs of customers looking for shortage parts with the needs of new product introduction customers. “It’s a balance of offering some emergency support for today’s needs while being cognizant of our role to support tomorrow’s designs,” said Doherty.

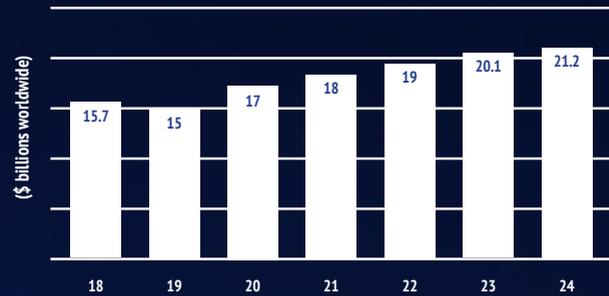
Doherty said that the broad category of transportation is a growth segment for Digi-Key. Transportation includes automotive but also farm and construction vehicles, recreational vehicles, boats, all-terrain vehicles and other forms of transportation.

Tech-filled tractors

He said that much of the growth in Digi-Key’s transportation business is because off-road vehicles and farm equipment such as tractors which are being equipped with the same technology that’s being used in automobiles.

“The sophistication that you get when you get into a tractor, you would think you’re in a spaceship,” said Doherty. You might see a tractor driver in a field reading a book while the tractor he is in

Automotive will need more connectors



Distributors expect to sell more connectors for automotive applications.
Source: Bishop & Associates

moves across the field with an accompanying driver-less tractor. “So essentially there are two tractors driving autonomously across the field,” said Doherty. Autonomous driving technology is also used in construction vehicles such as the graders, he said.

Wanted: rugged components

Such vehicles require not only the latest technology, but also more rugged semiconductors and passives. Those parts are increasingly in demand from non-automotive, non-transportation applications, said Doherty.

Many OEM customers like the “the ruggedness of components” used in automotive because there are many non-automotive applications “that have a slightly rugged environment,” he said.

Automotive has stringent quality requirements such as ISO 16949, a technical specification for development of quality management system to guarantee continual improvement, prevent defects and reduce variation and waste in the automotive industry supply chain.

Karim Yasmine, corporate vice president strategic supplier development for Future Electronics, said transportation/automotive is a big focus area for the Montréal-based distributor. “It is a growth engine for the

industry and has been for many years”, he said. “There will continue to be a lot opportunity for growth in traditional automotive, as well as the new wave” of ADAS applications, EVs, hybrids, the connected car and autonomous driving cars, said Yasmine.

A connected car is equipped with Internet access, and usually with a wireless local area network that allows the car to share internet access with other devices both inside and outside the vehicle. Researcher IHS Markit forecasts that by 2023, worldwide sales of connected cars will reach 72.5 million units, up from 24 million units in 2015.

Sales of autonomous or self-driving vehicles will grow from about 600,000 units in 2024 to 21 million in 2035, according to IHS Markit.

He added that demand for components by automotive OEMs will continue for years because less expensive car models are being equipped with ADAS and infotainment systems. In the not so distant past, only high-end models were equipped with such systems.

“A Corolla has a lot of intelligence now; it’s not just the Lexus,” said Yasmine.

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John Denslinger is a former executive VP Murata, president SyChip Wireless, and president/CEO ECTIA, the industry's trade association. His career spans 40 years in electronics

Environmental compliance: being green

In this article, John Denslinger takes a look at the electronics industry's environmental activities past, present and future

Environment • By John Denslinger

In the memorable words of Kermit the Frog: "it ain't easy being green". Forgive me for choosing a light-hearted analogy, but the words ring so true for our industry as well. 'It ain't easy' definitely describes the utter complexity and cost of pursuing a responsible environmental policy. Driven in part by necessity and part by a good stewardship desire, companies over time have institutionalized sizeable legal and environmental departments just to keep pace with lawmakers and regulatory oversight. For global companies, formulating and executing compliance plans, that effort is even more daunting. The rules are not always the rules. Continental, country and sometimes state interests and interpretations vary. It's just ain't that easy.

Green is the holy grail of environmentalism. Companies invest time, capital and human resources in energy conservation, electronic waste reduction and recovery, sourcing only verifiable/reputable suppliers, green supply chains, hazardous substance management, factory emissions, product labeling and documentation and just about everything else eco-centric until EOL. Each is addressed as a tangible, measurable event for any shareholder, employee, special interest or government to assess.

So how are we doing as an industry? Want to find out? Check social media, the intangible. With more than two dozen platforms connecting billions and billions of people worldwide offering commentary, judgement, photos, blogs and more, your company's reputation can change in an instant. A serious failure anywhere in the supply chain can alter opinion, factual or not, to you and everyone downstream.

The simplified flow chart below illustrates just that. Let's say you discover a company unknowingly introduced a conflict mineral from a restricted country into their production. One can easily see how

everyone along the supply chain must initiate containment actions, as well as countermeasures, preventing future use of that material, component and/or assembly.

Because of that, procurement plays a key role assuring a robust discovery and continuous review takes place. Buyers don't necessarily need to be eco-experts, but they should be well-acquainted with all the various rules and regulations when it comes to achieving environmental compliance.

So what are the most common regulations affecting the electronics industry? I would say (4) in particular: RoHS, Conflict Minerals, REACH and the forth-coming California Proposition 65. Both RoHS and REACH originated as European Union (EU) regulations but quickly spread to global adoption. Conflict Mineral regulation originated in the US with the passage of Dodd-Frank Wall Street Reform and Consumer Protection Act. Recently, the EU passed its version slated for 2021 adoption. Finally, remember I said earlier that states may affect commerce by implementing their own environmental rules, California Prop 65 is such a regulation targeting labeling and warning requirements. This law will affect component manufacturers and distributors the most not only in compliance but more so in shipping logistics. The law becomes effective late this summer and may be a matter of time before other regions consider the same.

Despite my 'it ain't easy being green' intro, our industry continually demonstrates incredible leadership in being green. Check out individual company websites for environmental responsibility statements.

Raw Mat'l Mining → Raw Mat'l Processing → Component Mfg → Distribution → EMS Assembly → OEM Label → Customer



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Are you ready to lead with clarity?

With a host of disruptive technologies on the horizon, the electronics industry is set for a period of rapid change. The ECIA Executive Conference will help you pilot your organization through the years ahead

The 2020s could well be a tumultuous decade, which is why the 2019 Electronic Components Industry Association Executive Conference has been organized around the theme: *Vision 2020 - Leading with Clarity*. To help delegates face the future with confidence, the event brings together a stellar roster of speakers who are experts in economics, strategic planning, change management, talent development and disruptive technologies like 5G and transportation all seen through the lens of their impact on the

electronic components industry.

Executive conference chair, Melanie Pizzey, commented: "The electronic components industry is experiencing rapid change and a new era of disruption is ahead of us. As we continue to transition into Industry 4.0, a unique set of leadership skills is required to manage organizations through these dramatic shifts. Every speaker we chose has something vital to contribute to our message, which we believe is what every CEO and executive in

our industry needs to understand in order to successfully lead their organization in the 2020s."

ECIA vice president, Debbie Conyers, added: "I'm confident the executives who attend will leave the conference in October well equipped to lead their organizations through the next decade with great success."

The Executive Conference runs 20 to 22 October at the Loews Chicago O'Hare.

www.ecianow.org/executive-conference



Components Industry Association Executive Conference has been organized around the theme: *Vision 2020 - Leading with Clarity*

Market Research

Innovation fuels semiconductor growth

Demand for advanced semiconductors continues to rise, prompting component manufacturers to invest in production equipment, but market volatility continues, warns SEMI

North America-based manufacturers of semiconductor equipment posted \$2.06 billion in billings worldwide in May 2019, according to the May Equipment Market Data Subscription Billings report published by SEMI. This figure is 7.4 per cent higher than the final April 2019 level of \$1.92 billion, but 23.6 per cent lower than the May 2018 billings level of \$2.69 billion.

President and CEO of SEMI, Ajit Manocha, explained:

"Expanding end-market applications continue to fuel demand for advanced semiconductors and the equipment necessary to manufacture those devices; hence billings of North American equipment manufacturers increased for the second consecutive month. However, market volatility continues due to the macroeconomic environment."

Purchasing professionals keen to see more in-depth data

may want to read SEMI's full monthly *North American Billings* report, as well as the *Worldwide Semiconductor Equipment Market Statistics* report, which it issues in collaboration with the Semiconductor Equipment Association of Japan. This details billings by equipment segment and by end market regions. SEMI also tracks semiconductor industry fab investments on a company-by-company and fab-by-fab basis in its *World Fab Forecast* and *SEMI FabView* databases.



Expanding end-market applications continue to fuel demand for advanced semiconductors

These tools provide access to spending forecasts, capacity ramp, technology transitions, and other useful information for over 1,000 fabs worldwide.

www.semi.org

Putting part validation to the test

Test and inspection techniques offered by distributors and laboratories go a long way to eliminating counterfeits from the supply chain, but only if purchasers choose their component validation partners wisely, says 4-Star Electronics

Despite many changes in the electronic component industry over the past decade, one thing has remained constant: counterfeiting. However, although counterfeiting techniques and entry of fraudulent parts into the supply chain has gotten more sophisticated, luckily, counterfeit detection has evolved due to the introduction of improved test and inspection techniques by distributors and test labs.

Historically, the counterfeit problem has been attributed to brokers or non-authorized distributors buying and selling material in the open market where traceability to the original component manufacturer has been lost. While this is somewhat true, the realities of modern procurement are such that parts may simply not be available with traceability due to obsolescence, end-of-life, or other market conditions, and buyers must look to the open market.

Part validation

When procuring open market material, OEMs and contract manufacturers can use approved independent distributors to help determine authenticity once parts are found. Typically, inspection and testing will feature best practice from industry standards such as IDEA-STD-1010 or AS6081. This could include external visual inspection, marking permanency testing, surface analysis, x-ray, XRF, and delid/decapsulation of the parts.

Alternatively, tests may be performed at a third-party independent test lab. Independent labs often have less experience conducting the standard IDEA-STD-1010 or AS6081 inspections, but will likely have greater capability to perform higher level optional tests from the newer AS6171 standard, such as functional electrical testing, acoustic microscopy, raman spectroscopy, Fourier

transform infrared spectroscopy, thermogravimetric analysis, or secondary ion mass spectrometry.

In many cases, when dealing with the highest risk parts, utilizing both the distributor's lab and an outside lab gives the greatest confidence of authenticity. Whichever is chosen, it's crucial that the lab is appropriately qualified and experienced and ideally, the end customer will be involved in the lab selection process, as well as specifying the test and inspection protocol.

A recent report about the owner of a company who was sentenced to federal prison for selling counterfeit integrated circuits to the military revealed that he employed a third-party lab to provide fraudulent information verifying that the parts were legitimate. The test lab, at the direction of the counterfeiter, certified the parts and produced a test report that concealed their poor condition. As this example highlights, it is vital for the end customer to

confirm that the inspection and testing of product is done by a trustworthy and reputable source.

Qualifying a laboratory

Understanding how to qualify a lab is vital to ensure that the lab's results are legitimate and traceable to recognized standards.

For any facility inspecting open market electronics, it is essential that the lab is certified to a recognized standard specific to counterfeit detection such as AS6081 or accredited to ISO 17025 with AS6171. Establish also whether inspections are performed by trained inspectors, with ICE-3000 certifications?

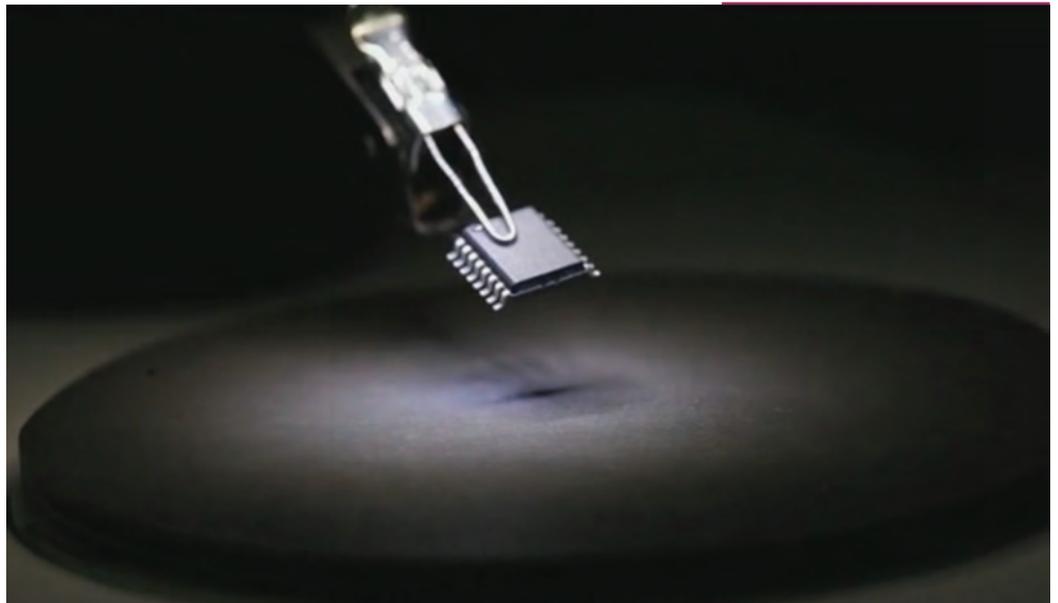
At a minimum, the lab should be equipped to perform levels A1 through A6 testing per the AS6081 standard using a recognized sampling plan. They should also be in good standing with various reporting agencies such as ERAI and GIDEP

Finally, look at the lab's previous experience of detecting and reporting suspect, fraudulent, or counterfeit material and ask whether ethics training is included as part of its quality system. A good lab will also make itself available for a walk-through inspection by the end customer.

Counterfeit prevention requires the due diligence of everyone within the industry to know and qualify testing facilities. End customers should develop relationships with high quality independent distributors who can supply critical parts and testing services, and all non-traceable parts should be tested by a qualified laboratory that has undergone careful evaluation by the distributor and the end customer. Only then, can there be confidence in the security of the supply chain.

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Why buyers need to stay vigilant

Co-chair of the SAE G-19AD committee and vice president, total quality at TTI, Kevin Sink, looks at the rise of new counterfeiting risks and the continued need for vigilance to mitigate future counterfeiting threats

Those who have studied military strategy know that a battlefield isn't a static map, but a constantly-evolving mix of dynamic elements. The same can be said for the electronics industry's battle against counterfeits, with the next major consumer technology or market instability likely to herald a fresh wave of counterfeit components.

However, there is some good news. Reports of suspect electronic components have leveled off over the past eight years, in part due to the preventive measures established by manufacturers and distributors. For years, SAE and other organizations have developed standards to help identify, contain and eradicate counterfeits.

More recently, the National Defense Authorization Acts (NDAA) and the Defense Federal Acquisition Regulation Supplement (DFARS) have created a legal necessity for following those standards. Self-regulation by distributors,

and increased scrutiny and testing throughout the electronics industry, have also helped root out counterfeit parts.

Prime targets

While ICs remain the most common target for counterfeiters, the recent shortage of multilayer ceramic chip capacitors led to an increase in counterfeit components in the supply chain. Not only did unscrupulous dealers substitute inferior parts for higher-grade ones, they also passed off low-cost parts from unknown brands as authentic components from premier manufacturers. All this because advances in consumer technology saw the number of MLCCs in mobile devices increase dramatically from one product generation to the next.

Despite new rules and standards, components destined for military applications continue to be prime territory for counterfeiters. According to

the Naval Surface Warfare Center, electronic components for military applications are 25 times more likely to be counterfeited than commercial parts. Again, this can be attributed to the fact that military-grade components are more expensive and therefore more profitable for counterfeiters.

New threats

Beyond military and aerospace applications, OEMs in other sectors must be aware of how counterfeit parts could impact their business too. For example, non-clinical medical devices used to monitor health symptoms could be adversely affected by counterfeit components. Likewise, as automobiles become increasingly reliant on electronics for safe operation, counterfeit components could easily create failures with immediate, life-threatening consequences.

Both the healthcare and transportation industries are relying on automation and connected devices

for key innovations, but manufacturers must weigh the potential negative consequences of failures or recalls brought on by counterfeit components. Fortunately, our industry is well-positioned to educate OEMs about the potential risks.

Although standards and regulations can help reduce risk, the best way to prevent counterfeiting is to remain vigilant. The ability to identify each step in a component's supply chain is the best way to eliminate risk and although counterfeiters will always look for a new way to make a quick profit, it's up to us to mitigate those risks by remaining focused on finding the next threat as it emerges.

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Three ways to spot a fake

Counterfeit electronic components are a serious threat. Fraudulent parts can be difficult to spot and aren't always immediately faulty. It's up to buyers to arm themselves with counterfeit identification techniques

One of the most significant issues with counterfeit components is that they often pass initial prototype tests, but then cause issues further down the line when they're used in electronic devices. Since counterfeits don't always show faults from the outset, they are arguably more problematic than parts that fail to work at all. Counterfeits aren't dangerous because they don't work outright, but because they nearly work or work intermittently. Initially, they show 'ideal' results, but when in use in the real world, the counterfeit part can fail to operate correctly and corrupt the device, causing major headaches and problems.

Electrical components can be counterfeited in many different ways: low specification parts have their part numbers removed and replaced with higher specification part numbers; rejected parts are re-purposed as working

components; old parts are recycled and resold as new; low specification parts are placed in high specification packaging; cheap copies of parts are manufactured in countries without the relevant regulatory requirements.

There are three basic ways procurement professionals can spot a counterfeit.

1) Always check the part number. Component part numbers are one of the biggest giveaways for counterfeit products as the producers of these fake parts don't always know what the original number would have been, or the format it would take. As such, they often print a completely random number which can be easy to identify as fraudulent. Buyers can check part numbers with legitimate manufacturers to ensure the parts are genuine.

2) Study the date and origin of the part. Purchasers should

check parts for obvious signs of fraud such as dates in the future or countries of origin where the manufacturer doesn't actually operate.

3) Visual examination of the product. Look for incorrect or incomplete logos or IC markings which can be removed by wiping them with acetone. Also watch out for signs of laser cutting, which would have been used to remove the original product number. These are all clear signs of counterfeiting.

While some counterfeit parts are easy to identify, unfortunately, many are extremely well disguised and hard to recognize as fakes even by using the three tips above. The most fool-proof way of avoiding counterfeits is to source all component parts from reputable suppliers. Buying from authorized distributors guarantees traceability and product control. Often those

tasked with procurement avoid purchasing from authorized distributors on the misconception that they need to buy in bulk. However, buying from a reputable supplier doesn't mean you have to buy products in large volumes. High service distributors such as Newark in North America and Farnell in EMEA can provide small volumes for prototype and design without the risk of receiving counterfeit goods.

Working with a trusted distribution partner can be a significant help when it comes to avoiding counterfeit parts, even for the most counterfeit-savvy purchaser. Procurement professionals should therefore look for a distributor like Newark that is certified to a global quality management standard to ensure that they are buying from a distributor with a record for quality management and reliability.

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Buyer's market for semiconductors may be short lived

Semiconductor lead times have shrunk and prices have fallen because of excess capacity and sluggish demand, but the chip market will move towards equilibrium near the end of the year



James Carbone

It will be a buyer's market for semiconductors for the rest of 2019 because of weakened demand, excess supply and falling prices for many chips, especially memory ICs.

The global semiconductor market will decline 12.1 per cent to \$412 billion in 2019 after three years of growth, according to World Semiconductor Trade Statistics (WSTS). All product categories, except discretely, will decline in 2019. Discrete semiconductor revenue will rise 1.4 per cent. However, memory ICs, including DRAM, NAND, NOR and several other types of memory will decline 30 per cent in 2019, according to WSTS. Revenue for analog chips will fall 5 per cent; logic will decline 4 per cent; optoelectronics, 1.5 per cent and sensors, .5 per cent, WSTS said.

However, the decline in the overall semiconductor market is due in large part to the fall of the memory chip segment, which represents about 33

per cent of the overall semiconductor market. Much of decline is due to falling prices for DRAM and NAND. The average selling price (ASP) for memory IC chips was about \$3.82 in the second quarter of 2018. In the second quarter of 2019, the ASP dropped to \$2.78, according to researcher IC insights.

The good news for semiconductor manufacturers is that the decline in chip revenue will be short lived. Sales will start to recover in the second half of the year and growth will resume in 2020 when semiconductor sales are forecast to grow 5.4 per cent, according to WSTS.

"The current market downturn is being driven by a broad weakness in demand specifically centered in China and an ingestion of excess inventories in some of the major markets including automotive, mobile phones, and cloud infrastructure," said Mario Morales, program vice president,

semiconductors at researcher IDC. "We expect the market to bottom by end of the third quarter this year" as high inventory levels are worked off, he said.

Recovery is imminent

Some chipmakers were expecting a rebound in their business even before the second half of the year. "Our second quarter outlook is for net revenue to increase about 2.4 per cent, said Jean-Marc Chery, STMicroelectronics president and CEO. "We are planning for strong sequential growth in the second half of the year across the industrial, automotive and personal electronics end markets," he said. For the full year 2019, ST's revenue would be in the range of about \$9.45 to \$9.85 billion, according to Chery.

Dr. Reinhard Ploss, CEO of Infineon, said while the semiconductor industry "boom is over and the momentum in demand has weakened," Infineon

would still grow sales about 5 per cent in 2019 to \$9 billion, plus or minus 2 per cent. He said Infineon had "excellent long-term prospects in our key target markets, including electro mobility, autonomous driving, renewable energy, data centers and mobile communications."

The company was expecting healthy growth from its automotive and industrial power control segments, but its power management segment revenue would grow at a slightly slower pace than the other segments. Revenue for the digital security solutions segment is likely to decrease by a mid-single-digit percentage year-on-year.

While chipmakers are expecting a rebound in business, it will likely remain a buyer's market through the year, according to Brian Matas, vice president of market research for IC Insight. "Buyers are welcoming lower prices, especially for memory and I

By the Numbers



\$468.7 billion

The size of the global semiconductor market in 2018. Source: WSTS



12.1%

The percentage that the semiconductor market will decline in 2019, Source: WSTS



\$434.3 billion

The forecast size of the worldwide semiconductor market in 2020. Source: WSTS



12%

The average price decline for integrated circuits in 2019. Source: IC Insights



6.5%

The compound annual growth rate for semiconductors used in consumer electronics from 2018-2023. Source: IDC



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think that will continue into the third quarter even into the fourth quarter before things stabilize,” he said.

Big capacity investment

Prices are lower because excess capacity was added last year and in the beginning of 2019, especially by memory IC manufacturers. “Over the last two years, Samsung has spent more than, \$20 billion in total semiconductor capital spending each year,” said Matas. “Probably two thirds of that for about \$14 billion was for flash and DRAM.”

While there are only three major DRAM manufacturers and about six major NAND flash memory manufacturers, those memory IC and manufacturers are concerned about competition from China which is investing in semiconductors, especially memory ICs.

For instance, Yangtze Memory Technologies Co., Ltd. (YMTC), based in Wuhan, began producing 3D NAND chips on 12-inch wafers in 2017.

“Samsung sees the threat from China so they are making sure they have the capacity in place,” said Matas. “They are supplying memory for their own products as well as to others. They’ve been intent about making sure they

stay ahead of the competition,” he said.

As a result, memory prices may increase but they won’t reach the levels of 2017 and 2018 because of competition among the major DRAM and NAND manufacturers and Chinese memory IC makers.

Matas added supply and demand may reach equilibrium near the end of the year and the chip market will start to recover.

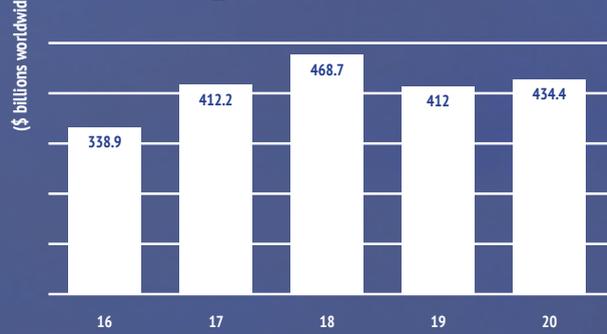
“The amplitude of that rebound still remains to be seen. We think the semiconductor industry will grow 15 per cent in the third quarter and 6 per cent in the fourth,” he said.

An uncertain future

Such a rebound in revenue “is good but it only gets us to -13 per cent growth this year” because semiconductor sales had slumped so severely in the first half, said Matas. He added what could impede growth in the second half recovery and in 2020 is uncertainty in the market. “Right now, there is a lot of uncertainty in the market,” especially with tariffs and trade issues involving China, he said. “Uncertainty is even worse than a down market because when the market is down, you can take steps to adjust,” said Matas. However, with uncertainty it’s difficult to determine

While semiconductor sales will decline for the first time in three years, the chip market will rebound in 2020 when sales increase 5.4 per cent. Source: WSTS

Worldwide chip market will decline 12.1 per cent in 2019



what’s the correct course of action. However, despite uncertainty in the market, semiconductor revenue growth will resume in 2020 when the chip market grows from \$412 billion in 2018 to \$434.4 billion in 2020, said WSTS.

Chip demand will rise over the next several years because of the buildout of 5G networks and continuing strong demand from automakers and their suppliers despite falling to flat automobile sales.

“The automotive market remains one of the strong growth drivers as semiconductor content and design activity for autonomous enabling technologies will continue to drive 3-4 times more growth than the overall market,” said Nina Turner, research manager for semiconductors at IDC. (see related story page 18 and 19)

Other segments will also help drive semiconductor demand. For instance, while semiconductor revenue from the computer segment will decline in 2019, it will still post a compound growth rate of 1.3 per cent from 2018 through 2023 because of strong demand from X86 servers and solid-state drives, said IDC.

A positive impact

The rollout of 5G networks and 5G handsets will also have a positive impact on semiconductor sales over the next several years. “The full 5G buildout, even though it is still a year or two years away from ramping, shows a lot of potential,” said Matas. He noted that more towers will be needed for 5G to operate efficiently, compared to 4G networks.

As a result, the mobile wireless communications segment will have a CAGR of 4.8 per cent for 2018-2023, according to IDC. Semiconductor revenue for 4G mobile phones will slow, but 5G phones will begin to ramp up in 2020, becoming mainstream by 2025. The RF subsystem in mobile devices will drive most of the revenue growth as the subsystem continues to support more complexity, additional antennas, and the increase in bands on every phone, IDC said.

The consumer semiconductor segment will also post robust growth as sales increase 6.5 per cent per year through 2023. Consumer IoT devices and home automation will gain traction, the researcher said.

Memory IC market drops



Falling prices will result in the memory chip market including DRAM, NAND, declining sharply in 2019. Source: WSTS

Check the spec: why switch sourcing can be tricky

When sourcing switches, some specification details are obvious, while others require careful attention. As Digi-Key explains, sometimes buyers may need to double check the spec

There are several things to consider when looking for switch products. Some obvious details include the type of switch, the number of poles and throws, or whether you require illuminated or non-illuminated options. With some specification details, however, it pays to be more careful.

For instance, when looking at voltage and current ratings, there is a difference between AC and DC operation. Most switch manufacturers will provide ratings for both of these, but this is not always the case. When looking at datasheets or drawings, a 50V AC voltage rating is self-explanatory, however, if the rating is 50V, then this is calling out a DC voltage rating.

Some switches have multiple ratings. Take the PS1024ARED from E-Switch as an example. This switch has two ratings listed: 3A at 125V AC and 1.5A at 250V AC. Since power equals voltage times current, this rating is focused on not exceeding a power rating of 375W. In any case, this switch should not be used in applications greater than 250V AC.

Often a switch will only have an AC rating in the datasheet. Luckily there is a standardized rule of thumb to determine the DC rating of an AC switch. This rule states that the DC current rating is equal to the maximum AC current rating

found on the datasheet with the DC voltage rating set at 30V. Taking the previous example, the PS1024ARED drawing only has AC ratings. The maximum AC current rating listed is 3A, therefore the DC rating for this switch would be 3A at 30V.

Appropriate accessories

Another thing to watch for when sourcing switches is accessories: what options are available, and would they be useful in the specified application? This is where the Digi-Key website can be helpful. For a given switch, the site will list any pertinent accessories if applicable. Take the KB16CKW01-5F-JF from NKK Switches. This has four related accessories to consider listed near the bottom of the product page in the 'Associated Product' section.

There are some useful accessories related to this switch. The wrench socket would be helpful when fitting this panel mount switch in its final location. As the socket works for all switches in this series, you only need one to mount any number of KB Series switches, including use on different future projects. A protective guard is also available for this switch series, which can be placed over the switch to prevent accidental actuation. Other accessories include a cap extractor and a replacement LED.

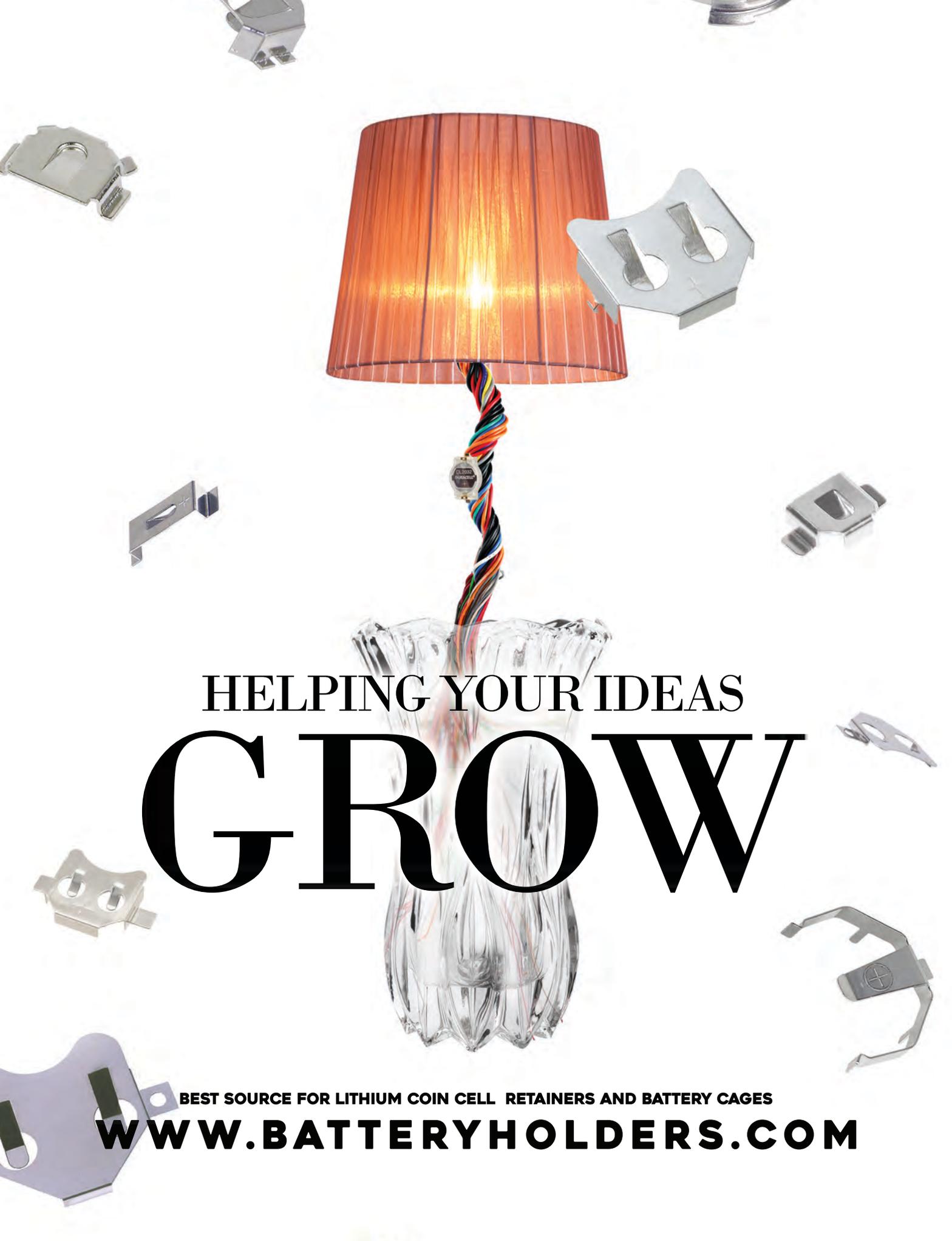
In summary, there are several things that can make finding

the right switch a bit tricky. Ensuring the proper voltage and current ratings are met and getting the right accessories are just a couple of parameters that buyers would do well to verify before placing their order.

www.digikey.com



This E-Switch pushbutton has multiple ratings



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5G

Fifth generation cell networks will boost component demand

The rollout of 5G infrastructure could result in a 1.5 to 2 per cent increase in semiconductor sales and component demand will further rise when new applications that take advantage of 5G speed kick in

The construction and deployment of 5G networks is in its infancy, but chipmakers and industry analysts say the technology could be the next big driver for the electronics industry and result in a surge in component demand.

Semiconductor manufacturers and other component suppliers need to increase capacity to meet an expected swelling of demand over the next five years. The buildout of 5G base stations and other infrastructure and the manufacturing of 5G handsets will heighten demand for many components, including field programmable gate arrays, power management chips, memory ICs, analog chips, passives and connectors.

Depending on how quickly the 5G rollout occurs, component lead times could stretch and prices could rise for a number of semiconductors and other components unless suppliers add the necessary capacity.

Some electronics buyers are concerned that there could be tight supply for some components if 5G takes off quickly. The scenario could be similar to when component demand increased as automakers added electronics intensive safety and infotainment features to more models of vehicles. Component demand by

automotive OEMs and their suppliers surged leading to shortages of multilayer ceramic capacitors, chip resistors, MOSFETs and other components. The same situation could arise when 5G rolls out and buyers may find greater competition for supply.

However, the good news for electronics purchasers concerned about the possibility of constrained supply is that the deployment of 5G networks and handsets won't happen overnight.

Limited rollout in 2019

Phil Solis, research director, connectivity and smartphone semiconductors with researcher IDC, said 5G rollout "will be very limited" in the U.S. in 2019. However, there will be more broader coverage in South Korea and Japan, he said. Five-G rollout will build in 2020, especially in the second half, according to Solis.

Researcher Strategic Analytics says global 5G smart phone shipments will reach 5 million units this year. While that may seem like a lot, it only represents about 1 per cent of smart phone shipments. However, shipments will gradually increase and in 2025 1 billion 5G handsets will ship, the researcher said.

While 5G may take several

years to ramp up, industry analysts say the transition from 4G to 5G may actually occur at a faster rate than the transition from 3G to 4G because 5G is such an enabling technology and offers many advantages over 4G.

For instance, transfer speeds are expected to be 10 times higher with 5G compared to 4G which means images and videos can be transmitted much faster. Latency is also greatly reduced with 5G so there would be virtually no delays in transmissions. Fifth generation cell phone towers will have greater capacity allowing more devices to communicate with each other at the same time.

Those improvements will mean faster and more efficient transmission for streaming and data cloud computing. Another benefit for consumers and businesses will be that 5G will present an alternative to cable or satellite television for entertainment and Internet, according to Jim Feldhan, president of Semico Research. Consumers and businesses will be able to get an Internet connection through cell phone carriers and have "one service that provides your Internet connection, your mobile service and entertainment. I think that's can be very competitive for the consumer," he said.

Feldhan said during the transition from 3G to 4G, there was "not as much social media, streaming video, and cloud applications as there is now," said Feldhan. "The need for bandwidth wasn't quite the same" as it is now so there's a great deal of interest in switching to 5G technology.

Mobile wireless carriers are starting to build the networks and cell phone manufacturers are already shipping or planning to ship 5G or 5G capable phones this year.

More chips needed

Feldhan said that the new 5G networks will especially drive semiconductor demand over the next several years. It will not be possible to retrofit 4G base stations with 5G technology so new base stations will need be built. In addition, 5G networks that use millimeter wave spectrum will need more base stations than 4G.

"The problem with 5G in terms of service providers is it is not like 4G where the base stations can be far apart," said Feldhan. With a 5G millimeter wave technology 5-10 times more base stations will be needed because 5G transmissions do not go through buildings and walls as well as 4G, said Feldhan.

"From a semiconductor

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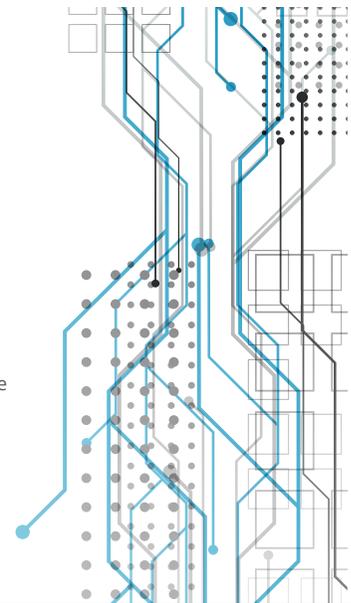
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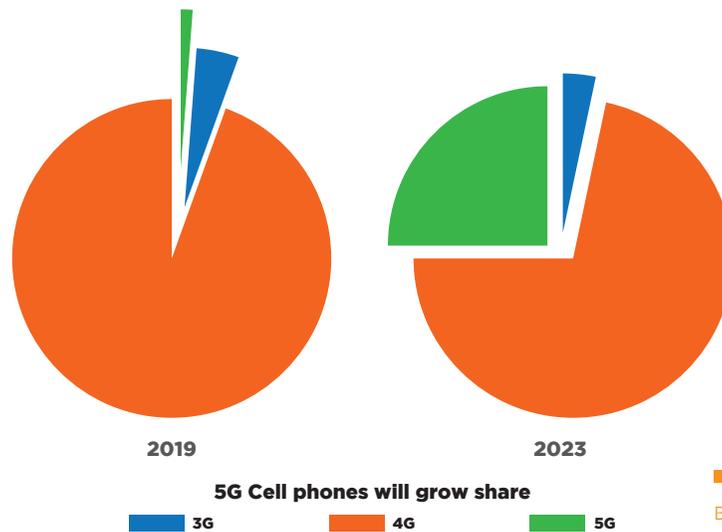
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Source: International Data Corp

By 2023 5G phones will represent 26 per cent of the market.

standpoint that's great news because you have a lot more of these base stations deployed," he said. So, chip demand for all these base stations is going to be great," he said. In addition, homes will need new 5G routers which will further drive chip demand, he said.

Fifth generation wireless technology will also enable more applications beyond cell phone communication. "Five G will expand cellular use to lots of other categories outside the telecom industry such as industrial and automotive," said Jon Erensen, senior director at Gartner Inc. He said 5G's speed, low latency and higher quality of service "are attractive to other markets besides smart phones. That kind of expansion presents bigger opportunities," he said.

Such opportunities could result in more semiconductor and other component demand. One such opportunity is IoT applications.

With IoT, 5G will help "enable data to the cloud through a higher-speed communication link particularly on the factory floor where you might have a data intensive manufacturing solution," said Feldhan. "You can do that wirelessly with 5G

and use that to connect that to your local server or to the cloud.

Wait until 2024

He said the rollout of 5G will begin in 2020, but the "hockey-stick type growth probably isn't until 2024 or 2025. That's when you will see things really spike up."

The 5G rollout will likely occur first in larger metropolitan areas. Service providers like Verizon and T-Mobile have to build out the infrastructure. That will likely occur first in larger metropolitan areas "where you have a lot of people, the bandwidth is limited because of the dense population and you can deploy a lot of smaller base stations and still have a high utilization rate," said Feldhan. He added it will take a while before people upgrade their handsets.

However, handsets will have less of impact on the components industry than the investment in infrastructure. The buildout of 5G infrastructure "will be a real boom for the semiconductor industry. "When you look at a bill of materials for a base station, it pretty much uses the entire spectrum of semiconductors," said Feldhan. Base stations use

discretes, power products, radios, digital signal processors, memory, and field programmable gate arrays (FPGAs)."

In addition, wireless providers will have to have 5 to 10 times as many base stations they do now to support 5G versus 4G, he said. He estimates that new 5G infrastructure could mean an extra 1.5 per cent to 2 per cent per year increase in sales growth for the industry in the short term.

New applications coming

Longer term, the increases in speed, bandwidth, and flexibility that 5G offers will result in more applications which will lead to great semiconductor demand and 5 per cent or even higher increase in chip sales. "I think we will see a plethora of new applications because of 5G that weren't around with 4G," said Feldhan.

For instance, 5G technology may make it possible for a doctor to perform remote surgery on a patient. Using dummies, trials have been done in which a doctor in one location uses a special sensor-equipped glove and a robot to perform surgery on a medical dummy in another location using 5G technology. Remote surgery could be possible

because 5G has low latency so the lag time between a device addressing a network and getting a response is mostly eliminated.

Another application that will be possible with 5G technology is an autonomous driving. While self-driving cars are being developed by companies, many automakers and analysts believe that autonomous driving is not possible without 5G. Once 5G networks are built, the faster, more responsive network and pervasive coverage means vehicles will be able to use 5G to communicate with others on the road and sensors around the city to avoid collisions and help a driver find the quickest route around the city.

"One of the applications might be finding a parking spot in a downtown of a major city," he said. The application coupled with the GPS, could tell a driver where the nearest parking spot is to his location and provide directions. Fifth generation networks will also be used in agriculture on smart farms. The technology will help farmers know when to water crops, apply pesticides and fertilize crops. Information from the sensors embedded in animals, farm equipment and soil will

communicate data through 5G networks so farmers will know how much water, pesticides and fertilizer crops need

Capacity investment needed

These new applications along with 5G infrastructure and handsets will require more semiconductors and other components. Electronics component manufacturers will need to invest more in research and development. In fact, major electronics companies, such as QUALCOMM, Broadcom, Intel, Texas Instruments have already made investments and will continue to make them to support 5G customers.

“All the different semiconductor manufacturers have a 5G initiative depending on what part of the semiconductor ecosystem they are involved in,” said Feldhan. In addition, companies are investing in capacity in the manufacturing of components for 5G infrastructure and handsets.

Fifth generation infrastructure and cell phone handsets will eat up capacity when 5G rolls out and more capacity will be needed, especially for logic chips manufactured by foundries.

“The vast majority of our manufacturing capacity is done by foundries such as TSMC, GlobalFoundries, UMC and others,” said Feldhan. “They continue to invest in system on chip. As demand ramps, they will make the major investments that are needed to provide the capacity,” he said.

Brian Matas, vice president of market research for IC Insights, said he expects there could be capacity issues “and not just processors. More memory ICs will be needed as well as power management ICs. “With 5G, there will be some power management type applications which will be needed to send signals reliably and be able to boost singles up or down,” he said.

Fifth generation handset shipments will result in a steady increase for some discrete sensors. “New RF power transistors and power management discrettes, including transistors and diodes will be needed in 5G phones and systems connecting to 5G transmission services,” said Rob Lineback, senior analyst with IC insights.

However, the real impact for sensors and discrettes will be the high-speed connection on other systems including Internet of Things applications, robotics, drones, and connected cars, according to Lineback.

“The advent of 5G connections to applications beyond smartphones will cause an increase in demand for sensors including image sensors and non-optoelectronics sensors for control, analysis, and artificial-intelligence processing in data centers through the cellular networks and Internet,” said Lineback.

Analysts say that 5G will be a “disruptive” force in the industry. “I think it’s going to be disruptive in a good way,” said Feldhan. It’s going to give businesses and consumers an alternative technology and will eventually drive down the cost of bandwidth. When bandwidth gets cheaper people figure out how to use it.”

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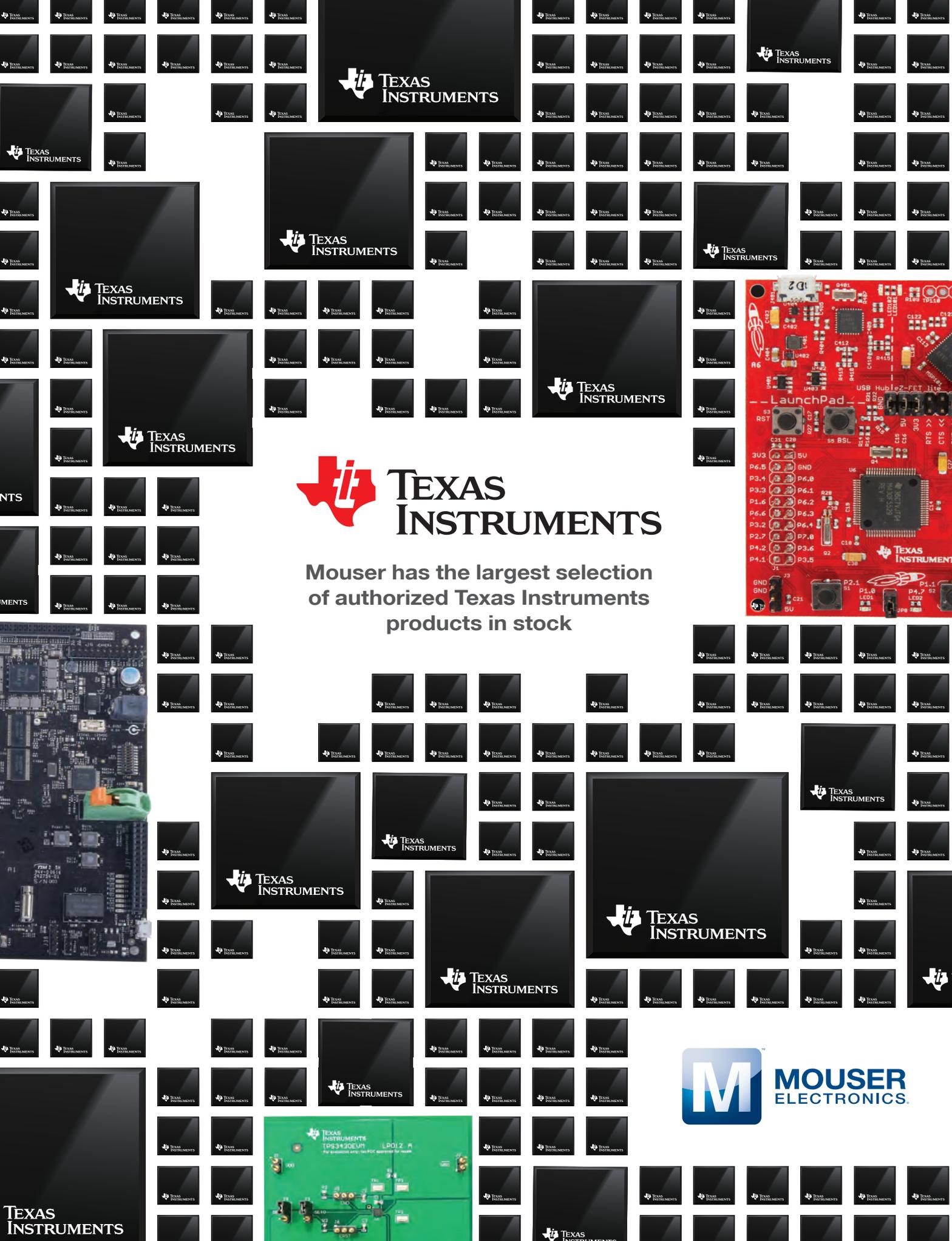
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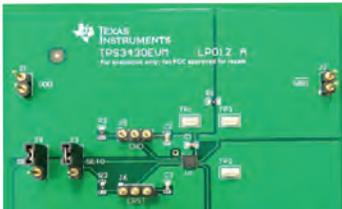
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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ELECTROMECHANICAL (Continued)											
Honeywell	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Keystone Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NKK Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	13,976	N/A	\$0	86.00%	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Panasonic	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
PUI Audio	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Schneider Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Sensata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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											
Abracorp Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,780	N/A	\$0	100%	50	1,000+	Y
CTS Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,889	N/A	\$0	100%	50	1,000+	Y
ECS Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,070	N/A	\$0	100%	50	1,000+	Y
Epson Toyocom	Mouser Electronics	800-346-6873	www.mouser.com	Y	178	N/A	\$0	100%	50	1,000+	Y
IQD Frequency Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kyocera	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Labs	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ICs & SEMICONDUCTORS											
Analog Devices, Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,749	N/A	\$0	95%	50	1,000+	Y
Broadcom Limited	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Central Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Central Semiconductor Corp.	Future Electronics	(800) 675-1619	www.futureelectronics.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
Cree, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cypress Semiconductor Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	\$0	81.00%	50	1,000+	Y
Digi International	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Diodes Incorporated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
FTDI	Mouser Electronics	800-346-6873	www.mouser.com	Y	94	N/A	\$0	100%	50	1,000+	Y
IDT (Integrated Device Technology)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Infineon	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,580	N/A	\$0	63%	50	1,000+	Y
Intel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ISSI	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Lattice	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
MACOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	5,800	N/A	\$0	100%	50	1,000+	Y
Microsemi	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Monolithic Power Systems (MPS)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Nexperia	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,205	N/A	\$0	100%	50	1,000+	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,486	N/A	\$0	96%	50	1,000+	Y
Power Integrations	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Qorvo	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Renesas Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
SanDisk	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Laboratories Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,141	N/A	\$0	100.00%	50	1,000+	Y
Skyworks	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	\$0	96.00%	50	1,000+	Y
Swissbit	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	29,676	N/A	\$0	94%	50	1,000+	Y

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Mouser has the largest selection of authorized Texas Instruments products in stock



TEXAS INSTRUMENTS

TEXAS INSTRUMENTS

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ICs & SEMICONDUCTORS (Continued)											
Toshiba	Mouser Electronics	800-346-6873	www.mouser.com	Y	800	N/A	N/A	N/A	N/A	N/A	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	53,781	N/A	\$0	77%	50	1,000+	Y
INTERCONNECTION											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	\$0	46.00%	50	1,000+	Y
Aero Conesys	ECCO	773-767-2200	www.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
OBSCULENCE / HARD TO FIND											
	America II Electronics	800-767-2637	www.americaii.com	M	1,900	\$1B	\$0	75.00%	59	550+	Y
	Chip 1 Exchange USA, Inc.	949-589-5400	www.chip1.com	Y	850,000	N/A	\$0	85%	20	150	
	Rochester Electronics	978-462-9332	www.rocelec.com	Y		N/A	\$250		10	400+	Y
OPTO ELECTRONICS											
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	\$0	99.00%	50	1,000+	Y
Finisar	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	\$0	99%	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
PASSIVES											
ABRACON	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	42,454	N/A	\$0	72%	50	1,000+	Y
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	\$0	78%	50	1,000+	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	\$0	71%	50	1,000+	Y
Coilcraft	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	\$0	98.00%	50	1,000+	Y
Fair-Rite	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kemet	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	\$0	66%	50	1,000+	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	\$0	58%	50	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	\$0	99%	50	1,000+	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	\$0	84.00%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	\$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	\$0	100.00%	50	1,000+	Y

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
PASSIVES (Continued)											
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	\$0	98.00%	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	\$0	100.00%	50	1,000+	Y
TT Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
United Chemi-Con (UCC)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	102,917	N/A	\$0	64.00%	50	1,000+	Y
Würth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	\$0	99.00%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	\$0	100.00%	50	1,000+	Y
POWER & BATTERIES											
Artesyn Embedded Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cincon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cosel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
CUI Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Delta Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
MEAN WELL	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Mornsun	+1-978-567-9610/+1-978-293-3923	www.mornsunamerica.com				N/A	\$0	100%	N/A	2000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Pihong	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
RECOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Schaffner	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TDK Lambda	Mouser Electronics	800-346-6873	www.mouser.com	Y	405	N/A	\$0	80.00%	N/A	N/A	Y
TRACO Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vicor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
REED SWITCHES											
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	\$200	100.00%	15	275	N
SENSORS											
ams	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Analog Devices Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Bosch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Honeywell Sensing and Control	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,059	N/A	\$0	64.00%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,379	N/A	\$0	45.00%	50	1,000+	Y
Melexis	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,915	N/A	\$0	59.00%	50	1,000+	Y
Sensirion	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
STMicroelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	914	N/A	\$0	65.00%	50	1,000+	Y
SWITCHES & KEYBOARDS											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TEST & MEASUREMENT											
B&K Precision	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Fluke	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,008	N/A	\$0	94.00%	50	1,000+	Y
Keysight	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Lascar Electronics		814-835-0621	www.lascarelectronics.com	Y	130	\$602,000	\$0	100%	10	175	Y
Tektronix	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Teledyne LeCroy	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	\$0	96.00%	50	1,000+	Y

Contract Manufacturers Buyers' Guide

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



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